Experimental License Request

1. Purpose of Operation:

Frequency authorization is being requested for the period of October 1, 2018 – October 31 2019 in X-band at frequencies between 9.5 – 9.6 GHz order to test and demonstrate a new antenna design. Outdoor testing, across multiple frequencies as noted above is required to assess hardware compliance with requirements.

File Number: 0649-EX-CN-2018

Station Class: FIXED

Start Date: October 1, 2018

End Date: October 31, 2019

2. Technical Synopsis:

- Spectrum needed: 9.5 – 9.6 GHz
- Power levels requested: 137.2 W ERP (457.33 W ERP for SS-DLE)
- Expected time of use: Less than 20 minutes of transmit time over the course of an 8 hour day
- Stop buzzer contact: Karen Dyberg (508-450-9236 cell)

3. Experimental Explanation:

The new antenna is planned to be tested at the Raytheon Pelham Test Facility in Pelham, NH over the period of October 1, 2018 – October 31, 2019. The purpose of this request for Special Temporary Authorization is to test compliance of performance requirements in a relevant environment. This test and demonstration is essential to keeping costs low for this technology development effort.

Test Summary:

The antenna being tested consists of 4 antenna elements, a dummy load and an RF switch for antenna element selection, and a radome. The antenna will be sent Built-In-Test (BIT) signals and element selection signals to validate and demonstrate RF transmission performance. Only one unit will be tested at a time.

RF Hazard Calculations and Site Safety Measures:

Initial calculations show that general public exposure limits will be reached at a 1.2 meters distance and occupational exposure limits at 1.8 meters, 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 10%.

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 is not required for this test due to the height of the antenna test fixture.

Raytheon Technical Point of Contact:

Name: Phillip Jones

Title: NASAMS Technical Director

Phone: 978-470-4463

Email: Phillip_E_Jones@Raytheon.com

Raytheon Spectrum Manager filing application:

Name: Karen Dyberg

Title: Spectrum Management/RF Safety

Phone: 508-490-2723 (desk), 508-450-9236 (cell)

Email: karen.dyberg@raytheon.com

Period of Use:

Start date: October 1, 2018

End date: October 31, 2019

Equipment Information:

Indicate all equipment that will be involved in this operation.

Transmitter info:

Manufacturer: Raytheon

Model: DLT

Number of units: 1

Experimental (Y/N): N

For each frequency band:

RF output at the transmitter terminals: 23.8 watts average (79.43 for SS-DLE)

(From EEEC eval: Within the DLE is a TWT which generates 300 watts (54.77 dBm) of power. There is a dB of loss from the output of the TWT to the output of the DLE which will give us 53.77 dBm (238.3 Watts) of power out of the DLE. Applying maximum duty factor of 10%, average power = 238.3 * 0.10 = 23.83 watts or 13.77 dBW.

(From EEEC eval: Within the DLE is a SS Amplifiler which generates 1000 watts (60.00 dBm) of power. There is a 1 dB of loss from the output of the TWT to the output of the DLE which will give us 59.00 dBm (794.33 Watts) of power out of the DLE. Applying maximum duty factor of 10%, average power = 794.33 * 0.10 = 79.43 watts or 19.00 dBW.

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 137.2 watts (457.33 watts for SS-DLE)

There is a 133” long cable (H352756) from the DLE to the DLA that has an additional 2.25 dB of loss; the power at the end of this cable (and the input of the DLA) will be 11.52 dBW or 14.19 Watts.

There is a 133” long cable (H352756) from the SS-DLE to the DLA that has an additional 2.25 dB of loss; the power at the end of this cable (and the input of the DLA) will be 16.75 dBW or 47.32 Watts.

Power * gain = EIRP, gain = 12 dBi or 15.85 numeric

EIRP = 14.2 watts * 15.85 numeric gain = 225.1 W

ERP = EIRP/1.64 = 137.2 W

Power * gain = EIRP, gain = 12 dBi or 15.85 numeric

EIRP = 47.32 watts * 15.85 numeric gain = 750.02 W (28.75 dBW)

ERP = EIRP/1.64 = 457.33 W

Frequency Tolerance:

Less than 0.001 %

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

6M00M1D – BIT signal

Necessary bandwidth: 6 MHz

Type of modulation (M): pulse position

Nature of signal(s) modulating the main carrier (1): a single channel containing quantized or digital information without the use of a modulating sub-carrier, excluding time-division multiplex

Type of information transmitted (D): data

List as appropriate for the type of modulation:

Pulse position modulation

Locations:

The Raytheon Test Facility is in Pelham, NH, located at North 42°44'14", West 71°21'16". The street address is 50 Bush Hill Rd, Pelham, NH 03076. The antenna testing will take place within 300 meters of these cited coordinates at a maximum ground elevation of 130 meters.

Is a directional antenna (other than radar used)?

Yes.

If yes, give the following info:

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

90° Azimuth per quadrant, 20° Elevation

Orientation in horizontal plane:

360°

Orientation in vertical plane:

+20° relative to horizon

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:

Approximately 4 meters

Elevation of ground at antenna site above mean sea level in meters:

130 meters

Approximate distances to various aircraft landing areas in km:

Boire Field - Nashua, NH (ASH / KASH)	12.9km
Lawrence Municipal Airport - Lawrence, MA (LWM/KLWM)	19.3km
Manchester-Boston Regional Airport – Manchester, NH (MHT/KMHT)	22.5km
Laurence G. Hanscom Field - Bedford, MA (BED/KBED)	30.6km
Laurence Hanscom - Burlington, MA (BBF)	30.6km
Minute Man Airfield - Stow, MA (MMN)	33.8km
Waltham Airport - Waltham, MA (WLT)	38.6km
Fitchburg Municipal Airport - Fitchburg, MA (UXO)	38.6km
Beverly Municipal Airport - Beverly, MA (BVY/KBVY)	40.2km

Logan International Airport – Boston, MA (BOS/KBOS) 49.9km

Note: This is not a complete list.

List any natural formations of existing man-made structures (hills, trees, water tanks, etc) which in the opinion of the applicant would tend to shield the antenna from aircraft and thereby minimize the aeronautical hazard of the antenna:

None.