Before the
Federal Communications Commission
Washington, D.C. 20554

2000 Biennial Regulatory Review --	)	
Streamlining and Other Revisions of	)	
Part 25 of the Commission's Rules	)	
Governing the Licensing of, and	)	IB Docket No. 00-248
Spectrum Usage by, Satellite Network	)	
Earth Stations and Space Stations	)	

SIXTH REPORT AND ORDER AND THIRD FURTHER NOTICE OF PROPOSED RULEMAKING

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By the Commission:

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I. INTRODUCTION

1. This *Sixth Report and Order and Third Further Notice of Proposed Rulemaking* represents the next step in our continuing examination of our rules governing satellite space station and earth station licensing. In the notice portion, we propose revisions to Part 25 of the Commission's rules[1] that should give earth station operators in the fixed-satellite service more flexibility in implementing state-of-the-art

[1] 47 C.F.R. Part 25.

earth stations. Specifically, we propose off-axis equivalent isotropically radiated power (EIRP)[2] envelopes for earth stations in the Fixed Satellite Service (FSS) in the conventional C-band and Ku-band.[3] Using these envelopes as criteria for licensing should allow us to license more earth station applications routinely, expediting the provision of satellite services to consumers and enhancing the types of services available, without increasing the likelihood of harmful interference to adjacent satellite operators or to terrestrial wireless operators. In the *Sixth Report and Order* portion of this document, we address two issues which are intertwined with the issues raised in this *Third Further Notice*, relating to earth station antenna gain pattern rules and VSAT networks. We stay the effectiveness of the antenna gain pattern rule changes pending our consideration of the off-axis EIRP envelope proposal in this *Third Further Notice*.

II. BACKGROUND

A. Two-Degree Spacing Framework

2. The Communications Act mandates that transmitting radiocommunication facilities must be licensed before they can operate.[4] The rules governing transmit-only and transmit/receive earth stations are contained in Part 25 of the Commission's rules.[5] The rules are intended primarily to ensure that satellite networks of space stations and earth stations can operate with a minimum of interference with respect to each other and with respect to other telecommunications services. Earth stations provide a critical link between satellites and terrestrial networks, and satellite networks depend on the Commission's earth station licensing rules to maintain an operating environment with a minimum of interference to other users operating in the band.[6]

3. As the satellite industry developed in the 1980s, the Commission instituted a 2° orbital spacing policy to maximize the number of in-orbit satellites operating in either the C-band or the Ku-band.[7] Previously, satellites had been operating 3º to 4º apart. Under the 2° orbital spacing framework, the Commission assigns adjacent in-orbit satellites to orbit locations 2° apart in longitude. This framework also established technical rules to govern earth stations communicating with these satellites, to ensure that

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[2] Equivalent Isotropically Radiated Power (EIRP) is the product of the gain of the antenna in a given direction relative to an isotropic antenna and the power supplied to that antenna. 47 C.F.R. § 2.1.

[3] For purposes of this Order, the conventional C-band is the 3700-4200 MHz and 5925-6425 MHz bands. The conventional Ku-band is the 11.7-12.2 GHz and 14.0-14.5 GHz bands.

[4] 47 U.S.C. § 301.

[5] 47 C.F.R. Part 25.

[6] 2000 Biennial Regulatory Review -- Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, *Notice of Proposed Rulemaking*, IB Docket No. 00-248, 15 FCC Rcd 25128, 25130 (para. 3) (2000) (*Notice*).

[7] *Notice*, 15 FCC Rcd at 25132 (para. 7), *citing* Licensing of Space Stations in the Domestic Fixed-Satellite Service and Related Revisions of Part 25 of the Rules and Regulations, *Report and Order*, CC Docket No. 81-704, FCC 83-184, 54 Rad. Reg. 2d 577 (released Aug. 16, 1983); *summary printed in* Licensing Space Stations in the Domestic Fixed-Satellite Service, 48 F.R. 40233 (Sept. 6, 1983) (*Two Degree Spacing Order*). *See also* Licensing of Space Stations in the Domestic Fixed-Satellite Service and Related Revisions of Part 25 of the Rules and Regulations, *Report and Order*, CC Docket No. 81-704, 99 FCC 2d 737 (1985) (*Two Degree Spacing Reconsideration Order*).

their operations do not cause unacceptable interference to adjacent satellite systems. Primarily, earth station technical requirements consist of minimum antenna diameter and maximum power level limits.

4. Antenna diameter is important because it affects the antenna gain. The antenna gain is the ratio of the power required at the input of a loss-free reference antenna to the power supplied to the input of a given antenna to produce, in a given direction, the same field strength or the same power flux-density at the same distance. When not specified otherwise, the gain refers to the direction of maximum radiation.[8] In other words, gain refers to an antenna's ability to collect, concentrate, and direct energy in a particular fashion, *i.e.*, a beam.[9] Many antennas are shaped like parabolas, or like large, curved bowls. The "axis," or boresight, is the line running through the center of the bowl and perpendicular to the plane of the edge of the bowl.[10] The boresight should extend directly into the antenna on the satellite with which the earth station is communicating. The majority of the energy is transmitted along the boresight in what is called the main beam of the antenna. The "off-axis" angle is the angle formed by the axis and any other line running through the center of the bowl.[11] The energy transmitted from an antenna forms "ripples," alternately increasing and decreasing in magnitude as the off-axis angle increases.[12] These ripples are called "side lobes."[13]

5. The antenna gain at various off-axis angles provides a measure of the interference potential of that earth station to other in-orbit satellites. For example, the antenna gain in the vicinity of 2° off-axis provides a measure of the potential of that earth station to cause interference to satellites located 2° away in orbit from the satellite with which the earth station is communicating. The gain of any earth station antenna must fall within the limits defined by equations in the Commission's rules. In other words, the main lobes and side lobes of an antenna must be less than the limits specified in those equations.[14] Because decreasing the antenna diameter produces wider main beams and larger side lobes, the antenna gain pattern envelope effectively creates a minimum earth station antenna diameter because at some point the main beam will become wide enough to cause unacceptable interference to adjacent satellites.[15]

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[8] *Notice*, 15 FCC Rcd at 25133 (para. 9), *citing* 47 C.F.R. § 2.1.

[9] *Notice*, 15 FCC Rcd at 25133 (para. 9).

[10] *Notice*, 15 FCC Rcd at 25133 (para. 9). This is true for center-fed antennas. However, since any portion of the bowl will effectively reflect the energy from the feed in the direction of the boresight, "offset fed antennas" can be constructed where the boresight is not necessarily perpendicular to the plane of the antenna's edge.

[11] *Notice*, 15 FCC Rcd at 25133 (para. 9).

[12] *Notice*, 15 FCC Rcd at 25133 (para. 9). Examples of these ripples can be seen in the antenna gain pattern diagrams in Appendix A of the *Notice*. *Notice*, 15 FCC Rcd at 25162-73 (App. A).

[13] *Notice*, 15 FCC Rcd at 25133 (para. 9).

[14] *Notice*, 15 FCC Rcd at 25133 (para. 10), *citing* 47 C.F.R. § 25.209.

[15] *Notice*, 15 FCC Rcd at 25133 (para. 11), *citing Two Degree Spacing Order*, 54 Rad. Reg. 2d at 605 (para. 93).

B. Current Earth Station Licensing Procedures

6. Currently, we "routinely" license C-band and Ku-band earth station facilities that meet the 2° orbital spacing technical requirements set forth in Part 25 of the Commission's rules.[16] In other words, if the earth station meets certain antenna diameter and power level restrictions,[17] we grant the earth station application without conducting a further technical review to verify that the earth station will not cause unacceptable interference into other satellite systems.[18]

7. The Commission began this proceeding in 2000 by inviting commenters to suggest revisions to the requirements for routine earth station processing, and by proposing a streamlined procedure for non-routine earth station applications.[19] In the *Fifth Report and Order* in this proceeding,[20] adopted concurrently with this *Sixth Report and Order and Third Further Notice*, the Commission establishes streamlined procedures for earth station applications that do not meet the revised routine processing standards. Those procedures are based on extensive comments filed in response to the *Notice* and a later 2002 *Further Notice* in this proceeding.[21] However, the *Fifth Report and Order* did not revise the basic framework of the Part 25 earth station licensing regime: Earth station applicants must meet *both* antenna diameter and power level requirements to be eligible for routine processing.

8. In this *Third Further Notice*, we invite comment on replacing the current Part 25 earth station licensing regime with an off-axis EIRP approach. Our goal is to give earth station operators flexibility to decrease their power levels to compensate for smaller earth station antennas, or to use larger earth station antennas to compensate for higher power levels. This increased flexibility should in turn enable the Commission to expedite its issuance of certain earth station applications considered non-routine under the rules adopted in the *Fifth Report and Order*. Moreover, adopting an off-axis EIRP envelope approach for

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[16] *Notice*, 15 FCC Rcd at 25132 (para. 7), *citing* 47 C.F.R. Part 25.

[17] 47 C.F.R. §§ 25.134, 25.209, 25.211, 25.212. *See also* Routine Licensing of Earth Station in the 6 GHz and 14 GHz Bands Using Antennas Less than 9 Meters and 5 Meters in Diameter, respectively, for Both Full Transponder and Narrowband Transmissions, *Declaratory Order*, 2 FCC Rcd 2149 (Com. Car. Bur., 1987), *cited in* 47 C.F.R. § 25.134.

[18] For purposes of this Order, we define "routine" earth stations as those that can be licensed without a case-by-case review. The Commission also grants "non-routine" earth station applications, but those applications require a case-by-case review to ensure that they will not cause harmful interference in a two-degree spacing environment. *Notice*, 15 FCC Rcd at 25132 (para. 7).

[19] *See Notice*, 15 FCC Rcd 25128.

[20] 2000 Biennial Regulatory Review -- Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, *Fifth Report and Order*, IB Docket No. 00-248, FCC 05-63 (adopted Mar. 10, 2005) (*Fifth Report and Order*).

[21] *Fifth Report and Order* at paras. 13-14; 2000 Biennial Regulatory Review -- Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, *Further Notice of Proposed Rulemaking*, IB Docket No. 00-248, 17 FCC Rcd 18585 (2002) (*Further Notice*). *See also Fifth Report and Order* at para. 13 (noting that interested parties were invited to submit additional comments in a status conference in February 2004). The *Notice* and *Further Notice* raised a number of issues in addition to routine earth station processing standards and non-routine earth station procedures. Many of those issues were resolved in earlier Orders in this proceeding. For a complete procedural history, see *Fifth Report and Order* at paras. 13-14.

FSS earth stations in the C-band and Ku-band would make those procedures consistent with the procedures for other earth stations.[22]

9. Before we invite comment on off-axis EIRP issues, we resolve issues deferred from the *Fifth Report and Order* that are interrelated with off-axis EIRP. In Section III.A., we adopt revisions to the earth station antenna gain pattern requirements. In Section III.B., we adopt the proposals from the *Notice* for very small aperture terminal (VSAT) networks using time division multiple access (TDMA), frequency division multiple access (FDMA) and code division multiple access (CDMA) transmission techniques. These two sections constitute the *Sixth Report and Order* in this proceeding.[23] We do not anticipate that these rule changes will increase the likelihood of harmful interference to adjacent satellite operators or to terrestrial wireless operators.

10. Section IV. is the *Third Further Notice* in this proceeding. In Section IV.A., we propose off-axis EIRP envelopes for FSS earth stations in the C-band and Ku-band. In Section IV.B., we invite comment on whether to adopt a procedure for applications for earth stations that exceed the applicable off-axis EIRP envelope. In Section IV.C., we propose new earth station application information requirements needed to implement off-axis EIRP envelopes. In Section IV.D., we seek further comment on issues raised by the use of contention protocols in VSAT networks. Finally, Section IV.E. invites comment on a proposal from the National Radio Astronomy Observatory (NRAO) to revise the rules governing the "Quiet Zone" for radio astronomy.[24]

III. SIXTH REPORT AND ORDER

A. Earth Station Antenna Gain Pattern Envelope

1. Background

11. As noted above, the Commission's current routine earth station standards include minimum antenna sizes. Those sizes are related to the Commission's antenna gain pattern requirements. Currently, the antenna gain pattern envelope begins at the same off-axis angle both within and outside the geostationary-satellite orbit (GSO) orbital plane, 1° off-axis for C-band earth stations and 1.25° off-axis

[22] *See* 47 C.F.R. § 25.138 (Ka-band FSS earth stations); Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands, *Report and Order*, IB Docket No. 02-10, FCC 04-286 (released Jan. 6, 2005) (*ESV Order*). In addition, the Boeing Company (Boeing) filed a petition for rulemaking on July 21, 2003, requesting, among other things, that the Commission adopt off-axis EIRP requirements for aeronautical earth stations. The Commission recently adopted a Notice of Proposed Rulemaking to invite comment on many of Boeing's proposals. Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service, *Notice of Proposed Rulemaking*, IB Docket No. 05-20, FCC 05-14 (released Feb. 9, 2005) (*AMSS NPRM*).

[23] We base our conclusions in this *Sixth Report and Order* on the record developed in response to the *Notice* and *Further Notice*. A complete list of commenters is provided in Appendix A.

[24] *See* 47 C.F.R. § 25.203(f) (current Quiet Zone coordination requirements); *see also*, Amendment of Part 2 of the Commission's Rules and Regulations to Give Interference Protection to Frequencies Utilized for Radio Astronomy, Amendment of Part 3, 4, 5, 6, 7, 9, 10, 11, 16, 20, and 21 of the Commission's Rules and Regulations to Give Interference Protection to Frequencies Utilized for Radio Astronomy, *Report and Order*, Docket No. 11745, FCC 58-1111, 17 Rad. Reg. 1738 (1958) (*Quiet Zone Order*).

for Ku-band earth stations.[25] However, the antenna gain pattern equations allow side lobes outside that GSO orbital plane to be greater than allowed within the GSO orbital plane at off-axis angles less than 9.2°.[26] The smallest antenna we license routinely under our current rules at C-band is 4.5 meters in diameter, while at Ku-band the smallest antenna we routinely license is 1.2 meters in diameter.[27]

12. As the Commission noted in the *Notice* and the *Further Notice*, however, some earth stations with main beams that are too wide to comply with the Commission's rules may still be sufficiently narrow to avoid causing harmful interference to adjacent satellites.[28] In their initial comments, a number of parties proposed starting the antenna gain pattern envelope at a wider off-axis angle, to permit wider main lobes and therefore smaller earth station antennas, or, as an alternative, revising the antenna gain pattern envelope equations in the Commission's rules to allow larger side lobes.[29] In the *Further Notice*, the Commission invited comment on these antenna gain pattern proposals and certain related proposals.[30]

13. Based on the record in response to the *Further Notice*, we change the starting point for the earth station antenna gain pattern envelope within the GSO orbital plane to 1.5° off-axis. We also consider and reject a number of *Further Notice* proposals intended to minimize pointing error, and instead adopt a proposal from commenters to require VSAT remote terminals to cease transmissions if they lose synchronization, in light of the revised earth station antenna gain pattern envelope.[31] Further, we propose to revise the earth station antenna gain pattern envelope outside the GSO orbital plane. Finally, we address backlobe issues.

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[25] *See* 47 C.F.R. § 25.209(g). When viewed from any point on the earth's surface, satellites near each other in the geostationary satellite orbit (GSO) appear to lie approximately in one plane.

[26] *See* 47 C.F.R. §§ 25.209(a)(1), (2).

[27] *Notice*, 15 FCC Rcd at 25133 (para. 11). Although an antenna 1.2 meters in diameter does not fit within the envelope established in Section 25.209(a)(1) between 1º and 1.25° off-axis, the Commission found that this slight failure to meet the Commission's antenna gain requirements does not generally cause unacceptable interference to adjacent satellite operators, and therefore created an exception for 1.2-meter antennas operating in the Ku-band. Specifically, the side lobe envelope for a 1.2-meter antenna operating in the Ku-band was revised to begin at 1.25º off-axis. *See* 47 C.F.R. § 25.209(g); Amendment of Part 25 of the Commission's Rules and Regulations to Reduce Alien Carrier Interference Between Fixed-Satellites at Reduced Orbital Spacings and to Revise Application Processing Procedures for Satellite Communications Services, *Second Report and Order and Further Notice of Proposed Rulemaking*, CC Docket No. 86-496, 8 FCC Rcd 1316, 1322 (paras. 38-39) (1993) (*Ku-band Antenna Gain Pattern Revision Order*).

[28] *Notice*, 15 FCC Rcd at 25132 (para. 7); *Further Notice*, 17 FCC Rcd at 18594-95 (para. 20).

[29] *See*, *e.g.*, Spacenet Comments at 12-14; Hughes Comments at 5-6. *See also* SIA December 10, 2001 *Ex Parte* Statement at 15-21; PanAmSat October 22, 2001 *Ex Parte* Statement.

[30] *Further Notice*, 17 FCC Rcd at 18599-18613 (paras. 29-73). SIA states that its proposals in its 2001 *ex parte* statements regarding the starting point for the Ku-band antenna gain pattern envelope are superceded by its proposals in its Further Comments. SIA Further Reply at 1 n.2. SIA did not explain why it changed its proposal. For a summary of SIA's original antenna gain pattern proposals, we direct the reader to the *Further Notice*, 17 FCC Rcd at 18606-10 (paras. 53-62).

[31] *Further Notice*, 17 FCC Rcd at 18604 (para. 44).

2. Antenna Gain Pattern Within the GSO Orbital Plane

14. *Background*. To be eligible for routine processing, earth station licensees must meet the antenna gain pattern within the GSO orbital plane at every off-axis angle greater than 1° off-axis in the C-band, and 1.25° off-axis in the Ku-band.[32] In pleadings in response to the *Notice*, Hughes and other commenters proposed starting the Ku-band earth station antenna gain pattern envelope at 1.8° off-axis.[33] Hughes argued that, because the satellites serving the United States at that time were spaced at least 1.9 degrees apart, beginning the off-axis angle at 1.8° would not increase the potential for inter-satellite interference.[34]

15. After the comment period had closed on the *Notice*, PanAmSat filed an *ex parte* statement voicing concerns regarding earth station antenna pointing error and smaller-than-routine antennas. Pointing error occurs whenever the boresight of an earth station antenna is not aimed perfectly at the desired satellite.[35] The effect of pointing error on an antenna gain pattern is to shift the entire antenna pattern away from the desired direction, thus potentially increasing the antenna gain toward a neighboring satellite.[36] The impact of this pointing error is generally negligible when larger antennas are employed and the interference path falls into a valley between two sidelobes. However, as the earth station antenna diameter decreases, the width of the main lobe increases. As a result, a given amount of pointing error becomes more likely to cause harmful interference as the diameter of the earth station antenna decreases, because it becomes more likely that the adjacent satellite interference path will fall on the edge of the wider mainlobe.[37]

16. In the *Further Notice*, the Commission determined that Hughes's arguments in favor of increasing the starting point of the Ku-band antenna gain pattern envelope to 1.8° off-axis were persuasive.[38] The Commission also found, however, that PanAmSat's concerns regarding earth station antenna pointing error warrant consideration. Therefore, in the *Further Notice*, the Commission invited commenters to propose a specific off-axis angle at which to start the Ku-band antenna gain pattern envelope. This envelope starting point was to be less than 1.8° off-axis, and the difference between 1.8° and the starting point was to be sufficient to account for the potential for pointing error.[39] In other words, the Commission proposed starting the Ku-band antenna gain pattern envelope at 1.8° - x, where "x" is a constant representing the potential for pointing error, and asked commenters to recommend definitions for

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[32] *Notice*, 15 FCC Rcd at 25133 (paras. 10-11); 47 C.F.R. §§ 25.209(a), (b), (g).

[33] *Further Notice*, 17 FCC Rcd at 18599 (para. 32), *citing* Hughes Comments at 8-11. Spacenet argued that we should start the Ku-band antenna gain pattern envelope at 2.0° off-axis, because satellites spaced 2.0° apart in the GSO orbital plane appear to be 2.2° apart when viewed from the earth's surface. *See Further Notice*, 17 FCC Rcd at 18599-18600 (para. 32). The Commission found that Spacenet's assertion is incorrect for earth stations with angles of elevation less than 35°. *Further Notice*, 17 FCC Rcd at 18640-41 (App. B).

[34] Hughes Comments at 8-11.

[35] *See Further Notice*, 17 FCC Rcd at 18602 (para. 40).

[36] *See Further Notice*, 17 FCC Rcd at 18602 (para. 40).

[37] *Further Notice*, 17 FCC Rcd at 18602 n.92.

[38] *Further Notice*, 17 FCC Rcd at 18602 (para. 39).

[39] *Further Notice*, 17 FCC Rcd at 18602-03 (paras. 40-41).

x. The Commission also asked for methods of estimating pointing error for purposes of revising the antenna gain pattern rules.[40] Although Hughes limited its proposal to the Ku-band, the Commission invited comment on revising the antenna gain pattern envelope for both C-band and Ku-band earth stations.[41]

17. *Pleadings*. As an alternative to the Commission's proposal in the *Further Notice*, SIA suggests an entirely different approach.[42] First, SIA would start the Ku-band antenna gain pattern envelope at 1.5° off-axis.[43] Thus, SIA would treat Ku-band earth stations routinely if they intersect the antenna gain pattern envelope at 1.5° off-axis or less.[44] Second, SIA defines a new term called the "maximum allowable pointing error." To calculate the maximum allowable pointing error, SIA starts with the antenna gain pattern envelope in Section 25.209(a). According to SIA, a typical earth station has a topocentric angle of 2.1° when looking at a satellite that is 2° away from the target satellite. SIA asserts that the antenna gain pattern envelope allows 20.94 dBi at an off-axis angle of 2.1°.[45] SIA takes a number of antenna gain patterns, and shifts them until the edge of the main lobe is equal to 20.94 dBi at an off-axis angle equal to 2.1°. SIA defines the shifted angle as the maximum allowable pointing error.[46] Finally, SIA plots the starting points of antenna gain envelopes, and the maximum allowable pointing error, for four sub-meter antennas.[47] According to SIA, these points approximate the function "y = 2 – x", where y is the maximum allowable pointing error, and x is the starting point of the antenna gain pattern envelope between 1.5° and 1.8° off-axis.[48] SIA states that focusing on the antenna gain pattern envelope

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[40] *Further Notice*, 17 FCC Rcd at 18603 (para. 41).

[41] *Further Notice*, 17 FCC Rcd at 18602 (para. 38).

[42] In the *Fifth Report and Order*, the Commission adopts streamlined procedures for non-routine earth stations. SIA's proposals could also be interpreted as alternatives to the procedures adopted in the *Fifth Report and Order*, in that SIA would create different classes of routine earth stations, and adopt different information requirements for each class. In particular, SIA would classify as routine both earth stations that intersect the antenna gain pattern envelope at an angle less than 1.5° off-axis, and at angles between 1.5° and 1.8° off-axis, provided that applicants that intersect the antenna gain pattern between 1.5° and 1.8° off-axis submit an additional showing, demonstrating the antenna's pointing accuracy. Even though this additional requirement appears analogous to a procedure for non-routine earth stations, SIA makes clear that it classifies earth stations that can make this showing as routine. SIA Further Comments at 24. *See also* SIA February 1, 2005 *Ex Parte* Statement at 1-2 (claiming that its proposals would streamline the earth station procedure by defining more earth stations as "routine.") Accordingly, the Commission decided to treat this SIA proposal as an antenna gain pattern issue here rather than as a non-routine earth station issue in the *Fifth Report and Order*.

[43] We address SIA's proposals for C-band earth stations below.

[44] SIA Further Comments at 8; SIA October 3, 2003 *Ex Parte* Statement at 4, SIA February 1, 2005 *Ex Parte* Statement at Att. In other words, SIA would consider an earth station routine if it started to comply with the antenna gain pattern envelope at an off-axis angle less than 1.5° off-axis, and at all angles greater than 1.5° off-axis.

[45] $29 - 25\log(2.1) = 20.94$. SIA Further Comments at 9-10. The "topocentric" angle is the angle measured from the earth's surface. We discuss the distinction between topocentric and geocentric angles further below.

[46] SIA Further Comments at 9-10.

[47] SIA Further Comments at 10-12.

