Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
2000 Biennial Regulatory Review --	)	
Streamlining and Other Revisions of	)	IB Docket No. 00-248
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

Adopted: September 16, 2002 Released: September 26, 2002

Comment Date: 75 Days After Publication in the Federal Register
Reply Comment Date: 105 Days After Publication in the Federal Register

By the Commission:

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I. INTRODUCTION

1. In this *Further Notice*, we invite comment on revising Part 25 of the Commission's rules to increase the number of earth station applications that can be processed routinely or, in the alternative, to streamline the processing of earth station applications. Adoption of these proposals should expedite the processing of earth station applications, thereby accelerating the provision of service to the public. We also invite further comment on issues related to very small aperture antenna terminal (VSAT) networks using random access techniques, to ensure that use of these techniques does not lead to an increase in harmful interference to satellite networks. We also seek comment on proposals made by the Satellite Industry Association (SIA). Finally, we propose to update two cross-references in Part 25.

II. BACKGROUND

2. In the *Notice*, we proposed several revisions to Part 25 of our rules to streamline our procedures for certain non-routine earth station applications, among other things.[1] The parties listed in Appendix A filed pleadings in response to the *Notice*.[2] While these pleadings provide an adequate record to resolve most of the issues for which we sought comment in the *Notice*, there are two issues that require us to supplement the record. The first issue relates to our rules governing antenna gain patterns.[3] The second issue concerns use of random access techniques in VSAT networks, such as the "Aloha" random access technique.[4] We provide more background on these two issues below in Sections II.A. and II.B., respectively. In Section II.C., we provide some background on proposals made by SIA.

A. Routine Treatment of Earth Station Applications

3. As we explained in the *Notice*,[5] and as we explain below in this *Further Notice*,[6] a "routine" earth station is one that meets all the technical standards for earth stations in Part 25 of

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[1] 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, FCC 00-435, 15 FCC Rcd 25128 (2000) (*Notice*).

[2] Comments were filed on March 26, 2001, and replies were filed on May 7, 2001. Appendix A also lists the abbreviations by which we refer to parties in this proceeding.

[3] *See* 47 C.F.R. § 25.209 (2001).

[4] *See Notice*, FCC 00-435, 15 FCC Rcd at 25145-48 (paras. 51-57) and 25206-10 (App. E); 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*, DA 00-2664, 15 FCC Rcd 23712 (Int'l Bur., 2000) (*Spacenet Order*).

[5] *Notice*, FCC 00-435, 15 FCC Rcd at 25132 (para. 7).

[6] Section III.B.1.

the Commission's rules,[7] including power spectral density and antenna diameter standards.[8] Because those standards were adopted in 1983,[9] however, subsequent technological improvements have made it possible in many cases for an earth station to use an antenna with a smaller-than-routine diameter without exceeding the technical parameters for earth stations in Part 25.[10] Use of these antennas in these cases does not affect adjacent satellite systems or terrestrial wireless operations any more than earth stations that meet the Commission's routine processing standards.[11] Accordingly, we do not dismiss or deny these "non-routine" earth station applications without conducting a case-by-case review.[12] The current procedure for reviewing non-routine earth station applications is burdensome, however, in light of increasing numbers of non-routine earth station applications,[13] the Commission proposed two streamlined procedures for earth stations applications seeking authority to use smaller-than-routine antennas.[14]

4. The Commission recognized several benefits to streamlining its review of smaller-than-routine earth station applications. First, it noted that technological improvements have enabled satellite communications systems to maintain service performance while decreasing the aperture of the earth station antennas used to deliver satellite services to end users. Those technological improvements benefit end users because smaller antennas are less expensive to manufacture, and it is easier to find suitable locations to install smaller antennas.[15] As a result, expediting the processing of applications for smaller-than-routine earth station antennas should

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[7] 47 C.F.R. Part 25.

[8] In the conventional C-band (3700-4200 MHz and 5925-6425 MHz), the minimum earth station antenna eligible for routine processing is 4.5 meters. In the conventional Ku-band (11.7-12.2 GHz and 14.0-14.5 GHz), the minimum earth station antenna eligible for routine processing is 1.2 meters.

[9] *Notice*, FCC 00-435, 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); Licensing Space Stations in the Domestic Fixed-Satellite Service, 48 F.R. 40233 (Sept. 6, 1983) (*Two Degree Spacing Order*).

[10] In particular, we note that satellite manufacturers can now construct space stations capable of higher transmit power than was possible in 1983, and that most satellite transmissions now use digital rather than analog modulation.

[11] *See Notice*, FCC 00-435, 15 FCC Rcd at 25132 (para. 7).

[12] *Notice*, FCC 00-435, 15 FCC Rcd at 25132 (para. 7).

[13] *Notice*, FCC 00-435, 15 FCC Rcd at 25134 (para. 12).

[14] *Notice*, FCC 00-435, 15 FCC Rcd at 25134-35 (paras. 13-14). The two proposals were as follows: (1) requiring the earth station operator to reduce its power enough to avoid potential adjacent satellite interference; and (2) requiring the earth station operator to submit affidavits from space station operators showing that they have coordinated the earth station's proposed non-routine operations with all other affected satellite systems, and that they will continue to reflect those non-routine operations in future coordination discussions.

[15] *Notice*, FCC 00-435, 15 FCC Rcd at 25134 (para. 12).

expedite the provision of useful satellite services to the public, including the provision of Internet services to rural areas.[16]

5. The Commission did not anticipate that adoption of its proposals for streamlining its review of smaller-than-routine earth station antennas would have any negative effect on terrestrial wireless operations in frequency bands that are shared with Fixed-Satellite Service (FSS) operations.[17] First, the Commission noted that none of its proposals would affect the procedures for coordinating terrestrial wireless operations with FSS operations in shared bands.[18] The Commission further observed that adoption of the proposals in the *Notice* would not affect the contours of any FSS earth station operating in bands shared with the Fixed Service.[19] In other words, none of the proposals in the *Notice* increase the risk of harmful interference to terrestrial wireless services. Specifically, the Commission did not propose any revision to the earth station antenna gain pattern envelope in Section 25.209,[20] nor did it propose any revision to the 5° minimum angle of elevation for earth stations in Section 25.205.[21] The Commission explicitly invited comments from any terrestrial wireless operator who believes its operations might be affected in some way by any of the proposals in the *Notice*.[22] No terrestrial wireless operator submitted any comments in response to the *Notice*.

6. For reasons explained in more detail in Section III. below, revising the Commission's antenna gain pattern envelope would enable us to reduce the minimum earth station antenna diameter eligible for routine treatment. Treating an earth station application as routine would enable us to act on the application more quickly than would be possible under any proposed streamlined procedure for non-routine earth stations. Although the Commission did not propose any revision to the antenna gain pattern envelope, several parties proposed such revisions in their pleadings. Specifically, commenters have proposed revising the backlobe requirements in the conventional Ku-band, which is not shared with the Fixed Service, and in the portions of the Ka-band that are not shared with other services.[23] Commenters also recommend increasing the off-axis angle at which we begin the antenna gain pattern envelope outside the geostationary satellite

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16 *Notice*, FCC 00-435, 15 FCC Rcd at 25132 (para. 4).

17 *Notice*, FCC 00-435, 15 FCC Rcd at 25131 (para. 5).

18 *Notice*, FCC 00-435, 15 FCC Rcd at 25131 (para. 5), *citing* 47 C.F.R. § 25.203(b).

19 *Notice*, FCC 00-435, 15 FCC Rcd at 25131 (para. 5).

20 47 C.F.R. § 25.209.

21 47 C.F.R. § 25.205. Section 25.205 requires that transmitting earth station antennas maintain a minimum of 5° between the horizontal plane and the direction of maximum radiation. The purpose of this rule is to protect terrestrial operations from harmful interference from earth stations. *See* PacAmTel, LLC, Petition for Waiver of Section 25.205 of the Commission's Rules, *Memorandum Opinion and Order*, DA 02-1496 (Policy Branch, Sat. Div., Int'l Bur., released June 27, 2002).

22 *Notice*, FCC 00-435, 15 FCC Rcd at 25131 (para. 5).

23 By "conventional Ku-band," we mean the 11.7-12.2 GHz and 14.0-14.5 GHz bands. The Ka-band frequency band segments not shared with terrestrial services are the 19.7-20.2 GHz, 28.35-28.6 GHz, 28.6-29.1, 29.25-29.5 GHz, and 29.5-30.0 GHz bands. Also, the 18.58-18.8 GHz and 18.8-19.3 GHz bands are shared with the fixed service, but only until June 8, 2010.

orbit (GSO) orbital plane in the conventional Ku-band. In addition, we take this opportunity to consider proposals to increase the off-axis angle at which we begin the antenna gain pattern envelope within the GSO orbital plane in both the conventional Ku-band and the conventional C-band.[24] Although the conventional C-band is shared with the Fixed Service, we do not believe that adoption of these proposals would significantly negatively affect fixed service providers. We explain our reasons for this assumption and invite comment below.

B. VSAT Issues

7. The Commission's rules permit parties to obtain a single license for a large number of technically identical small aperture antenna earth stations.[25] These networks are referred to as VSAT networks. VSAT networks are comprised of a hub station that transmits to, and receives from, multiple technically identical remote small aperture antennas via satellite.[26] Prior to the *Notice* in this proceeding, the International Bureau (Bureau) adopted a declaratory ruling concluding that one of the methods used by some VSAT network operators, the Aloha random access technique, is inconsistent with the Commission's rules.[27] In the *Notice*, the Commission proposed revisions to its VSAT rules to accommodate the Aloha random access technique.[28] In Section IV. of this *Further Notice*, we seek comment on revisions to the Commission's random access technique proposal, based on the pleadings filed in response to that proposal. Subsequently, in Section V., we invite comment on VSAT issues other than those related to random access techniques.

C. SIA Proposals

8. In November and December 2001, SIA filed two *ex parte* statements recommending several interrelated revisions to Part 25 and to many of the proposals in the *Notice*.[29] The current

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[24] The conventional C-band is the 3700-4200 MHz and 5925-6425 MHz band.

[25] 47 C.F.R. §§ 25.115, 25.134 (2001).

[26] *Notice,* FCC 00-435*,* 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). After the Commission adopted the *Notice,* it adopted rules allowing VSAT systems to operate in the C-band. *See FWCC/Onsat First Report and Order*, FCC 01-177, 16 FCC Rcd 11511.

[27] *Spacenet Order*, DA 00-2664, 15 FCC Rcd 23712.

[28] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25145-48 (paras. 51-57).

[29] Letter from Richard DalBello, Executive Director, Satellite Industry Association, to Magalie Roman Salas, Secretary, FCC (dated Nov. 5, 2001) (SIA November 5 *Ex Parte* Statement); Letter from Dori K. Bailey of Latham and Watkins, to Magalie Roman Salas, Secretary, FCC (dated Dec. 11, 2001) (SIA December 10 *Ex Parte* Statement). In addition, SIA made an oral *ex parte* presentation to Commission staff on November 19, but SIA did not file a written summary of its *ex parte* presentation until December 11. SIA states that it "regrets the inadvertent oversight in the late filing of this Notice of Ex Parte Presentation." Letter from Dori K. Bailey of Latham and Watkins, to Magalie Roman Salas, Secretary, FCC (dated Dec. 11, 2001) (SIA November 19 *Ex Parte* Statement) at 1. 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). We need not determine what action,

record in this proceeding is sufficient to enable us to act on some but not all of SIA's proposals.[30] In this *Further Notice*, we invite comment on those SIA proposals for which we do not have an adequate record.[31]

9. Among other things, SIA's recommendations include revisions to the earth station antenna gain pattern envelope rules and our proposed random access technique rules. We address SIA's antenna gain pattern proposals in Section III. and its random access technique proposals in Section IV. We consider SIA's VSAT proposals that are unrelated to its random access technique proposals in Section V. Finally, in Section VI., we invite comment on the rest of SIA proposals for which we do not have an adequate record. In a future Order, we will act on all of SIA's proposals together, and resolve the issues discussed in the *Notice* and this *Further Notice*.

III. ANTENNA GAIN PATTERNS

A. Introduction

10. We observed in the *Notice* that there are strong economic and other incentives to use the smallest possible diameter earth station antenna, because smaller antennas are less expensive to manufacture. It is also easier to find suitable locations to install smaller antennas.[32] Therefore, if we could revise our rules to allow smaller earth station antennas to be licensed "routinely," it would further the public interest by reducing costs, and by facilitating installation of antennas at new subscribers' locations, including homes. Thus, routine licensing of smaller earth station antennas would promote provision of satellite-based Internet services to all Americans, including those in rural and underserved communities. Furthermore, promoting satellite service encourages greater use of the spectrum, and would lead to better spectrum management.

11. On the other hand, allowing greater use of earth stations with smaller-than-routine antennas than we do now may raise some concerns. First, earth stations using smaller antennas are more likely to cause harmful interference to adjacent satellite systems if they are not aimed at the desired satellite within a small fraction of a degree. In addition, the wider beam widths associated with smaller antennas could possibly increase the risk of harmful interference to terrestrial wireless operations in the case of low elevation angle and/or high horizon angles. In other words, earth stations using smaller antennas create an increased risk of harmful interference resulting from wider beam widths and "pointing error." Accordingly, we will adopt the proposals in this *Further Notice* to facilitate licensing of smaller antennas only if the Commission makes a

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if any, is warranted with respect to SIA's late-filed *ex parte* statement, as the proposals in the November 19 *ex parte* statement are the same as those in SIA's other two *ex parte* statements.

[30] For example, the record is sufficient to act on SIA proposals to increase the downlink EIRP spectral density levels limit from 6 dBW/4 kHz to 9 dBW/4 kHz for Ku-band operations, and to exclude Ka-band earth stations from the Commission's proposed earth station antenna performance verification standards.

[31] Specifically, we address SIA's antenna gain pattern proposals in Section III.E. We consider SIA's comments on random access techniques used in Very Small Aperture Terminals (VSAT) in Section IV., together with other comments on these issues. We invite comment on other SIA VSAT proposals in Section V., on its proposed non-routine earth station procedure in Section VI.B., and on SIA's proposed revisions to the power limits for video, wideband, and narrowband transmissions in Section VI.C.

[32] *See Notice,* FCC 00-435, 15 FCC Rcd at 25134 (para. 12).

determination based on the record that such rule revisions would not increase the risk of harmful interference to other adjacently-located satellites or terrestrial wireless operations.

12. In the *Notice*, the Commission explained that it did not expect its proposals to facilitate licensing of smaller-than-routine earth station antennas to have any negative effect on terrestrial wireless operations.[33] Similarly, we expect that adoption of the antenna gain pattern revisions proposed in this Section of this *Further Notice* would have very little negative effect on existing or future terrestrial wireless operations. Many of the proposed revisions would be limited to operations in frequency bands that are not shared with the Fixed Service. Moreover, with respect to operations in shared frequency bands, we do not anticipate any significant negative effect on terrestrial wireless operations because we are not proposing any change in the procedures for coordinating terrestrial wireless operations with FSS operations.[34] In any case, given the minimal extent by which we are proposing to widen our main beam width limits, we believe that such a wider main beam transmitted by an earth station operating in a shared band could only have an adverse effect on a terrestrial wireless operator in certain, very limited circumstances. Those circumstances are when the terrestrial wireless operation is located at a much higher elevation than the earth station, the earth station is transmitting at a low elevation angle, and increasing the main beam width of the earth station transmission causes the terrestrial wireless operation to fall within the wider earth station main beam. We invite comments concerning the impact of the proposals in this *Further Notice* on terrestrial wireless operations.

13. Nor do we believe that that facilitating the licensing of smaller antennas would encourage antenna manufacturers to produce inferior antennas, or make it difficult to adopt measures in the future to improve overall spectrum planning or efficiency of spectrum use. In 1993, the Commission increased the off-axis angle at which it begins the antenna gain envelope for conventional Ku-band earth station antennas, from 1° to 1.25°.[35] That rule revision allowed for routine processing of smaller earth station antennas without resulting in an increase in substandard antennas. Furthermore, as the Commission observed in the *Notice*, facilitating smaller-than-routine earth station antennas would encourage greater deployment of satellite services because smaller antennas are less expensive to manufacture, and it is easier to find suitable locations to install smaller antennas.[36] To the extent that the proposals in the *Notice* and this *Further Notice* encourage greater deployment of satellite services without adversely affecting other Commission licensees, we believe that the proposals in this proceeding encourage more efficient spectrum usage. Moreover, similar to the flexible standards we adopted in 1997 for

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[33] *Notice,* FCC 00-435, 15 FCC Rcd at 25131 (para. 5).

[34] *See* 47 C.F.R. § 25.203(b). Furthermore, our proposals here are limited to changing the point at which we begin the antenna gain pattern envelope. Thus, we expect these proposals to allow FSS earth stations only to generate wider main beams, but not to generate any greater side lobes than are permitted under the current rules. We note further that we do not propose any increase in the earth station power spectral density limits. Finally, we do not propose any revision to the 5° minimum angle of elevation requirement in Section 25.205.

[35] *See* 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, FCC 93-38, 8 FCC Rcd 1316, 1322 (paras. 38-39) (1993) (*Ku-band Antenna Gain Pattern Revision Order*). *See also* 47 C.F.R. § 25.209(g).

[36] *Notice,* FCC 00-435, 15 FCC Rcd at 25134 (para. 12).

fixed microwave service antennas,[37] we believe that the proposals in this *Further Notice* are technologically neutral. We invite parties to comment on this analysis.

14. Finally, the Commission has adopted rules allowing conventional Ku-band earth stations to communicate with GSO and NGSO satellites.[38] We propose that any revisions to the Ku-band earth station antenna gain pattern envelope that we adopt should apply only to conventional Ku-band earth stations communicating with GSO satellites. This is because this proceeding is intended primarily to accelerate our review of earth station applications classified as "non-routine" under our current rules.[39] Conventional Ku-band earth stations communicating with NGSO satellites are not classified as routine or non-routine. We adopted specific downlink PFD requirements and antenna gain pattern limits for Ku-band earth stations communicating with NGSO satellites, rather than criteria for routine processing that can be exceeded if the earth station applicant shows that its operations will not adversely affect other licensees any more than an earth station that meets those criteria.[40] We seek comment on our proposal to direct our attention away from Ku-band earth stations communicating with NGSO satellites at this time.

15. In Section III.B. below, we define "routine" and "non-routine" earth stations. We also discuss earth station antenna gain patterns, and explain how the Commission's rules governing antenna gain patterns create a minimum earth station antenna size eligible for routine processing.

16. In Section III.C., we invite comment on reducing the minimum antenna size of conventional C-band earth stations eligible for routine processing to 3.7 meters in diameter.[41] The conventional C-band is shared with terrestrial wireless operations.

