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

In the Matter Of	
Amendment of the Commission's Policies and Rules for Processing Applications in the Direct Broadcast Satellite Service	IB Docket No. 06-160
Feasibility of Reduced Orbital Spacing for Provision of Direct Broadcast Satellite Service in the United States	Report No. SPB-196

COMMENTS OF SPECTRUM FIVE LLC

Spectrum Five LLC ("Spectrum Five") is pleased to submit these comments in response to the Commission's *Notice of Proposed Rulemaking* seeking comment on rules for the Direct Broadcast Satellite ("DBS") service, including rules for the provision of DBS from orbital locations which are spaced more closely than nine degrees.[1] As a new competitor that was recently granted authority to provide DBS service to the U.S. from a "tweener" location,[2] Spectrum Five applauds the Commission's effort to expedite the provision of additional and innovative DBS services to the public through this rulemaking. As discussed below, Spectrum Five believes that the Commission should adopt an "unavailability" benchmark and basic procedures to facilitate coordination negotiations between existing and new tweener operators. Doing so will ensure that

[1] *Amendment of the Commission's Policies and Rules for Processing Applications in the Direct Broadcast Satellite Service*, Notice of Proposed Rulemaking, 21 FCC Rcd 9443 (2006) ("Notice").

[2] *Spectrum Five, LLC, Petition for Declaratory Ruling to Serve the U.S. Market Using Broadcast Satellite Service (BSS) Spectrum from the 114.5° W.L. Orbital Location*, Order and Authorization, File Nos. SAT-LOI-20050312-00062, SAT-LOI-20050312-00063, DA No. 06-2439 (rel. Nov. 29, 2006).

existing DBS services are adequately protected and new services fully realize their potential.

I. INTRODUCTION AND SUMMARY

From the early 1980's, flexibility has been a hallmark of the Commission's DBS policy. In the 1982 order establishing DBS rules, the Commission concluded that rigid technical standards were inappropriate and instead decided "to allow the nascent service freedom to develop innovative technology to meet market demand."[3] Therefore, the Commission required only that early DBS systems meet international standards, subsequently adopted as the International Telecommunications Union ("ITU") Region 2 Broadcasting Satellite Service ("BSS") Plans ("Region 2 Plans").[4] After the adoption of the Region 2 Plans, the Commission continued to maintain flexibility for DBS licensees to propose and obtain modifications to the Region 2 Plans, a policy that proved its wisdom as advances in technology rendered many of the technical standards in the 1983 version of the Plans increasingly outdated with the passage of time.[5] The FCC's flexibility in implementing the modification process has fostered the natural evolution of the DBS industry, allowing operators to provide ever-increasing, innovative services to subscribers and creating a decisive success story in satellite regulation. For example, the

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[3] *Notice* ¶ 5 (*citing Inquiry into the Development of Regulatory Policy in Regard to Direct Broadcast Satellites for the Period following the 1983 Regional Administrative Radio Conference*, Report and Order, 90 FCC 2d 676, 708-709 (¶ 84) (1982), *recon. denied*, 53 RR2d 1637 (1983)).

[4] *Id.* DBS is the acronym used in the United States to describe the domestic implementation of BSS in the 12.2-12.7 GHz band. *See* 47 C.F.R. § 25.201.

[5] The 2000 World Radio Conference implemented modifications for the BSS Plans in Regions 1 and 3 to incorporate updated technical standards more representative of actual practices in the BSS industry. However, the older standards remain in place for Region 2.

modification process has allowed a progression from analog to digital transmissions, and from partial to full continental U.S. ("CONUS") coverage for many orbital locations.

Spectrum Five believes that this rulemaking is the next logical step in the continuation of that success story. Like DIRECTV, EchoStar and other prior DBS licensees, Spectrum Five seeks to work through the ITU modification process in order to ensure that services are deployed to the public as soon as possible. In this case, the potential benefits are significant. Reduced spacing of DBS satellites will potentially double the amount of capacity available in the 12.2-12.7 GHz band within the primary service arc (96.5° W.L. to 119° W.L.). While the introduction of reduced-spaced satellites will necessarily require some accommodation by existing nine-degree-spaced satellites, it is possible, through coordination, to allow the entry of new tweener systems while protecting existing services from objectionable interference. In order to realize the maximum benefits from this new capacity, however, coordination negotiations should produce results that not only protect incumbent operators but also ensure that the new networks can provide a high quality of service that is acceptable to subscribers and is therefore competitive with the older satellite systems and with terrestrial broadcasting and cable.

The FCC has asked what should happen if a coordination impasse occurs.[6] If coordination negotiations are to result in an appropriate balance between existing and new operators, the coordination cannot be arbitrary or open-ended but must be undertaken with reasonably clear objectives. Spectrum Five believes that the Commission should facilitate coordination by adopting a benchmark for acceptable

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[6] *Notice* at ¶ 41.

interference, which should be defined as a 10 percent increase in relative unavailability for existing services. In addition, as discussed below, the Commission should incorporate basic information requirements and procedures in its rules for the coordination process.

II. THE COMMISSION SHOULD UTILIZE AN "UNAVAILABILITY" BENCHMARK FOR COORDINATION

Spectrum Five supports coordination based on a system "unavailability" benchmark, as proposed in the *Notice*.[7] Unavailability is the best criterion for measuring acceptable interference because it is most directly "meaningful to the consumer."[8] As the Commission has previously found, this approach "strikes a reasonable balance between protecting incumbent licensees and their subscribers and providing sufficient flexibility for new service providers to deploy."[9] Such a balance would accommodate present operations as well as future system characteristics. Incumbent DBS operators have generally supported an approach based on unavailability in the past.[10]

Spectrum Five proposes that the Commission adopt a 10 percent increase in unavailability relative to an objective of 99.9 percent (*i.e.*, 99.89 percent) as a benchmark for acceptable interference in coordination of non-nine-degree satellites. In other words, the unavailability objective should be no more than 0.11% for those links currently

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[7] See *id.* ¶¶ 46-49. The Commission defined unavailability in the *Notice* as the "amount of time each year that the consumer's DBS receiver is not providing video and audio signals to the consumer's television display and sound system." *Id.*

[8] *Notice* ¶ 46.