[48] SIA Further Comments at 11-12.

between 1.5° and 1.8° off-axis is consistent with its proposal in its December 10, 2001 *ex parte* statement but otherwise does not provide any rationale for this proposal.[49] SIA maintains that Ku-band earth station applicants proposing antennas that intersect the antenna gain pattern envelope between 1.5° and 1.8° off-axis should be required to provide a technical showing that the installed antenna will meet the maximum allowable pointing error at the angle at which the antenna's antenna gain pattern intersects the envelope in Section 25.209.[50] SIA recommends basing this technical showing on the earth station antenna cross-polarization null at the antenna boresight direction, because the earth station installation process relies on the cross-polarization null to center the antenna accurately.[51] Alternatively, SIA suggests requiring Ku-band earth station applicants to submit coordination agreements, but not granting ALSAT authority to such earth stations.[52]

18. Originally, SIA asked the Commission to deny applications for earth stations intersecting the antenna gain pattern envelope greater than 1.8° off-axis,[53] but later stated that it would consider such applications for Ku-band antennas if they were coordinated with adjacent satellite operations at 2° away from the target satellite.[54] Aloha Networks criticizes SIA's approach because it does not address antenna movement after installation, due to wind or other factors.[55]

19. Spacenet supports the Commission's proposal to increase the starting angle for the antenna gain pattern envelope, and to consider pointing error in its determinations.[56] Spacenet also argues that SIA's proposals are "unworkable and would undermine the streamlining goals of this proceeding."[57] However, Spacenet contends that the angle between two satellites 2° apart is 2.2° when measured from the earth's surface.[58] Therefore, Spacenet recommends starting the antenna gain pattern envelope at 1.8

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[49] SIA Further Comments at 11, *citing* SIA December 10, 2001 *Ex Parte* Statement.

[50] SIA Further Comments at 12. *See also* SIA March 23, 2004 *Ex Parte* Statement at 2 and Annex; SIA February 1, 2005 *Ex Parte* Statement at Att.

[51] SIA Further Comments at 13.

[52] SIA Further Comments at 13. *See also* SIA October 3, 2003 *Ex Parte* Statement at 5-6; SIA February 1, 2005 *Ex Parte* Statement at Att.

[53] SIA Further Comments at 12.

[54] SIA March 23, 2004 *Ex Parte* Statement at 2.

[55] Aloha Networks May 12, 2004 *Ex Parte* Statement at 2.

[56] Spacenet Further Comments at 7-8.

[57] Spacenet Further Comments at 7.

[58] Spacenet Further Comments at 7 and Att. A at 27. *See also Further Notice*, 17 FCC Rcd at 18599-18600 (para. 32), *citing* Spacenet Comments at 12-14; Spacenet Reply at 7-8. In the *Further Notice*, the Commission explained that the angles between GSO satellites is usually expressed as the "geocentric" angle, *i.e.* measured from the center of the earth, and so is different from the angle as measured from an earth station on the earth's surface, which is defined as the "topocentric" angle. *Further Notice*, 17 FCC Rcd at 18600 n.78. In addition, the Commission found in the *Further Notice* that Spacenet's assumption regarding a 2.2° topocentric angle is not true for most of the United States outside of New England, and so would be likely to result in harmful interference in a 2° spacing environment. *Further Notice*, 17 FCC Rcd at 18640-41 (App. B).

off-axis.[59] According to Spacenet, its proposal allows for a 0.4° pointing error.[60] Spacenet considers this to be a conservative estimate because VSAT licensees can generally achieve a pointing error within 0.4° because of the steep cross-polarization null in most sub-meter antennas.[61] Spacenet further argues that the Commission has licensed several earth stations that meet the antenna gain pattern envelope starting at 1.8° off-axis.[62] According to SIA, pointing accuracy is routinely within 0.5°.[63]

20. Telesat maintains that measuring the angular installation pointing error is not practical.[64] Telesat contends that a pointing error of 0.5 dB is achievable.[65] Telesat argues that the technical information provided in SIA's comments support starting the Ku-band antenna gain pattern envelope at 1.5° off-axis, but recommends that this should be the starting point for the antenna gain pattern envelope in all frequency bands.[66] Telesat argues that there is no reason to have a different starting point for different frequency bands.[67] Spacenet states that the antenna gain pattern envelope for sub-meter Ka-band and Ku-band antennas should begin at the same point.[68]

21. As an alternative to SIA's proposal, Spacenet recommends requiring applicants planning to use antennas that intersect the antenna gain pattern envelope between 1.5° and 1.8° off-axis to certify that they will achieve sufficient pointing accuracy and that their wider main beam will not cause harmful interference. Otherwise, according to Spacenet, SIA's proposal to require coordination is unreasonably burdensome to VSAT operators, and its proposal to require a technical demonstration could require VSAT operators to disclose proprietary data regarding their antenna installation practices.[69]

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[59] Spacenet Further Comments at 8.

[60] Spacenet Further Comments at 8.

[61] Spacenet Further Comments at 8 and Att. A at 26-28.

[62] Spacenet Further Comments at 8-9. Spacenet cites earth stations with the call signs of E000035 and E000132, licensed to Spacenet, and E000166 and E970067, licensed to Hughes. Spacenet Further Comments at 8 n.9.

[63] SIA Further Comments at 7-8.

[64] Telesat Further Reply at 3.

[65] Telesat Further Reply at 3.

[66] Telesat Further Reply at 2.

[67] Telesat Further Reply at 2. Telesat also asserts that, as an alternative to SIA's recommendation, applicants proposing antennas with diameters less than 3.0 meters in the 6 GHz band, 1.2 meters in the 14 GHz band, and 0.6 meters in the 30 GHz band, should either certify that they meet the antenna gain pattern envelope starting at 1.5° off-axis, or demonstrate that their earth stations will not cause unacceptable interference by either providing evidence of coordination agreements or lowering earth station power levels. Telesat Further Reply at 2-3. Because we propose off-axis EIRP envelopes below, we will not address minimum routine antenna size issues at this time.

[68] Spacenet Further Comments at 7 n.7. Spacenet does not address the antenna gain pattern envelope for C-band earth stations.

[69] Spacenet Further Reply at 6-7.

22. *Discussion*. We revise our rules to begin the Ku-band antenna gain pattern envelope at 1.5° off-axis, instead of the current 1.25°. Spacenet and SIA argue that VSAT licensees can generally achieve a pointing error of 0.4° and 0.5°, respectively.[70] While this suggests starting the Ku-band antenna gain pattern envelope at 1.4° or 1.3° off-axis,[71] other commenters support starting the Ku-band antenna gain pattern envelope at 1.5° off-axis.[72] We adopt the 1.5° proposal. We base this decision in part on Spacenet's observation that the Commission has licensed a number of sub-meter earth station antennas in the past, and that those antennas intersect the antenna gain pattern envelope at 1.5° off-axis or less.[73] In addition, we note that the difference between geocentric and topocentric angles provides an additional safeguard against harmful interference to adjacent satellites. Satellites in the GSO orbital plane are generally spaced 2° apart, measured from the center of the earth. This angle is called the geocentric angle. The angle between two satellites viewed from an earth station located on the surface of the Earth is called the topocentric angle. The topocentric angle is always greater than the geocentric angle. At latitudes within the United States, the topocentric angle between two degree separated satellites is usually between 2.1° and 2.2°, depending on the earth station's angle of elevation.[74] Because Commission rules require that space stations be designed to be capable of maintaining orbital longitude within 0.05° of their assigned orbital location,[75] adjacent satellites at closest approach would be separated by at least a 2° topocentric angle. Thus, setting the starting point of the antenna gain pattern envelope at 1.5° off-axis will limit potential interference into 2° separated satellites, and adequately account for potential pointing error of those earth station facilities.

23. SIA and Spacenet would treat Ku-band earth stations routinely if they intersect the antenna gain pattern envelope at 1.5° off-axis or less. This is consistent with the new antenna gain pattern rules we adopt here. However, these commenters would require applicants for Ku-band earth stations that intersect the antenna gain pattern envelope between 1.5° and 1.8° off-axis to provide a specific technical demonstration that its pointing error will be less than SIA's proposed maximum allowable pointing error, or show that it has coordinated its operations.[76] We agree that many of those earth stations warrant

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[70] Spacenet Further Comments at 8 and Att. A at 26-28; SIA Further Comments at 7-8.

[71] In the *Further Notice*, the Commission found that it could start the antenna gain pattern envelope at 1.8° off-axis, but only if there were no possibility of pointing error. *Further Notice*, 17 FCC Rcd at 18602 (para. 39). The Commission explained further, however, that it must take the potential for pointing error into account. Therefore, the Commission invited comment on methods for estimating the average pointing error of an average earth station antenna. The Commission also stated that it would start the antenna gain pattern envelope at "1.8° - x", where "x" represents that average pointing error. *Further Notice*, 17 FCC Rcd at 18602-03 (paras. 40-41). Thus, estimates of pointing error of 0.4° or 0.5° suggest that we start the antenna gain pattern envelope at 1.4° or 1.3° off-axis, respectively.

[72] SIA Further Comments at 11-12; Telesat Further Reply at 2. *See also* PanAmSat November 19, 2004 *Ex Parte* Statement (providing an example of an earth station that intersects the antenna gain pattern at 1.7° off-axis. According to PanAmSat, starting the antenna gain pattern envelope at 1.7° off-axis does not by itself adequately account for the possibility of pointing error.

[73] *See* Spacenet Further Comments at 8-9.

[74] *Further Notice*, 17 FCC Rcd at 18640-41 (App. B).

[75] 47 C.F.R. § 25.210(j).

[76] SIA Further Comments at 13. As noted above, SIA has revised its original proposal. SIA would license earth stations whose antennas intersect the antenna gain pattern envelope at an off-axis angle greater than 1.8° off axis, but only if the earth station operations are coordinated with adjacent satellite operators. SIA March 23, 2004 *Ex Parte* Statement at 2.

licensing, and in the *Fifth Report and Order*, we adopted streamlined procedures to license antennas that intersect the earth station antenna gain pattern envelope at more than 1.5° off-axis.[77] Specifically, we adopted a coordination procedure, and a procedure under which the earth station applicant would reduce its power levels so that the earth station appears like a routine earth station to adjacent satellites. Under the Commission's streamlined approach for non-routine earth station applications, earth station applicants would be allowed to choose either the coordination procedure or the power reduction procedure. In light of the streamlined procedures adopted in the *Fifth Report and Order*, we find that requiring a complex showing of minimum pointing error is unnecessary.

24. Moreover, we conclude that the streamlined non-routine earth station procedures adopted in the *Fifth Report and Order* are preferable to the proposal to prohibit non-routine earth station operators from using the power reduction procedure unless they also coordinate their operations with adjacent satellite operators.[78] The power reduction procedure and the coordination procedure are each in themselves adequate to prevent harmful interference to adjacent satellite operators, and so proposals to require both are unnecessarily burdensome to earth station operators. We have also decided not to require earth station operators not eligible for routine processing to make the technical showing proposed by one of the commenters,[79] and described above. While that proposed technical showing is probably easier for earth station applicants than the technical analysis required before the *Fifth Report and Order*, it would be more difficult than the power reduction procedure that we adopted in that Order that serves the same purpose.[80]

25. We also will start the antenna gain pattern envelope at 1.5° off-axis in the C-band.[81] We agree with Telesat that technical information provided in SIA's comments support starting the antenna gain pattern envelope at 1.5° off-axis, and that there is no basis in the record for adopting a different starting point for different frequency bands.[82] Finally, we will not adopt Telesat's proposed Ka-band

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[77] *See Fifth Report and Order* at paras. 36-52.

[78] SIA Further Comments at 23; SIA March 23, 2004 *Ex Parte* Statement at 3.

[79] *See* SIA Further Comments, App. A at 22-23; SIA March 23, 2004 *Ex Parte* Statement at 2.

[80] SIA claims that its proposals constitute streamlining in part because SIA would classify as routine earth station applications that include its proposed minimum allowable pointing error showing. SIA February 1, 2005 *Ex Parte* Statement at 1-2. We find that merely labeling such applications as "routine" does not affect the burdens associated with SIA's proposed minimum allowable pointing error showing. SIA also proposes to revise Section 25.212 of the Commission's rules to cross-reference its proposed antenna gain pattern revisions discussed here. SIA December 10, 2001 *Ex Parte* Statement, App. at 16-17. Because we have decided not to adopt SIA's antenna gain pattern proposals, we need not reach the issue of SIA's proposal to revise Section 25.212 to be consistent with those antenna gain pattern revisions.

[81] Telesat Further Reply at 2.

[82] Telesat Further Reply at 2. As we noted above, the Commission initially started the antenna gain pattern envelope at 1.0° off-axis for both C-band and Ku-band earth station antennas. In 1993, the Commission revised the Ku-band earth station antenna gain pattern envelope to start at 1.25° off-axis, based on Advisory Committee recommendations. *Ku-band Antenna Gain Pattern Revision Order*, 8 FCC Rcd at 1322 (paras. 38-39). It appears that the Commission did not make similar revisions to the C-band earth station antenna gain pattern envelope simply because the Advisory Committee did not address that issue, not that there was evidence in the record that weighed against starting the C-band earth station antenna gain pattern envelope at 1.25° off-axis. *See also Further Notice*, 17 FCC Rcd at 18597 (para. 25) (proposing revisions to the C-band antenna gain pattern envelope to make it start at the same off-axis angle as the Ku-band earth station antenna gain pattern envelope).

antenna gain pattern starting point, because those earth station antennas are already adequately regulated by the off-axis EIRP envelope in Section 25.138, as SIA notes.

3. Antenna Pointing Accuracy

26. *Background*. Prior to the *Further Notice*, PanAmSat filed an *ex parte* statement advocating a number of measures to prevent or limit earth station antenna pointing error.[83] In particular, PanAmSat asks us to adopt rules requiring the following: (1) a pilot tone, under which the satellite would transmit a signal to the earth station, and the earth station would be precluded from transmitting if the received satellite signal level were to drop below some threshold downlink power level;[84] (2) professional installation for smaller-than-routine C-band and Ku-band antennas;[85] and (3) an automatic transmitter identification system (ATIS) for smaller-than-routine C-band and Ku-band antennas.[86] The Commission invited comment on whether such measures would be necessary, in the event that it revises the antenna gain pattern starting point as we did above.[87]

27. *Discussion*. Spacenet argues that pointing error has not been a serious problem in the past, and there is no reason to assume that it will be in the future. Spacenet also notes that the Commission's rules require licensees to maintain control over their earth station facilities, and prohibit earth stations from transmitting to a satellite unless authorized by the satellite licensee. Spacenet asserts that these rules adequately prevent pointing error.[88] According to Spacenet, PanAmSat based its recommendations on an incorrect assumption regarding VSAT operators' general practices when installing their remote antennas.[89] Spacenet maintains that the proposals in the *Further Notice* amount to micromanaging VSAT operators.[90]

28. As discussed further below, based on commenters' recommendations, we require VSAT system operators to design remote terminals to stop transmission when synchronization fails. We find that, by beginning the antenna gain pattern envelope at 1.5° off-axis, we have accounted for the possibility of pointing error sufficiently that no other pointing error requirements are needed at this time.

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[83] Letter from Joseph A. Godles, Attorney for PanAmSat Corporation, to Magalie Roman Salas, Secretary, FCC (dated Oct. 22, 2001) (PanAmSat October 22, 2001 *Ex Parte* Statement).

[84] *Further Notice*, 17 FCC Rcd at 18604-05 (paras. 46-48).

[85] *Further Notice*, 17 FCC Rcd at 18605 (para. 49).

[86] *Further Notice*, 17 FCC Rcd at 18605-06 (paras. 50-52).

[87] *Further Notice*, 17 FCC Rcd at 18604 (para. 44).

[88] Spacenet Further Comments at 9, *citing* 47 C.F.R. §§ 25.271(c), 25.272(d), 25.273(a), and 25.274.

[89] Spacenet Further Comments at 10. Specifically, Spacenet argues that its remote antennas have a steep null coincident with the co-polarization peak. Spacenet states further that, when it installs its antennas, it measures the remote antenna cross-polarization gain, and minimizes this to align the null with the desired satellite and polarization. Spacenet Further Comments at 10 n.12.

[90] Spacenet Further Comments at 10-14.

Therefore, for the reasons discussed below, we reject all the pointing error proposals in the *Further Notice*.[91]

a. Pilot Tone

29. *Background*. Aloha Networks recommends adopting a pilot tone requirement. According to Aloha Networks, when VSAT network operators deploy remote terminals with small antennas, pointing errors can become more significant.[92] Aloha Networks asserts that this requirement may not be necessary for two-way consumer Internet VSAT systems, however, because many of those systems require the signal to maintain synchronization for internal networking operation, and could achieve the same goal as a pilot tone by configuring the system to cease transmission when synchronization fails.[93] In addition, Aloha Networks argues that VSAT network operators should not be required to monitor their networks if they show that their emissions' power is "much lower" than the off-axis EIRP emissions allowed by Part 25.[94]

30. SIA opposes pilot tones as expensive, an inefficient use of spectrum in VSAT networks, and as duplicative of the outroute signal used to ensure that remote terminals cease transmission when they are improperly pointed.[95] Aloha Networks replies that there should be some automatic monitoring function, regardless of whether that function is based on measuring pilot tones at the remote terminal or measuring transmissions from remote terminals at the hub.[96]

31. *Discussion*. We agree with SIA that a pilot tone requirement for VSAT networks is not necessary. Both Aloha Networks and SIA argue that it is important to design remote terminals to stop transmission when synchronization fails.[97] Because there is a consensus for this alternative to a pilot tone, and the alternative achieves the same purpose but is less burdensome than a pilot tone requirement, we adopt this alternative. Specifically, we require VSAT network operators to employ some reasonable method of their choice to ensure that transmissions stop when synchronization fails.

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[91] *Further Notice*, 17 FCC Rcd at 18603-06 (paras. 42-52). As another alternative to these pointing error proposals, SIA recommends revisions to the interference resolution procedures. SIA Further Comments at 16-17. We address SIA's proposal in Section III.A.3.d. of this Order, below.

[92] Aloha Networks Further Comments at 6-7.

[93] Aloha Networks Further Comments at 7-8.

[94] Aloha Networks November 14, 2003 *Ex Parte* Statement. Later, Aloha Networks explained that it would limit the probability of some number of simultaneous 10-millisecond transmissions to 1.0 percent of the time, and the probability of some number of simultaneous 100-millisecond transmissions to 0.1 percent of the time. Aloha Networks would then limit the EIRP spectral density to 8.6 dBW/4 kHz, minus an amount of power sufficient to ensure that the number of permitted simultaneous transmissions do not cause the EIRP spectral density to exceed 8.6 dBW/4 kHz more than 1.0 percent or 0.1 percent of the time, respectively.

[95] SIA Further Comments at 13-14; SIA Further Reply at 9-10. *See also* Spacenet Further Comments at 10-11; Telesat Further Reply at 3-4.

[96] Aloha Networks Further Reply at 6-7.

[97] Aloha Networks Further Comments at 7-8; SIA Further Comments at 13-14; SIA Further Reply at 9-10.

b. Professional Installation

32. *Background*. Aloha Networks argues that professional installation is expensive, and should be required only for VSAT systems that are unable to monitor the pointing accuracy of their earth stations, and operating at or near certain thresholds that Aloha Networks does not discuss further.[98] SIA and Spacenet argue that it is expensive to require all small antennas to be installed professionally, and that, in cases where we believe professional installation is warranted, we can add a license condition to that effect.[99] Telesat asserts that VSAT operators have strong economic incentives to ensure that antennas are installed properly, and so a professional installation requirement is unnecessary.[100] Aloha Networks recommends adopting a rule specifying when professional installation will be required, rather than adopting a requirement on a case-by-case basis, to provide regulatory certainty, but does not offer an opinion on what that rule should require.[101]

33. *Discussion*. We will not adopt a professional installation requirement at this time. In the past, the Commission has adopted professional installation requirements on a case-by-case basis as a condition on "blanket" earth station licenses covering large numbers of technically identical VSAT terminals. However, none of the commenters have provided an adequate basis to impose a professional installation requirement on all blanket earth station licensees, or on all licensees using antennas that are smaller than a certain size. Moreover, nothing in the record provides a basis for crafting a rule that will properly limit the professional installation to those cases where such a requirement is warranted. Therefore, we will not adopt a generally applicable professional installation requirement, but instead will continue to impose such a requirement as a license condition on a case-by-case basis.[102]

c. Location Identifier System

34. Since 1991, the Commission has required satellite uplink transmissions carrying uplink broadband video information to use an automatic transmitter identification system (ATIS).[103] Under this requirement, parties transmitting video signals to satellites must include information in the transmissions that identify their source.[104] The Commission adopted this requirement in response to an increase of

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[98] Aloha Networks Further Comments at 8-10.

[99] SIA Further Comments at 14-15; SIA Further Reply at 10-11; Spacenet Further Comments at 13-14.

[100] Telesat Further Reply at 4-5.

[101] Aloha Networks Further Reply at 8-9.

[102] We note that the Commission raised issues regarding professional installation requirements in another pending notice of proposed rulemaking. Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields, *Notice of Proposed Rulemaking*, ET Docket No. 03-137, 18 FCC Rcd. 13187 (2003).

[103] *Further Notice*, 17 FCC Rcd at 18605 (para. 50), *citing* An Automatic Transmitter Identification System for Radio Transmitting Equipment, *First Report and Order*, GEN Docket No. 86-337, 5 FCC Rcd 3256 (1990) (*ATIS Order*), 47 C.F.R. § 25.281.

[104] ATIS transmits an encoded subcarrier message including, at minimum, the earth station's call sign, a telephone number providing immediate access to someone capable of resolving interference problems, and a unique ten-digit serial number. *Further Notice*, 17 FCC Rcd at 18605-06 (para. 50), *citing* 47 C.F.R. § 25.281(d)(3).

harmful interference in the satellite industry, including intentional interference.[105] In the *Further Notice*, the Commission invited comment on adopting an ATIS-like system for non-routine earth stations operating in the conventional C-band or Ku-band.[106] SIA argues that it is expensive to require all small antennas use an ATIS-like system, and questions whether it has been effective in identifying sources of interference.[107] We agree that the benefits of this proposed requirement do not justify its expense. Accordingly, we will not adopt an ATIS requirement for small earth station antennas.[108]

d. Obligations of VSAT Operators Using Smaller-than-Routine Antennas

35. *Background*. As an alternative to the Commission's pointing error proposals discussed above, SIA recommends several revisions to the procedures for resolving harmful interference contained in Section 25.274 of the Commission's rules: (1) require Ku-band VSAT licensees using sub-meter antennas to be able to identify the specific terminal at which each digital transmission originates; (2) require victims of interference to specify the time of day, frequency, and other relevant information of the interference events; and (3) place the burden for resolving the interference on the sub-meter licensee.[109] Telesat supports SIA's proposal in principle, but cautions that, in some cases, the problem may be the result of inadequately designed links by the operator affected by the purported interference.[110]

36. *Discussion*. We find that the current procedures enable licensees to resolve most if not all allegations of harmful interference quickly and easily, including allegations involving non-routine earth stations. Therefore, commenters' proposals for additional procedures for resolving harmful interference claims involving non-routine earth stations should not be needed. Furthermore, under the streamlined procedures for non-routine earth stations that we adopted in the *Fifth Report and Order*, non-routine earth station licensees should not be any more likely to cause harmful interference than other earth station licensees. Under the certification procedure, non-routine operations should be coordinated before the application is filed.[111] Under the alternative power reduction procedure, the non-routine earth station's off-axis EIRP is reduced so that its operations do not affect adjacent satellites any differently than a routine earth station.[112] For these reasons, we do not believe that any revisions to the procedures for resolving interference are warranted.

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[105] *Further Notice*, 17 FCC Rcd at 18605 (para. 50), *citing* An Automatic Transmitter Identification System for Radio Transmitting Equipment, *Notice of Proposed Rulemaking and Notice of Inquiry*, GEN Docket No. 86-337, 104 FCC 2d 1256 (1986) (*ATIS Notice*).

[106] *Further Notice*, 17 FCC Rcd at 18606 (para. 51).

[107] SIA Further Comments at 15-16. *See also* Spacenet Further Comments at 11-12.

[108] SIA and Spacenet also claim that the ATIS system was used primarily to prevent "intentional" interference, and that there is no evidence of intentional interference here. SIA Further Comments at 15-16; Spacenet Further Comments at 11-12. SIA and Spacenet are mistaken. At the time the Commission adopted its ATIS requirement, its goal was to reduce all occurrences of interference. In fact, the Commission observed that about 90 percent of the interference events reported in the previous fiscal year was accidental rather than deliberately induced. *See ATIS Order*, 5 FCC Rcd at 3256 (para. 3). Therefore, we place no weight on this part of SIA's and Spacenet's argument.

