between 5 and 15 degrees above the horizontal plane;

$-110 + 0.5\ (\delta - 15)$ dB(W/m²) in any 1 MHz band for angles of arrival δ (in degrees) between 15 and 25 degrees above the horizontal plane; and

-105 dB(W/m²) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane;

NOTE TO PARAGRAPH (t): These limits relate to the power flux-density that would be obtained under assumed free-space propagation conditions.

[48 FR 40255, Sept. 6, 1983, as amended at 52 FR 45636, Dec. 1, 1987; 59 FR 53329, Oct. 21, 1994; 65 FR 54171, Sept. 7, 2000; 66 FR 10623, Feb. 16, 2001; 66 FR 63515, Dec. 7, 2001; 67 FR 17299, Apr. 10, 2002; 67 FR 46911, July 17, 2002; 68 FR 16448, Apr. 4, 2003; 68 FR 43946, July 25, 2003; 69 FR 31745, June 7, 2004; 69 FR 52207, Aug. 25, 2004]

§ 25.209 Antenna performance standards.

(a) The gain of any antenna to be employed in transmission from an earth station in the geostationary satellite orbit fixed-satellite service (GSO FSS) shall lie below the envelope defined as follows:

(1) In the plane of the geostationary satellite orbit as it appears at the particular earth station location:

$$29\text{-}25 \log_{10} (\text{Theta}) \text{ dBi } 1° <= \text{Theta} <= 7°$$

$$+8 \text{ dBi } 7° < \text{Theta} <= 9.2°$$

$$32\text{-}25 \log_{10} (\text{Theta}) \text{ dBi } 9.2° < \text{Theta} <= 48°$$

$$-10 \text{ dBi } 48° < \text{Theta} <= 180°$$

where Theta is the angle in degrees from the axis of the main lobe, and dBi refers to dB relative to an isotropic radiator. For the purposes of this section, the peak gain of an individual sidelobe may not exceed the envelope defined above for Theta between 1.0 and 7.0 degrees. For Theta greater than 7.0 degrees, the envelope may be exceeded by no more than 10% of the sidelobes, provided no individual sidelobe exceeds the gain envelope given above by more than 3 dB.

(2) In all other directions, or in the plane of the horizon including any out-of-plane potential terrestrial interference paths:

Outside the main beam, the gain of the antenna shall lie below the envelope defined by:

$$32\text{-}25 \log_{10} (\text{Theta}) \text{ dBi } 1° <= \text{Theta} <= 48°$$

$$-10 \text{ dBi } 48° < \text{Theta} <= 180°$$

where Theta and dBi are defined above. For the purposes of this section, the envelope may be exceeded by no more than 10% of the sidelobes provided no individual sidelobe exceeds the gain envelope given above by more than 6 dB. The region of the main reflector spillover energy is to be interpreted as a single lobe and shall not exceed the envelope by more than 6 dB.

(b) The off-axis cross-polarization gain of any antenna to be employed in transmission from an earth station to a space station in the domestic fixed-satellite service shall be defined by:

$$19\text{-}25 \log_{10} (\text{Theta}) \text{ dBi } 1.8° < \text{Theta} <= 7°$$

$$-2 \text{ dBi } 7° < \text{Theta} <= 9.2°$$

(c) Earth station antennas licensed for reception of radio transmissions from a space station in the fixed-satellite service are protected from radio interference caused by other space stations only to the degree to which harmful interference would not be expected to be caused to an earth station employing an antenna conforming to the referenced patterns defined in paragraphs (a) and (b) of this section, and protected from radio interference caused by terrestrial radio transmitters identified by the frequency coordination process only to the degree to which harmful interference would not be expected to be caused to an earth station conforming to the reference pattern defined in paragraph (a)(2) of this section.

(d) The patterns specified in paragraphs (a) and (b) of this section shall apply to all new earth station antennas initially authorized after February 15, 1985 and shall apply to all earth station antennas after March 11, 1994.

