

Nemko Test Report:	5L0081R
Applicant:	Ditch Witch 1955 West Fir Avenue Perry, OK 73077
Equipment Under Test: (E.U.T.)	222-654 250MHz antenna /222-655 700MHz antenna Ground Penetrating Radar
FCC ID:	ITQ-2150GR250/ITQ-2150GR700
In Accordance With: Transmitters	FCC Part 15, Subpart F, 15.509
Tested By:	Nemko USA Inc. 802 N. Kealy Lewisville, Texas 75057-3136
Authorized By:	 Dustin Oaks, Engineer
Date:	April 7, 2005
Total Number of Pages:	52

EQUIPMENT: 222-654 Ground Penetrating Radar

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EQUIPMENT: 222-654 Ground Penetrating Radar

Section 1. Summary Of Test Results

Manufacturer: Ditch Witch

Model No.: 222-654/222-655

Serial No.: NA

General: All measurements are traceable to national standards.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15.509. All tests were conducted using measurement procedure ANSI C63.4-1992. Radiated Emissions were made on an open area test site with a 4 foot by 4 foot by 4 foot dry sand pit



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

This test report relates only to the item(s) tested.

The following deviations from, additions to, or exclusions from the test specifications have been made.
See "Summary of Test Data".



NVLAP LAB CODE: 100426-0

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EQUIPMENT: 222-654 Ground Penetrating Radar

Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Conducted Emissions	15.207	NA
Pulse Repitition Frequency	15.509	Complies
Occupied bandwidth	15.509(a)	Complies
Radiated Emissions	15.509(d)&(e)	Complies

The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class A Digital Devices. The engineering test report can be provided upon FCC requests.

Footnotes For N/A's:

EUT is a 12Vdc power device

Test Conditions:

The tests were performed with the EUT in contact with the ground as its intended use.

EQUIPMENT: 222-654 Ground Penetrating Radar

Section 2. General Equipment Specification

Frequency Range:	Single	
Operating Frequency(ies) of Sample:	250MHz (114.1-418.2 MHz)10db 700MHz (151.06-747.25MHz) 10db	
Tunable Bands:	N/A	
10 dB Occupied Bandwidth:	250 MHz (274.14MHz) 700MHz (596.193MHz)	
Emission Designator:	250M0N0N/700M0N0N	
User Frequency Adjustment:	NO	
Integral Antenna	Yes ☒	No ☐

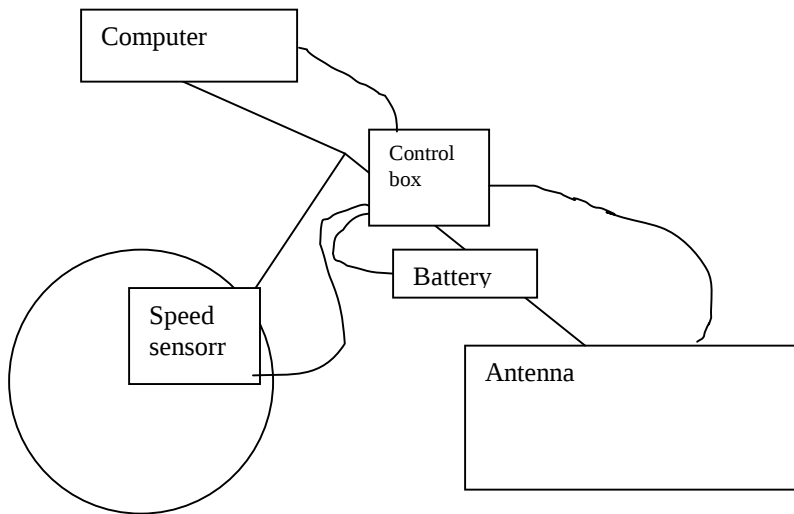
Note: If antenna is not integral to transmitter explain method of attachment and type of unique connector:

EQUIPMENT: 222-654 Ground Penetrating Radar

Description of Device Tested

Ground Penetrating Radar for locating underground utilities

System Diagram



EQUIPMENT: 222-654 Ground Penetrating Radar

Section 3. Pulse Repition Frequency

NAME OF TEST: Pulse Repition Frequency	PARA. NO.: 15.509
TESTED BY: Kevin Rose	DATE:3/2/04

Test Results: Complies. See attached graph(s).

Measurement Data: See attached graph(s).

Method of Measurement: (Procedure ANSI C63.4-1992)

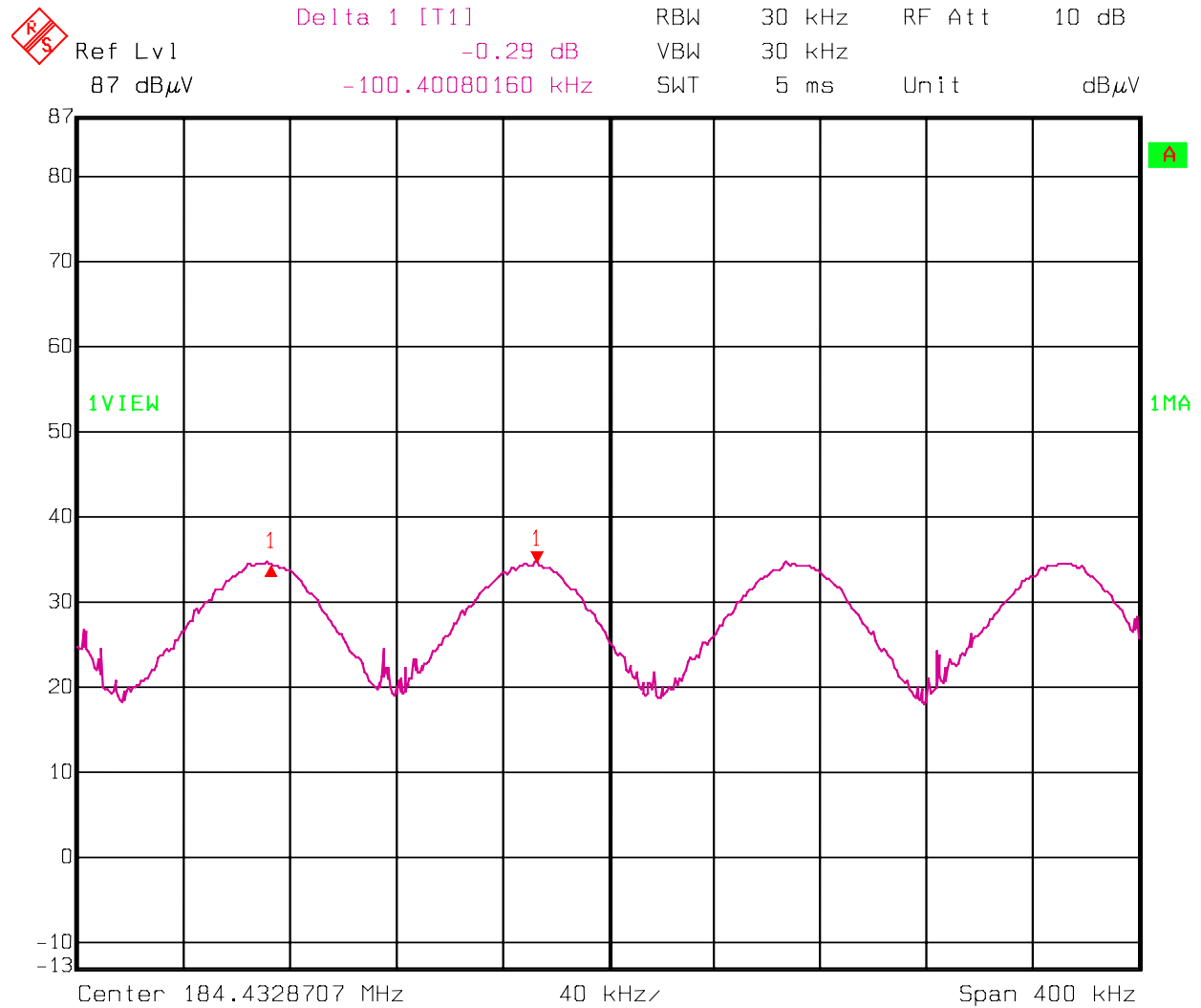
General:

Pulse Repition Frequency is control by the fireware and does not change with the 700MHz antenna

All measurements are traceable to national standards.

These tests were conducted using measurement procedures of ANSI C63.4-1992.

EQUIPMENT: 222-654 Ground Penetrating Radar



Date: 02.MAR.2005 14:25:55

EQUIPMENT: 222-654 Ground Penetrating Radar

Section 4. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.509(d)
TESTED BY: Kevin Rose	DATE: 3/2/05

Minimum Standard: Para no. 15.209

The field strengths shall not exceed the following:

FCC CFR 47, Part 15, Subpart C, Sec. 15.209(a) - Limits for Frequency below 960 MHz			
FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	Measuring RBW	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	1 kHz	300
0.490 - 1.705	24,000 / F (KHz)	10 kHz	30
1.705 - 30.0	30	10 kHz	30
30 - 88	100	100 kHz	3
88 - 216	150	100 kHz	3
216 - 960	200	100 kHz	3

Field strength limits are specified at a distance of 3 metres.

Test Results: Complies

Measurement Data: See attached table.

EQUIPMENT: 222-654 Ground Penetrating Radar

Radiated Photographs (Worst Case Configuration)

FRONT VIEW



REAR VIEW



EQUIPMENT: 222-654 Ground Penetrating Radar

FCC CFR 47, Part 15, Subpart F, Sec. 15.509(d) - Limits for Frequency above 960 MHz		
Frequency in MHz	EIRP Limits in dBm @ 1 MHz BW	Alternative E-Field Limits in dBm @ 3m @ 1 MHz BW
960-1610	-65.3	29.9
1610-1990	-53.3	41.9
Above 1990	-51.3	43.9

Field strength limits are specified at a distance of 3 metres.

Test Results: Complies

Measurement Data: See attached table.

EQUIPMENT: 222-654 Ground Penetrating Radar



NEMKO Dallas, Inc.

