

Raytheon Request for FCC Permanent Experimental License

Prototype C-Band Noise Antenna Test

Form 442 Confirmation Number: EL825154

04/02/2014

Exhibit 1: Narrative

This request is to provide continuation of WH9XCC, File Number 1051-EX-ST-2013

Purpose of Operation:

Frequency authorization is requested for the period of 6 May 2014– 5 May 2016 in the 5250–5850 MHz band in order to continue developing and testing a C-Band noise antenna test kit. The kit will be a diagnostic tool, allowing us to troubleshoot the radar when issues arise in field. The target radar will be in receive-only mode during these tests. Integration testing will take place at the Raytheon Test Facility, Pelham, NH.

FAA Approval (NGT#140059 see Exhibit #3) is verified for the use of the FAA restricted/protected 5600-5650 MHz band.

Permanent Experimental License Explanation:

The C-Band noise antenna test kit will be operated at the Raytheon Test Facility in Pelham, NH over the period of 6 May 2014 – 5 May 2016. The purpose of this request is to continue to integrate our proof of design, test, and make modifications to the prototype.

The original frequency license did not allow the band 5600-5650MHz without FAA coordination. That band has been added to this application and the FAA Coordination is EXHIBIT 3.

Test Summary:

An experimental permanent license is required to continue the evolution and development of the prototype C-Band radar antenna diagnostic tool before and after customer demonstration. Starting in May 2014, we plan to test the noise source generator across the entire 5250–5850 MHz band. The source is a 600MHz bandwidth continuous wave signal operating at a maximum 2W output. The calculations for the power output, cable losses, etc can be found below. The noise source will be emitted from a horn mounted atop a 9 m mast, connected to a 50 foot cable. It will be on just long enough (about 60-90 seconds) for the radar to receive the signal and run the test to evaluate the radar health. The radar under test will be in receive mode only.

Exhibit #2 provides a graphical view of the test site.

Exhibit #3 FAA has approved the use of the band 5600-5650MHz for this activity (NGT#140059). Their approval was based on the low power output, the lack of FAA facilities in the area that could receive harmful interference, the short time frame for the noise emission, and the directional nature of the transmit antenna.

Raytheon's RF safety group and hazard assessment team have been involved with this prototype integration preparation to ensure personnel are NOT subjected to RF power density levels that exceed 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. Raytheon has a Company Policy and Environmental, Health and Safety Standard which addresses electromagnetic energy exposure control. It is Raytheon's policy to ensure that our personnel, the general public and our customers are not exposed to RF levels which exceed applicable standards.

Electromagnetic Energy Exposure Control Evaluation:

Power Density, $P_d = (\text{Max Power} \times \text{Antenna Gain} \times \text{duty cycle}) / (4 \times \pi \times R^2)$, where R is distance in meters

Max Power = 33 dBm = 2 Watts

Antenna Gain = 17 dB (50.11 numeric) (this was rounded up)

Assuming 6 meters from source placed atop 26' (approx. 9 meters) tower

At 6 meter, $P_d = ((2 \times 50.11) / (12.56 \times (6^2))) / 10 = 0.2 \text{ W/m}^2 \text{ (.02 mW/cm}^2\text{)}$

Distance that meets general public limits of 5 W/m^2 , i.e. 1 mW/cm^2 :

Solving for R = $\sqrt{99.98 / (12.56 \times 5)} = .89$ meters is the safe distance from the antenna for personnel

NOTE: This evaluation did not take losses into account.

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Period of Use:

Start date: 6 May 2014

End date: 5 May 2016

Equipment Information:

Transmitter info:

Manufacturer: Noise Com, Inc.

Model: NC9282

Number of units: 1

Experimental (Y/N): Y

For each frequency band:

RF output at the transmitter terminals: 33 dBm, 5-6 GHz

RF Generator: 2 W peak/ 2W average because it is a CW source operating at 100% duty cycle

50-ft Cable: 7 dB loss

Power output after cable: 0.4 W

Effective radiated power from the antenna

Feedhorn: 15 dB, 7.59W effective radiated power (ERP),

34° beamwidth

366 meters to property line, resulting in 0.24 W rms

$$\text{Power equation: } \frac{P_t * G}{4\pi R^2} = \frac{-6.2 \text{ dBw} * 15 \text{ dBi}}{11 \text{ dB} + 51.27 \text{ dB}} = -53.47 \text{ dBw, 600 MHz} = 4.5 \mu\text{W}$$

Frequency Tolerance:

N/A

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

5250 MHz – 5850 MHz: 600M0N0N

Emission Designator Classification Symbols used:

600M0N0N

Emission Bandwidth: 600MHz

First Symbol -Type of modulation of the main carrier

N Emission of an unmodulated carrier.