(e) The operations of any earth station with an antenna not conforming to the standards of paragraphs (a) and (b) of this section shall impose no limitations upon the operation, location or design of any terrestrial station, any

other earth station, or any space station beyond those limitations that would be expected to be imposed by an earth station employing an antenna conforming to the reference patterns defined in paragraphs (a) and (b) of this section.

(f) An earth station with an antenna not conforming to the standards of paragraphs (a) and (b) of this section will be routinely authorized after February 15, 1985 upon a finding by the Commission that unacceptable levels of interference will not be caused under conditions of uniform 2° orbital spacings. An earth station antenna initially authorized on or before Feburary 15, 1985 will be authorized by the Commission to continue to operate as long as such operations are found not to cause any unacceptable levels of adjacent satellite interference. In either case, the Commission will impose appropriate terms and conditions in its authorization of such facilities and operations.

(g) The antenna performance standards of small antennas operating in the 12/14 GHz band with diameters as small as 1.2 meters starts at 1.25° instead of 1° as stipulated in paragraph (a) of this section.

(h)(1) The gain of any antennas to be employed in transmission from a gateway earth station antenna operating in the frequency bands 10.7–11.7 GHz, 12.75–13.15 GHz, 13.2125–13.25 GHz, 13.8–14.0 GHz, and 14.4–14.5 GHz and communicating with NGSO FSS satellites shall lie below the envelope defined as follows:

$29 - 25\log_{10}(\theta)$ dBi − 10 dBi

$1^B \leq \theta \leq 36^B$

$36^B \leq \theta \leq 180^B$

Where: θ is the angle in degrees from the axis of the main lobe, and dBi refers to dB relative to an isotropic radiator.

(2) For the purposes of this section, the peak gain of an individual sidelobe may not exceed the envelope defined in paragraph (h)(1) of this section.

[48 FR 40255, Sept. 6, 1983, as amended at 50 FR 2675, Jan. 18, 1985; 50 FR 39004, Sept. 26, 1985; 58 FR 13420, Mar. 11, 1993; 66 FR 10630, Feb. 16, 2001]

§ 25.210 Technical requirements for space stations in the Fixed-Satellite Service.

(a) All space stations in the Fixed-Satellite Service used for domestic service in the 4/6 GHz frequency band shall:

(1) Use orthogonal linear polarization with one of the planes defined by the equatorial plane;

(2) Be designed so that the polarization sense of uplink transmissions is opposite to that of downlink transmissions on the same transponder; and

(3) Shall be capable of switching polarization sense upon ground command.

(b) All space stations in the Fixed-Satellite Service in the 20/30 GHz band shall use either orthogonal linear or orthogonal circular polarization. Those space stations utilizing orthogonal linear polarization shall also comply with paragraph (a) of this section.

(c) All space stations in the Fixed-Satellite Service shall have a minimum capability to change transponder saturation flux densities by ground command in 4 dB steps over a range of 12 dB.

(d) All space stations in the Fixed Satellite Service in the 20/30 GHz band shall employ state-of-the-art full frequency reuse either through the use of orthogonal polarizations within the same beam and/or through the use of spatially independent beams.

(e) [Reserved]

(f) All space stations in the Fixed Satellite Service in the 3600–3700 MHz, 3700–4200 MHz, 5091–5250 MHz, 5825–5925 MHz, 5925–6425 MHz, 6425–6525 MHz, 6525–6700 MHz, 6700–7025 MHz, 10.7–10.95 GHz, 10.95–11.2 GHz, 11.2–11.45 GHz, 11.45–11.7 GHz, 11.7–12.2 GHz, 12.2–12.7 GHz, 12.75–13.15 GHz, 13.15–13.2125 GHz, 13.2125–13.25 GHz, 13.75–14.0 GHz, 14.0–14.5 GHz and 15.43–15.63 GHz bands shall employ state-of-the-art full frequency reuse either through the use of orthogonal polarizations within the same beam and/or the use of spatially independent beams.

(g)–(h) [Reserved]

(i) Space station antennas in the Fixed-Satellite Service must be designed to provide a cross-polarization isolation such that the ratio of the on axis co-polar gain to the cross-polar