Dallas Headquarters:

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Radiated Emissions Data

Complete	<u>X</u>	Job # :	<u>5L0081R</u>	Test # :	<u>REHE-01</u>
Preliminary	<u> </u>	Page	<u>1</u>	of	<u>6</u>
Client Name : <u>DITCH WITCH</u>					
EUT Name : <u>Ground Penetrating Radar</u>					
EUT Model # : <u>N/A</u>					
EUT Part # : <u>222-654</u>					
EUT Serial # : <u>N/A</u>					
EUT Config. : <u>EUT is intended to be transmitting into the ground</u>					
Specification : <u>CFR47 Part 15, Subpart B, Class B</u>					
Rod. Ant. # :	<u> </u>	Temp. (deg. C) :	<u>14</u>	Date :	<u>03/01/05</u>
Bicon Ant. # :	<u>1306</u>	Humidity (%) :	<u>44</u>	Time :	<u>12:30</u>
Log Ant. # :	<u>1311</u>	EUT Voltage :	<u>12VDC</u>	Staff :	<u>KEVIN ROSE</u>
Bilog Ant. # :	<u> </u>	EUT Frequency :	<u>0</u>	Photo ID :	<u>REHE-01</u>
Dipole Ant. # :	<u> </u>	Phase :	<u>0-Jan</u>	Peak Bandwidth :	<u>100 KHz</u>
Cable# :	<u>1522</u>	Location :	<u>D OATS</u>	Video Bandwidth :	<u>100 KHz</u>
Preamp# :	<u>1025</u>	Distance :	<u>3M</u>		
Limiter# :	<u>NA</u>				
Atten # :	<u>NA</u>				
Detector# :	<u> </u>				

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Atten. (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	QP readings Comment
110.4	H	0	44.5	13.5	3.4	27.6	33.8	43.5	-9.8	Pass	FRONT
112.4	H	0	43.4	13.5	3.4	27.6	32.7	43.5	-10.9	Pass	
116.8	H	0	43.6	14.1	3.4	27.6	33.5	43.5	-10.1	Pass	
117.6	H	0	42.8	14.1	3.4	27.6	32.7	43.5	-10.9	Pass	
123.6	H	0	42.4	13.8	3.4	27.6	32.0	43.5	-11.6	Pass	
118.4	H	0	43.3	14.1	3.4	27.6	33.2	43.5	-10.4	Pass	
220	H	0	40.1	16	5.0	27.6	33.5	46.0	-12.5	Pass	RIGHT SIDE
272	H	0	31.9	17.6	5.7	27.6	27.6	46.0	-18.4	Pass	
110.4	H	0	48.2	13.5	3.4	27.6	37.5	43.5	-6.1	Pass	
112.4	H	0	48.5	13.5	3.4	27.6	37.8	43.5	-5.8	Pass	
116.8	H	0	44	14.1	3.4	27.6	33.9	43.5	-9.7	Pass	
117.6	H	0	44.5	14.1	3.4	27.6	34.4	43.5	-9.2	Pass	
123.6	H	0	42.7	13.8	3.4	27.6	32.3	43.5	-11.3	Pass	
118.4	H	0	44.2	14.1	3.4	27.6	34.1	43.5	-9.5	Pass	
220	H	0	39.6	16	5.0	27.6	33.0	46.0	-13.0	Pass	
70	H	0	47.2	8	2.8	27.9	30.1	40.0	-9.9	Pass	

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EQUIPMENT: 222-654 Ground Penetrating Radar



NEMKO Dallas, Inc.

Dallas Headquarters:

 802 N. Kealy
 Lewisville, TX 75057
 Tel: (972) 436-9600
 Fax: (972) 436-2667

Radiated Emissions Data

 Complete X Job # : 5L0081R Test # : REHE-01
 Preliminary Page 2 of 6

 Client Name : DITCH WITCH
 EUT Name : Ground Penetrating Radar
 EUT Model # : N/A
 EUT Part # : 222-654
 EUT Serial # : N/A
 EUT Config. : EUT is intended to be transmitting into the ground

 Specification : CFR47 Part 15, Subpart B, Class B Reference :

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Det. Atten. (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
272	H	0	33.2	17.6	5.7	27.6	28.9	46.0	-17.1	Pass	
110.4	H	0	46.3	13.5	3.4	27.6	35.6	43.5	-8.0	Pass	
112.4	H	0	44.3	13.5	3.4	27.6	33.6	43.5	-10.0	Pass	
116.8	H	0	46.8	14.1	3.4	27.6	36.7	43.5	-6.9	Pass	
117.6	H	0	44.6	14.1	3.4	27.6	34.5	43.5	-9.1	Pass	
123.6	H	0	40.4	13.8	3.4	27.6	30.0	43.5	-13.6	Pass	
118.4	H	0	43.1	14.1	3.4	27.6	33.0	43.5	-10.6	Pass	
220	H	0	40.6	16	5.0	27.6	34.0	46.0	-12.0	Pass	
70	H	0	46.5	8	2.8	27.9	29.4	40.0	-10.6	Pass	
47.5	H	0	47.5	11.3	1.9	28.2	32.5	40.0	-7.5	Pass	
65.6	V	0	48	8.4	2.4	27.7	31.1	40.0	-8.9	Pass	
81.1	V	0	50.1	8.4	2.8	27.7	33.6	40.0	-6.4	Pass	
149.6	V	0	45.1	13.1	3.8	27.5	34.5	43.5	-9.0	Pass	
180.4	V	0	45.4	13.4	3.8	27.5	35.1	43.5	-8.4	Pass	
283.6	V	0	31.6	18.5	5.7	27.6	28.2	46.0	-17.8	Pass	
289.2	V	0	35.2	19	5.7	27.6	32.3	46.0	-13.7	Pass	
206.4	H	0	40.5	14.8	5.0	27.6	32.7	43.5	-10.8	Pass	
296	H	0	38.3	18.2	5.7	27.6	34.6	46.0	-11.4	Pass	
84.4	H	0	42.12	8.4	2.8	27.7	25.6	40.0	-14.4	Pass	
112	H	0	46.2	13.5	3.4	27.6	35.5	43.5	-8.1	Pass	
132	V	0	44	13.5	3.8	27.5	33.8	43.5	-9.7	Pass	

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802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Radiated Emissions Data

Complete	<u>X</u>
Preliminary	

Job #: 5L0081R Test #: REHE-01
Page 3 of 6

Client Name : DITCH WITCH

EUT Name : Ground Penetrating Radar

EUT Model # : N/A

EUT Part # : 222-654

EUT Serial # : N/A

EUT Config. : EUT is intended to be transmitting into the ground

Specification : CFR47 Part 15, Subpart B, Class B

Reference :

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Dallas Headquarters:

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Radiated Emissions Data

Complete X
Preliminary Job # : 5L0081R Test # : REHE-01
Page 4 of 6 Client Name : DITCH WITCHEUT Name : Ground Penetrating RadarEUT Model # : N/AEUT Part # : 222-654EUT Serial # : N/AEUT Config. : EUT is intended to be transmitting into the groundSpecification : CFR47 Part 15, Subpart B, Class BReference :

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Det. Atten. (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
308	V	0	33.6	14.3	6.3	27.6	26.6	46.0	-19.4	Pass	
396	V	0	24.1	16	6.3	27.7	18.7	46.0	-27.3	Pass	FL
444	V	0	25.9	16.4	7.4	27.6	22.1	46.0	-23.9	Pass	FH
708	V	0	18	20.6	9.9	27.4	21.1	46.0	-24.9	Pass	
308	V	0	28.2	14.3	6.3	27.6	21.2	46.0	-24.8	Pass	
396	V	0	28.2	16	6.3	27.7	22.8	46.0	-23.2	Pass	
444	V	0	28.4	16.4	7.4	27.6	24.6	46.0	-21.4	Pass	
708	V	0	19	20.6	9.9	27.4	22.1	46.0	-23.9	Pass	
308	H	0	40.3	14.3	6.3	27.6	33.3	46.0	-12.7	Pass	
396	H	0	31.2	16	6.3	27.7	25.8	46.0	-20.2	Pass	
444	H	0	28.9	16.4	7.4	27.6	25.1	46.0	-20.9	Pass	
708	H	0	20.5	20.6	9.9	27.4	23.6	46.0	-22.4	Pass	
308	H	0	30.4	14.3	6.3	27.6	23.4	46.0	-22.6	Pass	
396	H	0	26.1	16	6.3	27.7	20.7	46.0	-25.3	Pass	
444	H	0	23.5	16.4	7.4	27.6	19.7	46.0	-26.3	Pass	
708	H	0	22.2	20.6	9.9	27.4	25.3	46.0	-20.7	Pass	
308	H	0	33.9	14.3	6.3	27.6	26.9	46.0	-19.1	Pass	
396	H	0	26.3	16	6.3	27.7	20.9	46.0	-25.1	Pass	
444	H	0	26.2	16.4	7.4	27.6	22.4	46.0	-23.6	Pass	
708	H	0	22	20.6	9.9	27.4	25.1	46.0	-20.9	Pass	
308	H	0	38.1	14.3	6.3	27.6	31.1	46.0	-14.9	Pass	
396	H	0	32.2	16	6.3	27.7	26.8	46.0	-19.2	Pass	
444	H	0	28.6	16.4	7.4	27.6	24.8	46.0	-21.2	Pass	
708	H	0	23.9	20.6	9.9	27.4	27.0	46.0	-19.0	Pass	

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Dallas Headquarters:

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Radiated Emissions Data

Complete	<u>X</u>
Preliminary	<u> </u>

Job #: 5L0081R Test #: REHE-01
Page 5 of 6

Client Name : DITCH WITCH

EUT Name : Ground Penetrating Radar

EUT Model # : N/A

EUT Part # : 222-654

EUT Serial # : N/A

EUT Config. : EUT is intended to be transmitting into the ground

Specification : CFR47 Part 15, Subpart B, Class B

Reference :

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802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Radiated Emissions Data

Complete X
Preliminary

Job #: 5I0081E Test #: REHE-01
Page 2 of 6

Client Name : DITCH WITCH

EUT Name : Ground Penetrating Radar

EUT Model #: N/A

EUT Part # : 222-655

EUT Serial # : N/A

EUT Config. : EUT is intended to be transmitting into the ground

Specification : CFR47 Part 15, Subpart B, Class B

Reference :

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Dallas Headquarters:

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Lewisville, TX 75057
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Fax: (972) 436-2667

Radiated Emissions Data

Complete	<u>X</u>
Preliminary	

Job #: 5I0081E Test #: REHE-01
Page 3 of 6

Client Name : DITCH WITCH

EUT Name : Ground Penetrating Radar

EUT Model # : N/A

EUT Part # : 222-655

EUT Serial # : N/A

EUT Config. : EUT is intended to be transmitting into the ground

Specification : CFR47 Part 15, Subpart B, Class B

Reference :

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Radiated Emissions Data

Complete X
Preliminary Job # : 5I0081E Test # : REHE-01
Page 4 of 6 Client Name : DITCH WITCHEUT Name : Ground Penetrating RadarEUT Model # : N/AEUT Part # : 222-655EUT Serial # : N/AEUT Config. : EUT is intended to be transmitting into the groundSpecification : CFR47 Part 15, Subpart B, Class BReference :

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Det. Atten. (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
64.3	H	0	43.6	8.2	2.4	27.7	26.5	40.0	-13.5	Pass	
112.3	H	0	43.6	13.5	3.4	27.6	32.9	43.5	-10.7	Pass	
124.3	H	0	36.9	13.8	3.4	27.6	26.5	43.5	-17.1	Pass	
148.3	H	0	33.3	13.1	3.8	27.5	22.7	43.5	-20.8	Pass	
160.3	H	0	37.1	13	3.8	27.5	26.4	43.5	-17.1	Pass	
208.3	H	0	37.9	14.8	5.0	27.6	30.1	43.5	-13.4	Pass	
232.3	H	0	34.2	16	5.0	27.6	27.6	46.0	-18.4	Pass	
64.3	H	0	40.2	8.2	2.4	27.7	23.1	40.0	-16.9	Pass	
112.3	H	0	37.6	13.5	3.4	27.6	26.9	43.5	-16.7	Pass	
124.3	H	0	33	13.8	3.4	27.6	22.6	43.5	-21.0	Pass	
148.3	H	0	34.6	13.1	3.8	27.5	24.0	43.5	-19.5	Pass	
160.3	H	0	34.6	13	3.8	27.5	23.9	43.5	-19.6	Pass	
208.3	H	0	35.6	14.8	5.0	27.6	27.8	43.5	-15.7	Pass	
232.3	H	0	36	16	5.0	27.6	29.4	46.0	-16.6	Pass	
64.3	H	0	36	8.2	2.4	27.7	18.9	40.0	-21.1	Pass	
112.3	H	0	34	13.5	3.4	27.6	23.3	43.5	-20.3	Pass	
124.3	H	0	30	13.8	3.4	27.6	19.6	43.5	-24.0	Pass	
148.3	H	0	27.6	13.1	3.8	27.5	17.0	43.5	-26.5	Pass	
160.3	H	0	30	13	3.8	27.5	19.3	43.5	-24.2	Pass	
208.3	H	0	33.7	14.8	5.0	27.6	25.9	43.5	-17.6	Pass	
232.3	H	0	29.6	16	5.0	27.6	23.0	46.0	-23.0	Pass	
64.3	H	0	36.1	8.2	2.4	27.7	19.0	40.0	-21.0	Pass	
112.3	H	0	40.2	13.5	3.4	27.6	29.5	43.5	-14.1	Pass	
124.3	H	0	35.4	13.8	3.4	27.6	25.0	43.5	-18.6	Pass	
148.3	H	0	35.5	13.1	3.8	27.5	24.9	43.5	-18.6	Pass	
160.3	H	0	35.5	13	3.8	27.5	24.8	43.5	-18.7	Pass	
208.3	H	0	33.2	14.8	5.0	27.6	25.4	43.5	-18.1	Pass	
232.3	H	0	32.5	16	5.0	27.6	25.9	46.0	-20.1	Pass	

