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

In the Matter of	)	
	)	
The Establishment of Policies and Service Rules for the	)	
Broadcasting-Satellite Service at the 17.3-17.7 GHz	)	
Frequency Band and at the 17.7-17.8 GHz Frequency	)	
Band Internationally, and at the 24.75-25.25 GHz	)	IB Docket No. 06-123
Frequency Band for Fixed Satellite Services Providing	)	
Feeder Links to the Broadcasting-Satellite Service and	)	
for the Satellite Services Operating	)	
Bi-directionally in the 17.3-17.8 GHz Frequency Band	)	

To: The Commission

COMMENTS OF SES AMERICOM, INC.

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SUMMARY

SES Americom urges the Commission to act quickly to adopt a regulatory framework for 17/24 GHz BSS so that rules will be in place when the allocation takes effect next April. Exploitation of 17/24 GHz spectrum will permit the entry of new competitors for residential video services, facilitate the delivery of video to mobile users, and enhance the service quality and range of options available to government, enterprise, and educational private networks. However, investment in this important spectrum band – and the use of the band for innovative services to the public – will be significantly delayed if the Commission does not act expeditiously here.

In establishing service rules for 17/24 GHz BSS, the Commission's objective should be to permit new entrants to compete on a level playing field with current providers. Accordingly, the Commission should provide interference protection to user terminals as small as 45 centimeters, apply technical standards consistent with achieving service availability of 99.9%, and take steps to ensure that sufficient capacity is available to implement competing systems.

SES Americom proposes that orbital locations for 17/24 GHz systems be spaced four degrees apart and conform to the plan found in Table 1 herein. SES Americom's spacing proposal will optimize use of spectrum/orbital resources by permitting deployment of a large number of space stations capable of serving the U.S. while still allowing use of the small receive terminals that are most attractive to many consumers.

In order to promote co-frequency operation by adjacent satellites in the 17/24 GHz band, the Commission should adopt the off-axis e.i.r.p. density limits proposed in the *Notice* and impose a uniform downlink pfd limit of −113 dBW/m^2/MHz. SES Americom

believes that the issues raised by reverse band sharing can be addressed through coordination of ground stations and offsetting 17/24 GHz space stations from DBS satellites by .2-.3 degrees. We agree that there is no reason to impose polarization or channelization requirements in this band.

SES Americom recommends that the Commission use its existing first come, first served procedures for licensing 17/24 GHz space stations and apply the *DISCO II* framework to requests for U.S. market access by foreign licensees. Finally, if the Commission chooses to apply public interest programming and EAS delivery requirements to operations in the 17/24 GHz band, these obligations should be imposed directly on programming distributors, not on those who only provide space segment capacity to such distributors.

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To: The Commission

COMMENTS OF SES AMERICOM, INC.

SES Americom, Inc. ("SES Americom"), by its attorneys and pursuant to Section 1.415 of the Commission's Rules, 47 C.F.R. § 1.415, hereby submits its comments in response to the Notice of Proposed Rulemaking in the above-captioned proceeding, FCC 06-90, rel. June 23, 2006 ("*Notice*"). SES Americom urges the Commission to act expeditiously to adopt a regulatory framework for Broadcasting Satellite Service ("BSS") in the 17/24 GHz bands that will facilitate the entry of new competitors and the introduction of innovative services for U.S. consumers.

INTRODUCTION AND BACKGROUND

SES Americom has a strong interest in the development of rules to govern the use of the 17/24 GHz BSS spectrum in the United States. SES Americom is a leading provider of satellite telecommunications. SES Americom (formerly GE American Communications, Inc.)

launched its first satellite in 1976, and since then the system has grown to its present size of sixteen in-orbit Fixed Satellite Service ("FSS") spacecraft operating in the C-, Ku-, and Ka-bands. SES Americom also has an application pending before the Commission for authority to serve the U.S. market from a Direct Broadcast Satellite ("DBS") spacecraft to be located at 105.5° W.L.[1]

SES Americom offers a wide variety of satellite services to the public, including video and audio services to cable head-ends and capacity used for direct-to-home ("DTH") video services. SES Americom has been at the forefront of developing advanced satellite-based distribution systems for video and other services. For example, SES Americom's IP-PRIME™ platform allows service providers to affordably offer hundreds of high-quality video channels to consumers through a "virtual headend." The network uses next-generation MPEG-4 technology to enable programming that is packaged at SES Americom's IPTV broadcast center in Vernon Valley, New Jersey, to be distributed to video hubs anywhere in the country.

SES Americom is committed to continuing and expanding its leadership in the field by pursuing opportunities to deploy 17/24 GHz satellites to provide service to U.S. customers. To that end, SES Americom has been exploring options for deploying facilities in this band that are capable of providing U.S. service, either from a foreign-licensed or U.S.-licensed orbital location. Accordingly, SES Americom expects to be an active participant in this spectrum band.

The *Notice* seeks comment on a wide variety of issues relevant to the development of rules and policies for operations in the 17/24 GHz band. SES Americom urges

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[1] In the matter of SES Americom, Inc., Petition for Declaratory Ruling to Serve the U.S. Market Using BSS Spectrum from the 105.5° W.L. Orbital Location, FCC File No. SAT-PDR-200220425-00071.

the Commission to expeditiously adopt a regulatory framework for 17/24 GHz operations in order to provide certainty to prospective operators in advance of the effective date of the new allocation on April 1, 2007. Delay in finalizing the rules will deter investment in this important spectrum band and slow the delivery of new services to the public.

I. 17/24 GHz BSS SPECTRUM WILL ENABLE INTRODUCTION OF SIGNIFICANT NEW SERVICES

Adopting rules for use of the 17/24 GHz spectrum allocation will permit deployment of a range of services to individuals, businesses, and government users. The *Notice* recognizes the promise of the 17/24 GHz BSS band:

> The 17/24 GHz BSS will introduce a new generation of broadband services to the public, providing a mix of local and domestic video, audio, data, video-on-demand and multimedia services to residential and business subscribers in the United States. The services will potentially include standard-definition and high-definition formats and, in certain cases, may complement existing direct broadcast satellite (DBS) services. This should provide U.S. consumers with access to a wider variety of services and suppliers. Increased competition may also lead to reduced prices for those services and further technological innovation. *Notice* at ¶ 2 (footnotes omitted).

SES Americom agrees that exploiting this newly available spectrum as soon as possible will lead to significant public interest benefits. The 17/24 GHz band represents "green field" spectrum available to accommodate service demands that cannot be met in current Ku-band DBS bandwidth, which is fully occupied by the incumbent providers. In particular, we see three major areas where new 17/24 GHz BSS systems will play an important role.

<u>Video Delivery to Residential Users</u>: First, this band will significantly increase the available capacity for delivery of video programming to residential users at fixed locations. As a result, the spectrum will permit new competition to existing DBS operators.

The Commission has recognized that introduction of new competitors in the residential video market segment would serve the public interest. Access to new 17/24 GHz BSS spectrum provides an important opportunity for the development of such competition in this critical market segment, especially in areas where terrestrial multi-channel video services are limited.[2]

Video Delivery to Mobile Users: Second, the 17/24 GHz BSS band can be used by multi-channel video service providers and mobile service operators to offer mobile video services, including video delivery to vehicles. Similar services today require a large, heavy and expensive antenna that severely limits marketability. Technologies are available that would permit use of a smaller, lighter, less costly terminals, but these technologies require access to spectrum, and Ku-band DBS spectrum is fully occupied by existing services to fixed users. The availability of new spectrum for BSS services will therefore provide a foundation for deployment of new mobile video services on a significant scale.

Video Delivery for Enterprise, Government, and Educational Applications: Third, 17/24 GHz spectrum offers the prospect of significant service improvements for private network video delivery applications that have traditionally relied upon Ku-band FSS capacity. Use of Ka-band spectrum will permit significant cost savings and quality improvements in this market segment. Specific applications include telemedicine, corporate training, and distance learning.

Thus, the availability of new spectrum for BSS services will create opportunities for additional competition, enhancement of existing service offerings, and development of new services to the benefit of U.S. consumers.

