

Cornell University SSDS

Sprite Spacecraft

Link Budget

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*Boxes with black outlines are inputs

Constants	Standard	Decibels	
Boltzmann Constant, k	### J/K	### dB	
Speed of Light in Vacuum, c	### m/s		
Earth Radius, RE	6378.14 km		
Earth Mu	### cm ³ /s ²		
Frequency			
Frequency of Signal, f	437 MHz		
Wavelength of Signal, λ	0.686 m		
Orbit			
Altitude, h	325 km		<- Orbital altitude during pass goes here
Minimum Elevation Angle, φ	30 deg		<- Minimum Elevation Angle Goes Here
Line of Sight Range, S	608.5 km		
Orbital Period, T	91.0 min		
S/C Velocity in Circular Orbit, v	7.7 km/s		
S/C Velocity Relative to Ground Station, vr	6.7 km/s		
Maximum Estimated Doppler Shift, df	9.7 kHz		
Path Losses			
Link Loss (or free-space loss), Ls	8.1E-15	-141.0 dB	
Atmospheric Attenuation, La	0.631	-2.0 dB	<- Atmospheric attenuation goes here
Receiver			
Gain of Receiving Antenna, Gr	10.00	10.0 dB	<- Reciever Antenna Gain Goes Here
Receiver System Temperature, Ts	290.00 K	24.6 dBK	<- Receiver system noise temperature goes here
Receiver Noise Factor/Figure	25.119	14 dB	<- Receiver noise figure goes here
Polarization Losses, Lp	0.50	-3.0 dB	
Bandwidth, B	64.0 kHz	48.1 dBHz	<- Reciever bandwidth goes here
System Noise, N	### W	### dBW	
Transmitter			
Transmitting Antenna Gain, Gt	1.00	0.00 dB	<- Transmitter antenna gain goes here
Transmitter Power, P	0.010 W	-20 dBW	<- Transmitter power goes here
EIRP, W	0.010 W	-20.00 dBW	
Signal Encoding / Convolution			
Chip Rate, Rc	64.00 kbps		<- Chipping rate goes here
Effective Data Rate, R	125.00 bps		
Chips/Bit	512		<- Code Length goes here
Signal Processing Gain, Gsp	512.00	27.09 dB	
Link Quality			
Received Power, Carrier Power, C	### W	### dBW	
Carrier to Noise, C/N	0.040	### dB	
Eb/N0	20.3	13.07 dB	
Minimum Eb/N0	10.0	10.00 dB	
Margin, M	10.27	3.07 dB	

Constants	Standard	Decibels	
Boltzmann Constant, k	1.381E-23 J/K	-228.60 dB	
Speed of Light in Vacuum, c	3.00E+08 m/s		
Earth Radius, RE	6378.14 km		
Earth Mu	3.99E+05 km^3/s^2		
Frequency			
Frequency of Signal, f	437 Mhz		
Wavelength of Signal, λ	0.686 m		
Orbit			
Altitude, h	400 km		<- Orbital altitude during pass goes here
Minimum Elevation Angle, φ	60 deg		<- Minimum Elevation Angle Goes Here
Line of Sight Range, S	457.4 km		
Orbital Period, T	92.6 min		
S/C Velocity in Circular Orbit, v	7.7 km/s		
S/C Velocity Relative to Ground Station, vr	3.8 km/s		
Maximum Estimated Doppler Shift, df	5.6 kHz		
Path Losses			
Link Loss (or free-space loss), Ls	1.4E-14	-138.5 dB	
Atmospheric Attenuation, La	0.832	-0.8 dB	<- Atmospheric attenuation goes here
Receiver			
Gain of Receiving Antenna, Gr	1.45	1.6 dB	<- Reciever Antenna Gain Goes Here
Receiver System Temperature, Ts	290.00 K	39.3 dBK	<- Receiver system noise temperature goes here
Receiver Noise Factor/Figure	31.623	15 dB	<- Receiver noise figure goes here
Polarization Losses, Lp	0.50	-3.0 dB	
Bandwidth, B	10.0 kHz	40.0 dBHz	<- Reciever bandwidth goes here
System Noise, N	1.27E-15 W	-149.33 dBW	
Transmitter			
Transmitting Antenna Gain, Gt	3.98	6.00 dB	<- Transmitter antenna gain goes here
Transmitter Power, P	25.000 W	13.9794000867 dBW	<- Transmitter power goes here
EIRP, W	99.527 W	19.98 dBW	
Signal Encoding / Convolution			
Baud Rate, R	1200.00 bps		
Link Quality			
Received Power, Carrier Power, C	8.55E-13 W	-120.69 dBW	
Carrier to Noise, C/N	675.587	28.30 dB	
Eb/N0	5629.9	37.51 dB	
Minimum Eb/N0	10.0	10.00 dB	
Margin, M	5066.90	27.51 dB	