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

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| In the Matter of | ) | |
| | ) | |
| NEW SKIES SATELLITES B.V. | ) | File No. SAT-MPL-___________ |
| | ) | Call Sign S2591 |
| Request for Modification of the Terms of | ) | |
| U.S. Market Access for NSS-806 at 40.5° W.L. | ) | |

**MODIFICATION**

New Skies Satellites B.V. (doing business as "SES"), hereby respectfully requests that the Commission modify the terms pursuant to which the Netherlands-licensed NSS-806 space station is authorized to serve the U.S. market. Specifically, SES seeks modification to: (1) add direct-to-home ("DTH") service authority within the United States and between the U.S. and the other markets identified herein; and (2) seek flexibility to re-point the steerable conventional Ku-band[1] spot beam on NSS-806 to better meet customer requirements. Grant of the requested authority is consistent with Commission precedent and will serve the public interest by allowing SES to respond to customer demand for DTH capacity. SES anticipates that the NSS-806 DTH capacity will be needed beginning in December and therefore requests action on this modification by November 30, 2011.

A completed FCC Form 312 is attached, and SES incorporates by reference the technical information previously provided in support of NSS-806.[2] In addition, SES is providing

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1 The beam uses the 11.7-11.95 GHz downlink frequencies and the 14.25-14.5 GHz uplink frequencies.

2 *See* File Nos. SAT-PDR-19991227-00130 & SAT-PDR-20001031-00146.

information relating to the proposed modification in the attached narrative Technical Appendix and Schedule S.[3]

## I. BACKGROUND

NSS-806 is a C/Ku-band hybrid spacecraft operating at 40.5° W.L. pursuant to a license issued by The Netherlands. In 2001, the Commission added the NSS-806 satellite to the Permitted Space Station List ("Permitted List") to enable the satellite to provide Fixed Satellite Service ("FSS") in the United States using the standard C- and Ku-bands.[4]

NSS-806 was authorized to serve the U.S. pursuant to the market access policies for foreign-licensed satellites adopted by the Commission, which implement U.S. commitments under the World Trade Organization Basic Telecommunications Agreement ("WTO Telecom Agreement").[5] In the *DISCO II* proceeding, the Commission adopted a presumption that, with respect to satellite services covered by the WTO Telecom Agreement, entry into the U.S. market by satellites licensed by WTO-member countries will promote competition in the U.S. market.[6] For services such as DTH that are excluded from the U.S. commitments in the WTO Telecom Agreement, the Commission applies the "ECO-Sat" test, which requires a determination

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3 As discussed in the Technical Appendix, SES is providing more extensive technical data than is strictly required for a modification application. This comprehensive information is provided for the Commission's convenience given that more than a decade has elapsed since the filing of the original technical parameters for the spacecraft. *See* Technical Appendix at 2.

4 *New Skies Satellites, N.V.*, Order, DA 01-513, 16 FCC Rcd. 7482 (Sat. Div., rel. Mar. 29, 2001) ("NSS-806 Order"). The "standard" or "conventional" C-band refers to the 3700-4200 MHz and 5925-6425 MHz frequencies. The "standard" or "conventional" Ku-band refers to the 11.7-12.2 GHz and 14.0-14.5 GHz frequencies.

5 *See Amendment of the Commission's Policies to Allow Non-U.S. Licensed Space Stations providing Domestic and International Service in the United States,* Report & Order, 12 FCC Rcd 24094, 24096 (1997) ("*DISCO II*").

6 *Id.* at 24112.

whether U.S.-licensed satellites have "effective competitive opportunities" in the relevant foreign markets to provide analogous services.[7] The Commission's policies are intended to ensure that entry by a foreign-licensed satellite will not distort competition in the U.S.[8]

At the time it sought U.S. market access for NSS-806, SES did not seek DTH authority and accordingly did not make an ECO-Sat showing for the spacecraft. As a result, communications with NSS-806 for the purpose of providing DTH service to, from or within the United States were not authorized under the existing terms of the declaratory ruling adding NSS-806 to the Permitted List.[9]

SES now has a customer that wishes to use capacity on NSS-806 for services including DTH to Puerto Rico. In order to offer the requested services, SES seeks modification of the terms of U.S. market access for NSS-806 to permit the spacecraft to provide DTH service to, from, and within the U.S. and on the route markets described below. SES demonstrates herein that the ECO-Sat test is satisfied with respect to the relevant jurisdictions. In addition, SES requests flexibility to adjust the steerable conventional Ku-band beam on NSS-806 to meet customer requirements. Grant of these modifications will serve the public interest by permitting SES to make efficient use of the NSS-806 satellite to respond to customer demand.

## II. AUTHORIZING THE PROPOSED MODIFICATIONS IS CONSISTENT WITH COMMISSION POLICIES AND THE PUBLIC INTEREST

The Commission has generally permitted satellite operators the flexibility to design and modify their networks in response to customer requirements, absent compelling

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7 *Id.* at 24134.

8 *Id.* at 24137.

9 *See* NSS-806 Order at ¶ 20.

countervailing public interest considerations.[10] Here, grant of the requested modifications will permit SES to provide capacity for DTH service and to adjust the NSS-806 coverage pattern in response to customer demand.

### A. Grant of DTH Authority Is Consistent with Section 25.137

The *DISCO II* policies for determining whether to permit foreign-licensed satellites to serve the U.S. are codified in Section 25.137 of the Commission's Rules.[11] SES's modification request fully complies with the Commission's market access requirements.

As discussed above, the ECO-Sat test applies to this request for authority to provide services not covered by the WTO Telecom Agreement. Under the Commission's rules, the relevant foreign markets for this test are (i) the country in which the non-U.S.-licensed satellite is licensed; and (ii) the countries in which communications with U.S. earth stations will originate or terminate.[12] To assess compliance with the ECO-Sat test, the Commission looks at whether there are *de jure* or *de facto* barriers to entry for U.S. satellite operators seeking to provide comparable services in the relevant foreign jurisdiction.[13]

In this instance, SES is seeking authority to use capacity on NSS-806 to provide DTH services: (1) within the U.S., (2) between the U.S. and the Netherlands, (3) between the U.S. and other European Union member states, (4) between the U.S. and Mexico, and (5) between the U.S. and Brazil, the Netherlands Antilles, Guatemala, Honduras, Nicaragua, and the

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10 *See, e.g. AMSC Subsidiary Corporation*, 13 FCC Rcd 12316 at ¶ 8 (IB 1998) (the Commission generally leaves space station design decisions to the licensee "because the licensee is in a better position to determine how to tailor its system to meet the particular needs of its customers.") (footnote omitted).

11 47 C.F.R. § 25.137.

12 *See* 47 C.F.R. § 25.137(a).

13 *DISCO II*, 12 FCC Rcd at 24128.

overseas territories of the United Kingdom located in the Caribbean (Bermuda, the British Virgin Islands, and the Cayman Islands). As demonstrated below, all of these countries satisfy the ECO-Sat test.

The Netherlands. The Netherlands, which is the licensing administration for NSS-806, passes the ECO-Sat test. There are no *de jure* or *de facto* barriers in the Netherlands to U.S. satellite operators wishing to provide capacity for DTH service.[14] The Netherlands' policy conforms to the European Union ("EU") directive specifying that "Member States shall ensure that any regulatory prohibition or restriction on the offer of space segment capacity to any authorised satellite earth station network operator are abolished."[15] Accordingly, authorizing NSS-806 to offer DTH service within the U.S. and between the U.S. and the Netherlands is consistent with *DISCO II*.

Other EU Member States. Similarly, there are no *de jure* or *de facto* barriers in other EU member states to U.S. satellite operators wishing to provide capacity for DTH service. In addition to the Netherlands, the Commission has previously determined that the ECO-Sat test is satisfied with respect to EU member the United Kingdom and its offshore territory Gibraltar[16]

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[14] In support of its request to provide Direct Broadcast Satellite ("DBS") service to the U.S. using Netherlands-licensed satellites, Spectrum Five demonstrated that the "only Dutch regulation applicable to the provision of satellite services (including DBS) requires that a license be obtained from the Radiocommunications Agency Netherlands for the use of frequencies for a satellite earth station," and there are "no restrictions regarding the nationality of the applicant for a license." Petition for Declaratory Ruling of Spectrum Five LLC, File Nos. SAT-LOI-20050312-00062/00063, Narrative at 16. Given this undisputed showing, the International Bureau found no evidence "that suggests the existence of market entry barriers to the Netherlands." *Spectrum Five LLC*, Order and Authorization, DA 06-2439, 21 FCC Rcd 14023 (IB 2006) at ¶ 12; *applications for review denied*, FCC 08-64, 23 FCC Rcd 3252 (2008).

[15] Commission Directive 2002/77/EC, 16 September 2002 on competition in the markets for electronic communications networks and services, OJ L249, Article 7(1) at 21.

[16] *See SES Americom, Inc.*, Call Sign S2676, Consent to Assignment, File No. SAT-ASG-20080609-00120 (grant-stamped Aug. 6, 2008) ("AMC-21 Grant"), Attachment at 3.

and has applied an analysis similar to the ECO-Sat test with respect to EU member Luxembourg.[17] Further individual analyses are not necessary, however, because pursuant to the EU directive described above, all EU member states are prohibited from imposing any regulations or restrictions on satellite capacity, including capacity for DTH services. Accordingly, the ECO-Sat test is satisfied for every EU member state.[18]

Mexico. Mexico passes the ECO-Sat test. The U.S. and Mexico have entered into a bilateral agreement pursuant to which Mexico has agreed to permit U.S.-licensed satellites to provide FSS including DTH service to, from, and within Mexico provided that licensing and coordination conditions are met.[19] Accordingly, allowing NSS-806 to provide DTH capacity in Mexico is consistent with *DISCO II*.[20]

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[17] Specifically, the Commission considered competitive issues in connection with provision of DTH services by SES Americom using its U.S.-licensed satellites given the ultimate ownership of SES Americom by a Luxembourg entity. *See SES Americom, Inc.*, 18 FCC Rcd 16589 at ¶¶ 16-17 (IB 2003). In that context, the Commission considered whether "a foreign operator could provide services in the United States that a U.S.-owned operator could not provide because it could not obtain authorization to operate in the home market of the foreign operator." *Id.* at ¶ 16. The Commission concluded that "such concerns . . . have not been presented in this case," and that "no competitive concerns [were] presented by SES Global's indirect ownership in the Applicants as providers of DTH service in the United States." *Id.* at ¶ 17.

[18] The twenty-seven current member states of the EU are: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom. *See* http://europa.eu/about-eu/member-countries/index_en.htm.

[19] *See* Protocol Concerning the Transmission and Reception of Signals from Satellites for the Provision of Direct-to-Home Satellite Television Services in the United States of America and the United Mexican States, November 8, 1996.

[20] *See DISCO II*, 12 FCC Rcd at 24157 (there is no need for an inquiry into effective competitive opportunities where a bilateral agreement is in place with respect to the relevant service). *See also EchoStar Satellite LLC*, 21 FCC Rcd 4077, 4080 (Sat. Div. 2006) at ¶ 8 & n.20 (in light of U.S.-Mexico bilateral agreement, "no further market access analysis is required"

Brazil, Netherlands Antilles, Guatemala, Honduras, Nicaragua and U.K. Territories in the Caribbean. The Satellite Division has previously found that the ECO-Sat test is satisfied for DTH with respect to Brazil[21] and with respect to the Netherlands Antilles, Guatemala, Honduras, Nicaragua, Bermuda, British Virgin Islands, and Cayman Islands route markets.[22]

In sum, U.S.-licensed operators have effective competitive opportunities to provide DTH transmission capacity in the Netherlands and other EU member states, Mexico, Brazil, the Netherlands Antilles, Guatemala, Honduras, Nicaragua, and the relevant Caribbean islands. Thus, the ECO-Sat test is satisfied for both the home and route markets for DTH service by NSS-806.

The Commission has previously granted requests to modify the terms of U.S. market access for foreign-licensed satellites when an appropriate ECO-Sat showing has been submitted.[23] In these cases the Commission concluded that expanding the terms of market access will not result in competitive distortions, and that "making additional satellite capacity available to provide DTH services in the United States will result in public interest benefits."[24]

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under *DISCO II* in order to authorize U.S.-licensed earth stations to communicate with satellite operating under Mexican authority for DTH services).

[21] *See Hispamar Satelites, S.A.,* Call Sign S2622, File No. SAT-MOD-20040628-00124 (grant-stamped Aug. 26, 2004) ("Amazonas-1 Modification") (modifying the Permitted Space Station List entry for the Brazilian-licensed Amazonas-1 satellite to permit the provision of DTH service to, from, or within the U.S.); *Hispamar Satelites, S.A.,* Call Sign S2793, File Nos. SAT-PPL-20100506-00093 & SAT-APL-20101209-00257 (grant-stamped Dec. 21, 2010; grant reissued Jan. 7, 2011) (same with respect to Amazonas-2).

[22] *See* AMC-21 Grant, Attachment at 3.

[23] *See, e.g.,* Amazonas-1 Modification; *Horizons Satellite LLC,* Order and Authorization, DA 04-1315, 19 FCC Rcd 20349 (Sat. Div. 2004) ("Horizons 1 Modification").

[24] Horizons 1 Modification, 19 FCC Rcd at 20351.

The same conclusion is appropriate here. SES has demonstrated compliance with the terms of the Commission's market access test. Granting the requested authority will allow SES to offer DTH capacity using NSS-806 in competition with U.S.-licensed satellites and other foreign-licensed operators who have made the requisite ECO-Sat showing. Ultimately, U.S. DTH customers will be the beneficiaries of this enhanced competition.

Accordingly, SES respectfully requests that the Commission modify the terms of the Permitted Space Station List entry for NSS-806 to remove the prohibition on the use of the spacecraft to provide DTH services. The Commission should specify that NSS-806 is permitted to provide DTH capacity to, from, and within the U.S. and on the route markets addressed herein (the Netherlands and all other EU member states, Mexico, Brazil, the Netherlands Antilles, Guatemala, Honduras, Nicaragua, Bermuda, the British Virgin Islands, and the Cayman Islands).

**B. Authorizing SES to Repoint NSS-806 Will Allow Optimized Coverage**

As described in the Technical Appendix, NSS-806 is equipped with a steerable conventional Ku-band spot beam antenna. SES seeks authority to adjust the coverage of this antenna to better satisfy customer requirements.

In the short term, SES proposes to re-orient the beam to two different pointings over the United States and the Caribbean in order to facilitate the transfer of traffic from another satellite to NSS-806 and enhance coverage of Puerto Rico. These proposed changes in the Ku-band coverage of NSS-806 will not adversely affect any other operators. Contour maps showing the NSS-806 beam coverage areas with the revised orientations are included in the attached Technical Appendix. As the Technical Appendix demonstrates, the shift in NSS-806's coverage has a minimal effect on the interference environment in which adjacent satellites operate. The operational C- and Ku-band satellites adjacent to the 40.5°W.L. position are Telstar 11N and

SES's AMC-12/NSS-10 spacecraft at the nominal 37.5° W.L. orbital location and Intelsat 11 at 43° W.L. The adjacent satellites are all spaced more than two degrees away from NSS-806. The operations of NSS-806 with the pointing flexibility discussed herein are and will continue to be consistent with SES's coordination agreements with adjacent satellite operators.

## III. WAIVER REQUESTS

SES seeks limited waivers of the Commission's rules in connection with the requested modification to the NSS-806 market access authority. Grant of these waivers is consistent with Commission policy:

> The Commission may waive a rule for good cause shown. Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule. Generally, the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.[25]

*Sections 25.202(g), 25.210(a)(1) and (3), and 25.211(a)*: SES requests continued application of the waivers of Sections 25.202(g), 25.210(a)(1) and (3), and 25.211(a) that were granted in the NSS-806 Order.[26] Section 25.202(g) requires that Telemetry, Tracking and Control ("TT&C") functions be conducted at the edges of the allocated frequency band,[27] but the C-band TT&C carriers on NSS-806 are located near the center of the C-band.[28]

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[25] *PanAmSat Licensee Corp.*, 17 FCC Rcd 10483, 10492 (Sat. Div. 2002) (footnotes omitted).

[26] *See NSS-806 Order* at ¶¶ 15-16 & 22 (granting waivers of Sections 25.202(g), 25.210(a)(1) and (3), and 25.211(a) for U.S. earth stations communicating with NSS-806).

[27] 47 C.F.R. § 25.202(g).

[28] *See* Technical Appendix, Section 6.

Sections 25.210(a)(1) and (3) and 25.111(a)[29] specify C-band polarization and polarization switching requirements and impose a frequency plan for C-band analog video. The NSS-806 C-band payload does not conform to these specifications.[30]

The satellite's technical characteristics are a product of the historic international origins and specific design of satellites such as NSS-806 that were originally part of the INTELSAT system. SES inherited this technical design with the transfer of the NSS-806 satellite from INTELSAT together with the associated customer traffic. The NSS-806 satellite and frequencies have been authorized by the Dutch authorities, are coordinated with U.S. systems, and are not expected to cause any harmful interference. Accordingly, SES requests that the Commission continue to authorize operation of the satellite's C-band payload and TT&C frequencies pursuant to the existing waivers for this spacecraft.

*Sections 25.114(d)(14)(ii) and 25.283(c)*: These rules address requirements relating to venting stored energy sources at the spacecraft's end of life.[31] NSS-806 is a Lockheed Martin 7000 model spacecraft. As described in more detail in the attached Technical Appendix, the oxidizer tanks on the spacecraft were sealed following completion of the launch phase and will therefore retain residual pressure at end of life. Given the spacecraft design, it is physically impossible for SES to vent the oxidizer tanks in order to comply with Section 25.283(c).

No waiver of Section 25.283(c) appears to be necessary, however, for purposes of this modification because NSS-806 was launched in 1998, years before the venting requirement

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29 47 C.F.R. §§ 25.210(a)(1) and (3) and 25.111(a).