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[2] *See, e.g., Application of EchoStar Communications Corporation, General Motors Corporation, and Hughes Electronics Corporation, Transferors, and EchoStar Communications Corporation, Transferee*, Hearing Designation Order, FCC 02-284 (2002) at ¶ 89.

II. THE RULES FOR 17/24 GHz BSS SHOULD BE DESIGNED TO PROMOTE COMPETITION IN THE U.S. DBS/DTH MARKET

The Commission's objective in this proceeding should be the development of technical and procedural rules for 17/24 GHz BSS that encourage market entry by new suppliers and the expedited introduction of new service offerings. This requires that providers of 17/24 GHz BSS services be able to compete on a level playing field with existing DBS operators.

As discussed above, the *Notice* foresees substantial benefits to U.S. customers from implementation of 17/24 GHz systems. These benefits, however, can only be realized if the Commission takes immediate steps to ensure that the applicable service rules do not create obstacles to emerging competition. In particular, although the Commission acknowledges that 17/24 GHz BSS "may complement" existing DBS services (*Notice* at ¶ 2), the new capacity should not be relegated to a mere DBS add-on. Instead, the rules and policies for 17/24 GHz BSS should enable use of this spectrum for introduction of stand-alone services that are comparable to DBS offerings in customer appeal, performance, and capacity.

Specifically, the Commission should protect from interference user terminals as small as 45 centimeters, apply technical standards consistent with achieving service availability of 99.9%, and take steps to ensure that sufficient capacity is available to implement a competing system.

A. Consumer Antennas as Small as 45 Centimeters Should Be Protected

One critical factor in driving consumer acceptance of a new residential video service is antenna size. SES Americom urges the Commission to adopt a minimum antenna size of 45 centimeters for 17/24 GHz BSS operations so that the new service can compete with existing DBS offerings using small consumer terminals.

The 45 centimeter dish is the minimum size that all current U.S. applicants for 17/24 GHz systems have proposed to deploy, and has historically been the standard user equipment for DBS operators. The *Notice* acknowledges this, observing that DBS consumers "commonly purchase receive antennas on the order of 45 cm in diameter." *Notice* at ¶ 33. The Commission asks, however, whether limiting protection to larger antennas might be justified in order to achieve closer orbital spacing. *Id*. In particular, the Commission notes that larger dishes are accepted in other countries and are used in the U.S. to permit consumers to access multiple satellite feeds or to overcome rain fade effects. *Id*.

SES Americom strongly believes that limiting interference protection to terminals larger than those commonly used for DBS today would seriously limit the usefulness of the 17/24 GHz BSS band for new competition. Although it is true that some DBS customers today currently use the larger terminals, either because they receive service packages that require access to multiple orbital locations or because they need a larger dish to get satisfactory availability, these customers remain in the minority. Forcing a new entrant using the 17/24 GHz band to employ larger dishes would preclude the entity from effectively competing for the significant portion of the customer base for whom dish size is an important issue. A new service provider is unlikely to be able to survive in the market with such a significant competitive disadvantage vis-à-vis the existing DBS operators. Thus, a Commission decision not to protect 45 centimeter user terminals in the 17/24 GHz BSS spectrum would seriously impair a new entrant's ability to use this band for a stand-alone system.

Instead, protection only of larger dishes would effectively reinforce the market position of current DBS providers. These operators could continue to deploy small antennas to customers who require them, but use the 17/24 GHz band for additional capacity that could be

targeted to users who will accept larger antennas in order to access more programming. In both these market segments the incumbent DBS provider would have a significant advantage over a potential competitor. Customers for whom small antenna size is important would choose traditional DBS service because 17/24 GHz BSS would be required to use larger dishes. Moreover, even customers willing to accept a larger antenna to get additional programming capacity are likely to prefer the incumbent operator over a stand-alone 17/24 GHz BSS entrant, because the incumbent will be in a position to combine DBS and 17/24 GHz BSS spectrum to offer more programming choices.

Thus, the Commission can achieve the promise of new competition recognized in the *Notice* only by ensuring the ability of 17/24 GHz band operators to employ equipment that is comparable in size to standard DBS terminals. Protecting dishes as small as 45 centimeters is necessary to allow 17/24 GHz systems to compete on an equal basis for customers, while still permitting the option of using larger antennas as necessary to overcome rain fade or afford access to multiple feeds. Accordingly, the Commission should set 45 centimeters as the minimum antenna size entitled to interference protection in the 17/24 GHz BSS band.

B. Technical Requirements for 17/24 GHz BSS Systems Should Be Set to Achieve a 99.9% Signal Availability Level

In order to successfully compete with incumbent DBS services, a new 17/24 GHz BSS system must also be able to provide a service availability level that is comparable to DBS. The *Notice* recognizes that service availability is an important service parameter, and seeks comment on the availability level that the Commission should seek to protect. *Notice* at ¶ 42.

SES Americom urges the Commission to design technical rules for 17/24 GHz BSS, including the applicable power flux density ("pfd") limit, to allow systems to achieve a 99.9% availability level, comparable to that of DBS. New entrants in 17/24 GHz spectrum will

need the ability to offer customers service availability that is similar to that of existing DBS systems. A lower availability level would be a material disadvantage that the incumbent DBS operators would be able to exploit in defending their customer bases against competing 17/24 GHz systems and in seeking to gain new customers who might otherwise purchase service from a 17/24 GHz entrant.

Thus, in establishing technical rules for the 17/24 GHz band, the Commission should seek to provide operators with the ability to achieve a service availability level of at least 99.9%. In particular, as discussed in more detail below, SES Americom recommends that the Commission impose a downlink pfd limit of –113 dBW/m^2/MHz, which we derived using a 99.9% availability assumption. *See* Technical Appendix, Section A-3.

C. Commission Policies Should Facilitate Spectrum Access for New Entrants

A final critical element for new competitors is access to sufficient spectrum to allow the delivery of programming packages of comparable size and diversity to those of incumbent providers. This will require a new entrant to be able to deploy multiple BSS and/or FSS spacecraft within a portion of the orbital arc.

SES Americom has estimated the amount of capacity necessary to provide sufficient national and local programming channels to offer packages that would be comparable to those offered today by DBS operators. Based on our calculations, a total bandwidth requirement of approximately 9-10 Gbps would be required to permit a new entrant to offer a sufficient number of national and local channels (a significant portion of which would be in high definition format) to compete with existing service providers. This equates to approximately three BSS slots or two BSS slots combined with an FSS slot within a portion of the full-CONUS orbital arc no greater than 20 degrees from end to end.

In developing its policies for this band, the Commission must take into account the need for new entrants to accumulate this amount of spectrum. In particular, the Commission should not adopt limits on 17/24 GHz applications and licenses that would unduly restrict a new entrant's spectrum access. The *Notice* observes that in other bands the Commission allows entities to maintain up to five applications and/or licenses for unbuilt systems and asks whether it should impose tighter limits in the 17/24 GHz band. *Notice* at ¶ 10. In light of the need for a new competitor to use spectrum at multiple orbital locations, SES Americom urges the Commission not to place stricter constraints on 17/24 GHz applicants than those that apply in other bands.

The Commission also should take these spectrum requirements into account in its consideration of issues relating to spacing in the DBS bands.[3] Making available additional orbital locations in DBS spectrum will likely be necessary to allow a new entrant to accumulate sufficient capacity to compete with the current incumbents.[4]

III. ORBITAL ASSIGNMENTS FOR 17/24 GHz SATELLITES SERVING THE U.S. SHOULD BE SEPARATED BY 4 DEGREES AND SHOULD CONFORM TO THE LOCATIONS LISTED IN TABLE 1

The *Notice* seeks comment on multiple issues relating to the assignment of orbital locations for 17/24 GHz BSS systems and related matters regarding antenna performance. *Notice* at ¶¶ 35-43. As a threshold matter, the Commission asks whether it should adopt an orbital spacing policy for the 17/24 GHz band and if so, what spacing should be used. The

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[3] *See Amendment of the Commission's Policies and Rules for Processing Applications in the Direct Broadcast Satellite Service and Feasibility of Reduced Orbital Spacing for Provision of Direct Broadcast Satellite Service in the United States*, Notice of Proposed Rulemaking, FCC 06-120 (rel. Aug. 18, 2006) ("*DBS Spacing Notice*").

