Exhibit A

TECHNICAL NARRATIVE

(Response to Form 312 Question 43)

CONTENTS

1 - GENERAL SYSTEM DESCRIPTION

BSSNET2A-95W will consist of a geostationary satellite located at the 95.15 ° W.L. orbital location and associated ground station equipment. Since this orbital location is slightly offset (0.15°) from the presumptive “on-grid” location at 95° W.L. established in Appendix F of the *BSS R&O*[1] (an “Appendix F slot”), SPECTRUM FIVE proposes to operate at reduced power (reduced more than 0.43 dB compared to the maximum power allowed for a non-offset location) and with reduced interference protection, as contemplated in Section 25.262(b) of the Commission’s rules.

BSSNET2A-95W is designed to provide DTH services in the "Reverse Band" frequency ranges of 17.3-17.7 GHz (Space-to-Earth) and 24.75-25.25 GHz (Earth-to-Space). The Telemetry, Tracking and Control (“TT&C”) functions will also be provided at the edges of these same frequency bands.

The BSSNET2A-95W satellite is capable of supporting 26 "17/24" uplink/downlink "national" transponders (13 LHCP and 13 RHCP channels of 26 MHz nominal bandwidth) providing coverage via a "CONUS+" national beam of all 50 states (CONUS, Alaska and Hawaii), and Puerto Rico. All national

---

[1] *See Establishment of Policies and Service Rules for the Broadcasting Satellite Service at the 17.3-17.7 GHz Frequency Band and at the 17.7-17.8 GHz Frequency Band Internationally, and at the 24.75-25.25 GHz Frequency Band for Fixed Satellite Services Providing Feeder Links to the Broadcasting-Satellite Service and for the Satellite Services Operating Bi-directionally in the 17.3-17.8 GHz Frequency Band, 22 FCC Rcd. 8842 (2007) (“BSS R&O”).*

programming material will be aggregated and uplinked from the SPECTRUM FIVE broadcast center to be located in the Southwest U.S.

The available 400 MHz of spectrum in CONUS on the downlink will be channelized into 26 transponders (13 channels for each polarization) of 26 MHz nominal bandwidth each, with 29.16 MHz spacing between co-polar channel center frequencies. The cross-polar transponders are not offset relative to the co-polar ones in order to provide the maximum utilization of the operating bandwidth. The uplink is also channelized into 26 transponders (13 channels for each polarization) of 26 MHz nominal bandwidth for each channel, with 29.16 MHz spacing between channel center frequencies. The national broadcast uplink will use the corresponding lowest 400 MHz in the 24.75-25.25 GHz band for distribution of national channels. Full frequency use of both the uplink and downlink spectrum is achieved through the use of the two orthogonal circular polarizations.

2 - SPACE SYSTEM OPERATING CHARACTERISTICS

2.1 FREQUENCY AND POLARIZATION PLAN

Table 2-1 shows the frequency and polarization plan of the BSSNET2A-95W satellite, including the on-station command and telemetry bands for TT&C. National programming is broadcast with 26 MHz for each channel of both polarizations, with a frequency translation of 7,450 MHz between the uplink and downlink center frequencies. Transponders using the same frequency band with orthogonal circular polarizations will maintain co-polar to cross-polar antenna gain of at least 27 dB within the service area.

Transponder Channel	DL Freq (MHz) LCP	UL Freq (MHz) RCP	Transponder Channel	DL Freq (MHz) RCP	UL Freq (MHz) LCP
			Command 1		24,753.00
			Command 2		24,755.00
1	17,325.00	24,775.00	2	17,325.00	24,775.00
3	17,354.16	24,804.16	4	17,354.16	24,804.16
5	17,383.32	24,833.32	6	17,383.32	24,833.32
7	17,412.48	24,862.48	8	17,412.48	24,862.48
9	17,441.64	24,891.64	10	17,441.64	24,891.64
11	17,470.80	24,920.80	12	17,470.80	24,920.80
13	17,499.96	24,949.96	14	17,499.96	24,949.96
15	17,529.12	24,979.12	16	17,529.12	24,979.12
17	17,558.28	25,008.28	18	17,558.28	25,008.28
19	17,587.44	25,037.44	20	17,587.44	25,037.44
21	17,616.60	25,066.60	22	17,616.60	25,066.60
23	17,645.76	25,095.76	24	17,645.76	25,095.76
25	17,674.92	25,124.92	26	17,674.92	25,124.92
			Telemetry 1	17,303.00	
			Telemetry 2	17,306.00	

Table 2-1. Frequency Plan for Transponders and TT&C.

Table 2-2 below illustrates the connection of each national programming uplink channel to its corresponding downlink channel.

Downlink Channel	Freq (MHz)	Downlink Polarization	Uplink Channel	Freq (MHz)	Uplink Polarization	Shift (MHz)
1,2	17,325.00	LCP,RCP	1,2	24,775.00	RCP,LCP	7,450.00
3,4	17,354.16	LCP,RCP	2,4	24,804.16	RCP,LCP	7,450.00
5,6	17,383.32	LCP,RCP	5,6	24,833.32	RCP,LCP	7,450.00
7,8	17,412.48	LCP,RCP	7,8	24,862.48	RCP,LCP	7,450.00
9,10	17,441.64	LCP,RCP	9,10	24,891.64	RCP,LCP	7,450.00

Table 2-2. BSSNET2A-95W CONUS+ Uplink/Downlink Interconnection

As can be seen from Table 2-1 and Table 2-2, the 26 transponders that support national coverage are frequency translated from the 24.75-25.15 GHz satellite receive band by 7,450 MHz for re-transmission in the 17.3-17.7 GHz downlink band.

2.2 COMMUNICATIONS PAYLOAD

2.2.1 Uplink Channel Characteristics

The maximum receive antenna gain, receive system noise temperature, maximum G/T, and minimum Saturation Flux Density for both of the two polarization uplink service beams (SWRR, SWRL) of the BSSNET2A-95W satellite are specified in the accompanying Schedule S. Both polarization beams have identical parameters.

BSSNET2A-95W employs 1.1m diameter uplink receive antennas with a gain of 47.0 dB and a receive G/T of 17.5 dB / ^{o}K. At the peak of both of the receive antenna beams (SWRR, SWRL), the minimum Saturation Flux Density is -104 dBW/m^2 (see Schedule S7(p)). For the uplink beams, the SFD at any G/T contour may be determined using the following formula:

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

where:

SFD_D: SFD at desired G/T level (dBW/m^2)

SFD_P: Minimum SFD at peak G/T (dBW/m^2)

$(G/T)_D$: Desired G/T level (dB/K)

$(G/T)_P$: Peak G/T (dB/K)

A = Transponder attenuator setting (dB), ranging from 0 to 20 dB for the both polarization beams. At the peak of the uplink receive beams, the maximum Saturation Flux Density is therefore -104 dBW/m^2 + 20 dB = -84 dBW/m^2 for both polarization uplink beams.

BSSNET2A-95W will employ input multiplexer ("IMUX") and output multiplexer ("OMUX") filters to limit the bandwidth of received signals. The specified performance for these filters is shown in Table 2-3.