30 *See* Technical Appendix, Section 15.

31 Section 25.283(c) contains the substantive venting requirement, and Section 25.114(d)(14)(ii) requires applicants to submit information that addresses "whether stored energy will be removed at the spacecraft's end of life." 47 C.F.R. § 25.114(d)(14)(ii).

in Section 25.283(c) was even proposed.[32] That rule, therefore, does not apply to NSS-806. To read the rule otherwise would be to impermissibly "increase a party's liability for past conduct."[33] It is impossible at this point to make any changes to the design of a spacecraft that has already launched.

In any event, Section 25.283(c) does not appear to apply to foreign-licensed spacecraft such as NSS-806. By its terms, the rule applies only to "space station licensee[s]," *i.e.*, to spacecraft licensed by the Commission, rather than spacecraft licensed by other Administrations that are seeking U.S. market access. However, out of an abundance of caution, SES respectfully requests a waiver of Section 25.283(c), to the extent one is necessary, due to the impossibility of compliance.

Under Commission precedent, grant of a waiver is warranted. In a number of cases involving various spacecraft models with similar limitations, the Commission has waived Section 25.283(c) to permit launch and operation of spacecraft that do not allow for full venting of pressure vessels at end of life, based on a finding that modifying the space station design at a late stage of construction would pose an undue hardship.[34] In the case of NSS-806, which was

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[32] *See Mitigation of Orbital Debris*, Notice of Proposed Rulemaking, 17 FCC Rcd 5586 (2002).

[33] *See Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567, 11598 (¶ 78) (2004), *citing Celotronix Telemetry, Inc. v. FCC*, 272 F.3d 585, 588 (D.C. Cir. 2001).

[34] *See, e.g.*, *EchoStar Satellite Operating Corp.*, File No. SAT-LOA-20071221-00183, Call Sign S2746, grant-stamped Mar. 12, 2008, Attachment at ¶ 4 (granting a partial waiver of Section 25.283(c) for AMC-14, a Lockheed Martin A2100 model spacecraft, on grounds that requiring modification of satellite would present an undue hardship); *DIRECTV Enterprises LLC*, File No. SAT-LOA-20090807-00086, Call Sign S2797, grant-stamped Dec. 15, 2009, Attachment at ¶ 4 (same for DIRECTV 12, a Boeing 702 model spacecraft); *PanAmSat Licensee Corp.*, File Nos. SAT-MOD-20070207-00027, SAT-AMD-20070716-00102, Call Sign S2237, grant-stamped Oct. 4, 2007, Attachment at ¶ 7 (same for Intelsat 11, an Orbital Sciences Star model spacecraft).

launched and operational before the venting requirements were even proposed, there is no question of bringing the satellite into compliance with the rule. The Commission has expressly recognized this, finding a waiver of Section 25.283(c) to be justified for in-orbit spacecraft that cannot satisfy the rule's requirements. For example, in a decision involving the SES Americom AMC-2 satellite, which like NSS-806 was launched before Section 25.283(c) was adopted, the Commission waived the rule on its own motion, observing that venting the spacecraft's sealed oxidizer tanks "would require direct retrieval of the satellite, which is not currently possible."[35]

The same practical obstacle is present here. Because NSS-806 is already in orbit, SES can do nothing to enable full venting of residual pressure in the oxidizer tanks. Given this reality, if Section 25.283(c) applies here, a waiver is clearly warranted.

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[35] File No. SAT-MOD-20101215-00261, Call Sign S2134, grant-stamped Mar. 8, 2011, Attachment at ¶ 4. *See also XM Radio Inc.*, File No. SAT-MOD-20100722-00165, Call Sign S2616, grant-stamped Oct. 14, 2010, Attachment at ¶ 2 (waiving Section 25.283(c) for XM-4, a Boeing 702 model spacecraft, because "modification of the spacecraft would present an undue hardship, since XM-4 is an in-orbit space station and venting XM-4's helium and xenon tanks would require direct retrieval of the satellite, which is not currently possible").

## IV. CONCLUSION

For the foregoing reasons, SES respectfully requests modification of the terms pursuant to which NSS-806 is authorized to serve the U.S. market to permit use of the satellite for DTH service within the U.S. and between the U.S. and the route markets identified herein and to allow flexibility to repoint the satellite's steerable conventional Ku-band spot beam. SES requests action on this modification by November 30, 2011.

Respectfully submitted,

NEW SKIES SATELLITES B.V.

By: *<u>/s/ Joslyn R. Read</u>*

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# TECHNICAL ATTACHMENT FOR NSS-806

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## 3. Type of Authorization Requested

New Skies Satellites B.V. (doing business as "SES") hereby requests a modification to the declaratory ruling adding the Netherlands-licensed NSS-806 spacecraft to the Permitted Space Station List ("Permitted List").[1] Specifically, SES seeks flexibility to re-point the steerable conventional Ku-band spot beam (14.25-14.5 GHz uplink, 11.7-11.95 GHz downlink) on NSS-806 from its current pointing over South America. The requested authority will allow SES to adjust the

[1] *See New Skies Satellites, N.V.*, Order, DA 01-513, 16 FCC Rcd. 7482 (Sat. Div., rel. Mar. 29, 2001) ("*NSS-806 Order*").

pointing of the Ku-band beam in the future in order to optimize coverage and better accommodate customer demand.

In the near term, SES proposes to re-orient the beam to two different pointings over the United States and the Caribbean, and these nominal repointings are described herein. The current pointing and coverage of the Ku-band steerable spot beam is given in Appendix B (Figures B-7 and B-8). The planned repointing of the steerable Ku-band beam will be performed in two steps, first to "position 1" (Appendix B, Figures B-3 and B-4) and then to "position 2" (Appendix B, Figures B-5 and B-6). The purpose of this two-step re-pointing is to facilitate the transition of certain customers on another satellite in SES's fleet to the NSS-806 satellite. Operation of the steerable Ku-band beam at positions 1 and 2 will be consistent with applicable coordination agreements entered into by SES at the 40.5° W.L. orbital position.

The other technical parameters of the satellite remain unchanged. However, because the original documents submitted to the FCC to describe NSS-806 were filed more than a decade ago, SES is providing for the Commission's convenience a more extensive Technical Attachment and Schedule S than would otherwise be required for a modification application. *See* 47 C.F.R. § 25.117(d)(1) (requiring submission of "only those items of information listed in § 25.114 that change").

As the Commission is aware, in addition to its Ku-band payload the NSS-806 satellite is also capable of using certain conventional and extended C-band downlink frequencies. The use of the conventional C-band frequencies on NSS-806 has already been authorized by the Commission, and SES does not propose to change these operations. Use of the extended C-band frequencies on NSS-806 has not been generally authorized for service to the United States. Instead, U.S. earth stations seeking to communicate with NSS-806 in the extended C-band frequencies must be individually licensed.

**4. General Description of Overall System Facilities, Operations and Services**

NSS-806 is a geostationary satellite operating in the C- and Ku-bands that currently provides a range of fixed satellite services ("FSS") to users located in various countries in ITU Regions 1 and 2 from the 40.5º W.L. orbital location. The C- and Ku-band payloads can be cross-connected, as indicated in the Schedule S.

The C-band portion of the communications payload consists of 28 transponders. The Traveling Wave Tube Amplifiers ("TWTAs") on the C-band payload have two 16-for-14 groups for redundancy, using both left hand and right hand circular polarization to achieve dual frequency re-use. The satellite features a single C-band beam covering the Americas and Europe. Eight (8) of the C-band transponders have a bandwidth of 72 MHz, sixteen (16) transponders have a bandwidth of 36 MHz, two (2) transponders have a bandwidth of 34 MHz and two (2) transponders have a bandwidth of 41 MHz. No change to the C-band operations is proposed in this application.

The Ku-band portion of the communications payload consists of 3 transponders on a steerable spot beam that can be independently re-oriented toward any point on the Earth's surface. One (1) transponder on the Ku-band beam has a bandwidth of 77 MHz and two (2) transponders have a bandwidth of 72 MHz. The TWTAs on the Ku-band payload have a 4-for-5 redundancy. The polarization of the Ku-band spot beam is linear. As indicated above, SES plans in the near term to re-point the steerable Ku-band spot beam to two different positions over the United States and the Caribbean, as shown in Appendix B.

C-band is used for the Telemetry, Tracking and Control ("TT&C") functions of the NSS-806 satellite, but the steerable Ku-band beam also carries one beacon for tracking purposes only. The accompanying Schedule S includes information on which antenna beams are connected or switchable to each transponder where it is relevant for the Ku-band beam. Relevant information regarding the Ku-band tracking beacon is also provided.

## 5. Operational Characteristics

### 5.1 Frequency/Channelization and Polarization Plan

Details of the NSS-806 frequency/channelization and polarization plan, including the TT&C frequencies, are included in the accompanying Schedule S. Typical emission designators with associated bandwidth for the steerable Ku-band beam can also be found in the Schedule S.

### 5.2 Communications Payload

#### 5.2.1 Uplink Transmissions

The maximum receive antenna gain, receive system noise temperature, and beam peak G/T, SFD and cross-polarization isolation of the NSS-806 satellite are all specified in the accompanying Schedule S. Note that the G/T will decrease and the SFD level will increase, dB-for-dB, from the beam peak value as the uplink location moves away from beam peak.

#### 5.2.2 Downlink Transmissions

The peak transmit antenna gain, EIRP, cross-polarization, and associated parameters are specified in the accompanying Schedule S.

#### 5.2.3 Channel Filter Response

The predicted worst case channel filter response performance for each of the transponder bandwidths (77 MHz, 72 MHz, 41 MHz, 36MHz and 34 MHz), measured between the receive antenna reference interface point and the transmit antenna reference interface point, is shown in Table 5-1.

| Parameter | Frequency Offset from Channel Center ($F_c$) | Gain Relative to Channel Center Frequency |
|---|---|---|
| **Insertion Loss Variation 34 MHz Channel** | ±11.9 MHz | 1.1 $dB_{p-p}$ |
| | ±13.6 MHz | 1.1 $dB_{p-p}$ |
| | ±15.3 MHz | 1.3 $dB_{p-p}$ |
| | ±17.0 MHz | 2.0 $dB_{p-p}$ |
| **Insertion Loss Variation 36 MHz Channel** | ±12.6 MHz | 1.1 $dB_{p-p}$ |
| | ±14.4 MHz | 1.1 $dB_{p-p}$ |
| | ±16.2 MHz | 1.3 $dB_{p-p}$ |
| | ±18.0 MHz | 2.0 $dB_{p-p}$ |
| **Insertion Loss Variation 41 MHz Channel** | ±14.35 MHz | 1.1 $dB_{p-p}$ |
| | ±16.4 MHz | 1.1 $dB_{p-p}$ |
| | ±18.45 MHz | 1.3 $dB_{p-p}$ |
| | ±20.5 MHz | 2.0 $dB_{p-p}$ |
| **Insertion Loss Variation 72 MHz Channel** | ±25.2 MHz | 1.2 $dB_{p-p}$ |
| | ±28.8 MHz | 1.2 $dB_{p-p}$ |
| | ±32.4 MHz | 1.5 $dB_{p-p}$ |
| | ±36.0 MHz | 2.0 $dB_{p-p}$ |
| **Insertion Loss Variation 77 MHz Channel** | ±26.95 MHz | 1.2 $dB_{p-p}$ |
| | ±30.8 MHz | 1.2 $dB_{p-p}$ |
| | ±34.65 MHz | 1.5 $dB_{p-p}$ |
| | ±38.5 MHz | 2.0 $dB_{p-p}$ |

**Table 5-1. Response Characteristics of Representative NSS-806 Channel Filter**

The narrow-band receive and transmit out-of-band response, and the wide-band receive out-of-band response for each of the transponder bandwidths (77 MHz, 72 MHz, 41 MHz, 36 MHz and 34 MHz) are shown in Tables 5-2, 5-3 and 5-4.

| Parameter | Frequency Offset from Channel Center ($F_c$) | Gain Relative to Channel Center Frequency |
|---|---|---|
| **Insertion Loss Variation 34 MHz Channel** | ±23.6 MHz | -30 dB |
| | > ±28.3 MHz | -40 dB |
| **Insertion Loss Variation 36 MHz Channel** | ±25 MHz | -30 dB |
| | > ±30 MHz | -40 dB |
| **Insertion Loss Variation 41 MHz Channel** | ±28.5 MHz | -30 dB |
| | > ±34 MHz | -40 dB |
| **Insertion Loss Variation 72 MHz Channel** | ±50 MHz | -30 dB |
| | > ±60 MHz | -40 dB |
| **Insertion Loss Variation 77 MHz Channel** | ±53.5 MHz | -30 dB |
| | > ±64 MHz | -40 dB |

**Table 5-2. Narrow-band Receive Out-of-Band Response Characteristics of Representative NSS-806 Channels**

| Parameter | Frequency Offset from Channel Center ($F_c$) | Gain Relative to Channel Center Frequency |
|---|---|---|
| **Insertion Loss Variation 34 MHz Channel** | ±23.6 MHz | -25 dB |
| | > ±28.3 MHz | -30 dB |
| **Insertion Loss Variation 36 MHz Channel** | ±25 MHz | -25 dB |
| | > ±30 MHz | -30 dB |
| **Insertion Loss Variation 41 MHz Channel** | ±28.5 MHz | -25 dB |
| | > ±34 MHz | -30 dB |
| **Insertion Loss Variation 72 MHz Channel** | ±50 MHz | -25 dB |
| | > ±60 MHz | -30 dB |
| **Insertion Loss Variation 77 MHz Channel** | ±53.5 MHz | -25 dB |
| | > ±64 MHz | -30 dB |

**Table 5-3. Narrow-band Transmit Out-of-Band Response Characteristics of Representative NSS-806 Channels**

| Parameter | Frequency Offset from Bands Edges ($F_e$) | Gain Relative to Channel Center Frequency |
|---|---|---|
| **Hemi beam** | ±112 MHz | -20 dB |
| | ±150 MHz | -30 dB |
| **Spot beam** | ±160 MHz | -20 dB |
| | ±200 MHz | -30 dB |

**Table 5-4. Wide-band Receive Out-of-Band Response Characteristics of Representative NSS-806 Channels**

Each active satellite transmission chain (channel amplifiers and associated SSPA (C-band) or TWTA (Ku-band)) can be individually turned on and off by ground telecommand, resulting in cessation of emissions from the satellite, as required.

## 6. TT&C Subsystem

The TT&C frequency and polarization plan for the NSS-806 satellite is shown in Table 5-6.

**Table 5-6. NSS-806 TT&C Frequency and Polarization Plan**

| Carrier name | Channel ID in Schedule S | Frequency, MHz | Polarization |
|---|---|---|---|
| Telecommand 1 | CMD1 | 6173.7 | LHCP |
| Telecommand 2 | CMD2 | 6176.3 | LHCP |
| Telemetry 1 | TM1 | 3947.5 | RHCP |
| Telemetry 1 alternative | TM2 | 3948.0 | RHCP |
| Telemetry 2 | TM3 | 3952.5 | RHCP |

| | | | |
|---|---|---|---|
| Telemetry 2 alternative | TM4 | 3952.0 | RHCP |
| Tracking Beacon | BC1 | 3950.0 | V |
| Tracking Beacon | BK1 | 11701.0 | H |

Normal on-station commands will be received through the earth-facing horn antenna, and on-station telemetry will be transmitted through the earth-facing horn antenna, allowing the satellite to be commanded from anywhere on the Earth that is visible from its orbital location. The C-band tracking beacon will also be transmitted through the earth-facing horn antenna, but the Ku-band tracking beacon will be transmitted through the Ku-band communications antenna of the satellite. Both tracking beacons are intended to be used by earth station operators as a calibrated reference to compensate for rain attenuation and to adjust antenna pointing.

The Ku-band beacon link performance is summarized in the link budget analysis in Appendix C. The antenna patterns for the TT&C subsystem are discussed in Section 7.3. The emission designators associated with the TT&C subsystem are 800KF9D for command, 300KF9D for telemetry and 25K0N0N for the tracking beacons. The associated allocated bandwidth is 800 kHz, 300 kHz and 25 kHz for each of these emissions, respectively.

The C-band command and telemetry frequencies for NSS-806 are located near the center of the standard C-band. Coordination has been completed with adjacent satellite operator(s) to operate the TT&C carriers at these frequencies. The Commission previously granted a waiver of the FCC's rule requiring TT&C carriers to be located at the band edges for this spacecraft.[2]

## 7. Orbital Location

SES operates the NSS-806 satellite at 40.5° W.L.

[2] *See NSS-806 Order* at ¶¶ 15-16 & 22 (granting waiver of Section 25.202(g) for U.S. earth stations communicating with NSS-806, noting that the center-band TT&C frequencies had been fully coordinated with adjacent operations).

## 8. Spacecraft Antenna Gain Contours

### 8.1 Uplink Beams

The receive antenna gain contours for the NSS-806 receive beams are given in GXT format in the accompanying Schedule S. The contours can also be found in Appendix B to this Attachment.

### 8.2 Downlink Beams

The peak transmit gain and the antenna gain contours in GXT format are given in the accompanying Schedule S. The contours can also be found in Appendix B to this Attachment.

### 8.3 TT&C Beams

Command carriers are received by Omni antennas. Telemetry carriers are transmitted using Horn antennas. The receive and transmit antenna beam patterns are given in GXT format in the accompanying Schedule S (see also Sections 7.1 and 7.2 above).

## 9. Service Description, Link Performance Analysis, and Earth Station Parameters

### 9.1 Service Description

SES uses the NSS-806 satellite to provide a wide range of FSS services, including transmission of voice, video[3] and narrowband to wideband digital services, to customers throughout the Americas, Europe, and the northern part of Africa. In addition, as part of this application, SES is seeking authority to provide direct-to-home ("DTH") services within the United States, as well as between the United States and certain countries.

