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

In the Matter of **ECHOSTAR SATELLITE OPERATING CORPORATION** Application for Authority to Launch and Operate ECHO-45W Fixed-Satellite Service Payload	File No. SAT-AMD-20130614-_____ SAT-LOA-20120921-00152 Call Sign S2874

MINOR AMENDMENT

EchoStar Satellite Operating Corporation (individually or collectively with its affiliates, "EchoStar") submits this minor amendment ("Amendment") to its above-referenced application ("Application") for launch and operating authority to provide Fixed-Satellite Service ("FSS") in the Ku-band from the 45.1º W.L. orbital location. Specifically, EchoStar seeks authority for a Ku-band FSS payload ("ECHO-45W FSS") on a Brazilian-licensed hybrid Broadcasting Satellite Service ("BSS")/FSS satellite[1] to be launched and operated at 45.1° W.L., in lieu of the previous requested authority for a stand-alone Ku-band FSS satellite. It further asks that its Application, as amended, promptly be placed on Public Notice.

ECHO-45W FSS will operate on the same frequencies, with the same power, and provide the same services as the standalone FSS satellite detailed in the original Application.[2] The BSS payload is licensed to EchoStar's affiliate, HNS Americas Comunicações, Ltda. ("HNS

[1] The Brazilian-licensed satellite will operate with two payloads: (1) a Brazilian-licensed BSS payload; and (2) and a payload operating on Ku-band FSS frequencies allocated under Appendix 30B of the International Telecommunication Union ("ITU") Radio Regulations and subject to U.S. licensing authority requested under this amended Application.

[2] *See* EchoStar Application, File No. SAT-LOA-20120921-00152 (filed Sept. 21, 2012).

Brazil"),[3] and will be launched and operated under the authority of Brazil's Agência Nacional de Telecomunicações ("Anatel").[4] Attached as Exhibit 1 is a revised Technical Annex demonstrating that the proposed payload complies with the Commission's technical requirements.[5]

The proposed operations will expand the presence of a U.S. service provider in a foreign market, thus strengthening its competitiveness and ability to create U.S. jobs and contribute to U.S. economic growth. Significantly, the overseas market for U.S. programming will be expanded, which will benefit both the content industry and U.S. consumers who are likely to receive the benefits that flow from the creation of additional programming in the United States. The proposed operations also will create a valuable transmission route for programming and related traffic between the United States and Brazil; provide for full and efficient use of available orbital and spectral resources; and facilitate new, competitive satellite services to Brazil. The bottom line is that the proposed operations will advance the Commission's objectives of promoting U.S. investment, creating U.S. jobs, growing the U.S. economy, ensuring efficient spectrum use, and delivering new and innovative services to the public[6] – all without the

[3] An application for transfer of control of the BSS license from HNS Brazil to EchoStar 45, another EchoStar affiliate, was filed in late 2012 and is pending before Anatel.

[4] Brazil will be the administration on record as the launching state for purposes of the relevant U.N. conventions on liability and registration. Brazil will also be the licensing administration for the BSS payload for purposes of ITU Radio Regulation 18.1.

[5] As required by Anatel, telemetry, tracking, and control ("TT&C") of the hybrid spacecraft will be performed by earth station facilities in Brazil. Under an agreement between EchoStar and HNS Brazil, EchoStar will maintain the unilateral right at all times to direct HNS Brazil to cease operations of the FSS payload, as necessary to ensure compliance with the Federal Communications Commission's ("FCC" or "Commission") rules. The agreement between EchoStar and HNS Brazil will be assigned to EchoStar 45 upon consummation of the transfer of control of the BSS license to EchoStar 45.

[6] *See* Julius Genachowski, Chairman, FCC, *Winning the Global Bandwidth Race: Opportunities and Challenges for Mobile Broadband*, Prepared Remarks for the University of Pennsylvania – Wharton, Philadelphia, PA, at 8 (Oct. 4, 2012) (noting FCC objectives of "promot[ing] competition to drive wireless innovation, investment and spectrum efficiency").

potential for harmful interference to other services and in a manner consistent with ITU rules and procedures. In short, these operations will advance the "public interest."

BACKGROUND

EchoStar is a diverse and dynamic U.S. company. Founded by Charlie Ergen in 1980, EchoStar is a home-grown U.S. satellite operator, services provider, and technology company. Today, EchoStar owns, leases, or operates a fleet of 22 satellites in the Direct Broadcast Satellite ("DBS")/Broadcasting-Satellite Service ("BSS"), Fixed-Satellite Service ("FSS"), and Mobile-Satellite Service ("MSS") bands providing various innovative and competitive services, including multi-channel video programming distribution (through DISH Network Corporation ("DISH")) and state-of-the-art broadband services. Indeed, EchoStar is the fourth largest satellite operator in the world. It is also a leading satellite technology and services company and employs more than 2,000 engineers focused on creating hardware and service solutions (*e.g.,* digital set-top boxes and related products and technology, including Slingbox "placeshifting" technology) for cable, telecommunications, IPTV, and satellite companies worldwide.

In 2008, the satellite technology, operations, and non-consumer DBS service aspects of EchoStar's business were spun off into EchoStar Corporation, with the consumer DBS service remaining with DISH. Today, DISH's DBS network provides satellite television service to more than 14 million U.S. consumers, as well as approximately 2 million Mexican consumers, all of whom EchoStar supports.

EchoStar has a long history of bringing competitive satellite services to new markets throughout the United States and in other countries. EchoStar's proposed entry into the Brazilian market continues this effort. In April 2012, EchoStar's affiliate, HNS Brazil, secured rights from Anatel (pursuant to an auction) to use the 45.1º W.L. orbital slot to provide Ku-band BSS, Ka-

band, and S-band services to Brazil.[7] Through HNS Brazil, EchoStar has established itself in Brazil as a leading business supplier of satellite services, providing a wide range of managed network services to the banking, education, retail, and utilities sectors. With the addition of the 45.1º W.L. orbital location, EchoStar plans to expand its satellite-based business operations in Brazil to include video and enhanced mobile and fixed broadband data offerings. Brazil represents one of the world's strongest and fastest-growing economies, including booming video and broadband service sectors.[8] To compete effectively in this market, EchoStar plans to leverage U.S. innovation, content, and technology.

In order to leverage this important market opportunity, expand EchoStar's service offering to Brazil, and provide a new potential avenue for U.S. programming to reach an audience in Brazil, the EchoStar 15 satellite was recently relocated for BSS operations at the 45.1º W.L. orbital location pursuant to special temporary authority ("STA").[9] Additionally, on September 21, 2012, EchoStar filed the original Application with the Commission requesting use of Ku-band frequencies by a new satellite to be built and launched to 45.1º W.L. After further consideration, EchoStar has determined that launching a hybrid satellite (in lieu of two separate satellites) carrying both BSS and FSS payloads will be more cost-effective and efficient.

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[7] *See* Term of Satellite Exploration Right between Anatel and HNS Brazil (English Translation) (July 18, 2012) (material portions are attached as Exhibit 2, subject to a request for confidential treatment). The proposed satellite at 45.1º W.L. is covered under the "B-SAT-3A-3" filing, which has been submitted to Anatel for filing with the ITU. As a ratifying signatory to the United Nations ("U.N.") Convention on the Registration of Objects Launched into Outer Space ("Registration Convention") and founding member of the U.N. Committee on Peaceful Use of Outer Space ("Committee"), Brazil is expected to register the satellite with the Committee under the Registration Convention in due course.