17. In Section III.D., we invite comment on beginning the earth station antenna gain envelope within the GSO orbital plane at a greater off-axis angle, for earth stations operating in both the conventional C-band and the conventional Ku-band.[42] In Section III.D.2., we review the pleadings filed in response to the *Notice*, discussing antenna gain pattern requirements within the GSO orbital plane. We also find that, but for the pointing error issue, commenters have persuasively shown that beginning this antenna gain pattern envelope at 1.8° off-axis, thereby

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[37] Amendment of Parts 74, 78, 101 of the Commission's Rules to Adopt More Flexible Standards for Directional Microwave Antennas, *Report and* Order, ET Docket No. 96-35, FCC 97-1, 12 FCC Rcd 1016 (1997).

[38] Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range, *First Report and Order and Further Notice of Proposed Rulemaking*, ET Docket No. 98-206, FCC 00-418, 16 FCC Rcd 4096 (2000) (*Ku-band NGSO Order*). By "conventional Ku-band," we mean the 11.7-12.2 GHz and 14.0-14.5 GHz bands.

[39] *See Notice*, FCC 00-435, 15 FCC Rcd at 25132-33 (para. 8).

[40] *Ku-band NGSO Order*, FCC 00-418, 16 FCC Rcd at 4241-53 (App. A, revisions to Sections 25.204 and 25.209 of the Commission's rules, 47 C.F.R. §§ 25.204, 25.209).

[41] By "conventional C-band," we mean the 3700-4200 MHz and 5925-6425 MHz bands.

[42] By "conventional Ku-band," we mean the 11.7-12.2 GHz and 14.0-14.5 GHz bands. The conventional C-band is shared with the Fixed Service, and the conventional Ku-band is not.

allowing routine processing of smaller earth station antennas, will not increase the risk of harmful interference. None of the parties, however, discussed the pointing error issue, other than PanAmSat who raised the issue in an *ex parte* statement.[43] In Section III.D.3., we propose starting the earth station antenna gain pattern envelope at less than 1.8° off-axis to reflect the potential for pointing error. We also request that commenters recommend a specific off-axis angle less than 1.8° at which to begin the antenna gain pattern envelope. Finally, in Section III.D.4., we propose to require that earth station operators with small antennas comply with certain rules designed to reduce pointing error. In this context, by "small antenna," we mean less than 1.2 meters in diameter in the Ku-band, and less than either 3.7 or 4.5 meters in diameter in the C-band, depending on whether we adopt our proposal in Section III.C. to reduce the routine antenna diameter for C-band earth station applications to 3.7 meters.

18. Subsequently, in Section III.E., we invite comment on some of SIA's antenna gain pattern proposals as an alternative to our proposals in Section III.C. and III.D. We point out several concerns raised by SIA's recommendations, and propose not to adopt those recommendations.

19. Finally, in Section III.F., we propose to revise the earth station antenna gain pattern envelope for conventional Ku-band earth station antennas outside the GSO orbital plane, and at off-axis angles greater than 48°. These proposals are limited to earth stations operating in frequency bands that are not shared with the terrestrial wireless services.

B. Background

1. Routine and Non-Routine Earth Stations

20. Under our 2° spacing policy, we assign adjacent in-orbit satellites to geostationary satellite orbit locations 2° apart in longitude.[44] The 2° spacing policy also establishes technical standards to govern earth stations communicating with these satellites, including minimum earth station antenna diameter.[45] The size of the earth station antenna is important since, in general, smaller antennas produce wider transmission beams, which, in turn, create more potential interference to adjacent satellite operations or terrestrial wireless operations. We "routinely" license earth station facilities that meet these 2° spacing technical standards, now codified in Part 25 of our rules.[46] It is possible, however, for an earth station to operate without causing unacceptable interference in a 2° space station spacing environment without meeting all of the technical standards of Part 25, provided the operations are properly coordinated with all affected

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

[44] *Notice,* FCC 00-435, 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); Licensing Space Stations in the Domestic Fixed-Satellite Service, 48 F.R. 40233 (Sept. 6, 1983) (*Two Degree Spacing Order*).

[45] We also have standards governing other earth station parameters, such as power levels, but we focus exclusively on issues related to antenna diameter in this section of the *Further Notice*.

[46] 47 C.F.R. Part 25 (2001).

parties. Accordingly, we evaluate "non-routine" earth station applications on a case-by-case basis.[47]

2. Earth Station Antenna Gain Patterns

21. As part of the 2° spacing standards, Part 25 contains requirements for earth station antenna gain patterns.[48] The gain of an antenna is the ratio of the power required at the input of a loss-free omni-directional reference antenna to the power supplied to the input of the 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.[49] In other words, gain refers to an antenna's ability to collect, concentrate, and direct energy in a particular fashion, *i.e.*, a beam.[50] Many antennas are shaped like parabolas, or like large, relatively shallow, 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.[51] The boresight should run directly into the antenna on the satellite with which the earth station is communicating. The energy transmitted along the boresight is called the main beam. The "off-axis" angle is the angle formed by the boresight axis and any other line running through the center of the bowl.[52] The energy transmitted from an antenna forms ripples called "sidelobes," alternately increasing and decreasing in magnitude as the off-axis angle increases.[53] Examples of these ripples can be seen in the antenna gain pattern diagrams in Appendix A of the *Notice*.[54] These ripples are called "side lobes."[55]

22. Measuring the gain at various off-axis angles allows us to determine the interference potential of that earth station to other in-orbit satellites. For example, the antenna gain at 2° or slightly wider off-axis angles measures 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.[56] Section 25.209 contains equations that establish maximum limits for the gain

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47 *Notice,* FCC 00-435, 15 FCC Rcd at 25132 (para. 7).

48 47 C.F.R. § 25.209.

49 *Notice,* FCC 00-435, 15 FCC Rcd at 25133 (para. 9), *citing* 47 C.F.R. § 2.1 (2001).

50 *Notice,* FCC 00-435, 15 FCC Rcd at 25133 (para. 9).

51 *Notice,* FCC 00-435, 15 FCC Rcd at 25133 (para. 9).

52 *Notice,* FCC 00-435, 15 FCC Rcd at 25133 (para. 9).

53 *Notice,* FCC 00-435, 15 FCC Rcd at 25133 (para. 9). These "ripples" are in the form of a Bessel function of the first kind. Examples of such Bessel functions can be found in the theoretical antenna gain patterns shown in Appendix A of the *Notice*. *See Notice,* FCC 00-435, 15 FCC Rcd at 25162-73.

54 *Notice,* FCC 00-435, 15 FCC Rcd at 25162-73 (App. A).

55 *Notice,* FCC 00-435, 15 FCC Rcd at 25133 (para. 9). Earth station antennas can also be elliptical or other shapes in addition to circular, but all earth station antennas produce main beams and side lobes.

56 The angle between two adjacent satellites as viewed from the earth's surface is, for most surface locations, somewhat larger than the angle from the center of the earth, which defines satellite

of any earth station antenna at every off-axis angle greater than 1° in the C-band, and 1.25° in the Ku-band.[57]

23. Because decreasing the antenna diameter produces wider main beams,[58] 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 exceed the Section 25.209 antenna standard equation at 1.0° or 1.25° off-axis and thereby cause a potential for harmful interference to adjacent satellites or terrestrial wireless operations.[59] The smallest diameter antenna we license routinely under our current rules at C-band is 4.5 meters, while at Ku-band the smallest antenna we routinely license is 1.2 meters in diameter.[60]

3. Procedural History

24. In the *Notice*, we proposed several revisions to Part 25 of our rules to streamline our procedures for earth station applications seeking to use conventional C-band or conventional Ku-band antennas with non-routine antenna gain patterns.[61] Although we did not propose any revisions to the antenna gain pattern requirements, some commenters proposed beginning the antenna gain pattern at 1.8° off-axis or wider in the GSO orbital plane.[62] Later, SIA proposed different revisions to the antenna gain pattern envelope rules in its *ex parte* statements.[63] We discuss these proposals in detail in Section III.E. below. PanAmSat also filed an *ex parte*

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spacing. *See* Appendix B.

[57] *Notice,* FCC 00-435, 15 FCC Rcd at 25133 (paras. 10-11); 47 C.F.R. §§ 25.209(a), (b), (g). For purposes of this *Further Notice*, the terms "C-band" and "conventional C-band" denote the 3700-4200 MHz and 5925-6425 MHz frequency bands. The terms "Ku-band" and "conventional Ku-band" denote the 11.7-12.2 GHz and 14.0-14.5 GHz frequency bands. There are also the "extended" C-band and "extended" Ku-band, but earth stations are not routinely licensed in these frequency bands.

[58] *Notice,* FCC 00-435, 15 FCC Rcd at 25132 (para. 7).

[59] *Notice,* FCC 00-435, 15 FCC Rcd at 25133 (para. 11), *citing Two Degree Spacing Order*, 54 Rad. Reg. 2d at 605 (para. 93).

[60] *Notice,* FCC 00-435, 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 standards does not generally cause unacceptable interference, 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); *Ku-band Antenna Gain Pattern Revision Order*, FCC 93-38, 8 FCC Rcd at 1322 (paras. 38-39).

[61] *Notice,* FCC 00-435, 15 FCC Rcd at 25132-40 (paras. 8-30).

[62] Hughes Comments at 8-11; PanAmSat Comments at 3; Spacenet Comments at 12-14; Spacenet Reply at 7-8. When viewed from any point on the earth's surface, the satellites in the GSO appear to lie almost completely within one plane. The antenna gain pattern equation in Section 25.209(a)(1) applies to side lobes within that GSO orbital plane. 47 C.F.R. § 25.209(a)(1). The antenna gain pattern equation in Section 25.209(a)(2) allows side lobes outside that orbital plane to be greater than allowed within the orbital plane at off-axis angles less than 9.2°. 47 C.F.R. § 25.209(a)(2).

[63] SIA December 10 *Ex Parte* Statement at 15-21.

statement regarding pointing error issues, or in other words, the potential for harmful interference resulting from a small earth station antenna if it is not aimed at its desired satellite with sufficient accuracy.[64]

C. Routine C-band Earth Station Antenna Size

25. In 1999, an earth station operator, Onsat Network Communications, Inc. (Onsat), requested a waiver of the Commission's rules to process routinely 3.7-meter C-band earth station antennas.[65] Although the Bureau did not have a sufficient basis to grant Onsat's waiver request,[66] at that time it deferred further consideration of the matter to a future rulemaking. Onsat's statement that a 3.7-meter earth station antenna at C-band would cause no more harmful interference than a 1.2-meter earth station antenna at Ku-band merits further consideration. We note that we have licensed Onsat to operate C-band earth stations with 3.7-meter antennas, and we have adopted rules to facilitate issuing similar earth station licenses in the future.[67] Moreover, when we adopted those rules, we anticipated considering in an earth station streamlining proceeding whether we could revise our rules to allow routine processing of earth station applications like Onsat's.[68] Accordingly, we invite comment on processing applications for 3.7-meter earth station antennas routinely under Section 25.212(d).[69] In particular, we invite parties to identify the gain of a 3.7-meter C-band earth station antenna at 1.25° off-axis, and seek comment on how this compares to the gain of a 1.2-meter Ku-band earth station antenna at 1.25° off-axis.[70]

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[64] PanAmSat October 22 *Ex Parte* Statement.

[65] *See* Onsat Petition for Waiver to Permit Routine Licensing of 3.7 Meter Transmit and Receive Stations at C-Band, *Order*, DA 00-2663, 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.

[66] In part, Onsat claimed that 3.7-meter C-band antennas have less potential for causing harmful interference than 1.2-meter Ku-band antennas, which are routinely licensed. *Onsat Waiver Order*, DA 00-2663, 15 FCC Rcd at 24489 (para. 4). The Bureau denied Onsat's waiver petition. This was in part because Onsat planned to operate with a specific satellite, and did not provide sufficient data to show that the antenna Onsat planned to use would not cause harmful interference if Onsat communicates with other satellites. *Onsat Waiver Order*, DA 00-2663, 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*, DA 00-2663, 15 FCC Rcd at 24491-92 (para. 8). *See also* 47 C.F.R. § 1.3 (2001) (petitioners seeking a waiver must show "good cause"), WAIT Radio v. FCC, 418 F.2d 1153, 1159 (D.C. Cir. 1969) (*WAIT Radio*).

[67] *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, FCC 01-177, 16 FCC Rcd 11511 (2001) (*FWCC/Onsat First Report and Order*).

[68] *FWCC/Onsat First Report and Order*, FCC 01-177, 16 FCC Rcd at 11517 (para. 10).

[69] 47 C.F.R. § 25.212(d).

[70] The Commission has determined that starting the Ku-band antenna gain pattern envelope at 1.25° off-axis does not create a substantial increase in the likelihood of harmful interference. *Ku-band Antenna Gain Pattern Revision Order*, FCC 93-38, 8 FCC Rcd at1322 (paras. 38-39).

26. In addition, we invite parties to propose a minimum antenna size requirement less than 3.7 meters in diameter for routine processing of conventional C-band earth station applications. The gain of a 2.7-meter conventional C-band antenna in the uplink portion of the band at 1.25° off-axis may be approximately equal to the gain of a 1.2-meter antenna conventional Ku-band in the uplink portion of the band.[71] In other words, a 2.7-meter antenna in the conventional C-band may not cause any more harmful interference than a 1.2-meter antenna in the conventional Ku-band, but it may be more susceptible to receiving harmful interference. On the other hand, we note that the 14.0-14.5 GHz portion of the conventional Ku-band is not shared with terrestrial wireless operations, while the 5925-6425 MHz portion or the conventional C-band is shared with these services. Is this difference relevant in determining whether allowing routine processing of 2.7-meter antennas in the conventional C-band is likely to significantly adversely affect coordination between the Fixed Service and the Fixed Satellite Service? Therefore, we invite comment on routinely processing applications for 2.7-meter conventional C-band earth station antennas in cases where the applicant does not require protection from receiving interference any greater than that afforded to a 4.5-meter earth station antenna in the conventional C-band under our current rules.[72]

27. We observe that decreasing the minimum antenna size for routine processing of earth station applications could result in wider earth station main beams. This, in turn, could adversely affect terrestrial wireless operations in those relatively uncommon cases where the terrestrial wireless operation is located at a higher elevation than the earth station, the earth station is transmitting at a low elevation angle, and increasing the main beam of the earth station transmission causes the terrestrial wireless operation to fall within the wider earth station main beam. We invite comment on our belief that no revisions to the coordination procedures are needed to address these cases. We also seek comment on what effect, if any, the wider main beams and lower main beam gain of the smaller earth station antennas may have on the coordination areas.

28. In Section III.D. below, we invite comment on revising the Commission's rules to begin the antenna gain pattern envelope at an off-axis angle between the current requirements and 1.8°,[73] together with additional requirements applicable to small earth station antennas to help prevent pointing error. For purposes of those proposals, we would define "small" Ku-band earth station antennas as those less than 1.2 meters in diameter. We would define "small" C-band earth station antennas as those less than either 4.5 meters, 3.7 meters, or 2.7 meters in diameter, depending on whether the Commission adopts either of the proposals in this Section of the *Further Notice*. If the Commission adopts the proposals in Section III.D., then the criterion for determining eligibility for routine processing would be whether the earth station antenna meets the Commission's antenna gain pattern rules, rather than whether the antenna is greater than a minimum diameter as it is under the Commission's current rules. We invite parties to comment on these alternatives.

D. Earth Station Antenna Gain Pattern Envelope Within the GSO Orbital Plane

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[71] In other words, we compare the 5925-6425 MHz band with the 14.0-14.5 GHz band.

[72] *See* 47 C.F.R. § 25.209(c).

[73] The current requirements are 1.0° off-axis for C-band earth stations, and 1.25° off-axis for Ku-band earth stations. 47 C.F.R. § 25.209.

1. Introduction

29. When viewed from any point on the earth's surface, the satellites in the GSO appear to lie in one plane. The antenna gain pattern equation in Section 25.209(a)(1) applies to side lobes within that GSO orbital plane. Currently, the antenna gain pattern envelope begins at the same off-axis angle both within and outside the GSO orbital plane, 1° off-axis for conventional C-band earth stations and 1.25° off-axis for conventional Ku-band earth stations.[74] However, the antenna gain pattern equation in Section 25.209(a)(2) allows side lobes outside that orbital plane to be greater than allowed within the orbital plane at off-axis angles less than 9.2°.[75] When the Commission adopted the 2° spacing rules in 1983, it concluded that it needed to apply more stringent side lobe requirements within the GSO orbital plane to make 2° spacing possible, but also found that no revisions were necessary outside the GSO orbital plane because earth station side lobes in those directions do not affect orbital spacings.[76]

30. In Section III.D.2., we invite comment on issues raised by proposals in the record to start the antenna gain envelope within the GSO orbital plane at a greater off-axis angle for conventional C-band and conventional Ku-band antennas. Based on the record on this issue to date, we believe that we could begin the antenna gain pattern envelope as far as 1.8° off-axis in the GSO orbital plane if we could assume that there is no possibility of earth station antenna pointing error. We do not believe, however, that we can make this assumption based on the information in the record in this proceeding. We discuss pointing error in Sections III.D.3. and III.D.4.

2. Starting the Envelope at a Greater Off-Axis Angle

31. *Introduction*. In this Section, we consider contentions that starting the antenna gain pattern envelope within the GSO orbital plane at an off-axis angle greater than 1° in the C-band, and 1.25° in the Ku-band would permit earth station operators to use smaller antennas without increasing the potential for harmful interference to adjacent satellite operations and terrestrial wireless operations. Based on the record on this issue developed in response to the *Notice*, we believe that, if not for the issue of pointing error, we could start the antenna gain pattern envelope at 1.8° off-axis within the GSO orbital plane for conventional C-band and Ku-band antennas.

32. *Pleadings*. Hughes proposes beginning the off-axis angle for the Ku-band at 1.8° rather than 1.25°, as is now required. Hughes argues further that, because the satellites currently serving the United States are spaced at least 1.9° apart, beginning the off-axis angle at 1.8° will not increase the potential for intersatellite system interference.[77] Spacenet recommends measuring compliance with the Ku-band antenna gain pattern envelope beginning at 2° off-axis rather than 1.8° off-axis, because satellites spaced 2° apart in the geostationary satellite orbit

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[74] *See* 47 C.F.R. § 25.209(g). By "conventional C-band," we mean the 3700-4200 MHz and 5925-6425 MHz band. By "conventional Ku-band," we mean the 11.7-12.2 GHz and 14.0-14.5 GHz bands.

[75] 47 C.F.R. §§ 25.209(a)(1), (2).