[9] *See Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency*, 17 FCC Rcd 9614, ¶ 85 (2002) ("*MVDDS Second R&O*").

[10] *Id.* ¶ 60.

experiencing availability of 99.9% or better without interference from reduced-spaced satellites.[11] The 10 percent standard would also apply to subscriber links with lower than 99.9% availability (for example, a link with current unavailability of 0.2% should not be degraded by tweener interference by more than 10%, or an unavailability objective of 0.22%).

The FCC has previously held that a 10 percent relative increase in unavailability "should not be readily perceptible to DBS customers"[12] and should be "well tolerated by DBS subscribers in light of the overall dependability of the service."[13] Therefore, a 10 percent increase in potential unavailability "is much less than the seasonal, yearly, and city-to-city variability that already exists in the unavailability within the DBS service"[14] due to the uncertainties in the rain models used. For example, at 99.9% availability, a typical subscriber viewing television 24 hours a day would experience an outage of 525.6 minutes a year. If the unavailability is increased by 10%, the same subscriber would experience an outage increase of 52.6 minutes per year, or approximately 1 minute per week. Thus, from an interference perspective, the FCC has found that a 10 percent relative increase in availability is "marginal,"[15] "insubstantial," "does not approach a

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[11] The ITU Region 2 BSS Plan was based on a target of 99.7% availability. Domestic DBS operators typically aim for at least 99.9% availability for their systems, except in high-precipitation and fringe coverage areas. *Id.* ¶ 46.

[12] *Id.* ¶ 79.

[13] *Id.* ¶ 67.

[14] *Id.* ¶ 79. Ten percent represents a decrease in margins that are well within the uncertainties of the current rain models, such as the ITU P.618 or Crane Model.

[15] *Id.*

level that could be considered harmful interference"[16] and is not discernible to the subscriber.

Other operators have indicated in their applications for the new 17/24 GHz BSS band that an availability of less than 99.9% would be acceptable for their proposed systems. Pegasus cites a downlink availability objective due to rain of 99.7% (99.6% in the southeast) for a CONUS beam and 99.5% for spot-beams with greater than 99.9% for the uplink.[17] Similarly, EchoStar cites a downlink availability objective due to rain of 99.7%.[18] DIRECTV also cites a downlink availability objective due to rain of 99.7%.[19] These rain objectives indicate that the three applicants were willing to recommend an availability of 99.7% (yearly outages of at least 1,576.8 minutes) as acceptable for the new 17/24 GHz service.

The attached Technical Exhibit shows how Spectrum Five's proposed approach can enable the coordination and deployment of a DBS satellite at 114.5° W.L. within the 10 percent limitation, by varying three factors parametrically: (1) availability due to rain, (2) excess margin in the affected satellite link, and (3) signal strength from the reduced-spaced satellites. The analysis demonstrates that the introduction of tweeners amongst

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[16] *Id.* ¶ 72.

[17] Pegasus 17/24 GHz Applications, File Nos. SAT-LOA-20060412-00042, SAT-LOA-20060412-00043, SAT-LOA-20060412-00044 (April 2006) at 17.

[18] EchoStar 17/24 GHz Applications, File Nos. SAT-LOA-20020328-00050, SAT-LOA-20020328-00051, SAT-LOA-20020328-00052 (March 2002), Attachment A at 14. as amended by SAT-AMD-20051118-00245, SAT-AMD-20051118-00246, SAT-AMD-20051118-00247.

[19] DIRECTV 17/24 GHz Applications, File Nos. SAT-LOA-19970605-00049, SAT-LOA-19970605-00050, SAT-LOA-19970605-00051 at 39 (June 1997), as amended by SAT-AMD-200511118-00224, SAT-AMD-200511118-00225, SAT-AMD-200511118-00226.

operating satellites can be accomplished without significant changes in performance quality of either the target or tweener satellite.

III. THE COMMISSION SHOULD NOT ADOPT OTHER COORDINATION PROPOSALS IN THE *NOTICE*

Unavailability is clearly the best standard in comparison to the other coordination proposals discussed in the *Notice*. For example, the Commission asks if it should simply set a deadline for reaching agreement and to dismiss the application when the deadline expires if no agreement has been reached.[20] This approach, however, would permit incumbent operators to block new tweener entrants simply by stalling negotiations until the deadline expires. Spectrum Five also agrees with the Commission that the asymmetric C/I level approach proposed by DIRECTV would be tantamount to "dictating two different classes of service" and is not "appropriate for regulatory enforcement."[21] DIRECTV proposes a single-entry C/I level of 24 dB for interference into existing systems, and a 12 dB C/I level for interference into new tweener systems.[22] This asymmetry is not justifiable and should not be considered in coordination. Given the clear advantages of an "unavailability" standard, there is no need for the Commission to resort to other mechanisms.

IV. THE COMMISSION SHOULD ADOPT BASIC INFORMATION REQUIREMENTS AND PROCEDURES TO FACILITATE COORDINATION NEGOTIATIONS

Spectrum Five recommends that the Commission adopt the following rules to govern, and thereby facilitate, coordination negotiations:

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[20] *Notice* ¶ 42.

