

**Raytheon Request for New FCC Experimental License:**

File Number: 1703-EX-CN-2023

Confirmation Number: EL193949

Date: November 1, 2023

**Purpose of Operation:**

This application is to replace the following FCC callsign . The frequency authorization is being requested for the period of November 1, 2023 – December 31, 2025, in X-band at frequencies between 9.35 – 9.45 and 9.55 – 9.65 GHz, in order to test prototype radar arrays in a relevant environment. Outdoor testing, across multiple frequencies as noted above is required to assess hardware compliance with requirements and to continue research and development. Up to four units will be tested over this range simultaneously.

**Technical Synopsis:**

- Spectrum needed: 9.35 – 9.45 GHz and 9.55 – 9.65 GHz
- Power levels requested: 360 W output power, 1744 kW ERP (peak)
- Location of use: San Martin, CA
- Direction of radiation: 360 degrees coverage
- o Each antenna has a +/- 90-degree scan angle

**Test Summary:**

The system will transmit pulsed Frequency Modulated (Chirp) waveforms. For all waveform types, the maximum pulse duration is 55µs and the maximum duty factor is 22%. It is expected that the radars will be operated periodically during the period, < 8 hours a day, up to 7 days a week, for the duration of the license.

**RF Hazard Calculations and Site Safety Measures:**

Initial calculations show that general public exposure limits will be reached at a 2.25 meters distance and occupational exposure limits at 1.0 meter, using formula (7) from FCC OET Bulletin 65 “Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields”, dated August 1997. These calculations take into account the highest duty factor of 22% and the raster scan pattern utilized by the radar.

Raytheon’s RF safety group is involved in all testing that requires free space radiation to ensure that no personnel are subjected to RF power density levels exceeding the Maximum Permissible Exposure (MPE) limits of the Part 1.1310 of the FCC Rules and the guidelines in FCC’s OET Bulletin Number 65. An RF Safety Control Plan will be in place for the tests. The Plan will define the procedures and controls required to prevent personnel exposure to levels which exceed the MPE. To verify the safety of personnel, an RF survey will be performed at the initial turn-on 2 of the system. All measured levels, where personnel have access, must be below the MPE limits before testing can proceed.

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**Explanation:**

The purpose of this request for FCC Authorization is to test array compliance to RF performance requirements in a relevant environment. Radar development testing is planned in Brooksville, FL

**Period of Use:**

Start date: December 1, 2023  
End date: December 31, 2025

**Equipment Information:**

Indicate all equipment that will be involved in this operation.

**Transmitter Information:**

Manufacturer: Raytheon  
Model: LPR3  
Number of Units: 4  
Experimental (Y/N): Y

For each frequency band:

RF output at the transmitter terminals:  
360 Watts peak.

**Effective radiated power from the antenna (if pulsed emission, specify peak power):**

The effective radiated power from the antenna, including antenna transmit gain and front-end losses, is 1744 kW (peak power)

$EIRP = Power * gain$ , Power = 360 W, gain = 39 dBi,  $EIRP = 360 * 7043 = 2859480 W$   
 $ERP = EIRP/1.64 = 1743585 W$  or 1744 kW

**Frequency Tolerance:**

Less than 0.001 %

**List each type of emission separately for each frequency (basically list the emission designators)**

For each tunable frequency authorized, the LPR3 has the following emission designators:  
4M70Q3N – 55µsec FM-Pulsed (LP) with a 2 MHz LFM chirp, centered at Ftune – 3 MHz  
7M10Q3N – 6µsec FM-Pulsed (SP) with a 2.5 MHz NLFM chirp, centered at Ftune + 3 MHz  
15M0W8N – Chained long/short pulse with up to 9 MHz separation (4.7/2 + 7.1/2 +9 MHz)

**List as appropriate for the type of modulation:**

LP: Linear Frequency-Modulated Pulsed (Chirp)

SP: Non-Linear Frequency-Modulated Pulsed (Chirp)

Chained waveform consisting of sequential LP and SP

**Locations:**

City: San Martin, CA

Latitude/Longitude: **NL 37-04-54; WL 121-35-49**

Radius: **5 Km**

The radar will be located in San Martin at coordinates **NL 37-04-54; WL 121-35-49**. The ground elevation of the site is **279 ft** above sea level. The radars will be transported on a trailer within 1 Km of the following coordinates: **NL 37-04-54; WL 121-35-49**. Raytheon has proposed a mobile station class with a **5 km** radius for the license centered latitude/longitude. The purpose of the mobile station class is not for transmitting in motion from a vehicle, but to provide alternate locations in case the primary site does not support testing operations within the centered coordinates.

If the primary site is insufficient, Raytheon will place the radar in another location within the **5 km** mobile station radius, while keeping the field of view of the radar overlooking the site.

**Is a directional antenna (other than radar used)?**

No

**If yes, give the following info:** (Although not necessary for this application, additional antenna detail is provided below)

**Width of beam in degrees at the half-power point:**

1.98° Azimuth, 2.1° Elevation at boresight

Orientation in horizontal plane:

+/- 45° Electronically Scanned

**Orientation in vertical plane:**

0° to 30°, relative to ground horizontal, electronically scanned.

**Will the antenna extend more than 6 meters above ground, or if mounted on an existing building, will it extend more than 6 meters above the building, or will the proposed antenna be mounted on an existing structure other than a building?**

No.

**Overall height above ground to tip of antenna in meters:**

No more 3 meters above ground level if installed on a trailer.

**Necessary Bandwidth Calculation Table for each emission:**

	FM-Pulsed Radar		
Modulation	LFM	NLFM	LFM+NLFM
Pulse Width (μsec)	55	6	61
Rise Time (μsec)	0.128	0.128	0.128
Fall Time (μsec)	0.128	0.128	0.128
Chirp BW (MHz)	2	2.5	2+2.5
Necessary BW (MHz)	4.7	7.1	15
Designator	4M70Q3N	7M10Q3N	15M0W8N