COMPLIANCE WORLDWIDE INC.
TEST REPORT 355-11

In Accordance with the Requirements of

Industry Canada RSS 220, Issue 1, March 2009
Federal Communications Commission 47 CFR Part 15, Subpart F
Technical Requirements for Ground Penetrating Radar Systems
Class II Permissive Change Filing / Recertification

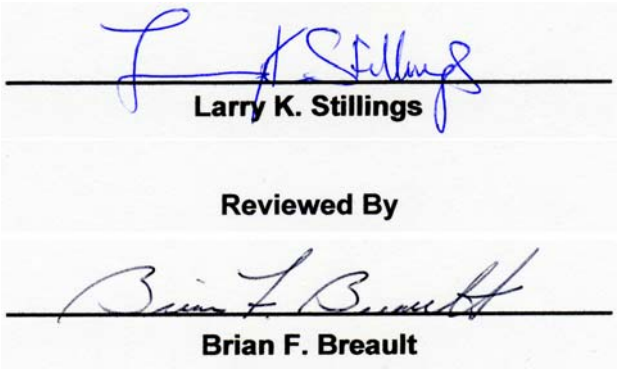
Issued to

Geophysical Survey Systems, Inc.
12 Industrial Way
Salem, NH 03079
603-893-1109

For the
MINISIR

FCC ID: GF7MINISIR
IC: 8498A-MINISIR

Report Issued on August 25, 2011



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(603) 887 3903 Fax 887 6445
http://www.cw-inc.com

1. Scope

This test report certifies that the Geophysical Survey Systems MINISIR operating at 800 kHz, as tested, meets the FCC Part 15, Subpart F and Industry Canada RSS 220 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

2. Product Details

2.1. Manufacturer:	Geophysical Survey Systems, Inc.
2.2. Model Number:	MINISIR
2.3. Serial Number:	800khz
2.4. Description:	Ground Penetrating Radar
2.5. Power Source:	Battery Powered
2.6. Hardware Revision:	N/A
2.7. Software Revision:	N/A
2.8. Modulation Type:	625 pS Impulse 800 kHz PRF
2.9. Operating Frequency:	1.6 GHz Nominal
2.10. EMC Modifications:	None

3. Product Configuration

3.1 Operational Characteristics & Software

Turn on the MINISIR and allow the unit to boot up.

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Software Setup:

For normal operation:

1. After boot up start the unit scanning by selecting the System menu and using FCC Test. The unit defaults to a 800 kHz PRF.

3.2. EUT Hardware

Manufacturer	Model	Serial Number	Description/Function
GSSI	MINISIR	800khz	GPR Handheld analyzer

3.3. EUT Cables/Transducers

None

3.4. Support Equipment

None

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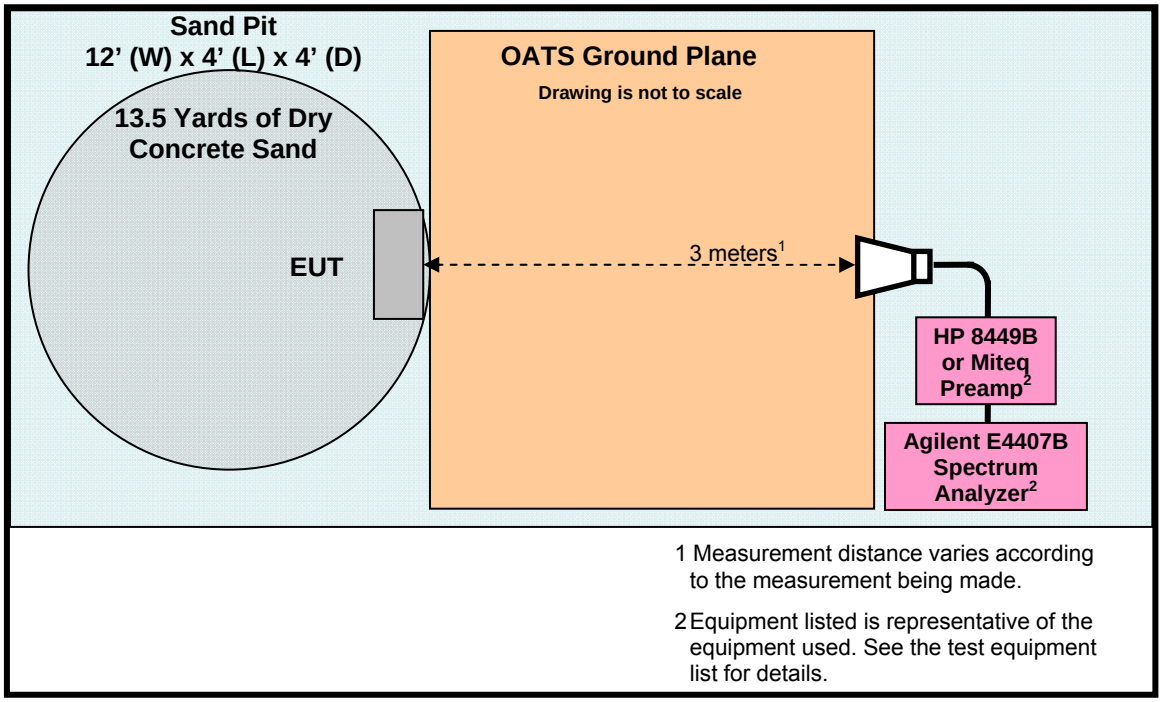
3. Product Configuration (continued)

