



1250 Peterson Dr., Wheeling, IL 60090

Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

FCC Rules and Regulations / Intentional Radiators

Operational in the Band 13.553-13.567 MHz

Part 15, Subpart C, Section 15.225

THE FOLLOWING "**MEETS**" THE ABOVE TEST SPECIFICATION

Formal Name: RFID Reader System

Kind of Equipment: RFID Enabled Industrial Controller

Test Configuration: Unit is designed to operate in a table or work station mounted configuration.
No External Device (Internal). (Tested at 120 vac, 60 Hz)

Model Number(s): A1479

Model(s) Tested: A1479

Serial Number(s): N/A

Date of Tests: April 23 & 30 and May 1 & 4, 2007

Test Conducted For: Northern Apex Corporation
14220 Plank Street
Fort Wayne, Indiana 46818

NOTICE: "This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government". Please see the "Additional Description of Equipment Under Test" page listed inside of this report.

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SIGNATURE PAGE

Report By:

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Test Engineer
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William Stumpf
OATS Manager

Approved By:

Brian Mattson
General Manager

Company Official:

Northern Apex Corporation



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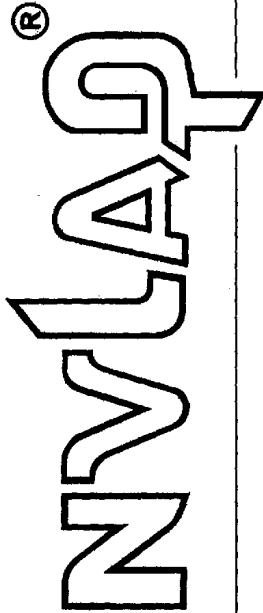
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United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communiqué dated 18 June 2005).*

2006-10-01 through 2007-09-30
Effective dates



Dolly A. Bruce
For the National Institute of Standards and Technology

NVLAP-01C (REV. 2006-09-13)



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1.0 SUMMARY OF TEST REPORT

It was found that the RFID Reader System, Model Number(s) A1479, "**meets**" the radio interference conducted and radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.225 for operational in the 13.553-13.567 MHz Band.

2.0 INTRODUCTION

On April 23 & 30 and May 1 & 4, 2007, a series of radio frequency interference measurements was performed on RFID Reader System, Model Number(s) A1479, Serial Number: N/A. The tests were performed according to the procedures of the FCC as stated in the "Methods of Measurement of Radio-Noise Emissions for Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" found in the American National Standards Institute, ANSI C63.4-2003. Tests were performed by personnel of D.L.S. Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

D.L.S. Electronic Systems, Inc. is a full service EMC/Safety Testing Laboratory accredited to ISO 17025. NVLAP Certificate and Scope can be viewed at <http://www.dlsemc.com/certificate>. Our facilities are registered with the FCC, Industry Canada, and VCCI.

3.0 OBJECT

The purpose of this series of tests was to determine if the test sample could meet the radio frequency interference emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Sections 15.209 & 15.225 for Intentional Radiators operating in the Band 13.553-13.567 MHz.



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4.0 TEST SET-UP

All emission tests were performed at D.L.S. Electronic Systems, Inc. and set up according to the American National Standards Institute, ANSI C63.4-2003, Section 8, (Figures 11a and 11b).

All emissions tests were performed with the test item placed on a 80 cm high rotating non-conductive table, located in the test room. Equipment normally operated on the floor was placed on a metal covered turntable which is flush with the surrounding conducting ground plane. The ground plane has an electrical isolation layer over its surface approximately 7 mm thick. The EUT is separated from the turntable ground plane by a non-conductive layer. The equipment under test was set up according to ANSI C63.4-2003, Sections 6, 7 and 8.

5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All preliminary data below 1000 MHz was automatically plotted using the HP Spectrum Analyzer or ESI 26/40 Fixed Tuned Receiver. The data was taken using Peak, Quasi-Peak or the Average Detector Functions as required. This information was then used to determine the frequencies of maximum emissions. Above 1000 MHz, final data was taken using the Average Detector.

Below 1000 MHz, final data was taken using the HP Spectrum Analyzer and/or ESI 26/40 Fixed Tuned Receiver. These plots were made using the Peak or Quasi-Peak Detector functions, with manual measurements performed on the questionable frequencies using the Quasi-Peak or the Average Detector Function of the Analyzer or ESI 26/40 Fixed Tuned Receiver as required. Above 1000 MHz, final data was taken using the Average Detector on the Spectrum Analyzer.

The bandwidths shown below are specified by ANSI C63.4-2003, Section 4.2.

Frequency Range	Bandwidth (-6 dB)
10 to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz

A list of the equipment used can be found in Table 1. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.



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6.0 AMBIENT MEASUREMENTS

For emissions measurements, broadband antennas and an EMI Test Receiver with a panoramic spectrum display are used. First the frequency range is scanned and displayed on the test receiver display. Next the scanned frequency range is divided into smaller ranges, and then it is manually tuned through to determine the emissions from the EUT. A headset or loudspeaker is connected to the test receiver's AM/FM demodulated output as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT. If there is any doubt as to the source of the emission, it is further investigated by rotating the EUT, or by disconnecting the power from the EUT.

The EUT is set up in its typical configuration and operated in its various modes. For tabletop systems, cables are manipulated within the range of likely configurations. For floor-standing equipment, the cables are located in the same manner as the user would install them and no further manipulation is made. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions. For each mode of operation, the frequency spectrum is monitored. Variations in antenna height, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) are explored to produce the emissions that have the highest amplitude relative to the limit. These methods are performed to the specifications in MP-5 or ANSI C63.4-2003, as appropriate.



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7.0 DESCRIPTION OF TEST SAMPLE: (See also Paragraph 8.0)

7.1 Description:

The unit is an embedded microcontroller based calculation and control system. It incorporates the ability to read a 13.56 MHz RFID enabled product along with the ability to process a calculation or algorithm related to that RFID device and print the output to a 3" thermal printer. The operator interfaces with the system via a touch screen enabled LCD screen.

7.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST

Length: x Width: x Height: 10.4" x 5.9" x 9.7"

7.3 LINE FILTER USED:

Interpower - 83511430

7.4 INTERNAL CLOCK FREQUENCIES:

Switching Power Supply Frequencies:

65 kHz

Clock Frequencies:

RFID = 13.56 MHz

Rabbit BL2500 = 29.4 MHz

7.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

- | | |
|---|-------------------------|
| 1. Rabbit Semiconductor - Coyote BL2500 | PN: 20-101-0575 |
| 2. TagSys - RFID Module PO13 | PN: DDP11404B0 |
| 3. TDK Power - Backlight Inverter | PN: CXA-L0612A-VJL |
| 4. Reach Technology - Serial LCD Controller | PN: 42-0070 |
| 5. Reach Technology - PowerCom4 | PN: 42-0089 |
| 6. Fujitsu - Printer Interface Board | PN: FTP-629DSL181 |
| 7. System Interface Board | PN: Northern Apex A1479 |

8.0 ADDITIONAL DESCRIPTION OF TEST SAMPLE:
(See also Paragraph 7.0)

1: Fixed ribbon cable to right side of interior housing.

NOTE:

- 1) Transmit, receive, and standby modes were used as appropriate for the standard/test.
- 2) For AC Line Conducted emissions, the Transmitter antenna was disconnected and a 50 Ohm load put in its place.

I certify that the above, as described in paragraph 7.0, describes the equipment tested and will be manufactured as stated.

By: _____
Signature Title

For: _____
Company Date



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9.0 PHOTO INFORMATION AND TEST SET-UP

Item 0 RFID Reader System

Model Number: A1479 Serial Number: N/A

Item 1 Shielded AC Power Cord.



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10.0 RADIATED PHOTOS TAKEN DURING TESTING





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10.0 RADIATED PHOTOS TAKEN DURING TESTING (CON'T)





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10.0 CONDUCTED PHOTOS TAKEN DURING TESTING





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11.0 RESULTS OF TESTS

The radio interference emission charts can be seen on the pages at the end of this report. Data sheets indicating the test measurements taken during testing can also be found at the end of this report.

12.0 CONCLUSION

It was found that the RFID Reader System, Model Number(s) A1479 "**meets**" the radio interference conducted and radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.225 for operational in the 13.553-13.567 MHz Band.



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TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 26	837491/010	20 Hz – 26 GHz	11/07
Receiver	Rohde & Schwarz	ESI 40	837808/006	20 Hz – 40 GHz	12/07
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	12/07
Antenna	EMCO	3104C	00054891	20 MHz – 200 MHz	2/08
Antenna	Electrometrics	LPA-25	1114	200 MHz – 1 GHz	3/08
Antenna	EMCO	3104C	00054892	20 MHz – 200 MHz	3/08
Antenna	Electrometrics	3146	1205	200 MHz – 1 GHz	3/08
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	2/08
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	3/08
Antenna	Rohde & Schwarz	HUF-Z1	829381001	20 MHz – 1 GHz	2/08
Antenna	Rohde & Schwarz	HUF-Z1	829381005	20 MHz – 1 GHz	8/07
Horn Antenna	EMCO	3115	4451	1 GHz – 18 GHz	8/07
Horn Antenna	EMCO	3115	99035731	1 GHz – 18 GHz	4/08
Horn Antenna	EMCO	3115	6204	1 GHz – 18 GHz	5/08
Horn Antenna	COM POWER	AH 118	071127	1 GHz – 18 GHz	5/08

All primary equipment is calibrated against known reference standards with a verified traceable path to NIST.



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TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Horn Antenna	EMCO	3116	2549	18 GHz – 40 GHz	5/08
Horn Antenna	ETS Lindgren	3116	00062917	18 GHz – 40 GHz	10/07
Horn Antenna	A.H. Systems	SAS-574	221	18 GHz – 40 GHz	4/08
Horn Antenna	A.H. Systems	SAS-574	222	18 GHz – 40 GHz	4/08
LISN	Solar	8012-50-R-24-BNC	8305116	10 MHz – 30 MHz	8/07
LISN	Solar	8012-50-R-24-BNC	814548	10 MHz – 30 MHz	8/07
LISN	Solar	9252-50-R-24-BNC	961019	10 MHz – 30 MHz	12/07
LISN	Solar	9252-50-R-24-BNC	971612	10 MHz – 30 MHz	10/07
LISN	Solar	9252-50-R-24-BNC	92710620	10 MHz – 30 MHz	7/07

All primary equipment is calibrated against known reference standards with a verified traceable path to NIST.



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APPENDIX A

TEST PROCEDURE

Part 15, Subpart C, Section 15.225a-e

OPERATION WITHIN THE BAND 13.110-14.010 MHz



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APPENDIX A

1.0 CONDUCTED EMISSION MEASUREMENTS

The conducted emissions were measured over the frequency range from 150 kHz to 30 MHz in accordance with the power line measurements, as specified in ANSI C63.4-2003. Since the device is operated from the public utility lines, the 120 Vac, 60 Hz power leads, high and low sides were measured by connecting the measuring equipment to the appropriate meter terminal of the LISN. All signals were then recorded. The allowed levels for Intentional Radiators cannot exceed 250 uV (47.96 dBuV) at any frequency between 150 kHz and 30 MHz, as stated in Section 15.207a.



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CONDUCTED DATA AND GRAPHS

TAKEN DURING TESTING

PART 15.207

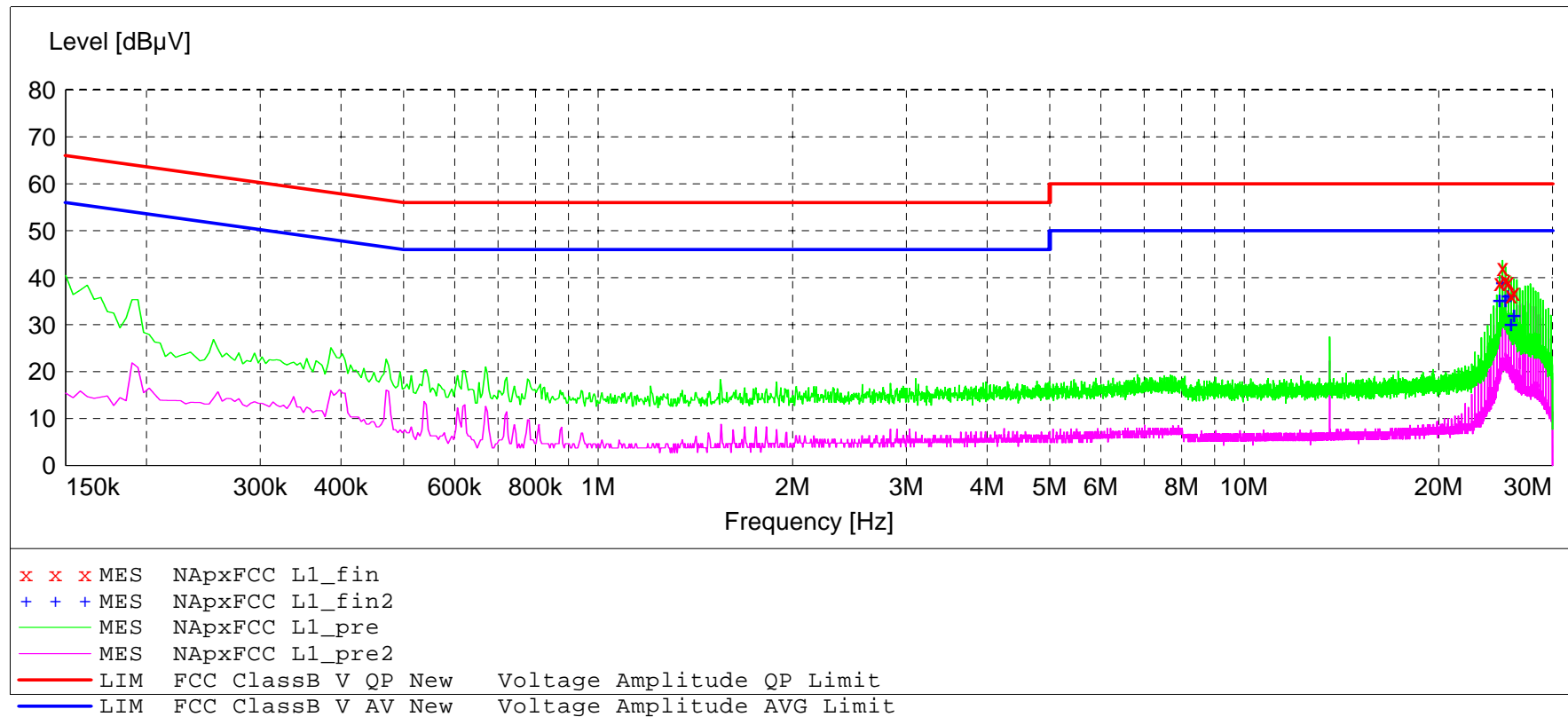
FCC Part 15 Class B

Voltage Mains Test - Line 1

EUT: Laboratory Water Filter Reader
Manufacturer: Northern Apex
Operating Condition: 69 deg. F, 38% R.H.
Test Site: DLS O.F. Site 1 (Screenroom)
Operator: Bill S
Test Specification: 120Vac @ 60Hz
Comment: RF output terminated @ 50 Ohms
Date: 04-30-2007

