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

In the Matter of	)	
	)	
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	)	IB Docket No. 00-248

COMMENTS OF THE

SATELLITE INDUSTRY ASSOCIATION

March 10, 2003

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[1] The paragraph numbers that SIA refers to in section headings identify the paragraph numbers of the FNPRM with which the sections are associated.

Introduction and Summary

Background

During 2001, in response to the Commission's streamlining proposals in its Notice of Proposed Rulemaking in this proceeding,[2] the Satellite Industry Association ("SIA") filed a set of Proposed Revisions to Part 25 of the Commission's Rules.[3] The Commission acted on the record in this proceeding in part on February 28, 2002,[4] and issued a Further Notice of Proposed Rulemaking on September 26, 2002.[5]

In the FNPRM, the Commission requested further comments and consideration on various proposals made during this proceeding, and asked the Satellite Industry Association in particular to further simplify its proposals. SIA has reviewed its earlier proposals and those of others in the record, and provides these revised proposals to the Commission for adoption ("SIA Further Revisions").[6] These Further Revisions provide consensus technical modifications to the Part 25 rules for earth station licensing, and are the result of many meetings among SIA

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2 *In the Matter of Biennial Regulatory Review – Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations*, FCC 00-435, IB Docket No. 00-248 (released Dec. 14, 2000) ("NPRM").

3 Proposed Revisions of the Satellite Industry Association, Part 25 Streamlining Proceeding, IB Docket No. 00-248, filed November 5, 2001 and December 10, 2001. Starband Communications Inc. joined SIA in making these earlier filings, but did not participate in the preparation of these comments.

4 *Amendment of the Commission's Space Station Licensing Rules and Policies; 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 and First Report and Order, 17 FCC Rcd 3847 (2002).

5 *In the Matter of 2000 Biennial Regulatory Review--Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations*, Further Notice of Proposed Rulemaking, 17 FCC Rcd 18585 (2002).

6 SIA is a U.S.-based national trade association representing the leading U.S. satellite manufacturers, service providers, and launch service companies. SIA serves as an advocate for the U.S. commercial satellite industry on regulatory and policy issues common to its members. With its member companies providing a broad range of manufactured products and services, SIA represents the unified voice of the U.S. commercial satellite industry. SIA's Executive Members are: The Boeing Company; Globalstar, L.P.; Hughes Network Systems; ICO Global Communications; Intelsat; Lockheed Martin Corp.; Loral Space & Communications Ltd.; Mobile Satellite Ventures; Northrop Grumman Corporation; PanAmSat Corporation; and SES Americom, Inc. Inmarsat participates as an SIA Associate Member.

members to fashion a set of rules that respond to the Commission's NPRM and FNPRM to streamline Part 25.

Summary of SIA Position

In general, SIA proposes that, for smaller antennas at C and Ku-Band, earth station licensing can be streamlined by starting the transmit antenna gain envelope of 25.209 at off-axis angles greater than the 1 degree or 1.25 degrees currently contained in the Rules. The SIA proposes starting the reference antenna gain envelope at 1.5 degrees off- axis in the Ku-band and between 1.5-1.7 degrees in the C-band. Antennas meeting this reference pattern at, or below, these increased off-axis angles would be routinely processed. SIA recognizes however, that as this off axis angle increases beyond 1.5 degrees in the Ku-band and beyond 1.5-1.7 degrees in the C-Band, proper antenna alignment can become a consideration in controlling interference to adjacent satellites. As such, SIA proposes Rules to address pointing accuracy for small antennas not meeting the reference transmit pattern until beyond 1.5 degrees off-axis in the Ku-Band and beyond 1.5-1.7 degrees in the C-Band. Such non-compliant antennas would not be routinely processed.

Throughout the discussion of routine processing, it is clear to SIA that eligibility for routine processing should be based solely on the transmit pattern of the antenna. By its terms, the 25.209(a) and (b) pattern requirements apply only to the transmit pattern of an antenna. Whether the receive pattern of an antenna meets the requirements of 25.209(a) or (b) does not in any way increase the potential for interference into other satellite networks. Thus, for purposes of routine processing, earth station receive pattern compliance with Section 25.209(a) or (b) is irrelevant and requiring such compliance would be unnecessary. Receive protection of all earth stations should be based on Section 25.209(c) of the Commission's Rules. In this way, both the Commission and the licensee will have a clear understanding of the protection to which any earth station is entitled. As the Commission has already recognized, without this change there may be little actual regulatory relief derived from this earth station licensing streamlining rulemaking. SIA addresses this issue through specific proposals to modify the Commission's Rules.

On the general issue of potential interference tied to antenna mispointing, industry experience to date indicates that antennas are accurately installed and that satellite operators and earth station licensees work cooperatively and expeditiously to resolve any interference events that do occur, whatever the cause. SIA does not support the adoption of the specific proposals made by the Commission in the FNRPM in relation to this issue, however it does propose procedures that it believes would enhance the resolution of interference events, in general, when such events do occur.

On the issue of random access techniques, SIA continues to maintain that there is absolutely no experience to date indicating that a power reduction needs to be imposed on systems that employ Aloha access techniques. The accumulated experience of hundreds of thousands of earth stations in operation on multiple satellite networks clearly indicates that this is a purely hypothetical issue that has not shown itself to be any cause of concern in actual practice. In the alternative, and notwithstanding the bulk of practical experience to the contrary, should the

Commission proceed to impose regulation in this area, SIA has included a discussion and resulting proposal that greatly clarifies this issue.

Moreover, in the event the Commission adopts any rules governing multiple access techniques using contention protocols, SIA strongly supports the grandfathering of existing VSAT systems and equipment. The proposed provisions, which would be extremely burdensome on a going-forward basis, would be disastrous if applied on a retroactive basis. Applying these provisions to existing systems would result in the disruption of existing services. Thus, SIA maintains its position that any rules adopted to govern multiple access techniques using contention protocols should not be applicable to existing licensed networks including future license modifications to those networks.

Public Interest Considerations

As the Commission noted in the NPRM, streamlining its earth station licensing rules will expedite the provision of essential satellite services to the public, including the provision of Internet and other broadband satellite services to rural areas.[7]

VSAT satellite networks are ubiquitous throughout the U.S. and are a critical element in the telecommunications infrastructure that supports economic growth in this country. These networks provide rapid, reliable transmissions of data, voice, and video to geographically dispersed sites and are used by a wide range of industries to provide cost-effective business services.

VSAT networks historically have been used for linking internal business data networks, point-of-service credit verification, multimedia image transfer, and broadcast and video communication. In the past few years, advances in technology have allowed VSATs also to be used for providing Internet access and other broadband services directly to consumers and small businesses. Many of these users would not have the capability to access broadband capacity were it not for the technological advances achieved by the satellite industry.

Technological improvements have enabled satellite communications systems to maintain service performance while decreasing the size of the antennas used to deliver satellite services to end users such as consumers. These technological improvements are extremely beneficial to the end user because smaller antennas are less expensive to manufacture and can be installed in a much wider range of locations.[8]

SIA's proposals to further streamline the Commission's rules will hasten the licensing of small VSAT antennas without increasing the potential for harmful interference. Thus, adopting these proposals will facilitate the satellite industry's goal of translating these technological advances into consumer benefits in the form of better service at lower prices and also facilitate the deployment of broadband services by satellite. Thus, SIA's streamlining proposals would provide a concomitant benefit to consumers and the public interest.

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7 NPRM ¶4.

8 FNRPM ¶4.

A. Antenna Gain Patterns

1. Routine C-Band Earth Station Antenna Size (paragraphs 25 and 26[9])

Paragraph 25

SIA supported the FCC's proposals in the Onsat proceeding. In that proceeding, the Commission adopted a limited change to its rules allowing routine licensing of C-band antenna sizes smaller than 4.5-meter to accommodate a special application. The key elements that alleviated SIA's concern in the Onsat proceeding for routine licensing of C-band antenna sizes smaller than 4.5 meter were the limited spectrum accessible by the small aperture antenna and the limit on the number of satellites with which a system could communicate.

SIA continues to support the FCC's efforts to expand the use of spectrum for special applications but, at the same time, the Commission must analyze the impact of the new service on the existing services and adopt regulation to protect the existing services. At the present time the C-band has been used extensively for cable head-end distribution utilizing relatively large antennas for uplinking programming material. The range of antenna size for this uplink service is between 6 and 16 meters and the majority of them are in the range between 9 to 11 meters. The power density used by these antennas is much less than the maximum allowable power density into the antenna flange as stipulated in §25.212(d). The existing rule allows a maximum power density of –2.7 dBW/4kHz for narrow band and wideband digital carriers for routine licensing of C-band terminals.

SIA is concerned that routine licensing of antenna sizes smaller than 4.5 meters employing the maximum allowable power density into the antenna flange this would degrade the system performance of large antennas used by cable head-end programming distribution services. The following table illustrates SIA's concern by showing the uplink carrier-to-interference ratio (C/I) at the satellite antenna output for a typical 9.2-meter uplink antenna accessing a typical US domestic C-band satellite for full transponder digital service such as MCPC and cable head-end programming distribution.

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9 The paragraph numbers that SIA refers to in section headings identify the paragraph numbers of the FNPRM with which the sections are associated.

Satellite saturation flux-density (SFD)[1] (dBW/m^2)	Earth station EIRP to saturate the transponder[2] (dBW)	Earth station transmitter power[3] (dBW)	Power density into the earth station antenna[4] (dBW/4kHz)	Uplink Carrier-to-interference ratio (C/I) **from both +/- 2^o satellites** Various power density into the interfering earth station antenna flange (dBW/4kHz)		
				-2.7	-9.0	-14
-76	86	32.5	-7.1	25.2	31.5	36.5
-83	79	25.5	-14.1	18.2	24.5	29.5
-90	72	18.5	-21.1	11.1	17.5	22.5

Note: 1. A typical US domsat has a SFD range between –90 to –76 dBW/m^2.
2. EIRP = SFD + 162
3. The 9.2-meter antenna has a boresight gain of 53.5 dBi.
4. The transponder bandwidth is 36 MHz.

This table indicates that the uplink C/I ratio is too low to provide sufficient protection if the adjacent satellite uplink earth stations utilize the maximum permissible power density of -2.7 dBW/4 kHz. The C/I protection level also seems low for some cases for the –9.0 dBW/4 kHz power density level. Therefore, SIA proposes that, for antennas with an aperture diameter as small as 2.4 meters, the maximum permissible power density into the antenna flange be limited to –12 dBW/4kHz. This limit is between –9.0 and –14.0 dBW/4kHz. SIA addresses below the rationale for adopting this requirement for 2.4-meter and smaller antennas.

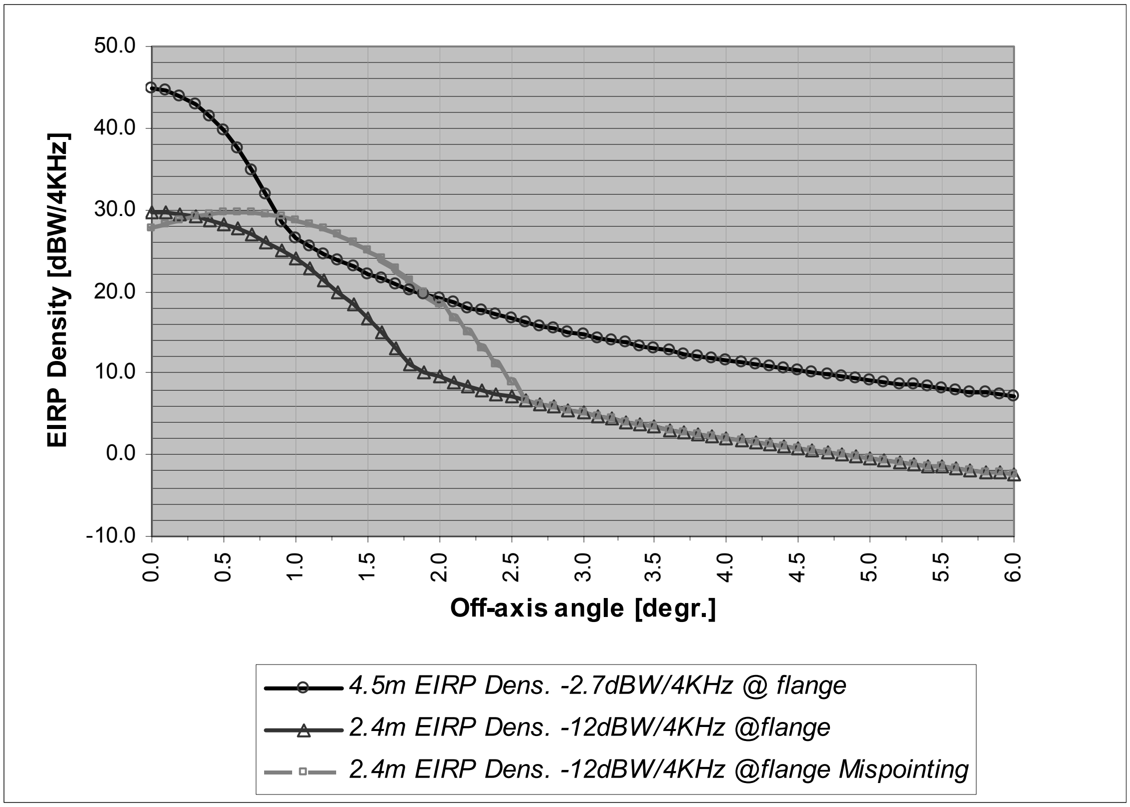
To support the power density proposal for small aperture C-band antennas, SIA would like to draw attention to two recent actions taken by the Commission in Public Notice Report No. SES-00466, dated 22 January 2003. In the PN, the Commission authorized the following:

Antenna diameter (m)	Transmitter power (dBW)	Emission designator	Power density into antenna flange (dBW/4kHz)
2.4	38.2	26K9G7D	-12.1
2.4	48.7	302KG7D	-12.1

It can be seen from these specific examples and other similar authorizations that the operational power density into the C-band antenna flange is lower than the maximum allowable level of –2.7 dBW/4kHz, and that SIA's power density proposal is comparable to these levels.

To further support SIA's proposal, the following graph shows a scenario for a 4.5 meter antenna and a 2.4 meter antenna. The abscissa shows the off-axis angle, in degrees, from the intended satellite and the ordinate shows the on-axis and off-axis EIRP density, in dBW/4kHz. The result highlights an important observation, that is, for a misaligned 2.4 m antenna having a power density of –12 dBW/4kHz into the antenna flange, the 2.4 m antenna would have a similar interference potential as a 4.5 m antenna having a power density of –2.7 dBW/4kHz. This analysis leads to the conclusion that, if the power density is higher than –12 dBW/4kHz, the

2.4 m antenna with pointing error greater than 0.6 degrees would cause more interference than a 4.5 m antenna having a –2.7 dBW/4kHz into the antenna flange.



Hence, SIA proposes to modify §25.212(d)(2) to read as follows:

> In the 6 GHz band, for an earth station with an antenna dimension of 2.4 meters or greater but less than 4.5 meters in the geostationary plane, the antenna may be routinely licensed for transmission of analog SCPC carriers with bandwidth up to 200 kHz or digital carriers, if the maximum power density into the antenna flange does not exceed –12 dB(W/4kHz) for analog carriers, and –12-10log(N) dB(W/4kHz) for digital carriers, where N is defined in (d)(1). To prevent unacceptable interference into adjacent satellites, the applicant for the 2.4 m antenna shall certify that the antenna would be installed such that it would not misaligned by more than 0.5 degrees from the intended satellite.

SIA is concerned that, unless this proposal is adopted, the potential uplink adjacent satellite interference into the existing C-band services would be excessive and would cause harmful interference into the existing services.

Paragraph 26

SIA supports routine processing of 2.4-meter antennas in the conventional C-band. Its support is conditioned upon this antenna not causing excess interference into existing C-band services. Secondly, the protection of this antenna in the receive band must follow §25.209(c). Any use of antenna size smaller than 2.4-meter shall be considered to be non-routine and requires coordination with the adjacent satellite operators.

This proposal is supported by the fact that this C-band antenna has an antenna gain envelope starting at about 1.6 to 1.7-degrees and with an input power of –12 dBW/4kHz would not cause more interference than a 4.5m antenna with an input power of –2.7 dBW/4kHz. Based on the experience that the Commission has on the implementation of the sub-meter Ku-band antennas, the use of the 2.4-meter antennas in the conventional C-band should not create any additional adjacent satellite interference if the antenna is aligned properly towards the desired satellite.

For C-band antennas having an antenna gain envelope starting at greater than 1.6 to 1.7-degrees (i.e., equivalent antenna diameter less than 2.4 meters), antenna alignment becomes an important factor in the control of uplink interference into adjacent satellites. The Commission has also raised the Ku-band sub-meter antenna alignment issue in this proceeding, which is addressed later in these Comments. At this time, SIA believes that it is prudent for the Commission to take a small step in reducing the C-band antenna size in routine licensing, since the starting angle of the antenna gain envelope for typical 2.4-meter C-band antennas is within 1.5-1.7 degrees.

With respect to potential interference to the terrestrial services, the increase in the antenna mainlobe beamwidth should not impact terrestrial coordination since the enlarged antenna mainlobe does not encompass the terrestrial stations. Coupling between the C-band earth station and the terrestrial services is the antenna sidelobe pattern and not the antenna mainlobe pattern. Since the antenna sidelobe remains the same, the adoption of the 2.4-meter antenna should not impact on the terrestrial coordination. More importantly, the power density into the antenna flange has been reduced to –12 dBW/4kHz from –2.7 dBW/4kHz. This reduction would further improve sharing with the terrestrial services.

