

# Engineering Statement

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## 1 Introduction

Intelsat License LLC (“Intelsat”) seeks authority in this application to launch and operate a new satellite designated as Intelsat 33e. This spacecraft will operate from 60.0° E.L. and will replace the Intelsat 904 spacecraft currently operating at that location. After commencement of Intelsat 33e’s operation, Intelsat 904 will be relocated to another orbital location.

The characteristics of the Intelsat 33e 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.

## 2 Spacecraft Overview

Intelsat 33e is a Boeing model 702MP spacecraft that is capable of operating in C-band, Ku-band, and Ka-band frequencies listed in the table below.

C-band:	Uplink:	5850 – 6725 MHz
	Downlink:	3625 – 4200 MHz
Ku-band:	Uplink:	13750 – 13850 MHz
		14000 – 14500 MHz
		17300 – 17800 MHz
	Downlink:	10950 – 12200 <sup>1</sup> MHz
		12500 – 12600 MHz
Ka-band:	Uplink:	28100 – 30000 MHz
	Downlink:	18300 – 20200 MHz

The spacecraft provides the following coverage:

C-band:	South Zone Beam:	Sub-Saharan Africa
	6 Spot Beams:	Central Africa, Europe, Middle East, South East Asia, South Asia and Australia
	Global Beam:	Global Coverage

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<sup>1</sup> Intelsat does not plan to use the 11200-11450 MHz band at this orbital location.

Ku-band:	70 Gateway and	
	User Spot beams:	Africa, Europe, Middle East and Asia
	Wide Beam:	Europe, Middle East, and Asia
Ka-band:	4 Spot Beams:	Europe, Middle East and Russia
	Global Beam:	Global Coverage

## 2.1 Spacecraft Characteristics

Intelsat 33e is a three-axis stabilized type spacecraft that has a rectangular outer body structure. Intelsat 33e utilizes two deployable solar array wings and a number of deployable and non-deployable antennas.

The Intelsat 33e spacecraft is composed of the following subsystems:

- 1) Thermal
- 2) Power
- 3) Attitude Control
- 4) Propulsion
- 5) Telemetry, Command and Ranging (“TC&R”)
- 6) Uplink Power Control (“ULPC”)
- 7) 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 33e 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.

A summary of the basic spacecraft characteristics is provided in Exhibit 1.

## 2.2 Communication Subsystem

Intelsat 33e provides active communication channels at C-band, Ku-band, and Ka-band frequencies. The C-band payload employs channels having a bandwidth of 36 MHz, 72 MHz, 184 MHz and 369 MHz. The Ku-band payload employs channels having bandwidths of 27 MHz, 48.6 MHz, 81 MHz, 97.2 MHz, 111.6 MHz, 194.4 MHz, 216 MHz and 441 MHz. The Ka-band payload employs channels having bandwidths of 441

MHz and 1900 MHz.<sup>2</sup> The Intelsat 33e frequency and polarization plan is provided in the Schedule S. Due to the extensive number of channel combinations, the uplink channels and downlink channels have been listed separately in the Schedule S S10 “Space Station Transponders” table.

Intelsat 33e utilizes a multiple spot-beam architecture in C-band, Ku-band, and Ka-band. In view of the large number of spot beams, only the coverage contours and performance characteristics for a single representative spot beam are provided for each spot beam type in the Schedule S. The latitude and longitude of each spot beam’s maximum gain point on the Earth is provided in Exhibit 2 in conformance with Section 25.114(c)(4)(vii)(B) of the Commission’s rules. Additionally, Intelsat has included the Schedule S beam designation for all beams in Exhibit 3.

Exhibits 4 and 5 provide the beam parameters for the Intelsat 33e 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 33e can be commanded through the use of two of four available command channels centered at the frequencies 5850.5 MHz, 5853.0 MHz, 6422.0 MHz and 6424.5 MHz. The spacecraft telemetry is received through two of four telemetry channels centered at the frequencies 4197.25 MHz, 4197.75 MHz, 4198.25 MHz and 4198.75 MHz.

The coverage patterns of the on-station command and telemetry beams are provided in the Schedule S in the format prescribed in Section 25.114(c)(4)(vi)(A) of the Commission’s rules. The pipe and hemispheric beams used for orbital maneuvers and on-station emergencies 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

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<sup>2</sup> The 1900 MHz channel is capable of being switched in polarization. As a result, all of the frequencies can be utilized in either Right Hand Circular Polarization (“RHCP”) or Left Hand Circular Polarization (“LHCP”).

S. The Intelsat 33e command and telemetry subsystem performance is summarized in Exhibit 6.

## **2.4 Uplink Power Control Subsystem**

Intelsat 33e utilizes two C-band, three Ku-band, and one Ka-band ULPC channels. The C-band ULPC channel center frequencies are 3626.29 MHz and 3628.89 MHz. The Ku-band ULPC channel center frequencies are 10951.29 MHz, 11698.68 MHz, and 12503.37 MHz. The Ka-band ULPC channel center frequency is 20199.5 MHz.

The coverage patterns of the C-band, Ku-band, and Ka-band ULPC 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 33e ULPC subsystem performance is summarized in Exhibit 6.

## **2.5 Satellite Station-Keeping**

The spacecraft will be maintained within  $0.05^\circ$  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 and Emission Designators**

Intelsat 33e is to be a general purpose communications satellite and has been designed to support various services offered within the Intelsat's satellite system. Depending upon the needs of the users, the transponders on Intelsat 33e 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 ("PFD")**

The power flux density (“PFD”) limits for space stations operating in the 3650 – 4200 MHz, 10950 – 11200 MHz, 11450 – 11700 MHz, 18300 – 18800 MHz, 18800 – 19300 MHz, and 19300 – 19700 MHz bands are contained in Section 25.208 of the Commission’s rules. With respect to the frequency bands 3625 – 3650 MHz and 12500 – 12600 MHz, there are PFD limits specified in No. 21.16 of the ITU Radio Regulations. Neither the Commission’s rules nor the ITU Radio Regulations specify any PFD limits for the 11700 – 12200 MHz and 19700 – 20200 MHz bands applicable to geostationary satellites operating in the fixed satellite service.

The maximum PFD levels for the Intelsat 33e transmissions were calculated for the 3625 – 4200 MHz, 10950 – 11200 MHz, 11450 – 11700 MHz, 12500 – 12600 MHz and 18300 – 19700 MHz bands. The PFD levels were also calculated for the Intelsat 33e telemetry and ULPC carriers. The results are provided in Schedule S and show that the downlink power flux density levels of the Intelsat 33e carriers do not exceed the limits specified in Sections 25.208 of the Commission’s rules or the limits specified in 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 33e 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 33e emissions.

## **6 Orbital Location**

Intelsat requests that it be assigned the 60.0° E.L. orbital location for Intelsat 33e. The 60.0° E.L. location satisfies Intelsat 33e 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.

As previously indicated, Intelsat 33e will replace Intelsat 904 at 60.0° E.L. These two satellites will be nominally collocated during transfer of traffic and Intelsat will ensure that sufficient spatial separation is achieved between these two satellites through the use of orbit eccentricity and inclination offsets.

## **7 Interference Analysis**

The impact of the proposed Intelsat 33e emissions on the transmissions of adjacent satellites located at 58.0° E.L.<sup>3</sup> and 62.0° E.L.<sup>4</sup> was analyzed. Interference analysis was

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<sup>3</sup> At the time of submission of this application, Astra 1G and Kazsat-3 are located at 59.9° E.L. and 58.5° E.L., respectively. Neither satellite was included in the interference analysis because both are closer than

conducted for a number of representative carriers at non-planned C-band, Ku-band, and Ka-band frequencies. It was assumed that there was a hypothetical satellite having the same operating characteristics as Intelsat 33e at the 58.0° E.L. orbital location. At the 62.0° E.L. orbital location, it was assumed that both the Intelsat 902 satellite (C-band and Ku-band) and a hypothetical satellite having the same operating characteristics as Intelsat 33e (Ka-band only) were operational.

For the satellite located at 58.0° E.L., it was assumed that the adjacent satellites were Intelsat 33e, located at 60.0° E.L., and a hypothetical satellite having the same operating characteristics as Intelsat 33e located at 56.0° E.L.<sup>5</sup>

For the Intelsat 902 C-band and Ku-band satellite located at 62.0° E.L., it was assumed that the adjacent satellites were Intelsat 33e, located at 60.0° E.L., and Intelsat 906, located at 64.0° E.L. For the hypothetical Ka-band satellite located at 62.0° E.L., it was assumed that the adjacent satellites were Intelsat 33e, located at 60.0° E.L., and a hypothetical satellite having the same operating characteristics as Intelsat 33e located at 64.0° E.L.