[76] *Two Degree Spacing Order*, 54 Rad. Reg. 2d at 606 (para. 97).

[77] Hughes Comments at 8-11.

appear to be 2.2° apart as viewed from the earth station on the Earth's surface.[78] PanAmSat recommends starting the off-axis angle at more than 1°. PanAmSat does not provide a recommendation for the angle at which to begin the antenna gain pattern envelope, nor state whether it would propose revision of the earth station antenna gain pattern rules in the C-band, Ku-band, or both.[79] Rather, PanAmSat observes that the industry is trying to develop a consensus on a proposal for starting the off-axis angle for reference patterns.[80]

33. Several commenters state that revising the antenna gain pattern envelope to begin at 1.8° off-axis will not adversely affect interleaved satellites, that is, satellites serving the Southern Hemisphere that are placed between two U.S.-licensed satellites serving North America that themselves are placed 2° apart in the geostationary orbit. This is because the interleaved satellites' internationally coordinated coverage areas (footprints) do not overlap the footprints of satellites serving the Northern Hemisphere, and there is adequate isolation due to the angular separation from the satellite antenna serving the two geographical areas to avoid unacceptable interference to adjacent satellites under these circumstances.[81]

34. Hughes also contends that revising the antenna gain pattern should not raise any concerns with respect to satellites that do not meet the Commission's station-keeping requirements, because there are very few satellites that cannot and do not meet the station-keeping requirements.[82] Hughes further contends that any inability to meet the station-keeping standards is almost always temporary because it usually results from damage during launch of the satellite, or develops at the end of the satellite's useful life. In both cases, according to Hughes, the operator usually replaces the satellite relatively quickly.[83]

35. *Discussion*. We believe we could revise the antenna gain pattern envelope to begin at as much as 1.8° off-axis in the GSO orbital plane for both conventional C-band and conventional Ku-band earth stations, if we did not have to consider earth station pointing error. In 1983, the Commission decided to begin the antenna gain pattern envelope at 1° off-axis to

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[78] Spacenet Comments at 12-14; Spacenet Reply at 7-8. When we say that two satellites are spaced 2° apart, that is measured from the center of the earth rather than at the Earth's surface.

[79] PanAmSat Comments at 3.

[80] PanAmSat Comments at 3. Eventually, SIA developed an antenna gain pattern proposal. We discuss that proposal in Section III.E. below.

[81] *See* PanAmSat Comments at 6; Andrew Corporation Comments at 2; Hughes Comments at 14; Hughes Reply at 9.

[82] Our station-keeping requirements are found in Section 25.210(j) of our rules, 47 C.F.R. § 25.210(j) (2001). Under these requirements, GSO satellites must be designed with the capability to be maintained in orbit within 0.05° of their maintained orbital longitude. In the *Notice,* we noted that, as an antenna gets smaller, its mainbeam gets wider, and that licensing more earth stations with smaller antennas could lead to occurrences of interference to or from adjacent geostationary satellite systems if those satellites drift away from their assigned orbital location. We did not see this as a serious concern, however, because we expected that our station-keeping requirements would preclude all but very minor drifting, and invited comment on this expectation. *Notice,* FCC 00-435, 15 FCC Rcd at 25138 (para. 27).

[83] *See* Hughes Comments at 13-14, Hughes Reply at 9.

protect non-U.S.-satellites from interference from interleaved U.S.-licensed satellites.[84] The Commission revised the antenna gain pattern envelope to begin at 1.25° off-axis for Ku-band earth stations in 1993 because it found that earth stations that did not meet the antenna gain pattern standard between 1° and 1.25° off-axis were not causing harmful interference to adjacent satellite systems.[85]

36. We find that the commenters in this proceeding are persuasive when they argue that revising the antenna gain pattern envelope to begin at 1.8° off-axis will not adversely affect currently operating interleaved satellites (satellites at less than 2° orbital spacings from U.S. satellites), because their internationally coordinated coverage areas (footprints) do not overlap the footprints of satellites serving the Northern Hemisphere.[86] We also believe that Hughes is persuasive in arguing that the possibility that a space station will not meet our station-keeping requirements is too remote to warrant rejection of the revisions to the earth station antenna gain pattern requirements proposed in this proceeding.[87] Accordingly, we seek comment on the position that any possible concerns regarding interleaved satellites or satellites that do not meet the Commission's station-keeping requirements do not, by themselves, warrant rejection of our proposals in this *Further Notice* to revise the antenna gain pattern rules for conventional C-band and conventional Ku-band earth stations.

37. Although Spacenet is correct that satellites 2° apart in the geostationary satellite orbit appear 2.2° apart to an earth station on the earth's surface at certain angles of elevation, we do not propose to adopt its proposal to start the earth station antenna gain pattern envelope at 2.0°.[88] We believe that Hughes's more conservative proposal of 1.8° may be preferable because three Canadian and two Mexican satellites nominally spaced 1.9° apart are now providing service in the United States.[89] Starting the antennas gain pattern envelope at 2.0° as Spacenet recommends

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[84] *Two Degree Spacing Order*, 54 Rad. Reg. 2d at 606 (para. 96).

[85] *Ku-band Antenna Gain Pattern Revision Order*, FCC 93-38, 8 FCC Rcd at1322 (para. 39).

[86] *See* PanAmSat Comments at 6, Andrew Corporation Comments at 2, Hughes Comments at 14, Hughes Reply at 9. This proposal will not affect the ability of the operator of any non-U.S.-licensed satellite to provide service in the United States. The interleaved satellites and U.S.-licensed satellites do not currently cause interference to each other because they are not co-coverage. In other words, their footprints do not overlap. *See Notice,* FCC 00-435, 15 FCC Rcd at 25139 (para. 39). These satellites would cause interference into each other if the satellite licensed to provide service only to the Southern Hemisphere were to provide service to the United States, regardless of whether we revise the antenna gain pattern rules.

[87] All U.S.-licensed satellites are designed to be maintained in orbit within ±0.05° of their assigned locations to meet the station-keeping requirement in Section 25.210(j). Non-U.S.-licensed satellite operators seeking access to the U.S. market must also show that they meet all the Commission's technical requirements applicable to U.S.-licensed satellites, including the station-keeping requirements. *See* Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Satellites Providing Domestic and International Service in the United States, *Report and Order*, IB Docket No. 96-111, FCC 97-399, 12 FCC Rcd 24094, 24161-62 (para. 156) (1997) (*DISCO II*).

[88] This is discussed in more detail in Appendix B.

[89] Canadian satellites providing FSS service in the United States at C-band and Ku-band are located at 107.3° W.L., 111.1° W.L., and 118.7° W.L. Mexican satellites providing service in the United States are located at 113.0° W.L. and 116.8° W.L. *See* Telesat Canada, Request for Declaratory Ruling or

might cause harmful interference to an adjacent satellite 1.9° away from the target satellite, if both satellites are 0.05° from their assigned locations, as permitted by the Commission's station-keeping rule.[90] We seek comment on these observations.

38. Finally, unlike the proposed backlobe gain limit revisions we discuss below, we note that the commenters do not limit their proposed sidelobe gain limit revisions to frequency bands that are not shared with terrestrial wireless services. We do not believe that beginning the antenna gain pattern envelope at 1.8° off-axis for C-band earth stations will adversely affect terrestrial wireless operations in the C-band, or will make it difficult to coordinate earth stations and terrestrial wireless operations in the C-band. Currently, the Commission's rules require earth stations to operate with a minimum angle of elevation of 5°,[91] and our proposed revisions to the antenna gain pattern envelope would not affect that minimum elevation requirement. We seek comment on this analysis.

39. In summary, we seek comment on our conclusion that we could begin the antenna gain pattern envelope as far as 1.8° off-axis in the GSO orbital plane if we could assume that there is no possibility of earth station antenna pointing error. We do not believe, however, that we can make this assumption based on the information in the record in this proceeding. We discuss pointing error in Sections III.D.3. and Sections III.D.4. below.

3. Adjusting Starting Point of Antenna Gain Envelope to Reflect Potential Pointing Error

40. 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.[92] The effect of pointing error on an antenna gain pattern is to shift the pattern away from the desired direction, thus potentially increasing the gain toward a neighboring satellite. PanAmSat alleges that, as an earth station's antenna diameter decreases, the width of its main beam increases, and the risk of harmful interference from pointing error increases as the main beam increases.[93] PanAmSat alleges further that, eventually, the main beam

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Petition for Waiver on Earth Stations' Use of ANIK E1 and ANIK E2 Satellite Capacity to Provide Basic Telecommunications Service in the United States, *Order*, DA 99-2752, 15 FCC Rcd 3649 (Int'l Bur. 1999); Telesat Canada, Request for Declaratory Ruling For Inclusion of ANIK F1 on the Permitted Space Station List, *Order*, 15 FCC Rcd 24828 (Int'l Bur., Sat. and Rad. Div., 2000); Telesat Canada, Request to Eliminate Conditions on ANIK E1 and E2's Inclusion on The Permitted Space Station List, *Order*, DA 01-2051, 16 FCC Rcd 15979 (Int'l Bur., Sat. and Rad. Div., 2001); Satelites Mexicanos, S.A. de C.V., Petition for Declaratory Ruling, *Order*, DA 00-1793, 15 FCC Rcd 19311 (Int'l Bur., Sat. and Rad. Div., 2000).

[90] 47 C.F.R. § 25.210(j)(1).

[91] 47 C.F.R. § 25.205 (2001).

[92] A certain amount of pointing error always exists, and is generally limited to a certain percentage of the antenna's half-power beam width. The impact of this pointing error is generally negligible when larger antennas are employed and the interference path couples through the sidelobes. However, with very small antennas, the same percentage pointing error results in much larger absolute angular error. With very small antennas, the adjacent satellite interference path can couple through the edge of the mainlobe where a change in angle can substantially increase the interference level.

[93] PanAmSat October 22 *Ex Parte* Statement at 7-9.

will become so wide that the risk of harmful interference becomes unacceptable because, essentially, the adjacent satellite would also be receiving signals from the earth station's main beam.[94]

41. Given the risk of harmful interference resulting from the potential for pointing error if we started the earth station antenna gain pattern envelope at 1.8° off-axis, we seek comment on beginning the earth station antenna gain pattern envelope at an off-axis angle less than 1.8° off-axis. In other words, we invite parties to recommend a method for determining an off-axis angle less than 1.8°, of the form "1.8° - x," where "x" represents pointing error. Specifically, we request interested parties to propose a methodology for estimating pointing error. For example, parties could provide statistical data showing that an average earth station antenna is capable of being aimed with no more than a specific amount of pointing error. Parties are free to recommend other methodologies. We request, however, that parties proposing another methodology also provide data sufficient to determine a reasonable starting point for the earth station antenna gain pattern envelope.

4. Improving Antenna Pointing Accuracy

a. Background

42. In the previous Section, we invited commenters to provide data on pointing error so that we could determine an off-axis angle less than 1.8° at which to start the earth station antenna gain pattern envelope. In this Section, we invite comment on proposals designed to reduce the likelihood of pointing error, in order to provide additional safeguards against harmful interference to adjacent satellite systems and terrestrial wireless operations.

43. In the *Notice*, we anticipated an increase in satellite-based Internet traffic.[95] Several satellite Internet providers supply their subscribers with two-way earth station terminals, capable of both transmitting and receiving. In response to the *Notice*, PanAmSat claimed that two-way consumer terminals could cause an increase in the potential for interference if the consumers install their own antennas. PanAmSat proposed several new rules for those terminals, including the following: (1) requiring systems to inhibit transmit capability until correct earth station pointing can be verified; (2) requiring systems to be able to shut off transmit capability remotely; (3) having terminals professionally installed unless (1) and (2) are achieved; and (4) having the ability to trace interference to individual subscribers.[96]

44. We find that PanAmSat has not shown that the deployment of two-way consumer terminals by itself warrants any of its proposals under the current Part 25 rules, including the current Part 25 earth station antenna gain pattern rules. The Commission has already adopted rules to encourage professional installation of two-way consumer terminals in several cases,[97] and

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[94] PanAmSat October 22 *Ex Parte* Statement at 13.

[95] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25131 (para. 4).

[96] PanAmSat Comments at 12-14. *See also* Letter from Joseph A. Godles, Attorney for PanAmSat, to Magalie R. Salas, Secretary, FCC (dated Nov. 20, 2001) (*ex parte* statement repeating its recommendations for rules applicable to two-way consumer terminals).

[97] Specifically, the Commission's rules give apartment owners more authority to adopt lease

PanAmSat has not shown that any additional rules are necessary at this time. Some or all of PanAmSat's proposed rules may become necessary, however, if we adopt the streamlined procedure for earth stations with non-routine antenna gain patterns discussed above. Accordingly, below we invite comment on whether we should adopt any of these proposals with respect to Ku-band earth stations less than 1.2 meters in diameter, if we revise the earth station antenna gain pattern envelope as proposed in this *Further Notice*. We also invite comment on adopting these proposals with respect to C-band earth stations less than 4.5 meters in diameter, or less than 3.7 meters in diameter if we adopt the proposal in Section III.C. above to process applications 3.7-meter C-band antennas routinely. We do not limit our proposals to consumer terminals as PanAmSat proposes because our proposed revisions to the antenna gain pattern rules would apply to all conventional Ku-band and C-band earth stations. In addition to our proposals based on PanAmSat's pleadings, we invite comment on whether it is necessary to adopt specifications for small antenna pointing accuracy applicable to small antenna manufacturers.

45. We propose to adopt one or more of the measures discussed below as requirements for earth station operators with C-band antennas less than 4.5 or 3.7 meters and for Ku-band earth station operators with antennas less than 1.2 meters in diameter. Although we propose above to start the earth station antenna gain pattern envelope at an off-axis angle less than 1.8°, we believe that one or more additional safeguards may be needed to avoid increasing the potential for harmful interference. We invite comment on this assumption. We also seek comment on whether we should limit these new requirements to earth stations with C-band antennas less than 4.5 or 3.7 meters and Ku-band antennas less than 1.2 meters in diameter, in light of the fact that we currently routinely license earth stations with diameters of these sizes or greater, and have not imposed these requirements on routine earth stations in the past.

b. Pilot Tone

46. PanAmSat proposes requiring consumer terminals to inhibit transmit capability until it can be verified that the earth station antenna has been pointed correctly.[98] We could implement PanAmSat's recommendation for smaller-than-routine C-band and Ku-band earth stations by adopting a "pilot tone" requirement. A pilot tone would be transmitted from the satellite to the earth station, and would preclude the earth station from transmitting if the received satellite signal level were to drop below some threshold downlink power level due to pointing error. Another possibility would be to use a pilot tone as a guide to ensure that small earth station antennas are aligned properly.

47. Here, we invite comment on whether a pilot tone requirement is warranted for non-routine antennas using the conventional Ku-band and C-band if we revise the earth station antenna gain pattern envelope as proposed above. We invite comment on this proposal either as

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provisions regulating their lessees' two-way consumer terminals if those terminals are professionally installed. When the two-way consumer terminals are to be placed where the antenna user has a direct or indirect ownership or leasehold interest in the property, the Commission's rules preempt many of the restrictions that could be placed on these terminals by state and local governments and landlords. *See* 47 C.F.R. § 1.4000 (2001); Promotion of Competitive Networks in Local Telecommunications Markets, *First Report and Order and Further Notice of Proposed Rulemaking*, WT Docket No. 99-217, FCC 00-366, 15 FCC Rcd 22983, 23025 (para. 94) (2000) (*Competitive Networks Order*). However, the Commission does not preempt such restrictions if local governments and property owners require professional installations of transmitting antennas. *Competitive Networks Order*, FCC 00-366, 15 FCC Rcd at 23036 (para. 119).

[98] PanAmSat Comments at 12-14.

alternative to or in addition to the proposed professional installation or automatic identification requirements discussed below. Both supporters and opponents of this proposal should explain their reasons with particularity. In addition, as we explained above, the pilot tone we proposed in the Ka-band proceeding discussed above would work by precluding the earth station from transmitting when the received satellite signal strength drops below a certain level. Therefore, we request parties supporting this proposal to propose a threshold downlink power level below which these earth station transmitters would cease to function.

48. Further, we invite comment on a second pilot tone proposal that would be used for alignment of the earth station antenna. This pilot tone would be cross-polarized relative to the communications signal. Rather than maximizing a co-polarized pilot tone in the carrier wave as we proposed above, earth station licensees would be required to minimize the cross-polarized pilot tone. This could be preferable to a co-polarized pilot tone because the null at the center of the cross-polarized antenna pattern is sharper and narrower than the peak of the co-polarized pattern. Based on all these considerations, we seek comment on a cross-polarized pilot tone requirement. We also seek comment on whether such a cross-polarized pilot tone could be effectively used to preclude transmission when the level of the cross-polarized pilot tone increases above a preset threshold.

c. Professional Installation

49. PanAmSat suggests requiring professional installation of consumer terminals. We invite comment on whether a professional installation requirement might be warranted for all Ku-band antennas less than 1.2 meters in diameter and C-band antennas less than 4.5 or 3.7 meters in diameter, if we revise the earth station antenna gain pattern envelope rules as proposed above. We invite comment on this proposal either as an alternative to or in addition to the proposed identification requirement discussed above. In particular, commenters should discuss the relative costs and benefits of a professional installation requirement. In addition, commenters should discuss what constitutes "professional installation." Does this imply certification or licensing of personnel by an industry standards group? Does it imply the availability and use of certain measurement equipment or techniques in performing an installation?

d. Location Identifier System

50. PanAmSat recommends requiring two-way consumer terminal systems to adopt some method of tracing cases of unacceptable interference to individual subscribers, and to be able to disable transmit capability remotely.[99] We note that, since 1991, the Commission has required satellite uplink transmissions carrying uplink broadband video information to use an automatic transmitter identification system (ATIS).[100] At the time the Commission proposed the ATIS requirement for satellite transmitters, the satellite industry had been experiencing an increase in harmful interference, including cases of intentional interference caused by an individual using the pseudonym "Captain Midnight."[101] The Commission intended the

[99] PanAmSat Comments at 12-14.

[100] An Automatic Transmitter Identification System for Radio Transmitting Equipment, *First Report and Order*, GEN Docket No. 86-337, FCC 90-150, 5 FCC Rcd 3256 (1990) (*ATIS Order*), 47 C.F.R. § 25.281 (2001).