SCAN TABLE: "Line Cond Scrn RmFin"

Short Description:		Line Conducted Emissions				
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Width				
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak	2.0 s	9 kHz	LISN DLS#128
			CISPR AV			



MEASUREMENT RESULT: "NAPxFCC L1_fin"

5/1/2007 8:01AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
24.850000	39.00	11.7	60	21.0	QP	---	---
25.110000	42.20	11.7	60	17.8	QP	---	---
25.374000	39.60	11.7	60	20.4	QP	---	---
25.634000	39.20	11.8	60	20.8	QP	---	---
25.898000	36.30	11.8	60	23.7	QP	---	---
26.158000	37.00	11.8	60	23.0	QP	---	---

MEASUREMENT RESULT: "NAPxFCC L1_fin2"

5/1/2007 8:01AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
24.850000	35.30	11.7	50	14.7	CAV	---	---
25.110000	39.10	11.7	50	10.9	CAV	---	---
25.374000	35.50	11.7	50	14.5	CAV	---	---
25.634000	36.40	11.8	50	13.6	CAV	---	---
25.898000	30.40	11.8	50	19.6	CAV	---	---
26.158000	32.20	11.8	50	17.8	CAV	---	---

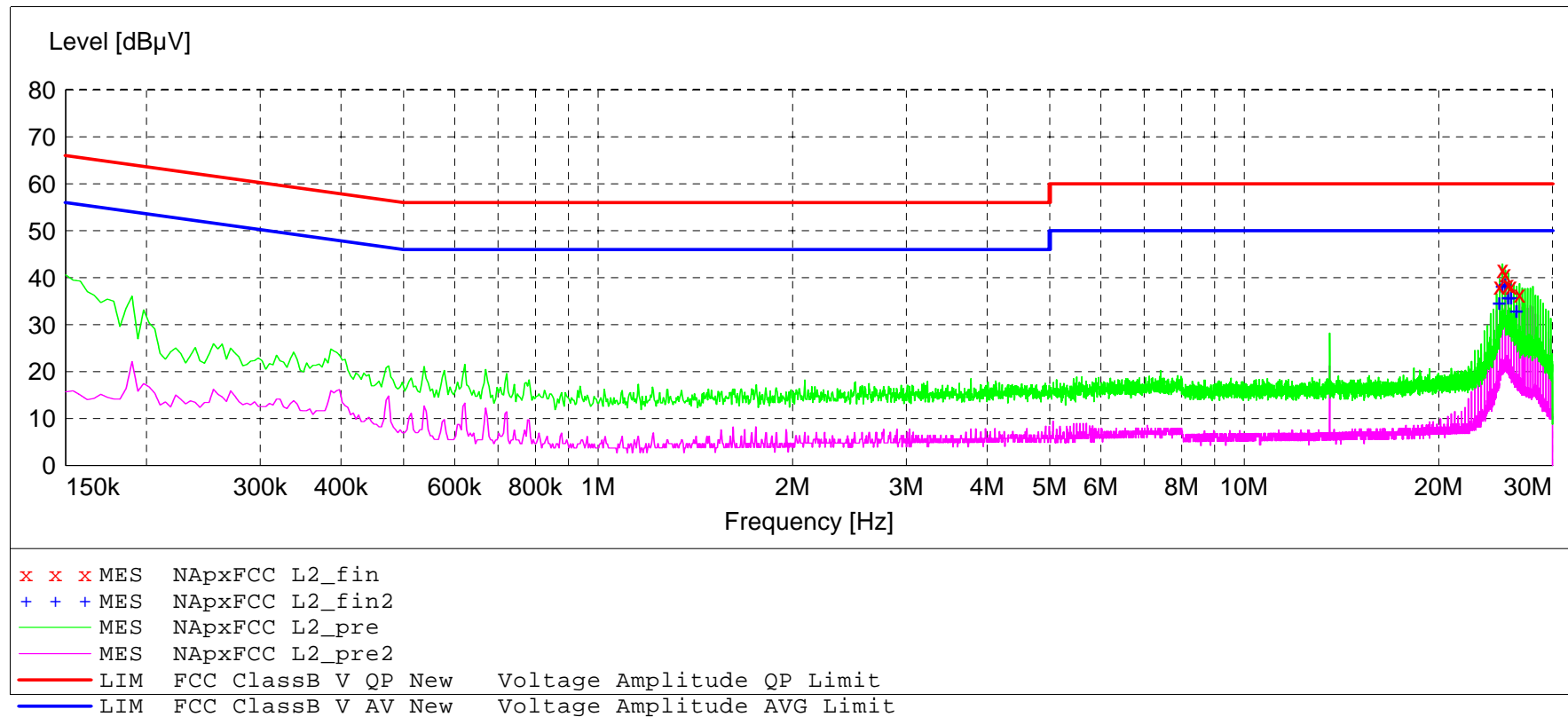
FCC Part 15 Class B

Voltage Mains Test - Line 2

EUT: Laboratory Water Filter Reader
Manufacturer: Northern Apex
Operating Condition: 69 deg. F, 38% R.H.
Test Site: DLS O.F. Site 1 (Screenroom)
Operator: Bill S
Test Specification: 120Vac @ 60Hz
Comment: RF output terminated @ 50 Ohms
Date: 04-30-2007

SCAN TABLE: "Line Cond Scrn RmFin"

Short Description:		Line Conducted Emissions				
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Width				
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak	2.0 s	9 kHz	LISN DLS#128
			CISPR AV			



MEASUREMENT RESULT: "NApxFCC L2_fin"

5/1/2007 8:06AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
24.838000	38.30	11.7	60	21.7	QP	---	---
25.098000	41.80	11.7	60	18.2	QP	---	---
25.358000	40.90	11.7	60	19.1	QP	---	---
25.622000	38.70	11.8	60	21.3	QP	---	---
25.882000	38.30	11.8	60	21.7	QP	---	---
26.666000	36.50	11.9	60	23.5	QP	---	---

MEASUREMENT RESULT: "NApxFCC L2_fin2"

5/1/2007 8:06AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
24.838000	34.90	11.7	50	15.1	CAV	---	---
25.098000	38.50	11.7	50	11.5	CAV	---	---
25.358000	38.80	11.7	50	11.2	CAV	---	---
25.622000	35.90	11.8	50	14.1	CAV	---	---
25.882000	35.90	11.8	50	14.1	CAV	---	---
26.406000	33.20	11.9	50	16.8	CAV	---	---



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APPENDIX A

2.0 BAND EDGE AND RESTRICTED BAND COMPLIANCE

The field strength of any emissions appearing outside the 13.110 MHz - 14.010 MHz band shall not exceed the general radiated emissions limits as stated Section 15.209. The fundamental from the RFID Reader System transmitter shall not be inside the restricted band 13.36 to 13.41 MHz.

NOTE: See the following page (s) for the graph (s) made showing compliance for Band Edge and Restricted Band:



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GRAPH (s) TAKEN SHOWING THE BAND EDGE COMPLIANCE

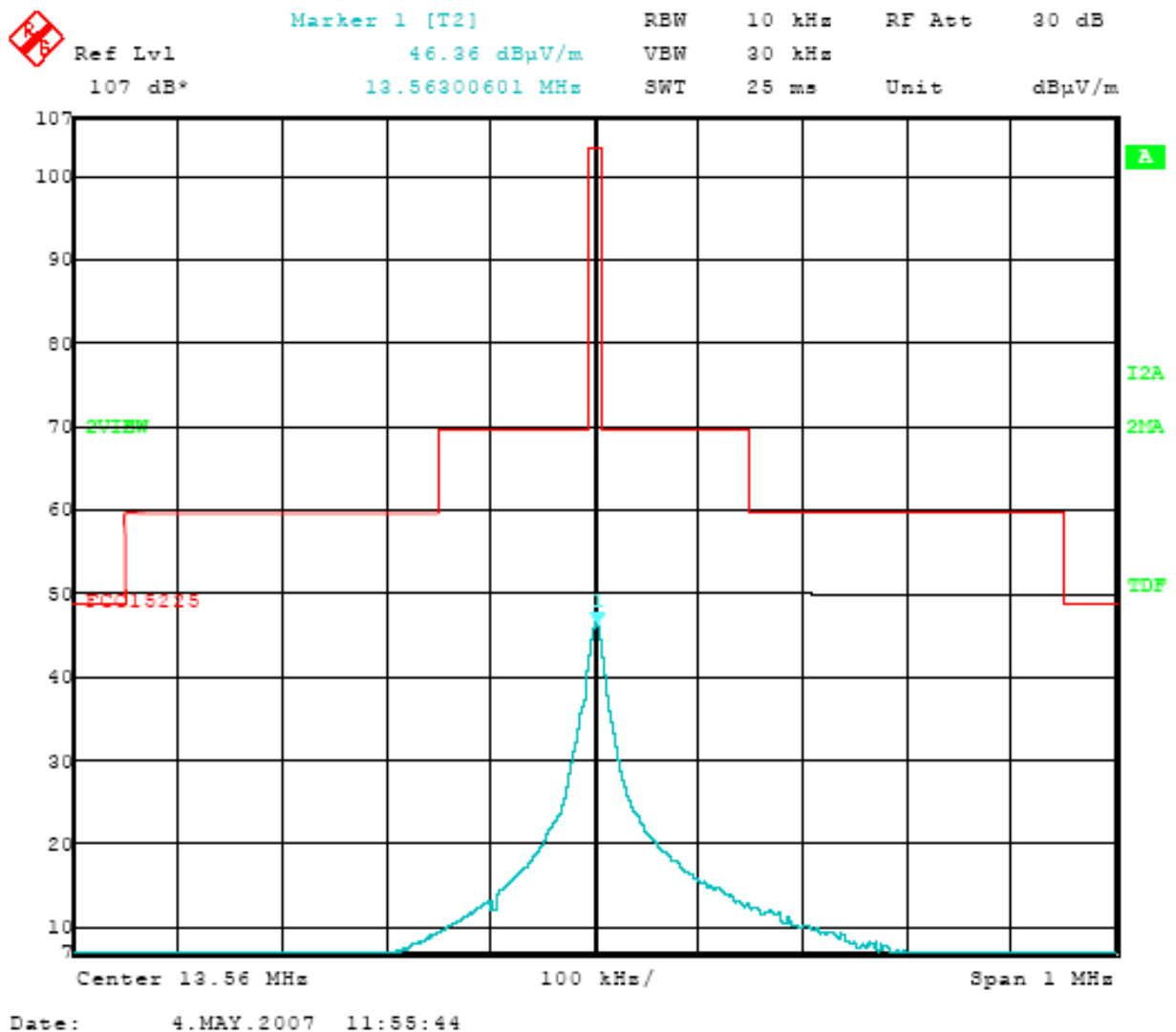
PART 15.225 (b)



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Test Date: 05-04-2007
Company: Northern Apex
EUT: Laboratory Water Filter Reader
Test: Emission Mask
Operator: Jason Lauer
Comment: Frequency – 13.56 MHz





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GRAPH (s) TAKEN SHOWING THE RESTRICTED BAND COMPLIANCE

PART 15.225 (b)

