GPS Booster Station Signal Strength Calculation High Bay 7C/D Reference file # 0265-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 7C/D 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 $@5 \text{ dB}/100 \text{ ft}$, $l = 62 \text{ ft}$ [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] |
|--|-----------|
| $L_{\text{space}} = 20 \text{ LOg}(\lambda/4 \pi D)$ | eq. 2 [2] |

Where λ = Wavelength of the GPS signal, L1 = .1904 meters π = 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 7C/D, and the 30 meter margin, the Path Loss is:

 $L_{\text{space}} = 20*Log(.1904/(4*\pi^*(30))) = -65.9 \text{ dB}$

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

 $P_{sig} = -130 + 35 + -3.1 + 23 + -10 + -65.9 = -151.0 \text{ dBm}$

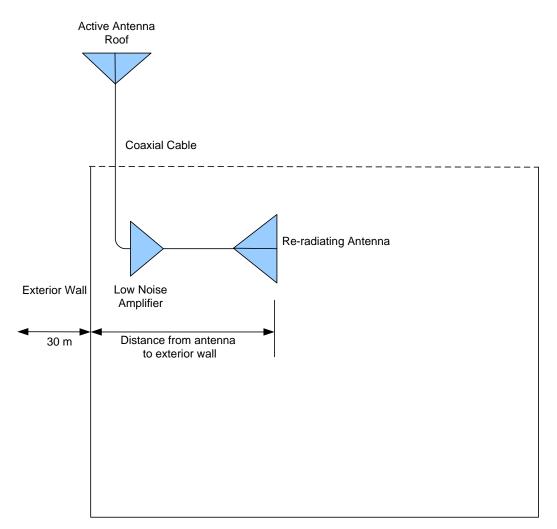
Maximum Power -140 dBm

Margin 11.0 dB

| GPS Booster Station (Re-Radiation System) Link Margin Evaluation | |
|--|--|
| High Bay 7C/D | |
| Reference # 0265-EX-PL-2009 | |

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|------------------------------------|---------|-------|--|--|
| L1 Frequency (MHz) | 1575.42 | | | |
| | | | | |
| Wavelength (m) | 0.1904 | | | |
| | 0.00 | | | |
| Distance (m) | 0.00 | | | |
| (re-rad antenna to exterior wall) | | | | |
| | 100 | ID | | |
| GPS Signal Strength | -130 | dBm | | |
| Deef Antenno/INA Coin | 25.0 | JD | | |
| Roof Antenna/LNA Gain | 35.0 | aв | | |
| RF Cable Loss | -3.1 | dB | | |
| KF Cable Loss | -3.1 | uБ | | |
| LNA Gain | 23.0 | dB | | |
| | 23.0 | uD | | |
| Re-Rad Antenna Gain | -10.0 | dBi | | |
| | 10.0 | (ID) | | |
| Power at Re-Rad Antenna | -85.1 | dBm | | |
| | 0011 | uDiii | | |
| Space Loss to Distance | -65.9 | dB | | |
| | 0017 | | | |
| Power at Specified Distance | -151.0 | dBm | | |
| | 101.0 | | | |
| Specified Maximum | -140.0 | dBm | | |
| specified maximum | -140.0 | uDIII | | |
| Maurin | 11.0 | αL | | |
| Margin | 11.0 | dB | | |

GPS Booster Station Illustration High Bay 7C/D



High Bay