

Raytheon Missile Systems
Exhibit to Experimental License Renewal Application
Call Sign: WF2XQR
File Number: 0434-EX-CR-2020

Explanation of Experimentation, Need for Spectrum, Advancement of Radio Art

Overview:

Raytheon Missile Systems (Raytheon) builds and tests various missiles which are developed for the US military and other US-government approved customers. Those missiles are tested by Raytheon in a number of ways including testing the command and control radio systems on the missiles and testing of the telemetry systems which send data back to control points to deliver key information on the missile flight and the health of the missile systems while in flight. The results of this testing advance the technologies built into the systems.

In this application, Raytheon is seeking authority to renew its ongoing testing of radio systems which will provide enhanced and more efficient telemetry systems which are essential to monitoring the flight of the missiles.

At the 2007 World Radio Conference, there was tentative international agreement to allocate additional spectrum in the “C Band” for aeronautical telemetry use. After that WRC, the Department of Defense encouraged its contractors to develop telemetry technology across the following bands: 4400 to 4940 MHz, 5091 to 5150 MHz, and 5925 to 6700 MHz. In 2010, Raytheon began developing telemetry technologies under this license, operating in all of the relevant bands. It needs to continue experimenting with these radio systems to deliver key telemetry data. This need will persist as long as the DoD has systems operating in all of the bands.

Synopsis:

Spectrum requested: renewal of all currently licensed frequencies

Power levels: renewal of currently licensed power levels

Purpose: Development of C band aeronautical mobile telemetry technology

Purpose of Experimentation:

Raytheon is applying to renew its experimental license for developing radio systems to advance aeronautical telemetry. Raytheon’s engineers and scientists are investigating the properties of the spectrum and how information is transmitted most efficiently over this

spectrum. They are optimizing use of the spectrum to ensure secure, reliable, timely transmission of the essential telemetry data. Development of these radio systems, testing their functioning, improving the systems, and honing the technology, so that the new radio systems can be developed into systems that are ready for use on Raytheon's products to better serve its customers takes years of work. The radio systems now under development examine ways of maximizing telemetry data throughput on this spectrum, minimizing the need for re-transmission of data, securing the data transmission, and ensuring that the transmission stream can withstand any potential for RF interference.

The experiments involve both the development of new radios and new software that can be used in conjunction with the radios to ensure the most efficient and secure use of spectrum for aeronautical telemetry. The radio development includes development of specialized antennas and use of various signals and modulations to create the best telemetry system possible.

Locations of the testing:

Raytheon is renewing its authorization to operate in two locations. The first is in the lab at the Raytheon facility in Tucson, Arizona. This experimentation will be where much of the development of the new systems will take place.

The second location on this application is for airborne, mobile use of the antennas in an area within the south east sector of a 100-mile radius of the Raytheon facility. Because the new radio development is exploring how the spectrum can be most effectively used to transmit telemetry data, it is necessary to test the systems in flight to see how they operate and determine what limitations need to be addressed and how to optimize operations in a real-world environment.

Resolution 418 Compliance: In 2019, Raytheon agreed to limit its airborne operations to that are south and east of its plant site. This limitation was necessary to meet the Res. 418 criteria for protection of AeroMACS operations at Phoenix Sky Harbor Airport. This application seeks renewed authorization for the area of operation approved in 2019. A copy of the Res. 418 calculations is being submitted as an additional exhibit to the application.

Radius of Operations:

Raytheon's requests renewal of its currently licensed locations: 1) a fixed location in a laboratory at Raytheon's main Tucson facility, and 2) airborne operations south and east of

the Raytheon plant Tucson. Operations in the laboratory are expected to have a radius of operations of .16 km, or about a tenth of a mile. The proposed airborne operations would operate at altitudes up to 10,000 feet, but not above 10,000 feet.

Lab testing: 0.1 miles
Airborne testing: 100 miles, limited to south and east of the plant site

Testing uses “listen-before-transmit” technology in radios:

A key part of the developing test plan for any airborne operation is to sort out which spectrum is best by “listening” for existing spectrum use and not using spectrum that is in use by other authorized operators. In sum, the airborne operations specifically include bringing a 4400-4940 MHz receiver on the aircraft and always listening for spectrum use prior to any proposed AMT transmission from the aircraft.

Stop Buzzer Point of Contact:

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Conclusion:

In sum, the goal of the testing is to maximize the efficiency of new aeronautical mobile telemetry equipment that must be designed and built for AMT users. The experiments ongoing under experimental license WF2XQR are designed to optimize performance and throughput, including HD video, with the goal of advancing the use of telemetry spectrum for more operations.

If there are any questions, please contact Anne Linton Cortez, Counsel, 520-360-0925, alc@conspecinternational.com.