Second Symbol -Nature of signals modulating the main carrier

0 No modulating signal.

Third Symbol -Type of info transmitted

N No information transmitted.

Locations:

The Raytheon facility in Pelham, NH, is located at North $42^{\circ} 44' 14.1''$, and West $071^{\circ} 21' 14.4''$ and ground elevation of 128.0 meters above sea level. The street address is 50 Bush Hill Road, Pelham, NH 03076.

Is a directional antenna (other than radar used)?

Yes.

If yes, give the following info:

Type of antenna, also (Manufacturer, model):

Narda Microwave-East, L3 Communications

Model: 643

Size: Length: 10.47" Width: 4.80" Height: 6.34"

See Figures 1 thru 2 for antenna diagrams

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

34° Azimuth, 34° Elevation

Orientation in horizontal plane:

+/- 1 degree relative to zero

Orientation in vertical plane:

90 degrees

Antenna will be pointed 94 – 100 degrees from True North depending on which radar is being tested

The antenna will be pointed directly at the radar being tested .

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?

YES The antenna horn will be mounted 9m from the ground on a mast.

If Yes,

Overall height above ground to tip of antenna in meters: 9.2m

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

128m (Pelham, NH facility)

Distance to nearest aircraft landing area in km:

Pelham, NH Test Facility:

Boire Field - Nashua, NH (ASH / KASH)	12.9km
Directly WEST of Pelham	
Lawrence Municipal Airport - Lawrence, MA (LWM / KLWM)	19.3km
EAST and BEHIND Pelham	

Manchester-Boston Regional Airport – Manchester, NH (MHT / KMHT) 22.5km

This is the closest FAA facility in the direction of the transmit antenna

Laurence G. Hanscom Field - Bedford, MA (BED / KBED) (Also HAFB)	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

All of the above are located BEHIND the Pelham location

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

Exhibit 2 provides a graphical overview of the site.

Figure 1. Narda 643 Standard Gain Horn Antenna

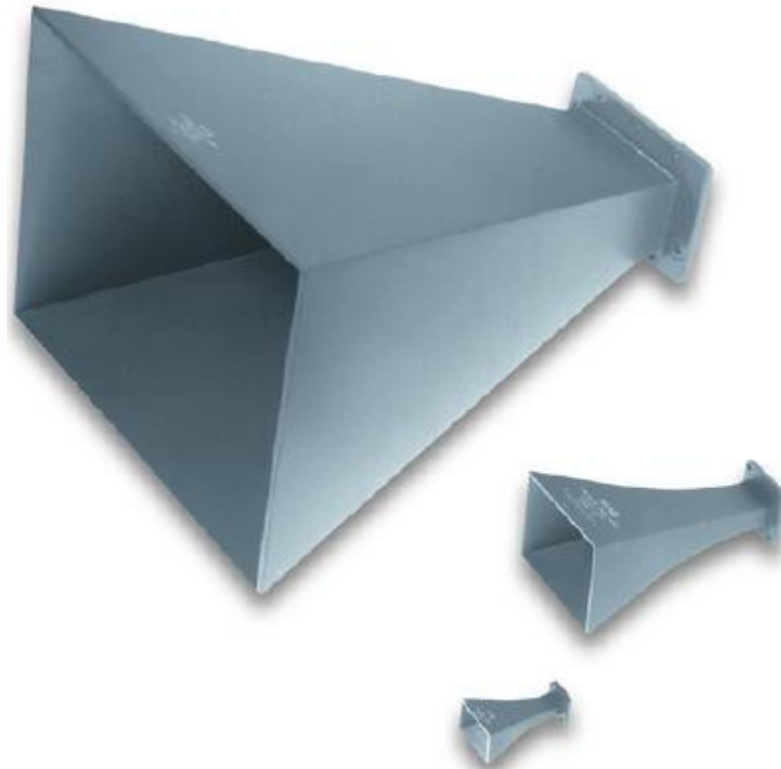


Figure 2. Antenna Mast and Ancillaries

