Raytheon Intelligence, Information and Services
Experimental License Application
File Number: 0464-EX-RR-2015

Exhibit 1 – Overview and Explanation

Overview: Raytheon Intelligence, Information and Services (Raytheon) is filing this application for use of a GPS re-radiation system at its facilities at 23030 Ladbrook Drive, Sterling, Virginia. Multiple products under test at Raytheon's Sterling, Virginia facility utilize GPS for positioning information and timing technologies. The GPS re-radiation system is required for the testing of GPS technologies that are being studied at 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 Anne Linton Cortez, Washington Federal Strategies, 520-360-0925, 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 to renew for two years.

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 installation is inside the Raytheon facility at Sterling, 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 budgets for the L1/L2 re-radiation are attached to this exhibit, and they show the calculations applicable to this installation.

   Location in building: The re-radiation device is installed inside the Raytheon building at 23030 Ladbrook Drive, Sterling, Va. 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 renewal 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:

Brain Kavalar, Raytheon IIS
(317) 306-7793
Brian_r_Kavalar@raytheon.com

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

Lab

GPS Signal Analysis Lab

Frequency	1227.6	MHz	Signal Level			
Wavelength	0.2444	meters	dBm	Watts	picoWatts	
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001	
GPS Receive Antenna amplifier gain	37.7	dB	-92.3	6E-13	0.59	GPS Source L1 Active Antenna
GPS RF Amplifier gain	33	dB	-59.3	1E-09	1174.90	GPS Source A11 Amplifier
GPS RF Attenuator	-10	dB	-69.3	1E-10	117.49	10 dB attenuator at A11 Amp output
LMR-240-LLPL Coax loss per foot	-0.088	dB				Based upon loss at 1200MHz
Coax Length	100	feet				
Total Coax Loss	-8.8	dB	-78.1	2E-11	15.488	
GPS Transmitting Antenna Gain	3	dB	-75.1	3E-11	30.903	GPS Source L1P- Passive GPS Antenna
Distance from transmit antenna	0.01	meters				
Distance from transmit antenna	0.0328	feet				
Pathloss to unit under test	5.7771	dB	-69.323	1E-10	116.87181	
Signal level at unit under test ERIP to ERP			-71.463	7E-11	71.401898	
Distance from transmit antenna	30.48	meters				
Distance from transmit antenna	100	feet				
Pathloss to 100 ft	-63.903	dB	-139	1E-17	1.258E-05	
Signal level at 100 ft ERP			**-141.14**	8E-18	7.686E-06	<----Potential system exceeding limits

Compliant if signal level at 100 ft ERP is less than -140 dBm

GPS Signal Analysis Lab

Frequency	1575.4	MHz	Signal Level			
Wavelength	0.1904	meters	dBm	Watts	picoWatts	
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001	
GPS Receive Antenna amplifier gain	37.7	dB	-92.3	6E-13	0.59	GPS Source L1 Active Antenna
GPS RF Amplifier gain	33	dB	-59.3	1E-09	1174.90	GPS Source A11 Amplifier
GPS RF Attenuator	-10	dB	-69.3	1E-10	117.49	10 dB attenuator at A11 Amp output
LMR-240-LLPL Coax loss per foot	-0.099	dB				Based upon loss at 1500MHz
Coax Length	100	feet				
Total Coax Loss	-9.9	dB	-79.2	1E-11	12.023	
GPS Transmitting Antenna Gain	3	dB	-76.2	2E-11	23.988	GPS Source L1P- Passive GPS Antenna
Distance from transmit antenna	0.01	meters				
Distance from transmit antenna	0.0328	feet				
Pathloss to unit under test	3.6103	dB	-72.59	6E-11	55.084677	
Signal level at unit under test ERIP to ERP			-74.73	3E-11	33.653544	
Distance from transmit antenna	30.48	meters				
Distance from transmit antenna	100	feet				
Pathloss to 100 ft	-66.07	dB	-142.27	6E-18	5.929E-06	
Signal level at 100 ft ERP			**-144.41**	4E-18	3.622E-06	**<----Potential system exceeding limits**

Compliant if signal level at 100 ft ERP is less than -140 dBm

X bay

GPS Signal Analysis X Bay Port 1

Frequency	1227.6	MHz	Signal Level			
Wavelength	0.2444	meters	dBm	Watts	picoWatts	
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001	
GPS Receive Antenna amplifier gain	37.7	dB	-92.3	6E-13	0.59	GPS Source L1 Active Antenna
GPS RF Amplifier gain	33	dB	-59.3	1E-09	1174.90	GPS Source A11 Amplifier
GPS RF Attenuator	0	dB	-59.3	1E-09	1174.90	No attenuator needed with longer cable
LMR-240-LLPL Coax loss per foot	-0.088	dB				Based upon loss at 1200MHz
Coax Length	230	feet				
Total Coax Loss	-20.24	dB	-79.54	1E-11	11.117	
GPS Transmitting Antenna Gain	3	dB	-76.54	2E-11	22.182	GPS Source L1P- Passive GPS Antenna
Distance from transmit antenna	0.01	meters				
Distance from transmit antenna	0.0328	feet				
Pathloss to unit under test	5.7771	dB	-70.763	8E-11	83.889915	
Signal level at unit under test ERIP to ERP			-72.903	5E-11	51.251875	
Distance from transmit antenna	30.48	meters				
Distance from transmit antenna	100	feet				
Pathloss to 100 ft	-63.903	dB	-140.44	9E-18	9.03E-06	
Signal level at 100 ft ERP			**-142.58**	6E-18	5.517E-06	**<----Potential system exceeding limits**

