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

In the Matter of	)	
	)	
ABS Global, Ltd.	)	
	)	
Petition for a Declaratory Ruling	)	File No.
Granting Access to	)	
the U.S. Market for	)	
that certain satellite known as ABS-3A	)	
	)	

PETITION FOR DECLARATORY RULING

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ABS Global, Ltd.

OF COUNSEL:
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November 30, 2016

ABS Global, Ltd. ("ABS") respectfully requests that the Federal Communications Commission (the "Commission") authorize the spacecraft known as ABS-3A to serve the United States ("U.S.") market and provide communication services to and from the U.S. and its territories from the 3.0° W.L. orbital location. Specifically, ABS respectfully requests that the Commission (i) add ABS-3A to the Commission's Permitted Space Station List ("Permitted List") for fixed-satellite services ("FSS") in the Ku-band and C-band frequencies of 5925 – 6426 MHz, 14000 – 14250 MHz, 3700 – 4200 MHz, 10950 – 11200 MHz, and (ii) authorize use of these frequencies on ABS-3A for service within the United States and between the U.S. and non-U.S. points. Grant of the requested authority is consistent with Commission precedent and will serve the public interest by permitting the provision of FSS services from the 3.0° W.L. orbital location, thereby responding to customer demand for such FSS services and enhancing competition in the provision of FSS services within the United States.

A completed FCC Form 312 is attached, along with a narrative form pursuant to Section 25.114 of the Commission's Rules. ABS is also submitting Schedule S to FCC Form 312 concurrently and in connection with this petition online through the Schedule S enterprise filing system.

I. BACKGROUND

ABS currently operates ABS-3A, a Boing model 702SP spacecraft that has been fully operational since September 1, 2015, and utilizes the C-band frequencies of 5925 – 6426 MHz and 3700 – 4200 MHz, and the Ku-band frequencies of 14000 – 14250 MHz and 10950 – 112000 MHz, at 3.0° W.L. ABS-3A provides a wide range of services, including VSAT services, TV distribution, IP trunking, cellular backhaul and maritime services, to customers in

the Americas (other than the U.S.), Europe, Africa and the Middle East. Specifically, ABS-3A utilizes 10 C-band channels to provide service to the Americas, 2 C-band channels to provide global service, and 3 Ku-band channels to provide service to the Americas (other than the U.S.) and the Caribbean.[1]

ABS-3A is authorized to utilize the relevant frequencies at the specified orbital location by the Government of the Russian Federation ("Russia"). Russia has filed appropriate notification documents with the International Telecommunication Union ("ITU") relating to the frequencies and orbital location of ABS-3A.

II. AUTHORIZING ABS-3A TO SERVE THE U.S. IS CONSISTENT WITH COMMISSION POLICIES AND THE PUBLIC INTEREST

ABS is a leading provider of satellite communications services around the world. The application to serve the U.S. using the proposed ABS-3A satellite reflects ABS' continuing commitment to meeting the existing and future needs of its customers. Granting ABS access to the U.S. market for ABS-3A will enable ABS to provide FSS at the 3.0° W.L. orbital location and to introduce new capacity for the benefit of U.S. satellite service customers. Furthermore, a grant of market access for ABS-3A will be consistent with the Commission's *DISCO II* policies.[2]

In the *Disco II* proceeding, the Commission adopted policies for determining whether to permit foreign-licensed satellites to serve the U.S. market. These standards are codified in

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[1] ABS-3A has additional channels. These channels, however, are used with other beams for which access is not requested to/from the United States of America and its territories.

[2] *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 (1997) ("*Disco II*").

Section 25.137 of the Commission's Rules.[3] The Commission's policies are intended to ensure that entry by a foreign-licensed satellite will not distort competition in the U.S.[4] The Commission also considers whether there are spectrum availability issues or concerns relating to national security, law enforcement, foreign policy or trade that would present an obstacle to U.S. market access.[5] This request to add ABS-3A to the Permitted List fully complies with the Commission's market access requirements and does not raise any obstacles for granting this petition.

A. FIXED-SATELITE SERVICES OPERATIONS

In *DISCO II*, the Commission adopted a presumption that, with respect to services covered by the World Trade Organization ("WTO") agreement, entry into the U.S. market by entities licensed by WTO member countries will promote competition in the U.S. market.[6] FSS operations are covered by the WTO agreement,[7] and Russia is a member of the WTO.[8] Thus, the ABS proposal to provide WTO-covered services is subject to the presumption in favor of entry described above under the *DISCO II* framework. There are no factors that could rebut the presumption in favor of ABS's proposal to provide WTO-covered services.

Allowing ABS to use ABS-3A to offer FSS to, from, and within the U.S. will promote competition and is otherwise consistent with the *DISCO II* framework. Therefore, the Commission should add ABS-3A to the Permitted List for services in the U.S.

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3 47 C.F.R. § 25.137.
4 *DISCO II* at ¶ 7.
5 *See id*. at ¶ 178.
6 *Id*. at ¶ 39.
7 *Id*. at ¶¶ 25 & 30.
8 *See* https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm.

III. RULE WAIVERS ARE WARRANTED FOR ABS-3A

ABS seeks a limited waiver of the Commission's rules in connection with this petition for ABS-3A U.S. 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.[9]

ABS-3A substantially complies with the Commission's rules. However, one waiver is necessary in light of the frequencies used. Specifically, ABS seeks a waiver of Section 25.210(f) of the Commission's Rules to the extent it requires full state-of-the-art frequency reuse in the 14000 – 14250 MHz and 11950 – 11200 MHz frequency bands.[10] Section 25.210(f) seeks to maximize use of the scarce orbit/spectrum resource and ensure the operation of efficient designs to enhance the public's ability to obtain a sufficient supply of transponder capacity.[11] While ABS-3A provides service to the Americas in only one polarization in the 14000 – 14250 MHz and 11950 – 11200 MHz frequency bands, ABS-3A provides services to regions outside of the U.S. U.S. market access will increase the public's ability to access additional transponder capacity and the scare orbit/spectrum resource where it currently is used to the exclusion of the

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

10 Please also see Engineering Statement at ¶ 2.2 for further detail.

11 *PanAmSat Licensee Corp.*, DA 04-277 (2004) at ¶ 8.

U.S. public. Furthermore, ABS-3A employs full frequency reuse at C-band frequencies through the use of orthogonal polarizations within the same beam and/or the use of spatially independent beams. In this situation and given that ABS-3A is an existing, operational satellite and that these frequency bands are also used on the satellite to provide service to regions outside of the Americas, the rationale for requiring full state-of-the-art frequency reuse in the U.S. does not apply in this case. Therefore, a waiver of the provisions of Section 25.210(f) of the Commission's Rules is justified and aligns with Commission policies.

IV. CONCLUSION

For the foregoing reasons, ABS respectfully requests that the Commission add ABS-3A to the Permitted List.

Respectfully submitted,

ABS GLOBAL, LTD.

By: /s/ James Keyes_____

James Keyes
Director
ABS Global, Ltd.

FCC Form 312, Response to Question 40:
Officers, Directors, and Ten Percent or Greater Shareholders

The applicant ABS Global, Ltd. ("ABS") is a limited liability company, duly organized under the laws of Bermuda. The company address is: O'Hara House, 3 Bermudiana Road, Hamilton, HM08, Bermuda

The following individuals serve as officers and directors of ABS and can be contacted through the address listed above:

Name	**Title**	**Nationality**
Thomas Choi	Director/Chief Executive Officer	United States of America
Willy Chow	Director/Chief Commercial Officer	Canada
James Brian Frownfelter	Director	United States of America
James Keyes	Director	United Kingdom
Sam Wong	Chief Financial Officer	Canada
Srini Prasanna	SVP Regulatory Affairs	USA
Mohamed Youssif	Chief Operation Officer	USA
Ken Betaharon	Chief Technology Officer	USA
Richard C Pak	Chief Development Officer	Korea

The names, addresses, and citizenship of stockholders of records directly or indirectly owning and/or voting 10% or more of ABS voting stock are:

Name	**Nationality/ Place of Incorporation**	**Address**	**Shares**	**Percent**
ABS Holdings, Ltd	Bermuda	O'Hara House, 3 Bermudiana Road., Hamilton HM 08, Bermuda	14,040	87%

No other individuals or entities directly or indirectly hold a 10% or greater ownership or voting interest in ABS.

Engineering Statement

1) Introduction

ABS Global, Ltd. ("ABS") seeks a declaratory ruling from the Federal Communications Commission ("FCC") to access the United States of America market and provide communication services to/from the United States of America and its territories through its non-U.S. licensed satellite, ABS-3A, from the 3.0° W.L. orbital location.

2.0) Spacecraft Overview

ABS-3A is a Boeing model 702SP spacecraft that operates on the C-band frequencies of 5925 – 6426 MHz, 3700 – 4200 MHz; and the Ku-band frequencies of 14000 – 14250 MHz, 10950 – 11200 MHz.[1] The spacecraft utilizes 10 C-band channels to provide service to the Americas, 2 C-band channels to provide global service, and 3 Ku-band channels to provide service to the Americas and the Caribbean[2].

2.1) Spacecraft Characteristics

ABS-3A is a three-axis stabilized type spacecraft that has a rectangular outer body structure. ABS-3A utilizes two deployable solar array wings and a number of deployable antennas.

The spacecraft is comprised of a number of subsystems:

- Thermal
- Power
- Attitude Control
- Propulsion
- Telemetry, Command and Ranging (TC&R)
- Uplink Power Control
- Communications

The structural design of ABS-3A provides mechanical support for all subsystems. The structure externally supports the communication antennas, solar arrays, and the thrusters. It also provides a stable platform for preserving the alignment of critical elements of the spacecraft.

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[1] ABS-3A has the capability to operate on other frequency bands in addition to those listed in this Engineering Statement. However, ABS is not requesting access to/from the United States of America and its territories for these additional frequencies.

[2] ABS-3A has additional channels, however, these channels are used with other beams for which access is not requested to/from the United States of America and its territories.

A summary of the basic spacecraft characteristics is provided in Exhibit 1. The ABS-3A mass and power budgets are provided in Exhibits 2 and 3, respectively.

2.2) Communication Subsystem

ABS-3A provides 12 active communication channels (also referred to as transponders) at C-band frequencies with each channel having a bandwidth of 72 MHz[3]. In Ku-band frequencies, ABS-3A employs 3 active with each channel having a bandwidth of 72 MHz[4]. The ABS-3A frequency, polarization and beam switching plan is contained in Exhibit 4.

For both the C and Ku-band channels, the output of each receiving antenna is fed to the receiving section of the transponder where the input signal frequency is converted to the transmitted downlink frequency.

The output of the receivers is routed to banks of Input Multiplexers ("IMUXs"). The IMUXs are filters that provide frequency band separation for each channel.

The output of each IMUX channel is connected to a corresponding amplifier through a redundancy switching network. The switching network allows for the output of each IMUX to be routed to a redundant amplifier should the primary unit fail.

ABS-3A uses 70 Watt Linearized Traveling Wave Tube Amplifiers ("LTWTA") for the C-band channels, and 150 Watt LTWTATs for the Ku-band channels.

The output of each amplifier is then routed through a bank of switches to the appropriate Output Multiplexer ("OMUX"). The switching network allows the output of a redundant amplifier to be forwarded to the appropriate OMUX should the primary amplifier unit fail.

The output of OMUX is then routed to the appropriate antenna feed for transmission to Earth.

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[3] The number of C-band channels specified only applies to those beams and frequency bands for which market access to the United States of America and its territories is being requested.

[4] The number of Ku-band channels specified only applies to those beams and frequency bands for which market access to the United States of America and its territories is being requested.