Frequency offset Offset from channel center	Gain relative to channel center frequency (p-p) (dB)		Comments
	Receive	Transmit	
±5 MHz	0.55	0.73	In-Band
±7 MHz	0.8	0.94	
±9 MHz	1.11	1.35	
±11 MHz		2.73	
±12 MHz	1.84	3.56	
±13 MHz	2.47		
±18 MHz	-12	0	Out-of-Band
±21 MHz	-33	-1	
±27 MHz	-38	-10	

Table 2-3. IMUX / OMUX Filtering

2.2.2 Downlink Channel Characteristics

BSSNET2A-95W will employ a dual 2.6m diameter multiple-beam transmit antenna system for 17/24 GHz BSS service to provide CONUS coverage, Alaska, Hawaii and Puerto Rico (the CONUS+ beam). The CONUS+ beam will be capable of transmitting across the frequency band 17.3-17.7 GHz using both LCP and RCP polarizations. The peak transmit gain for both polarization CONUS+ beams is 37.1dB, and the antenna gain contour of the two polarization beams (CONTR, CONTRL) in GXT format, are given in the accompanying Schedule S. The gain contours for each of the CONUS+ beams is also graphically depicted in Figure 2-1 below.

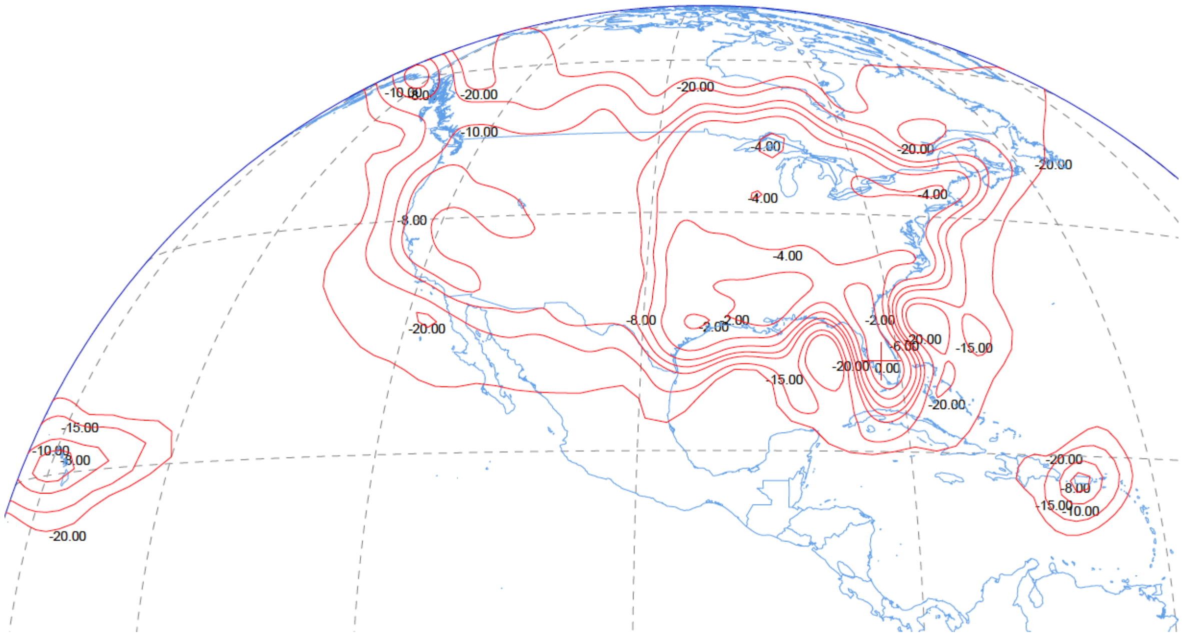

Figure 2-1. CONUS+ Antenna Gain Contours (CONTR, CONTL Beams)

Both of the two cross-polarized national coverage downlink beams (CONTR, CONTL) use "dual" combined output amplifiers (TWTAs) with power amplifier output power of 150 Watts (300 Watts combined). This produces a maximum EIRP in CONUS of 60.2 dBW in the South Florida area (see Schedule S7(m)). The resultant output power from each of these amplifier assemblies is shown in Table 2-4.

	Transmit Output Power (dBW)	Transmit Output Power (W)	Output Losses (dB)	Transmit Antenna Gain (dBi) Peak	Peak Transp EIRP (dBW)
CONUS$^+$ Beam	**23.1**	**300.0**	**1.7**	**37.1**	**60.2**

Table 2-4. TWT Powers and EIRPs (Both Polarizations)

The peak EIRP of both downlink beams corresponds to a maximum EIRP density of 46.1 dBW/MHz for both polarization beams (CONTR, CONTL).

2.3 ANTENNA AXIS ATTITUDE ACCURACY

The associated Schedule S submission provides values for maximum pointing error and rotational error for all beams in Schedule S7(e) and. S7(f). In addition, the worst-case antenna axis attitude accuracy will be 0.17^{o}.

2.4 TT&C SUB-SYSTEM

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

The BSSNET2A-95W TT&C sub-system provides for communications during pre-launch / transfer orbit and spacecraft emergencies, and on-station operations. The TT&C sub-system will operate at the edges of the 17/24 GHz BSS frequency bands.

During transfer orbit and on-station emergencies, TT&C signals will be received and transmitted by the satellite using a combination of antennas on the satellite that create a near omni-directional gain pattern. During normal on-station operation, TT&C signals will be transmitted to and received from a primary TT&C center on the Netherlands island of Curacao. A large earth station will transmit a command link to the satellite. The satellite will receive this signals through a high gain spot beam (CBRR) receive antenna. Telemetry signals will be transmitted to the TT&C center through the same high gain spot beam antenna (CBRT). A second TT&C site in the Southwest U.S. will receive telemetry signals transmitted across the CONUS+ service area through the CONTR transmit antenna. Command signals to the satellite will be transmitted to the satellite from a large earth station antenna, and received by a second high gain transmit spot beam antenna (SWUR), pointed toward the southwest U.S. uplink. A summary of the TT&C subsystem characteristics is given in Table 2-5.

COMMAND LINKS	
Command Modulation	PCM/FSK
Command/Ranging Frequencies (On-Station)	24,753.0 MHz 24 / 2755.0 MHz
Uplink Flux Density	Between -80 and -60 dBW/m^2 (LEOP). Between -93 and -83 dBW/m^2 (on-station).
Satellite Receive Antenna Types	Pseudo-omni antenna during transfer orbit and on-station emergencies High gain spot antenna during on-normal on-station mode (CBRR and SWUR beams) for Curacao and SW US TT&C Center
Polarization of Satellite Receive Antennas	RHCP for all antennas
Peak Deviation (Command/Ranging)	± 400 kHz
TELEMETRY LINKS	
Telemetry/Ranging Frequencies (Launch and Early Operations Phase and On-Station)	17,303.0 MHz / 17,306.0 MHz
Satellite Transmit Antenna Types	Pseudo-omni antenna during transfer orbit and on-station emergencies High gain spot antenna during on-normal on-station mode (CBRT beam) fo Curacao TT&C Center CONUS+ coverage antenna during on-normal on-station operations to SW US TT&C Center (CONTR beam)
Polarization of Satellite Transmit Antennas	RHCP for all antennas
Maximum Downlink EIRP	10 dBW (pseudo-omni antenna for LEOP) 16 dBW CONUS coverage antenna(CONTR) for TLM to SW US TT&C Center 41 dBW (Spot antenna) for TLM to Curacao TT&C Center

Table 2-5 TT&C Performance Characteristics

2.4.1 Telemetry Subsystem Characteristics

The telemetry subsystem performance requirements are summarized in Tables 2-6. Each satellite shall have a unique telemetry address assigned and transmitted in each frame.

