

Raytheon Request for FCC Experimental License

Reference File No.: 0417-EX-PL-2010

File number EL135425

Applicant Name (Company): Raytheon IDS

528 Boston Post Road

Sudbury, MA 01776

Date: 09-01-2010

Experimental License Explanation:

Raytheon has been operating the Prototype Demonstration System (PDS) Radar at Raytheon's Integrated Air Defense Center (IADC) in Andover, MA, since April 23, 2010 under STA Call Sign WE9XGB, file number 0076-EX-ST-2010. Raytheon is now requesting an experimental license in order to continue to operate the PDS radar for an additional year. Raytheon plans to continue to abide by the operational modes and conditions granted by the existing STA (WE9XGB) during the requested experimental license period.

Purpose of Operation:

Frequency authorization is being requested for the period of September 24, 2010 – September 24, 2011 in the 3.1 GHz to 3.4 GHz band in order to demonstrate the operation of a prototype radar system. Raytheon has been operating the prototype system in this band under STA Call Sign WE9XGB, file number 0076-EX-ST-2010 since April 23, 2010. Continuation of radar demonstrations beyond the current STA expiration date of September 23, 2010 is critical to Raytheon's winning a next phase proposal. Operation of the PDS radar is needed to demonstrate to our customer that key technologies designed and developed by Raytheon are mature and ready for inclusion in the proposed system. It is Raytheon's view that these technologies set Raytheon apart from our competitors so it is essential that performance is demonstrated in a radar environment similar to the proposed radar system. Raytheon has demonstrated the capabilities of these critical technologies under the existing STA but incremental improvements in radar performance must be demonstrated over the next year in order for Raytheon to be competitive in the next phase proposal.

Test Summary:

An experimental license is requested to continue to demonstrate the performance of the PDS to our customer for an additional year beyond the current STA Call Sign WE9XGB expiration date of September 23, 2010. Formal demonstrations for the customer began August 2010 and will be continued through September 2011. No operational modes outside of those granted by the existing STA are planned. The system will continue to transmit at the same peak and average power levels using either pulsed Linear FM (LFM) 100 KHz, pulsed LFM 300 KHz, or pulsed unmodulated carriers in the 3.1 GHz – 3.4 GHz band. It is expected that the radar will be nominally operated for periods of up to 20 minutes per day with at a maximum transmit duty factor of 30%.

Raytheon's RF safety group has been involved and will continue to be involved with these demonstrations 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. 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. To that end, we have an RF Safety Plan in place for the testing. The RF Safety Plan defines the procedures and controls required to prevent personnel exposure to levels which exceed the MPE. To verify the safety of personnel, several RF surveys have already been performed. All measured levels, where personnel have access, are well below the MPE.

Raytheon has also evaluated the potential susceptibility of aircraft and Electro-Explosive Devices (EEDs) in or on aircraft during the operation of the prototype radar. The results show that there are no radiation hazards to personnel, aircraft, aircraft equipment or EEDs, during the proposed testing. These results are documented in a separate attachment.

Additional information is also provided in slides attached to this summary which cover: power levels, test site layout, and transmit scan coverage.

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Period of Use:

Start date: September 24, 2010

End date: September 24, 2011

Equipment Information:

Indicate all equipment that will be involved in this operation.

Transmitter info:

Manufacturer: *Raytheon*

Model: *Prototype Demonstration System (PDS)*

Number of units: *1*

Experimental (Y/N): *Y*

For each frequency band:

RF output at the transmitter terminals:

226KQ3N 5120 Watts peak, 1536 Watts average

626KQ3N 5120 Watts peak, 1536 Watts average
26KPON 160 Watts peak, 48 Watts average
0H00NON 272 Watts (CW operation)

Effective radiated power from the antenna (if pulsed emission, specify peak power):

29.8 MWatts peak, 8.94 MWatts average (average is based on 30% duty cycle.) . The slides at the end of this document provide the effective radiated power for each emission type.

Frequency Tolerance:

Less than 0.01 %.

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

Emission is 3.1- 3.4 GHz Linear FM and pulsed CW. 226KQ3N, 626KQ3N, 26KPON and 0H00NON.

The transmit waveform pulses are either, Single Tone Unmodulated Carrier, 100 KHz LFM chirps, or 300 KHz LFM chirps. The total transmit on time does not exceed 2.45 msec in a 8.22 msec period establishing a maximum duty factor of 30%. Operation will either be sequence of unmodulated carriers at low power (used to calibrate the system), sequence of 100 KHz modulated carriers, or a sequence of 300 KHz modulated carriers. Operational modes are not mixed.

