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November 24, 2004

Stemco LLC
Attn: Mr. Mark Kranz
Box 1989
300 Industrial Blvd
Longview, TX 75606

UL Reference: File MC2255, Project 04CA44983

Subject: EMC Test and Measurement Report for
Model 800 RFID Tag Reader / Writer

Dear Mr. Kranz:

We have provided with this letter your EMC Test Report for the above referenced model. The product was determined to comply with the requirements noted in the report.

Please review the attached report and direct any questions or comments to me.

We appreciate your interest in UL's EMC Services, and encourage you to contact us in the future should you need EMC test services. This closes Project 04CA44983.

Best regards,

A handwritten signature in black ink that reads 'Bart Mucha'.

Bart Mucha (Ext 41216)
Project Engineer
International EMC Services

Reviewed by:

A handwritten signature in black ink that reads 'Jack Steiner'.

Jack Steiner
Section Manager
International EMC Services

REPORT DIRECTORY

SECTION TITLE

GENERAL

- 1.0 General Product Description
- 1.1 Model Differences
- 1.2 Environmental Conditions in Test Lab
- 1.3 Calibration Details of Equipment Used for Measurement
- 1.4 EUT (Equipment Under Test) Configuration
- 1.5 EUT Operating Mode
- 1.6 Device Modifications
- 1.7 Test Facility Description

EMISSIONS

- 2.0 Emission Measurements
- 2.1 Spurious Radiated Electric Field Emissions
- 2.2 Carrier Frequency Separation
- 2.3 Channel Bandwidth (20dB)
- 2.4 Number of Hopping Channels
- 2.5 Average Channel Occupancy Time and Channel Period
- 2.6 RF Conducted Peak Output Power
- 2.7 Reduced Output Gain if Directional Gain Exceeds 6dBi
- 2.8 Antenna Terminal Conducted Measurements
- 2.9 Band Edge – Spurious Emissions

CONCLUSION

- 3.0 General Remarks
- 3.1 Summary

APPENDICIES

- A Test Setups (Photos, Diagrams and Drawings)
- B Test Data
- C Sample Calculations

1.0 GENERAL PRODUCT DESCRIPTION

The Equipment Under Test (EUT) was a RFID TAG Reader / Writer operating in frequency range of 2400MHz - 2483.5MHz (spread-spectrum, frequency hopper).

1.0.1 Equipment Mobility:

Portable

1.0.2 Test Voltage and Frequency:

<u>Voltage (V)</u>	<u>Frequency (Hz)</u>
7.2	DC

1.1 MODEL DIFFERENCES

Any other model(s) represented by the models tested in this investigation will be documented by the manufacturer.

1.2 ENVIRONMENTAL CONDITIONS IN TEST LAB

Temperature:	20-25 °C
Relative Humidity:	30-60% RH
Atmospheric Pressure:	860-1060 mbar

1.3 CALIBRATION OF EQUIPMENT USED FOR MEASUREMENT

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST), therefore, all test data recorded in this report is traceable to NIST.

1.4 EUT CONFIGURATION(s)

See Appendix A for individual set-up configuration(s). In addition to the EUT, the following peripheral devices and/or cables were connected during the measurement:

Description of Test System				
Device	Manufacturer	Model	Serial #	FCC ID
EUT	Stemco	800	-	SNV-800 0000

Antenna(s) Employed				
Antenna Type	EUT Output Power	Antenna Gain	Total EIRP	Exposure Category
PCB	9.31dBm	2.809dBi	12.119dBm	Portable

The antenna in the handheld reader model 800-0000 is fixed to the main processor board through soldered connections and cannot be removed or changed by the customer.

The antennas are made up of 2 half wave patches with 2.809 dBi of gain. (15.203 statement)

1.5 EUT OPERATING MODE(s)

The equipment under test was operated during the measurements under the following conditions:

Continuous operation, transmitter operating at low, mid and high channels at maximum rated power.

1.6 DEVICE MODIFICATIONS

The following modifications were necessary for compliance:

None.

1.7 TEST FACILITY DESCRIPTION

Location of Test Site

Underwriters Laboratories Inc.
333 Pfingsten Road
Northbrook, IL 60062

FCC Site Number: 31040/SIT 1300F2

10-Meter Semi-Anechoic Chamber

The 10-meter semi-anechoic chamber, constructed by Lindgren RF Enclosures, is accredited for 10 or 3-meter final radiated emission measurements. The room consists of a 17.9 by 12 by 8.3-meter shield room lined with a hybrid absorber system manufactured by TDK. The walls, floor (conducting ground plane) and ceiling are constructed of double sided galvanized sheet steel supported by 3/4 inch particleboard. The interior walls and ceiling are covered with 10 by 10 cm, 6-mm thick ferrite tiles (TDK Type X191 100x100x6.0) and polystyrene absorber cones (TDK Type IP-090B).

The 10-meter chamber is provided with a 2.4 by 3-meter (width by height) door and a 4-meter diameter embedded turntable (Sunol Sciences Corp., Model FM4066). The turntable is provided with approximately 125 silver-graphite contacts with copper-beryllium springs mounted on adjustable brackets (see Figure 3) to provide continuity of the conducting ground plane. The turntable is mounted flush with the ground plane. The turntable is provided with a hole in the center for passage of the power and associated cables. Electrical power to the 10 meter and compact chambers is EMI filtered. The turntable and chamber floor are rated 14,000 and 10,000 lbs. respectively.

Two antenna masts are provided for measurement purposes. The antenna masts are pre-manufactured, portable units capable of remotely adjusting the antenna height from one to 4 meters above the conducting ground plane. The antenna masts are constructed of nonmetallic materials with the exception of the drive motors, which raise and lower the antennas.

The test equipment control station is located adjacent to the 10-meter chamber. The test equipment is connected to the chamber by double-shielded coaxial cables. The coaxial cables and control cable for the turntable and antenna mast are fed to connector ports on the outside of the chamber below the conducting ground plane. The cables are routed through a crawl space located under the chambers ground plane.

The EUT, turntable and antenna masts are monitored at the control station via fiber optic video system.

2.0 EMISSIONS TEST REGULATIONS

Emissions testing was performed according to the following regulations:

The Digital Part of the device

47 CFR Part 15.109 Subpart B: July 12, 2004 + ANSI C63.4 - 2000

The Radio Part of the device

47 CFR Part 15.247 Subpart C: July 12, 2004 + ANSI C63.4 - 2000

15.247 – Spread-spectrum devices operating within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

Testing was covered / required as noted below:

Test / Requirement	Reference	Result	Remarks
Conducted Voltage (AC Power Line)	15.207	NA	EUT is battery operated and is not operational when charger is attached. Per the manufacturer request testing was not conducted.
Spurious Radiated Emissions	15.209 and 15.247(d)	Compliant	
Carrier Frequency Separation	15.247(a)(1)	Compliant	The average channel separation was found to be 1.068MHz
Channel Bandwidth (20dB)	15.247(a)(1)	NA	Maximum bandwidth measured was 99.198kHz
Number of Hopping Channels	15.247(a)(1)(iii)	Compliant	The total number of hopping channels for this system is 76
Average Channel Occupancy Time and Channel Period	15.247(a)(1)(iii)	Compliant	The average channel occupancy time is 355.377ms and the maximum channel period is 33.28sec.
RF Conducted Peak Output Power	15.247(b)(1)	Compliant	Maximum measured power was 0.00853 watts
Reduced output if directional gain exceeds 6dBi	15.247(b)(4)	N/A	Not applicable. Antenna employed in EUT has directional gain less than 6dBi.
Spurious emissions (RF conducted & radiated)	15.247(d)	Compliant	
Channel Use	15.247(g)	Compliant	See Manufacturer Statement
Channel Avoidance	15.247(h)	Compliant	See Manufacturer Statement
Band-Edge Spurious Emissions	15.209 and 15.247(d)	Compliant	
RF Safety (SAR for portable devices)	15.247(i)		See statement in User's Manual

* Since the transmitter operates over a frequency range greater than 10MHz, measurements were performed on low, mid and high channels per 15.31(m).