3.5. Test Setup Diagram



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4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
Spectrum Analyzer 100 Hz to 26.5 GHz	Agilent	E4407B	MY45104493	12/22/2012
Spectrum Analyzer 100 Hz to 26.5 GHz	Agilent	E7405A	MY45115430	10/22/2011
Microwave Preamp 1 to 26.5 GHz	Hewlett Packard	8449B	3008A01323	12/1/2012
Preamp 100 MHz – 2 GHz	Miteq	AFS3-01000200	257561	5/24/2012
EMI Receiver 9 kHz to 6.5 GHz	Hewlett Packard	8546A	3330A00115	10/28/2011
Bilog Antenna 30 to 1000 MHz	Com-Power	AC-220	25509	8/30/2011
Horn Antenna 1 to 18 GHz	Electro-Metrics	EM-6961	6337	10/19/2012
Horn Antenna 18 to 26.5 GHz	Com-Power	AH-826	081051	06/30/2012
Barometer – Temperature, Humidity & Pressure	Control Company	4195	ID236	11/09/2011

4.2. Measurement & Equipment Setup

Test Date:	8/4/2011, 8/24/2011
Test Engineer:	Larry Stillings
Normal Site Temperature (15 - 35°C):	21.6
Relative Humidity (20 - 75%RH):	35
Frequency Range:	30 MHz to 18 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	120 kHz - 30 MHz to 960 MHz 1 MHz - Above 960 MHz
EMI Receiver Avg Bandwidth:	300 kHz - 30 MHz to 960 MHz 3 MHz - Above 960 MHz
Detector Function:	Peak, Quasi-Peak, EMI Average and RMS Average

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4. Measurements Parameters (continued)

4.3. Measurement Procedure

Test measurements were made in accordance FCC Part 15.509, 15.521, IC RSS-220 Issue I, ANSI C63.10:2009 Clause 7.10 and KDB Publication 393764.

The test methods used to generate the data is this test report is in accordance with ANSI C63.10:2009, American National Standard for Testing Unlicensed Wireless Devices.

In accordance with ANSI C63.10:2009, Section 7.10.2.2, the device under test was placed on a bed of dry sand and rotated through 16 azimuth angles (Clause 5.4) to determine which produced the highest emission relative to the limit. The azimuth that produced the highest emission relative to the limit was used for all radiated emission measurements.

4.4. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency (out of band)	$\pm$ 1x10^{-8}
Radiated Emission of Transmitter to 10 GHz	$\pm$ 4.55 dB
Radiated Emission of Receiver	$\pm$ 4.55 dB
Temperature	$\pm$ 0.91^{o} C
Humidity	$\pm$ 5%

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5. Measurements Summary

Test Requirement	FCC Rule Requirement	IC Rule Requirement	Test Report Section	Result	Comment
Antenna Requirement	15.203	RSS-GEN 7.1.4	6.1	Compliant	The antenna is housed within a sealed enclosure with the intentional radiator.
Operational Requirements	15.509 (b)	RSS-220 6	6.2	Compliant	
UWB Bandwidth	15.503 (a)	RSS-220 6.2.1 (a)	6.3	Compliant	
Spurious Radiated Emissions	15.509 (d) 15.209	RSS-220 3.4 RSS-220 6.2(c) & 6.2(d)	6.4	Compliant	No measurable spurious emissions.
Radiated Emissions in GPS Bands	15. 509 (e) 15.209	RSS-220 6.2(e)			No measurable spurious emissions.
Peak Emissions in a 50 MHz Bandwidth	15.509 (f)	RSS-220 6.2(g)	6.5	Compliant	
Conducted Emissions	15.207	RSS-GEN	6.6	Compliant	EUT is battery powered
Radio Frequency Exposure	FCC OET Bulletin 65	RSS-GEN	6.7	Compliant	

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6. Measurement Data

6.1. Antenna Requirement (15.203), RSS-GEN Section 7.1.4

Requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply

The antenna utilized by the device under test is an internal, non user replaceable unit.

6.2. Operational Requirements of the Device under Test (15.509 (b)), RSS-220 Sec 6

Requirement: Operation under the provisions of this section is limited to GPRs and wall imaging systems operated for the purposes with law enforcement, fire fighting, emergency rescue, scientific research, commercial mining, or construction.

The manufacturer states that the device under test complies with the requirements outlined in section FCC Part 15.509 (b).

6.3. UWB Bandwidth (15.503 (a)), RSS-220 Section 6.2.1 (a)

Requirement: The UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M. The center frequency f_C, equals $(f_H + f_L)/2$. The fractional bandwidth equals $2 * (f_H – f_L) / (f_H + f_L)$.

6.3.1. Measurement Data – Long Pulse Mode (Values in GHz)

f_M	The highest emission peak	1.6100
f_L	10 dB below the highest peak	1.2580
f_H	10 dB above the highest peak	1.8500
f_C	Calculated: $(f_H + f_L)/2$	1.5540
Bandwidth	Calculated: $(f_H - f_L)$	0.5920
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.3810

Note: The Fraction Bandwidth is greater than 0.2 and therefore the minimum UWB Bandwidth of 500 MHz requirement does not need to be met.

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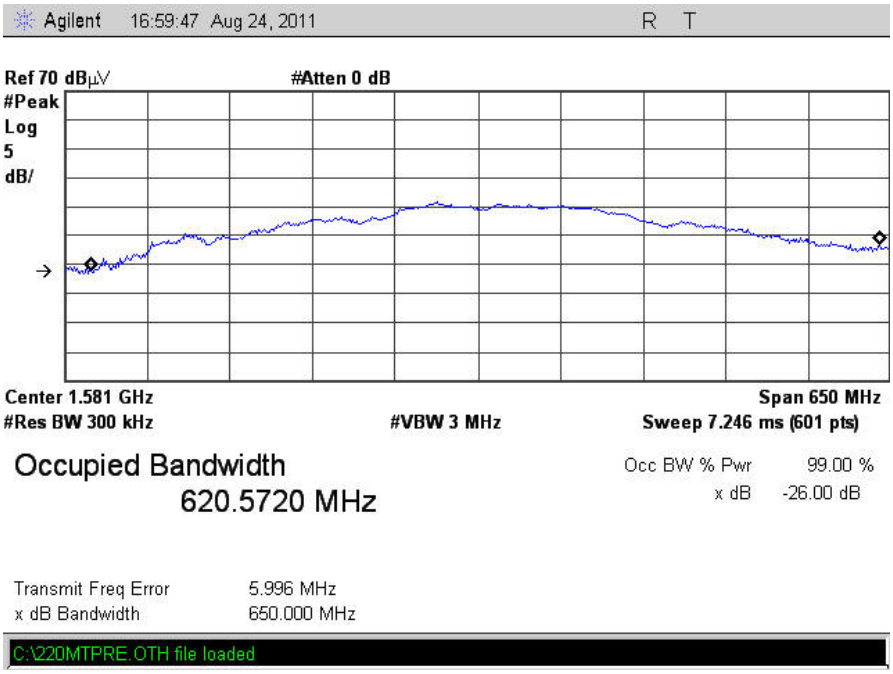
6. Measurement Data (continued)