Parameter	Performance
Data Word Size	8 bits
Frame Format	256 Words per Frame, 32 Minor Frames
Bit Rate	4800 bits per second
Carrier Stability	≤ ±10 PPM
Subcarrier Stability	≤ =/- 30 ppm
Output Data:	
Nominal Telemetry	Bi-Phase L on 48 kHz Subcarrier
Dwell Telemetry	Bi-Phase L on 72 kHz Subcarrier
Polarization	RHCP

Parameter	Performance
Frequency Transmitter #1 Transmitter #2	 17,303 MHz 17,306 MHz
Modulation Characteristics Type Indices	 Phase 1.0 radian, peak, for single subcarrier 0.7 radians per subcarrier for 2 subcarriers 0.6 radians per subcarrier for 3 subcarriers
Control Functions	Transmitter On/Off Ranging Modulation On/Off Telemetry Modulation On/Off
EIRP Omni (Transfer Orbit) CONUS+ Beam (GSO)	 > 0 dBW > 12.0 dBW
Spurious Outputs	-62 dBc in-band (excluding DC/DC converter frequencies, < -50 dBc out-of-band
Stability	< 2.0 dB, P-P, over life

Table 2-6 Telemetry Subsystem RF Performance

2.4.2 Command Subsystem Characteristics

The satellite command function receives, demodulates, processes, decodes, and executes commands. Command signals from the TT&C control center are received via a dual antenna system: (1) a narrow beam antenna located in the Southwest U.S, for GSO operation, and (2) an omni antenna for launch and transfer orbit operations. The outputs of this system are cross-strapped to dual command decoders. The command system performance is given in Table 2-7.

Parameter	Performance
Modulation	PCM/PSK/FM
Carrier Deviation	± 400 kHz
Command Sub-Carrier Frequency	16 kHz
Bit Rate	≥250 bits per second
Telemetry Verification	Each command verified via telemetry prior to execution
Polarization	RHCP

Frequency Receiver #1 Receiver #2	 24,753 MHz 24,755 MHz
Polarization	RHCP
Carrier Modulation	FM, deviation ±400 kHz
Baseband	16 kHz subcarrier or ranging tones
Dynamic Range	≥ 52 dB
Ranging	Routed to the associated telemetry transmitter on command for turn-around ranging operations

Table 2-7. Command Subsystem Receiver Performance

2.5 LINK MARGINS FOR TT&C GSO OPERATION

The key parameters for the command and telemetry links in normal GSO operation are shown in Appendix C.

3 - SERVICES

SPECTRUM FIVE will use the BSSNET2A-95W satellite to retransmit digital video and audio entertainment, educational and informational programming to subscribers throughout the United States, including Alaska, Hawaii, and the Puerto Rico.

4 - LINK ANALYSIS

Representative communication link budgets for the BSSNET2A-95W satellite are shown in Appendix A (Tables A-1 to A-4). There is one link budget for a city in each of the CONUS downlink power flux density ("PFD") regions defined by the Commission's rules, and one for a non-CONUS region (Hawaii). These budgets include an entry for adjacent satellite interference ("ASI") from neighboring 17/24 GHz BSS satellites nominally spaced at -7.85°, -3.85°, +4.15°, and +8.15° relative to BSSNET2A-95W at 95.15°.W.L. The link budgets also take into account station keeping accuracies of +- 0.05° for both satellites that reduces the case spacing by 0.15° compared to the 4° "on-grid" spacing".

SPECTRUM FIVE will utilize earth station antennas with equivalent circular diameter in the 65 cm range, providing shows availability exceeding 99.7% over a majority of CONUS, and > 99.5% throughout CONUS when operating the link with a high spectral efficiency modulation scheme. Outside CONUS, a slightly larger antenna may be used. These larger antennas can also reduce the interference effects of adjacent satellites operating at maximum power per Commission rules.

5 - EARTH STATIONS

There are three types of earth stations to be used with the BSSNET2A-95W satellite: subscriber terminals with small antennas (65cm), large feeder-link stations using for uplinking the video content (9m), and a large TT&C station antenna (9m). Subscriber terminals for reception outside CONUS may need to be somewhat larger, typically 1 meter.

6 - SATELLITE ORBIT CHARACTERISTICS

The BSSNET2A-95W satellite will be maintained in geosynchronous orbit at the 95.15° W.L. orbital location with a maximum North-South drift of ± 0.05°, and a maximum East-West station keeping of ± 0.05°.

7 - POWER FLUX DENSITY

7.1 CONUS+ OPERATION (NATIONAL BEAMS)

The allowable PFD levels in the 17.3-17.7 GHz band are defined in Section 25.208(w) of the Commission's rules for an "off-grid" orbital location on a regional basis for all conditions, including clear sky, and for all methods of modulation as:

1. In the region of the contiguous United States, located south of 38º North Latitude and east of 100° West Longitude: -115.43 dBW/m^2/MHz;
2. In the region of the contiguous United States, located north of 38º North Latitude and east of 100° West Longitude: -118.43 dBW/m^2/MHz;

3. In the region of the contiguous United States, located west of 100° West Longitude: -121.43 $dBW/m^2/MHz$; and

4. For all regions outside of the contiguous United States including Alaska and Hawaii: -115.43 $dBW/m^2/MHz$.

The reduced values shown above reflect the requirements associated with the EIRP reduction of a 0.15° offset of the 95.15° location explained earlier.

As discussed in Section 2.2.2 above, the maximum downlink EIRP for BSSNET2A-95W will be 60.2 dBW / 26 MHz channel. The maximum power flux density/MHz on the Earth's surface from this emission is calculated as follows:

Peak PFD (dBW/MHz) = EIRP(dB) - Spreading Loss (dB) - BW(dB) - EIRP Offset (dB)

where the bandwidth factor BW(dB) corresponds to the allocated bandwidth of the 8PSK downlink emissions for a transponder (26 MHz) and the EIRP offset is 0.43 dBW. The maximum EIRP of 60.2 dBW for the CONUS+ beam occurs in South Florida. The maximum allowed PFD in this region for "non-offset" operation is -115.43 $dBW/m^2/MHz$. For offset operation of 0.15°, this would allow a maximum ERP value of (-115.0 + 162.4 + 10*log(26) - 0.43dB) = 60.7 dBW for a slot with 0.15° offset from the 95° WL grid location. The maximum EIRP of the BSSNET2A-95W satellite is 60.2 dBW, well below the FCC maximum value for the offset slot at 95.15° West Longitude.

As discussed in Section 2.2.3.1 above, the downlink national beam antenna gain pattern for BSSNET2A-95W shows (1) that the maximum EIRP north of 38° North latitude and east of 100° W.L. is below -118.43 $dBW/m^2/MHz$, and (2) that the maximum EIRP west of 100° W.L. is is below -121.43 dBW/m²/MHz. As a result, the maximum PFD for the CONUS+ beam on the earth's surface complies with Section 25.208(w) for the national beams in each of the applicable regions within CONUS defined in the Commission's rules.