[21] *Id.* ¶ 44.

[22] Petition of DIRECTV Enterprises, LLC for a Rulemaking on the Feasibility of Reduced Orbital Spacing in the U.S. Direct Broadcast Satellite Service (filed Sept. 5, 2003).

- The unavailability objective should be no more than 0.11% for those links originally meeting (without tweener interference) an objective of 99.9%. Other links with lower objectives than 99.9% (for example, 99.89%) also shall not be degraded by more than 10% (for example, a link meeting an objective of 99.8% or an unavailability of 0.2% shall not be degraded by tweener interference by more than 10%, to an unavailability objective of 0.22%).

- Because light rain rate areas are more susceptible to adjacent satellite interference, it may be in the interests of all parties that a coordination agreement might be concluded with one or two locations not meeting the objective availability of 99.89%. Such a conclusion might be justified because present operations in the 17/12 GHz band, specifically in Florida, result in only 99.8% and proposals in the 17/24 GHz band also have set objective availabilities significantly below 99.89%.

- An operator requesting coordination shall provide detailed link parameters suitable for the coordination process. The operator with whom the coordination negotiation is to be conducted shall respond with like detailed link parameters within 60 days of the coordination request. This information shall include all planned or future operating parameters that might affect a coordination agreement.

- Both operators of existing satellites and proposed reduced-spaced satellites shall provide sufficient information on performance to evaluate interference over the entire U.S. (including the offshore U.S.). This information shall include, in the case of operating satellites, the link performance "as built."

- Coordination should be based on earth station antennas, including antennas larger than 45 cm or antennas having multiple beams, meeting Section 25.209[23] (or B.O.1213) standards over the range of sidelobe antenna gain of interest to the coordination process (*i.e.*, the near-in sidelobe gain).

- The two operators shall provide a report to the involved administrations within 120 days of the initial request for coordination, or sooner, describing the terms of their coordination agreement or summarizing the areas of disagreement. The Commission and other affected administrations can participate in these negotiations but normally need not be directly involved unless the negotiations reach an impasse.

[23] 47 C.F.R. § 25.209.

V. THE COMMISSION SHOULD FACILITATE COORDINATION TO ENCOURAGE NEW ENTRY, RATHER THAN IMPOSE A SPECTRUM CAP

Spectrum Five does not believe a spectrum cap is an effective way to foster competitive entry in DBS.[24] Instead, the Commission should adopt criteria and procedures, as described above, to ensure that coordination between new reduced-spaced entrants and incumbent operators is carried out as expeditiously and effectively as possible. The 12.2-12.7 GHz DBS band will continue to develop as new satellites are deployed at reduced-spaced orbital locations and new technology such as MPEG-4 HD, higher order modulations such as 8PSK, and better coding are employed. The expansion 17/24 GHz band also will provide new opportunities to enhance both capacity and services. Under these circumstances, a spectrum cap could potentially limit the flexibility of operators to innovate and deploy competitive new systems, without any concrete benefits.

VI. CURRENT MVDDS AND NGSO-FSS SHARING CRITERIA SHOULD BE EXTENDED TO REDUCED-SPACED SATELLITES

Spectrum Five believes that the current rules applicable to sharing between DBS and the Multichannel Video Distribution and Data Service ("MVDDS")/ Non-Geostationary Satellite Orbit Fixed Satellite Services ("NGSO FSS") are sufficient to adequately protect reduced-spaced DBS operations.[25]

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[24] *See Notice* ¶¶ 62-63.

[25] *See id.* ¶¶ 53-58.

VII. CONCLUSION

For the reasons discussed above, Spectrum Five urges the Commission to adopt an "unavailability" benchmark and procedures to facilitate coordination negotiations between incumbent DBS operators and new tweener entrants in the 12.2-12.7 GHz band. Adoption of the straightforward criteria proposed herein will help operators maximize the new services that can be provided to the public using this valuable spectrum.

Respectfully submitted,

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TECHNICAL EXHIBIT

INTRODUCTION. Spectrum Five has been authorized by the Commission to provide service to the United States from a "tweener" satellite network at 114.5° W.L.[1] EchoStar has been licensed for a tweener network at 86.5° W.L. between the Canadian orbital slots at 82.0° W.L. and 91° W.L.[2] SES Americom had also previously filed for a tweener satellite network at 105.5° W.L.[3]

ORBITAL PLAN. If the FCC adopts nominal satellite spacings of 4.5 degrees in the 17/24 GHz band, as advocated by EchoStar in the 17/24 GHz rulemaking proceeding, at least two orthogonally polarized satellites from each of the 17/24 GHz and 17/12 GHz service bands would be stationed near the nominal orbital position, requiring at least four orbital locations in order to avoid physical collision. The separation "offsets" of +/- 0.2 degrees, consistent with the Region 2 Plan result in only three orbital positions. Consequently it is recommended that this plan be modified by the Commission.

Further, because not all possible channels are assigned to one operator by the Commission in its 17/12 GHz plan, additional satellites may be required at and around some nominal orbital positions. For example, EchoStar is allocated 21 channels and DIRECTV is allocated 11 channels at 110° W.L. Presumably, these arrangements will be continued into the future thus requiring more than four orbital stations per nominal orbital station. Thus, an orbital plan having uniform offsets and orderly and fair assignments between the two services, 17/12 GHz and 17/24 GHz, would be desirable.

