Engineering Statement

1 Introduction

Intelsat License LLC ("Intelsat") seeks authority in this application to operate the satellite designated as Intelsat 805 from 169.0° E.L. Intelsat 8, currently located at 169.0° E.L., will be relocated to 168.9° E.L. following the transition of some traffic to Intelsat 805.

The characteristics of the Intelsat 805 spacecraft, as well as its compliance with the various provisions of Part 25 of the Federal Communication Commission's ("FCC" or "Commission") rules, are provided in the remainder of this Engineering Statement.

Intelsat requests that the Part 25 waivers originally granted to the Intelsat 805 spacecraft continue to apply at the 169.0° E.L. location, namely, the waivers of Sections 25.202(a)(1)[1], 25.202(g), 25.210(a)(3), 25.210(i)(1), and 25.210(f)[2] of the Commission's rules.[3]

2 Spacecraft Overview

Intelsat 805 is a Lockheed-Martin model LM7000 spacecraft that is capable of operating in C-band and Ku-band frequencies listed below.

C-band:	Uplink:	5850 – 6650 MHz
	Downlink:	3400 – 4200 MHz
Ku-band:	Uplink:	14000 – 14250 MHz
	Downlink:	12500 – 12750 MHz

[1] The existing waiver of Section 25.202(a)(1) applies only to C-bands frequencies on Intelsat 805.

[2] Intelsat 805 previously obtained a waiver of Section 25.210(g)(1), which required full frequency reuse. *Infra* n. 3. This requirement is now included in Section 25.210(f).

[3] *See* Applications of Intelsat LLC for Authority to Operate and Further Construct, Launch, and Operate C-Band and Ku-Band Satellites that Form a Global Communications System in Geostationary Orbit, 15 FCC Rcd 15460, 15529 (Appendix C)(2000)(Memorandum Opinion and Order and Authorization), *recon. denied*, 15 FCC Rcd 25234(2000)(Order on Reconsideration).

The spacecraft provides the following coverage:

C-band:		
	Regional Beam	Eastern Asia, Western North America, and Australia
Ku-band:		
	Spot Beam	Japan

Intelsat requests a waiver of Sections 25.202(a)(1) and 2.106 (the "U.S. Table of Frequency Allocation") of the Commission's rules to permit Intelsat to operate Intelsat 805 in the 12500 – 12750 MHz frequency band in the space-to-Earth direction for commercial Fixed-Satellite Service ("FSS") in International Telecommunication Union ("ITU") Region3. In ITU Region 3, where the IS 805 Ku-band coverage is, the band 12500 – 12750 MHz is allocated to the FSS in the space-to-Earth direction.

However, in the U.S. Table of Frequency Allocations, the 12500 – 12700 MHz frequency band is allocated for use by the Fixed Service ("FS") and Broadcast Satellite Service ("BSS"), and the 12700 –12750 MHz frequency band is allocated for use by the FS, Mobile Service ("MS") and Fixed Satellite Service ("FSS") (Earth-to-space). Since the Intelsat 805 space-to-Earth Ku-band beam has no coverage in the U.S or ITU Region 2, there is no potential for harmful interference to licensed services in ITU Region 2

2.1 Spacecraft Characteristics

Intelsat 805 is a three-axis stabilized type spacecraft that has a rectangular outer body structure. Intelsat 805 utilizes two deployable solar array wings and a number of deployable and non-deployable antennas.

The Intelsat 805 spacecraft is composed of the following subsystems:

- Thermal
- Power
- Attitude Control
- Propulsion
- Telemetry, Command and Ranging
- Uplink Power Control
- Communications

These subsystems maintain the correct position and attitude of the spacecraft, ensure that all internal units are maintained within the required temperature range, and ensure that the spacecraft can be commanded and controlled with a high level of reliability from launch to the

end of its useful life. The spacecraft design incorporates redundancy in each of the various subsystems in order to avoid single point failures.

The structural design of Intelsat 805 provides mechanical support for all subsystems. The structure 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.

2.2 Communication Subsystem

Intelsat 805 provides active communication channels at C-band and Ku-band frequencies. The C-band payload employs channels having bandwidths of 36 MHz, 41 MHz, and 72 MHz. The Ku-band payload employs channels having bandwidths of 72 MHz and 77 MHz. The Intelsat 805 frequency, polarization, and channel plan is provided in the Schedule S.

