RAYSAT ANTENNA SYSTEMS, LLC
APPLICATION FOR EXPERIMENTAL SPECIAL TEMPORARY AUTHORITY
E-7000 ANTENNA

I. INTRODUCTION

Raysat Antenna Systems, LLC ("RAS") respectfully requests an experimental special temporary authorization ("STA"), commencing on or about October 3, 2011, to test and demonstrate up to ten (10) vehicle-mounted earth stations ("VMES") (designated the E-7000 antenna) in the 14.0-14.5 GHz and 11.7-12.2 GHz frequency bands (collectively, the "Ku-band"). The earth stations will communicate with the Galaxy 16 satellite located at 99˚ W.L.

Grant of the experimental STA would strongly serve the public interest by supplementing RAS' currently authorized and requested VMES experimental authorizations[1] with an additional cost effective antenna, which will result in expanded service and equipment options for U.S. Government and commercial users. RAS requires an experimental STA to test and demonstrate the feasibility of this new antenna to potential customers in the Governmental and commercial sectors.

II. THE E-7000 ANTENNA

The E-7000 antenna is a single panel Ku-band array antenna developed in response to customer requests for higher transmit and receive performance. As with all RAS antennas, the E-7000 antenna uses a full motion tracking system that allows the user to have broadband data access while on the move. The antenna is designed for military and commercial users and will provide mobile access to the many information-rich applications these users require.

The E-7000 antenna technology builds upon RAS' proven antenna technology for mobile applications. The major enhancement is in the antenna panel. The element technology has been changed from a printed circuit design to a waveguide design, which results in higher performance. The panel is capable of both transmit (at 14.0-14.5 GHz) and receive (at 11.7-12.2 GHz) operation. The antenna allows tracking in three axes: azimuth, elevation and polarization.

The E-7000 antenna consists of a single 44 inch-by-8.3 inch panel array that is mounted on a rotatable platform, which rotates in azimuth to orient the panel towards the satellite. The panel array tilts to set the panel's elevation angle. In addition, the E-7000 antenna

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[1] *See, e.g.*, Call Sign WF2XQF, File No. 0506-EX-PL-2010 (two-year experimental license); Call Sign WE2XTW, File No. 0236-EX-RR-2010 (two year experimental license); Call Sign WE2XTX; File No. 0235-EX-RR-2010) (two year experimental license); Call Sign WE9XQH, File No. 0580-EX-ST-2010 (experimental STA); File No. 0284-EX-PL-2011 (pending request for two year experimental license).

has a polarization control mechanism that sets the correct polarization angle for both transmit and receive.

A. Antenna Operation

As with all RAS antennas, the E-7000 antenna maintains active control of the azimuth, elevation and polarization angles. The antenna scans mechanically in both azimuth and elevation.

For satellite acquisition and reacquisition, the E-7000 antenna uses a built-in GPS receiver to determine its position on the earth. It uses the geographical position and the longitudinal position of the satellite to determine the appropriate elevation angle. Once the elevation angle is set, the antenna rotates in azimuth. During the scanning process, the antenna monitors the received power level within a specified frequency band with the RSSI. When a power threshold is reached, the scanning is stopped and the antenna tracks on the signal. The ACU then queries the modem to see if there is a valid Eb/No. If there is a valid Eb/No verifying that the target satellite has been acquired, the antenna will continue to track on the signal. Conversely, if there is not a valid Eb/No, the antenna will resume scanning.

Once the satellite is acquired, the antenna dithers mechanically in both azimuth and elevation to maintain peaking on the signal and maintain accurate pointing to the satellite. The maximum scan angles are ±0.3° in azimuth and 0.9° in elevation. The antenna also uses internal 3-axis gyroscopes and 2-axis inclinometers to help with tracking while the antenna is in motion. The antenna will also use the information from the gyros to determine when the maximum pointing offset of 0.5º has been reached and will cease transmissions within 100 milliseconds when this occurs.[2] The E-7000 will not resume transmissions until pointing accuracy is within 0.35°.[3]

A simplified block diagram of the major components in the tracking and acquisition system is shown below in Figure 1.