Spectrum Five recommends that a uniform offset plan be adopted for both the 17/24 GHz and 17/12 GHz space networks on the basis that this approach provides the simplest way to establish a uniform plan for the U.S. This plan, based on the nominal Region 2 Plan for BSS, allows for six more satellites at each nominal orbital location but also is a plan that accommodates both Canada and Mexico so that this plan likely would be acceptable to all parties. This plan avoids the uncertainties involved with the negotiation of a new orbital plan with Canada, Mexico and other western hemisphere administrations. Thus,

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[1] *Spectrum Five, LLC, Petition for Declaratory Ruling to Serve the U.S. Market Using Broadcast Satellite Service (BSS) Spectrum from the 114.5° W.L. Orbital Location*, Order and Authorization, File Nos. SAT-LOI-20050312-00062, SAT-LOI-20050312-00063, DA No. 06-2439 (rel. Nov. 29, 2006).

[2] *EchoStar Satellite L.L.C., Application to Construct, Launch, and Operate a Direct Broadcast Satellite at the 86.5° W.L. Orbital Location*, Order and Authorization, File No. SAT-LOA-20030609-00113, DA No. 06-2440 (rel. Nov. 29, 2006).

[3] SES Americom's petition was dismissed on November 29, 2006, without prejudice to refiling, and subject to a waiver of the DBS freeze. *See* Letter from Robert G. Nelson, Chief, Satellite Division, to Nancy J. Eskenazi, Esq., SES AMERICOM, Inc., Re: SES AMERICOM, Inc. Petition for Declaratory Ruling To Serve the U.S. Market Using BSS Spectrum from the 105.5° W.L. Orbital Location, File Nos. SAT-PDR-20020425-00071, SAT-AMD-20051116-00219, SAT-AMD-20060120-00006 Call Sign: S2619, DA No. 06-2438 (Nov. 29, 2006).

the Region 2 Plan could serve as a basis for the BSS networks at both 17/12 GHz and 17/24 GHz.

One such plan is described as follows. For the western, primary arc, the "Nominal" orbital locations are 96.5° W.L., 101.0° W.L., 105.5° W.L., 110.0° W.L., 114.5° W.L. and 119° W.L. All negative orbital positions or "offsets" relative to the Nominal positions – that is, the -0.1, -0.3, -0.5 degree offsets – would be assigned to 17/12 GHz systems, and all positive offsets relative to the nominal positions – that is, +0.1, +0.3 and +0.5 degrees – would be assigned to 17/24 GHz systems. The result is that each of the six western arc orbital locations has six possible satellite locations, spaced 0.2 degrees, 36 total, with 18 assigned to the 17/12 GHz service and 18 assigned to the 17/24 GHz service. In this arrangement, co-service, co-channel satellites are spaced between 4.1 to 4.5 degrees, depending on the number of satellites. This requires an east-west station keeping accuracy of better than +/- 0.05 degrees (industry experience is +/-0.03 degrees). This is Spectrum Five's recommended plan. If the +/- 0.05 degrees east-west station keeping requirement is to be kept then the orbital offsets can be increased to +/- 0.125, +/- 0.375 and +/- 0.625 degrees, reducing the minimum spacing, for three satellites to 4.0 degrees.

Mexican western orbital slots are outside this plan. However, this plan also would be useful for the eastern slot at 61.5° W.L. (and possibly 65.35° W.L.) relative to the Mexican satellite at 69.2° W.L. If Canada were to adopt the same plan for 91° W.L. then the separation between co-channel systems also can be maintained in this portion of the service arc.

The new orbit locations, with orbital offsets, as suggested above, require a change in the Region 2 Plan (Appendix 30/30A); however, it does not appear that any significant change in the interference environment has occurred since satellites already operate at these offsets or very near these orbital offsets or plan to do so. The support of Canada and Mexico for this plan also would be desirable.

COORDINATION PLAN.

INTRODUCTION. The use of tweeners in the 17/12 GHz band doubles the bandwidth available to the public from the primary service arc, 96.5° W.L. to 119° W.L., and thus is a desirable goal for both the Commission and for the satellite broadcasting industry. The introduction of tweeners must necessarily increase the interference to existing, operating satellites but can be limited so that the results of any coordination negotiation can result in a service that is still acceptable and valuable to subscribers of both satellite systems. Until the Report & Order ("R&O") to this *Notice* is issued, tweeners will be coordinated in the usual manner by coordination negotiations between the affected administrations and operators. With the issuance of the R&O, further guidelines may be available to facilitate coordination. Specifically, all new satellites authorized by the Commission after the subject R&O is released would be expected to be designed to be compatible with the nominal 4.5 degree orbital spacing; there then would be a mix of operating satellites designed for either the nominal 9 or 4.5 degree spacing.

Eventually, due to attrition, all operating satellites will eventually have been designed for the 4.5 degree nominal spacing.

COORDINATION BEFORE RELEASE OF R&O. Before the issuance of the R&O pertaining to this *Notice*, processing of applications and coordination of satellites would be performed according to the Region 2 Plan and FCC requirements. The 17/12 GHz BSS service has been in operation for a number of years, has demonstrated its competitiveness relative to terrestrial broadcasting and cable and has demonstrated a high quality of service. Consequently it is important to introduce the new tweener satellite capability, which will double the capacity of the primary orbital arc, without causing objectionable interference to existing services. However there must be a balance accomplished by the coordination such that the tweener networks also provide a high quality of service and are competitive with the older satellite systems and with terrestrial broadcasting and cable. However, this coordination cannot be arbitrary or open-ended but must be undertaken with reasonably clear objectives.