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Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Radiated Emissions Data

Complete X
Preliminary Job #: 5I0081E Test #: REHE-01
Page 5 of 6 Client Name : DITCH WITCHEUT Name : Ground Penetrating RadarEUT Model #: N/AEUT Part #: 222-655EUT Serial #: N/AEUT Config. : EUT is intended to be transmitting into the groundSpecification : CFR47 Part 15, Subpart B, Class BReference :

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Det. Atten. (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
64.3	H	0	43.9	8.2	2.4	27.7	26.8	40.0	-13.2	Pass	
112.3	H	0	47.1	13.5	3.4	27.6	36.4	43.5	-7.2	Pass	
124.3	H	0	39.4	13.8	3.4	27.6	29.0	43.5	-14.6	Pass	
148.3	H	0	34.1	13.1	3.8	27.5	23.5	43.5	-20.0	Pass	
160.3	H	0	30.2	13	3.8	27.5	19.5	43.5	-24.0	Pass	
208.3	H	0	29	14.8	5.0	27.6	21.2	43.5	-22.3	Pass	
232.3	H	0	28.7	16	5.0	27.6	22.1	46.0	-23.9	Pass	
64.3	H	0	41.2	8.2	2.4	27.7	24.1	40.0	-15.9	Pass	
112.3	H	0	47.8	13.5	3.4	27.6	37.1	43.5	-6.5	Pass	
124.3	H	0	39.6	13.8	3.4	27.6	29.2	43.5	-14.4	Pass	
148.3	H	0	35.5	13.1	3.8	27.5	24.9	43.5	-18.6	Pass	
160.3	H	0	34.9	13	3.8	27.5	24.2	43.5	-19.3	Pass	
208.3	H	0	30	14.8	5.0	27.6	22.2	43.5	-21.3	Pass	
232.3	H	0	31	16	5.0	27.6	24.4	46.0	-21.6	Pass	
64.3	H	0	37	8.2	2.4	27.7	19.9	40.0	-20.1	Pass	
112.3	H	0	37	13.5	3.4	27.6	26.3	43.5	-17.3	Pass	
124.3	H	0	31.2	13.8	3.4	27.6	20.8	43.5	-22.8	Pass	
148.3	H	0	32.4	13.1	3.8	27.5	21.8	43.5	-21.7	Pass	
160.3	H	0	32.5	13	3.8	27.5	21.8	43.5	-21.7	Pass	
208.3	H	0	33.3	14.8	5.0	27.6	25.5	43.5	-18.0	Pass	
232.3	H	0	31.2	16	5.0	27.6	24.6	46.0	-21.4	Pass	
64.3	H	0	40.1	8.2	2.4	27.7	23.0	40.0	-17.0	Pass	
112.3	H	0	44.8	13.5	3.4	27.6	34.1	43.5	-9.5	Pass	
124.3	H	0	38.4	13.8	3.4	27.6	28.0	43.5	-15.6	Pass	
148.3	H	0	37.8	13.1	3.8	27.5	27.2	43.5	-16.3	Pass	
160.3	H	0	39	13	3.8	27.5	28.3	43.5	-15.2	Pass	
208.3	H	0	33.89	14.8	5.0	27.6	26.1	43.5	-17.4	Pass	
232.3	H	0	26.5	16	5.0	27.6	19.9	46.0	-26.1	Pass	

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Document Control #EMC DS EM RAD HFE

EQUIPMENT: 222-654 Ground Penetrating Radar



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Radiated Emissions Data

Complete X
Preliminary _____

Job #: 5I0081E Test #: REHE-01
Page 6 of 6

Client Name : DITCH WITCH

EUT Name : Ground Penetrating Radar

EUT Model #: N/A

EUT Part # : 222-655

EUT Serial # : N/A

EUT Config. : EUT is intended to be transmitting into the ground

Specification : CFR47 Part 15, Subpart B, Class B

Reference :

[illegible]

..\EMCS\Share\AUTOMATE\DATASHTS\RADEMEV Rev C.xls

Document Control #EMC DS EM RAD HFE

EQUIPMENT: 222-654 Ground Penetrating Radar

Maximizing Emission Levels:

Test Data - Radiated Emissions• The emissions were scanned from 30 MHz to 10000 MHz and all emissions within 20 dB below the limits were recorded.

- For frequency below 960 MHz, the emissions were measured using the EMI Quasi-Peak Detector, RBW =120 kHz,

VBW = 1 MHz

- For Frequency above 960 MHz and outside the below frequency bands, the emissions were measured using EMI Average Detector, RBW = 1MHz, VBW = 1MHz

- For frequencies fall inside 960-1610, 1610-1990 MHz bands, the emissions were measured using EMI RMS Average

Detector, RBW = 1 MHz, VBW = 1 MHz

- For frequencies fall inside 1164-1240 and 1559-1610 MHz, the emissions were measured using EMI RMS Average

Detector, RBW = 1 KHz, VBW = 1 MHz

Note: The above tests were performed with the EUT in contact with the ground as its intended use.

EQUIPMENT: 222-654 Ground Penetrating Radar

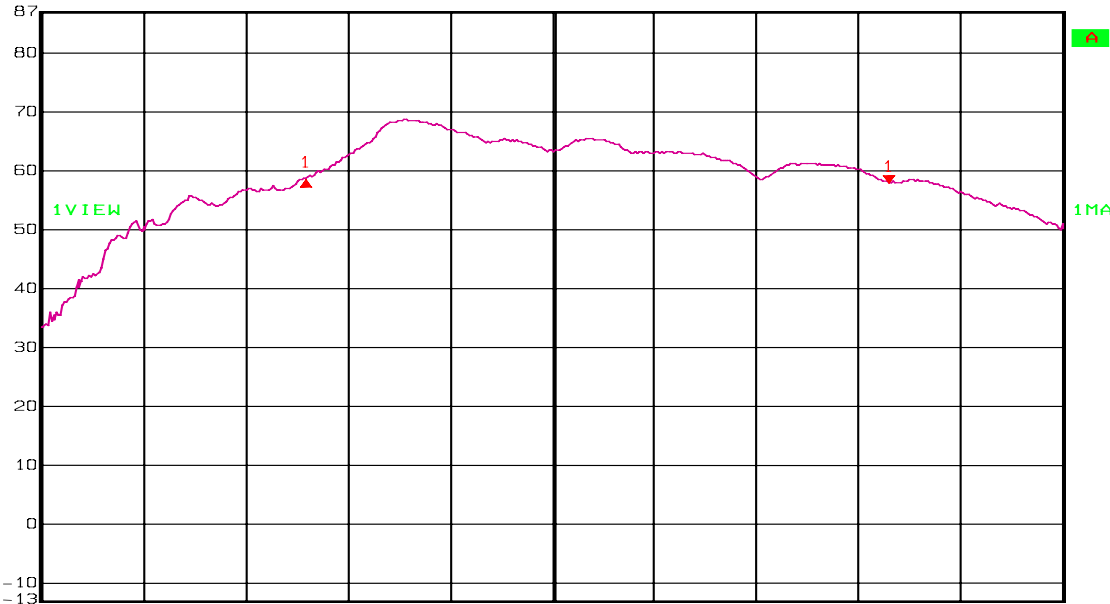
Section 5. OCCUPIED BANDWIDTH

NAME OF TEST: OCCUPIED BANDWIDTH	PARA. NO.: 15.509(a)
TESTED BY: Kevin Rose	DATE:3/3/04

Test Results: Complies

Measurement Data: See attached table.

EQUIPMENT: 222-654 Ground Penetrating Radar

		Dallas Headquarters: 802 N. Kealy Lewisville, TX 75057 Tel: (972) 436-9600 Fax: (972) 436-2667	
Nemko Dallas, Inc.			
Data Plot		OBW PLOTS	
Page 1 of 4		Complete <u>X</u>	
Job No.: 5L0081R	Date: 3/2/2005	Preliminary: _____	
Specification: 15.509	Temperature(°C): 21		
Tested By: Tom Tidwell	Relative Humidity(%): 42		
E.U.T.: GPR 250 mhz antenna			
Configuration: Transmitting			
Sample Number: 1			
Location: Lab 1	RBW: Refer to plots		
Detector Type: Peak	VBW: Refer to plots		
Test Equipment Used			
Antenna: 1480	Directional Coupler: _____		
Pre-Amp: 1016	Cable #1: _____		
Filter: _____	Cable #2: 1485		
Receiver: 1036	Cable #3: 1484		
Attenuator #1: _____	Cable #4: _____		
Attenuator #2: _____	Mixer: _____		
Additional equipment used: _____			
Measurement Uncertainty: +/-1.7 dB			
 Ref Lvl 87 dBμV Delta 1 [111] 0.64 dB -274.14829659 MHz RBW 3 MHz VBW 3 MHz SWT 5 ms RF Att 10 dB Unit dBμV			
			
Start 20 MHz 48 MHz/ Stop 500 MHz			
Date: 02.MAR.2005 14:22:08			
Notes: 274.148 MHz OBW			

EQUIPMENT: 222-654 Ground Penetrating Radar



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Dallas Headquarters:

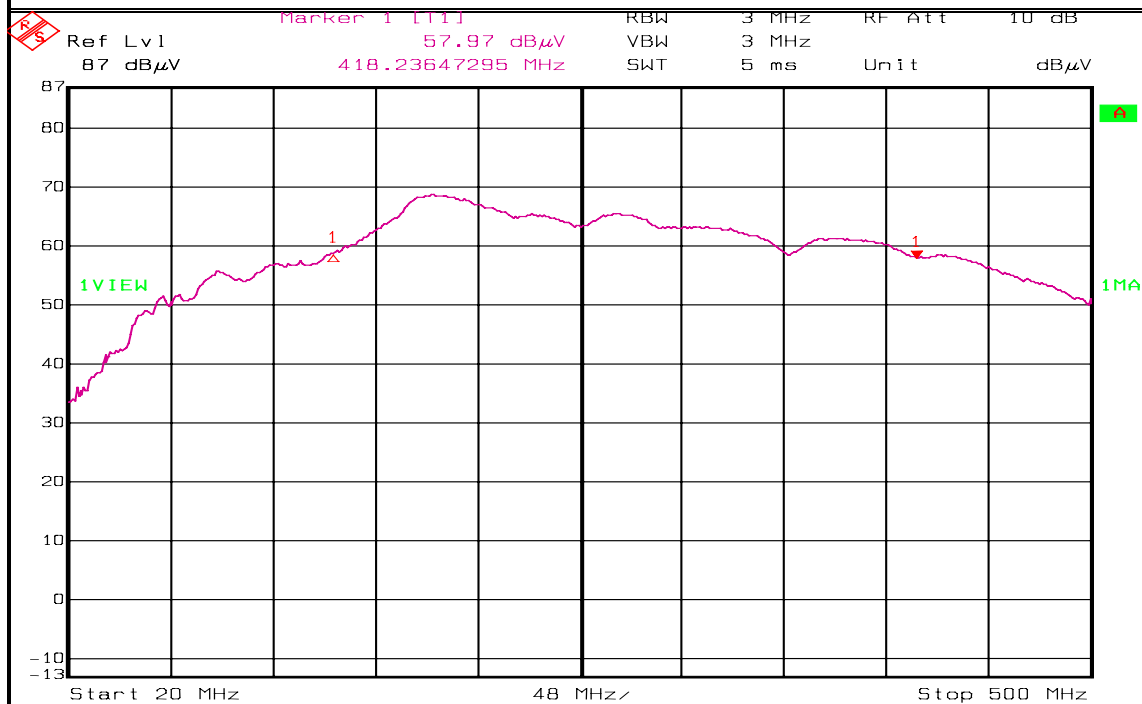
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Data Plot

Page 2 of 4

OBW PLOTS

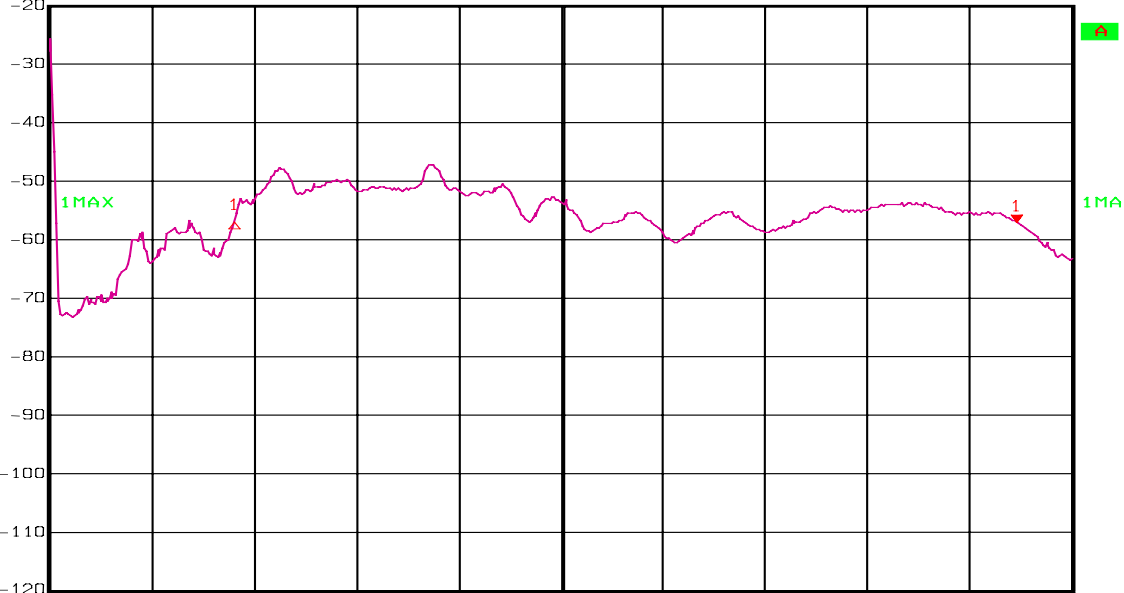
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.5 Temperature(°C): 21
Tested By: Tom Tidwell Relative Humidity(%) 42
E.U.T.: GPR 250 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 14:22:45

Notes: FH 418.236MHz

EQUIPMENT: 222-654 Ground Penetrating Radar

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		Nemko Dallas, Inc.	
Data Plot		OBW PLOTS	
Page 1 of 4		Complete <u>X</u>	
Job No.: 5L0081R	Date: 3/2/2005	Preliminary: _____	
Specification: 15.509	Temperature(°C): 21		
Tested By: Tom Tidwell	Relative Humidity(%) 42		
E.U.T.: GPR 700 mhz antenna			
Configuration: Transmitting			
Sample Number: 1			
Location: Lab 1	RBW: Refer to plots		
Detector Type: Peak	VBW: Refer to plots		
Test Equipment Used			
Antenna: 1480	Directional Coupler: _____		
Pre-Amp: 1016	Cable #1: _____		
Filter: _____	Cable #2: 1485		
Receiver: 1036	Cable #3: 1484		
Attenuator #1: _____	Cable #4: _____		
Attenuator #2: _____	Mixer: _____		
Additional equipment used: _____			
Measurement Uncertainty: +/-1.7 dB			
 Ref Lvl -20 dBm -57.20 dBm RBW 3 MHz RF Att 10 dB 747.25450902 MHz VBW 3 MHz Unit dBm SWT 5 ms			
			
Start 0 Hz 79 MHz Stop 790 MHz			
Date: 02.MAR.2005 13:49:50			
Notes: 747.254 MHz FH			
700 MHz ANTENNA			

EQUIPMENT: 222-654 Ground Penetrating Radar



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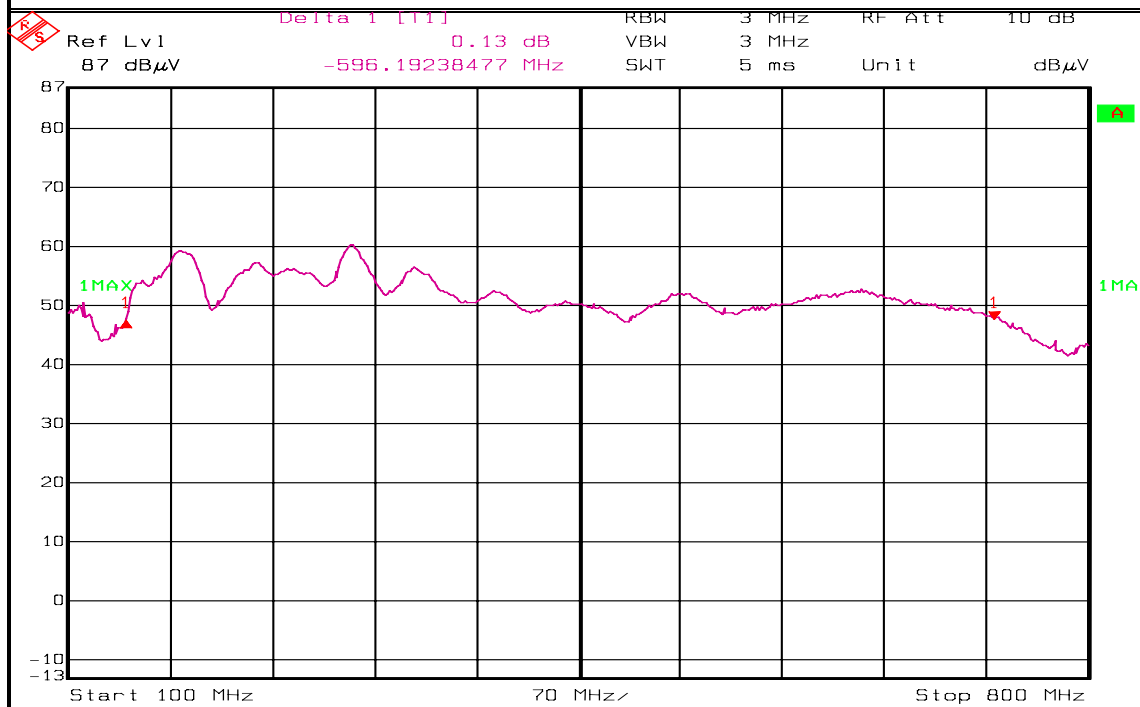
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Data Plot

Page 2 of 4

OBW PLOTS

Job No.: 5L0081R Date: 3/2/2005
Specification: 15.5 Temperature(°C): 21
Tested By: Tom Tidwell Relative Humidity(%) 42
E.U.T.: GPR 700 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 14:11:10

Notes: 596.193 MHz OBW
700 MHz ANTENNA

EQUIPMENT: 222-654 Ground Penetrating Radar

Section 6. SPURIOUS EMISSIONS

NAME OF TEST: SPURIOUS EMISSIONS	PARA. NO.: 15.509(e)
TESTED BY: Kevin Rose	DATE:3/3/04

FCC CFR 47, Part 15, Subpart F, Sec. 15.509(e) - Limits for Frequency above 10,600 MHz

Frequency in MHz	EIRP Limits in dBm @ 1 KHz	Alternative E-Field Limits in dBm @ 3m @ 1 KHz BW
1164-1240	-75.3	19.9
1559-1610	-75.3	19.9

Test Results: Complies

Measurement Data: See attached table.

EQUIPMENT: 222-654 Ground Penetrating Radar

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		Nemko Dallas, Inc.	
Data Plot		SPURIOUS EMISSIONS	
Page 1 of 8		Complete <u>X</u>	
Job No.: 5L0081R	Date: 3/2/2005	Preliminary: _____	
Specification: 15.509	Temperature(°C): 21		
Tested By: Kevin Rose	Relative Humidity(%): 42		
E.U.T.: GPR 250 mhz antenna			
Configuration: Transmitting			
Sample Number: 1			
Location: Lab 1	RBW: Refer to plots		
Detector Type: Peak	VBW: Refer to plots		
Test Equipment Used			
Antenna: 759	Directional Coupler: _____		
Pre-Amp: 1016	Cable #1: _____		
Filter: _____	Cable #2: 1485		
Receiver: 1036	Cable #3: 1484		
Attenuator #1: _____	Cable #4: _____		
Attenuator #2: _____	Mixer: _____		
Additional equipment used: _____			
Measurement Uncertainty: +/-1.7 dB			
R5 Ref Lvl -51 dBm Marker 1 [11] -125.74 dBm 1.55910220 GHz RBW 1 kHz VBW 10 kHz SWT 130 s RF Att 10 dB Unit dBm -51 -60 -70 -80 -90 -100 -110 -120 -130 -140 -151 -31 dB Offset 1VIEW 1AV Start 1.559 GHz 5.1 MHz Stop 1.61 GHz			
Date: 02.MAR.2005 16:02:39			
Notes: 1559-1610 HORIZONTAL			