7.2 PFD VALUES OUTSIDE CONUS

Schedule S requires a presentation of PFD maximum values at low elevation angles. These values may be conservatively calculated by using the maximum EIRP for the CONUS+ beam, and calculating the spreading loss at each elevation angle, as shown in Table 7-1 below. In all cases the maximum PFD values are below the required -115.43 dBW/m²/MHz limit for operation outside CONUS with elevation angles between 0° and 25°.

Elev Angle (deg)	0	5	10	15	20	25
Max EIRP (dBW)	60.2	60.2	60.2	60.2	60.2	60.2
Spreading Loss (dB)	-163.39	-163.27	-163.16	-163.05	-162.94	-162.83
Occupied Bandwidth (MHz)	26	26	26	26	26	26
Slant Range, Km.	41678.8	41126.6	40586.0	40060.7	39554.5	39070.4
Max pfd (dBW/m²/MH)	-117.2	-117.1	-117.0	-116.9	-116.9	-116.7
FCC Max pfd (dBW/m²/MH)	-115.4	-115.4	-115.4	-115.4	-115.4	-115.4
Margin (dB)	1.8	1.6	1.5	1.4	1.4	1.3

Table 7-1. Maximum PFD Outside CONUS at Low Elevation Angles

8 - PHYSICAL CHARACTERISTICS OF THE SPACE STATION

SPECTRUM FIVE has not yet settled upon exact specifications for the physical characteristics of the satellite as it has not yet contracted for the construction of the BSSNET2A-95W satellite. Accordingly, the payload envelope has been estimated to allow more than one spacecraft currently available with extensive heritage and fully qualified technology to serve as the design platform. SPECTRUM FIVE anticipates that the key spacecraft characteristics for BSSNET2A-95W are as summarized in the appropriate sections of the accompanying Schedule S.

9 - SPACECRAFT BUS SUBSYSTEM

As discussed above, SPECTRUM FIVE has not yet contracted with a manufacturer for the construction of the BSSNET2A-95W satellite and does not wish to show a preference by providing data specific to any one manufacturer. As such, it is difficult to discuss any specific characteristics of what may comprise the spacecraft bus subsystem beyond that already specified in the accompanying Schedule S.

SPECTRUM FIVE will provide the Commission with full spacecraft physical characteristics one a final spacecraft design has been adopted.

10 - SCHEDULE

SPECTRUM FIVE will contract for, begin construction of, and launch and operate BSSNET2A-95W in accordance with the milestones specified in Section 25.164(a) of the Commission's rules.

11 - INTERFERENCE ANALYSIS (LINK MARGINS)

In order to achieve maximum compatibility between diverse networks, the Commission has established coordination thresholds for earth station off-axis

EIRP density and spacecraft PFD in Sections 25.223 and 25.208, respectively. SPECTRUM FIVE has assumed for the purposes of this application regional maximum downlink PFD values from neighboring systems consistent with Section 25.208(w), maximum feeder link earth station off-axis transmit power density consistent with Section 25.223, and receive earth station compliance with Section 25.224 (Recommendation ITU-R BO.1213). The interference analyses that are included in this application were performed in conjunction with the end-to-end link performance analyses. Abbreviated link budgets are presented in Tables A-1 through A-4 in Appendix A, *i.e.,* one budget for each of the PFD regions defined in Section 25.208(w). In each case, the analysis includes the effects of adjacent satellite interference from satellites nominally located "off-grid" at -7.85°, -3.85°, +4.15°, and +8.15° relative to BSSNET2A-95W (located at 95.15° W.L.) to account for station keeping in evaluating whether the system accommodates the various data rates at acceptable C/(N+I) thresholds. The adjacent satellite interference calculated (including +-0.05° station-keeping of the interfering satellites) demonstrates that the BSSNET2A-95W satellite design described in this application is compatible with the aforementioned transmission parameters and interference environment. Accordingly, the proposed 17/24 GHz BSS satellite would operate successfully in such an environment.

12 - SPACE PATH INTERFERENCE ANALYSIS

SPECTRUM FIVE includes in Appendix B (and supporting files) the required data to provide the predicted transmitting antenna off-axis gain information for the BSSNET2A-111A satellite at 95.15° W.L., and to demonstrate that its predicted off-axis antenna patterns comply with the17/24 GHz Broadcasting Satellite Service 17BSS rules as specified in 47 C.F.R. § 25.264(a). In particular, the power flux density of SPECTRUM FIVE's BSSNET2A-95W space station does not exceed the coordination trigger of -117 dB W/m^2/100 kHz at the location of any prior-filed or operating U.S. DBS space station, with a margin of ~ 40 dB. In addition, consistent with Sections 25.114(d)(18) and 25.264(h)(2) of the Commission's rules, SPECTRUM FIVE will maintain the maximum orbital eccentricity to less than 3.1 x 10^{-4}.

13 - ORBITAL DEBRIS MITIGATION

13.1 ORBITAL DEBRIS AND ORBITAL STORAGE

This section is consistent with the requirements specified in the FCC's Second Report & Order, IB Docket 02-54, Released June 21, 2004, Part 25.114 of the FCC Rules and Public Notice DA –2698 "Disclosure of Orbital Debris Mitigation Plans, Including Amendment of Pending Applications". SPECTRUM FIVE's spacecraft procurement will be initiated during 2016, and have a construction contract in one year after license award. The new spacecraft, BSSNET2A-95W, a Satellite Operations Center, SOC, Network Operations, Center, NOC and feederlink earth stations will be fully defined by specifications, statement of work, test plans and contract. These documents will contain the FCC requirements and objectives described in the Orbital Debris Second Report and Order. In addition, design reviews will include consideration of these requirements and how they will be specifically implemented by the manufacturer and by the

SOC operator, including a requirement to cooperate and exchange vital information with both operators and the SOCs of neighboring satellites.

In addition, SPECTRUM FIVE will establish a contact point for receiving Joint Space Operations Center conjunction notifications, and describe any further measures with respect to collision avoidance procedures.

13.2 SPACECRAFT HARDWARE DESIGN

The SPECTRUM FIVE satellites will not be a source of debris either during the launch, drift or operating mode; no debris is planned to be released. All separation and deployment mechanisms, and any other potential source of debris will be retained by the spacecraft or launch vehicle. The spacecraft TT&C system, vital for orbit raising, will be extremely rugged with regard to meteoroids smaller than 1 cm, by virtue of its redundancy, shielding, separation of components and physical characteristics. Omni-directional antennas are mounted on opposite sides of the spacecraft. These antennas, each providing greater than hemispherical coverage patterns are extremely rugged and capable of providing adequate coverage even if struck and bent or otherwise damaged by a small or medium sized particle. Either omni-directional antenna, for either command or telemetry, is sufficient to enable orbit raising. The command receivers and decoders and telemetry encoders and transmitters will be located within a shielded area and will be totally redundant and physically separated. A single rugged thruster and shielded propellant tank provide the energy for orbit raising. Otherwise, there are no single points of failure in the system. SPECTRUM FIVE will continue to review these aspects of on-orbit operations with the spacecraft manufacturer and will make such adjustments and improvements as appropriate to assure that its spacecraft will not become sources of debris during operations or become derelicts in space due to a collision with a small, medium or large object.