6.3. UWB Bandwidth (15.503 (a), RSS-220 Sec 6.2.1(a)) (continued)

6.3.2. Measurement Plot of 10 dB BW on GPR Site

6.3.3. Measurement Plot of 99% BW on GPR Site



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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.509 (d), 15.209, RSS-220 Section 6.1(d))

Requirement: The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section 15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)
960 - 1610	-65.3
1610 - 1990	-53.3
1990 - 3100	-51.3
3100 - 10600	-41.3
Above 10600	-51.3

Spurious Radiated Emissions in GPS Bands
(15.509 (e), 15.209, RSS-220 Section 6.2(e))

Requirement: In addition to the radiated emission limits specified in the table in paragraph (d) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency (MHz)	EIRP (dBm)
1164 - 1240	-75.3
1559 - 1610	-75.3

Radiated Emissions Field Strength Limits at 3 Meters
(Section 15.209, RSS-GEN, RSS-220 Section 3.4)

Frequency (MHz)	Field Strength (dBµV/m)
30 - 88	40
88 - 216	43.5
216 - 960	46

Test Notes: Refer to Section 4.1 for the test equipment used and Section 4.2 for the test equipment setups.

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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.509 (d), 15.209, RSS-220 Section 6.1(d))

6.4.1. 30 MHz to 960 MHz, measured at 3 Meters

Geophysical Survey, MINISIR

Frequency (MHz)	Amplitude (dBµV/m)		Limit (dB)	Margin (dB)	Polarity (H/V)	Antenna Height (cm)	Azimuth (Dev.)
	Peak	Quasi-Peak	Quasi-Peak				
36.74	40.96	33.88	40.0	-6.12	V	100	90
39.37	44.60	34.28	40.0	-5.72	V	100	90
43.17	42.43	35.78	40.0	-4.22	V	100	90
52.42	43.41	38.70	40.0	-1.30	V	100	90
58.57	39.27	32.75	40.0	-7.25	V	100	90
62.35	38.95	34.23	40.0	-5.77	V	100	90
72.64	41.83	36.73	40.0	-3.27	V	100	90
75.99	40.33	34.90	40.0	-5.10	V	100	90
80.26	39.49	36.08	40.0	-3.92	V	100	90
84.32	38.96	34.79	40.0	-5.21	V	100	90
187.30	34.95	32.74	43.5	-10.76	V	100	90
255.10	42.98	39.60	46.0	-6.40	V	100	90
468.80	35.00	33.85	46.0	-12.15	V	100	90
906.50	27.68	22.56	46.0	-23.44	V	100	90
39.01	45.25	37.65	40.0	-2.35	H	200	0
40.42	44.62	36.08	40.0	-3.92	H	200	0
52.37	40.24	34.18	40.0	-5.82	H	200	0
57.40	41.76	37.09	40.0	-2.91	H	200	0
62.54	38.30	33.75	40.0	-6.25	H	200	0
72.61	37.82	33.33	40.0	-6.67	H	200	0
139.80	33.99	27.61	43.5	-15.89	H	175	0
670.40	32.88	29.39	46.0	-16.61	H	100	0
681.60	32.70	30.21	46.0	-15.79	H	100	0
770.10	31.42	28.32	46.0	-17.68	H	100	0
900.80	32.25	29.23	46.0	-16.77	H	100	0
921.60	32.63	29.04	46.0	-16.96	H	100	0