EQUIPMENT: 222-654 Ground Penetrating Radar



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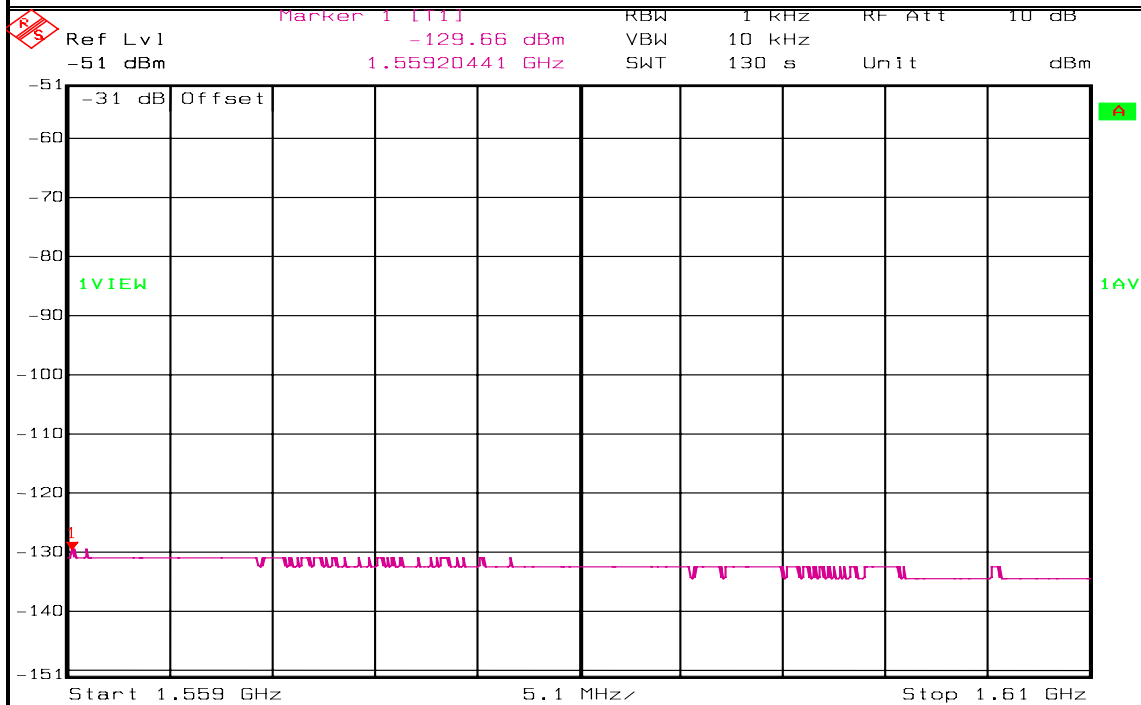
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Data Plot

SPURIOUS EMISSIONS

Page 2 of 8

Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 250 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 15:54:33

Notes: 1559-1610 VERTICAL

EQUIPMENT: 222-654 Ground Penetrating Radar



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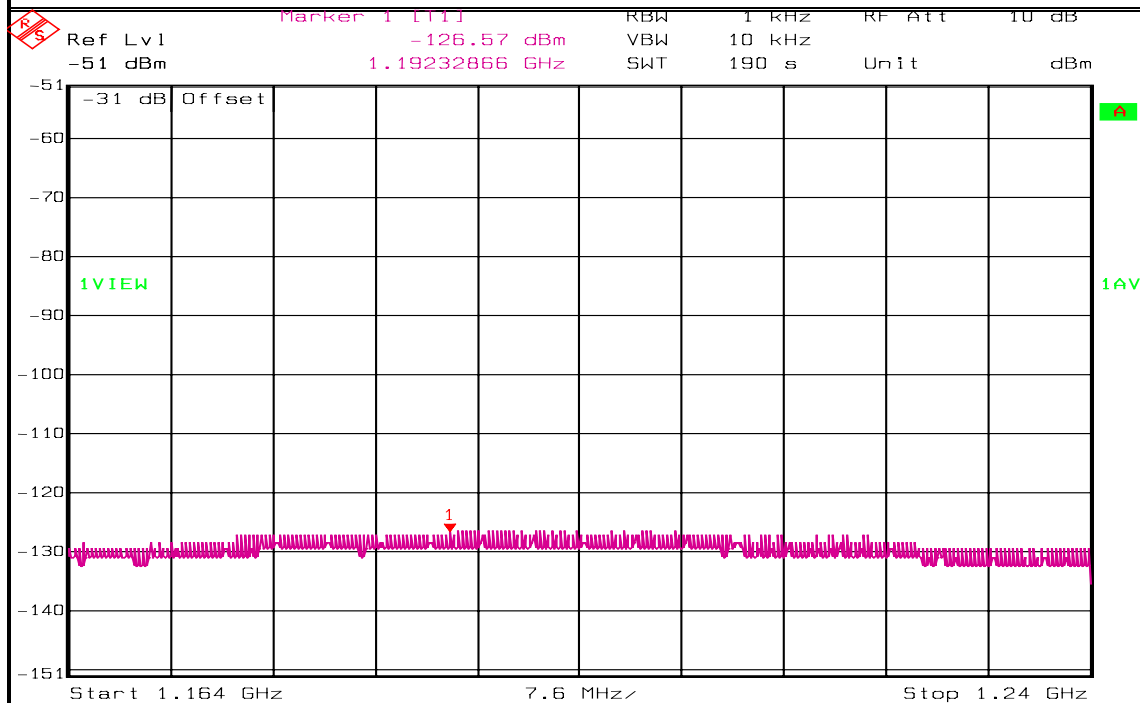
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Data Plot

SPURIOUS EMISSIONS

Page 3 of 8
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 250 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 15:50:31

Notes: 1164-1240 HORIZONTAL

EQUIPMENT: 222-654 Ground Penetrating Radar



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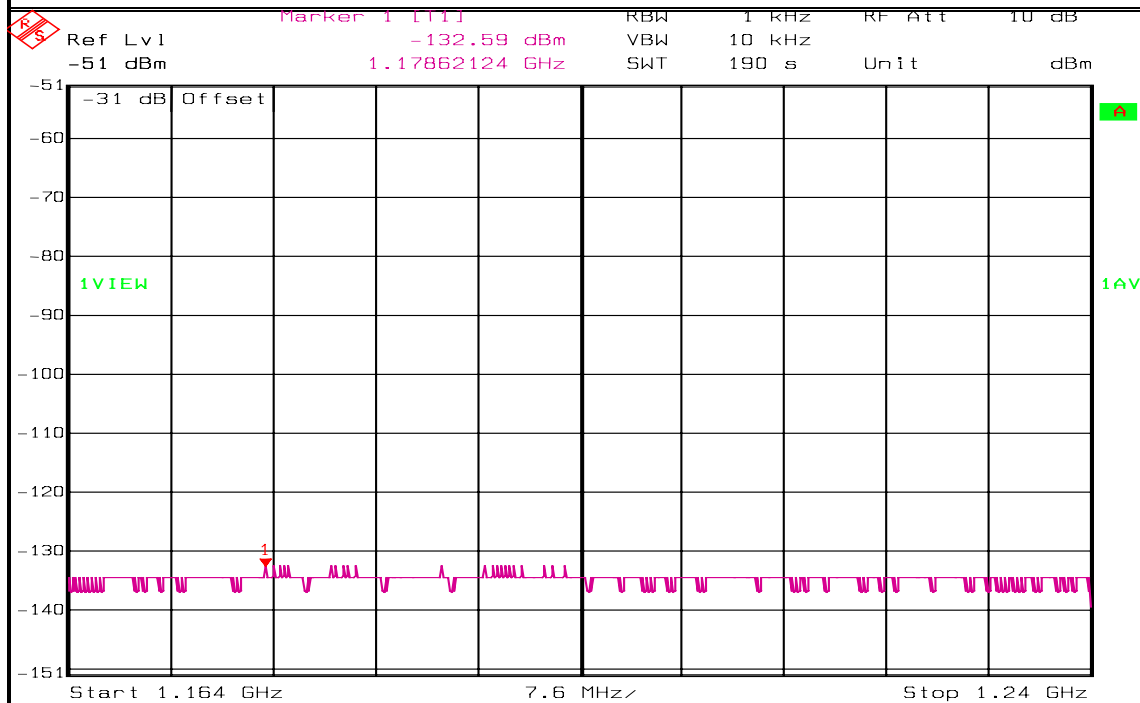
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Fax: (972) 436-2667

Data Plot

SPURIOUS EMISSIONS

Page 4 of 8

Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 250 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 16:11:47

Notes: 1164-1240 VERITCAL

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Page 1 of 1

Job No.:	5L0081R	Date:	3/2/2005	Complete:	X
Specification:	15.509	Temperature(°C):	21	Preliminary:	
Tested By:	Kevin Rose	Relative Humidity(%)	42		
E.U.T.:	GPR 250 mhz antenna				
Configuration:	Transmitting				
Sample Number:	1				
Location:	Lab 1	RBW:	Refer to plots		
Detector Type:	Peak	VBW:	Refer to plots		

Antenna:	759	Directional Coupler:	
Pre-Amp:	1016	Cable #1:	
Filter:		Cable #2:	1485
Receiver:	1036	Cable #3:	1484
Attenuator #1		Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-1.7 dB		

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EQUIPMENT: 222-654 Ground Penetrating Radar

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		Nemko Dallas, Inc.	
Data Plot		SPURIOUS EMISSIONS	
Page 1 of 4		Complete <u>X</u>	
Job No.:	5L0081R	Date:	3/2/2005
Specification:	15.509	Temperature(°C):	21
Tested By:	Kevin Rose	Relative Humidity(%)	42
E.U.T.:	GPR 700 mhz antenna		
Configuration:	Transmitting		
Sample Number:	1		
Location:	Lab 1	RBW:	Refer to plots
Detector Type:	Peak	VBW:	Refer to plots
Test Equipment Used			
Antenna:	759	Directional Coupler:	
Pre-Amp:	1016	Cable #1:	
Filter:		Cable #2:	1485
Receiver:	1036	Cable #3:	1484
Attenuator #1:		Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-1.7 dB		
R5 Ref Lvl -51 dBm Marker 1 [111] -125.74 dBm 1.55910220 GHz RBW 1 kHz VBW 10 kHz SWT 130 s RF Att 10 dB Unit dBm -51 -31 dB Offset 1VIEW 1AV -151 Start 1.559 GHz5.1 MHzStop 1.61 GHz			
Date: 02.MAR.2005 16:02:39			
Notes: 1559-1610 HORIZONTAL			

EQUIPMENT: 222-654 Ground Penetrating Radar



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Dallas Headquarters:

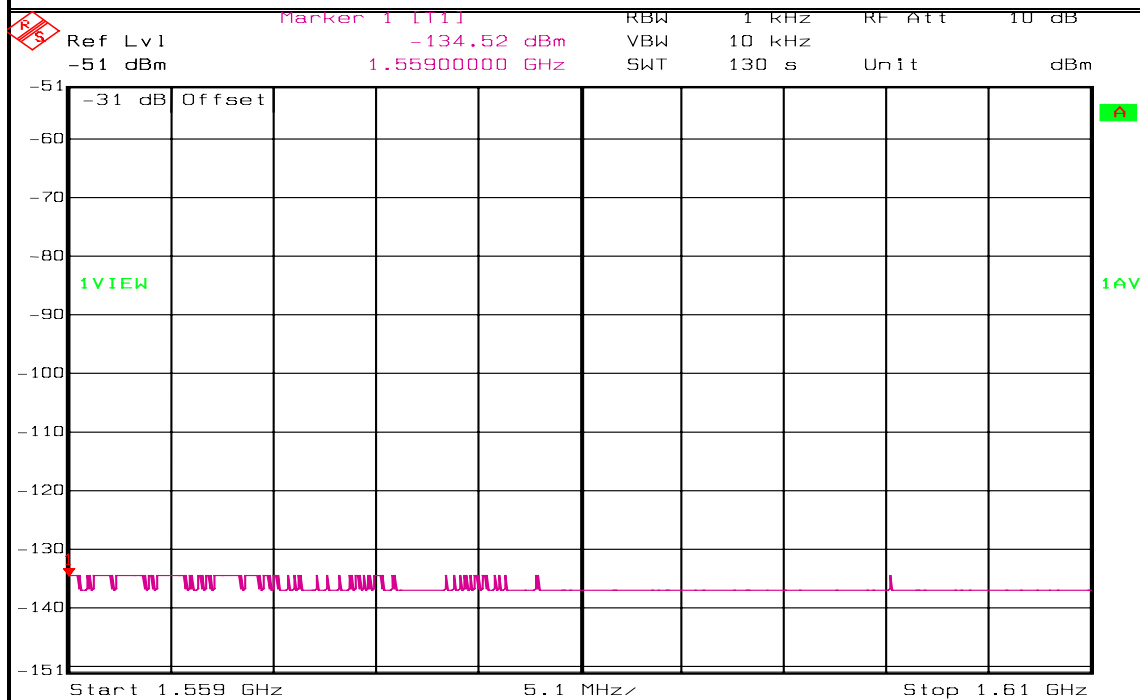
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Data Plot