The following individual is the RAS point-of-contact with the ability and authority to cease all emissions from the terminals:

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[2] *See* 47 CFR § 25.226(b)(1)(iv)(B). Although the antenna dithers in azimuth by ±0.3º and RAS expects pointing accuracy to typically remain at that value, RAS is implementing a declaring pointing accuracy of 0.5° -- the offset at which antenna transmissions automatically terminate – to set maximum transmit power levels. *See id*. at §§ 25.226(a)(1)(ii)(B), (b)(1).

[3] *Id*. Although the VMES rules permit the resumption of transmissions at the declared maximum pointing error (*i.e.*, 0.5º), RAW will not resume transmissions until the pointing accuracy is within 0.35º.

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B. Operational Satellite

RAS proposes to operate the E-7000 antenna on the Galaxy 16 satellite located at 99˚ W.L.[4] The maximum skew angle in CONUS for the Galaxy 16 is limited to a maximum of less than 37.5˚. Table 1 below lists the skew angles for various locations in CONUS.

Table 1: Skew Angles (Various Locations in CONUS) to Galaxy 16 Satellite

Site Name	Site Latitude (deg.deg)	Site Longitude (deg.deg)	Skew Angle (deg)
Seattle, WA	47.5	122.3	-19.2
San Diego, CA	32.4	117.2	-26.2
Bangor, ME	44.8	68.8	26.9
Miami, FL	25.8	80.2	33.7

C. Antenna Patterns

The transmit gain pattern shown below in Figure 2 exceeds the Commission's routine licensing guidelines, but by limiting the input power spectral density ("PSD") to -18.1/4kHz, the off axis EIRP density remains under the off-axis PSD mask even with a 0.5° degree pointing error in the GSO plane, as further shown below in Figure 3. Thus, at all times transmissions from the E-7000 antenna are compliant with the Commission's two-degree spacing levels.

The maximum level of off-pointing is set to 0.5° in the plane of the GSO arc after which the transmissions are commanded to turn off. In addition, reduced input PSD into the antenna ensures compliance with off-axis EIRP levels associated with two-degree spacing and the coordinated parameters of the serving satellite.

RAS has performed detailed analyses and confirmed that the adjacent satellite interference levels produced under the worst case operating conditions with a PSD of -18.1 dBW/4kHz at the input flange would be no worse than a Section 25.209 compliant antenna with a PSDR of -14dBW/4kHz at its input flange (*i.e.*, routinely licensed VSAT antenna).

[4] A coordination letter is being sought from Intelsat, which operates the Galaxy 16 satellite, and will be submitted as an attachment to the instant application as soon as it is available.

D. Other Technical Information

Tables 2 and 3a and 3b, below, list the relevant emission designators and power levels (expressed both in terms of EIRP and ERP) for the proposed experimental STA:

Table 2: Emission Designators for E-7000 Antenna

Emissions Designator	FEC Rate	Necessary Bandwidth (MHz)	Flange PSD (dBW/4kHz)
7M75G7W	0.477	7.75	-18.1
9M45G7W	0.5	9.45	-19.0

Table 3: Maximum EIRP and ERP

Power Measure	Maximum Power (dBW)	Maximum Power (Watts)
EIRP	49.8	95,499
ERP	47.65	58,210

A link budget (including two examples) for the E-7000 antenna is attached as Appendix A. A Radiation Hazard Analysis is being prepared and will be submitted shortly as an additional exhibit to the instant application.

II. CONCLUSION

In consideration of the foregoing, RAS respectfully requests the grant of an experimental STA, commencing on or by October 3, 2011 to test and demonstrate up to ten (10) VMES terminals in the Ku-band. The grant of the requested experimental STA would enable RAS to test and demonstrate the attributes of its newly developed E-7000 to potential U.S. Government and commercial users. The terminals will be operated intermittently solely for test and demonstration purposes and will not be used by RAS or a third party to provide communications services. In addition, as described above, the terminals will not increase the potential for interference to other incumbent users in the Ku-band and will meet the Commission's two-degree spacing requirements.