[8] *See infra* nn.11-14 and accompanying text.

[9] *See* EchoStar Application for STA, File No. SAT-STA-20130502-00065 (granted May 8, 2013). EchoStar's modification application for regular authority to operate EchoStar 15 at 45.1º W.L. remains pending before the FCC. *See* EchoStar Application for Minor Modification, File No. SAT-MOD-20130503-00066 (filed May 3, 2013).

EchoStar therefore submits this amendment seeking authority for the ECHO-45W FSS payload as detailed in the attached Technical Annex.

I. ECHO-45W FSS WILL OFFER SIGNIFICANT PUBLIC INTEREST BENEFITS

Enabling an FSS payload in the Ku-band under Appendix 30B of the ITU Radio Regulations at 45.1º W.L. will serve the public interest. The proposed operations will create valuable new market opportunities and strengthen relations between the United States and a key ally in this hemisphere. These operations will also benefit both U.S. and Brazilian consumers. In Brazil, consumers will benefit from a new and innovative broadcast service introduced by a competitive satellite service provider. In the United States, consumers will benefit from the creation of additional programming that is likely to be available in both markets – particularly foreign language programming that is not readily available today.

The provision of this service will also strengthen the U.S. video distribution, content, and satellite service industries. This, in turn, will benefit the U.S. economy by both creating jobs in the short term and by spurring demand for additional U.S. content across the Americas in the longer term. The proposed operations also will produce substantial economic efficiencies that the FCC has long recognized as resulting from hybrid satellite configurations.[10]

A. The Proposed Operations Will Create New Market Opportunities in Brazil

The proposed operations will support new, competitive multi-channel video offerings to the Brazilian market by creating a valuable transmission route between the United States and Brazil. The Brazilian economy as a whole is estimated to grow by an annual average of 4.1 percent over the next several years.[11] In 2012, demand for video content grew 31 percent over

[10] *See infra* nn. 24-27.

[11] *See 2016 Economic Statistics and Indicators*, Economy Watch, http://www.economywatch.com/economic-statistics/year/2016 (last visited June 7, 2013).

the prior year.[12] This growth, which has well outpaced the country's general growth rate, is expected to continue,[13] partly because the market for pay television services is still nascent in Brazil, with only 26.4 percent of the population currently receiving such services.[14] EchoStar's operations from the 45.1° W.L. orbital location, including the provision of backhaul services through ECHO-45W FSS, promise to position EchoStar to take advantage of this remarkable growth opportunity.

Although the content of EchoStar's Brazilian television service offering is not yet set, this content likely will include an array of specialty programming, including U.S.-produced Portuguese-language programming, an important content niche, as well as other U.S.-produced content. This in turn will create a domino effect, helping U.S. video programmers and the industries that support them to diversify and grow their revenue base. Increasing the availability of Portuguese-language programming also will advance the Commission's diversity goals, and this programming will almost surely be made available to U.S. consumers as well.[15] The

[12] *See* I ñ aki Ferreras, *Brazil's Pay-TV Market Reaches 14.8 Million*, RapidTV News (Aug. 30, 2012), http://www.rapidtvnews.com/index.php/2012083023815/brazil-s-pay-tv-market-reaches-14-8-million.html.

[13] *See* Eduardo Tude, *2013 Predictions: Brazil's Telecom Market Set for Change in 2013* (Jan. 10, 2013) ("Pay-TV, which increased 27% in 2012, due to DTH, is likely to keep this growth pace in 2013"), http://www.rcrwireless.com/americas/20130110/networks/2013-predictions-brazils-telecom-market-set-change-2013.

[14] Anatel, Correção: TV por Assinature Cresce 1,95% em Outubro, Nov. 29, 2012, http://www.anatel.gov.br/Portal/exibirPortalNoticias.do?acao=carregaNoticia&codigo=27371.

[15] *See Amendment of Section 73.658(i) of the Commission's Rules Concerning Network Representation of TV Stations in National Spot Sales,* Report and Order, 5 FCC Rcd 7280, ¶ 12 (1990) ("fostering foreign-language programming" is a "longstanding goal[]" of the Commission); *BBC Broadcasting, Inc.,* Letter, 23 FCC Rcd 2634, 2637 (MB Audio Div. 2008) ("The Commission has held that foreign-language programming furthers its diversity goals.").

Commission, of course, has for year taken actions to encourage the delivery of more foreign-language programming to U.S. consumers.[16]

Furthermore, ECHO-45W FSS will foster the growing economic and political ties between the United States and Brazil. These ties have become an increasing focus of both the U.S. and Brazilian administrations, as the countries have worked to expand joint economic dialogues to encompass more market sectors, including telecommunications, resulting in part in trade between the two countries tripling over the last ten years.[17]

B. The Proposed Operations Will Strengthen a U.S. Competitor and Contribute to the U.S. Economy

ECHO-45W FSS will help U.S.-based EchoStar to expand its service offerings internationally, producing jobs and revenue for the U.S. video distribution, content, and satellite service industries. In particular, EchoStar estimates that the project will result in the creation or preservation of jobs, including those in the Cheyenne, Wyoming and Gilbert, Arizona uplink centers, from where EchoStar plans to uplink U.S.-produced video content to ECHO-45W FSS.[18] Indirectly, through the combined operations of ECHO-45W FSS and its companion Brazilian

[16] For example, an FCC condition on the merger of satellite radio providers established diversity set-aside channels that the merged entity was required to make available to programmers offering content, including Spanish- and Korean-language fare, responsive to "historically underserved audiences." *Applications for the Consent to the Transfer of Control of Licenses xM Satellite Radio Holdings Inc., Transferor, to Sirius Satellite Radio Inc., Transferee*, Memorandum Opinion and Order, 25 FCC Rcd 14779, ¶ 18 (2010); News Release, FCC, *Sirius XM Implements Merger Condition that Provides Leased Channels to Diverse Programmers,* (Apr. 18, 2011). Similarly, the Commission has repeatedly waived certain broadcast network affiliation constraints in an effort to help bolster the financial viability of foreign-language networks and their station affiliates. *See, e.g.*, *Fox Networks Group, Inc. (MundoFox),* Order, 27 FCC Rcd 5158 (MB 2012) (discussing similar waivers dating back to 1990).

[17] Office of the Press Secretary, The White House, Fact Sheet: The U.S.-Brazil Economic Relationship, http://www.whitehouse.gov/the-press-office/2012/04/09/fact-sheet-us-brazil-economic-relationship.

[18] In order to minimize coordination challenges and impact on incumbent services, a limited number of earth stations at the existing Cheyenne and Gilbert uplink centers is envisioned to support the ECHO-45W FSS payload. All necessary earth station coordination will be conducted in accordance with Commission rules.

BSS payload, U.S. programming content will reach a broader audience and a burgeoning Brazilian market with all of its attendant opportunities.