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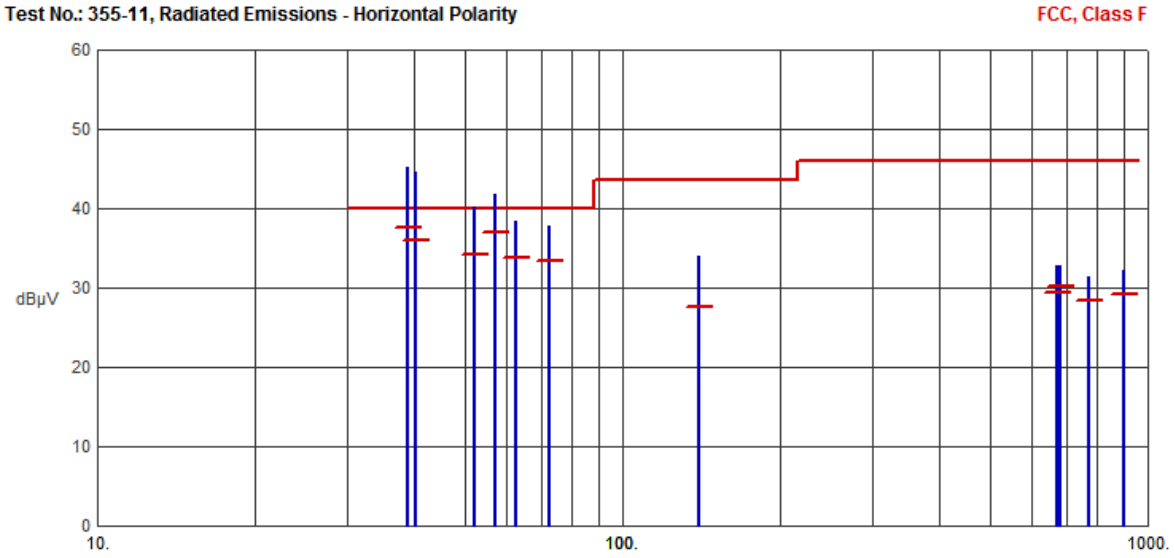
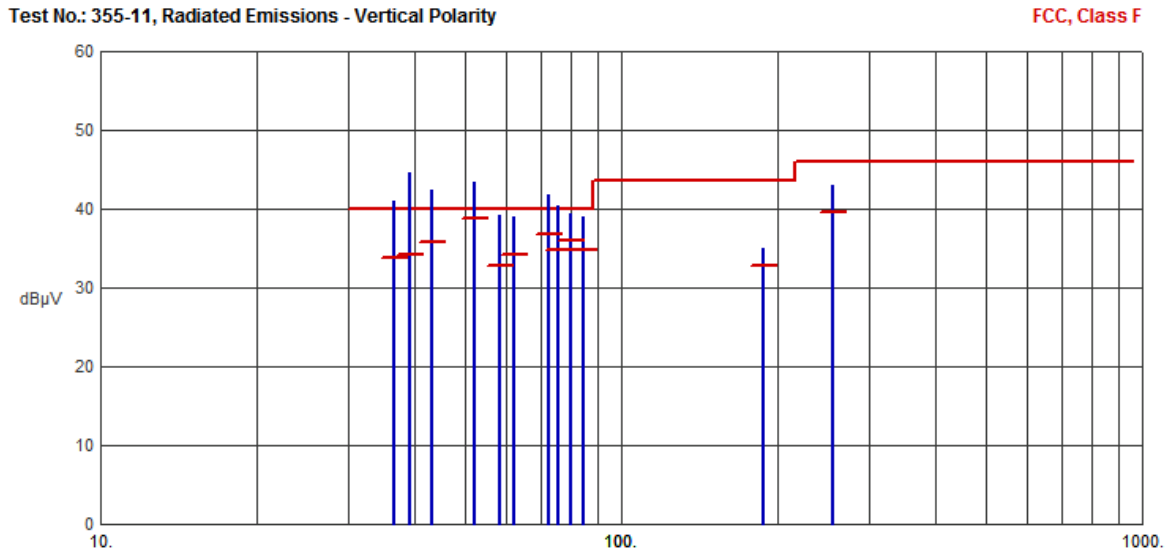
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.509 (d), 15.209, RSS-220 Section 6.1(d))

6.4.2. 30 MHz to 960 MHz, Horizontal Plot



6.4.3. 30 MHz to 960 MHz, Vertical Plot



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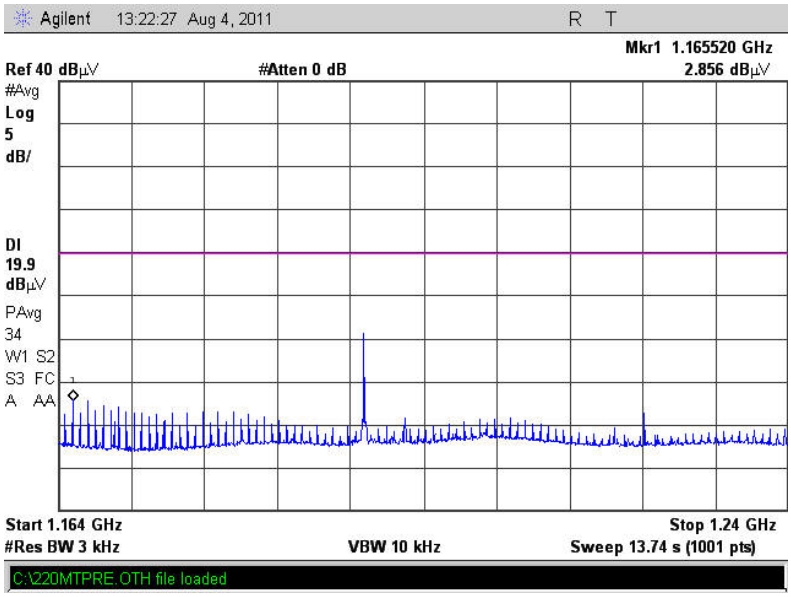
6. Measurement Data (continued)

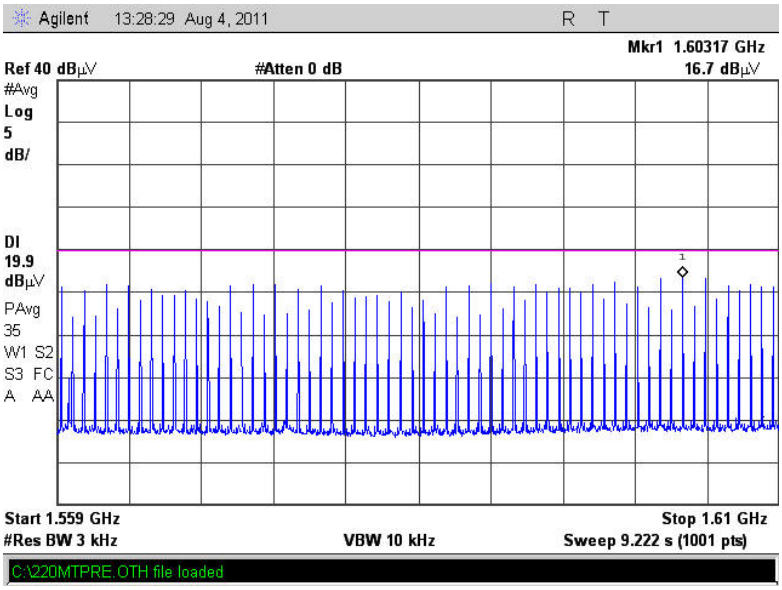
6.4. Spurious Radiated Emissions (15.509 (d), 15.209, RSS-220 Section 6.1(d))

Spurious Radiated Emissions in GPS Bands (15.509 (e), RSS-220 6.2(e))

6.4.2 1164 to 1240 MHz & 1559 to 1610 MHz

There were no broadband emissions related to the UWB transmitter. Measured signals were narrowband and related to the microprocessor / clocks and do not fall under the requirements of this section. Measurements were made at 3 Meters and the -75.3 dBm limit was converted to a field strength limit of 19.9 dBuV/m.