SPURIOUS EMISSIONS

Page 2 of 4

Job No.: 5L0081R Date: 3/2/2005
Specification: 15.5090 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 700 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 16:14:55

Notes: 1559-1610 VERTICAL

EQUIPMENT: 222-654 Ground Penetrating Radar



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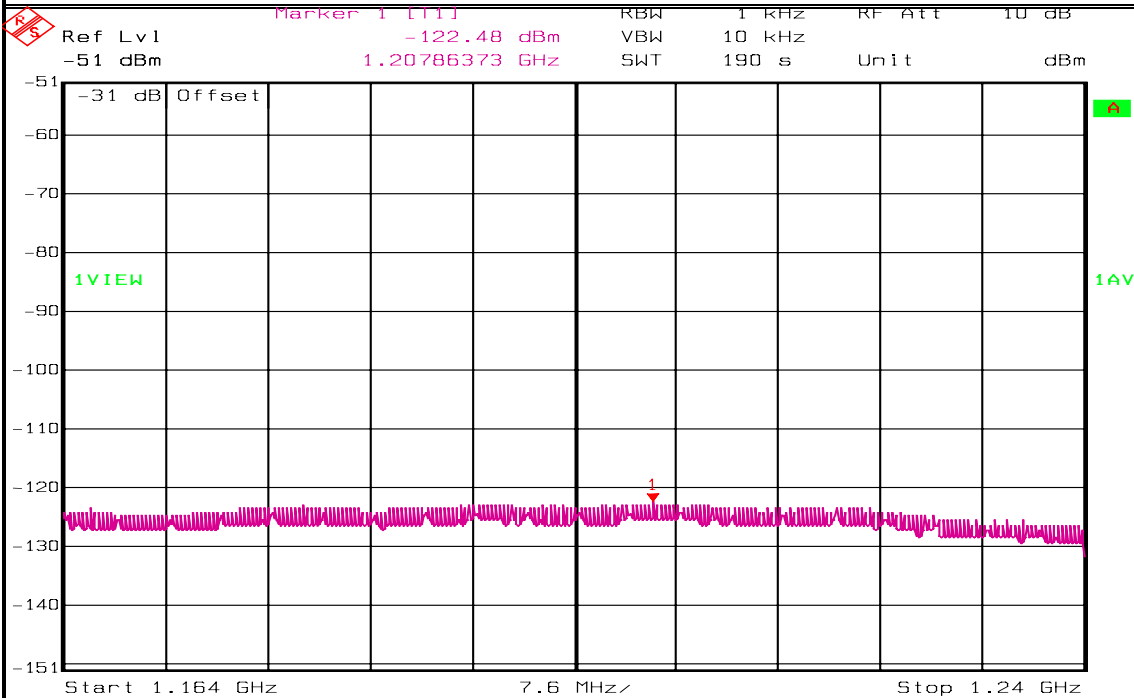
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Data Plot

SPURIOUS EMISSIONS

Page 3 of 4
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 700 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 16:07:02

Notes: 1164-1240 HORIZONTAL

EQUIPMENT: 222-654 Ground Penetrating Radar



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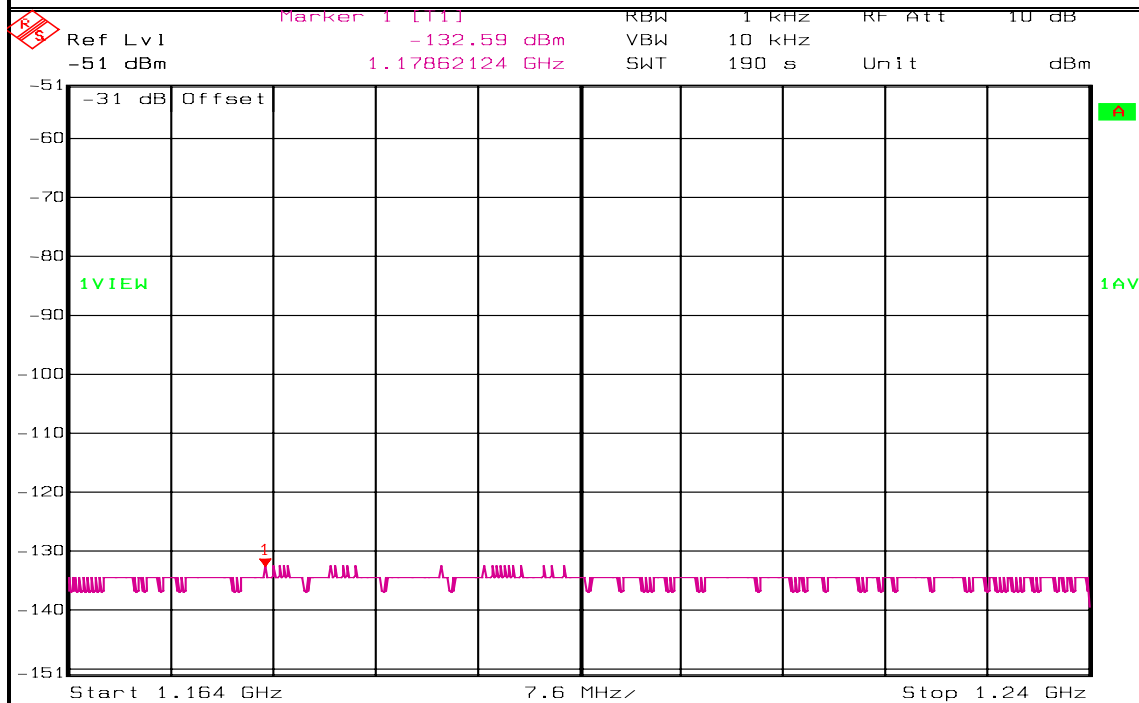
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Data Plot

SPURIOUS EMISSIONS

Page 4 of 4

Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 700 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 16:11:47

Notes: 1164-1240 VERITCAL

EQUIPMENT: 222-654 Ground Penetrating Radar



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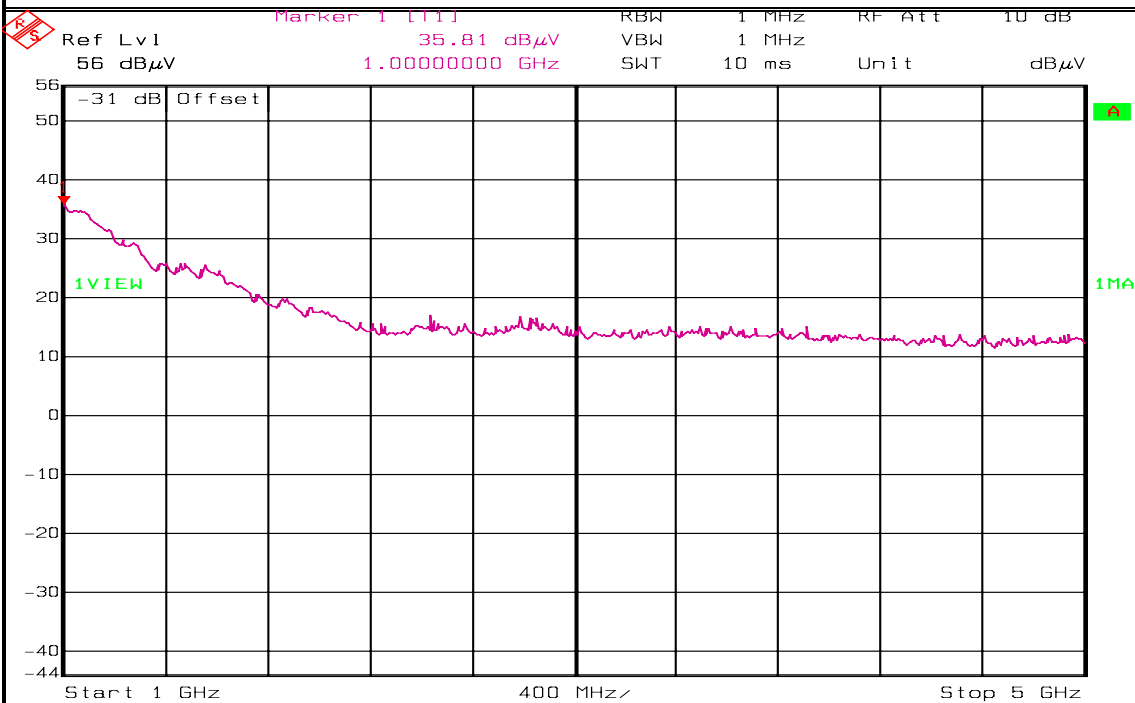
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Data Plot

SPURIOUS EMISSIONS

Page 5 of 4
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 700 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 13:57:20

Notes: HORIZONTAL

EQUIPMENT: 222-654 Ground Penetrating Radar



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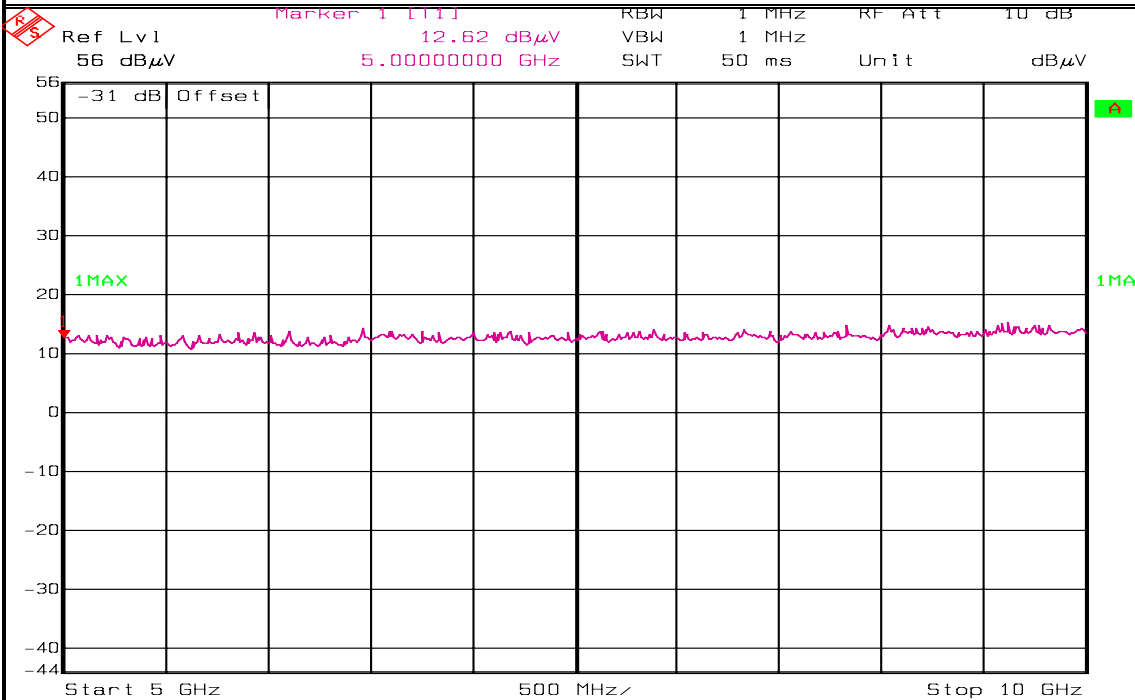
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Data Plot

