Greensboro Re-radiated Power Calculations

Re-radiated Power at 100 feet beyond the nearest outer wall

(1) $P_{Rerad} = P_{Rec} + G_1 + G_2 + A_1 - C_1 - C_2 - Z - FL$

Where: P_{Rerad} = Re-radiated signal strength 100 ft outside the building
P_{Rec} = Received Power from Satellites = -130 dBm
G_1 = Roof Antenna Gain = 38 dBi
G_2 = Re-radiating Antenna Gain = 3 dBic
A_1 = Amplifier Gain = 30 dB
C_1 = Coax Attenuation, Roof Antenna to Amplifier
= 6.5 dB/100 ft X 50 ft
= 3.25 dB
C_2 = Coax Attenuation, Amplifier to Re-radiating Antenna
= 6.5 dB/100 ft X 80 ft
= 5.2 dB
Z = Attenuator Value = 5 dB
FL = Freespace Loss

(2) FL = 20LogF + 20LogD + 36.56

Where: F = Frequency in MHz = 1575.42
D = Distance in Miles
= (Distance from antenna to outer wall in feet + 100)/5280
= (25 ft + 100 ft)/5280

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

FL = 20Log(1575.42) + 20Log((25+100)/5280) +36.56
= 67.99 dB

Inserting these values into equation (1) then becomes:

P_{Rerad} = -130 + 38 + 3 + 30 – 3.25 – 5.2 – 5 – 67.99
= - 140.44 dBm @ 100 ft

Power radiated from Antenna

(3) $P_{Ant} = P_{Rerad} + FL$

Where: P_{Ant} = power radiated from the antenna

Using values from (1) and (2) above, equation (3) becomes:

P_{Ant} = -140.44 + 67.99 = -72.45 dBm EIRP

(4) P_{ERP} (dB) = P_{EIRP} – 2.148

Convert power expressed in dBm from EIRP to ERP using value from (3) becomes:

P_{Ant} = -72.45 – 2.148
= -74.598 dBm ERP

(5) $P = P_{In} [\log^{-1}(P_{Ant}/10)]$

Convert power from dBm to Watts

Where: P = Power in Watts
P_{In} = Input (Reference) Power = 0.001 W

Using values from (3) above, equation (5) becomes:

P_{Ant} = $0.001[\log^{-1}(-72.45/10)]$
= 56.9 pW EIRP

Using value from (4) above, equation (5) becomes:

P_{Ant} = $0.001[\log^{-1}(-74.598/10)]$
= 34.7 pW ERP

Convert power expressed in Watts from EIRP to ERP

(6) P_{ERP} (W) = P_{EIRP} /1.64 (W)

Using values from (5) above, equation (6) becomes:

P_{ERP} = 56.9 pW / 1.64
= 34.7 pW

Power at Transmitter (Radiating Antenna Input)

(7) $P_T = P_{ANT} - G_2$

Where: P_T = Total Power at the Transmitter Output / Radiating Antenna Input (EIRP)

Using values for P_{ANT} expressed in dBm EIRP from (3) above, equation (7) becomes:

P_T = -72.45 – 3.0
= -75.45 dBm EIRP

Convert power from dBm to Watts using equation (5)

P_T = $0.001[\log^{-1}(-75.45/10)]$
= 28.5 pW