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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.509 (d), 15.209, RSS-220 Section 6.2(d))

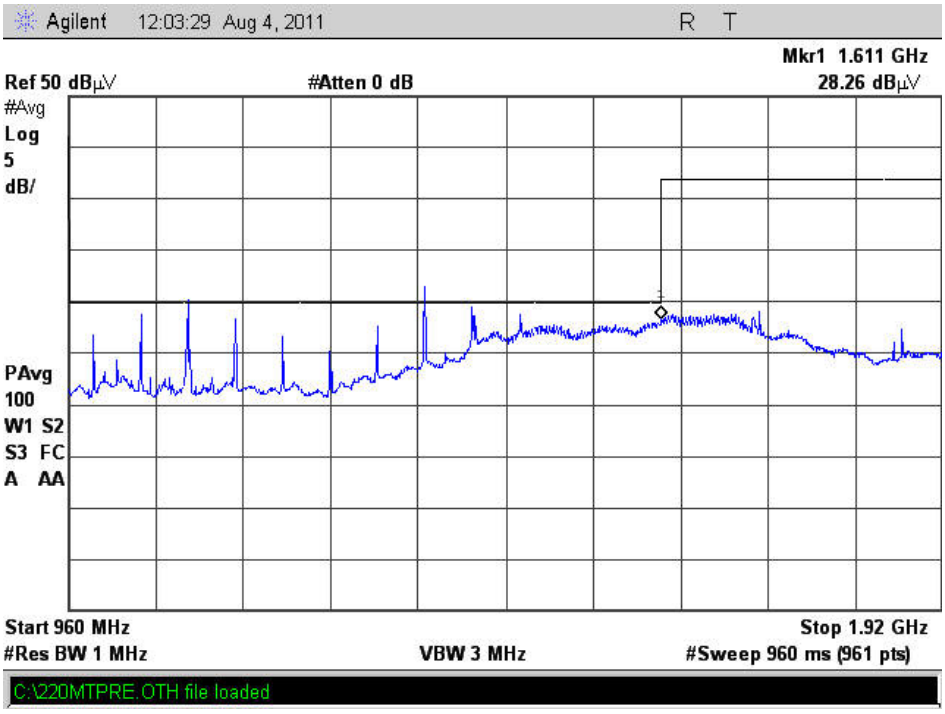
6.4.3. 960 MHz to 18 GHz

Freq. (MHz)	Amplitude (dBµV/m)	Corr. Factor (dB)	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol (H/V)	El. (cm)	Az. (deg)
	Avg		Avg					
1611.00	28.26	Included	28.26	29.90	-1.64	V	100	90

Note using: 1 MHz RBW / 3 MHz VBW and RMS Average Detector

There were no other measurable emissions between 960 MHz and 18 GHz.

6.4.4 Plot of Average Emission from 960 MHz to 1.92 GHz



Note: Spikes are narrowband signals related to the processor and do not comprise the makeup of the UWB signal

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6. Measurement Data (continued)

6.5. Peak Emissions in a 50 MHz Bandwidth (15.509 (f), RSS-220 Section 6.2 (g))

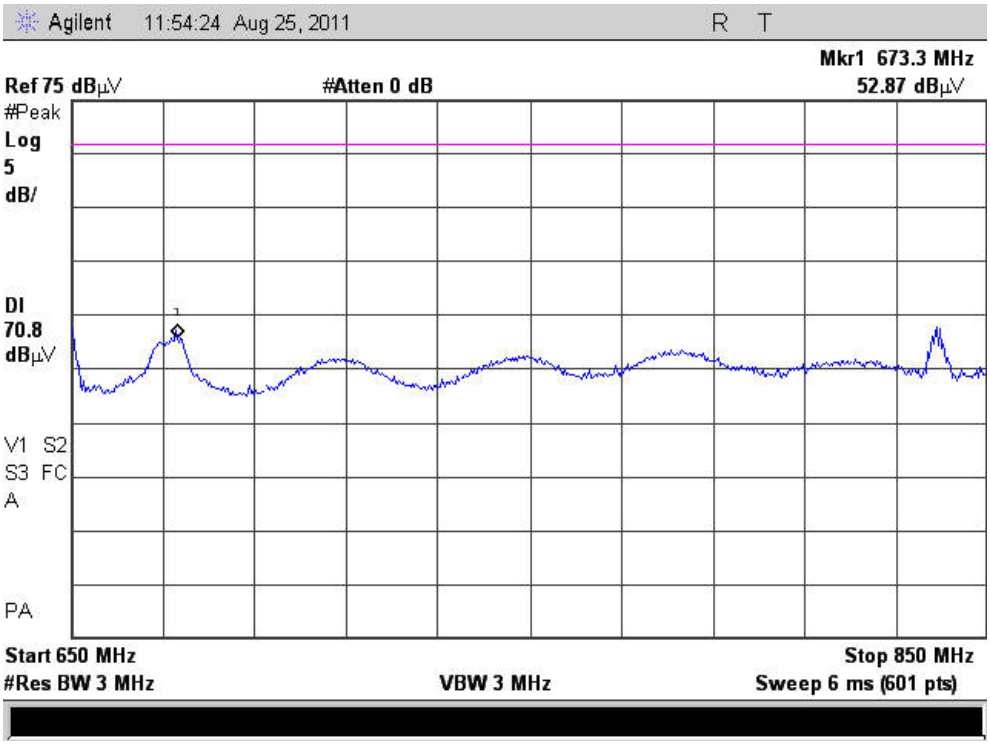
Requirement: For UWB devices where the frequency at which the highest radiated emissions occurs, f_M, is above 960 MHz, there is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency f_M. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in Section 15.521.