### 9.2 Link Performance

The table 9-1 below indicates the different connectivities that are possible on the NSS-806 spacecraft. Representative communications link budgets for the NSS-806 satellite are shown in Appendix A as Tables A-1 to A-5 for those connectivities that are related to the steerable Ku-band

[3] Analog TV/FM service in C-band will not be implemented in the U.S. and its territories, unless coordination with adjacent satellites has been completed.

beam only (i.e. SPOT/SPOT, SPOT/HEMI and HEMI/SPOT). The Ku-band beacon link budget is shown in Appendix C as Table C-1.

The link budgets assume two adjacent operating satellites at 2 degrees orbital separation each. For the C-band related digital carrier link budgets, the uplink power density of the emissions from each of the neighboring satellites was assumed to be -42 dBW/Hz. The downlink EIRP density of the emissions of each of the adjacent satellites was assumed to be -34 dBW/Hz. For the Ku-band related digital carriers, the uplink power density of the emissions from each of the adjacent satellites was assumed to be -50 dBW/Hz, and the maximum downlink EIRP density of the emissions from each of the hypothetical satellites was assumed to be -26 dBW/Hz.

**Table 9-1. Definitions of beam types used in the link analysis**

| Uplink Beam type | Downlink Beam type |
|---|---|
| HEMI (C-band) | HEMI (C-band) |
| HEMI (C-band) | SPOT (Ku-band) |
| SPOT (Ku-band) | HEMI (C-band) |
| SPOT (Ku-band) | SPOT (Ku-band) |

### 9.3 Earth Station Parameters

Earth station characteristics are reflected in the representative link budgets shown in Appendix A as Tables A-1 to A-5 as well as the accompanying Schedule S.

### 9.4 Channel Connectivity

The channel connectivities for the NSS-806 satellite are indicated in Schedule S. In addition to uplinks and downlinks that are wholly within the C-band frequencies and wholly within the Ku-band frequencies, cross-connections can be established between the C-band beam and steerable Ku-band beam.

**10. Satellite Orbit Characteristics**

The NSS-806 satellite is maintained in geosynchronous orbit at the 40.5º W.L. orbital location with a maximum N-S drift of ± 0.05° and a maximum E-W drift of ± 0.05°.

**11. Power Flux Density**

The allowable PFD levels in the C-band are defined in Section 25.208(a) of the Commission's rules, and the allowable PFD levels in the 10.95-11.20 GHz and 11.45-11.70 GHz bands (per 4 kHz) are defined in Section 25.208(b)(1) of the Commission's rules. No PFD limits are specified in either the FCC rules or the ITU Radio Regulations for the frequency band 11.70-11.95 GHz.

The NSS-806 payload will be operated such that all C-band and Ku-band downlink transmissions over U.S. territory will comply with the applicable PFD limits. In order to demonstrate such compliance, the carrier with the highest EIRP density in each of the possible beam connectivities, and based on the link budgets set forth in Appendix A, is depicted in Table 11-1 (the worst case for digital and analog transmissions is provided separately) and analyzed below.

Tables 11-2 to 11-12 below show the worst case PFD levels that will occur at various angles of arrival, for the different connectivities that relate to the Ku-band steerable beam, to demonstrate that they will comply with the requirements of Section 25.208(a) and 25.208(b).

The position of the steerable Ku-band beam used in the calculation is depicted in Figure B6 in Appendix B and corresponds to position 1 of the beam. The PFD levels that occur in relation to position 2 of the steerable Ku-band beam are lower than for position 1 and will therefore automatically comply with the relevant requirements.

**Table 11-1. Maximum power density levels for different connectivities**

| Connectivity | Analog/Digital Carrier | EIRP density (dBW/4kHz) | Carrier Type |
|---|---|---|---|
| SPOT/HEMI 36 MHz | Digital | 0.9 | 36M0G7W |
| Article I. | Analog | 10.8 | 36M0F3F |
| SPOT/HEMI 72 MHz | Digital | -0.6 | 72M0G7W |
| Article II. | Analog | 10.8 | 36M0F3F |
| HEMI/SPOT 36 MHz | Digital | 10.0 | 36M0G7W |
| Article III. | Analog | 18.2 | 36M0F3F |
| HEMI/SPOT 72 MHz | Digital | 9.9 | 72M0G7W |
| Article IV. | Analog | 18.2 | 36M0F3F |
| SPOT/SPOT 72 MHz | Digital | 9.9 | 72M0G7W |
| | Analog | 17.6 | 36M0F3F |

| **Angle of Arrival** Article V. | **Applicable PFD Limit for Angle of Arrival ($dBW/m^2/4$ kHz)** | **Spreading Loss ($dBW/m^2$)** | **Gain Contour (dB)** | **Worst Case PFD Level at Angle of Arrival ($dBW/m^2/4kHz$)** **Article VI.** | **PFD Margin** **Article VII.** **(dB)** |
|---|---|---|---|---|---|
| 0° | -152.0 | -163.4 | -1.4 | -163.9 | 11.9 |
| 5° | -152.0 | -163.3 | -1.4 | -163.8 | 11.8 |
| 10° | -149.5 | -163.2 | -1.4 | -163.7 | 14.2 |
| 15° | -147.0 | -163.0 | -1.4 | -163.5 | 16.5 |
| 20° | -144.5 | -162.9 | -1.4 | -163.4 | 18.9 |
| 25° | -142.0 | -162.8 | -1.4 | -163.3 | 21.3 |
| 80° (Peak) | -142.0 | -162.5 | 0.0 | -161.6 | 19.6 |

**Table 11-2. Maximum PFD Levels, SPOT/HEMI 36 MHz, Digital Carrier (36M0G7W)**

| **Angle of Arrival**<br>Article VI | **Applicable PFD Limit for Angle of Arrival (dBW/m²/4 kHz)** | **Spreading Loss (dBW/m²)** | **Gain Contour (dB)** | **Worst Case PFD Level at Angle of Arrival (dBW/m²/4kHz)**<br>**Article IX.** | **PFD Margin**<br>**Article X.**<br>**(dB)** |
|---|---|---|---|---|---|
| 0° | -152.0 | -163.4 | -1.4 | -154.0 | 2.0 |
| 5° | -152.0 | -163.3 | -1.4 | -153.9 | 1.9 |
| 10° | -149.5 | -163.2 | -1.4 | -153.8 | 4.3 |
| 15° | -147.0 | -163.0 | -1.4 | -153.6 | 6.6 |
| 20° | -144.5 | -162.9 | -1.4 | -153.5 | 9.0 |
| 25° | -142.0 | -162.8 | -1.4 | -153.4 | 11.4 |
| 80° (Peak) | -142.0 | -162.5 | 0.0 | -151.7 | 9.7 |

**Table 11-3. Maximum PFD Levels, SPOT/HEMI 36 MHz, Analog Carrier (36M0F3F)**

| **Angle of Arrival**<br>Article XI | **Applicable PFD Limit for Angle of Arrival (dBW/m²/4 kHz)** | **Spreading Loss (dBW/m²)** | **Gain Contour (dB)** | **Worst Case PFD Level at Angle of Arrival (dBW/m²/4kHz)**<br>**Article XII.** | **PFD Margin**<br>**Article XIII.**<br>**(dB)** |
|---|---|---|---|---|---|
| 0° | -152.0 | -163.4 | -1.4 | -165.4 | 13.4 |
| 5° | -152.0 | -163.3 | -1.4 | -165.3 | 13.3 |
| 10° | -149.5 | -163.2 | -1.4 | -165.2 | 15.7 |
| 15° | -147.0 | -163.0 | -1.4 | -165.0 | 18.0 |
| 20° | -144.5 | -162.9 | -1.4 | -164.9 | 20.4 |
| 25° | -142.0 | -162.8 | -1.4 | -164.8 | 22.8 |
| 80° (Peak) | -142.0 | -162.5 | 0.0 | -163.1 | 21.1 |

**Table 11-4. Maximum PFD Levels, SPOT/HEMI 72 MHz, Digital Carrier (72M0G7W)**

| **Angle of Arrival**<br>Article XI | **Applicable PFD Limit for Angle of Arrival ($dBW/m^2/4$ kHz)** | **Spreading Loss ($dBW/m^2$)** | **Gain Contour (dB)** | **Worst Case PFD Level at Angle of Arrival ($dBW/m^2/4kHz$)**<br>**Article XV.** | **PFD Margin**<br>**Article XVI.**<br>**(dB)** |
|---|---|---|---|---|---|
| 0° | -152.0 | -163.4 | -1.4 | -154.0 | 2.0 |
| 5° | -152.0 | -163.3 | -1.4 | -153.9 | 1.9 |
| 10° | -149.5 | -163.2 | -1.4 | -153.8 | 4.3 |
| 15° | -147.0 | -163.0 | -1.4 | -153.6 | 6.6 |
| 20° | -144.5 | -162.9 | -1.4 | -153.5 | 9.0 |
| 25° | -142.0 | -162.8 | -1.4 | -153.4 | 11.4 |
| 80° (Peak) | -142.0 | -162.5 | 0.0 | -151.7 | 9.7 |

**Table 11-5. Maximum PFD Levels, SPOT/HEMI 72 MHz, Analog Carrier (36M0F3F)**

| **Angle of Arrival**<br>Article XV | **Applicable PFD Limit for Angle of Arrival ($dBW/m^2/4$ kHz)** | **Spreading Loss ($dBW/m^2$)** | **Gain Contour (dB)** | **Worst Case PFD Level at Angle of Arrival ($dBW/m^2/4kHz$)**<br>**Article XVIII.** | **PFD Margin**<br>**Article XIX.**<br>**(dB)** |
|---|---|---|---|---|---|
| 0° | -150.0 | -163.4 | -5.9 | -159.3 | 9.3 |
| 5° | -150.0 | -163.3 | -5.5 | -158.8 | 8.8 |
| 10° | -147.5 | -163.2 | -4.9 | -158.1 | 10.6 |
| 15° | -145.0 | -163.0 | -3.9 | -156.9 | 11.9 |
| 20° | -142.5 | -162.9 | -2.9 | -155.8 | 13.3 |
| 25° | -140.0 | -162.8 | -1.8 | -154.6 | 14.6 |
| 48° (Peak) | -140.0 | -162.5 | 0.0 | -152.5 | 12.5 |

**Table 11-6. Maximum PFD Levels, HEMI/SPOT 36 MHz, Digital Carrier (36M0G7W)**

| Angle of Arrival<br><br>Article XX | Applicable PFD Limit for Angle of Arrival (dBW/m²/4 kHz) | Spreading Loss (dBW/m²) | Gain Contour (dB) | Worst Case PFD Level at Angle of Arrival (dBW/m²/4kHz)<br><br>Article XXI. | PFD Margin<br><br>Article XXII. (dB) |
|---|---|---|---|---|---|
| 0° | -150.0 | -163.4 | -5.9 | -151.1 | 1.1 |
| 5° | -150.0 | -163.3 | -5.5 | -150.6 | 0.6 |
| 10° | -147.5 | -163.2 | -4.9 | -149.9 | 2.4 |
| 15° | -145.0 | -163.0 | -3.9 | -148.7 | 3.7 |
| 20° | -142.5 | -162.9 | -2.9 | -147.6 | 5.1 |
| 25° | -140.0 | -162.8 | -1.8 | -146.4 | 6.4 |
| 48° (Peak) | -140.0 | -162.5 | 0.0 | -144.3 | 4.3 |

**Table 11-7. Maximum PFD Levels, HEMI/SPOT 36 MHz, Analog Carrier (36M0F3F)**

| Angle of Arrival<br><br>Article XX | Applicable PFD Limit for Angle of Arrival (dBW/m²/4 kHz) | Spreading Loss (dBW/m²) | Gain Contour (dB) | Worst Case PFD Level at Angle of Arrival (dBW/m²/4kHz)<br><br>Article XXIV. | PFD Margin<br><br>Article XXV. (dB) |
|---|---|---|---|---|---|
| 0° | -150.0 | -163.4 | -5.9 | -159.4 | 9.4 |
| 5° | -150.0 | -163.3 | -5.5 | -158.9 | 8.9 |
| 10° | -147.5 | -163.2 | -4.9 | -158.2 | 10.7 |
| 15° | -145.0 | -163.0 | -3.9 | -157.0 | 12.0 |
| 20° | -142.5 | -162.9 | -2.9 | -155.9 | 13.4 |
| 25° | -140.0 | -162.8 | -1.8 | -154.7 | 14.7 |
| 48° (Peak) | -140.0 | -162.5 | 0.0 | -152.6 | 12.6 |

**Table 11-8. Maximum PFD Levels, HEMI/SPOT 72 MHz, Digital Carrier (72M0G7W)**

| Angle of Arrival<br><br>Article XXVI. | Applicable PFD Limit for Angle of Arrival ($dBW/m^2/4$ kHz) | Spreading Loss ($dBW/m^2$) | Gain Contour (dB) | Worst Case PFD Level at Angle of Arrival ($dBW/m^2/4kHz$)<br><br>Article XXVII. | PFD Margin<br><br>Article XXVIII. (dB) |
|---|---|---|---|---|---|
| 0° | -150.0 | -163.4 | -5.9 | -151.1 | 1.1 |
| 5° | -150.0 | -163.3 | -5.5 | -150.6 | 0.6 |
| 10° | -147.5 | -163.2 | -4.9 | -149.9 | 2.4 |
| 15° | -145.0 | -163.0 | -3.9 | -148.7 | 3.7 |
| 20° | -142.5 | -162.9 | -2.9 | -147.6 | 5.1 |
| 25° | -140.0 | -162.8 | -1.8 | -146.4 | 6.4 |
| 48° (Peak) | -140.0 | -162.5 | 0.0 | -144.3 | 4.3 |

**Table 11-9. Maximum PFD Levels, HEMI/SPOT 72 MHz, Analog Carrier (36M0F3F)**

| Angle of Arrival<br><br>Article XXIX. | Applicable PFD Limit for Angle of Arrival ($dBW/m^2/4$ kHz) | Spreading Loss ($dBW/m^2$) | Gain Contour (dB) | Worst Case PFD Level at Angle of Arrival ($dBW/m^2/4kHz$)<br><br>Article XXX. | PFD Margin<br><br>Article XXXI. (dB) |
|---|---|---|---|---|---|
| 0° | -150.0 | -163.4 | -5.9 | -159.4 | 9.4 |
| 5° | -150.0 | -163.3 | -5.5 | -158.9 | 8.9 |
| 10° | -147.5 | -163.2 | -4.9 | -158.2 | 10.7 |
| 15° | -145.0 | -163.0 | -3.9 | -157.0 | 12.0 |
| 20° | -142.5 | -162.9 | -2.9 | -155.9 | 13.4 |
| 25° | -140.0 | -162.8 | -1.8 | -154.7 | 14.7 |
| 48° (Peak) | -140.0 | -162.5 | 0.0 | -152.6 | 12.6 |

**Table 11-10. Max. PFD Levels, SPOT/SPOT 72 MHz, Digital Carrier (72M0G7W)**

| **Angle of Arrival**<br><br>Article X | **Applicable PFD Limit for Angle of Arrival ($dBW/m^2/4$ kHz)** | **Spreading Loss ($dBW/m^2$)** | **Gain Contour (dB)** | **Worst Case PFD Level at Angle of Arrival ($dBW/m^2/4kHz$)**<br><br>**Article XXXIII.** | **PFD Margin**<br><br>**Article XXXIV.**<br>**(dB)** |
|---|---|---|---|---|---|
| 0° | -150.0 | -163.4 | -5.9 | -151.7 | 1.7 |
| 5° | -150.0 | -163.3 | -5.5 | -151.2 | 1.2 |
| 10° | -147.5 | -163.2 | -4.9 | -150.5 | 3.0 |
| 15° | -145.0 | -163.0 | -3.9 | -149.3 | 4.3 |
| 20° | -142.5 | -162.9 | -2.9 | -148.2 | 5.7 |
| 25° | -140.0 | -162.8 | -1.8 | -147.0 | 7.0 |
| 48° (Peak) | -140.0 | -162.5 | 0.0 | -144.9 | 4.9 |

**Table 11-11. Max. PFD Levels, SPOT/SPOT 72 MHz, Analog Carrier (36M0F3F)**

| **Angle of Arrival**<br><br>Article X | **Applicable PFD Limit for Angle of Arrival ($dBW/m^2/4$ kHz)** | **Spreading Loss ($dBW/m^2$)** | **Gain Contour (dB)** | **Worst Case PFD Level at Angle of Arrival ($dBW/m^2/4kHz$)**<br><br>**Article XXXVI.** | **PFD Margin**<br><br>**Article XXXVII.**<br>**(dB)** |
|---|---|---|---|---|---|
| 0° | -150.0 | -163.4 | -5.9 | -168.3 | 18.3 |
| 5° | -150.0 | -163.3 | -5.5 | -167.8 | 17.8 |
| 10° | -147.5 | -163.2 | -4.9 | -167.1 | 19.6 |
| 15° | -145.0 | -163.0 | -3.9 | -165.9 | 20.9 |
| 20° | -142.5 | -162.9 | -2.9 | -164.8 | 22.3 |
| 25° | -140.0 | -162.8 | -1.8 | -163.6 | 23.6 |
| 48° (Peak) | -140.0 | -162.5 | 0.0 | -161.5 | 21.5 |

**Table 11-12. Maximum PFD Levels for Ku-band beacon (25K0N0N)**

### 12. Arrangement for Tracking, Telemetry, and Control

SES will conduct primary TT&C operations for NSS-806 using antennas that are located in Gerrards Cross (Chalfont), United Kingdom. Back-up TT&C capability will also be available from Bristow (Manassas), Virginia in the United States. In addition, SES will have remote control capability from its headquarters in The Hague that will, if required by the Dutch Administration, enable satellite operations to be controlled from the territory of The Netherlands.

