LignoSat Link Budget

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		Downlink		Uplink
Parameters	Unit	GMSK (Telemetry and Main Mission Data, Freq.1)	CW Beacon (HK/ Amateur Mission Data, Freq.1)	GMSK (Command Uplink and Amateur Uplink, Freq.2)
Orbit Altitude	km	400	400	400
Distance of Elevation Angle at 5 deg	km	1804.5	1804.5	1804.5
Frequency	MHz	435	435	435
Bandwidth	Hz	15000	500	15000
Emission Type	-	9K000F1D	500HA1A	9K00F1D
Modulation	-	GMSK	Morse Code（CW）	GMSK
Protocol	-	AX.25	-	AX.25
Transmitter				
Transmitter Power Output	W	0.80	0.1	50
in dBW	dBW	-0.97	-10.0	16.99
in dBm	dBm	29.03	20.0	46.99
Total Transmission Line Losses	dB	1.00	1.0	2.03
Antenna Gain	dBi	2.14	2.14	21
EIRP	dBW	0.17	-8.86	35.96
Antenna Pointing Loss	dB	1.00	1.0	0.1
Path				
Antenna Polarization Loss	dB	3.00	3.00	3.00
Path Loss	dB	150.30	150.30	150.3
Atmospheric Loss	dB	1.00	1.00	1.00
Ionospheric Loss	dB	0.40	0.40	0.40
Rain Loss	dB	0.00	0.00	0.00
Isotropic Signal Level at Receiver	dB	-155.53	-164.56	-118.84
Receiver				
Antenna Pointing Loss	dB	0.1	0.1	1.00
Antenna Gain	dBi	21.00	21.00	2.14
Total Transmission Line Losses	dB	2.03	2.03	1.00
Effective Noise Temperature	K	500.00	500.00	500.00
Figure of Merrit (G/T)	dB/K	-8.12	-8.12	-26.85
Boltzmann's Constant	dBJ/K	-228.60	-228.60	-228.60
C/No	dB	64.95	55.92	82.91
System Desired Data Rate	bps	4800.00	-	4800.00
Receiver Bandwidth in dBHz	dBHz	41.76	-	41.76
Required Bit Error Rate (BER)	-	1.00E-0.5	-	1.00E-0.5
Required Eb/No	dB	9.60	-	9.60
Required C/No	dB	51.36	-	51.36
Signal Power at Ground Station LNA Input:	dBW	-	-145.7	-
Ground Station Receiver Bandwidth (B):	Hz	-	500	-
G.S. Receiver Noise Power (Pn = kTB)	dBW	-	-174.6	-
Signal-to-Noise Power Ratio at G.S. Rcvr:	dB	-	28.9	-
Analog or Digital System Required S/N:	dB	-	10.0	-
System Link Margin		13.59	18.9	31.55