

Raytheon Missile Systems
Experimental License Application File Number 0543-EX-PL-2010
Supplemental Exhibit and Explanation of Modification to Application

Additional Explanation of Experimentation and Request for Discrete Frequencies

Background:

Raytheon Missile Systems (Raytheon) filed a request for an experimental license from the FCC in December 2010, file number 0543-EX-PL-2010. The application requested the authority to test radio technologies being developed to deliver aeronautical mobile telemetry data over frequencies in the 4400 to 4940 MHz band, the 5091-5150 MHz band, and 5925 to 6700 MHz band.

After the application was filed, The FCC requested that Raytheon seek frequency coordination from the Federal Aviation Administration. That frequency coordination was completed in May 2011, and the frequency coordination was submitted to the FCC. Subsequently, the FCC sent Raytheon's application, at least the portion requesting use of 4400-4940 MHz and 5925 to 6700 MHz, to NTIA for consideration at the Interdepartment Radio Advisory Committee (IRAC). There, the application was tabled. NTIA sent a note back to the FCC requesting that Raytheon provide a radius of operations and also requesting that Raytheon select spot frequencies rather than requesting these entire frequency bands.

This filing is being made in response to the requests sent to FCC by NTIA.

Goal of the proposed testing:

Raytheon's purpose in filing this application is to undertake testing in the designated spectrum bands to determine how best to develop aeronautical mobile telemetry technology that can be used effectively and efficiently in these bands, adding to the current telemetry data being transmitted new high definition video streams. The goal is to provide existing AMT users with technology that can be used when the AMT users are pushed into some or all of these frequency bands. The testing is experimental in nature, and the bands were requested to ensure that the program has flexibility to design and build the best possible systems. One element of the testing is to determine what spectrum works best for this use, and a key aspect of this criterion is finding spectrum that is less heavily used.

Radius of Operations:

Raytheon's originally filed application requested two locations: 1) a fixed location in a laboratory at Raytheon's main Tucson facility, and 2) airborne operations in a 100 mile radius around Raytheon's main Tucson facility. 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 have a radius of operation of 160 km, 100 miles, around the Tucson facility and would operate at altitudes up to 10,000 feet, but not above 10,000 feet. This information was submitted as part of Raytheon's original filing as well.

Lab testing:	0.1 miles
Airborne testing:	100 miles

Proposed Condition for Airborne Operations Under This License

Through the process of trying to respond to the request from NTIA, Raytheon has learned more about the existing uses of spectrum in the 4400-4940 MHz band. As Raytheon has been told, from numerous sources ranging from the Air Force to AFTRCC to NTIA, this band is heavily used by the military, and the current operations must not suffer from harmful interference.

In its original filing, Raytheon did not specify fully all the conditions of the proposed testing it wishes to undertake. 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.

Raytheon would be willing to accept a condition on its license that any airborne use be subject to listen-before-transmit, and be limited to transmissions where there is no risk of harmful interference based on the results of the listening.

Request for Discrete Frequencies

Raytheon also realizes that it may not be possible for the government to approve a blanket use of the 4400-4940 MHz band. As a result, Raytheon has worked closely with the Air Force Spectrum Management Office to identify a number of discrete frequencies that could be used for airborne testing. The list below has 12 spot frequencies that Raytheon is requesting authorization to use when testing from its airborne platform. The reason for choosing a range of spot frequencies is to ensure that the testing looks thoroughly across the band and examines carefully different propagation and transmission characteristics in all segments of the band. This proposal should maximize the effectiveness of the testing, while ensuring the integrity of existing operations.

The frequencies below were selected after consultation with the Air Force, to protect from harmful interference to other users in the area. The frequencies follow the Channel Plans in the NTIA Manual Chapter 4, Section 4.3.18, Tables 2 and 8.

Spot Frequencies Requested – 30 MHz centered on the frequencies listed below:

4445 MHz
4475 MHz
4505 MHz
4535 MHz
4565 MHz
4595 MHz
4625 MHz
4655 MHz
4685 MHz
4715 MHz
4745 MHz
4775 MHz

Conclusion

Raytheon is providing the radius of operations for its proposed use of frequencies in the C band. Additionally, Raytheon is willing to accept a condition on any airborne operations that it must listen-before-transmitting, and if there is an existing user, it must not transmit on the frequency in use. Compliance with this condition was already part of the Raytheon test plan, and if it would help to secure authorization for experimentation on these frequencies, Raytheon recommends putting the condition on the experimental license. Finally, Raytheon has modified its application to seek spot frequencies in the 4400 to 4940 MHz band rather than seeking authorization to use the whole band. The spot frequencies requested are listed above. For effective testing, Raytheon is seeking 12 spot frequencies, and Raytheon has worked with the Air Force to choose spot frequencies that are least likely to face interference issues with other users.

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 who will be forced to move into the C band spectrum. The experiments proposed here are designed to optimize performance and throughput, including HD video, with the goal of having technology that is ready for use when other spectrum used for AMT is refarmed.

We urge approval of this application, as modified.

If there are any questions, please contact Thomas J. Fagan, Spectrum Manager, Raytheon Missile Systems, 520-794-0227 or tjfagan@raytheon.com, or Anne Linton Cortez, Counsel, 520-344-8525, alc@conspecinternational.com.