2. Earth Station Antenna Gain Pattern Envelope within the GSO Orbital Plane (paragraphs 30 and 36)

Paragraph 30

SIA agrees with the Commission's observation that if it did not have to consider earth station antenna pointing error, it could revise the antenna gain pattern envelope to begin at as much as 1.8^o off-axis angle in the GSO orbital plane.[10] SIA recognizes, however, that some small amount of antenna mispointing during antenna installation is possible. Experience

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[10] C.F.R. 47 Part 25.209(g) stipulates that the 1.2-meter antenna gain pattern envelope starts at 1.25^o.

indicates that pointing accuracy on the order of 0.5 degrees is routinely being achieved in practice. As such, and as is discussed more fully in the following paragraphs, SIA's proposals for extending the starting angle of the antenna gain envelope are based on the fact that 0.5 degrees of pointing accuracy is readily achieved in practice today.

Paragraph 36

The earth station topocentric angle for two adjacent satellites is directly related to the GSO satellite station-keeping tolerance. As such, should a space station not meet the FCC station-keeping requirements, it is theoretically possible that this operation could adversely impact antennas operating in compliance with the Commission's proposals for a revised antenna gain envelope. However, SIA continues to maintain that the possibility of satellites being operated with a station-keeping tolerance not meeting the Commission's requirements is too remote to warrant further consideration as a factor in deciding upon revision of the antenna gain envelope.

With respect to interleaving satellites serving South America into the US domestic satellite environment, the interleaved satellite has minimal impact on the operation of the US domestic satellites since the interleaved satellite is not providing co-coverage operation. Hence, spacecraft antenna spatial isolation provides sufficient isolation for both satellites to operate without unacceptable interference.

3. Adjusting Starting Point of Antenna Gain Envelope to Reflect Potential Pointing Error (paragraph 41)

The Commission raises the question of risk of harmful interference resulting from potential pointing error if the antenna gain pattern envelope were to start at 1.8 degrees. SIA observes that a misalignment of an antenna that meets the antenna gain pattern starting at 1.8 degrees may result in harmful interference. However, the SIA has determined that an antenna that meets the gain pattern envelope at off-axis angles of 1.5 degrees or less does not cause harmful interference and should not be subject to additional regulation regarding pointing error. Thus, SIA recommends that the Commission relax the antenna pattern requirements applicable to sub 1.2 m antennas that transmit in the 14.0-14.5 GHz band, so that the pattern starts at 1.5 degrees, instead of 1.25 degrees as currently provided in 25.209(g). These values represent the industry's consensus of transmit performance standards that are routinely met by many sub 1.2 meter antennas such as 0.74m elliptical antennas(dimensions of 98cm by 56cm having an equivalent diameter of 74cm) that are commonly and successfully used today without causing harmful interference. Thus, such antennas should be eligible for routine processing without any specific demonstration that unacceptable interference will not be caused under conditions of uniform 2 degree spacing.

As the Commission is aware, because the receive frequencies of a Ku band antenna are more than 2 GHz lower in the spectrum range than the transmit frequencies, the receive pattern of a Ku band antenna does not fit within the envelope of the transmit pattern of that same antenna. In other words, even if the transmit pattern of an antenna meets the requirements of 25.209(a), it is very possible that the receive pattern does not meet those same requirements.

By its terms, the 25.209(a) and (b) pattern requirements apply only to the transmit pattern of an antenna. Whether the receive pattern of an antenna meets the requirements of 25.209(a) or (b) does not in any way increase the potential for interference into other satellite systems. Thus, SIA urges the Commission to clarify that, for purposes of determining whether an antenna is eligible for routine processing, the receive pattern of that antenna is irrelevant. In other words, eligibility for routine processing should be based solely on whether the transmit pattern meets 25.209(a) and (b).

If the Commission does not base eligibility for routine processing solely on the transmit pattern of a sub 1.2 meter antenna, there will be little (if any) benefit to relaxing the 25.209(a) transmit pattern as described above. The receive pattern of today's 0.74 meter equivalent antennas, for example, typically meets the 29-25 log theta parameter starting at approximately 1.7 degrees. Requiring that the receive pattern of an antenna also meet the 25.209(a) pattern (i.e., starting at 1.5 degrees) would disqualify 0.74 m equivalent antennas from routine processing and obviate the need to modify 25.209(a) in the first place. The main purpose of adding a sub-section to 25.209(a) is to facilitate routine processing of sub-1.2 meter antennas, based on their transmit pattern characteristics.

In the case of antennas not meeting the transmit antenna gain envelope until beyond 1.5 degrees, antenna pointing accuracy becomes a factor in controlling interference to adjacent satellites. Antenna pointing error is the result of the initial physical installation of the antenna. The antenna pointing error depends on the installation procedure, which is highly proprietary to the earth station licensee. Therefore the process of seeking a methodology for estimating pointing error may not be the correct approach since the level of detail in the installation process is a business decision and therefore very difficult to regulate. Instead, it seems to SIA that the Commission should seek to ensure that small antennas, not meeting the transmit antenna gain envelope until beyond 1.5 degrees, are properly installed, and that small antennas that become misaligned over time can be readily identified. SIA addresses these issues later in this document.

As regards pointing error, the maximum permissible antenna pointing error is relatively easy to derive from the existing FCC rules. The first step is to determine the off-axis angle (or the starting point of the antenna gain envelope) at which the antenna mainlobe edge intersects the 29-25Log(theta) pattern for zero degree pointing error. The Commission already made that determination for the 1.2-meter antenna in 1993. In FCC 93-38, the Commission increased the off-axis angle at which the antenna begins the gain envelope for conventional Ku-band earth station antennas, from 1 degree to 1.25 degrees. In order words, § 25.209(g) stipulates that the 1.2-meter antenna mainlobe intersects the 29-25Log(theta) pattern at 1.25 degrees. For antennas less than 1.2 meters, SIA is now recommending that this off-axis angle be set at 1.5 degrees.

The second step is to determine the maximum permissible pointing error. The objective of the maximum permissible pointing error is to limit the uplink interference into the 2-degree adjacent satellite to the permissible level. The present FCC regulation limits the earth station antenna maximum off-axis EIRP density to 6.94 dBW/4kHz for digital carriers towards the 2-degree adjacent satellite. This is based on the –14 dBW/4kHz transmitter power density into the antenna flange as contained in § 25.212(c) and the 20.94 dBi antenna sidelobe gain towards the

2-degree adjacent satellite as contained in § 25.209(a)(1).[11] Based on the maximum allowable antenna gain of 20.94 dBi towards the 2-degree spaced satellite, the process of obtaining the maximum permissible pointing error is to shift the earth station antenna mainlobe from zero degree pointing error until the edge of the mainlobe gain is equal to 20.94 dBi at an off-axis angle equal to 2.1 degrees. The shifted angle is the maximum permissible pointing error. Graphically, at this misalignment angle, the edge of the antenna mainlobe pattern intersects the 29-25Log(theta) pattern at an off-axis angle equal to 2.1 degrees.

Using this method, the maximum permissible pointing error for the 1.2-meter antenna is about 0.73 degrees. Using the method on four sub-meter antennas, the maximum permissible pointing errors are shown in the following table for a 2-degree orbital spacing environment.

Antenna type	Starting point of antenna gain envelope[1] (degrees)	Maximum permissible pointing error (degrees)
Prodelin 98x56-cm	1.38	0.56
Prodelin circular 98-cm	1.57	0.43
Channel Master circular 96-cm	1.72	0.32
Channel Master 89x62-cm	1.73	0.30

Note: 1. At this off-axis angle, the edge of the antenna mainlobe intersects the 29-25Log(theta) pattern. Furthermore, due to the non-symmetrical nature of some of the actual measured patterns available to SIA, this is an average of the two intersecting points, one at the negative off-axis angle and the other at the positive off-axis angle.

To the best of SIA's knowledge, these four sub-meter antennas have been used extensively by the industry to provide VSAT/IP services in the Ku-band. Based on the number of known adjacent satellite interference cases from these sub-meter antennas, these antennas seem to be, to the best to SIA's knowledge, generally installed within the limits identified in the above table. For those known interfering cases, it is believed that the satellite operators have been cooperating to resolve the interference situations due to antenna misalignments. Based on this operational experience, and to eliminate any potential interference cases due to antenna misalignment in the future, SIA proposes that the Commission adopt the maximum permissible pointing error concept to manage the implementation of sub-meter antennas not meeting the antenna gain envelope until beyond 1.5 degrees in the Ku-band.

The following graph is based on the 4 points identified in the above table and the 1.2-meter and 1.8^{o} antenna. These points are shown as circles in the figure. The graph also shows a curve connecting all the points to express the antenna pointing error (pe):

$$pe = -1.8 x^2 + 5.62 x - 4.317 + 0.208/(x-1)$$

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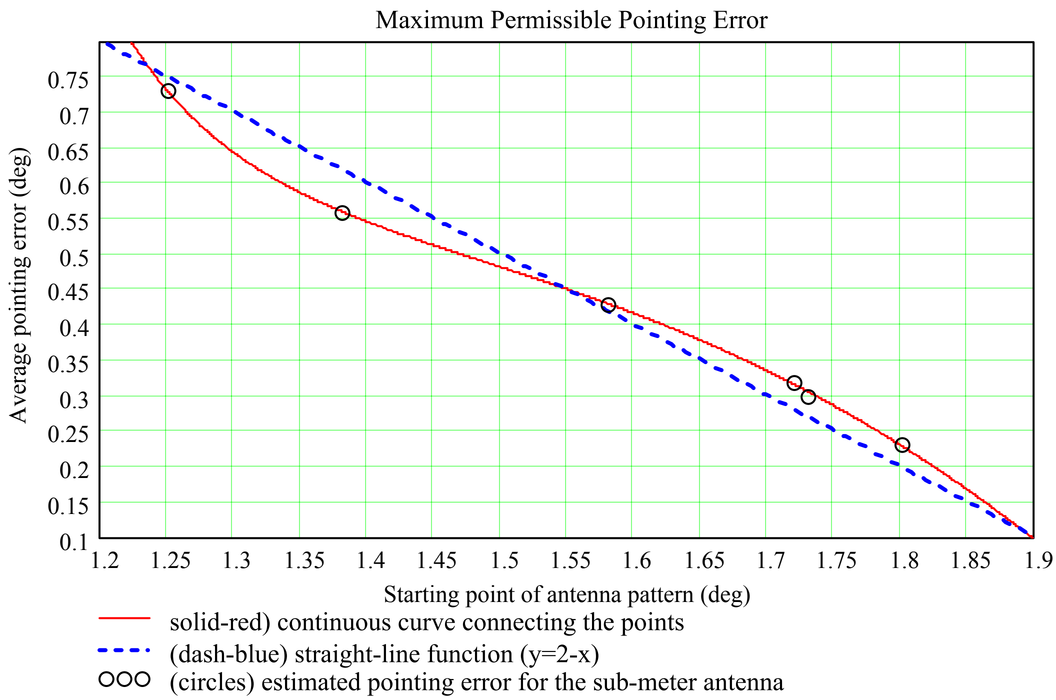
[11] In the US domestic satellite environment of 2-degree spaced satellites, the typical earth station antenna topocentric angle is about 2.1 degrees, taking into account of the geostationary-satellite longitudinal station-keeping tolerance of 0.05 degrees for both satellites. Substituting this angle into the antenna envelope pattern of 29-25Log(theta), the result is 20. 94 dBi.

where x is the sub-meter antenna starting point of the antenna gain envelope. It seems to SIA that the second curve (i.e., the straight-line function)

$$pe = 2 - x \qquad 1.5 < x \leq 1.8$$

is a simpler function and can be used to regulate the sub-meter antenna pointing error. Secondly, the minor discrepancy between these two curves is minimal and is acceptable to the industry.



This graph is for a 2-degree orbital spacing environment. SIA or the satellite operators can develop similar graphs for other orbital spacing environments, for example 2.5° and 3.0° if there is a need identified by the FCC. SIA also proposes to limit the equation to a range where x is greater than 1.5 and less than or equal to 1.8. This is consistent with SIA's Part 25 Streamlining Proceeding proposal submitted to the FCC on 10 December 2001. Specifically, SIA proposes to revise Part 25 by adding a subsection (d)(2) to §25.220 to read as follows:

> *For an antenna operating in the 14 GHz band, with dimension in the GSO plane less than 1.2 meters, if the transmit portion of the antenna proposed for use by the earth station applicant does not comply with the antenna performance standards contained in paragraph (a) or (b) of Section 25.209 because the actual gain envelope intersects the gain envelope in paragraph (a)(3) of 25.209 above 1.5 degrees and up to and including 1.8 degrees, the applicant shall submit during the earth station license*

application phase either (i) a technical showing demonstrating how the required maximum pointing accuracy will be met during antenna installation or (ii) a coordination agreement between the operator of the satellite with which the earth station will communicate, and the satellite operators within two degrees of the satellite with which the earth station will communicate. The required maximum antenna pointing error (pe) towards the desired satellite shall not exceed:

$$pe = 2 - x \text{ , degrees} \qquad 1.5 < x \leq 1.8$$

where x is the starting point of antenna gain envelope of the antenna.

Using the above equation, the following table identifies the maximum permissible pointing error for four antenna sizes, in terms of the starting point of the antenna gain envelope.

Antenna type	Starting point of antenna gain envelope[1] (degrees)	Maximum permissible pointing error (degrees)
Prodelin 98x56-cm	1.38	0.62
Prodelin circular 98-cm	1.57	0.43
Channel Master circular 96-cm	1.72	0.28
Channel Master 89x62-cm	1.73	0.27

Based on the entries of this table, the concept of "1.8-x,"where x represents antenna pointing error, as suggested by the Commission could lead to a smaller starting angle than realizable by actual sub-meter antennas. For this reason, SIA put forth the above maximum allowable pointing error proposal to reflect the actual sub-meter antenna performance for an antenna that meets the §25.209(a) gain envelope at an off-axis angle starting at greater than 1.5 degrees up to and including 1.8 degrees.

It is evident that the maximum allowable antenna pointing error in these cases is relatively small. Therefore, it is important for the applicant to provide a technical showing that the installed antenna would meet the maximum permissible pointing error requirement. This technical showing requirement is distinguishable from the certification procedure SIA is proposing for smaller C-band antennas.[12] Requiring a technical showing (or in the alternative a coordination agreement as described below) is appropriate for antennas in the Ku-band that do not meet the transmit antenna gain envelope until beyond 1.5 degrees and up to and including 1.8 degrees due to the variable pointing accuracy requirement for these Ku-band antennas. In the case of smaller C-band antennas, on the other hand, SIA is proposing a fixed, rather than a variable, pointing accuracy requirement.[13]

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12 *See* Section A.1, above.

13 *See id.*

One possible technical showing for Ku-band antennas for which x is greater than 1.5 and less than or equal to 1.8 is to take advantage of the earth station antenna cross-polarization null at the antenna boresight direction. In the process, the applicant must identify the antenna cross-polarization level for the given maximum allowable pointing error. The applicant must demonstrate that the antenna would achieve the required cross-polarization isolation during the installation process. It is important to note that this cross-polarization method must use the transmit antenna performance since many known sub-meter antennas do not have a cross-polarization null in the receive frequency band.

As an alternative to providing a technical showing demonstrating how this pointing accuracy will be met during installation, the applicant can submit a coordination agreement for the use of the sub-meter antenna between the space segment capacity provider and the satellites within two degrees. There is a critical distinction between these two methods. The technical showing for achieving pointing accuracy is valid for all orbital locations. Applicants relying on this method, therefore, should be eligible for "ALSAT" status. Coordination, on the other hand, is specific to a particular orbital location and the satellites that are adjacent to it. Applicants relying on coordination in lieu of a technical showing, therefore, should be authorized only for the orbital locations that they have coordinated.

4. Improving Antenna Pointing Accuracy / Improving the Interference Environment (paragraphs 46-52)

The Commission's concern about pointing accuracy stems from the fundamental concern that certain types of earth stations could cause more interference to adjacent satellite systems than has previously been experienced. SIA does not support adoption of the specific proposals made by the Commission. However, SIA does propose procedures that would enhance the resolution of interference events when they do occur. SIA provides its comments on the FCC's specific proposals, and then provides the alternative rule change language that it believes would be a more effective approach to resolving concerns about potential interference.

a. Pilot Tone (paragraphs 46-48)

The FNPRM raises the issue of inhibiting the transmit capability of terminals until it can be verified that the earth station antenna has been pointed correctly. It then suggests that this issue could be addressed by adopting a "pilot tone" requirement. Under this suggestion a separate pilot tone would be transmitted from the satellite to the earth station, and would preclude the earth station from transmitting if the received signal level were to drop below some threshold downlink power level due to pointing error.

This suggestion appears not to fully reflect what is routinely done in practice today. In a typical VSAT network, there is a broadcast (sometimes called outroute) transmission from the hub earth station that is received continuously by all terminals in the network in order to synchronize these terminals with the network timing and bring them under positive control of the hub earth station. Through the VSAT terminal design, this outroute transmission must be successfully received by a terminal before it can transmit. Under the current deployment of

VSAT networks, the remote terminals cease transmission when they no longer receive the outroute signal. As such, this outroute transmission is already serving the purpose of the so-called "pilot tone", and the Commission's proposal of imposing a separate pilot tone reception requirement does not add anything beyond what is already being routinely done today.