List as appropriate for the type of modulation:

Maximum speed of keying in bauds:	<i>Not Applicable, not a communication device</i>
Maximum audio modulating frequency:	<i>Not Applicable</i>
Frequency deviation of carrier:	<i>Not Applicable</i>
Pulse duration and rep rate:	<i>2.45 millisecond, 121 Hz rep rate</i>
For complex emissions, describe in detail:	<i>Linear FM and pulsed CW</i>

Necessary bandwidth. Explain how determined.

The necessary bandwidth was calculated using the equations in Annex J of the NTIA Manual. The slides at the end of this document provide the details of this calculation.

Location:

The Raytheon facility in Andover, MA, located at North 42°38'18.30", West 71°11'32.71". The street address is 350 Lowell Street, Andover, MA 01810.

Is a directional antenna (other than radar used)?

No. (Although not necessary for this application, additional antenna detail is provided in the slides at the end of this document)

If yes, give the following info:

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

13° Azimuth, 0.37° Elevation

Orientation in horizontal plane:

+/- 50 degrees East - West

Orientation in vertical plane:

+/- 50 degrees North - South

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. (Although not necessary for this application, additional detail related to height and location of the antenna is provided in the slides at the end of this document)

If Yes,

Overall height above ground to tip of antenna in meters:

4.2 m

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

40 m

Distance to nearest aircraft landing area in km:

Lawrence Municipal Airport – 8 km

Laurence G. Hanscom Field Airport – 23 km

Beverly Municipal Airport – 24 km

Manchester-Boston Regional Airport – 36 km

Logan International Airport – 36.5 km

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:

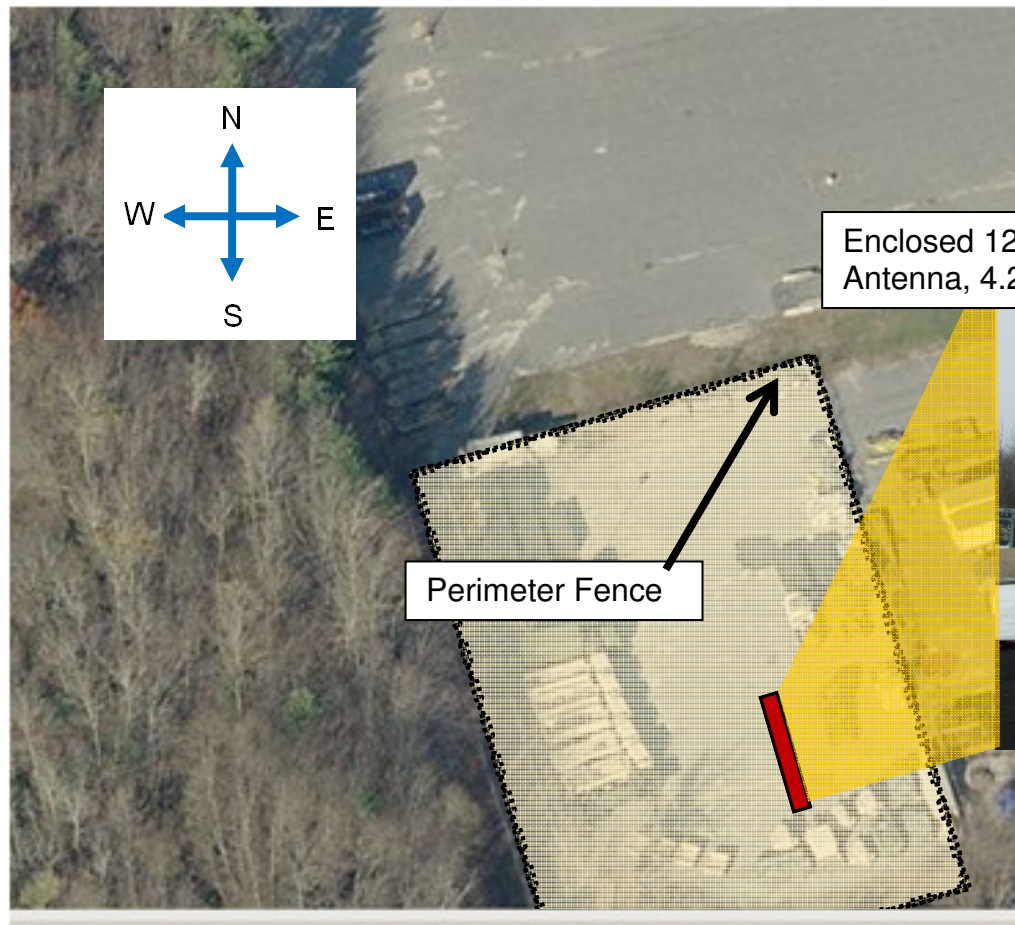
None.