[109] SIA Further Comments at 16-17.

[110] Telesat Further Reply at 6.

[111] *See Fifth Report and Order* at para. 52.

[112] *See Fifth Report and Order* at para. 42.

4. Antenna Gain Pattern Envelope Outside the GSO Orbital Plane

37. *Background*. When viewed from many points on the earth's surface, satellites near each other in the GSO appear to lie approximately in one plane. The Commission's rules contain different antenna gain pattern requirements within the GSO orbital plane and outside the GSO orbital plane.[113] In pleadings in response to the *Notice*, a number of commenters observed that ITU regulations start the antenna gain pattern envelope at 3° off-axis outside the GSO orbital plane.[114] Accordingly, the Commission proposed starting the antenna gain pattern envelope at 3° off-axis outside the GSO orbital plane for Ku-band earth stations, which operate in bands that are not shared with terrestrial services.[115]

38. *Discussion*. SIA supports this proposal,[116] while none oppose it. We adopt this proposal because it will facilitate the development of more advanced elliptical antennas and should not create any additional interference issues.[117] Therefore, we revise our rules to start the antenna gain pattern envelope at 3° off-axis outside the GSO orbital plane for earth stations operating in the conventional Ku-band. We will incorporate this new requirement into the off-axes EIRP envelopes we propose for Ku-band earth stations below.[118]

5. Backlobe Antenna Gain Patterns

39. *Background*. In response to the *Notice*, Hughes recommended increasing the antenna gain limit for conventional Ku-band antennas from – 10 dBi to 0 dBi for off-axis angles greater than 48°.[119] SIA also recommended revising the "backlobe" gain limit from – 10 dBi to 0 dBi, but only for off-axis angles greater than 85°.[120] SIA would also increase the backlobe gain limit for earth stations operating in parts of the Ka-band that are not shared with terrestrial operations.[121] The Commission invited comment

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[113] *See* 47 C.F.R. §§ 25.209(a)(2) and (b).

[114] *See Further Notice*, 17 FCC Rcd at 18610-11 (paras. 64-65).

[115] *See Further Notice*, 17 FCC Rcd at 18610-11 (para. 65).

[116] SIA Further Comments at 17.

[117] *See Further Notice*, 17 FCC Rcd at 18610 (para. 64).

[118] The Commission limited this proposal to the Ku-band earth station antenna gain pattern envelope. *Further Notice*, 17 FCC Rcd at 18610-11 (para. 65). Therefore, we do not adopt any revisions to the starting point for the C-band earth station antenna gain pattern envelope outside the GSO orbital plane at his time, other than starting the envelope at 1.5° off-axis to be consistent with the C-band earth station antenna gain pattern envelope within the GSO orbital plane. In the *Fifth Report and Order*, we adopted a definition for "equivalent antenna diameter" which will facilitate action on elliptical C-band earth station antennas. *See Fifth Report and Order* at para. 141.

[119] *See Further Notice*, 17 FCC Rcd at 18611 (para. 67), *citing* Hughes Comments at 11.

[120] *See Further Notice*, 17 FCC Rcd at 18611 (para. 66), *citing* SIA November 5, 2001 *Ex Parte* Statement at 12.

[121] *See Further Notice*, 17 FCC Rcd at 18611 (para. 66), *citing* SIA November 5, 2001 *Ex Parte* Statement at 12.

on both proposals in the *Further Notice*.[122] The Commission also invited comment on continuing to allow some fraction of the backlobes to exceed this limit by 3 or 6 dB, as is currently provided for in Sections 25.209(a)(1) and 25.209(a)(2).[123] Finally, the Commission proposed increasing the backlobe limit in the unshared portions of the Ka-band, and keeping the current limit in the 18.58-18.8 GHz and 18.8-19.3 GHz bands only until June 8, 2010, when this band will no longer be shared with terrestrial wireless operations.[124]

40. *Discussion*. In response to the *Further Notice*, SIA advocates increasing the backlobe antenna gain limit from -10 dBi to 0 dBi, but only at off-axis angles greater than 85°, and also recommends continuing to allow these to be exceeded by 3 or 6 dB.[125] Telesat supports relaxing the backlobe limit in the Ku-band, but is concerned that relaxing the backlobe limit in other frequency bands may be premature because it claims that an ITU Working Party is studying this issue.[126]

41. Based in part on SIA's recommendation, we increase the backlobe antenna gain limit from -10 dBi to 0 dBi, but only at off-axis angles greater than 85°, and only for the Ku-band and for parts of the Ka-band that are not shared with other services. This deregulatory action should make it easier for earth station operators to obtain licenses, without weakening our protection against harmful interference for services that share the Ka-band with earth station operators. Although Telesat is correct that ITU-R Working Party 4A is considering backlobe requirements, there is nothing in the record that suggests that relaxing the rules before the ITU completes its study would increase the risk of harmful interference to any other operations. Nevertheless, we will monitor ITU Working Party 4A's progress on this issue. If and when the ITU adopts a Recommendation, we will review our backlobe rules to determine what revisions, if any, would be appropriate. We also adopt our proposal to continue to allow the backlobe antenna gain limit to be exceeded by 3 or 6 dB, as is currently permitted by Sections 25.209(a)(1) and (2).

6. Alternative Antenna Gain Pattern Proposals

a. Background

42. In this *Sixth Report and Order*, we adopt new antenna gain pattern requirements for C-band and Ku-band earth stations. As discussed above, starting the antenna gain pattern envelope at a wider off-axis angle allows earth station operators to have wider main beams, which in turn allows them to use smaller diameter antennas.[127] Currently, the smallest antenna we license routinely at C-band is 4.5 meters in diameter, and at Ku-band, 1.2 meters in diameter.[128]

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122 *Further Notice*, 17 FCC Rcd at 18611 (para. 68).

123 *Further Notice*, 17 FCC Rcd at 18611 (para. 68), *citing* 47 C.F.R. §§ 25.209(a)(1), (2). Section 25.209(a)(1) allows 10 percent of the sidelobes at off-axis angles greater than 7.0° to exceed the equation by up to 3 dB. Section 25.209(a)(2) allows 10 percent of the sidelobes at off-axis angles greater than 1.0° off-axis to exceed the equation by up to 6 dB.

124 *Further Notice*, 17 FCC Rcd at 18612 (para. 69).

125 SIA Further Comments at 17, *citing* ITU-R Working Party 4A, Document 4A/TEMP/280.

126 Telesat Further Reply at 5-6.

127 *See* Section III.A.1.

128 Section III.A.1., *citing Notice*, 15 FCC Rcd at 25133 (para. 11).

43. There were two alternatives to the proposals we adopted above presented in the record. These proposals focus on the antenna gain pattern envelope for C-band earth stations, and also include recommended changes in routine antenna size and, in some cases, a suggestion for lowering the permitted power spectral density into the antenna. For the reasons discussed below, we find that neither of those proposals are preferable to the antenna gain pattern revisions we adopt in this *Sixth Report and Order* above.

b. Onsat Proposal

44. In the *Further Notice*, the Commission invited comment on an alternative approach for decreasing the routine antenna size for C-band earth stations, based on a proposal first raised in a waiver request filed by Onsat Network Communications, Inc. (Onsat).[129] In part, Onsat argued that the Commission should process 3.7-meter C-band earth station antennas routinely, because this would be consistent with beginning the C-band antenna gain pattern envelope at 1.25° off-axis. This, in turn, would make our treatment of C-band earth stations consistent with our treatment of Ku-band earth station antennas, in which we adopted rules in 1993 to start the antenna gain pattern envelope at 1.25° off-axis.[130] We decided to start the antenna gain pattern envelope for both C-band and Ku-band earth station antennas at 1.5° off-axis. Thus, Onsat's proposal for a 1.25° off-axis starting point is superceded by the rules we adopt above, and we need not address Onsat's proposal further.

c. SIA Proposal

45. *Background*. SIA recommends starting the C-band antenna gain pattern envelope at 1.7° off-axis.[131] According to SIA, doing so would support a minimum antenna size of 2.4 meters for routine processing in the C-band, but only if the power density into the antenna flange is limited to -12 dBW/4 kHz, down from -2.7 dBW/4 kHz in the current rules.[132] SIA notes that the Commission granted two earth station licenses meeting these criteria in January 2003.[133] SIA contends that such an earth station would meet the antenna gain pattern envelope in Section 25.209, provided that the pointing error is less

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[129] *Further Notice*, 17 FCC Rcd at 18597-98 (paras. 25-27). *See also* Onsat Petition for Waiver to Permit Routine Licensing of 3.7 Meter Transmit and Receive Stations at C-Band, *Order*, 15 FCC Rcd 24488 (Int'l Bur., 2000) (*Onsat Waiver Order*). By "C-band," we mean the 3700-4200 MHz and 5925-6425 MHz frequency bands. The Bureau denied Onsat's waiver petition. This was in part because, even though Onsat requested routine treatment for its 3.7-meter antennas, Onsat planned to operate with a specific satellite. The Bureau found that it could not treat Onsat's antennas routinely because Onsat did not provide sufficient data to show that its antenna would not cause harmful interference if it were granted an ALSAT earth station license. *Onsat Waiver Order*, 15 FCC Rcd at 24491-92 (para. 8). Also, Onsat failed to show that it faced any unusual hardship that would warrant a waiver of the Commission's rules. *Onsat Waiver Order*, 15 FCC Rcd at 24491-92 (para. 8). *See also* 47 C.F.R. § 1.3 (petitioners seeking a waiver must show "good cause"); WAIT Radio v. FCC, 418 F.2d 1153, 1159 (D.C. Cir. 1969) (*WAIT Radio*).

[130] *Onsat Waiver Order*, 15 FCC Rcd at 24489 (para. 4); *Ku-band Antenna Gain Pattern Revision Order*, 8 FCC Rcd at 1322 (paras. 38-39).

[131] SIA Further Comments, App. B at 9; SIA October 3, 2003 *Ex Parte* Statement at 3. *See also* SIA February 1, 2005 *Ex Parte* Statement at Att.

[132] SIA Further Comments at 4-6; SIA October 3, 2003 *Ex Parte* Statement at 2-3.

[133] SIA Further Comments at 5, *citing* Public Notice Report No. SES-00466.

than 0.5 degrees.[134] SIA further recommends requiring 2.4-meter C-band applicants to certify that their pointing error will be 0.5° or less.[135] SIA also emphasizes that the protection from interference should meet current Section 25.209(c).[136]

46. GCI recommends reducing the minimum antenna size for routinely processed C-band earth stations from 4.5 meters to 3.6 meters. GCI claims that it has used such antennas extensively in its network without causing harmful interference.[137] Alternatively, GCI suggests a minimum antenna size of 2.7 meters for routinely processed C-band earth stations, provided that the earth station operator reduce its power by 3 dB. This is because, according to GCI, the first sidelobe of a 2.7-meter antenna is 3 dB above the antenna gain pattern envelope in Section 25.209.[138] SIA asserts that GCI based its analysis on an inferior earth station antenna.[139]

47. *Discussion*. SIA asserts that 2.4 meter antennas in the C-band meet the antenna gain pattern envelope starting at "1.6° or 1.7°" off-axis.[140] If an earth station meets the antenna gain pattern envelope starting at 1.7° off-axis, and there is 0.5° of pointing error, the earth station could exceed the antenna gain pattern envelope at 2.2° off-axis. This would create a substantial risk that a satellite as close as 2° away from the earth station's target satellite could experience harmful interference.[141] Further, as GCI points out, the first sidelobe of some 2.7-meter earth station antennas in the C-band are double that allowed by the antenna gain pattern envelope in Section 25.209.[142] Whether this is an "inferior antenna," as SIA responds, is irrelevant. Treating an earth station application routinely means that the Commission has determined that it is not necessary to conduct a case-specific review of that application. Thus, to extend routine treatment to earth station antennas less than 2.7 meters in diameter, we would need to be certain that such earth stations would be compatible with a 2° orbital spacing environment if they meet all other applicable technical requirements in Part 25, without conducting a case-by-case analysis of each earth station application.[143] Because some earth station antennas less than 2.7 meters in diameter are not 2°

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134 SIA Further Comments at 6.

135 SIA Further Comments at 6.

136 SIA Further Comments at 7.

137 GCI Further Comments at 1-3.

138 GCI Further Comments at 3-4.

139 SIA Further Reply at 4-5.

140 SIA Further Comments at 7.

141 As explained in this Order above and in the *Further Notice*, a topocentric angle (measured from the earth's surface) of 2.2° is equivalent to a geocentric angle (measured from the center of the earth) of 2.0°, in cases where the earth station has an angle of elevation of 35°. *Further Notice*, 17 FCC Rcd at 18640-41 (App. B). The geocentric angle would be greater than 2.0° for earth stations with an angle of elevation less than 35°. ALSAT earth stations are by definition authorized to communicate in the conventional C-band and Ku-band with all U.S.-licensed satellites, and all non- U.S.-licensed satellites on the Permitted List. Thus, practically all ALSAT earth stations are authorized to communicate with one or more satellites that would require them to operate at angles of elevation less than 35°. As of October 1, 2004, 6579 of 6789 C-band earth stations, or about 97 percent, are ALSAT earth stations. Thus, SIA's proposal is inconsistent with the Commission's 2° spacing policy.

142 GCI Further Comments at 3-4.

143 *Notice*, 15 FCC Rcd at 25132 (para. 7); *Further Notice*, 17 FCC Rcd at 18587-88 (para. 3).

orbital spacing compatible, however, we need to conduct a case-by-case analysis of such earth station applications. Thus, we cannot treat sub-2.7-meter earth stations in the C-band routinely.[144]

48. Furthermore, SIA's proposal to begin the C-band antenna gain pattern envelope at 1.7° off-axis is also coupled with a substantial reduction in allowed power spectral density. On balance, we find this proposal more restrictive than the proposal we adopt herein, to begin the C-band antenna gain pattern envelope at 1.5° off-axis. Finally, we will not adopt GCI's proposals because GCI did not provide any technical study to support either of its proposals.

7. Antenna Gain Pattern Conclusions

49. We have decided to begin the antenna gain pattern envelope at 1.5° off-axis within the GSO orbital arc for C-band and Ku-band earth stations, and 3.0° off-axis outside the GSO orbital arc for Ku-band earth stations. We have also decided that the provisions proposed in the *Further Notice* to help reduce pointing error are not needed, but instead we require VSAT network operators to design their networks to stop transmissions when synchronization fails. Finally, we adopt SIA's and Hughes's proposals to increase the Commission's backlobe requirements to 0 dBi for off-axis angles greater than 85°.

50. We will stay the effective date of these requirements, except for the new synchronization requirement, pending resolution of the off-axis EIRP issues discussed below. In the event that we adopt off-axis EIRP envelopes for FSS earth stations, we will base those envelopes on the revised antenna gain pattern requirements we adopt here. In the *Third Further Notice* below, we invite parties to propose new minimum routine antenna sizes based on these revised antenna gain pattern requirements, in the event that we decide not to adopt off-axis EIRP envelopes for FSS earth stations. Such proposals should be supported by adequate technical analyses.

B. VSAT Multiple Access Technique Requirements

1. Background

51. The Commission's rules permit parties to obtain a license for networks comprised of a number of technically identical small aperture antenna earth stations. These networks are referred to as very small aperture terminal (VSAT) networks. VSATs are generally comprised of a hub station transmitting to a satellite, which then transmits the signal to multiple technically identical remote small aperture antennas.[145] The remote antennas can also transmit to the satellite, which then retransmits the signal to the hub station. VSAT networks were originally permitted only in the Ku-band,[146] which is allocated on a primary basis to the fixed satellite service, but have since been allowed in the C-band and Ka-band under certain conditions.[147]

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[144] Moreover, as explained further below, we have decided not to consider changes to the minimum routine earth station antenna size while we are addressing the off-axis EIRP proposals below.

[145] *Notice*, 15 FCC Rcd at 25145 (para. 50), *citing* Routine Licensing of Large Networks of Small Antenna Earth Stations Operating in the 12/14 GHz Frequency Bands, 51 Fed. Reg. 15067 (Apr. 22, 1986) (*1986 VSAT Order*); 47 C.F.R. § 25.134(a).

[146] *See Notice,* 15 FCC Rcd at 25145 (para. 50).

[147] *See* FWCC Request for Declaratory Ruling on Partial-Band Licensing of Earth Stations in the Fixed-Satellite Service that Share Terrestrial Spectrum, *First Report and Order*, IB Docket No. 00-203, 16 FCC Rcd

52. In the *Notice* and the *Further Notice*, the Commission explained that VSAT networks employ a number of techniques to prevent or limit interference among the multiple remote earth stations, and to prevent them from interfering with other adjacent satellite networks.[148] The original VSAT systems used a Single Channel Per Carrier (SCPC) channelization approach, in which each remote earth station was assigned its own block of spectrum. Subsequently, VSAT system operators developed techniques that enabled some remote earth stations to share frequencies. One sharing technique is known as time division multiple access (TDMA). The TDMA technique assigns each remote earth station a different time to transmit and receive information. Another technique is frequency division multiple access (FDMA). The FDMA technique assigns different frequencies or frequency band segments to different remote earth stations. The SCPC described above is an example of the FDMA technique. A third approach, code division multiple access (CDMA), prevents interference between remote earth stations by assigning a different orthogonal digital code to different earth stations.[149] We refer to TDMA, FDMA, and CDMA as "reservation" protocols, because these techniques "reserve" a time, frequency, or code for each transmission in a VSAT network.

53. Before the Commission adopted the *Notice*, Spacenet, Inc. (Spacenet) filed a petition for declaratory ruling that the Commission allow VSAT networks to use an access technique called "slotted Aloha."[150] In this technique, the hub earth station synchronizes all remote VSAT stations so that they transmit only in discrete time slots, like TDMA, typically tens of milliseconds in duration.[151] Unlike TDMA, however, Aloha transmissions are unsynchronized, and two or more remote earth stations are permitted to transmit simultaneously. Aloha relies on the statistical characteristics of unrelated transmissions from different earth stations to limit the number and duration of simultaneous transmissions. Because simultaneous transmissions can occur in VSAT networks using the Aloha random access technique, we refer to Aloha as a "contention" protocol to distinguish it from the more traditional reservation protocols discussed above.

11511 (2001) (*FWCC/Onsat First Report and Order*). Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use, *Report and Order*, IB Docket No. 98-172, 15 FCC Rcd 13430 (2000). We refer to C-band VSAT networks as "CSATs."

148 *Notice,* 15 FCC Rcd at 25145 (para. 50).

149 For a more detailed discussion of each of these techniques, *see Notice,* 15 FCC Rcd at 25206-10 (App. E).

150 Petition of Spacenet, Inc. for a Declaratory Ruling that Section 25.134 of the Commission's Rules Permits VSAT Remote Stations in the Fixed Satellite Service to Use Network Access Schemes that Allow Statistically Infrequent Overlapping Transmissions of Short Duration, or, in the Alternative, For Rulemaking to Amend that Section, *Order*, 15 FCC Rcd 23712 (Int'l Bur., 2000) (*Spacenet Order*). With the "unslotted Aloha" technique, remote earth stations in the VSAT network can transmit randomly at any time, meaning that the transmissions are not synchronized in time or duration. The "unslotted Aloha" technique is distinguishable from the "slotted Aloha" technique, in which remote earth stations transmit in specific time slots, which means that the transmissions are synchronized but not coordinated. In other words, the remote earth stations transmitting in a given time slot can transmit regardless of whether there are other earth stations transmitting in the same time slot. G. Maral, *VSAT Networks* at 144-45 (John Wiley and Sons, ed. 1995); *Spacenet Order,* 15 FCC Rcd at 23713 (para. 3).

151 *Spacenet Order,* 15 FCC Rcd at 23713 (para. 3).

54. When two or more remote earth stations using a contention protocol transmit simultaneously using the maximum allowed EIRP density per carrier, those transmissions can "collide." The resulting power level caused by these collisions at a received satellite exceeds the level specified in the Commission's rules during the time period of simultaneous transmission, although for no more than tens of milliseconds.[152] According to Spacenet, however, because the collisions in its VSAT network are infrequent and of short duration, they do not cause unacceptable interference to adjacent satellite systems.[153] In its petition for declaratory ruling, Spacenet requested that the Bureau conclude that the Commission's rules allow the slotted Aloha technique as a general matter, provided that the VSAT network operator limits the amount of traffic on its network sufficiently to reduce the probability of a collision to an acceptable level.[154]

55. The International Bureau (Bureau) denied Spacenet's petition for declaratory ruling because the power level resulting from transmission signal collisions can exceed the routine processing limits specified in Sections 25.134(a) of the Commission's rules.[155] The Bureau concluded, however, that Spacenet had shown that use of the slotted Aloha method is not currently causing unacceptable interference to other satellite systems. Accordingly, the Bureau granted Spacenet and other VSAT operators that employ various multiple access techniques a waiver of Section 25.134 for purposes of continuing to use existing multiple access methods while this rulemaking is pending.[156] The Bureau noted that its waiver does not prejudge our actions in this rulemaking proceeding.[157]

56. In the *Notice*, the Commission developed its own proposed VSAT multiple access rules. The Commission did not consider the statistical equation that Spacenet recommended in its petition for declaratory ruling, because the Commission believed that a more general and simplified approach addressing several random access techniques would better facilitate the licensing of earth stations than a rule limited to the slotted Aloha technique.[158] Specifically, the Commission invited comment on revising Section 25.134(a) to include the following language: "The maximum transmitter power spectral density of a digital modulated carrier into any GSO FSS earth station antenna shall not exceed -14.0 - 10log(N) dB(W/4 kHz)."[159] Section 25.134(a) would also specify different values of "N" for systems using FDMA, TDMA, CDMA, or Aloha multiple access techniques. Specifically, the Commission proposed setting N equal to 1 for FDMA and TDMA systems, and setting N equal to "the likely maximum number of co-

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[152] Spacenet maintained that the duration of an inbound transmission is typically between 15 and 50 milliseconds. *Spacenet Order,* 15 FCC Rcd at 23713 (para. 3), *citing* Spacenet Petition at 8.

[153] *See Spacenet Order,* 15 FCC Rcd at 23713 (para. 3).

[154] *See Spacenet Order,* 15 FCC Rcd at 23714-15 (para. 7).

[155] 47 C.F.R. § 25.134(a). *See also Spacenet Order,* 15 FCC Rcd at 23715 (para. 9).

[156] *Spacenet Order,* 15 FCC Rcd at 23716 (para.12).

[157] *Spacenet Order,* 15 FCC Rcd at 23716 (para.12).

[158] *Notice,* 15 FCC Rcd at 25146-47 (para. 54).

[159] *See Notice,* 15 FCC Rcd at 25147 (para. 55).

frequency simultaneously transmitting earth stations in the same satellite receiving beam" for CDMA systems. For VSAT networks using Aloha, N would be 2.[160]

57. Under those proposed rules, VSAT networks using TDMA and FDMA would not be required to change their transmit power levels, while VSAT networks using CDMA would have to lower their power by some amount, based on the likely maximum number of earth stations transmitting simultaneously in the same frequency band in the same victim satellite beam.[161] The Commission noted that those proposals are substantially similar to the rules it adopted in the *18 GHz Order* for blanket licensing of Ka-band systems using FDMA, TDMA, and CDMA.[162] In addition, VSAT system operators using the Aloha technique would be required to reduce the power spectral density emitted by as much as 3 dB from the existing limits specified in Section 25.134(a).[163]

58. In the *Further Notice*, the Commission found that the rule proposed in the *Notice* was too restrictive with respect to contention protocols.[164] Accordingly, the Commission revised its proposals and invited further comment.[165] At that time, the Commission also observed that there was some support for the FDMA, TDMA, and CDMA rules proposed in the *Notice*.[166] Nevertheless, the Commission invited comment on whether the separate FDMA, TDMA, and CDMA rules would be necessary in the event that it adopted the contention protocol rule proposed in the *Further Notice*.[167]

59. In the event that the Commission decided to adopt a separate CDMA rule, the Commission also sought comment on whether replacing the phrase "likely maximum number" with "maximum number" would make the rule clearer.[168] Moreover, in the *Further Notice*, the Commission noted that it had adopted rules subsequent to the *Notice* allowing licensees to operate to conventional C-band VSAT systems, also known as CSAT systems.[169] Therefore, the Commission proposed applying the same rules to CSAT networks as it applies to Ku-band VSAT networks.[170]

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160 *See Notice*, 15 FCC Rcd at 25207-10 (App. E). In the *Third Further Notice* below, we discuss the proposal in the *Notice* for VSAT systems using a combination of reservation and contention protocols. *See* Section IV.D.5.a.