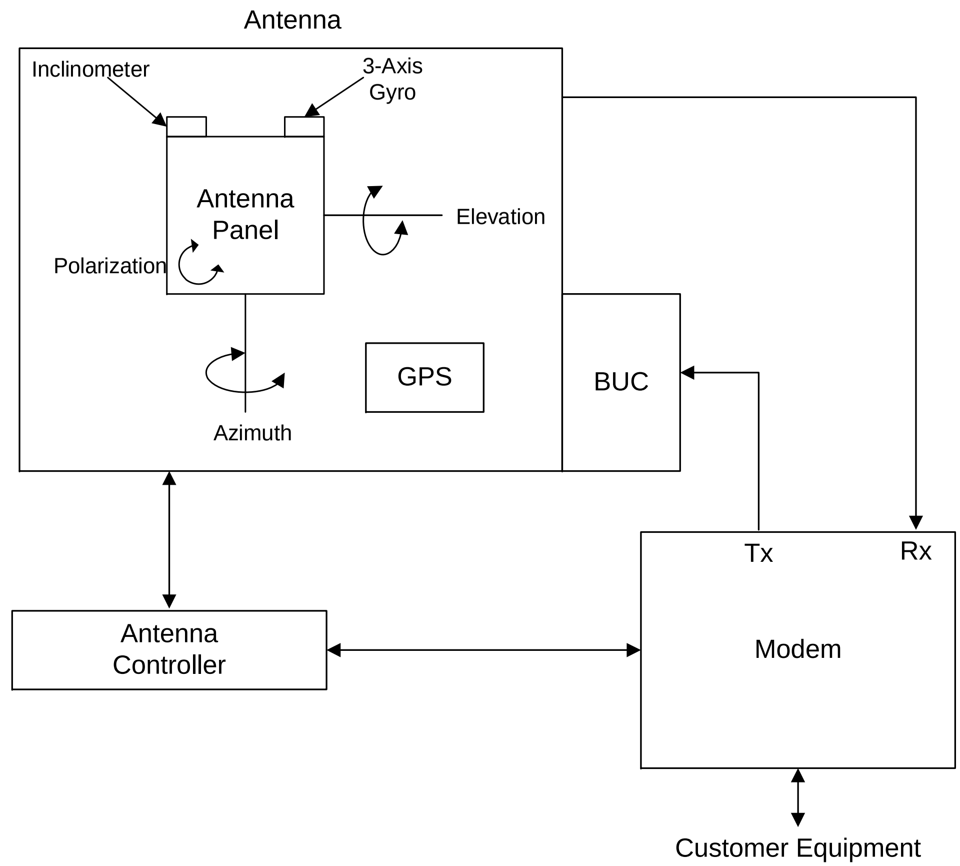

Figure 1
Typical Antenna Equipment Set-up

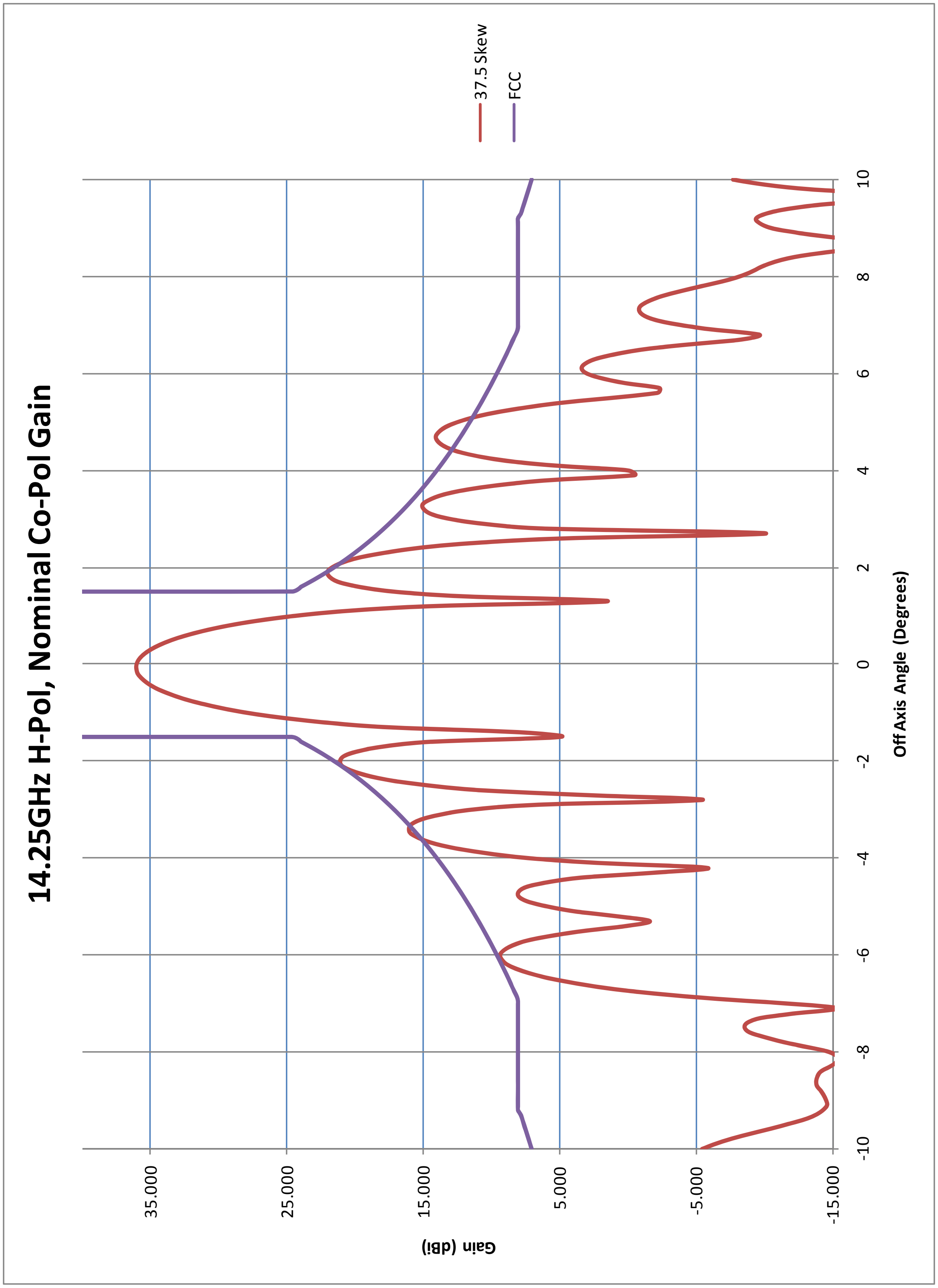

Figure 2
Close-In Gain Pattern 37.5˚ Skew Angle

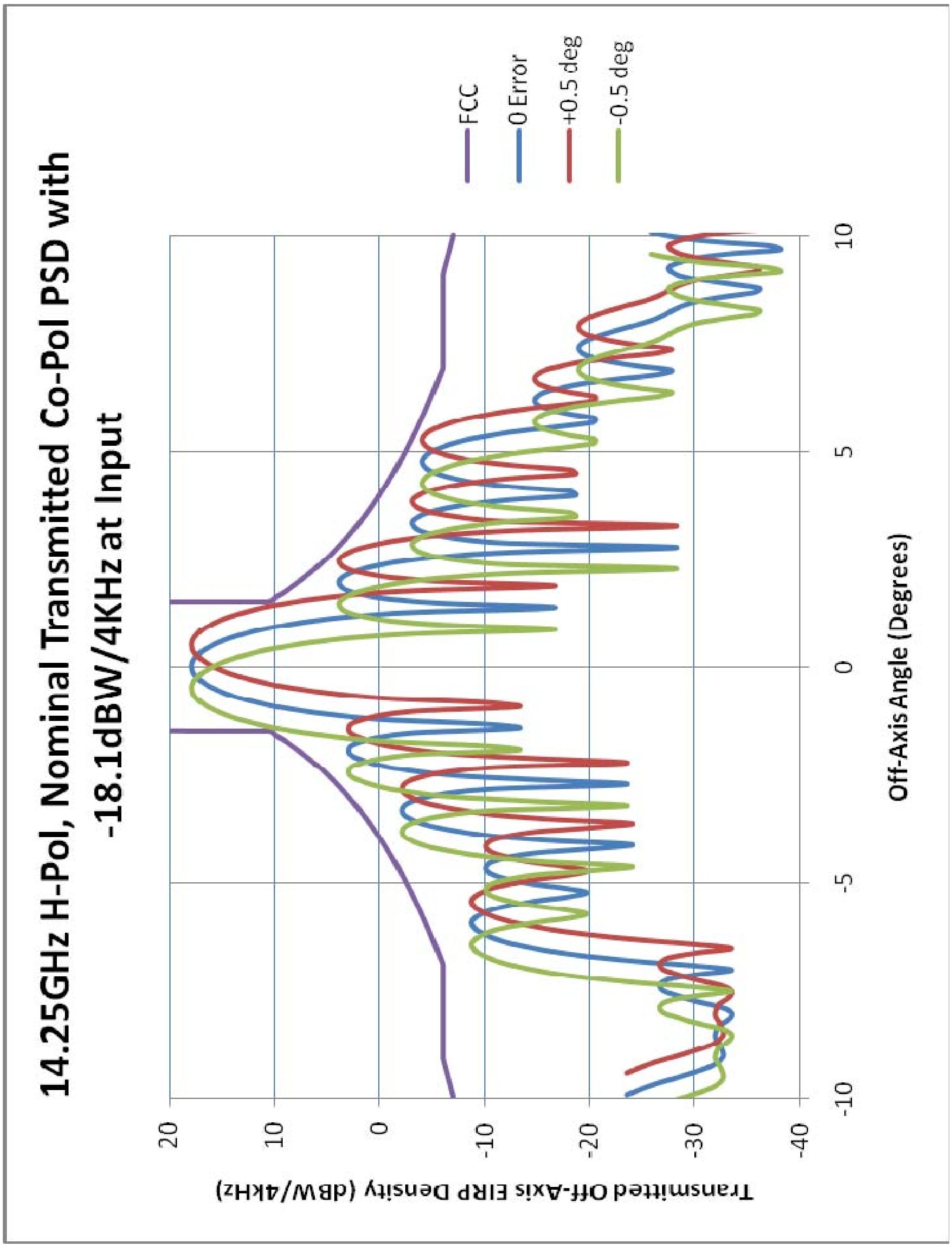

Figure 3
37.5 Degree Skew Angle
Off-Axis PSD Pattern

Appendix A
Link Budget Example 1

Data Parameters

Data Rate	5280.9	kbps
FEC	21/44	Turbo
Modulation	qpsk	BPSK / QPSK
Threshold Eb/No	2.80	dB
Occ BW	1.40	
Spread Spectrum	n	(Y / N)
Chip Rate	5.53	Mchips/s
Total # of spread Links	1	
Beta Factor	1.00	

Satellite Parameters

Sat Name	G16	
Sat Long.	99	deg
Sat Rx, G/T	2.8	dB/K
Sat Tx, EIRP	51.3	dBW
SFD	-94	dBW/m^2
IP / OP ratio	4	dB
U/L Freq	14.25	GHz
D/L Freq.	11.95	GHz

Rx Site Parameters

Rx Site Name	NY Hub	
Rx Lat	40.5	deg
Rx Long	74	deg
Rx G/T	37.4	dB/K
Ant Gain	59.2	dBi
System Temp	150	K

