Link budgets

The table below shows the link budgets for transmissions from the ground station to the Global-1 satellite. There are two uplink channels: a low-rate uplink at 450.2 MHz (UHF), and a higher-date rate uplink at 2071.875 MHz (S-band). The UHF ground antenna is a yagi antenna, and the S-band ground antenna is a parabolic antenna.

For the S-band uplink, different size antennas are used at each site. At the North Pole, AK, ground station, a 7.3 m parabolic antenna is used. A 9.1 m parabolic antenna is also available as a backup at the same location, and will only be used in the event that the 7.3 m goes offline. At the Invercargill, New Zealand site, a 3.7 m antenna is used. Thus at each site, there is a different combination of RF output power and antenna gain that achieve the desired EIRP. These parameters are given in the tables below.

This link budget assumes 550 km mean orbit altitude and a 5 degree elevation above the horizon. Note that the system was designed to operate in orbits up to 600 km altitude, hence the high margins.

Table 1. Link Budget

Parameter for Uplink	UHF Uplink	S-band uplink	Unit
Circular Altitude	550	550	km
Elevation from Ground Station	5	5	deg
Resulting slant range	2,205.9	2,205.90	km
Center Frequency	450.2	2071.875	MHz
GS Transmit power	13.0	*See table 2*	dBW
GS Antenna gain	12.7	*See table 2*	dBi
Expected Line Loss	2.9	*See table 2*	dB
GS EIRP	22.8	43.0	dBW
Isotropic Signal level at Spacecraft	-132.3	-125.6	dBW
Spacecraft Antenna Gain	-5	6	dBi
Spacecraft Expected Losses	0.9	2.3	dB
Spacecraft G/T	-31.7	-22.4	dB/K
Effective data rate (post-FEC)	19.2	153.6	kbps
Resulting Eb/No	21.8	28.7	dB
Specified bit error rate	1.0E-05	1.0E-05	-
Required Eb/No	10.6	10.6	dB
Resulting Link Margin	11.2	18.1	dB

Table 2. EIRP components per location

Parameter for each ground station	New Zealand S-band uplink	Alaska S-band uplink, 7.3 m antenna (primary)	Alaska S-band uplink, 9.1 m antenna (backup)	Unit
GS Transmit power	11.0	-0.4	-2.0	dBW
GS Antenna gain	34.4	41.0	42.6	dBi
Expected Line Loss	2.4	2.4	2.4	dB
GS EIRP	43.0	43.0	43.0	dBW