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) of the FCC 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) At C-band frequencies, degradation due to rain is not considered, given that rain (attenuation) effects are insignificant at C-band.
- d) At Ku- and Ka-band frequencies rain attenuation predictions are derived using Recommendation ITU-R P.618.
- e) At Ku- and Ka-band frequencies, increase in noise temperature of the receiving earth station due to rain is taken into account.
- f) For the cases where the transponder operates in a multi-carrier mode, the effects due to intermodulation interference are taken into account.

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two degrees from Intelsat 33e's planned location and neither are licensed by the United States. The use of either satellite would be inconsistent with a two-degree orbital separation environment and policy. Intelsat is currently coordinating Intelsat 33e operations with both parties.

<sup>4</sup> At the time of submission of this application, the ABS-4 satellite is located at 61°E.L. but does not have any shared bands with Intelsat 33e and is not licensed by the United States. Therefore, ABS-4 was not considered for the interference analysis.

<sup>5</sup> At the time of submission of this application, the Express ATI satellite is operating at 56° E.L. but was not included as an interference source since it is operating using the BSS Planned Bands.

All assumptions and the results of the analysis are documented in Exhibits 7, 8, and 9. The Intelsat 33e transmissions will be limited to those levels contained in Sections 25.212(c) and (d) and Section 25.138 of the Commission's rules, as applicable, unless higher levels are coordinated with affected adjacent satellite operators. In any case, pursuant to the results in Exhibits 7, 8, and 9, the uplink power density of the Intelsat 33e digital carriers will not exceed the levels specified below:

- a) 5850 – 6725 MHz: -38.7 dBW/Hz
- b) 13750 – 13850 MHz: -45.0<sup>6</sup> dBW/Hz
- c) 14000 – 14500 MHz: -45.0 dBW/Hz
- d) 17300 – 17800 MHz: -60.0 dBW/Hz
- e) 28100 – 30000 MHz: -55.0 dBW/Hz

The downlink EIRP density of Intelsat 33e digital carriers will not exceed the levels specified below:

- a) 3625 – 4200 MHz: -32.0 dBW/Hz
- b) 10950 – 11200 MHz: -20.0 dBW/Hz
- c) 11450 – 11700 MHz: -20.0 dBW/Hz
- d) 11700 – 12200 MHz: -17.2 dBW/Hz
- e) 12500 – 12600 MHz: -31.0 dBW/Hz
- f) 18300 – 20200 MHz: -15.0 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**

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<sup>6</sup> On-axis EIRP density will not exceed -10 dBW/Hz.

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 the removal of all stored energy on the spacecraft by depleting all propellant tanks, venting all pressurized systems and by leaving the batteries in a permanent discharge state.

### **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 904 during the traffic transition period, Intelsat 33e 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.

During the transition of traffic from Intelsat 904, Intelsat will take all the necessary steps, to minimize the risk of collision between Intelsat 904 and Intelsat 33e. With the exception of Intelsat 904, Intelsat 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 Intelsat 33e. Intelsat is also not aware of any system with an overlapping station-keeping volume with Intelsat 33e 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 will dispose of the spacecraft by moving it to a minimum altitude above the altitude established by the IADC formula. Intelsat has reserved 70.0 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, Intelsat has used simplifying assumptions as permitted under the Commission’s Orbital Debris Report and Order.<sup>7</sup> For reference, the effective area to mass ratio ( $Cr \cdot A/M$ ) of the Intelsat 33e spacecraft is 0.045 m<sup>2</sup>/kg, resulting in a minimum perigee disposal altitude under the IADC formula of at most 280 kilometers above the geostationary arc. Accordingly, the Intelsat 33e planned disposal orbit complies with the FCC’s rules.

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<sup>7</sup> *Mitigation of Orbital Debris*, Second Report and Order, IB Docket No. 02-54, FCC 04-130 (rel. June 21, 2004).



## **9 ITU Filing**

Intelsat 33e's operations in the 3625 – 4200 MHz, 5850 – 6425 MHz, 10950 – 11200 MHz, 114500 – 11700 MHz, 14000 – 14500 MHz bands have been coordinated under the Administration of the United States' legacy International Telecommunication Union ("ITU") filings: INTELSAT6 60E, INTELSAT8 60E, and INTELSAT9 60E.

Intelsat plans to support operations in the 11700 – 12200 GHz and 17300 – 17800 MHz bands with the Administration of the United Kingdom's ITU filing, INTELSAT KUEXT 60E, and the Administration of Papua New Guinea's ITU filing, NEW DAWN BSS-2. Intelsat requests that the United States state its non-objection to the use of the United Kingdom's and Papua New Guinea's filings INTELSAT KUEXT 60E and NEW DAWN BSS-2 for operation of the Intelsat 33e satellite, in accordance with ITU Circular Letter CR/333 (May 2, 2012).

Intelsat 33e's operations in the 6425 – 6725 MHz, 12500 – 12600 MHz, 13750 – 13850 MHz, 18300 – 20200 GHz, and 28100 – 30000 MHz bands will be supported by the Administration of the Papua New Guinea's ITU filings, NEW DAWN 21 and NEW DAWN 44. Intelsat requests that the United States state its non-objection to Intelsat's use of Papua New Guinea's ITU filing NEW DAWN 21 by the Intelsat 33e satellite, in accordance with ITU Circular Letter CR/333 (May 2, 2012).

## **10 TC&R Control Earth Stations**

Intelsat will conduct TC&R operations through one or more of the following earth stations: Fuchsstadt, Germany; Hartebeeshoek, South Africa; Mingenew, Australia; Kumsan, South Korea; or Fucino, Italy. Additionally, Intelsat is capable of remotely controlling Intelsat 33e from its facilities in McLean, VA or in Long Beach, CA.

# Certification Statement

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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/

March 27, 2015

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Roya Shambayati

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Date

Intelsat

Director, Spectrum Strategy

**EXHIBIT 1**  
**SUMMARY OF SPACECRAFT CHARACTERISTICS**

<b>General Spacecraft Characteristics</b>	
Spacecraft Name	Intelsat 33e
Orbital Location	60.0° E.L.
Spacecraft Manufacturer	Boeing
Spacecraft Model	702 MP
Spacecraft Type	3-axis stabilized
Spacecraft Expected Lifetime	15 years
Eclipse Capability	100%
Station-keeping	
North-South	±0.05°
East-West	±0.05°
Propulsion Type	Liquid Propulsion

## EXHIBIT 2 SPOT BEAM LOCATIONS

Beam Designation	Longitude (°E)	Latitude (°N)	Beam Designation	Longitude (°E)	Latitude (°N)
<b>C-Band User Beams</b>			<b>Ku-Band User Beams</b>		
C Spot 2	19.9	-3.8	Ku Spot 21	50.7	16.3
C Spot 3	106.3	-0.7	Ku Spot 22	35.3	18.8
C Spot 4	4.8	45.8	Ku Spot 23	43.6	22.1
C Spot 5	71.2	31.7	Ku Spot 24	34.3	27.9
C Spot 6	109.2	28.6	Ku Spot 25	8.9	32.3
C Spot 7	114.8	-26.3	Ku Spot 26	21.5	35.4
<b>Ku-Band User Beams</b>			Ku Spot 27	31.5	38.8
Ku Spot 1	16.8	-31.9	Ku Spot 28	-17.2	47.1
Ku Spot 2	30.5	-27.0	Ku Spot 29	9.0	49.7
Ku Spot 3	22.2	-22.0	Ku Spot 30	43.1	31.5
Ku Spot 4	33.8	-18.1	Ku Spot 31	51.8	25.2
Ku Spot 5	86.9	7.0	Ku Spot 32	58.3	19.8
Ku Spot 6	15.3	-15.6	Ku Spot 33	23.3	53.3
Ku Spot 7	27.0	-12.9	Ku Spot 34	41.4	42.7
Ku Spot 8	36.8	-9.5	Ku Spot 35	52.1	34.8
Ku Spot 9	18.9	-6.9	Ku Spot 36	60.2	28.9
Ku Spot 10	29.3	-4.7	Ku Spot 37	66.7	22.9
Ku Spot 11	38.3	-1.4	Ku Spot 38	73.0	17.6
Ku Spot 12	9.6	-1.9	Ku Spot 39	79.9	12.3
Ku Spot 13	21.3	1.5	Ku Spot 40	35.9	58.4
Ku Spot 14	31.1	3.8	Ku Spot 41	51.8	47.2
Ku Spot 15	42.8	5.0	Ku Spot 42	61.3	39.3
Ku Spot 16	50.1	8.1	Ku Spot 43	69.2	32.7
Ku Spot 17	10.2	6.4	Ku Spot 44	75.5	26.5
Ku Spot 18	22.1	9.8	Ku Spot 45	82.0	20.9
Ku Spot 19	35.0	10.4	Ku Spot 46	89.2	15.5
Ku Spot 20	43.0	13.4	Ku Spot 47	101.4	2.4