Further, imposing a requirement for an independent pilot tone in each network would unnecessarily increase the complexity and cost of VSAT network implementation as it would result in substantially increased VSAT terminal costs. In addition, such a requirement would result in a consequential requirement to redesign existing VSAT terminals and to retrofit the hundreds of thousands of terminals that are already fielded. This would clearly impose significant, if not staggering, cost burdens on existing VSAT network operators.

In addition to the above, setting aside spectrum in the operation of every VSAT network for the transmission of unique pilot tones that carry no information, would add to the operational cost of VSAT networks and reduce the overall spectrum efficiency of these networks.

The FNRPM proposes a second pilot tone method for alignment of the earth station antennas. In this method, a cross-polarized pilot tone relative to the communication signal is measured and minimized. Again, this method of alignment of VSAT antennas is effectively already being implemented by the VSAT network operators. During the antenna installation process, the VSAT antenna cross-polarization gain is measured and minimized to align the null with the desired satellite and polarization at the hub earth station using a large antenna to provide large signal to noise ratio. This method of installing VSAT antennas effectively minimizes the potential for adjacent satellite interference by providing excellent pointing accuracy.

For all of the above reasons, it is concluded that any Commission-imposed requirement to implement separate pilot tones would be redundant and thus unnecessary, prohibitively complex and costly on small-terminal network operators, and spectrally inefficient. Thus, SIA strongly opposes the adoption of any Commission-imposed requirement to implement separate pilot tones. Given that the intent of the Commission's proposal is already being implemented through normal small-terminal network operation in at least one way, should the Commission still feel it necessary to regulate this area of VSAT operations, it should consider developing a requirement that is consistent with what is being routinely done in practice today.

b. Professional Installation (paragraph 49)

As the Commission itself notes, it has already adopted rules to encourage professional installation of two-way consumer terminals in several cases[14]. In fact, where the Commission believes that it is warranted for any of its public interest determinations, it includes such a requirement as a condition of license for certain types of earth stations. This has proved effective over the last two years that these terminals have been licensed and deployed throughout the United States. Going forward, there could even be technological advances that could convince the Commission that such a requirement was not required with certain types of equipment. Thus, with the discretion that a condition of license offers–rather than a regulation–,

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14 FNPRM, Footnote 97.

the Commission could decide not to impose such a condition on a particular licensee and earth station type.

Today, the "professional installation" condition is implemented by individual licensees through their internal operational and commercial procedures which are designed to respond to its license obligations, to comply with its contractual obligations to space segment vendors through which it has obtained capacity, and to ensure the highest quality of service to its customers. Some, if not all, licensees already have training programs that are required for all authorized installers. In the end, antennas that are pointed and mounted properly will provide the best quality of service possible for the service subscribed. The measurement equipment and techniques for performing the installation of different companies' equipment will naturally differ (while still accomplishing the required regulatory goals) and cannot be effectively or responsively regulated by the federal government, or any standards group.

In sum, SIA strongly recommends that the Commission not adopt a professional installation requirement for Ku-band antennas less than 1.2 meters in diameter.

In the case of C-band antennas less than 4.5 or 3.7 meters in diameter SIA believes there is even less need for any special rules to encourage professional installation, since the antenna structure is sufficiently large and complex to require appropriate care and attention in installation. In addition, C-band antenna installations are generally for business or network connections which will be optimized to provide the maximum performance and accordingly ensure the pointing accuracy of the earth station. Therefore, SIA similarly proposes that no special regulations are required for professional installation of C-band antennas less than 4.5 or 3.7 meters.

c. Location Identifier System (paragraphs 50-52)

The FNPRM invites 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. The Commission points out that, since 1991, it has required satellite uplink transmissions carrying broadband video information to use an ATIS-like system. It is further noted that this requirement was an outgrowth of an increasing number of harmful interference events, including cases of "intentional" interference. It is important to note that the new proposal for an ATIS-like system was intended to address the issue of tracing cases of unacceptable interference to individual earth stations. There are a number of reasons why this proposal should not be adopted.

First, unlike the case for broadband video transmissions in the early 1990's, there certainly have been no reported cases of "intentional" interference associated with smaller Ku-Band and C-Band antennas.

Second, it is not clear that the ATIS system being implemented on broadband video carriers has actually been effective in determining the source of any interference. There must be a proven quantifiable benefit associated with such a system before the Commission considers imposing it on other terminal types.

Third, in the case of broadband video carriers, there were limited numbers of such transmitters in operation in the 1990's and there remain a limited number of such transmitters in operation today. While the imposition of an ATIS requirement on such a limited number of transmitters clearly had a financial impact on the operators of such transmitters, this financial impact was manageable. In the case of the Ku-Band and C-Band terminals being addressed in this FNPRM, the numbers of transmitters is in the hundreds of thousands. Imposing an ATIS-like requirement on these terminals would result not only in a requirement to re-design the transmitters and suffer the costs associated with this redesign, but would also clearly carry with it recurring cost implications as the price of each terminal would certainly have to absorb the cost of this system.

Fourth, if such a system were imposed upon Ku-Band and C-Band terminals, there would have to be extensive cooperation among equipment manufacturers to standardize such things as modulation, coding, transmission framing, digital word length, etc., in addition to the transmission frequency and power levels suggested by the Commission. In the alternative, there would be a necessity for every satellite operator to maintain a separate bank of receivers capable of receiving the transmission formats from all equipment manufacturers in order to have the capability to decipher the identifying information from transmissions from any manufacturer's equipment. Even if either of the two possibilities above could be accomplished, it is doubtful that successful reception (and deciphering of the identifying information) of the interfering signal could occur at the signal levels at which the interfering signal would be present in the victim system, or in the presence of the desired signal.

In light of all of the above considerations, SIA concludes that there is no demonstrated need for imposing an ATIS-like requirement on 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, and that even if there were a demonstrated need, the cost of such a system would be prohibitive to operators of such terminals and the effectiveness of such a system would be highly questionable. Thus, SIA strongly opposes adoption of an ATIS-like requirement for conventional Ku-band antennas less than 1.2 meters in diameter and for conventional C-band antennas less than 4.5 or 3.7 meters in diameter.

5. SIA's Alternative Proposed Rules to Address Antenna Mispointing

All of the above notwithstanding, SIA recognizes that the Commission's concern about pointing accuracy stems from the fundamental concern that certain types of earth stations could cause more interference to adjacent satellite systems. In lieu of the FCC's proposals, SIA proposes further procedures that, once adopted, would expedite the resolution of interference events, whatever their cause, when they do occur. SIA provides the following alternative rule language that it believes would be a more effective approach to resolving concerns about potential interference for small antennas than the proposals made in the FNPRM regarding antenna pointing accuracy.

25.271 Control of transmitting stations.

(f) VSAT licensees in the conventional Ku-Band shall have and maintain the capability to specifically identify the originating terminal for digital transmissions from sub-meter antennas within their network through reception of those transmissions, or through other network control mechanisms.

25.274 Procedures to be followed in the case of harmful interference.

(h) For sub-meter antennas operating in the conventional Ku-band, upon receipt of a complaint of harmful interference from an adjacent satellite operator, to include information on the:

- *time of day and duration of interference event(s)*
- *frequency of occurrence of interference event(s)*
- *center frequency and polarization of interfering signal(s)*
- *information, if any, within the possession of the satellite operator on the geographical location of interfering terminal(s)*
- *if possible, spectral signature (bandwidth, power, other identifying features) of interfering signal(s)*

the licensee of the potentially interfering transmitting terminal, in cooperation with the interfered-with satellite network operator, shall work expeditiously to identify the specific sub-meter transmitting antenna causing the harmful interference.

(i) Upon identification of the specific sub-meter transmitting antenna causing the harmful interference, the licensee of such terminal shall promptly take action to eliminate such harmful interference.

6. Antenna Gain Pattern Envelope outside the GSO Orbital Plane

SIA supports the conclusion of the Commission in adopting the starting off-axis angle at 3 degrees for the conventional Ku-band antenna gain envelope outside the GSO orbital plane in order to facilitate the routine processing of the elliptical or other asymmetrical antennas as currently being deployed.

7. Backlobe Antenna Gain Patterns

SIA agrees with the Commission proposal to increase the back lobe antenna gain limit from – 10 dBi to 0 dBi for the conventional Ku-band both within and outside the GSO orbital plane in order to improve the processing of conventional Ku-band earth station applications on a routine basis. SIA continues to recommend its original proposal of increasing the gain limit between 85 and 180 degrees off-axis angles. SIA also accepts the suggestion of the Commission that the 0 dBi limit should not be an absolute limit and should be allowed to be exceeded by 3 or 6 dB as is currently provided in Sections 25.209(a)(1) and 25.209(a)(2).

SIA has created a new Section 25.209(a)(3) for conventional Ku-band antennas to cover the above recommendation in the rules as detailed in these comments. SIA has also deleted the Section 25.209(g) as it is subsumed in this new section.

B. Random Access Techniques

1. Contention Protocols (paragraphs 81-95)

SIA repeats its strong recommendation that the FCC *not* adopt regulations regarding contention protocols for FDMA, TDMA or CDMA. SIA continues to believe, as detailed in the SIA Reply Comments[15], SIA Supplemental Comments [16], and the Joint Ex Parte Response to Aloha Networks[17] that it is unnecessary to impose power reduction for Aloha access techniques. Virtually all of the hundreds of thousands of VSAT terminals currently in use employ Aloha access at least part of the time, and extensive experience with these networks has demonstrated that this access technique is not a cause of significant or even detectable interference with adjacent systems. Almost two years have elapsed since the SIA Reply Comments were filed, and in that time the number of submeter antennas in use has grown substantially, as has the traffic carried by these networks. U.S. networks using submeter antennas are in operation on at least four Ku-band satellites, occupying more than one full satellite's worth of capacity in total. All of these networks use Aloha access. This accumulated experience continues to show that Aloha access is not a source of interference.

In the alternative, SIA observes the Commission's concern as stated in the FNPRM that additional regulation may be needed to control possible, yet still very hypothetically-harmful, interference from Aloha and other random access techniques. Should the Commission proceed to impose regulation, SIA proposes the following modification below that would replace parts (i), (ii) and (iii) of the rules proposed in paragraph 90 of the FNPRM:

~~(i) Each earth station individually satisfies the power density limits of Section 25.134(a)~~

~~(ii)~~ The maximum transmitter power spectral density of a digital modulated carrier into any GSO FSS earth station shall not exceed $-14 - 10 \log(N)$ dB(W/4kHz), where N is ~~the smallest number of co-frequency simultaneously transmitting earth stations in the same receiving beam such that the probability of an event with greater than N simultaneous transmitters is less than 0.001; and an integer.~~ an integer. The number N is defined such that, during any 100 milliseconds interval, the probability that Q>N*100 milliseconds is less than 0.01, where Q = the accumulated transmission time of all co-frequency

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15 Reply Comments of the Satellite Industry Association, IB Docket 00-248, filed May 7, 2001, at 12 ("SIA Reply Comments").

16 Supplemental Comments to the Proposed Revisions of the Satellite Industry Association, Part 25 Streamlining Proceeding IB Docket No. 00-248, filed December 11, 2001 ("SIA Supplemental Comments")

17 Joint Ex Parte Response to Aloha Networks of Hughes Network Systems Inc., Loral Space & Communications Ltd., Panamsat Corp., SES Americom, Spacenet Inc, and Starband Communications Inc, IB Docket No. 00-248, filed July 16, 2002 ("Joint Ex Parte Response to Aloha Networks").

simultaneously transmitting earth stations in the same satellite receiving beam. The maximum duration of any single collision is less than 100 milliseconds.

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

SIA again strongly recommends that the Commission not adopt regulations governing contention protocols. If the Commission were to adopt this revised rule, however, it would fit into the revisions proposed by SIA for 25.134 for Ku-band VSAT networks under 25.134(a)(1)(iii).

The genesis of this SIA proposal is the fact that the FCC's proposal in the FNPRM effectively limits the probability of collision, in a VSAT network with 100 millisecond transmissions, to 1 %. The offered load in such a network would have to be controlled so as to ensure that the probability of collision between any two transmissions is less than 1 %.

In making the proposal above, SIA recognizes that different VSAT networks are designed with different fundamental transmission durations. A VSAT network with shorter duration transmissions will in turn create shorter duration collisions, and these shorter duration collisions certainly will not have the same detrimental effect as a pair of 100 millisecond bursts colliding. As such, the offered load in a network with shorter duration transmissions would not have to be as restricted as it is in networks with longer duration transmissions, as it would take multiple shorter duration collisions, accumulated during any given time period, to create the same effect as a single longer duration collision. This is precisely what the SIA proposal above is addressing.

The proposed rule is intended to combine the limit contained in the original parts (i) and (ii) of paragraph 90 of the FNPRM with the implied averaging over 100 milliseconds contained in the original part (iii). The effect of the rule remains the same, namely to limit the probability that the composite interference power in 100 milliseconds exceeds -14dBW/4kHz to less than 1%; however, the proposed rule allows additional flexibility for systems with bursts of duration less than 100 milliseconds. This flexibility arises from the following statistical fact.

Consider two networks using the Aloha contention protocol, Network A with a burst length of 100 milliseconds, and Network B with a shorter burst length of (100/K) milliseconds. For these networks to operate without power reduction, Network A must maintain the probability of 2 simultaneous bursts below 1%, while Network B must maintain the probability of 2K bursts in 100 milliseconds below 1%. The probability of this latter event (2K bursts in 100 milliseconds) increases more slowly than the probability of 2 simultaneous bursts, as the Aloha slot loading is increased. This allows Network B to load its Aloha slots more while maintaining the total interference power in 100 milliseconds at or below the regulatory level and probability. This flexibility in the rule is necessary in order not to disadvantage VSAT networks using shorter transmission times, relative to networks using longer transmission times.

Furthermore, should the FCC pursue regulation of contention protocols, SIA recommends that the FCC accept certification from an earth station applicant that it satisfies the regulations, rather than supplying a technical showing with detailed probability calculations that places a significant burden on the Commission to analyze and on the applicant to prepare. Instead, a new question box could be created on the Form 312 to enable applicant certification in the simplest manner.

2. TDMA, FDMA and CDMA (paragraphs 96-100)

Current rules establish an input spectral density limit of -14.0 dBW/4KHz for all VSAT earth stations in the Ku-band. In the NPRM, the FCC proposed to modify the rules for TDMA, FDMA, and CDMA as well as Aloha access techniques by limiting the power spectral density into the VSAT earth stations to -14.0 – 10log(N) dBW/4KHz. For FDMA and TDMA, setting the value of N equal to one and in the CDMA case, setting the value of N equal to the likely maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

SIA agrees with the FCC proposal of exempting VSAT systems using FDMA and TDMA from any rule revisions. SIA reiterates its recommendation that the Commission not adopt rules governing contention protocols for CDMA/Aloha systems. But if any rules governing contention protocols are adopted, those rules should be applied to CDMA/Aloha systems only in the Ku-band.

In the FNRPM, the FCC proposes to modify the CDMA rule as proposed in the NPRM by replacing the term " likely maximum number " with simply " maximum number " based on the comments of Aloha Networks. SIA fully supports this modification for Ku-band CDMA systems and also supports its application to Ka-band CDMA VSAT systems as already adopted by the Commission in the 18 GHz Order (Section 25.138 of the rules).

3. Extension of Rules to Other Frequency Bands (paragraphs 101-105)

SIA agrees that the Commission need not adopt any further rules governing contention protocols such as Aloha to C-band and Ka-band VSAT systems. Certainly with regard to Ka-band systems, given that the first satellites are expected to be launched only this year, it is premature to layer any further regulations on the operation of these networks until some actual experience has been obtained.

SIA supports the FCC's proposal to adopt the same rules for the VSAT systems in the conventional C-band using CDMA as modified for the Ku-band VSAT systems using CDMA.

4. Single Channel per Carrier (paragraph 106)

SIA supports the Commission's proposal to revise Section 25.212 to apply the same rules to SCPC transmission as proposed for the VSAT networks.

5. Grandfathering of Requirements (paragraphs 107-108)

SIA strongly supports the grandfathering of existing VSAT systems and equipment should the Commission adopt any rules to govern multiple access techniques using contention protocols, and opposes the adoption of the rules proposed by the Commission in this section of the FNPRM on existing VSAT systems. Even Aloha Networks supports the grandfathering of existing networks.[18] The proposed provisions would be extremely burdensome on even a going-forward basis. The proposals would be disastrous if applied on a retroactive basis.

Consequent with its objection to regulations on multiple access techniques using contention protocols, should the FCC proceed to regulate these, SIA strongly disagrees with the Commission's proposals not to grandfather – other than during a transition period - existing VSAT operations or modifications to existing licenses. Several operators currently operate large VSAT networks and expect to add significant numbers of users to these networks in the future. It would not be commercially viable for any of them to operate their networks using different access schemes within the same network. The Commission's proposals, if adopted, would require existing operators to undertake the costly effort of retrofitting their entire existing customer networks (new software, new RF equipment, and possibly new antennas) to accommodate the new rules, unnecessarily in the view of SIA, and fail to provide any protection or consideration for existing VSAT networks or customers (enterprise or consumer).