Freq. (MHz)	Peak Amplitude (dBµV/m)	Corr. Factor (dB)	Peak Amplitude (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Pol (H/V)	El. (cm)	Az. (deg)
673.3	52.87	Included	52.87	70.80	-17.93	H	100	0
1140.0	54.12	Included	54.12	70.80	-16.68	V	125	0

Note using: 3 MHz RBW / 3 MHz VBW

There were no other measurable emissions between 960 MHz and 18 GHz.

6.5.1 Plot of Peak Power below 960 MHz



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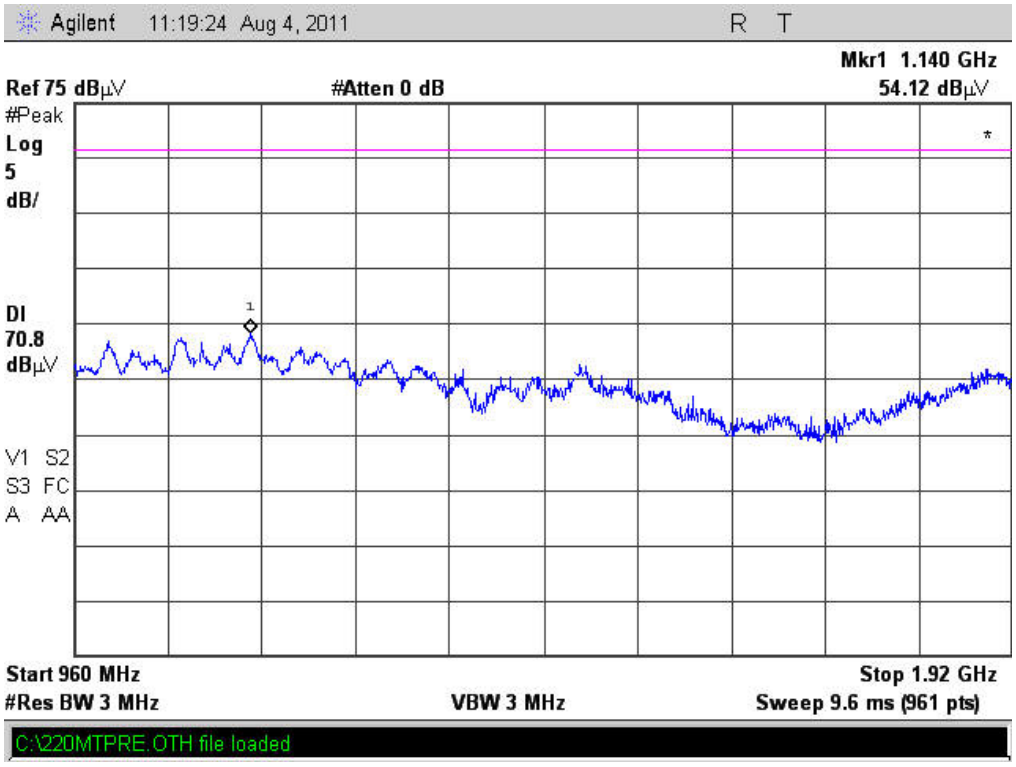
6. Measurement Data (continued)

6.5. Peak Emissions in a 50 MHz Bandwidth (15.509 (f), RSS-220 Section 6.2 (g))

Requirement: For UWB devices where the frequency at which the highest radiated emissions occurs, f_M, is above 960 MHz, there is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency f_M. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in Section 15.521.

6.5.2 Plot of Peak Power above 960 MHz



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6. Measurement Data (continued)

6.6. Regulatory Limit: FCC Part 15.209

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50
* Decreases with the logarithm of the frequency.		

6.6.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
LISN	EMCO	3825/2	9109-1860	2/12/2011
EMI Receiver	Hewlett Packard	8546A	3330A00115	10/28/2010

6.6.2. Measurement & Equipment Setup

Test Date:	N/A
Test Engineer:	N/A
Site Temperature (°C):	N/A
Relative Humidity (%RH):	N/A
Frequency Range:	0.15 MHz to 30 MHz
EMI Receiver IF Bandwidth:	9 kHz
EMI Receiver Avg Bandwidth:	30 kHz
Detector Functions:	Peak, Quasi-Peak. & Average

6.6.3. Test Procedure

Test measurements were made in accordance with ANSI C63.4-2003, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

EUT is battery powered and the batteries are recharged using a separate charger not contained in the device.

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6. Measurement Data (continued)

6.7. Public Exposure to Radio Frequency Energy Levels (1.1307 (b)(1)) RSS-GEN 5.5, RSS 102

6.7.1. MPE Power Density Table.

MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		Limit (mW/cm^2)	Result
			(mW/cm^2)	(W/m^2)		
(1)	(2)	(3)	(4)		(5)	
20	-0.20	0.00000	0.00019003	0.0019003	1.0	Compliant

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

PD = Power Density
OP = DUT Output Power (dBm)
AG = Antenna Gain (dBi)
D = MPE Distance

1. Reference CFR 2.1093(b): For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.
2. Section 6.1 of this test report.
3. Power density is calculated from conducted power output measurement and antenna gain.
4. Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (B): Limits for General Population/Uncontrolled Exposure.

