Project Number: 08198-10

Prepared for:

Houston Radar, LLC.

13814 Sherburn Manor Drive
Cypress, TX 77429

By
Professional Testing (EMI), Inc.
1601 FM 1460, Suite B
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November 2007
March 2008

CERTIFICATION
Electromagnetic Interference Test Report
Houston Radar, LLC.
DR1500 Doppler Radar

Table of Contents

Certificate Of Compliance

Applicant: Houston Radar, LLC.

Applicant's Address: 13814 Sherburn Manor Drive
Cypress, TX 77429

FCC ID: TIADR1500

Project Number: 08198-10

Test Dates:

I, Michael A. Royer, for Professional Testing (EMI), Inc., being familiar with the FCC and IC rules and test procedures have reviewed the test setup, measured data and this report. I believe them to be true and accurate.

The **Houston Radar, LLC., DR1500 Doppler Radar** was tested to and found to be in compliance with FCC Part 15 Subpart C for an Intentional Radiator.

The highest emissions generated by the above equipment are listed below:

	Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Fundamental	24142	120.7	137.5	-16.8
Spurious	7246	50.1	54	-3.9
Occupied Bandwidth	350 (kHz)			

Jason Anderson
Director of Testing Services

This report has been reviewed and accepted by Houston Radar, LLC.. The undersigned is responsible for ensuring that **Houston Radar, LLC, DR1500 Doppler Radar** will continue to comply with the FCC and IC rules.

1.0 EUT Description

The DR-1500 is a Doppler speed radar is powered by 12V DC nominal voltage. The microwave Gunn oscillator in the transceiver generates a 24.1 GHz signal and sends it continuously out of the patch antenna at the target. The signal also "illuminates" internal (to the microwave transceiver) mixer diodes that act as a receiver mixer. The transmitted radar waves are reflected off the moving target, change the reflected microwave frequency per the well-known "Doppler principle" and are received by the same transmitting horn antenna and mixed in the receiving mixer diodes with the local oscillator. The difference in the transmitted/received frequencies is produced as a low frequency (audio frequency range) out of the mixer diode and into the preamp.

The system tested consisted of the following:

Manufacturer & Model	FCC Number	Description
Houston Radar, LLC., DR1500	TIADR1500	Doppler Radar

1.1 Applicable Documents

Guidelines	FCC Rule Parts Part 15
Transmitter Characteristics	15.245
Spurious Radiated Power	15.205, 15.209, 15.245
Antenna Requirement	15.203
Spurious Conducted Emissions	15.207

1.2 EUT Operation

The EUT was operated in continuous transmit mode at max power to measure fundamental, harmonics, and spurious radiation.

2.0 Electromagnetic Emissions Testing

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates and expressions thereof for EMC testing.

2.2 Conducted Emissions Measurements

Conducted emissions measurements were made on the mains terminals of the EUT to determine the line-to-ground radio noise emitted from each power-input terminal. Conducted emissions measurements on the mains terminals were performed at Professional Testing, located in Austin, Texas.

2.1.1 Test Procedure

The EUT was configured and operated in a manner consistent with typical applications. The EUT power cord in excess of one meter was folded back and forth forming a bundle 30 to 40 cm long in the approximate center of the cable. Power supply cords for the peripheral equipment were powered from an auxiliary LISN. Excess interface cable lengths were separately bundled in

a non-inductive arrangement at the approximate center of the cable with the bundle 30 to 40 centimeters in length. The conducted emissions were maximized, by varying the operating states and configuration of the EUT. The tests were performed in a 12' x 16' RayProof modular shielded room. The EUT was placed on a non-metallic table 0.4 meters from a vertical metal reference plane and 0.8 meters from a horizontal metal reference plane.

The measurements were taken using a Line Impedance Stabilization Network (LISN). A Spectrum Analyzer with a measurement bandwidth of 9 kHz was used to record the conducted emissions measurements. The configuration of the shielded room showing the location of the EUT and the measurement equipment is given as Figure 1.