In sum, the most streamlined approach that the Commission could take on the issues related to contention protocols is (1) not to adopt regulation of multiple access techniques for VSATs of any kind, until and unless there are substantiated complaints of unresolved interference from actual operators, (2) leave the application and license modification process in place as it stands, and (3) if it proceeds with the regulation that this industry opposes, the Commission should revise its approach in the manner suggested above and should grandfather existing licensed networks including future license modifications to those networks, and only apply its new rules, as modified by SIA, to fully new network license applications – based on their *application* dates not their licensing dates.

Additional regulation of the satellite industry in the ways discussed in this section is unnecessary, would be burdensome to deployment, would impose unnecessary costs on end-users, and would be inconsistent with Executive Branch and Commission policy to deploy broadband services expeditiously throughout the United States.

6. Other Issues related to Contention Protocols

As discussed in the above section B.1., if the Commission decides to adopt the rules for the contention protocols for the TDMA type systems in the Ku-band VSAT networks, then the same rules need to be extended to the CDMA/Aloha type VSAT networks in the Ku-band. In this case, N is defined as the multiplication of the CDMA value of N as defined in the Section 25.134 under 25.134(a)(1)(ii) and the Aloha multiple access technique value of N as defined in the SIA proposed rule language provided earlier in this document. In addition, consistent with SIA's previously stated position on contention protocols, SIA requests that the Commission not adopt the language associated with this issue in 25.138.

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[18] Aloha Networks Reply Comments at 5-6.

C. Other Proposals

1. VSAT Uplink Power Spectral Density Limits (paragraph 113)

In the Further Notice of Proposed Rulemaking, the Commission seeks comment on a proposal, made by the Satellite Industry Association, that would allow VSAT operators to increase their VSAT power spectral density limit, up to 2dB, for antennas smaller than 1.8 meters in diameter, if the operators employed antennas that achieved improved side lobe performance[19].

SIA, upon further consideration of the Commission's comments, regarding this proposal, that suggest that implementation of this proposal would complicate the licensing process and would require more extensive examination by the Commission resulting in a protracted licensing process, withdraws its modified power spectral density limit proposal. The SIA after further analysis may revisit this issue in a future proceeding.

2. VSAT Hub EIRP Limit (paragraph 119)

The FCC adopted a maximum hub EIRP limit of 78.3 dBW for VSAT hubs under clear sky conditions in the 1986 VSAT Declaratory Order. The FCC again clarified in the 1996 Streamlining Order that the maximum EIRP limit is applied as an aggregate limit rather than a per carrier limit.

In reality, this VSAT hub EIRP limit is applied on the basis that the hub is accessing only a single transponder under clear sky condition. However, in today's environment, VSAT operators could be accessing multiple transponders from a single antenna and therefore the *total* hub EIRP might not be limited to 78.3 dBW.

Therefore to remove the confusion in its interpretation, SIA recommends using the input power spectral density of –14.0 dBW/4KHz into the VSAT hub antenna flange as a per carrier limit instead of using VSAT hub EIRP as a limit. For example, a broadcast carrier of 512 Kbps using 1600 KHz bandwidth could be transmitted from a hub earth station with a 6.1 meter antenna and would meet the 78.3 dBW EIRP limit but have an input power spectral density of as high as – 4.8 dBW/4KHz . This would clearly be more harmful to adjacent satellites than SIA's current proposal to use a –14.0 dBW/4KHz limit.

For these reasons, SIA believes that implementing a limit on input power spectral density is a much more effective way of controlling and regulating potential adjacent satellite interference from VSAT hubs than utilizing a limit on VSAT hub EIRP. SIA proposes the appropriate rule changes in Section 25.134 as attached.

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19 FNPRM ¶ 113 - 116

3. Streamlined Procedure for Non-Routine Earth Stations (paragraphs 123-132)

The Commission is seeking comments on the previous SIA proposal for non-conforming earth station operations in the C-band and Ku-bands. SIA provides the following clarifications and further proposals.

In its *ex parte* submission, the SIA proposed certain modifications to the new §25.220 proposed by the Commission. SIA continues to believe that its proposal will achieve the Commission's streamlining objective and create a framework that will enable space station and VSAT network operators to provide consistent levels of service with minimal delay.

In the new section, SIA proposes to streamline earth station license procedures for C and Ku band networks where service rules are well established and its members draw, collectively, from years of experience. Because this section proposes procedures for non-routine licensing of earth stations, and because the specific parameters of the proposed non-routine network(s) in certain cases will have to be coordinated by the target satellite operator, SIA proposes that in these specific circumstances the coordination agreement(s) for the use of the proposed non-conforming antenna negotiated by the operator of the target satellite, for the subject network, shall be submitted as attachments to the earth station license application.

In the case of non-conforming transmit earth station antennas in the C-band and the Ku-band having sidelobe levels exceeding the 29-25log(theta) standard, it is theoretically possible to bring the off-axis EIRP spectral density toward the adjacent satellite into compliance with the standard by reducing transmit input power density. Absent coordination with adjacent satellite operators, however, SIA opposes licensing such antennas on the basis of a power density reduction. SIA is concerned that permitting applicants to use lower power density to compensate for the poor performance of their antennas would provide an incentive for manufacturers to produce underperforming antennas, and would create an environment in which underperforming antennas would proliferate.[20] Accordingly, applicants proposing to reduce transmit input power density to compensate for an underperforming C-band or Ku-band transmit antenna (*i.e.*, an antenna having sidelobes exceeding the 29-25 log(theta) standard) should not be licensed unless they have coordinated their proposed operations with the operators of adjacent satellites. These concerns do not apply, however, to Ka-band applications, which are governed by Section 25.138 of the rules.

All receive-only antennas will be routinely processed regardless of the gain pattern of the antenna and will be protected from interference in accordance with Section 25.209(c). All transmit/receive antennas will be routinely processed based on the transmit portion of the antenna only (as discussed below), and will be protected from interference in accordance with Section 25.209(c).

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[20] The typical non-conforming antenna patterns submitted with earth station applications, moreover, are representative patterns derived from measurements made at an antenna range. These patterns do not represent worst case antenna performance.

SIA supports codifying the streamlined procedure for non-routine earth stations as proposed under new Section 25.220 for both C-band and Ku-band earth stations. Also under this procedure, as is current practice for non-conforming antennas, an earth station applicant that does not make the technical showing described in SIA's proposed Section 25.220(d)(2)(i) will not be granted ALSAT status and the license will be for the specific satellite(s) for which the specific coordination agreement has been obtained from the adjacent satellite(s) operator(s) by the target satellite(s) operator(s).

SIA believes that these procedures should apply only to the transmit portion of the earth station. SIA urges the Commission to clarify that, for purposes of determining whether an antenna is eligible for routine processing, the receive pattern of a transmit-and-receive antenna is irrelevant, because the antenna gain envelope begins at a larger angle for the receive frequencies than the transmit frequencies. Note that the receive frequencies are lower than the transmit frequencies by a factor of approximately 1.2 in the Ku-band and 1.5 in the C-band. For this reason, eligibility for routine processing of transmit-and-receive antennas should be based solely on whether the transmit pattern meets 25.209(a) and (b).

SIA has created a new Section 25.209(a)(3) for the conventional Ku-band and a new Section 25.209(a)(4) for the conventional C-band in order to extend routine licensing to small antennas which comply with the antenna gain envelope requirements starting at 1.5 degrees and 1.7 degrees, respectively, for the off-axis angle in the GSO orbital plane. SIA further recommends routine processing for smaller antennas in the Ku-band meeting the gain envelope at a starting angle greater than 1.5 degrees, but no more than 1.8 degrees off-axis, as long as the antenna complies with the specific pointing error requirements SIA is proposing for Section 25.220 or the applicant submits a coordination agreement between the operator of the satellite with which the earth station is communicating and the operators of satellites within two degrees. For non-routine processing, SIA also approves of allowing higher input spectral power density to the antenna flange for the conforming antennas and the higher satellite downlink EIRP density in accordance with Sections 25.134 and 25.212. Both of these cases are covered in the proposed new Section 25.220. In both cases, the earth station licensee will provide a technical showing or a statement from the target satellite operator(s) that the coordination agreements have been obtained from the adjacent satellites operators for the use of these antennas and or the higher input power density to the antenna flange and the higher satellite downlink EIRP density.

4. Video, Wideband, and Narrowband Power Limits (paragraph 133)

In the FNRPM, the FCC raised further questions concerning the Sections 25.211 and 25.212 dealing with the power limits for some routine FSS earth stations operating in the conventional C-band and Ku-band. SIA recommends that the power limits of the Section 25.211 apply only to analog video transmissions, and the digital video transmissions be subject to the power limits of Section 25.212. Also SIA proposes to replace the term ”input power limit to the earth station” with the term ”input power spectral density to the antenna flange”.

Regarding the definitions for wideband and narrowband transmissions, SIA continues to maintain its position that there is no need for these definitions. But again, the SIA recommends that the Commission adopt the SIA's definition of full transponder as proposed in Section 25.201 in the Appendix to these Comments. At this opportunity, SIA would like to correct a typographical error in the last equation in the definition of "Equivalent diameter" by replacing $[(l \times w)/\pi]^{1/2}$ with $[(l \times w)4/\pi]^{1/2}$ as recommended in the NPRM.

5. Elliptical Antennas (paragraph 137)

In the FNPRM under paragraph 137, the Commission asks whether elliptical antennas should be reviewed strictly on the basis of the length of the major axis rather than the surface area. Currently under the routine processing of earth stations, the FCC uses the criteria of the minimum antenna diameter. In the case of Ku-band, this minimum antenna diameter is 1.2 meters. This has been an acceptable metric up until recent times, since most of the antennas have been circular. However, over the past few years, VSAT operators have developed and deployed elliptical antennas in order to reduce the cost of these antennas while still providing the required off-axis gain performance in the GSO plane to control the adjacent satellite interference. For sub-meter elliptical antennas, the shape of the main lobe in the GSO plane is based on the dimension of the major axis of the antenna. The bigger the dimension, the narrower is the main lobe. However, the intersection of the main lobe with the sidelobe reference gain curve of 29-25log(theta) depends upon the area (i.e. gain) of the antenna. The larger the surface area, the higher the gain of the antenna, and the wider the main lobe at the intersection point with the reference gain pattern. This wider main lobe intersection will result in the intersection point occurring at higher values of off-axis angle. Therefore, an elliptical antenna with a 1.2 meter major axis dimension will in fact have better off-axis main lobe performance (i.e. lower value of off-axis angle at the main lobe intersection point with the reference gain pattern) than a 1.2 meter circular diameter antenna, due to the reduction in on-axis main beam gain for the elliptical antenna.

In the case of elliptical antennas, the equivalent diameter will be less than the actual major axis dimension of the antenna. The equivalent diameter is defined as the diameter of a hypothetical circular aperture antenna with the same aperture area as the actual antenna. Another example is a rectangular antenna having dimensions of 1.35 meters in length and 0.58 meters in width and having an equivalent diameter of 1.0 meter. This antenna will have side lobe gain performance in the GSO plane that is better than a circular antenna with a diameter of 1.2 meters.

Based on the above discussion, SIA recommends that the Commission use the dimension of the antenna in the GSO plane as the criteria wherever the diameter of the antenna is mentioned in the FCC rules. Also, the Commission raised the question in paragraph 28 of the FNRPM of whether the FCC should use the antenna gain pattern rule instead of the minimum antenna size for determining eligibility for routine processing. As a consequence of the discussion above, SIA supports the use of the antenna gain pattern rule for determining this eligibility.

6. Maximum GSO FSS Satellite EIRP Spectral Density Limit (footnote 30)

In November and December 2001, SIA filed two ex parte statements recommending several revisions to Part 25 and to many of the proposals in the NPRM. There were two recommendations made by SIA under Section 25.134 concerning blanket licensing applications for the Ku-band VSAT networks. The first proposal was to increase the current maximum limit of GSO FSS satellite EIRP density to 9 dBW/4KHz from the current level of 6 dBW/4KHz. The second proposal was to allow the limit to increase up to 13 dBW/4KHz as long as the operator/licensee of the satellite(s) on which such VSAT applicant/licensee wishes to use such power level has successfully coordinated with adjacent satellite operators.

SIA understands based on the FNRPM as indicated in footnote 30, that the FCC has a sufficient record to adopt the first proposal of the SIA. But it is not clear from the FNRPM whether the FCC is adopting the second proposal or not. SIA recommends again to adopt this proposal as a modification to the rules of Section 25.134.

7. Miscellaneous (paragraphs 138-139)

In paragraph 138 of the FNPRM, the Commission proposes to require that, in the case of frequency bands shared between government and non-government operations, earth station applicants be required to provide half-power beam width information to facilitate coordination with NTIA. SIA supports this proposal with respect to the 13.75-14.0 GHz band.[21]

In paragraph 139 of the FNPRM, the Commission proposes correcting two cross-references appearing in Part 25 of the rules. SIA supports these changes as well.

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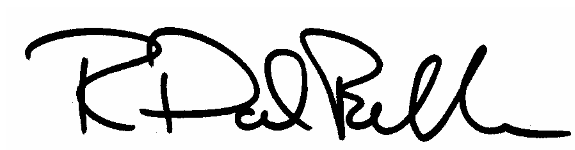
21 To the best of SIA's knowledge, the 13.75-14.0 GHz band is the only band as to which the Commission needs this information in order to coordinate with NTIA.

D. Conclusion

The views expressed in these Comments to the FNPRM represent consensus of the satellite industry regarding the technical modifications necessary to streamline the Part 25 rules for earth station licensing. The SIA respectfully requests that the Commission revise Part 25 of its rules as proposed in these Comments.

Respectfully submitted,

SATELLITE INDUSTRY ASSOCIATION



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March 10, 2003

Appendix A

Revised Proposals of the Satellite Industry Association
Part 25 Earth Station Streamlining Proceeding
IB Docket No. 00-248

-- Black-lined Version --

For the convenience of the reader, the text of the current Commission rule appears below in plain text.

Additional text proposed by the Commission in the NPRM appears in bold type. Text proposed by the Commission to be deleted in the NPRM appears with a single strikethrough.

Revised SIA additions appear in italics and revised SIA deletions appear with a double strikethrough.

This Appendix reflects, on a cumulative basis, changes to the rules that SIA already has proposed in response to the NPRM and is proposing now in response to the FNPRM. SIA has not made any changes to its proposals for Sections 25.132 and 25.211 of the rules. The proposed versions of these rules in the Appendix simply replicate what appeared in SIA's prior filings. SIA has, however, revised its prior proposals for Sections 25.134, 25.138, 25.201, 25.209, 25.212 , 25.220, 25.271, and 25.274 of the rules.

§25.132 Verification of earth station antenna performance standards.

(a) All applications for transmitting earth stations, *except for earth stations operating in the 20/30 GHz band,* ~~in the C and Ku-bands~~ must be accompanied by a certificate pursuant to §2.902 of this chapter from the manufacturer of each antenna that the results of a series of radiation pattern tests performed on representative equipment in representative configurations by the manufacturer which demonstrates that the equipment complies with the performance standards set forth in §25.209. The licensee must be prepared to demonstrate the measurements to the Commission on request~~ in the course of an investigation of a harmful interference incident~~.

(b)(1) In order to demonstrate compliance *of a C or Ku band antenna* with §25.209(a) and (b), the following measurements on a production antenna performed on calibrated antenna range, as a minimum, shall be made at the bottom, middle and top of each allocated frequency band and submitted to the Commission:

(i) Co-polariz*ation*~~ed~~ patterns for each of two orthogonal senses of polarizations in two orthogonal cuts of the antenna.

(A) In the azimuth plane, plus and minus 7 degrees and plus and minus 180 degrees.

(B) In the elevation plane, zero to forty-five degrees.

(ii) Cross-polarization patterns in the E- and H- planes, plus and minus 9 degrees.

(iii) Main beam gain.

~~(2)~~ *(iv)* The FCC envelope specified in §25.209 shall be superimposed on each pattern. The minimum tests specified above are recognized as representative of the performance of the antenna in most planes although some increase in sidelobe levels should be expected in the spar planes and orthogonal spar planes.

(2)~~(3)~~ **Applicants seeking authority to use an antenna** *in the C or Ku band* **that does not meet the standards set forth in Section~~s~~ 25.209(a) and (b) of this Chapter, pursuant to the procedure set forth in Section 25.220 of this Chapter, are required to submit a copy of the manufacturer's range test plots of the antenna gain patterns specified in paragraph (b)(1) of this section**.

(3) For earth station antennas in the 20/30 GHz band, the measurements specified in §§25.138(d) and (e) shall be performed.

(c) The tests specified in paragraph (b) of this section are normally performed at the manufacturer's facility; but for those antennas that are very large and only assembled on-site, on-site measurements may be used for product qualification data. If on-site data is to be used for qualification, the test frequencies and number of patterns should follow, where possible, the recommendations in paragraph (b) of this section, and the test data is to be submitted in the same manner as described in paragraph (a) of this section.

(d) For each new or modified transmitting antenna over 3 meters in diameter *in the C or Ku band*, the following on-site verification measurements must be completed at one frequency on an available transponder in each frequency band of interest and submitted to the Commission.

(1) Co-polariz*ation*~~ed~~ patterns in the elevation plane, plus and minus 7 degrees, in the transmit band.

(2) Co-polariz*ation*~~ed~~ patterns in the azimuth and elevation planes, plus and minus 7 degrees, in the receive band.