Tx Site Parameters

Tx Site Name	Rem	
Tx Lat	39	deg
Tx Long	77	deg
Tx Ant Gain	36	dBi
Tx Loss	1	dB
Radome loss	0.25	dB
Pointing Loss	1	dB
Tx HPA	40.00	W

Interference Parameters

ASI U/L EIRP in our direction	4.2	dBW/4KHz
DL interferemce, dBW/4KHz	-20	dBW/4KHz

DownLink Fade	0.0	dB

Threshold C/N	2.60	dB
C/Io Uplink WRT Saturation	62.1	dB/Hz
C/Io Downlink WRT Saturation	107.3	dB/Hz
Tx Slant Range	37937218.3	m
Tx FSL	207.1	dB
Uplink EIRP	49.8	dBW
Uplink C/No	73.4	dB-HZ
U/L C/N	5.9	dB
G(1m^2) Tx	44.5	dBi
U/L flux density @ satellite	-113.5	dBW/m^2
IPBO	19.5	dB
C/I up	14.1	dB
C/I dn	24.4	dB
Clear Sky C/(N + I)	**5.25**	**dB**
CS Eb/No	**5.46**	**dB**
Clear Sky (CS)Margin	**2.66**	**dB**
D/L Faded C/(N+I)	**5.25**	**dB**
D/L faded Eb/No	**5.46**	**dB**
D/L Faded Margin	**2.66**	**dB**
PSD @ ant Flange	-18.1	dBW / 4KHz
Occupied BW	7745.3	KHz
D/L PSD/4KHz	2.9	dBW/4KHz

Rx Slant Range	38159620.9	m
Rx FSL	205.6	dB
OPBO	15.5	dB
D/L EIRP	35.8	dBW
D/L C/No	95.7	dB/Hz
D/L C/N	28.2	dB

NOTES & CALCULATIONS

Set CDMA margin to 0 to get correct UL pwr

COPBO	4	dB	
Transponder BW	36	MHz	
%PWR	7.07	%	
PEB	2.55	MHz	
Occupied BW	7.75	MHz	
Percentage BW	21.51	%	
Hub Dia/effec.	9		0.65
Rx Gain / G/T	59.16		37.40
Tx Gain	60.69		
Spread Factor	1		

	Tx Site	Rx Site	
Az Angle	212.70	215.68	deg
El Angle	39.39	36.59	deg
Pol Angle	24.83	26.33	deg

Appendix A
Link Budget Example 2

Data Parameters

Data Rate	7000.0	kbps
FEC	1/2	LDPC
Modulation	qpsk	BPSK / QPSK
Threshold Eb/No	1.70	dB
Occ BW	1.35	
Spread Spectrum	n	(Y / N)
Chip Rate	7.00	Mchips/s
Total # of spread Links	1	
Beta Factor	1.00	

Satellite Parameters

Sat Name	G16	
Sat Long.	99	deg
Sat Rx, G/T	2.8	dB/K
Sat Tx, EIRP	51.3	dBW
SFD	-94	dBW/m^2
IP / OP ratio	4	dB
U/L Freq	14.25	GHz
D/L Freq.	11.95	GHz

Rx Site Parameters

Rx Site Name	NY Hub	
Rx Lat	40.5	deg
Rx Long	74	deg
Rx G/T	37.4	dB/K
Ant Gain	59.2	dBi
System Temp	150	K

Tx Site Parameters

Tx Site Name	Rem	
Tx Lat	39	deg
Tx Long	77	deg
Tx Ant Gain	36	dBi
Tx Loss	1	dB
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Pointing Loss	1	dB
Tx HPA	40.00	W

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CS Eb/No	**4.23**	**dB**
Clear Sky (CS)Margin	**2.53**	**dB**
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D/L PSD/4KHz	2.1	dBW/4KHz

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Rx FSL	205.6	dB
OPBO	15.5	dB
D/L EIRP	35.8	dBW
D/L C/No	95.7	dB/Hz
D/L C/N	27.2	dB

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