2.1 SPURIOUS RADIATED ELECTRIC FIELD EMISSIONS

Test Location

10 Meter Semi-Anechoic Chamber

Requirement

15.209 and 15.247(d)

UL Procedure

3014ANBK-LPG-002

Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector
Hewlett Packard Model 8566B Spectrum Analyzer (30-1000MHz)

Model 85650A Quasi-peak Adapter

Model 85685A RF Preselector No. EMC4015

Last Cal. 1-8-04, Next. Cal. 1-8-05

Rhode & Schwartz Model FSEK Spectrum Analyzer EMC4182 (1-10GHz)

Last Cal. 1-8-04, Next. Cal. 1-8-05

Antennas

Chase EMC Ltd., Biconical Antenna Model VBA6106A, EMC4078

Last Cal. 07-09-04 Next. Cal. 07-09-05

Chase EMC Ltd., Log Periodic Antenna Model UPA6108, EMC 4076

Last Cal. 07-15-04, Next. Cal. 07-15-05

Characterized and Calibrated ULBOMS Antenna Array

Last Cal. 07/2004 Next Cal. 07/2005

Frequency Range of Measurement

30MHz-25,000MHz

Measurement Distance

3 meters and 10 meters

Operating Mode

The unit was tested in its dominant modulation mode where maximum spurious products are produced for the longest durations. The unit was then tested in Low, Mid, and High bands. Though the unit does have second modulation, the carrier power is reduced thus producing lower spurious products.

Test Results

The requirements are:

MET

Remarks

Since the unit is considered “portable”, therefore all scans and measurements were conducted with the unit in three possible axis - X, Y, and Z. In addition, worst-case axis spurious emissions, which fell in the restricted bands and were within 6dB of the general limit based on the pre-scan plot were measured to assure compliance with the general limits.

See App. B for complete test result.

2.2 CARRIER FREQUENCY SEPARATION

Test Location

Open laboratory area

Requirement

15.247(a)(1) - Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

Operating Mode

Transmitter hopping all channels with modulation

Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector
Rhode & Schwartz Model FSEK Spectrum Analyzer EMC4182 (1-10GHz)
Last Cal. 1-8-04, Next. Cal. 1-8-05

Test Results

The requirements are:

MET

Remarks

See App. B for complete test results. For the purpose of this test, all channels frequencies were measured, the separation distance was found and averaged.

The average channel separation was found to be 1.068MHz

2.3 CHANNEL BANDWIDTH (20dB)

Test Location

Open laboratory area

Requirement

15.247(a)(1)

This measurement is necessary to obtain proper RBW and VBW information.

Operating Mode

For the purpose of this test, only the bandwidth of three channels was measured: low channel, middle channel and high channel with modulation.

Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector

Rhode & Schwartz Model FSEK Spectrum Analyzer EMC4182 (1-10GHz)

Last Cal. 1-8-04, Next. Cal. 1-8-05

Test Results

The requirements are:

N/A

Low Channel Bandwidth Measured: **84.168kHz**

Middle Channel Bandwidth Measured: **99.198kHz**

High Channel Bandwidth Measured: **99.198kHz**

Remarks

See App. B for complete test results.

2.4 NUMBER OF HOPPING CHANNELS

Test Location

Open laboratory area

Requirement

15.247(a)(1)(iii)

Frequency hopping systems in the 2400 – 2483.5 MHz band should use at least 15 channels.

Operating Mode

Transmitter hopping all channels with NO modulation

Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector

Rhode & Schwartz Model FSEK Spectrum Analyzer EMC4182 (1-10GHz)

Last Cal. 1-8-04, Next. Cal. 1-8-05

Test Results

The requirements are:

MET

The total number of hopping channels for this system is 76

Remarks

For purpose of this test, a scan in the frequency range 2400MHz – 2483.5MHz was made. Number of peaks and frequency of every peak was measured.

See App. B for complete test results.

2.5 AVERAGE CHANNEL OCCUPANCY TIME AND CHANNEL PERIOD

Test Location

Open laboratory area

Requirement

15.247(a)(1)(iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Operating Mode

Transmitter hopping all channels with modulation

Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector
Rhode & Schwartz Model FSEK Spectrum Analyzer EMC4182 (1-10GHz)
Last Cal. 1-8-04, Next. Cal. 1-8-05

Test Results

The requirements are:
MET

Low Channel Average Occupancy Time: **352.71mS**

Low Channel Period: **32.75s**

Middle Channel Average Occupancy Time: **360.72mS**

Middle Channel Period: **33.36s**

High Channel Average Occupancy Time: **360.72mS**

High Channel Period: **33.36s**

Minimum period: 30.4 seconds

Remarks

For purpose of this test, the low, middle, and high channel occupancy time were captured. The occupancy time was based on single measurement. The channel period was based on the following information:

- The Reader/Writer will only transmit on four channels per activation
- The minimum time between activations is 330ms (limited by software)

See App. B for complete test results.

2.6 RF CONDUCTED PEAK OUTPUT POWER

Test Location

Open laboratory area

Requirement

15.247(b)(1)

For frequency hopping systems operating in the 2400 – 2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt.

Operating Mode

For the purpose of this test, only the power of three channels was measured: low channel, middle channel and high channel with NO modulation.

Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector

Rhode & Schwartz Model FSEK Spectrum Analyzer EMC4182 (1-10GHz)

Last Cal. 1-8-04, Next. Cal. 1-8-05

Test Results

The requirements are:

MET

For the purpose of this test, the peak power was measured in dBuV at low, middle and high channels. The measured value then was converted to watts.

Low Channel Maximum Power: **0.00853 Watts**

Middle Channel Maximum Power: **0.00726 Watts**

High Channel Maximum Power: **0.00705 Watts**

Remarks

See App. B for complete test results.

2.7 REDUCED OUTPUT IF DIRECTIONAL GAIN EXCEEDS 6dBi

Requirement

15.247(b)(4)

Remarks

Antenna employed in EUT has directional gain less than 6dBi.

2.8 SPURIOUS EMISSIONS (CONDUCTED)

Test Location

Open laboratory area

Requirement

15.247(d)

Operating Mode

Transmitter hopping all channels with modulation

Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector
Rhode & Schwartz Model FSEK Spectrum Analyzer EMC4182 (1-10GHz)
Last Cal. 1-8-04, Next. Cal. 1-8-05

with characterized set of attenuators, adapters and cables

Frequency Range of Measurement

30MHz – 25GHz

Test Results

The requirements are:

MET

Remarks

See App. B for complete test results.

2.9 BAND EDGE - SPURIOUS EMISSIONS

Test Location

Open Laboratory area

Requirement

12.247(d)

In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector
Rhode & Schwartz Model FSEK Spectrum Analyzer EMC4182 (1-10GHz)
Last Cal. 1-8-04, Next. Cal. 1-8-05

Frequency Range of Measurement

2400MHz – 2483.5MHz

Operating Mode

Transmitter hopping all channels with modulation

Test Results

The requirements are:

MET

Remarks

For the purpose of this test a conducted scan was done in the frequency range of 2380MHz – 2503.5MHz. Low band-edge and High band-edge frequencies were measured and their level compared to the maximum recorded power. In addition radiated scans were conducted to show that all levels at the band edges are under the appropriate limit.

Maximum Power Recorded: **116.31dBuV**

Low Band-edge Frequency: **2399.057MHz**

Low Band-edge Level: **76.41dBuV**

High Band-edge Frequency: **2484.195MHz**

High Band-edge Level: **71.15dBuV**

See App. B for complete test results.