[4] SES Americom will comment more fully on the issues raised in the DBS spacing proceeding at the appropriate time.

Commission also requests input regarding whether the orbital locations for this spectrum should be aligned with satellite positions used for other frequency bands. The Commission asks whether its spacing policy should be uniform, or whether different spacing schemes should be applied in different segments of the orbital arc. Finally, the Commission solicits comment regarding whether antenna performance standards should be adopted for user terminals in this band.

SES Americom supports adoption of a spacing policy for 17/24 GHz BSS that requires applicants for U.S. licenses or seeking to serve the U.S. market to be spaced 4 degrees apart throughout the orbital arc capable of serving the U.S.. Interference protection should be limited to receive antennas that comply with technical standards for operation at 4 degree spacing. SES Americom proposes that 17/24 GHz orbital locations be offset from the assignments in the Appendix 30/30A Plan (the "Plan") of the ITU Radio Regulations in order to facilitate stationkeeping and mitigate potential interference issues. SES Americom proposes specific orbital locations for 17/24 GHz band systems in Table 1 below.

SES Americom believes that the spacing policy it outlines here will best serve the public interest by facilitating optimum use of the 17/24 GHz band to introduce new competition and innovative services for end users.

A. Requiring Orbital Spacing of 4 Degrees for 17/24 GHz Spacecraft Will Allow Use of 45 Centimeter User Terminals

Commission adoption of an orbital spacing policy for the 17/24 GHz band is necessary to provide certainty to providers and customers of U.S. BSS services. SES Americom proposes use of a minimum separation of 4 degrees between spacecraft serving the U.S. in order to facilitate use of 45 centimeter antennas.

The *Notice* observes that "there is merit in considering an orbital spacing policy for the 17/24 GHz BSS band that is different from either two or nine degrees," the separations used for FSS and DBS satellites today. *Notice* at ¶ 39. The Commission goes on to explain that using the FSS two degree model "would necessitate deployment of subscriber antennas with diameters that may be unacceptably large for the direct-to-home market." *Id*. Nine degree spacing, on the other hand, would limit the number of orbital locations available. The Commission seeks to determine "what orbital spacing best advances the competing goals of permitting small-diameter receiving antennas and relatively high-power transmissions, while simultaneously allowing for the greatest occupancy of the geostationary satellite orbit." *Id*.

As discussed above, SES Americom views accommodating 45 centimeter dishes as critical in order to permit use of the 17/24 GHz band to introduce new competition to incumbent DBS operators. SES Americom's technical analysis, which is provided in Section A-1 of the Technical Appendix, demonstrates that a minimum orbital spacing of 4 degrees allows deployment of 45 centimeter dishes while still providing a significant increase in the number of orbital locations available for U.S. service over the assignments in the DBS band.

Specifically, our analysis, which uses the ITU Recommendation BO.1213 reference pattern to characterize DTH antennas, indicates that the minimum orbital spacing needed to protect operations with 45 centimeter dishes is 4 degrees.[5] As a result, using spacing of less than 4 degrees would preclude use of 45 centimeter dishes in the 17/24 GHz band. The *Notice* reaches the same conclusion, observing that:

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[5] *See also Notice* at ¶ 45 ("antenna diameters of 0.45 m may be accommodated with orbital spacing of about four degrees"); *Notice* at ¶ 38 (Intelsat application states that "from the point of view of mutual interference, an orbital spacing of four-degrees is the minimum separation required for adequate provision of service to receiving earth stations larger than 18 inches (45 cm) at these frequencies") (footnote omitted).

> A spacing of three degrees or less would demand antennas of 0.6 meters in diameter or greater, and two-degree spacing would require receiving antennas on the order of 1 meter – a size that is likely to be unacceptable to a large percentage of U.S. consumers.

Id. Using 2 degree spacing in the 17/24 GHz band would also make it significantly more difficult to offer mobile services in this spectrum. Thus, although 2 degree spacing would allow a greater number of orbital locations to serve the U.S., SES Americom believes that the inability to offer small-dish services would make the capacity significantly less useful, reducing demand for the new capacity and undercutting the rationale for imposing closer spacing in the first place.

B. The Commission Should Adopt Sidelobe Performance Standards for User Terminals Based on 4 Degree Spacing

The Commission observes in the *Notice* that it has not historically regulated the performance characteristics of receive-only antennas but asks whether such standards should be applied here. *Id.* at ¶ 47. SES Americom believes that the adoption of performance criteria for 4.5 degree compliant terminals is necessary to achieve the Commission's objective of ensuring "that U.S.-licensed BSS systems receive sufficient interference protection and that subscribers' receive antennas will work effectively in current and future radio frequency interference environments." *Id*.

As the Commission recognizes, operators cannot afford to ignore the performance of their receive antennas because user terminals with poor off-axis discrimination performance will have lower service availability characteristics. Thus, it could be argued that it should be left up to the operator to determine how to best balance the cost of increased performance against the benefit of higher availability.

However, the antenna performance of a given system does not affect that system alone, but could also impact the ability of a new provider to enter the market. In coordination

discussions, an incumbent operator with poorly performing antennas might insist on a higher level of interference protection in an effort to avoid the consequences of its choice of the inferior user terminals.

The development of antenna performance standards will prevent such tactics by setting a baseline for determining the level of interference protection a system is entitled to receive. In particular, the Commission should adopt specifications for sidelobe performance.

Section A-1 of the Technical Appendix provides SES Americom's calculations for a sidelobe co-polarized gain envelope using the formulas found in ITU Recommendation BO.1213. Technical Appendix at pages 1-2. SES Americom requests that this envelope be incorporated into the Commission's technical rules for 17/24 GHz band operations.

C. The Locations Identified in Table 1 Should Be Available for 17/24 GHz BSS Operations Serving the U.S.

The *Notice* seeks comment on whether 17/24 GHz assignments should be aligned with existing FSS or BSS assignments in order to "capitalize on the possibility of marketing a single antenna with dual-band receivers." *Notice* at ¶ 41. However, the Commission also points out that "there are numerous unresolved technical and operational difficulties associated with co-locating 17/24 GHz BSS and DBS satellites, particularly problems associated with space-path interference." *Id*. As a result, the Commission suggests that "an orbital separation that is compatible with current FSS satellite spacing regimen might be preferable." *Id*.

SES Americom agrees that space-path interference issues are an obstacle to collocating 17/24 GHz BSS spacecraft with DBS operations. As discussed below, we believe that an offset of 0.2-0.3 degrees will be necessary between 17/24 GHz BSS and DBS satellites. Accordingly, we have developed an orbital assignment plan that permits collocation of 17/24 GHz and FSS satellites, rather than DBS spacecraft, in many locations. This will facilitate

use of a single feed antenna for the reception of both 17 GHz and Ku-band or Ka-band FSS signals. Our proposal also provides for 17/24 GHz assignments that are close enough to some DBS Plan locations to permit the use of a single feed antenna for the reception of both 17 GHz and DBS carriers, while avoiding the interference problems raised by collocation of satellites in these two bands.

Specifically, SES Americom proposes permitting deployment of 17/24 GHz BSS spacecraft at the orbital locations listed in Table 1 below:

Table 1: Proposed Orbital locations of 17/24 GHz satellites

Orbital Location
67° W.L.
71° W.L.
75° W.L.
79° W.L.
83° W.L.
87° W.L.
91° W.L.
95° W.L.
99° W.L.
103° W.L.
107° W.L.
111° W.L.
115° W.L.
119.5° W.L.
123.5° W.L.
127.5° W.L.
131.5° W.L.
136.5° W.L.
140.5° W.L.

The SES Americom proposal is based on 4 degree spacing, as discussed above. However, we have used 4.5 degree spacing in one instance, between 115° W.L. and 119.5° W.L. This increased separation is needed because there is a DBS Plan assignment at 119° W.L., and offset of the 17/24 GHz assignment is required to prevent space path interference.

D. A Consistent Orbital Spacing Policy Should Apply

SES Americom supports application of consistent orbital spacing requirements throughout the orbital arc capable of serving the U.S. The *Notice* raises the possibility of dividing up the arc and applying different separation factors in different arc sections. *Notice* at ¶ 42. SES Americom believes the disadvantages of a differential spacing policy would outweigh any potential advantages.