To accomplish these and the following objectives SPECTRUM FIVE plans to incorporate the material of this document into its satellite Technical Specifications, Statement of Work and Test Plans. The Statement of Work will include provisions to review orbit debris mitigation as part of PDR and CDR and to incorporate its requirements, as appropriate, into its Test Plan, including a formal Failure Mode Verification Analysis, FMVA, for orbital debris mitigation involving particularly the TT&C, propulsion and energy systems.

At the appropriate time, SPECTRUM FIVE intends to contract with an appropriate agency that can supply information regarding large orbital debris that may pose a threat to SPECTRUM FIVE's satellites. With the situation as described in this paragraph, only normal station-keeping regimens are necessary to avoid collisions. Frequency and physical coordination during orbital drift cannot be undertaken until license authorization and until the spacecraft and launch vehicle manufacturers are selected and a Launch Plan, launch vehicle and launch scenario developed. No pre-operational orbits requiring STA authority are now anticipated.

13.3 LIMITATION ON RELEASE OF ORBITAL DEBRIS DURING NORMAL OPERATIONS AND FROM COLLISIONS WITH SMALL DEBRIS OR METEOROIDS.

Spectrum Five has assessed the likelihood of the release of debris during normal operations and, based on the present design, believes that there will not be any planned release of debris during normal operations of the Spectrum Five satellites. The spacecraft will be designed with full redundancy for all active components, with shielding where appropriate. Location of critical components will minimize exposure to small debris or meteoroids that might cause catastrophic failure of the spacecraft control system or prevent orbital storage at the end of spacecraft life. SPECTRUM FIVE will continue to review these aspects of on-orbit operations with the spacecraft manufacturer and will make such adjustments and improvements as appropriate to assure that the spacecraft is not the source of debris during operations or becomes derelict in space due to collision with a small object. The following items are those that will be embodied in the procurement, launch and operational documents.

13.4 MINIMIZING ACCIDENTAL EXPLOSIONS

SPECTRUM FIVE will contract for a spacecraft design that limits the probability of accidental explosions that might fragment the satellite during and after completion of mission operations. All batteries and fuel tanks will be monitored for pressure and temperature. Excessive battery charging or discharging will be limited by a monitoring and control system that will automatically limit the possibility of fragmentation. Corrective action, if not automatically undertaken, will be immediately undertaken by the SOC to avoid destruction and fragmentation. Thruster temperatures, impulse and thrust duration are carefully monitored; any thruster may be turned off via redundant valves. Consequently, there is no possibility of explosion during the operating mission. After post-mission disposal all residual fuel is will be consumed, all fuel latch valves will be placed in an "open" position and any pressurized system will be vented. Spacecraft battery trickle charge and all automatic battery charging sequences will be disabled. Consequently, via its spacecraft documentation, design reviews, FMVA, test plans and testing, SPECTRUM FIVE will assess and limit the possibility of accidental explosions during mission operations and assure that all stored energy at the end of the spacecraft's mission operation will be removed.

13.5 SATELLITE COLLISIONS WITH LARGE OBJECTS

SPECTRUM FIVE has considered the possibility of its spacecraft becoming a source of debris by collisions with large debris other than spacecraft. Extensive damage may be done, perhaps rendering it inoperative with respect to its communications mission yet enabling the TT&C and propulsion systems to function sufficiently to permit the achievement of a parking orbit. This capability is due to the inherent ruggedness, shielding and redundancy of the TT&C and propulsion system. The preservation of this capability will be emphasized in SPECTRUM FIVE's procurement documents, design reviews, test plans and FMVA, as described above. Through these methods, Spectrum Five intends to limit the probability of its spacecraft becoming a source of debris by collisions with large debris or other operational space stations.

14 - SAFE FLIGHT PROFILES

SPECTRUM FIVE has reviewed the current FCC authorized satellite networks that potentially overlap the station keeping volume of the BSSNET2A-95W satellite at 95.15° W.L., as well as pending applications published by the FCC. In addition, networks for which a request for coordination has been published by the ITU within ±0.15° of 95.15° W.L. have also been reviewed.

With respect to currently authorized FCC networks, GALAXY-3C [2] (S2381), DLA-1 (S2887)[3] and DLA-2 [4] (S2924) operate at 95.05° W.L.

The ITU has also published several requests for coordination for new satellites operating within ±0.15° **of** 95.15 **°** W.L., including BLUE1 at 95.0 ° W.L, (PNG, 11 Sep 2011 API), MADAR-95W at 95.0 ° W.L, (UAE, 11 Sep 2011 API), USABSN-24 at 95.15 ° W.L, (USA, 11 Feb 2015 API), USASAT-60U at 95.0 ° W.L, (USA, 18 Jul 2013 API), USABSN-24 at 95.15 ° W.L., (USA, 11 Feb 2015 API), and BSSNET4-95W at 95.15 ° W.L. (HOL, 16 Jul 2013 API. With the exception of BSSNET4-95W (which will be self-coordinated with BSSNET2A-95W being a SPECTRUM FIVE satellite with a HOL ITU filing), SPECTRUM FIVE can find no evidence that a satellite construction contract have been awarded or is in progress for these networks.

15 - POST-MISSION DISPOSAL

---

[2] *See* IBFS File No. SAT- MOD-20040405-0079, Conditions of Authorization (Call Sign 2381) for the operation Galaxy 3-C at 95.05° W.L. with E/W station- keeping tolerance of ±0.05°

[3] *See* IBFS File No. SAT- LOA-20121625-00187, Conditions of Authorization (Call Sign 2887) for the operation of Intelsat 30 (DL-1) at 95.05° W.L. with E/W station- keeping tolerance of ±0.05°

[4] *See* IBFS File No. SAT- LOA-20140410-00038, Conditions of Authorization (Call Sign 2924) for the operation of Intelsat 31 (DL-2) at 95.05° W.L. with E/W station- keeping tolerance of ±0.05°

Consistent with the requirements of Section 25.283(a) of the Commission's rules, at the end of the operational life of the satellite, SPECTRUM FIVE will maneuver BSSNET2A-95W into a disposal orbit with an altitude no less than that calculated using the IADC formula:

$$36{,}021 \text{ km} + (1000 \cdot C_R \cdot A/m)$$

where: C_R = the solar radiation pressure coefficient

and: A/m = the aspect area (m^2) to mass (Kg) of the satellite

SPECTRUM FIVE anticipates that, once the satellite's actual characteristics have been determined, this calculation will lead to a disposal orbit with a minimum perigee of somewhat less than 300 km above the normal GSO operational orbit. Accordingly, SPECTRUM FIVE currently anticipates that it will maneuver BSSNET2A-95W to an altitude at least 300 km above GSO orbit at the end of its operational life, which should provide additional margin above the results of the IADC formula.

When the satellite parameters are finalized, SPECTRUM FIVE will assess fuel gauging uncertainty and ensure this budgeted propellant, taking into account such uncertainty, provides an adequate margin of fuel reserve so that the disposal orbit will be achieved.

