

# **Raytheon Request for FCC Special Temporary Authorization**

STA File Number: 0580-EX-ST-2017

Date: 5/5/2017

## **Purpose of Operation:**

The purpose of this testing is to measure X-band propagation loss over land from the Raytheon test site at 50 Bush Hill Road, Pelham NH, to two or more receiver sites of interest.

## **Technical Synopsis:**

- Spectrum needed: 8.5 – 8.99 GHz and 9.21 – 10 GHz
- Power levels requested: 419 kW peak ERP
- Location of use: 50 Bush Hill Rd., Pelham, NH
- Direction of radiation: 177.4, 183.3, 44.5 or 194.5 degrees from True North Azimuth;  
0.0 degrees Elevation
- Stop buzzer contacts: Thomas Lulsdorf (cell 978-815-9514), Karen Dyberg (cell 508-450-9236)

## **STA Explanation:**

This Special Temporary Authority (STA) is necessary because X-Band transmission is required in order to perform measurements of propagation loss in the directions of interest. Measurement under typical conditions is required because the land in the directions of interest is too complex and variable for reliable modeling of the over land propagation loss. The next stage of developmental testing is dependent on the results of this experiment and a speedy result is required to maintain schedule.

## **Test Summary:**

An X-band signal will be transmitted from a linearly polarized horn antenna in one of four directions of interest. Receiving equipment will be set up at the sites of interest to measure power received. The measured propagation loss overland can be determined from the power transmitted, power received and other known equipment parameters.

## **RF Hazard Calculations and Site Safety Measures:**

Initial calculations show that general public exposure limits will be reached at a 118 meter distance and occupational exposure limits at 17 meter, using peak power levels and formula (7) from FCC OET Bulletin 65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", dated August 1997. Accounting for duty cycle, the distance to meet the general public limit drops to 53 meters, and 8 meters for occupational. To avoid overexposure of authorized site personnel, an exclusion zone will be marked during transmit operations and an RF safety plan will be in place.

## **Raytheon Technical Point of Contact:**

Name: Thomas Lulsdorf

Position: Test Director

Phone: 978-815-9514 (cell)

Email: lulsdorf@raytheon.com

## **Raytheon Spectrum Manager filing application:**

Name: Karen Dyberg

Position: Spectrum Management/RF Safety

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

Email: Karen.Dyberg@raytheon.com

**Period of Use:**

Start date: May 24, 2017

End date: November 15, 2017

**Equipment Information:**

Synthesized signal generator (Tektronix AWG70001A).

TWT Amplifier (Applied Systems Engineering model 174X)

15 or 24 to 25 dBi linear polarized horn

(Narda 640 Standard Gain horn (15 dBi),

ATM Microwave 90-443-6 (24 dBi) or similar)

Adjustable tripod antenna mount.

**Transmitter info:**

Manufacturer: Applied Systems Engineering

Model: 174X

Number of units: 1

Experimental (Y/N): N

**For each frequency band:**

RF output at the transmitter terminals:

2172.7 Watts peak maximum

**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  $\leq 418.943$  kW (peak power). Used the highest gain of 3 possible antennas.

Power \* gain = EIRP, gain  $\leq 25$  dBi, EIRP  $\leq 687068$  W

ERP = EIRP/1.64  $\leq 418943$  W or 419 kW

**Frequency Tolerance:**

Less than 0.1 %

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

See information under Necessary Bandwidth below.

**List as appropriate for the type of modulation (and describe as necessary):**

Maximum speed of keying in bauds: N/A

Maximum audio modulating frequency: N/A

Frequency deviation of carrier:  $\leq 50$  MHz

Pulse duration and rep rate:  $\leq 15$   $\mu$ sec;  $\leq 400$  kHz

For complex emissions, describe in detail.

**Necessary bandwidth (Bn).** Explain how determined. See NTIA Manual Annex J.

Waveforms are intended to simulate pulsed linear FM radar waveforms. Therefore the formula

$B_n = 1.79/\text{sqrt}(t^*tr) + 2*B_c$  from Annex J for FM pulse radars is used.

Waveform 1. Wide band LFM. Emission Designator TBD.

Chirp Extent 100 MHz, Pulsewidth 10  $\mu$ sec; Rise/fall time 0.006  $\mu$ sec  
Bn =207.3 MHz

Waveform 2. Medium band LFM. Emission Designator TBD.

Chirp Extent 10 MHz, Pulsewidth 10  $\mu$ sec; Rise/fall time 0.006  $\mu$ sec  
Bn =27.3 MHz

Waveform 3. Narrow band LFM. Emission Designator TBD.

Chirp Extent 10 kHz, Pulsewidth 10  $\mu$ sec; Rise/fall time 0.006  $\mu$ sec  
Bn =7.3 MHz

**Locations (street address, coordinates, ground elevation above sea level, and radius of operation)**

Raytheon

50 Bush Hill Road

Pelham, NH 03076

Coordinates: 42° 44' 15" N, 071° 21' 16.6" W

Elevation: 130 m

**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:**

29 deg for 15 dBi antenna (Narda 640 or ATM Microwave 90-441-6)

11 deg for 24 dBi antenna (ATM Microwave 90-443-6)

**Orientation in horizontal plane:**

177.4, 183.3, 44.5 or 194.5 degrees from True North

**Orientation in vertical plane:**

0 degrees elevation

**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,**

No

**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:**

$\leq 6$

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

130