<b>Beam Designation</b>	<b>Longitude (°E)</b>	<b>Latitude (°N)</b>	<b>Beam Designation</b>	<b>Longitude (°E)</b>	<b>Latitude (°N)</b>
<b>Ku-Band User Beams</b>			<b>Ku-Band Gateway Beams</b>		
Ku Spot 48	49.5	67.3	G1	16.8	-31.9
Ku Spot 49	64.2	52.7	G2	30.5	-27.0
Ku Spot 50	72.5	43.8	G3	22.2	-22.0
Ku Spot 51	92.7	24.4	G4	33.8	-18.1
Ku Spot 52	82.7	60.0	G5	86.9	7.0
Ku Spot 53	87.9	49.1	G6	15.3	-15.6
Ku Spot 54	113.9	18.7	G7	27.0	-12.9
Ku Spot 55	111.0	9.1	<b>Ka-Band Gateway Beams</b>		
Ku Spot 56	117.1	29.2	Ka3	22.2	-22.0
Ku Spot 57	97.0	10.2	Ka4	33.8	-18.1
Ku Spot 58	110.4	-4.6	Ka5	86.9	7.0
Ku Spot 59	112.5	38.1	Ka6	15.3	-15.6
Ku Spot 60	-6.2	14.2			
Ku Spot 61	9.0	18.8			
Ku Spot 62	25.1	17.7			
Ku Spot 63	102.5	45.8			

## EXHIBIT 3

### Beam Polarizations and GXT File Names

Schedule S Beam GXT File Names								
Linear Polarization					Circular Polarization			
Beam Designation	Uplink (H-Pol.)	Uplink (V-Pol.)	Downlink (H-Pol.)	Downlink (V-Pol.)	Uplink (LHCP)	Uplink (RHCP)	Downlink (LHCP)	Downlink (RHCP)
<b>C-Band Beams</b>								
User Beams	----	CUVU	CUHD	----	CULU	CURU	CULD	CURD
Global Beam	----	----	----	----	CGLU	CGRU	CGLD	CGRD
South Zone Beam	----	----	----	----	CSLU	CSRU	CSLD	CSRD
ULPC	----	----	----	----	----	----	CLLD*	CLRD*
Telemetry Global	----	----	----	TGVD	----	----	----	----
Command Global	----	CGVU	----	----	----	----	----	----
Telemetry Pipe	----	----	----	----	----	----	TPLD*	----
Telemetry Hemi	----	----	----	----	----	----	THLD*	----
Command Pipe	----	----	----	----	CPLU*	----	----	----
Command Hemi	----	----	----	----	CHLU*	----	----	----
<b>Ku-Band Beams</b>								
User Beams	KUHU	KUVU	KUHD	KUVD	----	----	----	----
Wide Beam	KWHU	KWVU	KWHD	KWVD	----	----	----	----
ULPC2	----	----	----	----	----	----	----	KLRD*
ULPC3	----	----	----	----	----	----	KLLD*	----
ULPC4	----	----	----	KLVD*	----	----	----	----
Gateway Beams	KGHU	KGVU	KGHD	KGVD	----	----	----	----
<b>Ka-Band Beams</b>								
Gateway Beams	AWHU	AWVU	----	----	----	----	----	----
Global Beam	----	----	----	----	AGLU	AGRU	AGLD	AGRR
ULPC	----	----	----	----	----	----	ALLD*	ALRD*

\* GXT files are not provided for the indicated beams because their -8 dB gain contours extend beyond the edge of the Earth.

## EXHIBIT 4

### COMMUNICATION SUBSYSTEM UPLINK BEAM PARAMETERS

<b>Beam Name</b>	C-Band User LHCP	C-Band User RHCP	C-Band User Vertical
<b>Schedule S Beam ID</b>	CULU	CURU	CUVU
<b>Frequency Band (MHz)</b>	5850-6725	5850-6725	5925-6350
<b>Polarization</b>	LHCP	RHCP	Vertical
<b>Beam Peak Gain (dBi)</b>	36.9	36.9	37.2
<b>G/T (dB/K)</b>	11.1	11.1	12.7
<b>Minimum SFD-- (dBW/m<sup>2</sup>)</b>	-111.8	-111.8	-112.9
<b>Maximum SFD-- (dBW/m<sup>2</sup>)</b>	-83.8	-83.8	-84.9
<b>Beam Name</b>	C-Band User Horizontal	C-Band South Zone LHCP	C-Band South Zone RHCP
<b>Schedule S Beam ID</b>	CUHU	CSLU	CSRU
<b>Frequency Band (MHz)</b>	5925-6725	5850-6725	5850-6725
<b>Polarization</b>	Horizontal	LHCP	RHCP
<b>Beam Peak Gain (dBi)</b>	37.2	28.0	27.9
<b>G/T (dB/K)</b>	12.2	0.6	0.6
<b>Minimum SFD-- (dBW/m<sup>2</sup>)</b>	-111.8	-108.3	-108.2
<b>Maximum SFD-- (dBW/m<sup>2</sup>)</b>	-83.8	-80.3	-80.2
<b>Beam Name</b>	C-Band Global LHCP	C-Band Global RHCP	Ku-Band Gateway Vertical
<b>Schedule S Beam ID</b>	CGLU	CGRU	KGVU
<b>Frequency Band (MHz)</b>	6325-6425	6325-6425	17300-17800
<b>Polarization</b>	LHCP	RHCP	Vertical
<b>Beam Peak Gain (dBi)</b>	20.7	20.7	42.0
<b>G/T (dB/K)</b>	-5.8	-5.8	14.9
<b>Minimum SFD-- (dBW/m<sup>2</sup>)</b>	-110.2	-110.2	-108.9
<b>Maximum SFD-- (dBW/m<sup>2</sup>)</b>	-82.2	-82.2	-80.9
<b>Beam Name</b>	Ku-Band Gateway Horizontal	Ku-Band User Vertical	Ku-Band User Horizontal
<b>Schedule S Beam ID</b>	KGHU	KUVU	KUHU
<b>Frequency Band (MHz)</b>	17300-17800	13750-13850 14000-14500	14000-14500
<b>Polarization</b>	Horizontal	Vertical	Horizontal
<b>Beam Peak Gain (dBi)</b>	40.8	41.1	41.3
<b>G/T (dB/K)</b>	14.3	14.6	14.8
<b>Minimum SFD-- (dBW/m<sup>2</sup>)</b>	-108.2	-114.8	-115.0
<b>Maximum SFD-- (dBW/m<sup>2</sup>)</b>	-80.2	-86.8	-87.0
<b>Beam Name</b>	Ku-Band Wideband Vertical	Ku-Band Wideband Horizontal	Ka-Band Gateway Vertical
<b>Schedule S Beam ID</b>	KWVU	KWHU	AWVU
<b>Frequency Band (MHz)</b>	14200-14300	14200-14300	29500-30000
<b>Polarization</b>	Vertical	Horizontal	Vertical
<b>Beam Peak Gain (dBi)</b>	27.2	27.2	38.7
<b>G/T (dB/K)</b>	0.1	0.1	11.6
<b>Minimum SFD-- (dBW/m<sup>2</sup>)</b>	-106.1	-106.1	-105.6
<b>Maximum SFD-- (dBW/m<sup>2</sup>)</b>	-78.1	-78.1	-77.6
<b>Beam Name</b>	Ka-Band Gateway Horizontal	Ka-Band Global LHCP	Ka-Band Global RHCP
<b>Schedule S Beam ID</b>	AWHU	AGLU	AGRU
<b>Frequency Band (MHz)</b>	29500-30000	28100-30000	28100-30000
<b>Polarization</b>	Horizontal	LHCP	RHCP
<b>Beam Peak Gain (dBi)</b>	37.9	21.7	21.7
<b>G/T (dB/K)</b>	10.7	-7.2	-7.2
<b>Minimum SFD-- (dBW/m<sup>2</sup>)</b>	-104.6	-84.3	-84.3
<b>Maximum SFD-- (dBW/m<sup>2</sup>)</b>	-76.6	-72.3	-72.3

