

Raytheon Intelligence, Information and Services  
Experimental License Application  
File Number: 0441-EX-RR-2015

### **Exhibit 1 – Overview and Explanation**

Overview: Raytheon Intelligence, Information and Services (Raytheon) is filing this application to renew its license for use a GPS re-radiation system at its facilities at 22270 Pacific Boulevard, Dulles, Virginia. Multiple products under test at Raytheon's Dulles, Virginia (Sterling, Virginia) facility utilize GPS for positioning information and timing technologies that are embedded into the wireless technologies under development. The GPS re-radiation system is required for the testing of GPS technologies that are embedded into the communications systems that Raytheon is developing in this lab.

General compliance with NTIA section 8.3.28: set forth below are Raytheon's responses to the requirements of 8.3.28 as those answers apply for this location.

For any questions about this application, please contact Brian Kavalar, Spectrum Manager Raytheon IIS, 317-517-9989 or Anne Linton Cortez, Washington Federal Strategies, 520-360-0925, [alc@conspecinternational.com](mailto:alc@conspecinternational.com).

#### Compliance with the Requirements of NTIA Manual Section 8.3.28

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

This GPS re-radiation system is installed indoors in a laboratory with access that is limited to Raytheon authorized personnel only.

- 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.**

Raytheon requests the assistance of the FCC and NTIA to properly classify the frequency authorizations.

- 3. Approved application for frequency assignment will be entered in the GMF.**

Raytheon requests the assistance of NTIA and the FCC in entering this data into the GMF.

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

Raytheon is seeking an authorization for two years, and it will seek renewals when timely.

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

The proposed installation is inside the Raytheon facility at Dulles, Virginia. Access to the facility is limited to Raytheon personnel and limited authorized visitors. The building is a secure facility, and no unauthorized visitors can enter.

**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.)**

Link Budget: The link budget for the L1/L2 re-radiation is attached to this exhibit, and it shows the calculations applicable to this proposed installation of a GPS re-radiation system.

Location in building: The re-radiation device is installed inside the Raytheon building at 22270 Pacific Blvd., Dulles, Va. The installation is deep within the building, far from any outside wall. The attached link budget shows that the signal strength *at 100 feet from the re-radiating antenna* is below -140 dBm/24 MHz. Thus, the signal strength at 100 feet from the building is going to be significantly lower still, but Raytheon wanted to ensure that the signal strength was attenuated so much that there would be no chance of interference.

**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.**

Raytheon has posted signs in the lab where the re-radiation system is installed alerting those in the area that there are GPS re-radiation systems in use in that area.

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

Raytheon is requesting authorization to use a re-radiation system specifically for testing of GPS systems on its products.

- 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.**

The Stop Buzzer point of contact for all these devices is:

Todd Upchurch, Raytheon IIS  
571-250-1040 (office)  
[tupchurch@raytheon.com](mailto:tupchurch@raytheon.com)

Mr. Upchurch can initiate shut off a GPS re-radiation system at any time.

**Location Number: 1, 39°05.00"N 77°26'37.00"W**

Use: Re-radiation system used 100% for testing  
 installed: indoors

**Manufacturer: all components are part of GPS Source, maximum gain specifications.**

**GPS Signal Analysis - L1 Link Budget**

Frequency	1575.42	MHz	Signal Level		
			dBm	Watts	picoWatts
Wavelength	0.19042541	meters			
GPS Input Signal Level	-126.7	dBm	-126.7	2.1E-16	0.000213796
GPS Receive Antenna amplifier gain	38.5	dB	-88.2	1.5E-12	1.51
GPS RF Amplifier gain	49	dB	-39.2	1.2E-07	120226.44
GPS RF Attenuator	-20	dB	-59.2	1.2E-09	1202.26
LMR240 Coax loss per foot	-0.101	dB			
Coax Length	210	feet			
Total Coax Loss	-21.21	dB	-80.41	9.1E-12	9.099
GPS Transmitting Antenna Gain	3	dB	-77.41	1.8E-11	18.155
Distance from transmit antenna	1	meters			
Distance from transmit antenna	3.2808399	feet			
Pathloss to unit under test	-36.38969194	dB	-113.8	4.2E-15	0.00416899
Signal level at unit under test EIRP to ERP			-115.9	2.5E-15	0.002547011
Distance from transmit antenna	30.48	meters			
Distance from transmit antenna	100.0000002	feet			
Pathloss to 100 ft	-66.06999119	dB	-143.5	4.5E-18	4.48746E-06
Signal level at 100 ft ERP			-145.6	2.7E-18	2.74158E-06

- \* Specification per GPS Performance Standard, dated Feb 23, 2007.
- \* GPS Source L1L2-2GA, Max gain
- \* GPS Source GPSRKL12, Max gain; RMS116, Max gain
- \* Typical loss per foot @ 1575.5; connector/coupler loss not included (increases loss)

**GPS Signal Analysis - L2 Link Budget**

Frequency	1227.6	MHz	Signal Level		
			dBm	Watts	picoWatts
Wavelength	0.244379277	meters			
GPS Input Signal Level	-134.5	dBm	-134.5	3.5E-17	3.54813E-05
GPS Receive Antenna amplifier gain	41.5	dB	-93	5E-13	0.50
GPS RF Amplifier gain	49	dB	-44	4E-08	39810.72
GPS RF Attenuator	-20	dB	-64	4E-10	398.11
LMR240 Coax loss per foot	-0.089	dB			
Coax Length	210	feet			
Total Coax Loss	-18.69	dB	-82.69	5.4E-12	5.383
GPS Transmitting Antenna Gain	3	dB	-79.69	1.1E-11	10.740
Distance from transmit antenna	1	meters			
Distance from transmit antenna	3.2808399	feet			
Pathloss to unit under test	-34.22290244	dB	-113.9	4.1E-15	0.004061718
Signal level at unit under test EIRP to ERP			-116.1	2.5E-15	0.002481474
Distance from transmit antenna	30.48	meters			
Distance from transmit antenna	100.0000002	feet			
Pathloss to 100 ft	-63.9032017	dB	-143.6	4.4E-18	4.372E-06
Signal level at 100 ft ERP			-145.7	2.7E-18	2.67104E-06

- \* Specification per GPS Performance Standard, dated Feb 23, 2007.
- \* GPS Source L1L2-2GA, Max gain
- \* GPS Source GPSRKL12, Max gain; RMS116, Max gain
- \* Typical loss per foot @ 1227.6; connector/coupler loss not included (increases loss)