ABS-3A employs redundancy for a number of critical units in the receiving section as well as for the LTWTAs.

Section 25.202(d) of the rules requires that the carrier frequency of signals transmitted to (the ABS-3A) satellite be maintained within 0.001% of the reference frequency. ABS will comply with the provisions of this rule as it pertains to the transmission of command and tracking channels.

Section 25.202(e) of the rules requires that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency. ABS-3A is designed to be compliant with the provisions of this rule.

The coverage and performance of each ABS-3A C and Ku-band communication beam is provided in Exhibits 5A-1 through 5A-10 in the format described in Section 25.114(c)(4)(vi)(A) of the rules. For the uplink beams, the SFD at any G/T contour may be determined using the following formula:

$$SFD_D = SFD_P + [(G/T)_P - (G/T)_D] + A$$

where

SFD_D: SFD at desired G/T level (dBW/m^2)
SFD_P: Minimum SFD at peak G/T (dBW/m^2)
$(G/T)_D$: Desired G/T level (dB/K)
$(G/T)_P$: Peak G/T (dB/K)
A: Transponder attenuator setting (dB), ranging from 0 to 20 dB at C-band, and from 0 to 22 dB at Ku-band

Exhibit 6 provides a detailed calculation of the EIRP, G/T and SFD of the ABS-3A uplink and downlink beams.

ABS-3A employs full frequency reuse at C-band frequencies through the use of orthogonal polarizations within the same beam and/or the use of spatially independent beams. Accordingly, ABS-3A is compliant with Section 25.210(f) of the Commission's rules in the 5925 – 6425 MHz and 3700 – 4200 MHz frequency bands.

In the 14000 – 14250 MHz and 11950 – 11200 MHz frequency bands, ABS-3A provides service to the Americas in only one polarization. Consequently, ABS requests a waiver of the provisions of Section 25.210(f) with respect to

the 14000 – 14250 MHz and 10950 – 11200 MHz frequency bands. Given that ABS-3A is an existing, operational satellite and that these frequency bands are also used on the satellite to provide service to regions outside of the Americas (not shown in this Engineering Statement), a waiver of the provisions of Section 25.210(f) would be justified.

With respect to the use of the 10950 – 11200 MHz band, Section 25.202(a)(1) of the rules and footnote NG 52 of the United States Table of Frequency Allocations, as contained in Section 2.106 of the Commission's rules, permits the use of this band by non-federal fixed satellite service for international systems only (see note NG 104). ABS will comply with the provisions of footnote NG 104.

2.3) Telemetry, Command and Ranging Subsystem

The telemetry, command and ranging (TC&R") subsystem provides the following functions:

- Acquisition, processing and transmission of spacecraft telemetry data;
- Reception and retransmission of ground station generated ranging signals; and
- Reception, processing and distribution of telecommands.

The basic operating characteristics of the ABS-3A TC&R system is provided in Exhibit 7.

ABS-3A can be commanded through the use of two command channels centered at the frequencies of 6420 MHz and 6425 MHz. The spacecraft telemetry is transmitted through two channels centered at the frequencies of 4194.5 MHz and 4197 MHz.

The coverage contours of the ABS-3A command and telemetry beams used during normal on-station operations is provided in Exhibits 5A-11 and 5A-12, respectively, in the format described in Section 25.114(c)(4)(vi)(A) of the FCC rules. With respect to the ABS-3A command and telemetry antennas used during emergency operations, the -8 dB relative gain contour of each of these antennas, relative to their beam peak, falls entirely beyond the edge of the visible Earth. Consequently, in accordance with the provisions of Section 25.114(c)(4)(vi)(A), the antenna patterns for the command and telemetry antennas used during emergency operations is not

required and not provided in this Engineering Statement (or in the Schedule S).

Exhibit 8 contains the detail calculation of the EIRP, G/T and command threshold of the ABS-3A command and telemetry channels.

Section 25.202(d) of the rules requires that the carrier frequency of signals transmitted to (the ABS-3A) satellite be maintained within 0.001% of the reference frequency. ABS will comply with the provisions of this rule as it pertains to the transmission of command and tracking channels.

Section 25.202(e) of the rules requires that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency. ABS-3A is designed to be compliant with the provisions of this rule as it pertains to the transmission of telemetry and tracking channels.

Concerning the ABS-3A command channel centered at 6425 MHz, it is noted that with the exception of this command channel, no portion of the 6425-6725 MHz frequency band is utilized for the communication payload. However, there are no nearby satellites that utilize the 6425 – 6725 MHz frequency band. Moreover, interference to any future nearby adjacent satellite from ABS-3A command transmissions centered at 6425 MHz (and 6420 MHz) is limited given that ABS utilizes earth stations with large antenna diameters that have relatively high gain discrimination towards any nearby satellite that may be utilizing an overlapping frequency band. In view of the fact that ABS-3A is an operational satellite whose design cannot be altered; and that the risk of harmful interference due to ABS-3A command transmissions centered at 6425 MHz (and 6420 MHz) to any nearby satellite is small, it is requested that the Commission permit ABS-3A to utilize the command channel centered at 6425 MHz frequency band.

2.9) Satellite Station-Keeping

The spacecraft will continue to be maintained within 0.05° of its nominal longitudinal position in the east-west direction. Accordingly, it is in compliance with Section 25.210(j) of the Commission's rules.

The attitude of the spacecraft will continued be maintained with accuracy consistent with the achievement of the specified communications performance, after taking into account all error sources (i.e., attitude perturbations, thermal distortions, misalignments, orbital tolerances and thruster perturbations).

3.0) Services and Emission Designators

ABS-3A is to be a general purpose communications satellite and has been designed to support various services offered within ABS's satellite system. Depending upon the needs of the users, the transponders on ABS-3A can accommodate television, radio, voice and data communications. Typical communication services to be offered at C and Ku-band include:

Compressed digital video

High speed digital data

Digital single channel per carrier ("SCPC") data channels

Currently, ABS does not contemplate transmitting analog video through ABS-3A. Accordingly, the provisions of Section 25.140(a)(1) do not apply. However, should ABS be required to operate analog video to meet customer requirements, it shall coordinate such operation with other authorized co-frequency space stations located within six degrees of 3° W.L., as required under Section 25.140(a)(1).

In accordance with the provisions of Section 25.114(c)(4)(ii) of the rules, the maximum EIRP and EIRP density of those ABS-3A beams for which market access to the United States America is being requested is provided in Exhibit 9. It should be noted that ABS-3A will continue to be operated in a manner that is in accordance with the operating conditions agreed upon with the operators of other adjacent co-frequency satellites.

4.0) Power Flux Density ("PFD")

The power flux density ("PFD") limits for space stations operating in the 3700 – 4200 MHz and 10950 – 11200 MHz z bands are contained in Section 25.208 of the Commission's rules.

The maximum PFD levels for the ABS-3A transmissions were calculated for a number of digital carriers listed in Exhibit 11 operating in the 3700 – 4200 MHz and 10950 – 11200 MHz frequency bands. These carriers were chosen because they generally produce high PFD levels on the Earth's surface. The PFD levels were also calculated for the ABS-3A telemetry carriers. The results are provided in Exhibit 10 and show that the downlink power flux density levels of the ABS-3A carriers do not exceed limits specified in

Section 25.208 of the Commission's rules or in No. 21.16 of the ITU Radio Regulations.

5.0) Emission Limitations

ABS will comply with the provisions of Section 25.202(f) of the Commission's rules with regard to ABS-3A emissions.

In accordance with Section 25.140(a)(3)(i), in the C-band frequencies, ABS certifies that the downlink EIRP density of ABS-3A emissions will not exceed 3 dBW/4 kHz for digital transmissions or 8 dBW/4 kHz for analog transmissions and the associated uplink operation will not exceed the applicable EIRP density envelopes of Section 25.218 or 25.221(a)(1) unless the non-routine uplink and/or downlink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within 6 degrees of the orbital location of ABS-3A except as provided in Section 25.140(d).

In accordance with the provisions of Section 25. 140(a)(3)(ii) of the rules, in the Ku-band frequencies, ABS certifies that the downlink EIRP density of ABS-3A emissions will not exceed 14 dBW/4 kHz for digital transmissions or 17 dBW/4 kHz for analog transmissions and that associated uplink operation will not exceed applicable EIRP density envelopes in Sections 25.218, 25.222(a)(1), 25.226(a)(1) or 25.227(a)(1) unless non-routine uplink and/or downlink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of the orbital location of ABS-3A and except as provided in section 25.140(d).

6.0) Service Area

At C-band and Ku-band frequencies, the primary service area of ABS-3A is the North and South America, including the Caribbean (and the United States of America and its territories).

7.0) Orbital Location

ABS requests that it be assigned the 3° W.L orbital location for ABS-3A. The 3.0° W.L location satisfies ABS-3A requirements for optimizing coverage, elevation angles and service availability and ensures that maximum operational, economic and public interest benefits will be derived.

8.0) Orbital Arc Limitations

ABS-3A is intended to provide video, audio and data services to satellite users within its coverage area. The 3° W.L position affords reasonable earth station angles to the region. The attractiveness of ABS-3A to this market would be severely diminished if service to this area is not possible.

9.0) TC&R Earth Stations

ABS will conduct TC&R operations through one or more of earth stations at the following approximate locations: Askar, Bahrain, and Dubna, Russia.

10.0) ABS-3A Link Analysis

At C-band, the nearest co-frequency satellites to ABS-3A are Intelsat 10-02, located at 1° W.L., and Eutelsat 5 West A, located at 5° W.L. Intelsat 10-02 is a U.S. licensed satellite. Eutelsat 5 West A is not a U.S. licensed satellite and is not on the U.S. Permitted List. ABS has coordination agreements with the operators of Intelsat 10-02 and Eutelsat 5 West A covering the operation of these satellites and ABS-3A. Given that there are no co-frequency C-band satellites located within 2 degrees of the 3° W.L. orbital location and that ABS-3A emissions will be compliant with the limits specified in Section 25.140(a)(3)(i) of the rules, the C-band operations of ABS-3A would be compliant with the provisions of Section 25.140(a)(2) of the rules and no link analysis is required.

At Ku-band, the nearest co-frequency satellites to ABS-3A are Intelsat 10-02, located at 1° W.L., AMOS-2 and AMOS-3, located at 4° W.L., and Eutelsat 5 West A, located at 5° W.L. Intelsat 10-02 is a U.S. licensed satellite. Eutelsat 5 West A, AMOS-2 and AMOS-2 are not U.S. licensed satellites and are not on the U.S. Permitted List. ABS has coordination agreements with the operators of Intelsat 10-02 and Eutelsat 5 West A covering the operation of these satellites and ABS-3A. Additionally, ABS operates in accordance with a coordination agreement that covers the operation of ABS-3A, AMOS-2 and AMOS-3. Given that there are no co-frequency Ku-band satellites located within 2 degrees of the 3° W.L. orbital location other than AMOS-2 and AMOS-3, and that ABS is operating in accordance with existing coordination agreements relative to AMOS-2 and AMOS-3 (in addition to Intelsat 10-02 and Eutelsat 5 West A), and that ABS-3A emissions will be compliant with the limits specified in Section 25.140(a)(3)(ii) of the rules, the Ku-band operations of ABS-3A would be compliant with the provisions of Section 25.140(a)(2) of the rules and no link analysis is required.

11.0) Orbital Debris Mitigation Plan

ABS is proactive in ensuring safe operation and disposal of this and all spacecraft under its control. The four elements of debris mitigation are addressed below.

11.1) Limiting the Potential For Collision With Small Debris

ABS has assessed and limited the amount of debris released in a planned manner during normal operations, and has assessed and limited the probability of ABS-3A becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal.