3.0 GENERAL REMARKS

Sample Receipt Date : September 28, 2004

Test Dates

Start : September 28, 2004
End : November 24, 2004

3.1 SUMMARY

The requirements according to the technical regulations are:

MET

Underwriters Laboratories Inc.
333 Pfingsten Road
Northbrook, IL 60062 USA
FCC Site:

Test Engineer:



Bart Mucha (Ext 41216)
Project Engineer
International EMC Services

Reviewed by:



Jack Steiner
Section Manager
International EMC Services

APPENDIX A

PHOTOS

Emissions X-Axis Setup Photo



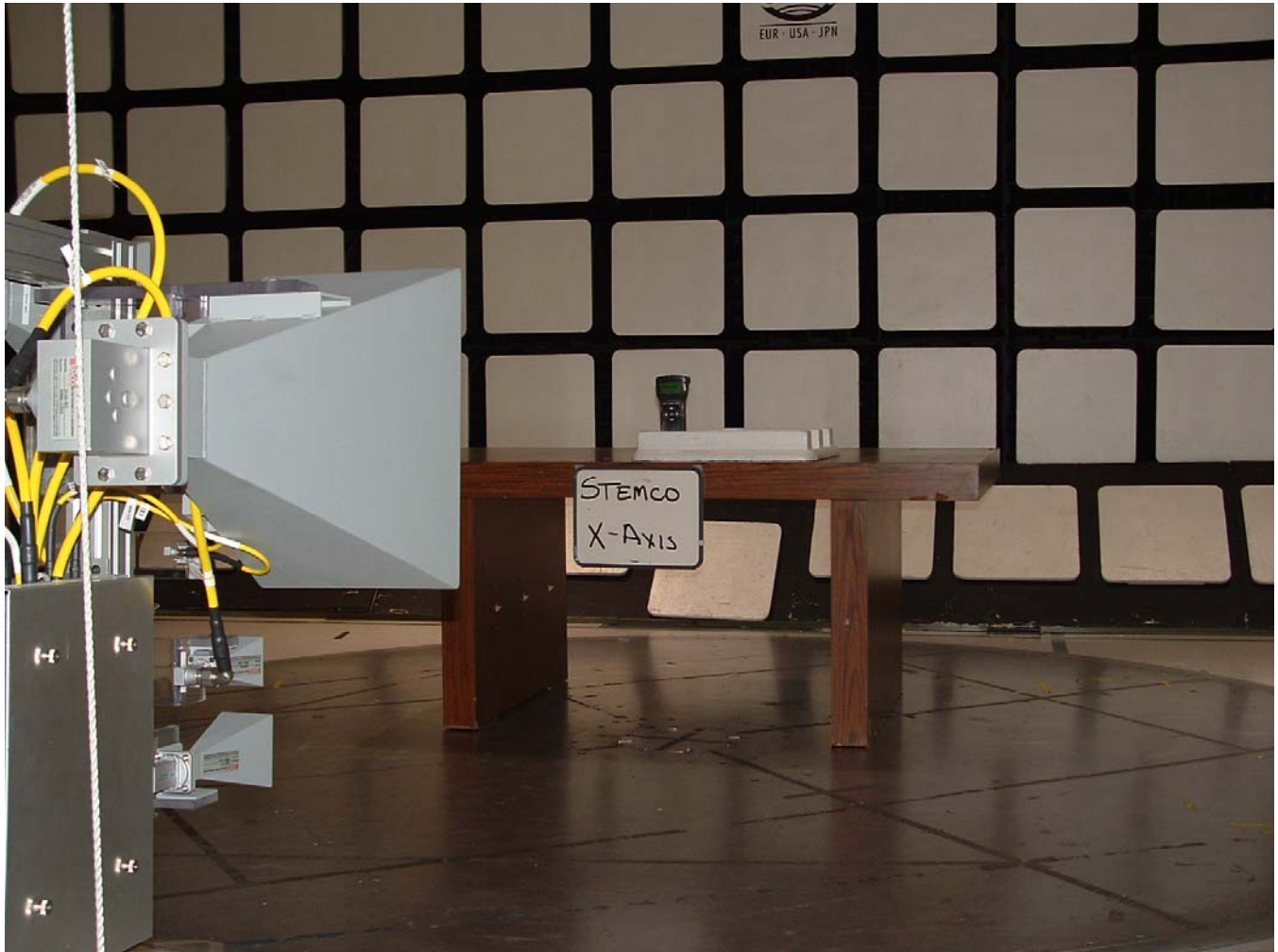
Emissions Y-Axis Setup Photo



Emissions Z-Axis Setup Photo



Emissions Setup Photo



APPENDIX B

TEST DATA

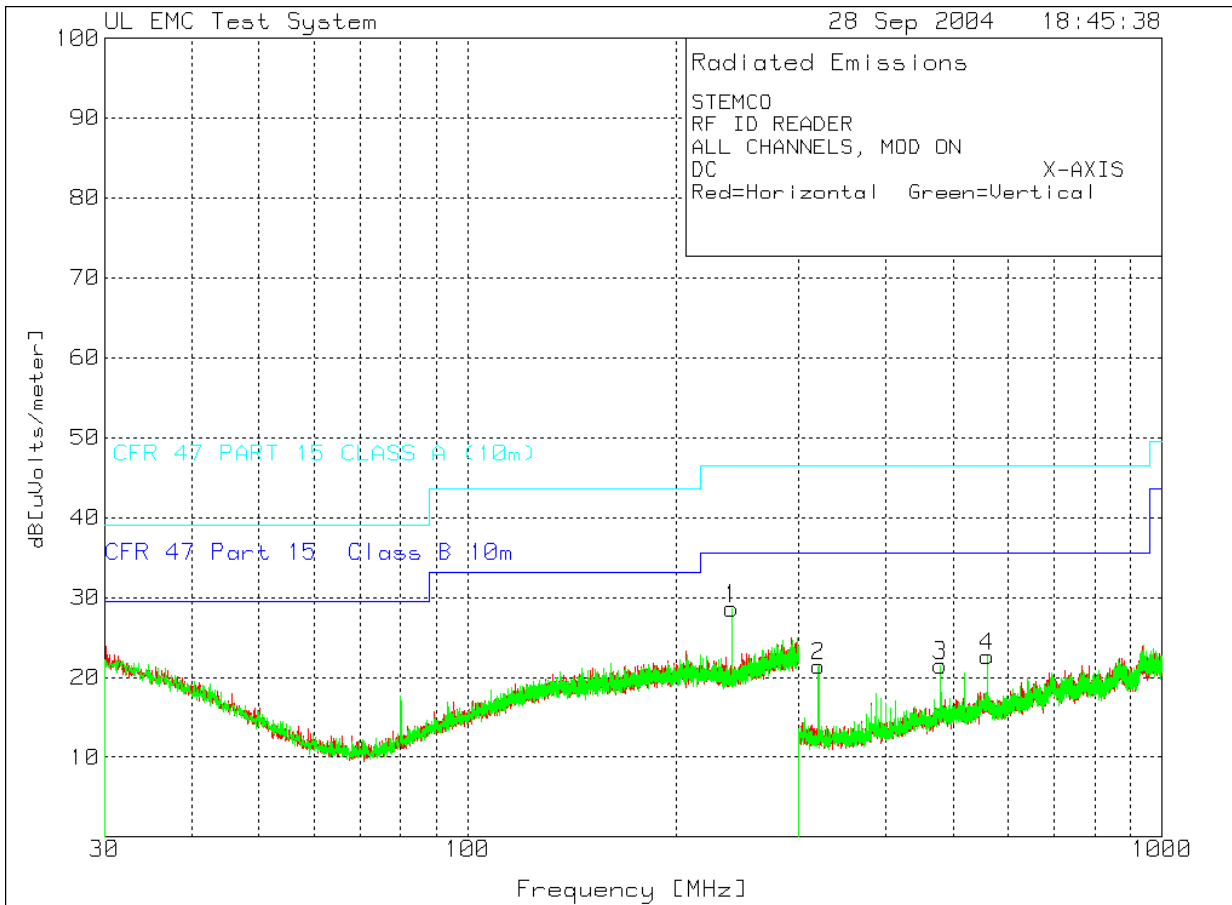
UNDERWRITERS LABORATORIES INC.
Radiated Emissions

Date Tested: September 28, 2004

Manufacturer : Stemco LLC
Equipment Under Test : 800 RFID Tag Reader / Writer
Requirement : FCC Class B
Detection Mode : Quasi-peak (qp) and Peak (pk)
Bandwidth : 120 kHz and 1MHz
Measurement Distance : 10 meter and 3 meter
Antenna Type : 30 - 300 MHz, Biconical
 300 - 1000 MHz, Log-Periodic
 1GHz – 25GHz, UL Antenna Array

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 3 meters
EUT Position: X – Axis

