

Exhibit 1  
Description of General Motors Research Corporation Operations

The General Motors (GM) Milford Proving Grounds is a GM facility in Milford, Michigan. The campus is home to 4,000 GM Engineers and Technicians and has been the premier GM testing facility since 1924. Many types of validation testing, including vehicle crash testing and telematics system testing, are conducted at the Milford Proving Grounds. Ever-changing crash safety regulations, and differences between such regulations from one jurisdiction to another, require GM to conduct vehicle crash testing and telematics system testing under a variety of constraints and scenarios.

General Motors Research Corporation (GMRC), a wholly owned indirect subsidiary of GM, requests a two-year experimental license to repeat GPS signals to support the communications requirements for the crash testing of vehicles and telematics systems. The crash test facilities at Milford Proving Grounds are uniquely equipped to conduct verification testing of telematics systems. Although GMRC is currently operating a GPS re-radiator pursuant to Special Temporary Authority (STA),<sup>1</sup> it would like to expand the testing to include vehicles for additional target jurisdictions and telematics systems.

The vehicle crash and telematics system testing at Milford Proving Grounds occurs indoors, and therefore the roof of the facility blocks GPS signals from reaching the test vehicles. GMRC requests authority to operate a GLI-Metro-G Unit by GPS Source inside the crash test building in order to successfully complete the required testing. GPS signals will be received and re-transmitted into the building for purposes of type approval, which will allow GMRC to certify that vehicles comply with new crash safety regulations, and the testing of vehicle telematics systems. The attached emission calculations demonstrate that the GPS Source equipment complies with the Commission's emission limits for GPS re-radiators.

FCC approval is requested in advance of November 11, 2015 so that GMRC may conduct vehicle crash and telematics system testing.

Objectives

GMRC seeks to accomplish the following objectives:

1. Transmission of GPS signals inside the crash testing building.
2. Conduct tests to certify that GM's vehicles satisfy the applicable crash safety regulations.
3. Test equipment implementation and troubleshoot problems in a controlled environment.

Contribution to Radio Art

Active crash notification reporting systems are under development and are being deployed in the marketplace. This project is necessary to validate the effectiveness of the developed crash notification system and the interaction of those systems with vehicle telematics. Crash notification systems have the ability to immediately notify emergency personnel when a crash occurs, which saves time and helps prevent the loss of life in emergency situations.

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<sup>1</sup> General Motors Research Corporation (GMRC), Experimental Special Temporary Authority Call Sign WI9XOF, ELS File No. 0447-EX-ST-2015 (granted May 11, 2015).



Figure 1 - Aerial photo of MPG Crash test building



Figure 2 – Inside MPG Crash Test Building Facing East



Figure 3 – Inside MPG Crash Test Building Facing South East



Figure 4 – Inside MPG Crash Test Building Facing South



Figure 5 – Inside MPG Crash Test Building Facing South West

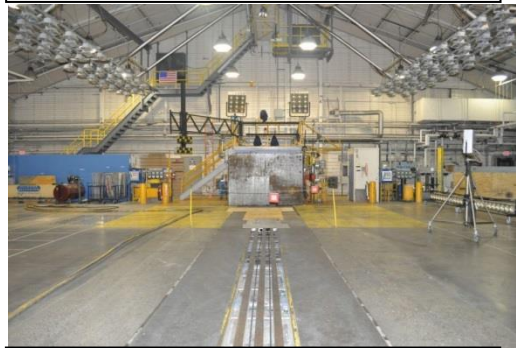




**Figure 6 – Inside MPG Crash Test Building Facing West**



**Figure 7 – Inside MPG Crash Test Building Facing North West**



**Figure 8 – Inside MPG Crash Test Building Facing North**



**Figure 9 – Inside MPG Crash Test Building Facing North East**

# The following two pages discuss the proposed unit for handling the transmission of GPS and GLONASS



## GLI-METRO-G

### KEY FEATURES

- » Precise control over output signal level
- » High Frequency Selectivity - Passes GPS, GLONASS & GALILEO frequencies while rejecting other out-of-band signals.
- » Continuous Built-In-Testing (BIT)
- » Automatic Oscillation Detection
- » Perfect for aircraft hangars, manufacturing test cells, R&D facilities, any automated test environment or an anechoic chamber
- » Use for any GNSS retransmission application