The spacecraft is designed such that no debris will be released during normal operations. ABS has assessed the probability of collision with meteoroids and other small debris (<1 cm diameter) and has taken the following steps to limit the effects of such collisions: (1) critical spacecraft components are located inside the protective body of the spacecraft and properly shielded; and (2) all spacecraft subsystems have redundant components to ensure no single-point failures. The spacecraft does not use any subsystems for end-of-life disposal that are not used for normal operations.

11.2) Minimizing Accidental Explosions

ABS has assessed and limited the probability of accidental explosions during and after completion of mission operations. The ABS-3A spacecraft is designed in a manner to minimize the potential for such explosions. The Xenon tank and thrusters are isolated using redundant valves and electrical power systems are shielded in accordance with standard industry practices. Xenon is non-explosive. At the completion of the mission, and upon disposal of the spacecraft, ABS will ensure the removal of all stored energy on the spacecraft by depleting the Xenon tank, by powering off reaction wheels, and by leaving the batteries in a permanent discharge state.

11.3) Limiting the Potential For Collision With Large Debris

ABS has assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations.

ABS-3A will not be located at the same orbital location as another satellite or at an orbital location that has an overlapping station keeping volume with another satellite. ABS is not aware of any other FCC licensed system, or any other system applied for and under consideration by the FCC, having an overlapping station-keeping volume with ABS-3A. ABS is also not aware of any system with an overlapping station-keeping volume with ABS-3A that is the subject of an ITU filing and that is either in orbit or progressing towards launch.

11.4) Post Mission Disposal

At the end of the mission, ABS will dispose of the spacecraft by moving it to a minimum altitude of 300 kilometers above the geostationary arc, which is the altitude established by the IADC formula. ABS has reserved 0.6 kilograms of fuel for this purpose. The reserved fuel figure was determined by the spacecraft manufacturer and provided for in the propellant budget. To calculate this figure, the "rocket equation" was used, taking into account the expected mass of the satellite at the end of life and the required delta-velocity to achieve the desired orbit. The fuel gauging uncertainty has been taken into account in these calculations.

In calculating the disposal orbit, ABS has used simplifying assumptions as permitted under the Commission's Orbital Debris Report and Order. For reference, the effective area to mass ratio (Cr*A/M) of the ABS-3A spacecraft is .055m2/kg, resulting in a minimum perigee disposal altitude under the IADC formula of at most 290 kilometers above the geostationary arc. Accordingly, the ABS-3A planned disposal orbit complies with the requirements if the IADC formula.

12.0) Schedule S

Concerning the command beams having the Schedule S beam designations CDO, CDFP and CDAP, Section 25.114(c)(4)(v) of the Commission's rules require that the beam peak flux density at the command threshold be provided. In the Schedule S, no such data item is designated for command beams. Consequently, for each of the three aforementioned command beams, this information is provided in the data item corresponding to the minimum saturated flux density level. Additionally, in order to ensure that the Schedule S worked properly, the data item corresponding to the maximum saturated flux density was arbitrarily set to be 0.1 dB higher than the minimum value, since the Schedule S software does not permit the minimum and maximum saturated flux density levels to be identical.

Certification Statement

I hereby certify that I am a technically qualified person and am familiar with Part 25 of the Commission's rules. The contents of this engineering statement were prepared by me or under my direct supervision and to the best of my knowledge are complete and accurate.

/s/ Abdolmajid Khalilzadeh	November 30, 2016
Abdolmajid Khalilzadeh	Date
ABS Global Ltd.	
Director	
Spectrum Management	

EXHIBIT 1: SUMMARY OF SPACECRAFT CHARACTERISTICS

GENERAL	
Spacecraft Name	ABS-3A
Orbital Location	3° W. L.
Spacecraft Manufacturer	Boeing Satellite Systems
Spacecraft Model	702SP
Spacecraft Type	3-axis stabilized
Spacecraft Dimensions	
Length **Width** **Depth (Height)**	32.6 meters 8.3 meters 4.3 meters
Spacecraft Expected Lifetime	26.7 years
Eclipse Capability	100%
Station-keeping	
North-South **East-West**	±0.05° ±0.05°
Antenna Pointing Accuracy	
North-South, East-West, Rotational	0.1°, 0.1°, 0.2 °
Spacecraft Reliability	
Payload Reliability **Bus Reliability**	94.1% 88.3%
Propulsion Type	Electric (Xenon Ion Propulsion)
Deployed Area of Solar Array	51.7 sq. meters
Ranging Accuracy	≤ 40 meters

EXHIBIT 2: SPACECRAFT MASS SUMMARY

Mass of Spacecraft without Fuel (kg)	1701.0
Mass of Fuel and Disposables (kg)	269.3
Launch Mass (kg)	1970.3
Mass of Fuel at Beginning of Life (kg)	144.7

EXHIBIT 3: SPACECRAFT POWER BUDGET

	BEGINNING OF LIFE		END OF LIFE	
	AUTUMN EQUINOX	**SUMMER SOLSTICE**	**AUTUMN EQUINOX**	**SUMMER SOLSTICE**
PAYLOAD (WATTS)	7500	7500	7500	7500
BUS - NO XIPS FIRING (WATTS)	1539	1028	1539	1028
TOTAL LOAD (WATTS)	9039	8528	9039	8528
SOLAR ARRAY POWER (WATTS)	12565	12163	10461	9534
DEPTH OF BATTERY DISCHARGE (%)	70	N/A	77.3	N/A

EXHIBIT 4: FREQUENCY ASSIGNMENT#

Uplink Transponder Designation	Uplink Beam Name	Uplink Polarization	Uplink Center Frequency (MHz)	Downlink Transponder Designation	Downlink Beam Name	Downlink Polarization	Downlink Center Frequency (MHz)	Channel Bandwidth	Maximum Channel Gain (dB)
13C	West Hemi	H	5970	13C	West Hemi	V	3745	72	133.8
15C	West Hemi	H	6050	15C	West Hemi	V	3825	72	133.8
17C	West Hemi	H	6130	17C	West Hemi	V	3905	72	133.8
19C	West Hemi	H	6210	19C	West Hemi	V	3985	72	133.8
21C	West Hemi	H	6290	21C	West Hemi	V	4065	72	133.8
14C	West Hemi	V	5970	14C	West Hemi	H	3745	72	133.8
16C	West Hemi	V	6050	16C	West Hemi	H	3825	72	133.8
18C	West Hemi	V	6130	18C	West Hemi	H	3905	72	133.8
20C	West Hemi	V	6210	20C	West Hemi	H	3985	72	133.8
22C	West Hemi	V	6290	22C	West Hemi	H	4065	72	133.8
23C	Global	H	6373	23C	Global	V	4148	72	133.7
24C	Global	V	6373	24C	Global	H	4148	72	134.9
S13	Americas	V	14040	S13	Americas	H	10990	72	139.0
S14	Americas	V	14120	S14	Americas	H	11070	72	139.0
S15	Americas	V	14200	S15	Americas	H	11150	72	139.0
CM1O	East Hemi	V	6420					1	
CM2O	East Hemi	V	6425					1	
CM1F	Forward Pipe	LHCP	6420					1	
CM2F	Forward Pipe	LHCP	6425					1	
CM1A	Aft Pipe	LHCP	6420					1	
CM2A	Aft Pipe	LHCP	6425					1	
				TM1O	Global	H	4194.5	0.5	
				TM2O	Global	H	4197	0.5	
				TM1F	Forward Pipe	LHCP	4194.5	0.5	
				TM2F	Forward Pipe	LHCP	4197	0.5	
				TM1A	Aft Pipe	LHCP	4194.5	0.5	
				TM2A	Aft Pipe	LHCP	4197	0.5	

#This table only lists those beam/frequency channel connections for which market access to/from the United States of America is being requested. ABS-3A has the capability to operate in other frequency bands and/or with other beams that are not listed in this table and for which market access to/from the United States is not being requested.

EXHIBIT 5A-1: C-Band West Hemi Receive Beam
(Schedule S Beam ID: WHVU)

Beam Polarization: Vertical
Beam Peak Gain: 32.9 dBi
Beam Peak G/T: 7.0 dB/K
Saturated Flux Density @ Beam Peak G/T: -92.0 to -112.0 dBW/m2

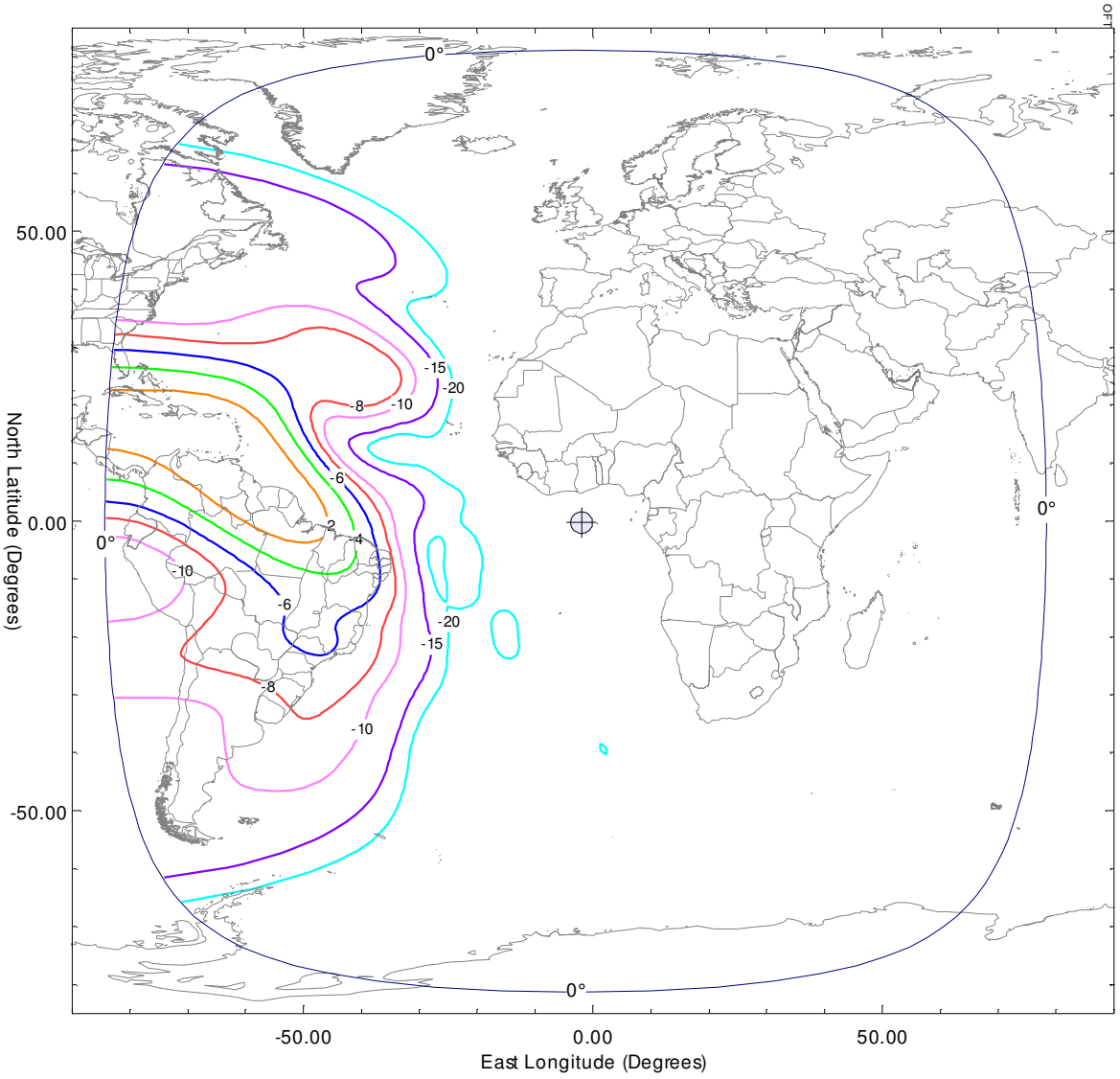

EXHIBIT 5A-2: C-Band West Hemi Receive Beam
(Schedule S Beam ID: WHHU)

