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)

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

Received Power on Earth	**-160.83 dBW**
	-130.83 dBm
Gain of Receive Antenna	38 dBic
RF losses in LMR400 cabling and connectors from Receive Antenna to Line Amplifier	-6.7 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)

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

RF power level at 100 ft distance	**-142.60 dBm**