GPS Booster Station Signal Strength Calculation High Bay 8A Reference file # 0213-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 8A location is in compliance with the NTIA requirement.

The signal strength is defined by:

$$P_{\text{sig}} = P_{\text{rec}} + G_{\text{roof}} + L_{\text{cable}} + G_{\text{lna}} + G_{\text{ant}} + L_{\text{space}}$$
 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, 1 = 62 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.

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

Where $\lambda = \text{Wavelength of the GPS signal}, L1 = .1904 \text{ meters}$

 $\pi = Pi$

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 8A, and the 30 meter margin, the Path Loss is:

$$L_{\text{space}} = 20*\text{Log}(.1904/(4*\pi*(30+7.47))) = -67.9 \text{ dB}$$

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

$$P_{sig} = -130 + 35 + -3.1 + 23 + -10 + -67.9$$
 = -153.0 dBm

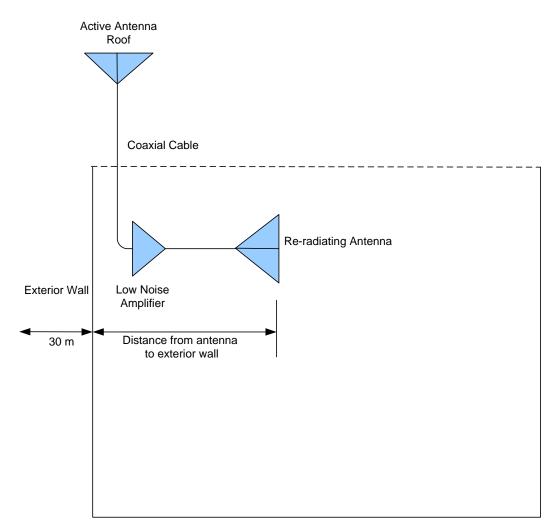
Maximum Power -140 dBm

Margin 13.0 dB

GPS Booster Station (Re-Radiation System) Link Margin Evaluation High Bay 8A Reference # 0213-EX-Pl-2009

Margin	13.0	dB
Specified Maximum	-140.0	dBm
Power at Specified Distance	-153.0	dBm
Space Loss to Distance	-67.9	dB
Power at Re-Rad Antenna	-85.1	dBm
Re-Rad Antenna Gain	-10.0	dBi
LNA Gain	23.0	dB
RF Cable Loss	-3.1	dB
Roof Antenna/LNA Gain	35.0	dB
GPS Signal Strength	-130	dBm
Distance (m) (re-rad antenna to exterior wall)	7.47	
Wavelength (m)	0.1904	
L1 Frequency (MHz)	1575.42	

GPS Booster Station Illustration High Bay 8A



High Bay