(3) System cross-polarization discrimination on-axis. The FCC envelope specified in §25.209 shall be superimposed on each pattern. The transmit patterns are to be measured with the aid of a co-operating earth station in coordination with the satellite system control center under the provisions of §25.272.

(e) Certification that the tests required by paragraph (c) of this section have been satisfactorily performed shall be provided to the Commission in notification that construction of the facilities has been completed as required by §25.133.

(f) Antennas less than 3 meters in diameter and antennas on simple (manual) drive mounts that are operated at a fixed site are exempt from the requirements of paragraphs (c) and (d) of this section provided that a detailed technical showing is made that confirms proper installation, pointing procedures, and polarization alignment and manufacturing quality control. These showings must also include a plan for periodic testing and field installation procedures and precautions.

(g) Records of the results of the tests required by this section must be maintained at the antenna site or the earth station operator's control center and be available for inspection.

§25.134 Licensing provisions of very small aperture terminal (VSAT) networks *in the 12/14 GHz band*.

~~(a) All applications for digital VSAT networks with a maximum outbound downlink EIRP density of +6.0 dBW/4 kHz per carrier and earth station antennas with maximum input power density of -14 dBW/4 kHz and maximum hub EIRP of 78.3 dBW will be processed routinely. All applications for analog VSAT networks with maximum outbound downlink power densities of +13.0 dBW/4 kHz per carrier and maximum antenna input power densities of -8.0 dBW/4 kHz shall be processed routinely in accordance with Declaratory Order in the Matter of Routine Licensing of Earth Stations in the 6 GHz and 14 GHz Bands Using Antennas Less Than 9 Meters and 5 Meters in Diameter, Respectively, for Both Full Transponder and Narrowband Transmissions, 2 FCC Rcd 2149 (1987) (Declaratory Order).~~

~~(b) Each applicant for digital and/or analog VSAT network authorization proposing to use transmitted satellite carrier EIRP densities in excess of +6.0 dBW/4 kHz and +13.0 dBW/4 kHz, respectively, and/or maximum antenna input power densities of -14.0 dBW/4 kHz and maximum hub EIRPs of 78.3 dBW and -8.0 dBW/ 4 kHz per carrier, respectively, shall conduct an engineering analysis using the Sharp, Adjacent Satellite Interference Analysis (ASIA) program. Applicants shall submit a complete description of those baseline parameters they use in conducting their analysis and tabular summaries of the ASIA program's output detailing potential interference shortfalls. Applicants shall also submit a narrative summary which must indicate whether there are margin shortfalls in any of the current baseline services as a result of the addition of the new applicant's high power service, and if so, how the applicant intends to resolve those margin shortfalls. Applicants shall submit link budget analyses of the operations proposed along with a detailed written explanation of how each uplink and each transmitted satellite carrier density figure is derived. Applicants shall provide proof by affidavit that all potentially affected parties acknowledge and do not object to the use of the applicant's higher power density.~~

(a) All applications for VSAT service in the 12/14 GHz band that meet the following requirements will be routinely processed:

(1) *If t***he maximum ~~transmitter~~** *input* **power spectral density of a digital modulated carrier into any GSO FSS earth station antenna** *does* **~~shall~~ not exceed - 14.0 - 10log(N) dB(W/4 kHz).**

(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.**~~

(2) *If t***he maximum GSO FSS satellite EIRP spectral density of the digital modulated emission** *of any transmission* ~~**shall**~~ *does* **not exceed** *9dB (W/4kHz)* ~~**6 dB (W/4kHz)**~~ **for all methods of modulation and accessing techniques.**

(3) If the maximum GSO FSS satellite EIRP spectral density of the digital modulated emission exceeds 9dB (W/4kHz) but does not exceed 13dB (W/4kHz) for all methods of modulation and accessing techniques provided that the operator/licensee of the satellite(s) on which such VSAT applicant wishes to use such power level has successfully coordinated that power level with adjacent satellite operators.

*(4) If t***he maximum** *input power spectral density into the antenna flange* ~~**hub earth station EIRP**~~ *of the hub earth station supporting the VSAT network* ~~**shall**~~ *does* **not exceed** ~~**78.3 dBW**~~ *–14dBW/4kHz* **for all methods of multiple access techniques** ~~**and supporting VSAT network identified in paragraph (a)(1) of this section.**~~

*(5) If t***he maximum** ~~**transmitter**~~ *input* **power spectral density of an analog carrier into** *the antenna flange of* **a**~~**ny**~~ **GSO FSS earth station antenna** ~~**shall**~~ *does* **not exceed – 8.0 dB(W/4kHz) and the maximum GSO FSS satellite EIRP spectral density** ~~**shall**~~ *does* **not exceed + 13.0 dB(W/4kHz).**

(b) Each applicant for digital and/or analog VSAT network authorization proposing to use *maximum input power spectral density at the antenna flange of the earth station or* **transmitted satellite carrier EIRP** *spectral* **densit***y*~~**ies**~~ ~~**and/or maximum antenna input power**~~ **in excess of those specified in paragraph (a) of this Section must comply with the procedures set forth in § 25.220 of this Chapter.**

~~(c) Licensees authorized pursuant to paragraph (b) of this section shall bear the burden of coordinating with any future applicants or licensees whose proposed compliant VSAT operations, as defined by paragraph (a) of this section, is potentially or actually adversely affected by the operation of the non-compliant licensee. If no good faith agreement can be reached, however, the non-compliant licensee shall reduce its power density levels to those compliant with~~ ~~*Section 25.212*~~ ~~the VSAT Order or the Declaratory Order, whichever is applicable~~.

~~(d) An application for VSAT authorization shall be filed on FCC Form 312, Main Form and Schedule B. A VSAT licensee applying to renew its license must include on FCC Form 405, the number of constructed VSAT units in its network..~~

(c)~~**(d)**~~ **An application for VSAT authorization shall be filed on FCC Form 312, Main Form and Schedule B.** ~~**A VSAT licensee applying to renew its license must follow the procedures provided in § 25.121(e)(3) of this part.**~~

§25.138[22] Blanket licensing provisions of GSO FSS Earth Stations in the 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space) and 29.25-30.0 GHz (Earth-to-space) bands.

(a) All applications for a blanket earth station license in the GSO FSS in the 18.3-18.8 GHz, 19.7-20.2 GHz, 28.35-28.6 GHz and 29.25-30.0 GHz bands that meet the following requirements shall be routinely processed:

(1) GSO FSS earth station antenna off-axis EIRP spectral density for co-polarized signals shall not exceed the following values, within ±3° of the GSO arc, under clear sky conditions:

$18.5 - 25\log(\Theta) - 10\log$ dBW/40kHz for $2.0° \leq \Theta \leq 7°$
$-2.63 - 10\log(N)$ dBW/40kHz for $7° \leq \Theta \leq 9.23°$
$21.5 - 25\log(\Theta) - 10\log$ dBW/40kHz for $9.23° \leq \Theta \leq 48°$

$-10.5 - 10\log(N)$ dBW/40kHz for $48° \leq \Theta \leq 180°$

Where: Θ is the angle in degrees from the axis of the main lobe; for systems where more than one earth station is expected to transmit simultaneously in the same bandwidth, e.g., CDMA systems, N is the ~~likely~~ maximum number of simultaneously transmitting co-frequency earth stations in the receive beam of the satellite; N=1 for TDMA and FDMA systems. **~~N = two for Aloha systems. N = 2 times the likely maximum number of co-frequency simultaneously transmitting earth stations in the receive beam of the satellite for CDMA/Aloha systems.~~**

(2) GSO FSS earth station antenna off-axis EIRP spectral density for co-polarized signals shall not exceed the following values, for all directions other than within ±3° of the GSO arc, under clear sky conditions:

$21.5 - 25\log(\Theta) - 10\log$ dBW/40kHz for $3.5° \leq \Theta \leq 7°$
$0.37-10\log(N)$ dBW/40kHz for $7° \leq \Theta \leq 9.23°$
$24.5 - 25\log(\Theta) - 10\log$ dBW/40kHz for $9.23° \leq \Theta \leq 48°$
$-7.5-10\log(N)$ dBW/40kHz for $48° \leq \Theta \leq 180°$

Where: Θ is the angle in degrees from the axis of the main lobe; for systems where more than one earth station is expected to transmit simultaneously in the same bandwidth, e.g., CDMA systems, N is the ~~likely~~ maximum number of simultaneously transmitting co-frequency earth stations in the receive beam of the satellite; N=1 for TDMA and FDMA systems. **~~N = two for~~**

22 This §25.138 reflects the revisions the Commission made in its recent order on blanket licensing in the Ka-band. *See* Second Order on Reconsideration, IB Docket No. 98-172 (released Nov. 26, 2002).

~~**Aloha systems. N = 2 times the likely maximum number of co-frequency simultaneously transmitting earth stations in the receive beam of the satellite for CDMA/Aloha systems.**~~

(3) The values given in paragraphs (a)(1) and (2) of this section may be exceeded by 3 dB, for values of Θ >10°, provided that the total angular range over which this occurs does not exceed 20 deg. when measured along both sides of the GSO arc.

(4) GSO FSS earth station antenna off-axis EIRP spectral density for cross-polarized signals shall not exceed the following values, in all directions relative to the GSO arc, under clear sky conditions:

8.5 - 25log(Θ) - 10log(N) dBW/40kHz for 2.0° ≤ Θ ≤ 7°

-12.63 - 10log(N) dBW/40kHz for 7° ≤ Θ ≤ 9.23°

Where: Θ is the angle in degrees from the axis of the main lobe; for systems where more than one earth station is expected to transmit simultaneously in the same bandwidth, e.g., CDMA systems, N is the ~~likely~~ maximum number of simultaneously transmitting co-frequency earth stations in the receive beam of the satellite; N=1 for TDMA and FDMA systems.

(5) For earth stations employing uplink power control, the values in paragraphs (a)(1), (2), and (4) of this section may be exceeded by up to 20 dB under conditions of uplink fading due to precipitation. The amount of such increase in excess of the actual amount of monitored excess attenuation over clear sky propagation conditions shall not exceed 1.5 dB or 15 % of the actual amount of monitored excess attenuation in dB, whichever is larger, with a confidence level of 90 percent except over transient periods accounting for no more than 0.5% of the time during which the excess is no more than 4.0 dB.

(6) Power flux-density (PFD) at the Earth's surface produced by emissions from a space station for all conditions, including clear sky, and for all methods of modulation shall not exceed a level of -118 $dBW/m^2/MHz$, in addition to the limits specified in §25.208 (d).

(b) Each applicant for earth station license(s) that proposes levels in excess of those defined in paragraph (a) of this section shall submit link budget analyses of the operations proposed along with a detailed written explanation of how each uplink and each transmitted satellite carrier density figure is derived. Applicants shall also submit a narrative summary which must indicate whether there are margin shortfalls in any of the current baseline services as a result of the addition of the applicant's higher power service, and if so, how the applicant intends to resolve those margin short falls. Applicants shall certify that all potentially affected parties (i.e., those GSO FSS satellite networks that are 2, 4, and 6 degrees apart) acknowledge and do not object to the use of the applicant's higher power densities.

(c) Licensees authorized pursuant to paragraph (b) of this section shall bear the burden of coordinating with any future applicants or licensees whose proposed compliant operations at 6° or smaller orbital spacing, as defined by paragraph (a) of this section, is potentially or actually adversely affected by the operation of the non-compliant licensee. If no good faith agreement can be reached, however, the non-compliant licensee shall reduce its earth station and space station power density levels to be compliant with those specified in paragraph (a) of this section.

(d) The applicant shall provide for each earth station antenna type, a series of radiation patterns measured on a production antenna performed on a calibrated antenna range and, as a minimum, shall be made at the bottom, middle, and top frequencies of the 30 GHz band. The radiation patterns are:

(1) Co-polarized patterns for each of two orthogonal senses of polarizations in two orthogonal planes of the antenna.

(i) In the azimuth plane, plus and minus 10 degrees and plus and minus 180 degrees.

(ii) In the elevation plane, zero to 30 degrees.

(2) Cross-polarization patterns in the E- and H-planes, plus and minus 10 degrees.

(3) Main beam gain

(e) Protection of receive earth stations from adjacent satellite interference is based on either the antenna performance specified in §25.209(a) and (b), or the actual receiving earth station antenna performance, if actual performance provides greater isolation from adjacent satellite interference. For purposes of insuring the correct level of protection, the applicant shall provide, for each earth station antenna type, the antenna performance plots for the 20 GHz band, including the format specified in paragraph (d) of this section.

(f) The earth station licensee shall not transmit towards a GSO FSS satellite unless it has prior authorization from the satellite operator or a space segment vendor authorized by the satellite operator. The specific transmission shall be conducted in accordance with the operating protocol specified by the satellite operator.

(g) A licensee applying to renew its license must include on FCC Form 405 the number of constructed earth stations.

§25.201 Definitions

(7*)***   **Equivalent diameter. When circular aperture reflector antennas are employed, the size of the antenna is generally expressed as the diameter of the antenna's main reflector. When non-reflector or non-circular aperture antennas are employed, an equivalent diameter can be computed for the antenna. The equivalent diameter is the diameter of a hypothetical circular aperture antenna with the same aperture area as the actual antenna. For example, an elliptical aperture antenna with major axis, a, and minor axis, b, will have an equivalent diameter of $[a \times b]^{1/2}$. A rectangular aperture antenna with length, l, and width, w, will have an equivalent diameter of $[(l \times w)4/\pi]^{1/2}$**.

(10)   Full Transponder. Radio emissions or transmissions that occupy, or nearly occupy, the entire satellite transponder *power and/or bandwidth.* ~~**C-band and Ku-band satellite systems typically have transponder bandwidths on the order of 36 MHz or more. Single carrier full transponder transmissions can include full motion analog video, thousands of multiplexed voice channels, or high data rates on the order of 50 Mb/s.**~~

~~**(18)   Narrowband. Radio emissions or transmissions with narrow or limited spectral bandwidths. Narrowband satellite transmissions generally provide a single channel or a very limited number of channels. Narrowband satellite transmissions generally have bandwidths of 40 kHz to 5 MHz.**~~

~~**(41)   Wideband. See Full Transponder.**~~

§25.209 Antenna performance standards.

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

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

29 - 25 log10 (Theta) dBi	1° </= Theta </= 7°
+8 dBi	7° < Theta </= 9.2°
32 - 25 log10 (Theta) dBi	9.2° < Theta </= 48°
-10 dBi	48° < Theta </= 180°

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

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

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

32 - 25 log10 (Theta) dBi	1° </= Theta </= 48°
-10 dBi	48° < Theta </= 180°

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

(3) For an earth station employed for transmissions in the conventional Ku-band (14.0-14.5 GHz):

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

29 - 25 log10 (Theta) dBi	*1° </= Theta </= 7°*
+8 dBi	*7° < Theta </= 9.2°*
32 - 25 log10 (Theta) dBi	*9.2° < Theta </= 48°*

-10 dBi 48° < Theta </= 85°
0 dBi 85° < Theta </= 180°

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

(ii) In all other directions, or in the plane of the horizon including any out-of-plane potential terrestrial interference paths:
Outside the main beam, the gain of the antenna shall lie below the envelope defined by:

32 - 25 log10 (Theta) dBi 3° </= Theta </= 48°
-10 dBi48° < Theta </= 85°
0 dBi 85° < Theta </= 180°

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

(iii) For antennas with dimensions in the GSO plane from 1.2 to 1.8 meters, the starting point of the antenna gain envelope is at 1.25 degrees instead of 1 degree as stipulated in the above section (i).

(iv) For antennas with dimensions in the GSO plane less than 1.2 meter, the starting point of the antenna gain envelope is at 1.5 degrees instead of 1 degree as stipulated in the above section (i).

(4) For an earth station antenna employed for transmissions in the conventional C-band (5.925-6.425 GHz) with dimensions in the GSO plane less than 4.5 meters and greater than or equal to 2.4 meters, the starting point of the antenna gain envelope shall be less than 1.7 degrees instead of the 1 degree as stipulated in sections (1) and (2).

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

19 - 25 log10 (Theta) dBi   1.8° < Theta </= 7°
-2 dBi   7° < Theta </= 9.2°

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

(d) ~~The patterns specified in paragraphs (a) and (b) of this section shall apply to all new earth station antennas initially authorized after February 15, 1985 and shall apply to all earth station antennas after March 11, 1994.~~ *The patterns specified in paragraphs (a) and (b) of this section shall apply to all earth station antennas after [insert date of Commission's Second Report and Order].*

(e) The operations of any earth station with an antenna not conforming to the standards of paragraphs (a) and (b) of this section shall impose no limitations upon the operation, location or design of any terrestrial station, any other earth station, or any space station beyond those limitations that would be expected to be imposed by an earth station employing an antenna conforming to the reference patterns defined in paragraphs (a) and (b) of this section.