30MHz – 1000MHz, All Channels Hopping



STEMCO
 RF ID READER
 ALL CHANNELS, MOD ON
 DC X-AXIS
 Red=Horizontal Green=Vertical

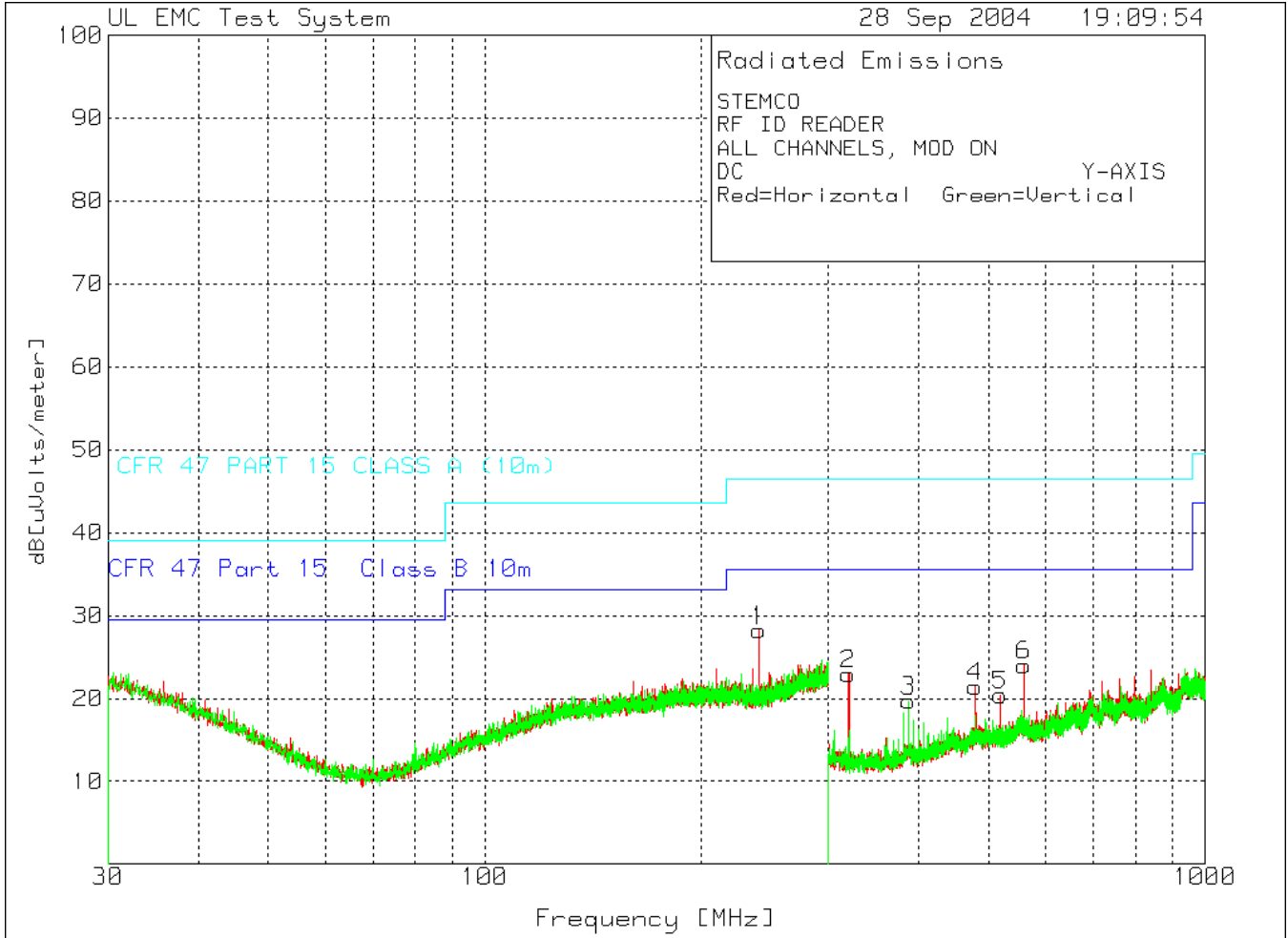
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level Limit:1 dB[uVolts/meter]	2	3	4
1	240.0362 Azimuth:357	38.9 pk Height:100	-26 Vert	15.7 Margin [dB]	28.6		46.4	35.6
2	320.1099 Azimuth:245	39.5 pk Height:100	-32.7 Vert	14.6 Margin [dB]	21.4		46.4	35.6
3	479.9402 Azimuth:70	35.7 pk Height:300	-32 Vert	17.8 Margin [dB]	21.5		46.4	35.6
4	560.0302 Azimuth:29	35.2 pk Height:300	-31.6 Vert	19 Margin [dB]	22.6		46.4	35.6

LIMIT 1: NONE
 LIMIT 2: NONE
 LIMIT 3: CFR 47 PART 15 CLASS A (10m)
 LIMIT 4: CFR 47 Part 15 Class B 10m

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 3 meters
EUT Position: Y - Axis

30MHz – 1000MHz, All Channels Hopping



STEMCO
 RF ID READER
 ALL CHANNELS, MOD ON
 DC Y-AXIS
 Red=Horizontal Green=Vertical

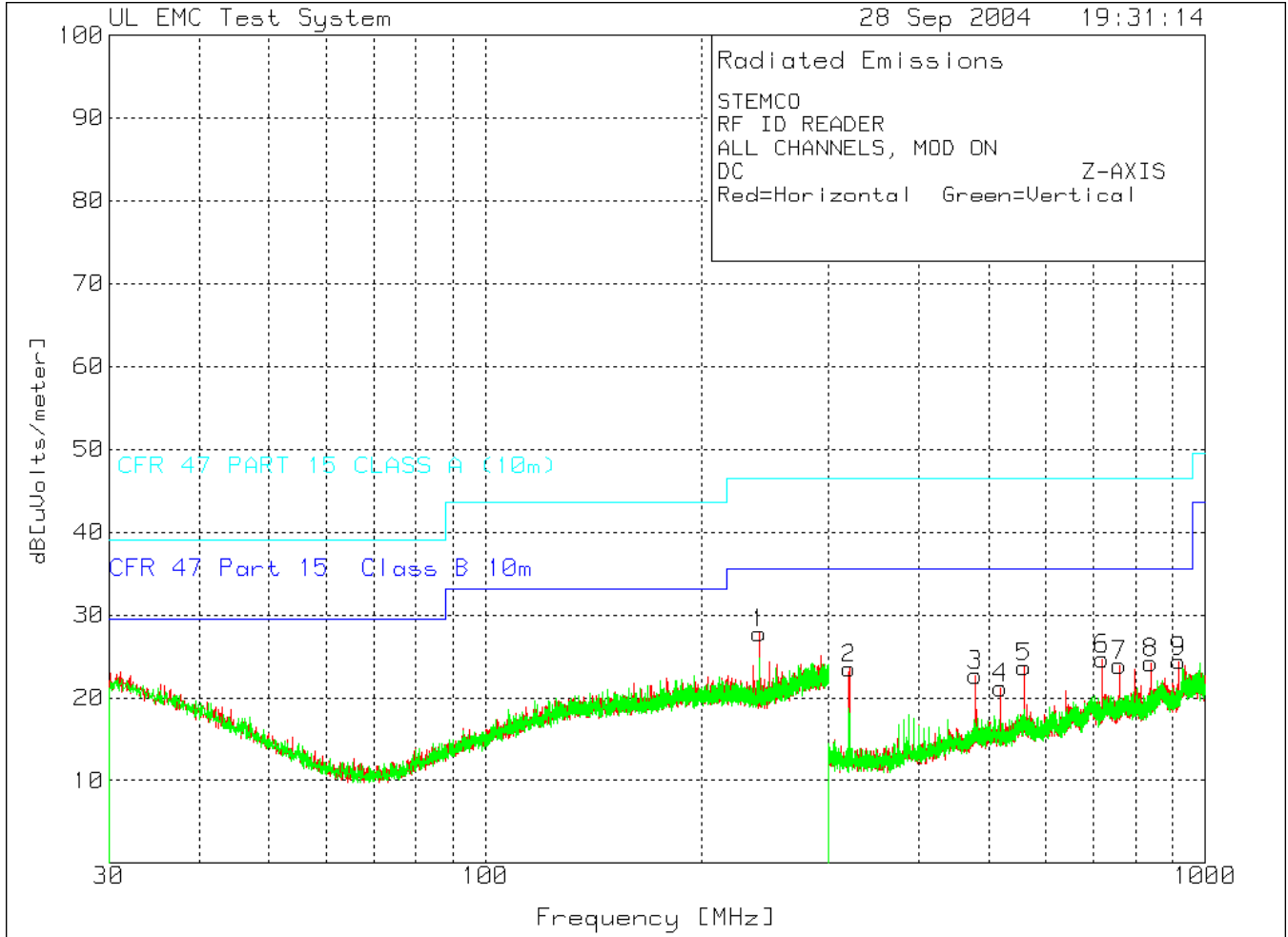
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB [uVolts/meter]	Limit:1	2	3	4
1	240.0362	38.5 pk	-26	15.7	28.2			46.4	35.6
	Azimuth:318	Height:300	Horz	Margin [dB]				-18.2	-7.4
2	320.0225	41 pk	-32.7	14.6	22.9			46.4	35.6
	Azimuth:357	Height:299	Horz	Margin [dB]				-23.5	-12.7
4	479.9402	35.6 pk	-32	17.8	21.4			46.4	35.6
	Azimuth:30	Height:100	Horz	Margin [dB]				-25	-14.2
5	519.9852	34.5 pk	-31.8	17.7	20.4			46.4	35.6
	Azimuth:57	Height:100	Horz	Margin [dB]				-26	-15.2
6	560.0302	36.6 pk	-31.6	19	24			46.4	35.6
	Azimuth:358	Height:100	Horz	Margin [dB]				-22.4	-11.6
3	387.7842	36.4 pk	-32.3	15.6	19.7			46.4	35.6
	Azimuth:118	Height:299	Vert	Margin [dB]				-26.7	-15.9