Beam Polarization: Horizontal
Beam Peak Gain: 32.9 dBi
Beam Peak G/T: 6.9 dB/K
Saturated Flux Density @ Beam Peak G/T: -91.9 to -111.9 dBW/m2

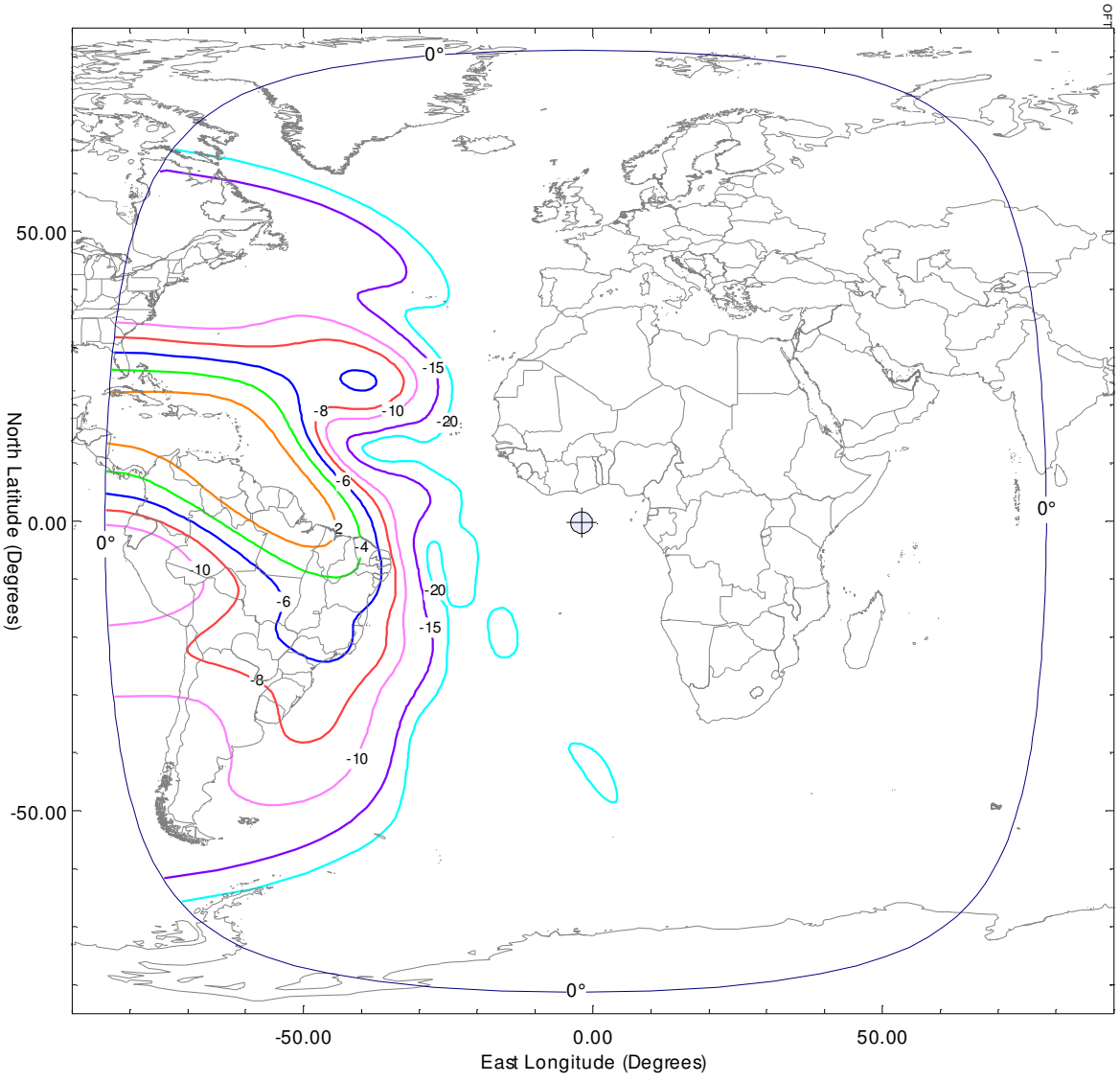

EXHIBIT 5A-3: C-Band Global Receive Beam
(Schedule S Beam ID: GVU)

Beam Polarization: Vertical
Beam Peak Gain: 22.2 dBi
Beam Peak G/T: -3.0 dB/K
Saturated Flux Density @ Beam Peak G/T: -82.0 to -102.0 dBW/m2

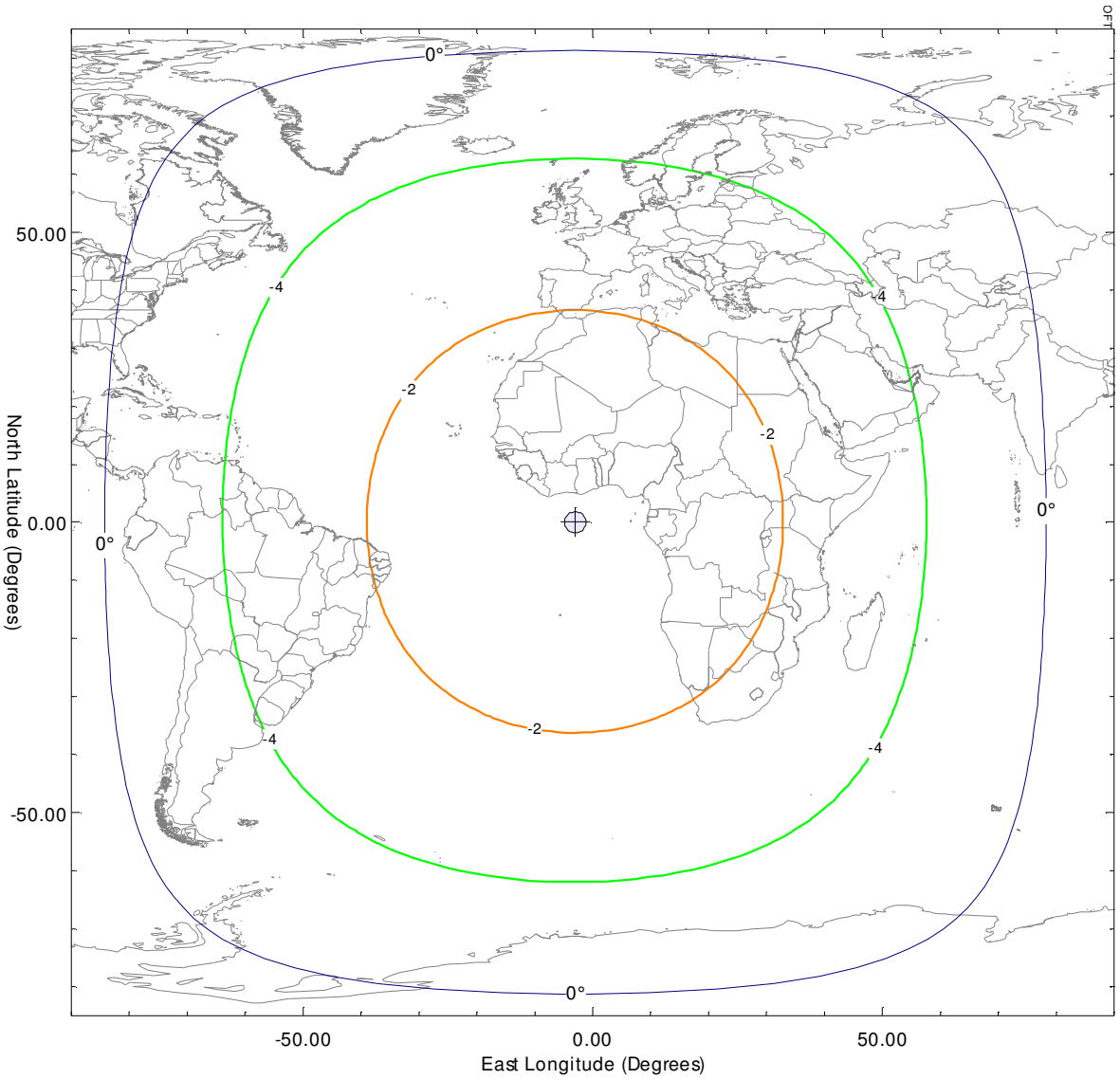

EXHIBIT 5A-4: C-Band Global Receive Beam
(Schedule S Beam ID: GHU)

Beam Polarization: Horizontal
Beam Peak Gain: 22.3 dBi
Beam Peak G/T: -3.7 dB/K
Saturated Flux Density @ Beam Peak G/T: -81.3 to -101.3 dBW/m2

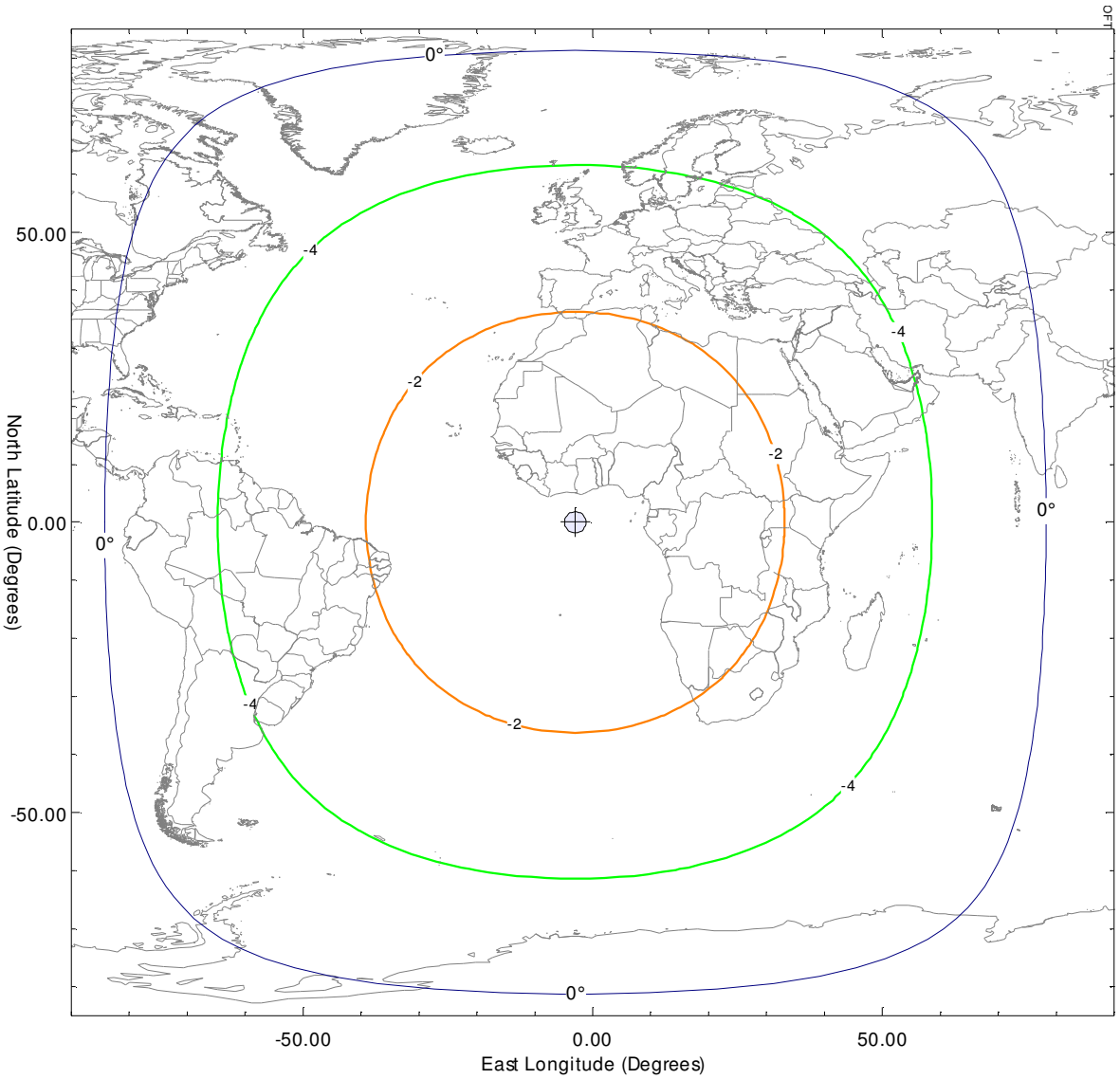

EXHIBIT 5A-5: Ku-Band Americas Receive Beam
(Schedule S Beam ID: AMVU)