SPURIOUS EMISSIONS

Page 6 of 4
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 700 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 13:59:23

Notes: HORIZONTAL

EQUIPMENT: 222-654 Ground Penetrating Radar



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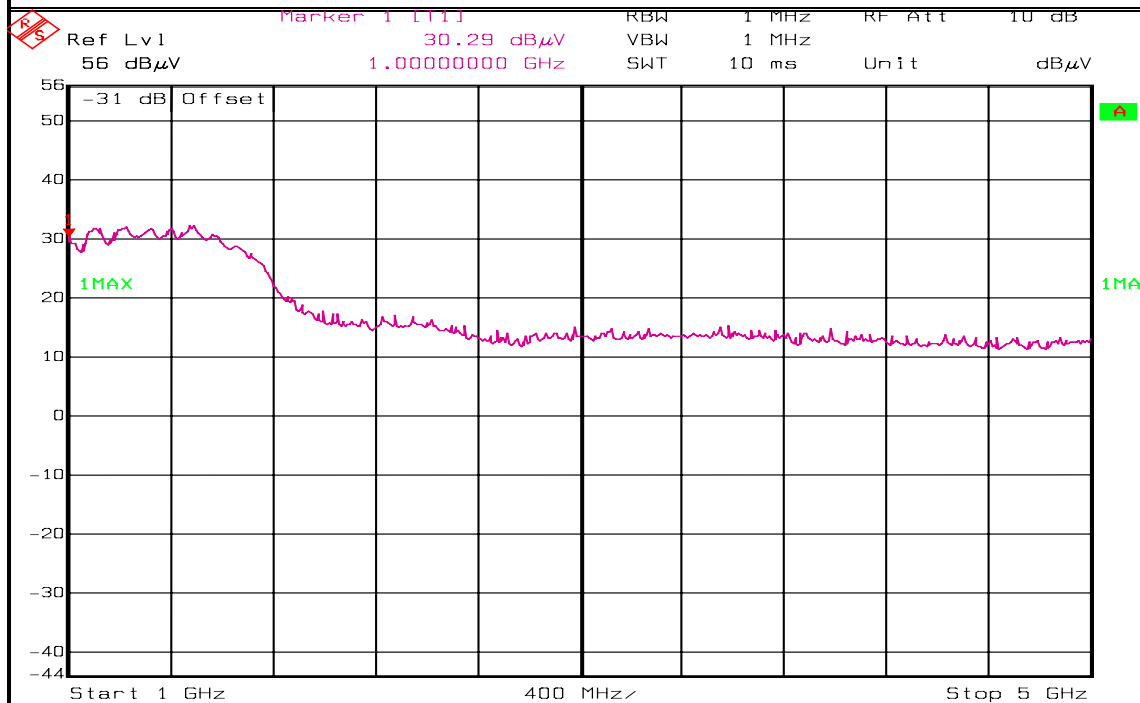
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Fax: (972) 436-2667

Data Plot

SPURIOUS EMISSIONS

Page 6 of 4
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 700 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 14:03:51

Notes: VERTICAL

EQUIPMENT: 222-654 Ground Penetrating Radar



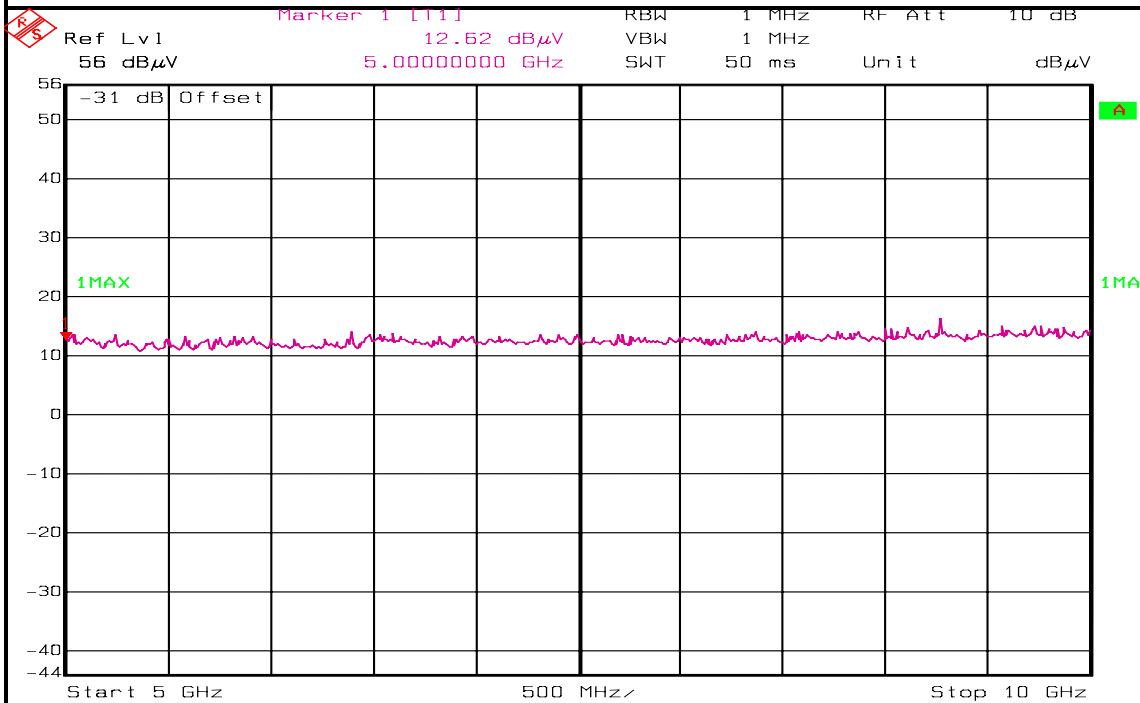
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Fax: (972) 436-2667

Data Plot

Page 6 of 4
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 700 mhz antenna
Configuration: Transmitting

SPURIOUS EMISSIONS



Date: 02.MAR.2005 14:05:15

Notes: VERTICAL

EQUIPMENT: 222-654 Ground Penetrating Radar

FCC CFR 47, Part 15, Subpart F, Sec. 15.509(d) - Limits for Frequency above 960 MHz

Frequency in MHz	EIRP Limits in dBm @ 1 MHz BW	Alternative E-Field Limits in dBm @ 3m @ 1 MHz BW
960-1610	-65.3	29.9
1610-1990	-53.3	41.9
Above 1990	-51.3	43.9

EQUIPMENT: 222-654 Ground Penetrating Radar



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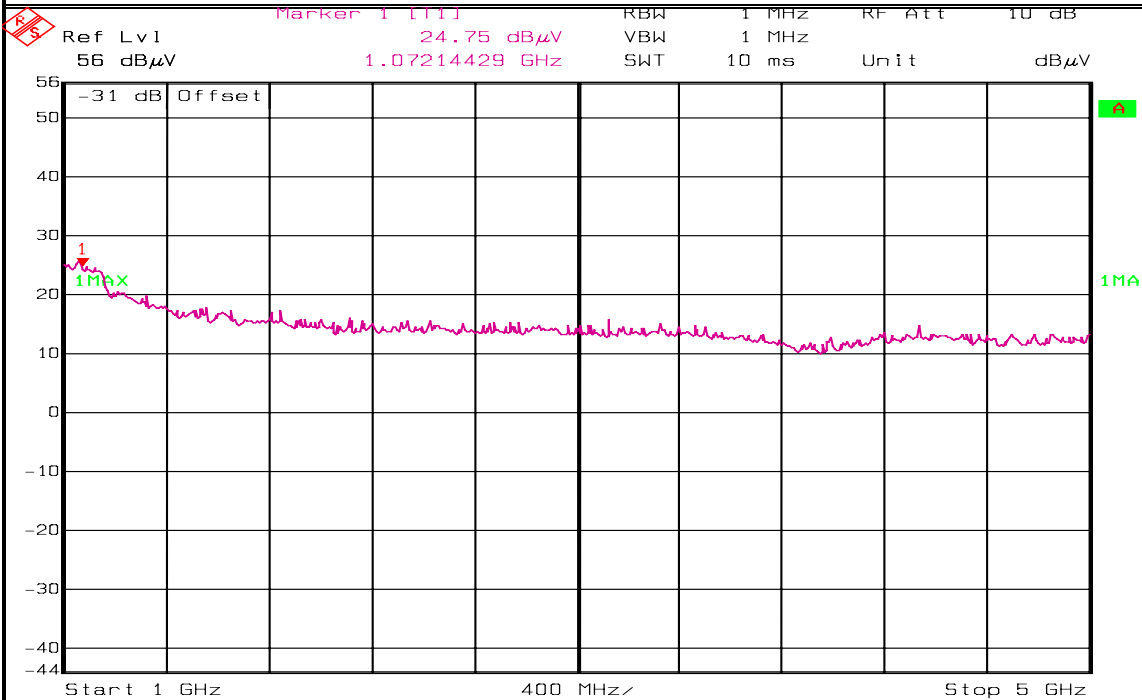
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Data Plot

SPURIOUS EMISSIONS

Page 5 of 8
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 250 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 14:34:16

Notes: HORIZONTAL

EQUIPMENT: 222-654 Ground Penetrating Radar



Nemko Dallas, Inc.

