

General Motors:

Exhibit 1 – Description

The GPS re-radiation equipment will be used inside the 2900 W Geronimo Pl, Chandler, AZ 85224 laboratory, to test GPS receivers and antennas. Products are either produced by General Motors for customers use, or vendors provide their devices to General Motors for testing for the purpose of integration into GM vehicles. The GPS re-rad system will allow synchronization of both time and location for validation testing with various systems.

Exhibit 2 – Section 8.3.28 of NTIA Manual Use of Fixed Devices That Re-Radiate Signals Received from the Global Positioning System

8.3.28 Use of Fixed Devices that Re-Radiate Signals Received from a GPS Antenna 8.3.28 Use of Fixed Devices That Re-Radiate Signals Received from the Global Positioning System Except as otherwise authorized under Part 7.14, federal agencies and departments may, under the following conditions, operate fixed devices that re-radiate signals received from the Global Positioning System (GPS).

1. Individual authorization is for indoor use only and is required for each device at a specific site.

YES

2. Applications for frequency assignment should be applied for as an XT station class with a note indicating the device is to be used as an Experimental RNSS Test Equipment for the purpose of testing GPS receivers" and describing how the device will be used.

YES

3. Approved applications for frequency assignment will be entered in the GMF.

N/A

4. The maximum length of the assignment will be two years, with possible renewal.

YES

5. The area of potential interference to GPS reception (e.g., military or contractor facility) has to be under the control of the user.

YES

6. The maximum equivalent isotropically radiated power (EIRP) must be such that the calculated emissions are no greater than -140 dBm/24 MHz as received by an isotropic antenna at a distance of 100 feet (30 meters) from the building where the test is being conducted. The calculations showing compliance with this requirement must be provided with the application for frequency assignment and should be based on free space propagation with no allowance for additional attenuation (e.g., building attenuation.)

SEE INCLUDED EXHIBIT 3 FOR ERP CALCULATIONS

7. GPS users in the area of potential interference to GPS reception must be notified that GPS information may be impacted for periods of time.

YES

8. The use is limited to activity for the purpose of testing equipment/systems.

YES

9. 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.

YES

Contact Information is accurate and up to date.

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Exhibit 3 - New Calculation Compliance with NTIA Guidelines

2900 W Geronimo PI, Chandler, AZ 85224	Signal Level	Scale	Product Manufacturer	Part Number
Roof Antenna Avg. Receive Power of GPS Signal Input (P_R)	-130.00	dBm		
Roof Antenna Gain (G_{RX})	29.00	dB	Novatel	GNSS-501
Roof Antenna Cable Loss (L_C)	-7.50	dB	Andrew	HL4-RPV-50
Lightning Arrestor (L_A)	-0.10	dB	Polyphaser	DGXZ+15NF
Other Losses or Gain: Splitter, etc. (G_{SP})	0.00	dB		NF-A
Amplifiers: AGC Microprocessor Amp/Repeater (G_{AMP})	32.50	dB	Saturn Antennas	L1TXR
Location Transmitter Antenna Gain (G_{TX})	2.00	dB	Saturn Antennas	MSM-L1
Total Gain 2900 W Geronimo PI, Chandler, AZ 85224	55.90	dB		
Equivalent Isotropically Radiated Power IERP, GPS_{Roof}	-74.10	dB		
Effective Radiated Power ERP, GPS_{Roof} , ($ERP = EIRP - 2.15$)	-71.95	dBd		
Effective Radiated Power, ERP-30	-101.95	dBd		
$ERP_{GPS_{Roof}} = 10((ERP-30)/10)$ in P_{Watts}	-1.0195E-07	W		
Transmit Power, GPS_{Roof}	-0.00013	pW		
Frequency Tolerance, 1575 MHz +/- 15 MHz, $FT = (15-1575)*100$	1	%		
Mean/Peak	P			
Modulating Signal	10.23	MHz		
Emission Designator	20M5W7D			
Transmit antenna distance to outside wall	12	ft		

2900 W Geronimo PI, Chandler, AZ 85224.

GPS Re-radiator Signal Strength Calculation for L1-Band

100 ft free-space calculations from radiation point + distance from radiation point to outside wall	112	ft
1 Kilometer	3280.9	ft
Frequency	1575.42	MHz
Equivalent Isotropically Radiated Power (EIRP)	-74.10	dB
Free Space Loss: $20 * \log_{10}(\text{Frequency in MHz}) + 20 * \log_{10}(\text{Distance in Km}) + 32.44 \text{ dB} = L_{FS}$	-67.05	dB
P_{sig_GPS} , Free Space Power Calc for total distance from TX Ant to 100ft from building, EIRP	-141.15	dB

$$P_{sig_GPS} (EIRP) = P_R + G_{RX} + L_C + L_A + G_{SP} + G_{AMP} + G_{TX} + L_{FS} = -130 + 33 - 3.00 - 0.1 + 0 + 24 + 2 - 67.05 = -141.15 \text{ dBm/24 MHz}$$