### 13. Physical Characteristics of the Space Station

NSS-806 was constructed by Lockheed Martin based on the Series 7000 satellite design, a three-axis stabilized system. The spacecraft had a launch mass of 3,275 kg, total power of 4826 watts (end-of-life), and a maneuver lifetime of 17 years. Additional key spacecraft characteristics for NSS-806 can be found in the appropriate sections of the accompanying Schedule S.

### 14. Common Carrier Status

SES intends to market all of the conventional C-band and conventional Ku-band transponders on the NSS-806 satellite on a non-common carrier basis.

### 15. Polarization Information

The polarization information for the C-band and Ku-band payloads is provided in Schedule S. The NSS-806 C-band payload operates using circular polarization and is not capable of switching polarization sense upon ground command, and thus does not comply with Sections 25.210(a)(1) and 25.210(a)(3) of the Commission's rules. The C-band payload also does not conform to the FM/TV frequency plan requirement in Section 25.211(a) of the Commission's rules. SES was granted a waiver of these provisions when NSS-806 was added to the Permitted List.[4] No change is proposed to C-band operations on NSS-806 in this application.

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[4] *See NSS-806 Order* at ¶¶ 15-16 & 22.

**16. Public Interest Considerations**

*See* Narrative, at Section II.

**17. Interference Analysis**

There is no change to the C-band operations of the NSS-806 satellite. As a result, no adjacent satellite interference analysis is provided with respect to those frequencies.

With respect to the Ku-band frequencies, the nearest operational Ku-band satellites to NSS-806 are Intelsat-11 at 43.0° W.L. (2.5 degrees orbital separation) and the Telstar-11N at 37.55° W.L. (2.95 degrees orbital separation). NSS-806 has been fully coordinated with both of these satellites and the proposed re-pointings of the Ku-band beam will be consistent with SES's coordination agreements.

Although the two nearest adjacent satellites are separated by more than two degrees as indicated above, in order to demonstrate compliance with the Commission's two-degree spacing policy, SES has assumed for the purposes of this application that the transmission parameters of the NSS-806 satellite are both the wanted and victim transmissions in a two-degree spacing environment. This analysis is performed for digital signals in both networks, and analog TV/FM signal link calculations are provided in Appendix A to this Attachment. Analog TV/FM signals are coordinated on a case-by-case basis with nearby spacecraft.

Tables 17.1, 17.3, 17.5, 17.7 and 17.9 provide summaries of the Ku-band related transmission parameters derived from the NSS-806 link budgets for the different connectivity options that are presented in Tables A-1 through A-5 in Appendix A and embedded in the accompanying Schedule S form. The interference calculations assume a 1 dB advantage for topocentric-to-geocentric conversion, co-polarization of all wanted and interfering carriers, and all earth station antennas conforming to a sidelobe pattern of 29-25 log(θ), as specified in Section 25.209(a)(1) of the Commission's Rules.

Tables 17.2, 17.4, 17.6, 17.8 and 17.10 show the results of the Ku-band related interference calculations in terms of the overall C/I margins for the different possible connectivities on the NSS-806 satellite. For ease of reference and analysis, these tables are provided in a format similar to the output of the commonly-used Sharp Adjacent Satellite Interference Analysis program. There is no difference in the result of the C/I analysis with respect to the different pointings of the Ku-band spot beam as discussed earlier in this document. The Ku-band downlink analysis assumes that the peak of the interfering Ku-band spot beam is located at the edge of coverage (i.e. at the 3.9 dB contour from peak) of the interfered-with Ku-band spot beam of the hypothetical satellite at 2 degrees spacing.

Further, Table 17-11 provides the C/I calculations for the Ku-band beacon. It is assumed that the beacon frequencies are co-frequency and operate in the same polarization. The analysis assumes a C/N threshold of 0 dB and the C/I criteria was set to be 14 dB. Receive antenna sizes taken into consideration are 1.8m and 2.4m. The analysis further assumes that the peak of the interfering Ku-band beacon is located at the edge of coverage (i.e. at the 3.9 dB contour from peak) of the interfered-with Ku-band beacon of the hypothetical satellite at 2 degrees spacing.

**SPOT/HEMI beam connectivity 36 MHz**

| Carrier ID | Emission Designator | Bandwidth (MHz) | Tx E/S Gain (dBi) | Uplink EIRP (dBW) | Downlink EIRP (dBW | Rx E/S Gain (dBi) | C/I Criterion (dB) |
|---|---|---|---|---|---|---|---|
| 1 | 346KG7W | 0.256 | 51.0 | 54.5 | 18.2 | 39.8 | 18.2 |
| 2 | 461KG7W | 0.341 | 52.8 | 56.3 | 20.0 | 41.8 | 21.5 |
| 3 | 1M84G7W | 1.365 | 52.8 | 62.3 | 26.0 | 41.8 | 21.5 |
| 4 | 8M25G7W | 6.111 | 51.0 | 68.2 | 31.9 | 39.8 | 19.1 |
| 5 | 36M0G7W | 30.000 | 52.8 | 76.9 | 39.6 | 39.8 | 19.1 |

**Table 17-1. Summary of Typical Transmission Parameters for the NSS-806 SPOT/HEMI beam connectivity (36 MHz)**

| | | Interfering Carriers | | | | |
|---|---|---|---|---|---|---|
| | Carrier ID | 1 | 2 | 3 | 4 | 5 |
| Wanted Carriers | 1 | 0.8 | 0.3 | 0.3 | 0.8 | 0.1 |
| | 2 | -0.1 | -0.5 | -0.5 | -0.1 | -0.8 |
| | 3 | -0.1 | -0.5 | -0.5 | -0.1 | -0.8 |
| | 4 | -0.2 | -0.6 | -0.6 | -0.1 | -0.9 |
| | 5 | 0.7 | 0.2 | 0.2 | 0.7 | 0.0 |

**Table 17-2. Summary of Overall C/I Margins for the NSS-806 SPOT/HEMI beam (36 MHz) connectivity (dB)**

A number of C/I margins in Table 17-2 are slightly negative. The worst case is represented for Wanted Carrier 4 with respect to Interfering Carrier 5. The deficit with respect to the 6% C/I criterion is 0.9dB, which is equivalent to an increase of 7.3% of victim noise temperature (instead of the normal criterion of 6%). The C/I levels as calculated here are consistent with SES's existing coordination agreements.

**SPOT/HEMI beam connectivity 72 MHz**

| Carrier ID | Emission Designator | Bandwidth (MHz) | Tx E/S Gain (dBi) | Uplink EIRP (dBW) | Downlink EIRP (dBW | Rx E/S Gain (dBi) | C/I Criterion (dB) |
|---|---|---|---|---|---|---|---|
| 1 | 346KG7W | 0.256 | 50.9 | 53.3 | 15.1 | 41.6 | 18.2 |
| 2 | 461KG7W | 0.341 | 52.8 | 55.9 | 17.6 | 45.0 | 21.5 |
| 3 | 1M84G7W | 1.365 | 52.8 | 61.9 | 23.7 | 45.0 | 21.5 |
| 4 | 8M25G7W | 6.111 | 50.9 | 67.2 | 29.0 | 43.1 | 19.1 |
| 5 | 72M0G7W | 63.330 | 56.4 | 80.7 | 41.4 | 46.9 | 24.9 |

**Table 17-3. Summary of Typical Transmission Parameters for the NSS-806 SPOT/HEMI beam connectivity (72 MHz)**

| | | Interfering Carriers | | | | |
|---|---|---|---|---|---|---|
| | Carrier ID | 1 | 2 | 3 | 4 | 5 |
| Wanted Carriers | 1 | 2.4 | 1.3 | 1.3 | 2.3 | 0.3 |
| | 2 | 3.3 | 2.3 | 2.3 | 3.2 | 1.5 |
| | 3 | 3.3 | 2.3 | 2.3 | 3.2 | 1.5 |
| | 4 | 2.9 | 1.8 | 1.8 | 2.8 | 0.9 |
| | 5 | 2.7 | 1.8 | 1.8 | 2.6 | 1.1 |

**Table 17-4. Summary of Overall C/I Margins for the NSS-806 SPOT/HEMI beam (72 MHz) connectivity (dB)**

As shown in Table 17-4, all C/I margins are positive and consistent with the coordination agreements.

**HEMI/SPOT beam connectivity 36 MHz**

| Carrier ID | Emission Designator | Bandwidth (MHz) | Tx E/S Gain (dBi) | Uplink EIRP (dBW) | Downlink EIRP (dBW | Rx E/S Gain (dBi) | C/I Criterion (dB) |
|---|---|---|---|---|---|---|---|
| 1 | 346KG7W | 0.256 | 45.5 | 53.2 | 28.0 | 45.1 | 18.2 |
| 2 | 461KG7W | 0.341 | 47.2 | 54.6 | 29.4 | 47.6 | 21.5 |
| 3 | 1M84G7W | 1.365 | 47.2 | 60.4 | 35.2 | 49.5 | 21.5 |
| 4 | 8M25G7W | 6.111 | 45.5 | 67.0 | 41.8 | 45.1 | 19.1 |
| 5 | 36M0G7W | 30.000 | 49.1 | 75.9 | 48.7 | 45.1 | 19.1 |

**Table 17-5. Summary of Typical Transmission Parameters for the NSS-806 HEMI/SPOT beam connectivity (36 MHz)**

| | | Interfering Carriers | | | | |
|---|---|---|---|---|---|---|
| | **Carrier ID** | 1 | 2 | 3 | 4 | 5 |
| **Wanted Carriers** | 1 | 1.1 | 1.5 | 1.7 | 1.1 | 1.5 |
| | 2 | -0.4 | 0.1 | 0.3 | -0.4 | 0.1 |
| | 3 | 0.4 | 1.1 | 1.4 | 0.4 | 1.2 |
| | 4 | 0.3 | 0.6 | 0.8 | 0.2 | 0.6 |
| | 5 | 0.7 | 0.9 | 1.1 | 0.7 | 1.0 |

**Table 17-6. Summary of Overall C/I Margins for the NSS-806 HEMI/SPOT beam (36 MHz) connectivity (dB)**

A number of C/I margins in Table 17-6 are slightly negative. The worst case is represented for Wanted Carrier 2 with respect to Interfering Carriers 1 and 4. The deficit with respect to the 6% C/I criterion is 0.4dB, which is equivalent to an increase of 6.6% of victim noise temperature (instead of the normal criterion of 6%). Nevertheless, the C/I levels as calculated here remain consistent with our existing coordination agreements.

**HEMI/SPOT beam connectivity 72 MHz**

| Carrier ID | Emission Designator | Bandwidth (MHz) | Tx E/S Gain (dBi) | Uplink EIRP (dBW) | Downlink EIRP (dBW | Rx E/S Gain (dBi) | C/I Criterion (dB) |
|---|---|---|---|---|---|---|---|
| 1 | 346KG7W | 0.256 | 45.3 | 51.8 | 26.6 | 45.1 | 18.2 |
| 2 | 461KG7W | 0.341 | 47.1 | 53.1 | 27.9 | 49.5 | 21.5 |
| 3 | 1M84G7W | 1.365 | 47.1 | 58.1 | 32.9 | 51.6 | 21.5 |
| 4 | 8M25G7W | 6.111 | 45.3 | 65.1 | 39.9 | 47.6 | 19.1 |
| 5 | 72M0G7W | 63.330 | 54.9 | 80.1 | 51.9 | 56.9 | 24.9 |

**Table 17-7. Summary of Typical Transmission Parameters for the NSS-806 HEMI/SPOT beam connectivity (72 MHz)**

| | | Interfering Carriers | | | | |
|---|---|---|---|---|---|---|
| | Carrier ID | 1 | 2 | 3 | 4 | 5 |
| Wanted Carriers | 1 | 1.1 | 1.5 | 2.5 | 1.6 | 0.8 |
| | 2 | 0.5 | 1.3 | 2.3 | 1.0 | 1.4 |
| | 3 | 0.4 | 1.4 | 2.4 | 0.9 | 2.0 |
| | 4 | 1.4 | 1.9 | 2.9 | 1.9 | 1.7 |
| | 5 | 3.0 | 4.2 | 5.2 | 3.5 | 5.4 |

**Table 17-8. Summary of Overall C/I Margins for the NSS-806 HEMI/SPOT beam (72 MHz) connectivity (dB)**

As shown in Table 17-8, all C/I margins are positive and consistent with the coordination agreements.

**SPOT/SPOT beam connectivity 72 MHz**

| Carrier ID | Emission Designator | Bandwidth (MHz) | Tx E/S Gain (dBi) | Uplink EIRP (dBW) | Downlink EIRP (dBW | Rx E/S Gain (dBi) | C/I Criterion (dB) |
|---|---|---|---|---|---|---|---|
| 1 | 346KG7W | 0.256 | 51.0 | 52.1 | 26.3 | 45.1 | 18.2 |
| 2 | 461KG7W | 0.341 | 52.8 | 54.4 | 28.7 | 47.6 | 21.5 |
| 3 | 1M84G7W | 1.365 | 52.8 | 59.0 | 33.2 | 49.5 | 21.5 |
| 4 | 8M25G7W | 6.111 | 51.0 | 66.5 | 40.7 | 45.1 | 19.1 |
| 5 | 72M0G7W | 63.330 | 52.8 | 79.6 | 51.9 | 51.4 | 24.9 |

**Table 17-9. Summary of Typical Transmission Parameters for the NSS-806 SPOT/SPOT beam connectivity (72 MHz)**

| | | Interfering Carriers | | | | |
|---|---|---|---|---|---|---|
| | Carrier ID | 1 | 2 | 3 | 4 | 5 |
| Wanted Carriers | 1 | 2.1 | 1.1 | 2.6 | 1.4 | 0.4 |
| | 2 | 2.1 | 1.2 | 2.7 | 1.4 | 0.4 |
| | 3 | 2.2 | 1.5 | 2.9 | 1.5 | 0.5 |
| | 4 | 1.8 | 0.9 | 2.3 | 1.2 | 0.2 |
| | 5 | 2.7 | 1.9 | 3.3 | 2.0 | 1.0 |

**Table 17-10. Summary of Overall C/I Margins for the NSS-806 SPOT/SPOT beam (72 MHz) connectivity (dB)**

As shown in Table 17-10, all C/I margins are positive and consistent with the coordination agreements

**Ku-band beacon analysis**

| | | Frequency (MHz) 11701 | |
|---|---|---|---|
| Rx Antenna Size | (m) | 1.8 | 2.4 |
| Rx Antenna Gain | (dBi) | 44.8 | 47.3 |
| Off-Axis gain | (dBi) | 21.0 | 21.0 |
| Discrimination | (dB) | 23.8 | 26.3 |
| Delta EIRP | (dB) | -3.9 | -3.9 |
| C/I | (dB) | 19.9 | 22.4 |
| Threshold | (dB) | 14.0 | 14.0 |
| **Margin** | **(dB)** | **5.9** | **8.4** |

**Table 17-11. C/I calculations for the NSS-806 Ku-band beacon**

It can be seen from the analysis in the above table that the C/I margins are positive, and that therefore there will be no interference from the NSS-806 Ku-band beacon into the Ku-band beacon of the hypothetical satellite at 2 degrees spacing.

## 18. Orbital Debris Mitigation

***Spacecraft Hardware Design***

SES has assessed and limited the amount of debris released in a planned manner during normal operations. No debris is generated during normal on-station operations, and the spacecraft will be in a stable configuration. On-station operations require stationkeeping within the +/- 0.05

degree N-S and E-W control box, thereby ensuring adequate collision avoidance distance from other satellites in geosynchronous orbit. In the event that co-location of this and another satellite is required, use of the proven Inclination-Eccentricity (I-E) separation method can be employed. This strategy is presently in use by SES's affiliates to ensure proper operation and safety of multiple satellites within one orbital box.

SES has also assessed and limited the possibility of NSS-806 becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control of the spacecraft and prevent post-mission disposal. Specifically, the NSS-806 satellite has been designed and constructed in a manner that incorporates redundancy, shielding, separation of components, and other physical characteristics into the satellite's design. For example, omni-directional antennas are mounted on opposite sides of the spacecraft, and either will be sufficient to support orbit raising. The command receivers and decoders, telemetry encoders and transmitters, and the bus control electronics are fully redundant, physically separated, and located within a shielded area to minimize the probability of the spacecraft becoming a source of debris due to a collision.

SES uses the Space Data Center ("SDC") system from the Space Data Association to monitor the risk of close approach of its satellites with other objects. Any close encounters (separation of less than 10 km) are flagged and investigated in more detail. If required, avoidance maneuvers are performed to eliminate the possibility of collisions.

During any relocation, the moving spacecraft is maneuvered such that it is at least 30 km away from the synchronous radius at all times. In most cases, much larger deviation from the synchronous radius is used. In addition, the SDC system is used to ensure no close encounter occurs during the move. When de-orbit of a spacecraft is required, the initial phase is treated as a satellite move, and the same precautions are used to ensure collision avoidance.

***Minimizing Accidental Explosions***

SES has assessed and limited the probability of accidental explosion during and after completion of mission operations. The key areas reviewed for this purpose included leakage of propellant and mixing of fuel and oxidizer as well as battery pressure vessels. The basic propulsion design (including component and functional redundancy, and the placement of fuel tanks inside a central cylinder which provides a high level of shielding), propulsion subsystem component construction, preflight verification through both proof testing and analysis, and quality standards have been designed to ensure a very low risk of propellant leakage and fuel and oxidizer mixing that can result in subsequent explosions. During the mission, batteries and various critical areas of the propulsion subsystem will be continually monitored (for both pressure and temperature) to preclude conditions that could result in the remote possibility of explosion and subsequent generation of debris.