[101] An Automatic Transmitter Identification System for Radio Transmitting Equipment, *Notice of Proposed Rulemaking and Notice of Inquiry*, GEN Docket No. 86-337, FCC 86-356, 104 FCC 2d

identification of transmissions to facilitate the orderly management of the spectrum.[102] 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.[103]

51. We invite comment on adopting an ATIS-like system for conventional Ku-band antennas less than 1.2 meters in diameter and conventional C-band antennas less than 4.5 or 3.7 meters in diameter in response to PanAmSat's proposal. Parties opposing this proposal should explain in detail why some identification system is not necessary, or should explain in detail why they believe the costs of such a system would outweigh the benefits of prevention of unacceptable interference. We also invite comment on whether it is necessary to prescribe technical parameters for the identification transmissions, such as transmission frequency or power level.[104]

52. Hughes also maintains that tracing interference to individual subscribers might require provision of proprietary information.[105] We do not believe that implementing PanAmSat's proposal would require disclosure of proprietary information. Rather, we propose to require that the identification transmissions include a serial number that the operator of the system experiencing harmful interference can provide to the satellite operator or blanket licensee. Thus, the satellite operator or blanket licensee can identify the transmitter causing the interference and take remedial action without disclosing proprietary customer information. We seek comment on this proposal and how it should be implemented.

E. SIA's Antenna Gain Pattern Proposals

53. *Introduction*. As an alternative to the proposed revision to the minimum diameter for C-band earth station antennas eligible for routine processing discussed in Section III.C., and the proposed C-band and Ku-band earth station antenna gain pattern revisions we discuss in Section III.D., we invite comment on SIA's proposed revisions to the antenna gain pattern for conventional Ku-band earth station antennas within the GSO orbital plane.[106] Since we invite

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1256 (1986) (*ATIS Notice*).

[102] *ATIS Notice*, FCC 86-356, 104 FCC 2d at 1256-58 (paras. 2-7).

[103] 47 C.F.R. § 25.281(d)(3). We note that the ATIS requirement is similar to technology cellular telephone service providers use. When a mobile phone is turned on, it sends out its Electronic Serial Number (ESN) and Mobile Identification Number (MIN) to enable the network to keep track of the subscriber's location so that incoming telephone calls can be routed correctly. Thus, transmission of ESN and MIN information is critical in that wireless telephone calls could not be completed without it. Although our proposed ATIS requirement would not play the same critical role as MIN transmission does, in that ATIS is not used to route satellite transmissions to particular earth stations, ATIS would still be useful in tracing a particular earth station's transmission in the event that it causes harmful interference.

[104] Section 25.281(d)(1) of the Commission's rules requires ATIS signals to consist of a subcarrier signal generated at a frequency of 7.1 MHz +/- 25 kHz and injected at a level no less than -26 dB (referenced to the unmodulated carrier). The subcarrier deviation shall not exceed 25 kHz peak deviation. Section 25.281(d)(2) requires that ATIS signals use International Morse Code keyed by a 1200 Hz +/- 800 Hz tone representing a mark and a message rate of 15 to 25 words per minute.

[105] Hughes Reply at 21.

[106] By "conventional C-band," we mean the 3700-4200 MHz and 5925-6425 MHz band. By

comment in Section III.F. below for SIA's proposal for beginning the conventional Ku-band antenna gain pattern envelope outside the GSO, we will not discuss it further here.

54. The SIA-proposed rule revisions we discuss here are also interrelated with SIA's proposals for VSAT antenna gain pattern rules and VSAT uplink power spectral density limits that we discuss in Section V.B.[107] Moreover, SIA's proposals are interrelated with its proposed procedure for non-routine earth station applications, discussed in Section VI.B.[108] Therefore, as a preliminary matter, we invite comment on whether we should consider SIA's proposed antenna gain pattern envelope revisions together with its VSAT proposals and non-routine earth station proposals as interrelated proposals. Would it be reasonable to consider each proposal independently and adopt one or two but not all three of these interrelated proposals?

55. *Pleadings*. SIA proposes substantial and complex revisions to our antenna gain pattern rules, apparently designed for non-circular antennas. For antennas operating in the 14 GHz band with dimensions from 1.2 to less than 1.8 meters in the GSO orbital plane, SIA would start the antenna gain pattern envelope at 1.25° off-axis in the GSO orbital plane.[109]

56. For antennas operating in the 14 GHz band with dimensions less than 1.2 meters in the GSO orbital plane, SIA proposes different requirements for ALSAT earth stations and non-ALSAT earth stations.[110] For ALSAT earth stations, SIA would start the antenna gain pattern envelope at 1.5° off-axis in the GSO orbital plane.[111] For non-ALSAT earth stations, SIA would start the antenna gain pattern envelope at 1.8° off-axis in the GSO orbital plane.[112] For those non-

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"conventional Ku-band," we mean the 11.7-12.2 GHz and 14.0-14.5 GHz bands.

[107] *See* SIA November 5 *Ex Parte* Statement, Att. A at 4, proposed revisions to Section 25.134(a). Specifically, SIA proposes incorporating a cross-reference to its proposed antenna gain pattern rules in its proposed VSAT rule revisions.

[108] *See* SIA December 10 *Ex Parte* Statement at 28 (SIA proposes a more burdensome affidavit procedure in part because it asserts that adoption of its proposed antenna gain pattern revisions would reduce the number of non-routine earth station applications). *See also* Letter from Joseph A. Godles, Attorney for PanAmSat, to Magalie R. Salas, Secretary, FCC (dated Dec. 19, 2001). In this *ex parte* statement, SIA opposed considering the issues in this proceeding in a "piecemeal fashion." Clearly, in this *ex parte* statement, SIA requests us to consider all its proposals at the same time. This *ex parte* statement could also be read as a request to consider SIA's proposals as an integrated package.

[109] SIA November 5 *Ex Parte* Statement at 12, proposed Section 25.209(g)(1)(i).

[110] "ALSAT" means "all U.S.-licensed space stations." Originally, under an ALSAT earth station license, an earth station operator providing fixed-satellite service in the conventional C- and Ku-bands could access any U.S. satellite without additional Commission action, provided that those communications fall within the same technical parameters and conditions established in the earth stations' licenses. *See* Amendment of the Commission's Regulatory Policies to Allow Non-U.S.-Licensed Space Stations to Provide Domestic and International Satellite Service in the United States, *First Order on Reconsideration*, IB Docket No. 96-111, FCC 99-325, 15 FCC Rcd 7207, 7210-11 (para. 6) (1999) (*DISCO II First Reconsideration Order*). The *DISCO II First Reconsideration Order* expanded ALSAT earth station licenses to permit access to any satellite on the Permitted List. *DISCO II First Reconsideration Order*, FCC 99-325, 15 FCC Rcd at 7215-16 (para. 19).

[111] SIA November 5 *Ex Parte* Statement at 12, proposed Section 25.209(g)(1)(i).

[112] SIA November 5 *Ex Parte* Statement at 12, proposed Section 25.209(g)(1)(i).

ALSAT earth stations, however, SIA would also require the earth station applicant to provide written confirmation from "each of the adjacent satellite operators within 3° that the antenna has been successfully coordinated."[113] SIA does not propose that we require written confirmation of coordination with operators of satellites more than 3° from the target satellite. It asserts that, by requiring earth station operators to meet the current antenna gain pattern envelope at off-axis angles greater than 1.8°, "adjacent satellite operators located at 4 and 6 degrees from the target satellite will not experience any additional interference from the operation of these antennas."[114]

57. SIA proposes another standard for antennas operating in the 11.7-12.2 GHz band with dimensions less than 1.8 meters in the geostationary satellite orbital plane. SIA would start the antenna gain pattern envelope at 2° off-axis for these antennas.[115] However, SIA also proposes to include the following language in the Commission's rules: "For purposes of determining receive protection, as opposed to routine processing, protection will be provided for such antennas to the extent specified in Section 25.209(c)."[116] We understand this language to mean that, while SIA recommends adopting a new Ku-band antenna gain pattern envelope for purposes of routine earth station licensing, SIA recommends retaining the current antenna gain pattern envelope beginning at 1.25° for purposes of determining the extent to which Ku-band earth stations should be give protection from receiving interference. Furthermore, SIA appears to advocate different antenna gain patterns in the Ku-band for transmit and receive operations. SIA recommends additional antenna gain pattern requirements for VSAT networks, discussed further in the next section of this *Further Notice*.

58. Finally, in addition to the antenna gain pattern standards for (1) 14 GHz antennas between 1.2 and 1.8 meters; (2) 14 GHz antennas less than 1.2 meters with ALSAT authority; (3) 14 GHz antennas less than 1.2 meters without ALSAT authority; (4) 12 GHz receive earth station antennas,[117] and (5) VSAT networks, SIA recommends that we retain the antenna gain pattern standard for gateway earth stations operating in certain segments of the conventional and extended Ku-bands with NGSO FSS satellites.[118] This antenna gain pattern would extend the current near-in standard of $29 - 25\log(\theta)$ beyond the current 7° limit, out to 36°, and would start the -10 dBi requirement at 36° rather than the current 48° for these gateway earth stations.[119]

Presumably, SIA means to say "within 3° of the desired satellite."

[113] SIA November 5 *Ex Parte* Statement at 12, proposed Section 25.209(g)(1)(i).

[114] SIA December 10 *Ex Parte* Statement at 18.

[115] SIA November 5 *Ex Parte* Statement at 13, proposed Section 25.209(g)(2).

[116] SIA November 5 *Ex Parte* Statement at 13, proposed Section 25.209(g)(2).

[117] As noted above, SIA's proposal would apply to the FSS receive band, 11.7-12.2 GHz, rather than the Direct Broadcast Satellite (DBS) frequency band, 12.2-12.7 GHz.

[118] These frequency bands are 10.7-11.7 GHz, 12.75-13.15 GHz, 13.2125-13.25 GHz, 13.8-14.0 GHz, and 14.4-14.5 GHz. SIA November 5 *Ex Parte* Statement at 13, proposed Section 25.209(h). The Commission adopted antenna gain patterns for these earth stations in Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range, *First Report and Order and Further Notice of Proposed Rulemaking*, ET Docket No. 98-206, FCC 00-418, 16 FCC Rcd 4096, 4253 (2000) (*Ku-band NGSO Order*).

[119] SIA November 5 *Ex Parte* Statement at 13, proposed Section 25.209(h).

59. *Discussion*. SIA's proposals raise several concerns. First, SIA's proposal is highly complex, in that it involves different regulatory requirements for several kinds of earth stations. It could defeat the purpose of distinguishing between routine and non-routine applications if the distinction is so complex that it could increase the time needed to review all earth station license applications.

60. Furthermore, SIA's proposal may increase the administrative burdens associated with some earth station applications we now treat routinely. For example, all applications for Ku-band earth stations with antennas with equivalent diameters of 1.2 meters or greater are now eligible for routine processing. SIA's proposal creates a new set of requirements for some Ku-band earth station applications with antennas with dimensions in the GSO orbital plane between 1.2 and 1.8 meters, and these earth stations would not remain eligible for routine processing under SIA's proposed rules. In particular, SIA's proposal would require such Ku-band earth station applicants to have their operations coordinated with adjacent satellite operators if they meet the antenna gain pattern envelope between 1.5° and 1.8° off-axis.[120] There is no such requirement today.

61. We also find that many of SIA's proposals would blur the distinction between routine and non-routine antennas.[121] For example, some earth station applications that would be called "routine" under SIA's proposed rule language would not be eligible for ALSAT earth station licenses.[122] SIA does not provide any rationale to support its proposal to preclude routine earth stations from being considered for ALSAT authority. In addition, SIA proposes that these "routine" earth station antennas would still require coordination with adjacent satellite operators.[123] If they require coordination, these earth station antennas should not be considered "routine," nor should they be considered "ALSAT." SIA also advocates treating some non-conforming receive antennas as routine.[124] If they are non-conforming antennas, SIA needs to

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[120] SIA November 5 *Ex Parte* Statement at 12, proposed Section 25.209(g)(1)(i) ("[F]or antennas with dimensions less than 1.2 meters in the geostationary satellite orbital plane not seeking ALSAT authorization, at up to 1.8° instead of 1° as stipulated in paragraph (a)(1) of this section, *provided that the satellite operator(s) of the satellite(s) with which the applicant is seeking authority to communicate has provided written confirmation from each of the adjacent satellite operators within 3° that the antenna has been successfully coordinated*.") (emphasis added).

[121] SIA December 10 *Ex Parte* Statement at 28.

[122] "Thus, *routine processing* would be provided for antennas operating in the 14 GHz band with dimensions less than 1.2 meters in the geostationary satellite orbital plane that comply with the antenna performance standards starting at greater than 1.5° and less than or equal to 1.8° off-axis, as long as the antennas are coordinated with the satellite operators within 3°. *These antennas would not receive an ALSAT designation*." SIA December 10 *Ex Parte* Statement at 18 (emphasis added).

[123] SIA December 10 *Ex Parte* Statement at 18.

[124] Specifically, SIA states the following: "SIA proposes . . . that non-conforming receive antennas be eligible for routine processing to the extent they satisfy the standards set forth in SIA's proposed Section 25.209(g)(2)." SIA December 10 *Ex Parte* Statement at 27. SIA's proposed Section 25.209(g)(2) reads as follows: "Small antennas operating in the 12 GHz band with dimensions less than 1.8 meters in the geostationary satellite orbital plane shall be deemed to meet the receive antenna performance standards of Section 25.209(a) and (g)(1)(ii) for purposes of determining whether such antennas qualify for routine processing, as long as such antennas meet such standards starting at 2 degrees in the geostationary satellite orbital plane. For purposes of determining receive protection, as opposed to

provide additional information on how they can be treated as "routine." Above, we noted that SIA recommends different standards for determining whether the transmit operations and receive operations of an earth station application should be processed routinely.[125] In other words, under SIA's proposals, one earth station could be both routine and non-routine at the same time, and so we would have to process the transmit and receive operations of a single earth station application separately.

62. In light of this discussion, we invite comment on each of SIA's proposed revisions to our antenna gain pattern rules discussed in this section, as alternatives to the proposed rule revisions we discuss in Section III.D. above. Commenters should also consider SIA's proposed antenna gain pattern revisions in conjunction with its proposed Ku-band backlobe rules discussed below.[126]

F. Other Antenna Gain Pattern Envelope Proposals

1. Antenna Gain Pattern Envelope Outside the GSO Orbital Plane

63. We explained above that, when viewed from any point on the earth's surface, the satellites in the GSO appear to lie in one plane. The Commission's current rules establish different antenna gain pattern requirements within the GSO orbital plane and outside the GSO orbital plane.[127] In Sections III.D. and III.E., we discuss proposed revisions to the antenna gain pattern requirements within the GSO orbital plane. Here, we invite comment on proposed revisions to the antenna gain pattern requirements outside the GSO orbital plane.

64. In its pleadings, Spacenet argues persuasively in favor of starting the antenna gain pattern envelope for conventional Ku-band earth stations at 3° off-axis outside the GSO orbital plane.[128] Spacenet notes that this would facilitate the development of more advanced elliptical antennas.[129] Hughes and SIA support Spacenet's proposal as consistent with Article S22.26 of the ITU's Radio Regulations.[130]

65. Accordingly, we propose to start the conventional Ku-band antenna gain envelope at 3° off-axis outside the GSO orbital plane. We recognize that, at WRC-2000, the ITU revised

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routine processing, protection will be provided for such antennas to the extent specified in Section 25.209(c)."

[125] *See* SIA November 5 *Ex Parte* Statement at 13, proposed Section 25.209(g)(2).

[126] *See* Section III.F.2. below.

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

[128] Spacenet Comments at 12-14; Spacenet Reply at 7-8.

[129] Spacenet Comments at 14.

[130] Hughes Reply at 5, *citing* ITU Radio Regulations, Art. S22.26, § 9; SIA December 10 *Ex Parte* Statement at 19.

Article S22.26 to establish an antenna gain pattern envelope that begins at 3° off-axis.[131] Furthermore, because Spacenet limits its proposal to Ku-band operations where terrestrial services are not authorized,[132] revising the antenna gain pattern envelope outside the GSO orbital plane cannot result in harmful interference from earth stations operating at low elevation into terrestrial wireless operations. We seek comment on these proposals.

2. Backlobe Antenna Gain Patterns

66. SIA recommends revisions to the antenna gain pattern envelope at off-axis angles between 85° and 180°, for antennas with dimensions of 1.8 meters or less in the GSO orbital plane and operating in frequency bands between 11.7 GHz and 30 GHz not shared on a co-primary basis with terrestrial services. For this "backlobe," SIA recommends an antenna gain pattern envelope of 0 dBi instead of the –10 dBi limit in our current rules.[133] SIA observes that this backlobe revision is consistent with ITU-R Recommendation S.1428.[134]

67. Hughes also advocates revising the Ku-band backlobe gain limit of -10 dBi limit with a 0 dBi limit, but Hughes would apply this revision to off-axis angles greater than 48° rather than 85° off-axis as SIA suggests.[135] Hughes argues that, because this backlobe limit is designed to protect terrestrial wireless operators, it is not necessary in the conventional Ku-band where terrestrial operations are not co-primary with FSS.[136] Hughes argues further that the gain at angles greater than 48° is not significant enough to cause adjacent satellite interference.[137] There were no objections to Hughes' proposal.

68. We find merit in SIA's and Hughes' proposals to increase the "backlobe" antenna gain limits for conventional Ku-band antennas. Increasing the backlobe gain limits would increase the number of conventional Ku-band earth station applications we can process routinely. Accordingly, we propose to increase the conventional Ku-band backlobe gain limit to 0 dBi, both within and outside the GSO orbital plane. We invite comment on whether to increase the gain limit between 85° and 180° off-axis as SIA recommends, or between 48° and 180° as Hughes proposes. We also invite comment concerning whether the proposed 0 dBi limit in the backlobes should be an absolute limit, or whether some fraction of the sidelobes would still be allowed 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).[138]

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131 WRC-2000 Final Acts, at 88-89.

132 Unlike the conventional C-band, the conventional Ku-band is not shared with terrestrial wireless facilities. By "conventional C-band," we mean the 3700-4200 MHz and 5925-6425 MHz band. By "conventional Ku-band," we mean the 11.7-12.2 GHz and 14.0-14.5 GHz bands.