As we have demonstrated, 45 centimeter dish availability is critical to competitive viability for a new provider, and 4 degree spacing permits deployment of these small user terminals. Applying closer orbital spacing (*e.g.*, 3 degrees) in a portion of the arc will materially disadvantage any licensee in that arc segment by making it infeasible for the licensee to offer service to small antennas. Conversely, there is no net benefit to decreasing the number of available orbital locations by applying greater than 4 degree spacing in a portion of the arc because use of 4 degree spacing permits deployment of 45 centimeter dishes.

IV. THE COMMISSION SHOULD ESTABLISH UPLINK AND DOWNLINK POWER LIMITS

In order to promote co-frequency operation by adjacent satellites in the 17/24 GHz band, the Commission should adopt uplink and downlink power limits. The Commission should require applicants seeking to deploy non-compliant antennas to coordinate their planned operations with satellites within a 9 degree arc on either side.

A. The Commission Should Adopt the Off-Axis EIRP Density Limits Proposed in the *Notice*

The *Notice* seeks comment on whether uplink power limits should be imposed in the 17/24 GHz band in order to ensure that feeder link earth stations do not cause interference to adjacent satellite operations. *Notice* at ¶ 48. The Commission notes that it has established limits

on uplink power density in FSS spectrum, and asks whether such limits will be needed in the 17/24 GHz band if spacing of greater than 2 degrees is adopted. *Id*. In Table 1 of the *Notice*, the Commission sets forth equivalent isotropically radiated power ("e.i.r.p.") density limits derived using the clear-sky power density levels proposed by 17/24 GHz applicants and applying the GSO FSS antenna performance standards in Section 25.209 of the Commission's rules. *Id*. at ¶ 49 & Table 1.

SES Americom supports adoption of the e.i.r.p. density limits specified in Table 1 of the *Notice*. In our view these levels, which are based on the highest clear-sky power density values currently being proposed, will adequately protect adjacent satellites while allowing the use of sufficient power to accommodate higher availability and potential advances in transponder power.. We also support expansion of Section 25.204(g) of the Commission's rules to impose a requirement for mandatory uplink power control on 17/24 GHz operations, using the same parameters specified in Section 25.138(a)(5) for Ka-band uplinks.

B. Non-Compliant Operations Should Be Subject to Case-by-Case Coordination

The *Notice* asks what steps the Commission should take to address situations in which an applicant proposes to operate with uplink power levels in excess of the applicable limit. *Id*. at ¶ 51. The Commission seeks comment on whether a process similar to that in place for FSS bands, which requires a non-compliant operator to coordinate with adjacent satellites, should be imposed in the 17/24 GHz BSS band, and if so, what coordination arc should apply. *Id*.

SES Americom supports use of the framework used in the FSS environment to proposals by 17/24 GHz systems to use higher uplink power densities. Specifically, the rules should "place the burden on the applicant to provide a technical showing to the Commission, and

to coordinate its non-conforming operations with adjacent operators." *Id*. SES Americom proposes that coordination be required with other satellites within 9 degrees of the proposed non-compliant system.

C. The Commission Should Adopt a Uniform Downlink PFD Limit of −113 dBW/m^2/MHz

The *Notice* also asks commenters whether the Commission should adopt power flux density limits for 17/24 GHz space stations, noting that such limits are applied in certain FSS bands. *Id*. at ¶ 54. The Commission points out that an advantage of imposing pfd limits is "to establish a relatively homogeneous transmitting environment, and to ensure that established receiving antennas are not subject to unforeseen levels of adjacent satellite interference, particularly as newer generation satellites are brought into service." *Id*. The Commission asks whether limits for the 17 GHz BSS band should be based on the ITU's pfd limits for FSS operations, with an upper value of −115 dBW/m^2/MHz, or "whether a different, perhaps higher power level is preferable in order to provide for future generation satellites, or to compensate for anticipated interference sources." *Id*. at ¶ 55.

SES Americom supports adoption of a downlink pfd limit of −113 dBW/m^2/MHz for 17/24 GHz BSS operations. The calculations supporting this value are provided in Section A-3 of the Technical Appendix. Specifically, SES Americom derived this value by conducting link analyses at several potential receive sites to arrive at a maximum e.i.r.p. level that would achieve the required service margin. As discussed in Section II.B. above, it is critical for a new 17/24 GHz BSS provider to be able to achieve service availability levels that are comparable to those offered by DBS incumbents. Accordingly, SES Americom used a 99.9% availability factor in performing its link budget calculations. The link budget analysis demonstrates that the maximum e.i.r.p. density required to achieve a positive service margin is

−10 dBW/Hz, which corresponds to a pfd limit of −113.3 dBW/m^2/MHz. SES Americom rounded off this number to produce its proposed pfd limit of −113 dBW/m^2/MHz.

This level is 2 dBW higher than the −115 dBW/m^2/MHz limit applicable under ITU rules to FSS operations. SES Americom believes that its proposed limit is preferable to the ITU number because SES Americom's limit is derived from service requirements specific to the 17/24 GHz band, taking into account rain attenuation levels at this frequency band. Furthermore, the higher limit will facilitate accommodation of next-generation systems, as recognized by the Commission.

SES Americom proposes that this −113 dBW/m^2/MHz limit be applied to any beam shape serving the U.S., whether an area beam or a spot beam. SES Americom recognizes that a spot beam would have to limit peak power to comply with this limit but believes that it is more important to protect the ability to use 17/24 GHz BSS spectrum for broad area coverage. Attempting to accommodate higher power spot beams in this band would make it significantly more difficult to prevent interference to an adjacent system's user terminals in the areas where the spot beams' power is highest. In light of the availability of other spectrum for spot beam applications, such as Ka-band FSS spectrum, SES Americom believes that restricting peak power for spot beams in the 17/24 GHz BSS band is justified.

Specifying a single number for the maximum pfd over the U.S. gives operators the ability to choose where the highest e.i.r.p. will be used. This freedom provides flexibility in the design of the system, but also creates the possibility that in a given area the e.i.r.p.'s used by adjacent systems will differ by a significant amount. Accordingly, the maximum pfd must be set to ensure that in any given area, the lower power system will be adequately protected from adjacent-satellite interference. In particular, application of a uniform maximum pfd will help

facilitate the development of mobile services in the 17/24 GHz band by limiting the interference into mobile receivers.

V. THE COMMISSION SHOULD ADOPT OTHER SERVICE RULES FOR THE 17/24 GHz BAND TO FACILITATE SPECTRUM SHARING

A. Reverse Band Sharing Matters Can Be Addressed Through Technical Accommodations

The *Notice* observes that reverse band operation (use of the spectrum assigned to Ku-band DBS feeder links for 17/24 GHz system user links) creates the potential for new interference scenarios. *Notice* at ¶ 41. Specifically, the Commission notes that reverse-band sharing could lead to interference between the earth stations of different systems, known as ground path interference. In addition, interference between the space stations of different systems – space path interference – could also result. The *Notice* seeks comment on measures needed to address these interference scenarios. In each case, SES Americom believes that interference concerns can be managed through use of straightforward sharing techniques.

Ground Path Interference: SES Americom agrees that the levels of interference created by an existing DBS feeder link into the downlinks of a 17/24 GHz network could be harmful if the receiver is located within 20-30 kilometers of the feeder-link earth station. However, the number of DBS feeder link stations is relatively small, so this should not significantly affect 17/24 GHz systems. As new DBS feeder link earth stations are deployed, a number of measures could be taken to alleviate potential interference into 17/24 GHz receivers. These include site selection at low population density areas, limits on the energy emitted in the direction of the horizon, and antenna shielding.

Space Path Interference: The *Notice* requests comment on rules needed to prevent harmful space path interference from 17/24 GHz spacecraft into nearby Ku-band DBS satellites.

Notice at ¶¶ 71-79. In particular, the Commission asks what orbital separation is needed to protect Ku-band DBS satellites from interference and whether other measures, such as requirements relating to Tracking, Telemetry and Command ("TT&C") frequencies used for 17/24 GHz systems, are necessary to minimize interference.