After NSS-806 reaches its final disposal orbit, all on-board sources of stored energy will be depleted, all residual fuel will be depleted, all fuel line valves will be left "open," all batteries will be left in a permanent discharge state, and all pressurized systems (except for the oxidizer tank) will be vented. The solar cells will also be slewed away from the sun to minimize power generation. As with all Lockheed 7000 series spacecraft, the oxidizer tank on NSS-806 was sealed using a pyrotechnic valve at the end of transfer orbit and therefore cannot be vented at spacecraft end-of-life. This is a design feature of the Lockheed 7000 series spacecraft (and the later Lockheed A2100 spacecraft) that cannot now be changed or remedied. Information regarding the residual oxidizer in the tank is as follows:

| Tank | Volume [l] | Pressure [bar] | Temp. [deg C] | Oxidizer mass [kg] |
|---|---|---|---|---|
| Ox 1 | 643 | 18.4 | 21 | 20 |

The oxidizer tank is well shielded, and the residual pressure in the tank will be well below its maximum rating.

As explained in the main narrative, Section 25.283(c) of the Commission's rules, which requires space station licensees to discharge all stored energy sources on board a satellite at end-of-life, apparently does not apply to the NSS-806 satellite. Out of an abundance of caution, however, SES is requesting a waiver of this rule to the extent one is necessary.

***Safe Flight Profiles***

SES has assessed and limited the probability of NSS-806 becoming a source of debris by collisions with large debris or other operational space stations through detailed and conscientious mission planning. SES has reviewed the list of licensed systems and systems that are under consideration by the Commission for the nominal 40.5° W.L. orbital location where it operates. In addition, in order to address non-U.S. licensed systems, SES has reviewed the list of satellite networks in the vicinity of 40.5° W.L. for which a request for coordination has been submitted to the ITU. Only those networks that are operating, or are planned to be operating, within ± 0.2° have been taken into account in this review. The analysis shows that there are no current or planned satellites that have or would have an overlap in station-keeping volume with NSS-806 at the 40.5° W.L. orbital location.

***Post-Mission Disposal***

At the end of the mission, SES expects to dispose of the spacecraft by moving it to a planned minimum altitude of 200 kilometers] (perigee) above the geostationary arc. This is consistent with SES's obligations in its authorization issued under The Netherlands' Space Activities Act. Such license requires SES to ensure (among other things) that, at the end of a space object's life span, adequate fuel supply is onboard to transport the space object to a de-commissioning orbit or de-commissioning zone. While the license does not define the de-commissioning orbit or zone, the Explanatory Memorandum to the Dutch Space Activities Act does refer to a "de-commissioning zone" of "around 200 km higher than geostationary orbit."

SES has reserved 23.6 kilograms of propellant to reach a de-orbit altitude of above 200 km for post-mission disposal. Propellant gauging uncertainty (as discussed further below) has been taken into account in these calculations. Nevertheless, because there is no mechanism for precisely calculating the amount of fuel left on the spacecraft once it is in orbit, it is possible that the spacecraft will not meet the planned minimum disposal altitude notwithstanding all good faith efforts to reserve sufficient fuel to do so.

In addition, SES provides the following information regarding the proposed disposal orbit:

1) Planned orbital eccentricity: 5.6E-04 (This is a best estimate of optimal eccentricity to match the natural eccentricity circle due to Sun and Moon perturbations after decommission)[5]

2) Planned apogee altitude: 247 km

3) Information concerning the methods that will be used to assess and provide adequate margins concerning fuel gauging uncertainty: For the NSS-806 spacecraft, in addition to the nominal hold-back provided by the manufacturer, the fuel reserve takes into account the propellant uncertainty resulting from the fuel book-keeping method, including the mixture ratio uncertainty. In addition, SES performs thermal gauging near the spacecraft's end of life by inferring the remaining propellant from the thermal signature when SES applies heat to different parts of the propellant tank system. This information is considered when determining the additional hold-back and adjustments to book values to attempt to ensure sufficient propellant to achieve

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5 Because it is extremely difficult to anticipate end-of-life thruster performance and operational conditions, it is extremely difficult to achieve the planned eccentricity. SES's priority is to achieve the planned minimum perigee of 200 kilometers. In order to achieve the planned eccentricity, not only must there be sufficient propellant reserved but, in addition, individual thrusters must be fired at specific times during satellite decommissioning because the timing of thruster firing will affect eccentricity. Due to difficulties in predicting the thruster end-of-life performance, as well as earth station availability and visibility as the satellite drifts, it

(footnote continued)

> the planned minimum altitude. There are, however, many uncertainties to both methods that could lead to incorrect conclusions regarding remaining fuel.

The proposed disposal altitude is consistent with the FCC's rules and policies. Under Section 25.283(d), satellites launched prior to March 18, 2002, such as NSS-806, are designated as grandfathered satellites not subject to a specific disposal altitude. In any event, in its Second Report and Order in IB Docket 02-54 (FCC Document Number: 04-130), the FCC declared that non-U.S.-licensed satellites seeking U.S. market access could satisfy the FCC's post-mission disposal requirements "by showing that the satellite system's debris mitigation plans are subject to direct and effective regulatory oversight by the satellite system's national licensing authority." The condition in SES's license under The Netherlands' Space Activities Act (as discussed above) qualifies as such oversight. Moreover, the FCC in other cases has accepted similar disposal altitudes for grandfathered U.S.-licensed satellites. For these reasons, the NSS-806 planned disposal orbit complies with the FCC's rules.

Although NSS-806 is not subject to the minimum perigee requirement of Section 25.283(a), for the Commission's information, the disposal orbit altitude resulting from the IADC formula would be 285.5 km based on the following calculation:

Area of the satellite (average aspect area): 82 $m^2$
Mass of the spacecraft: 1542 kg
CR (solar radiation pressure coefficient): 0.95

Therefore the minimum disposal orbit perigee altitude as calculated under the IADC formula would be:

36,021 km + (1000 x CR x A/m) = 36071.5 km, or 285.5 km above the GSO arc (35,786 km).

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may not be possible to fire the right thrusters at the optimal times. Thus, optimal eccentricity may not be achieved, which, in turn, will affect the apogee altitude.

# APPENDIX A

## Link Budget Analysis

TABLE A-1. LINK BUDGET, SPOT/HEMI (36 MHZ TRANSPONDER)

| | | SPOT/HEMI 36 MHz Transponder | | | | | |
|---|---|---|---|---|---|---|---|
| **Link Parameters** | **Units** | **346KG7W** | **461KG7W** | **1M84G7W** | **8M25G7W** | **36M0G7W** | **36M0F3F** |
| Uplink Frequency | GHz | 14.125 | 14.125 | 14.125 | 14.125 | 14.125 | 14.125 |
| Downlink Frequency | GHz | 3.843 | 3.843 | 3.843 | 3.843 | 3.843 | 3.843 |
| Carrier Allocated Bandwidth | kHz | 346.0 | 461.0 | 1840.0 | 8250.0 | 36000.0 | 36000.0 |
| Energy Dispersal | MHz | n/a | n/a | n/a | n/a | n/a | 2.0 |
| **Uplink:** | | | | | | | |
| Nominal E/S e.i.r.p. per carrier | dBW | 54.5 | 56.3 | 62.3 | 68.2 | 76.9 | 77.6 |
| Earth Station Diameter | m | 3.0 | 3.7 | 3.7 | 3.0 | 3.7 | 7.6 |
| Earth Station Gain | dBi | 51.0 | 52.8 | 52.8 | 51.0 | 52.8 | 59.1 |
| Uplink Input Power per Carrier | dBW | 3.5 | 3.4 | 9.5 | 17.2 | 24.1 | 18.4 |
| Free Space Loss | dB | 207.1 | 207.1 | 207.1 | 207.1 | 207.1 | 207.1 |
| G/T Satellite (EOC) | dB/K | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| C/N Thermal Uplink | dB | 22.9 | 23.4 | 23.4 | 22.8 | 24.6 | 24.5 |
| C/I XPOL, ACI, IM, ASI | dB | 26.4 | 27.0 | 27.0 | 26.4 | 28.2 | 28.1 |
| C/(N+I) uplink | dB | 21.3 | 21.8 | 21.8 | 21.3 | 23.0 | 22.9 |
| **Downlink:** | | | | | | | |
| Satellite e.i.r.p. per carrier (-3.9dB contour) | dBW | 14.3 | 16.1 | 22.1 | 28.0 | 35.7 | 33.9 |
| Maximum e.i.r.p. density | dBW/4kHz | 0.1 | 0.7 | 0.7 | 0.1 | 0.9 | 10.8 |
| Free Space Loss | dB | 196.3 | 196.3 | 196.3 | 196.3 | 196.3 | 196.3 |
| Earth Station Diameter | m | 3.0 | 3.8 | 3.8 | 3.0 | 3.0 | 3.8 |
| Earth Station Gain | dBi | 39.8 | 41.8 | 41.8 | 39.8 | 39.8 | 41.8 |
| Noise Temperature | kHz | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 |
| Earth Station G/T | dB/K | 20.0 | 22.0 | 22.0 | 20.0 | 20.0 | 22.0 |
| C/N Thermal Downlink | dB | 12.6 | 15.1 | 15.1 | 12.5 | 13.3 | 12.7 |
| C/I XPOL, ACI, IM, ASI | dB | 13.0 | 15.6 | 15.6 | 13.0 | 13.8 | 16.2 |
| C/(N+I) downlink | dB | 9.8 | 12.4 | 12.4 | 9.7 | 10.5 | 11.1 |
| **Adjacent Satellite Interference:** | | | | | | | |
| Uplink Inp. Pwr. Dens. @ 2 degrees | dBW/Hz | -50 | -50 | -50 | -50 | -50 | -50 |
| Downlink e.i.r.p. Dens @ 2 degrees | dBW/Hz | -34 | -34 | -34 | -34 | -34 | -37 |
| C/I up (single satellite) | dB | 29.4 | 30.0 | 30.0 | 29.4 | 31.2 | 31.1 |
| C/I dn (single satellite) | dB | 16.0 | 18.6 | 18.6 | 16.0 | 16.8 | 19.2 |
| Aggregate C/I up | dB | 26.4 | 27.0 | 27.0 | 26.4 | 28.2 | 28.1 |
| Aggregate C/I down | dB | 13.0 | 15.6 | 15.6 | 13.0 | 13.8 | 16.2 |
| **Overall:** | | | | | | | |
| C/(N+I) overall | dB | 9.5 | 11.9 | 11.9 | 9.5 | 10.3 | 10.8 |
| C/(N+I) required | dB | 6.0 | 9.3 | 9.3 | 6.9 | 6.9 | 10.0 |
| System Margin | dB | 3.5 | 2.6 | 2.6 | 2.5 | 3.4 | 0.8 |

TABLE A-2. LINK BUDGET, SPOT/HEMI (72 MHZ TRANSPONDER)

| | | SPOT/HEMI 72 MHz Transponder | | | | | |
|---|---|---|---|---|---|---|---|
| **Link Parameters** | **Units** | **346KG7W** | **461KG7W** | **1M84G7W** | **8M25G7W** | **72M0G7W** | **36M0F3F** |
| Uplink Frequency | GHz | 14.043 | 14.043 | 14.043 | 14.043 | 14.043 | 14.043 |
| Downlink Frequency | GHz | 3.743 | 3.743 | 3.743 | 3.743 | 3.743 | 3.743 |
| Carrier Allocated Bandwidth | kHz | 346.0 | 461.0 | 1840.0 | 8250.0 | 72000.0 | 36000.0 |
| Energy Dispersal | MHz | n/a | n/a | n/a | n/a | n/a | 2.0 |
| **Uplink:** | | | | | | | |
| Nominal E/S e.i.r.p. per carrier | dBW | 53.3 | 55.9 | 61.9 | 67.2 | 80.7 | 77.6 |
| Earth Station Diameter | m | 3.0 | 3.7 | 3.7 | 3.0 | 5.6 | 7.6 |
| Earth Station Gain | dBi | 50.9 | 52.8 | 52.8 | 50.9 | 56.4 | 59.1 |
| Uplink Input Power per Carrier | dBW | 2.4 | 3.1 | 9.2 | 16.3 | 24.3 | 18.4 |
| Free Space Loss | dB | 207.1 | 207.1 | 207.1 | 207.1 | 207.1 | 207.1 |
| G/T Satellite (EOC) | dB/K | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| C/N Thermal Uplink | dB | 21.8 | 23.1 | 23.1 | 21.9 | 25.2 | 24.5 |
| C/I XPOL, ACI, IM, ASI | dB | 25.3 | 26.6 | 26.6 | 25.4 | 28.7 | 28.1 |
| C/(N+I) uplink | dB | 20.2 | 21.5 | 21.5 | 20.3 | 23.6 | 22.9 |
| **Downlink:** | | | | | | | |
| Satellite e.i.r.p. per carrier (-3.9dB contour) | dBW | 11.2 | 13.7 | 19.8 | 25.1 | 37.5 | 33.9 |
| Maximum e.i.r.p. density | dBW/4kHz | -3.0 | -1.7 | -1.7 | -2.9 | -0.6 | 10.8 |
| Free Space Loss | dB | 196.0 | 196.0 | 196.0 | 196.0 | 196.0 | 196.3 |
| Earth Station Diameter | m | 3.8 | 5.6 | 5.6 | 4.5 | 7.0 | 3.8 |
| Earth Station Gain | dBi | 41.6 | 45.0 | 45.0 | 43.1 | 46.9 | 41.6 |
| Noise Temperature | kHz | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 |
| Earth Station G/T | dB/K | 21.8 | 25.2 | 25.2 | 23.3 | 27.1 | 21.8 |
| C/N Thermal Downlink | dB | 11.5 | 16.2 | 16.2 | 13.1 | 19.2 | 12.5 |
| C/I XPOL, ACI, IM, ASI | dB | 11.7 | 16.4 | 16.4 | 13.3 | 19.5 | 16.0 |
| C/(N+I) downlink | dB | 8.6 | 13.3 | 13.3 | 10.2 | 16.3 | 10.9 |
| **Adjacent Satellite Interference:** | | | | | | | |
| Uplink Inp. Pwr. Dens. @ 2 degrees | dBW/Hz | -50 | -50 | -50 | -50 | -50 | -50 |
| Downlink e.i.r.p. Dens @ 2 degrees | dBW/Hz | -34 | -34 | -34 | -34 | -34 | -37 |
| C/I up (single satellite) | dB | 28.3 | 29.6 | 29.6 | 28.4 | 31.7 | 31.1 |
| C/I dn (single satellite) | dB | 14.7 | 19.4 | 19.4 | 16.3 | 22.5 | 19.0 |
| Aggregate C/I up | dB | 25.3 | 26.6 | 26.6 | 25.4 | 28.7 | 28.1 |
| Aggregate C/I down | dB | 11.7 | 16.4 | 16.4 | 13.3 | 19.5 | 16.0 |
| **Overall:** | | | | | | | |
| C/(N+I) overall | dB | 8.3 | 12.7 | 12.7 | 9.8 | 15.6 | 10.6 |
| C/(N+I) required | dB | 6.0 | 9.3 | 9.3 | 6.9 | 12.7 | 10.0 |
| System Margin | dB | 2.3 | 3.4 | 3.4 | 2.9 | 2.9 | 0.6 |

TABLE A-3. LINK BUDGET, HEMI/SPOT (36 MHZ TRANSPONDER)

| | | HEMI/SPOT 36 MHz Transponder | | | | | |
|---|---|---|---|---|---|---|---|
| **Link Parameters** | **Units** | **346KG7W** | **461KG7W** | **1M84G7W** | **8M25G7W** | **36M0G7W** | **36M0F3F** |
| Uplink Frequency | GHz | 6.068 | 6.068 | 6.068 | 6.068 | 6.068 | 6.068 |
| Downlink Frequency | GHz | 11.830 | 11.830 | 11.830 | 11.830 | 11.830 | 11.830 |
| Carrier Allocated Bandwidth | kHz | 346.0 | 461.0 | 1840.0 | 8250.0 | 36000.0 | 36000.0 |
| Energy Dispersal | MHz | n/a | n/a | n/a | n/a | n/a | 2.0 |
| **Uplink:** | | | | | | | |
| Nominal E/S e.i.r.p. per carrier | dBW | 53.2 | 54.6 | 60.4 | 67.0 | 75.9 | 72.9 |
| Earth Station Diameter | m | 3.7 | 4.5 | 4.5 | 3.7 | 5.6 | 7.6 |
| Earth Station Gain | dBi | 45.5 | 47.2 | 47.2 | 45.5 | 49.1 | 51.8 |
| Uplink Input Power per Carrier | dBW | 7.7 | 7.4 | 13.2 | 21.5 | 26.8 | 21.1 |
| Free Space Loss | dB | 200.2 | 200.2 | 200.2 | 200.2 | 200.2 | 200.2 |
| G/T Satellite (EOC) | dB/K | -8.0 | -8.0 | -8.0 | -8.0 | -8.0 | -8.0 |
| C/N Thermal Uplink | dB | 19.5 | 19.6 | 19.4 | 19.5 | 21.6 | 17.7 |
| C/I XPOL, ACI, IM, ASI | dB | 17.2 | 17.3 | 17.1 | 17.2 | 19.2 | 15.4 |
| C/(N+I) uplink | dB | 15.2 | 15.3 | 15.1 | 15.2 | 17.2 | 13.4 |
| **Downlink:** | | | | | | | |
| Satellite e.i.r.p. per carrier (-3.9dB contour) | dBW | 24.1 | 25.5 | 31.3 | 37.9 | 44.8 | 41.3 |
| Maximum e.i.r.p. density | dBW/4kHz | 10.0 | 10.0 | 9.8 | 10.0 | 10.0 | 18.2 |
| Free Space Loss | dB | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 |
| Earth Station Diameter | m | 1.8 | 2.4 | 3.0 | 1.8 | 1.8 | 3.0 |
| Earth Station Gain | dBi | 45.1 | 47.6 | 49.5 | 45.1 | 45.1 | 49.5 |
| Noise Temperature | kHz | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 |
| Earth Station G/T | dB/K | 25.3 | 27.8 | 29.8 | 25.3 | 25.3 | 29.8 |
| C/N Thermal Downlink | dB | 18.4 | 20.9 | 22.7 | 18.4 | 18.4 | 18.5 |
| C/I XPOL, ACI, IM, ASI | dB | 20.2 | 22.8 | 24.5 | 20.2 | 20.2 | 20.3 |
| C/(N+I) downlink | dB | 16.2 | 18.8 | 20.5 | 16.2 | 16.2 | 16.3 |
| **Adjacent Satellite Interference:** | | | | | | | |
| Uplink Inp. Pwr. Dens. @ 2 degrees | dBW/Hz | -42 | -42 | -42 | -42 | -42 | -42 |
| Downlink e.i.r.p. Dens @ 2 degrees | dBW/Hz | -26 | -26 | -26 | -26 | -26 | -26 |
| C/I up (single satellite) | dB | 20.2 | 20.3 | 20.1 | 20.2 | 22.2 | 18.4 |
| C/I dn (single satellite) | dB | 23.2 | 25.8 | 27.5 | 23.2 | 23.2 | 23.3 |
| Aggregate C/I up | dB | 17.2 | 17.3 | 17.1 | 17.2 | 19.2 | 15.4 |
| Aggregate C/I down | dB | 20.2 | 22.8 | 24.5 | 20.2 | 20.2 | 20.3 |
| **Overall:** | | | | | | | |
| C/(N+I) overall | dB | 12.6 | 13.7 | 14.0 | 12.7 | 13.7 | 11.6 |
| C/(N+I) required | dB | 6.0 | 9.3 | 9.3 | 6.9 | 6.9 | 10.0 |
| System Margin | dB | 6.6 | 4.4 | 4.7 | 5.8 | 6.8 | 1.6 |