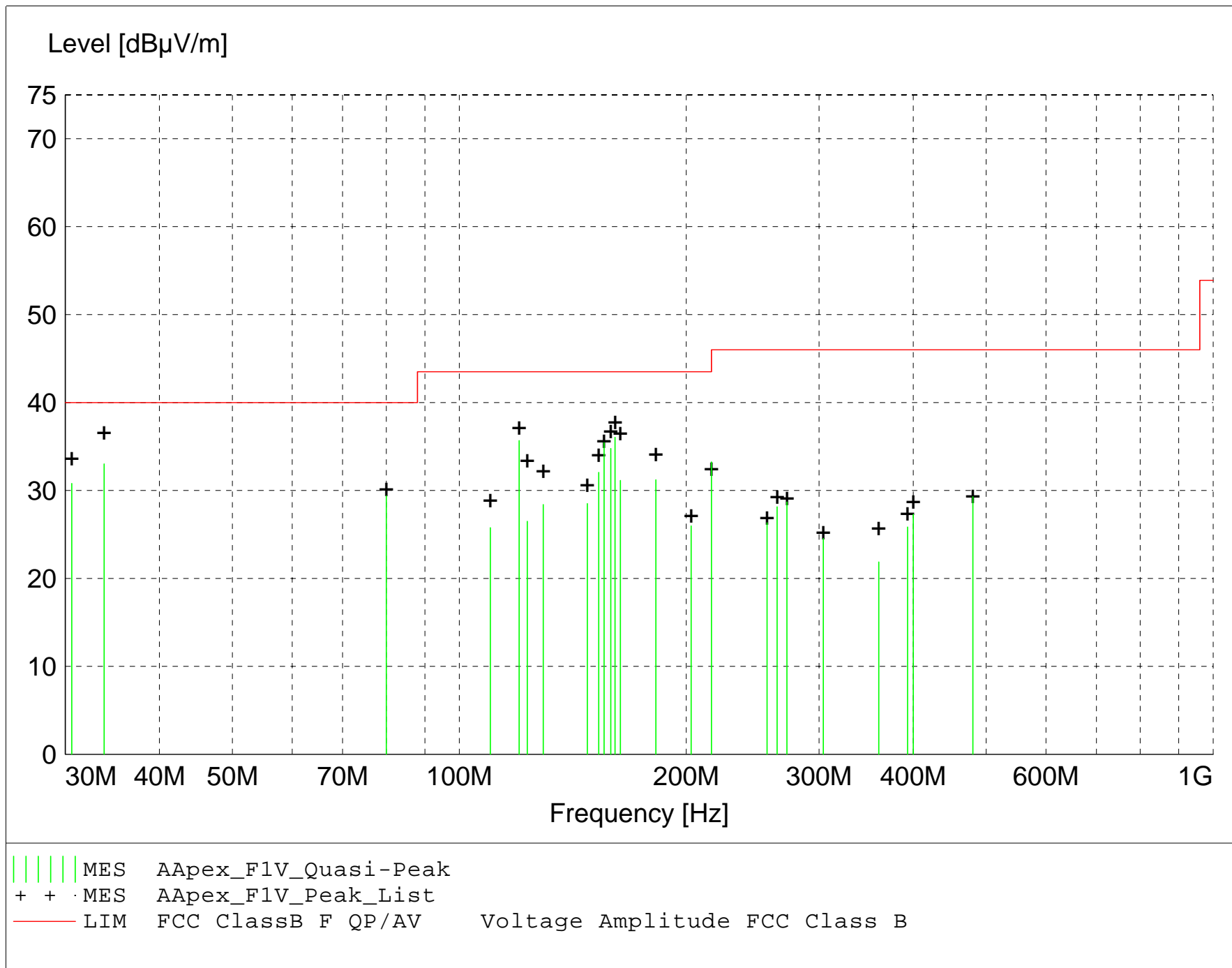
FCC Part 15 Class B

Electric Field Strength

EUT: Laboratory Water Filter Reader
Manufacturer: Northern Apex
Operating Condition: 70 degF; 31% R.H.
Test Site: D.L.S. O.F. Site 2
Operator: Tim O
Test Specification: 120Vac @ 60Hz
Comment:
Date: 04/23/2007

TEXT: "Site 2 MidV 3M"

Short Description: Test Set-up Vert30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 26 SN: 837460/002
Antennas ---
Biconical -- EMCO 3104C SN: 0005-4892
Log Periodic -- Electro Metrics LPA-25 SN: 1205
Pre-Amp --- Rohde&Schwarz TS-PR10 SN: 032001/004
TEST SET-UP: EUT Measured at 3 Meters with VERTICAL Antenna Polarization



MEASUREMENT RESULT: "Aapex_FlV_Final"

4/23/2007 2:07PM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBμV	Factor	Loss	Level			Ant.	Angle	Detector	
		dBμV/m	dB	dBμV/m	dBμV/m	dB	m	deg		
33.780000	46.76	10.81	-24.6	33.0	40.0	7.0	1.00	330	QUASI-PEAK	None
160.900000	46.77	12.60	-23.3	36.0	43.5	7.5	1.00	245	QUASI-PEAK	None
120.020000	46.85	12.19	-23.4	35.7	43.5	7.8	1.00	225	QUASI-PEAK	None
155.620000	46.72	12.07	-23.4	35.4	43.5	8.1	1.00	240	QUASI-PEAK	None
158.800000	45.75	12.37	-23.3	34.8	43.5	8.7	1.00	230	QUASI-PEAK	None
30.600000	45.16	10.19	-24.5	30.8	40.0	9.2	1.00	300	QUASI-PEAK	None
79.980000	46.58	6.53	-23.7	29.4	40.0	10.6	1.00	5	QUASI-PEAK	None
153.040000	43.19	12.21	-23.4	32.0	43.5	11.5	1.00	230	QUASI-PEAK	None
182.260000	37.94	16.27	-23.0	31.2	43.5	12.3	1.00	300	QUASI-PEAK	None
163.540000	41.62	12.82	-23.3	31.1	43.5	12.4	1.00	225	QUASI-PEAK	None
216.020000	44.97	11.02	-22.7	33.3	46.0	12.7	1.00	240	QUASI-PEAK	None
147.800000	39.07	12.78	-23.3	28.5	43.5	15.0	1.00	230	QUASI-PEAK	None
129.200000	40.24	11.40	-23.2	28.4	43.5	15.1	1.00	45	QUASI-PEAK	None
480.000000	33.46	16.95	-21.1	29.3	46.0	16.7	1.00	185	QUASI-PEAK	None
123.020000	37.79	12.03	-23.3	26.5	43.5	17.0	1.00	235	QUASI-PEAK	None
272.000000	38.34	12.75	-22.4	28.7	46.0	17.3	1.00	310	QUASI-PEAK	None
203.060000	37.63	11.14	-22.8	26.0	43.5	17.5	1.00	255	QUASI-PEAK	None
109.940000	37.02	12.24	-23.5	25.8	43.5	17.7	1.00	300	QUASI-PEAK	None
264.020000	38.42	12.16	-22.4	28.1	46.0	17.9	1.00	300	QUASI-PEAK	None
399.980000	33.24	15.50	-21.4	27.3	46.0	18.7	1.00	320	QUASI-PEAK	None
255.980000	36.80	11.92	-22.4	26.3	46.0	19.7	1.00	320	QUASI-PEAK	None
393.260000	31.96	15.37	-21.5	25.9	46.0	20.1	1.00	275	QUASI-PEAK	None
303.980000	31.24	15.42	-22.1	24.6	46.0	21.4	1.00	310	QUASI-PEAK	None
360.020000	28.78	14.64	-21.5	21.9	46.0	24.1	1.00	300	QUASI-PEAK	None

FCC Part 15 Class B

Electric Field Strength

EUT: Laboratory Water Filter Reader
Manufacturer: Northern Apex
Operating Condition: 70 degF; 31% R.H.
Test Site: D.L.S. O.F. Site 2
Operator: Tim O
Test Specification: 120Vac @ 60Hz
Comment:
Date: 04/23/2007

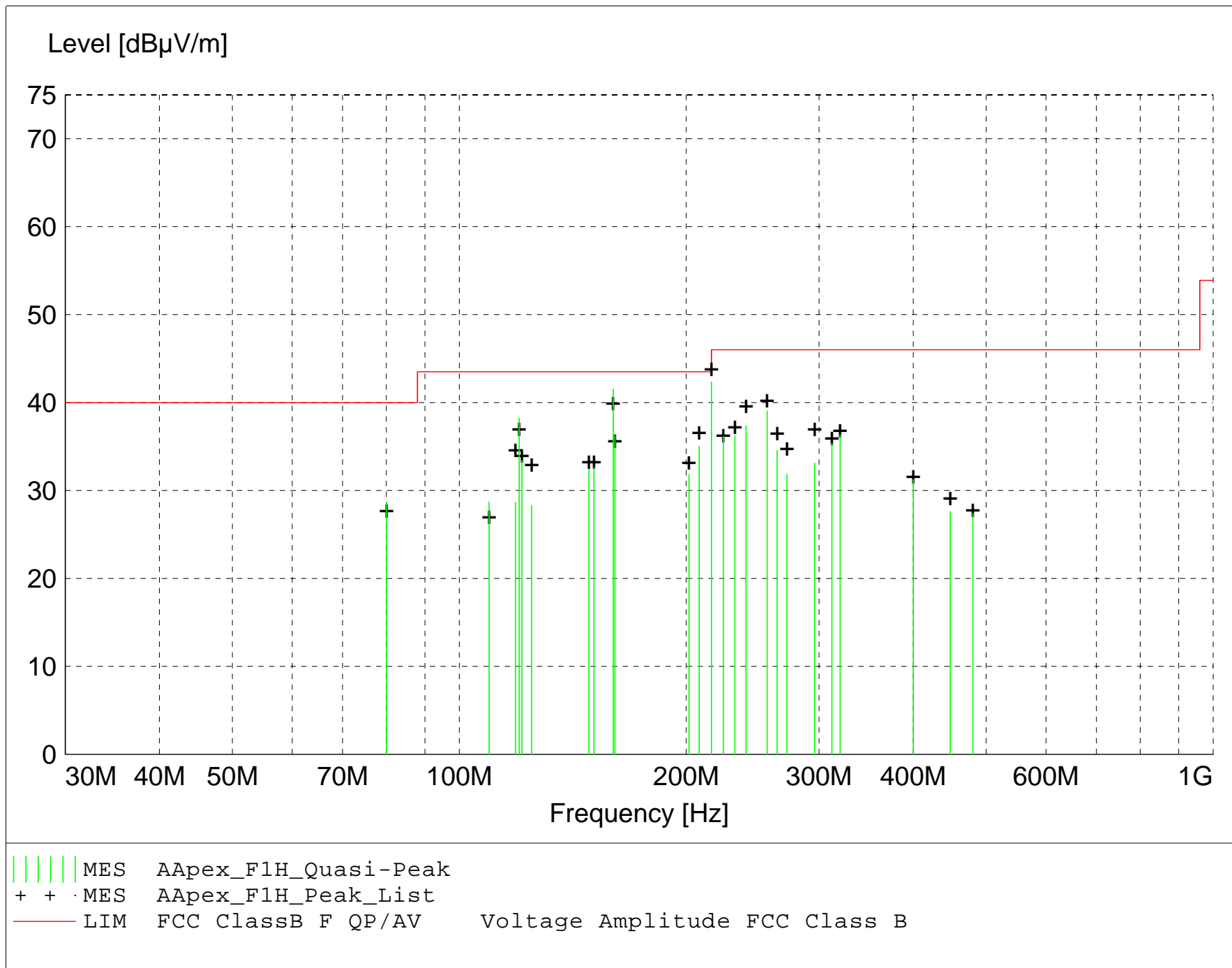
TEXT: "Site 2 MidH 3M"

Short Description: Test Set-up Horz30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 26 SN: 837460/002

Antennas ---
Biconical -- EMCO 3104C SN: 0005-4892
Log Periodic -- Electro Metrics LPA-25 SN: 1205

Pre-Amp --- Rohde&Schwarz TS-PR10 SN: 032001/004

TEST SET-UP: EUT Measured at 3 Meters with HORIZONTAL Antenna Polarization



MEASUREMENT RESULT: "Aapex_FlH_Final"

4/23/2007 2:18PM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBμV	Factor	Loss	Level	dBμV/m	dB	Ant.	Angle	Detector	
		dBμV/m	dB	dBμV/m	dBμV/m		m	deg		
160.000000	51.41	12.46	-23.3	40.5	43.5	3.0	1.50	240	QUASI-PEAK	None
216.020000	54.06	11.02	-22.7	42.4	46.0	3.6	2.00	225	QUASI-PEAK	None
120.020000	49.42	12.19	-23.4	38.3	43.5	5.3	2.50	95	QUASI-PEAK	None
256.040000	49.53	11.92	-22.4	39.1	46.0	6.9	2.00	325	QUASI-PEAK	None
160.780000	46.97	12.58	-23.3	36.2	43.5	7.3	1.00	225	QUASI-PEAK	None
207.980000	46.66	11.13	-22.8	35.0	43.5	8.5	1.50	110	QUASI-PEAK	None
240.020000	48.85	11.00	-22.5	37.4	46.0	8.6	1.50	185	QUASI-PEAK	None
320.000000	44.84	13.55	-22.1	36.3	46.0	9.7	1.00	170	QUASI-PEAK	None
231.980000	48.19	10.58	-22.5	36.2	46.0	9.8	1.50	185	QUASI-PEAK	None
224.000000	48.15	10.64	-22.6	36.2	46.0	9.8	1.00	190	QUASI-PEAK	None
121.040000	44.61	12.16	-23.4	33.4	43.5	10.1	2.00	265	QUASI-PEAK	None
312.020000	43.08	14.39	-22.1	35.4	46.0	10.6	1.00	180	QUASI-PEAK	None
150.880000	43.56	12.44	-23.4	32.6	43.5	10.9	2.00	225	QUASI-PEAK	None
148.520000	42.98	12.77	-23.3	32.4	43.5	11.1	2.00	225	QUASI-PEAK	None
80.040000	45.85	6.53	-23.7	28.7	40.0	11.3	1.00	300	QUASI-PEAK	None
264.020000	44.83	12.16	-22.4	34.6	46.0	11.4	1.50	5	QUASI-PEAK	None
201.680000	43.53	11.07	-22.8	31.8	43.5	11.7	1.50	120	QUASI-PEAK	None
296.000000	41.55	13.73	-22.2	33.1	46.0	12.9	2.00	35	QUASI-PEAK	None
272.000000	41.48	12.75	-22.4	31.8	46.0	14.2	1.00	110	QUASI-PEAK	None
399.980000	37.17	15.50	-21.4	31.2	46.0	14.8	2.50	0	QUASI-PEAK	None
109.520000	40.03	12.15	-23.5	28.7	43.5	14.8	1.50	45	QUASI-PEAK	None
118.700000	39.65	12.39	-23.4	28.7	43.5	14.9	1.50	220	QUASI-PEAK	None
124.700000	39.73	11.86	-23.3	28.3	43.5	15.2	2.00	50	QUASI-PEAK	None
448.020000	32.39	16.41	-21.2	27.6	46.0	18.4	2.50	5	QUASI-PEAK	None
480.000000	31.52	16.95	-21.1	27.3	46.0	18.7	3.00	5	QUASI-PEAK	None



1250 Peterson Dr., Wheeling, IL 60090

Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

APPENDIX A

3.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS (SECTION 15.225a & b)

The radiated measurements made at D.L.S. Electronic Systems, Inc., for the RFID Reader System, Model Number: A1479, are shown in tabulated and graph form. Preliminary radiation measurements were performed at a 3 meter test distance with the limits adjusted linearly when required. The frequency range from 9 kHz to over 960 MHz, depending upon the fundamental frequency as stated in Part 15.33a, was automatically scanned and plotted at various angles.

