GPS Booster Station Signal Strength Calculation

Reference file # 0516-EX-PL-2007

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) $P_{sig} = P_{Rec} + G_{rant} + G_{amp} - L_1 - L_2 - L_3 + G_{rrant} + L_S$

Where:

- P_{sig} = Re-radiated signal strength 30 meters (m) outside the aircraft
- P_{Rec} = Received power from GPS satellites (L1) = -130 dBm
- G_{rant} = Aircraft top of fuselage active antenna, Trimble PN: 16248-50, antenna gain = 5.0 dBi
- G_{amp} = Aircraft top of fuselage active antenna amplifier gain = 48 dB, maximum
- L_1 = Coaxial cable attenuation, top of fuselage antenna to bias tee = X dB/m x Y m (cable type: RG142/U) = 4.3 dB
- L_2 = Bias Tee insertion loss = 0.4 dB
- L_3 = Coaxial cable attenuation, bias tee to bottom of fuselage = X dB/m x Y m (cable type: RG142/U) = 2.4 dB
- G_{rrant} = Re-radiating antenna, Trimble PN: 16185-00, antenna gain = 6.0 dBi
- L_S = Free space loss

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

Where:

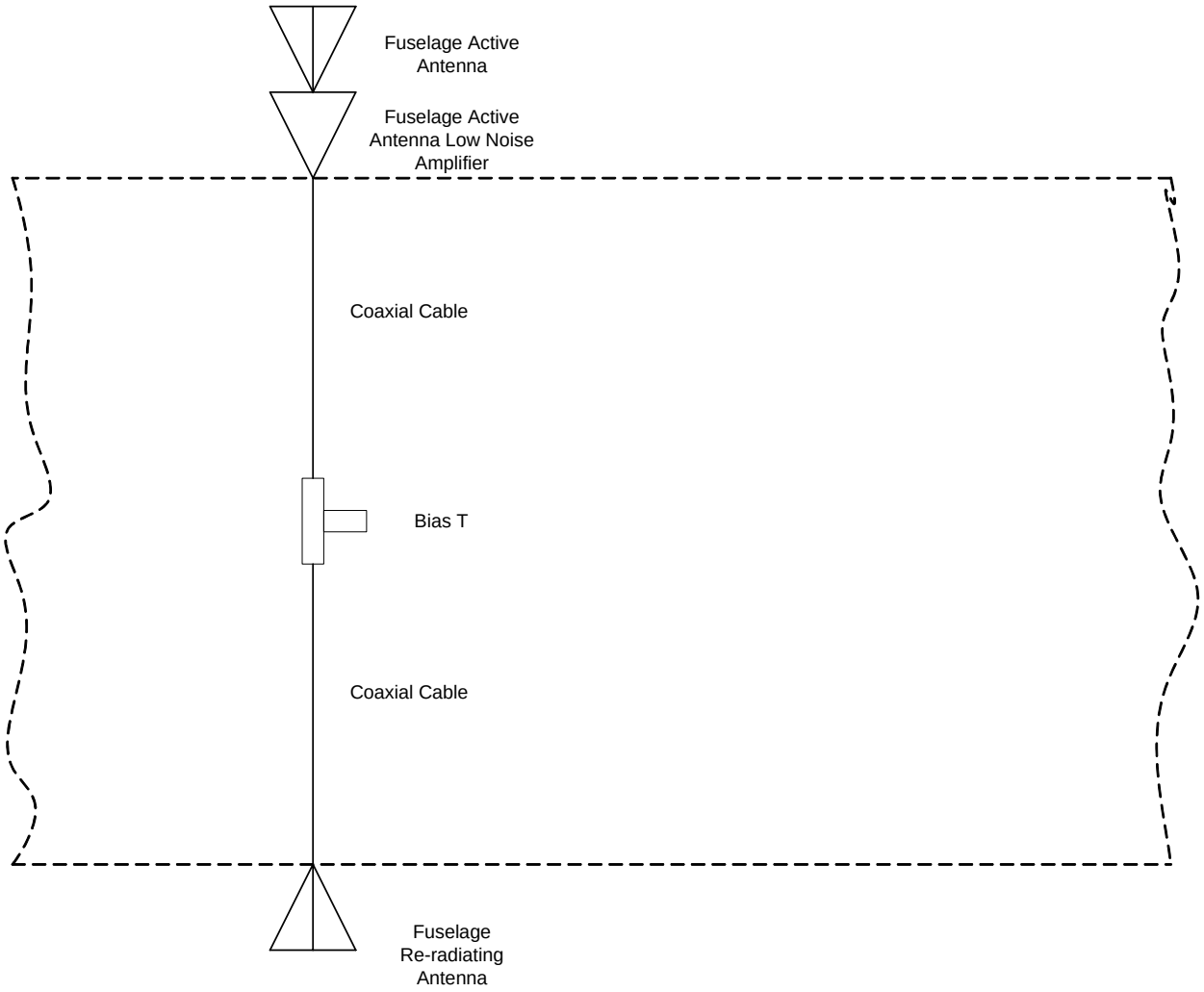
- λ = c/f = 3E8/1575.42E6 = 19.04E-2 m
- D = 30 meters (from re-radiating antenna) = 30 m

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

$L_S = 20\text{Log}(19.04\text{E-}2/4\pi(30.0))$
$= -65.9$ dB

Inserting these values into equation (1) yields

$P_{sig} = -130 + 5.0 + 48 - 4.3 - 0.4 - 2.4 + 6.0 - 65.9$
$= -144.0$ dBm


Fuselage Active Antenna
Fuselage Active Antenna Low Noise Amplifier
Coaxial Cable
Bias T
Coaxial Cable
Fuselage Re-radiating Antenna