

Raytheon Missile Systems  
Experimental License Renewal Application  
Call Sign: WH2XYE  
File Number: 0403-EX-CR-2017

### Explanation of Experiment

Raytheon Missile Systems (Raytheon) is a US defense contractor that builds missile systems and a variety of radio and Radar systems that are necessary for the navigation, target detection, command and control, and communications required for the operation of its technologies.

Raytheon is seeking to renew authorization for a project that examines how to adapt commercial, off the shelf marine radar technology into a new product. The challenge is to work with this well-developed technology in a new way that could produce advances in radar and missile system performance.

### Synopsis:

- Spectrum to be used: 9405 MHz +/- 20 MHz
- Locations: Albuquerque NM, operations at the Raytheon facility, outdoors
- Latitude: 35° 3' 26.71"N, Longitude: 106° 31' 54.06"W
- Power level: 12 Kilowatts
- Rotation rate of radar signal: 24-48 rpm
- Signal beamwidth: 1.85 degree horizontal beamwidth
- Signal Beamwidth: 25 degree vertical beamwidth

### Explanation of Experimentation:

Raytheon is using Raymarine commercial off the shelf marine radar system, 48" Super HD color open array radar (P/N RA3048SHD M/N T52086) to enhance the performance of its surface detection technologies. The planned testing uses the Raymarine technology to improve performance of radar detection.

Test time: The testing will be during the work day, with sporadic use of the radar systems. Testing and data collection will be followed by periods of data evaluation. So, the spectrum use will be discontinuous. The pulse widths are short enough, see table below, to make the signals hard to discern.

Range			
Range (Nm)	Expanded range (Nm)	Pulse width (nominal)	PRF
0.125, 0.25	N/A	75 ns	3 kHz
0.5	N/A	100 ns	3 kHz
0.75	0.125, 0.25	150 ns	3 kHz
N/A	0.5	250 ns	3 kHz
1.5	0.75	350 ns	2 kHz
3	N/A	450 ns	1.5 kHz
N/A	1.5	600 ns	1.3 kHz
6 +	3 +	1.0 us	820 Hz

*Table 1. Table of Ranges and Pulse widths for Raymarine Radar System*

Nature of operation of radar system: The radar antenna rotates at the rate of 24 to 48 revolutions per minute. The transmitted radar signal is a very narrow beamwidth signal, with a horizontal beamwidth of only 1.85 degrees. The narrow beamwidth signal will sweep through 360 degrees in 2.5 seconds when revolving at 24 revolutions per minute. That will drop to 1.25 seconds if the radar is sweeping at 48 rpm. With a beamwidth of less than 2 degrees, the duty cycle of the signal in any given direction will be 0.69% at 48 rpm and at 24 rpm the duty cycle in any given direction will be only 1.39%. When combined with the short pulse width of the radar signals (75 nanoseconds for objects up to one quarter nm away, and up to 1 microsecond for objects more than 6 nm away) the duty cycle is even lower.

Narrow vertical beamwidth: The system has a narrow vertical beamwidth as well. This radar system is being tested for its surface object detection adaptability to be incorporated into new Raytheon products. Therefore, the signals will be primarily in the vertical plane from 0 degrees up to about 40 degrees. This should minimize any chance of harmful interference to other radar operations in the same band.

Other uses of band: The primary federal use of this radar band is by the US Coast Guard, which operates radars in the band in crowded harbors. Raytheon's K-tech facility is in Albuquerque, NM, which is not only land-locked, but sits hundreds of miles from any area where the Coast Guard would be using this system.

Stop Buzzer:

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Conclusion:

Raytheon is expanding a productive research program to advance the surface detection radar capabilities of some of its radar and missile systems. The testing requests the ongoing use of commercial off the shelf Raymarine marine radar systems. An experimental license is needed because the radar system will not be used in a marine environment. There is no ULS license

available for this testing, and the testing is specifically focused on development of radar technologies, so it is properly the subject of an experimental license.

For additional information about this program or if there are questions on the application, please contact Bart Turner, see above, or Anne Linton Cortez, WFS, Counsel to Raytheon, 520-360-0925, or [alc@conspecinternational.com](mailto:alc@conspecinternational.com).