TABLE A-4. LINK BUDGET, HEMI/SPOT (72 MHZ TRANSPONDER)

| | | HEMI/SPOT 72 MHz Transponder | | | | | |
|---|---|---|---|---|---|---|---|
| **Link Parameters** | **Units** | **346KG7W** | **461KG7W** | **1M84G7W** | **8M25G7W** | **72M0G7W** | **36M0F3F** |
| Uplink Frequency | GHz | 5.968 | 5.968 | 5.968 | 5.968 | 5.968 | 5.968 |
| Downlink Frequency | GHz | 11.748 | 11.748 | 11.748 | 11.748 | 11.748 | 11.748 |
| Carrier Allocated Bandwidth | kHz | 346.0 | 461.0 | 1840.0 | 8250.0 | 72000.0 | 36000.0 |
| Energy Dispersal | MHz | n/a | n/a | n/a | n/a | n/a | 2.0 |
| **Uplink:** | | | | | | | |
| Nominal E/S e.i.r.p. per carrier | dBW | 51.8 | 53.1 | 58.1 | 65.1 | 80.1 | 72.9 |
| Earth Station Diameter | m | 3.7 | 4.5 | 4.5 | 3.7 | 11.0 | 7.6 |
| Earth Station Gain | dBi | 45.3 | 47.1 | 47.1 | 45.3 | 54.9 | 51.8 |
| Uplink Input Power per Carrier | dBW | 6.5 | 6.1 | 11.1 | 19.8 | 25.2 | 21.1 |
| Free Space Loss | dB | 200.1 | 200.1 | 200.1 | 200.1 | 200.1 | 200.2 |
| G/T Satellite (EOC) | dB/K | -8.0 | -8.0 | -8.0 | -8.0 | -8.0 | -8.0 |
| C/N Thermal Uplink | dB | 18.3 | 18.3 | 17.3 | 17.8 | 22.6 | 17.7 |
| C/I XPOL, ACI, IM, ASI | dB | 15.8 | 15.8 | 14.8 | 15.3 | 20.1 | 15.4 |
| C/(N+I) uplink | dB | 13.8 | 13.9 | 12.9 | 13.4 | 18.2 | 13.4 |
| **Downlink:** | | | | | | | |
| Satellite e.i.r.p. per carrier (-3.9dB contour) | dBW | 22.7 | 24.0 | 29.0 | 36.0 | 48.0 | 41.3 |
| Maximum e.i.r.p. density | dBW/4kHz | 8.6 | 8.6 | 7.6 | 8.1 | 9.9 | 18.2 |
| Free Space Loss | dB | 205.5 | 205.5 | 205.5 | 205.5 | 205.5 | 205.6 |
| Earth Station Diameter | m | 1.8 | 3.0 | 3.8 | 2.4 | 7.0 | 3.0 |
| Earth Station Gain | dBi | 45.0 | 49.5 | 51.5 | 47.5 | 56.8 | 49.5 |
| Noise Temperature | kHz | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 |
| Earth Station G/T | dB/K | 25.3 | 29.7 | 31.7 | 27.8 | 37.1 | 29.7 |
| C/N Thermal Downlink | dB | 17.0 | 21.4 | 22.5 | 19.0 | 30.1 | 18.4 |
| C/I XPOL, ACI, IM, ASI | dB | 18.7 | 23.2 | 24.3 | 20.7 | 31.9 | 20.2 |
| C/(N+I) downlink | dB | 14.7 | 19.2 | 20.3 | 16.7 | 27.9 | 16.2 |
| **Adjacent Satellite Interference:** | | | | | | | |
| Uplink Inp. Pwr. Dens. @ 2 degrees | dBW/Hz | -42 | -42 | -42 | -42 | -42 | -42 |
| Downlink e.i.r.p. Dens @ 2 degrees | dBW/Hz | -26 | -26 | -26 | -26 | -26 | -26 |
| C/I up (single satellite) | dB | 18.8 | 18.8 | 17.8 | 18.3 | 23.1 | 18.4 |
| C/I dn (single satellite) | dB | 21.7 | 26.2 | 27.3 | 23.7 | 34.9 | 23.2 |
| Aggregate C/I up | dB | 15.8 | 15.8 | 14.8 | 15.3 | 20.1 | 15.4 |
| Aggregate C/I down | dB | 18.7 | 23.2 | 24.3 | 20.7 | 31.9 | 20.2 |
| **Overall:** | | | | | | | |
| C/(N+I) overall | dB | 11.3 | 12.8 | 12.2 | 11.7 | 17.8 | 11.6 |
| C/(N+I) required | dB | 6.0 | 9.3 | 9.3 | 6.9 | 12.7 | 10.0 |
| System Margin | dB | 5.3 | 3.5 | 2.9 | 4.8 | 5.1 | 1.6 |

TABLE A-5. LINK BUDGET, SPOT/SPOT (72 MHZ TRANSPONDER)

| | | SPOT/SPOT 72 MHz Transponder | | | | | |
|---|---|---|---|---|---|---|---|
| **Link Parameters** | **Units** | **346KG7W** | **461KG7W** | **1M84G7W** | **8M25G7W** | **72M0G7W** | **36M0F3F** |
| Uplink Frequency | GHz | 14.125 | 14.125 | 14.125 | 14.125 | 14.125 | 14.125 |
| Downlink Frequency | GHz | 11.830 | 11.830 | 11.830 | 11.830 | 11.830 | 11.830 |
| Carrier Allocated Bandwidth | kHz | 346.0 | 461.0 | 1840.0 | 8250.0 | 72000.0 | 36000.0 |
| Energy Dispersal | MHz | n/a | n/a | n/a | n/a | n/a | 2.0 |
| **Uplink:** | | | | | | | |
| Nominal E/S e.i.r.p. per carrier | dBW | 52.1 | 54.4 | 59.0 | 66.5 | 79.6 | 72.8 |
| Earth Station Diameter | m | 3.0 | 3.7 | 3.7 | 3.0 | 3.7 | 7.6 |
| Earth Station Gain | dBi | 51.0 | 52.8 | 52.8 | 51.0 | 52.8 | 59.1 |
| Uplink Input Power per Carrier | dBW | 1.1 | 1.6 | 6.2 | 15.5 | 26.8 | 13.7 |
| Free Space Loss | dB | 207.1 | 207.1 | 207.1 | 207.1 | 207.1 | 207.1 |
| G/T Satellite (EOC) | dB/K | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| C/N Thermal Uplink | dB | 20.5 | 21.6 | 20.1 | 21.1 | 24.1 | 19.7 |
| C/I XPOL, ACI, IM, ASI | dB | 24.0 | 25.1 | 23.7 | 24.7 | 27.7 | 23.3 |
| C/(N+I) uplink | dB | 18.9 | 20.0 | 18.5 | 19.5 | 22.5 | 18.2 |
| **Downlink:** | | | | | | | |
| Satellite e.i.r.p. per carrier (-3.9dB contour) | dBW | 22.4 | 24.8 | 29.3 | 36.8 | 48.0 | 40.6 |
| Maximum e.i.r.p. density | dBW/4kHz | 8.2 | 9.3 | 7.9 | 8.9 | 9.9 | 17.6 |
| Free Space Loss | dB | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 |
| Earth Station Diameter | m | 1.8 | 2.4 | 3.0 | 1.8 | 3.7 | 2.4 |
| Earth Station Gain | dBi | 45.1 | 47.6 | 49.5 | 45.1 | 51.4 | 47.6 |
| Noise Temperature | kHz | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 | 95.0 |
| Earth Station G/T | dB/K | 25.3 | 27.8 | 29.8 | 25.3 | 31.6 | 27.8 |
| C/N Thermal Downlink | dB | 16.6 | 20.2 | 20.7 | 17.3 | 24.5 | 15.9 |
| C/I XPOL, ACI, IM, ASI | dB | 18.5 | 22.1 | 22.6 | 19.1 | 26.4 | 17.7 |
| C/(N+I) downlink | dB | 14.4 | 18.1 | 18.5 | 15.1 | 22.3 | 13.7 |
| **Adjacent Satellite Interference:** | | | | | | | |
| Uplink Inp. Pwr. Dens. @ 2 degrees | dBW/Hz | -50 | -50 | -50 | -50 | -50 | -50 |
| Downlink e.i.r.p. Dens @ 2 degrees | dBW/Hz | -26 | -26 | -26 | -26 | -26 | -26 |
| C/I up (single satellite) | dB | 27.0 | 28.1 | 26.7 | 27.7 | 30.7 | 26.3 |
| C/I dn (single satellite) | dB | 21.5 | 25.1 | 25.6 | 22.1 | 29.4 | 20.7 |
| Aggregate C/I up | dB | 24.0 | 25.1 | 23.7 | 24.7 | 27.7 | 23.3 |
| Aggregate C/I down | dB | 18.5 | 22.1 | 22.6 | 19.1 | 26.4 | 17.7 |
| **Overall:** | | | | | | | |
| C/(N+I) overall | dB | 13.1 | 15.9 | 15.5 | 13.8 | 19.4 | 12.4 |
| C/(N+I) required | dB | 6.0 | 9.3 | 9.3 | 6.9 | 12.7 | 10.0 |
| System Margin | dB | 7.1 | 6.6 | 6.3 | 6.9 | 6.7 | 2.4 |

# APPENDIX B

## Antenna Beam Diagrams

**Figure B-1.**
**Hemi Uplink Beam**
**Peak G/T = -3.1 dB/K**
**Peak Beam Gain = 24.4 dBi**
**Min. Saturation Flux Density = -93 dBW/m²**
**Polarization LHCP and RHCP**
**Schedule S beam designators: HAU and HBU**

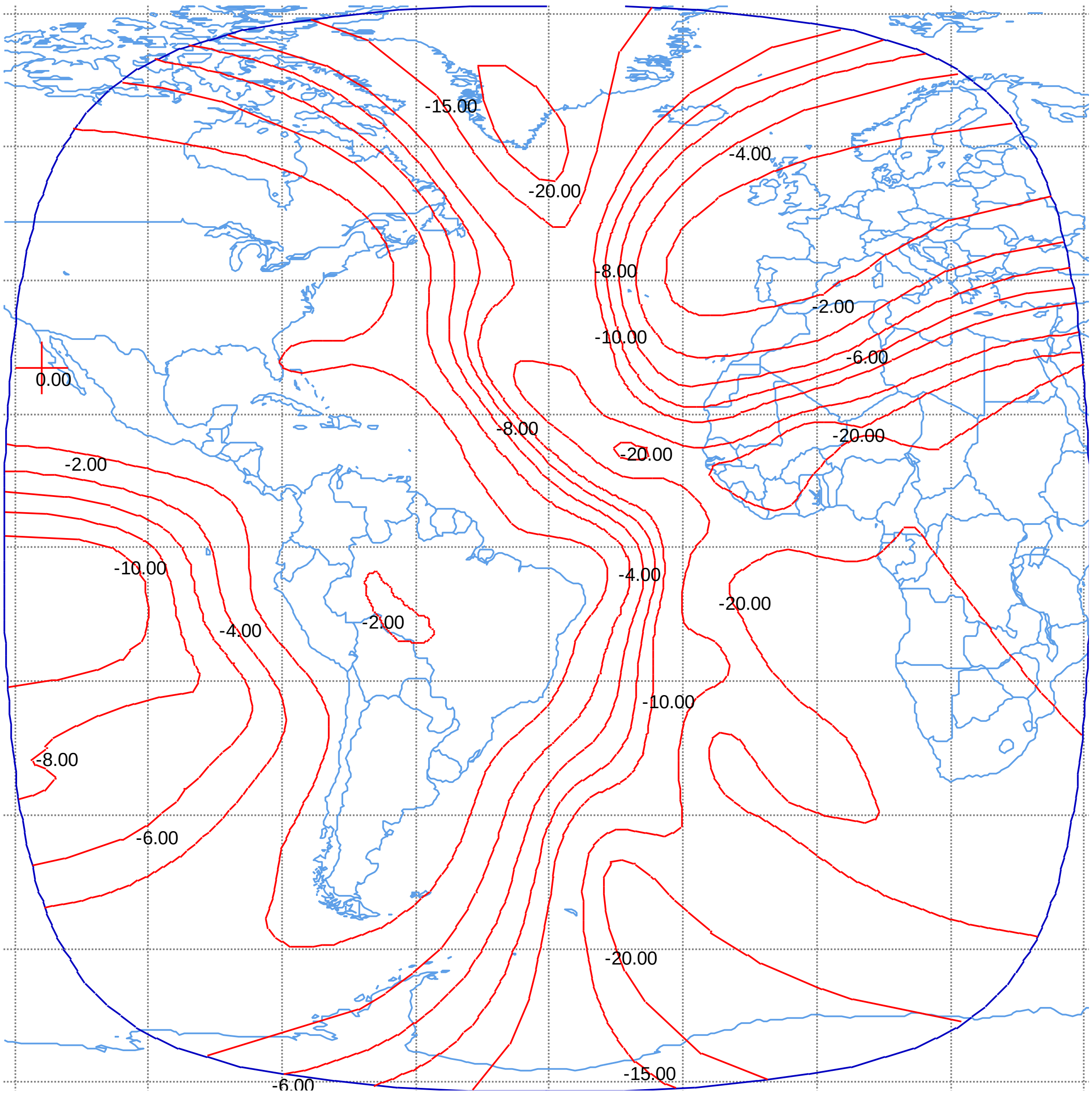


**Figure B-2.**
**Hemi Downlink Beam**
**Peak EIRP = 41.4 dBW**
**Peak Beam Gain = 24.8 dBi**
**Polarization RHCP and LHCP**
**Schedule S beam designators: HAD and HBD**

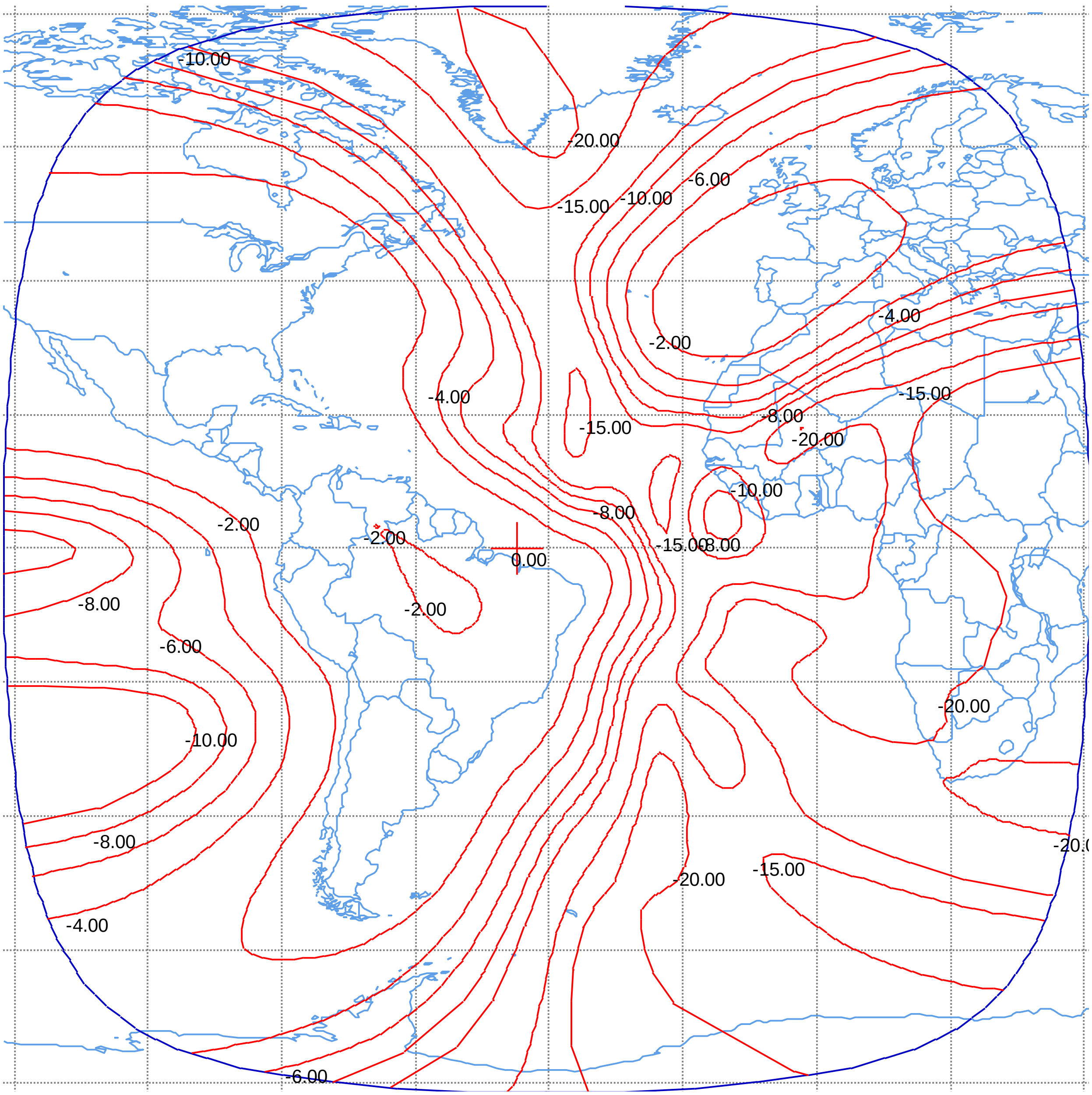


**Figure B-3.**
**Spot Uplink Beam**
**Peak G/T = 5.0 dB/K**
**Peak Beam Gain = 33.0 dBi**
**Min. Saturation Flux Density = -100 dBW/m$^2$**
**Polarization V**
**Schedule S beam designators: S1U**
**(Position 1)**