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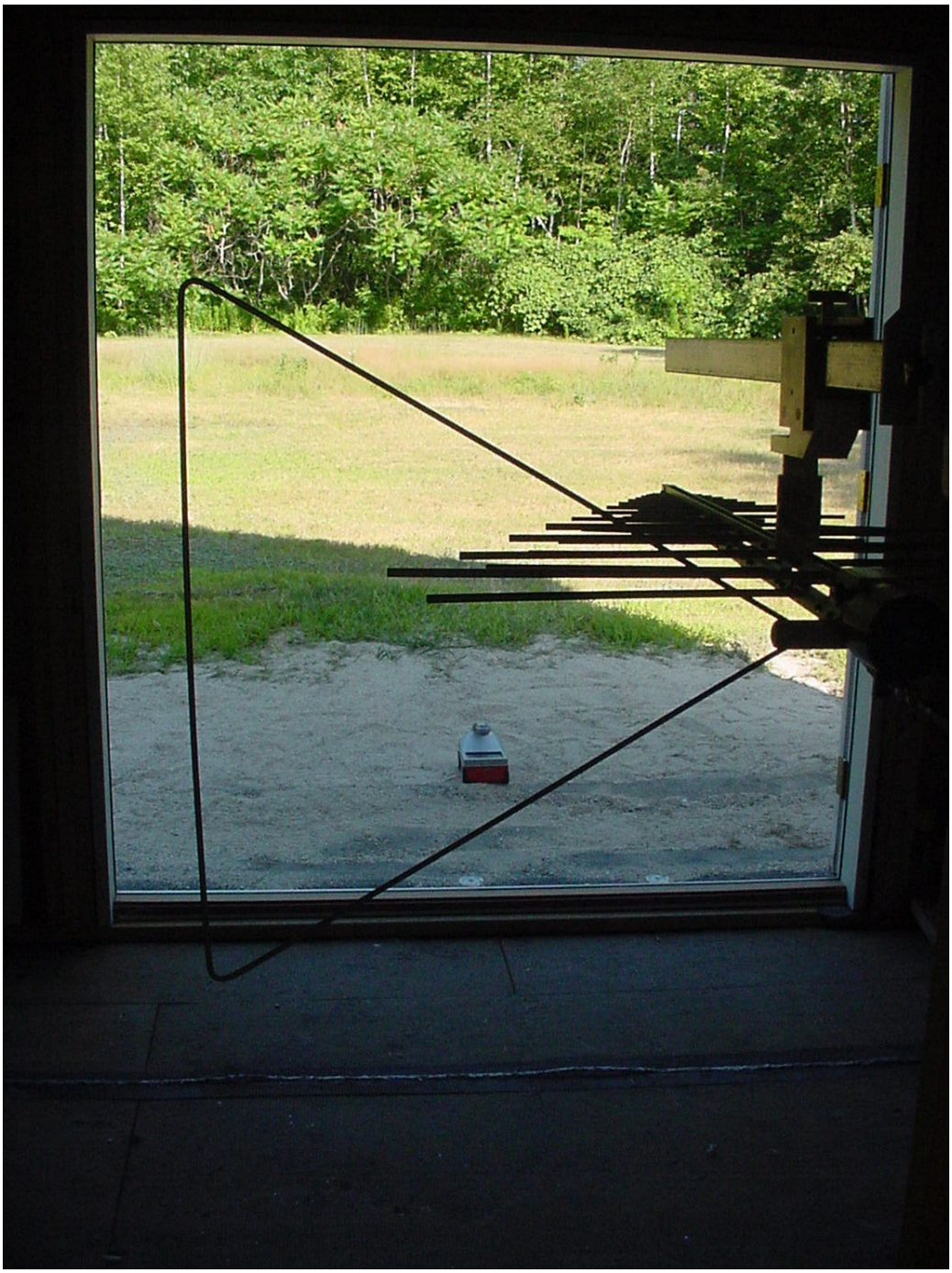
7. Test Images

7.1. Spurious Emissions – 30 MHz – 960 MHz Front



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7. Test Images

7.2. Spurious Emissions – 30 MHz – 960 MHz Rear

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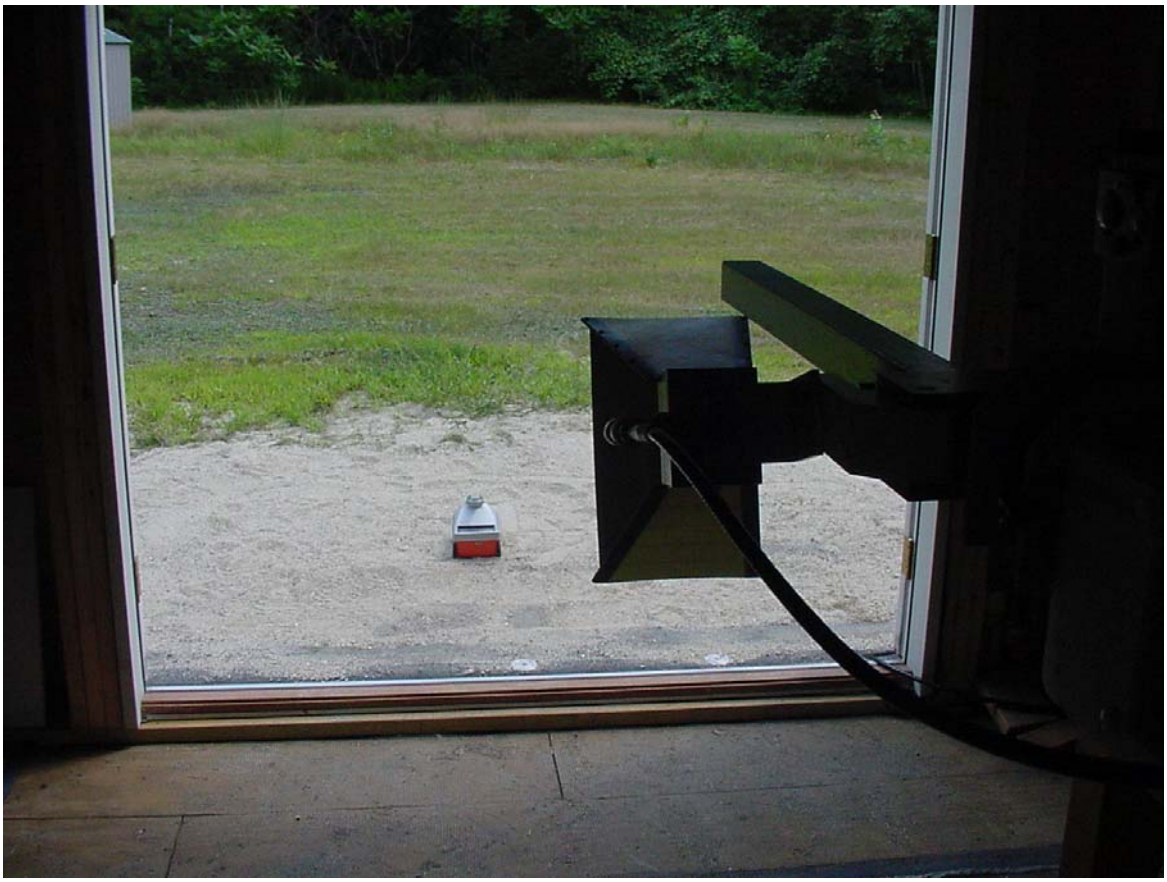
7. Test Images