SES Americom believes that issues relating to space path interference can be resolved through offset of orbital locations and coordination between the involved operators with respect to TT&C frequencies. In particular, it is our view that an orbital separation of 0.2-0.3 degrees will be necessary to prevent space path interference among nominally collocated satellites. Appendix 30A of the ITU Radio Regulations contains antenna reference patterns required to perform an interference analysis.

Similarly, we believe that a frequency separation of as little as 500 KHz is adequate to prevent interference from the beacon of a 17/24 GHz satellite into the command carrier of a Ku-band DBS space station. Coordination between nominally collocated operations will allow licensees to come to agreement on appropriate TT&C frequencies.

B. The Commission Should Take a Flexible Approach with Respect to TT&C Frequencies

The *Notice* seeks comment on matters relating to frequencies for TT&C for 17/24 GHz systems. *Notice* at ¶¶ 81-86. In particular, the Commission notes that Section 25.202(f) of the rules requires TT&C to be conducted at the edges of the allocated band, but observes that several applicants have proposed to use frequencies outside of the 17/24 GHz spectrum for TT&C operations. The Commission solicits input regarding whether a departure from the existing rule is warranted, on either an across-the-board or case-by-case basis, to accommodate the current lack of available 24 GHz band ground facilities or to increase reliability of TT&C links in light of rain-fade attenuation in this band.

SES Americom believes that licensees could successfully perform TT&C using narrowband carriers at the edge of the 17/24 GHz bands. The higher degree of rain fade in this spectrum could likely be overcome by using large antennas with uplink power control and back-up TT&C stations that are geographically separated by large distances (*e.g.*, stations on the east and west coasts of the U.S.). SES Americom, however, does not object to authorizing licensees to depart from the requirements of Section 25.202(g) to perform TT&C in alternative spectrum, especially for the uplink telecommand carriers, provided that the applicant successfully coordinates its proposed frequency use with adjacent operators licensed in that band.

C. The Commission Should Require Full Frequency Re-Use but Should Not Impose Channelization or Polarization Requirements

The *Notice* also seeks comment on appropriate requirements for polarization and full frequency re-use in the 17/24 GHz band. Specifically, the Commission indicates that it does not plan to impose channelization or polarization requirements in this band, other than to require the use of orthogonally polarized signals. *Notice* at ¶ 88. The Commission proposes to require space stations to meet full frequency re-use requirements through the use of dual orthogonal polarizations in the same beam and/or the use of spatially independent beams. *Id*. at ¶ 89. The Commission also asks whether a cross-polarization isolation requirement should be imposed on 17/24 GHz operations, and if so, whether the 30 dB required for FSS systems is an appropriate cross-polarization standard. *Id*. at ¶ 90.

SES Americom agrees with the Commission that no frequency channelization rule should be applied to 17/24 GHz systems. In particular, we support assignment of the full spectrum available at a given orbital location to a single licensee, rather than dividing up the frequencies among multiple entities as was done in Ku-band DBS. In addition, we agree that operators should have the flexibility with respect to polarization.

We also support adoption of a full frequency re-use rule as proposed by the Commission, recognizing that waiver of the rule may be warranted in certain circumstances if coordination constraints limit the licensee's ability to achieve full frequency re-use. We believe a cross-polarization rule is appropriate, but that the requirement should be to achieve cross-polarization isolation of 25 dB in the primary coverage area, rather than 30 dB as specified for FSS operations. We anticipate that this requirement will adequately protect adjacent operators, and that licensees will be able to manage intra-system interference.

D. The Commission Should Permit Non-U.S. Service in the 17.7-17.8 GHz Band

The Notice seeks comment on issues relating to use of the 17.7-17.8 GHz band, which is allocated internationally for BSS service in Region 2 but cannot be used for BSS downlinks under the U.S. table of allocations. *Id*. at ¶¶ 28-33. Specifically, the Commission proposes to permit operators to use the 17.7-17.8 GHz band for services to be received outside the U.S. and its possessions and seeks comment on proposed pfd limits to protect domestic terrestrial fixed services in that band.

SES Americom strongly supports the Commission's plan to allow operators to use the Region 2 BSS allocation in the 17.7-17.8 GHz band to serve foreign points. We also agree with the Commission's proposal to extend the pfd limits found in Section 25.208(c) and in Table 21-4 of the ITU Radio Regulations to BSS operations in this band. These limits will adequately protect U.S. terrestrial operations near the U.S. border that might be covered by a beam designed to serve non-U.S. locations.

E. Current Commission Rules Are Sufficient to Protect 24 GHz Fixed Systems

The *Notice* requests comment on sharing issues affecting the 24 GHz BSS band. *Id*. at ¶¶ 91-93. The Commission observes that the 25.05-25.25 GHz band is allocated

domestically on a co-primary basis to the fixed service and requests comment on appropriate sharing criteria for this band. In particular, the Commission asks whether existing coordination, power limit and antenna pattern requirements will adequately protect existing fixed service deployments.

SES Americom believes that the provisions of Sections 25.203, 25.204, and 25.209 of the Commission's rules provide a reasonable framework for sharing with fixed services in the 24 GHz band. In addition, as the Commission recognizes, use of this band for BSS operations will involve a limited number of relatively large antennas, and these characteristics will facilitate coordination with fixed service operations. *See id*. at ¶ 92.

VI. THE COMMISSION SHOULD ADOPT LICENSING AND LEGAL REQUIREMENTS FOR 17/24 GHz OPERATIONS THAT ARE CONSISTENT WITH ITS UNDERLYING POLICY GOALS

SES Americom supports the use of the first come, first served processing model for 17/24 GHz license applications and use of the *DISCO II* analysis to consider requests for U.S. market access. However, SES Americom opposes the Commission's proposal for extending public interest programming obligations and EAS requirements to the 17/24 GHz band to the extent that the rules would apply to space station operators not offering programming to end users.

A. 17/24 GHz Applications Should Be Processed Using the FSS Framework

The *Notice* seeks comment on the appropriate framework for processing license applications and requests for U.S. market access in the 17/24 GHz band. In particular, the Commission asks whether U.S. licenses should be awarded through the first come, first served procedures that currently apply to FSS applications or whether the Commission should award such licenses through competitive bidding. *Notice* at ¶¶ 7-9. For non-U.S. licensees seeking to

serve the U.S. market, the Commission proposes to apply the framework established in the *DISCO II* proceeding.[6]

SES Americom supports applying the rules for processing FSS applications to the 17/24 GHz band. For applicants seeking U.S. licenses, the Commission should apply the first come, first served approach adopted in the *Space Station Licensing Reform* proceeding.[7] This licensing methodology has proved to be an effective way to expedite processing of space station applications.

SES Americom also supports the Commission's plan to apply the *DISCO II* framework to applications seeking authority to serve the U.S. market with a non-U.S. licensed satellite. In particular, the ECO-Sat test should be applied to requests to use foreign-licensed 17/24 GHz spacecraft to provide U.S. DTH services.

B. Only Distributors of Programming to End Users Should Be Subject to Public Interest or EAS Requirements

The Commission also seeks comment on whether public interest programming obligations imposed pursuant to Section 335 of the Communications Act and requirements to deliver Emergency Alert System ("EAS") warnings pursuant to Section 11.11 of the Commission's rules should be extended to 17/24 GHz systems. *Notice* at ¶¶ 19-21 & 26-27. SES Americom opposes any application of these requirements to 17/24 GHz satellite system operators unless they are engaged in distributing programming to end users. There is no justification for imposing these requirements on space segment providers that have no control over program content and therefore no ability to comply with the rules.

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[6] *Id.* at ¶ 15, *citing Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Satellites to Provide Domestic and International Service in the United States*, Report and Order, 12 FCC Rcd 24094 (1997).

[7] *Amendment of the Commission's Space Station Licensing Rules and Policies*, First Report and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 10760 (2003).