Measurements for the RFID Reader System were made up to 1000 MHz, in accordance with Section 15.33a for Intentional Radiators with a fundamental frequency of 13.56 MHz. For intentional radiators, the frequency range to be investigated is determined by the lowest radio frequency generated by the device without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or 1000 MHz, whichever is lower. At those frequencies where significant signals were detected, measurements were made at an open field test site, located at Genoa City, Wisconsin, FCC file number **31040/SIT**, to determine the actual radiation levels.

All signals in the frequency range of 9 kHz to 30 MHz were measured with a low frequency Loop Antenna as a pickup device. From 30 to 200 MHz, a Biconical Antenna or tuned dipoles were used and from 200 MHz to 1000 MHz, a Log Periodic or Tuned Dipoles were used. During the test the equipment was rotated and the antenna was raised and lowered from 1 meter to 4 meters to find the maximum level. In order to find maximum emissions, the cables were moved through all the positions the equipment would be expected to experience in the field. Tests were made in the vertical polarization with the Loop Antenna, rotated 360° around its vertical axis. Tests were also made in both the horizontal and vertical planes of polarization with the Biconical and Log Periodic. In each case, the table was rotated to find the maximum emissions.

When the equipment is out of limit at 3 meters, and the signals from the equipment at 30 meters cannot be recorded due to the background, a representative sample of these frequencies were re-measured at various distances such as 4, 5, 6, 8, 15 meters and the greatest distance that can be measured to demonstrate graphically that the emissions are dropping off and will be under the limit at the specified distance. All signals were then recorded. The allowed levels for Intentional Radiators in the 13.553 MHz to 13.567 MHz band shall not exceed 15,848 uV measured at 30 meters. For bands 13.410 MHz – 13.553 MHz and 13.567 MHz – 13.710 MHz shall not exceed 334 uV measured at 30 meters. Within bands 13.110 MHz – 13.410 MHz and 13.710 MHz – 14.010 MHz shall not exceed 106 uV measured at 30 meters. The field strength of any emissions appearing outside 13.110 MHz – 14.010 MHz shall not exceed the radiated emissions limits shown in Section 15.209.



1250 Peterson Dr., Wheeling, IL 60090

Company:	Northern Apex Corporation
Model Tested:	A1479
Report Number:	13176

RADIATED DATA AND GRAPHS TAKEN FOR

FUNDAMENTAL FIELD STRENGTH

SPURIOUS EMISSION MEASUREMENTS

PART 15.225

FCC Part 15.225(a)(d)

Electric Field Strength

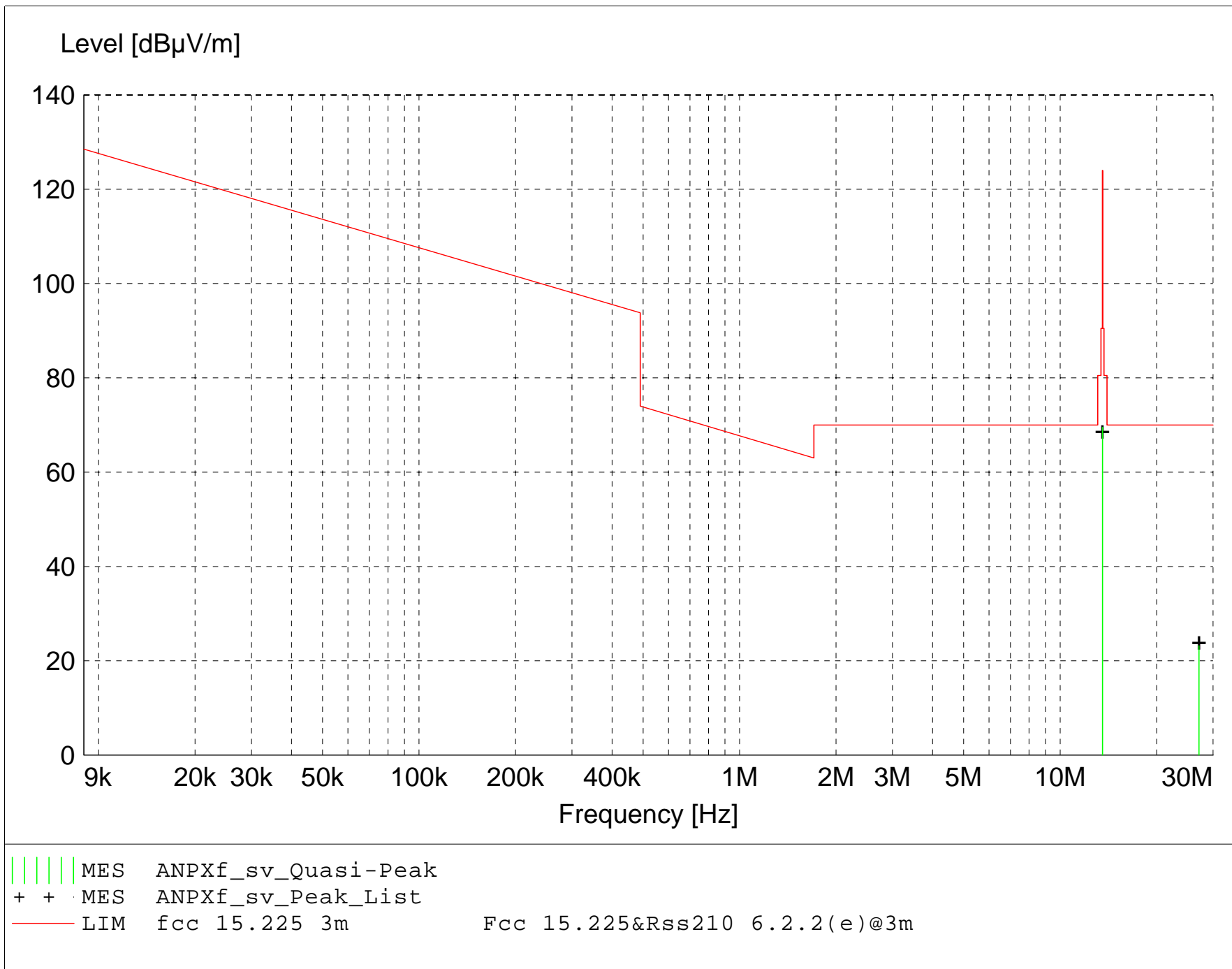
EUT: Laboratory Water Filter Reader
Manufacturer: Northern Apex
Operating Condition: 74 degF;43% R.H.
Test Site: D.L.S. O.F. Site 1
Operator: Tim O
Test Specification: 120Vac @ 60Hz
Comment: EUT transmits and receives simultaneously
Date: 05/1/2007

TEXT: "Site 1 LowH 3M"

Short Description: Equip info Site1 HFld low-30
TEST EQUIPMENT: Receiver --- RhodeandSchwartz ESI40 SN: 837808/005

Antennas --- EMCO 3000-4897 SN 34890
EMCO 3021-5949 SN 34849

TYPE OF TEST: H-FIELD MEASURED AT 3 METERS



MEASUREMENT RESULT: "ANPxf_sv_Final"

5/1/2007 11:13AM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBμV	Factor	Loss	Level			Ant.	Angle	Detector	
		dBμV/m	dB	dBμV/m	dBμV/m	dB	m	deg		
27.121000	13.45	8.58	1.2	23.2	70.0	46.8	1.00	15	QUASI-PEAK	None
13.560000	58.25	10.44	0.8	69.5	124.0	54.5	1.00	180	QUASI-PEAK	None



1250 Peterson Dr., Wheeling, IL 60090

Company:	Northern Apex Corporation
Model Tested:	A1479
Report Number:	13176

RADIATED DATA TAKEN FOR

FIELD STRENGTH

SPURIOUS EMISSION MEASUREMENTS

PART 15.209

FCC Part 15-225(a)(d)

Electric Field Strength

EUT: Laboratory Water Filter Reader
Manufacturer: Northern Apex
Operating Condition: 74 degF;43% R.H.
Test Site: D.L.S. O.F. Site 1
Operator: Tim O
Test Specification: 120Vac @ 60Hz
Comment: TX/RX 13.56Mhz - EUT transmits and receives simultaneously
Date: 05/1/2007

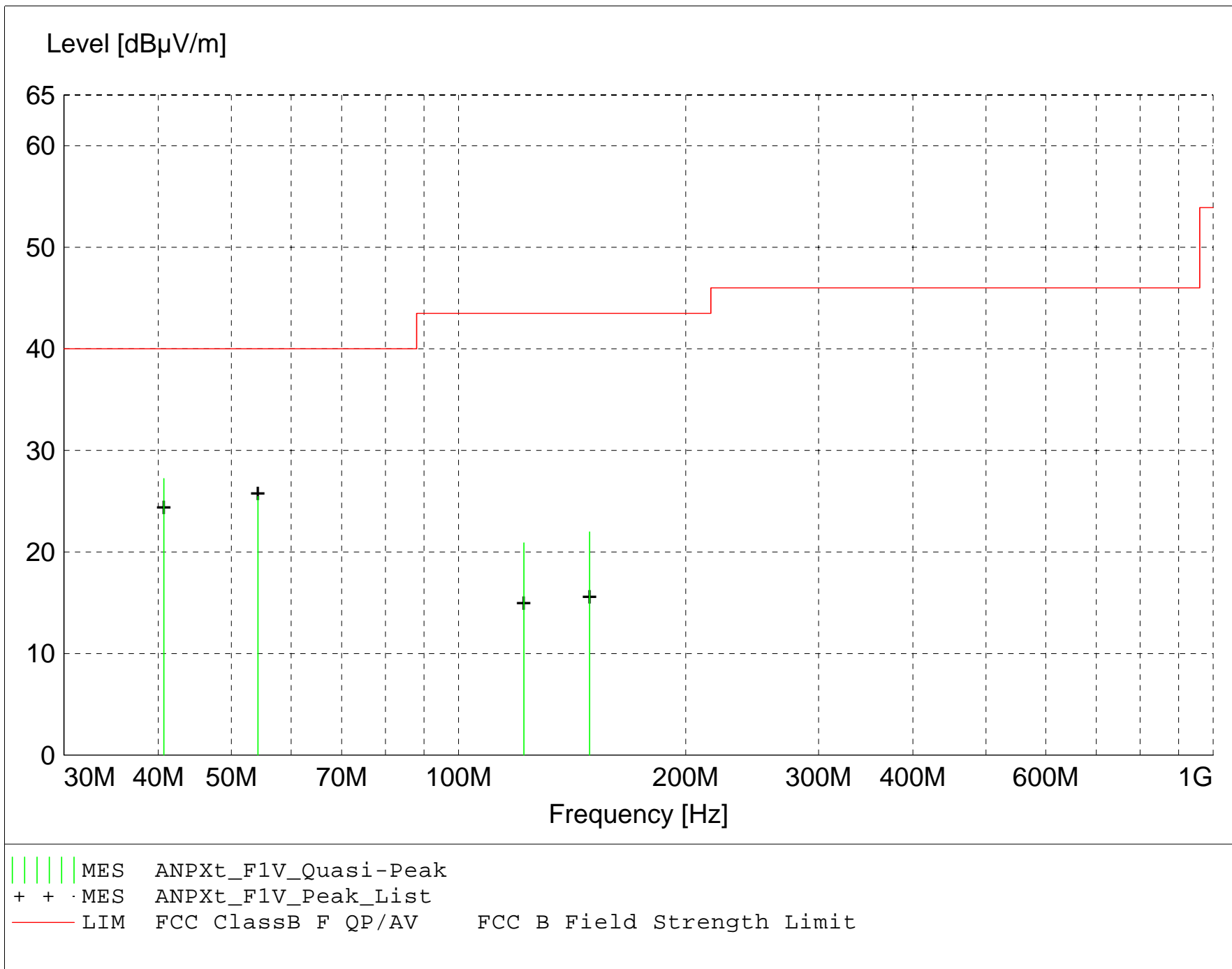
TEXT: "Site 1 MidV 3M"

