Kyutech
Kyushu Institute of Technology
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La SEINE

BIRDS-X

Link Budget
Telemetry, Missions data

Uplink

PARAMETERS		
Objective		APRS-Digipeater and Store and Forward Mission
Beam		U2
Frequency	[MHz}	145.825
Emission Type		15K0F2D
Modulation		AFSK
Data Rate	[bps]	1200
Protocol		AX.25
GROUND STATION		
Ground Station Transmitter Power Output	[W]	50.0
	[dBw]	17.0
Ground Station Total Transmission Line Losses	[dB]	1.5
Antenna Gain	[dBi]	16.0
Ground Station EIRP	[dBw]	31.5
UPLINK PATH		
Orbit Altitude	[km]	400
Elevation Angle	[degree]	10.0
Slant Range	[km]	1439.8
Ground Station Antenna Pointing Loss	[dB]	1.0
Ground Station to Spacecraft Antenna Polarization Loss	[dB]	3.0
Path Loss	[dB]	138.9
Atmospheric Losses	[dB]	1.1
Ionospheric Losses	[dB]	0.7
Rain Losses	[dB]	0.0
Isotropic Signal Level at Spacecraft	[dBw]	-113.2
SPACECRAFT (RX Power Sensitivity Method)		
Spacecraft Antenna Pointing Loss	[dB]	5.0
Spacecraft Antenna Gain	[dBi]	2.2
Spacecraft Total Transmission Line Losses	[dB]	2.3
Signal Power at Spacecraft LNA Input	[dBw]	-118.4
	[dBmW]	-88.4
Required Signal Power at Spacecraft LNA Input	[dBmW]	-105.0
System Link Margin	[dB]	16.6

Downlink

UHF1: Addnics
UHF2: 自作

VHF1:
APRS レフェレンス＃1

VHF2: APRS
APRSレフェレンス＃2

VHF3 - 7:
APRS コンペ＃3 - ＃7

PARAMETERS						
Objective		Telemetry and other Mission Data (UHF 1)	Telemetry and other Mission Data (UHF 2)	CW Beacon (UHF 1, 2)	APRS-Digipeater and Store and Forward Mission (VHF 1)	APRS-Digipeater and Store and Forward Mission (VHF 2-7)
Beam		D2	D3	D1	D4	D4
Frequency	[MHz}	437.375	437.375	437.375	145.825	145.825
Emission Type		6K20F1D	16K0F1D	500HA1A	12K0F2D	12K5F2D
Modulation		GMSK	GMSK	Morse Code	AFSK	AFSK
Data Rate	[bps]	4800	4800	20 wpm	1200	1200
Protocol		AX.25	AX.25	-	AX.25	AX.25
SPACECRAFT						
Spacecraft Transmitter Power Output	[W]	0.8	0.80	0.1	2.0	2.0
	[dBw]	-1.0	-1.0	-10.0	3.0	3.0
Spacecraft Total Transmission Line Losses	[dB]	3.0	3.0	3.0	2.4	2.4
Spacecraft Antenna Gain	[dBi]	2.2	2.2	2.2	2.2	2.2
Spacecraft EIRP	[dBw]	-1.8	-1.8	-10.9	2.9	2.9
DOWNLINK PATH						
Orbit Altitude	[km]	400	400	400	400	400
Elevation Angle	[degree]	10.0	10.0	10.0	10.0	10.0
Slant Range	[km]	1439.8	1439.8	1439.8	1439.8	1439.8
Spacecraft Antenna Pointing Loss	[dB]	5.0	5.0	5.0	5.0	5.0
Spacecraft-to-Ground Antenna Polarization Loss	[dB]	3.0	3.0	3.0	3.0	3.0
Path Loss	[dB]	148.4	148.4	148.4	138.9	138.9
Atmospheric Losses	[dB]	1.0	1.0	1.0	1.1	1.1
Ionospheric Losses	[dB]	0.4	0.4	0.4	0.7	0.7
Rain Losses	[dB]	0.0	0.0	0.0	0.0	0.0
Isotropic Signal Level at Ground Station	[dBw]	-159.6	-159.6	-168.7	-145.8	-145.8
GROUND STATION (SNR Method)						
Ground Station Antenna Pointing Loss	[dB]	1.0	1.0	1.0	1.0	1.0
Ground Station Antenna Gain	[dBi]	22.0	22.0	22.0	16.0	16.0
Ground Station Total Transmission Line Losses	[dB]	3.4	3.4	3.4	1.5	1.5
Ground Station Effective Noise Temperature	[K]	1000.0	1000.0	1000.0	1000.0	1000.0
Signal Power at Ground Station LNA Input	[dBw]	-142.0	-142.0	-151.1	-132.3	-132.3
Ground Station Receiver Bandwidth	[Hz]	15000.0	15000.0	500.0	15000.0	15000.0
Ground Station Receiver Noise Power	[dBw]	-156.8	-156.8	-171.6	-156.8	-156.8
Signal-to-Noise Power Ratio (SNR) at Ground Station Receiver	[dB]	14.8	14.8	20.5	24.5	24.5
Required SNR for Ground Station receiver	[dB]	10.6	10.6	10.0	11.5	11.5
System Link Margin	[dB]	4.2	4.2	10.5	13.0	13.0

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