16 - CONCLUSION

The proposed space station will provide SPECTRUM FIVE with a highly capable 17/24 GHz BSS satellite that will enhance its ability to provide high quality multichannel video service to millions of Americans. For these reasons, SPECTRUM FIVE submits that the proposed satellite will serve the public interest and respectfully requests that the Commission expeditiously grant this request.

Respectfully submitted,

SPECTRUM FIVE LLC

By: /s/

Dr. Thomas E. Sharon

COO

APPENDIX A - SERVICE CHANNELS LINK BUDGETS

Downlink :		LA		CONUS			
Satellite Location:		95.15 WL					
Uplink		**Clear**	**Rain**	**Downlink**		**Clear**	**Rain**
UL Freq	GHz	25.0	25.0	DL Freq	GHz	17.5	17.5
ES Ant Dia	m	9.0	9.0	ES Ant Dia	inches	26.0	26.0
ES Ant Gain	dBW	65.2	65.2	Satellite EIRP	dBW	51.7	51.7
ES Tx Power w/ -3dB OBO	dBW	7.4	14.8	ES ptg loss	dB	0.2	0.2
ES Output Losses	dBW	1.2	1.2	Free Space loss	dB	208.8	208.8
ES ptg loss	dB	0.5	0.5	Atmos/Scint loss	dB	0.5	0.5
ES EIRP	dBW	70.9	78.3	Rain & Other loss	dB	0.0	3.4
Free space loss	dB	211.9	211.9	Wetting loss	dB	0.0	0.5
Sat G/T	dB/K	17.5	17.5	Total loss	dB	0.5	4.5
Atmospheric+Rain Losses	dB	2.0	9.4	ES G/T	dB/K	18.0	15.1
Bandwidth	dB-Hz	73.4	73.4	Bandwidth	dB-Hz	73.4	73.4
C/N (thermal)	dB	29.2	29.2	C/N (thermal)	dB	15.4	8.5
UL Spot Beam Interf C/I	dB	60.0	60.0	DL Spot Beam Interf	dB	60.0	60.0
Adj Carr Interf C/I	dB	30.0	30.0	Adj Carr Interf	dB	30.0	30.0
Adj Sat Interf C/I	dB	66.2	66.2	Adj Sat Interf	dB	23.1	23.1
Cross Pol, NPR C/I	dB	27.0	27.0	Cross Pol	dB	27.0	27.0
Total UL C/I	dB	25.2	25.2	Total DL C/I	dB	23.7	21.0

SUMMARY

Clear			**Rain**		
UL C/N (thermal)	dB	29.2	UL C/N (thermal)	dB	29.2
DL C/N (thermal)	dB	15.4	DL C/N (thermal)	dB	8.5
Total UL C/I	dB	25.2	Total UL C/I	dB	25.2
Total DL C/I	dB	23.7	Total DL C/I	dB	23.7
Total C/(N+I)	dB	14.3	Total C/(N+I)	dB	8.3
Req'd C/(N+I)	dB	7.5	Req'd C/(N+I)	dB	7.5

TABLE A-1

Downlink :	New York			CONUS			
Satellite Location:	95.15 WL						
Uplink		Clear	Rain	**Downlink**		Clear	Rain
UL Freq	GHz	25.0	25.0	DL Freq	GHz	17.5	17.5
ES Ant Dia	m	9.0	9.0	ES Ant Dia	inches	26.0	26.0
ES Ant Gain	dBW	65.2	65.2	Satellite EIRP	dBW	56.2	56.2
ES Tx Power w/ -3dB OBO	dBW	7.4	14.8	ES ptg loss	dB	0.2	0.2
ES Output Losses	dBW	1.2	1.2	Free Space loss	dB	209.8	209.8
ES ptg loss	dB	0.5	0.5	Atmos/Scint loss	dB	0.6	0.6
ES EIRP	dBW	70.9	78.3	Rain & Other loss	dB	0.0	3.6
Free space loss	dB	211.9	211.9	Wetting loss	dB	0.0	0.5
Sat G/T	dB/K	17.5	17.5	Total loss	dB	0.6	4.7
Atmospheric+Rain Losses	dB	2.0	9.4	ES G/T	dB/K	18.0	15.1
Bandwidth	dB-Hz	73.4	73.4	Bandwidth	dB-Hz	73.4	73.4
C/N (thermal)	dB	29.2	29.2	C/N (thermal)	dB	17.2	12.7
UL Spot Beam Interf C/I	dB	60.0	60.0	DL Spot Beam Interf	dB	60.0	60.0
Adj Carr Interf C/I	dB	30.0	30.0	Adj Carr Interf	dB	30.0	30.0
Adj Sat Interf C/I	dB	66.2	66.2	Adj Sat Interf	dB	23.7	23.7
Cross Pol, NPR C/I	dB	27.0	27.0	Cross Pol	dB	27.0	27.0
Total UL C/I	dB	25.2	25.2	Total DL C/I	dB	23.7	23.7

SUMMARY

Clear			**Rain**		
UL C/N (thermal)	dB	29.2	UL C/N (thermal)	dB	29.2
DL C/N (thermal)	dB	17.2	DL C/N (thermal)	dB	12.7
Total UL C/I	dB	25.2	Total UL C/I	dB	25.2
Total DL C/I	dB	23.7	Total DL C/I	dB	23.7
Total C/(N+I)	dB	15.6	Total C/(N+I)	dB	12.1
Req'd C/(N+I)	dB	7.5	Req'd C/(N+I)	dB	7.5

TABLE A-2

Downlink : ORLANDO CONUS

Satellite Location: 95.15 WL

Uplink		Clear	Rain	Downlink		Clear	Rain
UL Freq	GHz	25.0	25.0	DL Freq	GHz	17.5	17.5
ES Ant Dia	m	9.0	9.0	ES Ant Dia	inches	26.0	26.0
ES Ant Gain	dBW	65.2	65.2	Satellite EIRP	dBW	59.1	59.1
ES Tx Power w/ -3dB OBO	dBW	7.4	14.2	ES ptg loss	dB	0.2	0.2
ES Output Losses	dBW	1.2	1.2	Free Space loss	dB	208.6	208.6
ES ptg loss	dB	0.5	0.5	Atmos/Scint loss	dB	0.6	0.6
ES EIRP	dBW	70.9	77.7	Rain & Other loss	dB	0.0	5.1
Free space loss	dB	211.8	211.8	Wetting loss	dB	0.0	0.5
Sat G/T	dB/K	17.5	17.5	Total loss	dB	0.6	6.2
Atmospheric+Rain Losses	dB	2.0	8.8	ES G/T	dB/K	18.0	14.6
Bandwidth	dB-Hz	73.4	73.4	Bandwidth	dB-Hz	73.4	73.4
C/N (thermal)	dB	29.3	29.3	C/N (thermal)	dB	22.9	13.2
UL Spot Beam Interf C/I	dB	60.0	60.0	DL Spot Beam Interf	dB	60.0	60.0
Adj Carr Interf C/I	dB	30.0	30.0	Adj Carr Interf	dB	30.0	30.0
Adj Sat Interf C/I	dB	49.5	49.5	Adj Sat Interf	dB	23.0	23.0
Cross Pol, NPR C/I	dB	27.0	27.0	Cross Pol	dB	27.0	27.0
Total UL C/I	dB	25.2	25.2	Total DL C/I	dB	23.7	23.7