161 *Notice*, 15 FCC Rcd at 25208 (App. E).

162 *Notice,* 15 FCC Rcd at 25147 (para. 55), *citing* 47 C.F.R. § 25.138(a), *adopted in 18 GHz Order*, 15 FCC Rcd at 13492.

163 *Notice,* 15 FCC Rcd at 25147 (paras. 55-56), 25206-10 (App. E).

164 *Further Notice*, 17 FCC Rcd at 18618 (para. 85).

165 *Further Notice*, 17 FCC Rcd at 18620-21 (paras. 92-95).

166 *Further Notice*, 17 FCC Rcd at 18622 (para. 98).

167 *Further Notice*, 17 FCC Rcd at 18622 (para. 99).

168 *Further Notice*, 17 FCC Rcd at 18622 (para. 100).

169 *Further Notice*, 17 FCC Rcd at 18623 (para. 101); *citing* FWCC Request for Declaratory Ruling on Partial-Band Licensing of Earth Stations in the Fixed Satellite Service That Share Terrestrial Spectrum, *First Report and Order*, IB Docket No. 00-203, 16 FCC Rcd 11511 (2001) (*FWCC/Onsat First Report and Order*).

170 *Further Notice*, 17 FCC Rcd at 18624 (para. 104).

60. Below, in the *Third Further Notice*, we conclude that the record does not adequately support adoption of the contention protocol rules proposed in the *Further Notice*. Accordingly, we further refine our contention protocol proposals below and invite additional comment. Moreover, our decision below to reject the Commission's prior contention protocol proposal moots the issue raised in the *Further Notice* regarding whether rules for TDMA, FDMA, and CDMA would be needed if we had adopted that contention protocol proposal. For that reason, we adopt rules for VSAT systems using FDMA, TDMA, or CDMA protocols in this section of the *Sixth Report and Order*.

2. Reservation Protocols

61. *Background*. SIA supports the Commission's proposal to apply existing power level requirements for VSAT systems using TDMA and FDMA.[171] SIA also argues that, if the Commission adopts rules for contention protocols, it should also adopt rules for CDMA VSAT systems.[172] In this case, SIA supports revising the proposed CDMA rule as the Commission did in the *Further Notice*, by replacing the phrase "likely maximum number" with "maximum number" for the definition of "N" for Ku-band VSAT systems.[173] SIA further supports applying the Ku-band VSAT CDMA rules to C-band VSAT networks using CDMA.[174] No other party commented on these issues.

62. *Discussion*. SIA's recommendations are consistent with the rules proposed in the *Further Notice*. Moreover, applying those rules to CSAT networks using CDMA would make the treatment of those VSAT networks consistent with the Commission's treatment of VSAT systems in other bands using CDMA. Accordingly, we adopt the proposal in the *Further Notice* to apply the Ku-band VSAT CDMA rules to CSAT networks using CDMA.

63. Accordingly, for C-band and Ku-band VSAT systems using TDMA or FDMA, we will define "N" as 1, so that there is no change to the power limits in Section 25.134 applicable to those VSAT systems.[175] We will also define "N" for VSAT systems using CDMA in the C-band and Ku-band, as we proposed in the *Further Notice*, as the maximum number of earth stations transmitting simultaneously in the same frequency band segment in the same satellite beam.[176] We will also base the off-axis EIRP envelopes we propose below on these requirements.[177]

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171 SIA Further Comments at 20.

172 SIA Further Comments at 21.

173 SIA Further Comments at 20. *See also* SIA March 23, 2004 *Ex Parte* Statement at 3.

174 SIA Further Comments at 20.

175 As we explained above, the power limit we adopt here for reservation protocols is - 14 – 10log(N) dBW/4 kHz. When N equals 1, 10log(N) equals 0. Therefore, by setting N equal to 1 for TDMA and FDMA, we ensure that the new rule does not require VSAT network operators using TDMA or FDMA to make any adjustment.

176 *Further Notice*, 17 FCC Rcd at 18622 (para. 100). *See also Notice*, 15 FCC Rcd at 25208 (App. E).

177 We recently adopted off-axis EIRP envelopes for ESVs. *ESV Order* at para. 55. In the rule revisions we adopt today, we incorporate the provisions for FDMA, TDMA, and CDMA that we adopt here into those ESV requirements.

3. Single Channel per Carrier

64. *Background*. To the extent that TDMA, FDMA, and CDMA techniques can be applied to narrowband single channel per carrier (SCPC) transmissions, it is reasonable to apply the same requirements to SCPC transmissions as we apply to VSAT transmissions. In the *Notice* and the *Further Notice*, the Commission proposed applying the multiple access technique rules it proposed for VSAT networks to single channel per carrier (SCPC) transmissions subject to Section 25.212.[178] Section 25.212 of the Commission's rules establishes power spectral density limits for narrowband transmissions, including SCPC transmissions in the C-band.[179]

65. *Discussion*. SIA supports the Commission's proposal to apply the same requirements to SCPC earth stations and VSAT networks.[180] No one commenting on this proposal opposes it. Accordingly, we adopt this proposal. In this *Sixth Report and Order* above, we note that the Commission has adopted provisions similar to this proposal for Ka-band VSAT networks.[181] In addition, we decided to apply these requirements to Ku-band VSAT networks, CSAT networks, and ESV networks in this *Sixth Report and Order* above.[182] There is no basis in the record in this proceeding to apply different requirements to SCPC earth stations.

4. Grandfathering Multiple Access Requirements

66. *Background*. In response to the *Notice*, some commenters recommended grandfathering existing VSAT systems in the event that we adopt any new VSAT rules. The Commission did not propose any grandfathering proposals.[183] Instead, the Commission proposed transition mechanisms. The Commission did not focus on transition mechanisms for VSAT networks using TDMA and FDMA, because the rule changes proposed for those networks do not require any change in operations. For CDMA, the Commission proposed that any rules take effect 90 days after publication in the Federal Register rather than 30 days.[184] For contention protocols, the Commission invited comment on a three-part transition.[185] We discuss this proposal further in the *Third Further Notice* below.

67. *Discussion*. SIA and Spacenet oppose the Commission's proposed transition.[186] In addition, SIA recommends grandfathering of all existing VSAT systems that would otherwise be subject to new

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178 *Notice*, 15 FCC Rcd at 25187 (App. B, proposed Section 25.212(d)(2)), *Further Notice*, 17 FCC Rcd at 18624 (para. 106).

179 *See* 47 C.F.R. § 25.212(d).

180 SIA Further Comments at 20.

181 *See* Section III.B.1. above, *citing* 47 C.F.R. § 25.138(a) (Ka-band VSAT networks).

182 *See* Section III.B.2. above. *See also ESV Order* at para. 55, n.154.

183 *Further Notice*, 17 FCC Rcd at 18625 (paras. 107-08).

184 *Further Notice*, 17 FCC Rcd at 18625 (para. 107).

185 *Further Notice*, 17 FCC Rcd at 18625 (para. 108).

186 SIA Further Comments at 21; Spacenet Further Reply, Att. B at 4.

requirements.[187] SIA argues that it would be very costly to retrofit all remote terminals in all VSAT networks.[188] SIA further recommends that the cut-off date for determining whether the new rules apply to any particular earth station should be based on the date the application was filed, rather than the date the license was granted.[189]

68. We share SIA's concerns regarding the costs of retrofitting VSAT networks. We did not intend to require VSAT operators to retrofit all their remote terminals to comply with our rules. Accordingly, we will not adopt the transition mechanism proposed in the *Further Notice*. Instead, we adopt SIA's proposal in part. All VSAT systems licensed on or before the release date of this Order may be required to continue complying with the current rules. We will not base grandfathering on the date VSAT applications are filed. Instead, all VSAT systems licensed after this *Sixth Report and Order* is adopted will be required to comply with those rules at the time they take effect, 30 days after publication in the Federal Register. The concern that VSAT systems licensed in the future might be required to conduct costly retrofitting is misplaced, because the earth stations in those VSAT systems can be designed to comply with these requirements at the time they are deployed.[190]

5. Information Requirements

69. The Commission did not specifically invite comment on what information we should require applicants to provide, if any, to enable us to verify that they will comply with the TDMA, FDMA, and CDMA rules we adopt here. We note, however, that Ka-band VSAT network operators are required to comply with TDMA, FDMA, and CDMA rules substantially similar to the rules we adopt for Ku-band and C-band VSAT network operators here.[191] Ka-band VSAT network operators must provide a showing only if they exceed the power levels prescribed by the Ka-band TDMA, FDMA, and CDMA rules.[192] We adopt a similar requirement here. In cases where Ku-band and C-band VSAT network applicants plan to comply with the TDMA, FDMA, and CDMA rules, they do not need to provide any information in their applications other than that required elsewhere in Part 25. If those applicants plan to exceed those power levels, they must file their applications pursuant to the procedure for non-routine earth station applications adopted in the *Fifth Report and Order*.[193]

6. VSAT Multiple Access Conclusions

70. As noted above, the *Sixth Report and Order* in this proceeding is made up of Section III. above. In this *Sixth Report and Order*, we adopt rules to govern Ku-band and C-band VSAT systems using TDMA, FDMA, and CDMA, as proposed in the *Notice*. The new rules do not require any adjustment to the power levels of VSAT systems using TDMA or FDMA, but require a power decrease

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187 SIA Further Comments at 20-21. *See also* SIA March 23, 2004 *Ex Parte* Statement at 3.

188 SIA Further Comments at 20-21.

189 SIA Further Comments at 21.

190 Applicants are permitted to commence construction of earth stations prior to licensing, but any such construction is at the applicant's own risk. *See* 47 C.F.R. § 25.113.

191 *See* 47 C.F.R. § 25.138(a).

192 *See* 47 C.F.R. § 25.138(b).

193 *See* 47 C.F.R. § 25.220.

for VSAT systems using CDMA. The required power decrease is based on the number of simultaneously transmitting earth stations. These requirements will also apply to SCPC transmissions. VSAT networks licensed before the adoption date of this Order will not be subject to the new rules.

71. Section IV of this document below constitutes the *Third Further Notice* in this proceeding. In Section IV.D. of the *Third Further Notice* below, we refine the proposal in the *Further Notice* regarding contention protocols, and request additional comment.

IV. THIRD FURTHER NOTICE

A. Off-Axis EIRP

1. Review of Earth Station Applications Based on Off-Axis EIRP Envelope

72. *Background*. To review, the Commission currently limits routine treatment of earth station applications to those which meet *both* power level and antenna diameter requirements. We consider non-routine earth station applications on a case-by-case basis. In response to the *Notice*, a number of parties suggested an alternative: adopting a new envelope establishing off-axis EIRP spectral density limits.[194] Hughes recommends treating Ku-band VSAT systems routinely if their transmissions comply with the off-axis EIRP density envelope based on the antenna gain pattern envelope in Section 25.209 and the - 14 dBW/4 kHz input power density limit in Section 25.134, but starting at 1.8° off-axis.[195] Hughes argues that its approach combines power density and antenna gain pattern requirements into one rule. Hughes argues further that this would give earth station license applicants more flexibility because they would be able to adjust their power to compensate for their antenna gain pattern, and vice versa.[196] Hughes recommends one EIRP spectral density envelope for co-polarized beams and another for cross-polarized beams.[197]

73. Spacenet recommends adopting an off-axis EIRP density envelope for all transmissions, including those outside the GSO orbital plane.[198] Spacenet proposes starting the off-axis EIRP density envelope within the GSO orbital plane at 2° off-axis, however.[199] Furthermore, Spacenet proposes an off-axis EIRP density envelope outside of the GSO orbital plane, but instead of subtracting 14 dBW/4 kHz from the antenna gain pattern envelope in Section 25.209 as Hughes recommends, Spacenet proposes to add 3 dBW/4 kHz.[200]

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194 Hughes Comments at 11-12; PanAmSat Comments at 4; Spacenet Reply at 7-8.

195 Hughes Comments at 11-12.

196 Hughes Comments at 12.

197 Hughes Comments at 11-12.

198 Spacenet Reply at 7-8 and n.7.

199 Spacenet Reply at 7.

200 Spacenet Reply at 8 n.7. Spacenet also asserts that the power reduction proposal adopted in the *Fifth Report and Order* would be unnecessary if the Commission were to adopt an off-axis EIRP density envelope. Spacenet Reply at 9. We note that the streamlined procedures for non-routine earth stations are intended to remain in place only while we consider off-axis EIRP envelopes.

74. *Discussion*. For several reasons, we invite comment on adopting an off-axis EIRP density envelope for FSS earth stations, as Hughes and Spacenet recommend. First, we agree with Hughes that earth station license applicants should have the flexibility to reduce their power levels to compensate for a higher antenna gain pattern.[201] In fact, the Commission reached the same conclusion in the *Fifth Report and Order*,[202] in which it adopted a streamlined procedure for earth station applicants proposing to use antennas with non-routine antenna gain patterns if the applicant proposes to reduce its transmit power levels dB for dB to compensate for the amount that its antenna gain pattern exceeds the Section 25.209 standard envelope.[203] In addition, this off-axis EIRP approach might enable us to streamline our review of earth station antennas often used for broadband Internet access, even more than the streamlined earth station procedures adopted in the *Fifth Report and Order*.[204] While we expect those procedures to expedite our case-by-case review of non-routine earth station applications, case-by-base review could never be as fast as routine processing. Thus, an off-axis EIRP approach should expedite our review of all earth station applications not now considered routine, but should not increase the potential for interference to other satellite networks. Moreover, an off-axis EIRP approach for conventional C-band and Ku-band FSS earth stations would be consistent with our treatment of Ka-band FSS earth stations, and earth stations on vessels (ESVs).[205]

75. Accordingly, we seek comment on the following issue: Should the Commission review FSS earth station applications in the C-band and Ku-band solely on the basis of an off-axis EIRP envelope? In the event that we decide not to adopt off-axis EIRP envelopes for FSS earth stations, we invite parties to propose new minimum routine antenna sizes based on the revised antenna gain pattern requirements adopted in the *Sixth Report and Order* above.[206] Such proposals should be supported by adequate technical analyses. In particular, we request parties to explain the method or methods they use to replicate or estimate the antenna gain patterns generated by earth station antennas of different sizes.

76. We do not request comment on Spacenet's specific proposal for an off-axis EIRP envelope. Spacenet's recommendation would allow earth station operators to increase their EIRP spectral density by 17 dB above the levels now allowed. Spacenet provides no justification for allowing power increases that high. In addition, we noted above in the *Sixth Report and Order* that starting the antenna gain pattern envelope at an off-axis angle greater than 1.5° off-axis could unreasonably increase the risk of harmful

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201 Hughes Comments at 12.

202 *Fifth Report and Order* at para. 12.

203 *Fifth Report and Order* at paras. 41-42. Further, we agree with Spacenet that an off-axis EIRP spectral density envelope is a close substitute for the power reduction proposal adopted in the *Fifth Report and Order*. Spacenet Reply at 9. Accordingly, to facilitate implementation of the dB-for-dB power reduction procedure, we will incorporate an off-axis EIRP spectral density envelope into that procedure. In other words, earth station applicants seeking to use the streamlined power reduction procedure for non-routine earth station applications adopted in the *Fifth Report and Order* may submit a technical showing demonstrating that they meet the off-axis EIRP spectral density envelope implied by the antenna gain pattern envelope in Section 25.209 and the relevant power level rules. The "relevant" power level rules are in Section 25.134 for VSAT systems, and in Section 25.212 for other earth stations.

204 *Fifth Report and Order* at para. 12.

205 *See* 47 C.F.R § 25.138 (Ka-band earth stations); *ESV Order* at para. 55.

206 *See* Section III.A.

interference.[207] For the same reason, adopting an off-axis EIRP envelope that starts at 2° off-axis could also unreasonably increase the risk of harmful interference. Therefore, instead of Spacenet's proposed off-axis EIRP envelope, we seek comment on the off-axis EIRP envelopes discussed below.

2. Development of Off-Axis EIRP Envelope for FSS Earth Stations

a. EIRP Density Into the Antenna

77. Generally, an off-axis EIRP envelope is determined by the applicable earth station antenna gain pattern envelope and the allowed EIRP density into the antenna.[208] In Appendix C of this *Third Further Notice*, we list several proposed off-axis EIRP envelopes, designed for digital and analog transmissions from both C-band and Ku-band earth stations. Those envelopes are based on the earth station antenna gain pattern envelope rules and power requirements in Part 25 as revised in the *Sixth Report and Order* we adopt above concurrently with this *Notice*.

78. We propose adopting the off-axis EIRP envelopes in Appendix C, based on the rules adopted in the *Fifth Report and Order*, unless one or more commenters provide a convincing reason to adopt different envelopes. While we are confident that the off-axis EIRP envelopes in Appendix C provide a reasonable balance between technical requirements that are not overly restrictive for earth station applicants, yet sufficient to limit unacceptable interference, we invite parties to propose envelopes that may provide a better balance. We developed an extensive record on the antenna gain pattern envelope rule revisions we adopt in the *Sixth Report and Order* above,[209] and with one exception, discussed below, we do not intend to reopen those issues in this *Third Further Notice*. Accordingly, we will start the off-axis EIRP envelope at 1.5° off-axis within the GSO orbital plane, for both C-band and Ku-band earth stations. We will start the Ku-band off-axis EIRP envelope at 3° off-axis outside the GSO orbital plane. Below, we invite comment on starting the C-band off-axis EIRP envelope at 3° off-axis outside the GSO orbital plane.

79. Parties proposing alternative EIRP envelopes should support their proposals with a technical study showing that any proposed increase in EIRP will not result in unacceptable interference to other adjacent satellite or terrestrial operations. One possible format for such a study is the Adjacent Satellite Interference Analysis (ASIA).[210] We also request that parties conducting such studies provide their data and discuss their calculations in sufficient detail that the Commission and interested parties can review their studies. The Commission will place much more weight on a study whose methods and data are fully discussed in the record than a study in which the results are presented only in summary fashion.

80. In summary, we invite commenters to provide detailed technical studies that are adequate to support adoption of off-axis EIRP envelopes other than those listed in Appendix C to this *Third Further Notice*. In the event that no such studies are submitted, or that the studies that are submitted are not discussed in sufficient detail, we proposed adopting the antenna gain pattern envelopes in Appendix C.

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[207] *See* Section III.A.2.

[208] *See ESV Order* at paras. 55, 99.

[209] *See* Section III.A. above.

[210] The Commission used ASIA to develop the downlink EIRP density requirements adopted in the *Fifth Report and Order*. *See Fifth Report and Order* at App. C.

b. Elliptical C-band Earth Stations

81. In the *Sixth Report and Order* in this proceeding, we adopt rule revisions to begin the Ku-band antenna gain pattern envelope outside the GSO orbital plane at 3.0° off-axis.[211] This will allow us to license more Ku-band elliptical earth station antennas on a routine basis than was possible in the past.[212] The Commission limited its proposed rule revisions to Ku-band antennas to be consistent with new ITU requirements, and because the Ku-band is not shared with terrestrial wireless operations.[213]

82. Here, we propose starting the C-band antenna gain pattern envelope outside the GSO orbital plane, and the comparable C-band off-axis EIRP envelope, at 3.0° off-axis, rather than 1.5° off-axis.[214] Adopting this proposal would enable the Commission to adopt routine processing standards for elliptical C-band earth station antennas. This, in turn, could reduce the costs of installing and operating C-band earth stations, particularly in the case of temporary-fixed earth stations. Also, we invite comment on whether the existing coordination procedure in Section 25.203(c) of the Commission's rules is adequate for coordinating elliptical C-band earth stations with terrestrial wireless operations. Finally, we invite comment on whether we should increase the minimum angle of elevation for elliptical C-band earth stations above the 5° minimum currently in the rules,[215] to further reduce the possibility of harmful interference to terrestrial wireless operations, in the event that the Commission adopts the rule proposed here.

83. The C-band off-axis EIRP envelopes in Appendix C assume that we will adopt the proposal to start the envelope outside the GSO orbital plane at 3° off-axis. In the event that the record in this proceeding persuades us to reject this proposal, we tentatively conclude that we should retain the current rule and start the C-band off-axis EIRP envelope outside the GSO orbital plane at 1.5° off-axis.

c. Analog Video Services

84. Historically, Part 25 has not provided EIRP density limits for analog video transmissions, in either the C-band or the Ku-band. The revisions to Part 25 adopted in the *Fifth Report and Order* do not change this. Instead, Section 25.211(d) of the Commission's rules provides EIRP limits rather than EIRP density limits for analog video transmissions.[216] Accordingly, we invite comment on several possible approaches for addressing analog video transmissions under off-axis EIRP requirements.

85. One option is to apply the off-axis EIRP limits proposed in Appendix C for other narrowband analog transmissions to analog video transmissions. A potential concern with this option is that analog video transmissions are generally the most likely to cause interference into other licensed operations.[217] It

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211 Section III.A.4. above.

212 Section III.A.4. above.

213 *Further Notice*, 17 FCC Rcd at 18610-11 (para. 65).

214 Section III.A. above.

215 47 C.F.R. § 25.205.

216 The analog video EIRP limits are 26.5 dBW in the C-band, and 27 dBW in the Ku-band. 47 C.F.R. § 25.211(d).

217 *See Further Notice*, 17 FCC Rcd at 18635 (para. 136), *citing Ku-band Antenna Gain Pattern Revision Order*, 8 FCC Rcd at 1320 (para. 24). *See also* Section III.A. above.

is not clear whether the analog off-axis EIRP envelopes proposed in Appendix C are sufficient to protect other licensed transmissions. Therefore, we request commenters supporting this approach to provide an appropriate technical study. Such studies should be sufficiently detailed to enable the Commission and other interested parties to review the calculations and to comment on the results. We noted above that a complete ASIA study can fit this description, but we will consider studies in other formats.

86. Another option is to develop new off-axis EIRP envelopes applicable to C-band and Ku-band analog video transmissions. Such requirements should be sufficient to prevent analog video transmissions from causing harmful interference to other licensed operations, but still allow analog video licensees to complete their links with the satellites with which they are communicating. Again, parties supporting this approach should provide a sufficiently detailed technical study to support their recommendation.

87. Finally, the Commission could prohibit analog video transmissions, the alternative we propose here. The Commission has observed in the past that analog video transmissions are more susceptible to harmful interference from other transmissions and more likely to cause harmful interference to other transmissions.[218] Thus, a prohibition on analog video transmissions may result in more efficient spectrum use. We also note that analog satellite transmissions are declining.[219] Thus, technical rules for analog video may no longer be necessary.

88. Accordingly, we propose prohibiting analog video transmissions, unless one or more commenters makes a convincing case that analog video transmissions are necessary, and a detailed technical study that provides a sufficient basis for an analog video off-axis EIRP envelope. We also propose a transition period of no more than one year. Commenters supporting continued use of analog video transmissions should specify the extent to which they currently use analog technology to transmit video, and the extent to which they plan to continue doing so. They should also indicate whether and to what extent converting from analog to digital transmissions will cause them any particular hardship, in terms of equipment costs or for any other reason, and how those costs compare to any benefits that might result from such a transition. Some of those benefits may accrue only to the licensee, in the form of higher quality or faster transmissions. Other benefits may accrue to society as a whole, in terms of more efficient spectrum use. Parties supporting prohibition of analog video services should explain whether a transition period for analog video is necessary or desirable, and if so, how long.

d. Other Services

89. As we noted above, the Commission has already adopted an off-axis EIRP envelope for FSS earth stations in the Ka-band.[220] In addition, the Commission has adopted off-axis EIRP requirements for

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[218] *Further Notice*, 17 FCC Rcd at 18635 (para. 136); *Ku-band Antenna Gain Pattern Revision Order*, 8 FCC Rcd at 1320 (para. 24); *Fifth Report and Order* at para. 106.

[219] In the *Fifth Report and Order*, the Commission found that there were no licensed analog emissions in the Ku-band as of October 1, 2004. *Fifth Report and Order* at para. 94. However, in 2001 the Commission staff reviewed the licenses in the earth station database, and found that only 183 of 4884 licensed emissions in the 14.0-14.5 GHz band (approximately 3.7 percent) and 52 of 2134 licensed emissions in the 11.7-12.2 GHz band (approximately 2.4 percent) were for analog audio operations.

[220] 47 C.F.R. § 25.138.