Over the past three decades, the FCC has found that the public interest is served by authorizing satellite operations at vacant orbital slots (including non-U.S. orbital slots) for the provision of new services (including service to foreign markets), so as to allow licensees flexibility to decide whatever services will best meet their customers' needs.[19] Specifically, in authorizing satellite service to foreign markets, the FCC has cited to the public interest benefits of fully utilizing satellite capacity and expanding the presence of U.S. satellite operators in foreign markets.[20] There can be little doubt, of course, that the expansion of U.S. businesses in foreign markets serves the public interest. Thus, as recently as December 2012, the FCC authorized DIRECTV, a U.S. licensee, to operate its satellite at a vacant orbital location pursuant to a Russian ITU filing in order to provide service to Russia – with TT&C and feeder link operations from earth stations outside the United States.[21] Last year the FCC also authorized

[19] *See SES Americom, Inc.,* Memorandum Opinion and Order, 20 FCC Rcd 436, ¶ 8 (IB 2005) ("*SES 2005*") (citing *Satellite Business Systems*, Mimeo No. 5207 (Com Car. Bur. 1984); *ARC Professional Services Group*, Order and Authorization, 5 FCC Rcd 5398 (Com. Car. Bur. 1990)).

[20] *See, e.g.*, *Intelsat*, Order and Authorization, 19 FCC Rcd 2775, ¶ 9 (IB 2004) (finding that fixed satellite service downlink exclusively to Latin American countries will serve the public interest by "allowing Intelsat to fully utilize available unused capacity . . . and by expanding the presence of U.S. satellite operators in Latin America"); *see also Amendment to the Commission's Regulatory Policies Governing Domestic Fixed Satellites and Separate International Satellite Systems*, Report and Order, 11 FCC Rcd 2429, ¶ 24 (1996) ("We have permitted both domestic and international U.S.-licensed satellite capacity to be used for service to locations that do not involve U.S. service.").

[21] *See DIRECTV Enterprises, LLC*, Stamp Grant, File Nos. SAT-A/O-20120817-00137 *et al.* (granted Dec. 21, 2012); *see also Lockheed Martin Corp.,* Order and Authorization, 20 FCC Rcd 14558, ¶¶ 9-11 (IB 2005) ("*Anik-F1R Order*") (authorizing U.S. payload aboard Canadian-licensed satellite with TT&C operations from earth stations in Canada).

service to sub-Saharan Africa pursuant to a Swedish ITU filing[22] and service to the Middle East pursuant to a Turkish ITU filing.[23]

C. The Proposed Operations Will Produce Substantial Economic Efficiencies Resulting from a Hybrid Satellite Configuration

The Commission has long favored hybrid satellite configurations, such as the one proposed here, as a way to promote the efficient use of orbital resource. As the Commission has found:

> Operating a state-of-the-art hybrid satellite at a particular orbital location may be more efficient than operating two single-band satellites at that location. Construction, launch and insurance costs for one, albeit larger, satellite will be lower than for two satellites. Moreover, advances over the past several years have made it possible to construct hybrid satellites that have technical capabilities equivalent to single-band satellites. Thus, hybrid satellites can provide cost savings to operators and customers with no decrease in technical performance.[24]

As a result, the Commission has routinely granted requests to place two or more payloads on a single spacecraft.[25]

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[22] *See SES Americom, Inc.*, Stamp Grant, File No. SAT-MOD-20111025-00209 (granted Feb. 24, 2012).

[23] *See Intelsat License LLC*, Stamp Grant, File No. SAT-MOD-20110420-00073 (granted Mar. 2, 2012); *see also Intelsat License LLC*, Stamp Grant, SAT-LOA-20111024-00208, Call Sign S2847 (granted July 26, 2012) (authorizing satellite operations at 68.5º E.L.); *Intelsat License LLC*, Stamp Grant, SAT-LOA-20110929-00193, (granted Mar. 15, 2012) (authorizing satellite operations at 72.1º E.L); *Intelsat North America LLC*, Stamp Grant, SAT-LOA-20100726-00167 (granted Nov. 17, 2010) (authorizing satellite operations at 66º E.L.); *PanAmSat Licensee Corp.,* Stamp Grant, File No. SAT-MOD-20080225-00051 (granted July 22, 2008) (authorizing satellite relocation to 32.8° E.L.); *AfriSpace, Inc.*, Order and Authorization, 21 FCC Rcd. 17 (IB 2006) (authorizing satellite operations at 21º E.L. to provide BSS (sound) to Africa and Europe); *DIRECTV Enterprises, LLC,* 19 FCC Rcd. 15529 (IB Sat. Div. 2004) (authorizing satellite operations at 72.5º W.L. pursuant to a Canadian ITU filing).

[24] *Hughes Communications Galaxy, Inc.,* Order and Authorization, 5 FCC Rcd 3423, ¶ 8 (CCB 1990).

[25] *See, e.g.*, *DIRECTV Enterprises, LLC*, Stamp Grant, File No. SAT-LOA-20090807-00086 (granted Dec. 15, 2009) (authorizing addition of a Ka-band payload to DIRECTV 12); *SES Americom, Inc.,* Stamp Grant, File No. SAT-MOD-20040227-00022 (granted Sept. 2, 2004) (authorizing hybrid Ku-/Ka-band system for AMC-16); *PanAmSat Corp*., Order and Authorization, 15 FCC Rcd. 11747 (IB 2000) (approving C-/Ku-band hybrid payloads for PAS-23); *GTE Spacenet Corp.*, Memorandum Opinion, Order and Authorization, 2 FCC Rcd. 5312 (CCB 1987) (authorizing RDSS payload aboard FSS satellite).

The FCC has extended this support to hybrid satellites with payloads authorized by different national administrations.[26] These arrangements are increasingly being utilized by satellite operators as a way to address the dynamic satellite services market in a cost and spectrally efficient manner. As the Commission has found, these arrangements offer substantial benefits and are permitted under ITU Radio Regulations.[27]

In these cases, the Commission typically issues a letter to the foreign licensing administration to confirm the mutual understanding regarding the proposed hybrid satellite operations, and the latter responds with a brief letter confirming that understanding.[28] The Commission also has required the U.S. licensee to maintain the capability to cease operations of its U.S.-licensed spacecraft or payload, if necessary.[29] Consistent with this requirement, EchoStar will maintain at all times the unilateral contractual right to direct HNS Brazil to cease operations of the ECHO-45W FSS payload, if necessary.[30]

EchoStar seeks the same efficiencies and practical benefits of a hybrid BSS/FSS satellite that the Commission previously has found to serve the public interest. The proposed operations

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[26] *See, e.g., Intelsat North America LLC,* Stamp Grant, File No. SAT-A/O-20091208-00141 (granted June 4, 2010) ("*NSS-5 Grant*"); *Anik-F1R Order,* ¶ 9; *EchoStar Satellite Corp.*, Order and Authorization, 18 FCC Rcd. 15862, ¶ 6 (IB 2003); *PanAmSat Licensee Corp.,* Order and Authorization, 18 FCC Rcd. 19680, ¶ 3 (IB 2003); *AMSC Subsidiary Corp.*, Order and Authorization, 13 FCC Rcd. 12316, ¶ 16 (IB 1998) ("*AMSC-1 Order*").

[27] *See AMSC-1 Order* ¶ 16; *see also Anik-F1R Order*, ¶ 9 ("Such arrangements . . . are not without precedent.").

[28] *See Anik-F1R Order* ¶ 9 (noting that the administrations had already exchanged letters); *NSS-5 Grant* ¶ 6 (same); *AMSC-1 Order* ¶ 16 (indicating that the United States and Canada would exchange letters to ensure common understanding of the arrangement).

