



Link Budget

2025/12/15

Uplink Budget COM, APRS

PARAMETERS			
Objective		Command UHF (MAIN COM)	APRS DIGIPEATER VHF (EIRU-4S)
Beam		U1	U2
Frequency	[MHz}	435.XXX	145.825
Emission Type		8K5F1D	12K5F2D
Modulation		GMSK	AFSK
Data Rate	[bps]	4800	1200
Protocol		AX.25	AX.25
GROUND STATION			
Ground Station Transmitter Power Output	[W]	50.00	50.00
	[dBw]	16.99	16.99
Ground Station Total Transmission Line Losses	[dB]	3.00	1.50
Antenna Gain	[dBi]	19.00	7.00
Ground Station EIRP	[dBw]	32.99	22.49
UPLINK PATH			
Orbit Altitude	[km]	550.00	550.00
Minimal Elevation Angle	[degree]	60.00	35.00
Slant Range	[km]	627.00	892.00
Ground Station Antenna Pointing Loss	[dB]	2.00	2.00
Ground Station to Spacecraft Antenna Polarization Loss	[dB]	3.00	3.00
Path Loss	[dB]	141.16	134.73
Atmospheric Losses	[dB]	1.00	1.00
Ionospheric Losses	[dB]	0.50	0.80
Isotropic Signal Level at Spacecraft	[dBw]	-114.67	-119.04

SPACECRAFT (RX Power Sensitivity Method)			
Spacecraft Antenna Pointing Loss	[dB]	5.00	5.00
Spacecraft Antenna Gain	[dBi]	2.15	2.15
Spacecraft Total Transmission Line Losses	[dB]	3.00	1.50
Received Power to the TRX	[dBw]	-120.52	-123.39
	[dBm]	-90.52	-93.39
Receiver Sensitivity	[dBm]	-94.00	-98.20
System Link Margin	[dB]	3.48	4.81
SPACECRAFT (SNR Method)			
Spacecraft Effective Noise Temperature	[K]	1000.00	1000.00
Spacecraft Receiver Bandwidth	[Hz]	8500.00	12500.00
Spacecraft Receiver Noise Power	[dBW]	-159.31	-157.63
Signal-to-Noise Power Ratio (SNR) at Spacecraft Receiver	[dB]	38.78	34.25
Required SNR for Spacecraft	[dB]	10.60	12.00
System Link Margin	[dB]	28.18	22.25
SPACECRAFT (Eb/No Method)			
Spacecraft Figure of Merit (G/T)	[dB/K]	-30.85	-29.35
Spacecraft Signal-to-Noise Power Density (S/No)	[dBHz]	78.93	74.57
System Desired data Rate	[bps]	4800	1200
Command System Eb/No	[dB]	42.12	43.77
Specified BER		1.00E-05	1.00E-05
Eb/No Threshold	[dB]	10.6	24.2
System Link Margin	[dB]	31.52	19.57

Downlink Budget COM, APRS

PARAMETERS				
Objective		Telemetry and other Mission Data UHF (MAIN COM)	CW Beacon UHF (MAIN COM)	APRS DIGIPEATER VHF (CABUREI-4S)
Beam		U1	U1	U2
Frequency	[MHz]	437.375	437.375	145.825
Emission Type		8K5F1D	500HA1A	12K5F2D
Modulation		GMSK	Morse Code (CW)	AFSK
Data Rate	[bps]	4800	20 wpm	1200
Protocol		AX.25	-	AX.25
SPACECRAFT				
Spacecraft Transmitter Power Output	[W]	0.80	0.10	1.00
	[dBw]	-0.97	-10.00	0.00
Spacecraft Total Transmission Line Losses	[dB]	3.00	3.00	1.50
Spacecraft Antenna Gain	[dBi]	2.15	2.15	2.15
Spacecraft EIRP	[dBw]	-1.82	-10.85	0.65
DOWNLINK PATH				
Orbit Altitude	[km]	550.00	550.00	550.00
Minimal Elevation Angle	[degree]	35.00	25.00	40.00
Slant Range	[km]	892.00	1123.00	812.00
Spacecraft Antenna Pointing Loss	[dB]	5.00	5.00	5.00
Spacecraft-to-Ground Station Antenna Polarization Loss	[dB]	3.00	3.00	3.00
Path Loss	[dB]	144.27	146.27	133.91
Atmospheric Losses	[dB]	1.00	1.00	1.00
Ionospheric Losses	[dB]	0.50	0.50	0.80
Isotropic Signal Level at Ground Station	[dBw]	-155.59	-166.62	-146.07

GROUND STATION (RX Power Sensitivity Method)				
Ground Station Antenna Pointing Loss	[dB]	2.00	2.00	2.00
Ground Station Antenna Gain	[dBi]	19.00	19.00	7.00
Ground Station Total Transmission Line Losses	[dB]	3.00	3.00	1.50
Received Power at LNA Ground Station	[dBw]	-141.59	-152.62	-142.57
	[dBm]	-111.59	-122.62	-112.57
Receiver (Rx) Sensitivity	[dBW]	-146.00	-156.00	-151.90
System Link Margin	[dB]	4.41	3.38	9.33
GROUND STATION (SNR Method)				
Ground Station Receiver Effective Noise Temperature	[K]	1000.00	1000.00	1000.00
Ground Station Receiver Bandwidth	[Hz]	8500.00	500.00	12500.00
Ground Station Receiver Noise Power	[dBW]	-159.31	-171.61	-157.63
Signal-to-Noise Power Ratio (SNR) at Ground Station Receiver	[dB]	17.72	19.00	15.06
Required SNR for Ground Station Rx	[dB]	10.60	10.00	12.00
System Link Margin	[dB]	7.12	9.00	3.06
GROUND STATION (Eb/No Method)				
Ground Station Figure of Merit (G/T)	[dB/K]	-14.00	N/C	-24.50
Ground Station-to-Noise Power Density (S/No)	[dBHz]	57.02	N/C	56.03
System Desired data Rate	[bps]	4800.00	N/C	1200.00
Command System Eb/No	[dB]	20.20	N/C	25.24
Specified BER		0.00001	N/C	0.00001
Eb/No Threshold	[dB]	10.60	N/C	24.20
System Link Margin	[dB]	9.60	N/C	1.04