Ku-band FSS earth stations communicating with NGSO satellites.[221] We do not propose any revisions to those requirements at this time.[222]

90. We also find that we do not need to propose any off-axis EIRP requirements for mobile satellite service (MSS) earth stations. Those earth stations generally have little or no directivity towards a satellite, so that the earth station must track the satellite in all directions, such as hand-held satellite telephones. As a result, satellite systems communicating with MSS earth stations generally cannot operate on the same spectrum without causing unacceptable interference to each other.[223] Because the Commission usually does not license more than one MSS system to communicate in any given frequency band,[224] there is no need to limit the off-axis EIRP transmissions of MSS earth stations.

3. Protection from Interference

91. The off-axis EIRP rules proposed above are designed to ensure that earth stations do not cause harmful interference into adjacent satellite space stations with their Earth-to-space transmissions. In this section, we invite comment on developing rules to protect earth station licensees from receiving harmful interference from space-to-Earth transmissions. We request comment on whether earth stations should be protected from harmful radio interference and if so, by what procedures.[225] As a starting point for discussion, we note that under current rules, earth station antennas licensed in the fixed satellite service are protected from harmful interference caused by other space stations (not their communications target) so long as the antenna conforms to the antenna gain reference patterns specified in our rules.[226] Limiting off-axis EIRP, by itself, does not protect the earth station from receiving interference. Accordingly, if we replace the current antenna gain reference pattern requirements in Section 25.209 with an off-axis EIRP envelope for earth stations in the fixed satellite service, we invite comment on whether to adopt a standard comparable to Section 25.209(c) to protect earth stations from harmful interference? Should our decision to revise the antenna gain reference pattern to start at 1.5° from the main lobe affect an earth station operator's ability to claim protection from harmful interference?

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221 *See* 47 C.F.R. § 25.146(a)(2).

222 As we noted above, the Commission has also adopted off-axis EIRP envelopes for ESVs. We conclude that no revisions to the ESV off-axis EIRP envelopes are warranted, other than the incorporation of rules to reflect TDMA, FDMA, and CDMA multiple access techniques, as discussed above.

223 *See* Amendment of the Commission's Space Station Licensing Rules and Policies, *First Report and Order*, IB Docket No. 02-34, 18 FCC Rcd 10760, 10773 (para. 21) (2003) (*Space Station Reform First Report and Order*).

224 There are some exceptions to this general rule. For example, the Commission has issued MSS licenses in the Little LEO bands and the Big LEO bands that require sharing with other MSS operators in certain bands. Nevertheless, we do not propose imposing off-axis EIRP requirements on these licensees at this time. This is because the sharing requirements and other technical rules in both the Little LEO and Big LEO bands are based on a careful balancing of competing interests, and imposing new off-axis EIRP requirements at this time might adversely affect those balances.

225 We also note that, in the *Interference Temperature Inquiry*, the Commission is exploring spectrum management based on cumulative effects of all undesired radio frequency energy. Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands, *Notice of Inquiry and Notice of Proposed Rulemaking*, ET Docket No. 03-237, 18 FCC Rcd 25309 (2003) (*Interference Temperature Inquiry*).

226 47 C.F.R. § 25.209(c).

92. We also seek general comment on procedures employed to resolve complaints of harmful interference. The general approach of the Commission's rules in these situations has been to require earth station operators to make every effort to identify the source of harmful interference and to coordinate in good faith with the source in order to resolve the interference. In dealing with instances of harmful interference, our current rules allow satellite system control center operators to contact the Commission's Columbia, Maryland Operations Center for assistance in resolving problems.[227] These procedures have generally been effective in minimizing Commission involvement in problems while at the same time allowing neutral expert advice from the Commission. We propose continuing to apply these procedures if and when earth station antennas are licensed based on an off-axis EIRP envelope. We invite any proposals that address the potential for inter-system harmful interference, and any proposed procedures for resolving instances of harmful interference.

B. Procedure for Earth Station Applications that Exceed the Off-Axis EIRP Envelope

93. Much of the Commission's Part 25 satellite rules is premised on the expectation that adjacent satellite system operators will maintain a cooperative working relationship with each other, which should allow them to accommodate a given earth station's non-conforming operations if those operations do not result in unacceptable interference. Based on that expectation, in the *Fifth Report and Order*, the Commission codified a procedure for applicants proposing smaller-than-routine earth stations by requiring those applicants to certify that their target satellite operator has coordinated the non-conforming operations with adjacent satellite operators. Likewise, applicants proposing earth stations with higher-than-routine power levels must certify that their target satellite has coordinated with adjacent satellites. In either case, the certified coordination would have taken place prior to the filing of the earth station application. In addition, as a backstop mechanism, the Commission adopted a post-filing coordination procedure consisting of 30 days of comment after public notice of the earth station application, together with an ensuing 60-day period to resolve any coordination issues raised in public comment.[228]

94. If, based on the record filed in response to this *Third Further Notice*, the Commission decides to adopt an off-axis EIRP envelope, we request parties to discuss whether any additional procedures are necessary to ensure that earth stations exceeding the applicable off-axis EIRP envelope have been fully coordinated, or whether any such earth station application should be immediately denied because it is likely to cause harmful interference to adjacent satellites or to terrestrial wireless operations. In the *Sixth Report and Order* above, we relaxed the starting point for the antenna gain pattern envelope. Also, in this *Third Further Notice*, we invite comment on relaxing the transmitting EIRP levels. As a result of these rules, it may not be possible to exceed the off-axis EIRP envelope without causing harmful interference to adjacent satellites. We invite comment on limiting these procedures to frequency bands that are not shared with terrestrial wireless operations, and requiring earth stations operating in shared bands to comply with any off-axis EIRP envelopes that we adopt in this proceeding.

95. In the event that we adopt a procedure for applications for earth station that exceed the applicable off-axis EIRP envelope, we seek comment on what procedural coordination requirements the Commission should employ to evaluate non-routine earth station applications. We seek comment on whether the procedures adopted in the *Fifth Report and Order* -- consisting of certification of pre-filing coordination and post-filing coordination based on public comment and additional inter-operator discussion -- are appropriate for use in evaluating applications that exceed specified off-axis EIRP

[227] 47 C.F.R. § 25.274.

[228] *Fifth Report and Order* at paras. 70-79.

envelopes. We also request comment on any additional or alternative procedures that might be used in evaluating earth station applications that exceed the applicable off-axis EIRP envelope.

96. In addition, we seek comment on whether to employ case-by-case evaluation of adjacent satellite coordination for other purposes. Much of the streamlining and efficiency expected from the rules adopted in the *Fifth Report and Order*, as well as the further flexibility we propose in this further notice of proposed rulemaking, relies on advance coordination among satellite operators before an earth station application is filed. We request comment on whether our expectation of good-faith coordination among satellite system operators is well-founded and is self-policing. If not, should the Commission consider any additional regulation designed to enforce good-faith coordination? For example, if an earth station operator repeatedly filed applications without the required advance certification from affected adjacent satellite operators, or repeatedly omitted affected operators, should that operator be penalized in some fashion? One possibility would be to declare the offending earth station operator ineligible for streamlined evaluation of its applications, requiring that each and every future application be evaluated on a case-by-case basis. If such a penalty were to be employed to enforce the coordination rules, how many faults, and what type of fault, would trigger the penalty? How long should the penalty be enforced before the Commission could again reasonably rely on the earth station operator's certifications in support of streamlined grant? We invite comment on whether this or any other type of enforcement may be necessary to ensure reliable operation of earth station evaluation based on off-axis EIRP envelopes.

C. Information Requirements

97. In the event that the Commission adopts an off-axis EIRP approach for earth stations, we invite comment on revising the Commission's information requirements associated with earth station applications. We see two general options. Under one option, the Commission could require earth station applicants to submit a graph showing that their proposed earth station will meet the applicable off-axis EIRP envelope. Under the other option, earth station applicants would be required to provide a table showing the EIRP of the antenna at various specific off-axis angles.

98. We propose requiring a table. It would be easier to develop a computer program to automate the review of tabular information than it would to develop a program for reviewing graphs. Developing such a computer program is necessary to enable the Commission to act on earth station applications under off-axis EIRP requirements as quickly as it acts on routine earth station applications under the current rules. We believe that the public interest would suffer if adopting off-axis EIRP requirements were to result in a slower earth station procedure.

99. We also propose delegating authority to the International Bureau (Bureau) to develop and implement new electronic application forms and revisions to the International Bureau Filing System (IBFS) necessitated by an off-axis EIRP requirement for earth stations. This delegation includes determining when the revised IBFS program should be initiated, establishing any procedures needed to assure security, and addressing any other issues that may arise regarding the electronic filing of earth station applications under an off-axis EIRP approach. In addition, we propose directing the Bureau to consult with industry and potential users informally and share plans for its proposed implementation, and to make any necessary adjustments in light of industry and user views, as appropriate. Finally, we propose directing the Bureau to implement this program in coordination with other electronic filing initiatives within the agency, as appropriate. We note that the delegation of authority we propose here is comparable to delegations the Commission has adopted in the past to implement electronic filing requirements.[229]

[229] Implementation of Section 402(b)(1)(A) of the Telecommunications Act of 1996, *Report and Order*, CC Docket No. 96-187, 12 FCC Rcd 2170, 2195 (para. 48) (1997).

D. Contention Protocol Proposals

1. Background

100. Earlier, we revised our rules for VSAT networks and SCPC earth stations using TDMA, FDMA, and CDMA protocols.[230] Now, we discuss VSAT networks using contention protocols, reaching decisions on some issues and refining our contention protocol proposals further on other issues.

2. Need for Rule Revisions

101. *Background*. SIA and Spacenet argue that the Commission does not need to regulate VSAT contention protocols because there have not been any reported cases of interference caused by use of contention protocols, and because licensees can work together to resolve any interference.[231] According to Aloha Networks, there have been no interference complaints because use of contention protocols is fairly limited. Aloha Networks also claims that VSAT usage for Internet access is not yet widespread, but expects VSAT-based Internet access to grow in the near future, and expects contention protocol usage to grow as VSAT-based Internet access grows.[232] Aloha Networks also points out, however, that technology now exists that can address potential interference that cannot be controlled through mutual cooperation, such as the Spread Aloha Multiple Access technique, contention-based CDMA, or fast frequency hopping.[233] SIA replies that consumer Internet-access VSAT networks have been in operation since 2000, and now have hundreds of thousands of customers, and this large growth has not resulted in interference claims.[234] Aloha Networks alleges that opposition to regulating contention protocols is based on reliance on older equipment and resistance to newer technologies.[235] Spacenet contends that Aloha Networks is seeking rules that would give it a competitive advantage in marketing its technology.[236]

102. Spacenet also contends that satellite operators and VSAT network operators have incentives to limit collisions, and this will result in limiting harmful adjacent satellite interference.[237] Aloha Networks doubts whether these economic incentives to maintain network quality will limit harmful interference.[238]

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230 Section III.B. above.

231 SIA Further Comments at 18; SIA Further Reply at 5; Spacenet Further Comments at 15 and Att. B; Spacenet Further Reply at 2-3. *See also* SIA March 23, 2004 *Ex Parte* Statement at 3.

232 Aloha Networks Further Reply at 1-4.

233 Aloha Networks Further Reply at 2.

234 SIA Further Reply at 5.

235 Aloha Networks Further Reply at 6.

236 Spacenet Further Reply at 5 and Att. B at 2-3.

237 Spacenet Further Comments at 15.

238 Aloha Networks Further Reply at 3.

103. *Discussion*. Section 25.134 of the Commission's rules establishes limits for individual earth station antenna input power densities as received by the satellite receiver.[239] Use of contention protocols results in aggregate antenna input power densities that exceed these limits.[240] The Commission observed in the *Further Notice* that use of contention protocols can increase the efficiency of VSAT networks.[241] Therefore, we want to revise Section 25.134 to allow VSAT network operators to take advantage of those efficiencies.

104. We also find unpersuasive SIA's and Spacenet's assertions that we do not need any regulations for contention protocols. While there have been no allegations of harmful interference to date, that by itself does not warrant allowing VSAT operators to operate their networks with an unlimited number of collisions of unlimited duration and unlimited input power levels. Any VSAT operator using a contention protocol is doing so pursuant to the Bureau's December 2000 waiver, and that waiver was limited to VSAT operators using multiple access techniques at the time the waiver was granted.[242] Thus, any growth in satellite Internet service that employs a contention protocol would exceed the terms of the waiver. Consequently, we have not seen, as SIA asserts, a large growth in the use of contention protocols since 2000. Further, Spacenet has not adequately supported its argument that the incentive to limit interference within a VSAT network will be adequate to prevent harmful interference to adjacent satellite systems.[243]

3. Outstanding Proposals

a. The *Further Notice* Proposal

105. In the *Further Notice*, the Commission invited comment on a rule that would provide for routine processing for Ku-band VSAT systems using multiple access techniques under the following conditions:

> (i) Each earth station individually satisfies the power density limits of Section 25.134(a);
> (ii) The maximum transmitter power spectral density of a digital modulated carrier into any GSO FSS earth station antenna shall not exceed - 14.0 - 10 log(N) dB(W/4 kHz), where N is the smallest number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam such that the probability of an event with greater than N simultaneous transmitters is less than 0.01; and

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239 47 C.F.R. § 25.134(a), (b). *See also* Spacenet Further Comments at 14-15.

240 *Spacenet Order*, 15 FCC Rcd at 23715 (para. 9).

241 *Further Notice*, 17 FCC Rcd at 18618 (para. 85).

242 *See Spacenet Order*, 15 FCC Rcd at 23716 (para. 12). The Commission stated that this waiver will remain in effect until any multiple access technique rules adopted in this proceeding take effect. *Further Notice*, 17 FCC Rcd at 18626 n.219.

243 In the *Further Notice*, the Commission explained that there was nothing in the record at that time to warrant a conclusion that the amount of traffic in a VSAT network that would result in uneconomic levels of internal interference would be less than the traffic levels that would cause harmful interference to adjacent satellites. *Further Notice*, 17 FCC Rcd at 18619 (para. 87). Spacenet repeats this argument in their further pleadings, but does not provide any further support.

(iii) The maximum duration of any single collision is less than 100 milliseconds.[244]

This proposed rule was based on a recommendation by Aloha Networks. Aloha Networks based Clauses (i) and (iii) of its proposed rule on Spacenet's proposal in its petition for declaratory ruling.[245] Aloha Networks also explained that its clause (ii) is not system-specific, as Spacenet's was. Rather, it uses a quantifiable standard that could be applied to systems developed in the future.[246]

106. The Commission stated that this proposal would ensure that VSAT network operators would decrease their power spectral density when the number of transmissions on the same frequency within the VSAT network is likely to exceed a certain level, and is applicable to any random access technique using a contention protocol.[247] Aloha Networks proposed a probability of 0.001, but the Commission increased this to 0.01 based on Hughes's observation that the Commission found that a 0.01 probability would not be excessive in the *Notice*.[248] The Commission expected that this would provide a reasonable balance between protecting against interference in the future as satellite traffic increases, and limiting burdens on VSAT licensees.[249] None of the commenters support this proposal, and several propose alternatives. Below, we summarize the parties' criticisms of the *Further Notice* proposal, and each of their alternatives.

b. Aloha Networks

107. Aloha Networks asserts that the Commission's proposal does not provide adequate protection against adjacent satellite interference during collisions.[250] Aloha Networks recommends reducing the maximum allowable probability of collision from 1 percent to 0.1 percent, or decreasing the maximum duration of collision from 100 milliseconds to 10 milliseconds.[251] SIA asserts that Aloha Networks has not provided an adequate basis for a rule more restrictive than the rule proposed in the *Further Notice*.[252]

c. SIA and Spacenet

108. In their further comments, both SIA and Spacenet oppose the Commission's proposal, and recommended revisions in the event that the Commission finds it necessary to adopt any rules. In

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244 *Further Notice*, 17 FCC Rcd at 18619-21 (paras. 90-94).

245 *Further Notice*, 17 FCC Rcd at 18620 (para. 91), *citing Spacenet Order*, 15 FCC Rcd at 23714-15 (para. 7).

246 *Further Notice*, 17 FCC Rcd at 18620 (para. 91).

247 *Further Notice*, 17 FCC Rcd at 18620 (para. 92).

248 *See Further Notice*, 17 FCC Rcd at 18620 (para. 93); *Notice,* 15 FCC Rcd at 25209 (App. E).

249 *Further Notice*, 17 FCC Rcd at 18620-21 (para. 94).

250 Aloha Networks Further Comments at 4-6; Aloha Networks Further Reply at 4-5.

251 Aloha Networks Further Comments at 3-4; Aloha Networks Further Reply at 5.

252 SIA Further Reply at 6-7. *See also* SIA October 3, 2003 *Ex Parte* Statement at 7.

Spacenet's reply, it combines elements of its original proposal with SIA's proposal, to form a new proposal.

109. In its further comments, Spacenet asserts that the Commission's proposal contains an inflexible power limit which might unreasonably restrict the growth of VSAT services.[253] Instead, Spacenet argues that VSAT operators should be allowed to exceed the -14 dBW/4kHz limit by small but increasing amounts as the probability of collisions decreases.[254] Specifically, Spacenet's initial proposal is as follows:

> (i) Each earth station individually satisfies the power density limits of Section 25.134(a);
> (ii) The maximum transmitter power spectral density of a digital modulated carrier into any GSO FSS earth station antenna shall not exceed the lesser of - 14.0 dB(W/4 kHz) or - 14 + 2K - 10log{N(K)} dB(W/4kHz), where N(K) is the smallest number of simultaneously transmitting co-channel earth stations in the same satellite receiving beam such that the probability of an event with greater than N(K) simultaneous transmissions is less than 10^{-K} for integer values of K greater or equal to one; and
> (iii) The maximum duration of any single collision is less than 100 milliseconds.[255]

Clauses (i) and (iii) are the same as the ones in the *Further Notice* proposal. Spacenet originally proposed to add the "2K" and the "10log{N(K)}" terms to Clause (ii), where K is an integer greater than or equal to one, and N(K) is an integer defined as the smallest number of simultaneously transmitting co-channel earth stations in the same satellite receiving beam such that the probability of an event with greater than N(K) simultaneous transmissions is less than 10^{-K}. Thus, as the probability of a collision involving any given number of transmissions decreases, the power increase permitted during that collision increases.[256]

110. SIA maintains that the Commission's proposed rule places VSAT operators with relatively short bursts of data at a disadvantage, even though such VSAT networks are less likely to cause harmful interference than a network with longer bursts.[257] In particular, SIA explains that the Commission's proposal limits the probability of collision in a VSAT network with 100-millisecond transmissions to one percent.[258] SIA explains further that VSAT networks with transmissions shorter-than-100 milliseconds should not be regulated as strictly as VSAT networks with 100-millisecond transmissions, because shorter transmissions result in shorter collisions, and so are less likely to cause harmful interference.[259] Accordingly, SIA recommends replacing Clause (ii) of the Commission's proposal with the following:

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253 Spacenet Further Comments at 16.

254 Spacenet Further Comments at 19-20.

255 *See* Spacenet Further Comments at 17.

256 Spacenet Further Comments at 17, 19-20, Spacenet Further Reply at Att. A.

257 SIA Further Comments at 19; SIA Further Reply at 6-7.

258 SIA Further Comments at 19.

259 SIA Further Comments at 19.

> "The maximum transmitter power spectral density of a digital modulated carrier into any GSO FSS earth station shall not exceed -14 - 10log(N) dB(W/4 kHz), where N is an integer. The number N is defined such that, during any 100 milliseconds interval, the probability that Q>N*100 is less than 0.01, where Q = the accumulated transmission time of all co-frequency simultaneously transmitting earth stations in the same satellite receiving beam. The maximum duration of any single collision is less than 100 milliseconds."[260]

SIA observes that, by adding "Q", the accumulated transmission time of all co-frequency simultaneously transmitting earth stations in the same satellite receiving beam, the rule still limits the probability of a collision in any 100-millisecond interval to one percent, without disadvantaging VSAT networks with shorter transmissions relative to those with longer transmissions.[261]

111. In its Further Reply, SIA observes that Spacenet's alternative gives VSAT operators greater flexibility than the Commission's proposed rule, but asserts that Spacenet's alternative would still place VSAT systems with shorter transmission times at a disadvantage.[262] In Spacenet's Further Reply, it concurs with SIA regarding transmission times, and incorporates SIA's proposed rule into a revised proposal as follows:

> (i) Each earth station individually satisfies the power density limits of Section 25.134(a).
> (ii) The maximum transmitter power spectral density of a digital modulated carrier into any GSO FSS earth station antenna shall not exceed the lesser of -14 dB(W/4kHz) or - 14 + 2K - 10log{N(K)} dB(W/4kHz), where N(K) is an integer. N(K) is defined such that, during any 100 millisecond interval, the probability that Q>N(K) x 100 milliseconds is less than 10^{-K}, where Q = the accumulated transmission time of all co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.
> (iii) The maximum duration of any single collision is less than 100 milliseconds.[263]

112. Aloha Networks contends that allowing a one percent probability of collisions lasting for 100 milliseconds is not acceptable for a VSAT network transmitting packets that are six milliseconds or 80 microseconds.[264] Aloha Networks also argues that there is no reason to allow higher power levels for shorter periods of time, as Spacenet recommends, and asserts that this proposal undercuts Spacenet's contention that economic factors can adequately limit harmful interference.[265] Telesat supports Spacenet's proposal.[266]

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260 SIA Further Comments at 18-19; SIA Further Reply at 6; SIA October 3, 2003 *Ex Parte* Statement at 6-7.

261 SIA Further Comments at 19.

262 SIA Further Reply at 8-9.

263 Spacenet Further Reply at 4-5.

264 Aloha Networks Further Reply at 6.

265 Aloha Networks Further Reply at 5-6.

d. Discussion

113. All the contention protocol rule proposals in the record have four elements: (i) a power density limit on individual earth stations in the VSAT network; (ii) a limit on the power generated during collisions, (iii) a limit on the probability of collisions, and (iv) a limit on the duration of any collision. Generally, the proposed rules state the allowed power during collisions as a function of the probability of collision. As an initial matter, we note that the record provides an adequate basis to resolve several of these issues. We also find, however, that we need to develop the record further on other issues. We also find that none of the proposals in the record would be consistent with the off-axis EIRP envelope approach proposed in this *Third Further Notice* above. We discuss these issues further below.

114. First, we note that the Commission in the *Further Notice* proposed requiring that each earth station in a VSAT network using a contention protocol individually satisfy the power density limits of Section 25.134(a).[267] All the commenters include identical or substantially similar requirements in their proposals. Accordingly, we conclude that any contention protocol rule we adopt should include a similar requirement. However, we also observe that we will no longer have VSAT power density limits if we adopt the off-axis EIRP envelope proposals discussed above. Accordingly, in the event that we adopt off-axis EIRP envelopes, we propose applying an aggregate off-axis EIRP envelope to VSAT networks. Implicit in the concept of an off-axis EIRP envelope is an assumption that the technical parameters of an earth station examined in a vacuum is not as relevant as determining whether those parameters considered together would cause harmful interference to an adjacent satellite. Similarly, it may be reasonable to conclude that the power levels of individual earth stations in a VSAT network are not as relevant as determining whether the VSAT network in the aggregate would cause harmful interference to an adjacent satellite. We invite comment on this analysis, and discuss this further below.

115. We also conclude that the record does not provide a basis for determining whether or to what extent to limit the power levels resulting from collisions. On one hand, we are sympathetic to Spacenet's concern that an inflexible power limit of the kind proposed in the *Further Notice* might unreasonably restrict the growth of VSAT services.[268] We also agree with SIA that there is no need to treat collisions of 100 milliseconds the same as collisions of shorter duration, and so conclude that some sort of averaging of the kind that SIA proposes with its "Q" term is warranted. Similarly, one of the commenters in the *Spacenet Order* proposes an averaging approach: "The total average power radiated toward the target satellite by all the remote earth stations in the network, using an averaging period of one second, is less than that of a single remote earth station transmitting continuously."[269] On the other hand, the SIA/Spacenet proposal would allow VSAT operators to exceed, in the aggregate, the -14 dBW/4 kHz power limit by 2 dB 10 percent of the time, whenever the probability of two or more simultaneous transmissions is greater than 10 percent. In the absence of any evidence to the contrary, we conclude that such a high power level increase for such a large amount of time would cause unacceptable interference to adjacent satellite operators.

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266 Telesat Further Reply at 5.