SUMMARY

Clear			Rain		
UL C/N (thermal)	dB	29.3	UL C/N (thermal)	dB	29.3
DL C/N (thermal)	dB	22.9	DL C/N (thermal)	dB	13.2
Total UL C/I	dB	25.2	Total UL C/I	dB	25.2
Total DL C/I	dB	23.7	Total DL C/I	dB	23.7
Total C/(N+I)	dB	18.7	Total C/(N+I)	dB	12.5
Req'd C/(N+I)	dB	7.5	Req'd C/(N+I)	dB	7.5

TABLE A-3

Downlink :		Hawaii		CONUS			
Satellite Location:		95.15 WL					
Uplink		Clear	Rain	**Downlink**		Clear	Rain
UL Freq	GHz	25.0	25.0	DL Freq	GHz	17.5	17.5
ES Ant Dia	m	9.0	9.0	ES Ant Dia	inches	36.0	36.0
ES Ant Gain	dBW	65.2	65.2	Satellite EIRP	dBW	52.2	52.2
ES Tx Power w/ -3dB OBO	dBW	7.4	14.2	ES ptg loss	dB	0.4	0.4
ES Output Losses	dBW	1.2	1.2	Free Space loss	dB	209.0	209.0
ES ptg loss	dB	0.5	0.5	Atmos/Scint loss	dB	0.7	0.7
ES EIRP	dBW	70.9	77.7	Rain & Other loss	dB	0.0	7.6
Free space loss	dB	211.8	211.8	Wetting loss	dB	0.0	0.5
Sat G/T	dB/K	17.5	17.5	Total loss	dB	0.7	8.9
Atmospheric+Rain Losses	dB	2.0	8.8	ES G/T	dB/K	23.9	20.0
Bandwidth	dB-Hz	73.4	73.4	Bandwidth	dB-Hz	73.4	73.4
C/N (thermal)	dB	29.0	29.0	C/N (thermal)	dB	17.2	7.8
UL Spot Beam Interf C/I	dB	60.0	60.0	DL Spot Beam Interf	dB	60.0	60.0
Adj Carr Interf C/I	dB	30.0	30.0	Adj Carr Interf	dB	30.0	30.0
Adj Sat Interf C/I	dB	49.5	49.5	Adj Sat Interf	dB	25.5	25.5
Cross Pol, NPR C/I	dB	27.0	27.0	Cross Pol	dB	27.0	27.0
Total UL C/I	dB	25.2	25.2	Total DL C/I	dB	23.8	23.8

SUMMARY

Clear			Rain		
UL C/N (thermal)	dB	29.0	UL C/N (thermal)	dB	29.0
DL C/N (thermal)	dB	17.2	DL C/N (thermal)	dB	7.8
Total UL C/I	dB	25.2	Total UL C/I	dB	25.2
Total DL C/I	dB	23.8	Total DL C/I	dB	23.8
Total C/(N+I)	dB	15.6	Total C/(N+I)	dB	7.6
Req'd C/(N+I)	dB	7.5	Req'd C/(N+I)	dB	7.5

TABLE A-4

APPENDIX B - SPACE PATH INTERFERENCE ANALYSIS

SPECTRUM FIVE includes in this appendix the required data to provide the predicted transmitting antenna off-axis gain information for the BSSNET2A-95W satellite at 95.15^{o} W.L. and to demonstrate that its predicted off-axis antenna patterns comply with the17/24 GHz Broadcasting Satellite Service 17BSS rules as specified in 47 C.F.R. § 25.264(a). In particular, the power flux density of SPECTRUM FIVE's space station will not exceed the coordination trigger of -117 dB W/m^2/100 kHz at the location of any prior-filed or operating U.S. DBS space station.

Section 25.264(a) requires the submission of the following predicted transmitting antenna off-axis antenna gain information:

(1) In the X-Z plane, i.e., the plane of the geostationary orbit, over a range of 30 Degrees from the positive and negative X-axes in increments of 5 degrees or less.

(2) In planes rotated from the X-Z plane about the Z-axis, over a range of up to 60 degrees relative to the equatorial plane, in increments of 10 degrees or less.

(3) In both polarizations.

(4) At a minimum of three measurement frequencies determined with respect to the entire portion of the 17.3-17.8 GHz frequency band over which the space station is designed to transmit: 5 MHz above the lower edge of the band; at the band center frequency; and 5 MHz below the upper edge of the band (namely, at frequencies of 17.305 GHz, 17.5 GHz, and 17.695 GHz).

(5) Over a greater angular measurement range, if necessary, to account for any planned spacecraft orientation bias or change in operating orientation relative to the reference coordinate system. Because SPECTRUM FIVE does not plan for any spacecraft orientation bias or change in operating orientation relative to the reference coordination system, it does not provide predictions over a greater angular measurement range as specified in Section 25.264(a)(5). (*See* 47 C.F.R. § 25.264(a)). Similarly, because the power flux density of the BSSNET2A-95W space station will not exceed the coordination trigger of -117 dB W/m2/100 kHz at the location of any prior-filed U.S. DBS space station, SPECTRUM FIVE has not provided the calculation otherwise required in Section 25.264(b). *See* 47 C.F.R. § 25.264(b).

Because SPECTRUM FIVE does not plan for any spacecraft orientation bias or change in operating orientation relative to the reference coordination system, it does not provide predictions over a greater angular measurement range as specified in Section 25.264(a)(5). *See* 47 C.F.R. § 25.264(a). Similarly, because the power flux density of the BSSNET2A-95W space station will not exceed the coordination trigger of -117 dB W/m^2/100 kHz at the location of any prior-filed U.S. DBS space station, SPECTRUM FIVE has not provided the calculation otherwise required in Section 25.264(b). *See* 47 C.F.R. § 25.264(b).

In addition, consistent with Sections 25.114(d)(18) and 25.264(h)(2) of the Commission's rules, SPECTRUM FIVE will maintain the maximum orbital eccentricity to less than 3.1 x 10^{-4}.

The attached table provides a summary of the analysis of the off-axis antenna patterns and conformance with the coordination trigger of -117 dB W/m^2/100 kHz. Because of the wide separation to the nearest operating DBS satellite at 110.2^o W.L., the power flux density at this location is greater than 25 dB below the required -117 dB W/m^2/100 kHz level.

The predicted transmitting antenna off-axis antenna gain plots as described above are contained in Appendix B.