2.1.2 Test Criteria

The table below shows FCC conducted limits for an intentional radiator operating under the provisions of part 15.207.

Frequency MHz	Maximum RF Line Voltage (dBuV) Average	Quasi-Peak
0.15 to 0.5	66 to 56	56 to 46
0.5 to 5.0	56	46
5.0 to 30.0	60	50

2.1.3 Test Results

The conducted emission test data is included in Appendix A. The conducted emissions generated by the DR1500 Doppler Radar are below the FCC Part 15.207 limits.

2.2 Radiated Emissions Measurements

Radiated emission measurements were made of the Fundamental and Spurious Emission levels for DR1500 Doppler Radar. Measurements of the occupied bandwidth were also made for the EUT.

Measurements of the maximum emission levels for the fundamental and the spurious/harmonic emissions of the DR1500 Doppler Radar were made at the Professional Testing Site 45, located in Austin, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

Tests of the fundamental for the device were performed to determine the worst case polarization of the devices. The fundamental emissions of the device were measured with the antenna of the device in horizontal and vertical polarization.

2.2.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation. For measurements of

the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. For spurious measurements below 1 GHz the measurement antennas were located 10 meters from the EUT. The associated 3 meter limit was extrapolated to 10 meters. For spurious/harmonic measurements from 1-24 GHz, the measurement antenna was placed 1 meter from the EUT. From 24-100 GHz the measurement antenna was placed 0.1 meters from the EUT. The radiated emissions were maximized by rotating the EUT.

A Spectrum Analyzer with peak detection was used to find the maximums of the radiated emissions during the variability testing. A drawing showing the test setup is given as Figure 2.

2.2.2 Test Criteria

The table below shows FCC radiated limits for an intentional radiator operating under the provisions of part 15.245. The measurement of the harmonics was performed to 100 GHz. The reference distance for each limit is also shown in this table.

Frequency MHz	Test Distance (Meters)	Field Strength (uV/m)@3m	(dBuV/m)@Test Distance
30 to 88	10	100	29.5
88 to 216	10	150	33.0
216 to 960	10	200	35.5
960 to 1000	10	500	43.5
1000 to 24000	1	500	63.5
24000 to 100000	.1	500	83.5
Fundamental	1	2500000	137.5
Harmonics	.1	25000	97.5

Note: Fundamental and Harmonic Limits are expressed in Average field strengths. The spurious limits are expressed in Quasi-Peak.

2.2.3 Test Results

The radiated test data for the fundamental is included in Appendix A. Peak detection was used during the test for the fundamental and harmonics. Quasi-Peak detection was used for spurious emissions below 1 GHz. The radiated emission test data is included in Appendix A. The radiated emissions generated by the DR1500 Doppler Radar are below the FCC Part 15.245 limits.

3.0 Occupied Bandwidth Measurements

Measurements of the occupied bandwidth for the fundamental signals were made at Professional Testing Austin, Texas site. All measurements were made in a controlled indoor environment in a configuration which did not present measurement distortion or ambient interference.

3.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor. The table was rotated to an angle which presented the highest signal level. The occupied bandwidth was based on a 20 dB criteria (20 dB down either side of the emission from the peak emission). A drawing showing the test setup is given as Figure 1.

3.2 Test Criteria

According to FCC Part 15.245, the bandwidth of the emission shall not be outside of the specified band of 24075-24175 MHz.

3.3 Test Results

The occupied bandwidth test data is included in Appendix B. The occupied bandwidth for the fundamental frequency is 350 kHz. This occupied bandwidth complies with the FCC requirement.

4.0 Antenna Requirement

An analysis of the DR1500 Doppler Radar was performed to determine compliance with FCC Section 15.203. This section requires specific handling and control of antennas used for devices subject to regulations.