133 SIA November 5 *Ex Parte* Statement at 12, proposed Section 25.209(g)(1)(ii).

134 SIA December 10 *Ex Parte* Statement at 19-20.

135 Hughes Comments at 11.

136 Hughes Comments at 11.

137 Hughes Comments at 11. Hughes recommends several rule revisions to reflect its proposals. Hughes Comments at 28.

138 Our present antenna standard in Section 25.209 allows single sidelobes to exceed the

69. Hughes recommends increasing the backlobe gain limit only in the conventional Ku-band. SIA, however, proposes increasing the backlobe gain limit in the conventional Ku-band and the portions of the Ka-band that are not shared with terrestrial wireless services.[139] Neither Hughes nor SIA propose increasing the backlobe gain limit in the conventional C-band,[140] nor do we propose such a revision here. Increasing the backlobe gain limit in bands shared with terrestrial wireless operations may have a negative impact on those wireless operations. We note that several bands at Ka-band are shared with terrestrial services. Therefore, we also seek comment on whether to apply this reduced backlobe requirement to Ka-band earth stations for frequency bands not shared with terrestrial services,[141] in addition to conventional Ku-band earth stations as discussed above. We also note that the 18.58-18.8 GHz and 18.8-19.3 GHz bands are shared with the Fixed Service, but only until June 8, 2010.[142] Therefore, we propose to retain the current -10 dBi backlobe limit in these bands, and to increase the limit to 0 dBi in these bands starting June 9, 2010. We seek comment on these proposals.

G. Summary

70. In this section of this *Further Notice*, we invite comment on reducing the minimum antenna size of C-band earth stations eligible for routine processing to 3.7 meters in diameter. We also propose to reduce the minimum routine C-band earth station antenna size to 2.7 meters if the earth station operator is willing to forgo some protection from receiving interference.

71. We find that, but for pointing error, we could begin our antenna gain pattern envelope within the GSO orbital plane at 1.8° off-axis, thereby allowing us to process smaller earth station antennas routinely. However, smaller antennas produce wider main beams, and so magnify the effects of small pointing errors, which in turn creates a risk of harmful interference to adjacent satellite systems. Accordingly, we invite comment on starting the earth station antenna gain pattern envelope at an off-axis angle less than 1.8° to address pointing error. We also propose requiring operators of C-band earth stations with less-than-routine diameter antennas[143]

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antenna standard equation. For example, 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. Also, 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.

[139] *See* SIA November 5 *Ex Parte* Statement at 12, proposed Section 25.209(g)(1)(ii).

[140] Hughes Comments at 11.

[141] The Ka-band frequency band segments not shared with terrestrial services are the 19.7-20.2 GHz, 28.35-28.6 GHz, 28.6-29.1, 29.25-29.5 GHz, and 29.5-30.0 GHz bands.

[142] Also, until June 8, 2010, FSS operators are required to relocate existing terrestrial wireless operators pursuant to procedures specified in the Commission's rules in the event that the FSS licensee causes harmful interference to the wireless licensee. *See* 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, FCC 00-212, 15 FCC Rcd 13430 (2000) (*18 GHz Order*), *recon*. 16 FCC Rcd 19808 (2001).

[143] In this case, by "non-routine," we mean either (1) less than 3.7 meters in diameter if we adopt our proposal above to reduce the routine antenna size to 3.7 meters in the C-band; or (2) less than 4.5 meters in diameter if we do not adopt that proposal.

to comply with certain measures designed to improve antenna pointing accuracy at the time of the installation. We would also place these requirements on operators of Ku-band earth stations with antennas less than 1.2 meters in diameter.

72. In addition, we invite comment on SIA's proposed revisions to our antenna gain pattern rules. We note that SIA's proposals are closely interrelated to its proposals on revising the VSAT antenna gain pattern rules and uplink power spectral density limits discussed in Section V.B. SIA's antenna gain pattern proposal is also interrelated with its recommended streamlined procedure for non-routine earth station applications discussed in Section VI.B. We invite comment on whether it would be reasonable to adopt any of these SIA proposals independently. We also note that SIA's antenna gain pattern proposals are complex, and therefore could increase the time needed to process earth station applications.

73. Finally, we invite comment on revising the earth station antenna gain pattern envelope for conventional Ku-band earth station antennas at off-axis angles greater than 48°, and outside the GSO orbital plane.

IV. RANDOM ACCESS TECHNIQUES

A. Background

74. The Commission's rules permit parties to obtain a single license for a large number of technically identical small aperture antenna earth stations.[144] These networks are referred to as VSAT networks. VSAT networks are comprised of a hub station that transmits to, and receives from, multiple technically identical remote small aperture antennas via satellite.[145] They were originally permitted only in the Ku-band.[146]

75. The *Notice* solicited comment on several proposals related to VSAT networks, including the techniques that VSAT networks employ to prevent or limit interference among the multiple remote earth stations, and to prevent them from interfering with other adjacent satellite networks.[147] 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

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[144] 47 C.F.R. §§ 25.115, 25.134 (2001).

[145] *Notice,* FCC 00-435, 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). After the Commission adopted the *Notice,* it adopted rules allowing VSAT systems to operate in the C-band. *See FWCC/Onsat First Report and Order*, FCC 01-177, 16 FCC Rcd 11511.

[146] *See Notice,* FCC 00-435, 15 FCC Rcd at 25145 (para. 50).

[147] *Notice,* FCC 00-435, 15 FCC Rcd at 25145 (para. 50).

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.[148] We refer to TDMA, FDMA, and CDMA as "reservation" protocols, because these techniques "reserve" a time, frequency, or code to each transmission in a VSAT network to ensure that its does not cause interference to other transmissions in that VSAT network.

76. Before the Commission adopted the *Notice*, Spacenet, Inc. (Spacenet) filed a petition for declaratory ruling that the Commission allows VSAT networks to use an access technique called "slotted Aloha."[149] 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.[150] Unlike TDMA, however, Aloha transmissions are unsynchronized, and two or more remote earth stations are permitted to transmit simultaneously. Aloha relies on statistical probability calculations 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.

77. 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.[151] Increasing the power levels of a transmission increases the possibility that two simultaneous transmissions from two remote terminals on the same frequency will cause unacceptable interference to adjacent satellite systems. 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.[152] 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

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[148] For a more detailed discussion of each of these techniques, *see Notice,* FCC 00-435*,* 15 FCC Rcd at 25206-10 (App. E).

[149] *Spacenet Order*, DA 00-2664, 15 FCC Rcd 23712. 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*, DA 00-2664, 15 FCC Rcd at 23713 (para. 3).

[150] *Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23713 (para. 3).

[151] Spacenet maintained that the duration of an inbound transmission is typically between 15 and 50 milliseconds. *Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23713 (para. 3), *citing* Spacenet Petition at 8.

[152] *See Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23713 (para. 3).

VSAT network operator limits the amount of traffic on its network sufficiently to reduce the probability of a collision to an acceptable level.[153]

78. The International Bureau (Bureau) denied Spacenet's petition for declaratory ruling because Section 25.134(a) specifies maximum input power density limits for each earth station in a routinely-licensed VSAT network.[154] When transmission signals from two or more earth stations collide, the resulting power level received at the adjacent satellite can exceed the routine processing limits specified in Sections 25.134(a).[155] The Bureau, however, concluded that Spacenet had shown that its 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]

79. The *Notice* did not solicit comment on the statistical equation that Spacenet recommended for our rules, 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 techniques.[158] Instead, the Commission invited comment on a slightly different proposal, which would revise Sections 25.134(a) and 25.212(d) 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] The Commission also proposed specifying different values of "N" in Section 25.134(a) for systems using FDMA, TDMA, CDMA, or Aloha multiple access techniques.[160] Our proposed values of "N" were designed to prevent harmful interference to adjacent satellite systems by reducing VSAT earth station's power spectral density by 3 dB in cases where two or more terminals in a VSAT network could transmit simultaneously in the same frequency band.[161] The Commission also noted that this proposal is substantially similar to the

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153 *See Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23714-15 (para. 7).

154 47 C.F.R. § 25.134(a). Section 25.134(b) states that VSAT system licensees can exceed the power limits in Section 25.134(a) if they submit an Adjacent Satellite Interference Analysis (ASIA) with their license applications showing that their VSAT systems will not cause harmful interference to a two-degree-compliant satellite system. 47 C.F.R. § 25.134(b).

155 *Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23715 (para. 9).

156 *Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23716 (para.12).

157 *Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23716 (para.12).

158 *Notice,* FCC 00-435*,* 15 FCC Rcd at 25146-47 (para. 54).

159 *Notice,* FCC 00-435, 15 FCC Rcd at 25147 (para. 55).

160 *Notice,* FCC 00-435, 15 FCC Rcd at 25147 (para. 55).

161 *Notice,* FCC 00-435, 15 FCC Rcd at 25147 (para. 56) and 25210 (App. E).

rules we adopted in the *18 GHz Order* for blanket licensing of Ka-band systems using FDMA, TDMA, and CDMA.[162] The proposed values for "N" were as follows:

> (i) For a VSAT network using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one.
> (ii) For a VSAT network using code division multiple access (CDMA) technique, N is the likely maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.
> (iii) For a VSAT network using contention Aloha multiple access technique, N is equal to two.
> (iv) For a VSAT network using contention CDMA/Aloha multiple access technique, N is twice the likely maximum number of co-frequency simultaneously transmitting earth stations in the same satellite-receiving beam without contention.[163]

80. In Section IV.B. below, we revise our previous proposal for rules for the Aloha technique, based on the pleadings filed in response to the *Notice*, SIA's November 5 *ex parte* statement, and an *ex parte* statement filed by Aloha Networks on November 14, 2001.[164] We invite comment on two other proposals for rules for the Aloha technique and other contention protocols. In Section IV.C., we discuss our proposals for TDMA, FDMA, and CDMA rules. We also find that the record in this proceeding at this time supports adoption of our proposed TDMA, FDMA, and CDMA rules as proposed in the *Notice*. If we adopt either of our newly proposed contention protocol rules herein, however, the *Notice* proposals could become unnecessary. We discuss our proposals further below.

B. Contention Protocols

1. The *Notice* Proposal

81. *Background*. In the *Notice*, The Commission proposed VSAT rule revisions that would require VSAT earth station operators to reduce their power spectral density by 3 dB in cases where two or more terminals in a VSAT network could transmit at the same time in the same frequency band, such as when they use the slotted Aloha or Aloha technique.[165]

82. *Pleadings*. Several parties oppose the Aloha aspect of our proposed rule. A number of commenters maintain that it is unnecessary to require VSAT system operators using Aloha to reduce their power by 3 dB 100 percent of the time, especially in cases where the channel loading results in a lower probability of collisions than that contemplated in the Spacenet petition for declaratory ruling.[166] Hughes and SIA dispute the Commission's assumption that a 3 dB power

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[162] *Notice,* FCC 00-435, 15 FCC Rcd at 25147 (para. 55), *citing* 47 C.F.R. § 25.138(a) (2001), *adopted in 18 GHz Order*, FCC 00-212, 15 FCC Rcd at 13492.

[163] *Notice,* FCC 00-435, 15 FCC Rcd at 25180 (App. B, proposed Section 25.134(a)(1)).

[164] Letter from Jacob Farber, Counsel for Aloha Networks, to Magalie Roman Salas, Secretary, FCC (dated Nov. 14, 2001) (Aloha Networks November 14 *Ex Parte* Statement).

[165] *Notice,* FCC 00-435, 15 FCC Rcd at 25147 (para. 56) and 25210 (App. E).

[166] Astrolink Comments at 11-13; Astrolink Reply at 4-5; Spacenet Comments at 38-39; Hughes Comments at 19-21.

reduction would still allow operators to provide a technically viable service.[167] In addition, Aloha Networks observes that the definition for N for VSAT networks using the Aloha multiple access technique is 2, based on an assumption of a 38 percent channel load. Aloha Networks observes that the proposed Section 25.134 does not limit such networks to a 38 percent channel load.[168]

83. Aloha Networks argues that the Commission's proposed rule is flawed because it assumes that there are only four multiple access techniques. Aloha Networks notes that the multiple access techniques can be combined to form a considerable number of variations.[169] Aloha Networks also notes that some military networks use a frequency-hopping technique, and argues that this technique may be employed in commercial networks some day.[170] Aloha Networks also asserts that the proposed rule would become obsolete if or when other techniques are developed in the future.[171]

84. SIA claims that no regulation of random access techniques is necessary.[172] Several commenters state that there have been no examples reported of harmful or unacceptable interference caused by Aloha collisions, and so question whether there is a need for any rule.[173] Some commenters maintain that economic forces create a disincentive to operate VSAT systems using random access techniques in a way that will cause interference into other satellite systems. They contend that as traffic volume increases to a value high enough to cause such interference, that number of collisions would also result in unacceptable self-interference to its transmissions within the VSAT system.[174] Aloha Networks doubts that these economic forces will be sufficient to deter interference.[175] Aloha Networks further contends that use of VSAT networks for Internet service should lead to a large increase in VSAT traffic.[176] Aloha Networks argues further that

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[167] Hughes Comments at 22-23; Hughes Reply at 14; SIA Reply at 14. *See Notice,* FCC 00-435, 15 FCC Rcd at 25147 (para. 56).

[168] Aloha Networks Comments at 7-8.

[169] Aloha Networks Comments at 5-6; Aloha Networks Reply at 2. *See also* Spacenet Comments at 40.

[170] Aloha Networks Comments at 6.

[171] Aloha Networks Comments at 6-7.

[172] SIA Reply at 14. *See also* Spacenet Reply at 19; Hughes Reply at 15-16 (arguing that no regulations are necessary, but proposing rule revisions in the event that the Commission decides to adopt some rules). *But see* SIA December 10 *Ex Parte* Statement at 6-7 (proposing rule revisions for TDMA, FDMA, and CDMA).

[173] Loral Comments at 11-12; Hughes Comments at 22; Astrolink Comments at 11; Astrolink Reply at 3; SIA Reply at 12; Hughes Reply at 13; Spacenet Reply at 16-18.

[174] Spacenet Comments at 36; Astrolink Comments at 12-13; Hughes Reply at 13-14; Spacenet Reply at 17-19.

[175] Aloha Networks Reply at 3-5.

[176] Aloha Networks November 14 *Ex Parte* Statement at 3.

these new VSAT terminals are likely to have smaller-than-routine antennas, and are likely to be installed by end users inexperienced in satellite antenna installation.[177] According to Aloha Networks, these factors will probably increase the potential for harmful interference to adjacent satellites.[178] Aloha Networks did not discuss the potential for interference within a VSAT network.

85. *Discussion*. The commenters have shown persuasively that adoption of the random access scheme requirements for Aloha systems proposed in the *Notice* would not be in the public interest. First, the potential for interference resulting from collisions is statistically infrequent, and of very short duration. As we explained above, the VSAT network power spectral density at the received adjacent satellite can exceed the levels specified in the Commission's rules for only tens of milliseconds.[179] In addition, the probability of two remote earth station transmissions causing a collision on the same frequency within a VSAT network is less than 5 percent in most VSAT networks using Aloha.[180] Moreover, a 3 dB reduction in power is equivalent to a 50 percent reduction in power, which is a substantial reduction, particularly if that reduction would be required 100 percent of the time. It is not clear, based on the record in this proceeding at this time, whether such a reduction would allow VSAT operators to provide a technically viable service.[181] On the other hand, we believe that VSAT operators should be allowed to use contention protocols. Because contention protocols enable VSAT remote terminals to transmit simultaneously, use of contention protocols can enable VSAT networks to carry more traffic than they could without using contention protocols, and so increase their efficiency. Furthermore, there have been no examples reported of interference to adjacent satellite networks caused by Aloha collisions.[182] For all these reasons, we agree with parties who argue that the burdens of requiring VSAT system operators using Aloha to reduce their power by 3 dB reduction 100 percent of the time are excessive.[183] Those burdens outweigh the benefits of preventing potential interference resulting from collisions that last for tens of milliseconds. As a result of this conclusion, we do not need to address each of the criticisms raised against our first proposal.

86. Although the record on this issue weighs against adoption of our original proposal for Aloha and CDMA/Aloha networks, we remain convinced that we should adopt some rules governing multiple access techniques such as Aloha. The current version of Section 25.134 prescribes only absolute limits on power density for 100 percent of the time, which on their face

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[177] Aloha Networks November 14 *Ex Parte* Statement at 3.

[178] Aloha Networks November 14 *Ex Parte* Statement at 3.

[179] Section IV.A. above. *See also Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23713 (para. 3); *Notice,* FCC 00-435, 15 FCC Rcd at 25146 (para. 52).

[180] *Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23719 (App. A).

[181] Hughes Comments at 22-23; Hughes Reply at 14; SIA Reply at 14. *See Notice,* FCC 00-435, 15 FCC Rcd at 25147 (para. 56).

[182] Loral Comments at 11-12; Hughes Comments at 22; Astrolink Comments at 11; Astrolink Reply at 3; SIA Reply at 12; Hughes Reply at 13; Spacenet Reply at 16-18.

[183] Astrolink Comments at 11-13; Astrolink Reply at 4-5; Spacenet Comments at 38-39; Hughes Comments at 19-21.

preclude the use of the Aloha access technique.[184] We also believe, however, that it would be unreasonable to prohibit use of multiple access techniques at this time. The Bureau also determined that use of Aloha, as implemented at this time, does not cause harmful interference to other satellite systems.[185] Therefore, we invite comment below on another proposal for revising Section 25.134 to permit multiple access techniques.

87. We disagree, however, with parties that argue that VSAT operators' economic incentives are sufficient to prevent harmful interference from VSAT networks using multiple access techniques to adjacent satellite systems on a going-forward basis. As Aloha Networks points out, Internet traffic over satellite systems is likely to increase in the future.[186] At least some of that increased Internet traffic will be over VSAT networks using smaller-than-routine earth station antennas, thereby increasing main beam widths and increasing the probability of transmission collisions within a VSAT network. Furthermore, there is no basis in the current record for concluding 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. Therefore, we believe that we should adopt some rules establishing some constraint on power levels and/or duration and probability of those transmission collisions.

2. Revised Contention Protocol Proposal

88. *Introduction*. In this section, we consider proposals offered by commenters as alternatives to the *Notice* proposals to prevent interference resulting from transmission collisions without the burdens associated with our proposal in the *Notice* to require VSAT operators using Aloha to reduce their power spectral density by 3 dB. Our proposals here are designed to prevent the excessive power levels resulting from transmission collisions from occurring too often or lasting too long. Specifically, we propose to incorporate statistical equations into the Commission's rules that would prohibit VSAT system operators from using contention protocols in a way that creates more than a certain probability of collisions of transmissions on a particular frequency being used by a VSAT network.

89. In this section, we invite comment on applying these proposed rules only to contention protocols. In Section IV.C. below, we solicit comment on whether to (1) apply the rules we propose in this section to both contention protocols and TDMA, FDMA, and CDMA, or (2) adopt the TDMA, FDMA, and CDMA rules we proposed in the *Notice*.

90. *Pleadings*. Aloha Networks suggests 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);

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[184] The Bureau allowed VSAT systems using the Aloha multiple access technique at the time of the *Spacenet Order* to continue their operations pursuant to a waiver of Sections 25.134(a) and (b). *See Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23716 (para. 12).

[185] *Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23716 (para. 12).