[29] *See NSS-5 Grant* ¶ 2 (requiring U.S. licensee to retain "the sole right to direct" the Netherlands licensee "to promptly deactivate these Ku-band frequencies in order to comply with U.S. laws and regulations"); *Anik-F1R Order* ¶ 11 (approving agreement with Canadian licensee to implement a computer-based system to allow automated deactivation of U.S. payload from a U.S. facility without individual intervention at Canadian TT&C facilities).

[30] *See* Agreement between EchoStar and HNS Brazil (June 5, 2013) (attached as Exhibit 3, subject to a request for confidential treatment).

will allow HNS Brazil, to track and manage a single spacecraft, while providing the same array of services and opportunities otherwise offered on two separate satellites. This efficient configuration will enable EchoStar to leverage its operations in Brazil and the United States to offer more diverse and innovative programming to consumers.

II. THE PROPOSED FSS IS CONSISTENT WITH THE TWO-DEGREE SPACING RULES AND WILL CAUSE NO HARMFUL INTERFERENCE

As demonstrated in the attached interference analysis,[31] the proposed FSS is consistent with the Commission's two-degree spacing requirements.[32] The Commission has applied its two-degree spacing requirements to geostationary satellite orbit ("GSO") FSS satellites for the past 30 years.[33] In 2003, the Commission codified the two-degree spacing requirements in Section 25.140(b)(2) of its rules, and stated that it "will apply the two-degree-spacing requirements that we currently apply to GSO-like satellites in the C-band, Ku-band, and Ka-band satellites to GSO-like proposed satellites in different frequency bands."[34] The Commission later clarified that Section 25.140(b)(2) applies to the FSS bands regardless of how the end-user

[31] *See* Exhibit 1 (Technical Appendix), Annex 1 (Interference and PFD Analyses).

[32] *See* 47 C.F.R. § 25.140(b)(2) (requiring FSS applicants to "provide an interference analysis to demonstrate the compatibility of their proposed system two degrees from any authorized space station"); *see also International Bureau Satellite Division Information: Clarification of 47 C.F.R. § 25.140(b)(2),* Public Notice, 19 FCC Rcd 10652 (IB 2004) (clarifying technical information required to be included in interference analysis demonstrating compliance with two-degree spacing requirement); *International Bureau Satellite Division Information: Clarification of 47 C.F.R. § 25.140(b)(2),* Public Notice, 18 FCC Rcd 25099 (IB 2003) (same).

[33] *See Licensing of Space Stations in the Domestic Fixed Satellite Service and Related Revisions of Part 25 of the Rules and Regulations,* Report and Order, 54 RR2d 577, ¶¶ 2-4 (1983) (adopting two-degree spacing policy for domestic GSO FSS satellites in order to maximize the number of satellites in orbit). In 1996, the Commission extended its two-degree spacing requirements to GSO FSS satellites outside of the traditional domestic arc. *See Amendment to the Commission's Regulatory Policies Governing Domestic Fixed Satellites and Separate International Satellite Systems,* Report and Order, 11 FCC Rcd 429 (1996).

[34] *Amendment of the Commission's Space Station Licensing Rules and Policies,* First Report and Order and Further Notice of Proposed Rulemaking in IB Dkt. No. 02-34 and First Report and Order in IB Dkt. No. 02-54, 18 FCC Rcd 10760, ¶ 119 (2003).

service is classified (*e.g.,* MSS) or whether the FSS band is a "planned band."[35] Thus, the Commission held that "in the absence of specific service rules for any particular FSS band, the two-degree spacing rules apply to GSO FSS bands."[36]

The Commission in fact has applied two-degree spacing to GSO FSS satellites operating in the Appendix 30B "planned bands," precisely the same spectrum at issue here.[37] Notably, the Commission stated that its "FSS satellite licensing policy is predicated upon two-degree orbital spacing," and expressly found that the FSS feeder link and TT&C operations of two satellites in the Appendix 30B "planned bands" are two-degree compliant.[38]

Here, the nearest co-frequency satellite is the Intelsat 11 ("IS-11") satellite at 43.0º W.L., which is slightly more than two degrees away. The attached interference analysis shows the compatibility of ECHO-45W FSS with IS-11 at an assumed two-degree separation. Moreover, the license application for IS-11 shows the compatibility of that satellite with another co-frequency satellite at 45º W.L.[39] Thus, ECHO-45W FSS will be compatible with the Commission's two-degree spacing environment.

Further, coordination between ECHO-45W FSS and any affected satellite system, including currently authorized and planned satellite systems, will be conducted in accordance with Commission rules and the ITU Radio Regulations. Until such coordination is completed,

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[35] *See Mobile Satellite Ventures Subsidiary LLC,* Order, 19 FCC Rcd 18133, ¶¶ 9-10 (IB 2004).

[36] *Id.* ¶ 10.

[37] *See Mobile Satellite Ventures Subsidiary LLC,* Order and Authorization, 20 FCC Rcd 9752, ¶ 36 (IB 2005) ("*MSV Order I*") (applying two-degree spacing to MSV-1 satellite operating on Appendix 30B Ku-band frequencies); *Mobile Satellite Ventures Subsidiary LLC,* Order and Authorization, 20 FCC Rcd 479, ¶ 25 (IB 2005) ("*MSV Order II*") (applying two-degree spacing to MSV-2 satellite operating on Appendix 30B Ku-band frequencies).

[38] *MSV Order I*, ¶ 36; *MSV Order II*, ¶ 25; s*ee also Northrop Gruman Space & Mission Systems Corp.,* 24 FCC Rcd 2330, ¶ 80 (IB 2009) (applying two-degree spacing to the V-band).

[39] *See* Application of PanAmSat Licensee Corp., SAT-MOD-20090108-00004, Exhibit 1, Engineering Statement, at 22-24 (Jan. 8, 2009).

EchoStar commits to operating ECHO-45W FSS on a non-interference basis as a condition of grant of this Application. As stated above, under contract, EchoStar will retain the unilateral right to direct HNS Brazil to cease operations of ECHO-45W FSS, if required. EchoStar also will comply with all applicable ITU Radio Regulations.

III. THE AMENDED APPLICATION IS CONSISTENT WITH ITU RADIO REGULATIONS, INCLUDING ARTICLE 2.6*BIS* OF APPENDIX 30B

This amendment proposes that the FCC license a payload on Ku-band frequencies that are subject to the provisions of Appendix 30B of the ITU Radio Regulations, including Article 2.6*bis*. This Article provides that:

> When submitting additional system(s), ***administrations shall fully comply with the requirements stipulated in Article 44 of the ITU Constitution***. In particular, these administrations shall limit the number of orbital positions and associated spectrum so that: *a)* the orbital/spectrum natural resources are used rationally, efficiently and economically; and *b)* the use of multiple orbital locations to cover the same service area is avoided.[40]

Self-evidently, the primary obligation of an administration under 2.6*bis* is to comply with Article 44 of the ITU Constitution, which simply directs administrations to "*endeavour* to limit the number of frequencies and the spectrum used to the minimum essential to provide in a satisfactory manner the necessary services."[41] The secondary admonition of Article 2.6*bis* – that Administrations comply with Article 44 "in particular" by "limiting" the number of orbital slots and frequencies "so that the use of multiple orbital slots to cover the same service area is avoided" – cannot expand the obligation set forth in Article 44 since it is by its own terms derivative of that obligation. Put another way, as long as this amended Application limits the use

[40] ITU Radio Regulations, App. 30B, Art. 2.6*bis* (2012) (emphasis added).