267 *Further Notice*, 17 FCC Rcd at 18619-20 (para. 90).

268 Spacenet Further Comments at 16.

269 *See Spacenet Order*, 15 FCC Rcd at 23715 (para. 8).

116. Regarding limits on the probability of collision, we reject the Aloha Networks proposal to limit the probability to 0.1 percent. We agree with SIA and Spacenet, however, that Aloha Networks does not provide a persuasive reason to adopt its proposal. Aloha Networks claims that VSAT networks can transmit messages as short as six milliseconds, and a rule that allows a 100-to-1 chance that a transmission in a VSAT network will experience a collision for 0.1 seconds will result in too much harmful interference in cases where the victim of the interference is a six-millisecond transmission.[270] Although a victim transmission on a particular satellite network may need to be retransmitted, if forward error correction cannot correct any reception errors resulting from a collision in transmissions on an adjacent satellite network, Aloha Networks has not shown that the number of collisions that would be allowed by a 1 percent probability of collision would result in a noticeable increase in the number of data transmission errors, retransmission rate, or latency in adjacent satellite networks.

117. Moreover, we take this opportunity to question whether a hard limit on the probability of collision is necessary. We note that neither SIA nor Spacenet proposed such a limit. Instead, they proposed flexible power limits that increase as the probability of collision decreases, and *vice versa*. Our concern with SIA's and Spacenet's proposals is that, under certain circumstances, it would allow VSAT operators to exceed the applicable power limit by 2 dB as much as 10 percent of the time, not that the probability of collision must be limited regardless of the increase in power resulting from the collision. Furthermore, we observe that the use of the Aloha multiple access technique as described in the *Spacenet Order* results in a probability of collision greater than 1 percent.[271] We will incorporate these considerations into the new contention protocol requirements we propose below.

118. Finally, we find that there is sufficient support in the record for the requirement proposed in the *Further Notice* to limit the maximum duration of any collision to 100 milliseconds. Both SIA and Spacenet include a 100-millisecond limit in their proposals. Aloha Networks is the only commenters suggesting a more restrictive limit. Aloha Networks proposes a 10-millisecond limit, as an alternative to its proposed limit on the probability of collision discussed above. For the same reason that we found that the Aloha Networks probability of collision limit is too restrictive, we find that it would be too restrictive to limit the duration of collisions to 10 milliseconds. Accordingly, we conclude that any contention protocol rule we adopt should limit the maximum duration of any collision to no more than 100 milliseconds. Based on these all the considerations above, we seek comment on a new contention protocol proposal below.

4. Revised Proposal

119. Based on the analysis above, we propose adopting a contention protocol rule that would apply an aggregate limit on off-axis EIRP density for VSAT networks using a contention protocol. Based on SIA's and Spacenet's pleadings, we also find that it would be reasonable to allow the power levels caused by collisions to increase as the probability of collision decreases, and to permit the power increases to be averaged over some period of time, such as one second. We further conclude that VSAT network operators using contention protocols should be required to limit the maximum duration of any collision to no more than 100 milliseconds. Based on these considerations, we propose that VSAT network operators using a contention protocol must meet the following requirements:

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[270] Aloha Networks Further Reply at 6.

[271] Based on Spacenet's assumptions on throughput and channel loading, the Bureau found that there was a 4.9 percent probability of a collision of two transmissions. *Spacenet Order*, 15 FCC Rcd at 23719 (App. A).

(i) For VSAT networks using a contention protocol, the aggregate off-axis EIRP shall not exceed the envelope set forth in Table 1 by more than the amounts set forth in Table 2;
(ii) The maximum duration of any single collision is less than 100 milliseconds.

Table 1 is the off-axis EIRP envelope proposed in Appendix C for digital transmissions from a single earth station in the Ku-band in the plane of the geostationary satellite orbit as it appears at the particular earth station location:

Table 1

$15 - 25\log_{10}\theta$	dBW/4 kHz	For	$1.5° \leq \theta \leq 7°$
-6	dBW/4 kHz	For	$7° < \theta \leq 9.2°$
$18 - 25\log_{10}\theta$	dBW/4 kHz	For	$9.2° < \theta \leq 48°$
- 24	dBW/4 kHz	For	$48° < \theta \leq 85°$
- 14	dBW/4 kHz	For	$85° < \theta \leq 180°$

where θ is the angle in degrees from the axis of the main lobe. Table 2 allows VSAT network operators to exceed the aggregate off-axis EIRP envelope by an increasing amount for a decreasing percentage of the time. The amounts in Table 2 are based on the SIA/Spacenet proposal in that the table would allow a 2 dB increase in EIRP for each decrease in order of magnitude in percentage of time.[272] Table 2 varies from the SIA/Spacenet proposal, however, in that it would not allow VSAT network operators to exceed the off-axis EIRP envelope for as much as 10 percent of the time. Instead, VSAT network operators may exceed the envelope for no more than 1 percent of the time under the proposal in Table 2.

[272] The "2K" and "10^{-K}" terms in the SIA/Spacenet proposal by themselves result in allowing a 2 dB increase in power for each order of magnitude decrease in probability of collision.

Table 2

Percentage of Time	Increase in Aggregate EIRP Allowed *
10% (10^{-1})	0 dB
1% (10^{-2})	2 dB
0.1% (10^{-3})	4 dB
0.01% (10^{-4})	6 dB
0.001% (10^{-5})	8 dB
0.0001% (10^{-6})	10 dB
0.00001% (10^{-7})	12 dB
0.000001% (10^{-8})	14 dB
0.0000001% (10^{-9})	16 dB

* The baseline for this power increase is – 14 dBW/4 kHz.

120. This approach seems to strike a reasonable balance between protecting adjacent satellites from harmful interference and allowing VSAT network operators to make efficient use of their facilities. Specifically, by requiring VSAT operators to meet an off-axis EIRP envelope in the aggregate, we should not allow any increase in the potential for harmful interference to adjacent satellites. On the other hand, VSAT network operators are given substantial flexibility as a result requiring operators to meet the envelope in the aggregate rather than on an individual earth station basis, and by allowing the operators to exceed the off-axis EIRP envelope by increasing amounts, provided that the amount of time that the envelope is exceeded is sufficiently low.

121. Parties opposing this proposal must provide an alternative proposal, and must explain in sufficient detail why they believe that their proposal strikes a better balance than the proposal in this *Third Further Notice* between (1) protection from harmful interference to adjacent satellites, and (2) allowing efficient VSAT network use.

122. Furthermore, while we are willing to consider the possibility that no power limit is required for collisions limited to 100 milliseconds, we expect parties supporting such an approach to provide more extensive justification for their recommendations. Arguing merely that their proposal strikes a reasonable balance between protection from harmful interference and efficient VSAT network use will not be sufficient by itself. In particular, we observe that the Commission originally was concerned that an earth station's transmission data would be significantly degraded, possibly beyond recovery, in cases where the earth station experiencing interference is operating in a narrower bandwidth or approximately the same as the interfering earth station.[273] Parties advocating no power limit should provide an adequate basis in the record for concluding that the Commission's concerns regarding narrow-bandwidth transmissions do not warrant some limit on power levels during collisions. We also repeat the recommendation in the *Further Notice* that commenters arguing that collisions are sufficiently limited by economic incentives should provide data showing that the amount of traffic in a VSAT network that would result in uneconomic levels of internal interference is less than the traffic levels that would cause harmful interference to adjacent satellites.[274]

[273] *See Notice*, 15 FCC Rcd at 25146-47 (para. 54). *See also Spacenet Order*, 15 FCC Rcd at 23716 (para. 10), *cited in Notice*, 15 FCC Rcd at 25146-47 (para. 54).

[274] *See Further Notice*, 17 FCC Rcd at 18619 (para. 87).

123. In addition, we will consider proposals to limit power increases during collisions. Such a power increase limit could be set at a specific dB level, or it could increase as the probability of collision decreases, of the kind proposed by SIA and Spacenet.[275] Commenters recommending such an approach, however, must demonstrate that their proposals would not result in harmful interference to adjacent satellite operators. Such demonstrations must be adequately supported. We would consider interference analyses or link budgets, or any other data that the commenter believes to be persuasive.

124. We are also willing to consider proposals similar to those in the *Notice* and *Further Notice*, to require VSAT network operators using contention protocols to reduce their power levels to compensate for the power increases that will result from collisions.[276] As we emphasized above, however, parties advocating such a proposal must show that their proposal strikes a better balance between protection from harmful interference and efficient VSAT network use. In particular, any party proposing a limit must show that its proposal is not so restrictive that it would significantly limit the advantages of using contention protocols.

5. Other Contention Protocol Issues

a. Combination of Reservation and Contention Protocols

125. *Background*. In the *Notice*, the Commission noted that a VSAT network could use a combination of CDMA and Aloha multiple access techniques. Under this approach, transmissions are given codes to distinguish them from most other transmissions, and the VSAT network could rely on Aloha-type statistical calculations to keep simultaneous transmissions of signals with the same code within acceptable limits.[277]

126. Above, we explained that, in the *Notice*, the Commission's proposed power spectral density limit for VSAT networks using CDMA was -14.0 - 10log(N) dB(W/4 kHz), where N is "the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam."[278] For CDMA/Aloha systems, the Commission proposed setting N equal to 2 times the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam. This proposal was based on the value of N the Commission proposed for VSAT networks using Aloha, 2, and the value of N proposed it for VSAT networks using CDMA, the maximum number of co-frequency simultaneously transmitting earth stations.[279] We adopted the Commission's CDMA proposal above. The Commission decided in the *Further Notice*, however, to invite comment on alternatives to its proposal for CDMA/Aloha.[280]

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[275] Spacenet Further Reply at 4-5; SIA Further Comments at 18-19; SIA Further Reply at 6; SIA October 3, 2003 *Ex Parte* Statement at 6-7.

[276] *See Notice*, 15 FCC Rcd at 25147 (para. 55) and 25206-10 (App. E); *Further Notice*, 17 FCC Rcd at 18619-21 (paras. 90-94).

[277] *Notice*, 15 FCC Rcd at 25209 (App. E).

[278] *See* Section III.B.2. above, *citing Notice*, 15 FCC Rcd at 25208 (App. E). In the *Further Notice*, the Commission proposed defining "N" in terms of the "maximum" number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam, rather than the "likely maximum number." *Further Notice*, 17 FCC Rcd at 18622 (para. 100).

[279] *See Notice*, 15 FCC Rcd at 25207-10 (App. E).

[280] *Further Notice*, 17 FCC Rcd at 18618 (paras. 85-86).

127. *Discussion*. As part of its contention protocol proposal, SIA recommends a requirement for VSAT networks using CDMA/Aloha that is somewhat similar to the Commission's proposal in the *Notice*. Specifically, for VSAT networks using a combination of CDMA and Aloha, SIA would multiply the N from its proposed contention protocol rule discussed above by "the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam."[281]

128. We have decided not to adopt this proposal, for several reasons. First, as we pointed out above, this contention protocol proposal would allow licensees to exceed the otherwise applicable power spectral density limit by 2 dB up to 10 percent of the time, whenever the probability of two or more simultaneous transmissions is greater than 10 percent. We find that this would be excessive for VSAT networks using CDMA/Aloha for the same reasons that we found it was excessive for VSAT networks using other contention protocols. Second, part of the reason that the Commission decided not to adopt its original proposal for contention protocols was that it was limited to specific multiple access techniques.[282] This proposal seems to be designed specifically for VSAT networks using CDMA/Aloha, and so does not appear to be generally applicable. Finally, our proposed contention protocol requirements in this *Third Further Notice* are applicable to VSAT networks using either a contention protocol by itself, or in combination with a reservation protocol.

129. Accordingly, we invite comment on whether the contention protocol requirements proposed in this *Third Further Notice* above strike a reasonable balance between protecting adjacent satellites from harmful interference and not unreasonably restricting VSAT network operators who use contention protocols and reservation protocols in combination. Parties arguing that we need a distinct set of rules for contention protocols used in combination with reservation protocols should propose such rules, and explain in detail why those separate rules are necessary.

b. Extension of Contention Protocol Rules to Other Frequency Bands

130. *Background*. The Commission did not propose rules for C-band and Ka-band VSAT systems using contention protocols in the *Further Notice*.[283] The Commission reasoned that Ku-band contention protocol rules are needed because of the increase in anticipated future traffic volumes. Because C-band and Ka-band VSAT systems have just recently been introduced, the traffic volumes in those systems are not as great as they are in Ku-band VSAT systems. Therefore, the Commission proposed excluding C-band and Ka-band VSAT systems from contention protocol rules at this time.[284]

131. *Discussion*. SIA supports this proposal.[285] We will not propose any contention protocol rules for C-band or Ka-band VSATs at this time, for the reasons discussed in the *Further Notice*. Specifically, the traffic volumes in C-band or Ka-band VSAT networks at this time are not so great as to pose a significant risk of harmful interference to adjacent satellites. Instead, we will complete this

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281 SIA Further Comments at 21.

282 *Further Notice*, 17 FCC Rcd at 18620 (para. 92).

283 *Further Notice*, 17 FCC Rcd at 18624 (para. 103).

284 *Further Notice*, 17 FCC Rcd at 18624 (para. 103).

285 SIA Further Comments at 20.

proceeding to adopt contention protocol rules in the Ku-band, and develop experience with those rules before considering whether to extend those rules to other frequency bands.

c. Information Requirements

132. *Background*. In the *Further Notice*, the Commission invited comment on requiring VSAT system applicants to provide data on their planned levels of throughput, and to calculate the probability of transmissions on the same frequency within their respective VSAT networks. The Commission also sought comment on requiring these calculations as an attachment to the Form 312 earth station application.[286]

133. *Discussion*. SIA and Spacenet recommend that any regulations require a certification of compliance rather than a detailed probability showing.[287] We propose adopting SIA's and Spacenet's recommendation. In a prior Order, when the Commission adopted out-of-band emission requirements for mobile earth terminals (METs) in the 1.6 GHz band, it rejected a proposal to require advance approval of any plan to rely on network software to meet those emission requirements. Specifically, given that there was no convincing showing that there was a need for a prior approval process, the Commission stated that it would require only that MET licensees certify that they will comply with the applicable requirements.[288] Similarly, we find here that, in the absence of a convincing showing that a more detailed technical requirement is warranted, we should require VSAT licensees only to certify that they will meet any applicable requirements for contention protocols that we may adopt in this proceeding. We invite comment on this analysis. We also invite comment on requiring any party questioning a license applicant's contention protocol certification to provide a technical analysis showing that the applicant's planned contention protocol usage is likely to cause harmful interference to adjacent satellites or terrestrial wireless operations.

d. Grandfathering

134. For contention protocols, the Commission invited comment on a three-part transition.[289] First, VSAT systems using Aloha or other contention protocol random access techniques licensed before the release date of the *Report and Order* in this proceeding would be allowed to continue operations under the current requirements. After the effective date of any rules we adopt, however, the first time that those VSAT system operators request a modification or renewal of their licenses, they would be required to include a modification of their operations to comply with those rules.[290] Second, with respect to VSAT systems licensed between the release date of this Order and the effective date of any rules we adopt, the Commission proposed requiring those system operators to file modifications to their systems to come into compliance with these rules within 90 days after those rules take effect.[291] Third, the Commission

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286 *Further Notice*, 17 FCC Rcd at 18620 (para. 93).

287 SIA Further Comments at 19-20; SIA Further Reply at 9; Spacenet Further Reply at 5.

288 Amendment of Parts 2 and 25 to Implement the Global Mobile Personal Communications by Satellite (GMPCS) Memorandum of Understanding and Arrangements, *Report and Order and Further Notice of Proposed Rulemaking*, IB Docket No. 99-67, 17 FCC Rcd 8903, 8920 (para. 40) (2002).

289 *Further Notice*, 17 FCC Rcd at 18625 (para. 108).

290 *Further Notice*, 17 FCC Rcd at 18625 (para. 108).

291 *Further Notice*, 17 FCC Rcd at 18625 (para. 108).

proposed requiring VSAT systems licensed after the effective date of any rules we adopt to comply with those rules. The Commission proposed basing the transition mechanism on licensing dates rather than application filing dates to avoid a large influx of VSAT applications prior to the transition dates.[292]

135. In the *Sixth Report and Order* above, we noted that SIA opposes applying any new VSAT requirements to existing VSAT networks, because of the expense of retrofitting all the remote earth stations in a VSAT network.[293] Accordingly, we will not apply the TDMA, FDMA, and CDMA requirements adopted in the *Sixth Report and Order* above to earth stations licensed before this Order is adopted. We propose adopting the same grandfathering provisions for any contention protocol requirements we adopt, and we seek comment on that proposal.

6. Contention Protocol Conclusions

136. In summary, we find that we must revise Section 25.134 to allow contention protocols. We also find that the new contention protocol rules should (i) impose an aggregate off-axis EIRP limit on VSAT networks, rather than a power limit on individual earth stations; (ii) allow VSAT operators to exceed the proposed aggregate off-axis EIRP envelope for a small percentage of the time; and (iii) limit the maximum duration of any collision to no more than 100 milliseconds. Based on those determinations, we develop a new proposal for contention protocol requirements, and we invite further comment on that proposal. We also explain that any party proposing different contention protocol requirements must show that its proposal strikes a better balance between protecting adjacent satellites from harmful interference and allowing VSAT network operators to make efficient use of their facilities.

137. We propose limiting the new contention protocol rule to Ku-band VSAT networks. We do not propose any new requirements for C-band and Ka-band VSAT systems using contention protocols, because those systems are relatively new, they do not carry the same traffic volumes as Ku-band VSAT networks. We also propose requiring VSAT applicants to certify that they will meet the contention protocol requirements, and grandfathering existing VSAT networks. We seek comment on all these proposals.

E. Quiet Zone For Radio Astronomy

138. *Background*. In addition to the off-axis EIRP issues discussed above, the Commission deferred another issue to this proceeding. Specifically, in the *Fifth Report and Order*, the Commission adopted its proposal to permit multiple hub stations under a single VSAT network license.[294] Although none of the commenters opposed this proposal, the National Radio Astronomy Observatory (NRAO) recommended placing a limitation on multiple-hub VSAT networks that may operate within the "Quiet Zone." NRAO observes that Section 25.203(f) of the Commission's rules establishes a "Quiet Zone" for radio astronomy in a 13,000 square mile area in Virginia, West Virginia, and Maryland.[295] Under Section

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[292] *Further Notice*, 17 FCC Rcd at 18625 (para. 108).

[293] SIA Further Comments at 20-21. *See also* SIA February 1, 2005 *Ex Parte* Statement at 2 (recommending grandfathering for any contention protocol requirements that the Commission may adopt).

[294] *Fifth Report and Order* at para. 125; *Notice*, 15 FCC Rcd at 25148 (paras. 58-59).

[295] The Quiet Zone is an area bounded by 39° 15' N.L., 78° 30' W.L., 37° 30' N.L., and 80° W.L. *See* 47 C.F.R. § 25.203(f).

25.203(f), anyone seeking a license in that area must notify the NRAO.[296] NRAO is given 20 days to file an objection to the proposed operations with the Commission. If NRAO files an objection, Section 25.203(f) states that the Commission may take whatever action it deems appropriate.[297]

139. NRAO requested that the Commission adopt procedures to ensure that VSAT systems that are authorized to add hubs or remotes to their system without filing an additional application continue to protect NRAO's radio astronomy operations in the Quiet Zone, and proposed adding the following language to the end of Section 25.203(f).[298]

> Licensees or permittees of systems serving geographic areas which are authorized to add transmission facilities without further application to, or approval by, the Commission, and which additional transmission facilities are located within the coordinates specified above, shall, prior to allowing such additional transmission facilities to operate, notify the National Radio Astronomy Observatory (NRAO) and coordinate the construction and operation to minimize possible harmful interference to the NRAO. A certificate of coordination signed by an authorized representative of the NRAO shall be made available to the Commission upon request. Comments or objections by the NRAO in response to such coordination, or non-coordination if appropriate, will be considered by the Commission in the same manner as comments or objections to applications as stated above.

140. In the *Fifth Report and Order*, the Commission concluded that the language proposed by NRAO is unnecessary with respect to hub earth stations because VSAT network applicants are required to specify the location and the operating parameters of all the hubs in their networks, and cannot add hubs without filing a modification application.[299] The Commission also found that NRAO's request for a new coordination requirement on VSAT remote terminals was beyond the scope of the *Notice* and *Further Notice*, and deferred that issue to this *Third Further Notice*.

141. *Discussion*. We seek comment on NRAO's proposed coordination requirements for remote terminals within the Quiet Zone. On one hand, we understand NRAO's concerns regarding the Quiet Zone. The Commission created the Quiet Zone in 1958 to minimize possible harmful interference to NRAO's radio astronomy operations.[300] The Commission has since maintained this level of protection.[301]

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296 NRAO Reply at 1-2, *citing* 47 C.F.R. § 25.203(f); Amendment of Part 2 of the Commission's Rules and Regulations to Give Interference Protection to Frequencies Utilized for Radio Astronomy, Amendment of Part 3, 4, 5, 6, 7, 9, 10, 11, 16, 20, and 21 of the Commission's Rules and Regulations to Give Interference Protection to Frequencies Utilized for Radio Astronomy, *Report and Order*, Docket No. 11745, FCC 58-1111, 17 Rad. Reg. 1738 (1958) (*Quiet Zone Order*).

297 47 C.F.R. § 25.203(f).

298 NRAO Reply at 2-3.

299 *Fifth Report and Order* at para. 127.

300 *Quiet Zone Order*, 17 Rad. Reg. at 1741 (para. 7).

301 *See* Amendment of the General Mobile Radio Service (Part 95) and Amateur Mobile Radio Service (Part 97) Rules to Establish Procedures to Minimize Potential Interference to Radio Astronomy Operations, *Report and Order*, SS Docket No. 78-352, 85 FCC 2d 738, 742 (para. 17) (1981), *aff.d* 88 FCC 2d 78 (1981)

We do not intend our rules allowing multiple-hub VSAT systems to reduce the protection afforded by the Quiet Zone to NRAO's radio astronomy operations. On the other hand, the Commission did not intend the Quiet Zone to impede the development of radio services.[302] Thus, the Commission's rules generally give NRAO an opportunity to comment on proposed radio operations in the Quiet Zone.[303] The Commission does not currently require any licensee to obtain a certificate of coordination from NRAO prior to beginning operations in the Quiet Zone.

142. Accordingly, we invite interested parties to discuss whether we should require VSAT network operators to complete coordination with NRAO prior to placing any remote earth stations in the Quiet Zone, rather than simply notifying NRAO as they are required to do now. Would placing such a coordination requirement on VSAT network operators create a better balance between protecting NRAO's important radio astronomy operations and removing impediments to the development of other radio services, relative to the current balance under the Quiet Zone notification requirement in effect since 1958? We note that the Commission currently has only a notification requirement, rather than a coordination requirement, for terrestrial wireless operations in the Quiet Zone.[304]

V. CONCLUSIONS

143. In the *Sixth Report and Order* adopted in this document, we adopted revisions to the earth station antenna gain pattern requirements, and we addressed issues raised by the use of contention protocols in very small aperture terminal networks.

144. In the *Third Further Notice* adopted in this document, we propose to replace the current Part 25 earth station licensing regime with processing based on earth station applications meeting proposed off-axis EIRP envelope in the conventional C-band and Ku-band. We also propose procedures for processing earth station applications that do not meet the proposed off-axis EIRP envelopes, and we proposed information requirements that will needed in applications filed under the proposed off-axis EIRP envelope regime. We expect that the adopted and proposed changes in this document will continue to encourage innovation in the development of earth station communications, and thereby accelerate additional and improved service to the public, without increasing harmful interference.

(extending Quiet Zone protection to Amateur radio and General Mobile radio station licenses); Review of Quiet Zones Application Procedures, *Report and Order*, WT Docket No. 01-319, 19 FCC Rcd 3267 (2004) (Streamlining procedures for terrestrial wireless applications requiring Quiet Zone coordination without reducing or eliminating Quiet Zone protection).

[302] *Quiet Zone Order*, 17 Rad. Reg. at 1741 (para. 10). *See also* Amendment of Section 22.949 of the Commission's Rules to Provide for a Moratorium on Acceptance of Unserved Area Cellular Applications Within the National Radio Quiet Zone, *Order*, RM-8647, 15 FCC Rcd 2728 (Wireless Bur., 2000) (granting waivers to two cellular licensees to allow them to expand their networks into Quiet Zone).