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

## EXHIBIT 5

### COMMUNICATION SUBSYSTEM DOWNLINK BEAM PARAMETERS

Beam Name	C-Band User LHCP	C-Band User RHCP	C-Band User Horizontal	C-Band User Vertical
Schedule S Beam ID	CULD	CURD	CUHD	CUVD
Frequency Band (MHz)	3625-4115	3625-4115	3625-4115	3625-4115
Polarization	LHCP	RHCP	Horizontal	Vertical
Peak Antenna Gain (dBi)	36.0	36.0	34.2	34.3
EIRP (dBW)	51.7	51.6	50.4	50.1
Beam Name	C-Band South Zone LHCP	C-Band South Zone RHCP	C-Band Global LHCP	C-Band Global RHCP
Schedule S Beam ID	CSLD	CSRD	CGLD	CGRD
Frequency Band (MHz)	3625-4200	3625-4200	4115-4200	4115-4200
Polarization	LHCP	RHCP	LHCP	RHCP
Peak Antenna Gain (dBi)	26.6	26.4	20.8	20.8
EIRP (dBW)	42.3	42.2	36.3	36.3
Beam Name	Ku-Band Gateway Horizontal	Ku-Band Gateway Vertical	Ku-Band User Horizontal	Ku-Band User Vertical
Schedule S Beam ID	KGHD	KGVD	KUHD	KUVD
Frequency Band (MHz)	10950 - 11200 11450 - 11700 11700 - 12200	10950 - 11200 11450 - 11700 11700 - 12200	10950 - 11200 11450 - 11700 11700 - 12200	10950 - 11200 11450 - 11700 11700 - 12200 12500-12600
Polarization	Horizontal	Vertical	Horizontal	Vertical
Peak Antenna Gain (dBi)	40.7	38.7	40.3	40.3
EIRP (dBW)	61.3	59.4	58.1	57.6
Beam Name	Ku-Band Wide Beam Horizontal	Ku-Band Wide Beam Vertical	Ka-Band Global LHCP	Ka-Band Global RHCP
Schedule S Beam ID	KWHD	KWVD	AGLD	AGRD
Frequency Band (MHz)	11170 - 11480	11170 - 11480	18300-20200	18300-20200
Polarization	Horizontal	Vertical	LHCP	RHCP
Peak Antenna Gain (dBi)	24.7	24.8	20.7	20.7
EIRP (dBW)	44.8	45.0	34.5	34.5

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



**EXHIBIT 6**  
**TC&R SUBSYSTEM CHARACTERISTICS**

<b>Beam Name</b>	Command - Global	Command – Pipe	Command – Hemi
<b>Schedule S Beam ID</b>	CGVU	CPLU	CHLU
<b>Frequencies (MHz)</b>	6422, 6424.5	6422, 6424.5	5850.5, 5853
<b>Polarization</b>	Vertical	LHCP	LHCP
<b>Beam Peak Gain (dBi)</b>	20	1.2	4.8
<b>Minimum Flux Density -- (dBW/m<sup>2</sup>)</b>	-101	-80	-80
<b>Maximum Flux Density -- (dBW/m<sup>2</sup>)</b>	-75	-60	-60
<b>Beam Name</b>	Telemetry - Global	Telemetry – Pipe	Telemetry – Hemi
<b>Schedule S Beam ID</b>	TGVD	TPLD	THLD
<b>Frequencies (MHz)</b>	4197.25, 4197.75, 4198.25, 4198.75		
<b>Polarization</b>	Vertical	LHCP	LHCP
<b>Peak Antenna Gain (dBi)</b>	20.1	7.6	3.3
<b>Maximum EIRP (dBW)</b>	13.7	15.4	11.9
<b>Beam Name</b>	ULPC 1	ULPC 2	ULPC 3
<b>Schedule S Beam ID</b>	CLRD	KLRD	KLLD
<b>Frequencies (MHz)</b>	3626.3	10951.3	11698.7
<b>Polarization</b>	RHCP	RHCP	LHCP
<b>Peak Antenna Gain (dBi)</b>	11.5	18.1	19.4
<b>Maximum EIRP (dBW)</b>	9.4	16	16.8
<b>Beam Name</b>	ULPC 4	ULPC 5	ULPC 6
<b>Schedule S Beam ID</b>	KLVD	CLLD	ALRD/ALLD
<b>Frequencies (MHz)</b>	12503.4	3628.9	20199.5
<b>Polarization</b>	Vertical	LHCP	RHCP or LHCP
<b>Peak Antenna Gain (dBi)</b>	38.7	11.5	21.2
<b>Maximum EIRP (dBW)</b>	16	9.4	22.2

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

## EXHIBIT 7

### INTELSAT 902 - 62°E INTERFERENCE ANALYSIS

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	C-Band Hemi	C-Band Hemi	C-Band Hemi	C-Band Hemi
Uplink Frequency (MHz)	6125	6125	6125	6125
Uplink Beam Polarization	LHCP	LHCP	LHCP	LHCP
Uplink Beam Peak G/T (dB/K)	-2.3	-2.3	-2.3	-2.3
Uplink Beam Peak SFD (dBW/m2)	-85.5	-83.5	-83.5	-83.5
Uplink Relative Contour Level (dB)	-4	-4	-4	-4
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	C-Band Hemi	C-Band Hemi	C-Band Hemi	C-Band Hemi
Downlink Frequency (MHz)	3900	3900	3900	3900
Downlink Beam Polarization	RHCP	RHCP	RHCP	RHCP
Downlink Beam Peak EIRP (dBW)	39.2	39.2	39.2	39.2
Downlink Relative Contour Level (dB)	-4	-4	-4	-4
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
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
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Intelsat 906	Intelsat 906	Intelsat 906	Intelsat 906
Orbital Location	64.0E	64.0E	64.0E	64.0E
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
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	5.0	5.0	2.4	1.8
Earth Station Gain (dBi)	47.7	47.7	41.4	38.9
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	5.5	5.5	5.0	5.0
Earth Station Gain (dBi)	45.4	45.4	44.6	44.6
Earth Station G/T (dB/K)	27.0	27.0	22.7	22.7
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	73.5	69.0	61.1	58.1
Uplink Path Loss, Clear Sky (dB)	-200.9	-200.9	-200.9	-200.9
Satellite G/T(dB/K)	-6.0	-6.0	-6.0	-6.0
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Uplink Thermal C/N(dB)	20.9	21.9	22.7	21.8
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	31.8	23.8	15.8	12.8
Downlink Path Loss, Clear Sky (dB)	-196.8	-196.8	-196.8	-196.8
Downlink Earth Station G/T (dB/K)	27.0	27.0	22.7	22.7
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	16.3	13.8	10.2	9.3
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	27.6	28.6	29.3	28.5
C/N Thermal Uplink (dB)	20.9	21.9	22.7	21.8
Uplink Interference C/I (dB)	24.2	27.7	24.9	20.7
Uplink Adjacent Satellite C/I (dB)	14.5	15.5	16.2	15.4
Intermodulation C/IM (dB)	34.0	22.6	24.3	24.1
Downlink Thermal C/N (dB)	16.3	13.8	10.2	9.3
Downlink Interference C/I (dB)	24.8	22.3	19.2	19.3
Downlink Adjacent Satellite C/I (dB)	13.2	7.9	7.7	6.9
Subtotal C/N (dB)	9.1	6.0	5.0	4.2
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.6	4.5	3.5	2.7
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	2	8	50	88
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-48.5	-47.5	-40.4	-38.8
Downlink EIRP Density At Beam Peak (dBW/Hz)	-42.5	-45.0	-44.3	-45.2