4.1 Evaluation Procedure

The structure and application of the DR1500 Doppler Radar was analyzed with respect to the rules. The antenna is an integral antenna, and is interchangeable by the user. An auxiliary antenna port is not present.

4.2 Evaluation Criteria

Section 15.203 of the rules states that the subject device must meet at least one of the following criteria:

(a) Antenna must be permanently attached to the unit.

(b) Antenna must use a unique type of connector to attach to the EUT.

(c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

4.3 Evaluation Results

The DR1500 Doppler Radar meets the criteria of this rule by virtue of having an integral antenna. The EUT is therefore compliant.

5.0 Modifications to Equipment

No modifications were made to the EUT.

6.0 List of Test Equipment

A list of the test equipment utilized to perform the testing is given below. The date of calibration is given for each.

Asset #	Manufacturer	Model #	Description	Calibration Due
275	HP	85650A	Quasi-peak Adapter (high band)	June 18, 2008
83	HP	85662A	Spectrum Analyzer Display (high band)	NCR
84	HP	8566B	Spectrum Analyzer (high band)	March 27, 2008
1035	HP	85685A	RF Preselector (high band)	December 8, 2007
1277	HP	85650A	Quasi-peak Adapter (low band)	June 18, 2008
45	HP	85662A	Spectrum Analyzer Display (low band)	NCR
1148	HP	8568B	Spectrum Analyzer (low band)	June 18, 2008
990	HP	85685A	RF Preselector (low band)	January 11, 2008
1455	HP	8447D	RF Preamplifier	May 1, 2008
1497	Emco	3108	Biconical Antenna	April 18, 2008
1486	Emco	3147	Log Periodic Dipole Araay Antenna	April 19, 2008
C026	none	none	Coaxial Cable (low band)	June 28, 2008
C027	none	none	Coaxial Cable (high band)	June 28, 2008
C056-059	Paternack	LLS	4 sections, 12ft	January 25, 2008
0267	EMCO	3115	Ridge Guide Antenna	August 22, 2008
1594	Miteq	AFS44-001-02650	Microwave Preamplifier	January 25, 2008
1342	Rohde & Schwarz	ESMI	EMI Test Receiver	October 26, 2008
1343	Rohde & Schwarz	ESMI	EMI Test Receiver Display	October 26, 2008
1542	AH Systems	SAS-572	Horn Antenna, Standard Gain, 20 dB	NCR
0730	Millitech/Pacific Microwave		Horn/Mixer, 40-60 GHz	NCR
0730	Millitech/Pacific Microwave		Horn/Mixer, 60-90 GHz	NCR
0730	Millitech/Pacific Microwave		Horn/Mixer, 90-140 GHz	NCR
0716	Tektronix	492AP	Spectrum Analyzer	April 10, 2008
0716	Tektronix		Diplexer/Mixer	April 10, 2008
1153	Solar	8012	LISN	May 7, 2008

