

Raytheon Missile Systems
Experimental License Renewal
Application

File Number: 0 1 5 3 - E X - C R -
2 0 1 9

Exhibit 1 – Overview and Explanation

Overview: Raytheon Missile Systems (Raytheon) is filing this application for renewal of WH2XQK, a GPS re-radiation system at its facilities at 3292 East Hemisphere Loop, Tucson, Arizona. This was acquired by Raytheon as part of a larger corporate transaction. The facility uses GPS for positioning information and timing technologies in the development of advanced unmanned aerial systems development for the Department of Defense and other US government customers.

For any questions about this application, please contact Jim Ortega, Spectrum Manager, 520-794-0227, james.e.ortega@raytheon.com or Anne Linton Cortez, Washington Federal Strategies, 520-360-0925, alc@conspecinternational.com.

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.

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 will be 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 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 will be inside the Raytheon facility at Tucson, Arizona. 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 will be installed inside Raytheon's building at 3292 E. Hemisphere Loop, Tucson, AZ. 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 will post 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 this re-radiation system is:

Jim Ortega
520.794.0227 (office, forwards to cell)
James.e.ortega@raytheon.com

Location: Latitude 32-08-13 N Longitude 110-55-20 W

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

installed: indoors

Manufacturer: all components are part of GPS Source Re-radiation kit

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	23	dB	-69	1.3E-10	125.89
GPS RF Attenuator	-22	dB	-91	7.9E-13	0.79
LMR400 Coax loss per foot	-0.067	dB			
Coax Length	100	feet			
Total Coax Loss	-6.7	dB	-97.7	1.7E-13	0.170
GPS Transmitting Antenna Gain	3	dB	-94.7	3.4E-13	0.339
Distance from transmit antenna	1	meters			
Distance from transmit antenna	3.2808399	feet			
Pathloss to unit under test	-36.38969194	dB	-131.1	7.8E-17	7.78E-05
Signal level at unit under test EIRP to ERP			-133.2	4.8E-17	4.75E-05
Distance from transmit antenna	30.48	meters			
Distance from transmit antenna	100.0000002	feet			
Pathloss to 100 ft	-66.06999119	dB	-160.8	8.4E-20	8.38E-08
Signal level at 100 ft ERP			-162.9	5.1E-20	5.12E-08

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	23	dB	-69	1.3E-10	125.89
GPS RF Attenuator	-22	dB	-91	7.9E-13	0.79
LMR400 Coax loss per foot	-0.067	dB			
Coax Length	100	feet			
Total Coax Loss	-6.7	dB	-97.7	1.7E-13	0.170
GPS Transmitting Antenna Gain	3	dB	-94.7	3.4E-13	0.339
Distance from transmit antenna	1	meters			
Distance from transmit antenna	3.2808399	feet			
Pathloss to unit under test	-34.22290244	dB	-128.9	1.3E-16	0.000128
Signal level at unit under test EIRP to ERP			-131.1	7.8E-17	7.83E-05
Distance from transmit antenna	30.48	meters			
Distance from transmit antenna	100.0000002	feet			
Pathloss to 100 ft	-63.9032017	dB	-158.6	1.4E-19	1.38E-07
Signal level at 100 ft ERP			-160.7	8.4E-20	8.43E-08