COORDINATION AFTER RELEASE OF THE R&O. It is proposed that the Commission include procedures and criteria for coordination in its R&O in order to expedite the coordination process and to balance the interference between operating satellites and satellites yet to be launched. It is Spectrum Five's belief that the present objectives for rain availability are 99.9% excepting the vicinity of Miami where it might be 99.8% (with 45 cm antennas). Somewhat higher objectives are obtained in practice because satellite manufacturers take measuring equipment errors and other uncertainties into account when they demonstrate conformance to specifications. Consequently, the performance objectives typically are exceeded; *i.e.*, the availability due to rain over most of CONUS may exceed 99.9%. In addition, there may be additional "excess" margins, particularly for CONUS or national beams, because the antenna gain is not optimum everywhere; larger earth station antennas or modified emission parameters such as increased coding also may be used. Consequently, the coordination amongst the parties can take advantage of these factors, protecting the existing systems but enabling new systems to offer similar service quality. That is, the tweener operator may adjust its transmission parameters, availability objectives and/or earth station size so as to meet these objectives over most or even all of CONUS. This would necessitate a detailed sharing of key transmission and performance parameters over CONUS between the coordination negotiators. Spectrum Five anticipates that the DBS service will naturally evolve so that replacement satellites will be designed to maximize the available orbital and spectrum resources.

COORDINATION OBJECTIVES. The Commission has acknowledged, in the MVDDS proceeding and other proceedings, that a 10% degradation in unavailability to subscribers may not be discernible to subscribers and therefore, might be acceptable. For a typical subscriber viewing TV 24 hours per day, the outage for 99.9% availability would be 525.6 minutes a year. If the unavailability is increased by 10%, the same subscriber would experience an outage increase of 52.6 minutes per year. This 10% represents a decrease in margins that are well within the uncertainties of the current rain models, such as the ITU P.618 or Crane Model, which are based on ten year averages. It

is believed that present operators serve the southeastern U.S. at an availability of approximately 99.8%, a yearly outage of 1051.2 minutes. Spectrum Five plans to provide 99.9% availability within CONUS in the 17/12 GHz band including Miami and its vicinity. Pegasus, in its April 2006 application for service in the 17/24 GHz band cites a downlink availability objective due to rain of 99.7% (99.6% in the southeast) for a CONUS beam and 99.5% for spot-beams with > 99.9% for the uplink.[4] Similarly, EchoStar in its March 2002 application for service in the 17/24 GHz band cites a downlink availability objective due to rain of 99.7%.[5] DIRECTV, in its June 1997 application for service in the 17/24 GHz band cites a downlink availability objective due to rain of 99.7%.[6] These rain objectives indicate that the three applicants were willing to recommend an availability of 99.7% (yearly outages of at least 1,576.8 minutes) as adequate for the new 17/24 GHz service, despite their ongoing experience with an availability of 99.9% in the 17/12 GHz band.

The Commission may recall that the original analog Region 2 Plan was based on 99.7% availability but that BSS operations now achieve better than 99.9% over most of CONUS. In paragraphs 47 to 49 of the *Notice*, the Commission notes that NGSO interference to DBS is proposed to be a maximum increase in unavailability of 10%; for DBS unavailability of 0.1% to 0.2%, the increase in unavailability due to NGSO would be 0.11% or 0.22% respectively.

Considering all of these objectives, increasing the unavailability objective due to rain of an operating system to 0.11% (from 0.1%) due solely to interference from a tweener satellite spaced nominally 4.5 degrees away is a reasonable approach which can serve as a useful and effective objective for accomplishing coordination

COORDINATION ANALYSIS AND PROPOSAL. An actual coordination must consider actual system operating parameters with an adequate number of locations over CONUS and offshore. This information is not readily available and can only be obtained by the parties engaged in a coordination negotiation. Alternatively, Spectrum Five has constructed a satellite model to illustrate the interplay of certain key parameters and what might be accomplished during coordination. The model consists of a "target" satellite assumed to operate at 110° W.L. with a downlink CONUS beam and uplink spot-beams; Alaska and Hawaii also are served by spot-beams. Adjacent satellite interference is received from satellites at 119° W.L., 101° W.L. and from a tweener satellite at 114.5° W.L.

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[4] Pegasus 17/24 GHz Applications, File Nos. SAT-LOA-20060412-00042, SAT-LOA-20060412-00043, SAT-LOA-20060412-00044 (April 2006) at 17.

[5] EchoStar 17/24 GHz Applications, File Nos. SAT-LOA-20020328-00050, SAT-LOA-20020328-00051, SAT-LOA-20020328-00052 (March 2002), Attachment A at 14. as amended by SAT-AMD-20051118-00245, SAT-AMD-20051118-00246, SAT-AMD-20051118-00247.

[6] DIRECTV 17/24 GHz Applications, File Nos. SAT-LOA-19970605-00049, SAT-LOA-19970605-00050, SAT-LOA-19970605-00051 at 39 (June 1997), as amended by SAT-AMD-200511118-00224, SAT-AMD-200511118-00225, SAT-AMD-200511118-00226.

The target uplink, provided via a 12 meter antenna, results in an uplink C/N+I = 25 dB via satellite spot-beam receive antennas and is included in the model. The feederlink earth station receives negligible interference from the tweener at 114.5° W.L. Thus uplink characteristics are not considered further in this analysis.

The downlinks of all four satellites are identical initially, but a variable "excess" margin, as discussed above, can be added to the target satellite downlink, and the interfering power of the tweener satellite is variable to either simulate a tweener with different emission characteristics, such as a spot-beam satellite or tweener system with larger antennas, etc.

17 points are considered within CONUS and two points for Anchorage-Juneau and one point for Hawaii, as listed in Table 1. The points are selected to be representative of the surrounding areas and to represent the broad range of rain statistics over the U.S. Link performance is computed at the stated latitudes and longitudes; the names of the locations are only for reference and either may be at or near the respective points.