Short Description: Test Set-up Vert30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 26 SN: 837491/010

Antennas ---
Biconical -- EMCO 3104C SN: 0005-4891
Log Periodic -- Electro-Metrics LPA-25 SN: 1114

Pre-Amp --- Rohde&Schwarz TS-PR10 SN: 032001/003

TEST SET-UP: EUT Measured at 3 Meters with VERTICAL Antenna Polarization



MEASUREMENT RESULT: "ANPxt_FlV_Final"

5/1/2007 1:18PM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBμV	Factor	Loss	Level			Ant.	Angle	Detector	
		dBμV/m	dB	dBμV/m	dBμV/m	dB	m	deg		
40.680000	40.72	11.50	-25.0	27.2	40.0	12.8	1.00	240	QUASI-PEAK	None
54.240000	39.04	11.23	-24.8	25.5	40.0	14.5	1.00	45	QUASI-PEAK	None
149.180000	33.45	11.93	-23.4	22.0	43.5	21.5	1.00	55	QUASI-PEAK	None
122.060000	32.05	12.70	-23.8	20.9	43.5	22.6	1.00	230	QUASI-PEAK	None

FCC Part 15-225(a)(d)

Electric Field Strength

EUT: Laboratory Water Filter Reader
Manufacturer: Northern Apex
Operating Condition: 74 degF;43% R.H.
Test Site: D.L.S. O.F. Site 1
Operator: Tim O
Test Specification: 120Vac @ 60Hz
Comment: TX/RX 13.56Mhz - EUT transmits and receives simultaneously
Date: 05/1/2007

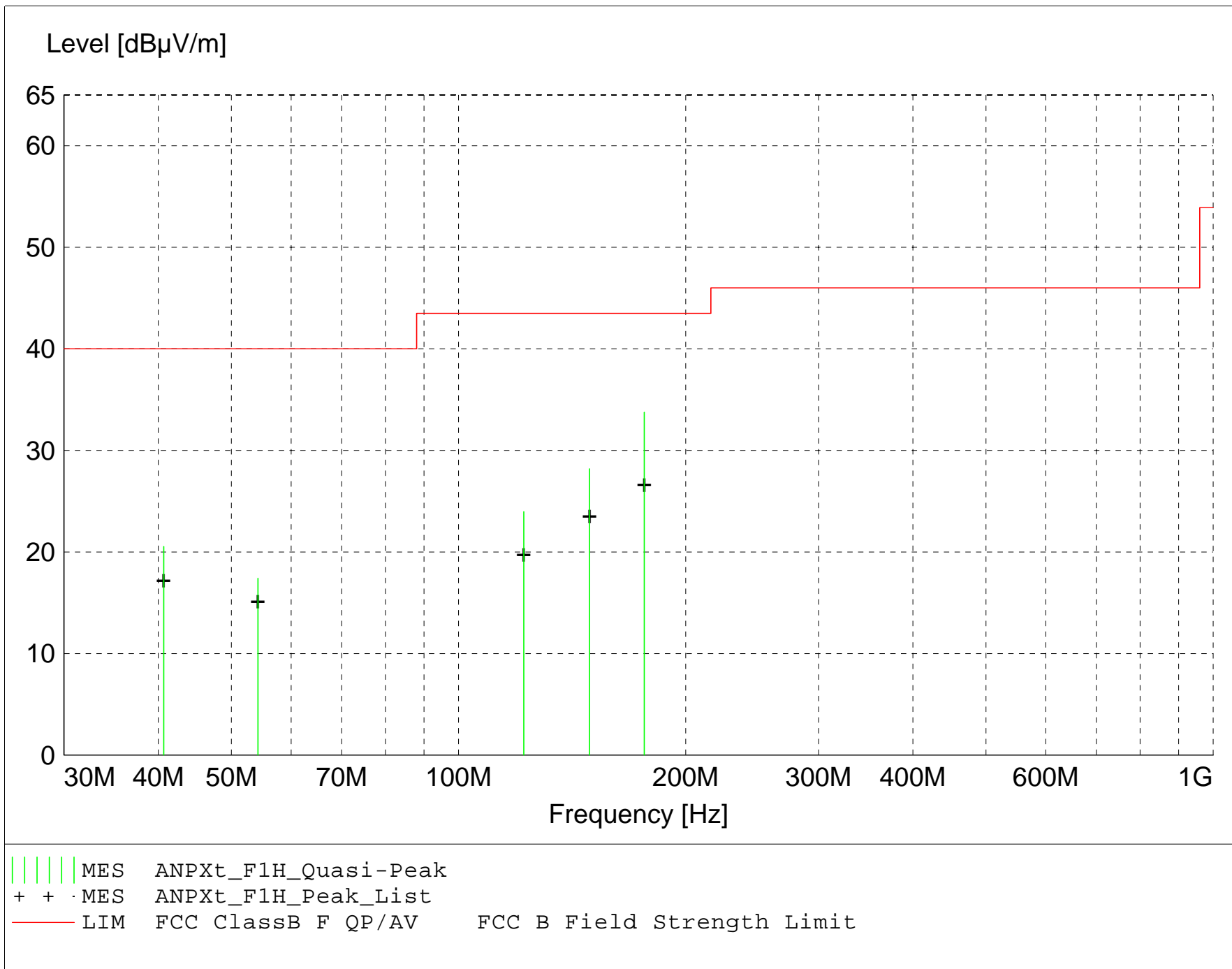
TEXT: "Site 1 MidH 3M"

Short Description: Test Set-up Horz30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 26 SN: 837491/010

Antennas ---
Biconical -- EMCO 3104C SN: 0005-4891
Log Periodic -- Electro-Metrics LPA-25 SN: 1114

Pre-Amp --- Rohde&Schwarz TS-PR10 SN: 032001/003

TEST SET-UP: EUT Measured at 3 Meters with HORIZONTAL Antenna Polarization



MEASUREMENT RESULT: "ANPxt_FlH_Final"

5/1/2007 1:18PM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBμV	Factor	Loss	Level			Ant.	Angle	Detector	
		dBμV/m	dB	dBμV/m	dBμV/m	dB	m	deg		
176.280000	41.13	15.72	-23.1	33.8	43.5	9.7	1.50	255	QUASI-PEAK	None
149.154000	39.66	11.93	-23.4	28.2	43.5	15.3	1.50	270	QUASI-PEAK	None
40.670000	34.03	11.50	-25.0	20.5	40.0	19.5	2.00	175	QUASI-PEAK	None
122.040000	35.12	12.70	-23.8	24.0	43.5	19.5	2.50	265	QUASI-PEAK	None
54.230000	30.98	11.24	-24.8	17.4	40.0	22.6	3.00	230	QUASI-PEAK	None



1250 Peterson Dr., Wheeling, IL 60090

Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

APPENDIX A

4.0 FREQUENCY STABILITY - PART 2.1055a (Temperature)

The frequency stability was measured from -30° to +50° centigrade at intervals of 10° centigrade throughout the range. Prior to each frequency measurement, the equipment was left alone for a sufficient period of time (approximately 30 minutes or more) to allow the components of the RFID Reader System oscillator circuitry to stabilize. The following information was taken:

FREQUENCY STABILITY FOR TEMPERATURE VARIATION IN MHz:

-20°	13.5601022
-10°	13.55996994
0°	13.55986974
+10°	13.55980962
+20°	13.55975752
+30°	13.55991383
+40°	13.55986172
+50°	13.55976553

Worst Case Variance:

1355975752 Hz

As stated in Part 15, Section 15.225 (c), the Frequency Tolerance and Margin for this range are as follows:

Ambient Frequency: = 1355991373.00 Hz

Frequency Tolerance: = 0.0001

$1355991373.00 * 0.0001 = 135599.14 \text{ Hz}$

This is well within the specified limits.



1250 Peterson Dr., Wheeling, IL 60090

Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

APPENDIX A

GRAPHS TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE

TEMPERATURE

PART 2.1055a



Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

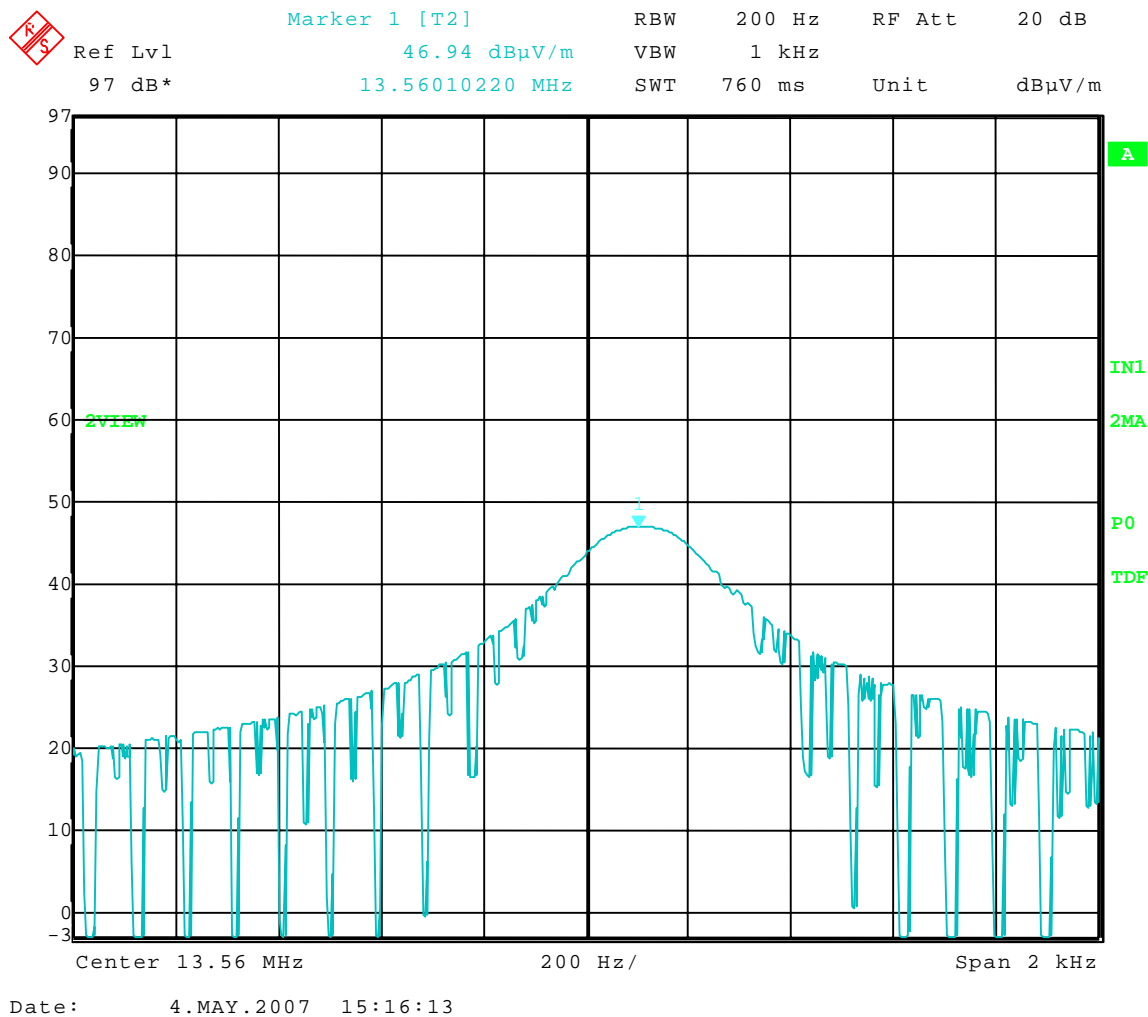
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