The coverage contours and performance characteristics of all Intelsat 805 beams are provided in the Schedule S. Exhibits 1 and 2 provide the beam parameters for the Intelsat 805 uplink and downlink beams, respectively.

2.3 Telemetry, Command and Ranging Subsystem

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

1) Acquisition, processing and transmission of spacecraft telemetry data;

2) Reception and retransmission of ground station generated ranging signals; and

3) Reception, processing and distribution of telecommands.

Intelsat 805 can be commanded through the use of the command channels centered at the frequencies 6173.7 MHz and 6176.3 MHz. The spacecraft telemetry is received through telemetry channels centered at the frequencies 3947.5 MHz, 3948.0 MHz, 3952.0 MHz and 3952.5 MHz.

The coverage patterns of the command and telemetry beams have gain contours that vary by less than 8 dB across the surface of the Earth and accordingly the gain at 8 dB below the peak falls beyond the edge of the Earth. Therefore, pursuant to Section 25.114(c)(4)(vi)(A) of the Rules, contours for these beams are not required to be provided and the associated GXT files have not been included in Schedule S. The Intelsat 805 command and telemetry subsystem performance is summarized in Exhibit 3.

2.4 Uplink Power Control Subsystem

Intelsat 805 utilizes one C-band channel, 3950.0 MHz, and one Ku-band channel, 12501.0 MHz, for uplink power control ("ULPC") and antenna tracking.

The coverage patterns of the C-band ULPC beam has gain contours that vary by less than 8 dB across the surface of the Earth and accordingly the gain at 8 dB below the peak falls beyond the edge of the Earth. Therefore, pursuant to Section 25.114(c)(4)(vi)(A) of the Rules, contours for this beam is not required to be provided and the associated GXT file has not been included in Schedule S. The Ku-band ULPC channel is transmitted through the Ku-band Spot beam for which the associated GXT file is included in Schedule S. The Intelsat 805 ULPC subsystem performance is summarized in Exhibit 3.

2.5 Satellite Station-Keeping

The spacecraft will 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 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, etc.).

3 Services

Intelsat 805 is a general purpose communications satellite and has been designed to support various services offered within the Intelsat satellite system. Depending upon the needs of the users, the transponders on Intelsat 805 can accommodate television, radio, voice, and data communications. Typical communication services include:

a) Compressed digital video

b) High speed digital data

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

Emission designators and allocated bandwidths for representative communication carriers are provided in Schedule S.

4 Power Flux Density

The power flux density ("PFD") limits for space stations operating in the 3650 – 4200 MHz bands are contained in Section 25.208 of the Commission's rules. With respect to the frequency bands 3400 – 3650 MHz and 12500 – 12750 MHz, there are PFD limits specified in No. 21.16 of the ITU Radio Regulations.

The maximum PFD levels for the Intelsat 805 transmissions were calculated for the 3400 – 4200 MHz and 12500 – 12750 MHz bands. The PFD levels were also calculated for the Intelsat 805 telemetry and ULPC carriers. The results are provided in Schedule S and show that the

downlink PFD levels of the Intelsat 805 carriers do not exceed the limits specified in Section 25.208 of the Commission's rules or No. 21.16 of the ITU Radio Regulations.

5 Emission Compliance

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. Intelsat 805 is designed to be compliant with the provisions of this rule.

Intelsat will comply with the provisions of Section 25.202(f) of the Commission's rules with regard to Intelsat 805 emissions.

6 Orbital Location

Intelsat requests that it be assigned the 169.0° E.L. orbital location for Intelsat 805. The 169.0° E.L. location satisfies Intelsat 805 requirements for optimizing coverage, elevation angles, and service availability. Additionally, the location also ensures that the maximum operational, economic, and public interest benefits will be derived.

7 Interference Analysis

The impact of the proposed Intelsat 805 emissions on the transmissions of adjacent satellites located at 167.0° E.L. and 171.0º E.L. was analyzed. The interference analysis was conducted for a number of representative carriers at C-band and Ku-band frequencies. It was assumed that there were hypothetical satellites having the same operating characteristics as Intelsat 805 at the 167.0° E.L. [4] and 171.0°E.L. orbital locations.

