UPLINK LINK BUDGET SUMMARY

PARAMETERS					
Objective		Command	Command	APRS-DP + SF-WARD Mission	APRS-DP + SF-WARD Mission
Frequency	[MHz}	435.313	435.313	145.825	145.825
Emission Type		26K0F1D	26K0F1D	26K0F1D	26K0F1D
Modulation		GMSK	BPSK	AFSK	BPSK
Data Rate	[bps]	4800	600	1200	1200
Protocol		AX.25	AX.25	AX.25	AX.25
GROUND STATION					
Ground Station Transmitter Power Output	[W]	50.00	50.00	50.00	50.00
	[dBw]	16.99	16.99	16.99	16.99
Ground Station Total Transmission Line Losses	[dB]	3.00	3.00	3.00	3.00
Antenna Gain	[dBi]	22.00	22.00	22.00	22.00
Ground Station EIRP	[dBw]	35.99	35.99	35.99	35.99
UPLINK PATH					
Ground Station Antenna Pointing Loss	[dB]	1.00	1.00	1.00	1.00
Ground Station to Spacecraft Antenna Polarization Loss	[dB]	3.00	3.00	3.00	3.00
Path Loss	[dB]	148.38	148.38	138.88	138.88
Atmospheric Losses	[dB]	1.00	1.00	1.00	1.00
Ionospheric Losses	[dB]	0.40	0.40	0.40	0.40
Rain Losses	[dB]	0.00	0.00	0.00	0.00
Isotropic Signal Level at Spacecraft	[dBw]	-117.79	-117.79	-108.29	-108.29
SPACECRAFT (Eb/No Method)					
Spacecraft Antenna Pointing Loss	[dB]	3.00	3.00	3.00	3.00
Spacecraft Antenna Gain	[dBi]	2.15	2.15	2.15	2.15
Spacecraft Total Transmission Line Losses	[dB]	1.00	1.00	1.00	1.00
Spacecraft Effective Noise Temperature	[K]	600.00	600.00	600.00	600.00
Spacecraft Figure of Merit (G/T)	[dB/K]	-26.63	-26.63	-26.63	-26.63
Spacecraft Signal-to-Noise Power Density (S/No)	[dBHz]	81.17	81.17	90.67	90.67
System Desired Data Rate	[bps]	4800	600	1200	1200
Command System Eb/No	[dB]	44.36	53.39	59.88	59.88
Specified BER		1.00E-05	1.00E-06	1.00E-05	1.00E-06
Telemetry System Required Eb/No	[dB]	9.60	4.80	23.20	10.50
Eb/No Threshold	[dB]	10.60	5.80	24.20	11.50
System Link Margin	[dB]	33.76	47.59	35.68	48.38
SPACECRAFT (SNR Method)					
Signal Power at Spacecraft LNA Input	[dBw]	-119.64	-119.64	-110.14	-110.14
Spacecraft Receiver Bandwidth	[Hz]	26000	26000	26000	26000
Spacecraft Receiver Noise Power	[dB]	-156.67	-156.67	-156.67	-156.67
Signal-to-Noise Power Ratio (SNR) at Spacecraft Receiver	[dB]	37.03	37.03	46.53	46.53
Required SNR for spacecraft receiver	[dB]	14	14	14	14
System Link Margin	[dB]	23.03	23.03	32.53	32.53

DOWNLINK LINK BUDGET SUMMARY

PARAMETERS				
Objective		Telemetry and Mission Data	CW	HNT Mission
Frequency	[MHz}	437.375	437.375	437.375
Emission Type		26K0F1D	A1A	26K0F1D
Modulation		GMSK	Morse Code	GMSK
Data Rate	[bps]	4800	20 wpm	4800
Protocol		AX.25	-	AX.25
SPACECRAFT				
Spacecraft Transmitter Power Output	[W]	0.8	0.1	0.1
	[dBw]	-0.97	-10.00	-10.00
Spacecraft Total Transmission Line Losses	[dB]	1	1	1
Spacecraft Antenna Gain	[dBi]	2.15	2.15	2.15
Spacecraft EIRP	[dBw]	0.18	-8.85	-8.85
DOWNLINK PATH				
Spacecraft Antenna Pointing Loss	[dB]	1.00	1.00	1.00
Spacecraft-to-Ground Antenna Polarization Loss	[dB]	3.00	3.00	3.00
Path Loss	[dB]	148.43	148.43	148.43
Atmospheric Losses	[dB]	1.00	1.00	1.00
Ionospheric Losses	[dB]	0.40	0.40	0.40
Rain Losses	[dB]	0.00	0.00	0.00
Isotropic Signal Level at Ground Station	[dBw]	-153.64	-162.68	-162.68
GROUND STATION (Eb/No Method)				
Ground Station Antenna Pointing Loss	[dB]	1	1	1
Ground Station Antenna Gain	[dBi]	22	22	22
Ground Station Total Transmission Line Losses	[dB]	3	3	3
Ground Station Effective Noise Temperature	[K]	600	600	600
Ground Station Figure of Merit (G/T)	[dB/K]	-8.78	-8.78	-8.78
Ground Station Signal-to-Noise Power Density (S/No)	[dBHz]	65.17	56.14	56.14
System Desired Data Rate	[bps]	4800		4800
Telemetry System Eb/No	[dB]	28.36		19.33
Specified BER		1.00E-05		1.00E-05
Telemetry System Required Eb/No	[dB]	9.60		9.60
Eb/No Threshold	[dB]	10.60		10.60
System Link Margin	[dB]	17.76		8.73
GROUND STATION (SNR Method)				
Signal Power at Ground Station LNA Input	[dBw]	-135.64	-144.68	-144.68
Ground Station Receiver Bandwidth	[Hz]	26000	500	26000
Ground Station Receiver Noise Power	[dB]	-156.67	-173.83	-156.67
Signal-to-Noise Power Ratio (SNR) at Ground Station Receiver	[dB]	21.03	29.15	11.99
Required SNR for Ground Station receiver	[dB]	10	10	10
System Link Margin	[dB]	11.03	19.15	1.99