FIGURE 1: Conducted Emissions Test Setup

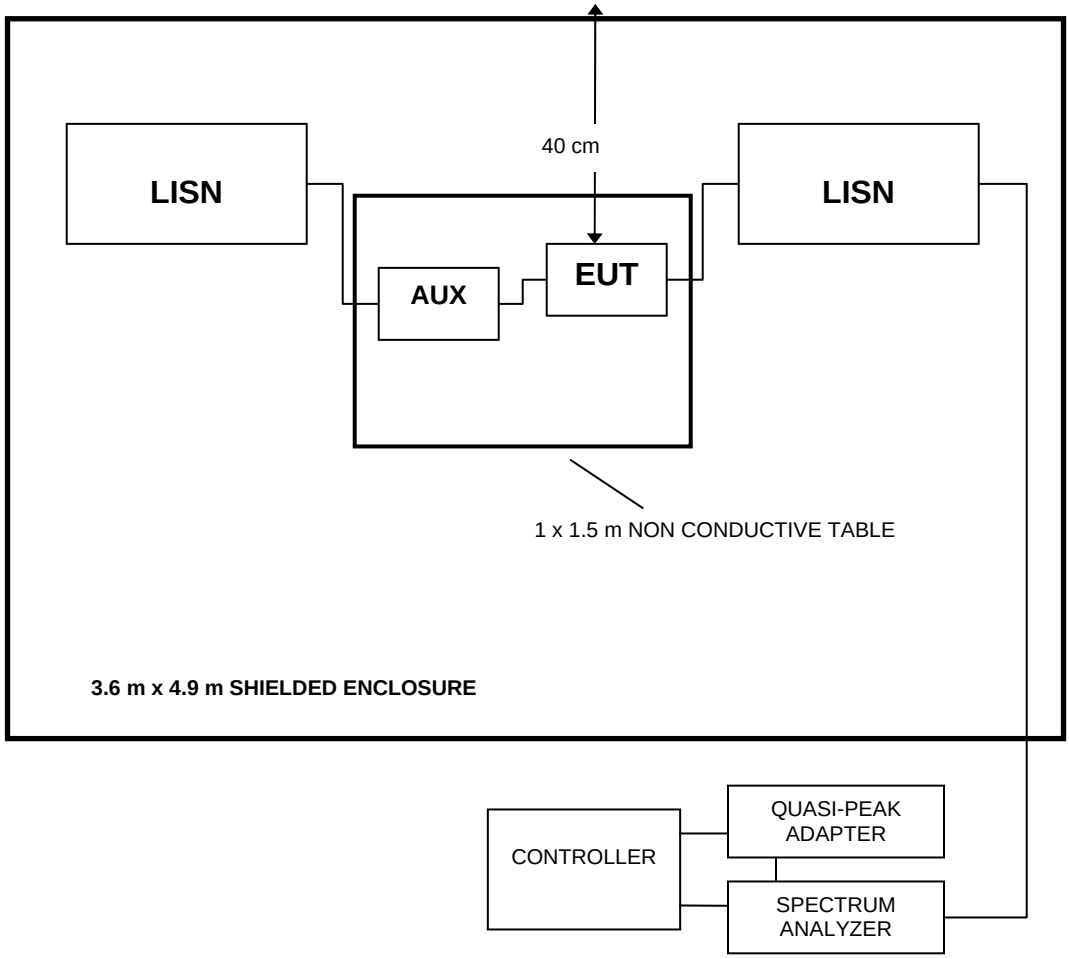
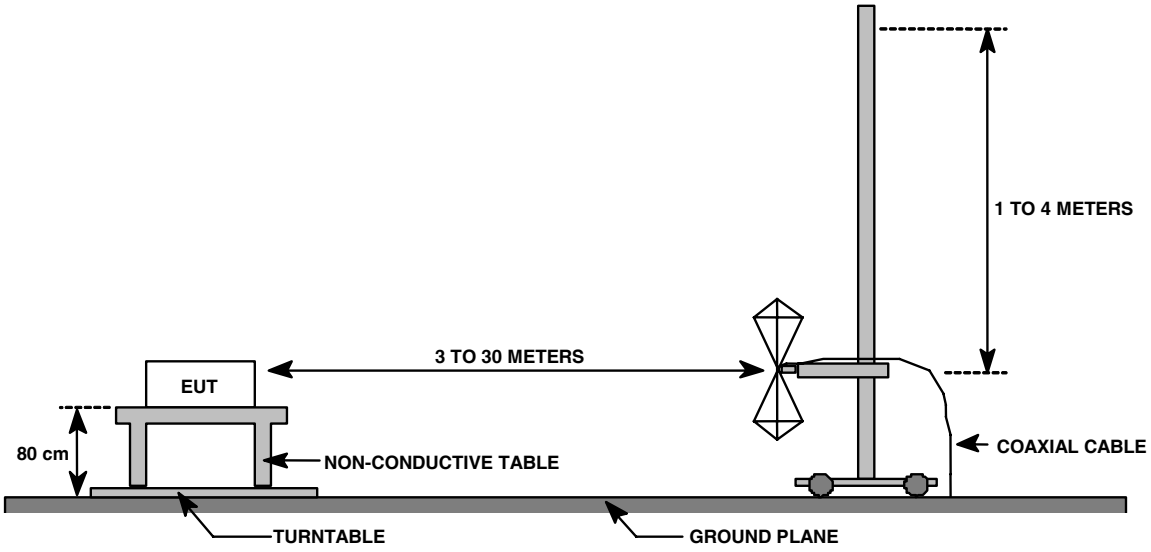