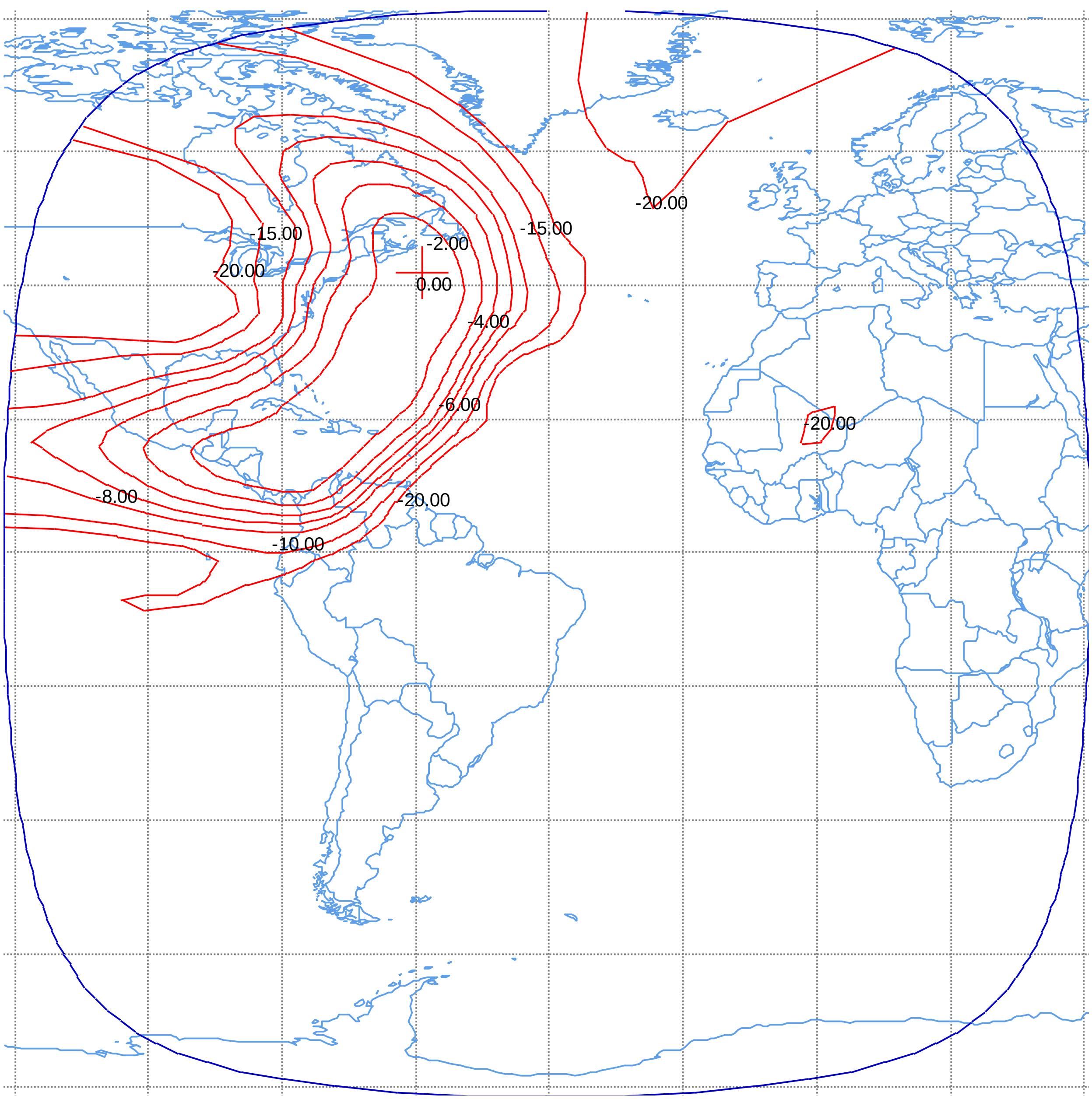


**Figure B-4.**
**Spot Downlink Beam**
**Peak EIRP = 51.9 dBW**
**Peak Beam Gain = 32.2 dBi**
**Polarization H**
**Schedule S beam designators: S1D**
**(Position 1)**

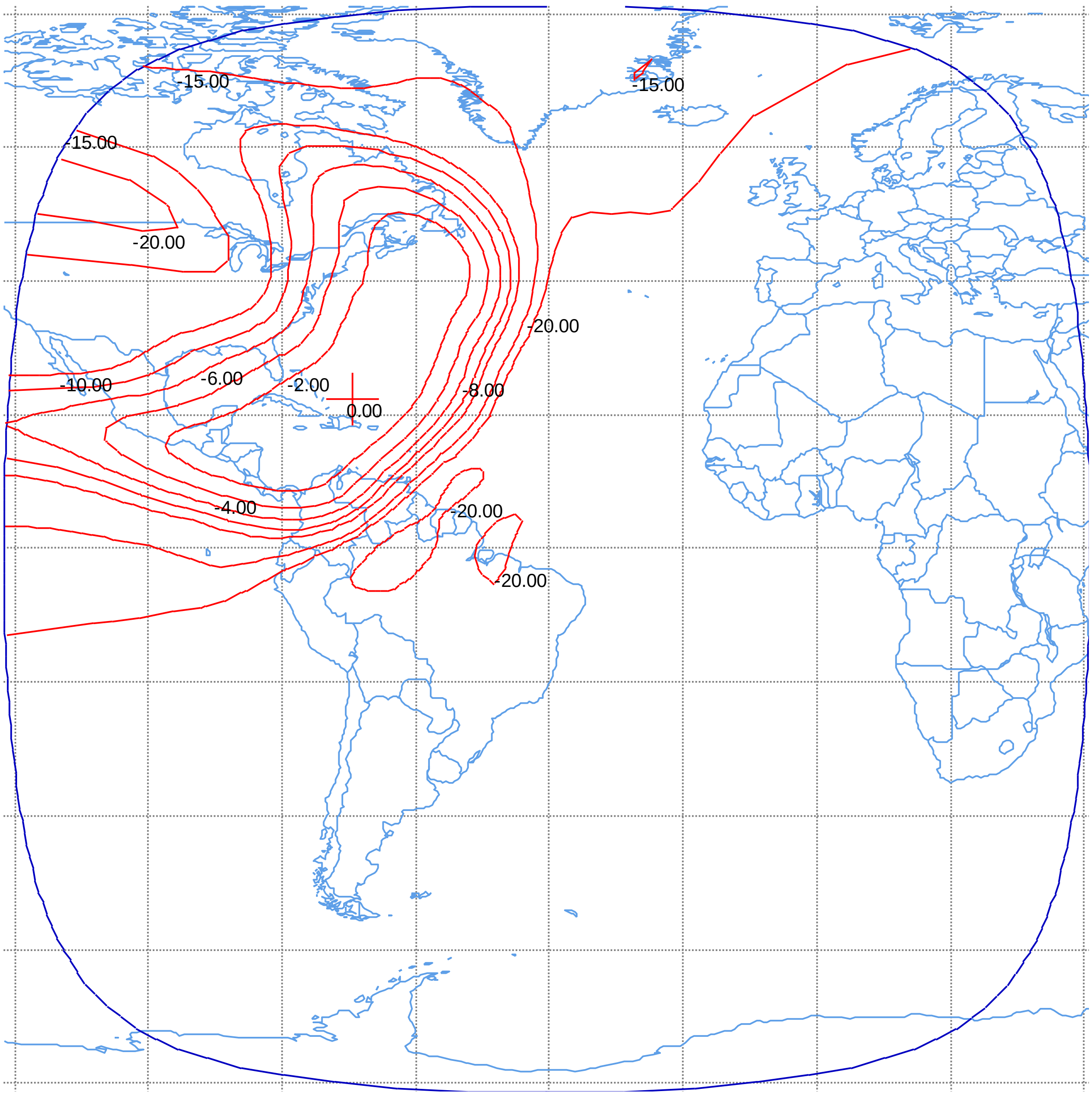


**Figure B-5.**
**Spot Uplink Beam**
**Peak G/T = 5.0 dB/K**
**Peak Beam Gain = 33.0 dBi**
**Min. Saturation Flux Density = -100 $dBW/m^2$**
**Polarization V**
**Schedule S beam designators: S1U**
**(Position 2)**

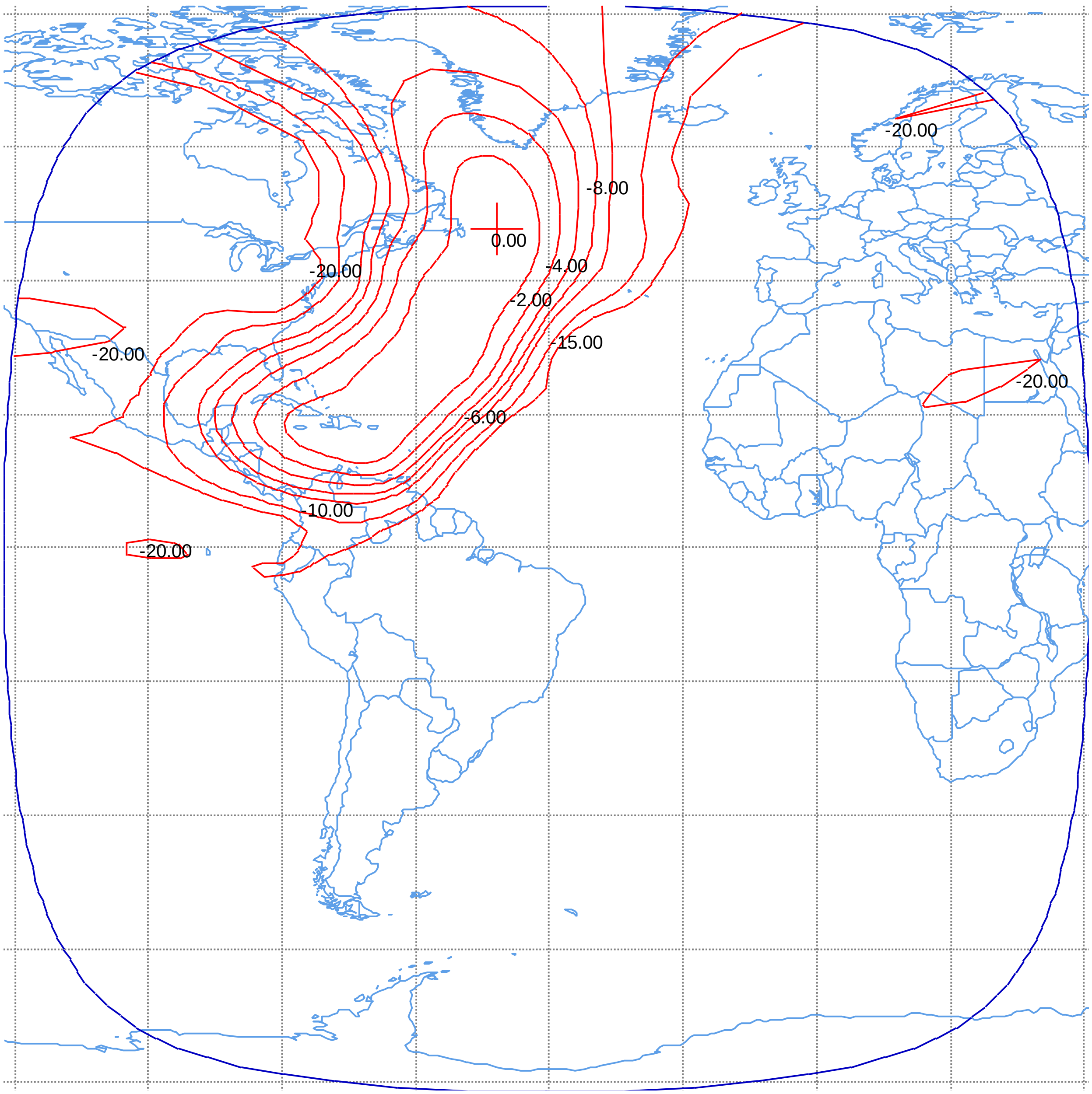


**Figure B-6.**
**Spot Downlink Beam**
**Peak EIRP = 51.9 dBW**
**Peak Beam Gain = 32.2 dBi**
**Polarization H**
**Schedule S beam designators: S1D**
**(Position 2)**

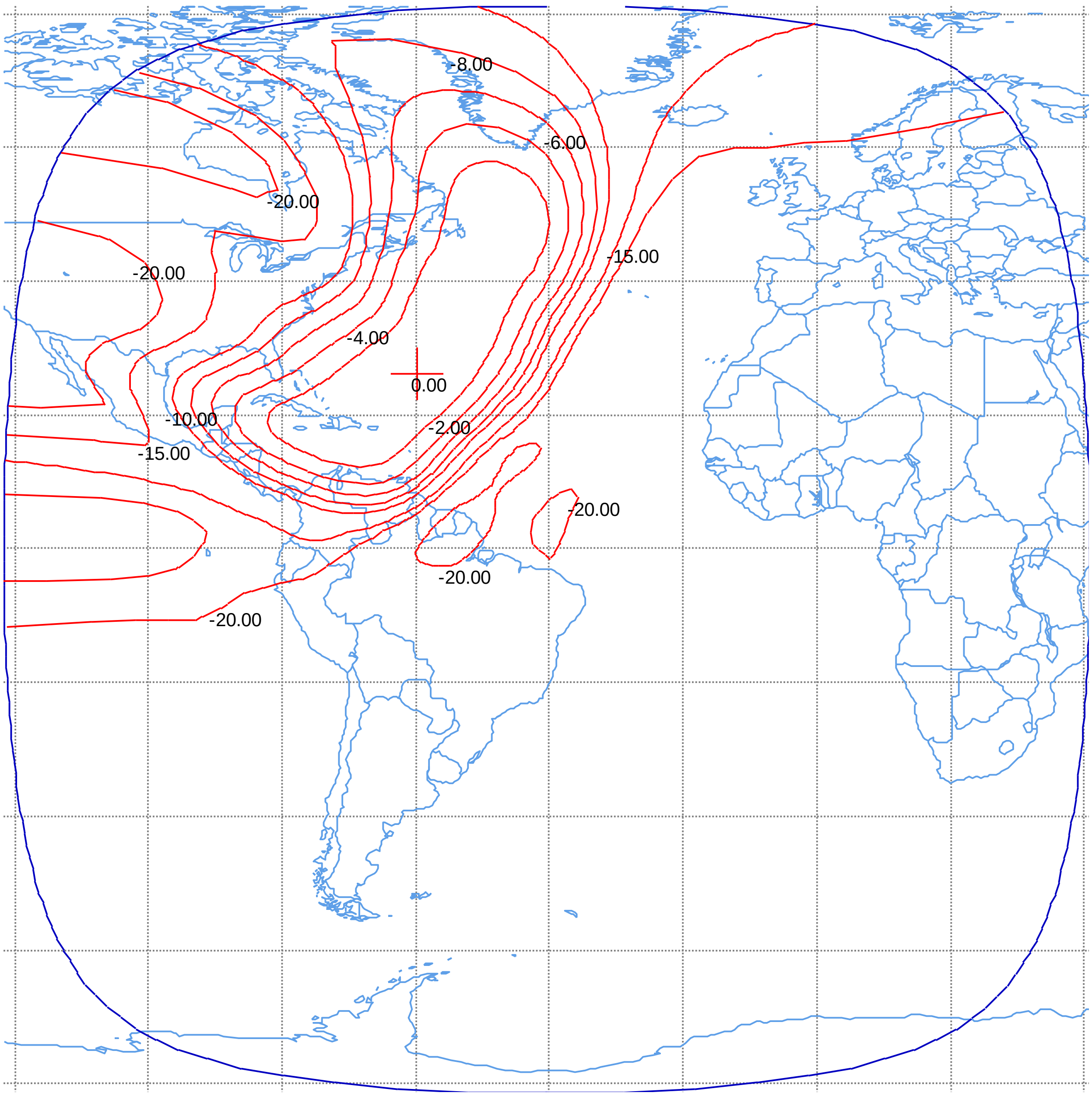


**Figure B-7.**
**Spot Uplink Beam**
**Peak G/T = 5.0 dB/K**
**Peak Beam Gain = 33.0 dBi**
**Min. Saturation Flux Density = -100 dBW/m$^2$**
**Polarization V**
**Schedule S beam designators: S1U**
**(Current Position)**