The Commission acknowledges that Section 335, which is the statutory basis for the Commission's public interest programming rule, "does not expressly identify satellite licensees in the 17/24 GHz band because this band was not then allocated domestically for BSS." *Notice* at ¶ 20. Similarly, Section 25.701(a) of the Commission's rules, which implements this statutory requirement, makes no mention of 17/24 GHz operations. 47 C.F.R. § 25.701(a). Nevertheless, the Commission proposes to extend public interest obligations to 17/24 GHz licensees to the extent they provide "DBS-like services." *Notice* at ¶ 20. The Commission does not explain whether it proposes to apply the public interest rules only to distributors using 17/24 GHz spectrum to offer service directly to consumers, or whether it seeks to apply the rules to 17/24 GHz licensees regardless of whether they are offering programming to end users.

SES Americom has consistently opposed the Commission's extension of the public interest programming obligations to satellite licensees with no control over content.[8] We continue to believe that Section 25.701(a) represents an erroneous interpretation of the statutory language of Section 335 and a misguided policy decision. At a minimum, however, the Commission must not compound the problem by using Section 25.701(a) as a model for the 17/24 GHz band. To be clear, SES Americom does not oppose application of program obligations to program distributors, including satellite-based distributors. But the Commission should achieve that objective through direct regulation of the MVPDs themselves, not vendors of inputs used by MVPDs. Thus, if the Commission imposes public interest programming obligations in this band, responsibility for compliance must rest on the programming distributor

[8] *See, e.g.*, Petition for Reconsideration of GE American Communications, Inc., MM Docket No. 93-25, filed March 10, 1999. Under the Commission's interpretation of Section 335, insofar as that provision makes no mention of the 17/24 GHz band, it does not give the Commission jurisdiction to impose public interest programming obligations here at all.

that offers service to the end user, because that is the only entity who is in a position to satisfy the obligations.

Similarly, the Commission should not repeat here the errors made in the EAS rulemaking proceeding.[9] By incorporating the definition provisions of Section 25.701(a) into the EAS rule, the Commission created a situation in which FSS satellite licensees without any involvement in the packaging of program content are subject to a requirement to ensure that EAS alerts are incorporated into that programming. SES Americom and other FSS operators have conclusively demonstrated that choosing to place EAS obligations on the licensee instead of the programming distributor impairs the effectiveness of the EAS program and prevents the Commission from penalizing a programming distributor that fails to deliver a required alert.[10] Our request that the Commission reconsider this rule and impose the EAS requirement directly on the multi-channel programming distributor in a position to ensure compliance is currently pending before the Commission.

In short, Section 25.701(a) is an inappropriate model for extending the public interest broadcasting obligations or EAS rules to a new band. If the Commission decides to apply these requirements to the 17/24 GHz band, it should ensure that they are placed only on the programming distributor who can effectuate compliance with the requirements, not on underlying satellite operators with no programming control.

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[9] *See Review of the Emergency Alert System*, First Report and Order and Further Notice of Proposed Rulemaking, EB Docket No. 04-296, FCC 05-191 (rel. Nov. 10, 2005)

[10] *See* Petition for Partial Reconsideration of PanAmSat Corporation, SES Americom, Inc., and Intelsat, Ltd., EB Docket No. 04-296, filed Dec. 27, 2005.

CONCLUSION

SES Americom urges the Commission to adopt a regulatory framework for 17/24 GHz operations based on the proposals discussed herein to enable use of this band to introduce new competition and promote service innovation and enhancement for the benefit of U.S. consumers.

Respectfully submitted,

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TECHNICAL APPENDIX

A-1. The minimum orbital separation between adjacent 17/24 GHz satellites needed to permit the use of 45 centimeter dishes is 4 degrees.

The technical support for this statement is based on the following factors:

a) We propose using the ITU Recommendation BO.1213[11] reference pattern to characterize DTH antennas.
b) The main lobe of the reference pattern of the 45 centimeter dish occupies the off-axis angle range [-95λ/D, +95λ/D] degrees, *i.e.*, [-3.66°, +3.66°] at 17.3 GHz.[12]
c) If S degrees is the geocentric separation between two satellites, the topocentric separation is larger by 5% to 10%, depending on the receiver site location and satellite longitude. With an antenna pointing error of 0.5° and an additional 0.1° error for the stationkeeping of the two satellites, the minimum value of S for which any receiver would not get main lobe interference would be (3.66 + 0.6)/1.05, i.e., 4.06 degrees, approximated to 4.0 degrees.
d) The 4° compliant antenna would have the co-polarization sidelobe envelope characteristic:

   Sidelobe co-polarization gain envelope $\leq 29 - 25 \log \theta$ dB, for $\theta \geq 3.6°$

   ITU Rec. BO.1213 shows formulas for computing the cross-polarization gain in this off-axis angle range.

   Alternatively, technical standards for the antenna may be defined by using equations similar to those given in Section 25.209(a) and (b) of the Commission's rules, but with a start angle of 3.6 degrees.

[11] Rec. BO.1213 was originally developed for use in ITU Regions 1 and 3 for antennas with diameter of 60 centimeters or larger, but has also been widely used in designing digital services in Region 2 for antenna sizes as small as 45 centimeters.
[12] At frequencies 17.55 GHz and 17.80 GHz the corresponding ranges are [-3.6°, 3.6°], and [-3.56°,3.56°], respectively.

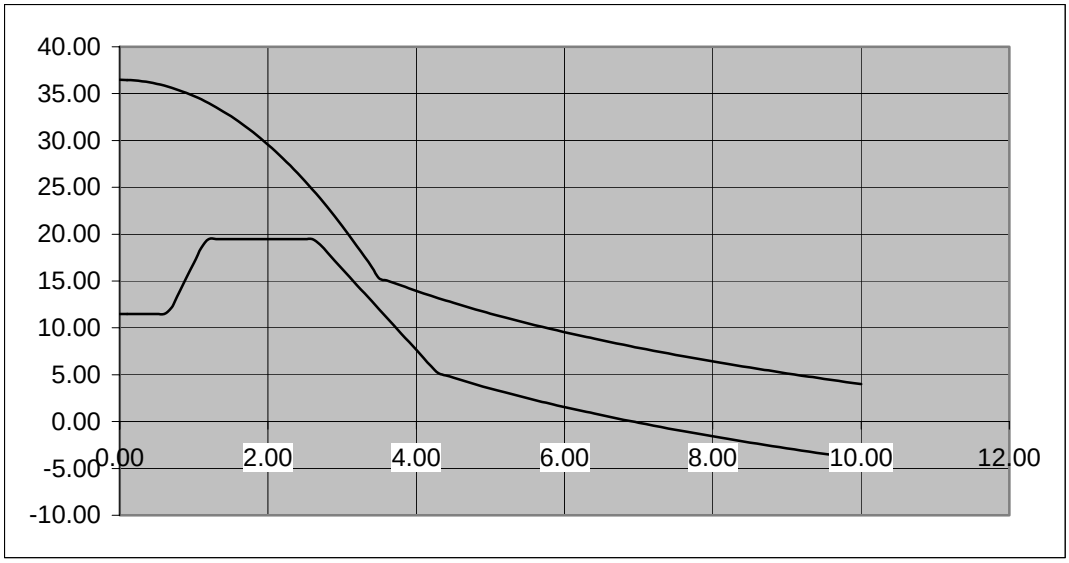

Fig. 1: BO.1213 pattern for 45 centimeter dish (top curve: co-polarization gain, bottom curve cross-polarization gain)