### OPTIONS

- » Waterproof
- » L1 Only vs. L1/L2 Filtering
- » Multiple Connector Types
- » Power Always ON or Power ON/OFF



GLI-Metro-G

### INTRODUCTION

The GLI-METRO-G is a GNSS\* smart amplifier, perfect for the commercial and public sector. When used in conjunction with an active GPS/GLONASS receive antenna, it will pass GPS+GLONASS signals inside a building, hangar or any structure where signal is not accessible. It can be used in an automated test environment or in a shielded room that needs GNSS signal.

GLI-METRO-G has the unique benefit of allowing selection for the power control between signals. A user can easily decide which signal output the GLI-METRO-G will use to control signal power: GPS+GLONASS, GLONASS only or GPS only. This reduces the need for multiple antennas, receive devices and multiple antenna runs, while lowering maintenance and installation costs.

### AUTOMATIC SIGNAL LEVEL CONTROL

The GLI-METRO-G employs an automatic control to maintain the set output signal level, regardless of the uncertain loss or gain in the receive antenna cable network. Derived from high performance systems for military applications, this device allows precise determination over effective radiated power (ERP) levels, regardless of the uncertain loss or gain in the receive antenna cable network. It will automatically condition the signal and prevent changes in performance.

### BUILT-IN TROUBLESHOOTING

The GLI-METRO-G will identify and isolate the following:

- Oscillation condition
- High gain
- Low gain
- Short/Open circuit
- Internal component failure
- Less than four satellites
- No satellites with adequate signal  
*(call for complete list of conditions)*

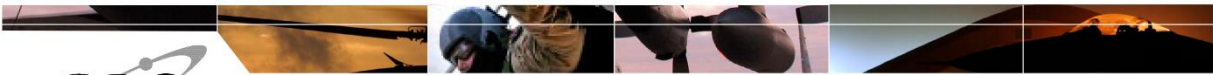
*\*GLI-Metro-G offers support for present and future GNSS signals, including Galileo, ensuring operation with future devices.*

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AS9100 Rev C and ISO 9001 Certified



