

Raytheon Missile Systems  
Special Temporary Authorization  
File No: 0037-EX-ST-2011

**Exhibit 1 – Need for STA and Explanation of Experimentation and Antenna Information**

Raytheon Missile Systems (Raytheon) is a manufacturer of missiles and related technologies that it sells to the US Department of Defense and other approved customers. Raytheon develops precision positioning and high performance technologies that improve the effectiveness and safety of its products. Many of those technologies require the use of radio signals for command and control, detection, positioning information, and other essential performance characteristics. The experiment proposed here is a short term study of signal propagation.

**Need for STA:**

The current application proposes a signal propagation study that is expected to last three months. Because of the short duration of the experiment, it is appropriate to seek a Special Temporary Authorization.

**Explanation of Experimentation:**

**Frequencies and required bandwidth:** Raytheon is proposing the installation of a radio antenna that will transmit at four discrete frequencies, 86 MHz, 87.5 MHz, 87.7 MHz, and 87.9 MHz. The transmissions require bandwidth of only 200 Hz.

**Experiment:** The experiment will start with turning on the transmit antenna, and then driving south from the Raytheon facility to measure signal strength variability with distance. The testing is expected to require about one (1) hour of radio transmission time per day, with the rest of the day spent in analysis. The testing of the transmitter will take place about five days per week over the course of about 12 weeks. In that time, the program will have gathered enough data for the required signal propagation studies and have a better ability to develop radio antennas and signals that significantly advance the effectiveness of radio transmissions at these frequencies.

**Azimuth of transmission:** The Raytheon facility is situated southwest of Tucson, on the outskirts of town. The antenna will be oriented to the south away from the center of Tucson and its population center. The antenna will be pointed out toward unpopulated desert. It is a directional antenna with little signal in the back lobe, most of the signal strength is to directed either forward or to the sides.

**Minimal chance of interference to local broadcast operations:** The proposed spectrum is not in use as broadcast spectrum in Tucson. The lowest frequency broadcast FM radio station in Tucson operates at 88.5 MHz. The television station that operated on Channel

6 has made the DTV transition and is operating at Channel 30. Because the bandwidth requirement for the proposed transmission is only 200 Hz, the transmissions will be well outside of the guard bands for the FM radio station. Furthermore, the filters on FM radios will eliminate any noise from the proposed transmission. Raytheon is prepared to coordinate as necessary with the Society of Broadcast Engineers to ensure that there are no interference issues with licensees operating in these frequencies under part 74 of the Commission's Rules.

Stop buzzer: To further ensure that there are no interference problems, Raytheon is providing a stop buzzer point of contact to ensure that the transmissions can be turned off immediately in the event of a problem:

Thomas J. Fagan, Spectrum Manager  
Raytheon Missile Systems  
(520) 794-0227 (office)  
(520-465-7087 (cell)

Henry Knoepfle  
Raytheon Missile Systems  
(520) 545-9458 (office)  
(520) 390-7692 (cell)

Conclusion: The proposed short-term experimentation is intended to advance the study of signal propagation and signal strength variability at distance. The goal is to develop advanced radio transmission technologies that are more efficient and effective than those in use today. If there are any questions about this application, please contact Thomas J. Fagan, Spectrum Manager, Raytheon Missile Systems, [tjfagan@raytheon.com](mailto:tjfagan@raytheon.com), (520) 794-0227, or Anne Linton, Counsel, [alc@wfsllc.biz](mailto:alc@wfsllc.biz), (301) 980-2335.

### **Antenna Data**

The antenna data is set forth in the next two pages, which are taken from the manufacturer's literature on this antenna.



**SYSTEMS WITH RELIABILITY, Inc.**  
**Broadcast Antennas & Transmission Systems**

## SYSTEM DATA SHEET

**Customer** RAYTHEON  
**Contact** Mr. Brad Handloser  
**Location** Tucson, AZ  
**Antenna Model** FM2V/6-BB-0.80WS  
**Channel / Frequency** 82.0-102.0 MHz

### ELECTRICAL SPECIFICATION

<b>Polarization Type</b>	Vertical	
<b>Polarization Ratio</b>	100.00	%
<b>Elevation Directivity (ED) V-Pol.</b>	5.782	
	7.621	<b>dBd</b>
<b>Azimuth Directivity (AD) V-Pol.</b>	1.633	
	2.130	<b>dBd</b>
<b>Antenna Gain V-Pol (GV)</b>	9.44	
	9.75	<b>dBd</b>
<b>Line Type (Antenna Inter-Bay &amp; Element)</b>	1 5/8"	<b>EIA</b>
<b>Attenuation per 100 ft.</b>	0.182	<b>dB</b>
<b>Line length</b>	7.25	<b>ft.</b>
1 5/8" EIA line attenuation	0.013	<b>dB</b>
<b>Line Type (Antenna Branch Feeders)</b>	5/8" Foam	<b>LDF4.5-50</b>
<b>Attenuation per 100 ft.</b>	0.453	<b>dB</b>
<b>Line length</b>	110.0	<b>ft.</b>
5/8" Foam line attenuation	0.498	<b>dB</b>
<b>Line Type (TX to Antenna Input)</b>	1 5/8" Air	<b>HJ7-50A</b>
<b>Attenuation per 100 ft.</b>	0.198	<b>dB</b>
<b>Line length</b>	23.0	<b>ft.</b>
1 5/8" Air line attenuation	0.046	
<b>Total line attenuation</b>	0.557	<b>dB</b>
<b>Antenna System Gain @ 92.0 MHz</b>	9.19	<b>dBd</b>
	11.36	<b>dBi</b>