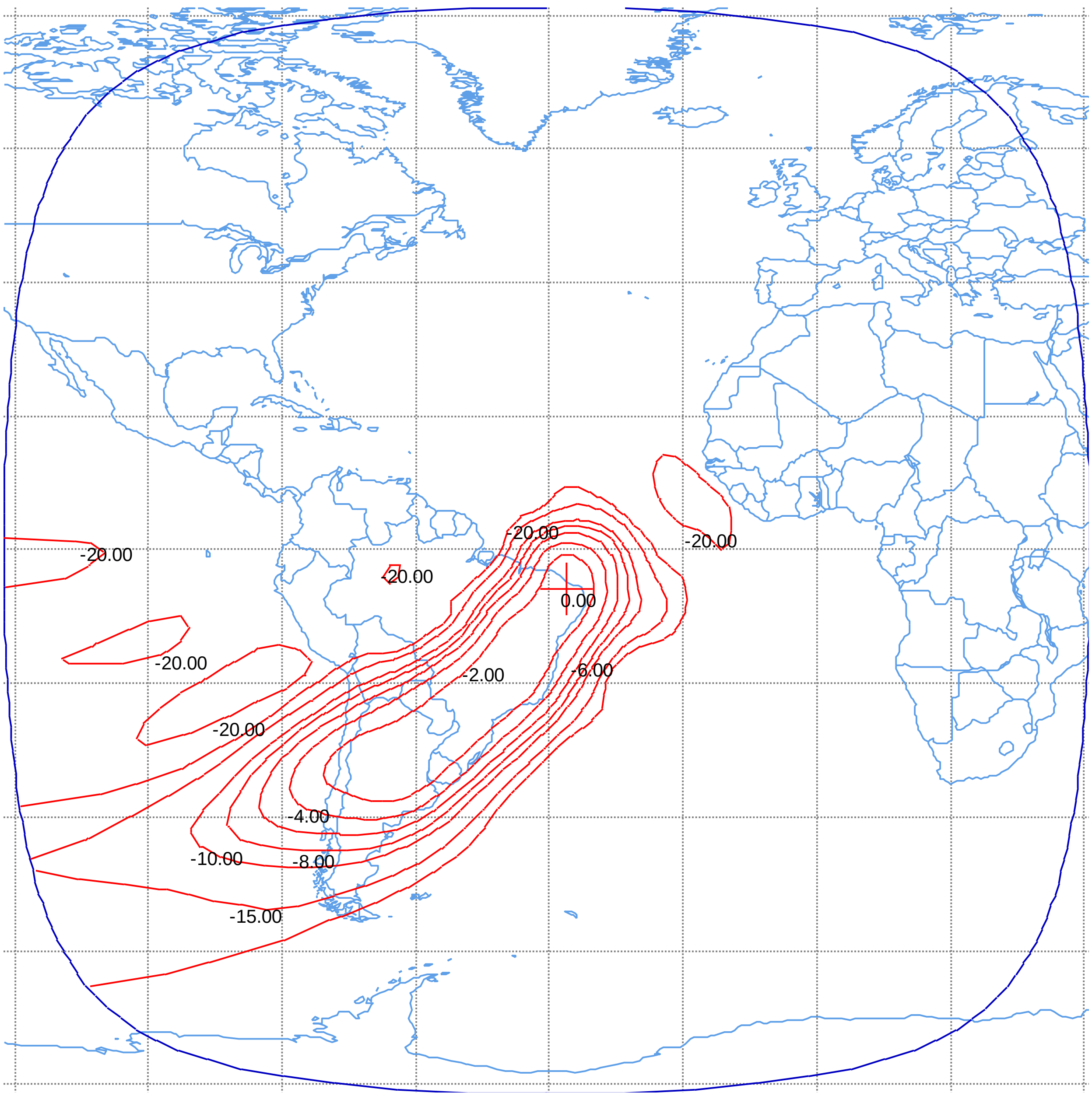


**Figure B-8.**
**Spot Downlink Beam**
**Peak EIRP = 51.9 dBW**
**Peak Beam Gain = 32.2 dBi**
**Polarization H**
**Schedule S beam designators: S1D**
**(Current Position)**

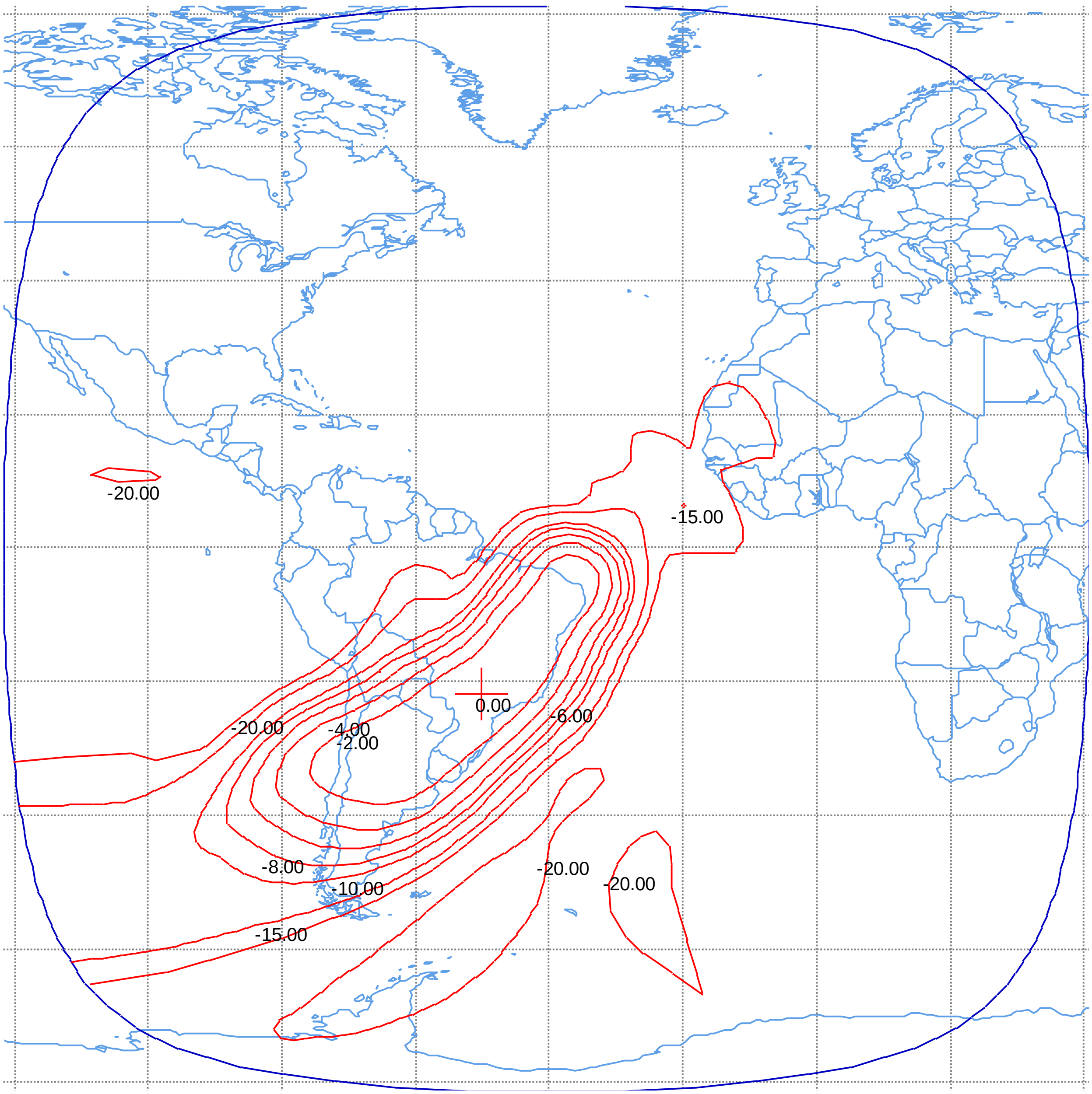


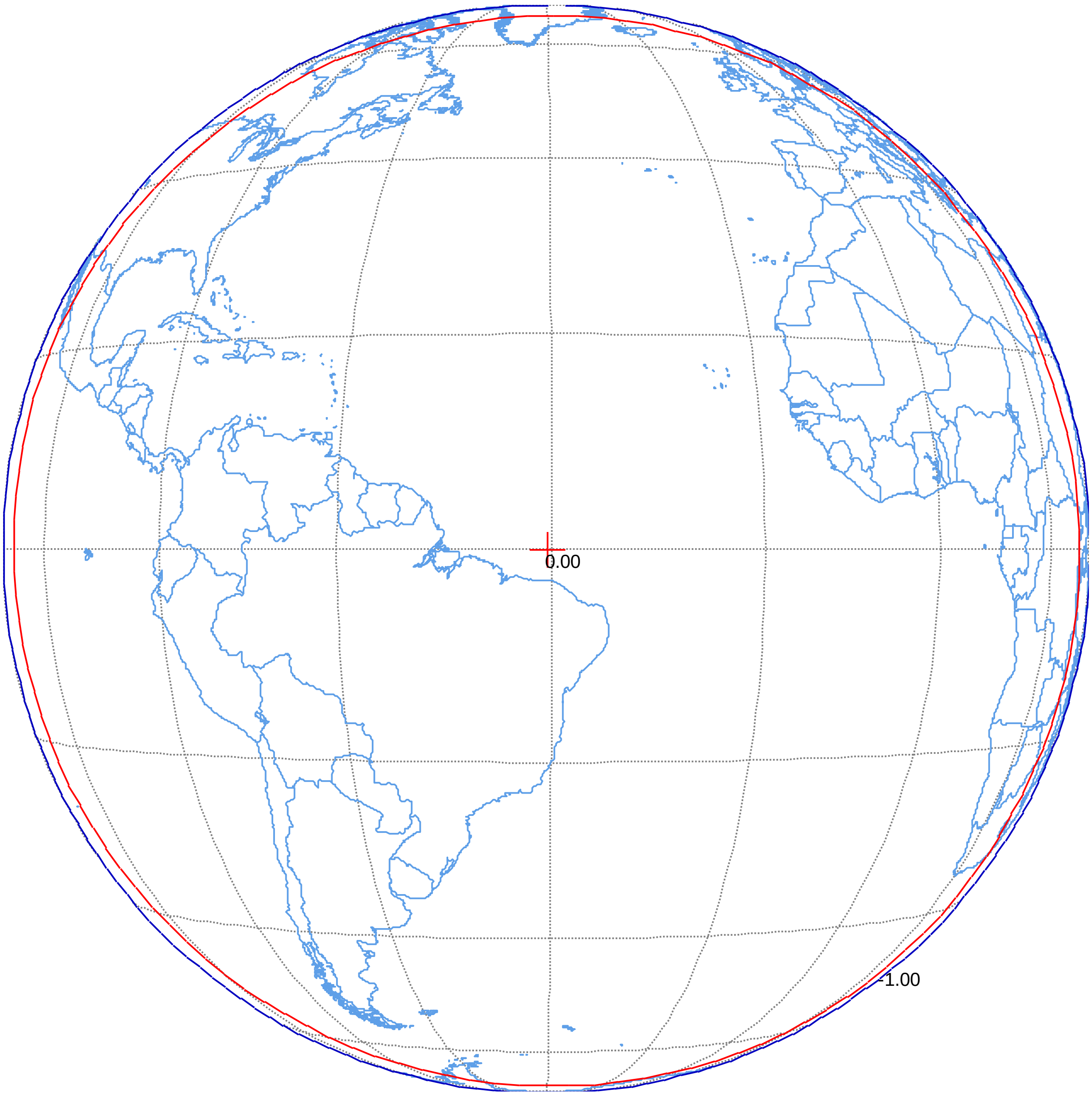
**Figure B-9.**
**Command Carrier Earth Facing Receive Horn[6]**
**Maximum receive gain = 10.3 dBi**
**Command Threshold Flux Density = -90 dBW/m²**
**Peak Beam Gain = 32.2 dBi**
**Polarization LHCP**
**Schedule S beam designators: CMD**


[6] Additional gain contours, as requested in Section 25.114(d)(3), are not provided because they do not intersect with the Earth's surface

**Figure B-10.**
**Telemetry Carrier Earth Facing Transmit Horn[7]**
**Maximum EIRP = 10 dBW**
**Maximum transmit gain = 11.3 dBi**
**Polarization RHCP**
**Schedule S beam designators: TLM**

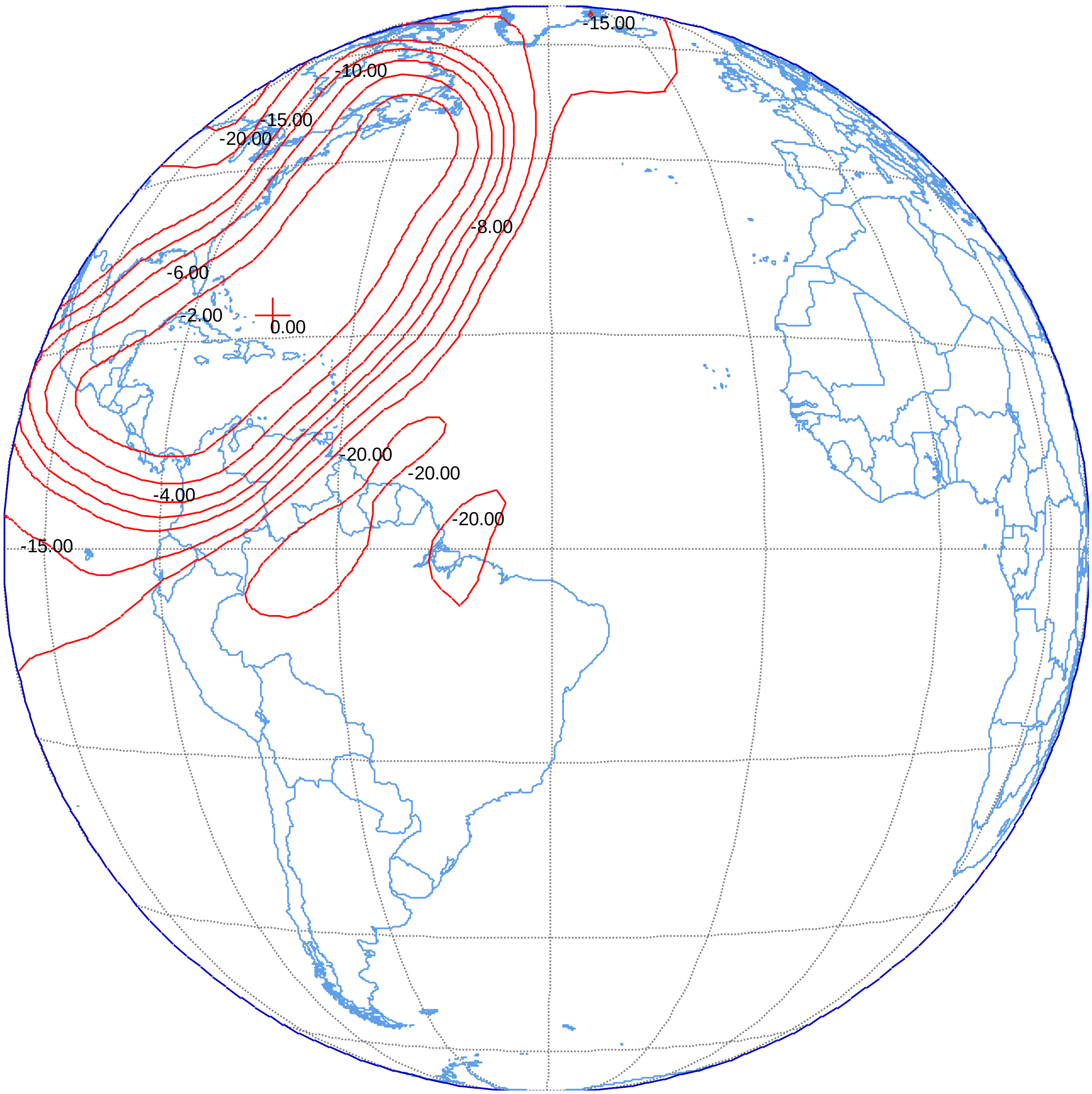

[7] Additional gain contours, as requested in Section 25.114(d)(3), are not provided because they do not intersect with the Earth's surface

**Figure B-11.**
**C-band Tracking Beacon Earth Facing Transmit Horn[8]**
**Maximum EIRP = 11 dBW**
**Maximum transmit gain = 11.3 dBi**
**Polarization Vertical Linear**
**Schedule S beam designators: BNC**




[8] Additional gain contours, as requested in Section 25.114(d)(3), are not provided because they do not intersect with the Earth's surface

**Figure B-11.**
**Ku-band Tracking Beacon Antenna**
**Maximum EIRP = 9 dBW**
**Maximum transmit gain = 32.2 dBi**
**Polarization Horizontal Linear**
**Schedule S beam designators: BNK**



# APPENDIX C

## TT&C Link Budgets

TABLE C-1. LINK BUDGET, BEACON CARRIER, 25K0N0N

| **Link Parameters** | **Units** | **25K0N0N** |
|---|---|---|
| Downlink Frequency | GHz | 11.701 |
| Carrier Allocated Bandwidth | kHz | 25.0 |
| **Downlink:** | | |
| Downlink e.i.r.p. (- 3.9dB contour) | dBW | 5.1 |
| Free Space Loss | dB | 205.7 |
| Atmospheric and Polarization Losses | dB | 1.0 |
| Rain Fade | dB | 5.0 |
| Receive E/S Pointing Loss | dB | 0.3 |
| Receive E/S G/T | dB/K | 38.4 |
| Downlink C/No | dB | 60.1 |
| Required C/No | dB | 47.0 |
| Margin | dB | 13.1 |

**DECLARATION**

I, Patrick van Niftrik, hereby certify under penalty of perjury that I am the technically qualified person responsible for preparation of the technical information contained in the foregoing exhibit; that I am familiar with the technical requirements of Part 25; and that I either prepared or reviewed the technical information contained in the exhibit and that it is complete and accurate to the best of my knowledge, information and belief.

_/s/_*Patrick van Niftrik* ____________________
Senior Manager, Spectrum Development
New Skies Satellites B.V.

Dated: September 23, 2011