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	C-Band Zone	C-Band Zone	C-Band Zone	C-Band Zone
Uplink Frequency (MHz)	6125	6125	6125	6125
Uplink Beam Polarization	RHCP	RHCP	RHCP	RHCP
Uplink Beam Peak G/T (dB/K)	4.5	4.5	4.5	4.5
Uplink Beam Peak SFD (dBW/m2)	-88.5	-76.5	-76.5	-76.5
Uplink Relative Contour Level (dB)	-5	-5	-5	-5
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	C-Band Zone	C-Band Zone	C-Band Zone	C-Band Zone
Downlink Frequency (MHz)	3900	3900	3900	3900
Downlink Beam Polarization	LHCP	LHCP	LHCP	LHCP
Downlink Beam Peak EIRP (dBW)	39.2	39.2	39.2	39.2
Downlink Relative Contour Level (dB)	-7	-7	-7	-7
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
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
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Intelsat 906	Intelsat 906	Intelsat 906	Intelsat 906
Orbital Location	64.0E	64.0E	64.0E	64.0E
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
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	7.5	11.0	5.0	5.0
Earth Station Gain (dBi)	51.2	54.5	48.6	47.7
Earth Station Elevation Angle	5	5	5	5
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	7.5	5.5	5.0	5.0
Earth Station Gain (dBi)	48.1	45.4	44.6	44.6
Earth Station G/T (dB/K)	29.0	27.0	22.7	22.7
Earth Station Elevation Angle	5	5	5	5
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	73.8	77.3	69.4	67.0
Uplink Path Loss, Clear Sky (dB)	-200.9	-200.9	-200.9	-200.9
Satellite G/T(dB/K)	-0.5	-0.5	-0.5	-0.5
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Uplink Thermal C/N(dB)	26.7	35.7	36.5	36.2
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	32.5	24.5	16.5	14.1
Downlink Path Loss, Clear Sky (dB)	-196.8	-196.8	-196.8	-196.8
Downlink Earth Station G/T (dB/K)	29.0	27.0	22.7	22.7
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	19.0	14.5	10.9	10.6
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	25.9	35.0	35.7	35.4
C/N Thermal Uplink (dB)	26.7	35.7	36.5	36.2
Uplink Interference C/I (dB)	28.1	39.7	41.0	43.6
Uplink Adjacent Satellite C/I (dB)	14.8	23.9	24.6	24.3
Intermodulation C/IM (dB)	34.0	22.6	24.0	24.4
Downlink Thermal C/N (dB)	19.0	14.5	10.9	10.6
Downlink Interference C/I (dB)	26.3	23.1	21.0	21.0
Downlink Adjacent Satellite C/I (dB)	12.1	6.8	6.7	6.4
Subtotal C/N (dB)	9.4	5.9	5.1	4.8
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.9	4.4	3.6	3.3
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	2	8	50	88
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-51.7	-46.0	-39.3	-38.7
Downlink EIRP Density At Beam Peak (dBW/Hz)	-41.8	-44.3	-43.6	-43.9

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	C-Band Global	C-Band Global	C-Band Global	C-Band Global
Uplink Frequency (MHz)	6400	6400	6400	6400
Uplink Beam Polarization	LHCP/RHCP	LHCP/RHCP	LHCP/RHCP	LHCP/RHCP
Uplink Beam Peak G/T (dB/K)	-6.3	-6.3	-6.3	-6.3
Uplink Beam Peak SFD (dBW/m2)	-88.6	-87.6	-87.6	-87.6
Uplink Relative Contour Level (dB)	-3	-3	-3	-3
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	C-Band Global	C-Band	C-Band	C-Band
Downlink Frequency (MHz)	4175	4175	4175	4175
Downlink Beam Polarization	RHCP/LHCP	RHCP/LHCP	RHCP/LHCP	RHCP/LHCP
Downlink Beam Peak EIRP (dBW)	34.5	34.5	34.5	34.5
Downlink Relative Contour Level (dB)	-2	-2	-2	-2
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
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
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Intelsat 906	Intelsat 906	Intelsat 906	Intelsat 906
Orbital Location	64.0E	64.0E	64.0E	64.0E
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
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	7.5	3.7	1.8	1.8
Earth Station Gain (dBi)	51.2	45.1	38.9	38.9
Earth Station Elevation Angle	5	5	5	5
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	7.5	7.5	5.5	5.0
Earth Station Gain (dBi)	48.1	48.1	45.4	44.6
Earth Station G/T (dB/K)	29.0	29.0	27.0	22.7
Earth Station Elevation Angle	5	5	5	5
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	74.0	67.3	59.5	57.1
Uplink Path Loss, Clear Sky (dB)	-201.3	-201.3	-201.3	-201.3
Satellite G/T(dB/K)	-9.5	-9.5	-9.5	-9.5
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Uplink Thermal C/N(dB)	17.5	16.3	17.2	16.9
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	31.2	21.9	13.9	11.5
Downlink Path Loss, Clear Sky (dB)	-197.5	-197.5	-197.5	-197.5
Downlink Earth Station G/T (dB/K)	29.0	29.0	27.0	22.7
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	17.1	13.2	11.9	7.3
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	26.6	25.5	26.3	26.0
C/N Thermal Uplink (dB)	17.5	16.3	17.2	16.9
Uplink Interference C/I (dB)	28.6	25.9	27.7	32.4
Uplink Adjacent Satellite C/I (dB)	15.0	13.9	14.7	14.4
Intermodulation C/IM (dB)	200.0	23.9	26.7	26.5
Downlink Thermal C/N (dB)	17.1	13.2	11.9	7.3
Downlink Interference C/I (dB)	33.4	23.4	24.7	21.9
Downlink Adjacent Satellite C/I (dB)	13.3	9.2	7.1	5.9
Subtotal C/N (dB)	9.3	6.1	5.0	2.9
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.8	4.6	3.5	1.4
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	1	4	25	44
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-51.5	-46.6	-39.5	-39.8
Downlink EIRP Density At Beam Peak (dBW/Hz)	-43.0	-46.9	-46.2	-46.5

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot
Uplink Frequency (MHz)	14250	14250	14250	14250
Uplink Beam Polarization	H/V	H/V	H/V	H/V
Uplink Beam Peak G/T (dB/K)	8.7	8.7	8.7	8.7
Uplink Beam Peak SFD (dBW/m2)	-88.6	-87.6	-87.6	-87.6
Uplink Relative Contour Level (dB)	-6	-6	-6	-6
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot
Downlink Frequency (MHz)	11075	11075	11075	11075
Downlink Beam Polarization	V/H	V/H	V/H	V/H
Downlink Beam Peak EIRP (dBW)	53.4	53.4	53.4	53.4
Downlink Relative Contour Level (dB)	-6	-6	-6	-6
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
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
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Intelsat 906	Intelsat 906	Intelsat 906	Intelsat 906
Orbital Location	64.0E	64.0E	64.0E	64.0E
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
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	2.4	1.2	1.2	1.2
Earth Station Gain (dBi)	48.7	42.6	42.6	42.6
Earth Station Elevation Angle	5	5	5	5
<b>DOWNLINK EARTH STATION</b>				
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	5	5	5	5
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	73.0	61.0	52.0	50.0
Uplink Path Loss, Clear Sky (dB)	-209.0	-209.0	-209.0	-209.0
Satellite G/T(dB/K)	2.3	2.3	2.3	2.3
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Uplink Thermal C/N(dB)	20.6	14.1	13.8	13.9
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	38.9	32.9	24.9	22.5
Downlink Path Loss, Clear Sky (dB)	-206.8	-206.8	-206.8	-206.8
Downlink Earth Station G/T (dB/K)	29.0	29.0	25.0	25.0
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	15.4	14.9	11.6	11.3
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	24.7	20.5	21.2	20.9
C/N Thermal Uplink (dB)	20.6	14.1	13.8	13.9
Uplink Interference C/I (dB)	26.3	21.2	28.4	28.0
Uplink Adjacent Satellite C/I (dB)	26.0	21.9	22.6	22.3
Intermodulation C/IM (dB)	50.2	27.2	28.9	29.3
Downlink Thermal C/N (dB)	15.4	14.9	11.6	11.3
Downlink Interference C/I (dB)	24.2	21.9	25.0	24.6
Downlink Adjacent Satellite C/I (dB)	11.2	10.7	6.9	6.5
Subtotal C/N (dB)	9.1	7.5	4.9	4.5
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.6	6.0	3.4	3.0
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	2	8	50	88
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-50.0	-50.4	-50.7	-50.6
Downlink EIRP Density At Beam Peak (dBW/Hz)	-35.4	-35.9	-35.2	-35.5