FCC Part 15.225e

-20 deg C

120 VAC at 60 Hz





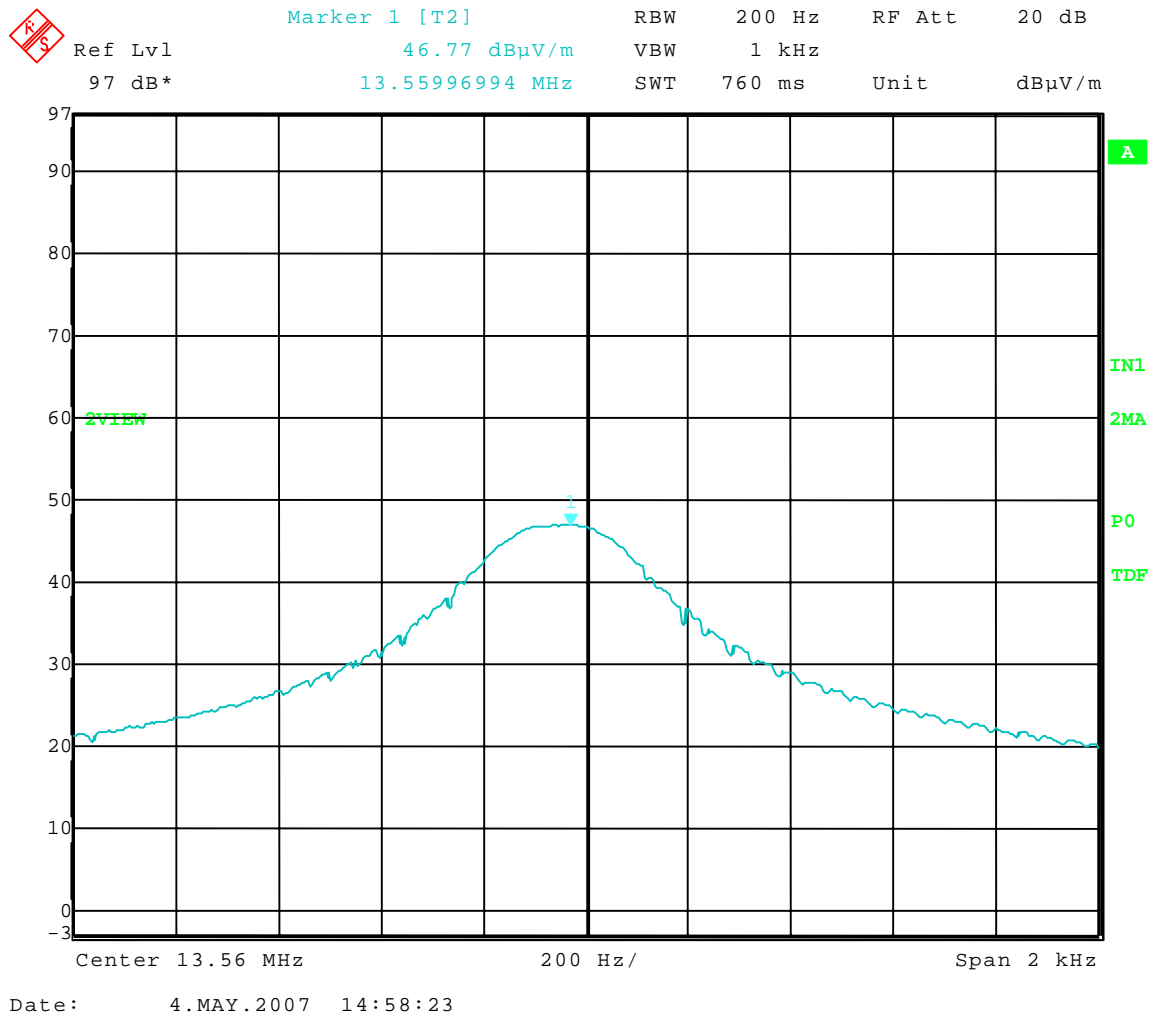
Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

FCC Part 15.225e

-10 deg C
120 VAC at 60 Hz





1250 Peterson Dr., Wheeling, IL 60090

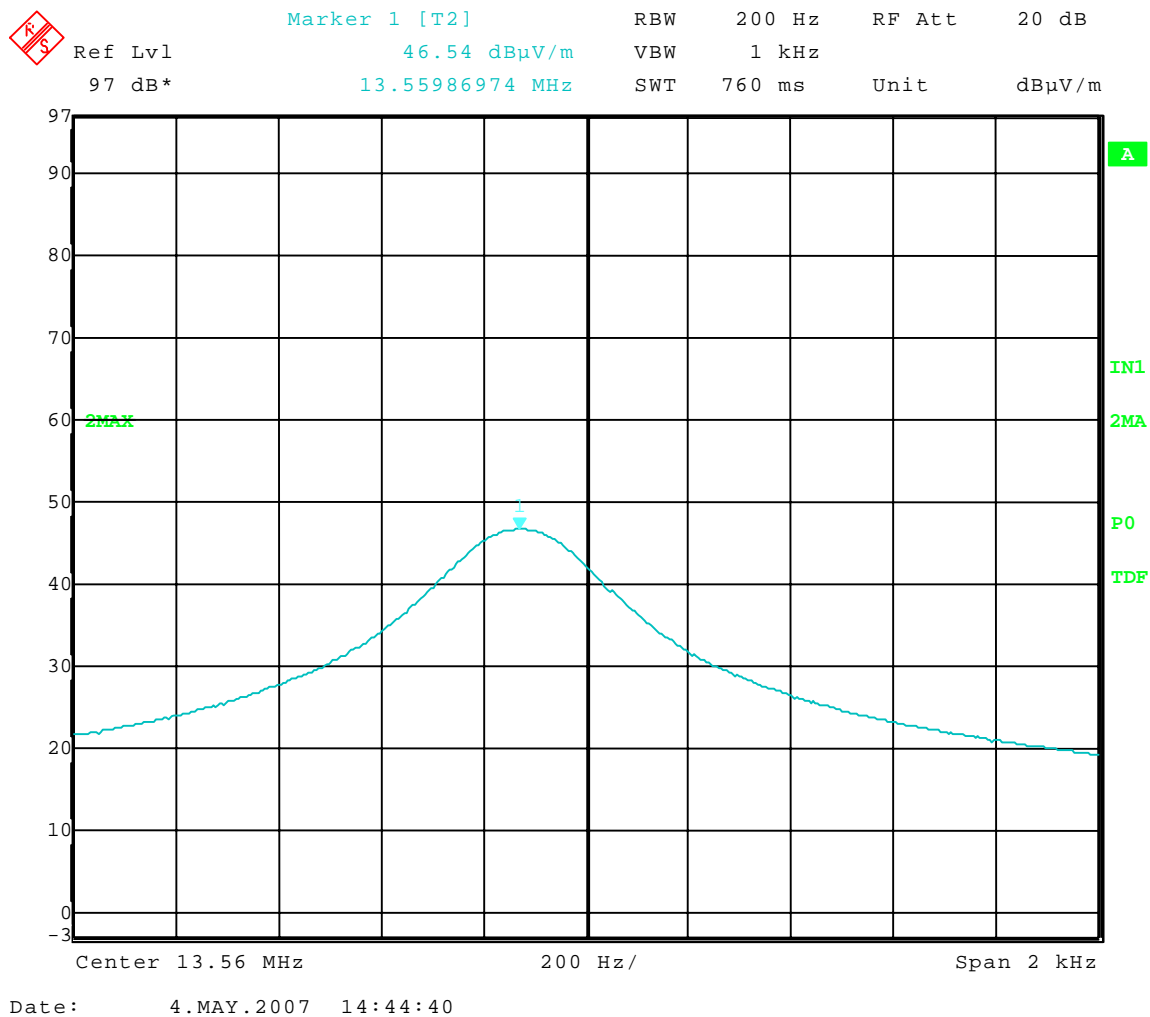
Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

APPENDIX A

FCC Part 15.225e

0 deg C

120 VAC at 60 Hz





Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

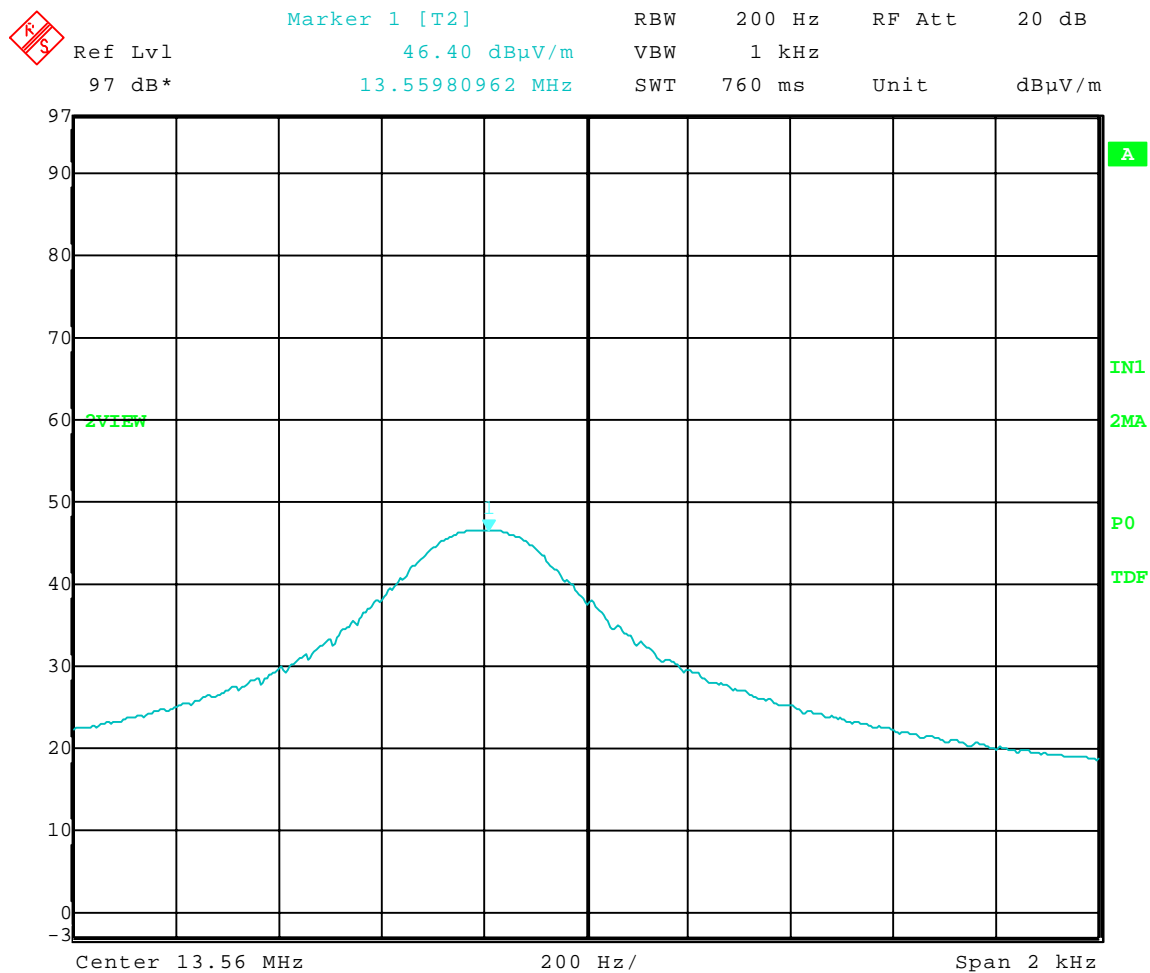
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

FCC Part 15.225e

10 deg C

120 VAC at 60 Hz



Date: 4.MAY.2007 14:29:14



Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

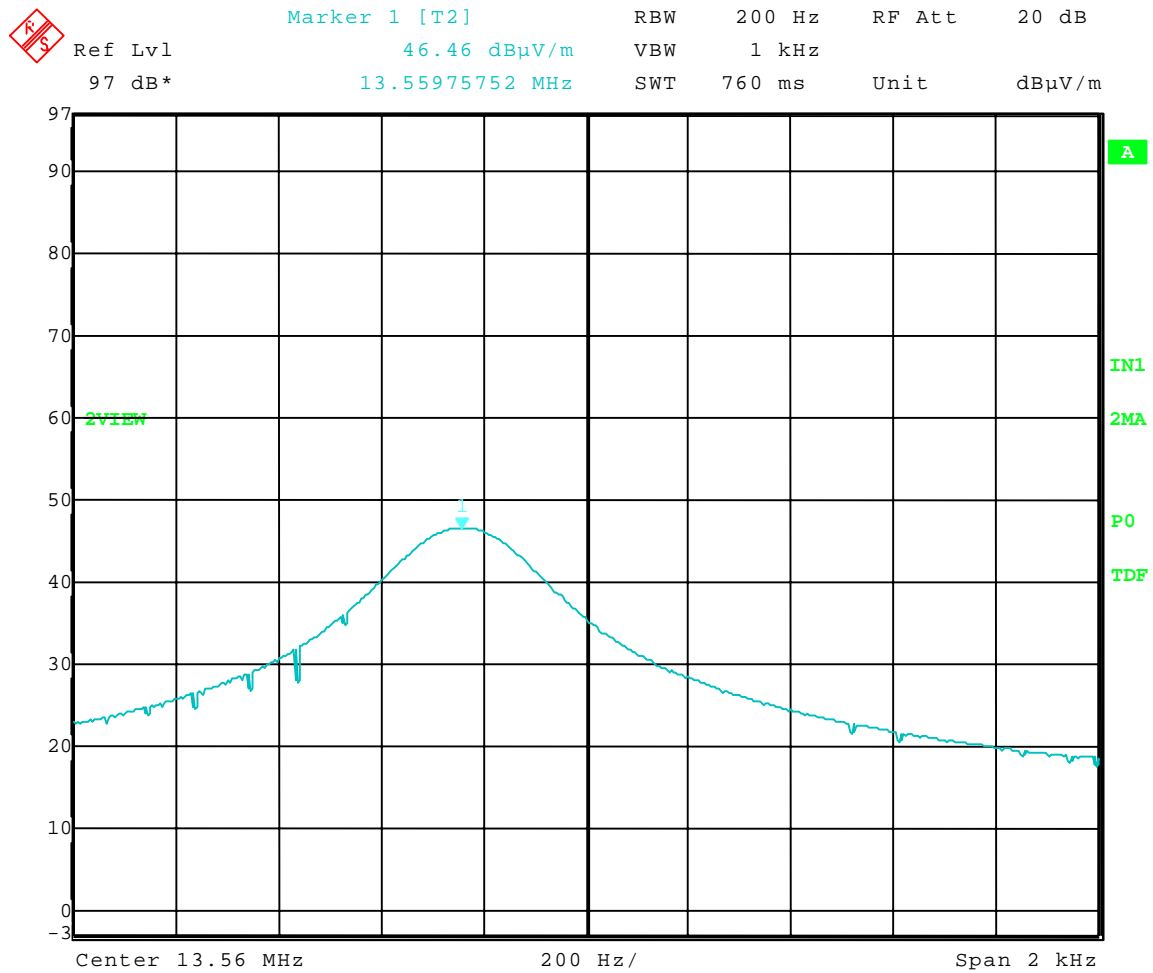
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