[186] Aloha Networks November 14 *Ex Parte* Statement at 3.

> (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 0.001; and
> (iii) The maximum duration of any single collision is less than 100 milliseconds.[187]

91. Aloha Networks explains that its clauses (i) and (iii) are based on the proposal Spacenet provided in its petition for declaratory ruling.[188] Aloha Networks contends that its clause (ii) is not system-specific, as Spacenet's was, it uses a quantifiable standard, and it could be applied to systems developed in the future.[189] Hughes asserts that the power spectral density reduction needed to achieve a probability of transmission collisions in the VSAT network of less than 0.001, as Aloha Networks proposes, is too great to maintain a viable service, and is inconsistent with the finding in Appendix E of the *Notice* that a 0.01 probability of transmission collisions is negligible.[190]

92. *Discussion*. We believe that the general approach recommended by Aloha Networks satisfies our concerns. Aloha Network's 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. Also, we agree that it is applicable to any random access technique using a contention protocol.

93. We also agree with Hughes, however, that requiring a maximum 0.001 probability of transmission collisions on the same frequency within a VSAT network is more restrictive than necessary to maintain a reasonable interference environment. As Hughes observes, we tentatively concluded in the *Notice* that a one percent probability of a transmission collision is not excessive.[191] Accordingly, we invite further comment on the Aloha Networks proposal, revised to require a maximum probability of transmission collisions of 0.01 in subparagraph (ii) of the proposal. Under this proposal, we would require 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 network. We propose to require these calculations as an attachment to the Form 312 earth station application.

94. In summary, we believe that the Aloha Network approach as revised above strikes a reasonable balance between (1) limiting the increase in the potential for harmful interference as satellite traffic increases; and (2) limiting the burdens on VSAT operators who must comply with

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[187] Aloha Networks Comments at 8-9; Aloha Networks Reply at 2-3.

[188] Aloha Networks Comments at 9. *See Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23714-15 (para. 7).

[189] Aloha Networks Comments at 9-10.

[190] Hughes Reply at 14-15.

[191] *Notice,* FCC 00-435, 15 FCC Rcd at 25209 (App. E).

the rule we adopt. Therefore, we invite interested parties to comment on the revised Aloha Networks approach.

95. Several parties have suggested on the record other approaches for regulating VSAT random access techniques in response to the *Notice*.[192] Any party who supports one of those approaches over the proposal we set forth above is free to provide additional support for their recommendations in their pleadings in response to this *Further Notice*. We will consider in detail all the suggested alternatives for regulating VSAT random access techniques, and all the pleadings filed in response to those suggested alternatives, in a *Report and Order* in this proceeding.

C. TDMA, FDMA, and CDMA

96. *Background*. The *Notice* proposed rules for TDMA, FDMA, and CDMA as well as Aloha. As we noted above, the current rules establish a power spectral density limit of -14.0 dB(W/4 kHz) for all VSAT hub earth stations.[193] In the *Notice*, we proposed limiting the power spectral density of VSAT network earth stations using one of these techniques to -14.0 - 10log(N) dB(W/4 kHz).[194] For FDMA and TDMA, we proposed setting "N" equal to one, which would allow the current power spectral density limit to remain in effect for these VSAT systems.[195] For CDMA, we proposed setting "N" equal to "the likely maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam."[196] We explained that this value for "N" was designed to require a power spectral density reduction of 3 dB for VSAT systems using CDMA.[197] We also noted that this proposal is substantially similar to the rules the Commission adopted in the *18 GHz Order* for blanket licensing of Ka-band systems using FDMA, TDMA, and CDMA.[198]

97. *Pleadings*. Only Aloha Networks and Hughes commented directly on our proposed rules for FDMA, TDMA, and CDMA systems. Aloha Networks does not oppose these proposals, but instead notes that we define "N" for CDMA systems as the "likely maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam." Aloha Networks states that the "likely maximum number" is vague, because it varies according to the number of earth stations transmitting.[199] Hughes states that the rule revisions for FDMA and

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[192] Astrolink Comments at 13-14; Astrolink Reply at 4; Spacenet Comments at 29-30, 37-41; Spacenet Reply at 19; GE Americom Comments at 4; SIA Reply at 13-15.

[193] 47 C.F.R. § 25.134.

[194] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25147 (para. 55).

[195] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25207 (App. E). When N = 1, 10log(N) = 0.

[196] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25208 (App. E).

[197] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25147 (para. 56) and 25210 (App. E).

[198] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25147 (para. 55), *citing* 47 C.F.R. § 25.138(a), *adopted in 18 GHz Order*, FCC 00-212, 15 FCC Rcd at 13492.

[199] Aloha Networks Comments at 7.

TDMA may be unnecessary, but that CDMA "may present unique issues."[200] In SIA's *ex parte* statement, it proposes rule revisions for FDMA, TDMA, and CDMA systems that are consistent with our proposed rules.[201]

98. *Discussion*. Although there is some support in the current record for the rule revisions for FDMA, TDMA, and CDMA systems that we proposed in the *Notice*, we invite comment on revising these proposals, to be consistent with the proposed contention protocol rule set forth in this *Further Notice* above. As an initial matter, we invite comment on exempting VSAT systems using FDMA or TDMA from any rule revisions we adopt for contention protocol multiple access techniques. The rule revisions proposed in the *Notice* do not require any power reduction for FDMA or TDMA VSAT systems, relative to the power spectral density limits in the current rules. The power spectral density limits for FDMA and TDMA VSAT systems may be clearer if we exempt those VSAT systems from any VSAT rule revisions in this proceeding.

99. In addition, we invite comment on whether to adopt the rule revision for CDMA VSAT systems that we proposed in the *Notice*, or to apply the rule revisions we proposed above for Aloha and other contention protocols. Above, we propose three new rules, including a power spectral density limit of - 14.0 - 10log(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.[202] It is possible that our proposed contention protocol rules would place a reasonable power spectral density limit on CDMA systems. Therefore, we seek comment on applying the rules proposed in this *Further Notice* for Aloha and other contention protocols to Ku-band CDMA systems.

100. In the event that we find that we need a separate rule for CDMA systems, the *Notice* proposals could be reasonable if modified slightly. We agree with Aloha Networks that the term "likely maximum number" in our CDMA rule is not as precise as it should be. VSAT system operators using CDMA know how many remote earth stations can transmit simultaneously under the codes they plan to use in their networks. Therefore, licensees will be able to determine the maximum number for purposes of complying with our rule. The word "likely" does not add anything to the requirement, and therefore, we will remove it from our proposed CDMA rule. In addition, we will consider additional recommendations for clarifying the language of the CDMA rule we propose here, and the CDMA rule we adopted for Ka-band VSAT systems in the *18 GHz Order*.[203]

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[200] Hughes Comments at 19 and n.39. However, Hughes also proposed creating an envelope for off-axis EIRP spectral density limits for VSAT systems, similar to the antenna gain pattern envelope in Section 25.209 of the Commissions rules. As part of its proposal, Hughes included power reduction provisions for FDMA, TDMA, and CDMA systems based on 10log(N), just as we proposed in the *Notice*. Both Hughes and the *Notice* proposed defining N as 1 for FDMA and TDMA, and the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite transmitting beam for CDMA. *See* Hughes Comments at 11-12.

[201] SIA November 5 *Ex Parte* Statement, Att. 1 at 4-5. Specifically, SIA proposes an input power spectral density limit of - 14 + X - 10log(N) dB(W/4 kHz), where the definition of "N" is identical to ours for TDMA, FDMA, and CDMA. We discuss SIA's proposal for the definition of "X" in its rule in Section V.B. below.

[202] *See* Section IV.B.1. above.

[203] *See* 47 C.F.R. § 25.138(a), *adopted in 18 GHz Order*, FCC 00-212, 15 FCC Rcd at 13492.

D. Extension of Rules to Other Frequency Bands

1. Background

101. In the *Notice*, the Commission observed that, in another proceeding, it was considering expanding its VSAT rules from the conventional Ku-band to the conventional C-band.[204] In other words, the Commission was considering rules for issuing blanket licenses for large numbers of technically identical small C-band earth station antennas. The Commission also found that it should extend the multiple access rules to conventional C-band VSAT (CSAT) networks in the event that we adopt such rules in this proceeding.[205] As we noted above, the Commission adopted CSAT rules after it released the *Notice*.[206] In addition, the *Notice* sought comment on revising the rules governing blanket licensing for remote terminals in the Ka-band to incorporate requirements for the Aloha access technique.[207] The Commission already has adopted rules governing TDMA, FDMA, and CDMA VSAT operations in the Ka-band.[208]

102. Astrolink and Hughes oppose application of Aloha requirements to Ka-band VSAT systems.[209] Astrolink argues that Ka-band system operators plan to use random access techniques only when transmitting signaling information, to reserve a time slot for subsequent TDMA transmissions, and so the probability of transmission collisions is lower than it would be in most Ku-band VSAT systems using random access techniques.[210] Astrolink asserts that no regulations for Ka-band VSAT systems using random access techniques are needed, but would consider supporting a proposal similar to that put forward by Hughes in the *Spacenet Order*.[211]

2. Contention Protocols

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[204] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25147 (para. 55), *citing* FWCC Request for Declaratory Ruling on Partial-Band Licensing of Earth Stations in the Fixed-Satellite Service that Share Terrestrial Spectrum, *Notice of Proposed Rulemaking*, IB Docket No. 00-203, FCC 00-369, 15 FCC Rcd 23127 (2000) (*FWCC/Onsat NPRM*).

[205] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25147-48 (para. 57).

[206] *See* Section IV.A., *citing FWCC/Onsat First Report and Order*, FCC 01-177, 16 FCC Rcd 11511.

[207] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25147-48 (para. 57). For purposes of this *Further Notice*, the "Ka-band" denotes the 19.7-20.2 GHz and 27.5-30.0 GHz frequency bands.

[208] *See* 47 C.F.R. § 25.138(a), *adopted in 18 GHz Order*, FCC 00-212, 15 FCC Rcd at 13492. With the exception of the Ka-band and the conventional C-band, we have not proposed extending the VSAT rules to any other frequency bands, including the "extended" C-band and "extended" Ku-band.

[209] Astrolink Comments at 14; Hughes Comments at 24; Astrolink Reply at 5-6; Hughes Reply at 16.

[210] Astrolink Reply at 6.

[211] Astrolink Reply at 7.

103. We do not propose rules for C-band and Ka-band VSAT systems using contention protocols. The Bureau noted in the *Spacenet Order* that Aloha systems are not currently a problem.[212] The *Notice* proposed Aloha rules for Ku-band VSAT systems in part to ensure that use of the Aloha random access technique does not become a problem in the future as Ku-band VSAT system traffic grows.[213] 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, at this time, we are not as concerned about the effect of contention protocol random access techniques on C-band and Ka-band VSAT transmissions. Accordingly, we do not propose rules governing contention protocols such as Aloha to C-band and Ka-band VSAT systems at this time. We request comment on this proposal.

3. CDMA

104. In the event that we adopt rules for Ku-band VSAT systems using CDMA, we propose to apply the same rules for VSAT systems in the conventional C-band. The potential for interference from VSAT systems using CDMA should be approximately the same regardless of whether the VSAT system operates in the Ku-band or C-band, although we note that power flux density (PFD) values vary with frequency band. Therefore, it seems reasonable to apply the same rules to VSAT systems using CDMA operating in the Ku-band and C-band. We seek comment on this proposal.

105. We also observe, however, that we have already adopted rules for Ka-band VSAT systems using CDMA,[214] and those rules are very similar to the proposed rules for Ku-band VSAT systems. We do not believe that any further revisions are needed for these Ka-band VSAT systems. Therefore, we invite comment on not revising these rules.

E. Single Channel Per Carrier

106. Section 25.212 of the Commission's rules establishes power spectral density limits for narrowband transmissions, including single channel per carrier (SCPC) transmissions in the C-band.[215] In the *Notice*, the Commission proposed applying the multiple access technique rules it proposed for VSAT networks to SCPC transmissions subject to Section 25.212.[216] Here, we invite comment on revising Section 25.212 to apply the same rules to SCPC transmissions as we adopt for VSAT networks.

F. Grandfathering of Requirements

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212 *Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23716 (para.12).

213 *Notice,* FCC 00-435*,* 15 FCC Rcd at 25146-47 (para. 54), *citing Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23716 (para. 10). *See also* Aloha Networks November 14 *Ex Parte* Statement at 3 (Internet traffic over satellite systems is likely to increase in the future).

214 *See* 47 C.F.R. § 25.138. Section 25.138 does not include regulations for Ka-band VSAT systems using Aloha and other contention protocols, but, as explained above, we do not think such requirements are necessary at this time.

215 *See* 47 C.F.R. § 25.212(d) (2001).

216 *Notice,* FCC 00-435*,* 15 FCC Rcd at 25187 (App. B, proposed Section 25.212(d)(2)).

107. According to Hughes and Aloha Networks, if the Commission adopts any rules to govern multiple access techniques, existing VSAT systems should be grandfathered.[217] We do not propose to grandfather existing VSAT systems. First, none of the commenters suggested that the proposed provisions for CDMA systems are burdensome. It is possible, however, that some existing VSAT network operators using CDMA might have to lower their downlink EIRP to comply with these rules. Therefore, to ensure that such operators of CDMA networks have adequate time to make revisions to their networks, we propose that any rules we finally adopt take effect 90 days after publication in the Federal Register rather than 30 days. We seek comment on these proposals.

108. Further, we do not propose to grandfather existing VSAT systems using Aloha and other random access techniques. As we explained above, we believe we need some rules limiting the probability and the duration of transmission collisions within a VSAT network, and establishing some commensurate constraint on power levels during those transmission collisions, in the future as VSAT system traffic increases.[218] Because VSAT systems using Aloha are not currently causing harmful interference, however, we tentatively conclude that we could establish a transition period for implementation of any contention protocol random access technique requirements we adopt. Therefore, we invite comment on a three-part transition. 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. Second, with respect to VSAT systems licensed between the release date of this Order and the effective date of any rules we adopt, we propose 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. Third, we propose requiring VSAT systems licensed after the effective date of any rules we adopt to comply with those rules. We propose basing our transition mechanism on licensing dates rather than application filing dates to avoid a large influx of VSAT applications prior to the transition dates. We invite comment on this proposed transition mechanism.

G. Summary and Conclusions

109. In this *Further Notice*, we observe that the current record in this proceeding weighs against adopting the Commission's proposals for VSAT systems using Aloha multiple access techniques set forth in the *Notice*. We remain concerned, however, that unrestrained use of multiple access techniques might cause an unacceptable increase in the potential for harmful interference as VSAT network traffic increases. Therefore, we invite comment on a new proposal for VSAT systems using Aloha and other contention protocols. We believe this proposal provides a better balance between (1) limiting the increase in the potential for harmful interference as satellite traffic increases; and (2) limiting the burdens on VSAT operators who must comply with the rule we adopt. We also invite comment on whether we should adopt rules for CDMA VSAT systems if we adopt the rules for contention protocols proposed above.

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[217] Hughes Comments at 23-24; Aloha Networks Reply at 5-6.

[218] *See* Section IV.B.1. above, *citing* Aloha Networks November 14 *Ex Parte* Statement at 3 (Internet traffic over satellite systems is likely to increase in the future).

110. We invite comment on applying our CDMA rules to VSAT networks operating in the C-band, to be consistent with our Ka-band VSAT rules and proposed Ku-band VSAT rules for the CDMA technique. We recognize that PFD values vary with frequency band. Nevertheless, the potential for interference from VSAT systems using CDMA should be about the same regardless of the frequency band in which the VSAT system operates, because the probability of transmission collisions in each of these techniques does not vary depending on the frequency band in which the VSAT system operates. We also seek comment on applying our CDMA requirements to SCPC systems, and on extending any other random access technique requirements to SCPC systems. Finally, we solicit comment on the transition mechanism for existing networks we discuss above.[219]

V. OTHER SIA VSAT PROPOSALS

A. Introduction

111. In this Section, we discuss two proposed VSAT rule revisions other than the random access technique issues we consider in Section IV. above. SIA proposed both these revisions. First, we consider SIA's proposed revisions to the VSAT antenna gain pattern rules and uplink power spectral density limits. We then invite comment on whether the VSAT hub EIRP limit should be an aggregate or per-carrier limit.

112. We noted above that SIA's general antenna gain pattern proposals discussed in Section III.E. are closely interrelated with the VSAT antenna gain pattern and uplink power spectral density proposals we discuss in Section V.B. below. These proposals are also interrelated with SIA's proposed non-routine earth station procedure discussed in Section VI.B. We therefore request parties to comment on whether it would be reasonable to adopt one of these SIA proposals without also adopting the other two.

B. VSAT Uplink Power Spectral Density Limits

113. *Background*. SIA proposes allowing VSAT operators to increase their uplink power spectral density by some amount up to 2 dB, as discussed further below, if they use antennas of 1.8 meters or less in the GSO plane, and meet "improved" side lobe requirements.[220] SIA claims that the improved side lobe requirements it proposes for VSAT operations differ in three ways from the current side lobe requirements.[221] First, SIA states that "the gain of the antenna at certain off-axis angles may be reduced by a value of 0 to 2 dB depending upon the level of transmit power required."[222] Second, SIA would begin the antenna gain envelope at 1.5° off-axis for antennas less than 1.2 meters in the GSO plane. SIA would continue to begin the antenna gain envelope at 1.25° off-axis for antennas between 1.2 meters and 1.8 meters in the

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[219] In the *Spacenet Order*, the Bureau granted a waiver of Sections 25.134(a) and (b) to VSAT system operators using multiple access techniques at the time the *Spacenet Order* took effect. *Spacenet Order*, DA 00-2664, 15 FCC Rcd at 23716 (para.12). This waiver will remain in effect until any multiple access technique rules we adopt take effect.

[220] SIA December 10 *Ex Parte* Statement at 1-2.

[221] SIA December 10 *Ex Parte* Statement at 3, *citing* 47 C.F.R. § 25.209(a)(1).

[222] SIA December 10 *Ex Parte* Statement at 3.

GSO plane.[223] SIA notes that we currently begin the antenna gain envelope at 1.25° off-axis for all Ku-band earth station antennas.[224] Finally, SIA proposes requiring applicants to provide a manufacturer's certificate showing that the manufacturer has tested representative equipment and found that it complies with SIA's proposed VSAT side lobe standards.[225]

114. SIA would allow VSAT operators to increase their uplink power spectral density by an amount defined by "X" in its proposed rules.[226] SIA states that X is a value from 0 to 2 dB, which "corresponds to"[227] or "is associated with"[228] its proposed improved antenna side lobe performance standards. SIA explains that "increasing the transmit power by 2 dB while decreasing the gain of the antenna by the same amount at certain off-axis angles will not cause any increase in adjacent satellite interference."[229]

115. *Discussion*. SIA's proposal raises several issues, some of which are similar to or are interrelated with the issues we found with respect to SIA's antenna gain pattern proposals discussed in Section V.B. above. First, SIA's power spectral density is complex, and so may increase the time needed to review VSAT applications.