## EXHIBIT 8

### HYPOTHETICAL 62°E SATELLITE INTERFERENCE ANALYSIS

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	Ka-Band Global	Ka-Band Global	Ka-Band Global	Ka-Band Global
Uplink Frequency (MHz)	29750	29750	29750	29750
Uplink Beam Polarization	LHCP/RHCP	LHCP/RHCP	LHCP/RHCP	LHCP/RHCP
Uplink Beam Peak G/T (dB/K)	-7.3	-7.3	-7.3	-7.3
Uplink Beam Peak SFD (dBW/m2)	-82.3	-78.3	-78.3	-78.3
Uplink Relative Contour Level (dB)	-4	-4	-4	-4
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	Ka-Band Global	Ka-Band Global	Ka-Band Global	Ka-Band Global
Downlink Frequency (MHz)	19950	19950	19950	19950
Downlink Beam Polarization	RHCP/LHCP	RHCP/LHCP	RHCP/LHCP	RHCP/LHCP
Downlink Beam Peak EIRP (dBW)	34.5	34.5	34.5	34.5
Downlink Relative Contour Level (dB)	-3	-3	-3	-3
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
Uplink Power Density (dBW/Hz)	-56.5	-56.5	-56.5	-56.5
Beam Peak Downlink EIRP Density (dBW/Hz)	-18.9	-18.9	-18.9	-18.9
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 64E	Hypothetical 64E	Hypothetical 64E	Hypothetical 64E
Orbital Location	64.0E	64.0E	64.0E	64.0E
Uplink Power Density (dBW/Hz)	-56.5	-56.5	-56.5	-56.5
Beam Peak Downlink EIRP Density (dBW/Hz)	-18.9	-18.9	-18.9	-18.9
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	12.0	10.0	10.0	10.0
Earth Station Gain (dBi)	69.5	67.9	67.9	67.9
Earth Station Elevation Angle	21	21	21	21
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	10.0	9.0	9.0	9.0
Earth Station Gain (dBi)	64.6	63.6	63.6	63.6
Earth Station G/T (dB/K)	39.5	42.5	42.5	42.5
Earth Station Elevation Angle	23	23	23	23
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	87.1	80.0	71.3	69.2
Uplink Path Loss, Clear Sky (dB)	-215.5	-215.5	-215.5	-215.5
Satellite G/T (dB/K)	-11.3	-11.3	-11.3	-11.3
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Uplink Thermal C/N(dB)	14.6	13.0	13.0	13.0
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	31.1	23.1	13.3	11.2
Downlink Path Loss, Clear Sky (dB)	-212.0	-212.0	-212.0	-212.0
Downlink Earth Station G/T (dB/K)	39.5	42.5	42.5	42.5
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	12.9	13.4	12.3	12.3
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	43.9	42.9	42.2	42.8
C/N Thermal Uplink (dB)	14.6	13.0	13.0	13.0
Uplink Interference C/I (dB)	15.2	12.3	11.7	12.3
Uplink Adjacent Satellite C/I (dB)	200.0	200.0	200.0	200.0
Intermodulation C/IM (dB)	200.0	27.2	19.3	18.8
Downlink Thermal C/N (dB)	12.9	13.4	12.3	12.3
Downlink Interference C/I (dB)	33.8	23.9	23.9	24.0
Downlink Adjacent Satellite C/I (dB)	17.9	14.4	13.2	12.3
Subtotal C/N (dB)	8.8	7.1	6.2	6.1
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.3	5.6	4.7	4.6
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	1	3	29	42
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-56.7	-56.7	-56.7	-56.7
Downlink EIRP Density At Beam Peak (dBW/Hz)	-43.2	-45.7	-46.8	-46.8

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	Ka-Band Spot	Ka-Band Spot	Ka-Band Spot	Ka-Band Spot
Uplink Frequency (GHz)	28930	28930	28930	28930
Uplink Beam Polarization	H/V	H/V	H/V	H/V
Uplink Beam Peak G/T (dB/K)	11.6	11.6	11.6	11.6
Uplink Beam Peak SFD (dBW/m2)	-96.9	-84.9	-84.9	-84.9
Uplink Relative Contour Level (dB)	-4	-4	-4	-4
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot
Downlink Frequency (GHz)	11150	11150	11150	11150
Downlink Beam Polarization	V/H	V/H	V/H	V/H
Downlink Beam Peak EIRP (dBW)	57.6	57.6	57.6	57.6
Downlink Relative Contour Level (dB)	-6	-6	-6	-6
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
Uplink Power Density (dBW/Hz)	-56.5	-56.5	-56.5	-56.5
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 64E	Hypothetical 64E	Hypothetical 64E	Hypothetical 64E
Orbital Location	64.0	64.0	64.0	64.0
Uplink Power Density (dBW/Hz)	-56.5	-56.5	-56.5	-56.5
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N_Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	2.4	2.4	3.0	2.4
Earth Station Gain (dBi)	55.5	55.5	57.5	55.5
Earth Station Elevation Angle	21	21	21	21
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	4.0	1.8	1.8	1.2
Earth Station Gain (dBi)	51.4	44.5	44.5	40.9
Earth Station G/T (dB/K)	29.0	23.3	23.3	19.8
Earth Station Elevation Angle	31	31	31	31
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	69.0	67.8	58.9	57.0
Uplink Path Loss, Clear Sky (dB)	-215.5	-215.5	-215.5	-215.5
Satellite G/T(dB/K)	7.6	7.6	7.6	7.6
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Uplink Thermal C/N(dB)	15.4	19.7	19.5	19.7
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	43.8	37.8	29.7	26.4
Downlink Path Loss, Clear Sky (dB)	-205.7	-205.7	-205.7	-205.7
Downlink Earth Station G/T (dB/K)	29.0	23.3	23.3	19.8
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	21.4	15.2	15.8	11.1
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	25.5	30.6	29.9	30.9
C/N Thermal Uplink (dB)	15.4	19.7	19.5	19.7
Uplink Interference C/I (dB)	13.0	13.0	13.0	13.0
Uplink Adjacent Satellite C/I (dB)	27.6	200.0	200.0	200.0
Intermodulation C/IM (dB)	19.1	18.6	19.1	18.8
Downlink Thermal C/N (dB)	21.4	15.2	15.8	11.1
Downlink Interference C/I (dB)	23.0	23.0	23.0	23.0
Downlink Adjacent Satellite C/I (dB)	17.2	9.7	10.3	6.1
Subtotal C/N (dB)	9.1	6.6	7.0	4.0
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.6	5.1	5.5	2.5
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	3	12	78	136
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-60.8	-56.5	-58.7	-56.5
Downlink EIRP Density At Beam Peak (dBW/Hz)	-30.5	-31.0	-30.4	-31.6

## EXHIBIT 9

### HYPOTHETICAL 58°E SATELLITE INTERFERENCE ANALYSIS

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	C-Band South Zone	C-Band South Zone	C-Band South Zone	C-Band South Zone
Uplink Frequency (MHz)	6125	6125	6125	6125
Uplink Beam Polarization	LHCP/RHCP	LHCP/RHCP	LHCP/RHCP	LHCP/RHCP
Uplink Beam Peak G/T (dB/K)	0.6	0.6	0.6	0.6
Uplink Beam Peak SFD (dBW/m2)	-82.3	-85.3	-85.3	-85.3
Uplink Relative Contour Level (dB)	-2	-2	-2	-2
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	C-Band South Zone	C-Band South Zone	C-Band South Zone	C-Band South Zone
Downlink Frequency (MHz)	3900	3900	3900	3900
Downlink Beam Polarization	RHCP/LHCP	RHCP/LHCP	RHCP/LHCP	RHCP/LHCP
Downlink Beam Peak EIRP (dBW)	42.2	42.2	42.2	42.2
Downlink Relative Contour Level (dB)	-2	-2	-2	-2
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
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
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E
Orbital Location	56.0E	56.0E	56.0E	56.0E
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
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	7.5	2.4	1.8	1.8
Earth Station Gain (dBi)	51.2	41.4	38.9	38.9
Earth Station Elevation Angle	5	5	5	5
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	5.5	5.0	5.0	3.7
Earth Station Gain (dBi)	45.4	44.6	44.6	41.9
Earth Station G/T (dB/K)	27.0	22.7	22.7	22.7
Earth Station Elevation Angle	5	5	5	5
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	73.2	64.6	56.7	54.3
Uplink Path Loss, Clear Sky (dB)	-201.0	-201.0	-201.0	-201.0
Satellite G/T (dB/K)	-1.6	-1.6	-1.6	-1.6
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Quantization Noise Degradation	3.6	2.2	2.2	2.2
Uplink Thermal C/N(dB)	21.3	19.6	20.4	20.1
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	34.0	28.0	20.0	17.6
Downlink Path Loss, Clear Sky (dB)	-197.0	-197.0	-197.0	-197.0
Downlink Earth Station G/T (dB/K)	27.0	22.7	22.7	22.7
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	18.3	13.5	14.2	13.9
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	26.4	23.3	24.1	23.7
C/N Thermal Uplink (dB)	21.3	19.6	20.4	20.1
Uplink Interference C/I (dB)	26.5	23.4	24.1	23.8
Uplink Adjacent Satellite C/I (dB)	14.2	11.1	11.9	11.6
Intermodulation C/IM (dB)	41.8	21.3	22.8	23.3
Downlink Thermal C/N (dB)	18.3	13.5	14.2	13.9
Downlink Interference C/I (dB)	24.2	17.7	18.1	22.5
Downlink Adjacent Satellite C/I (dB)	12.4	11.1	10.0	5.4
Subtotal C/N (dB)	9.1	6.2	6.3	3.7
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.6	4.7	4.8	2.2
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	2	8	50	88
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-52.3	-45.6	-42.3	-42.6
Downlink EIRP Density At Beam Peak (dBW/Hz)	-40.3	-40.8	-40.1	-40.4