Beam Polarization: Vertical
Beam Peak Gain: 32.1 dBi
Beam Peak G/T: 6.7 dB/K
Saturated Flux Density @ Beam Peak G/T: -83.7 to -105.7 dBW/m2

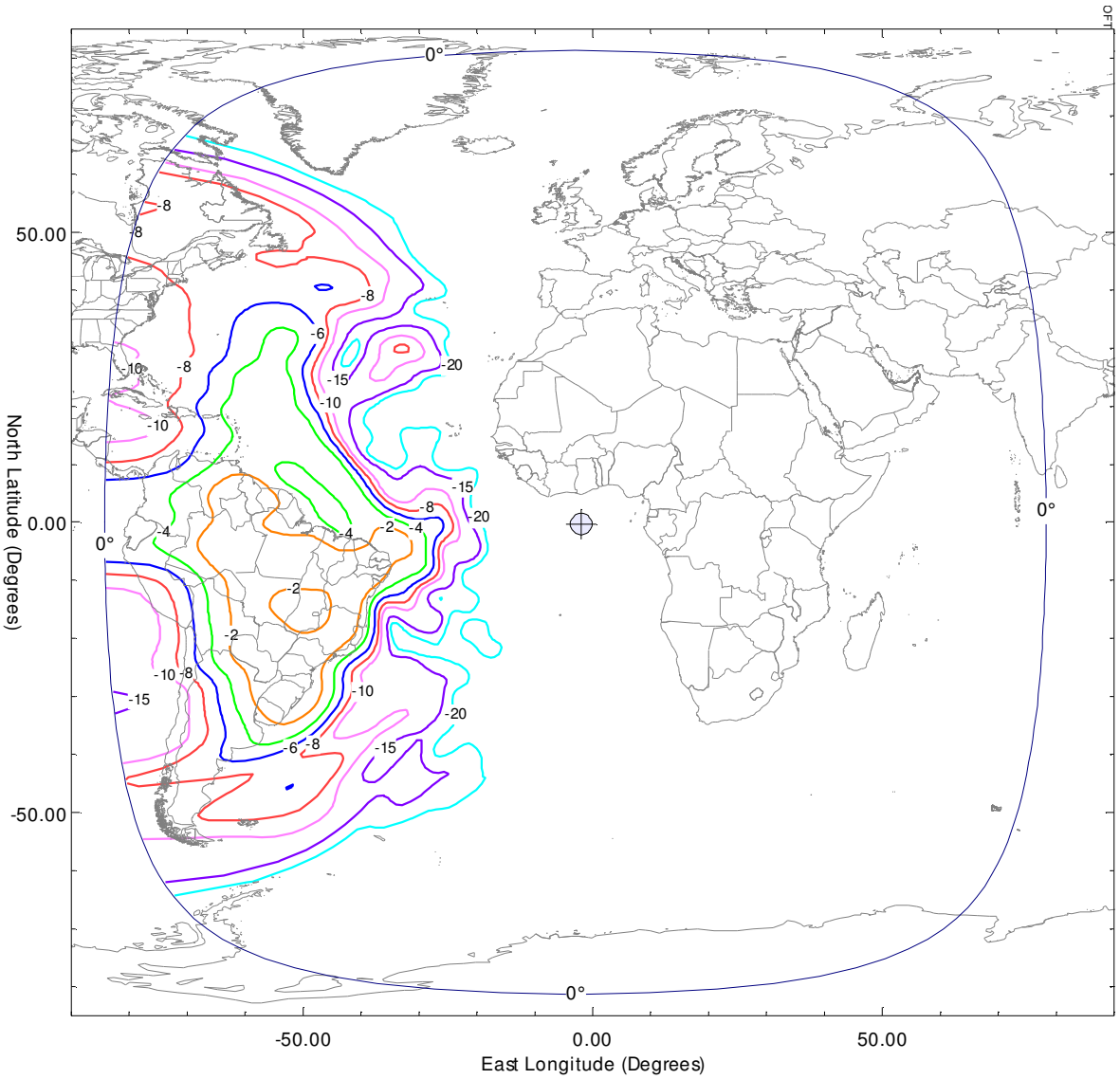

EXHIBIT 5A-6: C-Band West Hemi Transmit Beam
(Schedule S Beam ID: WHHD)

Beam Polarization: Horizontal
Beam Peak Gain: 30.5 dBi
Beam Peak dBW: 48.0 dBW

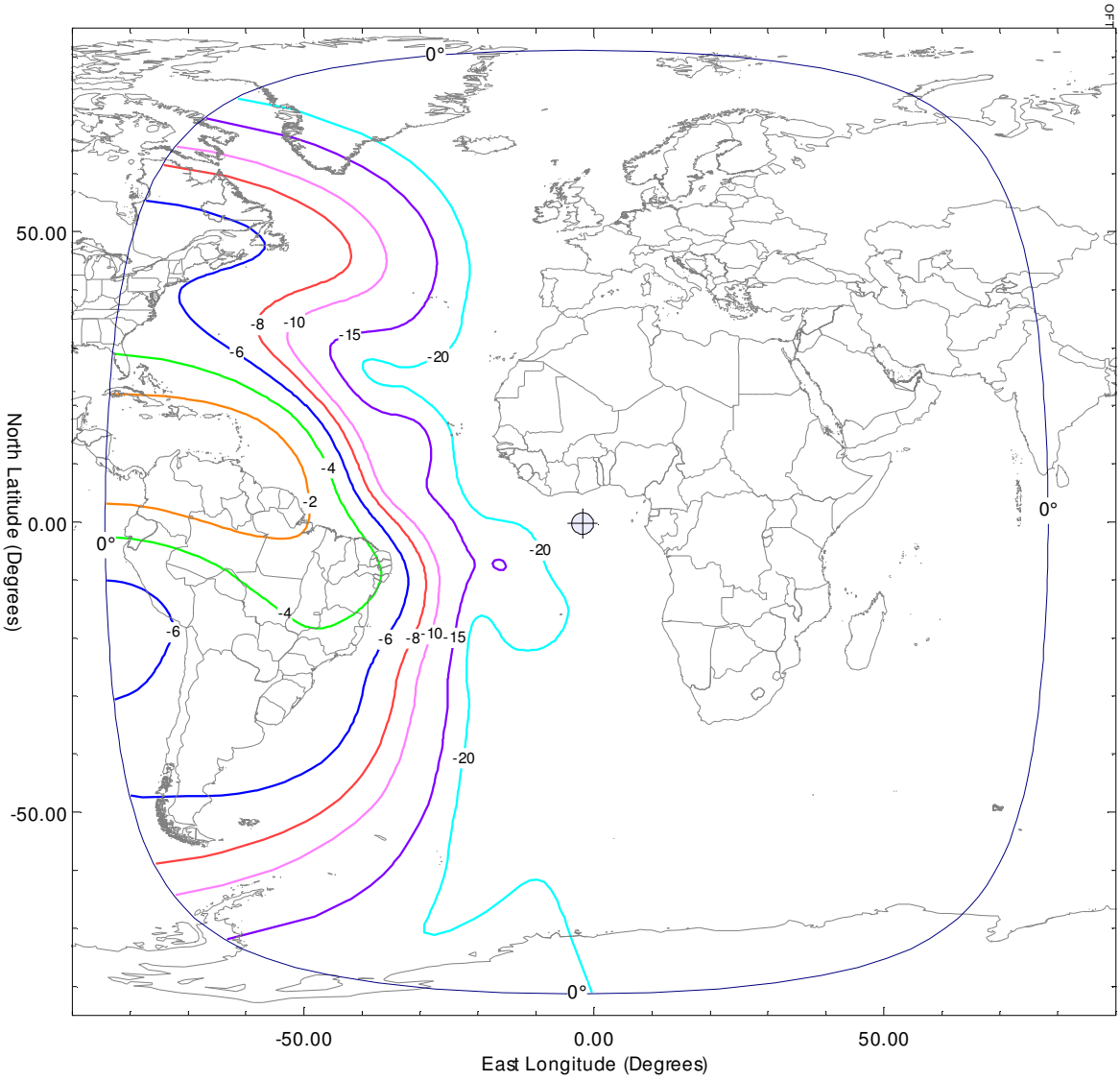

EXHIBIT 5A-7: C-Band West Hemi Transmit Beam
(Schedule S Beam ID: WHVD)

