

GPS Booster Station Signal Strength Calculation  
 High Bay 7A/B  
 Reference file # 0264-EX-PL-2009

This GPS booster station re-radiates the GPS L1 (1575.42 MHz) signal. Calculations are performed per Section 8.3.28 of the NTIA regulations [1]. The re-radiated power is limited by requirement 6 which states “that the calculated emissions are no greater than -140 dBm/24 MHz as received by an isotropic antenna at a distance of 100 feet (30 meters) from the building.” Also, any attenuation by the building will be neglected. This worksheet shows that the re-radiated signal for the High Bay 7A/B location is in compliance with the NTIA requirement.

The signal strength is defined by:

$$P_{sig} = P_{rec} + G_{roof} + L_{cable} + G_{lna} + G_{ant} + L_{space} \quad \text{eq. 1 [2]}$$

Where

- $P_{sig}$  = The Re-Radiated signal strength at 30 meters from the building.
- $P_{rec}$  = The power of the received GPS signal, L1 = -130 dBm
- $G_{roof}$  = Gain of the active receiving antenna of the GPS re-rad system, 35 dB [3]
- $L_{cable}$  = Losses for the RF cabling of the re-rad system @5 dB/100 ft, l = 146 ft [3]
- $G_{lna}$  = Gain of the LNA of the re-rad system. 23 dB (typical) [3]
- $G_{ant}$  = Gain of the re-radiating antenna, -10 dBi [3]
- $L_{space}$  = Free space loss of the re-radiated signal

The free space loss is dependent upon the distance from the re-radiating antenna to the exterior wall and from the exterior wall to the designated measurement distance, 30 meters.

$$L_{space} = 20 \text{ Log}(\lambda/4\pi D) \quad \text{eq. 2 [2]}$$

- Where  $\lambda$  = Wavelength of the GPS signal, L1 = .1904 meters
- $\pi$  = Pi
- D = The distance from antenna to exterior wall plus 30 meter required distance

Using the measured distance from the re-radiating antenna to exterior wall of High Bay 7A/B, and the 30 meter margin, the Path Loss is:

$$L_{space} = 20 * \text{Log}(.1904 / (4 * \pi * (30 + 9.5))) = -68.3 \text{ dB}$$

The power of the re-radiated signal at the specified distance is:

$$P_{sig} = -130 + 35 + -7.3 + 23 + -10 + -68.3 = -157.6 \text{ dBm}$$

Maximum Power            -140 dBm

Margin                        17.6 dB

**GPS Booster Station (Re-Radiation System) Link Margin Evaluation  
High Bay 7A/B**

**Reference # 0264-EX-PL-2009**

L1 Frequency (MHz)	1575.42
Wavelength (m)	0.1904
Distance (m) (re-rad antenna to exterior wall)	9.50
GPS Signal Strength	-130 dBm
Roof Antenna/LNA Gain	35.0 dB
RF Cable Loss	-7.3 dB
LNA Gain	23.0 dB
Re-Rad Antenna Gain	-10.0 dBi
Power at Re-Rad Antenna	-89.3 dBm
Space Loss to Distance	-68.3 dB
Power at Specified Distance	-157.6 dBm
Specified Maximum	-140.0 dBm
<b>Margin</b>	<b>17.6 dB</b>

GPS Booster Station Illustration  
High Bay 7A/B