CONUS Beam Maximum Allowable EIRP / Antenna Gain[1] to Meet -117dBW/m²/100KHz

CONUS BEAM	
Satellite Location° WL	-95.15
Nearest DBS Satellite Location° WL	-100.85
Miniumum Spacing (w/Station Keeping @+--0.05)	5.60
Max PFD Flux Density, -117 dBW/m²/100 kHz	-117.0
Channel Bandwidth, MHz	26.0
Symbol rate band width modification factor	1
Effective channel bandwidth, MHz	26.0
Effective Bandwidth, dB-100 kHz	24.1
PFD Flux Density Allowed per Channel, dBW/m²	-92.9
R, Radial Distance to GEO, km	42,164.0
Min. Angle of Separation between Satellites, deg	5.60
Range between Satellites, km	4121.0
Spreading factor, dB/ m²	-143.3
Atmospheric loss, dB	0
Maximum EIRP Allowed at Minimum Separation, dBW	50.4
Peak Satellite EIRP, dBW[2]	60.2
Boresight Antenna Gain, dB[3]	37.1
Tx Power into Antenna, dBW	23.1
Max Antenna Gain to Meet Space Path Spec, dB	27.3
Max Off-Axis EIRP from Plots[4,] dBW	5.62
Max Antenna Gain from Plots, dB	-17.48
PFD / Ant Gain Margin, dB	44.8

[1] As defined in FCC Section 25.264(a)

[2] from Schedule S7
temperature and life]

[3] from Schedule S7, column (c)

[4] Reference to Plot File: tx-17.5-rhcp-30.cut

Table B-1

APPENDIX C - TELEMETRY AND COMMAND LINK BUDGETS

TELEMETRY LINK MARGIN

SPACE STATION to SWU TT&C CENTER	GSO CONUS+	Common Parameters	
SS Tx Power, dBW	-7.0	Freq, GHz	17.30
OBO	-3.0	Wavelength, in	0.68
Output Loss, dB	-2.0	Bandwidth,MHz	1.00
SS Tx Pwr, dBW	-12.0	Bandwidth,dB-Hz	60.00
SS Tx Pwr, W	0.06	Slant Range,kM	37,166
SS Ant Gain, Peak dBi	37.1		
EIRP, Peak dBW	25.1		
SS Ant Gain, to Station dBi	28.7		
SS Tx EIRP, to Station dBW	16.7		
Eirp, dBW	16.7		
Pwr Density, dBW/Hz	-72.0		
Spreading Loss, dB	-162.39		
PFD, dBW/m^2/MHz,	-138.3		
Space Loss, dB	-208.6		
Rain & Atmos Atten, dB, 99.9%	-3.6		
Total Loss, dB	-212.2		
ES Dia, m	9.0		
ES Gain, dB	61.2		
ES Rx Temp, deg K	100.0		
G/T, peak, dB/K	41.2		
C/T, dB/K	-154.3		
Bandwidth,MHz, dB	0.0		
DL C/I, dB	30.0		
DL CNR, dB	14.3		
DL C/N+I, dB	14.2		

TABLE C-1

COMMAND LINK LINK MARGIN

TT&C (SWU TO SPACE STATION)	GSO Clear	GSO Rain	Common Parameters	
ES Transmitter Power,per ch, dBW	26.0	26.0	Freq, GHz	24.75
OBO	-19.0	-3.0	Wavelength, in	0.48
Output Loss, dB	-1.5	-1.5	Bandwidth,MHz	1.00
ES Tx Pwr, dBW	5.5	21.5	Bandwidth,dB-Hz	60.00
ES Tx Pwr, W	3.5	141.3		
ES Antenna, meters	9.0	9.0	Slant Range,kM	37,166
ES Peak Antenna Gain, dBi	65.2	65.1		
ES Tx EIRP, dBW	70.7	86.6		
Pointing Loss, dB	-0.5	-0.5		
Eirp, dBW	70.2	86.1		
Pwr Density, dBW/Hz	-54.5	-38.5		
SFD, dBW/m^2,	-83.2	-85.8		
Space Loss, dB	-211.7	-211.7		
Rain & Atmos Atten, dB, 99.99%	-2.0	-20.5		
Total Loss, dB	-213.7	-232.2		
G/T, peak, dBi/K	14.5	14.5		
Sat. Temp., K	30.5	30.5		
Sat Antenna Gain, 1.1m, dBi	45.0	45.0		
C/T, dB/K	-128.5	-131.1		
Bandwidth,MHz, dB	0.0	0.0		
Uplink C/I, dB	50.0	50.0		
Uplink CNR, dB	40.1	37.5		
Uplink C/N+I, dB	39.7	37.2		
Sat Received Signal, dBW	-98.5	-101.1		
Rx Losses, dB	-20.0	-20.0		
Input to RX, dBm	-88.5	-91.1		

TABLE C-2

TELEMETRY LINK MARGIN

SPACE STATION to CRB TT&C CENTER	CONUS+ Beam	Common Parameters	
SS Tx Power, dBW	3.0	Freq, GHz	17.30
OBO	-3.0	Wavelength, in	0.68
Output Loss, dB	-2.0	Bandwidth,MHz	1.00
SS Tx Pwr, dBW	-2.0	Bandwidth,dB-Hz	60.00
SS Tx Pwr, W	0.63	Slant Range,kM	37,842
Sat Ant Gain, Peak dBi	45.5		
Sat Ant Gain, at Station dBi	43.0		
SS Tx ERP, Peak, dBW	43.5		
EIRP to Station, dBW	41.0		
Pwr Density, dBW/Hz	-62.0		
Spreading Loss, dB	-162.55		
PFD, dBW/m^2/MHz,	-120.1		
Space Loss, dB	-208.8		
Rain & Atmos Atten, dB, 99.9%	-20.8		
Total Loss, dB	-229.5		
ES Dia, m	9.0		
ES Gain, dB	61.2		
ES Rx Temp, deg K	100.0		
G/T, peak, dB/K	41.2		
ES Pointing Loss, dB	-0.5		
C/T, dB/K	-147.8		
Bandwidth,MHz, dB	0.0		
DL C/I, dB	30.0		
DL CNR, dB	20.8		
DL C/N+I, dB	20.3		

TABLE C-3

COMMAND LINK MARGIN

TT&C (CRB) TO SPACE STATION	GSO Clear	GSO Rain	Common Parameters	
ES Transmitter Power,per ch, dBW	26.0	26.0	Freq, GHz	24.75
OBO	-19.0	-3.0	Wavelength, in	0.48
Output Loss, dB	-1.5	-1.5	Bandwidth,MHz	1.00
ES Tx Pwr, dBW	5.5	21.5	Bandwidth,dB-Hz	60.00
ES Tx Pwr, W	3.5	141.3		
ES Antenna, meters	9.0	9.0	Slant Range,kM	37,834
ES Peak Antenna Gain, dBi	65.2	65.2		
ES Tx EIRP, dBW	70.7	86.7		
Pointing Loss, dB	-0.5	-0.5		
Eirp, dBW	70.2	86.2		
Pwr Density, dBW/Hz	-54.5	-38.5		
SFD, dBW/m^2,	-83.4	-92.3		
Space Loss, dB	-211.9	-211.9		
Rain & Atmos Atten, dB, 99.7%	-2.0	-26.9		
Total Loss, dB	-213.9	-238.8		
G/T, peak, dB/K	16.5	16.5		
Sat. Temp., dB-K	30.5	30.5		
Sat Ant Gain, Peak dBi	47.0	47.0		
Sat Ant Gain, at Station dBi	44.5	44.5		
C/T, dB/K	-129.2	-138.1		
Bandwidth,MHz, dB	0.0	0.0		
Uplink C/I, dB	50.0	50.0		
Uplink CNR, dB	39.4	30.5		
Uplink C/N+I, dB	39.0	30.5		
Sat Received Signal, dBW	-99.2	-108.1		
Rx Losses, dB	-20.0	-20.0		
Input to RX, dBm	-89.2	-98.1		

TABLE C-4