LIMIT 1: NONE
 LIMIT 2: NONE
 LIMIT 3: CFR 47 PART 15 CLASS A (10m)
 LIMIT 4: CFR 47 Part 15 Class B 10m

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 3 meters
EUT Position: Z - Axis

30MHz – 1000MHz, All Channels Hopping



STEMCO
 RF ID READER
 ALL CHANNELS, MOD ON
 DC Z-AXIS
 Red=Horizontal Green=Vertical

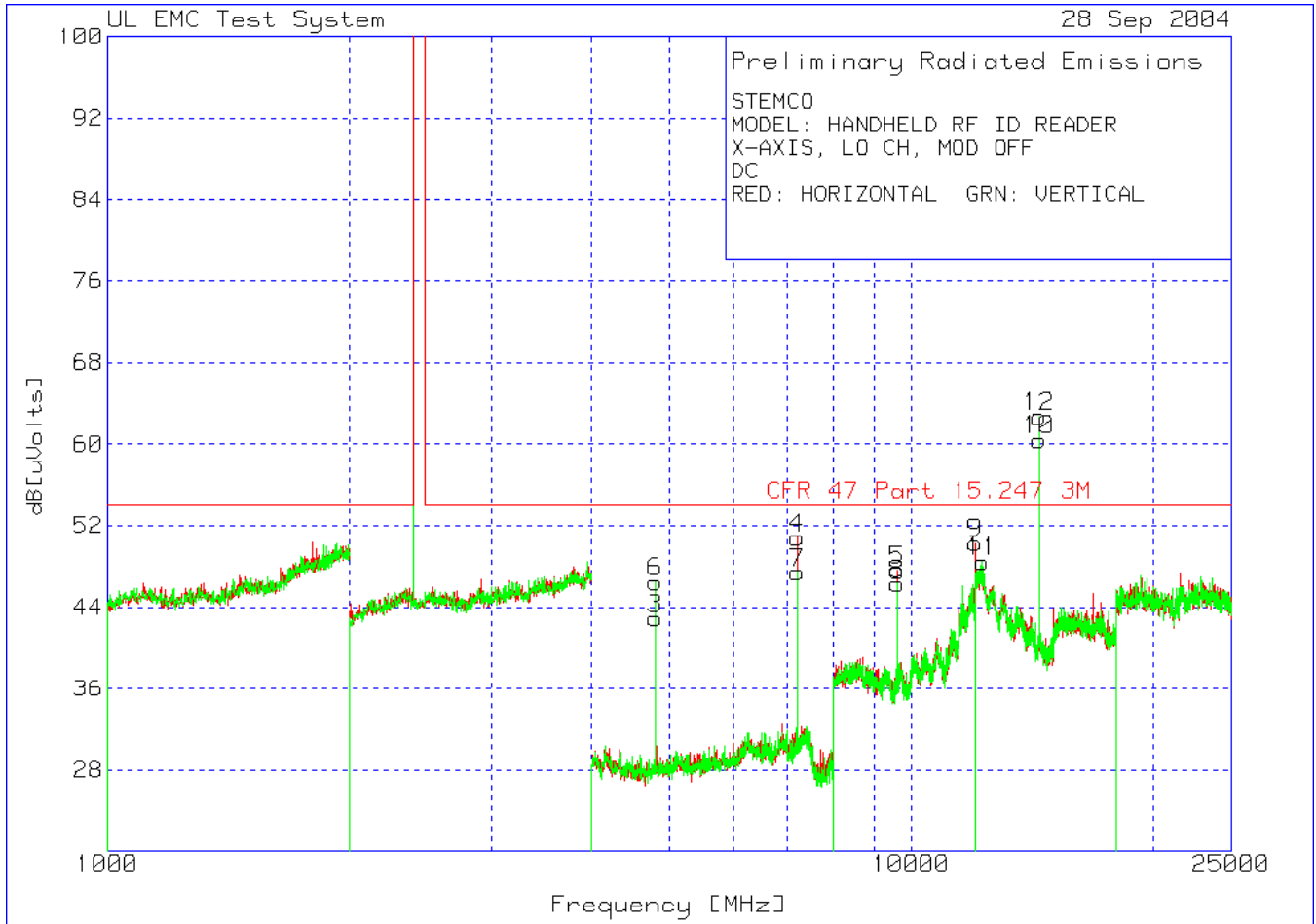
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3	4
1	240.1036	38.1 pk	-26	15.7	27.8			46.4	35.6
	Azimuth:350	Height:300	Horz	Margin [dB]				-18.6	-7.8
2	320.1099	41.6 pk	-32.7	14.6	23.5			46.4	35.6
	Azimuth:232	Height:299	Horz	Margin [dB]				-22.9	-12.1
3	479.9402	36.9 pk	-32	17.8	22.7			46.4	35.6
	Azimuth:348	Height:100	Horz	Margin [dB]				-23.7	-12.9
4	519.9852	35.3 pk	-31.8	17.7	21.2			46.4	35.6
	Azimuth:358	Height:100	Horz	Margin [dB]				-25.2	-14.4
5	560.0302	36.3 pk	-31.6	19	23.7			46.4	35.6
	Azimuth:43	Height:100	Horz	Margin [dB]				-22.7	-11.9
6	719.8605	35.4 pk	-31.4	20.7	24.7			46.4	35.6
	Azimuth:12	Height:100	Horz	Margin [dB]				-21.7	-10.9
7	759.7306	34.4 pk	-31.6	21.1	23.9			46.4	35.6
	Azimuth:314	Height:100	Horz	Margin [dB]				-22.5	-11.7
8	839.9955	33.8 pk	-31.7	22.1	24.2			46.4	35.6
	Azimuth:18	Height:100	Horz	Margin [dB]				-22.2	-11.4
9	919.9106	33.6 pk	-31.9	22.7	24.4			46.4	35.6
	Azimuth:12	Height:100	Horz	Margin [dB]				-22	-11.2

LIMIT 1: NONE
 LIMIT 2: NONE
 LIMIT 3: CFR 47 PART 15 CLASS A (10m)
 LIMIT 4: CFR 47 Part 15 Class B 10m

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 1.5 meters
EUT Position: X – Axis