[41] Constitution of the ITU, Chapter VII (Special Provisions for Radio, Art. 44(1) (Use of the Radio-Frequency Spectrum and of the Geostationary-Satellite and Other Satellite Orbits) (emphasis added).

of orbital resources to the minimum necessary to provide the necessary services, it is consistent with Article 2.6*bis*.

Even if Article 2.6*bis* could be construed to create some obligation inconsistent with Article 44 (*e.g.*, prohibiting an application that would use only the minimum resources necessary to provide the necessary services), it merely says that Administrations "shall ***limit*** the number of orbit slots … ***so that*** … the use of ***multiple*** orbital slots to cover the same service area is ***avoided.***" The only obligation is to "limit" the number of orbital slots. It does not say that the use of multiple slots is "prohibited" – only something to be avoided – and it is certainly not clear in this context that "multiple orbital slots" means "two.". Multiple could well mean "many" slots. The bottom line is that it is a stretch, at best, to read Article 2.6*bis* as forbidding outright an administration from assigning two orbital locations in the Appendix 30B band. Said another way, it would be unreasonable and arbitrary to read Article 44 or Article 2.*6bis* to imposes a hard numerical limit on assigned orbital locations or frequencies.

Nor do other Administrations read Article 44 or Article 2.*6bis* to impose some hard numerical limit; it has been common practice, even after WRC-07 (which adopted this language), to allow administrations to file for and obtain rights to more than one Appendix 30B orbital location. For example, Saudi Arabia has completed the Appendix 30B procedures for two orbital locations at 26º E.L. and 30.9º E.L., and has put both into operation. The two underlying ITU networks have both frequency and service area overlap. Russia also has done the same at 55º E.L. and 90º E.L., with one satellite currently operational and the second to be launched and put into operation later this year. Further, since EchoStar is planning to operate the service between the United States and Brazil, EchoStar has coordinated with Anatel on the use of this Appendix 30B orbital location and frequencies.

IV. THE AMENDED APPLICATION SHOULD BE PLACED ON PUBLIC NOTICE

Under the Commission's rules, applications are to be placed on Public Notice unless they are incomplete, do not substantially comply with Commission rules, or "request authority to operate a space station in a frequency band that is not allocated internationally for such operations under the Radio Regulations" of the ITU.[42] This amended Application is complete, fully complies with FCC rules, and proposes FSS operations on Ku-band frequencies that have been specifically allocated for FSS internationally under Appendix 30B of the ITU Radio Regulations.[43] Moreover, regardless of its interpretation, Article 2.6*bis* is merely a definitional provision, and nothing in its language purports to alter the international spectrum allocation for FSS operations under Appendix 30B.[44] Accordingly, EchoStar's proposed Appendix 30B use at 45.1º W.L. d is consistent with international spectrum allocations, and this request should be placed on public notice expeditiously.

CONCLUSION

With both BSS and supporting FSS payloads aboard a single satellite, EchoStar expects to leverage the efficiencies and other advantages that, as the Commission has long recognized, flow from such arrangements. The operations of the hybrid BSS/FSS satellite, in turn, will

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[42] *See* 47 C.F.R. § 25.112(a)(3) (requiring dismissal of applications proposing satellite operations on frequencies not allocated internationally for such operations).

[43] *See* 47 C.F.R. § 2.106 (Table of Frequency Allocations, International Table); ITU Radio Regulations, App. 30B, Art. 3.1 (2012) (specifying frequencies allocated internationally for FSS under Appendix 30B).

[44] Furthermore, an unduly narrow interpretation of Article 2.*6bis* to prohibit an administration from assigning two or more orbital locations under Appendix 30B would result in underutilized orbital and spectral resources, and undercut the provision's underlying purpose. Prior to adoption of Article 2.6*bis* at the World Radiocommunication Conference 2007 ("WRC-07"), "little use [had] been made of the precious spectrum … regulated by this Appendix [30B]." *See* United States Department of State, *United States Delegation Report: World Radiocommunication Conference 2007*, at 45, http://www.state.gov/documents/organization/108955.pdf. Article 2.6*bis* was adopted as part of the WRC-07 efforts to revise the Appendix 30B procedures in order to account for (i) prior experience with the FSS plan under Appendix 30B; (ii) new technological developments; and (iii) requirements of new ITU members admitted since 1988. *See id.*

enable EchoStar to introduce a truly competitive video programming service to the burgeoning Brazilian market, strengthening the competitiveness of a U.S. satellite service provider domestically and abroad, and providing additional international outlets for U.S. programming content. EchoStar therefore respectfully requests grant of its Application as amended in order to achieve all of these substantial public interest benefits.

EXHIBIT 1

TECHNICAL APPENDIX

ECHO-45W

ATTACHMENT A

Technical Information to Supplement Schedule S

1 SCOPE

This Attachment contains additional information required by Part 25 of the FCC's rules that cannot be entered into the Schedule S submission concerning the proposed operation of the ECHO-45W satellite at the 45.1° W.L. orbital location.

2 GENERAL DESCRIPTION

The ECHO-45W satellite will operate at the 45.1° W.L. orbital location. The ECHO-45W is a hybrid Broadcasting-Satellite Service ("BSS") and Fixed-Satellite Service ("FSS") Ku-band satellite, with the latter payload providing a range of FSS services to North and South America. The 32-channel BSS payload will provide service to South America and will operate under the authority of Brazil's telecommunications regulator Anatel. EchoStar does not seek Commission authority to operate the BSS payload and, accordingly, the technical details of the BSS payload are not provided herein or within the associated Schedule S form.

The satellite's FSS payload will use the planned "Appendix 30B" portion of the Ku-band: the 12.75-13.25 GHz uplink band and the 10.7-10.95 GHz / 11.2-11.45 GHz downlink bands. This payload will be equipped with two beams, each of which will operate in both transmission directions: a North America ("N.A.") beam and a South America ("S.A.") beam.

The FSS payload will have eight 115 MHz channels operating in both left-hand circular polarization ("LHCP") and right-hand circular polarization ("RHCP"), thereby achieving full frequency re-use in accordance with Section 25.210 of the FCC's rules. The payload power for

the FSS mission by itself is approximately 2300 W[1]. The peak downlink equivalent isotropically radiated power ("EIRP") for the N.A. beam will be 56.2 dBW. The peak downlink EIRP for the South America beam will be 53.4 dBW.

Switching capabilities for all channels will allow for either intra-beam connectivity (e.g., N.A.-to-N.A.) or inter-beam connectivity (e.g., S.A.-to-N.A.). Table 2-1 shows the satellite's frequency plan and beam inter-connectivity switching options.