For the satellite located at 167.0º E.L., it was assumed that the adjacent satellites were Intelsat 805, located at 169.0º E.L., and a hypothetical satellite having the same operating characteristics as Intelsat 805 located at 165.0º E.L.[5] For the satellite located at 171.0º E.L., it was assumed that the adjacent satellites were Intelsat 805, located at 169.0º E.L., and a hypothetical satellite having the same operating characteristics as Intelsat 805 located at 173.0º E.L.[6]

---

[4]At the time of submission of this application, Luch-5A is located at 167° E.L. Its frequency plan overlaps Intelsat 805 in the 12500 – 12750 MHz band. Luch-5A was not included in the interference analysis because it is not licensed by the United States nor does it have U.S. market access. Intelsat is coordinating the use of the overlapping frequencies pursuant to ITU rules.

[5] At the time of submission of this application, Intelsat 19 is located at 166°E.L. Intelsat 19 is not included in the interference analysis because it is less than 2° away from 167° E.L., and so its use in the interference analysis would be inconsistent with a two-degree orbital separation environment and policy.

[6] Other satellites in the vicinity of 167° E.L. and 171° E.L. were not included in the interference analysis because they are not licensed by the United States nor do they have U.S. market access. Intelsat is coordinating the use of the overlapping frequencies pursuant to ITU rules.

Other assumptions made for the interference analysis were as follows:

a) In the plane of the geostationary satellite orbit, all transmitting and receiving earth station antennas have off-axis co-polar gains that are compliant with the limits specified in Section 25.209(a)(1) and (2) of the FCC's rules.
b) All transmitting and receiving earth stations have a cross-polarization isolation value of at least 30 dB within their main beam lobe.
c) Rain attenuation predictions are derived using Recommendation ITU-R P.618.
d) Increase in noise temperature of the receiving earth station due to rain is taken into account.
e) For the cases where the transponder operates in a multi-carrier mode, the effects due to intermodulation interference are taken into account.

Results of the analysis are documented in Exhibits 4 and 5. The Intelsat 805 transmissions will be limited to those levels contained in Sections 25.212(c) and (d) of the Commission's rules, as applicable, unless higher levels are coordinated with affected adjacent satellite operators. In any case, the uplink power density of the Intelsat 805 digital carriers will not exceed the levels specified below:

a) 5850 – 6650 MHz: -38.7 dBW/Hz
b) 14000 – 14250 MHz: -42.0 dBW/Hz

The downlink EIRP density of Intelsat 805 digital carriers will not exceed the levels specified below:

a) 3400 – 4200 MHz: -32.0 dBW/Hz
b) 12500 – 12750 MHz: -20.0 dBW/Hz

8 Orbital Debris Mitigation Plan

Intelsat 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.

8.1 Spacecraft Hardware Design

The spacecraft is designed such that no debris will be released during normal operations. Intelsat 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.

8.2 Minimizing Accidental Explosions

Intelsat has assessed the probability of accidental explosions during and after completion of mission operations. The spacecraft is designed in a manner to minimize the potential for such explosions. Propellant tanks and thrusters are isolated using redundant valves and electrical power systems are shielded in accordance with standard industry practices. At the completion of the mission and upon disposal of the spacecraft, Intelsat will ensure that all active units are turned off and propellant tanks are depleted. However, due to the design of Intelsat 805, Intelsat will not be able to vent all pressurized systems. Intelsat 805 has two helium tanks with a volume of 68.63 liters each. The estimated mass and pressure of residual helium in each tank will be 414.0 grams and 3639.74222 kPa (527.9 psia) at 17.3 degrees C, respectively, at end-of-life. Intelsat respectfully requests a waiver of Sections 25.114(d)(14)(ii) and 25.283(c). Intelsat 805 was designed and constructed prior to the adoption of the orbital debris mitigation rules by the FCC. Given that Intelsat 805 is an operating spacecraft and its design cannot be changed, Intelsat believes that a waiver of Sections 25.114(d)(14)(ii) and 25.283(c) is justified.

8.3 Safe Flight Profiles

Intelsat has assessed and limited the probability of the space station becoming a source of debris as a result of collisions with large debris or other operational space stations. With the exception of Intelsat 8 during the traffic transition period, Intelsat 805 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. Intelsat 8, currently located at 169.0° E.L., will be relocated to 168.9° E.L. following the transition of some traffic to Intelsat 805.