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

(f) An earth station with a~~n~~ *transmitting* **antenna not conforming to the standards of paragraph~~s~~ (a) and (b) of this section will be authorized ~~after February 15, 1985~~ upon finding by the Commission that** *the antenna will not cause* **unacceptable levels of interference ~~will not be caused~~ under conditions of uniform 2º orbital spacing. An earth station antenna initially authorized on or before February 15, 1985 will be authorized by the Commission to continue to operate as long as such operations are found not to cause unacceptable levels of adjacent satellite interference. In either case, the Commission will impose appropriate terms and conditions in its**

authorization of such facilities and operations. The applicant has the burden of demonstrating that its *transmitting* **antenna not conforming to the standards of paragraph~~s~~ (a) and (b) of this section will not cause unacceptable interference. This demonstration must comply with the procedures set forth in § 25.220 of this Chapter.**

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

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

$29 - 25\log(\theta)$ dBi	$1° \le \theta < 36°$
-10 dBi	$36° \le \theta \le 180°$

where θ is the angle in degrees from the axis of the main lobe, and dBi refers to dB relative to an isotropic radiator. For the purposes of this section, the peak gain of an individual sidelobe may not exceed the envelope defined above.

§25.211: *Analog* Video ~~t~~ *T*ransmissions in the Fixed-Satellite Service.

(a) Downlink analog video transmissions in the band 3700-4200 MHz shall be transmitted only on a center frequency of 3700 + 20N MHz, where N=1 to 24. The corresponding uplink frequency shall be 2225 MHz higher.

(b) All 4/6 GHz analog video transmissions shall contain an energy dispersal signal at all times with a minimum peak-to-peak bandwidth set at whatever value is necessary to meet the power flux density limits specified in §25.208(a) and successfully coordinated internationally and accepted by adjacent U.S. satellite operators based on the use of state of the art space and earth station facilities. Further, all transmissions operating in frequency bands described in §25.208(b) and (c) shall also contain an energy dispersal signal at all times with a minimum peak-to-peak bandwidth set at whatever value is necessary to meet the power flux density limits specified in §25.208(b) and (c) and successfully coordinated internationally and accepted by adjacent U.S. satellite operators based on the use of state of the art space and earth station facilities. The transmission of an unmodulated carrier at a power level sufficient to saturate a transponder is prohibited, except by the space station licensee to determine transponder performance characteristics. All 12/14 GHz video transmissions for TV/FM shall identify the particular carrier frequencies for necessary coordination with adjacent U.S. satellite systems and affected satellite systems of other administrations.

(c) All initial analog video transmissions shall be preceded by a video test transmission at an uplink e.i.r.p. at least 10 dB below the normal operating level. The earth station operator shall not increase power until receiving notification from the satellite network control center that the frequency and polarization alignment are satisfactory pursuant to the procedures specified in §25.272. The stationary earth station operator that has successfully transmitted an initial video test signal to a satellite pursuant to this paragraph is not required to make subsequent video test transmissions if subsequent transmissions are conducted using exactly the same parameters as the initial transmission.

~~(d) In the 6 GHz band, an earth station with an equivalent diameter of 9 meters or smaller may be routinely licensed for transmission of full transponder services if the maximum power into the antenna does not exceed 450 watts (26.5 dBW). In the 14 GHz 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).~~

(d) An earth station may be routinely licensed for transmission ~~to~~ *of* **full-transponder** *analog video* **services provided:**

(1) In the 6 GHz band, with an antenna ~~equivalent diameter~~ *dimension of* **4.5** *to 9* **meters ~~or greater~~** *in the geostationary satellite orbital plane***, the maximum power into the antenna does not exceed 26.5 dBW; or**

(2) In the 14 GHz band, with an antenna ~~equivalent diameter~~ *dimension of* **1.2** *to 5* **meters ~~or greater~~** *in the geostationary satellite orbital plane,* **the maximum power into the antenna does not exceed 27 dBW.**

(e) Antennas with a~~n equivalent diameter~~ *dimension* **smaller than those specified in paragraph (d) of this section ~~are subject to the provisions of Section 25.220 of this Chapter, which may include power reduction requirements. These antennas~~ will not be routinely licensed for transmission of full transponder** *analog video* **services***.*

(f) Each applicant for authorization for *analog* **video in the fixed-satellite service proposing to use transmitted satellite carrier EIRP densities, and/or maximum power into the antenna in excess of those specified in Section 25.211(d), must comply with the procedures set forth in § 25.220 of this Chapter.**

~~(g) The Commission has authority to apply the power level limits in this section to earth station applications for authority to operate in any other FSS frequency band to the extent it deems necessary to prevent unacceptable interference into adjacent satellite systems, to the extent that power limits have not been established elsewhere in this Part.~~

§25.212 Narrowband *Analog* ~~t~~ *T*ransmissions *and Digital Transmissions* in the GSO Fixed-Satellite Service.

(a) Except as otherwise provided by these rules and regulations, criteria for unacceptable levels of interference caused by other satellite networks shall be established on the basis of nominal operating conditions and with the objective of minimizing orbital separations between satellites.

(b) Emissions with an occupied bandwidth of less than 2 MHz are not protected from interference from wider bandwidth transmissions if the r.f. carrier frequency of the narrowband signal is within ±1 MHz of one of the frequencies specified in §25.211(a).

(c) In the *12/*14 GHz band,

(i) an earth station *whose transmit pattern meets the requirements of paragraph (a) and (b) of Section 25.209* ~~with an equivalent diameter of 1.2 meters or greater~~ may be routinely licensed *under this Section 25.212* for transmission of narrowband analog services with bandwidths up to 200 kHz if the maximum input power *spectral* density into the antenna *flange* does not exceed -8 dBW/4 kHz and the maximum transmitted satellite carrier EIRP *spectral* density does not exceed 13 dBW/4 kHz, ~~and~~

(ii) an earth station whose transmit pattern meets the requirements of Section 25.209(a) and Section 25.209(b) may be routinely licensed under this Section 25.212 for transmission of digital services if the maximum input power spectral density into the antenna of the earth station does not exceed –14dBW/4kHz - 10log(N) where N is defined in Section 25.134(a)(1) of this Chapter, or in the case of full transponder digital video services, the maximum power into the antenna flange does not exceed 27 dBW for an antenna with a dimension of 1.2 meters to 5 meters in the geostationary orbital plane, and, either

(1) the maximum transmitted satellite carrier EIRP spectral density does not exceed 9dBW/4kHz, or

(2) the maximum transmitted satellite carrier EIRP spectral density exceeds 9 dBW/4kHz but does not exceed 13dBW/4kHz and provided that the operator/licensee of the satellite(s) on which the applicant wishes to use such power level has successfully coordinated that power level with adjacent satellite operators.

~~Antennas~~ ~~with an equivalent diameter smaller than 1.2 meters~~ *Earth stations* **in the 14 GHz band** *not meeting the applicable requirements of clause (i) or (ii)* **are subject to the provisions of §25.220 of this chapter~~, which may include power reduction requirements~~.**

~~(d) **(1)** In the 6 GHz 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. **Antennas with an equivalent diameter smaller than 1.2 meters in the 14 GHz band are subject to the provisions of §25.220 of this chapter, which may include power reduction requirements.**~~

(d)*(1)* ~~**(2)**~~ **In the 6 GHz band, an earth station with an** ~~**equivalent diameter**~~ **antenna** *dimension* **of 4.5 meters or greater** *in the geostationary satellite orbital plane* **may be routinely licensed for transmission of SCPC services if the maximum** *input* **power spectral densities into the antenna** *flange* **do not exceed + 0.5 dB(W/4kHz) for analog SCPC carriers with bandwidths up to 200 kHz and do not exceed –2.7 – 10log(N) dB (W/4kHz) for** ~~**narrow and/or wideband**~~ **digital** ~~**SCPC**~~ **carriers.**

(i) **For digital** ~~**SCPC**~~ *transmissions* **using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one.**

(ii) **For digital** ~~**SCPC**~~ *transmissions* **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 digital SCPC using contention Aloha multiple access technique, N is equal to two.**~~

~~**(iv) For digital SCPC 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.**~~

(d)(2) In the 6 GHz band, for an earth station with an antenna dimension of 2.4 meters or greater but less than 4.5 meters in the geostationary plane, the antenna may be routinely licensed for transmission of analog SCPC carriers with bandwidth up to 200 kHz or digital carriers, if the maximum power density into the antenna flange does not exceed –12 dB(W/4kHz) for analog carriers, and –12-10log(N) dB(W/4kHz) for digital carriers, where N is defined in (d)(1). To prevent unacceptable interference into adjacent satellites, the applicant for the 2.4 m antenna shall certify that the antenna would be installed such that it would not misaligned by more than 0.5 degrees from the intended satellite.

(d)(3) In the 6 GHz band, antennas with a dimension smaller than 2.4 meters in the geostationary satellite orbital plane are subject to the provisions of §25.220 of this chapter.

(e) Each applicant for authorization for narrowband *analog transmissions and/or digital* **transmissions in the fixed-satellite service proposing to use transmitted satellite carrier EIRP densities, and/or maximum antenna input power densities in excess of those specified in paragraph (c) of this Section for Ku-band service, or paragraph (d) of this Section for C-band service, respectively, must comply with the procedures set forth in § 25.220 of this Chapter.**

~~**(f) The Commission has authority to apply the power level limits in this section to earth station applications for authority to operate in any other FSS frequency band to the extent it deems necessary to prevent unacceptable interference into adjacent satellite systems, to the extent that power limits have not been established elsewhere in this Part.**~~

§ 25.220 Non-conforming transmit~~/receive~~ earth station operations *in the C and Ku bands*.

(a)(1) This *S***ection** *25.220* **applies to earth station applications** *for antennas proposed to operate in the C band and/or Ku band* **in which:**

(i) the *transmit portion of the* **proposed antenna does not conform to the standards of §25.209(a) and (b) of this Chapter, and/or**

(ii) the proposed *transmit* **power density levels are in excess of those specified in §25.134, §25.211, or §25.212 of this Chapter, or those derived by the procedure set forth in paragraph (c)~~(1)~~ of this Section, whichever is applicable.**

Protection from interference will be provided for the receive portion of such antennas to the extent specified in Section 25.209(c),

~~**(2) Paragraphs (b) through (e) of this section apply to the earth station applications described in paragraph (a)(1) of this section, in which the applicant seeks transmit/receive authority.**~~

~~**(3) Paragraph (f) of this section applies to the earth station applications described in paragraph (a)(1) of this section in which the applicant seeks transmit-only or receive-only authority.**~~

(2)~~**(4)**~~ **The requirements for petitions to deny applications filed pursuant to this section are set forth in Section 25.154 of this Chapter.**

(b) If ~~**an**~~ *the transmit portion of the* **antenna proposed for use by the applicant does not comply with the antenna performance standards contained in §25.209(a) and (b), the applicant must provide, as an exhibit to its FCC Form 312 application, the antenna gain patterns specified in §25.132(b) of this Chapter.**

(c) If ~~**an**~~ *the transmit portion of the* **antenna proposed for use by the applicant does not comply with the** *antenna* **performance standards contained in §25.209(a) and (b), the applicant must meet the requirements of either** *this* **paragraph (c)***,*~~**(1)**~~ *paragraph (d)(1),* **or** *paragraph (d)(2)* ~~**(c)(2)**~~ **of this Section***, as applicable***,** ~~**to obtain protection from receiving interference from adjacent satellite operators. The applicant must meet the requirements of either paragraph (c)(1) or (c)(3) of this Section**~~ **to obtain authority to transmit.**

The applicant must provide*:*

(i) **in its Form 312, Schedule B, the power and power density levels that result by reducing the values stated in §25.134, §25.211, or §25.212, whichever is applicable, by the number of decibels that the non-compliant antenna fails to meet the antenna performance standard*s* of §25.209(a) and (b),** *and* ~~**or**~~

(ii) statement(s) that the operator(s) of the satellite(s) with which the applicant is seeking authority to communicate has obtained from the adjacent satellite operators within 3 degrees, indicating that the operation of the proposed antenna has been coordinated.

~~**(2) The applicant will not receive protection from adjacent satellite interference from any satellite unless the applicant has provided the affidavits listed in paragraph (d)(1) of this Section from the operator of that satellite(s).**~~

~~**(3) The applicant will not be permitted to transmit to any satellite unless the applicant has provided the affidavits listed in paragraph (c)(1) of this Section from the operator of that satellite(s).**~~

~~**(d)(1) If an antenna proposed for use by the applicant does not comply with the performance standards contained in §25.209(a) and (b), the applicant must submit the affidavits listed in paragraphs (d)(1)(i) through (d)(1)(iv) of this Section to qualify for protection from receiving interference from other satellite systems. The applicant will be granted protection from receiving interference only with respect to the satellite systems included in the coordination agreements referred to in the affidavit required by paragraph (d)(1)(ii) of this section, and only to the extent that protection from receiving interference is afforded by those coordination agreements.**~~

~~**(i) a statement from the satellite operator acknowledging that the proposed operation of the subject non-conforming earth station with its satellite(s) has the potential to receive interference from adjacent satellite networks that may be unacceptable.**~~

~~**(ii) a statement from the satellite operator that it has coordinated the operation of the subject non-conforming earth station accessing its satellite(s), including its required downlink power density based on the information contained in the application, with all adjacent satellite networks within 6° of orbital separation from its satellite(s), and the operations will not violate any existing coordination agreement for its satellite(s) with other satellite systems.**~~

~~(iii)~~ **~~a statement from the satellite operator that it will include the subject non-conforming earth station operations in all future satellite network coordinations, and~~**

~~(iv)~~ **~~a statement from the Earth station applicant certifying that it will comply with all coordination agreements reached by the satellite operator(s).~~**

~~(2)~~ **~~A license granted pursuant to paragraph (d)(1) of this section will include, as a condition on that license, that if no good faith agreement can be reached between the satellite operator and the operator of a future 2° compliant satellite, the earth station operator shall accept the power density levels that would accommodate the 2° compliant satellite.~~**

~~(c)~~ *(d)***(1)** *If the transmit portion of the antenna proposed for use by the* **~~An~~** **earth station applicant** *does not comply with the antenna performance standards contained in paragraph (a) or (b) of Section 25.209, and neither paragraph (c) nor (d)(2) of this section applies, and/or the antenna has* **~~proposing to use~~** **transmitted satellite carrier EIRP densities, and/or maximum** *input* **power** *spectral density* **into the antenna** *flange* **in excess of the levels in §25.134, §25.211, §25.212**~~**, or the power density levels derived through the procedure set forth in paragraph (c)(1) of this Section, whichever is applicable, shall provide**~~ **the following** **~~affidavits~~** *shall be provided* **as an exhibit to** *the* **~~its~~** **earth station application:**

(i) **a statement from the satellite operator acknowledging that the proposed operation of the subject non-conforming earth station with its satellite(s) has the potential to create interference to adjacent satellite networks that may be unacceptable.**

(ii) **~~a~~ statement***(s) that the operator(s) of the satellite(s) with which the applicant is seeking authority to communicate has obtained* **from the** *adjacent* **satellite operator***s within 6 degrees, indicating* **that** **~~it has coordinated~~** **the operation of the subject non-conforming Earth Station** *has been coordinated***.** **~~accessing its satellite(s), and its corresponding downlink power density requirements (based on the information contained in the application) with all adjacent satellite networks within 6° of orbital separation from its satellite(s), and the operations will not violate any existing coordination agreement for its satellite(s) with other satellite systems.~~**

(iii) **a statement from the satellite operator that it will include the subject non-conforming Earth Station** *operations with respect to the antenna performance standards referenced in paragraph (d)(1) of this section***,** **power and power densities in all future satellite network coordinations, and**

(iv) a statement from the Earth Station applicant certifying that it will comply with all coordination agreements reached by the satellite operator(s).

(2) For an antenna operating in the 14 GHz band, with dimension in the GSO plane less than 1.2 meters, if the transmit portion of the antenna proposed for use by the earth station applicant does not comply with the antenna performance standards contained in paragraph (a) or (b) of Section 25.209 because the actual gain envelope intersects the gain envelope in paragraph (a)(3) of 25.209 above 1.5 degrees and up to and including 1.8 degrees, the applicant shall submit during the earth station license application phase either (i) a technical showing demonstrating how the required maximum pointing accuracy will be met during antenna installation or (ii) a coordination agreement between the operator of the satellite with which the earth station will communicate, and the satellite operators within two degrees of the satellite with which the earth station will communicate. The required maximum antenna pointing error (pe) towards the desired satellite shall not exceed:

$$pe = 2 - x \text{ , degrees} \qquad 1.5 < x \leq 1.8$$

where x is the starting point of antenna gain envelope of the antenna.

(3) A license granted pursuant to paragraph ~~(e)~~ *(d)*(1) of this section will include, as a condition on that license, that if no good faith agreement can be reached between the satellite operator and the operator of a future 2° compliant satellite, the earth station operator shall reduce its power to those levels that would accommodate the 2° compliant satellite.

~~**(f)(1) If an earth station applicant requests transmit-only authority, and its proposed antenna does not conform to the standards of §25.209(a) and (b) of this Chapter, it must meet the requirements of paragraphs (b) and (c) of this section.**~~

~~**(2) If an earth station applicant requests transmit-only authority, and its proposed power density levels are in excess of those specified in §25.134, §25.211, or §25.212 of this Chapter, or those derived by the procedure set forth in paragraph (e)(1) of this section, it must meet the requirements of paragraph (c) of this section.**~~

~~**(3) If an earth station applicant requests receive-only authority, and its proposed antenna does not conform to the standards of §25.209(a) and (b) of this Chapter, it must meet the requirements of paragraphs (b) and (d) of this section.**~~

§ 25.271 Control of transmitting stations.

(a) The licensee of a facility licensed under this Part is responsible for the proper operation and maintenance of the station.

