

Link budget for FramSat-1

Sheet updated/valid from

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Sheet updated by

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Sheet LOCKED

NO (edits OK)

Constants			
Speed of light	[m/s]		299792458
MHz and km	[1]		1000000000
Boltzmanns constant	[J/K]		1.38E-23
	[dBW/K/Hz]		-228.60
	[dBm/K/Hz]		-198.60

Parameter		Unit	UHF down	UHF up
General				
	Valid numbers in calculation?		NO	NO
f	Carrier Frequency	[MHz]	437.9	437.9
	Wavelength	[meter]	0.685	0.685
d	Distance	[km]	1160	1160
R	Data rate	[bps]	9600	9600
	Modulation		2-FSK	2-FSK
	Required BER		1E-04	1E-04
	Required E _b /N ₀ for BER	[dB]	12.3	12.3
TX				
	Power	[mW]	2000	2000

Pt	Power input to antenna, eff = 1	[dBm]	33.0	33.0
	Connection Loss	[dB]	-0.1	-0.1
	Cable Loss	[dB]	-0.3	-1.8
Gt	HPA Gain	[dB]	0	42
	HPA Power Backoff	[dB]	0.0	-27.0
	Antenna Gain	[dBi]	-4.4	14.1
EIRP		[dBm]	28.2	60.2

Propagation

	Free Space Loss	[dB]	-146.6	-146.6
	Pointing Loss	[dB]	0	0
	Atmospheric loss	[dB]	-0.2	-0.2
	Ionospheric loss (scintillation + auroral abs)	[dB]	-6.0	-6.0
	Polarization Loss (circ --> lin)	[dB]	-3	-3
Total Transmission Loss		[dB]	-155.8	-155.8

Gr

RX

	Antenna Gain	[dBi]	14.1	-4.4
S	Connector/cable/filter Loss	[dB]	-1.8	-0.3
	Receiver frontend gain	[dB]	13.6	13.6
Received Power at demodulator		[dBm]	-101.7	-86.7

T

Noise

I	Noise temperature	[K]	348	348
G/T	Bandwidth	[Hz]	19200.0000	19200.0000
N	Expected noise added from interference	[dB]	8.4	8.4
	Receiver G/T		0.0405	-0.0126
Noise Power excl. interference			-130.4	-130.4

Resulting Link Quality

Signal to noise ratio, C/N	[dB]	28.7	43.7
Signal to noise ratio, C/N	[dBHz]	71.5	86.5
C/(N0+I0)	[dB]	20.3	35.3
Eb/N0 for link (incl. interference)	[dB]	23.3	38.3
Eb/N0 for link (excl. interference)	[dB]	31.7	46.7
SYSTEM FADE MARGIN (excl. interference)	[dB]	19.4	34.4
SYSTEM FADE MARGIN (incl. interference)	[dB]	11.0	26.0
		UHF down	UHF up

	dB in	lin in
x lin	1.21338885	2
x dB	0.84	3.010299957

Distance vs. Elevation angle Calculator (only considers passes directly over head):				
What			Value	Unit
Orbit height above ground			300	[km]
Earth radius			6371	[km]
(Minimum) elevation angle			10	[degrees]
Resulting distance GS to Satellite [km]			1160	[km]
Pass duration [s]			297.06	[s]
Pass duration [hh:mm:ss]			12:04:57 AM	[hh:mm:ss]
Data pr. pass [b]			2851759.621	[b]
Data pr. pass [kB]			356.47	[kB]
Data pr. day [kB]			5679.88	[kB]

