

GPS Booster Station Signal Strength Calculation

Reference file # 0254-EX-PL-2006

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, where item 7 states "the maximum equivalent isotropically radiated power must be such that the calculated emissions are no greater than -140 dBm/24 MHz at a distance of 100 feet (30 meters) from the building where the test is being conducted." Additionally, building attenuation has been ignored. This calculation shows that the re-radiated signal strength is in compliance with the regulation.

$$(1) \quad P_{\text{sig}} = P_{\text{Rec}} + G_{\text{rant}} + G_{\text{amp}} - L_1 + G_{\text{La}} + G_{\text{rrant}} + L_S$$

Where:

P_{sig}	= Re-radiated signal strength 30 meters (m) outside the building
P_{Rec}	= Received power from GPS satellites (L1) = -130 dBm
G_{rant}	= Roof active antenna, Antcom PN: 3G15A-XN-1, antenna gain = 5.4 dBi
G_{amp}	= Roof active antenna amplifier gain = 33 dB
L_1	= Coaxial cable attenuation, roof antenna to line amplifier = 32.4 dB/100 m x 0.155 (15.5 m cable length, PN: LMR-240) = 5.0 dB
G_{La}	= Line amplifier, GPS Source PN: A11, gain = 15 dB
G_{rrant}	= Re-radiating antenna, Antcom PN: 2G15P-XS-1, gain = 5.0 dBi
L_S	= Free space loss

$$(2) \quad L_S = 20\text{Log}(\lambda/4\pi(D))$$

Where:

λ	= $c/f = 3E8/1575.42E6 = 19.04E-2$ m
D	= Distance (d) from antenna to outer wall in meters + 30 = 15.2 m + 30 = 45.2 m

Inserting the values for λ and D into equation (2) yields

$$L_S = 20\text{Log}(19.04E-2/4\pi(45.2)) \\ = -69.5 \text{ dB}$$

Inserting these values into equation (1) yields

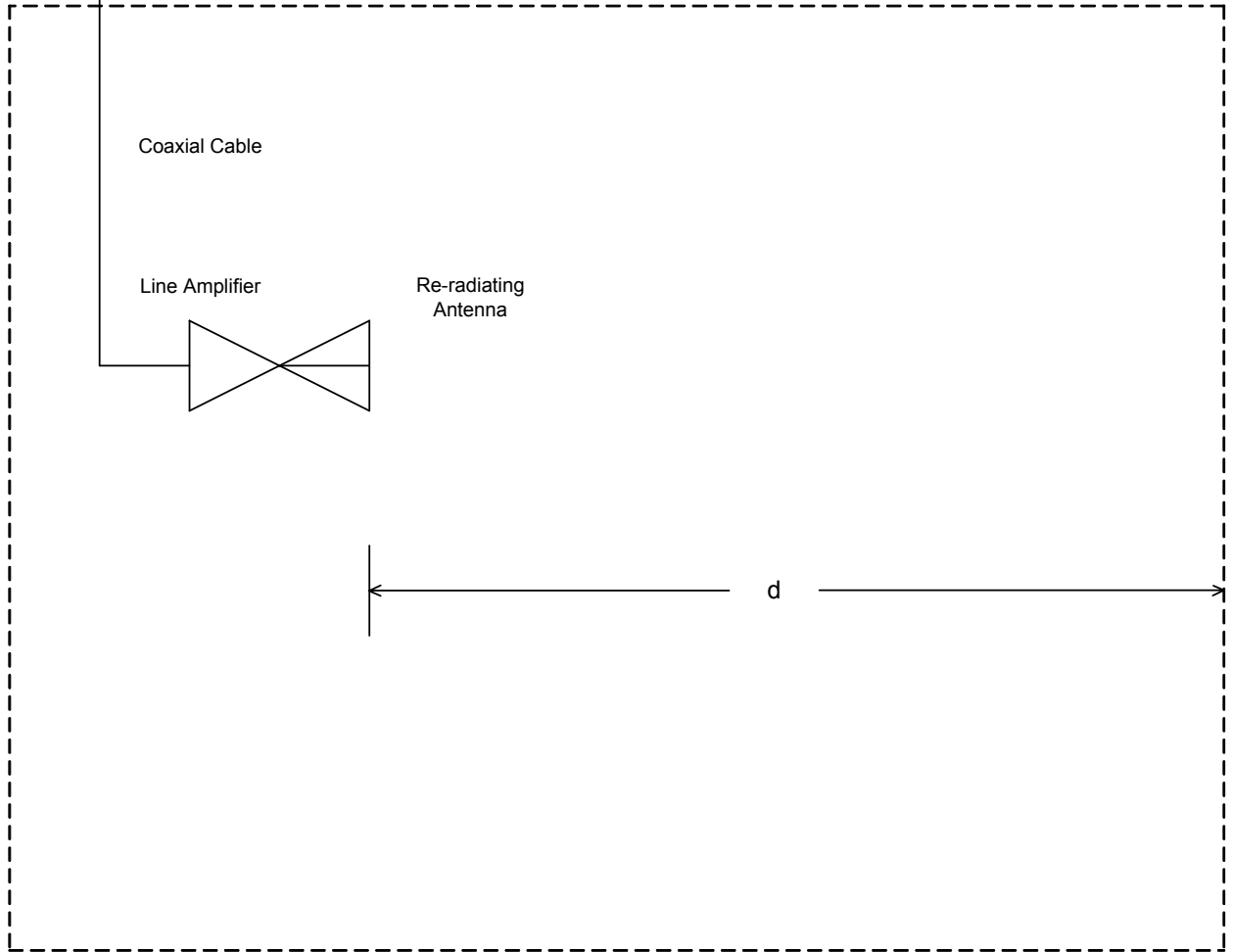
$$P_{\text{sig}} = -130 + 5.4 + 33 - 5.0 + 15 + 5.0 - 69.5 \\ = -146.1 \text{ dBm}$$



Roof Active Antenna



Roof Active Antenna
Low Noise Amplifier



Coaxial Cable

Line Amplifier

Re-radiating
Antenna