During the relocation of Intelsat 805, Intelsat will take all the necessary steps to coordinate the move with other operators to minimize the risk of collision or interference between Intelsat 805 and any other satellite. During the transition of traffic from Intelsat 8, Intelsat will take all the necessary steps, to minimize the risk of collision between Intelsat 805 and Intelsat 8. With the exception of Intelsat 8, Intelsat is not aware of any other FCC licensed system, or any other system applied for and under consideration by the FCC, that will have an overlapping station-keeping volume with Intelsat 805. Intelsat is also not aware of any system with an overlapping station-keeping volume with Intelsat 805 that is the subject of an ITU filing and that is either in orbit or progressing towards launch.

8.4 Post Mission Disposal

At the end of the mission, Intelsat expects to dispose of the spacecraft by moving it to a planned minimum altitude of 150 kilometers (perigee) above the geostationary arc. Intelsat has reserved 15.97 kilograms of fuel for this purpose. The propellant gauging uncertainty has been taken into account in these calculations. In addition to the nominal hold-back and reserves provided to us by the manufacturer, Intelsat propulsion engineers review the current propellant usage – particularly the mixing ratio – to properly allocate sufficient margin to account for unavailable propellant that may result from a non-optimal mixing ratio. In addition, Intelsat performs thermal

gauging near the spacecraft's end of life by inferring the remaining propellant from the thermal signature. Section 25.283(d) of the Commission's rules states that satellites launched prior to March 18, 2002, such as Intelsat 805, are not expected to meet the minimum perigee requirement of Section 25.283(a). Therefore, the Intelsat 805 post-mission disposal plan complies with the FCC's rules.

9 ITU Filing

Intelsat 805's operations in the 3700 – 4200 MHz, 5925 – 6425 MHz, 12500 – 12750 MHz, and 14000 – 14250 MHz bands have been coordinated under the Administration of the United States' International Telecommunication Union ("ITU") filing USASAT-60J.

Intelsat currently has no United States filing with the ITU for a satellite network that specifies operation in the frequency bands 3400 – 3700 MHz, 5850 – 5925 MHz, and 6425 – 6650 MHz at the nominal orbital location of 169° E.L. Intelsat will submit to the Commission Appendix 4 information for a new satellite network that utilizes these frequency bands at the nominal orbital of 169° E.L., to be forwarded to the ITU.

10 TC&R Control Earth Stations

Intelsat will conduct TC&R operations through one or more of the following earth stations: Fillmore, CA; Paumalu, Hawaii; or Mingenew, Australia. Additionally, Intelsat is capable of remotely controlling Intelsat 805 from its facilities in McLean, VA or Long Beach, CA.

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/ Candice DeVane	October 19, 2015
Candice DeVane Intelsat Manager, Spectrum Policy	Date

EXHIBIT 1

COMMUNICATION SUBSYSTEM UPLINK BEAM PARAMETERS

Beam Name	C-Band Linear	C-Band Linear	Ku-Band Linear
Schedule S Beam ID	HAU	HBU	S1U
Frequency Band (MHz)	5850-6650	5850-6650	14000 - 14250
Polarization	Horizontal	Vertical	Horizontal
Beam Peak Gain (dBi)	24.4	24.4	33.9
G/T (dB/K)	-4.1	-4.1	6.1
Minimum SFD-- (dBW/m^2)	-96.1	-96.0	-101.6
Maximum SFD-- (dBW/m^2)	-76.1	-76.0	-79.6

EXHIBIT 2

COMMUNICATION SUBSYSTEM DOWNLINK BEAM PARAMETERS

Beam Name	C-Band Linear	C-Band Linear	Ku-Band Linear
Schedule S Beam ID	HAD	HBD	S1D
Frequency Band (MHz)	3400 - 4200	3400 - 4200	12500 - 12750
Polarization	Vertical	Horizontal	Vertical
Peak Antenna Gain (dBi)	24.9	24.9	31.8
EIRP (dBW)	42.8	42.8	53.6

