



EXHIBIT 2 GPS SIGNAL LEVEL CALCULATIONS Revision A

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SYSTEM 12
LMAC PLANT 10
BUILDING 601 WEST
F-22 MOD LINE HANGAR
IDENTIFIERS: 601T1

The following calculations are for System 12 transmit identifier 601T1. Calculations are based upon an average re-transmitted receive power for L1 of -130 dBm at the unit under test at the roof-mounted receive antenna. Transmit antenna, inside the building, is permanently installed pointing downward. The maximum antenna gain is 4.7 dBi at the focal point and is reduced at off-axis angles. The GLI-Metro signal level controller input range is -85 to -115 dBm. The range of output power level adjustment is -85 to -65dBm.

The attenuation of the GPS signal while traveling through free space is calculated with the following formula:

$$\text{FSL} = K1 + 20 \cdot \text{LOG}(D) + 20 \cdot \text{LOG}(F)$$

Where:

K1 = the constant factor (-37.87) for the desired units (feet),

F = the frequency in MHz; and

D = the slant range distance from the transmitter antenna to 100 feet beyond the nearest exterior wall in feet.

D_0 = Distance to the nearest outside wall (120 feet).

Slant Angle = The angle, based on the slant range, used to calculate the reduced antenna gain directed 100' beyond the nearest exterior wall.

We are calculating the GPS Re-radiation at 1575.42 MHz for L1.

Therefore, the Free Space Path Loss (FSL) for the horizontal distance from the antenna to the nearest exterior wall plus 100' equals:

1. For L1: $\text{FSL} = -37.87 + 20 \cdot \text{LOG}(220) + 20 \cdot \text{LOG}(1575.42) = 72.93 \text{ dB}$ **(Worst case scenario)**

A **worst case scenario** is using the maximum antenna gain transmitted at the horizontal distance. In this case, at 100' beyond the nearest exterior wall, the power is as follows:

1. L1 Transmitted Power = 50.0 pW ERP= 82.03 pW EIRP = -70.86 dBm/24 MHz (Based on maximum antenna gain)
At 100' = $-70.86 - 72.93 = -143.79 \text{ dBm/24 MHz}$ **(Worst case scenario, maximum antenna gain pointing horizontally out of the building)**



SYSTEM 12
LMAC PLANT 10
BUILDING 601 WEST
F-22 MOD LINE HANGAR
IDENTIFIERS: 601T2

The following calculations are for System 12 transmit identifier 601T2. Calculations are based upon an average receive power for L1 of -130 dBm at the unit under test at the roof-mounted receive antenna. Transmit antenna, inside the building, is permanently installed pointing downward. The maximum antenna gain is 4.7 dBi at the focal point and is reduced at off-axis angles. The GLI-Metro signal level controller input range is -85 to -115 dBm. The range of output power level adjustment is -85 to -65dBm.

The attenuation of the GPS signal while traveling through free space is calculated with the following formula:

$$FSL = K1 + 20 \cdot \log(D) + 20 \cdot \log(F)$$

Where:

K1 = the constant factor (-37.87) for the desired units (feet),

F = the frequency in MHz; and

D = the slant range distance from the transmitter antenna to 100 feet beyond the nearest exterior wall in feet (350.5').

D₀ = Distance to the nearest outside wall (250 feet).

Slant Angle = The angle, based on the slant range, used to calculate the reduced antenna gain directed 100' beyond the nearest exterior wall.

We are calculating the GPS Re-radiation at 1575.42 MHz for L1.

Therefore, the Free Space Path Loss (FSL) for the horizontal distance from the antenna to the nearest exterior wall plus 100' equals:

1. For L1: $FSL = -37.87 + 20 \cdot \log(350) + 20 \cdot \log(1575.42) = 76.96 \text{ dB}$ (**Worst case scenario**)

A **worst case scenario** is using the maximum antenna gain transmitted at the horizontal distance. In this case, at 100' beyond the nearest exterior wall, the power is as follows:

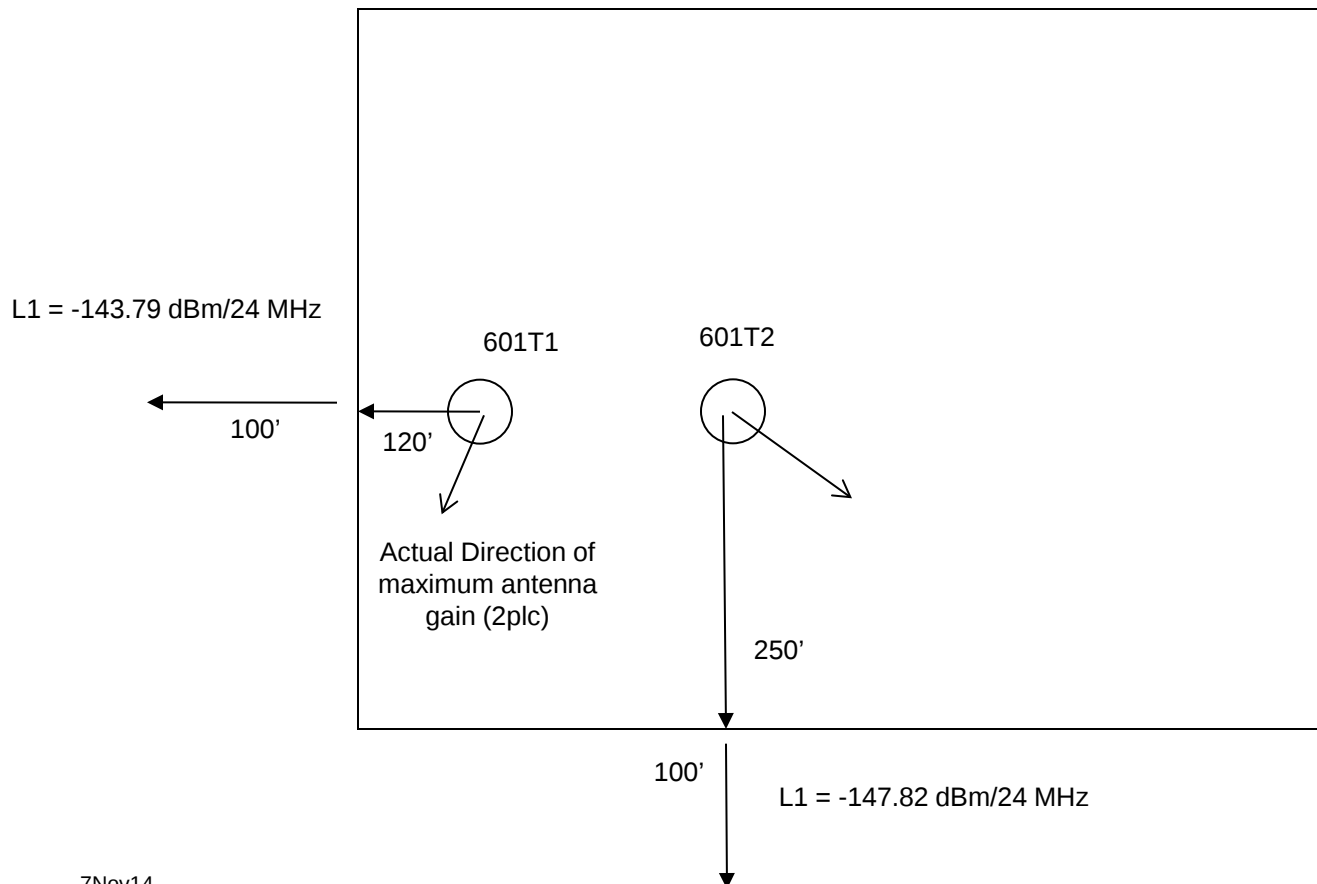
1. L1 Transmitted Power = 50.0 pW ERP= 82.03 pW EIRP = -70.86 dBm/24 MHz (Based on maximum antenna gain)

At 100' = $-70.86 - 76.96 = -147.82 \text{ dBm/24 MHz}$ (**Worst case scenario, maximum antenna gain pointing horizontally out of the building**)



SYSTEM 12
LMAC PLANT 10
BUILDING 601
F-22 MOD LINE
IDENTIFIERS: 601T1/T2
BUILDING DIMENSION: 940' X 590'
(Diagram not proportional)

EXTERIOR WALLS (Top View)



Side View

Antenna Transmit gain towards
roof = -9.29 dBi