FCC Part 15.225e

20 deg C

120 VAC at 60 Hz (rated supply voltage)



Date: 4.MAY.2007 12:38:21



Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

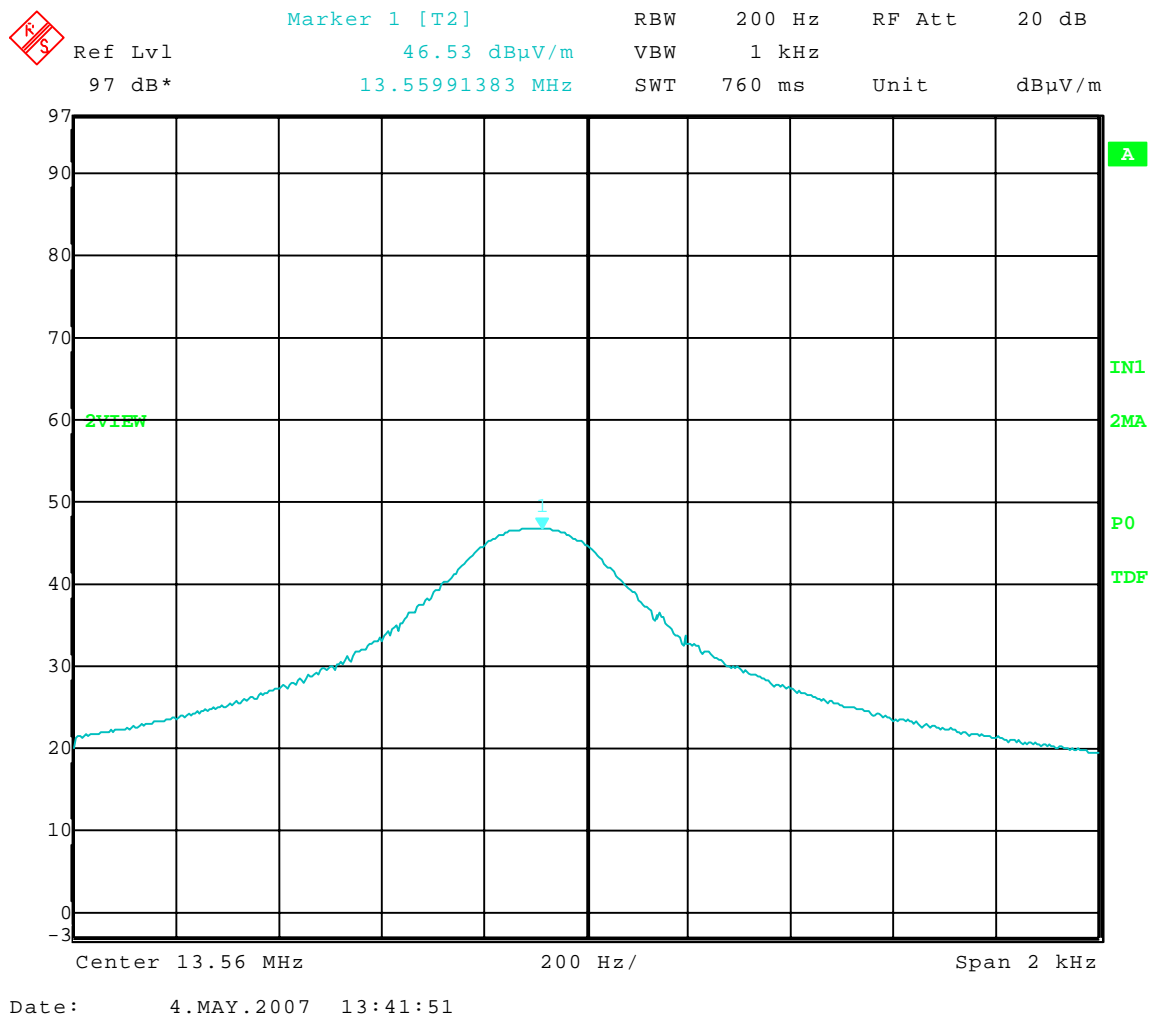
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

FCC Part 15.225e

30 deg C

120 VAC at 60 Hz





Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

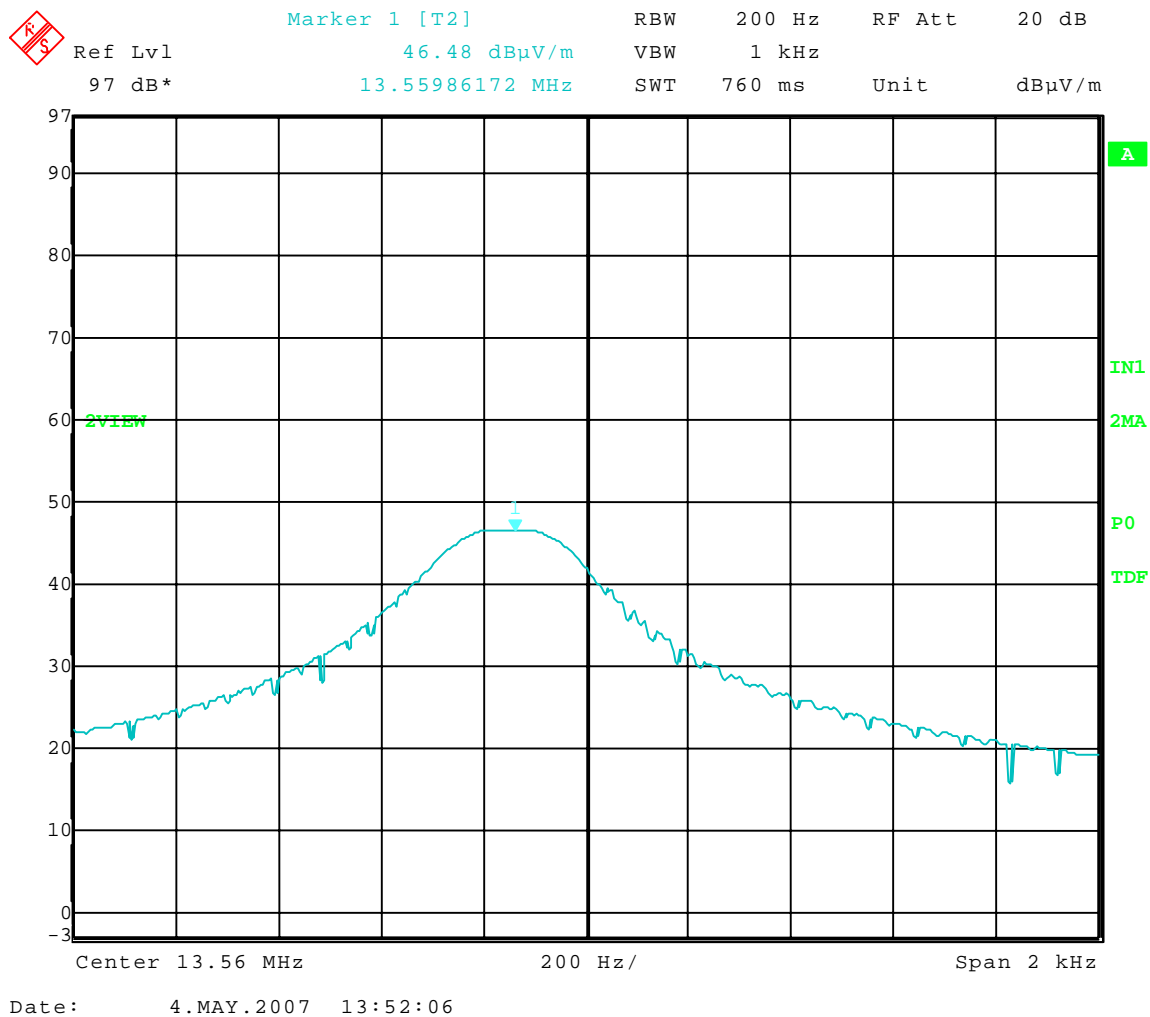
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

FCC Part 15.225e

40 deg C

120 VAC at 60 Hz





Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

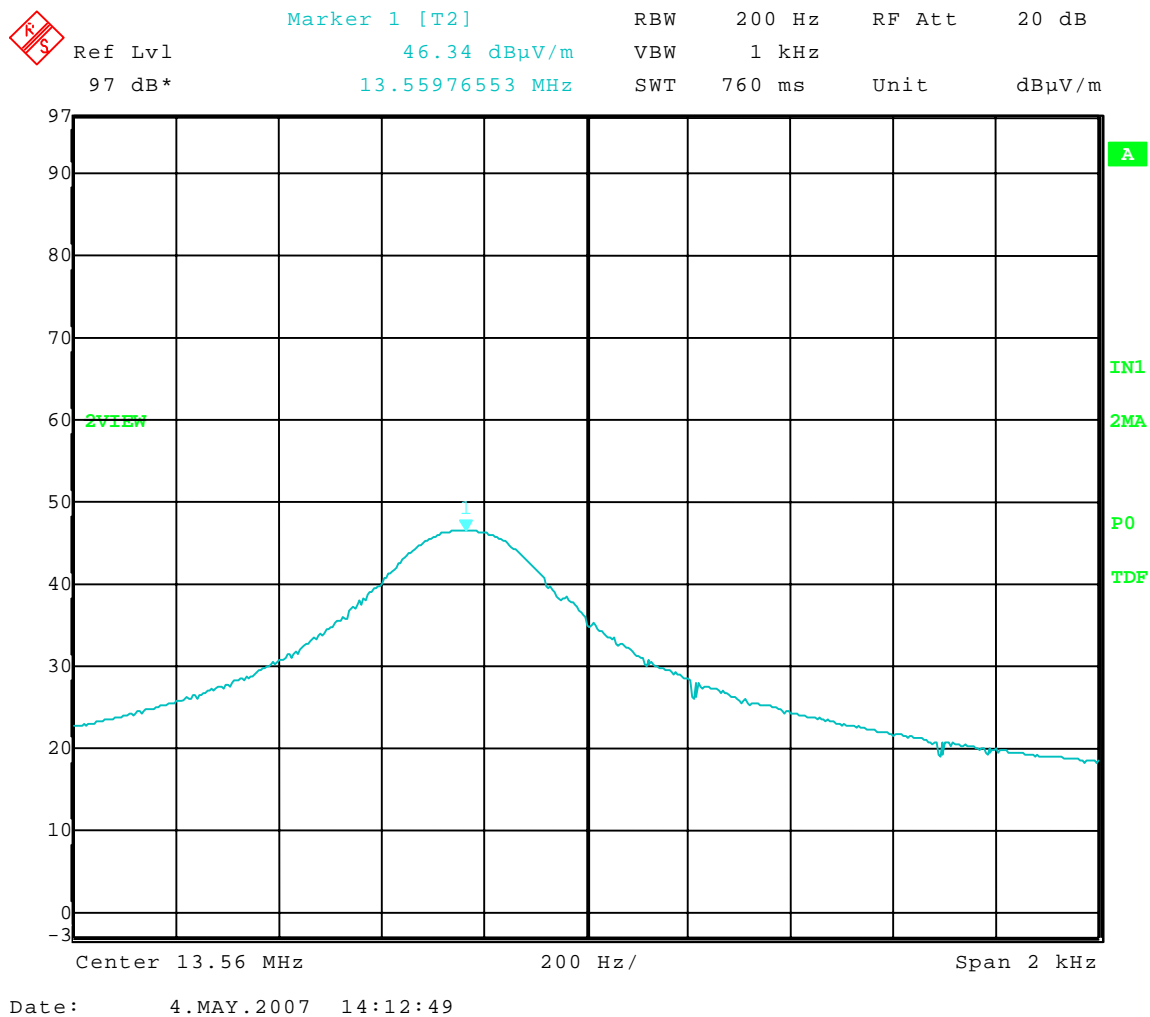
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

FCC Part 15.225e

50 deg C

120 VAC at 60 Hz





Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

1250 Peterson Dr., Wheeling, IL 60090

Test Condition	Nominal (MHz)	Measured (MHz)	Variation $\pm .1355976$ max	Pass/Fail ($\pm 01\%$)
20°C @ normal supply voltage	13.55975752	-	-	-
20°C @ 85% supply voltage	13.55975752	13.55977756	-.00002	Pass
20°C @ 115% supply voltage	13.55975752	13.55978156	-.000024	Pass
-20°C @ normal supply voltage	13.55975752	13.56010220	-.000345	Pass
-10°C @ normal supply voltage	13.55975752	13.55996994	-.000212	Pass
0°C @ normal supply voltage	13.55975752	13.55986974	-.000112	Pass
10°C @ normal supply voltage	13.55975752	13.55980962	-.000139	Pass
30°C @ normal supply voltage	13.55975752	13.55991383	-.000156	Pass
40°C @ normal supply voltage	13.55975752	13.55986172	-.000104	Pass
50°C @ normal supply voltage	13.55975752	13.55976553	-.000008	Pass



1250 Peterson Dr., Wheeling, IL 60090

Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

APPENDIX A

5.0 FREQUENCY STABILITY - PART 2.1055d (**Voltage**)

The frequency stability of RFID Reader System was measured by varying the primary supply voltage from 85% to 115% of nominal value for all equipment other than hand carried battery equipment.

