

Raytheon Request for FCC Special Temporary Authorization (STA)

STA File Number 0574-EX-ST-2007

STA Confirmation Number EL519709

12/3/07

Purpose of Operation:

The operation will demonstrate Raytheon's Tempwave™ frost protection system for citrus crops. The system is intended to prevent freeze damage to crops by delivering low intensity microwave heating sufficient to make up the net energy lost during a radiation frost event. A field test is desired to show system effectiveness in an actual frost event on real crops.

STA Explanation:

Testing this winter is required to show system effectiveness which allows product design, production planning and system sales for the 2008-2009 growing season in North America. Without a proof of principle demonstration this winter, there is no strong marketing feature for sales next year. The system was conceived, designed and US patent applied within the last 6 months. The need for a field test was realized in the last month.

Test Summary:

Raytheon's team mate in this effort is Paramount Citrus. They are providing the test site and power for the demonstration. The location is an orange orchard in Vasaila, CA.

The test setup will consist of 4 towers at the corners of a 30 meter x 30 meter area within the orchard. Each tower is 10 meters tall and will have 4 identical transmitter/antenna combinations at the top. (There will be a total of 16 identical antennas/transmitters.) See figure 1 attached. The antennas are arranged, and the antenna patterns designed to uniformly illuminate the orchard and supply energy lost by the crop. The system should deliver energy directly to the crop during a freeze.

Our research shows that the crop needs small but steady energy input during a frost night. An analysis predicts an RF power density of 1.8 mW/cm^2 at the tree tops within the test area. Tests inside a shielded will be performed assess various parameters of the equipment/configuration in preparation of the outdoor field test. Raytheon's RF safety group is involved in this demonstration 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 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 will have an RF Safety Plan in place for the testing. The RF Safety Plan will define the procedures and controls required to prevent personnel exposure to levels which exceed the MPE. To verify the safety of personnel, an RF survey will be performed at the initial turn-on of the system. All measured levels, where personnel have access, must be below the MPE before testing can proceed.

Raytheon is also performing ambient RF surveys at each corner of the test area and at 6 other locations up to 5 miles away. The frequency range measured is between 80 MHz to 5 GHz. Raytheon will review this data to assess interference potential to the locality.

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Period of Use:

Start date: January 10, 2008

End date: April 30, 2008

Equipment Information:

Indicate all equipment that will be involved in this operation.

Transmitter info:

Manufacturer: *Raytheon*

Model: *Tempwave® Mk-I*

Number of units: *16*

Experimental (Y/N): *Y*

For each frequency band:

RF output at the transmitter terminals: *1300 Watts CW mean for each transmitter*

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

24,800 Watts (This is the CW output multiplied by the Gain of the output horn (12.8 dB)), each antenna

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

Emission is 2.450 GHz ±10MHz, CW, 1300W output.

List as appropriate for the type of modulation:

Maximum speed of keying in bauds: *Not Applicable, not a communication device*

Maximum audio modulating frequency: *No Modulation*

Frequency deviation of carrier: *10 MHz*

Pulse duration and rep rate: *Not Applicable*

For complex emissions, describe in detail: *Simple emission*

Necessary bandwidth. Explain how determined.

The bandwidth is 20 MHz (± 10 MHz), centered on 2.450 GHz. This bandwidth is determined by the magnetron tube manufacturer's specifications for the output frequency accuracy of the magnetron.

Location:

Measurements made using GPS receiver at Northeast corner of the 30 meter x30 meter test area.

Coordinates for the other 3 corners can be provided if needed.

Latitude: 36° – 26' – 17.8'' N

Longitude: 119° – 11' – 26.0'' W

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:

19° (Horiz Plane), 18° (Vert. Plane)

Orientation in horizontal plane:

There will be 16 antennas, each pointing in a different direction in the horizontal plane, for 360° coverage

Orientation in vertical plane:

The beam center of the antennas will be pointed between 20° and 50° below level in the vertical plane, depending on test conditions.

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

If Yes,

Overall height above ground to tip of antenna in meters:

10m

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

115m

Distance to nearest aircraft landing area in km:

15.4km (Sequoia Airfield, to the west)

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, although the antenna will be angled down toward the ground between 20° and 50°

See attached figure. Note: Photo not of actual test site, trees are representative of "an orchard". Actual site has no hills or buildings nearby.



Figure 1. Raytheon's Frost Protection System Test Setup