FIGURE 2: Radiated Emissions Test Setup

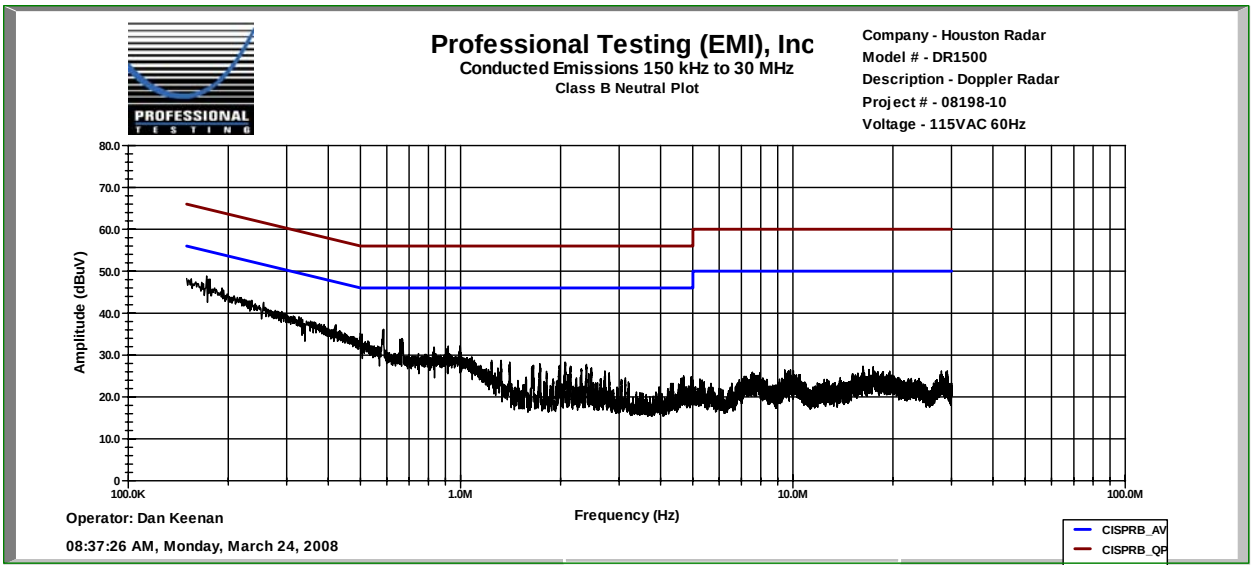


APPENDIX A EMISSIONS DATA SHEET

Radiated Data Sheet
Neutral Line
Houston Radar, LLC.
DR1500 Doppler Radar
Quasi-Peak Detection RBW =9 kHz VBW = 100kHz
Average Detection RBW = 9kHz VBW = 10Hz

Test Date: March 24, 2008

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)
0.150143	41.9	32.3	66	-24.1	56	-23.7
0.5795	32.3	30.1	56	-23.7	46	-15.9
0.65471	27.6	24.7	56	-28.4	46	-21.3
0.66141	27.3	24.8	56	-28.7	46	-21.2
0.99233	26	22	56	-30	46	-24
9.4557	20.4	14.7	60	-39.6	50	-35.3
9.78418	20.4	13.8	60	-39.6	50	-36.2
10.0374	18.3	11.6	60	-41.7	50	-38.4
16.2352	19.7	13.9	60	-40.3	50	-36.1
17.4803	20.8	15	60	-39.2	50	-35