Table 1. Characteristics of 20 Selected Points, Satellite At 110° W.L.

Point	Location*	Latitude °N	Longitude °W	Elevation deg	Point	Location*	Latitude °N	Longitude °W	Elevation deg
1	Seattle	47.62	122.33	34.00	10	Minn	44.98	93.23	35.58
2	Denver	39.75	105.0	43.72	11	Phoenix	33.48	112.07	51.01
3	New York	40.78	73.97	30.27	12	Dallas	32.77	96.77	49.29
4	L.A.	34.05	118.25	49.45	13	Houston	29.75	95.35	51.78
5	Memphis	35.15	90.05	43.99	14	St Louis	38.58	90.20	40.79
6	Atlanta	33.75	84.38	42.14	15	Salt Lk Cy	40.77	111.90	42.84
7	Miami	25.77	80.2	45.30	16	Minot	48.47	103.98	34.07
8	Boston	42.21	71.08	27.49	17	Waco	27.18	98.47	55.77
9	Chicago	41.83	87.62	36.59	18	Anchorage	61.30	149.8	13.20
					19	Juneau	58.00	135.0	20.58
					20	Hawaii	21.15	157.25	31.91

Parameters common to all links are given in Table 2. Other performance parameters for each point are given in Table 3.

Table 2. Parameters Common To All Points.

Uplink Frequency, GHz	17.55 GHz
Downlink Frequency, GHz	12.45 GHz
Uplink C/N+I, dB	25.0
Satellite Power Into Antenna, dBW	21.54
Earth Station Noise Temp., dBK	19.5 (clear sky)
Bandwidth, MHz	26
Threshold CNR, dB	6.9
Earth Station Antenna Diameter, cm	45
Earth Station Pointing Loss, dB	0.2
Rain Model	ITU P.618
Satellite Spacing, degrees	4.5 (topocentric spacing used in analysis)
Antenna Sidelobe Model	Part 25.209 (for close-in sidelobes)

Rain Availability Objective, %	99.9 (CONUS & offshore)
Crosspol, dB	30

Table 3. Downlink Performance Parameters of Selected Points.

Coverage Locations	1	2	3	4	5	6	**7**	8	9	10	11
Antenna Gain, dBi	29.6	27.4	31.1	28.0	32.5	33.4	36.2	32.1	30.8	30.8	28.0
Eirp, dBW	51.2	48.9	52.7	49.6	54.1	54.9	57.8	53.7	52.4	52.3	49.5
Rain+Atmos loss, dB	2.5	1.4	3.4	1.7	4.5	5.1	7.5	4.0	3.2	3.2	1.7
Downlink C/I, dB*	23.8	24.0	23.8	24.0	23.9	23.9	24.0	23.7	23.9	23.9	24.0

Coverage Locations	12	13	14	15	16	17	18	19	20
Antenna Gain, dBi	30.9	33.2	32.2	28.1	28.3	31.9	37.9	49.4	49.4
Eirp, dBW	52.4	54.8	53.7	49.6	49.9	53.5	52.0	52.3	55.2
Rain+Atmos loss, dB	3.4	5.1	4.2	1.7	1.7	4.2	2.7	3.0	5.2
Downlink C/I, dB*	24.0	24.0	23.9	23.9	23.8	24.1	23.5	23.7	23.8

- Nominal case, no tweener adjacent satellite interference and no excess margin.

Using Spectrum Five's unique approach to CONUS antenna design (patent pending) all links for the Target satellite are designed to just meet the threshold C/N+I = 6.9 dB, corresponding to an availability of 99.9% with no excess margin and with no interfering signal from the tweener satellite at 114.5° W.L. Then, the availability due to rain, excess margin in the target satellite link and the tweener interfering signal strength are varied parametrically in order to establish the range of acceptability, meaning that all links achieve a C/N+I of at least 6.90 dB.

When the tweener "C/I factor" = 0 dB the tweener has the same radiation characteristics as the target satellite; if this factor is – 2 dB (the tweener interfering C/I is reduced, i.e., made worse, by this factor) then the tweener radiates 2 dB more power toward the target satellite. The "excess" margin is that resulting either from the procurement process or from the operator's design process wherein some or all links, for the convenience of the operator, have excess margin. Excess margins are noted in the applications submitted to the FCC over the years and can be several dB in some links.

In general it is noted that links with low rain rates fail first, because the rain margins for these links are small. This is illustrated for one particular case listed as follows, for an excess margin of 0 dB and a tweener C/I factor = –4 dB;

Unavailability (excess margin = 0 dB and C/I factor = -4 dB)

0.10%	All links fail
0.11%	All links fail except Miami
0.12%	Links 1, 2, 4, 11, 15, 16, 19 fail
0.135%	Only link 2 fails (C/N+I ~ 6.89 dB)
0.136%	All links good (C/N+I = 6.90 dB or better)

It should be noted that the differences in rain fade (attenuation and increased receiver noise) over the range in unavailability from 0.10% to 0.11% are small, as illustrated below for three links. This means that the tweener interference effect also is small.

Denver	New York	Miami
Point 2	Point 3	Point 7
0.1 dB	0.23 dB	0.38 dB

The results are depicted in Figure 1 for three cases of "excess" margin = 0 dB, 0.25 dB and 0.5 dB. If there is no excess margin then only tweener satellite emission characteristics identical to, or less than, that of the target satellite (C/I factor = 0 dB) are acceptable. With an "excess" margin of only 0.25 dB, however, the objective 0.11% unavailability is achievable with a C/I factor of –4 dB, that is, the 0.11% objective is achieved even though the tweener satellite emission exceeds that of the target satellite by 4 dB. It is apparent that we are dealing with small changes in rain availability and small changes in operating parameters; nevertheless, the analysis indicates that the introduction of tweeners amongst operating satellites can be accomplished without significant changes in performance quality of either the target or tweener satellite.