(b) The licensee of a transmitting earth station licensed under this Part shall ensure that a trained operator is present on the earth station site, or at a designated remote control point for the earth station, at all times that transmissions are being conducted. No operator's license is required for a person to operate or perform maintenance on facilities authorized under this Part.

(c) Authority will be granted to operate a transmitting earth station by remote control only on the conditions that:

(1) The parameters of the transmissions of the remote station monitored at the control point, and the operational functions of the remote earth stations that can be controlled by the operator at the control point, are sufficient to insure that the operations of the remote station(s) are at times in full compliance with the remote station authorization(s);

(2) The earth station facilities are protected by appropriate security measures to prevent unauthorized entry or operations;

(3) Upon detection by the licensee, or upon notification from the Commission of a deviation or upon notification by another licensee of harmful interference, the operation of the remote station shall be immediately suspended by the operator at the control point until the deviation or interference is corrected, except that transmissions concerning the immediate safety of life or property may be conducted for the duration of the emergency; and

(4) The licensee shall have available at all times the technical personnel necessary to perform expeditiously the technical servicing and maintenance of the remote stations.

(d) The licensee shall insure that the licensed facilities are properly secured against unauthorized access or use whenever an operator is not present at the transmitter.

(e) The licensee of an NGSO FSS system operating in the 10.7-14.5 GHz bands shall maintain an electronic web site bulletin board to list the satellite ephemeris data, for each satellite in the constellation, using the North American Aerospace Defense Command (NORAD) two-line orbital element format. The orbital elements shall be updated at least once every three days.

(f) VSAT licensees in the conventional Ku-Band shall have and maintain the capability to specifically identify the originating terminal for digital transmissions from sub-meter antennas within their network through reception of those transmissions, or through other network control mechanisms.

§25.274 Procedures to be followed in the event of harmful interference.

(a) The earth station operator whose transmission is suffering harmful interference shall first check the earth station equipment to ensure that the equipment is functioning properly.

(b) The earth station operator shall then check all other earth stations in the licensee's network that could be causing the harmful interference to ensure that none of the licensee's earth stations are the source of the interference and to verify that the source of interference is not from a local terrestrial source.

(c) After the earth station operator has determined that the source of the interference is not another earth station operating in the same network or from a terrestrial source, the earth station operator shall contact the satellite system control center and advise the satellite operator of the problem. The control center operator shall observe the interference incident and make reasonable efforts to determine the source of the problem. A record shall be maintained by the control center operator and the earth station operator of all harmful interference incidents and their resolution. These records shall be made available to an FCC representative on request.

(d) Where the suspected source of the interference incident is the operation of an earth station licensed to operate on one or more of the satellites in the satellite operator's system, the control center operator shall advise the offending earth station of the harmful interference incident and assist in the resolution of the problem where reasonably possible.

(e) The earth station licensee whose operations are suspected of causing harmful interference to the operations of another earth station shall take reasonable measures to determine whether its operations are the source of the harmful interference problem. Where the operations of the suspect earth station are the source of the interference, the licensee of that earth station shall take all measures necessary to eliminate the interference.

(f) At any point, the system control center operator may contact the Commission's Columbia Operations Center in Columbia, Maryland to assist in resolving the matter. This office specializes in the resolution of satellite interference problems. All licensees are required to cooperate fully with the Commission in any investigation of interference problems.

(g) Where the earth station suspected of causing interference to the operations of another earth station cannot be identified or is identified as an earth station operating on a satellite system other than the one on which the earth station suffering undue interference is operating, it is the responsibility of a representative of the earth station suffering harmful interference to contact the control center of other satellite systems.

(h) For sub-meter antennas operating in the conventional Ku-band, upon receipt of a complaint of harmful interference from an adjacent satellite operator, to include information on the:

- *time of day and duration of interference event(s)*
- *frequency of occurrence of interference event(s)*
- *center frequency and polarization of interfering signal(s)*
- *information, if any, within the possession of the satellite operator on the geographical location of interfering terminal(s)*
- *if possible, spectral signature (bandwidth, power, other identifying features) of interfering signal(s)*

the licensee of the potentially interfering transmitting terminal, in cooperation with the interfered-with satellite network operator, shall work expeditiously to identify the specific sub-meter transmitting antenna causing the harmful interference.

(i) Upon identification of the specific sub-meter transmitting terminal causing the harmful interference, the licensee of such terminal shall promptly take action to eliminate such harmful interference.

Appendix B

Revised Proposals of the Satellite Industry Association
Part 25 Earth Station Streamlining Proceeding
IB Docket No. 00-248

-- Clean Version --

§25.132 Verification of earth station antenna performance standards.

(a) All applications for transmitting earth stations, except for earth stations operating in the 20/30 GHz band, must be accompanied by a certificate pursuant to §2.902 of this chapter from the manufacturer of each antenna that the results of a series of radiation pattern tests performed on representative equipment in representative configurations by the manufacturer which demonstrates that the equipment complies with the performance standards set forth in §25.209. The licensee must be prepared to demonstrate the measurements to the Commission on request.

(b)(1) In order to demonstrate compliance of a C or Ku band antenna with §25.209(a) and (b), the following measurements on a production antenna performed on calibrated antenna range, as a minimum, shall be made at the bottom, middle and top of each allocated frequency band and submitted to the Commission:

(i) Co-polarization patterns for each of two orthogonal senses of polarizations in two orthogonal cuts of the antenna.

(A) In the azimuth plane, plus and minus 7 degrees and plus and minus 180 degrees.

(B) In the elevation plane, zero to forty-five degrees.

(ii) Cross-polarization patterns in the E- and H- planes, plus and minus 9 degrees.

(iii) Main beam gain.

(iv) The FCC envelope specified in §25.209 shall be superimposed on each pattern. The minimum tests specified above are recognized as representative of the performance of the antenna in most planes although some increase in sidelobe levels should be expected in the spar planes and orthogonal spar planes.

(2 Applicants seeking authority to use an antenna in the C or Ku band that does not meet the standards set forth in Section~~s~~ 25.209(a) and (b) of this Chapter, pursuant to the procedure set forth in Section 25.220 of this Chapter, are required to submit a copy of the manufacturer's range test plots of the antenna gain patterns specified in paragraph (b)(1) of this section.

(3) For earth station antennas in the 20/30 GHz band, the measurements specified in §§25.138(d) and (e) shall be performed.

(c) The tests specified in paragraph (b) of this section are normally performed at the manufacturer's facility; but for those antennas that are very large and only assembled on-site, on-site measurements may be used for product qualification data. If on-site data is to be used for qualification, the test frequencies and number of patterns should follow, where possible, the recommendations in paragraph (b) of this section, and the test data is to be submitted in the same manner as described in paragraph (a) of this section.

(d) For each new or modified transmitting antenna over 3 meters in diameter in the C or Ku band, the following on-site verification measurements must be completed at one frequency on an available transponder in each frequency band of interest and submitted to the Commission.

(1) Co-polarization patterns in the elevation plane, plus and minus 7 degrees, in the transmit band.

(2) Co-polarization patterns in the azimuth and elevation planes, plus and minus 7 degrees, in the receive band.

(3) System cross-polarization discrimination on-axis. The FCC envelope specified in §25.209 shall be superimposed on each pattern. The transmit patterns are to be measured with the aid of a co-operating earth station in coordination with the satellite system control center under the provisions of §25.272.

(e) Certification that the tests required by paragraph (c) of this section have been satisfactorily performed shall be provided to the Commission in notification that construction of the facilities has been completed as required by §25.133.

(f) Antennas less than 3 meters in diameter and antennas on simple (manual) drive mounts that are operated at a fixed site are exempt from the requirements of paragraphs (c) and (d) of this section provided that a detailed technical showing is made that confirms proper installation, pointing procedures, and polarization alignment and manufacturing quality control. These showings must also include a plan for periodic testing and field installation procedures and precautions.

(g) Records of the results of the tests required by this section must be maintained at the antenna site or the earth station operator's control center and be available for inspection.

§25.134 Licensing provisions of very small aperture terminal (VSAT) networks in the 12/14 GHz band.

(a) All applications for VSAT service in the 12/14 GHz band that meet the following requirements will be routinely processed:

(1) If the maximum input power spectral density of a digital modulated carrier into any GSO FSS earth station antenna does not exceed - 14.0 - 10log(N) dB(W/4 kHz).

(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 maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

(2) If the maximum GSO FSS satellite EIRP spectral density of the digital modulated emission of any transmission does not exceed 9dB (W/4kHz) for all methods of modulation and accessing techniques.

(3) If the maximum GSO FSS satellite EIRP spectral density of the digital modulated emission exceeds 9dB (W/4kHz) but does not exceed 13dB (W/4kHz) for all methods of modulation and accessing techniques provided that the operator/licensee of the satellite(s) on which such VSAT applicant wishes to use such power level has successfully coordinated that power level with adjacent satellite operators.

(4) If the maximum input power spectral density into the antenna flange of the hub earth station supporting the VSAT network does not exceed –14dBW/4kHz for all methods of multiple access techniques.

(5) If the maximum input power spectral density of an analog carrier into the antenna flange of a GSO FSS earth station antenna does not exceed – 8.0 dB(W/4kHz) and the maximum GSO FSS satellite EIRP spectral density does not exceed + 13.0 dB(W/4kHz).

(b) Each applicant for digital and/or analog VSAT network authorization proposing to use maximum input power spectral density at the antenna flange of the earth station or transmitted satellite carrier EIRP spectral in excess of those specified in paragraph (a) of this Section must comply with the procedures set forth in § 25.220 of this Chapter.

(c) An application for VSAT authorization shall be filed on FCC Form 312, Main Form and Schedule B.

§25.138 Blanket licensing provisions of GSO FSS Earth Stations in the 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space) and 29.25-30.0 GHz (Earth-to-space) bands.

(a) All applications for a blanket earth station license in the GSO FSS in the 18.3-18.8 GHz, 19.7-20.2 GHz, 28.35-28.6 GHz and 29.25-30.0 GHz bands that meet the following requirements shall be routinely processed:

(1) GSO FSS earth station antenna off-axis EIRP spectral density for co-polarized signals shall not exceed the following values, within ±3° of the GSO arc, under clear sky conditions:

18.5 - 25log(Θ) - 10log dBW/40kHz for 2.0° ≤ Θ ≤ 7°
-2.63 - 10log(N) dBW/40kHz for 7° ≤ Θ ≤ 9.23°
21.5 - 25log(Θ) - 10log dBW/40kHz for 9.23° ≤ Θ ≤ 48°

-10.5 - 10log(N) dBW/40kHz for 48° ≤ Θ ≤ 180°

Where: Θ is the angle in degrees from the axis of the main lobe; for systems where more than one earth station is expected to transmit simultaneously in the same bandwidth, e.g., CDMA systems, N is the maximum number of simultaneously transmitting co-frequency earth stations in the receive beam of the satellite; N=1 for TDMA and FDMA systems.

(2) GSO FSS earth station antenna off-axis EIRP spectral density for co-polarized signals shall not exceed the following values, for all directions other than within ±3° of the GSO arc, under clear sky conditions:

21.5 - 25log(Θ) - 10log dBW/40kHz for 3.5° ≤ Θ ≤ 7°
0.37-10log(N) dBW/40kHz for 7° ≤ Θ ≤ 9.23°
24.5 - 25log(Θ) - 10log dBW/40kHz for 9.23° ≤ Θ ≤ 48°
-7.5-10log(N) dBW/40kHz for 48° ≤ Θ ≤ 180°

Where: Θ is the angle in degrees from the axis of the main lobe; for systems where more than one earth station is expected to transmit simultaneously in the same bandwidth, e.g., CDMA systems, N is the maximum number of simultaneously transmitting co-frequency earth stations in the receive beam of the satellite; N=1 for TDMA and FDMA systems.

(3) The values given in paragraphs (a)(1) and (2) of this section may be exceeded by 3 dB, for values of Θ >10°, provided that the total angular range over which this occurs does not exceed 20 deg. when measured along both sides of the GSO arc.

(4) GSO FSS earth station antenna off-axis EIRP spectral density for cross-polarized signals shall not exceed the following values, in all directions relative to the GSO arc, under clear sky conditions:

$8.5 - 25\log(\Theta) - 10\log(N)$ dBW/40kHz for $2.0° \leq \Theta \leq 7°$

$-12.63 - 10\log(N)$ dBW/40kHz for $7° \leq \Theta \leq 9.23°$

Where: Θ is the angle in degrees from the axis of the main lobe; for systems where more than one earth station is expected to transmit simultaneously in the same bandwidth, e.g., CDMA systems, N is the maximum number of simultaneously transmitting co-frequency earth stations in the receive beam of the satellite; N=1 for TDMA and FDMA systems.

(5) For earth stations employing uplink power control, the values in paragraphs (a)(1), (2), and (4) of this section may be exceeded by up to 20 dB under conditions of uplink fading due to precipitation. The amount of such increase in excess of the actual amount of monitored excess attenuation over clear sky propagation conditions shall not exceed 1.5 dB or 15 % of the actual amount of monitored excess attenuation in dB, whichever is larger, with a confidence level of 90 percent except over transient periods accounting for no more than 0.5% of the time during which the excess is no more than 4.0 dB.

(6) Power flux-density (PFD) at the Earth's surface produced by emissions from a space station for all conditions, including clear sky, and for all methods of modulation shall not exceed a level of -118 $dBW/m^2/MHz$, in addition to the limits specified in §25.208 (d).

(b) Each applicant for earth station license(s) that proposes levels in excess of those defined in paragraph (a) of this section shall submit link budget analyses of the operations proposed along with a detailed written explanation of how each uplink and each transmitted satellite carrier density figure is derived. Applicants shall also submit a narrative summary which must indicate whether there are margin shortfalls in any of the current baseline services as a result of the addition of the applicant's higher power service, and if so, how the applicant intends to resolve those margin short falls. Applicants shall certify that all potentially affected parties (i.e., those GSO FSS satellite networks that are 2, 4, and 6 degrees apart) acknowledge and do not object to the use of the applicant's higher power densities.

(c) Licensees authorized pursuant to paragraph (b) of this section shall bear the burden of coordinating with any future applicants or licensees whose proposed compliant operations at 6° or smaller orbital spacing, as defined by paragraph (a) of this section, is potentially or actually adversely affected by the operation of the non-compliant licensee. If no good faith agreement can be reached, however, the non-compliant licensee shall reduce its earth station and space station power density levels to be compliant with those specified in paragraph (a) of this section.

(d) The applicant shall provide for each earth station antenna type, a series of radiation patterns measured on a production antenna performed on a calibrated antenna range and, as a minimum, shall be made at the bottom, middle, and top frequencies of the 30 GHz band. The radiation patterns are:

(1) Co-polarized patterns for each of two orthogonal senses of polarizations in two orthogonal planes of the antenna.

(i) In the azimuth plane, plus and minus 10 degrees and plus and minus 180 degrees.

(ii) In the elevation plane, zero to 30 degrees.

(2) Cross-polarization patterns in the E- and H-planes, plus and minus 10 degrees.

(3) Main beam gain

(e) Protection of receive earth stations from adjacent satellite interference is based on either the antenna performance specified in §25.209(a) and (b), or the actual receiving earth station antenna performance, if actual performance provides greater isolation from adjacent satellite interference. For purposes of insuring the correct level of protection, the applicant shall provide, for each earth station antenna type, the antenna performance plots for the 20 GHz band, including the format specified in paragraph (d) of this section.

(f) The earth station licensee shall not transmit towards a GSO FSS satellite unless it has prior authorization from the satellite operator or a space segment vendor authorized by the satellite operator. The specific transmission shall be conducted in accordance with the operating protocol specified by the satellite operator.

(g) A licensee applying to renew its license must include on FCC Form 405 the number of constructed earth stations.

§25.201 Definitions

(7) Equivalent diameter. When circular aperture reflector antennas are employed, the size of the antenna is generally expressed as the diameter of the antenna's main reflector. When non-reflector or non-circular aperture antennas are employed, an equivalent diameter can be computed for the antenna. The equivalent diameter is the diameter of a hypothetical circular aperture antenna with the same aperture area as the actual antenna. For example, an elliptical aperture antenna with major axis, a, and minor axis, b, will have an equivalent diameter of $[a \text{ x } b\}^{1/2}$. A rectangular aperture antenna with length, l, and width, w, will have an equivalent diameter of $[(l \text{ x } w)4/\pi]^{1/2}$.

(10) Full Transponder. Radio emissions or transmissions that occupy, or nearly occupy, the entire satellite transponder power and/or bandwidth.

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§25.209 Antenna performance standards.

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

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

29 - 25 log10 (Theta) dBi	1° </= Theta </= 7°
+8 dBi	7° < Theta </= 9.2°
32 - 25 log10 (Theta) dBi	9.2° < Theta </= 48°
-10 dBi	48° < Theta </= 180°

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

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

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

32 - 25 log10 (Theta) dBi	1° </= Theta </= 48°
-10 dBi	48° < Theta </= 180°

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

(3) For an earth station employed for transmissions in the conventional Ku-band (14.0-14.5 GHz):

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

29 - 25 log10 (Theta) dBi	1° </= Theta </= 7°
+8 dBi	7° < Theta </= 9.2°
32 - 25 log10 (Theta) dBi	9.2° < Theta </= 48°

-10 dBi 48° < Theta </= 85°
0 dBi 85° < Theta </= 180°

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

(ii) In all other directions, or in the plane of the horizon including any out-of-plane potential terrestrial interference paths:
Outside the main beam, the gain of the antenna shall lie below the envelope defined by:

32 - 25 log10 (Theta) dBi 3° </= Theta </= 48°
-10 dBi 48° < Theta </= 85°
0 dBi 85° < Theta </= 180°

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

(iii) For antennas with dimensions in the GSO plane from 1.2 to 1.8 meters, the starting point of the antenna gain envelope is at 1.25 degrees instead of 1 degree as stipulated in the above section (i).

