

**EXHIBIT 1**  
**Experimental License Renewal**  
**Form 405 File #0089-EX-CR-2018**  
**Call Sign: WG2XYB**

**Overview**

Raytheon Company (“Raytheon”) is filing this application to renew its experimental license for continued use of a global positioning service (“GPS”) re-radiation system at its facilities at 23030 Ladbroke Drive, Sterling, Virginia (“Facility”). Multiple products at the 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.

**Compliance with 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 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.**

n/a

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

n/a

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

Raytheon requests renewal for two (2) years in order to continue product development and testing.

**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 Facility is secured and under the sole control of Raytheon with access only to authorized personnel.

**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.)**

The GPS device is installed deep within the Facility and far from any exterior walls. The attached link budget shows that the signal strength *at 100 feet from the re-radiating antenna* is below -140 dBm/24 MHz.

There have been no changes to the equipment from the prior application.

**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.**

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#### **License Contact Information**

For questions about this license, please contact:

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# 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 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   |              |       |           |                                         |
| 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**