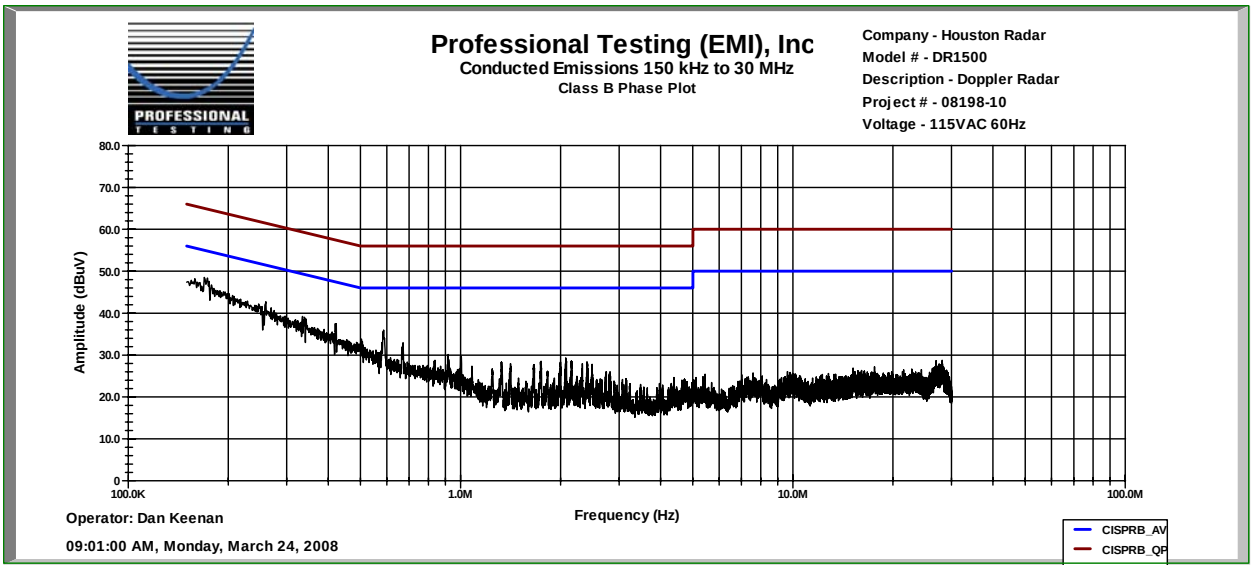


COMMENT #1: 115VAC/60Hz
Graphical data for overview only.

Radiated Data Sheet
Phase Line
Houston Radar, LLC.
DR1500 Doppler Radar
Quasi-Peak Detection RBW =9 kHz VBW = 100kHz
Average Detection RBW = 9kHz VBW = 10Hz

Test Date: March 24, 2008

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)
0.17048	42.1	36.1	65.4	-23.3	55.4	-19.3
0.24991	36.3	28.3	63.1	-26.9	53.1	-24.9
0.40746	30.8	27.7	58.6	-27.8	48.6	-20.9
0.58135	32.7	31.1	56	-23.3	46	-14.9
0.66764	28.5	26.2	56	-27.5	46	-19.8
9.58722	20.2	14.4	60	-39.8	50	-35.6
15.2126	21.2	14.9	60	-38.8	50	-35.1
17.5423	20.9	15	60	-39.1	50	-35
26.9431	22.5	16.5	60	-37.5	50	-33.5
28.1033	23.5	17.5	60	-36.5	50	-32.5



COMMENT #1: 115VAC/60Hz
Graphical data for overview only.

