GPS Booster Station Signal Strength Calculation High Bay 8G Reference file # 0267-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 8G location is in compliance with the NTIA requirement.

The signal strength is defined by:

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

Where

P _{sig}	= The Re-Radiated signal strength at 30 meters from the building.
P _{rec}	= The power of the received GPS signal, $L1 = -130 \text{ dBm}$
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, $1 = 136$ ft [3]
G _{lna}	= Gain of the LNA of the re-rad system. 23 dB (typical) [3]
Gant	= 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]
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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 8G, and the 30 meter margin, the Path Loss is:

 $L_{\text{space}} = 20*Log(.1904/(4*\pi*(30+13.05))) = -69.1 \text{ dB}$

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

 $P_{sig} = -130 + 35 + -6.8 + 23 + -10 + -69.1 = -157.9 \text{ dBm}$

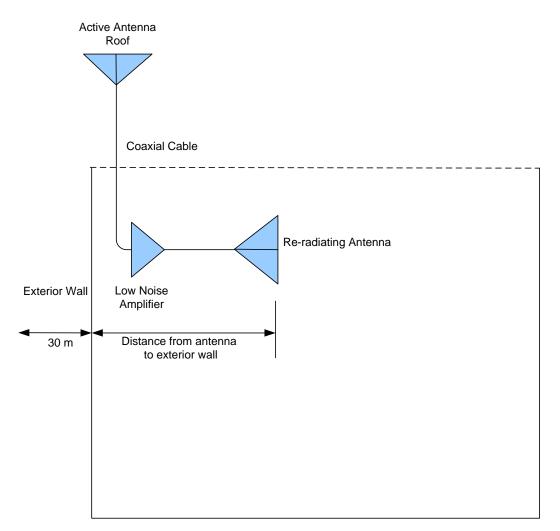
Maximum Power -140 dBm

Margin 17.9 dB

L1 Frequency (MHz) Wavelength (m) Distance (m) (re-rad antenna to exterior wall) GPS Signal Strength Roof Antenna/LNA Gain RF Cable Loss LNA Gain Re-Rad Antenna Gain Power at Re-Rad Antenna	1575.42 0.1904 13.05 -130 35.0 -6.8 23.0	
Distance (m) (re-rad antenna to exterior wall) GPS Signal Strength Roof Antenna/LNA Gain RF Cable Loss LNA Gain Re-Rad Antenna Gain	13.05 -130 35.0 -6.8	dB dB
(re-rad antenna to exterior wall) GPS Signal Strength Roof Antenna/LNA Gain RF Cable Loss LNA Gain Re-Rad Antenna Gain	-130 35.0 -6.8	dB dB
(re-rad antenna to exterior wall) GPS Signal Strength Roof Antenna/LNA Gain RF Cable Loss LNA Gain Re-Rad Antenna Gain	-130 35.0 -6.8	dB dB
GPS Signal Strength Roof Antenna/LNA Gain RF Cable Loss LNA Gain Re-Rad Antenna Gain	35.0 -6.8	dB dB
Roof Antenna/LNA Gain RF Cable Loss LNA Gain Re-Rad Antenna Gain	35.0 -6.8	dB dB
Roof Antenna/LNA Gain RF Cable Loss LNA Gain Re-Rad Antenna Gain	-6.8	dB
RF Cable Loss LNA Gain Re-Rad Antenna Gain	-6.8	dB
LNA Gain Re-Rad Antenna Gain		
LNA Gain Re-Rad Antenna Gain		
Re-Rad Antenna Gain	23.0	dB
Re-Rad Antenna Gain	23.0	aв
	-10.0	dBi
Power at Re-Rad Antenna		
	-88.8	dBm
Space Loss to Distance	-69.1	dB
Power at Specified Distance	-157.9	dBm
Const Cont Manian	140.0	ID
Specified Maximum	-140.0	aBm
Margin		dB

GPS Booster Station (Re-Radiation System) Link Margin Evaluation High Bay 8G Reference # 0267-EX-PL-2009

GPS Booster Station Illustration High Bay 8G



High Bay