# 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) $P_{sig} = P_{Rec} + G_{rant} + G_{amp} - L_1 + G_{La} + G_{rrant} + L_S$

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

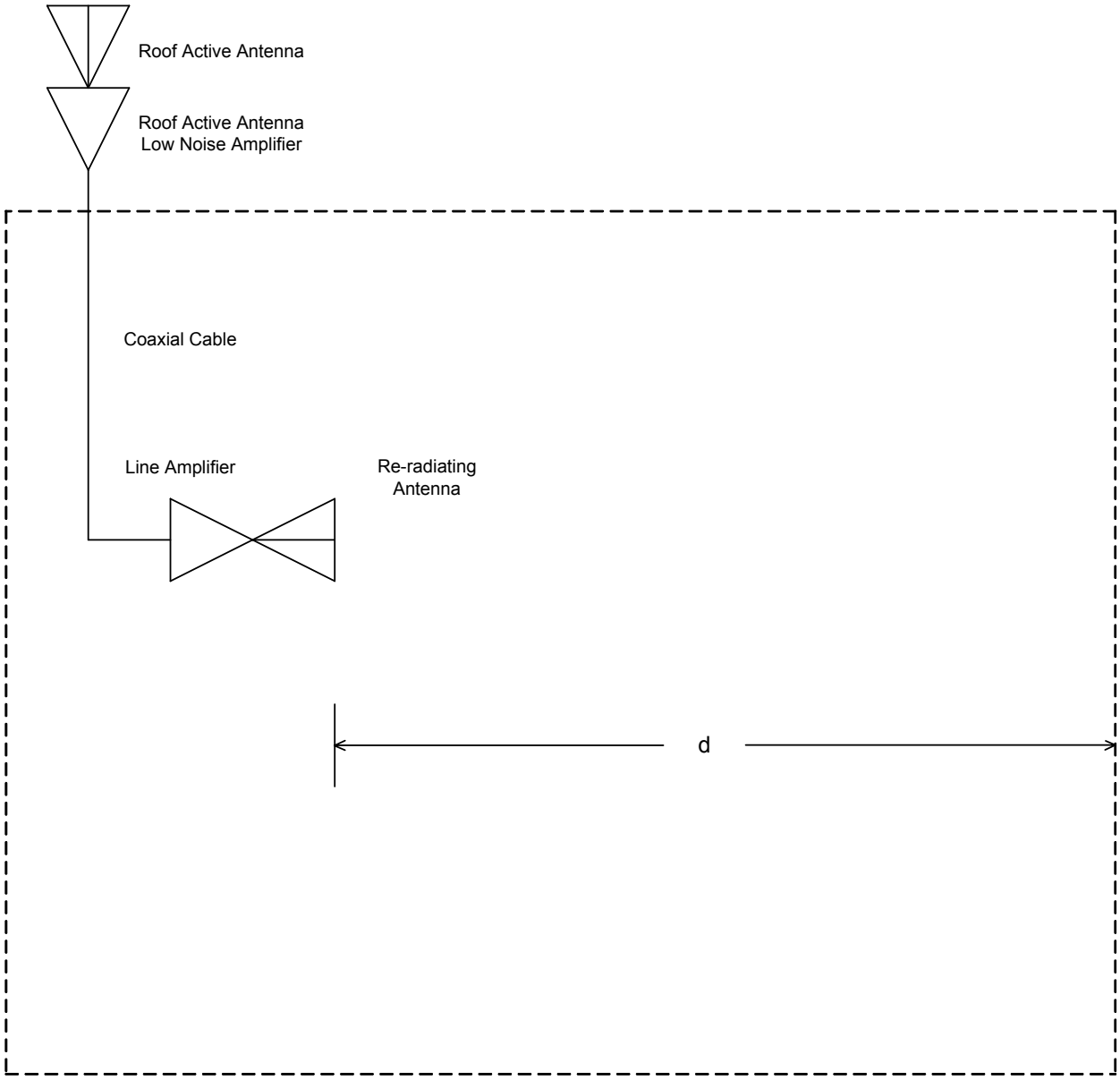
Where:
- $\lambda$ = c/f = 3E8/1575.42E6 = 19.04E-2 m
- D = Distance (d) from antenna to outer wall in meters + 30
  = 15.2 m + 30
  = 45.2 m

Inserting the values for $\lambda$ and D into equation (2) yields

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

Inserting these values into equation (1) yields

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


Roof Active Antenna
Roof Active Antenna
Low Noise Amplifier
Coaxial Cable
Line Amplifier
Re-radiating
Antenna
d