[303] *See* 47 C.F.R. § 25.203(f) (applicants must notify NRAO, NRAO is given a 20-day period to comment, and the Commission "will consider all aspects of the problem and take whatever action is deemed appropriate.") *See also* 47 C.F.R. § 1.924 (wireless service applicants must follow a procedure substantially similar to that spelled out in Section 25.203(f)).

[304] 47 C.F.R. § 1.924.

VI. PROCEDURAL MATTERS

145. *Final Regulatory Flexibility Analysis.* As required by the Regulatory Flexibility Act (RFA),[305] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated into the *Notice* and the *Further Notice*.[306] The Commission sought written public comments on the possible significant economic impact of the proposed policies and rules on small entities in the *Notice* and *Further Notice*, including comments on the IRFA. No one commented specifically on the IRFA. Pursuant to the RFA,[307] a Final Regulatory Flexibility Analysis is contained in Appendix D.

146. *Paperwork Reduction Act Analysis*. The rule revisions adopted in this *Sixth Report and Order* have been analyzed with respect to the Paperwork Reduction Act of 1995, Pub. L. 104-13, and do not contain new and/or modified information collections subject to Office of Management and Budget review.

147. This *Third Further Notice* contains proposed new and modified information collection(s). The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and the Office of Management and Budget (OMB) to comment on the information collection(s) contained in this NPRM, as required by the Paperwork Reduction Act of 1995, Public Law No. 104-13. Public and agency comments are due 60 days from date of publication of the NPRM in the Federal Register. Comments should address: (a) whether the proposed collection of information is necessary for the proper performance of the functions of the Commission, including whether the information shall have practical utility; (b) the accuracy of the Commission's burden estimates; (c) ways to enhance the quality, utility, and clarity of the information collected; and (d) ways to minimize the burden of the collection of information on the respondents, including the use of automated collection techniques or other forms of information technology. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law No. 107-198, *see* 44 U.S.C. § 3506(c)(4), we seek specific comment on how we might "further reduce the information collection burden for small business concerns with fewer than 25 employees."

148. A copy of any comments on the information collections contained herein should be submitted to Judy Boley Herman, Federal Communications Commission, Room 1-C804, 445 12th Street, SW, Washington, DC 20554, or via the Internet to jbHerman@fcc.gov and to Kristy L. LaLonde, OMB Desk Officer, Room 10234 NEOB, 725 17th Street, N.W., Washington, DC 20503, via the Internet to Kristy_L. LaLonde@omb.eop.gov, or via fax at 202-395-5167.

149. *Initial Regulatory Flexibility Analysis.* Appendix E to this document contains the analysis required by the Regulatory Flexibility Act of 1980, 5 U.S.C. § 603.

150. *Ex Parte Presentations.* This is a permit-but-disclose rulemaking proceeding. *Ex parte* presentations are permitted, provided they are disclosed as provided in Sections 1.1202, 1.1203, and 1.1206(a) of the Commission's Rules, 47 C.F.R. §§ 1.1202, 1.1203, 1.1206(a).

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305 *See* 5 U.S.C. § 603.

306 *Notice*, 15 FCC Rcd at 25212-15 (App. G); *Further Notice*, 17 FCC Rcd at 18642-45 (App. C).

307 *See* 5 U.S.C. § 604.

151. *Comment.* Pursuant to sections 1.415 and 1.419 of the Commission's rules,[308] interested parties may file comments within 90 days after this *Further Notice* is published in the Federal Register and reply comments within 120 days after this *Further Notice* is published in the Federal Register. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by filing paper copies.[309] Comments filed through the ECFS can be sent as an electronic file via the Internet to http://www.fcc.gov/cgb/ecfs/. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of the proceeding, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, U.S. Postal Service mailing address, and the applicable docket or rulemaking number, in this case, **IB Docket No. 00-248**. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form." A sample form and directions will be sent in reply. Parties who choose to file by paper must file an original and four copies of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number.

152. Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail (although we continue to experience delays in receiving U.S. Postal Service mail). **Parties are strongly encouraged to file comments electronically using the Commission's ECFS.**

153. The Commission's contractor, Natek, Inc., will receive hand-delivered or messenger-delivered paper filings for the Commission's Secretary at 236 Massachusetts Avenue, N.E., Suite 110, Washington, D.C. 20002.

- The filing hours at this location are 8:00 a.m. to 7:00 p.m.
- All hand deliveries must be held together with rubber bands or fasteners.
- Any envelopes must be disposed of before entering the building.
- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743.
- U.S. Postal Service first-class mail, Express Mail, and Priority Mail should be addressed to 445 12th Street, SW, Washington, D.C. 20554.

154. All filings must be addressed to the Commission's Secretary, Marlene H. Dortch, Office of the Secretary, Federal Communications Commission, 445 12th Street, SW, Washington, D.C. 20554. Parties should also send a copy of their filings to Victoria Goldberg, Pricing Policy Division, Wireline Competition Bureau, Federal Communications Commission, Room 5-A266, 445 12th Street, SW, Washington, D.C. 20554, or by e-mail to victoria.goldberg@fcc.gov. Parties shall also serve one copy with the Commission's copy contractor, Best Copy and Printing, Inc. (BCPI), Portals II, 445 12th Street, SW, Room CY-B402, Washington, D.C. 20554, (202) 488-5300, or via e-mail to fcc@bcpiweb.com.

155. Documents in IB Docket No. 00-248 are available for public inspection and copying during business hours at the FCC Reference Information Center, Portals II, 445 12th St. SW, Room CY-A257, Washington, DC 20554. The documents may also be purchased from BCPI, telephone (202) 488-5300, facsimile (202) 488-5563, TTY (202) 488-5562, e-mail fcc@bcpiweb.com.

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[308] 47 C.F.R. §§ 1.415, 1.419.

[309] *See Electronic Filing of Documents in Rulemaking Proceedings*, GC Docket No. 97-113, Report and Order, 13 FCC Rcd 11322 (1998).

156. *Additional Information.* For general information concerning this rulemaking proceeding, contact Steven Spaeth, International Bureau, at (202) 418-1539, or Mark Young, International Bureau, at (202) 418-0762.

VII. ORDERING CLAUSES

157. Accordingly, IT IS ORDERED, pursuant to Sections 4(i), 7(a), 303(c), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 157(a), 303(c), 303(f), 303(g), 303(r), that this *Sixth Report and Order* in IB Docket No. 00-248 is hereby ADOPTED.

158. IT IS FURTHER ORDERED that Part 25 of the Commission's rules IS AMENDED as set forth in Appendix B. An announcement of the effective date of these rule revisions will be published in the Federal Register.

159. IT IS FURTHER ORDERED that the Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Order, including the Final Regulatory Flexibility Certification, to the Chief Counsel for Advocacy of the Small Business Administration.

160. Accordingly, IT IS ORDERED, pursuant to Sections 4(i), 7(a), 11, 303(c), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 157(a), 161, 303(c), 303(f), 303(g), 303(r), that this *Third Further Notice of Proposed Rulemaking* is hereby ADOPTED.

161. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Notice of Proposed Rulemaking, including the Initial Regulatory Flexibility Analysis, to the Chief, Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Parties filing Pleadings

Comments (March 26, 2001)

1. Aloha Networks, Inc. (Aloha Networks)
2. Andrew Corporation
3. Astrolink International LLC (Astrolink)
4. GE American Communications, Inc. (GE Americom)
5. Globalstar USA, Inc. and Globalstar, L.P. (Globalstar)
6. Hughes Network Systems, Hughes Communications, Inc., and Hughes Communications Galaxy, Inc. (together, Hughes)
7. Loral Space & Communications Ltd. (Loral)
8. Motient Services, Inc. (Motient)
9. New Skies Satellites N.V. (New Skies)
10. PanAmSat Corporation (PanAmSat)[1]
11. Spacenet, Inc., and StarBand Communications, Inc. (together, Spacenet)
12. Telesat Canada (Telesat)
13. WorldCom, Inc. (WorldCom)

Replies (May 7, 2001)

1. Aloha Networks[2]
2. Astrolink
3. Comtech Mobile Datacom Corp. (CMDC)
4. GE Americom
5. Hughes
6. National Radio Astronomy Observatory (NRAO)
7. OnSat Network Communications, Inc. (Onsat)
8. PanAmSat
9. Satellite Industry Association (SIA)
10. Spacenet
11. Telesat

Further Comments (March 10, 2003)

1. Aloha Networks, Inc. (Aloha Networks)
2. General Communication, Inc. (GCI)
3. QUALCOMM, Incorporated (Qualcomm)
4. SIA
5. Spacenet

Further Replies (April 8, 2003)

1. Aloha Networks

[1] On April 10, 2001, PanAmSat corrected certain minor errors and re-filed its comments.

[2] On May 9, 2001, Aloha Networks corrected certain minor errors and re-filed its reply.

2. Qualcomm
3. SIA
4. Spacenet
5. Telesat

Ex Parte Statements

1. Letter from Joseph A. Godles, Attorney for PanAmSat Corporation, to Magalie Roman Salas, Secretary, FCC (dated Oct. 22, 2001) (PanAmSat October 22, 2001 *Ex Parte* Statement).
2. Letter from Richard DalBello, Executive Director, Satellite Industry Association, to Magalie Roman Salas, Secretary, FCC (dated Nov. 5, 2001) (SIA November 5, 2001 *Ex Parte* Statement).
3. Letter from Dori K. Bailey of Latham and Watkins, to Magalie Roman Salas, Secretary, FCC (dated Dec. 11, 2001) (SIA November 19, 2001 *Ex Parte* Statement).[3]
4. Letter from Joseph A. Godles, Attorney for PanAmSat Corporation, to Magalie Roman Salas, Secretary, FCC (dated Nov. 20, 2001) (PanAmSat November 20, 2001 *Ex Parte* Statement).
5. Letter from Dori K. Bailey of Latham and Watkins, to Magalie Roman Salas, Secretary, FCC (dated Dec. 11, 2001) (SIA December 10, 2001 *Ex Parte* Statement).
6. Letter from Dori K. Bailey of Latham and Watkins, to Magalie Roman Salas, Secretary, FCC (dated Dec. 21, 2001) (Hughes December 21, 2001 *Ex Parte* Statement).
7. Surreply of the Satellite Industry Association to the Reply Comments of Telesat Canada and Qualcomm, Incorporated (dated Oct. 3, 2003) (SIA October 3, 2003 *Ex Parte* Statement).
8. Letter from Jacob S. Farber, Attorney for Aloha Networks, Inc., to Marlene H. Dortch, Secretary, FCC (dated Nov. 14, 2003) (Aloha Networks November 14, 2003 *Ex Parte* Statement).
9. Letter from Lewis J. Paper, Attorney for Aloha Networks, Inc., to Marlene H. Dortch, Secretary, FCC (dated Feb. 3, 2004) (Aloha Networks February 3, 2004 *Ex Parte* Statement).
10. Letter from Richard DalBello, President, Satellite Industry Association, to Marlene H. Dortch, Secretary, FCC (dated Mar. 23, 2004) (SIA March 23, 2004 *Ex Parte* Statement).
11. Letter from Dean R. Brenner, Attorney for Qualcomm Incorporated, to Marlene H. Dortch, Secretary, FCC (dated Mar. 31, 2004) (Qualcomm March 31, 2004 *Ex Parte* Statement).
12. Letter from Carlos M. Nalda, Attorney for The Boeing Company, to Marlene H. Dortch, Secretary, FCC (dated Apr. 14, 2004) (Boeing April 14, 2004 *Ex Parte* Statement).
13. Letter from Carlos M. Nalda, Attorney for The Boeing Company, to Marlene H. Dortch, Secretary, FCC (dated Apr. 19, 2004) (Boeing April 19, 2004 *Ex Parte* Statement).
14. Letter from Jacob S. Farber, Attorney for Aloha Networks, Inc., to Marlene H. Dortch, Secretary, FCC (dated May 12, 2004) (Aloha Networks May 12, 2004 *Ex Parte* Statement).
15. Letter from Joseph A. Godles, Attorney for PanAmSat Corporation, to Marlene H. Dortch, Secretary, FCC (dated Nov. 19, 2004) (PanAmSat November 19, 2004 *Ex Parte* Statement).
16. Letter from Joseph A. Godles, Attorney for PanAmSat Corporation, to Marlene H. Dortch, Secretary, FCC (dated Feb. 1, 2005) (SIA February 1, 2005 *Ex Parte* Statement).

[3] Although SIA made this oral *ex parte* presentation to Commission staff on November 19, 2001, it did not file a written summary of its *ex parte* presentation until December 11, 2001. Section 1.1206(b)(2) of the Commission's rules requires persons making oral *ex parte* presentations that include new data or arguments to summarize the new information in writing and file it with the Commission no later than one business day after the *ex parte* presentation. 47 C.F.R. § 1.1206(b)(2). In the *Further Notice*, the Commission determined that it need not determine what action, if any, is warranted with respect to SIA's late-filed *ex parte* statement, as the proposals in the November 19, 2001 *Ex Parte* Statement are the same as those in the SIA November 5, 2001 *Ex Parte* Statement and the SIA December 10, 2001 *Ex Parte* Statement. *Further Notice*, 17 FCC Rcd at 18590 n.29.

APPENDIX B

Rule Changes

For the reasons discussed above, the Federal Communications Commission amends title 47 of the Code of Federal Regulations, part 25, as follows:

PART 25 -- SATELLITE COMMUNICATIONS

1. The authority citation for Part 25 continues to read as follows:

Authority: 47 U.S.C. 701-744. Interprets or applies Sections 4, 301, 302, 303, 307, 309, and 332 of the Communications Act, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 307, 309, 332, unless otherwise noted.

2. Amend § 25.134 by revising paragraph (a)(1) and adding paragraphs (g) and (h), to read as follows:

§ 25.134 Licensing provisions of Very Small Aperture Terminal (VSAT) and C-band Small Aperture Terminal (CSAT) networks.

(a)(1) VSAT networks operating in the 12/14 GHz bands. All applications for digital VSAT networks granted on or before **[Insert effective date of rule]** with a maximum outbound downlink EIRP density of +10.0 dBW/4 kHz per carrier and earth station antennas with maximum input power density of -14 dBW/4 kHz will be processed routinely. All applications for analog VSAT networks with maximum outbound downlink power densities of +17.0 dBW/4 kHz per carrier and maximum antenna input power densities of -8.0 dBW/4 kHz shall be processed routinely in accordance with Declaratory Order in the Matter of Routine Licensing of Earth Stations in the 6 GHz and 14 GHz Bands Using Antennas Less than 9 Meters and 5 Meters in Diameter, Respectively, for Both Full Transponder and Narrowband Transmissions, 2 FCC Rcd 2149 (1987) (Declaratory Order).

* * *

(g) Starting **[Insert adoption date of order]** , all applications for VSAT service in the 12/14 GHz band that meet the following requirements will be routinely processed:

(1) The maximum transmitter power spectral density of a digital modulated carrier into any GSO FSS earth station antenna shall not exceed - 14.0 - 10log(N) dB(W/4 kHz). For a VSAT network using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one. For a VSAT network using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

(2) The maximum GSO FSS satellite EIRP spectral density of the digital modulated emission shall not exceed 10 dB (W/4kHz) for all methods of modulation and accessing techniques.

(3) The maximum transmitter power spectral density of an analog carrier into any GSO FSS earth station antenna shall not exceed – 8.0 dB(W/4kHz) and the maximum GSO FSS satellite EIRP spectral density shall not exceed + 17.0 dB(W/4kHz).

(h) VSAT operators licensed pursuant to this section are prohibited from using remote earth stations in their networks that are not designed to stop transmissions from their remote earth stations when synchronization with the target satellite fails.

3. In § 25.212, revise paragraph (d) to read as follows:

§ 25.212 Narrowband analog transmissions, digital transmissions, and video transmissions in the GSO Fixed-Satellite Service.

* * * * *

(d)(1) For earth stations licensed before **[Insert adoption date of order]** in the 5925-6425 MHz band, an earth station with an equivalent diameter of 4.5 meters or greater may be routinely licensed for transmission of SCPC services if the maximum power densities into the antenna do not exceed +0.5 dBW/4 kHz for analog SCPC carriers with bandwidths up to 200 kHz, and do not exceed -2.7 dBW/4 kHz for narrow and/or wideband digital SCPC carriers.
(2) For earth stations licensed after **[Insert adoption date of order]** in the 5925-6425 MHz band, an earth station with an equivalent diameter of 4.5 meters or greater may be routinely licensed for transmission of SCPC services if the maximum power densities into the antenna do not exceed +0.5 dBW/4 kHz for analog SCPC carriers with bandwidths up to 200 kHz, and do not exceed -2.7 – 10log(N) dBW/4 kHz for narrow and/or wideband digital SCPC carriers. For digital SCPC using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one. For digital SCPC using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.
(3) Antennas with an equivalent diameter smaller than 4.5 meters in the 5925-6425 MHz band are subject to the provisions of §25.220 of this chapter, which may include power reduction requirements.

* * * * *

4. In § 25.221, revise paragraphs (a)(1), (a)(2), and (a)(4) to read as follows:

§ 25.221 Blanket Licensing provisions for Earth Stations on Vessels (ESV) receiving in the 3700-4200 MHz (space-to-Earth) frequency band and transmitting in the 5925-6425 MHz (Earth-to-space) frequency band, operating with Geostationary Satellites in the Fixed-Satellite Service.

(a) All applications for licenses for ESVs transmitting in the 5925-6425 MHz (Earth-to-space) bands to geostationary-orbit satellites in the fixed-satellite service shall provide sufficient data to demonstrate that the ESV operations meet the following criteria, which are ongoing requirements that govern all ESV licensees and operations in these bands:

(1) The off-axis EIRP spectral density for co-polarized signals, emitted from the ESV, in the plane of the geostationary satellite orbit as it appears at the particular earth station location (*i.e.*, the plane determined by the focal point of the antenna and the line tangent to the arc of the geostationary satellite orbit at the position of the target satellite), shall not exceed the following values:

$26.3 - 25\log(\theta) - 10\log(N)$ dBW/4kHz	for	$1.0° \le \theta \le 7.0°$
$5.3 - 10\log(N)$ dBW/4kHz	for	$7.0° < \theta \le 9.2°$
$29.3 - 25\log(\theta) - 10\log(N)$ dBW/4kHz	for	$9.2° < \theta \le 48°$
$-12.7 - 10\log(N)$ dBW/4kHz	for	$48° < \theta \le 180°$

where θ is the angle in degrees from the axis of the main lobe. For an ESV network using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one. For an ESV network using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

(2) In all other directions, the off-axis EIRP spectral density for co-polarized signals emitted from the ESV shall not exceed the following values:

29.3 - 25log(θ) - 10 log(N) dBW/4kHz	for	$1.0° \leq \theta \leq 48°$
-12.7 - 10 log(N) dBW/4kHz	for	$48° < \theta \leq 180°$

where θ and N are defined as set forth in paragraph (a)(1).

* * *

(4) In all directions, the off-axis EIRP spectral density for cross-polarized signals emitted from the ESV shall not exceed the following values:

16.3 - 25log(θ) - 10 log(N) dBW/4kHz	for	$1.8° \leq \theta \leq 7.0°$
-4.7 - 10 log(N) dBW/4kHz	for	$7.0° < \theta \leq 9.2°$

where θ and N are defined as set forth in paragraph (a)(1).

* * * * *

5. In § 25.222, revise paragraphs (a)(1), (a)(2), and (a)(4) to read as follows:

§ 25.222 Blanket Licensing provisions for Earth Stations on Vessels (ESVs) receiving in the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) frequency bands and transmitting in the 14.0-14.5 GHz (Earth-to-space) frequency band, operating with Geostationary Satellites in the Fixed-Satellite Service.

(a) All applications for licenses for ESVs receiving in the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) frequency bands, and transmitting in the 14.0-14.5 GHz (Earth-to-space) frequency band, to Geostationary Satellites in the fixed-satellite service shall provide sufficient data to demonstrate that the ESV operations meet the following criteria, which are ongoing requirements that govern all ESV licensees and operations in these bands:

(1) The off-axis EIRP spectral density for co-polarized signals, emitted from the ESV in the plane of the geostationary satellite orbit as it appears at the particular earth station location (*i.e.*, the plane determined by the focal point of the antenna and the line tangent to the arc of the geostationary satellite orbit at the position of the target satellite), shall not exceed the following values:

15 - 25log(θ) - 10 log(N) dBW/4kHz	for	$1.25° \leq \theta \leq 7.0°$
-6 - 10 log(N) dBW/4kHz	for	$7.0° < \theta \leq 9.2°$
18 - 25log(θ) - 10 log(N) dBW/4kHz	for	$9.2° < \theta \leq 48°$
-24 - 10 log(N) dBW/4kHz	for	$48° < \theta \leq 180°$

where θ is the angle in degrees from the axis of the main lobe. For an ESV network using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one.

For an ESV network using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

(2) In all other directions, the off-axis EIRP spectral density for co-polarized signals emitted from the ESV shall not exceed the following values:

$18 - 25\log(\theta) - 10\log(N)$ dBW/4kHz	for	$1.25° \leq \theta \leq 48°$
$-24 - 10\log(N)$ dBW/4kHz	for	$48° < \theta \leq 180°$

where θ and N are defined as set forth in paragraph (a)(1).

* * *

(4) In all directions, the off-axis EIRP spectral density for cross-polarized signals emitted from the ESV shall not exceed the following values:

$5 - 25\log(\theta) - 10\log(N)$ dBW/4kHz	for	$1.8° \leq \theta \leq 7°$
$-16 - 10\log(N)$ dBW/4kHz	for	$7° < \theta \leq 9.2°$

where θ and N are defined as set forth in paragraph (a)(1).

* * * * *

APPENDIX C

Proposed Off-Axis EIRP Envelopes for FSS Earth Station Applications

In this Appendix, we propose several off-axis EIRP envelopes for various types of FSS earth station transmissions. These proposals are based in large part on the earth station requirements of Part 25, as revised in the *Sixth Report and Order* adopted concurrently with this *Third Notice of Proposed Rulemaking*.

I. Power Limits for C-band Analog Earth Stations

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

$29.5 – 25\log_{10}\theta$	dBW/4 kHz	For	$1.5° \leq \theta \leq 7°$
8.5	dBW/4 kHz	For	$7° < \theta \leq 9.2°$
$32.5 - 25\log_{10}\theta$	dBW/4 kHz	For	$9.2° < \theta \leq 48°$
-9.5	dBW/4 kHz	For	$48° < \theta \leq 180°$

where θ is the angle in degrees from the axis of the main lobe. For the purposes of this section, the peak EIRP of an individual sidelobe may not exceed the envelope defined above for θ between 1.5° and 7.0°. For θ greater than 7.0°, the envelope may be exceeded by no more than 10% of the sidelobes, provided no individual sidelobe exceeds the envelope given above by more than 3 dBW/4 kHz.

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

$32.5 – 25\log_{10}\theta$	dBW/4 kHz	For	$3° \leq \theta \leq 48°$
-9.5	dBW/4 kHz	For	$48° < \theta \leq 180°$

where θ is 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 envelope given above by more than 6 dBW/4 kHz. 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 dBW/4 kHz.

II. Power Limits for C-band Digital Earth Stations

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

$27.3 - 10\log_{10}(N) - 25\log_{10}\theta$	dBW/4 kHz	For	$1.5° \leq \theta \leq 7°$
$5.3 - 10\log_{10}(N)$	dBW/4 kHz	For	$7° < \theta \leq 9.2°$
$29.3 - 10\log_{10}(N) - 25\log_{10}\theta$	dBW/4 kHz	For	$9.2° < \theta \leq 48°$
$- 12.7 - 10\log_{10}(N)$	dBW/4 kHz	For	$48° < \theta \leq 180°$

where θ is the angle in degrees from the axis of the main lobe, and N is defined below. For the purposes of this section, the peak EIRP of an individual sidelobe may not exceed the envelope defined above for θ between 1.5° and 7.0°. For θ greater than 7.0°, the envelope may be exceeded by no more than 10% of the sidelobes, provided no individual sidelobe exceeds the envelope given above by more than 3 dBW/4 kHz.

For digital SCPC using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one.
For digital SCPC using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

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

$29.3 - 10\log_{10}(N) – 25\log_{10}\theta$	dBW/4 kHz	For	$3° \leq \theta \leq 48°$
$-12.7 - 10\log_{10}(N)$	dBW/4 kHz	For	$48° < \theta \leq 180°$

where θ and N 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 envelope given above by more than 6 dBW/4 kHz. 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 dBW/4 kHz.