FREQUENCY STABILITY FOR VOLTAGE VARIATION:

85%	13.55977756
100%	13.55975752
115%	13.55978156

This is well within the specified limits.

FREQUENCY STABILITY FOR HAND HELD DEVICES:

For hand carried, battery powered equipment, the supply voltage was reduced to the battery operating end point specified by the manufacturer. Readings were taken at the reduced end point and with a fresh battery:

This device runs off of 120 vac, 60 Hz, therefore this test was not required.



1250 Peterson Dr., Wheeling, IL 60090

Company:	Northern Apex Corporation
Model Tested:	A1479
Report Number:	13176

GRAPHS TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE

PRIMARY SUPPLY VOLTAGE

PART 2.1055d



Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

1250 Peterson Dr., Wheeling, IL 60090

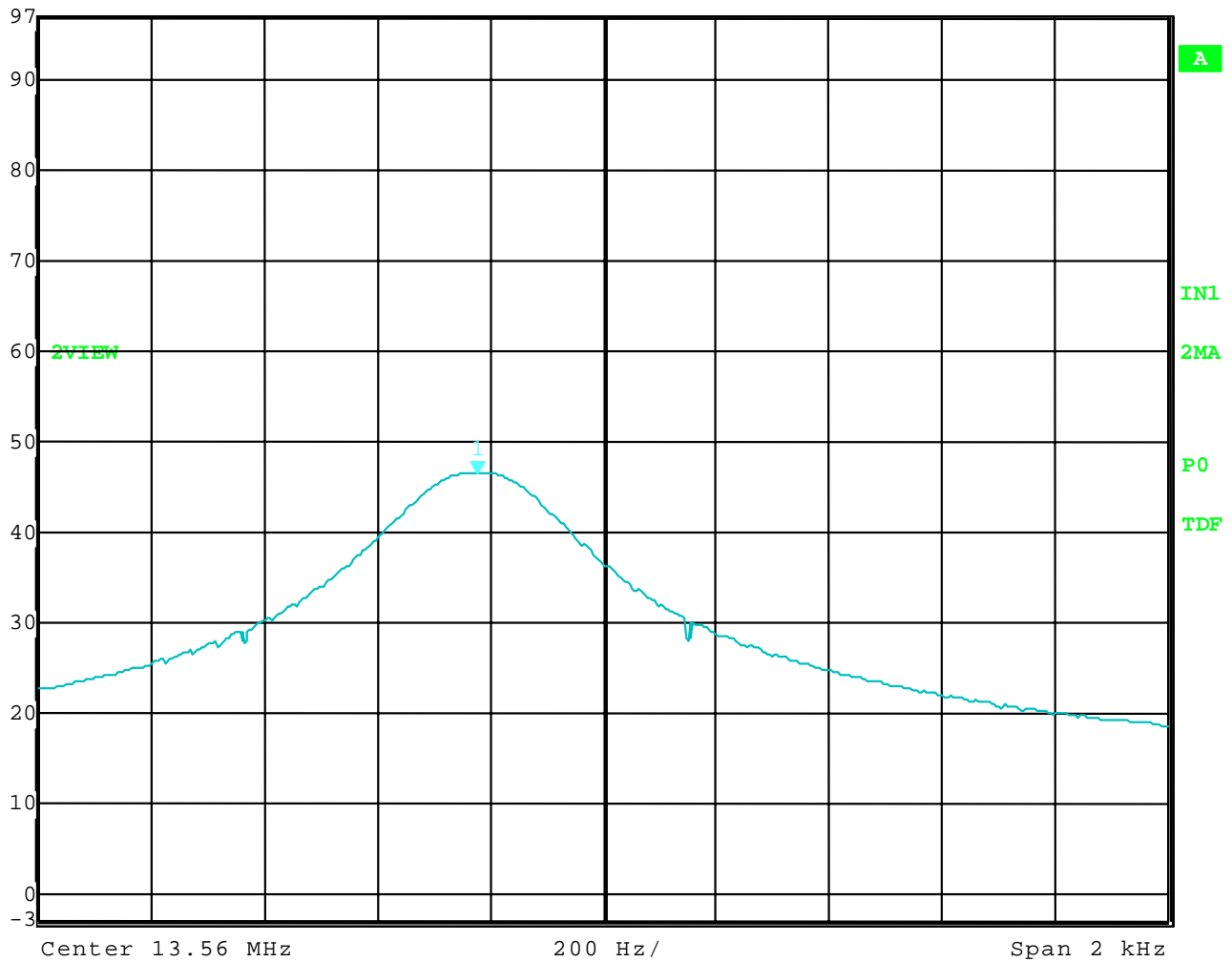
FCC Part 15.225e

20 deg C

108 VAC at 60 Hz (85% rated supply voltage)



Marker 1 [T2] RBW 200 Hz RF Att 20 dB
Ref Lvl 46.48 dBμV/m VBW 1 kHz
97 dB* 13.55977756 MHz SWT 760 ms Unit dBμV/m



Date: 4.MAY.2007 12:42:08



Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

1250 Peterson Dr., Wheeling, IL 60090

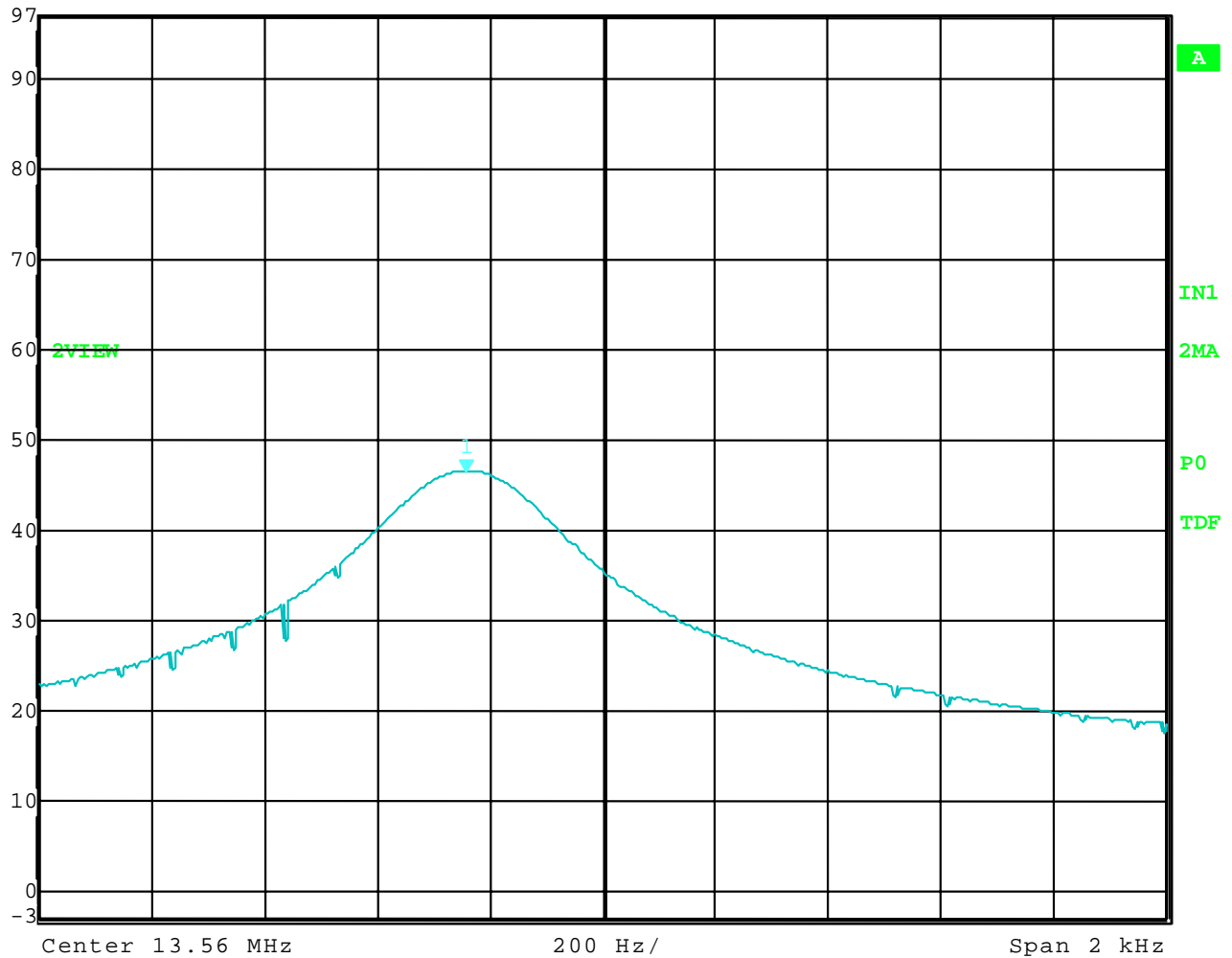
FCC Part 15.225e

20 deg C

120 VAC at 60 Hz (rated supply voltage)



Ref Lvl	Marker 1 [T2]	RBW	200 Hz	RF Att	20 dB
97 dB*	46.46 dBμV/m	VBW	1 kHz		
	13.55975752 MHz	SWT	760 ms	Unit	dBμV/m



Date: 4.MAY.2007 12:38:21



Company: Northern Apex Corporation
Model Tested: A1479
Report Number: 13176

1250 Peterson Dr., Wheeling, IL 60090

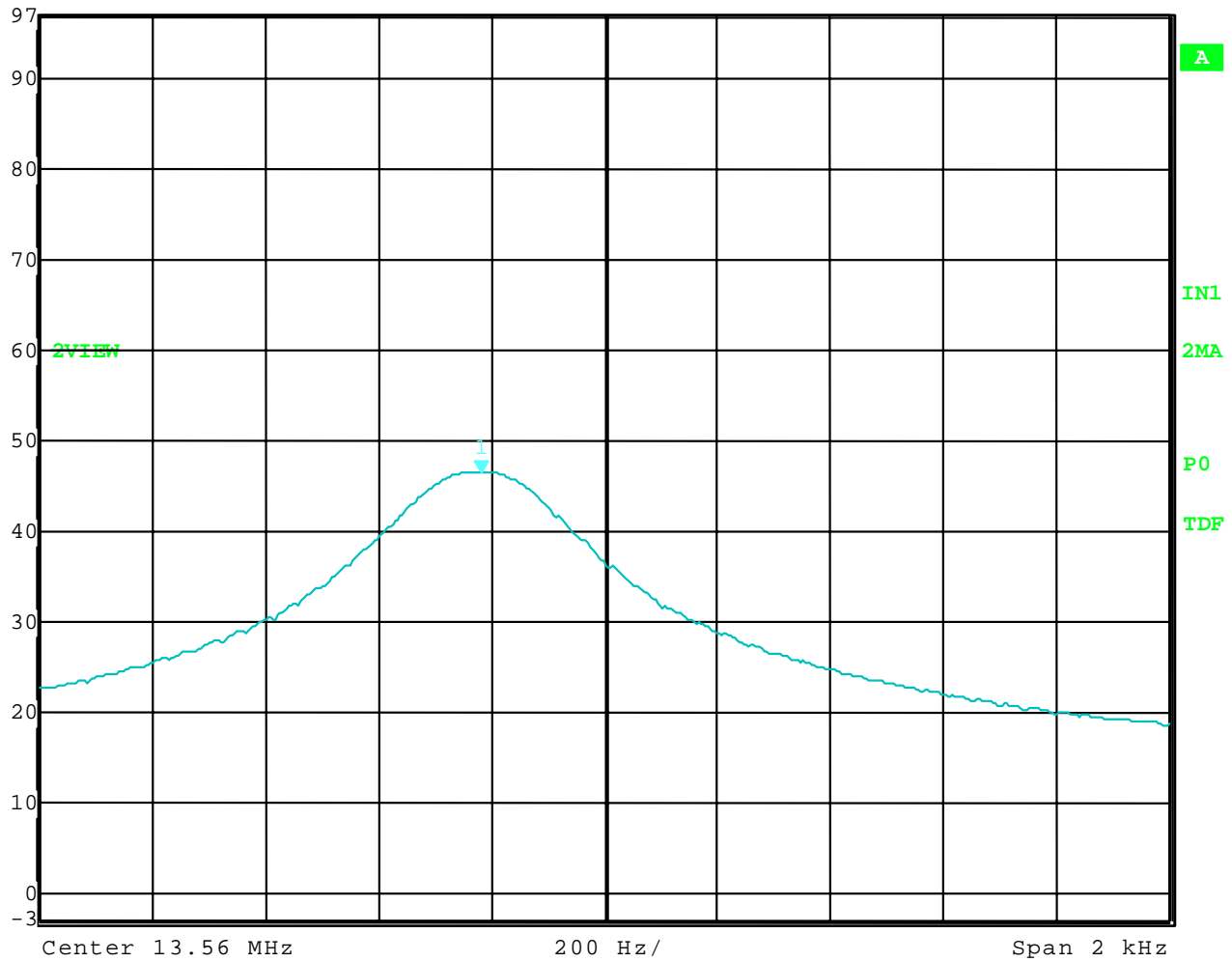
FCC Part 15.225e

20 deg C

138 VAC at 60 Hz (115% rated supply voltage)



Ref Lvl 97 dB*
Marker 1 [T2] 46.48 dB μ V/m
13.55978156 MHz
RBW 200 Hz
VBW 1 kHz
SWT 760 ms
RF Att 20 dB
Unit dB μ V/m



Date: 4.MAY.2007 12:46:18