EXHIBIT 3

TC&R SUBSYSTEM CHARACTERISTICS

Beam Name	Command - Global	Command – Bicone	Command – Bicone
Schedule S Beam ID	CMD	CBRU	CBLU
Frequencies (MHz)	6173.7	6176.3	6173.7
Polarization	LHCP	RHCP	LHCP
Peak Antenna Gain (dBi)	10.3	12.0	13.0
Minimum Flux Density (dBW/m^2)	-90.0	-90.0	-90.0
Maximum Flux Density (dBW/m^2)	-65.0	-65.0	-65.0

Beam Name	Telemetry - Global	Telemetry – Bicone	ULPC	ULPC
Schedule S Beam ID	TLM	TBRD	BNC	S1D
Frequencies (MHz)	3947.5, 3948.0	3952.0, 3952.5	3950.0	12501.0
Polarization	RHCP	RHCP	Linear 45°	Vertical
Peak Antenna Gain (dBi)	11.3	12.5	13.0	31.8
Maximum Channel EIRP (dBW)	6.9	7.0	9.6	12.8

Note: *RHCP: Right Hand Circular Polarization, LHCP: Left Hand Circular Polarization*

EXHIBIT 4

HYPOTHETICAL 167°E SATELLITE INTERFERENCE ANALYSIS

UPLINK BEAM INFORMATION				
Uplink Beam Name	HA & HB	HA & HB	HA & HB	HA & HB
Uplink Frequency (MHz)	6130	6130	6130	6130
Uplink Beam Polarization	Horizontal/Vertical	Horizontal/Vertical	Horizontal/Vertical	Horizontal/Vertical
Uplink Beam Peak G/T (dB/K)	-4.1	-4.1	-4.1	-4.1
Uplink Beam Peak SFD (dBW/m2)	-82.1	-82.1	-82.1	-82.1
Uplink Relative Contour Level (dB)	-5	-5	-5	-5
DOWNLINK BEAM INFORMATION				
Downlink Beam Name	HA & HB	HA & HB	HA & HB	C-Band
Downlink Frequency (MHz)	3905	3905	3905	3905
Downlink Beam Polarization	Vertical/Horizontal	Vertical/Horizontal	Vertical/Horizontal	Vertical/Horizontal
Downlink Beam Peak EIRP (dBW)	42.8	42.8	42.8	42.8
Downlink Relative Contour Level (dB)	-5	-5	-5	-5
ADJACENT SATELLITE 1				
Satellite Name	Hypothetical 165E	Hypothetical 165E	Hypothetical 165E	Hypothetical 165E
Orbital Location	165E	165E	165E	165E
Uplink Power Density (dBW/Hz)	-38.7	-38.7	-38.7	-38.7
Beam Peak Downlink EIRP Density (dBW/Hz)	-32.0	-32.0	-32.0	-32.0
ADJACENT SATELLITE 2				
Satellite Name	IS 805@169E	IS 805@169E	IS 805@169E	IS 805@169E
Orbital Location	169E	169E	169E	169E
Uplink Power Density (dBW/Hz)	-38.7	-38.7	-38.7	-38.7
Beam Peak Downlink EIRP Density (dBW/Hz)	-32.0	-32.0	-32.0	-32.0
CARRIER INFORMATION				
Carrier ID	36M0G7W	8M25G7W	1M43G7W	861KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	8448	1024	272
Code Rate	3/4x188/204	3/4x188/204	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	6111.3	1024	717
Allocated Bandwidth(kHz)	36000	8250.5	1434	861
Minimum C/N, Rain (dB)	7.3	7.3	1.8	0.8
UPLINK EARTH STATION				
Earth Station Diameter (meters)	11.0	7.5	3.7	2.4
Earth Station Gain (dBi)	54.5	51.2	45.1	41.4
Earth Station Elevation Angle	8.2	8.2	8.2	8.2
DOWNLINK EARTH STATION				
Earth Station Diameter (meters)	7.5	5.5	5.5	5.5
Earth Station Gain (dBi)	48.1	45.4	45.4	45.4
Earth Station G/T (dB/K)	29.0	27.0	27.0	27.0
Earth Station Elevation Angle	5.3	5.3	5.3	5.3
COMPOSITE LINK PERFORMANCE				
Uplink Earth Station HPA Intermodulation C/N (dB)	30.6	33.4	28.0	26.5
C/N Thermal Uplink (dB)	23.5	26.3	20.9	19.5
Uplink Interference C/I (dB)	26.4	28.8	24.2	22.0
Uplink Adjacent Satellite C/I (dB)	14.5	17.3	11.9	10.4
Intermodulation C/IM (dB)	34.9	22.2	15.0	15.1
Downlink Thermal C/N (dB)	19.7	20.2	14.5	13.1
Downlink Interference C/I (dB)	23.9	24.3	25.0	18.1
Downlink Adjacent Satellite C/I (dB)	12.8	12.4	6.8	5.3
Subtotal C/N (dB)	9.6	10.0	4.5	3.0
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	8.1	8.5	3.0	1.5
Minimum Required C/N (dB)	7.3	7.3	1.8	0.8
Number of Carriers	2	3	13	23
CARRIER DENSITY LEVELS				
Uplink Power Density (dBW/Hz)	-51.5	-45.4	-44.7	-42.5
Downlink EIRP Density At Beam Peak (dBW/Hz)	-36.9	-34.5	-40.1	-41.5