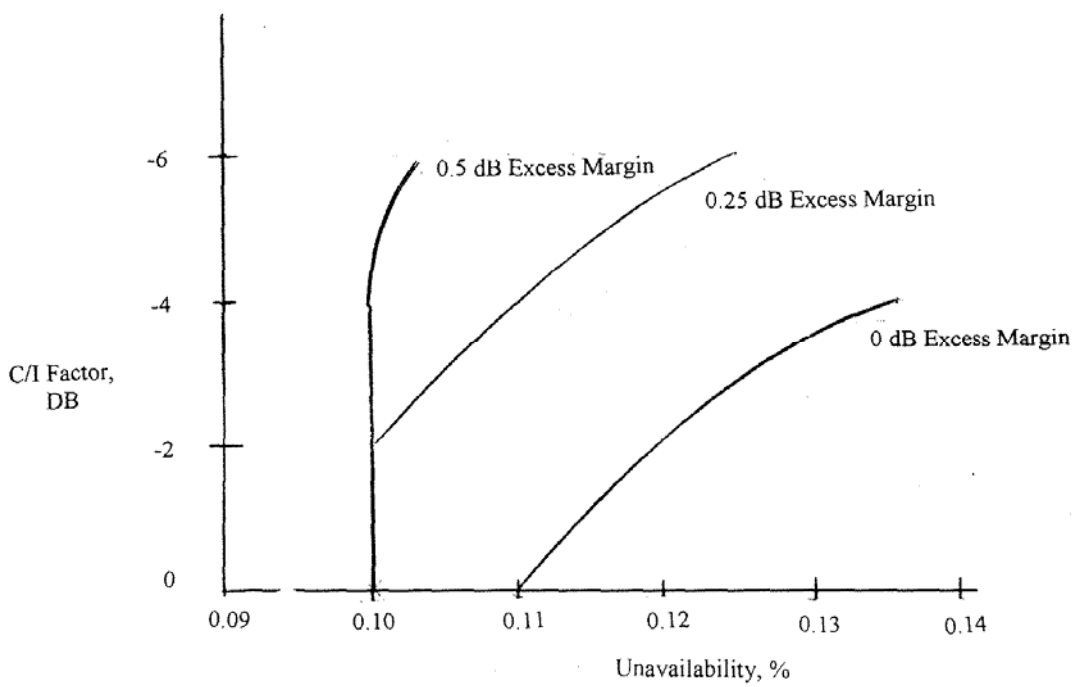

Figure 1. Coordination Range of Tweener Satellite.

The analysis is somewhat idealized in that not every possible situation or problem occurring in a coordination negotiation can be considered; target and tweener emission characteristics may differ somewhat from those assumed; and the implementation of the orbital offset plan described herein may result in satellite separations less than 4.5 degrees. However, the analysis shows that coordination is very feasible as long as the parties involved have access to real-world data on existing and proposed satellite operations. Spectrum Five proposes that this approach to defining certain coordination

criteria, including the 10% increase in unavailability, and other items defined below, appears workable and will be helpful during the coordination process.

1. The unavailability objective should be no more than 0.11% for those links originally meeting (without tweener interference) an objective of 99.9%. Other links with lower objectives than 99.9% (for example, 99.89%) also shall not be degraded by more than 10% (for example, a link meeting an objective of 99.8% or an unavailability of 0.2% shall not be degraded by tweener interference by more than 10%, to an unavailability objective of 0.22%).

2. Because light rain rate areas are more susceptible to adjacent satellite interference, it may be in the interests of all parties that a coordination agreement might be concluded with one or two locations not meeting the objective availability of 99.89%. Such a conclusion might be justified because present operations in the 17/12 GHz band, specifically in Florida, result in only 99.8% and proposals in the 17/24 GHz band also have set objective availabilities significantly below 99.89%.

3. An operator requesting coordination shall provide detailed link parameters suitable for the coordination process. The operator with whom the coordination negotiation is to be conducted shall respond with like detailed link parameters within 60 days of the coordination request. This information shall include all planned or future operating parameters that might affect a coordination agreement.

4. Both operators of existing satellites and proposed reduced-spaced satellites shall provide sufficient information on performance to evaluate interference over the entire U.S. (including the offshore U.S.). This information shall include, in the case of operating satellites, the link performance "as built."

5. Coordination should be based on earth station antennas, including antennas larger than 45 cm or antennas having multiple beams, meeting Section 25.209[7] (or B.O.1213) standards over the range of sidelobe antenna gain of interest to the coordination process (*i.e.*, the near-in sidelobe gain).

6. The two operators shall provide a report to the involved administrations within 120 days of the initial request for coordination, or sooner, describing the terms of their coordination agreement or summarizing the areas of disagreement. The Commission and other affected administrations can participate in these negotiations but normally need not be directly involved unless the negotiations reach an impasse.

