# GPS L2 Link Budget

## Satellite Tranmitter

| | | | |
|---|---|---|---|
| Transmitter Power (4.32 Watts) | 6.35 | dBW | |
| RF Losses in trasmitter path | -1.25 | dB | |
| Antenna Gain (with respect to an isotrope) | 11.5 | dBi | |
| **Satellite EIRP (wrt isotropic radiator)** | **16.60** | **dBW** | **45.71 Watts** |

## Propagation

| | | | |
|---|---|---|---|
| Atmoshperic and Polarization Losses | -0.5 | dB | |

$$Free\ Space\ Path\ Loss = -10\times\log_{10}\left[\left(\frac{4\pi d}{\lambda}\right)^2\right]$$

| | | |
|---|---|---|
| where d = distance from antenna = | 2.52E+07 | meters |
| c = speed of light = | 3.00E+08 | m/sec |
| f = frequency = | 1.23E+09 | Hz |
| lambda = wavelength = c/f = | 2.44E-01 | meters |

$$= -10\log_{10}\left[3.17E{+}08 \Big/ 2.44E{-}01\right]^2$$

$$= -10\log_{10}\left[1.30E{+}09\right]^2$$

| | | |
|---|---|---|
| Free Space Path Loss over Distance | -182.26 | dB |

| | | | |
|---|---|---|---|
| **Received Power on Earth** | **-166.16** | **dBW** | |
| | **-136.16** | **dBm** | **2.42E-05 pW** |
| Gain of Receive Antenna | 38 | dBic | |
| RF losses in 300 feet of LMR400UF cabling and connectors from Receive Antenna to Line Amplifier | -6.7 | dB | |
| Gain of Line Amplifier | 20 | dB | |
| ***RF Power at Input to Re-Radiating Antenna*** | ***-84.86*** | ***dBm*** | **3.26 pW** |
| Gain of Passive Re-Radiating Antenna | 3 | dBic | |
| **Re-Radiated EIRP (wrt isotropic radiator)** | **-81.86** | **dBm** | **6.51 pW** |
| **Re-Radiated ERP (wrt dipole radiator)** | **-84.01** | **dBm** | **3.97 pW** |

$$Free\ Space\ Path\ Loss = -10\times\log_{10}\left[\left(\frac{4\pi d}{\lambda}\right)^2\right]$$

where d = distance from antenna = 100 feet

$$= -10\log_{10}\left[383.02298 \Big/ 2.44\text{E-}01\right]^2$$

$$= -10\log_{10}\left[1.57\text{E+}03\right]^2$$

Free Space Path Loss over Distance -63.90 dB

**RF power level at 100 ft distance = -145.77 dBm** wrt isotropic antenna

**-147.92 dBm** wrt dipole antenna