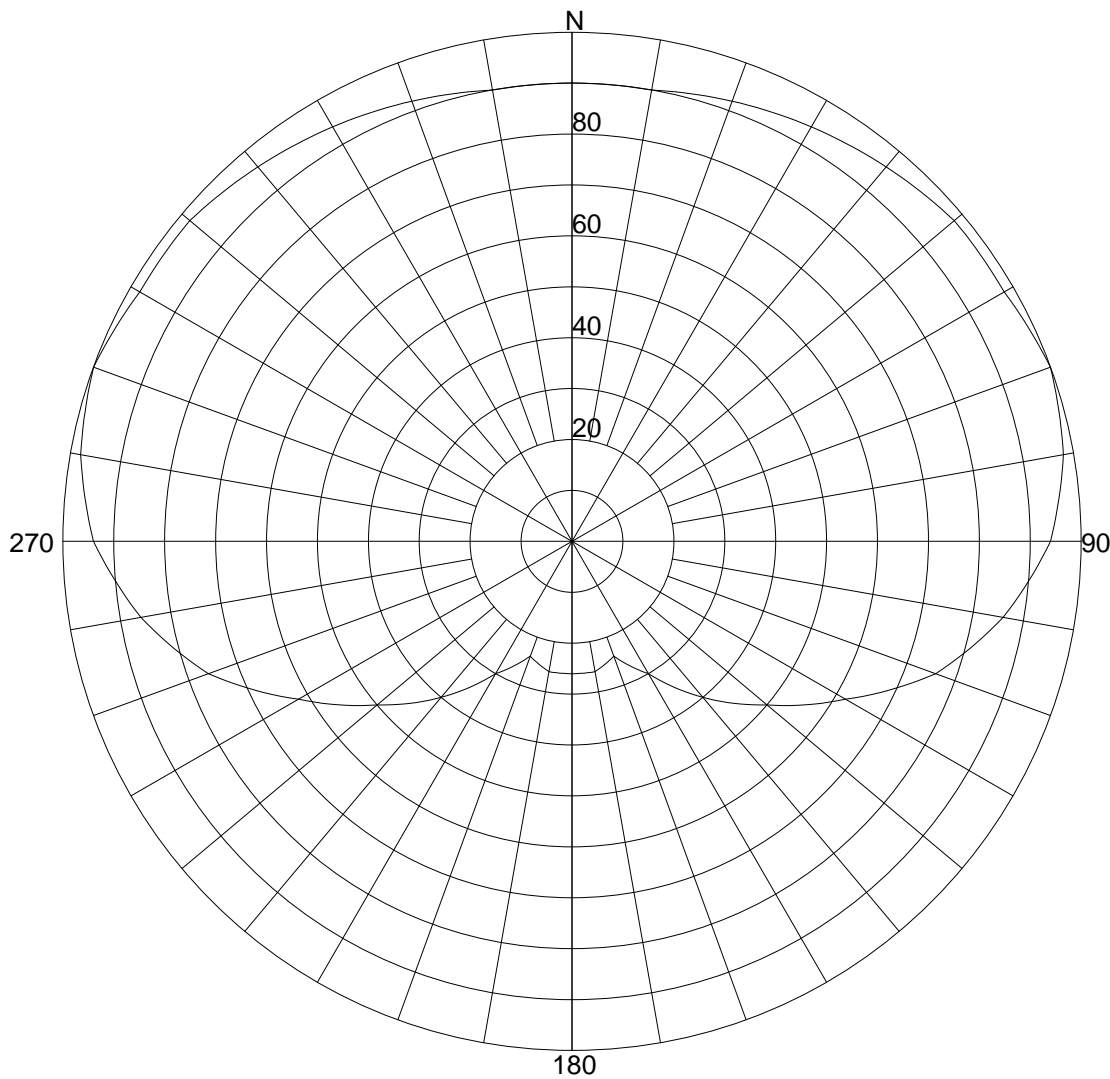
### MECHANICAL SPECIFICATION

<b>No. Of Bays</b>	6	<b>#</b>		
<b>Antenna Aperture</b>	42.50	<b>ft.</b>	12.96	<b>m</b>
<b>Antenna Total Length</b>	47.64	<b>ft.</b>	14.52	<b>m</b>
<b>Center of Radiation AGL (Estimated)</b>	100.00	<b>ft.</b>	30.48	<b>m</b>
<b>Antenna Weight (Includes Interbays)</b>	115.00	<b>lbs.</b>	52.27	<b>kg</b>
<b>Windload (50/33 psf)/CaAc (Includes Interbays)</b>	276.00	<b>lbs.</b>	9.20	<b>ft.^2</b>

Prepared by:

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Mark A. Gergely  
 SWR, LP, Engineering



## Azimuth Pattern

Scale: Linear

Unit: Relative Field

### Systems With Reliability

CLIENT: <i>Raytheon</i>	Date: 3/19/2010
ANTENNA TYPE: FM2V/6-BB-0.80WS	
FREQUENCY: 92.0 MHz	
PATTERN POL.: Vertical	CIRCULARITY(+/-dB):
AZ. DIRECTIVITY: 1.633 / 2.130 dB	PATTERN RMS: 0.781