Beam Polarization: Vertical
Beam Peak Gain: 30.4 dBi
Beam Peak EIRP: 48.0 dBW

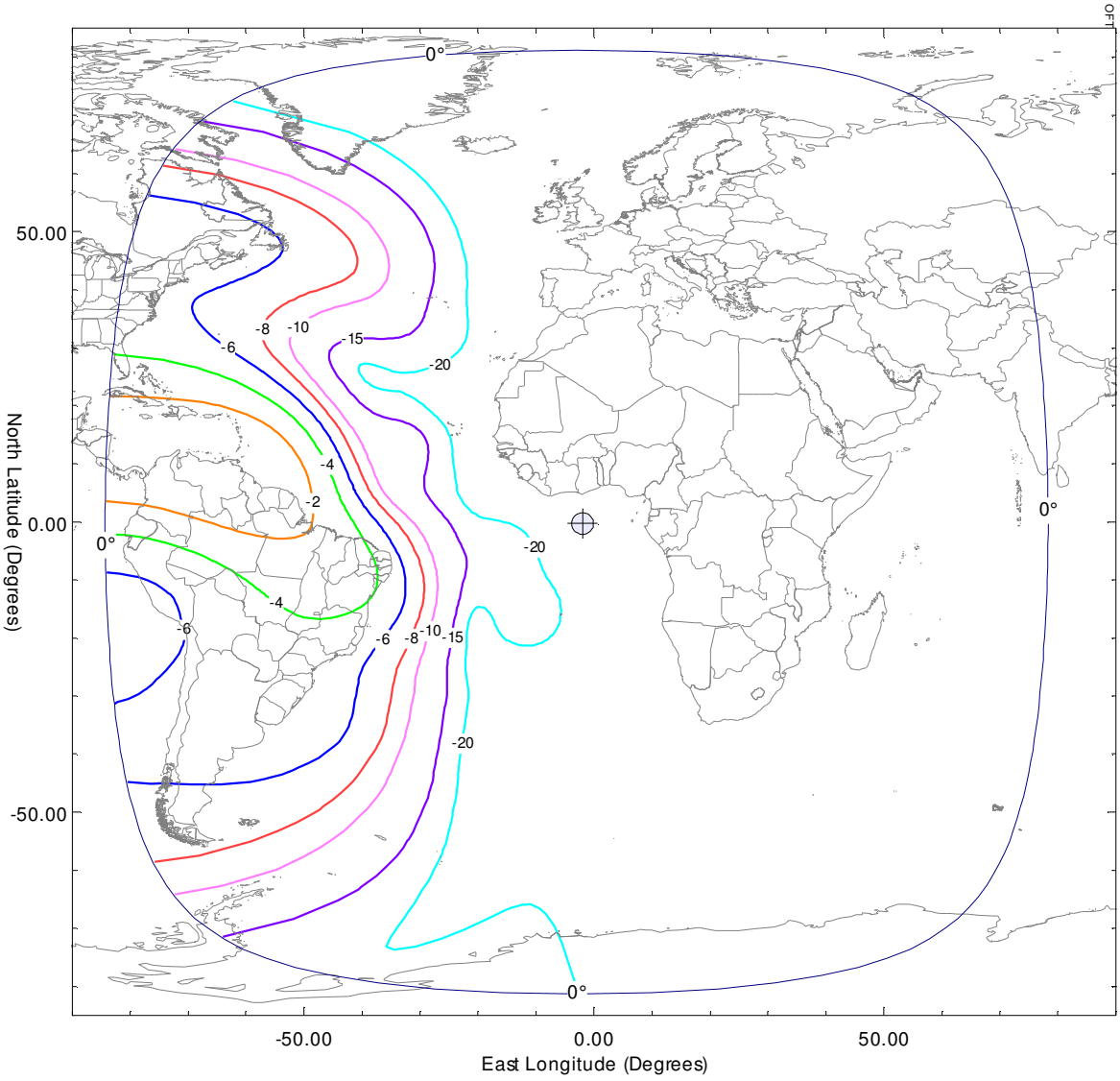

EXHIBIT 5A-8: C-Band Global Transmit Beam
(Schedule S Beam ID: GHD)

Beam Polarization: Horizontal
Beam Peak Gain: 22.0 dBi
Beam Peak EIRP: 39.6 dBW

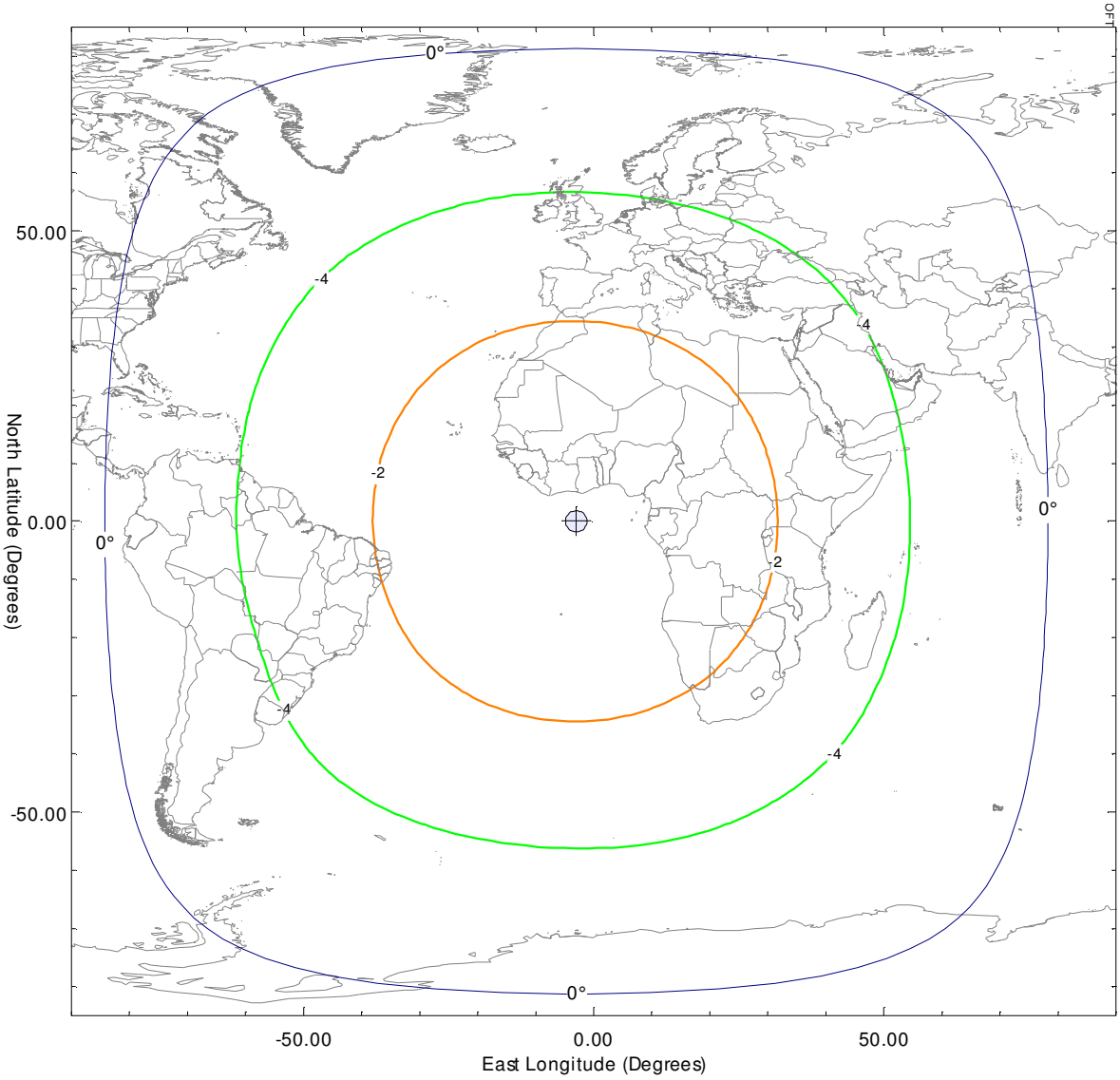

EXHIBIT 5A-9: C-Band Global Transmit Beam
(Schedule S Beam ID: GVD)

Beam Polarization: Vertical
Beam Peak Gain: 22.1 dBi
Beam Peak EIRP: 39.3 dBW

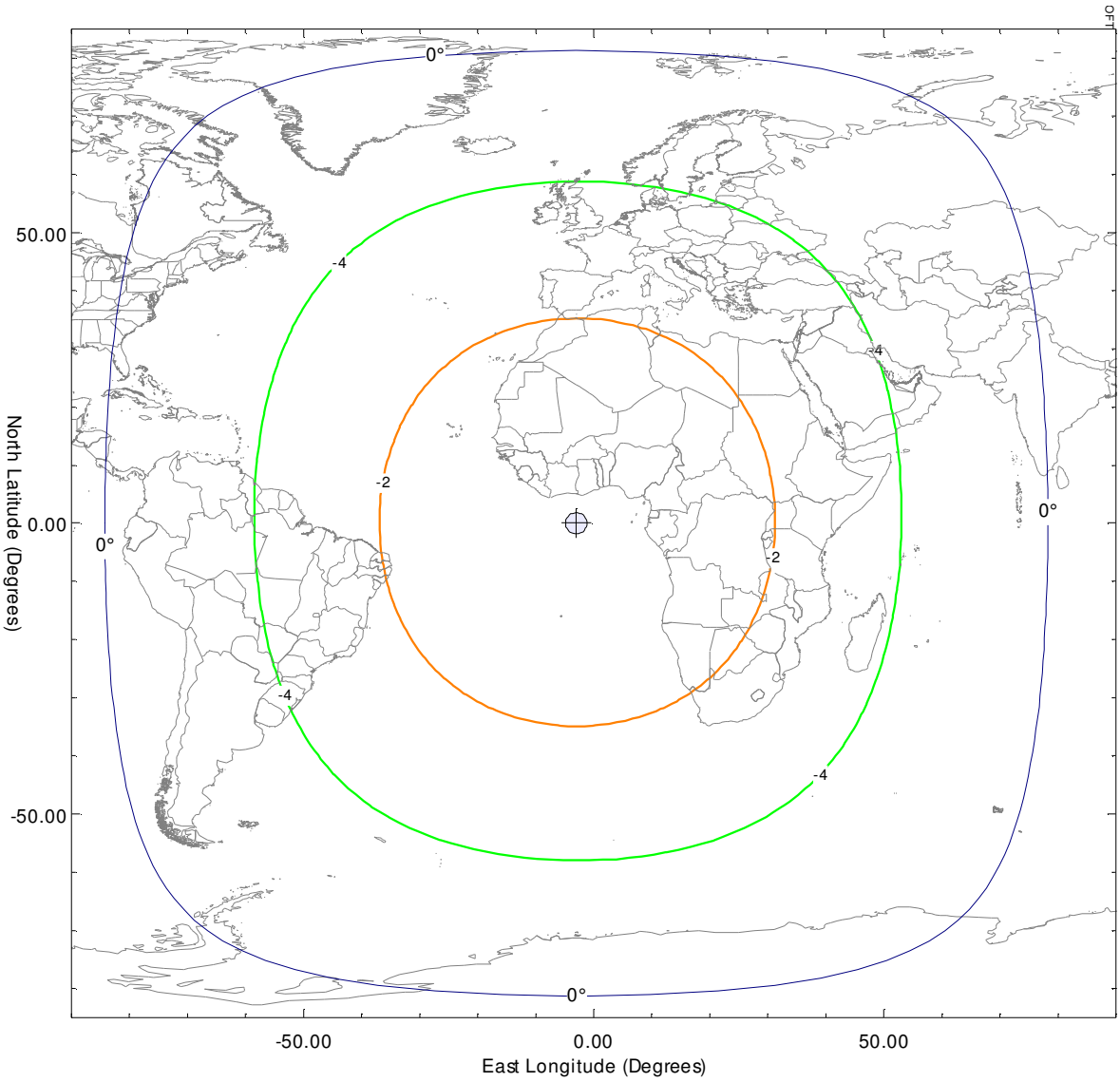

EXHIBIT 5A-10: Ku-Band Americas Transmit Beam (Schedule S Beam ID: AMHD)

