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 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.

\[61 \text{ FR} 26677, \text{May} 28, 1996, \text{as amended at} 62 \text{ FR} 24582, \text{May} 6, 1997; 65 \text{ FR} 59358, \text{Oct.} 5, 2000; 67 \text{ FR} 43038, \text{June} 26, 2002; 68 \text{ FR} 4957, \text{Jan.} 31, 2003; 69 \text{ FR} 3266, \text{Jan.} 23, 2004; 69 \text{ FR} 31746, \text{June} 7, 2004\]
(b) The power of transmitters that use Automatic Transmitter Power Control shall not exceed the power input or output specified in the instrument of station authorization. The power of non-ATPC transmitters shall be maintained as near as practicable to the power input or output specified in the instrument of station authorization.

(c)(1) Transmitter power limitations. Point-to-point stations in the 29.1–29.25 GHz band for the LMDS backbone between LMDS hubs shall be limited to a maximum allowable e.i.r.p. density per carrier of 23 dBW/MHz in any one megahertz in clear air, and may exceed this limit by employment of adaptive power control in cases where link propagation attenuation exceeds the clear air value due to precipitation and only to the extent that the link is impaired.

(2) Hub transmitter EIRP spectral area density limit. LMDS applicants shall demonstrate that, under clear air operating conditions, the maximum aggregate of LMDS transmitting hub stations in a Basic Trading Area in the 29.1–29.25 GHz band will not transmit a co-frequency hub-to-subscriber e.i.r.p. spectral area density in any azimuthal direction in excess of $X$ dBW/(MHz-km$^2$) when averaged over any 4.375 MHz band, where $X$ is defined in Table 1. Individual hub stations may exceed their clear air e.i.r.p.s by employment of adaptive power control in cases where link propagation attenuation exceeds the clear air value and only to the extent that the link is impaired.

(i) The e.i.r.p. aggregate spectral area density is calculated as follows:

$$10 \log_{10} \frac{\sum_{i=1}^{N} pi}{A} \text{dBW/MHz-km}^2$$

where:

- $N$ = number of co-frequency hubs in BTA.
- $A = $ Area of BTA in km$^2$.
- $pi = $ spectral power density into antenna of i-th hub (in W/MHz).
- $gi = $ gain of i-th hub antenna at zero degree elevation angle.
- Each $pi$ and $gi$ are in the same 1 MHz within co-frequency hub-to-subscriber e.i.r.p.

(ii) The climate zones in Table 1 are defined for different geographic locations within the US as shown in Appendix 28 of the ITU Radio Regulations.

### Table 1

<table>
<thead>
<tr>
<th>Climate zone</th>
<th>e.i.r.p. Spectral Density (Clear Air) (dBW/MHz-km$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>3,4,5</td>
<td>26</td>
</tr>
</tbody>
</table>

1. LMDS system licensees in two or more BTAs may individually or collectively deviate from the spectral area density computed above by averaging the power over any 200 km by 400 km area, provided that the aggregate interference to the satellite receiver is no greater than the spectral area density as specified in Table 1. A showing to the Commission comparing both methods of computation is required and copies shall be served on any affected non-GSO 20/30 GHz MSS providers.

2. See §21.1007(c)(i) for the population density of the BTA.

3. Hub transmitter e.i.r.p. spectral area density limit at elevation angles above the horizon. LMDS applicants shall demonstrate that, under clear air operating conditions, the maximum aggregate of LMDS transmitting hub stations in a Basic Trading Area in the 29.1–29.25 GHz band will not transmit a co-frequency hub-to-subscriber e.i.r.p. spectral area density in any azimuthal direction in excess of $X$ dBW/(MHz-km$^2$)
§ 101.115 Directional antennas.

(a) Unless otherwise authorized upon specific request by the applicant, each station authorized under the rules of this part must employ a directional antenna adjusted with the center of the major lobe of radiation in the horizontal plane directed toward the receiving station with which it communicates; provided, however, where a station communicates with more than one point, a multi- or omni-directional antenna may be authorized if necessary. New Periscope antenna systems will not, under ordinary circumstances, be authorized.

(b) Fixed stations (other than temporary fixed stations and DEMS nodal stations) operating at 952.5 MHz or higher must employ transmitting and receiving antennas (excluding second receiving antennas for operations such