See the attached figures for a top view of the radar test site and transmit scan coverage. The prototype radar hardware is in a 53 foot isocontainer with a radome housing the antenna array on the top. The test area is cordoned off in an unused area on Raytheon property.

Transmit Configuration

Raytheon IADC Facility, Andover, MA

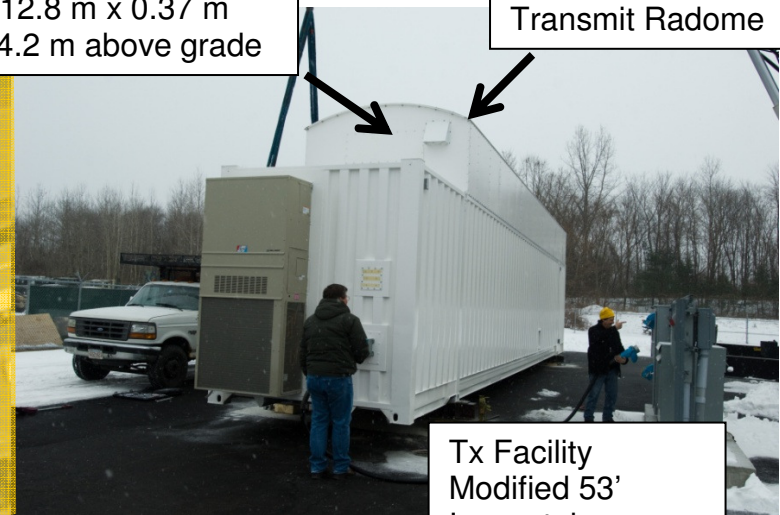
North 42°38'18.30" West 71°11'32.71"
40 meters above sea level



Flat antenna facing upwards,
radiation looking skyward
3dB BW 13.0 deg AZ, 0.37 deg
EL
+/- 50 deg East – West
+/- 50 deg North - South

Enclosed 12.8 m x 0.37 m
Antenna, 4.2 m above grade

Transmit Radome



Tx Facility
Modified 53'
Isocontainer

Prototype Demonstration System (PDS)

Transmit Modes of Operation

Prototype Transmitter Waveform Modes											
Mode Emissions Designator	Fc (GHz)	Scan ° AZ	Scan ° EL	Beam Width AZ (deg)	Beam Width EL (deg)	Pulse Width (ms)	Duty Factor %	PEAK ERP* MW	AVERAGE ERP* MW	Linear FM (LFM) Chirp BW KHz	Necessary BW KHz
226KQ3N	3.101 - 3.399	+/-50	+/-50	13 °	0.37 °	2.5	30	29.80	8.94	100	225.60
626KQ3N	3.101 - 3.399	+/-50	+/-50	13 °	0.37 °	2.5	30	29.80	8.94	300	625.60
26KP0N	3.101 - 3.399	NA	NA	NA	NA	2.5	30	0.020	0.006	NA	25.60
OHOONON	3.25	Fixed	Fixed	13 °	0.37 °	NA	NA	1.7	1.7	NA	0.00

*ERP includes COAX loss from transmitter to

ANNEX J

Guidance for Determination of Necessary Bandwidth

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Guidance for Determination of Necessary Bandwidth

Description of Emission	Formula
FM-pulse radars (intentional FM)10	$B_n = B(20dB) = \frac{1.79}{\sqrt{t_r t}} + 2B_c$

PON - Sequence of Unmodulated Carrier Pulses	
0 MHz Chirp BW	
2450 usec chirp pulse	
2 usec rise time	
1.79 Formula Factor	
0 MHz 2*ChirpBW	
0.03	$= \frac{1.79}{\sqrt{t_r t}}$
0.03 MHz	
25.6 KHz	

LFM Chirp BW = 100KHz	
0.1 MHz Chirp BW	
2450 usec chirp pulse	
2 usec rise time	
1.79 Formula Factor	
0.2 MHz 2*ChirpBW	
0.03	$= \frac{1.79}{\sqrt{t_r t}}$
0.23 MHz	
225.6 KHz	

LFM Chirp BW = 300 KHz	
0.3 MHz Chirp BW	
2450 usec chirp pulse	
2 usec rise time	
1.79 Formula Factor	
0.6 MHz 2*ChirpBW	
0.03	$= \frac{1.79}{\sqrt{t_r t}}$
0.63 MHz	
625.6 KHz	

Prototype Demonstration System (PDS) Transmit Scan Coverage (226KQ3N,626KQ3N Modes)

$\pm 50^\circ$

EL

South

North

$\pm 50^\circ$

AZ

East West