UPLINK BEAM INFORMATION				
Uplink Beam Name	S1U	S1U	S1U	S1U
Uplink Frequency (MHz)	14125	14125	14125	14125
Uplink Beam Polarization	Horizontal	Horizontal	Horizontal	Horizontal
Uplink Beam Peak G/T (dB/K)	6.1	6.1	6.1	6.1
Uplink Beam Peak SFD (dBW/m2)	-85.6	-85.6	-85.6	-85.6
Uplink Relative Contour Level (dB)	-3	-3	-3	-3
DOWNLINK BEAM INFORMATION				
Downlink Beam Name	S1D	S1D	S1D	C-Band
Downlink Frequency (MHz)	12625	12625	12625	12625
Downlink Beam Polarization	Vertical	Vertical	Vertical	Vertical
Downlink Beam Peak EIRP (dBW)	53.6	53.6	53.6	53.6
Downlink Relative Contour Level (dB)	-4	-4	-4	-4
ADJACENT SATELLITE 1				
Satellite Name	Hypothetical 165E	Hypothetical 165E	Hypothetical 165E	Hypothetical 165E
Orbital Location	165E	165E	165E	165E
Uplink Power Density (dBW/Hz)	-50.0	-50.0	-50.0	-50.0
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
ADJACENT SATELLITE 2				
Satellite Name	IS805@169E	IS805@169E	IS805@169E	IS805@169E
Orbital Location	165E	165E	165E	165E
Uplink Power Density (dBW/Hz)	-50.0	-50.0	-50.0	-50.0
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
CARRIER INFORMATION				
Carrier ID	36M0G7W	8M25G7W	1M43G7W	861KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	8448	1024	272
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	6111.3	1024	717
Allocated Bandwidth(kHz)	36000	8250.5	1434	861
Minimum C/N, Rain (dB)	7.3	7.3	1.8	0.8
UPLINK EARTH STATION				
Earth Station Diameter (meters)	4.0	4.0	2.4	1.8
Earth Station Gain (dBi)	53.1	53.1	48.7	46.2
Earth Station Elevation Angle	8.5	8.5	8.5	8.5
DOWNLINK EARTH STATION				
Earth Station Diameter (meters)	4.0	4.0	2.4	2.4
Earth Station Gain (dBi)	51.4	51.4	47.0	47.0
Earth Station G/T (dB/K)	29.0	29.0	25.0	25.0
Earth Station Elevation Angle	7.9	7.9	7.9	7.9
COMPOSITE LINK PERFORMANCE				
Uplink Earth Station HPA Intermodulation C/N (dB)	26.7	25.2	24.0	22.5
C/N Thermal Uplink (dB)	21.6	20.0	18.9	17.4
Uplink Interference C/I (dB)	200.0	200.0	200.0	200.0
Uplink Adjacent Satellite C/I (dB)	21.9	20.4	19.3	17.8
Intermodulation C/IM (dB)	37.8	26.2	25.1	24.7
Downlink Thermal C/N (dB)	19.6	17.8	12.6	11.1
Downlink Interference C/I (dB)	28.6	28.2	25.6	25.3
Downlink Adjacent Satellite C/I (dB)	15.1	14.1	8.4	6.9
Subtotal C/N (dB)	12.3	11.0	6.4	4.9
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	10.8	9.5	4.9	3.4
Minimum Required C/N (dB)	7.3	7.3	1.8	0.8
Number of Carriers	2	4	14	15
CARRIER DENSITY LEVELS				
Uplink Power Density (dBW/Hz)	-53.6	-55.1	-51.9	-50.9
Downlink EIRP Density At Beam Peak (dBW/Hz)	-26.7	-27.9	-29.1	-30.5