1000MHz – 25000MHz, Low Channel, No Modulation



STEMCO
 MODEL: HANDHELD RF ID READER
 X-AXIS, LO CH, MOD OFF
 DC
 RED: HORIZONTAL GRN: VERTICAL

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2400.802	80.03 pk Height:149	3.3 Horz	21.8	105.13	999
				Margin [dB]		-893.87
2	2400.802	76.18 pk Height:150	3.3 Vert	21.8	101.28	999
				Margin [dB]		-897.72
3	4800.801	66.69 pk Height:100	-51.5 Horz	27.7	42.89	54
				Margin [dB]		-11.11
4	7203.203	68.33 pk Height:100	-47.2 Horz	29.7	50.83	54
				Margin [dB]		-3.17
5	9605.606	60.71 pk Height:149	-49.5 Horz	36.4	47.61	54
				Margin [dB]		-6.39
6	4800.801	70.27 pk Height:149	-51.5 Vert	27.7	46.47	54
				Margin [dB]		-7.53
7	7203.203	64.93 pk Height:100	-47.2 Vert	29.7	47.43	54
				Margin [dB]		-6.57
8	9605.606	59.39 pk Height:100	-49.5 Vert	36.4	46.29	54
				Margin [dB]		-7.71
9	12000	52.08 pk Height:149	-41.2 Horz	39.4	50.28	54
				Margin [dB]		-3.72
10	14408.408	63.31 pk Height:149	-42.7 Horz	39.8	60.41	54
				Margin [dB]		*6.41
11	12246.246	49.75 pk Height:100	-40.7 Vert	39.4	48.45	54
				Margin [dB]		-5.55
12	14408.408	65.6 pk Height:150	-42.7 Vert	39.8	62.7	54
				Margin [dB]		8.7

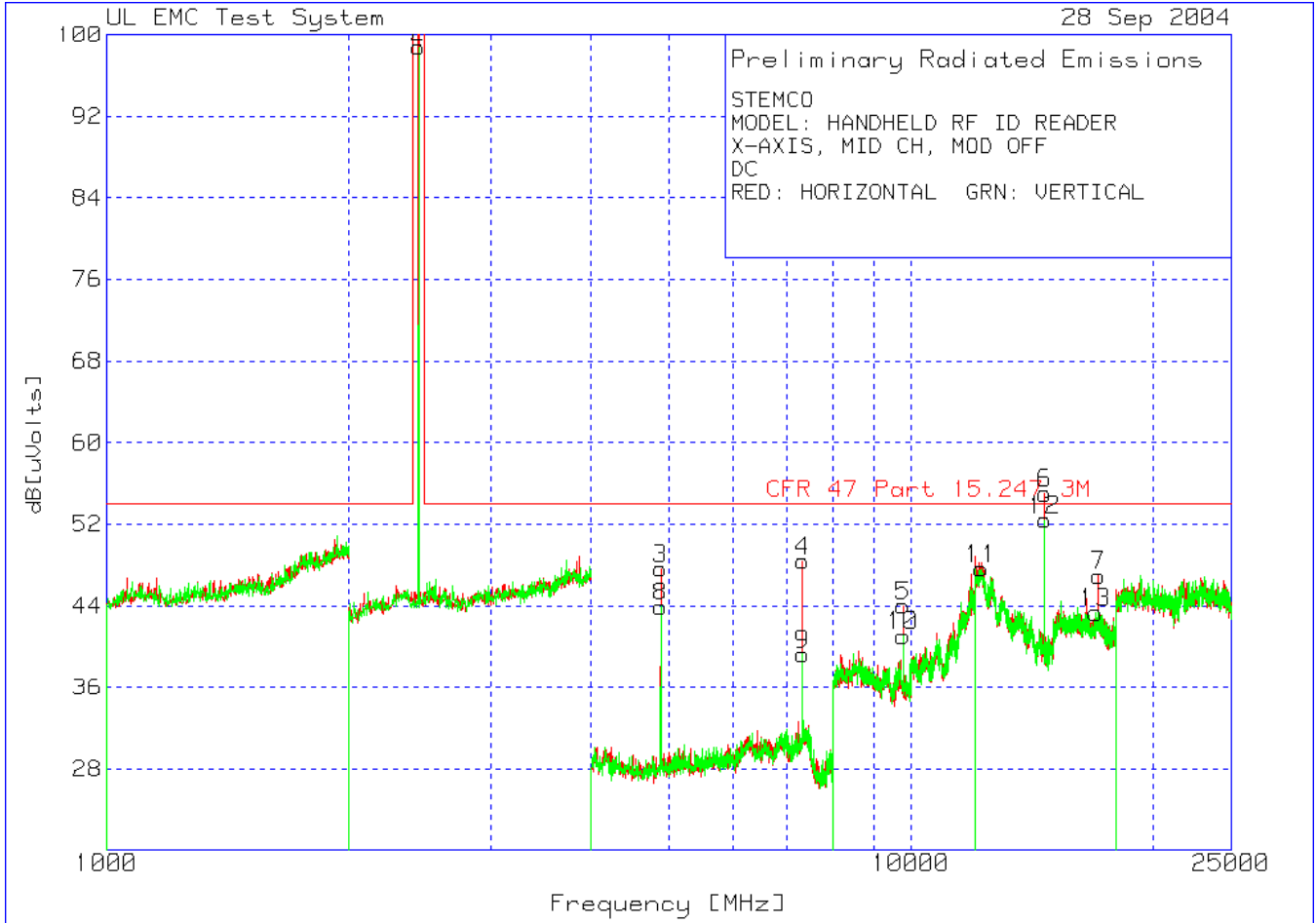
LIMIT 1: CFR 47 Part 15.247 3M

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

* - Emission not in restricted band

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 1.5 meters
EUT Position: X – Axis

1000MHz – 25000MHz, Middle Channel, No Modulation



STEMCO
 MODEL: HANDHELD RF ID READER
 X-AXIS, MID CH, MOD OFF
 DC
 RED: HORIZONTAL GRN: VERTICAL

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2440.882	78.21 pk Height:150	3.3 Horz	21.9	103.41	999
				Margin [dB]		-895.59
2	2440.882	73.6 pk Height:149	3.3 Vert	21.9	98.8	999
				Margin [dB]		-900.2
3	4880.881	71.34 pk Height:100	-51.4 Horz	27.7	47.64	54
				Margin [dB]		-6.36
4	7327.327	64.79 pk Height:100	-47.1 Horz	30.7	48.39	54
				Margin [dB]		-5.61
5	9765.766	57.89 pk Height:150	-50.3 Horz	36.4	43.99	54
				Margin [dB]		-10.01
6	14648.649	57.43 pk Height:150	-42.2 Horz	39.8	55.03	54
				Margin [dB]		*1.03
7	17093.093	48.57 pk Height:150	-41.9 Horz	40.3	46.97	54
				Margin [dB]		-7.03
8	4880.881	67.62 pk Height:150	-51.4 Vert	27.7	43.92	54
				Margin [dB]		-10.08
9	7327.327	55.66 pk Height:100	-47.1 Vert	30.7	39.26	54
				Margin [dB]		-14.74
10	9765.766	54.95 pk Height:150	-50.3 Vert	36.4	41.05	54
				Margin [dB]		-12.95
11	12210.21	49.45 pk Height:100	-41.2 Vert	39.4	47.65	54
				Margin [dB]		-6.35
12	14648.649	54.81 pk Height:150	-42.2 Vert	39.8	52.41	54
				Margin [dB]		-1.59
13	16951.952	45.15 pk Height:150	-42.1 Vert	40.3	43.35	54
				Margin [dB]		-10.65

