GPS Booster Station Signal Strength Calculation

Reference file # 0233-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) $P_{sig} = P_{Rec} + G_{rant} + G_{amp} - L_1 + G_{rrant} + L_S$

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: 2104NW/C, antenna gain = 4.5 dBi
- G_{amp} = Roof active antenna amplifier gain = 53 dB
- L_1 = Coaxial cable attenuation, roof antenna to re-radiating antenna
  = 24.3 dB/100 m x 0.3 (30 m cable length, Andrew PN: FSJ1-50A)
  = 7.3 dB
- G_{rrant} = Re-radiating antenna, Orbital-made, antenna gain = 1.0 dBi
- L_S = Free space loss

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

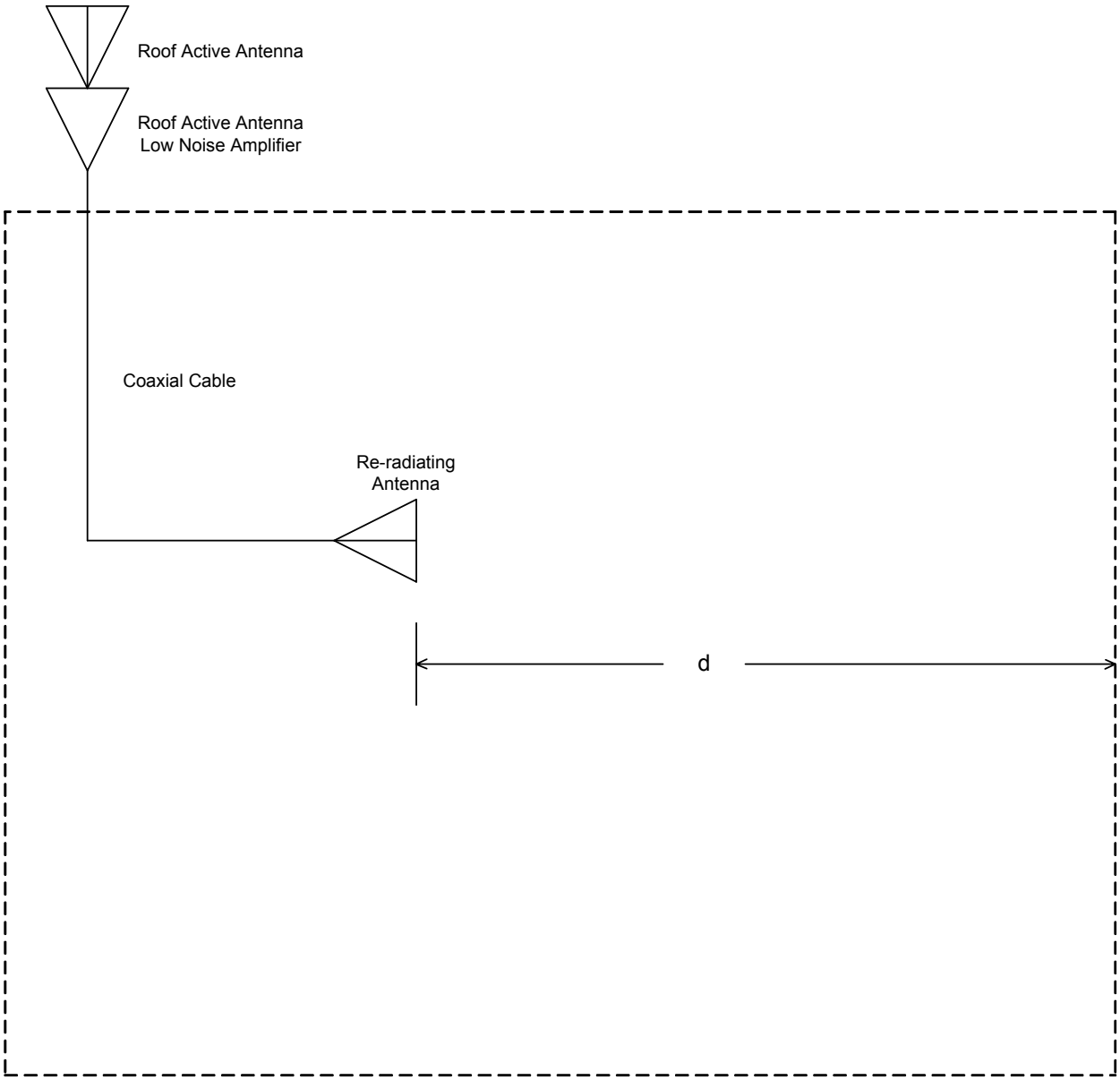
Where:
- λ = c/f = 3E8/1575.42E6 = 19.04E-2 m
- D = Distance (d) from antenna to outer wall in meters + 30
  = 2.7 m + 30
  = 32.7 m

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

$L_S = 20\text{Log}(19.04\text{E-}2/4\pi(32.7))$
$= -66.7$ dB

Inserting these values into equation (1) yields

$P_{sig} = -130 + 4.5 + 53 - 7.3 + 1.0 - 66.7$
$= -145.5$ dBm


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