# GLI-Metro-G

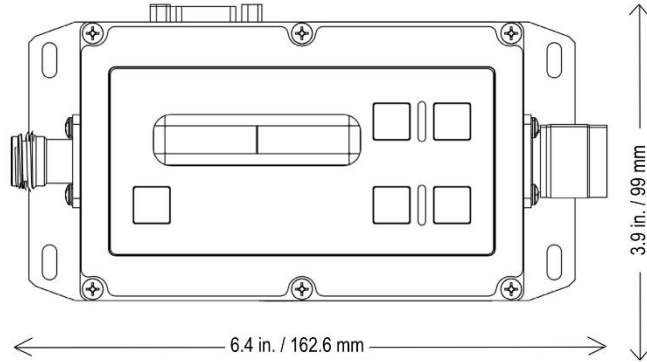
## GLI-METRO-G 1X1

### GLI-METRO-G OUTPUT PORTS

- » Number of ports 1

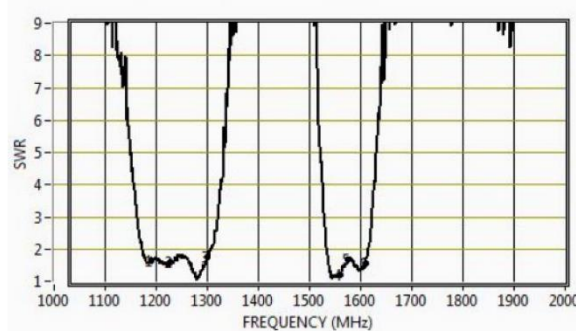
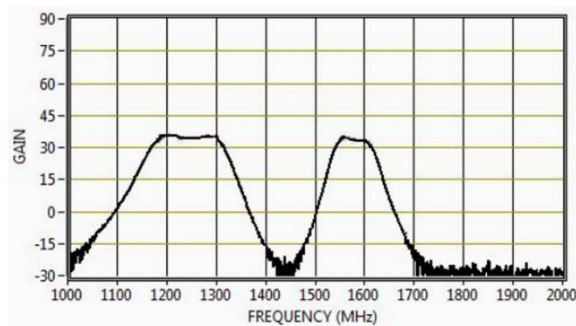
### GLI-METRO-G ELECTRICAL SPECIFICATIONS

- » Input/Output impedance 50Ω
- » SWR all ports (typical)
  - Input: 2:1
  - Output: 2:1
- » Bandwidth
  - GPS & GLONASS L1 1560-1615 MHz
  - GPS & GLONASS L1/L2 1170 - 1310 MHz
- » Gain (nominal) 33 dB
- » Gain Range 0-55dB
- » Gain flatness <3 dB
- » Noise figure <3 dB
- » AC input level
  - 110 VAC
  - 230VAC UK
  - 230VAC European
- » DC input level 16 - 28 VDC
- » Active Antenna Output Power Supply Output 6.8V



### GLI-METRO-G PHYSICAL SPECIFICATIONS

- » RF connectors
  - N (m, f)
  - SMA (m, f)
  - TNC (m, f)
  - SMB (f)
  - SMC (f)
- » RS232 serial connector DB9(F) DCE
- » Weight:
  - 1x1 1.2 lbs (544.3 g)
- » Size:
  - 1x1 6.4" x 3.9" x 2.0"
  - (162.6 mm x 99 mm x 50.8 mm)
- » Operating temperature -40 to +85°C



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## 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.

**YES**

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 EXHIBIT 2.**

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 RNSS equipment/systems.

**YES**

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

**Primary-Robert Van Ham--Engineer 248-515-5939**

**robert.vanham@gm.com**

**Backup-Douglas Blodgett -- Global Functional Test Lead-248-904-7428**

**doug.blodgett@gm.com**

Exhibit 2  
Emission Calculations

### L1 Calculation

Label	Parameter	Value	Units	Notes / Formula
<b>A</b>	Transmit ERP	<b>24</b>	pW	
<b>B</b>	Frequency	1575.42	MHz	L1 center frequency
<b>C</b>	Distance	100	feet	Required distance
<b>D</b>	Distance	30.5	meters	= <b>C</b> / 3.2808 feet/meter
<b>E</b>	Free Space Path Loss	66.1	dB	= 20 * log( <b>B</b> ) + 20 * log( <b>D</b> ) - 27.55
<b>F</b>	Transmit ERP	-76.2	dBm	= 10 * log( <b>A</b> / 1,000,000,000)
<b>G</b>	Transmit EIRP	-74.0	dBm	= <b>F</b> + 2.15
<b>H</b>	Received Power	<b>-140.1</b>	dBm	= <b>G</b> - <b>E</b>

### L2 Calculation

Label	Parameter	Value	Units	Notes / Formula
<b>A</b>	Transmit ERP	<b>15</b>	pW	
<b>B</b>	Frequency	1227.60	MHz	L2 center frequency
<b>C</b>	Distance	100	feet	Required distance
<b>D</b>	Distance	30.5	meters	= <b>C</b> / 3.2808
<b>E</b>	Free Space Path Loss	63.9	dB	= 20 * log( <b>B</b> ) + 20 * log( <b>D</b> ) - 27.55
<b>F</b>	Transmit ERP	-78.2	dBm	= 10 * log( <b>A</b> / 1,000,000,000)
<b>G</b>	Transmit EIRP	-76.1	dBm	= <b>F</b> + 2.15
<b>H</b>	Received Power	<b>-140.0</b>	dBm	= <b>G</b> - <b>E</b>