Table 2-1: Frequency Plan and Beam Inter-Connectivity Options

UPLINK					DOWNLINK				
BEAM				Center Freq. (MHz)	BEAM				Center Freq. (MHz)
NAUR	NAUL	SAUR	SAUL		NADR	NADL	SADR	SADL	
X				12812.5		X		X	10762.5
X				12937.5		X		X	10887.5
X				13062.5		X		X	11262.5
X				13187.5		X		X	11387.5
	X			12812.5	X		X		10762.5
	X			12937.5	X		X		10887.5
	X			13062.5	X		X		11262.5
	X			13187.5	X		X		11387.5
		X		12812.5		X		X	10762.5
		X		12937.5		X		X	10887.5
		X		13062.5		X		X	11262.5
		X		13187.5		X		X	11387.5
			X	12812.5	X		X		10762.5
			X	12937.5	X		X		10887.5
			X	13062.5	X		X		11262.5
			X	13187.5	X		X		11387.5

[1] Total spacecraft payload power for the BSS and FSS missions combined will be 15.6 kW at beginning-of-life ("BOL"), with the total payload power for the FSS mission being approximately 2.3 kW BOL.

3 PREDICTED SPACE STATION ANTENNA GAIN CONTOURS

As required by Section 25.114(d)(3), the ECHO-45W antenna gain contours for the receive and transmit beams are given in GXT format and embedded in the associated Schedule S submission.

4 SERVICES TO BE PROVIDED

The ECHO-45W satellite will provide a variety of FSS services to North and South America ranging from narrowband to wideband digital services. Representative link budgets, which include details of the transmission characteristics, performance objectives, and earth station characteristics, are provided in the associated Schedule S submission.

5 TT&C CHARACTERISTICS

The information provided in this section complements that provided in the associated Schedule S submission.

The TT&C sub-system provides for communications during launch, transfer orbit and on-station operations, as well as during spacecraft emergencies. During transfer orbit and on-station emergencies the TT&C signals will be received and transmitted by the satellite using dual wide-angle antennas on the satellite that create a near omni-directional gain pattern around the satellite and using the edges of the BSS frequency bands. When on-station, TT&C operations can be performed at the edges of either the BSS or FSS frequency bands. TT&C operations using the BSS frequencies will operate under the authorization of Brazil's telecommunication regulator, and accordingly, Commission authority is not being sought for TT&C operations using the BSS frequencies. On-station TT&C operations using the BSS frequencies are conducted using the BSS South American beam; said beam is not described within this application. On-station TT&C operations using the FSS frequencies are conducted using the North American beam. The FSS TT&C earth station locations are expected to be located at EchoStar's facilities in Cheyenne, WY and Gilbert, AZ.

Table 5-1 shows the TT&C frequencies and polarizations for both on-station and emergency operations.

Table 5-1: TT&C Frequencies and Polarizations

Command/Ranging Frequencies (Launch and Early Operations Phase)	17,792 MHz (HP) 17,793 MHz (HP)
Telemetry/Ranging Frequencies (Launch and Early Operations Phase)	12,696 MHz (HP) 12,697 MHz (HP)
Command/Ranging Frequencies for BSS (On-Station)	17,792 MHz (RHCP) 17,793 MHz (RHCP)
Telemetry/Ranging Frequencies for BSS (On-Station)	12,696 MHz (RHCP) 12,697 MHz (RHCP)
Command Frequencies for AP 30B (On-Station)	13,248 MHz (RHCP)
Telemetry Frequencies for AP 30B (On-Station)	11,448 MHz (RHCP)

6 SATELLITE TRANSPONDER FREQUENCY RESPONSES

The predicted receive and transmit channel filter response performance is given in Table 6-1 below. In addition, the frequency tolerances of Section 25.202(e) and the out-of-band emission limits of Section 25.202(f)(1), (2) and (3) will be met.

Table 6-1: Predicted Transponder Frequency Response

Frequency offset from channel center	Gain relative to channel center frequency (dB p-p)	
	Receive	Transmit
CF±30 MHz	-0.50	-0.85
CF±45 MHz	-1.0	-1.90
CF±57.5 MHz	-2.0	-4.3

7 CESSATION OF EMISSIONS

All downlink transmissions can be turned on and off by ground telecommand, thereby causing cessation of emissions from the satellite, as required.

8 INTERFERENCE AND PFD ANALYSES

The interference and power-flux density ("PFD") analyses are contained in Annex 1 to this Attachment.

9 ORBITAL DEBRIS MITIGATION PLAN

Although the spacecraft manufacturer for the ECHO-45W satellite has not yet been selected, EchoStar will incorporate the objectives and requirements of Section 25.114(d)(14) into its satellite Technical Specifications, Statement of Work, and Test Plans. The Statement of Work will include provisions to review orbital debris mitigation as part of the preliminary design review ("PDR") and the critical design review ("CDR") and to incorporate the relevant requirements, as appropriate, into the Test Plan, including a formal Failure Mode Verification Analysis ("FMVA") for orbital debris mitigation involving particularly the TT&C, propulsion, and energy systems. Should this process indicate that changes to the Orbital Debris Mitigation Plan are advisable or required, EchoStar will provide the Commission with updated information, as appropriate.

9.1 Spacecraft Hardware Design

Although the ECHO-45W satellite is an early stage design, based on its experience, EchoStar does not expect that the satellite will undergo any release of debris during its operation. Furthermore, all separation and deployment mechanisms, and any other potential source of debris are expected to be retained by the spacecraft or launch vehicle.

In conjunction with the spacecraft manufacturer, EchoStar will assess and limit the probability of the satellite becoming a source of debris by collisions with small debris or meteoroids of less than one centimeter in diameter that could cause loss of control and prevent post-mission disposal. EchoStar will take steps to limit the effects of such collisions through the use of shielding, the placement of components, and the use of redundant systems.

EchoStar will incorporate a rugged TT&C system with regard to meteoroids smaller than 1 cm through redundancy, shielding, and appropriate physical separation of components. The TT&C

subsystem will have no single points of failure, as it will be equipped with near omni-directional antennas mounted on opposite sides of the spacecraft. These antennas, each providing greater than hemispherical coverage patterns, are extremely rugged and capable of providing adequate coverage even if struck, bent or otherwise damaged by a small- or medium-sized particle. Either one of the two omni-directional antennas, for both command and telemetry, will be sufficient to enable orbit raising. The command receivers and decoders and telemetry encoders and transmitters will be located within a shielded area and will be totally redundant and physically separated. A single rugged thruster and shielded propellant tank provide the energy for orbit-raising.

The propulsion subsystem will be designed so that it will not be separated from the spacecraft after de-orbit maneuvers. It will be protected from the effects of collisions with small debris through shielding. Moreover, propulsion subsystem components critical to disposal (e.g., propellant tanks) will be located deep inside the satellite, while other externally placed components (e.g., the thrusters) will be redundant to allow for de-orbit despite a collision with debris.

9.2 Minimizing Accidental Explosions

EchoStar and the manufacturer will assess and limit the probability of accidental explosions during and after completion of mission operations. The satellite will be designed to ensure that debris generation will not result from the conversion of energy sources onboard the satellite into energy that fragments the satellite. The propulsion subsystem pressure vessels will be designed with high safety margins. Bipropellant mixing will be prevented by the use of valves that prevent backwards flow in propellant lines and pressurization lines. All pressures will be monitored by telemetry. EchoStar will work with the satellite's manufacturer to ensure that, at the end of its life and once the satellite has been placed into its final disposal orbit, all stored energy from the spacecraft will be released to the fullest extent possible, thereby leaving the spacecraft in a safe state with minimal or no possibility of debris release or radio frequency transmission. Once the satellite design is finalized, EchoStar will update the Commission with the precise procedures to be used in conformance with Section 25.114(d)(14)(ii) or request relevant waivers.

