Raytheon Company (Missiles & Defense – M)
Experimental License Modification Application
Call Sign: WK2XUC
File Number: 0224-EX-CM-2020

Explanation of Experiment

Raytheon Company (Missiles & Defense – M) (Raytheon) is the primary missile manufacturer in the US, supplying ordinance ready to operate to the US military. Raytheon's experience with missiles has led its customers to seek UAV technology based on some of its existing platforms and knowledge. This has led Raytheon to develop advanced UAV technology as well. These UAV systems are essential to the national security of the United States. This application is for the testing of innovations in UAV system performance.

This application seeks authorization for the use of a variety of radio systems that are used in the development and testing of its advanced UAVs. The radios incorporated into the UAVs support the mission of the UAV testing. This application seeks to modify experimental license WK2XUC to allow for mobile operations at one site and to update the operational area at another.

Technical Synopsis:

Spectrum requested: 430-450 MHz, 1357.5-1387.5 MHz, 2212-2320 MHz, 2345-2472 MHz
4435-4940 MHz, 4950-4990 MHz, 6750-8000 MHz
Limited time of use: 1-2 hours per day of radio use
Limited area of operations: 1 km, radius around each location, maximum 3000 feet elevation
Power levels are low: 430 MHz 10 W, L band 5.5 W, S Band 5.4 W, C band 6 W, 6750 10 W

Description of Operations:

Raytheon is continuing experimentation on its Coyote UAV. The testing in Tucson is designed to determine whether the Coyote system can perform the tasks required in the contract. Periodically, the customer will attend demonstrations to evaluate the progress of the UAV development. This application seeks authorization for operations that will allow for advanced development of the UAV platform at Raytheon's facilities.

This UAV platform has been designed to perform a range of tasks. They include surveillance and monitoring. Those tasks require the UAV to carry a range of radio links to ensure its proper performance. Each link is described in more detail below.

Limited Time of Use:

The UAVs are tested using batteries. The battery life lasts up to two hours. Because the program will need to process test results, they normally only schedule one test per day to take advantage of overnight recharging for the batteries.

Further, the program will not be testing in all locations at the same time, so the amount of spectrum use at any location will be very limited.

Locations of Testing: updated location information is highlighted in the table below. These are the only two changes to the license.

Location	Latitude	Longitude	Radius of Operations
Raytheon Building M07	32-08-13 N	110-55-20 W	1 km
Raytheon Airport Site	32-06-16 N	110-57-11 W	1 km
Raytheon Rita Road	32-05-39 N	110-48-27 W	1 km

Spectrum Use by Band:

430-450 MHz band: This band is used for flight terminate transmissions. The radio uses a listen-before-transmit protocol. The radio is not in use most of the time that the UAV is in flight. It is very limited to the time that a flight terminate message needs to be transmitted. The power level used is only 10 W, with 9 dBi of gain. The flight terminate link must be robust.

L/S/C band frequencies 1357.5-1387.5, 2212-2320, 2345-2472, 4435-4940, 4950-4990 MHz bands: These frequencies are used as datalinks to transmit data while the UAVs are in flight. These radios use a specifically configured frequency within the band. Most of the spectrum will be unused. The radios are programmed for the flights. L band power level is 5.5 W, with 5 dBi of gain to improve signal throughput. S band power level is 5.4 W, with 4 dBi of gain. The C band power level is 6 W with 7.38 dBi of gain to ensure signal reliability.

6750-8000 MHz band: This band is used for terminal guidance seeker operations. The radios step to various channels within the band. They are not listen-before-transmit radios. Only part of the band will be in use at any time. And, the frequencies to be used will change. The 6750-8000 MHz link uses 25 W of power with 7 dBi of gain. The signal is not in use for the entirety of the flight, at this frequency, the signal attenuates quickly.

Local deconfliction: the program will work with local spectrum managers prior to any flight operations to deconflict radio operations that are local to the area. The operations requested on this application are local to Tucson, and most operations will be indoors in the lab, as the program works on advanced development of the UAV platform.

Stop Buzzer Point of Contact:

Jim Ortega, Spectrum Manager
Raytheon Missile Systems
520-794-0227 (office #, forwards to cell)
James.e.ortega@raytheon.com

Conclusion:

Raytheon is seeking an experimental license to continue operations at its headquarters facilities to advance the development of its Coyote UAV system. The proposed testing will be limited in nature. The testing is required under federal contract number HQ 0727-18-F-1632. The advanced testing will support demonstrations for the customer. The radio use will be limited, because the systems

will not be tested in all locations at the same time. Furthermore, only selected parts of the frequency bands requested will be in use at any time. The bands were requested to expedite local spectrum coordination.

If there are any questions about this proposed operation, please contact Anne E. Cortez, counsel, Washington Federal Strategies, at 520-360-0925 or alc@conspecinternational.com.