

Meeting NTIA Recommendation Chap. 8.3.28
Authorizing GPS Re-Radiators Under Specific Circumstances

(GPS Re-Radiation (Re-Rad) System to Support Military Aircraft Production)

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NAD83

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by

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This document is in response to the FCC's request for a compliance statement for Chapter 8.3.28.

The following is the text of the FCC's Request:

In order to perform GPS re-radiation, 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. Calculations showing compliance with this requirement must be provided with this application for frequency assignment and should be based on free space propagation with no allowance for building attenuation.

Also, please submit the name and telephone number (preferably the cell phone number) of a person who will be available to stop transmissions at all times during GPS re-radiation operation of the device under any condition.

The following is Boeing's response:

Chapter 8.3.28 Item 7

RF power from antenna to the 100 foot measurement point is calculated as:

Gain of the antenna at the -9.7 degree lobe of (negative) tilt is -7.5 dB. The antenna is located 30 feet above the factory floor illuminating an area directly below about 100 feet in diameter where the aircraft is located. The antenna is placed no less than 75 feet from any building outside edge perimeter.

Refer to MathCAD Computer Model on page 3.

Frequency of interest is GPS L1 1575.42 MHz. The roof mounted antenna has a built-in band-pass filter with 60 dB skirts at +/- 1.0 MHz

Main lobe power at each antenna + Side lobe loss to negative tilt = Side lobe power from any antenna toward the corresponding measurement point

$(-74.0 \text{ dBm}) + (-10.5 \text{ dB}) = -84.5 \text{ dBm}$ or 3.5 Pico watts

75 feet min. from any antenna to building perimeter + 100 feet to measurement point = 175 foot free space path loss

Therefore using the free space equation: $\text{dB(D)} := \text{FT} + 20 \cdot \log(\text{D}) + 20 \cdot \log(\text{F})$ the...

Side lobe power from any antenna + 175 foot path loss = **RF at 100 feet from building perimeter**

$(-84.5 \text{ dBm}) + (-70.9 \text{ dB}) = \textbf{-155.4 dBm}$

This value exceeds the requirements of Item 7 by 15.4 dB.

Chapter 8.3.28 Item 10

A "Stop Buzzer" point of contact for the authorized device must be identified and available at all times during GPS re-radiation operation of the device under any condition.

<u>Name</u>	<u>Office Desk</u>	<u>Office Mobile</u>	<u>Office Pager</u>	<u>Home Phone</u>
Gary Hart	314-777-7296	314-705-2358	314-507-0668	636-225-8235
Glen Seganfredo	314-777-7298	314-705-2349	314-318-5206	618-637-2246
Ross Dunagan	314-777-4109	314-306-4632	None	636-940-7350

Chapter 8.3.28, Items 1 to 6, 8 and 9

Boeing certifies compliance with all other items listed in Chapter 8.3.28.

MathCAD Computer Model

MATHCAD COMPUTER MODEL THAT CALCULATES FREE SPACE PATH LOSS OF A GPS SIGNAL OVER DISTANCE EXPRESSED IN MHZ, IN THE SELECTED DISTANCE UNIT BY MODIFYING THE EQUATION FOR A PARTICULAR RANGE OF DISTANCE FROM THE ANTENNA.

FREQUENCY MHZ	RANGE	CHOOSE ONE	
F := 1575.000	D := 150.0, 150.1.. 200	FACTOR MILES	MI := 36.6
		FACTOR KILO-METERS	KM := 32.45
		FACTOR FEET	FT := -37.87
		FACTOR METERS	MT := -27.55
EDIT EQUATION BELOW FOR DISTANCE UNIT			

dB(D) := FT + 20·log(D) + 20·log(F)

