From: Joe Malone

To: Anthony Serafini
Date: June 27, 2013

Subject:

Message:

(MAB B7319)
Reference file # 0357-EX-PL-2013

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 [1], 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) Psig = PRec + Grant - L1 + GLa + Grrant + LS
Where: Psig = Re-radiated signal strength 30 meters (m) outside the building
PRec = Received power from GPS satellites (L1) = -130 dBm [2]
Grant = Roof active antenna, from PN: VGHNRRKIT, antenna/amp gain = 40 dBi (max) [3]
L1 = Coaxial cable attenuation [4], roof antenna to line amplifier
= 5.26 dB/100 ft x 0.6 (60 ft cable length)
= 3.2 dB
GLa = Re-radiating amplifier, from PN: VGHNRRKIT, gain = 23 dB (max) [3]
Grrant = Re-radiating antenna, from PN: VGHNRRKIT, gain = 3.0 dBi (typ) [3]
LS = Free space loss

(2) LS = 20Log(?/4?(D))
Where: ? = c/f = 3E8/1575.42E6 = 19.04E-2 m
D = Distance (d) from antenna to outer wall in meters + 30
= 6.1 m + 30
= 36.1 m

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

LS = 20Log(19.04E-2/4?(36.1))
= -67.5 dB

Inserting these values into equation (1) yields

Psig = -130 + 40 – 3.2 + 23 – 61 – 67.5
= -143.7 dBm

1Closest wall is 90° from antenna boresight. Antenna gain at 90° from boresight is -6 dBi, from ref. [5].

REFERENCES

[1] Manual of Regulations and Procedures for Federal Radio Frequency Management, Section 8.3.28, pg. 8-70
[2] ICD-GPS-200, Navstar GPS Space Segment/Navigation User Interfaces
[3] VGHNRRKIT, Technical Product Data
[4] LMR-400 datasheet
[5] Test Report, Model: PA175, Antenna polar plot
[6] Memorandum, “LSG GPS RERAD LEGALITY,” Chuck Smith to Richard Jeppesen, December 19, 2005.
[7] Email correspondence with John Reed, April 4, 2006 – RE: Quantity of experimental licenses.