Radiated Data Sheet
Fundamental
Houston Radar, LLC.
DR1500 Doppler Radar
Peak Detection RBW =1 MHz

Test Date: October 29, 2007
Measurement Distance (Meters): 1

Vertical

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
24.142	180	1	73.59	0.0	37.1	10.3	121.0	137.5	-16.5

Horizontal

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
24.142	45	1	58.25	0.0	37.1	10.3	105.7	137.5	-31.8

TEST ENGINEER: Jason Anderson

Radiated Data Sheet
Spurious/Harmonics >18GHz
Houston Radar, LLC.
DR1500 Doppler Radar
Peak Detection RBW =1 MHz

Test Date: October 29, 2007
Measurement Distance (Meters): 0.1

Vertical

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Conversion Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
48.284	0	1	39.8	0.0	39.9	0.0	79.6	97.5	-17.9
72.426	0	1	49.4	0.0	43.4	0.0	92.7	97.5	-4.8
96.568	0	1	49	0.0	45.9	0.0	94.8	97.5	-2.7

Horizontal

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB))	Antenna Factor (dB/m)	Conversion Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
48.284	0	1	39.8	0.0	39.9	0.0	79.6	97.5	-17.9
72.426	0	1	49.4	0.0	43.4	0.0	92.7	97.5	-4.8
96.568	0	1	49	0.0	45.9	0.0	94.8	97.5	-2.7

Note: No detectable emissions.

TEST ENGINEER: Jason Anderson

Radiated Data Sheet
Spurious <1 GHz
Houston Radar, LLC.
DR1500 Doppler Radar
Quasi-Peak Detection
RBW=120kHz

Test Date: October 29, 2007
Measurement Distance (Meters): 10

Vertical

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
84.6	175	2	38.8	26.3	7.6	1.0	21.1	29.5	-8.4
101.8	0	1	36.5	26.3	9.2	1.1	20.5	33	-12.5
135.6	100	1	34.3	26.1	11.7	1.4	21.2	33	-11.8
169.6	0	1	32.3	26.0	12.5	1.7	20.4	33	-12.6
399	330	1	33.2	37.2	16.6	3.0	15.5	35.5	-20.0
432	0	3.75	44.8	37.2	17.6	3.1	28.3	35.5	-7.2

Horizontal

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
156	250	4	21.9	26.1	12.5	1.4	9.7	33	-23.3
203	250	4	32.3	35.2	10.9	1.9	9.9	33	-23.1
432	250	4	35.8	37.2	17.6	3.1	19.3	35.5	-16.2
532	250	4	30.2	37.1	19.2	3.6	15.9	35.5	-19.6
610	250	4	29.6	37.1	19.9	3.8	16.2	35.5	-19.3
665	250	4	29.6	36.9	20.3	4.1	17.0	35.5	-18.5

TEST TECHNICIAN: Matt Whipple

Radiated Data Sheet
Spurious 1-18 GHz
Houston Radar, LLC.
DR1500 Doppler Radar
Peak Detection
RBW=1MHz

Test Date: October 29, 2007
Measurement Distance (Meters): 3

Vertical

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1601	max	max	66.6	57.0	25.7	3.6	38.9	54	-15.1
2295	max	max	63.3	56.6	28.0	4.8	39.5	54	-14.5
4991	max	max	54.9	54.6	34.5	7.6	42.4	54	-11.6
7246	max	max	56.6	53.6	36.8	10.3	50.1	54	-3.9

Horizontal

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1334	max	max	66.2	57.0	24.7	3.4	37.2	54	-16.8
1714	max	max	65.9	56.9	26.2	3.6	38.8	54	-15.2
3846	max	max	58.6	55.8	32.8	7.3	42.9	54	-11.1
7215	max	max	56.3	53.6	36.7	10.3	49.8	54	-4.2

TEST TECHNICIAN: Matt Whipple

Occupied Bandwidth Datasheet
Houston Radar, LLC.
DR1500 Doppler Radar