9.3 Safe Flight Profiles

In considering current and planned satellites that may have a station-keeping volume that overlaps the ECHO-45W satellite, EchoStar has reviewed the lists of FCC-licensed satellite networks, as well as those that are currently under consideration by the FCC. In addition, non-U.S. networks for which a request for coordination has been published by the International Telecommunication Union ("ITU") within ±0.15° of 45.1° W.L. have been reviewed.

The Intelsat 14 ("IS-14") satellite operates at 45.0° W.L. with an east-west station-keeping tolerance of ±0.05°. DIRECTV has a pending application before the Commission for the DIRECTV KU-45W satellite, which is to be operated at 45.2° W.L. with an east-west station-keeping of ±0.05°.[2] EchoStar has a pending application before the Commission to operate the ECHOSTAR-15 satellite at 45.1° W.L.[3] In the event the ECHO-45W satellite is temporarily collocated with the ECHOSTAR-15 satellite during traffic transfer, EchoStar will use the proven inclination-eccentricity technique to ensure adequate separation between its two satellites. After traffic transfer is complete, EchoStar will move the ECHOSTAR-15 satellite to another location, following Commission approval.

With respect to ITU networks, EchoStar is not aware of any satellite with an overlapping station-keeping volume with the ECHO-45W satellite that is the subject of an ITU filing and that is either in orbit or progressing towards launch.

Based on the preceding, EchoStar seeks to locate the ECHO-45W satellite at 45.1° W.L. and operated with an east-west station-keeping tolerance of ±0.05° which eliminates the possibility of any station-keeping volume overlap with the IS-14 satellite and the proposed DIRECTV KU-45W satellite. EchoStar therefore concludes that physical coordination of the ECHO-45W satellite with another party is not required at the present time.

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[2] *See* SAT-LOA-20130205-00016.

[3] *See* SAT-MOD-20130503-00066.

9.4 Post Mission Disposal Plan

At the end of the operational life of the ECHO-45W satellite, EchoStar will maneuver the satellite to a disposal orbit with a minimum perigee of 300 km above the normal operational orbit for geostationary orbit ("GSO") satellites. This proposed disposal orbit altitude exceeds the minimum perigee required for the satellite, based on the following calculation, as required in Section 25.283:

Total Solar Pressure Area "A" = 110 m^2
"M" = Dry Mass of Satellite = 3034 kg
"C_R" = Solar Pressure Radiation Coefficient = 1.5

Therefore the Minimum Disposal Orbit Perigee Altitude:

= 36,021 km + 1000 x C_R x A/m
= 36,021 km + 1000 x 1.5 x 110/3034
= 36,075.4 km
= 289.4 km above GSO (35,786 km)

Thus, the designed disposal orbit of 300 km above GSO exceeds the required minimum by a margin of more than 10 km. Maneuvering the satellite into a disposal orbit will require approximately 14.5 kg of propellant, taking account of all fuel measurement uncertainties, and this quantity of fuel will be reserved to perform final orbit raising maneuvers.

EchoStar will apply standard propellant accounting methodologies to track propellant usage to ensure the necessary amount of fuel is reserved to perform deorbit procedures. Such methodologies include the bookkeeping method and the pressure volume-temperature ("PVT") method. These methodologies may also be used in conjunction with any methodologies specifically recommended by the spacecraft manufacturer.

10 ITU FILING FOR ECHO-45W

All materials related to the ITU filing for ECHO-45W (to be filed as the "USASAT-55X" network) are attached to this application. These consist of the following:

- SpaceCap database file (USASAT-55X AP30B.mdb) containing the data required by the ITU as stated in Appendix 4 of the Radio Regulations.
- Contour data files in .gxt format for the transmit and receive beams and their service area definitions. These are combined into a single database file (USASAT-55X GIMSDB.mdb) that can be read by the ITU's GIMS software.
- The file USASAT-55X (VAL).txt which contains the validation results using SpaceVal version 7.0. There are no fatal errors.

11 ESTIMATED OPERATIONAL LIFETIME AND RELIABILITY

EchoStar will update the Commission with full and precise spacecraft physical characteristics when the satellite manufacturer has been selected and the satellite design has been finalized. Estimates of these characteristics are included in the Schedule S form.

The ECHO-45W satellite will be designed for a 15 year life once on station. The spacecraft reliability will be consistent with current manufacturing standards in place for the major suppliers of space hardware. Bus and FSS payload reliability will be greater than 0.8 and 0.9, respectively, with an overall reliability to EOL of greater than 0.7. Transponder sparing will be consistent with documented failure rates which allow attaining the overall spacecraft reliability numbers listed above.

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this application, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this application, and that it is complete and accurate to the best of my knowledge and belief.

/s/

Stephen D. McNeil
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Ottawa, Ontario, Canada
(613) 270-1177

ANNEX 1

INTERFERENCE AND PFD ANALYSES

1.0 Interference Analyses

There are no adjacent satellites within two degrees of 45.1° W.L. that have overlapping FSS frequencies with those proposed for ECHO-45W. The nearest co-frequency satellite to 45.1º W.L. is the Intelsat 11 ("IS-11") satellite at 43.0° W.L., operated by PanAmSat Licensee Corp. ("PanAmSat"). Although the two satellites would be slightly more than two degrees apart, this section nevertheless demonstrates that the operation of the ECHO-45W satellite network would be compatible with the operation of the IS-11 satellite network with an assumed two degree separation (i.e., IS-11 assumed to be located at 43.1° W.L.).

Table 1 provides a summary of the ECHO-45W satellite network's transmission parameters derived from the ECHO-45W link budgets that are embedded in the Schedule S form. Table 2 provides a summary of the Ku-band transmission parameters as contained in the FCC application for the IS-11 satellite.[4]

The interference calculations assumed the following: a 1 dB advantage for topocentric-to-geocentric conversion; that all wanted and interfering carriers are co-polarized; and that all earth station antennas conform to a sidelobe pattern of 29-25 log(θ). The C/I calculations were performed on a per Hz basis. Note that the interference analysis used the conclusions of Recommendation ITU-R S.1555-0 to assess the interference of the dual circularly polarized ECHO-45W transmissions into the dual linearly polarized IS-11 transmissions.

Tables 3 and 4 show the results of the interference calculations between the two networks in terms of overall C/I margins. All C/I margins are positive, demonstrating the compatibility between the two networks. The results are not surprising considering that both the maximum uplink power density and downlink EIRP density of the ECHO-45W satellite network are

[4] *See* PanAmSat Licensee Corp., Application, Exhibit 1, SAT-MOD-20090108-00004 (filed March 6, 2009).

identical to those of the IS-11 satellite network (i.e., an uplink power density of -47.7 dBW/Hz and a downlink EIRP density of -19.4 dBW/Hz). Further, PanAmSat's two-degree compatibility demonstration shows that the IS-11 satellite network is technically compatible with a two-degree adjacent network transmitting at equal or higher power density levels than those proposed for the ECHO-45W satellite network.

