SORTIE Link Budget Analysis

Constants	Symbol	Values	Units
Earth gravitational constant	m	398600.5	km3/s2
Earth radius	RE	6,378.14	km
Speed of Light	c	3.00E+08	m
Boltzmann Constant	k	1.38E-23	J/K

Color Code Key	
User Inputs	
calculated value	
Heading	
Sub Heading	

Design Element	Symbol	Units	Uplink	Downlink	Downlink
Link Frequency	f	GHz	0.45	0.468	0.468
Transmitter Power	Ptx	Watts	5.00	0.50	0.50
Transmitter Power	Ptx	dBW	6.99	-3.01	-3.01
Transmitter					
Antenna Gain	Gtx	dB	37.00	-1.00	-1.00
Antenna Transmitter Losses	Ltx	dB	-0.5	-0.5	-0.5
Antenna Beam width	qtx	Deg	2.6	180.0	180.0
Antenna Misalignment	atx	Deg	0.5	0	0
Alignment Loss	Lqtx	dB	-0.44	0.00	0.00
Equivalent Isotropic Radiated Power	EIRP	dBW	43.05	-4.51	-4.51
Losses					
Propagation Path Length	S	Km	1944.0	420.0	1861.3
Space Loss	Ls	dB	-151.29	-138.32	-151.25
Atmospheric	La	dB	-0.5	-0.5	-0.5
Polarization Loss	Lp	dB	-1	-1	-1
Total Losses	L	dB	-152.79	-139.82	-152.75
Receiver					
Antenna Gain	Gr	dB	-1.0	37.0	37.0
Antenna Receiver Loss	Lr	dB	-0.5	-1	-1
Antenna Beam width	qr	Deg	180.0	2.6	2.6
Antenna Misalignment	ar	Deg	0	0.5	0.5
Alignment Loss	Lqr	dB	0.00	-0.44	-0.44
Total Receiver	G	dB	-1.50	35.56	35.56
Sky (Antenna) Noise Temperature	Ta	K	300	200	200
Receiver Temperature	Tr	K	3270.00	300.00	300.00
System Noise Temperature	Ts	K	3570.00	500.00	500.00
Receiver Merit	G/T	DB(1/K)	-37.03	8.57	8.57
Powers					
Power Flux Density	f	dB(W/m2)	-93.72	-127.97	-140.90
Occupied Bandwidth		kHz	0.00	3000	3000
Power Flux Spectral Density	ff	dB(W/m2/kHz)	-106.55	-162.74	-175.67
Power Flux Spectral Density Limit	ff	dB(W/m2/kHz)	0.00	-158.02	-158.02
Carrier Power Received	Prx	dBW	-111.24	-108.77	-121.70
Noise Spectral Density	No	dB(W/Hz)	-193.07	-201.61	-201.61
Carrier to Noise Density	Prx/No	dB(Hz)	81.83	92.84	79.91
Rates					
Data Rate	R	Bps	1.92E+04	3.00E+06	1.50E+06
Eb/No	Eb/No	dB	39.00	28.07	18.15
Required Eb/No - Modulation Format	Eb/No	dB	10.3	9.6	9.6
Coding gain		dB	0	2.5	2.5
Implimention Loss		dB	-15	-2	-2
Required Eb/No	Eb/No	dB	25.30	9.10	9.10
Required Margin		dB	3	3	3
Margin		dB	10.70	15.97	6.05

<- Downlink calculated (1) Directly Overhead; and (2) At 5 Deg Above Horizon

<- Spectral limit as defined by NTIA Red Book for 460-470 MHz Secondary User