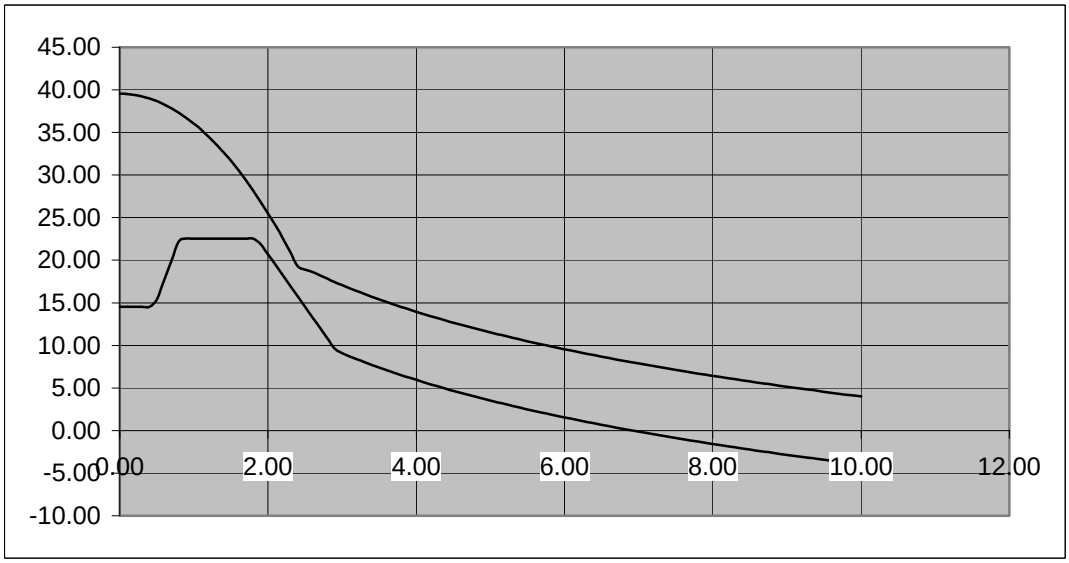

Fig. 2: BO.1213 pattern for 60 centimeter dish (top curve: co-polarization gain, bottom curve cross-polarization gain)

A-2. The maximum PFD in the 17.3-17.7 GHz band should be −113dBW/m^2/MHz

Currently in this band PFD limits are not specified. However, in order that interference into a DTH user's receiver from adjacent satellites is constrained to acceptable values, the interfering EIRP density should be limited to some specific

value. The PFD limits are then computed from the EIRP density limits. Note that we are seeking a single number, the maximum EIRP density over CONUS. There would be large regions of CONUS where the EIRP density could be lower by several dB.

The general principles behind the analysis leading to the PFD limit are as follows.

Link analysis was done at several receive sites to determine the minimum satellite EIRP density required in a "wanted" satellite to realize acceptable link margins. The link degradations include downlink rain attenuation for a specified availability requirement. Adjacent satellite interference, which is determined by the EIRP density of the interfering satellites, is included in the link budget. All the interfering satellites are, conservatively, assumed to be operated at the maximum allowed EIRP density. Using this methodology the interfering satellite EIRP density is adjusted to a value which coincides with the highest EIRP density of the wanted satellite among several receiver locations.

The following assumptions are made in the link budgets:

- The "wanted" satellite is located at 107° W.L.
- The receive antenna is 45 centimeters in diameter, and obeys the co-polarization and cross-polarization gain patterns of BO.1213.
- Downlink rain availability requirement is 99.9%. Link attenuations are computed using the ITU-DAH model. Link degradation includes fading and increases in noise temperature. System noise temperature is assumed to be 150K in clear weather.
- A frequency plan similar to the DBS 24 MHz transponders is assumed for the wanted and interfering transponders. C/I values, however, are computed conservatively using EIRP densities without taking into account bandwidth advantage factors. Hence the results are not specific to a single frequency plan.
- Each "wanted" carrier receives interference from co-polarized and cross-polarized carriers from an interfering satellite separated from the wanted satellite by +4 degrees, and two more such carriers from the interfering satellite at –4 degrees orbital separation. In addition, four such interfering components are assumed from +/- 8 degree orbital locations. Thus, a total of 8 interfering components is used in the analysis.
- The threshold carrier-to-noise ratio is 5.3 dB, which corresponds to a rate ¾ Turbo code or DVB-S2 FEC. This value of C/N assumes an implementation margin of approximately 1 dB. The information rate per carrier is 30 Mbps, with a symbol rate of 20 Msps.

Table 1 shows the satellite EIRP densities required to achieve positive margins at six receiver locations when there is no interference from adjacent satellites. The required EIRP density is seen to be highest at Miami (-10.44 dBW/Hz), due to the large rain

margin requirement. As a result, the maximum EIRP density over CONUS should be greater than –10.44 dBW/Hz.

Table 2 shows the satellite EIRP densities required to achieve positive margins at six receiver locations when the EIRP densities of the adjacent satellites are –10 dBW/Hz. The required EIRP density is again seen to be highest at Miami (-10.19 dBW/Hz), due to the large rain margin requirement. As a result, the maximum EIRP density over CONUS can be selected to be –10 dBW/Hz, which is equivalent to a PFD limit of –113.3 dBW/m^2/MHz. The proposed PFD limit is a number close to this limit, −113 dBW/m^2/MHz.

Table 1: Link budgets at six CONUS sites, without adjacent satellite interference

			Atlanta	Chicago	Los Angeles	Miami	New York	Seattle
1	RxES Latitude	deg, N	33.75	41.83	34.00	25.75	40.67	47.60
2	RxES Longitude	deg, E	-84.38	-87.75	-118.28	-80.17	-73.83	-122.33
3	Wanted Satellite Longitude	deg, E	-107	-107	-107	-107	-107	-107
4	Orbital separation from the first adjacent satellite	deg	4	4	4	4	4	4
5	Orbital separation from the second adjacent satellite	deg	8	8	8	8	8	8
6	Satellite station keeping (for each sat)	deg	0.05	0.05	0.05	0.05	0.05	0.05
7	Start angle for 29 - 25 log (Theta) sidelobe	deg	3.61	3.61	3.61	3.61	3.61	3.61
8	RxES pointing error	deg	0.50	0.50	0.50	0.50	0.50	0.50
9	Threshold C/N (required)	dB	5.23	5.23	5.23	5.23	5.23	5.23
10	Excess link margin reqd	dB	2.00	2.00	2.00	2.00	2.00	2.00
11	Interfering Satellite EIRP (same for all)	dBW	N/A	N/A	N/A	N/A	N/A	N/A
12	Interfering Satellite EIRP density (same for all)	dBW/Hz	N/A	N/A	N/A	N/A	N/A	N/A
13	Interfering satellite PFD	dBW/m2/MHz	N/A	N/A	N/A	N/A	N/A	N/A
14	Wanted satellite EIRP	dBW	58.97	56.20	52.82	62.59	56.83	55.20
15	Wanted satellite EIRP density	dBW/Hz	-14.04	-16.81	-20.19	-10.42	-16.18	-17.81
16	Bandwidth(symbol rate)	MHz	20.00	20.00	20.00	20.00	20.00	20.00
17	Frequency (DL)	MHz	17550.00	17550.00	17550.00	17550.00	17550.00	17550.00
18	Free space loss	dB	208.80	208.91	208.75	208.74	209.01	209.01
19	Link Loss	dB	209.30	209.41	209.25	209.24	209.51	209.51
20	RxES dia	m	0.45	0.45	0.45	0.45	0.45	0.45
21	RxES, D/Lambda		26.33	26.33	26.33	26.33	26.33	26.33
22	RxES Gain(max)	dBi	36.48	36.48	36.48	36.48	36.48	36.48
23	RxES Gain(with 0.5 dB pointing loss)	dBi	36.05	36.05	36.05	36.05	36.05	36.05
24	Noise temperature (clear weather)	K	150.00	150.00	150.00	150.00	150.00	150.00
25	G/T (clear weather)	dB/K	14.29	14.29	14.29	14.29	14.29	14.29
26	C/N(thermal)	dB	19.53	16.65	13.45	23.21	17.17	15.57
27	DL Rain availability (avg. year)	%	99.90	99.90	99.90	99.90	99.90	99.90
28	Rain attenuation	dB	7.92	5.45	3.04	11.34	5.88	4.59
29	Rain degradation (with Temp increase)	dB	11.92	9.04	5.84	15.60	9.56	7.96
30	C/N (UL, self-XPOL etc)	dB	18.00	18.00	18.00	18.00	18.00	18.00
31	C/(N+I)total	dB	7.23	7.23	7.23	7.23	7.23	7.23
32	Excess Margin	dB	2.00	2.00	2.00	2.00	2.00	2.00

