GPS Booster Station Signal Strength Calculation

Reference file # 0252-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) $P_{sig} = P_{Rec} + G_{rant} + G_{amp} - L_1 - L_2 + G_{rrant} + L_S$

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, MicroPulse PN: 1234NW/C, antenna gain = 4.5 dBi
- G_{amp} = Roof active antenna amplifier gain = 55 dB
- L_1 = Coaxial cable #1 attenuation, roof antenna to coaxial cable #2
  = 0.35 dB/m x 23 m (cable type: RG213/U)
  = 8.0 dB
- L_2 = Coaxial cable #2 attenuation, coaxial cable #1 to re-radiating antenna
  = 24.3 dB/100 m x 0.225 (22.5 m cable length, Andrew PN: FSJ1-50)
  = 5.5 dB
- G_{rrant} = Re-radiating antenna, Orbital-made, antenna gain = 1.0 dBi
- L_S = Free space loss

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

Where:

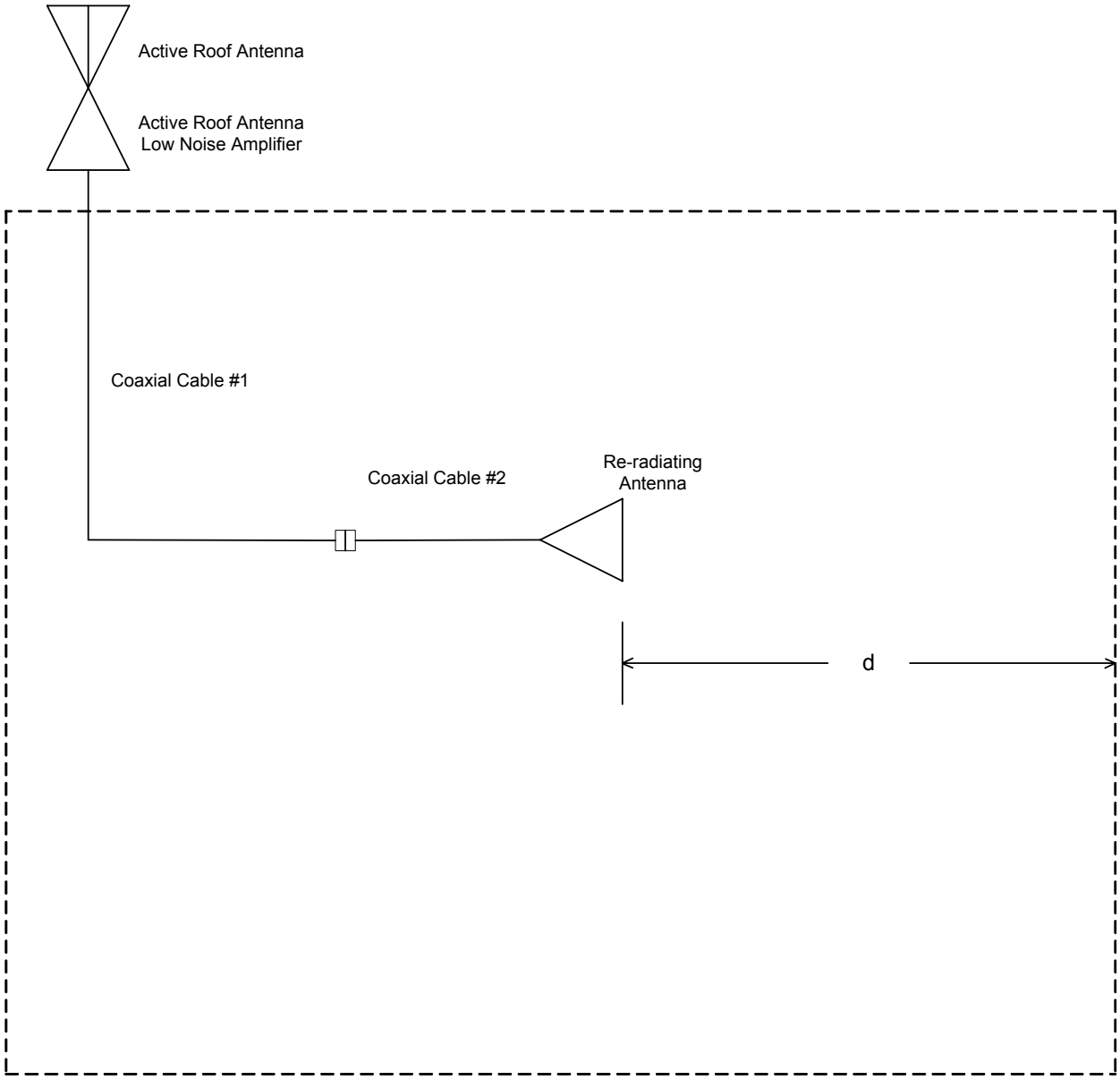
- λ = c/f = 3E8/1575.42E6 = 19.04E-2 m
- D = Distance (d) from antenna to outer wall in meters + 30
  = 30.5 m + 30
  = 60.5 m

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

$L_S = 20\text{Log}(19.04\text{E-}2/4\pi(60.5))$
$= -72.0$ dB

Inserting these values into equation (1) yields

$P_{sig} = -130 + 4.5 + 55 - 8.0 - 5.5 + 1.0 - 72.0$
$= -155.0$ dBm


Active Roof Antenna
Active Roof Antenna
Low Noise Amplifier
Coaxial Cable #1
Coaxial Cable #2
Re-radiating
Antenna
d