Beam Polarization: Horizontal
Beam Peak Gain: 30.5 dBi
Beam Peak EIRP: 51.4 dBW

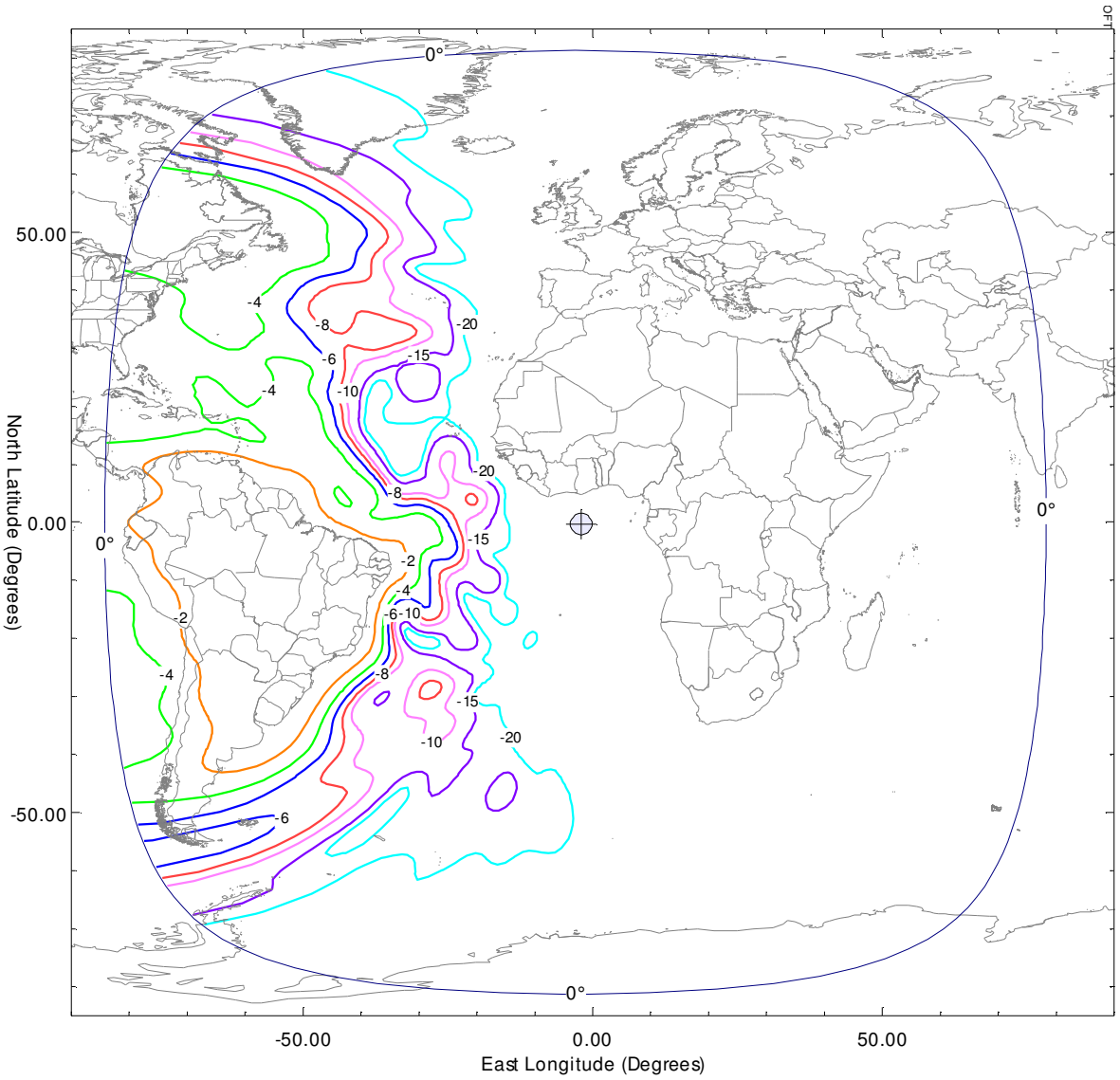

EXHIBIT 5A-11: C-Band East Hemi Command Beam (Schedule S Beam ID: CDO)

Beam Polarization: Vertical
Peak Beam Gain: 30.4 dBi
Beam Peak G/T: -10.6 dB/K
Command Threshold @ Peak Beam: -117.8 dBW/m2

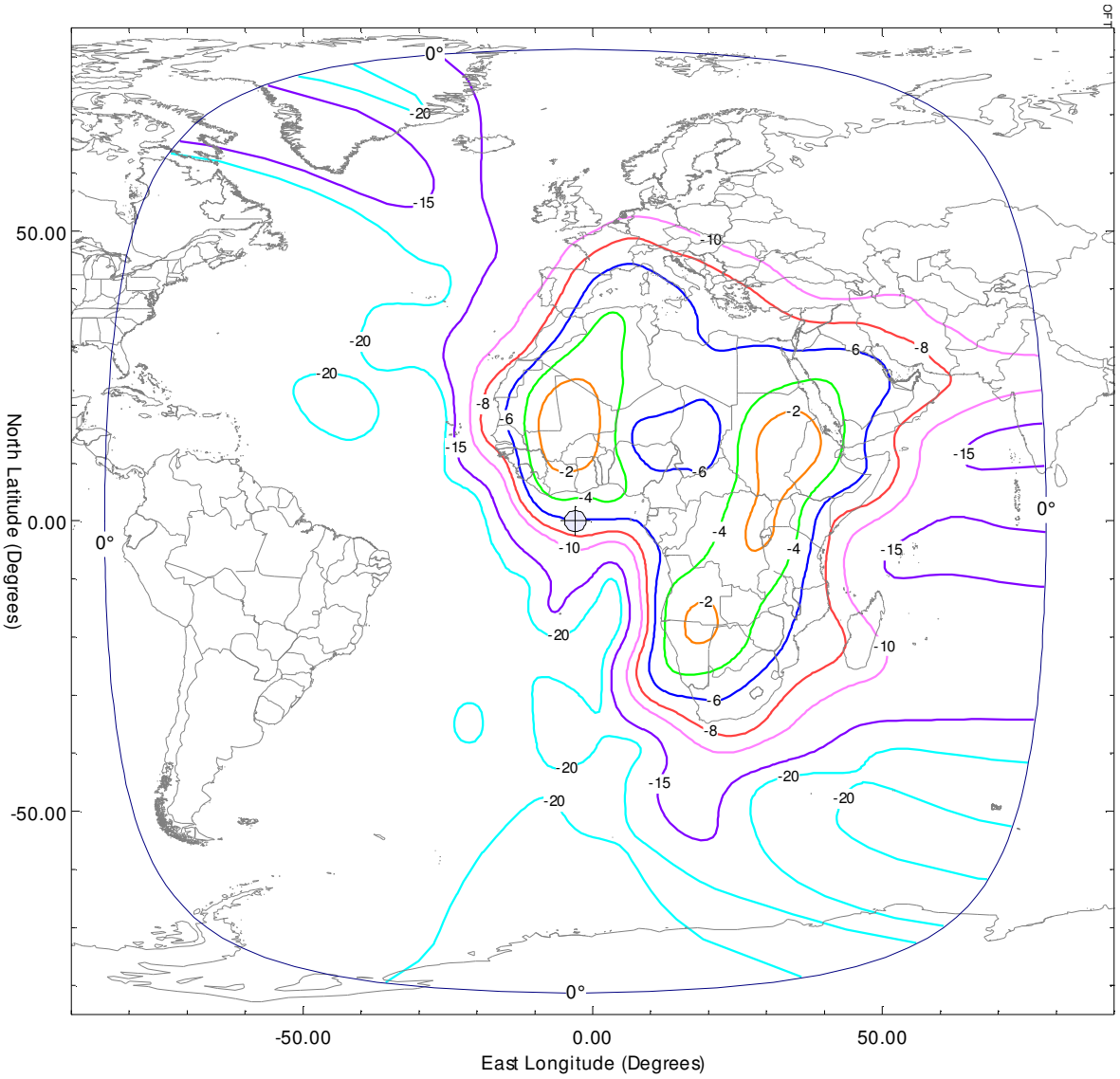

EXHIBIT 5A-12: C-Band Global TelemetryBeam
(Schedule S Beam ID: TMO)

Beam Polarization: Horizontal
Beam Peak Gain: 22.0 dBi
Beam Peak EIRP: 18.7 dBW

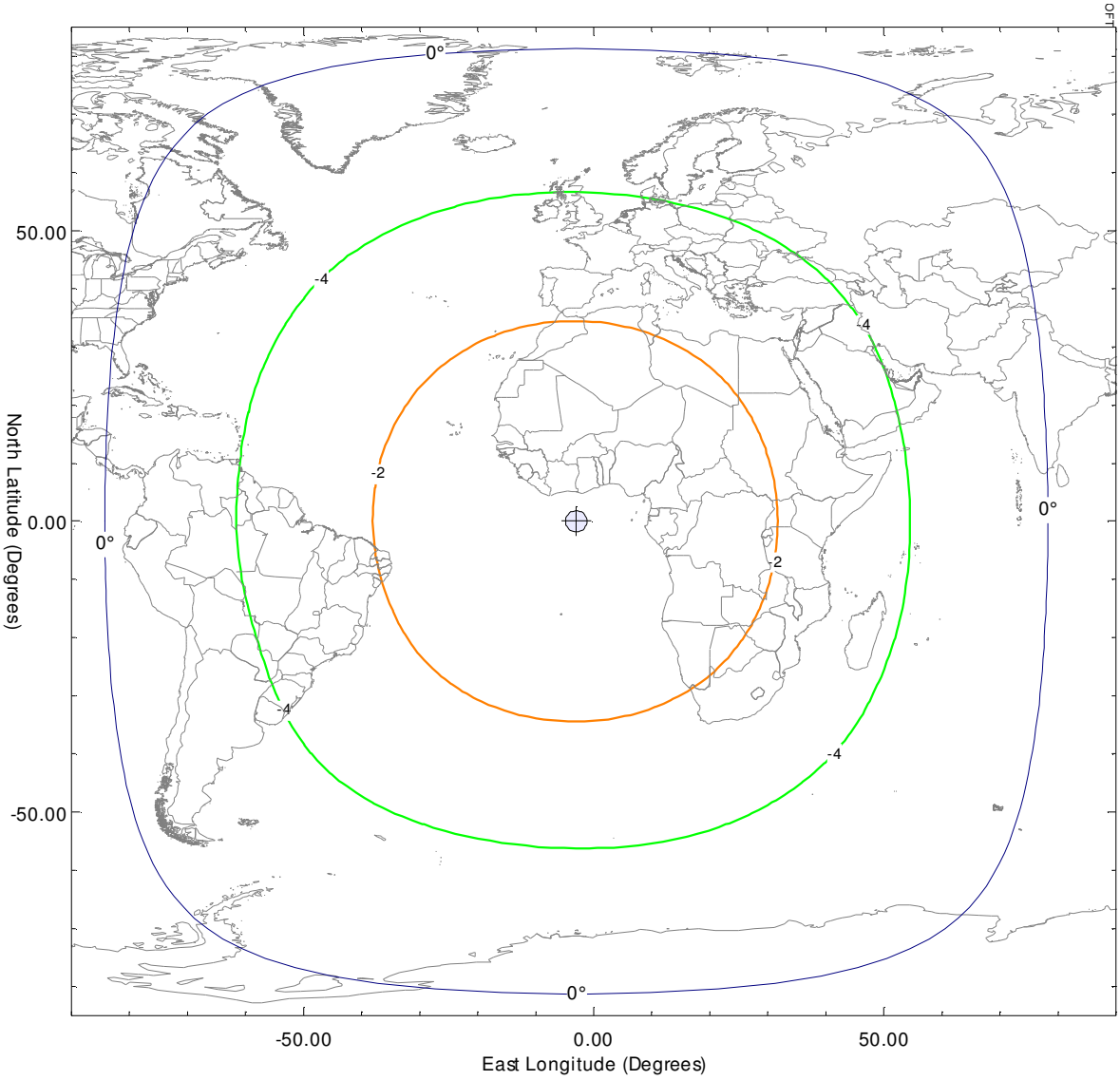

EXHIBIT 6 COMMUNICATION SUBSYSTEM EIRP AND GT BUDGETS

Beam Name	**West Hemi**	**West Hemi**
Frequency Band (MHz)	5934 - 6326	5934 - 6326
Polarization	Horizontal	Vertical
Channel Bandwidth (MHz)	72	72
Antenna Noise Temperature (^{o}Kelvin)	163	163
Receiver Noise Temperature (^{o}Kelvin)	237.9	228.7
Total System Noise Temperature (^{o}Kelvin)	400.9	391.7
Total System Noise Temperature (dB/K)	26.0	25.9
Peak Gain of Satellite Receive Antenna (dB)	32.9	32.9
Peak G/T (dB/K)	6.9	7.0
Minimum SFD [G/T: Peak, Attn: 0 dB] - (dBW/m^2)	-111.9	-112