<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	C-Band Global	C-Band Global	C-Band Global	C-Band Global
Uplink Frequency (MHz)	6375	6375	6375	6375
Uplink Beam Polarization	LHCP/RHCP	LHCP/RHCP	LHCP/RHCP	LHCP/RHCP
Uplink Beam Peak G/T (dB/K)	-5.8	-5.8	-5.8	-5.8
Uplink Beam Peak SFD (dBW/m2)	-85.2	-82.2	-82.2	-82.2
Uplink Relative Contour Level (dB)	-2	-2	-2	-2
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	C-Band Global	C-Band Global	C-Band Global	C-Band Global
Downlink Frequency (MHz)	4150	4150	4150	4150
Downlink Beam Polarization	RHCP/LHCP	RHCP/LHCP	RHCP/LHCP	RHCP/LHCP
Downlink Beam Peak EIRP (dBW)	36.3	36.3	36.3	36.3
Downlink Relative Contour Level (dB)	-2	-2	-2	-2
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
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
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E
Orbital Location	56.0E	56.0E	56.0E	56.0E
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
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	7.5	3.7	1.8	1.8
Earth Station Gain (dBi)	51.2	45.1	38.9	38.9
Earth Station Elevation Angle	34	34	34	34
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	5.5	3.7	3.7	3.7
Earth Station Gain (dBi)	45.4	41.9	41.9	41.9
Earth Station G/T (dB/K)	27.0	22.7	22.7	22.7
Earth Station Elevation Angle	35	35	35	35
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	71.8	65.4	57.6	55.2
Uplink Path Loss, Clear Sky (dB)	-200.2	-200.2	-200.2	-200.2
Satellite G/T(dB/K)	-7.8	-7.8	-7.8	-7.8
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Quantization Noise Degradation	0.4	0.2	0.2	0.2
Uplink Thermal C/N(dB)	17.7	17.0	17.9	17.6
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	32.7	26.7	18.7	16.3
Downlink Path Loss, Clear Sky (dB)	-196.5	-196.5	-196.5	-196.5
Downlink Earth Station G/T (dB/K)	27.0	22.7	22.7	22.7
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	17.5	12.7	13.4	13.1
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	25.1	24.2	25.0	24.7
C/N Thermal Uplink (dB)	17.7	17.0	17.9	17.6
Uplink Interference C/I (dB)	26.4	25.4	26.2	26.0
Uplink Adjacent Satellite C/I (dB)	12.9	11.9	12.8	12.5
Intermodulation C/IM (dB)	200.0	23.5	26.2	25.9
Downlink Thermal C/N (dB)	17.5	12.7	13.4	13.1
Downlink Interference C/I (dB)	28.0	23.3	22.7	23.6
Downlink Adjacent Satellite C/I (dB)	14.2	9.7	10.3	10.0
<b>Subtotal C/N (dB)</b>				
Subtotal C/N (dB)	8.9	5.9	6.6	6.3
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.4	4.4	5.1	4.8
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	1	4	25	44
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-53.7	-48.5	-41.4	-41.7
Downlink EIRP Density At Beam Peak (dBW/Hz)	-41.6	-42.1	-41.4	-41.7

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	C-Band Spot	C-Band Spot	C-Band Spot	C-Band Spot
Uplink Frequency (MHz)	6125	6125	6125	6125
Uplink Beam Polarization	Linear/Circular	Linear/Circular	Linear/Circular	Linear/Circular
Uplink Beam Peak G/T (dB/K)	12.7	12.7	12.7	12.7
Uplink Beam Peak SFD (dBW/m2)	-85.9	-89.9	-89.9	-89.9
Uplink Relative Contour Level (dB)	-6	-6	-6	-6
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	C-Band Spot	C-Band Spot	C-Band Spot	C-Band Spot
Downlink Frequency (MHz)	3900	3900	3900	3900
Downlink Beam Polarization	Linear/Circular	Linear/Circular	Linear/Circular	Linear/Circular
Downlink Beam Peak EIRP (dBW)	50.1	50.1	50.1	50.1
Downlink Relative Contour Level (dB)	-4	-4	-4	-4
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
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
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E
Orbital Location	56.0E	56.0E	56.0E	56.0E
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
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	7.5	2.4	1.8	1.8
Earth Station Gain (dBi)	51.2	41.4	38.9	38.9
Earth Station Elevation Angle	15	15	15	15
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	5.0	3.7	3.7	3.7
Earth Station Gain (dBi)	44.6	41.9	41.9	41.9
Earth Station G/T (dB/K)	22.7	22.7	22.7	22.7
Earth Station Elevation Angle	17	17	17	17
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	72.7	62.9	54.8	52.4
Uplink Path Loss, Clear Sky (dB)	-200.6	-200.6	-200.6	-200.6
Satellite G/T(dB/K)	6.7	6.7	6.7	6.7
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Quantization Noise Degradation	3.4	1.4	1.4	1.4
Uplink Thermal C/N(dB)	29.7	27.4	28.0	27.7
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	35.3	29.3	21.5	19.1
Downlink Path Loss, Clear Sky (dB)	-196.7	-196.7	-196.7	-196.7
Downlink Earth Station G/T (dB/K)	22.7	22.7	22.7	22.7
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	15.6	15.1	16.0	15.7
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	25.6	25.5	26.3	26.0
C/N Thermal Uplink (dB)	29.7	27.4	28.0	27.7
Uplink Interference C/I (dB)	39.0	34.7	35.6	39.0
Uplink Adjacent Satellite C/I (dB)	13.7	9.4	10.0	9.7
Intermodulation C/IM (dB)	24.0	20.5	22.1	22.5
Downlink Thermal C/N (dB)	15.6	15.1	16.0	15.7
Downlink Interference C/I (dB)	24.5	24.2	24.8	24.9
Downlink Adjacent Satellite C/I (dB)	13.2	9.8	10.5	10.2
Subtotal C/N (dB)	9.0	5.8	6.5	6.2
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.5	4.3	5.0	4.7
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	5	20	128	224
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-52.8	-47.3	-44.2	-44.5
Downlink EIRP Density At Beam Peak (dBW/Hz)	-39.0	-39.5	-38.6	-38.9

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	Ku-Band Wideband	Ku-Band Wideband	Ku-Band Wideband	Ku-Band Wideband
Uplink Frequency (MHz)	14225	14225	14225	14225
Uplink Beam Polarization	H/V	H/V	H/V	H/V
Uplink Beam Peak G/T (dB/K)	0.1	0.1	0.1	0.1
Uplink Beam Peak SFD (dBW/m2)	-88.1	-79.1	-79.1	-79.1
Uplink Relative Contour Level (dB)	-2	-2	-2	-2
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	Ku-Band Wideband	Ku-Band Wideband	Ku-Band Wideband	Ku-Band Wideband
Downlink Frequency (GHz)	11175	11175	11175	11175
Downlink Beam Polarization	V/H	V/H	V/H	V/H
Downlink Beam Peak EIRP (dBW)	44.8	44.8	44.8	44.8
Downlink Relative Contour Level (dB)	-6	-6	-6	-6
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
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
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E
Orbital Location	56.0E	56.0E	56.0E	56.0E
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
<b>CARRIER INFORMATION</b>				
Carrier ID	27M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	27650	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	20002.1	7500	1024	630.7
Allocated Bandwidth(kHz)	27000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	4.0	4.0	4.0	4.0
Earth Station Gain (dBi)	53.1	53.1	53.1	53.1
Earth Station Elevation Angle	5	5	5	5
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	4.0	6.0	4.0	4.0
Earth Station Gain (dBi)	51.4	57.4	51.4	51.4
Earth Station G/T (dB/K)	29.0	34.0	29.0	29.0
Earth Station Elevation Angle	5	5	5	5
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	71.4	69.9	61.7	59.5
Uplink Path Loss, Clear Sky (dB)	-209.6	-209.6	-209.6	-209.6
Satellite G/T(dB/K)	-1.6	-1.6	-1.6	-1.8
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	20.0	7.5	1.0	0.6
Quantization Noise Degradation	2.0	2.0	2.0	2.0
Uplink Thermal C/N(dB)	13.8	16.5	17.0	16.7
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	38.6	28.3	20.0	17.9
Downlink Path Loss, Clear Sky (dB)	-206.8	-206.8	-206.8	-206.8
Downlink Earth Station G/T (dB/K)	29.0	34.0	29.0	29.0
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	20.0	7.5	1.0	0.6
Downlink Thermal C / N(dB)	16.4	15.3	10.7	10.7
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	28.0	29.7	30.4	30.1
C/N Thermal Uplink (dB)	13.8	16.5	17.0	16.7
Uplink Interference C/I (dB)	33.0	35.4	36.1	35.8
Uplink Adjacent Satellite C/I (dB)	25.0	27.7	28.2	28.1
Intermodulation C/IM (dB)	200.0	37.1	41.1	40.3
Downlink Thermal C/N (dB)	16.4	15.3	10.7	10.7
Downlink Interference C/I (dB)	31.1	24.6	22.8	23.6
Downlink Adjacent Satellite C/I (dB)	12.4	10.0	6.7	6.8
Subtotal C/N (dB)	9.0	8.0	4.9	4.9
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.5	6.5	3.4	3.4
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	1	3	19	33
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-54.7	-52.0	-51.5	-51.6
Downlink EIRP Density At Beam Peak (dBW/Hz)	-34.4	-40.5	-40.1	-40.1