UPLINK EIRP DENSITY. Parameters like limits on uplink eirp density and PFD might simplify coordination or even make it semi-automatic such as is done in the C, Ku

[7] 47 C.F.R. § 25.209.

and Ka band FSS. Feederlink earth stations for uplinking to CONUS or national beam satellites presently make use of 9-12 meter antennas. Since only one or two sites are required for these feederlinks, site selection and antenna shielding to avoid harmful interference to other users of the band is readily done. Spectrum Five notes, however, that spot-beam satellites providing local-into-local and related services may require feederlink or gateway antenna uplinks within each spot-beam coverage area. Spectrum Five's authorized spot-beam satellite network is planned with a 3.5 meter antenna installed in each of 48 gateway locations within each of 48 spot beams within CONUS. These antennas are readily installed, aligned and operated. More important, since the 17 GHz band is shared with other services, and will eventually be shared by TV subscribers receiving in the 17 GHz band from the new 17/24 GHz service, more effective shielding may be possible with 3.5 meter antennas than with larger 9-12 meter antennas, such that the horizontal radiation energy actually would be smaller for the 3.5 meter antenna. The one-sided side-lobe characteristic of Part 25.209 predicts a C/I = 41.6 dB at 17 GHz with 4.5 degree separation, adequate with regard to adjacent satellite interference. Thus the limiting uplink eirp density should be based on a 3.5 meter antenna.

Spectrum Five has computed uplink eirp density for two cases, one with 48 co-axial uplink/downlink spot-beams covering CONUS and the other with a CONUS coverage downlink and spot-beam uplink. Offshore areas are covered by spot beams. The uplink, clear sky eirp density for the spot-beam system is –15.7 dBW/Hz at beam center or –11.7 dBW/Hz if the gateway earth station is located at the beam edge. The corresponding eirp density (for a CONUS downlink) with spot beam uplink is –11.7 dBW/Hz assuming the earth station location or spot beam pointing locates the feederlink near the beam center. These values are independent of the uplink antenna size but are based, in both cases, on a spot-beam satellite antenna gain of 49.4 dBi, 8PSK with Rate ¾ Turbo coding, 99.9% uplink fade (uplink availability >99.97%) and 99.9% downlink fade including Miami.

The use of an uplink CONUS satellite antenna for reception is not desirable considering both coordination and cost because the CONUS beam antenna will have of the order of 15 dB less gain. Consequently, it is believed that all systems should have uplink spot-beams in order to more or less equalize the uplink eirp density from satellite to satellite. Spectrum Five supports a maximum uplink eirp density limit of –5 dBW/Hz, allowing for disparate system characteristics but precluding the use of a CONUS beam uplink antenna. An eirp density limit can then be based on a minimum uplink antenna size of 3.5 meters, meeting Part 25.209.

DOWNLINK PFD. The PFD of Spectrum Five's CONUS authorized spot-beam system and design of a CONUS beam system is based on the use of 45 cm subscriber antennas, 99.9% rain availability within CONUS, including Miami and vicinity, 8PSK and Rate ¾ Turbo code. Under these circumstances the spot-beam PFD is a maximum of –113.5 dBW/MHz/m^2 (at beam peak) for the vicinity of Miami and the maximum CONUS beam PFD is –114.8 dBW/MHz/m^2 also for the Miami vicinity. The spot-beam PFD is higher because of interbeam co-channel spot-beam coupling in the satellite and because the PFD is computed at the spot-beam peak (there are also offsetting factors). For coordination

purposes, Spectrum Five recommends a limiting value of –110 dBW/MHz/m^2. If QPSK is used, coupled with rate ¾ Turbo coding (similar but not identical to the coding presently used) then the maximum Spectrum Five PFD would be approximately 3.8 dB less. Spectrum Five believes that 8PSK is required for future systems in order to provide the higher data rate needed for MPEG-4 HD and anticipates that coordination of its proposed satellite system at 114.5° W.L. might need to deal with either QPSK or 8PSK in the neighboring satellites.

DIRECTV PROPOSAL. In paragraph 17 of the *Notice*, the Commission reports on a DIRECTV proposal for coordination with tweeners with a single entry C/I = 24 dB for like systems, including the effect of an antenna pointing error of 0.5 degrees and a 1.05 dB bandwidth factor due to either crosspol or frequency offset. DIRECTV proposes a lower C/I for the interfering tweener system. This asymmetry is not justifiable and should not be considered in coordination. It is believed that Part 25.209 is an accurate representation of the sidelobes of a 45 cm antenna, particularly near the main lobe. Section 25.209 characteristics for a 45 cm antenna having an efficiency of 70% and a gain of 33.83 dBi is 12.67 dBi at 4.5 degrees, a one-sided C/I = 21.16 dB. Topographic spacing over CONUS is typically 4.8 degrees, adding 0.7 dB of isolation, resulting in a typical C/I = 21.86 dB. Further, Spectrum Five believes subscriber pointing error effects are almost negligible. If two adjacent satellites are considered, with a given subscriber antenna pointing error, the interference from one adjacent satellite increases while the interference from the other adjacent satellite decreases, the overall result will be a slight decrease in the C/I (approximately 0.3 dB) assuming all satellites have the same PFD. It is believed that a better approach is to compute the increase in unavailability resulting from the tweener as discussed above in the section dealing with coordination (see Coordination Analysis and Proposal).

Spectrum Five believes the only rational approach is coordination based on an increase in rain unavailability (see Coordination Analysis and Proposal). This provides all parties sufficient flexibility to accommodate present and future system characteristics.

NGSO INTERFERENCE. The Commission, in paragraphs 55 to 58 of the *Notice*, requests comments on the estimate of NGSO interference based on DBS antenna characteristic BO.1443. Spectrum Five believes this characteristic is acceptable for its 17/12 GHz tweener network.

CERTIFICATION OF PERSON RESPONSIBLE
FOR PREPARING ENGINEERING INFORMATION

I hereby declare under penalty of perjury that I am the technically qualified person responsible for preparation of the information contained in the foregoing comments, that I have either prepared or reviewed the engineering information submitted in these comments, and that it is complete and accurate to the best of my knowledge and belief.

/s/ John Kiesling

John Kiesling

Technical Consultant

Dated: December 12, 2006