EXHIBIT 5
HYPOTHETICAL 171°E SATELLITE INTERFERENCE ANALYSIS

UPLINK BEAM INFORMATION				
Uplink Beam Name	HA & HB	HA & HB	HA & HB	HA & HB
Uplink Frequency (MHz)	6130	6130	6130	6130
Uplink Beam Polarization	Horizontal/Vertical	Horizontal/Vertical	Horizontal/Vertical	Horizontal/Vertical
Uplink Beam Peak G/T (dB/K)	-4.1	-4.1	-4.1	-4.1
Uplink Beam Peak SFD (dBW/m2)	-82.2	-82.2	-82.2	-82.2
Uplink Relative Contour Level (dB)	-5	-5	-5	-5
DOWNLINK BEAM INFORMATION				
Downlink Beam Name	HA & HB	HA & HB	HA & HB	C-Band
Downlink Frequency (MHz)	3905	3905	3905	3905
Downlink Beam Polarization	Vertical/Horizontal	Vertical/Horizontal	Vertical/Horizontal	Vertical/Horizontal
Downlink Beam Peak EIRP (dBW)	42.8	42.8	42.8	42.8
Downlink Relative Contour Level (dB)	-5	-5	-5	-5
ADJACENT SATELLITE 1				
Satellite Name	Hypothetical 173E	Hypothetical 173E	Hypothetical 173E	Hypothetical 173E
Orbital Location	173E	173E	173E	173E
Uplink Power Density (dBW/Hz)	-38.7	-38.7	-38.7	-38.7
Beam Peak Downlink EIRP Density (dBW/Hz)	-32.0	-32.0	-32.0	-32.0
ADJACENT SATELLITE 2				
Satellite Name	IS 805@169E	IS 805@169E	IS 805@169E	IS 805@169E
Orbital Location	169E	169E	169E	169E
Uplink Power Density (dBW/Hz)	-38.7	-38.7	-38.7	-38.7
Beam Peak Downlink EIRP Density (dBW/Hz)	-32.0	-32.0	-32.0	-32.0
CARRIER INFORMATION				
Carrier ID	36M0G7W	8M25G7W	1M43G7W	861KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	8448	1024	272
Code Rate	3/4x188/204	3/4x188/204	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	6111.3	1024	717
Allocated Bandwidth(kHz)	36000	8250.5	1434	861
Minimum C/N, Rain (dB)	7.3	7.3	1.8	0.8
UPLINK EARTH STATION				
Earth Station Diameter (meters)	11.0	7.5	3.7	2.4
Earth Station Gain (dBi)	54.5	51.2	45.1	41.4
Earth Station Elevation Angle	8.2	8.2	8.2	8.2
DOWNLINK EARTH STATION				
Earth Station Diameter (meters)	7.5	5.5	5.5	5.5
Earth Station Gain (dBi)	48.1	45.4	45.4	45.4
Earth Station G/T (dB/K)	29.0	27.0	27.0	27.0
Earth Station Elevation Angle	5.3	5.3	5.3	5.3
COMPOSITE LINK PERFORMANCE				
Uplink Earth Station HPA Intermodulation C/N (dB)	30.6	33.4	28.0	26.5
C/N Thermal Uplink (dB)	23.5	26.3	20.9	19.5
Uplink Interference C/I (dB)	26.4	28.8	24.2	22.0
Uplink Adjacent Satellite C/I (dB)	14.5	17.3	11.9	10.4
Intermodulation C/IM (dB)	34.9	22.2	15.0	15.1
Downlink Thermal C/N (dB)	19.7	20.2	14.5	13.1
Downlink Interference C/I (dB)	23.9	24.3	25.0	18.1
Downlink Adjacent Satellite C/I (dB)	12.8	12.4	6.8	5.3
Subtotal C/N (dB)	9.6	10.0	4.5	3.0
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	8.1	8.5	3.0	1.5
Minimum Required C/N (dB)	7.3	7.3	1.8	0.8
Number of Carriers	2	3	13	23
CARRIER DENSITY LEVELS				
Uplink Power Density (dBW/Hz)	-51.5	-45.4	-44.7	-42.5
Downlink EIRP Density At Beam Peak (dBW/Hz)	-36.9	-34.5	-40.1	-41.5