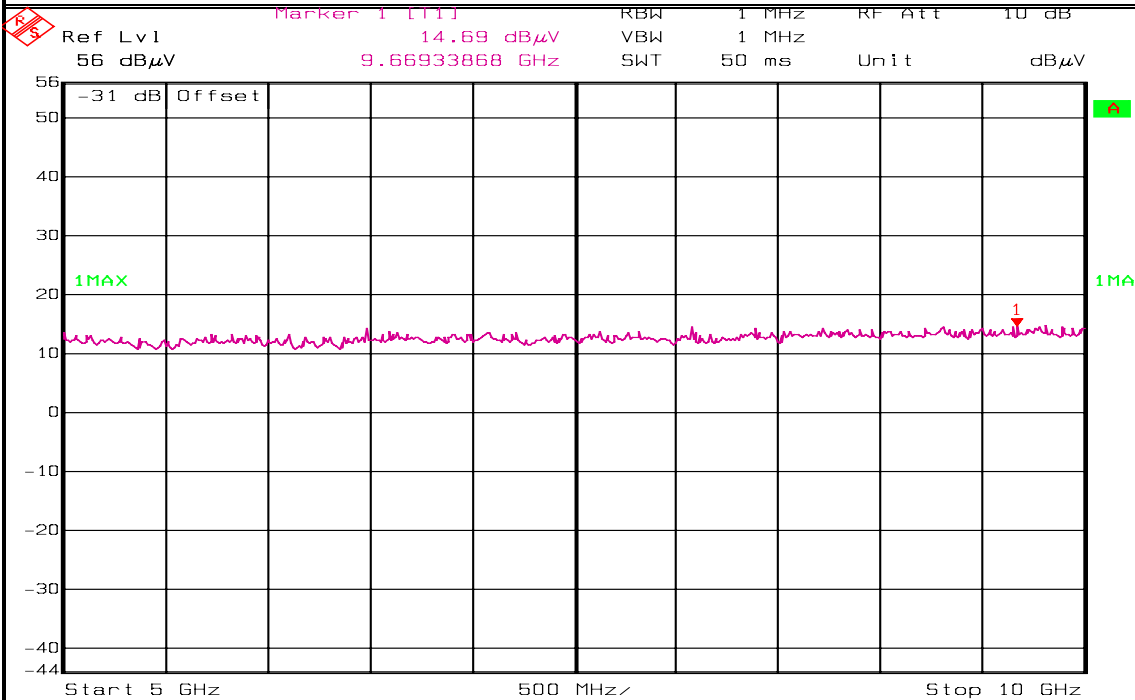
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Data Plot

SPURIOUS EMISSIONS

Page 6 of 8
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 250 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 14:32:56

Notes: HORIZONTAL

EQUIPMENT: 222-654 Ground Penetrating Radar



Nemko Dallas, Inc.

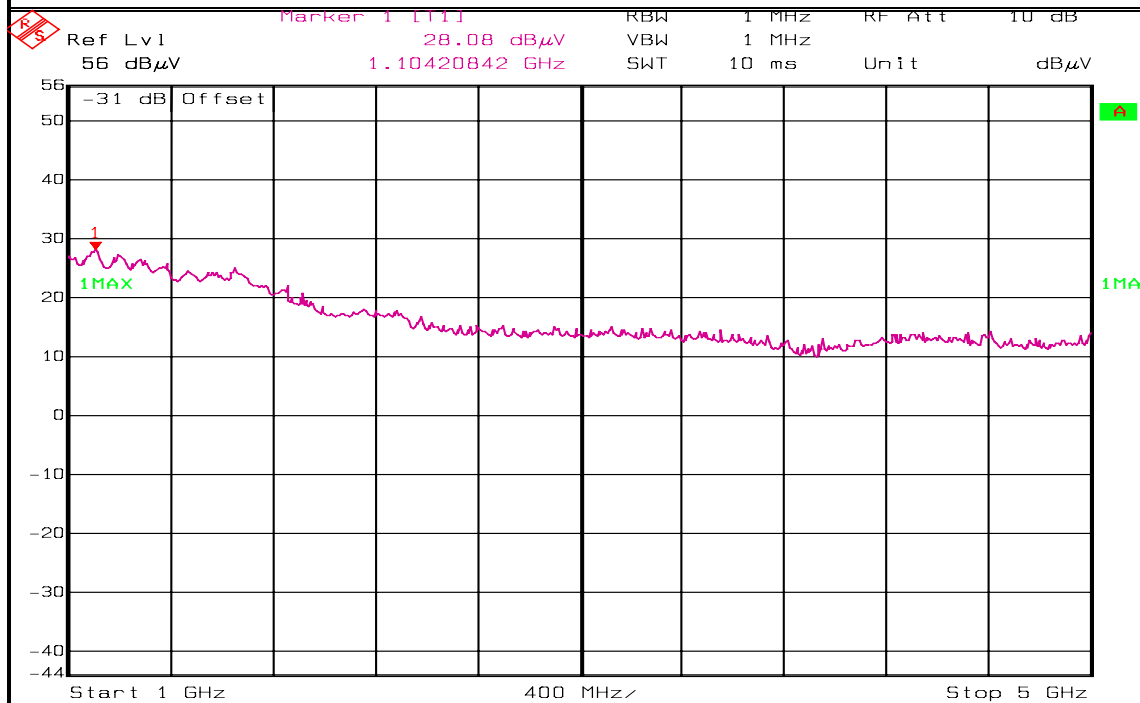
Dallas Headquarters:

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Data Plot

SPURIOUS EMISSIONS

Page 6 of 8
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 250 mhz antenna
Configuration: Transmitting



Date: 02.MAR.2005 14:29:35

Notes: VERTICAL

EQUIPMENT: 222-654 Ground Penetrating Radar



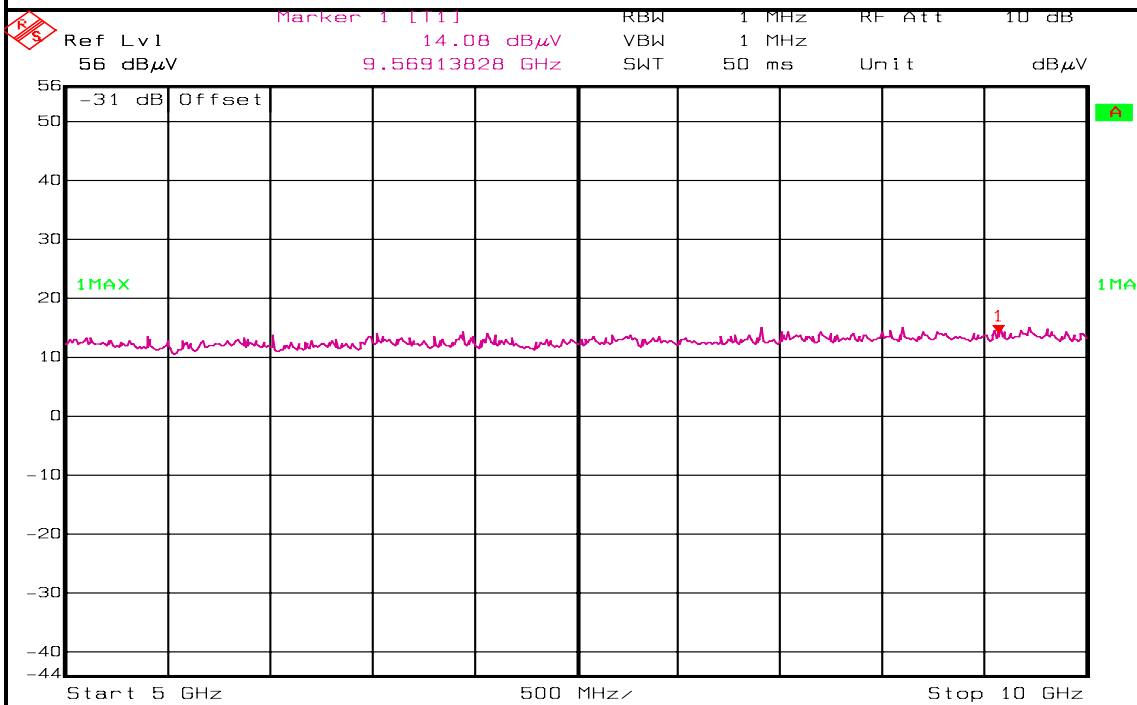
Nemko Dallas, Inc.

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Data Plot

Page 6 of 8
Job No.: 5L0081R Date: 3/2/2005
Specification: 15.509 Temperature(°C): 21
Tested By: Kevin Rose Relative Humidity(%) 42
E.U.T.: GPR 250 mhz antenna
Configuration: Transmitting

SPURIOUS EMISSIONS



Date: 02.MAR.2005 14:30:59

Notes: VERTICAL

EQUIPMENT: 222-654 Ground Penetrating Radar

Radiated Photographs (Worst Case Configuration)



*EQUIPMENT: 222-654 Ground Penetrating Radar***Section 7. Test Equipment List**

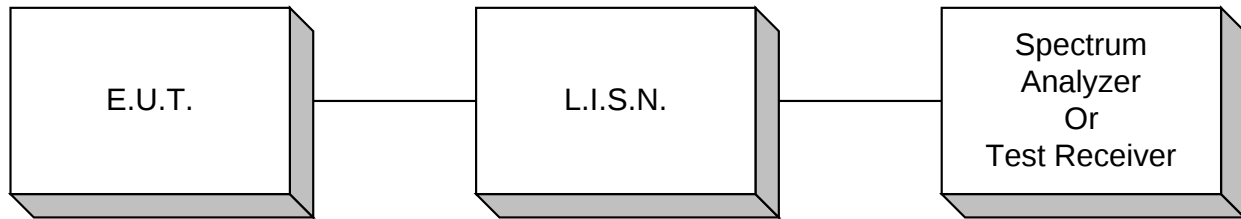
	Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1	1306	Antenna biconical	ICC BCON 30300	212	01/24/05	01/24/06
2	1311	ANTENNA, LOG PERIODIC	EMCO 3146	1753	06/04/04	06/04/05
4	1025	PREAMP, 25dB	ICC LNA25	399	06/09/04	06/09/05
5	1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
6	1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/04	11/12/05
7	1025	PREAMP, 25dB	ICC LNA25	399	06/09/04	06/09/05
8	1522	Cable Assy, LAB 5 - D OATS	KTL Site D OATS	N/A	03/11/04	03/11/05
9	1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/04	08/26/05
10	1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/02/04	08/02/05
11	1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	03/22/04	03/23/06
12	765	RECEIVER (20-1000 MHz)	ROHDE & SCHWARZ ESVS 30	843710/0001	03/04/05	03/04/06

ANNEX A

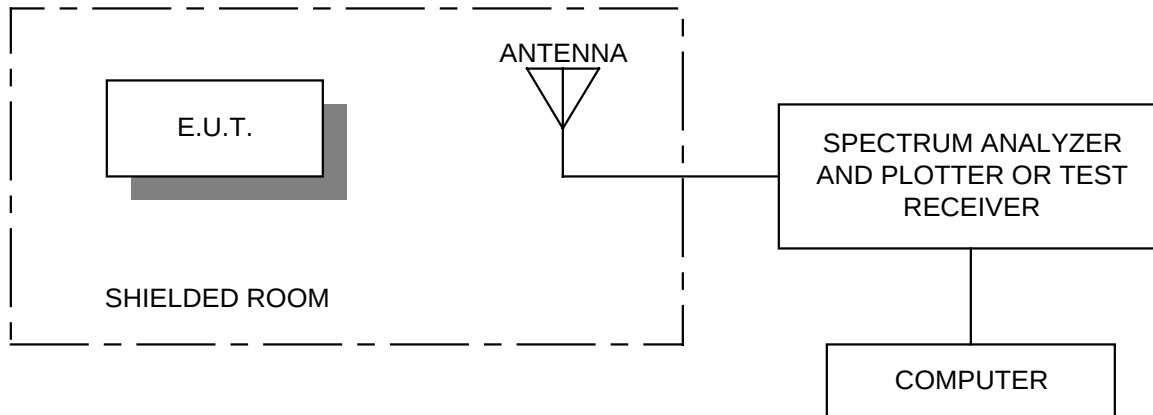
TEST DIAGRAMS

EQUIPMENT: 222-654 Ground Penetrating Radar

Conducted Emissions



Radiated Prescan



EQUIPMENT: 222-654 Ground Penetrating Radar

Test Site For Radiated Emissions