Table 2: Link budgets at six CONUS sites, with adjacent satellite interference

			Atlanta	Chicago	Los Angeles	Miami	New York	Seattle
1	RxES Latitude	deg, N	33.75	41.83	34.00	25.75	40.67	47.60
2	RxES Longitude	deg, E	-84.38	-87.75	-118.28	-80.17	-73.83	-122.33
3	Wanted Satellite Longitude	deg, E	-107.00	-107.00	-107.00	-107.00	-107.00	-107.00
4	Orbital separation from the first adjacent satellite	deg	4.00	4.00	4.00	4.00	4.00	4.00
5	Orbital separation from the second adjacent satellite	deg	8.00	8.00	8.00	8.00	8.00	8.00
6	Satellite station keeping (for each sat)	deg	0.05	0.05	0.05	0.05	0.05	0.05
7	Start angle for 29 - 25 log (Theta) sidelobe	deg	3.61	3.61	3.61	3.61	3.61	3.61
8	Topocentric sep, 1ASI	deg	4.48	4.43	4.54	4.50	4.36	4.40
9	Topocentric sep, 2ASI	deg	8.94	8.84	9.09	8.98	8.70	8.81
10	RxES pointing error	deg	0.50	0.50	0.50	0.50	0.50	0.50
11	Threshold C/N (required)	dB	5.23	5.23	5.23	5.23	5.23	5.23
12	Excess link margin reqd	dB	2.00	2.00	2.00	2.00	2.00	2.00
13	Interfering Satellite EIRP (same for all)	dBW	63.00	63.00	63.00	63.00	63.00	63.00
14	Interfering Satellite EIRP density (same for all)	dBW/Hz	-10.01	-10.01	-10.01	-10.01	-10.01	-10.01
15	Interfering satellite PFD	dBW/m2/MHz	-113.31	-113.31	-113.31	-113.31	-113.31	-113.31
16	Wanted satellite EIRP	dBW	59.73	57.59	55.27	62.94	58.12	56.93
17	Wanted satellite EIRP density	dBW/Hz	-13.28	-15.42	-17.74	-10.08	-14.89	-16.08
18	Bandwidth(symbol rate)	MHz	20.00	20.00	20.00	20.00	20.00	20.00
19	Frequency (DL)	MHz	17550.00	17550.00	17550.00	17550.00	17550.00	17550.00
20	Free space loss	dB	208.82	208.92	208.74	208.76	209.03	209.01
21	Link Loss	dB	209.32	209.42	209.24	209.26	209.53	209.51
22	RxES dia	m	0.45	0.45	0.45	0.45	0.45	0.45
23	RxES, D/Lambda		26.33	26.33	26.33	26.33	26.33	26.33
24	RxES Gain(max)	dBi	36.48	36.48	36.48	36.48	36.48	36.48
25	RxES Gain(with 0.5 dB pointing loss)	dBi	36.05	36.05	36.05	36.05	36.05	36.05
26	Noise temperature (clear weather)	K	150.00	150.00	150.00	150.00	150.00	150.00
27	G/T (clear weather)	dB/K	14.29	14.29	14.29	14.29	14.29	14.29
28	C/N(thermal)	dB	20.29	18.05	15.90	23.55	18.46	17.29
29	DL Rain availability (avg. year)	%	99.90	99.90	99.90	99.90	99.90	99.90
30	Rain attenuation	dB	7.92	5.45	3.04	11.34	5.88	4.59
31	Rain degradation (with Temp increase)	dB	11.92	9.04	5.84	15.60	9.56	7.96
32	Off ax angle for 4 deg interferer	deg	3.88	3.83	3.94	3.90	3.76	3.80
33	Off ax angle for –4 deg interferer	deg	4.98	4.93	5.04	5.00	4.86	4.90
34	Off ax angle for 8 deg interferer	deg	8.34	8.24	8.49	8.38	8.10	8.21
35	Off ax angle for –8 deg interferer	deg	9.44	9.34	9.59	9.48	9.20	9.31
36	Co-Pol discrim, 4 deg interferer	dB	-22.20	-22.06	-22.37	-22.27	-21.87	-21.98
37	Co-Pol discrim, -4 deg interferer	dB	-24.91	-24.80	-25.04	-24.96	-24.66	-24.74
38	Co-Pol discrim, 8 deg interferer	dB	-30.50	-30.38	-30.70	-30.56	-30.19	-30.34
39	Co-Pol discrim, -8 deg interferer	dB	-31.85	-31.74	-32.02	-31.90	-31.58	-31.71
40	X-Pol discrim, 4 deg interferer	dB	-27.79	-27.38	-28.32	-28.00	-26.80	-27.13
41	X-Pol discrim, -4 deg interferer	dB	-32.91	-32.80	-33.04	-32.96	-32.66	-32.74
42	X-Pol discrim, 8 deg interferer	dB	-38.50	-38.38	-38.70	-38.56	-38.19	-38.34
43	X-Pol discrim, -8 deg interferer	dB	-39.85	-39.74	-40.02	-39.90	-39.58	-39.71
44	C/I(Co-pol & XPOL, from 4 deg)	dB	17.87	15.54	13.65	21.17	15.78	14.75
45	C/I(Co-pol & XPOL, from 8 deg)	dB	26.60	24.34	22.33	29.85	24.67	23.63
46	C/I(Co- & XPOL, all ASI sources)	dB	15.52	13.22	11.26	18.80	13.51	12.46
47	C/N (UL, self-XPOL etc)	dB	18.00	18.00	18.00	18.00	18.00	18.00
48	C/(N+I)total	dB	7.23	7.23	7.23	7.23	7.23	7.23
49	Excess Margin	dB	2.00	2.00	2.00	2.00	2.00	2.00

Table 3: Rain fade and degradations at Miami. Rain degradation is defined as the combined effect of rain fade and increase in noise temperature.

Rain availability (%)	Rain fade at 17.55 GHz	Rain fade at 12.45 GHz	Rain degradation at 17.55 GHz with T: 150 K	Rain degradation at 12.45 GHz with T: 150 K	Additional degradation at 17.55 GHz, relative to that at 12.45 GHz
99.99	28.1	13.9	32.6	18.2	14.4
99.98	22.2	10.7	26.7	14.9	11.7
99.97	19.1	9.1	23.5	13.2	10.3
99.96	17.0	8.0	21.4	12.0	9.4
99.95	15.5	7.3	19.9	11.2	8.7
99.94	14.3	6.7	18.7	10.5	8.2
99.93	13.4	6.2	17.7	9.9	7.8
99.92	12.6	5.8	16.9	9.5	7.4
99.91	11.9	5.5	16.2	9.1	7.1
99.9	**11.3**	**5.2**	**15.6**	**8.7**	**6.9**
99.8	8.0	3.6	12.0	6.6	5.4
99.7	6.3	2.8	10.1	5.5	4.6
99.6	5.3	2.3	8.9	4.8	4.1
99.5	4.6	2.0	8.0	4.2	3.8
99.4	4.1	1.8	7.3	3.8	3.5
99.3	3.6	1.6	6.7	3.4	3.2
99.2	3.3	1.4	6.2	3.2	3.0
99.1	3.0	1.3	5.8	2.9	2.9
99	2.8	1.2	5.4	2.7	2.7

The reason for requiring higher PFD limits in the 17 GHz band than in the standard Ku-DBS band (by 7-8 dB) is the increase in rain degradation at 17 GHz for the same availability. Table 3 shows the rain fade and degradation at Miami at the two frequency bands. It is seen that the rain degradation for 99.9% availability (a typical design goal in DTH systems) is 6.9 dB poorer at 17 GHz than that at the standard DBS frequencies.

- The limit of –113 dBW/m^2/MHz is applicable to any beam shape over CONUS (broad-area beams and spot beams).

- Coordination of satellites for downlink interference:

If the above limit is accepted by the FCC, the implication is that power levels up to this level would be routinely licensed. As a result, any operator designing a 17/24 GHz system should expect that adjacent satellites (at +/- 4° and +/- 8° spacing) will be operating at this PFD limit. This methodology is similar to what is currently practiced in the FSS bands.

- The PFD limit –113 dBW/m^2/MHz was derived for a baseline system operating at 107° W.L. There could be situations where the PFD required in a transponder would be higher (e.g., at very low elevation angles). Similarly, use of error correction codes with higher rate (*e.g.*, 7/8), or modulation such as 8PSK, will require higher EIRP. These cases could be considered as extreme, for which technical solutions would exist without increasing the regulatory PFD limit. For instance, a satellite at 129° W.L. may operate with –113 dBW/m^2/MHz, but the DTH dish size may be increased to 65 centimeters in high-rain rate regions.