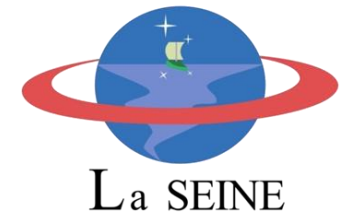


COM- Link Budget

DATE: 28- 04- 2025



Uplink Link Budget

PARAMETERS					
Objective		Command (UHF MAIN COM)	Command (UHF NEW COM)	APRS DIGIPEATER VHF (CABUREI-4S)	
Beam		U1	U1	U2	Data Values
Frequency	[MHz]	435.313	435.313	145.825	Calculated Values
Emission Type		8K50F1D	8K50F1D	12K5F2D	Link Margin OK !!
Modulation		GMSK	GMSK	AFSK	Link Margin NO OK!!!
Data Rate	[bps]	4800	4800	1200	
Protocol		AX.25	AX.25	AX.25	
GROUND STATION					
Ground Station Transmitter Power Output	[W]	50.00	50.00	5.00	Assumed for BIRDS-X Link Budget
	[dBw]	16.99	16.99	6.99	
Ground Station Total Transmission Line Losses	[dB]	3.40	3.40	1.50	Assumed for BIRDS-X Link Budget
Antenna Gain	[dBi]	22.00	22.00	16.00	Assumed for BIRDS-4 Link Budget
Ground Station EIRP	[dBw]	35.59	35.59	21.49	
UPLINK PATH					
Orbit Altitude	[km]	400.00	400.00	400.00	
Elevation Angle	[degree]	10.00	10.00	25.00	
Slant Range	[km]	1527.00	1527.00	901.00	
Ground Station Antenna Pointing Loss	[dB]	2.00	2.00	2.00	
Ground Station to Spacecraft Antenna Polarization Loss	[dB]	3.00	3.00	3.00	
Path Loss	[dB]	148.89	148.89	134.81	
Atmospheric Losses	[dB]	1.00	1.00	1.00	
Ionospheric Losses	[dB]	0.50	0.50	0.80	
Isotropic Signal Level at Spacecraft	[dBw]	-119.80	-119.80	-120.12	
SPACECRAFT (RX Power Sensitivity Method)					
Spacecraft Antenna Pointing Loss	[dB]	5.00	5.00	5.00	Assumed for BIRDS-4 Link Budget
Spacecraft Antenna Gain	[dBi]	2.15	2.15	2.15	
Spacecraft Total Transmission Line Losses		3.00	3.00	2.35	Assumed for BIRDS-4 Link Budget
Received Power to the TRX	[dBw]	-125.65	-125.65	-125.32	
	[dBm]	-95.65	-95.65	-95.32	
Receiver Sensitivity	[dBm]	-109.80	-117.00	-98.20	• Command (UHF MAIN COM) based from BIRDS-RPM Engineering Models Anechoic Chamber Sensitivity test results • Command (UHF MAIN COM) based from BIRDS-RPM BreadBoard Model using signal generator Initial sensitivity test results • APRS DIGIPEATER VHF (CABUREI-4S) based from BIRDS-X Anechoic Chamber Sensitivity test results
System Link Margin	[dB]	14.15	21.35	2.88	



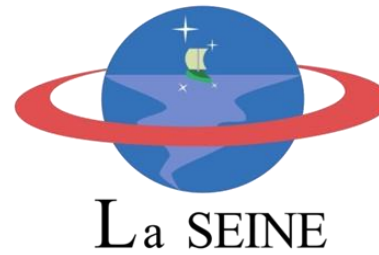
Downlink Link Budget

PARAMETERS								
Objective		Telemetry and other Mission Data (UHF MAIN COM)	Telemetry and other Mission Data (UHF NEW COM)	CW Beacon (UHF MAIN)	CW Beacon (NEW UHF)	APRS DIGIPEATER VHF (CABUREI-4S)		
Frequency	[MHz]	437.375	437.375	437.375	437.375	145.825		
Emission Type		8K50F1D	8K50F1D	500HA1A	500HA1A	12K5F2D		Data Values
Modulation		GMSK	GMSK	Morse Code	Morse Code	AFSK		Calculated Values
Data Rate	[bps]	4800	4800	20 wpm	20 wpm	1200		Means OK !!
Protocol		AX.25	AX.25	-	-	AX.25		Means NO OK!!!
SPACECRAFT								
Spacecraft Transmitter Power Output	[W]	0.80	0.80	0.10	0.10	1.00		Assumed for BIRDS-4 Link Budget
	[dBw]	-0.97	-0.97	-10.00	-10.00	0.00		Assumed for BIRDS-4 Link Budget
Spacecraft Total Transmission Line Losses	[dB]	2.00	2.00	2.00	2.00	2.35		Assumed for BIRDS-4 Link Budget
Spacecraft Antenna Gain	[dBi]	2.15	2.15	2.15	2.15	2.15		Assumed for BIRDS-4 Link Budget
Spacecraft EIRP	[dBw]	-0.82	-0.82	-9.85	-9.85	-0.20		
DOWNLINK PATH								
Orbit Altitude	[km]	400.00	400.00	400.00	400.00	400.00		
Elevation Angle	[degree]	10.00	10.00	10.00	10.00	15.00		
Slant Range	[km]	1527.00	1527.00	1527.00	1527.00	1251.00		
Spacecraft Antenna Pointing Loss	[dB]	5.00	5.00	5.00	5.00	5.00		
Spacecraft-to-Ground Antenna Polarization Loss	[dB]	3.00	3.00	3.00	3.00	3.00		
Path Loss	[dB]	148.94	148.94	148.94	148.94	137.66		
Atmospheric Losses	[dB]	1.00	1.00	1.00	1.00	1.00		
Ionospheric Losses	[dB]	0.40	0.40	0.40	0.40	0.70		
Rain Losses	[dB]	0.00	0.00	0.00	0.00	0.00		
Isotropic Signal Level at Ground Station	[dBw]	-159.15	-159.15	-168.19	-168.19	-147.56		
GROUND STATION								
Ground Station Antenna Pointing Loss	[dB]	1.00	1.00	1.00	1.00	1.00		
Ground Station Antenna Gain	[dBi]	22.00	22.00	22.00	22.00	15.00		Assumed for BIRDS-4 Link Budget
Ground Station Total Transmission Line Losses	[dB]	3.40	3.40	3.40	3.40	1.50		Assumed for BIRDS-4 Link Budget
Signal Power at Ground Station LNA Input	[dBw]	-141.55	-141.55	-150.59	-150.59	-135.06		
	[dBm]	-111.55	-111.55	-120.59	-120.59	-105.06		
GS (RX Power Sensitivity Method)								
Rceiver Sensitivity	[dBm]	-121.00	-121.00	-136.00	-136.00	-122.00		Based on ICOM-9100 data sheet value
System Link Margin	[dB]	9.45	9.45	15.41	15.41	16.94		





Kumo



LAST SLIDE