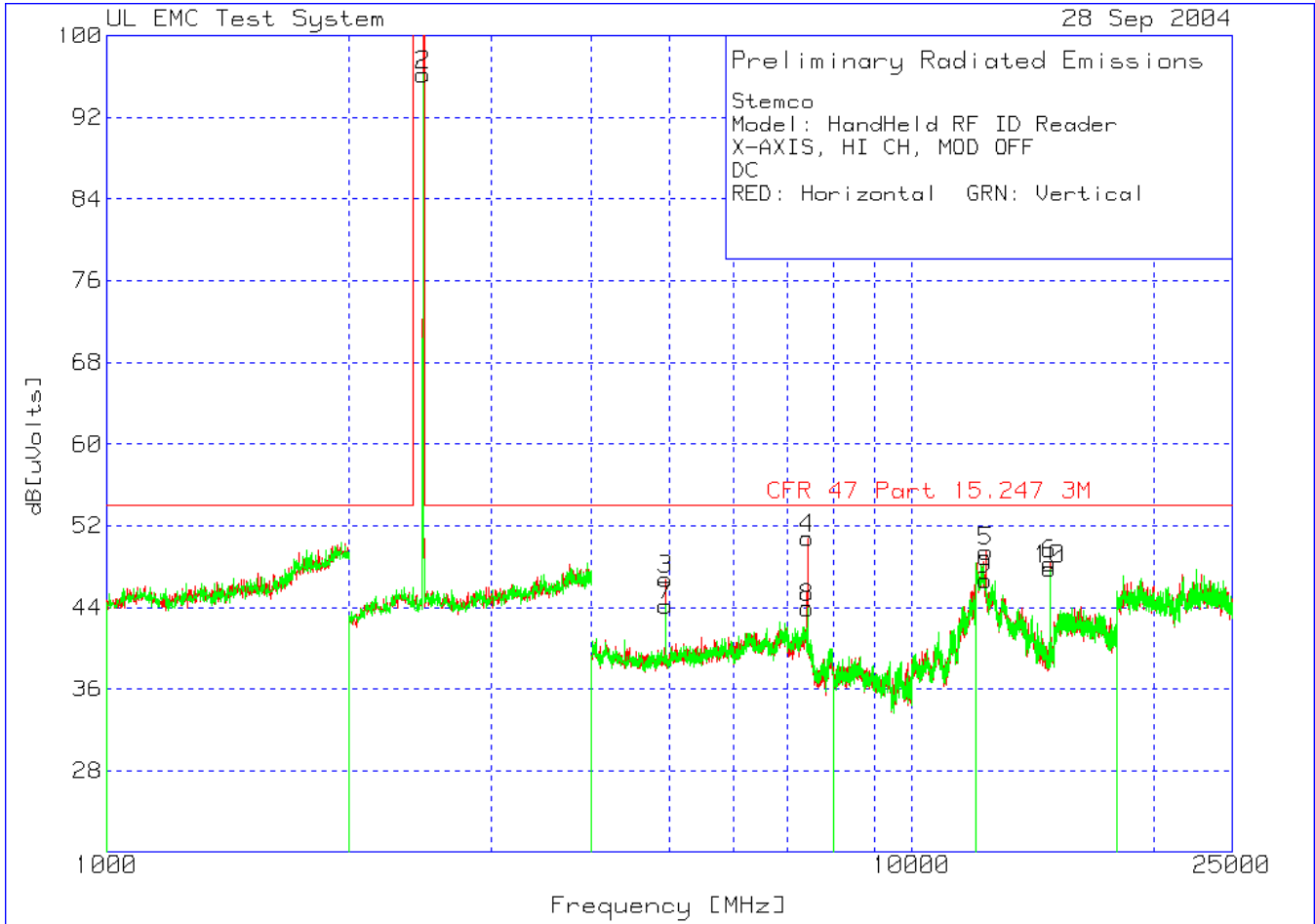
LIMIT 1: CFR 47 Part 15.247 3M

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

* - Emission not in restricted band

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 1.5 meters
EUT Position: X – Axis

1000MHz – 25000MHz, High Channel, No Modulation



Stemco
 Model: HandHeld RF ID Reader
 X-AXIS, HI CH, MOD OFF
 DC
 RED: Horizontal GRN: Vertical

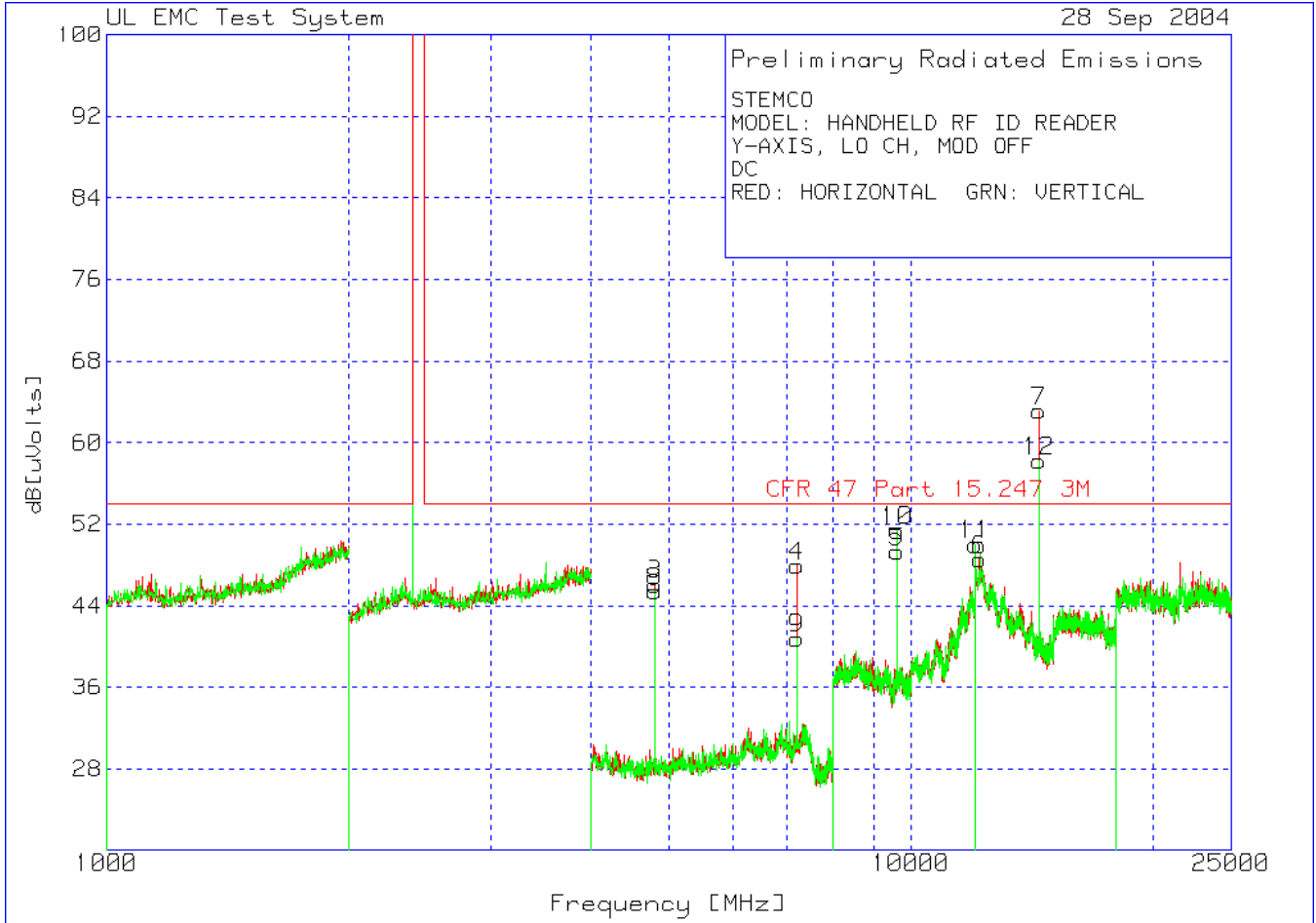
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2468.938	75.9 pk Height:150	3.3	22	101.2	999
				Margin [dB]		-897.8
2	2468.938	70.89 pk Height:150	3.3	22	96.19	999
				Margin [dB]		-902.81
3	4940.941	70.57 pk Height:100	-51.6	27.8	46.77	54
				Margin [dB]		-7.23
4	7415.415	66.79 pk Height:100	-47	31	50.79	54
				Margin [dB]		-3.21
5	12354.354	52.77 pk Height:149	-42.7	39.4	49.47	54
				Margin [dB]		-4.53
6	14828.829	50.89 pk Height:149	-42.4	39.8	48.29	54
				Margin [dB]		-5.71
7	4940.941	67.97 pk Height:149	-51.6	27.8	44.17	54
				Margin [dB]		-9.83
8	7415.415	59.97 pk Height:149	-47	31	43.97	54
				Margin [dB]		-10.03
9	12336.336	49.62 pk Height:149	-42.3	39.4	46.72	54
				Margin [dB]		-7.28
10	14828.829	50.38 pk Height:149	-42.4	39.8	47.78	54
				Margin [dB]		-6.22