III. Power Limits for Ku-band Analog Earth Stations

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

$21 - 25\log_{10}\theta$	dBW/4 kHz	For	$1.5° \leq \theta \leq 7°$
0	dBW/4 kHz	For	$7° < \theta \leq 9.2°$
$24 - 25\log_{10}\theta$	dBW/4 kHz	For	$9.2° < \theta \leq 48°$
-18	dBW/4 kHz	For	$48° < \theta \leq 85°$
- 8	dBW/4 kHz	For	$85° < \theta \leq 180°$

where θ is the angle in degrees from the axis of the main lobe. For the purposes of this section, the peak EIRP of an individual sidelobe may not exceed the envelope defined above for θ between 1.5° and 7.0°. For θ greater than 7.0°, the envelope may be exceeded by no more than 10% of the sidelobes, provided no individual sidelobe exceeds the envelope given above by more than 3 dBW/4 kHz.

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

$24 - 25\log_{10}\theta$	dBW/4 kHz	For	$3° \leq \theta \leq 48°$
-18	dBW/4 kHz	For	$48° < \theta \leq 85°$
- 8	dBW/4 kHz	For	$85° < \theta \leq 180°$

where θ is 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 envelope given above by more than 6 dBW/4 kHz. 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 dBW/4 kHz.

IV. Power Limits for Ku-band Digital Earth Stations

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

$15 - 10\log_{10}(N) - 25\log_{10}\theta$	dBW/4 kHz	For	$1.5° \leq \theta \leq 7°$
$-6 - 10\log_{10}(N)$	dBW/4 kHz	For	$7° < \theta \leq 9.2°$
$18 - 10\log_{10}(N) - 25\log_{10}\theta$	dBW/4 kHz	For	$9.2° < \theta \leq 48°$
$-24 - 10\log_{10}(N)$	dBW/4 kHz	For	$48° < \theta \leq 85°$
$-14 - 10\log_{10}(N)$	dBW/4 kHz	For	$85° < \theta \leq 180°$

where θ is the angle in degrees from the axis of the main lobe, and N is defined below. For the purposes of this section, the peak EIRP of an individual sidelobe may not exceed the envelope defined above for θ between 1.5° and 7.0°. For θ greater than 7.0°, the envelope may be exceeded by no more than 10% of the sidelobes, provided no individual sidelobe exceeds the envelope given above by more than 3 dBW/4 kHz.

For digital SCPC using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one.
For digital SCPC using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

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

$18 - 10\log_{10}(N) - 25\log_{10}\theta$	dBW/4 kHz	For	$3° \leq \theta \leq 48°$
$-24 - 10\log_{10}(N)$	dBW/4 kHz	For	$48° < \theta \leq 85°$
$-14 - 10\log_{10}(N)$	dBW/4 kHz	For	$85° < \theta \leq 180°$

where θ and N 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 envelope given above by more than 6 dBW/4 kHz. 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 dBW/4 kHz.

APPENDIX D

FINAL REGULATORY FLEXIBILITY ANALYSIS

As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[1] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Notice of Proposed Rule Making* (*Notice*) and the *Further Notice of Proposed Rulemaking (Further Notice*) in IB Docket No. 00-248.[2] The Commission sought written public comment on the proposals in the *Notice* and *Further Notice*, including comment on the IRFA. This Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[3]

A. Need for, and Objectives of, the Report and Order

The Telecommunications Act of 1996 requires the Commission in every even-numbered year beginning in 1998 to review all regulations that apply to the operations or activities of any provider of telecommunications service and to determine whether any such regulation is no longer necessary in the public interest due to meaningful economic competition. Our objective is to repeal or modify any rules in Part 25 that are no longer necessary in the public interest, as required by Section 11 of the Communications Act of 1934, as amended.

Specifically, in this *Sixth Report and Order*, the Commission increases the starting point for the earth station antenna gain pattern envelope, from 1.0° to 1.5° off-axis in the C-band, and from 1.25° to 1.5° off-axis in the Ku-band. This will allow the Commission to increase the number of earth station applications eligible for routine treatment. The Commission also adopts new rules to clarify the requirements for very small aperture terminal (VSAT) networks using reservation protocols.

B. Summary of Significant Issues Raised by Public Comments In Response to the IRFA

No comments were submitted directly in response to the IRFAs in either the *Notice* or the *Further Notice*.

C. Description and Estimate of the Number of Small Entities to Which Rules Will Apply

The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the rules adopted herein.[4] The RFA generally defines the term "small entity " as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[5] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[6] A small business concern is one which:

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1 *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Title II, 110 Stat. 857 (1996).

2 2000 Biennial Regulatory Review -- Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, *Notice of Proposed Rulemaking*, IB Docket No. 00-248, 15 FCC Rcd 25128 (2000) (*Notice*); 2000 Biennial Regulatory Review -- Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, *Notice of Proposed Rulemaking*, IB Docket No. 00-248, 17 FCC Rcd 18585 (2002) (*Further Notice*).

3 *See* 5 U.S.C. § 604.

4 5 U.S.C. § 604(a)(3).

5 5 U.S.C. § 601(6).

6 5 U.S.C. § 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies "unless an agency, after

(1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).[7]

1. Cable Services. The SBA has developed a small business size standard for Cable and Other Program Distribution, which consists of all such firms having $12.5 million or less in annual receipts.[8] According to Census Bureau data for 1997, in this category there was a total of 1,311 firms that operated for the entire year.[9] Of this total, 1,180 firms had annual receipts of under $10 million, and an additional fifty-two firms had receipts of $10 million to $24,999,999.[10] Thus, under this size standard, the majority of firms can be considered small.

The Commission has developed its own small business size standard for a small cable operator for the purposes of rate regulation. Under the Commission's rules, a "small cable company" is one serving fewer than 400,000 subscribers nationwide.[11] Based on our most recent information, we estimate that there were 1,439 cable operators that qualified as small cable companies at the end of 1995.[12] Since then, some of those companies may have grown to serve over 400,000 subscribers, and others may have been involved in transactions that caused them to be combined with other cable operators. Consequently, we estimate that there are fewer than 1,439 small cable companies that may be affected by the proposed rules.

The Communications Act of 1934, as amended, also contains a size standard for a "small cable operator," which is "a cable operator that, directly or through an affiliate, serves in the aggregate fewer than one percent of all subscribers in the United States and is not affiliated with any entity or entities whose gross annual revenues in the aggregate exceed $250,000,000."[13] The Commission has determined that there are 67,700,000 subscribers in the United States.[14] Therefore, an operator serving fewer than 677,000 subscribers shall be deemed a small operator, if its annual revenues, when combined with the total annual revenues of all of its affiliates, do not exceed $250 million in the aggregate.[15] Based on available data, we estimate that the number of cable operators serving 677,000 subscribers or less totals approximately 1,450.[16] We do not request or collect information on whether cable operators are affiliated with entities whose gross annual revenues exceed $250,000,000,[17] and therefore are unable to estimate

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consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." 5 U.S.C. § 601(3).

7 Small Business Act, 15 U.S.C. § 632 (1996).

8 13 C.F.R. § 121.201, NAICS code 517510.

9 U.S. Census Bureau, 1997 Economic Census, Subject Series: Information, "Establishment and Firm Size (Including Legal Form of Organization)," Table 4, NAICS code 513220 (issued October 2000).

10 *Id*.

11 47 C.F.R. § 76.901(e). The Commission developed this definition based on its determinations that a small cable company is one with annual revenues of $100 million or less. *See Implementation of Sections of the Cable Television Consumer Protection and Competition Act of 1992: Rate Regulation*, MM Doc. Nos. 92-266 and 93-215, Sixth Report and Order and Eleventh Order on Reconsideration, 10 FCC Rcd 7393, 7408-7409 ¶¶ 28-30 (1995).

12 Paul Kagan Assocs., Inc., Cable TV Investor, Feb. 29, 1996 (based on figures for Dec. 30, 1995).

13 47 U.S.C. § 543(m)(2).

14 *See FCC Announces New Subscriber Count for the Definition of Small Cable Operator,* Public Notice, 16 FCC Rcd 2225 (2001).

15 47 C.F.R. § 76.1403(b).

16 *See FCC Announces New Subscriber Count for the Definition of Small Cable Operator,* Public Notice, 16 FCC Rcd 2225 (2001).

17 We do receive such information on a case-by-case basis only if a cable operator appeals a local franchise authority's finding that the operator does not qualify as a small cable operator pursuant to section 76.901(f) of the Commission's rules. *See* 47 C.F.R. § 76.990(b).

accurately the number of cable system operators that would qualify as small cable operators under the definition in the Communications Act.

2. Satellite Telecommunications. The rules proposed in this *Further Notice* would affect providers of satellite telecommunications services, if adopted. Satellite telecommunications service providers include satellite operators and earth station operators. The Commission has not developed a definition of small entities applicable to satellite operators. Therefore, the applicable definition of small entity is generally the definition under the SBA rules applicable to Satellite Telecommunications.[18] This definition provides that a small entity is expressed as one with $12.5 million or less in annual receipts.[19] 1997 Census Bureau data indicate that, for 1997, 273 satellite communication firms had annual receipts of under $10 million. In addition, 24 firms had receipts for that year of $10 million to $24,999,990.[20]

3. Auxiliary, Special Broadcast and other program distribution services. This service involves a variety of transmitters, generally used to relay broadcast programming to the public (through translator and booster stations) or within the program distribution chain (from a remote news gathering unit back to the station). The Commission has not developed a definition of small entities applicable to broadcast auxiliary licensees. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) rules applicable to radio broadcasting stations,[21] and television broadcasting stations.[22] These definitions provide that a small entity is one with either $6.0 million or less in annual receipts for a radio broadcasting station or $12.0 million in annual receipts for a TV station.[23] There are currently 3,237 FM translators and boosters, 4913 TV translators.[24] The FCC does not collect financial information on any broadcast facility and the Department of Commerce does not collect financial information on these auxiliary broadcast facilities. We believe, however, that most, if not all, of these auxiliary facilities could be classified as small businesses by themselves. We also recognize that most translators and boosters are owned by a parent station which, in some cases, would be covered by the revenue definition of small business entity discussed above. These stations would likely have annual revenues that exceed the SBA maximum to be designated as a small business (as noted, either $6.0 million for a radio station or $12.0 million for a TV station). Furthermore, they do not meet the Small Business Act's definition of a "small business concern" because they are not independently owned and operated.

4. Microwave Services. Microwave services include common carrier,[25] private-operational fixed,[26] and broadcast auxiliary radio services.[27] At present, there are approximately 22,015 common

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[18] "This industry comprises establishments primarily engaged in providing point-to-point telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications." Small Business Administration, NAICS code 517310.

[19] 13 C.F.R. § 120.121, NAICS code 517310.

[20] U.S. Census Bureau, 1997 Economic Census, Subject Service: Information, "Establishment and Firm Size," Table 4, NAICS 513340 (Issued Oct. 2000).

[21] 13 C.F.R. § 121.201, NAICS code 515112.

[22] 13 C.F.R. § 121.201, NAICS code 515120.

[23] 13 C.F.R. § 121.201.

[24] FCC News Release, Broadcast Station Totals as of September 30, 1999, No. 71831 (Jan. 21, 1999).

[25] *See* 47 CFR § 101 *et seq*. (formerly, part 21 of the Commission's Rules).

[26] Persons eligible under parts 80 and 90 of the Commission's rules can use Private Operational-Fixed Microwave services. *See* 47 CFR parts 80 and 90. Stations in this service are called operational-fixed to distinguish them from common carrier and public fixed stations. Only the licensee may use the operational-fixed station, and only for communications related to the licensee's commercial, industrial, or safety operations.

[27] Auxiliary Microwave Service is governed by part 74 of Title 47 of the Commission's Rules. *See* 47 CFR part 74 *et seq*. Available to licensees of broadcast stations and to broadcast and cable network entities, broadcast

carrier fixed licensees and 61,670 private operational-fixed licensees and broadcast auxiliary radio licensees in the microwave services. The Commission has not yet defined a small business with respect to microwave services. For purposes of this FRFA, we will use the SBA's definition applicable to cellular and other wireless communications companies -- *i.e.*, an entity with no more than 1,500 persons.[28] We estimate that all of the Fixed Microwave licensees (excluding broadcast auxiliary licensees) would qualify as small entities under the SBA definition for radiotelephone (wireless) companies.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

None of the rules adopted in this *Sixth Report and Order* will affect small businesses differently from other non-routine earth station applicants. The revisions to the earth station antenna gain pattern envelope will make it easier for all earth station operators, including small businesses, to comply with the rule. The revisions to the VSAT rules do not create any new reporting or recordkeeping requirements.

E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives: (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.[29]

This *Sixth Report and Order* adopts revisions to the earth station antenna gain pattern envelope that will increase the number of earth station applications that can be treated routinely, thereby enabling the Commission to act on those earth station applications more quickly. The Commission specifically considered and rejected an alternative proposal to such earth station operators to include in their applications a complex technical demonstration that their earth stations will comply with a new regulatory standard called the "minimum acceptable pointing error." Requiring these technical demonstrations would have increased the burdens placed on these earth station operators, including those that are small entities. Thus, rejection of that proposal benefits these earth station applicants, including small entities.

F. Report to Congress

The Commission will send a copy of the *Sixth Report and Order*, including this FRFA, in a report to be sent to Congress pursuant to the Congressional Review Act, *see* 5 U.S.C. § 801(a)(1)(A). In addition, the Commission will send a copy of the *Sixth Report and Order*, including FRFA, to the Chief

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auxiliary microwave stations are used for relaying broadcast television signals from the studio to the transmitter, or between two points such as a main studio and an auxiliary studio. The service also includes mobile TV pickups, which relay signals from a remote location back to the studio.

[28] *See* 13 CFR § 121.201, NAICS code 517212.

[29] 5 U.S.C. §§ 603(c)(1) – (c)(4).

Counsel for Advocacy of the Small Business Administration. A copy of the *Sixth Report and Order* and FRFA (or summaries thereof) will also be published in the Federal Register. *See* 5 U.S.C. § 604(b).

APPENDIX E

INITIAL REGULATORY FLEXIBILITY ANALYSIS

As required by the Regulatory Flexibility Act (RFA),[1] the Commission has prepared this Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities by the policies and rules proposed in this *Third Further Notice*. We request written public comments on this IRFA. Commenters must identify their comments as responses to the IRFA and must file the comments by the deadlines for comments on the *Third Further Notice* provided above in Section VI. The Commission will send a copy of the *Third Further Notice*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration.[2] In addition, the *Third Further Notice* and IRFA (or summaries thereof) will be published in the Federal Register.[3]

A. Need for, and Objectives of, the Proposed Rules

The Telecommunications Act of 1996 requires the Commission in every even-numbered year beginning in 1998 to review all regulations that apply to the operations or activities of any provider of telecommunications service and to determine whether any such regulation is no longer necessary in the public interest due to meaningful economic competition.

Our objective is to repeal or modify any rules in Part 25 that are no longer necessary in the public interest, as required by Section 11 of the Communications Act of 1934, as amended. Specifically, this *Third Further Notice* proposes adoption of an off-axis EIRP envelope for earth stations in the Fixed Satellite Service (FSS). Adoption of this proposal would allow earth station operators more flexibility in their choice of power level and antenna size. In addition, *Third Further Notice* invites comment on revising the rules governing very small aperture terminal (VSAT) networks, to allow VSAT operators to use contention protocols, which are not allowed under the current VSAT rules. However, the *Third Further Notice* also invites comment on creating certain operating parameters for VSAT networks that use contention protocols, so that they do not cause harmful interference to adjacent satellites.

B. Legal Basis

The proposed action is supported by Section 11 of the Communications Act of 1934, as amended, 47 U.S.C. § 161.

C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules May Apply

The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the rules adopted herein.[4] The RFA generally defines the term "small entity " as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[5] In addition, the term "small business" has the same meaning as

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1 *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et seq.*, has been amended by the Contract With America Advancement Act of 1996, Pub. L. No. 104-121, Title II, 110 Stat. 847 (1996) (CWAAA).

2 *See* 5 U.S.C. § 603(a).

3 *See* 5 U.S.C. § 603(a).

4 5 U.S.C. § 604(a)(3).

5 5 U.S.C. § 601(6).

the term "small business concern" under the Small Business Act.[6] A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).[7]

1. Cable Services. The SBA has developed a small business size standard for Cable and Other Program Distribution, which consists of all such firms having $12.5 million or less in annual receipts.[8] According to Census Bureau data for 1997, in this category there was a total of 1,311 firms that operated for the entire year.[9] Of this total, 1,180 firms had annual receipts of under $10 million, and an additional fifty-two firms had receipts of $10 million to $24,999,999.[10] Thus, under this size standard, the majority of firms can be considered small.

The Commission has developed its own small business size standard for a small cable operator for the purposes of rate regulation. Under the Commission's rules, a "small cable company" is one serving fewer than 400,000 subscribers nationwide.[11] Based on our most recent information, we estimate that there were 1,439 cable operators that qualified as small cable companies at the end of 1995.[12] Since then, some of those companies may have grown to serve over 400,000 subscribers, and others may have been involved in transactions that caused them to be combined with other cable operators. Consequently, we estimate that there are fewer than 1,439 small cable companies that may be affected by the proposed rules.

The Communications Act of 1934, as amended, also contains a size standard for a "small cable operator," which is "a cable operator that, directly or through an affiliate, serves in the aggregate fewer than one percent of all subscribers in the United States and is not affiliated with any entity or entities whose gross annual revenues in the aggregate exceed $250,000,000."[13] The Commission has determined that there are 67,700,000 subscribers in the United States.[14] Therefore, an operator serving fewer than 677,000 subscribers shall be deemed a small operator, if its annual revenues, when combined with the total annual revenues of all of its affiliates, do not exceed $250 million in the aggregate.[15] Based on available data, we estimate that the number of cable operators serving 677,000 subscribers or less totals approximately 1,450.[16] We do not request or collect information on whether cable operators are affiliated

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6 5 U.S.C. § 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." 5 U.S.C. § 601(3).

7 Small Business Act, 15 U.S.C. § 632 (1996).

8 13 C.F.R. § 121.201, NAICS code 517510.

9 U.S. Census Bureau, 1997 Economic Census, Subject Series: Information, "Establishment and Firm Size (Including Legal Form of Organization)," Table 4, NAICS code 513220 (issued October 2000).

10 *Id*.

11 47 C.F.R. § 76.901(e). The Commission developed this definition based on its determinations that a small cable company is one with annual revenues of $100 million or less. *See Implementation of Sections of the Cable Television Consumer Protection and Competition Act of 1992: Rate Regulation*, MM Doc. Nos. 92-266 and 93-215, Sixth Report and Order and Eleventh Order on Reconsideration, 10 FCC Rcd 7393, 7408-7409 ¶¶ 28-30 (1995).

12 Paul Kagan Assocs., Inc., Cable TV Investor, Feb. 29, 1996 (based on figures for Dec. 30, 1995).

13 47 U.S.C. § 543(m)(2).

14 *See FCC Announces New Subscriber Count for the Definition of Small Cable Operator,* Public Notice, 16 FCC Rcd 2225 (2001).

15 47 C.F.R. § 76.1403(b).

16 *See FCC Announces New Subscriber Count for the Definition of Small Cable Operator,* Public Notice, 16 FCC Rcd 2225 (2001).

with entities whose gross annual revenues exceed $250,000,000,[17] and therefore are unable to estimate accurately the number of cable system operators that would qualify as small cable operators under the definition in the Communications Act.

2. Satellite Telecommunications. The rules proposed in this *Further Notice* would affect providers of satellite telecommunications services, if adopted. Satellite telecommunications service providers include satellite operators and earth station operators. The Commission has not developed a definition of small entities applicable to satellite operators. Therefore, the applicable definition of small entity is generally the definition under the SBA rules applicable to Satellite Telecommunications.[18] This definition provides that a small entity is expressed as one with $12.5 million or less in annual receipts.[19] 1997 Census Bureau data indicate that, for 1997, 273 satellite communication firms had annual receipts of under $10 million. In addition, 24 firms had receipts for that year of $10 million to $24,999,990.[20]

3. Auxiliary, Special Broadcast and other program distribution services. This service involves a variety of transmitters, generally used to relay broadcast programming to the public (through translator and booster stations) or within the program distribution chain (from a remote news gathering unit back to the station). The Commission has not developed a definition of small entities applicable to broadcast auxiliary licensees. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) rules applicable to radio broadcasting stations,[21] and television broadcasting stations.[22] These definitions provide that a small entity is one with either $6.0 million or less in annual receipts for a radio broadcasting station or $12.0 million in annual receipts for a TV station.[23] There are currently 3,237 FM translators and boosters, 4913 TV translators.[24] The FCC does not collect financial information on any broadcast facility and the Department of Commerce does not collect financial information on these auxiliary broadcast facilities. We believe, however, that most, if not all, of these auxiliary facilities could be classified as small businesses by themselves. We also recognize that most translators and boosters are owned by a parent station which, in some cases, would be covered by the revenue definition of small business entity discussed above. These stations would likely have annual revenues that exceed the SBA maximum to be designated as a small business (as noted, either $6.0 million for a radio station or $12.0 million for a TV station). Furthermore, they do not meet the Small Business Act's definition of a "small business concern" because they are not independently owned and operated.

4. Microwave Services. Microwave services include common carrier,[25] private-operational fixed,[26] and broadcast auxiliary radio services.[27] At present, there are approximately 22,015 common

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17 We do receive such information on a case-by-case basis only if a cable operator appeals a local franchise authority's finding that the operator does not qualify as a small cable operator pursuant to section 76.901(f) of the Commission's rules. *See* 47 C.F.R. § 76.990(b).

18 "This industry comprises establishments primarily engaged in providing point-to-point telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications." Small Business Administration, NAICS code 517310.

19 13 C.F.R. § 120.121, NAICS code 517310.

20 U.S. Census Bureau, 1997 Economic Census, Subject Service: Information, "Establishment and Firm Size," Table 4, NAICS 513340 (Issued Oct. 2000).

21 13 CFR § 121.201, NAICS code 515112.

22 13 CFR § 121.201, NAICS code 515120.

23 13 C.F.R. § 121.201.

24 FCC News Release, Broadcast Station Totals as of September 30, 1999, No. 71831 (Jan. 21, 1999).

25 *See* 47 CFR § 101 *et seq*. (formerly, part 21 of the Commission's Rules).

26 Persons eligible under parts 80 and 90 of the Commission's rules can use Private Operational-Fixed Microwave services. *See* 47 CFR parts 80 and 90. Stations in this service are called operational-fixed to distinguish

carrier fixed licensees and 61,670 private operational-fixed licensees and broadcast auxiliary radio licensees in the microwave services. The Commission has not yet defined a small business with respect to microwave services. For purposes of this FRFA, we will use the SBA's definition applicable to cellular and other wireless communications companies -- *i.e.*, an entity with no more than 1,500 persons.[28] We estimate that all of the Fixed Microwave licensees (excluding broadcast auxiliary licensees) would qualify as small entities under the SBA definition for radiotelephone (wireless) companies.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

None of the proposed rules in this notice are intended to increase the reporting, record keeping and other compliance requirements of any telecommunications carrier. Adoption of an off-axis EIRP approach for the regulation of FSS earth stations would require changes to the application form for earth station licenses, those changes are not intended to be more or less burdensome than the current application requirements. Furthermore, those changes, if adopted, would not affect small business earth station operators any differently than other earth station operators.

E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives: (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.

In the *Third Further Notice*, the Commission considers a proposal from the *Further Notice* regarding VSAT networks using contention protocols, and also considers several proposals from commenters. The Commission rejects all those proposals as too restrictive for all earth station operators, including small business operators, and seeks comment on a new proposal which it believes to be less restrictive.

F. Federal Rules that May Duplicate, Overlap, or Conflict With the Proposed Rules

None.

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them from common carrier and public fixed stations. Only the licensee may use the operational-fixed station, and only for communications related to the licensee's commercial, industrial, or safety operations.

[27] Auxiliary Microwave Service is governed by part 74 of Title 47 of the Commission's Rules. *See* 47 CFR part 74 *et seq*. Available to licensees of broadcast stations and to broadcast and cable network entities, broadcast auxiliary microwave stations are used for relaying broadcast television signals from the studio to the transmitter, or between two points such as a main studio and an auxiliary studio. The service also includes mobile TV pickups, which relay signals from a remote location back to the studio.

[28] *See* 13 CFR § 121.201, NAICS code 517212.