(iv) For antennas with dimensions in the GSO plane less than 1.2 meter, the starting point of the antenna gain envelope is at 1.5 degrees instead of 1 degree as stipulated in the above section (i).

(4) For an earth station antenna employed for transmissions in the conventional C-band (5.925-6.425 GHz) with dimensions in the GSO plane less than 4.5 meters and greater than or equal to 2.4 meters, the starting point of the antenna gain envelope shall be less than 1.7 degrees instead of the 1 degree as stipulated in sections (1) and (2).

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

19 - 25 log10 (Theta) dBi	1.8° < Theta </= 7°
-2 dBi	7° < Theta </= 9.2°

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

(d) The patterns specified in paragraphs (a) and (b) of this section shall apply to all earth station antennas after [insert date of Commission's Second Report and Order].

(e) The operations of any earth station with an antenna not conforming to the standards of paragraphs (a) and (b) of this section shall impose no limitations upon the operation, location or design of any terrestrial station, any other earth station, or any space station beyond those limitations that would be expected to be imposed by an earth station employing an antenna conforming to the reference patterns defined in paragraphs (a) and (b) of this section.

(f) An earth station with a~~n~~ transmitting antenna not conforming to the standards of paragraph~~s~~ (a) and (b) of this section will be authorized upon finding by the Commission that the antenna will not cause unacceptable levels of interference under conditions of uniform 2° orbital spacing. An earth station antenna initially authorized on or before February 15, 1985 will be authorized by the Commission to continue to operate as long as such operations are found not to cause unacceptable levels of adjacent satellite interference. In either case, the Commission will impose appropriate terms and conditions in its authorization of such facilities and operations. The applicant has the burden of demonstrating that its transmitting antenna not conforming to the standards of paragraph~~s~~ (a) and (b) of this section will not cause unacceptable interference. This demonstration must comply with the procedures set forth in § 25.220 of this Chapter.

(g) Reserved.

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

29 - 25log (θ) dBi	$1° \leq \theta < 36°$
-10 dBi	$36° \leq \theta \leq 180°$

where θ is the angle in degrees from the axis of the main lobe, and dBi refers to dB relative to an isotropic radiator. For the purposes of this section, the peak gain of an individual sidelobe may not exceed the envelope defined above.

§25.211: Analog Video ~~t~~ Transmissions in the Fixed-Satellite Service.

(a) Downlink analog video transmissions in the band 3700-4200 MHz shall be transmitted only on a center frequency of 3700 + 20N MHz, where N=1 to 24. The corresponding uplink frequency shall be 2225 MHz higher.

(b) All 4/6 GHz analog video transmissions shall contain an energy dispersal signal at all times with a minimum peak-to-peak bandwidth set at whatever value is necessary to meet the power flux density limits specified in §25.208(a) and successfully coordinated internationally and accepted by adjacent U.S. satellite operators based on the use of state of the art space and earth station facilities. Further, all transmissions operating in frequency bands described in §25.208(b) and (c) shall also contain an energy dispersal signal at all times with a minimum peak-to-peak bandwidth set at whatever value is necessary to meet the power flux density limits specified in §25.208(b) and (c) and successfully coordinated internationally and accepted by adjacent U.S. satellite operators based on the use of state of the art space and earth station facilities. The transmission of an unmodulated carrier at a power level sufficient to saturate a transponder is prohibited, except by the space station licensee to determine transponder performance characteristics. All 12/14 GHz video transmissions for TV/FM shall identify the particular carrier frequencies for necessary coordination with adjacent U.S. satellite systems and affected satellite systems of other administrations.

(c) All initial analog video transmissions shall be preceded by a video test transmission at an uplink e.i.r.p. at least 10 dB below the normal operating level. The earth station operator shall not increase power until receiving notification from the satellite network control center that the frequency and polarization alignment are satisfactory pursuant to the procedures specified in §25.272. The stationary earth station operator that has successfully transmitted an initial video test signal to a satellite pursuant to this paragraph is not required to make subsequent video test transmissions if subsequent transmissions are conducted using exactly the same parameters as the initial transmission.

(d) An earth station may be routinely licensed for transmission ~~to~~ of full-transponder analog video services provided:

  (1) In the 6 GHz band, with an antenna dimension of 4.5 to 9 meters in the geostationary satellite orbital plane, the maximum power into the antenna does not exceed 26.5 dBW; or

  (2) In the 14 GHz band, with an antenna dimension of 1.2 to 5 meters in the geostationary satellite orbital plane, the maximum power into the antenna does not exceed 27 dBW.

(e) Antennas with dimension smaller than those specified in paragraph (d) of this section will not be routinely licensed for transmission of full transponder analog video services.

(f) Each applicant for authorization for analog video in the fixed-satellite service proposing to use transmitted satellite carrier EIRP densities, and/or maximum power into the antenna in excess of those specified in Section 25.211(d), must comply with the procedures set forth in § 25.220 of this Chapter.

§25.212 Narrowband Analog ŧ Transmissions and Digital Transmissions in the GSO Fixed-Satellite Service.

(a) Except as otherwise provided by these rules and regulations, criteria for unacceptable levels of interference caused by other satellite networks shall be established on the basis of nominal operating conditions and with the objective of minimizing orbital separations between satellites.

(b) Emissions with an occupied bandwidth of less than 2 MHz are not protected from interference from wider bandwidth transmissions if the r.f. carrier frequency of the narrowband signal is within ±1 MHz of one of the frequencies specified in §25.211(a).

(c) In the 12/14 GHz band,

(i) an earth station whose transmit pattern meets the requirements of paragraph (a) and (b) of Section 25.209 may be routinely licensed under this Section 25.212 for transmission of narrowband analog services with bandwidths up to 200 kHz if the maximum input power spectral density into the antenna flange does not exceed -8 dBW/4 kHz and the maximum transmitted satellite carrier EIRP spectral density does not exceed 13 dBW/4 kHz,

(ii) an earth station whose transmit pattern meets the requirements of Section 25.209(a) and Section 25.209(b) may be routinely licensed under this Section 25.212 for transmission of digital services if the maximum input power spectral density into the antenna of the earth station does not exceed –14dBW/4kHz - 10log(N) where N is defined in Section 25.134(a)(1) of this Chapter, or in the case of full transponder digital video services, the maximum power into the antenna flange does not exceed 27 dBW for an antenna with a dimension of 1.2 meters to 5 meters in the geostationary orbital plane, and, either

(1) the maximum transmitted satellite carrier EIRP spectral density does not exceed 9dBW/4kHz, or

(2) the maximum transmitted satellite carrier EIRP spectral density exceeds 9 dBW/4kHz but does not exceed 13dBW/4kHz and provided that the operator/licensee of the satellite(s) on which the applicant wishes to use such power level has successfully coordinated that power level with adjacent satellite operators.

Earth stations in the 14 GHz band not meeting the applicable requirements of clause (i) or (ii) are subject to the provisions of §25.220 of this chapter.

(d)(1) In the 6 GHz band, an earth station with an antenna dimension of 4.5 meters or greater in the geostationary satellite orbital plane may be routinely licensed for transmission of SCPC services if the maximum input power spectral densities into the antenna flange do not exceed + 0.5 dB(W/4kHz) for analog SCPC carriers with bandwidths up to 200 kHz and do not exceed –2.7 – 10log(N) dB (W/4kHz) for digital carriers.

(i) For digital transmissions using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one.

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

(d)(2) In the 6 GHz band, for an earth station with an antenna dimension of 2.4 meters or greater but less than 4.5 meters in the geostationary plane, the antenna may be routinely licensed for transmission of analog SCPC carriers with bandwidth up to 200 kHz or digital carriers, if the maximum power density into the antenna flange does not exceed –12 dB(W/4kHz) for analog carriers, and –12-10log(N) dB(W/4kHz) for digital carriers, where N is defined in (d)(1). To prevent unacceptable interference into adjacent satellites, the applicant for the 2.4 m antenna shall certify that the antenna would be installed such that it would not misaligned by more than 0.5 degrees from the intended satellite.

(d)(3) In the 6 GHz band, antennas with a dimension smaller than 2.4 meters in the geostationary satellite orbital plane are subject to the provisions of §25.220 of this chapter.

(e) Each applicant for authorization for narrowband analog transmissions and/or digital transmissions in the fixed-satellite service proposing to use transmitted satellite carrier EIRP densities, and/or maximum antenna input power densities in excess of those specified in paragraph (c) of this Section for Ku-band service, or paragraph (d) of this Section for C-band service, respectively, must comply with the procedures set forth in § 25.220 of this Chapter.

§ 25.220 Non-conforming transmit earth station operations in the C and Ku bands.

(a)(1) This Section 25.220 applies to earth station applications for antennas proposed to operate in the C band and/or Ku band in which:

(i) the transmit portion of the proposed antenna does not conform to the standards of §25.209(a) and (b) of this Chapter, and/or

(ii) the proposed transmit power density levels are in excess of those specified in §25.134, §25.211, or §25.212 of this Chapter, or those derived by the procedure set forth in paragraph (c) of this Section, whichever is applicable.

Protection from interference will be provided for the receive portion of such antennas to the extent specified in Section 25.209(c),

(2) The requirements for petitions to deny applications filed pursuant to this section are set forth in Section 25.154 of this Chapter.

(b) If the transmit portion of the antenna proposed for use by the applicant does not comply with the antenna performance standards contained in §25.209(a) and (b), the applicant must provide, as an exhibit to its FCC Form 312 application, the antenna gain patterns specified in §25.132(b) of this Chapter.

(c) If the transmit portion of the antenna proposed for use by the applicant does not comply with the antenna performance standards contained in §25.209(a) and (b), the applicant must meet the requirements of either this paragraph (c), paragraph (d)(1), or paragraph (d)(2) of this Section, as applicable, to obtain authority to transmit.

The applicant must provide:

(i) in its Form 312, Schedule B, the power and power density levels that result by reducing the values stated in §25.134, §25.211, or §25.212, whichever is applicable, by the number of decibels that the non-compliant antenna fails to meet the antenna performance standards of §25.209(a) and (b), and

(ii) statement(s) that the operator(s) of the satellite(s) with which the applicant is seeking authority to communicate has obtained from the adjacent satellite operators within 3 degrees, indicating that the operation of the proposed antenna has been coordinated.

(d)(1) If the transmit portion of the antenna proposed for use by the earth station applicant does not comply with the antenna performance standards contained in paragraph (a) or (b) of Section 25.209, and neither paragraph (c) nor (d)(2) of this section applies, and/or the antenna has transmitted satellite carrier EIRP densities, and/or maximum input power spectral density into the antenna flange in excess of the levels in §25.134, §25.211, §25.212, the following shall be provided as an exhibit to the earth station application:

(i) a statement from the satellite operator acknowledging that the proposed operation of the subject non-conforming earth station with its satellite(s) has the potential to create interference to adjacent satellite networks that may be unacceptable.

(ii) statement(s) that the operator(s) of the satellite(s) with which the applicant is seeking authority to communicate has obtained from the adjacent satellite operators within 6 degrees, indicating that the operation of the subject non-conforming Earth Station has been coordinated.

(iii) a statement from the satellite operator that it will include the subject non-conforming Earth Station operations with respect to the antenna performance standards referenced in paragraph (d)(1) of this section, power and power densities in all future satellite network coordinations, and

(v) a statement from the Earth Station applicant certifying that it will comply with all coordination agreements reached by the satellite operator(s).

(2) For an antenna operating in the 14 GHz band, with dimension in the GSO plane less than 1.2 meters, if the transmit portion of the antenna proposed for use by the earth station applicant does not comply with the antenna performance standards contained in paragraph (a) or (b) of Section 25.209 because the actual gain envelope intersects the gain envelope in paragraph (a)(3) of 25.209 above 1.5 degrees and up to and including 1.8 degrees, the applicant shall submit during the earth station license application phase either (i) a technical showing demonstrating how the required maximum pointing accuracy will be met during antenna installation or (ii) a coordination agreement between the operator of the satellite with which the earth station will communicate, and the satellite operators within two degrees of the satellite with which the earth station will communicate. The required maximum antenna pointing error (pe) towards the desired satellite shall not exceed:

$$pe = 2 - x \text{ , degrees} \qquad 1.5 < x \leq 1.8$$

where x is the starting point of antenna gain envelope of the antenna.

(3) A license granted pursuant to paragraph (d)(1) of this section will include, as a condition on that license, that if no good faith agreement can be reached between the satellite

operator and the operator of a future 2° compliant satellite, the earth station operator shall reduce its power to those levels that would accommodate the 2° compliant satellite.

§ 25.271 Control of transmitting stations.

(a) The licensee of a facility licensed under this Part is responsible for the proper operation and maintenance of the station.

(b) The licensee of a transmitting earth station licensed under this Part shall ensure that a trained operator is present on the earth station site, or at a designated remote control point for the earth station, at all times that transmissions are being conducted. No operator's license is required for a person to operate or perform maintenance on facilities authorized under this Part.

(c) Authority will be granted to operate a transmitting earth station by remote control only on the conditions that:

(1) The parameters of the transmissions of the remote station monitored at the control point, and the operational functions of the remote earth stations that can be controlled by the operator at the control point, are sufficient to insure that the operations of the remote station(s) are at times in full compliance with the remote station authorization(s);

(2) The earth station facilities are protected by appropriate security measures to prevent unauthorized entry or operations;

(3) Upon detection by the licensee, or upon notification from the Commission of a deviation or upon notification by another licensee of harmful interference, the operation of the remote station shall be immediately suspended by the operator at the control point until the deviation or interference is corrected, except that transmissions concerning the immediate safety of life or property may be conducted for the duration of the emergency; and

(4) The licensee shall have available at all times the technical personnel necessary to perform expeditiously the technical servicing and maintenance of the remote stations.

(d) The licensee shall insure that the licensed facilities are properly secured against unauthorized access or use whenever an operator is not present at the transmitter.

(e) The licensee of an NGSO FSS system operating in the 10.7-14.5 GHz bands shall maintain an electronic web site bulletin board to list the satellite ephemeris data, for each satellite in the constellation, using the North American Aerospace Defense Command (NORAD) two-line orbital element format. The orbital elements shall be updated at least once every three days.

(f) VSAT licensees in the conventional Ku-Band shall have and maintain the capability to specifically identify the originating terminal for digital transmissions from sub-meter antennas within their network through reception of those transmissions, or through other network control mechanisms.

§25.274 Procedures to be followed in the event of harmful interference.

(a) The earth station operator whose transmission is suffering harmful interference shall first check the earth station equipment to ensure that the equipment is functioning properly.

(b) The earth station operator shall then check all other earth stations in the licensee's network that could be causing the harmful interference to ensure that none of the licensee's earth stations are the source of the interference and to verify that the source of interference is not from a local terrestrial source.

(c) After the earth station operator has determined that the source of the interference is not another earth station operating in the same network or from a terrestrial source, the earth station operator shall contact the satellite system control center and advise the satellite operator of the problem. The control center operator shall observe the interference incident and make reasonable efforts to determine the source of the problem. A record shall be maintained by the control center operator and the earth station operator of all harmful interference incidents and their resolution. These records shall be made available to an FCC representative on request.

(d) Where the suspected source of the interference incident is the operation of an earth station licensed to operate on one or more of the satellites in the satellite operator's system, the control center operator shall advise the offending earth station of the harmful interference incident and assist in the resolution of the problem where reasonably possible.

(e) The earth station licensee whose operations are suspected of causing harmful interference to the operations of another earth station shall take reasonable measures to determine whether its operations are the source of the harmful interference problem. Where the operations of the suspect earth station are the source of the interference, the licensee of that earth station shall take all measures necessary to eliminate the interference.

(f) At any point, the system control center operator may contact the Commission's Columbia Operations Center in Columbia, Maryland to assist in resolving the matter. This office specializes in the resolution of satellite interference problems. All licensees are required to cooperate fully with the Commission in any investigation of interference problems.

(g) Where the earth station suspected of causing interference to the operations of another earth station cannot be identified or is identified as an earth station operating on a satellite system other than the one on which the earth station suffering undue interference is operating, it is the responsibility of a representative of the earth station suffering harmful interference to contact the control center of other satellite systems.

(h) For sub-meter antennas operating in the conventional Ku-band, upon receipt of a complaint of harmful interference from an adjacent satellite operator, to include information on the:

- time of day and duration of interference event(s)
- frequency of occurrence of interference event(s)
- center frequency and polarization of interfering signal(s)
- information, if any, within the possession of the satellite operator on the geographical location of interfering terminal(s)
- if possible, spectral signature (bandwidth, power, other identifying features) of interfering signal(s)

the licensee of the potentially interfering transmitting terminal, in cooperation with the interfered-with satellite network operator, shall work expeditiously to identify the specific sub-meter transmitting antenna causing the harmful interference.

(i) Upon identification of the specific sub-meter transmitting terminal causing the harmful interference, the licensee of such terminal shall promptly take action to eliminate such harmful interference.