Raytheon Intelligence, Information and
Services Experimental License New Application
Related Past Call Sign: WH2XWM
File Number: 0737-EX-CN-2021

Overview and Explanation of Use & Compliance with NTIA 8.3.27

Overview: Raytheon Intelligence & Space (Raytheon) is filing a new application to replace call sign WH2XWM for use of a GPS re-radiation system at its facilities at 13900 Lincoln Park Dr., Herndon Virginia facility that utilizes GPS for positioning information and timing technologies for test equipment for its wireless test bed. 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 8.3.27: set forth below are Raytheon's responses to the requirements of 8.3.27 as those answers apply for this location.

For any questions about this application, please contact Brian Kavalar, Raytheon RIS at 317-517-998, brian_r_kavalar@raytheon.com or Janine Smith Raytheon RIS at W-301-851-8144, C-703-944-4432 Janine_Smith@raytheon.com.

Compliance with the Requirements of NTIA Manual Section 8.3.27

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 a renewed authorization for two years, and it will seek renewals when required.

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 Herndon, Virgina. 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 at each of the two locations are attached to this exhibit, and they show the calculations applicable to this proposed installation of a GPS re-radiation system.
   Location in building: The re-radiation device will be installed inside Raytheon building 13900 Lincoln Park Dr., Herndon, Virginia. 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:
   Janine Smith, Raytheon RIS
   301-851-8144 (office)
   703-944-4432 (cell)
   Janine_Smith@raytheon.com

Location 1 Link Budgets for GPS L-1 and L-2

Location Number: 1, Latitude 38 55 33 N Longitude 77 25 43 W , June 18, 2015
Use: Re-radiation system used 100% for testing
installed: indoors
Manufacturer: all components are made by GPS Networking

GPS Signal Analysis - L1 Link Budget

Frequency	1575.42	MHz	Signal Level		
Wavelength	0.19042541	meters	dBm	Watts	picoWatts
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001
GPS Receive Antenna amplifier gain	38	dB	-92	6.3E-13	0.63
GPS RF Amplifier gain	22	dB	-70	1E-10	100.00
GPS RF Attenuator	0	dB	-70	1E-10	100.00
LMR400 Coax loss per foot	-0.067	dB			
Coax Length	155.22	feet			
Total Coax Loss	-10.39974	dB	-80.4	9.1E-12	9.121
GPS Transmitting Antenna Gain	3	dB	-77.4	1.8E-11	18.198
Distance from transmit antenna	30.55	meters			
Distance from transmit antenna	3.2800399	feet			
Pathloss to unit under test	-66.08991623	dB	-143.5	4.5E-18	4.477E-06
Signal level at unit under test EIRP to ERP			-145.6	2.7E-18	2.735E-06
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	4.498E-06
Signal level at 100 ft ERP			-145.6	2.7E-18	2.748E-06

GPS Signal Analysis - L2 Link Budget

Frequency	1227.6	MHz	Signal Level		
Wavelength	0.244379277	meters	dBm	Watts	picoWatts
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001
GPS Receive Antenna amplifier gain	38	dB	-92	6.3E-13	0.63
GPS RF Amplifier gain	22	dB	-70	1E-10	100.00
GPS RF Attenuator	0	dB	-70	1E-10	100.00
LMR400 Coax loss per foot	-0.067	dB			
Coax Length	155.22	feet			
Total Coax Loss	-10.39974	dB	-80.4	9.1E-12	9.121
GPS Transmitting Antenna Gain	3	dB	-77.4	1.8E-11	18.198
Distance from transmit antenna	30.55	meters			
Distance from transmit antenna	100.2296589	feet			
Pathloss to unit under test	-63.92312674	dB	-141.3	7.4E-18	7.374E-06
Signal level at unit under test EIRP to ERP			-143.5	4.5E-18	4.505E-06
Distance from transmit antenna	30.48	meters			
Distance from transmit antenna	100.0000002	feet			
Pathloss to 100 ft	-63.9032017	dB	-141.3	7.4E-18	7.408E-06
Signal level at 100 ft ERP			-143.4	4.5E-18	4.526E-06

Location 2 Link Budgets for GPS L-1 and L-2

Location Number: 2, Latitude 38 55 34 N Longitude 77 25 43 W , June 18, 2015
Use: Re-radiation system used 100% for testing installed antennas
installed: indoors
Manufacturer: all components are made by GPS Networking

GPS Signal Analysis - L1 Link Budget

Frequency	1575.42	MHz	Signal Level		
Wavelength	0.190425	meters	dBm	Watts	picoWatts
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001
GPS Receive Antenna amplifier gain	38	dB	-92	6.31E-13	0.63
GPS RF Amplifier gain	42	dB	-50	1E-08	10000.00
GPS RF Attenuator	0	dB	-50	1E-08	10000.00
LMR400 Coax loss per foot	-0.067	dB			
Coax Length	410.44	feet			
Total Coax Loss	-27.4995	dB	-77.4995	1.78E-11	17.785
GPS Transmitting Antenna Gain	3	dB	-74.4995	3.55E-11	35.486
Distance from transmit antenna	30.48	meters			
Distance from transmit antenna	100	feet			
Pathloss to unit under test	-66.07	dB	-140.569	8.77E-18	8.77E-06
Signal level at unit under test EIRP to ERP			-142.709	5.36E-18	5.36E-06
Distance from transmit antenna	30.48	meters			
Distance from transmit antenna	100	feet			
Pathloss to 100 ft	-66.07	dB	-140.569	8.77E-18	8.77E-06
Signal level at 100 ft ERP			-142.709	5.36E-18	5.36E-06

GPS Signal Analysis - L2 Link Budget

Frequency	1227.6	MHz	Signal Level		
Wavelength	0.244379	meters	dBm	Watts	picoWatts
GPS Input Signal Level	-130	dBm	-130	1E-16	0.0001
GPS Receive Antenna amplifier gain	38	dB	-92	6.31E-13	0.63
GPS RF Amplifier gain	42	dB	-50	1E-08	10000.00
GPS RF Attenuator	0	dB	-50	1E-08	10000.00
LMR400 Coax loss per foot	-0.067	dB			
Coax Length	410.44	feet			
Total Coax Loss	-27.4995	dB	-77.4995	1.78E-11	17.785
GPS Transmitting Antenna Gain	3	dB	-74.4995	3.55E-11	35.486
Distance from transmit antenna	30.48	meters			
Distance from transmit antenna	100	feet			
Pathloss to unit under test	-63.9032	dB	-138.403	1.44E-17	1.44E-05
Signal level at unit under test EIRP to ERP			-140.543	8.83E-18	8.83E-06
Distance from transmit antenna	30.48	meters			
Distance from transmit antenna	100	feet			
Pathloss to 100 ft	-63.9032	dB	-138.403	1.44E-17	1.44E-05
Signal level at 100 ft ERP			-140.543	8.83E-18	8.83E-06