Beam Name	**West Hemi**	**West Hemi**
Frequency Band (MHz)	3709 - 4101	3709 - 4101
Polarization	Horizontal	Vertical
Channel Bandwidth (MHz)	72	72
Maximum Power at the Output of Last Stage Amplifier (dBW)	18.6	18.7
Loss from Last Stage Amplifier to Transmit Antenna Interface (dB)	1.1	1.1
Power into Transmit Antenna (dBW)	17.5	17.6
Power into Transmit Antenna (Watts)	56.2	57.5
Peak Gain of Satellite Transmit Antenna (dBi)	30.5	30.4
Maximum Downlink EIRP (dBW)	48.0	48.0

EXHIBIT 6 COMMUNICATION SUBSYSTEM EIRP AND GT BUDGETS (continued)

Beam Name	**Global**	**Global**
Frequency Band (MHz)	6337 - 6409	6337 - 6409
Polarization	Horizontal	Vertical
Channel Bandwidth (MHz)	72	72
Antenna Noise Temperature (^{o}Kelvin)	140	140
Receiver Noise Temperature (^{o}Kelvin)	255.4	195.7
Total System Noise Temperature (^{o}Kelvin)	395.4	335.0
Total System Noise Temperature (dB/K)	26.0	25.2
Peak Gain of Satellite Receive Antenna (dB)	22.3	22.2
Peak G/T (dB/K)	-3.7	-3.0
Minimum SFD [G/T: Peak, Attn: 0 dB] - (dBW/m^2)	-101.3	-102

Beam Name	**Global**	**Global**
Frequency Band (MHz)	4108 - 4188	4108 - 4188
Polarization	Vertical	Horizontal
Channel Bandwidth (MHz)	72	72
Maximum Power at the Output of Last Stage Amplifier (dBW)	18.6	18.8
Loss from Last Stage Amplifier to Transmit Antenna Interface (dB)	1.3	1.2
Power into Transmit Antenna (dBW)	17.3	17.6
Power into Transmit Antenna (Watts)	53.1	57.8
Peak Gain of Satellite Transmit Antenna (dBi)	22.1	22.0
Maximum Downlink EIRP (dBW)	39.3	39.6

EXHIBIT 6 COMMUNICATION SUBSYSTEM EIRP AND GT BUDGETS

Beam Name	**Americas**
Frequency Band (MHz)	14004 - 14236
Polarization	Vertical
Channel Bandwidth (MHz)	72
Antenna Noise Temperature (^{o}Kelvin)	193
Receiver Noise Temperature (^{o}Kelvin)	153.7
Total System Noise Temperature (^{o}Kelvin)	346.7
Total System Noise Temperature (dB/K)	25.4
Peak Gain of Satellite Receive Antenna (dB)	32.1
Peak G/T (dB/K)	6.7
Minimum SFD [G/T: Peak, Attn: 0 dB] - (dBW/m^2)	-105.7

Beam Name	**Americas**
Frequency Band (MHz)	10954 - 11186
Polarization	Horizontal
Channel Bandwidth (MHz)	72
Maximum Power at the Output of Last Stage Amplifier (dBW)	22.6
Loss from Last Stage Amplifier to Transmit Antenna Interface (dB)	1.7
Power into Transmit Antenna (dBW)	20.9
Power into Transmit Antenna (Watts)	124.5
Peak Gain of Satellite Transmit Antenna (dBi)	30.5
Maximum Downlink EIRP (dBW)	51.4

EXHIBIT 7: TC&R SUBSYSTEM CHARACTERISTICS

	East Hemi	Global	Forward pipe	Aft pipe
Command Frequency (MHz) / Polarization				
Transfer-Orbit / Emergency	n/a	n/a	6420 (LHCP) 6425 (LHCP)	6420 (LHCP) 6425 (LHCP)
On-Station	6420 (V) 6425 (V)	n/a	n/a	n/a
Command Modulation	FM	n/a	FM	FM
Bandwidth of Command Carrier (kHz)				
Occupied Bandwidth	800	n/a	800	800
Allocated Bandwidth	1000	n/a	1000	1000
Command Threshold (dBW/m^2)				
Beam Peak	-117.8	n/a	-94.9	-96.4
Edge of Coverage	-106.9	n/a	-91.2	-92.8
Telemetry Frequency (MHz) / Polarization				
Transfer-Orbit / Emergency	n/a	n/a	4194.5 (LHCP) 4197 (LHCP)	4194.5 (LHCP) 4197 (LHCP)
On-Station	n/a	4194.5 (H) 4197.0 (H)	n/a	n/a
Telemetry Modulation	n/a	PM	PM	PM
Bandwidth of Command Carrier (kHz)				
Occupied Bandwidth	n/a	300	300	300
Allocated Bandwidth	n/a	500	500	500
Telemetry EIRP				
Beam Peak	n/a	18.7	7.8	8.2
Edge of Coverage	n/a	14.0	5.2	6.3
On-Station Ranging Accuracy (meters)	≤ 40	≤ 40	≤ 40	≤ 40

EXHIBIT 8: TC&R SUBSYSTEM EIRP and G/T BUDGETS

Operating Mode	**On-Station**	**Back-Up**	**Back-Up**
Antenna Type	East Hemi	Forward pipe	Aft pipe
Frequency (MHz)	6425/6420		
Polarization	V	LHCP	LHCP
Antenna Noise Temperature (^{o}Kelvin)	290	290	290
Receiver Noise Temperature (^{o}Kelvin)	12166	7605	5270
Total System Noise Temperature (^{o}Kelvin)	12456	7895	5560
Total System Noise Temperature (dB/K)	41.0	39.0	37.5
Peak Gain of Satellite Receive Antenna (dB)	30.4	5.5	5.5
Peak G/T (dB/K)	-10.6	-33.5	-32.0
FD Threshold at Peak G/T (dBW/m^2)	-117.8	-94.9	-96.4
Operating Mode	**On-Station**	**Back-Up**	**Back-up**
Antenna Type	Global	Forward pipe	Aft pipe
Frequency (MHz)	4194.5/4197		
Polarization	H	LHCP	LHCP
Maximum Power at the Output of Last Stage Amplifier (dBW)	-1.7	9.9	9.8
Loss from Last Stage Amplifier to Transmit Antenna Interface (dB)	1.6	6.7	6.0
Power into the Transmit Antenna (dBW)	-3.3	3.2	3.8
Power into the Transmit Antenna (Watts)	0.47	2.1	2.4
Peak Gain of Satellite Transmit Antenna (dB)	22.0	4.6	4.4
Maximum Downlink EIRP (dBW)	18.7	7.8	8.2

EXHIBIT 9: Beam EIRP Density Calculations

Beam Name	Beam Polarization	Frequency Band (MHz)	Beam Peak EIRP (dBW)	Channel Bandwidth (kHz)	EIRP Density (dBW/4kHz)
West Hemi	Horizontal	3709 - 4101	48.0	72.0	3.0*
West Hemi	Vertical	3709 - 4101	48.0	72.0	3.0*
Global	Horizontal	4112 - 4184	39.6	72.0	-2.2
Global	Vertical	4112 - 4184	39.3	72.0	-2.5
Americas	Horizontal	10954 - 11186	51.4	72.0	9.6
Telemetry - Global	Horizontal	4194.25 – 4194.75	18.7	0.5	0.7
Telemetry - Global	Horizontal	4196.75 – 4197.25	18.7	0.5	0.7
Telemetry - Forward Pipe	Left Hand Circular	4194.25 – 4194.75	7.8	0.5	-10.2
Telemetry - Forward Pipe	Left Hand Circular	4196.75 – 4197.25	7.8	0.5	-10.2
Telemetry - Aft Pipe	Left Hand Circular	4194.25 – 4194.75	8.2	0.5	-9.8
Telemetry - Aft Pipe	Left Hand Circular	4196.75 – 4197.25	8.2	0.5	-9.8

*ABS-3A's West Hemi can operate at levels higher than that listed. However, ABS will limit the EIRP density of ABS-3A of its digital transmissions so as to not exceed 3 dBW/4 kHz.

EXHIBIT 10: POWER FLUX DENSITY CALCULATIONS

FREQUENCY BAND : 3.7 - 4.2 GHz							
West Hemi Beam (Horizontal Polarization): 60M0G7W							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	48.0	48.0	48.0	48.0	48.0	48.0	48.0
Occupied Bandwidth (kHz)	60000	60000	60000	60000	60000	60000	60000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-157.2	-157.0	-156.9	-156.8	-156.7	-156.6	-155.8
PFD Limit (dBW/m^2/4kHz)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	5.2	5.0	7.4	9.8	12.2	14.6	13.8
West Hemi Beam (Vertical Polarization): 60M0G7W							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	48.0	48.0	48.0	48.0	48.0	48.0	48.0
Occupied Bandwidth (kHz)	60000	60000	60000	60000	60000	60000	60000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-157.2	-157.0	-156.9	-156.8	-156.7	-156.6	-155.8
PFD Limit (dBW/m^2/4kHz)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	5.2	5.0	7.4	9.8	12.2	14.6	13.8

EXHIBIT 10: POWER FLUX DENSITY CALCULATIONS (continued)

FREQUENCY BAND : 3.7 - 4.2 GHz							
Global Beam (Horizontal Polarization): 60M0G7W							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	39.6	39.6	39.6	39.6	39.6	39.6	39.6
Occupied Bandwidth (kHz)	60000	60000	60000	60000	60000	60000	60000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-165.6	-165.4	-165.3	-165.2	-165.1	-165.0	-164.2
PFD Limit (dBW/m^2/4kHz)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	13.6	13.4	15.8	18.2	20.6	23.0	22.2
Global Beam (Vertical Polarization): 60M0G7W							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	39.3	39.3	39.3	39.3	39.3	39.3	39.3
Occupied Bandwidth (kHz)	60000	60000	60000	60000	60000	60000	60000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-165.9	-165.7	-165.6	-165.5	-165.4	-165.3	-164.5
PFD Limit (dBW/m^2/4kHz)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	13.9	13.7	16.1	18.5	20.9	23.3	22.5

EXHIBIT 10: POWER FLUX DENSITY CALCULATIONS (continued)

FREQUENCY BAND : 3.7 - 4.2 GHz							
Telemetry (On-Station Operation)							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	18.7	18.7	18.7	18.7	18.7	18.7	18.7
Occupied Bandwidth (kHz)	300	300	300	300	300	300	300
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-163.4	-163.3	-163.2	-163.1	-163.0	-162.9	-162.1
PFD Limit (dBW/m^2/4kHz)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	11.4	11.3	13.7	16.1	18.5	20.9	20.1
Telemetry - Forward Pipe (Back-up Operation)							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Occupied Bandwidth (kHz)	300	300	300	300	300	300	300
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-174.3	-174.2	-174.1	-174.0	-173.9	-173.8	-173.0
PFD Limit (dBW/m^2/4kHz)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	22.3	22.2	24.6	27.0	29.4	31.8	31.0

EXHIBIT 10: POWER FLUX DENSITY CALCULATIONS (continued)

FREQUENCY BAND : 3.7 - 4.2 GHz							
Telemetry - Aft Pipe (Back-up Operation)							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Occupied Bandwidth (kHz)	300	300	300	300	300	300	300
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-173.9	-173.8	-173.7	-173.6	-173.5	-173.4	-172.6
PFD Limit (dBW/m^2/4kHz)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	21.9	21.8	24.2	26.6	29.0	31.4	30.6
FREQUENCY BAND : 10.95 - 11.7 GHz							
Americas Beam (Horizontal Polarization): 60M0G7W							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	51.4	51.4	51.4	51.4	51.4	51.4	51.4
Occupied Bandwidth (kHz)	60000	60000	60000	60000	60000	60000	60000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-153.8	-153.6	-153.5	-153.4	-153.3	-153.2	-152.4
PFD Limit (dBW/m^2/4kHz)	-150	-150	-147.5	-145.0	-142.5	-140.0	-140.0
Margin (dB)	3.8	3.6	6.0	8.4	10.8	13.2	12.4