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot
Uplink Frequency (MHz)	14200	14200	14200	14200
Uplink Beam Polarization	H/V	H/V	H/V	H/V
Uplink Beam Peak G/T (dB/K)	14.9	14.9	14.9	14.9
Uplink Beam Peak SFD (dBW/m2)	-96.9	-93.9	-93.9	-93.9
Uplink Relative Contour Level (dB)	-6	-6	-6	-6
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot
Downlink Frequency (MHz)	11150	11150	11150	11150
Downlink Beam Polarization	V/H	V/H	V/H	V/H
Downlink Beam Peak EIRP (dBW)	57.6	57.6	57.6	57.6
Downlink Relative Contour Level (dB)	-6	-6	-6	-6
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
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
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E
Orbital Location	56.0E	56.0E	56.0E	56.0E
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
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	1.2	1.2	1.2	1.2
Earth Station Gain (dBi)	42.6	42.6	42.6	42.6
Earth Station Elevation Angle	32	32	32	32
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	1.8	1.8	1.2	1.2
Earth Station Gain (dBi)	44.5	44.5	40.9	40.9
Earth Station G/T (dB/K)	23.3	23.3	19.8	19.8
Earth Station Elevation Angle	31	31	31	31
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	63.3	58.1	50.2	47.7
Uplink Path Loss, Clear Sky (dB)	-207.3	-207.3	-207.3	-207.3
Satellite G/T(dB/K)	9.0	9.0	9.0	9.0
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Quantization Noise Degradation	2.5	2.5	2.5	2.5
Uplink Thermal C/N(dB)	16.8	17.1	17.9	17.5
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	46.1	37.9	30.0	27.5
Downlink Path Loss, Clear Sky (dB)	-205.7	-205.7	-205.7	-205.7
Downlink Earth Station G/T (dB/K)	23.3	23.3	19.8	19.8
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	18.0	15.3	12.6	12.2
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	28.0	29.7	30.4	30.1
C/N Thermal Uplink (dB)	16.8	17.1	17.9	17.5
Uplink Interference C/I (dB)	24.0	24.3	24.5	24.3
Uplink Adjacent Satellite C/I (dB)	15.6	15.9	16.6	16.3
Intermodulation C/IM (dB)	45.4	28.6	30.2	30.6
Downlink Thermal C/N (dB)	18.0	15.3	12.6	12.2
Downlink Interference C/I (dB)	27.4	23.7	24.3	24.0
Downlink Adjacent Satellite C/I (dB)	12.4	9.7	6.6	6.3
Subtotal C/N (dB)	9.0	7.2	4.9	4.6
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.5	5.7	3.4	3.1
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	2	11	68	119
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-53.6	-53.3	-52.5	-52.9
Downlink EIRP Density At Beam Peak (dBW/Hz)	-28.2	-30.9	-30.1	-30.5

<b>UPLINK BEAM INFORMATION</b>				
Uplink Beam Name	Ka-Band Spot	Ka-Band Spot	Ka-Band Spot	Ka-Band Spot
Uplink Frequency (GHz)	28930	28930	28930	28930
Uplink Beam Polarization	H/V	H/V	H/V	H/V
Uplink Beam Peak G/T (dB/K)	11.6	11.6	11.6	11.6
Uplink Beam Peak SFD (dBW/m2)	-96.6	-84.6	-84.6	-84.6
Uplink Relative Contour Level (dB)	-4	-4	-4	-4
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot	Ku-Band Spot
Downlink Frequency (GHz)	11150	11150	11150	11150
Downlink Beam Polarization	V/H	V/H	V/H	V/H
Downlink Beam Peak EIRP (dBW)	57.6	57.6	57.6	57.6
Downlink Relative Contour Level (dB)	-6	-6	-6	-6
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 33e	Intelsat 33e	Intelsat 33e	Intelsat 33e
Orbital Location	60.0E	60.0E	60.0E	60.0E
Uplink Power Density (dBW/Hz)	-56.5	-56.5	-56.5	-56.5
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E	Hypothetical 56E
Orbital Location	56.0E	56.0E	56.0E	56.0E
Uplink Power Density (dBW/Hz)	-56.5	-56.5	-56.5	-56.5
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	9M00G7W	1M43G7W	820KG7W
Carrier Modulation	QPSK	QPSK	QPSK	BPSK
Information Rate(kbps)	36860	10875	1024	256
Code Rate	3/4x188/204	3/4	1/2	0.431
Occupied Bandwidth(kHz)	26664.7	7500	1024	630.7
Allocated Bandwidth(kHz)	36000	9000	1434	820
Minimum C/N, Rain (dB)	7.3	4.3	3.3	1.3
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	2.4	2.4	3.0	2.4
Earth Station Gain (dBi)	55.5	55.5	57.5	55.5
Earth Station Elevation Angle	21	21	21	21
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	4.0	1.8	1.8	1.2
Earth Station Gain (dBi)	51.4	44.5	44.5	40.9
Earth Station G/T (dB/K)	29.0	23.3	23.3	19.8
Earth Station Elevation Angle	31	31	31	31
<b>UPLINK PERFORMANCE</b>				
Uplink Earth Station EIRP (dBW)	69.0	67.8	58.9	57.0
Uplink Path Loss, Clear Sky (dB)	-215.5	-215.5	-215.5	-215.5
Satellite G/T(dB/K)	7.6	7.6	7.6	7.6
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Uplink Thermal C/N(dB)	15.4	19.7	19.5	19.7
<b>DOWNLINK PERFORMANCE</b>				
Downlink EIRP per Carrier (dBW)	43.8	37.8	29.7	26.4
Downlink Path Loss, Clear Sky (dB)	-205.7	-205.7	-205.7	-205.7
Downlink Earth Station G/T (dB/K)	29.0	23.3	23.3	19.8
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (MHz)	26.7	7.5	1.0	0.6
Downlink Thermal C / N(dB)	21.4	15.2	15.8	11.1
<b>COMPOSITE LINK PERFORMANCE</b>				
Uplink Earth Station HPA Intermodulation C/N (dB)	25.5	30.6	29.9	30.9
C/N Thermal Uplink (dB)	15.4	19.7	19.5	19.7
Uplink Interference C/I (dB)	13.0	13.0	13.0	13.0
Uplink Adjacent Satellite C/I (dB)	27.6	200.0	200.0	200.0
Intermodulation C/IM (dB)	19.1	18.6	19.1	18.8
Downlink Thermal C/N (dB)	21.4	15.2	15.8	11.1
Downlink Interference C/I (dB)	23.0	23.0	23.0	23.0
Downlink Adjacent Satellite C/I (dB)	17.2	9.7	10.3	6.1
Subtotal C/N (dB)	9.1	6.6	7.0	4.0
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	7.6	5.1	5.5	2.5
Minimum Required C/N (dB)	7.3	4.3	3.3	1.3
Number of Carriers	3	12	78	136
<b>CARRIER DENSITY LEVELS</b>				
Uplink Power Density (dBW/Hz)	-60.8	-56.5	-58.7	-56.5
Downlink EIRP Density At Beam Peak (dBW/Hz)	-30.5	-31.0	-30.4	-31.6