# GPS L1 Link Budget

## Satellite Tranmitter

| | |
|---|---|
| Transmitter Power (25 Watts) | 14 dBW |
| RF Losses in trasmitter path | -1.25 dB |
| Antenna Gain (with respect to a dipole) | 11.35 dBd |
| **Satellite ERP** | **24.10 dBW** |

## 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 (25236 km)
lambda = wavelength = c/f
c = speed of light (3x10^8 m/sec)
f = frequency (1.57542 GHz)

$= -10 \log [317.125\text{x}10^{6}/190.425\text{x}10^{-3}]^2$
$= -10 \log [1.665\text{x}10^{9}]^2$
$= -184.43$ dB

**Received Power on Earth** **-160.83 dBW**
**-130.83 dBm**

| | |
|---|---|
| Gain of Receive Antenna | 33 dBic |
| RF loss for 40 feet (-2dB) LMR400 cable from Receive Antenna to Splitter and also from Splitter Output 3, 200 feet (-10dB) to Line Amplifier Plus Splitter Amplification (+6 dB) | |
| Net Gain/Loss= | -6 dB |
| Gain of Line Amplifier | 20 dB |
| Gain of Passive Radiating Antenna | 3 dBic |

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

where d = 100 feet distance (30.48m)
lambda = wavelength = c/f
c = speed of light (3x10^8 m/sec)
f = frequency (1.57542 GHz)

$= -10 \log [383.023/190.425\text{x}10^{-3}]^2$
$= -10 \log [2011.41]^2$
$= -66.07$ dB **100 foot distance**

**RF power level at 100 ft distance** **-146.90 dBm**