Compliant if signal level at 100 ft ERP is less than -140 dBm

GPS Signal Analysis X Bay Port 2

Frequency	1227.6	MHz	Signal Level			
Wavelength	0.2444	meters	dBm	Watts	picoWatts	
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001	
GPS Receive Antenna amplifier gain	37.7	dB	-92.3	6E-13	0.59	GPS Source L1 Active Antenna
GPS RF Amplifier gain	33	dB	-59.3	1E-09	1174.90	GPS Source A11 Amplifier
GPS RF Attenuator	0	dB	-59.3	1E-09	1174.90	No attenuator needed with longer cable
LMR-240-LLPL Coax loss per foot	-0.088	dB				Based upon loss at 1200MHz
Coax Length	230	feet				
Total Coax Loss	-20.24	dB	-79.54	1E-11	11.117	
GPS Transmitting Antenna Gain	3	dB	-76.54	2E-11	22.182	GPS Source L1P- Passive GPS Antenna
Distance from transmit antenna	0.01	meters				
Distance from transmit antenna	0.0328	feet				
Pathloss to unit under test	5.7771	dB	-70.763	8E-11	83.889915	
Signal level at unit under test ERIP to ERP			-72.903	5E-11	51.251875	
Distance from transmit antenna	30.48	meters				
Distance from transmit antenna	100	feet				
Pathloss to 100 ft	-63.903	dB	-140.44	9E-18	9.03E-06	
Signal level at 100 ft ERP			**-142.58**	6E-18	5.517E-06	**<----Potential system exceeding limits**

Compliant if signal level at 100 ft ERP is less than -140 dBm

GPS Signal Analysis X Bay Port 1

Frequency	1575.4	MHz	Signal Level			
Wavelength	0.1904	meters	dBm	Watts	picoWatts	
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001	
GPS Receive Antenna amplifier gain	37.7	dB	-92.3	6E-13	0.59	GPS Source L1 Active Antenna
GPS RF Amplifier gain	33	dB	-59.3	1E-09	1174.90	GPS Source A11 Amplifier
GPS RF Attenuator	0	dB	-59.3	1E-09	1174.90	No attenuator needed with longer cable
LMR-240-LLPL Coax loss per foot	-0.099	dB				Based upon loss at 1500MHz
Coax Length	230	feet				
Total Coax Loss	-22.77	dB	-82.07	6E-12	6.209	
GPS Transmitting Antenna Gain	3	dB	-79.07	1E-11	12.388	GPS Source L1P- Passive GPS Antenna
Distance from transmit antenna	0.01	meters				
Distance from transmit antenna	0.0328	feet				
Pathloss to unit under test	3.6103	dB	-75.46	3E-11	28.446629	
Signal level at unit under test ERIP to ERP			-77.6	2E-11	17.379241	
Distance from transmit antenna	30.48	meters				
Distance from transmit antenna	100	feet				
Pathloss to 100 ft	-66.07	dB	-145.14	3E-18	3.062E-06	
Signal level at 100 ft ERP			**-147.28**	2E-18	1.871E-06	**<----Potential system exceeding limits**

Compliant if signal level at 100 ft ERP is less than -140 dBm

GPS Signal Analysis X Bay Port 2

Frequency	1575.4	MHz	Signal Level			
Wavelength	0.1904	meters	dBm	Watts	picoWatts	
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001	
GPS Receive Antenna amplifier gain	37.7	dB	-92.3	6E-13	0.59	GPS Source L1 Active Antenna
GPS RF Amplifier gain	33	dB	-59.3	1E-09	1174.90	GPS Source A11 Amplifier
GPS RF Attenuator	0	dB	-59.3	1E-09	1174.90	No attenuator needed with longer cable
LMR-240-LLPL Coax loss per foot	-0.099	dB				Based upon loss at 1500MHz
Coax Length	230	feet				
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Distance from transmit antenna	0.01	meters				
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Pathloss to unit under test	3.6103	dB	-75.46	3E-11	28.446629	
Signal level at unit under test ERIP to ERP			-77.6	2E-11	17.379241	
Distance from transmit antenna	30.48	meters				
Distance from transmit antenna	100	feet				
Pathloss to 100 ft	-66.07	dB	-145.14	3E-18	3.062E-06	
Signal level at 100 ft ERP			**-147.28**	2E-18	1.871E-06	**<----Potential system exceeding limits**

Compliant if signal level at 100 ft ERP is less than -140 dBm