116. Furthermore, as a general matter, we believe that the uplink power should be able to be increased if the overall power flux density in the off-axis angles does not increase with respect to that provided by the current maximum transmit power rules and the antenna gain pattern. In this regard, we invite comment on whether SIA's proposal includes unnecessary restrictions. For example, SIA would allow VSAT operators to increase their uplink power spectral density to the extent that those power increases would not cause the transmission to exceed the applicable antenna gain pattern envelope, but only if that power increase is less than 2 dB. We believe this is generally a reasonable way to proceed. We request comment, however, on whether a power increase greater than 2 dB should also be allowed if the applicant can show that such a power increase would not cause the transmission to exceed the combined power spectral density envelope at the various off-axis angles provided by the applicable antenna gain pattern reference envelope combined with the maximum power of transmission. Furthermore, the antenna gain pattern envelope that SIA recommends for VSAT operations appears to be the same as the one it recommends for other Ku-band earth station operations. Yet, SIA would allow only VSAT operators to take advantage of its proposed power spectral density increases. We believe that this advantage should be applicable to all earth station antennas, and seek comment on this view.

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223 SIA December 10 *Ex Parte* Statement at 3-4.

224 SIA December 10 *Ex Parte* Statement at 4. *See also* 47 C.F.R. § 25.209(g).

225 SIA December 10 *Ex Parte* Statement at 6.

226 SIA December 10 *Ex Parte* Statement at 2.

227 SIA December 10 *Ex Parte* Statement at 2.

228 SIA November 5 *Ex Parte* Statement, Att. A at 4, proposed revisions to Section 25.134(a).

229 SIA December 10 *Ex Parte* Statement at 3.

117. Moreover, if we adopt SIA's proposal, we note that we cannot adopt the rule revisions it recommended in its *ex parte* statements. The language of SIA's proposed rule states that the allowable increase in power spectral density is "a value between 0 and 2 dB," and "shall be associated with the antenna patterns" it proposes adding to Section 25.209.[230] If we are to adopt this proposal, we will need additional information to revise the language in Section 25.134 substantially to explain with specificity the allowed power increase. We seek further comment on this SIA proposal.

118. Finally, with respect to SIA's proposal to require antenna manufacturers to provide a certificate demonstrating that they have tested their antennas for compliance with SIA's proposed Section 25.134,[231] we observe that our rules currently include a certification requirement in Section 25.132.[232] Therefore, we believe that SIA's proposed certification requirement is duplicative, and seek comment on this view.

C. VSAT Hub EIRP Limit

119. *Background*. SIA requests that we "clarify" that the EIRP limit of 78.3 dBW for VSAT hubs in Sections 25.134(a) and (b) of our current rules is specific to each carrier wave transmitted by the earth station, and therefore is a per-carrier limit.[233] Hughes and Spacenet made similar requests in the original record.[234]

120. *Discussion*. Hughes also raised this issue in the context of the *1996 Streamlining Order*.[235] At that time, the Commission explained that we did *not* consider the 78.3 dBW limit to be a per-carrier limit, but rather an aggregate limit.[236] At the time we adopted this EIRP limit, in 1986, we determined that an EIRP limit higher than 78.3 dBW could cause unacceptable

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[230] SIA November 5 *Ex Parte* Statement, Att. A at 4, proposed revisions to Section 25.134(a). Specifically, SIA's proposed rule reads as follows: "For antennas with dimensions less than 1.8 meters in the geostationary orbital plane, X is a value from 0 dB to 2 dB, and the use of this maximum input power spectral density shall be associated with the antenna patterns in paragraph (a)(2) of this section. For antennas with dimensions of 1.8 meters in the geostationary satellite orbital plane, X is equal to zero, and the use of this maximum input power spectral density shall be associated with the antenna patterns in paragraphs (a), (b) and (g)(1)(ii) of Section 25.209. For antennas with dimensions greater than 1.8 meters in the geostationary orbital plane, X is equal to zero, and the use of this maximum input power spectral density shall be associated with the antenna patterns in paragraphs (a) and (b) of Section 25.209."

[231] SIA December 10 *Ex Parte* Statement at 6.

[232] Section 25.132 requires applicants for C-band and Ku-band earth station licenses to submit a certification from the antenna manufacturer that it has performed a series of radiation pattern tests that demonstrate that the antenna meets the antenna gain pattern requirements in Section 25.209 of our rules. *See* 47 C.F.R. § 25.132(a) (2001).

[233] SIA December 10 *Ex Parte* Statement at 30.

[234] Hughes Comments at 27; Spacenet Reply at 14.

[235] Streamlining the Commission's Rules and Regulations for Satellite Application and Licensing Procedures, *Report and Order*, IB Docket No. 95-117, FCC 96-425, 11 FCC Rcd 21581, 21593 (para. 29) (1996) (*1996 Streamlining Order*).

[236] *1996 Streamlining Order*, FCC 96-425, 11 FCC Rcd at 21593 (para. 29).

interference.[237] Although the Commission indicated that it might revisit this issue in a future rulemaking proceeding to determine whether this limit could be increased to reflect advancements in technology,[238] neither SIA, Hughes, nor Spacenet have provided any basis for changing the Commission's decision in this proceeding. Therefore, we invite these parties and other interested parties to provide additional information supporting such a rule revision. We request that any such information demonstrate with particularity that a per-carrier 78.3 dBW EIRP limit would not cause unacceptable interference.

VI. OTHER PROPOSALS

A. Introduction

121. In this Section, we invite comment on proposed rule revisions other than the antenna gain pattern and VSAT proposals we discuss above. Many of these proposals were suggested by SIA. We noted above that SIA has filed several *ex parte* statements recommending a series of interrelated proposals. Some of those proposals are new, and others are alternatives to proposals the Commission made in the *Notice*. We have an adequate record to act on some but not all of SIA's proposals. Therefore, below, we invite comment on the SIA proposals for which we need to supplement the record.

122. In Section VI.B., we invite comment on SIA's proposed non-routine earth station procedure. Section VI.C. invites parties to address SIA's proposed video, wideband, and narrowband power limits. Finally, Section V.D. proposes other miscellaneous revisions to Part 25.

B. Streamlined Procedure for Non-Routine Earth Stations

123. *Background*. The *Notice* invited comment on streamlining two types of non-routine earth station applications: (1) those seeking authority to operate an earth station with an antenna diameter too small to meet the routine processing standards of Part 25;[239] and (2) those seeking authority to operate an earth station at a power level greater than those specified in Part 25.[240] For applications seeking authority to use a small antenna, the Commission proposed two alternative procedures. One procedure would allow the Commission to require the applicant proposing a small antenna to operate at a lower power level, to compensate for the use of the smaller antenna diameter.[241] The second procedure would allow applicants to submit affidavits[242] from operators

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[237] *See* Streamlining the Commission's Rules and Regulations for Satellite Application and Licensing Procedures, *Notice of Proposed Rulemaking*, IB Docket No. 95-117, FCC 95-285, 10 FCC Rcd 10624, 10628 n.26, *citing 1986 VSAT Order* at para. 14.

[238] *1996 Streamlining Order*, FCC 96-425, 11 FCC Rcd at 21593 (para. 29).

[239] The smallest diameter antenna routinely licensed at C-band is 4.5 meters, and the smallest antenna routinely licensed at Ku-band is 1.2 meters in diameter. *See Notice,* FCC 00-435*,* 15 FCC Rcd at 25133 (para. 11). The size of the earth station antenna is important since, in general, smaller antennas produce wider transmission beams, which, in turn, can create more potential interference to adjacent satellite operations. *Notice,* FCC 00-435*,* 15 FCC Rcd at 25132 (para. 7).

[240] *See* 47 C.F.R. §§ 25.134 (VSAT networks), 25.211 (2001) (video transmissions), 25.212 (narrowband transmissions); *Notice,* FCC 00-435*,* 15 FCC Rcd at 25140 (para. 31).

[241] *Notice,* FCC 00-435, 15 FCC Rcd at 25135-36 (paras. 15-19).

of satellites potentially affected by the proposed non-routine earth station, showing that the target satellite operator has coordinated the non-routine earth station with other affected satellite systems.[243] For applications to operate at a non-routine power level, the Commission proposed only one procedure, an affidavit procedure. This affidavit procedure would be substantially similar to the affidavit procedure now being used for applications proposing non-routine earth station antenna diameters.[244] Finally, the Commission proposed codifying these procedures in Section 25.220 of its rules.[245]

124. SIA proposes a different procedure for non-routine earth station applications.[246] SIA proposes substantially restricting the streamlined procedure for non-routine earth station antennas. First, SIA would restrict earth station operators' ability to obtain authorization for smaller-than-routine antennas by reducing their power levels. SIA would limit this procedure to operations in the 5925-6425 MHz band only.[247] In addition, SIA would require target satellite operators to coordinate these earth station operations with adjacent satellite operators.[248] SIA asserts that the Commission's proposal could encourage "substandard" antennas to proliferate, and "would blur the distinction between conforming and non-conforming antennas."[249]

125. In addition, SIA recommends requiring certification from all neighboring satellite operators that coordination is complete, rather than simply one certification from the target satellite operator. SIA considers this necessary to ensure adjacent satellite operators are contacted before each new non-routine earth station is authorized.[250]

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[242] Loral states that we should refer to the statements from satellite operators as "certifications" rather than "affidavits," because affidavits must be notarized and meet other legal requirements. Loral Comments at 5-6. We will determine whether to adopt Loral's terminology in a future *Report and Order* in this proceeding. In this *Further Notice*, however, we continue to use the word "affidavit" to be consistent with the terminology in the *Notice*.

[243] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25136-37 (paras. 20-24).

[244] *Notice,* FCC 00-435, 15 FCC Rcd at 25140-41 (paras. 31-33).

[245] *Notice,* FCC 00-435, 15 FCC Rcd at 25187-88 (App. B).

[246] We remind commenters that this proposal is interrelated with SIA's antenna gain pattern proposals discussed in Section III.E and its VSAT proposals discussed in Section V.B. We also invite comment on whether it would be reasonable to adopt this proposal without also adopting the proposals that are interrelated with this proposal.

[247] SIA December 10 *Ex Parte* Statement at 28.

[248] SIA December 10 *Ex Parte* Statement at 28.

[249] SIA December 10 *Ex Parte* Statement at 28.

[250] SIA December 10 *Ex Parte* Statement at 28.

126. Finally, SIA opposes a streamlined procedure for non-routine receive-only earth stations or the receive operations of non-routine transmit/receive earth stations.[251] SIA asserts only that there is no need for such procedures.[252]

127. *Discussion*. SIA suggests requiring earth station operators seeking authority to use non-routine antennas, in addition to reducing their power, to obtain affidavits from adjacent satellite operators, and to allow only C-band earth station operators to use this procedure.[253] We observe that the Commission proposed a less restrictive procedure in the *Notice*, and we invite SIA to explain in more detail why it believes its proposed additional safeguards are necessary. Specifically, we proposed, as one option available to earth station operators seeking authority to use smaller than routine antennas, that those earth station operators would be required to decrease their power levels to the extent necessary to meet the Commission's antenna gain pattern envelope. "[E]arth station applicants seeking authority to use a non-compliant antenna will have to reduce the earth station transmit power and power density to the extent necessary to compensate, decibel for decibel, for any shortfall in the antenna performance relative to the antenna standards of Section 25.209."[254] SIA has not explained why requiring earth station operators to meet the Commission's antenna performance standards would need to be coordinated with adjacent satellite operators. Without more explanation, SIA's suggestion appears to be somewhat inconsistent with its proposals to allow VSAT operators to increase their power spectral density if those power increases do not exceed the off-axis power flux density values associated with the Commission's antenna performance standards, summarized in Section V.B. above. With respect to its proposed VSAT rules, SIA states that "increasing the transmit power by 2 dB while decreasing the gain of the antenna by the same amount at certain off-axis angles will not cause any increase in adjacent satellite interference."[255] SIA should explain why the converse is not also true, that decreasing transmit power and increasing the earth station antenna gain by the same amount would not cause any increase in adjacent satellite interference.

128. Aside from the concerns discussed above, the reasons SIA provides in its *ex parte* statements do not sufficiently explain why it is necessary to restrict its proposed non-routine earth station procedure to C-band earth station applications. Specifically, SIA has not shown that our antenna performance verification standards already in our rules[256] would be inadequate to prevent "substandard" antennas under our proposed non-routine earth station procedure.[257] Also, since its proposal would permit only C-band earth station operators to reduce their power levels to meet the antenna gain pattern envelope, but not Ku-band earth stations,[258] SIA appears to assume that

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251 SIA December 10 *Ex Parte* Statement at 27.

252 SIA December 10 *Ex Parte* Statement at 27.

253 SIA December 10 *Ex Parte* Statement at 28.

254 *Notice,* FCC 00-435*,* 15 FCC Rcd at 25136 (para. 18).

255 SIA December 10 *Ex Parte* Statement at 6.

256 47 C.F.R. § 25.132.

257 SIA December 10 *Ex Parte* Statement at 28.

258 SIA December 10 *Ex Parte* Statement at 28.

manufacturers are less likely to produce "substandard" C-band antennas than "substandard" Ku-band antennas. Other than stating that adoption of its proposed Ku-band antenna gain pattern revisions would reduce the need for this procedure for Ku-band earth stations,[259] SIA provides no explanation for this distinction. Furthermore, we cannot assume that an earth station antenna is substandard merely because its diameter is smaller-than-routine under our current rules, given that, as the Commission explained in the *Notice*, technological advances have made it possible to meet the Commission's earth station technical requirements with antennas smaller in diameter than was possible when the Commission adopted those standards in 1983.[260]

129. SIA recommends requiring non-routine earth station applicants to submit statements from all affected adjacent satellite operators that the proposed non-routine operations have been coordinated, rather than just one statement from the target satellite operator. This recommendation also seems unnecessarily burdensome, and SIA has not explained why its procedure is preferable to the one the Commission proposed in the *Notice*. SIA is mistaken in arguing that we would not solicit comment from affected satellite operators before we would consider authorizing non-routine earth station operations under the procedure proposed in the *Notice*. The Commission explicitly contemplated requiring the target satellite operator to state in an affidavit that it "has coordinated the proposed earth station operations with affected satellite systems...."[261] Furthermore, as a normal procedure, we will place non-routine earth station applications on public notice to give adjacent satellite operators and other interested parties an opportunity to comment, to ensure that the non-routine earth station has been properly coordinated.[262] In light of the protections for adjacent satellite operators in our proposed rules, it is not clear that requiring statements from each adjacent satellite operator is necessary. It is clear, however, that such a requirement to seek certification of coordination from each adjacent satellite operator would generate additional administrative burdens for satellite operators, and non-routine earth station applicants, and so would undercut our policy goal of facilitating the provision of innovative new services to the public.[263] Accordingly, we invite comment on whether the proposed procedure in the *Notice* sufficiently addresses SIA's concern, or whether we should require non-routine earth station applicants to submit statements from all affected satellite operators, whether a U.S.-licensed or non-U.S.-licensed satellite operator. We also invite comment on whether the proposed procedure in the *Notice* would sufficiently address SIA's concern if we revised the language in the proposed rule to require a statement from the target satellite operator that it has reached a "coordination agreement" with adjacent satellite operators regarding the specifically proposed non-routine earth station operations, rather than stating that the proposed non-routine earth station operations are "consistent with existing coordination agreements."

130. Moreover, SIA suggests eliminating the applicability of the streamlined non-routine earth station procedure to receive-only earth stations and the receive operations of transmit/receive earth stations. SIA would extend protection from harmful interference to such

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259 SIA December 10 *Ex Parte* Statement at 28.

260 *Notice*, FCC 00-435, 15 FCC Rcd at 25132 (para. 7).

261 *Notice,* FCC 00-435*,* 15 FCC Rcd at 25136-37 (para. 21).

262 *Notice,* FCC 00-435, 15 FCC Rcd at 25141 (paras. 34-36).

263 *See Notice,* FCC 00-435*,* 15 FCC Rcd at 25131 (para. 4).

earth station operations to the extent that they meet the antenna gain pattern envelope at 1.25° off-axis, but process license applications routinely for non-routine receive-only earth stations or the receive portion of transmit/receive operations if they meet the antenna gain pattern envelope at 2° off-axis.[264] This raises a number of issues. First, when we recognized in the *Notice* that reducing the power of an earth station using a smaller-than-routine antenna would not affect its potential for receiving interference, we contemplated allowing those earth station applicants to ask their target satellite operators to seek coordination agreements giving those earth stations protection from receiving interference.[265] Unless we misunderstand SIA's proposal, non-routine earth station operators would be precluded from requesting target satellite operators to negotiate agreements extending protection from receiving interference to those earth stations. Second, SIA's proposed rule potentially would establish different standards for routinely processing the transmit and receive operations respectively of a single earth station antenna.[266] SIA does not explain how it envisions that we would treat an application for an earth station that qualifies for routine processing with respect to its receive operations but not its transmit operations.

131. Regarding the narrower issue of whether it would be reasonable to adopt different standards for protection from receiving interference and routine processing of receive-only antenna applications, we do not have an adequate record at this point to develop a preliminary assessment of this proposal. Therefore, we request comment on this issue.

132. In summary, we seek comment on the following issues: (1) Should a non-routine transmitting earth station applicant proposing to operate at a reduced power level sufficient to comply with the applicable antenna gain pattern envelope be required to ask its target satellite operator to coordinate the earth station operations with adjacent satellite operators, in addition to operating at the reduced power level that meets the off-axis EIRP limits implicit in Sections 25.209 and 25.212? (2) In cases where non-routine earth station operations are coordinated with adjacent satellite operators, can we rely on a statement from the target satellite operator declaring that it has completed coordination, or must we require all affected satellite operators to provide statements? (3) Should we adopt SIA's proposal to preclude non-routine earth station applicants other than C-band applicants from using any streamlined procedure for non-routine earth station applications? (4) Should we have any streamlined procedure for the receive operations of non-routine earth stations? (5) Should the standards for extending protection from receiving interference be different from the standards for determining whether a receive-only earth station application is eligible for routine processing? (6) Should the standards for determining whether the transmit operations of an earth station application are eligible for routine processing be different from the standards for determining whether the receive operations of that application are eligible for routine processing?