Table 1: ECHO-45W Typical Transmission Parameters

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	48K6G7W	0.0486	42.3	41.5	16.2	46.9	15.9
2	1M34G7W	1.34	48.4	61.9	30.6	44.4	15.9
3	6M33G7W	6.33	52.1	67.1	37.4	46.9	16.0
4	36M0G7W	36	53.8	81.7	52.2	38.3	15.9
5	36M0G7W	36	53.8	81.7	44.4	46.9	16.7
6	72M0G7W	72	53.8	84.7	52.2	52.3	16.7
7	48K6G7W	0.0486	42.3	41.5	13.4	48.8	15.9
8	1M34G7W	1.34	48.4	61.9	27.8	46.9	15.9
9	6M33G7W	6.33	52.1	67.1	34.6	46.9	16.0
10	19M0G7W	19	53.8	78.9	49.4	38.3	16.7
11	36M0G7W	36	53.8	81.7	41.6	48.8	16.7
12	72M0G7W	72	53.8	84.7	49.4	52.3	16.7
13	48K6G7W	0.0486	48.4	47.5	19.4	40.8	15.9
14	48K6G7W	0.0486	48.4	47.5	22.2	40.8	15.9

Table 2: IS-11 Satellite Network's Transmission Parameters

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	30M1G7W	30.133	56.7	80.1	51.4	40.6	16.2
2	4M15G7W	4.154	56.7	73.3	42.1	40.6	15.9
3	1M21G7W	1.2128	56.7	67.2	36.0	40.6	15.1
4	1M23G7W	1.229	56.7	63.1	31.9	44.1	15.5
5	307KG7W	0.307	46.2	53.4	22.2	54.8	18.2
6	75K4G7W	0.0754	56.7	52.5	21.4	40.6	13.5

Table 3: Summary of the Overall Link C/I Margins (dB); ECHO-45W Interfering into IS-11

		Interfering Carriers													
	Carrier ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Wanted Carriers	1	10.1	10.1	10.9	3.7	10.4	6.5	12.0	12.0	13.3	3.8	12.3	8.9	7.4	4.9
	2	10.1	10.1	10.6	3.4	10.5	6.3	12.4	12.4	13.2	3.5	12.8	8.9	7.3	4.6
	3	10.2	10.2	10.7	3.5	10.6	6.4	12.4	12.4	13.2	3.5	12.8	8.9	7.3	4.7
	4	8.4	8.4	9.4	2.3	8.7	5.0	10.2	10.2	11.7	2.3	10.5	7.3	5.9	3.4
	5	6.7	6.7	10.5	4.2	6.79	5.6	7.1	7.1	11.5	4.2	7.1	6.4	5.9	4.8
	6	9.2	9.2	9.7	2.6	9.6	5.4	11.5	11.5	12.3	2.6	11.8	8.0	6.4	3.7

Table 4: Summary of the Overall Link C/I Margins (dB); IS-11 Interfering into ECHO-45W

		Interfering Carriers					
	Carrier ID	1	2	3	4	5	6
Wanted Carriers	1	2.4	2.5	3.2	7.4	5.1	5.8
	2	0.6	1.2	2.0	6.1	7.9	4.5
	3	2.8	3.2	4.0	8.2	8.2	6.5
	4	1.9	2.6	3.3	7.5	10.3	5.9
	5	1.9	2.5	3.3	7.5	10.1	5.8
	6	11.5	11.8	12.6	16.7	15.4	15.1
	7	1.7	1.9	2.6	6.8	4.9	5.2
	8	0.3	0.9	1.7	5.8	7.7	4.2
	9	0.2	0.8	1.5	5.7	7.0	4.1
	10	1.1	1.8	2.5	6.7	9.5	5.1
	11	1.1	1.7	2.5	6.6	9.5	5.0
	12	9.0	9.5	10.2	14.4	14.5	12.8
	13	0.3	0.9	1.7	5.8	7.7	4.2
	14	3.0	3.5	4.3	8.4	9.2	6.8

The preceding demonstrates that the transmission characteristics of the IS-11 and ECHO-45W satellite networks are compatible when both networks transmit digitally modulated carriers.

The FCC application for the IS-11 satellite network also includes analog television/frequency-modulation ("TV/FM") carriers.[5] An interference assessment of TV/FM carriers interfering into the digital transmissions of the ECHO-45W satellite network was not performed since TV/FM carriers have most of their power-density near the center frequency of the carrier. Accordingly, sensitive narrowband carriers of an adjacent network cannot typically be assigned within the high power-density bandwidth of the TV/FM carrier. Operation of TV/FM carriers is normally achieved through coordination with the adjacent operator on a case-by-case basis, and in this particular case, would only take place in the unlikely event that transmissions of TV/FM carriers by the IS-11 satellite network are actually in-use. Performing a C/I calculation would simply demonstrate the well-known result that narrowband carriers typically cannot operate, on a two-degree basis, when assigned near the center frequency of the adjacent TV/FM carrier.

2.0 PFD Analyses

EchoStar will operate the ECHO-45W satellite such that all downlink transmissions will comply with the PFD limits of Article 21 of the ITU's Radio Regulations. While the FCC's Part 25 rules do not contain PFD limits for the Appendix 30B Ku-bands, Article 21 of the ITU Radio Regulations does include PFD limits that are applicable to GSO satellites using the 10.7-10.95 and 11.2-11.45 GHz bands. These ITU limits are identical to those of Section 25.208(b), which pertains to the adjacent 10.95-11.2 GHz and 11.45-11.7 GHz bands.

Tables 5 and 6 show the PFD levels that will occur at various angles of arrival for the N.A. beam and S.A. beam, respectively, when both beams are transmitting with a peak downlink EIRP density of -19.4 dBW/Hz.

Tables 5 and 6 demonstrate compliance with the ITU's Article 21 PFD limits in all cases.

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[5] *Id.* at 21.

Table 5: Maximum PFD Levels of Beams NADR and NADL

Angle of Arrival	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^2/4 kHz)	PFD Margin (dB)
0°	-150.0	-163.4	-4.9	-151.7	1.7
5°	-150.0	-163.3	-3.8	-150.5	0.5
10°	-147.5	-163.2	-2.8	-149.3	1.8
15°	-145.0	-163.0	-1.8	-148.2	3.2
20°	-142.5	-162.9	-1.5	-147.8	5.3
25°	-140.0	-162.8	-1.5	-147.7	7.7
34.8° (Peak)	-140.0	-162.6	0	-146.0	6.0

Table 6: Maximum PFD Levels of Beams SADR and SADL

Angle of Arrival	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^2/4 kHz)	PFD Margin (dB)
0°	-150.0	-163.4	-20	-166.8	16.8
5°	-150.0	-163.3	-20	-166.7	16.7
10°	-147.5	-163.2	-20	-166.5	19.0
15°	-145.0	-163.0	-20	-166.4	21.4
20°	-142.5	-162.9	-16	-162.3	19.8
25°	-140.0	-162.8	-10	-156.2	16.2
53.3° (Peak)	-140.0	-162.3	0	-145.7	5.7

EXHIBIT 2

MATERIAL PORTIONS OF TERM OF SATELLITE EXPLORATION RIGHT BETWEEN ANATEL AND HNS BRAZIL (ENGLISH TRANSLATION) (JULY 18, 2012)

REDACTED IN ITS ENTIRETY

EXHIBIT 3

LETTER AGREEMENT BETWEEN ECHOSTAR AND HNS BRAZIL (JUNE 5, 2013)

REDACTED IN ITS ENTIRETY