UPLINK BEAM INFORMATION				
Uplink Beam Name	S1U	S1U	S1U	S1U
Uplink Frequency (MHz)	14125	14125	14125	14125
Uplink Beam Polarization	Horizontal	Horizontal	Horizontal	Horizontal
Uplink Beam Peak G/T (dB/K)	6.1	6.1	6.1	6.1
Uplink Beam Peak SFD (dBW/m2)	-85.6	-85.6	-85.6	-85.6
Uplink Relative Contour Level (dB)	-3	-3	-3	-3
DOWNLINK BEAM INFORMATION				
Downlink Beam Name	S1D	S1D	S1D	C-Band
Downlink Frequency (MHz)	12625	12625	12625	12625
Downlink Beam Polarization	Vertical	Vertical	Vertical	Vertical
Downlink Beam Peak EIRP (dBW)	53.6	53.6	53.6	53.6
Downlink Relative Contour Level (dB)	-4	-4	-4	-4
ADJACENT SATELLITE 1				
Satellite Name	Hypothetical 173E	Hypothetical 173E	Hypothetical 173E	Hypothetical 173E
Orbital Location	173E	173E	173E	173E
Uplink Power Density (dBW/Hz)	-50.0	-50.0	-50.0	-50.0
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
ADJACENT SATELLITE 2				
Satellite Name	IS805@169E	IS805@169E	IS805@169E	IS805@169E
Orbital Location	165E	165E	165E	165E
Uplink Power Density (dBW/Hz)	-50.0	-50.0	-50.0	-50.0
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
CARRIER INFORMATION				
Carrier ID	36M0G7W	8M25G7W	1M43G7W	861KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	8448	1024	272
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	6111.3	1024	717
Allocated Bandwidth(kHz)	36000	8250.5	1434	861
Minimum C/N, Rain (dB)	7.3	7.3	1.8	0.8
UPLINK EARTH STATION				
Earth Station Diameter (meters)	4.0	4.0	2.4	1.8
Earth Station Gain (dBi)	53.1	53.1	48.7	46.2
Earth Station Elevation Angle	8.5	8.5	8.5	8.5
DOWNLINK EARTH STATION				
Earth Station Diameter (meters)	4.0	4.0	2.4	2.4
Earth Station Gain (dBi)	51.4	51.4	47.0	47.0
Earth Station G/T (dB/K)	29.0	29.0	25.0	25.0
Earth Station Elevation Angle	7.9	7.9	7.9	7.9
COMPOSITE LINK PERFORMANCE				
Uplink Earth Station HPA Intermodulation C/N (dB)	26.7	25.2	24.0	22.5
C/N Thermal Uplink (dB)	21.6	20.0	18.9	17.4
Uplink Interference C/I (dB)	200.0	200.0	200.0	200.0
Uplink Adjacent Satellite C/I (dB)	21.9	20.4	19.3	17.8
Intermodulation C/IM (dB)	37.8	26.2	25.1	24.7
Downlink Thermal C/N (dB)	19.6	17.8	12.6	11.1
Downlink Interference C/I (dB)	28.6	28.2	25.6	25.3
Downlink Adjacent Satellite C/I (dB)	15.1	14.1	8.4	6.9
Subtotal C/N (dB)	12.3	11.0	6.4	4.9
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	10.8	9.5	4.9	3.4
Minimum Required C/N (dB)	7.3	7.3	1.8	0.8
Number of Carriers	2	4	14	15
CARRIER DENSITY LEVELS				
Uplink Power Density (dBW/Hz)	-53.6	-55.1	-51.9	-50.9
Downlink EIRP Density At Beam Peak (dBW/Hz)	-26.7	-27.9	-29.1	-30.5