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[264] SIA states that routine processing eligibility would be governed by its proposed Section 25.209(c), and receive protection by its proposed Section 25.209(g)(2). SIA December 10 *Ex Parte* Statement at 27; SIA November 5 *Ex Parte* Statement, Att. A at 18, proposed Section 25.220(a)(1). Sections 25.209(c) and 25.209(g)(2) appear to have the same standards, except for the off-axis angles at which they would begin the antenna gain pattern envelope.

[265] *Notice,* FCC 00-435*,* 15 FCC Rcd at 25135 (para. 16).

[266] Under SIA's proposal, different antennas would qualify for routine processing with respect to transmit operations if they meet the antenna gain pattern envelope at different off-axis angles ranging from 1° to 1.8°. All antennas would qualify for routine processing with respect to receive operations if they meet the antenna gain pattern envelope at 2° off-axis.

C. Video, Wideband, and Narrowband Power Limits

133. *Background*. Sections 25.211 and 25.212 establish power limits for some routine FSS earth stations operating in the conventional C-band and Ku-band. Section 25.211 establishes power limits for video transmissions, and Section 25.212 governs FSS narrowband transmissions.[267] SIA proposes several revisions to Sections 25.211 and 25.212.[268] First, SIA proposes increasing the power limits in Section 25.212©.[269] SIA further recommends applying the power limits in Section 25.211 only to *analog* video transmissions. SIA would expand the power limits in Section 25.212 to apply to all digital transmissions, including digital video. SIA also recommends revising Sections 25.211 and 25.212 to prescribe antenna sizes based on the "dimension parallel to the GSO plane" rather than "equivalent antenna diameter," thus implicitly recommending that we base our review of elliptical antennas exclusively on the length of the major axis rather than its surface area. SIA requests us to specify that the input power density limits in Section 25.212 apply to the input power spectral density into the antenna flange.[270] Also, SIA proposes to replace cross-references to the streamlined non-routine earth station procedure with cross-references to its proposed routine earth station standards in Section 25.209, discussed above.

134. In the *Notice*, the Commission proposed revising Section 25.201 of our rules, the definitions section, to define the terms "narrowband" and "wideband." A few commenters recommended minor revisions to our definitions. Hughes would define "wideband" as anything having a necessary bandwidth wider than 5 MHz.[271] Spacenet proposes defining "narrowband" as

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[267] Section 25.211(d) reads as follows: "In the [conventional C-band], an earth station with an equivalent diameter of 9 meters or smaller may be routinely licensed for transmission to full transponder services if the maximum power into the antenna does not exceed 450 watts (26.5 dBW). In the [conventional Ku-band], an earth station with an equivalent diameter of 5 meters or smaller may be routinely licensed for transmission of full transponder services if the maximum power into the antenna does not exceed 500 watts (27 dBW)." 47 C.F.R. § 25.211(d). Section 25.212(c) states: "In the [conventional Ku-band], an earth station with an equivalent diameter of 1.2 meters or greater may be routinely licensed for transmission of narrowband analog services with bandwidths up to 200 kHz if the maximum input power density into the antenna does not exceed -8 dBW/4 kHz and the maximum transmitted satellite carrier EIRP density does not exceed 13 dBW/4 kHz, and for transmission of narrowband and/or wideband digital services, if the maximum input power density into the antenna does not exceed -14 dBW/4 kHz and the maximum transmitted satellite carrier EIRP density does not exceed +6.0 dBW/4 kHz." 47 C.F.R. § 25.212(c). Section 25.212(d) states: "In the [conventional C-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." 47 C.F.R. § 25.212(d).

[268] In the *Notice,* we also proposed a number of revisions to Sections 25.211 and 25.212. *See Notice,* FCC 00-435, 15 FCC Rcd at 25187 (App. B). We expect, however, that the record as supplemented by the comments in response to Section IV.E. above will be sufficient to enable us to act on all our proposed revisions for Section 25.211 and 25.212. Accordingly, we need not invite further comment on those issues here.

[269] SIA December 10 *Ex Parte* Statement at 24.

[270] The antenna flange is the radiofrequency connector at the input to the antenna.

[271] Hughes Comments at 15; Hughes Reply at 8.

modulated carriers with a necessary bandwidth less than 3 MHz and "wideband" as modulated carriers with a bandwidth greater than 3 MHz.[272] Similarly, PanAmSat recommends defining "narrowband" as any carrier below 3 MHz in a multi-carrier mode.[273] PanAmSat also proposes distinguishing between single wideband, dual wideband, and multiple wideband carriers, and adopting different definitions in Part 25 for each term.[274]

135. SIA, however, claims that its proposed revisions to Section 25.212 obviate the need for our proposed definitions. SIA also suggests a new definition for "full transponder," to classify transmissions as "full transponder" if they use all the transponder's power, regardless of whether they occupy the full bandwidth of the transponder.[275]

136. *Discussion*. Many of SIA's requested revisions to Sections 25.211 and 25.212 and our Section 25.201 definitions are related to its proposals for increasing power limits and revising antenna gain pattern requirements. Therefore, our decisions on these recommendations will be interrelated with our decisions on those other issues. There are, however, additional issues we need to address. First, should the power limits in Section 25.211 apply only to analog video transmissions, and should digital video transmissions be subject to the power limits set forth for other transmissions in Section 25.212? It may be reasonable to treat analog video transmissions separately from other transmissions, because the Commission has determined in the past that those transmissions are more susceptible to harmful interference from other transmissions, and more likely to cause harmful interference to other transmissions.[276]

137. In addition to the analog video power issues, we invite comment on the following issues: (1) Should we state input power limits to the earth station in terms of power spectral density into the antenna flange?[277] (2) Should we base our review of elliptical antennas exclusively on the length of the major axis rather than its surface area? (3) Should we adopt our proposed definitions of "narrowband" and "wideband," revise the definitions as recommended by

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[272] Spacenet Reply at 20. Spacenet supported the Commission's proposed definitions of "wideband" and "narrowband" in its comments, but refined its position on this issue in its reply. *See* Spacenet Comments at 42.

[273] PanAmSat Comments at 10-11. PanAmSat did not define "multi-carrier mode" in this context.

[274] PanAmSat would define "Single wideband" as carrier bandwidth close to entire transponder bandwidth at or close to saturation; "Dual wideband" as carrier bandwidth close to half-transponder bandwidth at half-transponder power; and "Multiple wideband" as carrier bandwidth above 3 MHz operating in multi-carrier mode. PanAmSat did not incorporate transponder size considerations into its proposed definitions. PanAmSat Comments at 10-11.

[275] Hughes Comments at 15; Hughes Reply at 8; PanAmSat Comments at 10-11; Spacenet Reply at 20. Spacenet supported the Commission's proposed definitions of "wideband" and "narrowband" in its comments, but refined its position on this issue in its reply. *See* Spacenet Comments at 42.

[276] *See Ku-band Antenna Gain Pattern Revision Order*, FCC 93-38, 8 FCC Rcd at1320 (para. 24).

[277] This issue is relevant to VSAT antennas as well as the earth station antennas governed by Sections 25.211 and 25.212.

any of the commenters on this issue, or reject our proposed definitions as SIA recommends? (4) Should we adopt SIA's proposed definition of "full transponder"?

D. Miscellaneous

138. Several frequency bands in the Table of Frequency Allocations are shared between government and non-government operations.[278] When an earth station applicant seeks authority to operate in such a shared band, the Commission must coordinate with the National Telecommunications and Information Administration (NTIA). We must have the half-power beam width to complete coordination with NTIA. Our rules currently do not require applicants to submit half-power beam width. As a result, we often must request the applicant to provide this information, and as a result, completion of coordination and our action on the application can be delayed. Therefore, to enable us to expedite our review of earth station applications in shared government-commercial bands, we propose to require applicants for earth station authority in shared government-commercial bands to provide information on half-power beam width.

139. Finally, in the *Notice*, the Commission proposed updating a number of cross-references in Part 25 rules.[279] In addition to those proposals, we invite comment on revising Section 25.161(b)[280] so that the reference to the license renewal requirements is "Section 25.121(e) rather than "Section 25.120(e)." We also seek comment on revising Section 25.203(g)(1)[281] so that the reference of FCC monitoring stations is "Section 0.121(b)" rather than "Section 0.121(c)."

VII. SUMMARY AND CONCLUSIONS

140. In this *Further Notice*, we propose to reduce the minimum antenna size for routine processing of C-band earth stations to 3.7 meters. We also propose to begin the antenna gain envelope at 3° off-axis outside the GSO orbital plane for Ku-band earth stations, and to increase the antenna gain pattern limits in the backlobe for Ku-band earth stations, and for Ka-band earth stations operating in frequency bands that are not shared with terrestrial wireless operations. Further, we believe that we could begin the antenna gain envelope for conventional C-band and Ku-band earth stations at 1.8° off-axis in the GSO orbital plane but for concerns about pointing error. We also invite comment on proposals for addressing our pointing error concerns.

141. In addition, we decide against adopting the *Notice* proposal for VSAT networks using the Aloha random access technique. We find, however, that it is necessary to adopt some measure to protect other satellite transmissions from receiving interference from those VSAT networks in the future as VSAT traffic increases. We seek comment on such protective measures.

142. We also solicit comment on several SIA proposals for which the record in this proceeding is not yet fully developed. In its *ex parte* statements, SIA proposes several new and

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278 One example of this is the 13.75-14.0 GHz band. *See* 47 C.F.R. § 2.106 (2001).

279 *See Notice,* FCC 00-435*,* 15 FCC Rcd at 25157 (para. 90).

280 47 C.F.R. § 25.161(b) (2001).

281 47 C.F.R. § 25.203(g)(1) (2001).

revised rules. Many of those proposals were also raised in the original record in this proceeding, and that record is sufficient to enable us to act on those issues. We have decided not to act on any of SIA's proposals at this time, however, until we can consider all of SIA's proposals together.

VIII. PROCEDURAL MATTERS

143. ***Initial Regulatory Flexibility Analysis***. Appendix C to this *Further Notice* in this proceeding contains a Initial Regulatory Flexibility Analysis as required by the Regulatory Flexibility Act of 1980, 5 U.S.C. § 603.

144. ***Paperwork Reduction Act.*** This *Further Notice* contains proposed new and modified information collections. As part of its continuing effort to reduce paperwork burdens, we invite the general public and the Office of Management and Budget (OMB) to take this opportunity to comment on the information collections contained in this *Further Notice*, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. Public and agency comments are due at the same time as other comments on this *Further Notice*; OMB comments are due 105 days from date of publication of this *Further Notice* 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.

145. ***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. Sections 1.1202, 1.1203, and 1.1206(a).

146. ***Comment***. Pursuant to Sections 1.415 and 1.419 of the Commission's Rules, 47 C.F.R. Sections 1.415 and 1.419, interested parties may file comments on or before 75 days following publication in the Federal Register**,** and reply comments on or before 105 days following publication in the Federal Register. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by paper copies. *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 Fed. Reg. 24,121 (1998).

147. Comments filed through the ECFS can be sent as an electronic file via the Internet to <http://www.fcc.gov/e-file/ecfs.html>. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, 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. 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 <your e-mail address>." 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 appear in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number. 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). The

Commission's contractor, Vistronix, 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. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

148. Written comments by the public on the proposed new and modified information collections are due on or before 75 days following publication in the Federal Register. Written comments must be submitted by the Office of Management and Budget (OMB) on the proposed new and modified information collections on or before 105 days after date of publication in the Federal Register. In addition to filing comments with the Secretary, a copy of any comments on the information collection(s) contained herein should be submitted to Judy Boley, Federal Communications Commission, Room 1-C804, 445 12th Street, SW, Washington, DC 20554, or via the Internet to jboley@fcc.gov and to Edward Springer, OMB Desk Officer, Room 10236 NEOB, 725 17th Street, N.W., Washington, DC 20503 or via the Internet to edward.springer@omb.eop.gov.

149. ***Additional Information***. For general information concerning this rulemaking proceeding, contact Steven Spaeth, International Bureau, at (202) 418-1539, International Bureau; Federal Communications Commission, Washington, DC 20554.

IX. ORDERING CLAUSES

150. 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 Further Notice of Proposed Rulemaking is hereby ADOPTED.

151. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Further 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

[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.

APPENDIX B
Differences in Geocentric and Topocentric Angles At Various Angles of Elevation

The angle as seen from the surface of the earth (topocentric angle) is always larger than the GSO satellite orbital spacing as seen from the center of the earth (geocentric angle). The topocentric angle varies with the earth station's elevation angle as shown in the table below.[1] The ratio of topocentric to geocentric angle provides an excess of approximately 3% at an elevation angle of 10°, 5% at an elevation angle of 17°, and 10% at an elevation angle of 35°.

Spacenet's assertion that 2° spaced satellites actually appear to be 2.2° apart appears to be based upon an assumption that the earth station elevation angle is approximately 35° or higher. At the same 35° elevation angle, two satellites spaced at 1.9° apart in the GSO will appear to be 2.09° apart with perfect satellite stationkeeping, and 1.98° apart if both are at their worst allowable stationkeeping extreme of ±0.05°. However, with a 10° elevation angle, two satellites spaced at 1.9° apart in the GSO will appear to be 1.96° apart with perfect satellite stationkeeping, and 1.85° apart if both are at their worst allowable stationkeeping extreme of ±0.05°.

Geocentric Angle (degrees)	Topocentric Angle (degrees)		
	10° elevation angle (approx. 3% excess)	17° elevation angle (approx. 5% excess)	35° elevation angle (approx. 10% excess)
1.8°	1.85°	1.89°	1.98°
1.9°	1.96°	2.00°	2.09°
2.0°	2.06°	2.10°	2.20°

Earth stations located in the northeastern part of CONUS (New England, PA, MD, DE, *etc*.) will have elevation angles in the range of 16.5° to 24.3° to a satellite located at 119°W. These same earth stations will have elevation angles in the range of 23.4° to 30.7° to a satellite located at 107°W. However, elevation angles throughout most of the rest of CONUS will exceed 35° when accessing satellites in the 107°-119° orbital arc, where Canadian and Mexican satellites are located under the Trilateral Agreement.[2]

Therefore, adopting an antenna gain pattern envelope beginning at 2° off-axis, as Spacenet recommends, would not prevent adjacent satellite interference resulting from communications between many U.S.-licensed earth stations and 1.9° spaced satellites in the 107°-

[1] G. Sharp, "Reduced Domestic Satellite Orbital Spacings at 4/6 GHz", Federal Communications Commission, Office of Science and Technology, FCC/OST Report R83-2, May, 1983. The calculations presented in this appendix are based upon equation 6.4 on page 23 of this report. See pages 22-25 of this report for more details concerning topocentric and geocentric angles.

[2] *See* Trilateral Arrangement Regarding Use of the Geostationary Orbit by Canada, Mexico, and the United States, Public Notice, Mimeo No. 4406 (Sept. 2, 1988).

119° orbital arc. To protect U.S.-licensed, low elevation angle, earth stations operating with satellites spaced 1.9° apart when at their worst case stationkeeping tolerances will require beginning the antenna gain envelope at 1.8° off-axis.

APPENDIX C

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 Further Notice of Proposed Rulemaking. 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 Notice of Proposed Rulemaking provided above in Section VII. The Commission will send a copy of the Notice of Proposed Rulemaking, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration. *See* 5 U.S.C. § 603(a). In addition, the Further Notice of Proposed Rulemaking and IRFA (or summaries thereof) will be published in the Federal Register.

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 61 that are no longer necessary in the public interest, as required by Section 11 of the Communications Act of 1934, as amended.

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 proposed rules, if adopted.[2] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[3] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[4] 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

[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), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[2] 5 U.S.C. § 603(b)(3).

[3] *Id*. § 601(6).

[4] 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."

the Small Business Administration (SBA).[5] A small organization is generally "any not-for-profit enterprise which is independently owned and operated and is not dominant in its field."[6] Nationwide, as of 1992, there were approximately 275,801 small organizations.[7] "Small governmental jurisdiction" generally means "governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than 50,000."[8] As of 1992, there were approximately 85,006 such jurisdictions in the United States.[9] This number includes 38,978 counties, cities, and towns; of these, 37,566, or 96 percent, have populations of fewer than 50,000.[10] The Census Bureau estimates that this ratio is approximately accurate for all governmental entities. Thus, of the 85,006 governmental entities, we estimate that 81,600 (91 percent) are small entities. Below, we further describe and estimate the number of small entity licensees that may be affected by the proposed rules, if adopted.

1. Cable Services. 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

[5] 15 U.S.C. § 632.
[6] 5 U.S.C. § 601(4).
[7] 1992 Economic Census, U.S. Bureau of the Census, Table 6 (special tabulation of data under contract to Office of Advocacy of the U.S. Small Business Administration).
[8] 5 U.S.C. § 601(5).
[9] U.S. Dept. of Commerce, Bureau of the Census, "1992 Census of Governments."
[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).

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 Services. 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 (NAICS 513112) and television broadcasting stations (NAICS 513120). 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. 13 C.F.R. § 121.201. As of September 199, there were 3,237 FM translators and boosters, 4913 TV translators.[21] 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,[22] private-operational fixed,[23] and broadcast auxiliary radio services.[24] The proposed rules could

[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, 1997 NAICS Definitions, NAICS 513340.

[19] 13 C.F.R. § 120.121, NAICS code 513340.

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

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

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

[23] Persons eligible under parts 80 and 90 of the Commission's rules can use Private Operational-Fixed

affect all common carrier and private operational fixed microwave licensees who are authorized under Part 101 of the Commission's Rules. There is currently no definition of small entities applicable to these specific licensees. Therefore the applicable small business size standard is the SBA size standard for "Cellular and Other Wireless Telecommunications," which provides that a small entity in this category is one employing no more than 1,500 persons.[25] For 1997, there were 2,872 firms in this category, total, which operated for the entire year. Of this total, only 25 had 1,000 or more employees.[26]

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

None of the proposed rules in this notice are expected to increase the reporting, record keeping and other compliance requirements of any telecommunications carrier.

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.

This Further Notice solicits comment on alternatives for more efficient processing of non-routine earth station applications and simplifying earth station application forms. For example, we seek comment on several alternative proposals for revising the earth station antenna gain pattern rules. Adoption of some of these proposals would allow us to treat as routine some earth station applications that are considered non-routine under the current rules. This would benefit all earth station applicants, including small entities.

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

None.

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.

[24] 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.

[25] 13 C.F.R. § 121.201, Standard Industrial Classification (SIC) Code 4812.

[26] U.S. Census Bureau, 1997 Economic Census, Subject Series: Information, "Employment Size of Establishments of Firms subject to Federal Income Tax: 1997," Table 5, NAICS code 51332 (issued October, 2000).