7.3. Spurious Emissions – 960 MHz - 18 GHz Front



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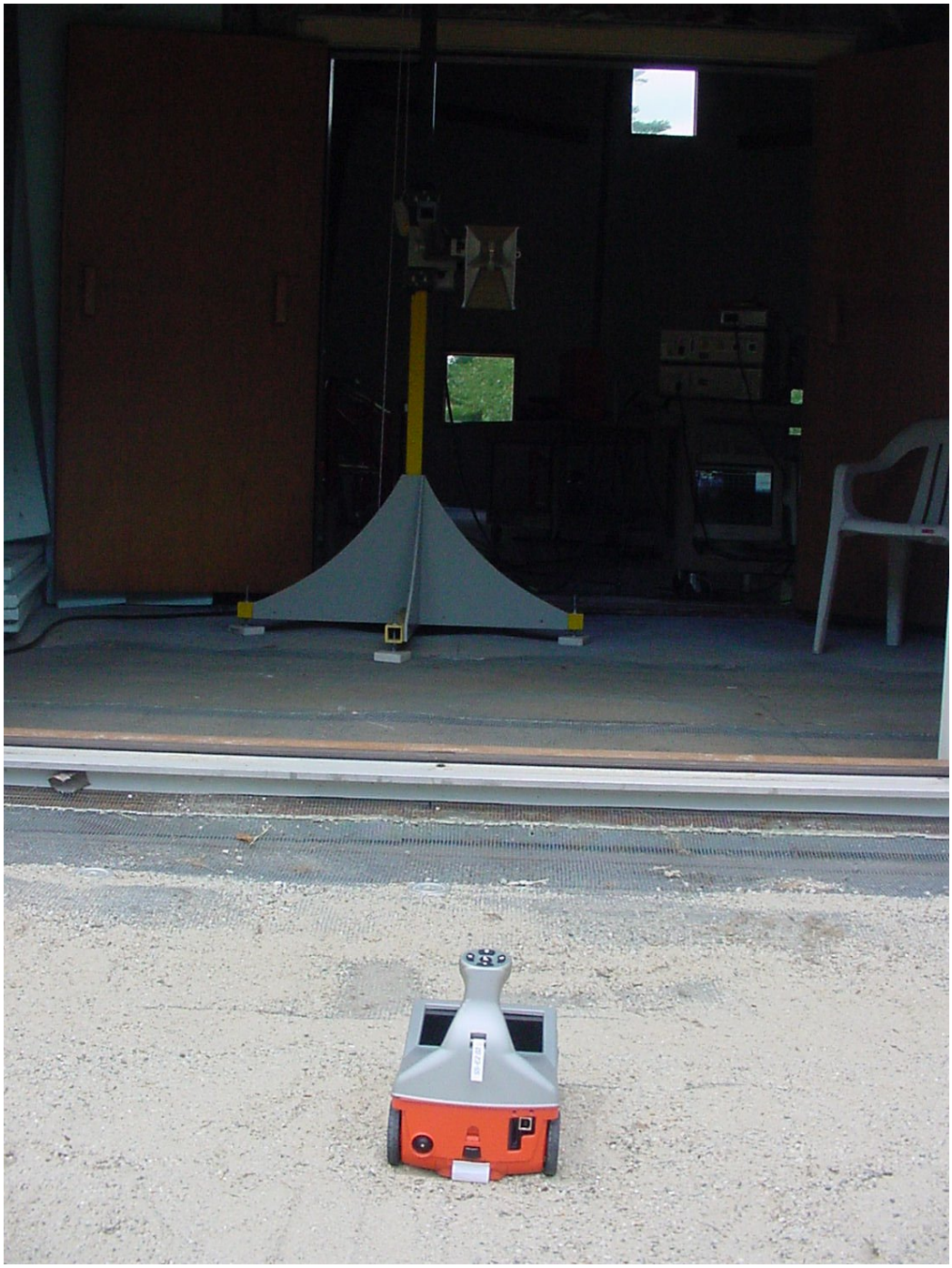
7. Test Images

7.4. Spurious Emissions – 960 MHz - 18 GHz Rear



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8. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with Federal Communications Commission (FCC) and Industry Canada standards. A description of the test sites is on file with the FCC (registration number **96392**) and Industry Canada (file number **IC 3023A-1)**.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

Off of the rear of the 10 Meter Enclosed Open Area test a Sandpit has been added to accommodate the testing of Ground Penetrating Radar (GPR) products. The sand pit measures 12’ (L) x 4’ (W) x 4’ (D) and is filled with 13.5 yards of dry concrete sand.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane.

Both sites are designed to test products or systems 1.5 meter W x 1.5 meter L x 2.0 meter H, floor standing or table top.

Compliance Worldwide, Inc. - 357 Main Street - Sandown, NH 03873
(603) 887 3903 Fax 887 6445
http://www.cw-inc.com