LIMIT 1: CFR 47 Part 15.247 3M

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 1.5 meters
EUT Position: Y – Axis

1000MHz – 25000MHz, Low Channel, No Modulation



STEMCO
 MODEL: HANDHELD RF ID READER
 Y-AXIS, LO CH, MOD OFF
 DC
 RED: HORIZONTAL GRN: VERTICAL

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2400.802	77.29 pk Height:100	3.3 Horz	21.8	102.39	999
				Margin [dB]		-896.61
2	2400.802	78.56 pk Height:100	3.3 Vert	21.8	103.66	999
				Margin [dB]		-895.34
3	4800.801	69.87 pk Height:150	-51.5 Horz	27.7	46.07	54
				Margin [dB]		-7.93
4	7203.203	65.43 pk Height:100	-47.2 Horz	29.7	47.93	54
				Margin [dB]		-6.07
5	9605.606	62.42 pk Height:149	-49.5 Horz	36.4	49.32	54
				Margin [dB]		-4.68
6	12150.15	51.15 pk Height:150	-42 Horz	39.4	48.55	54
				Margin [dB]		-5.45
7	14408.408	65.99 pk Height:150	-42.7 Horz	39.8	63.09	54
				Margin [dB]		9.09
8	4800.801	69.22 pk Height:150	-51.5 Vert	27.7	45.42	54
				Margin [dB]		-8.58
9	7203.203	58.3 pk Height:100	-47.2 Vert	29.7	40.8	54
				Margin [dB]		-13.2
10	9605.606	64.45 pk Height:150	-49.5 Vert	36.4	51.35	54
				Margin [dB]		-2.65
11	12000	51.81 pk Height:150	-41.2 Vert	39.4	50.01	54
				Margin [dB]		-3.99
12	14408.408	61.1 pk Height:150	-42.7 Vert	39.8	58.2	54
				Margin [dB]		*4.2

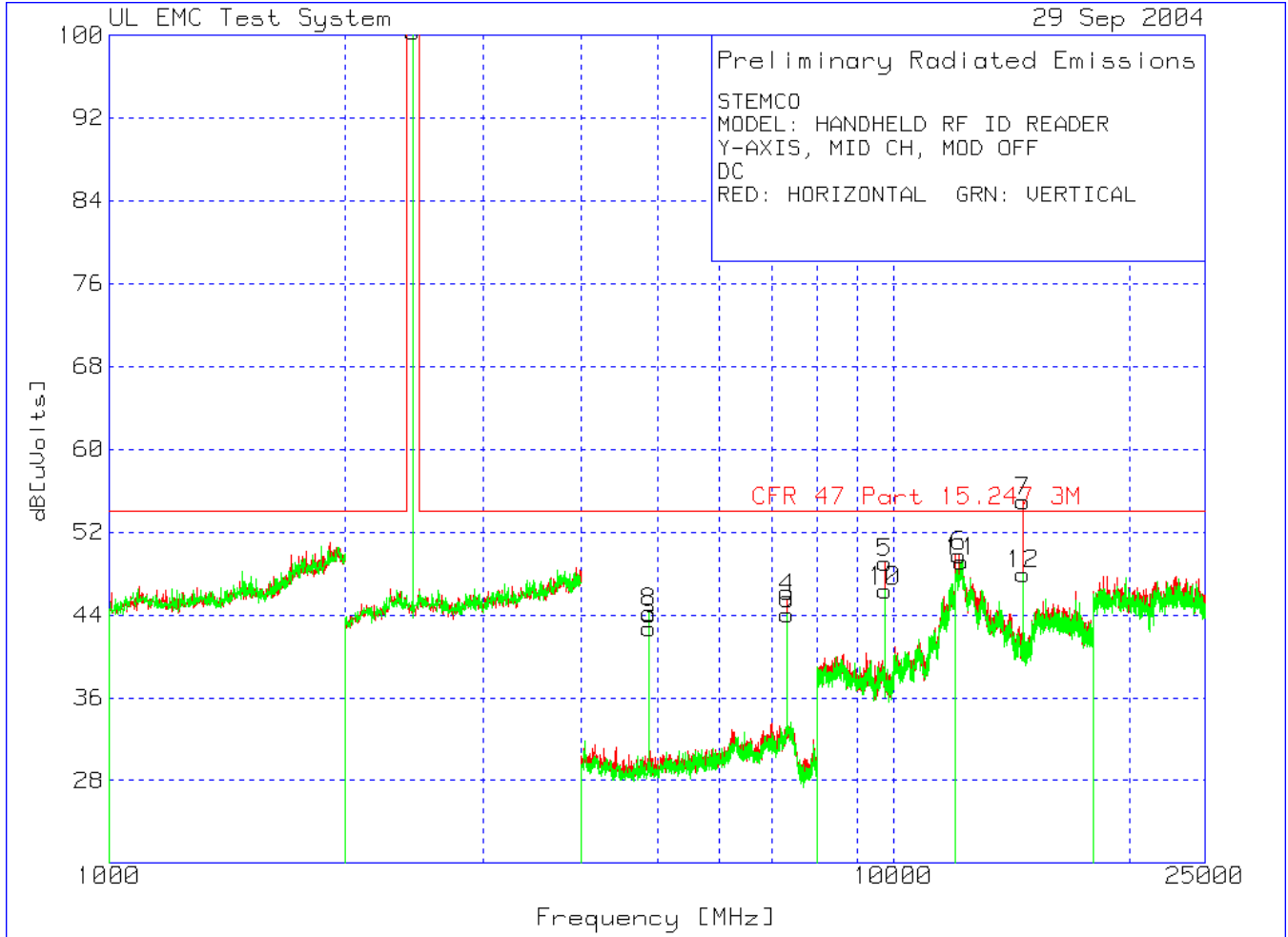
LIMIT 1: CFR 47 Part 15.247 3M

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

* - Emission not in restricted band

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 1.5 meters
EUT Position: Y- Axis

1000MHz – 25000MHz, Middle Channel, No Modulation



STEMCO
 MODEL: HANDHELD RF ID READER
 Y-AXIS, MID CH, MOD OFF
 DC
 RED: HORIZONTAL GRN: VERTICAL

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2440.882	77.99 pk	3.3	21.9	103.19	999
		Height:100	Horz	Margin [dB]		-895.81
2	2440.882	75.11 pk	3.3	21.9	100.31	999
		Height:100	Vert	Margin [dB]		-898.69
3	4880.881	66.38 pk	-51.4	27.7	42.68	54
		Height:149	Horz	Margin [dB]		-11.32
4	7327.327	61.95 pk	-47.1	30.7	45.55	54
		Height:100	Horz	Margin [dB]		-8.45
5	9765.766	62.93 pk	-50.3	36.4	49.03	54
		Height:149	Horz	Margin [dB]		-4.97
6	12144.144	52.42 pk	-42.1	39.4	49.72	54
		Height:100	Horz	Margin [dB]		-4.28
7	14648.649	57.37 pk	-42.2	39.8	54.97	54
		Height:150	Horz	Margin [dB]		*.97
8	4880.881	67.95 pk	-51.4	27.7	44.25	54
		Height:150	Vert	Margin [dB]		-9.75
9	7327.327	60.44 pk	-47.1	30.7	44.04	54
		Height:150	Vert	Margin [dB]		-9.96
10	9765.766	60.22 pk	-50.3	36.4	46.32	54
		Height:150	Vert	Margin [dB]		-7.68
11	12204.204	50.93 pk	-41.2	39.4	49.13	54
		Height:150	Vert	Margin [dB]		-4.87
12	14648.649	50.33 pk	-42.2	39.8	47.93	54
		Height:150	Vert	Margin [dB]		-6.07

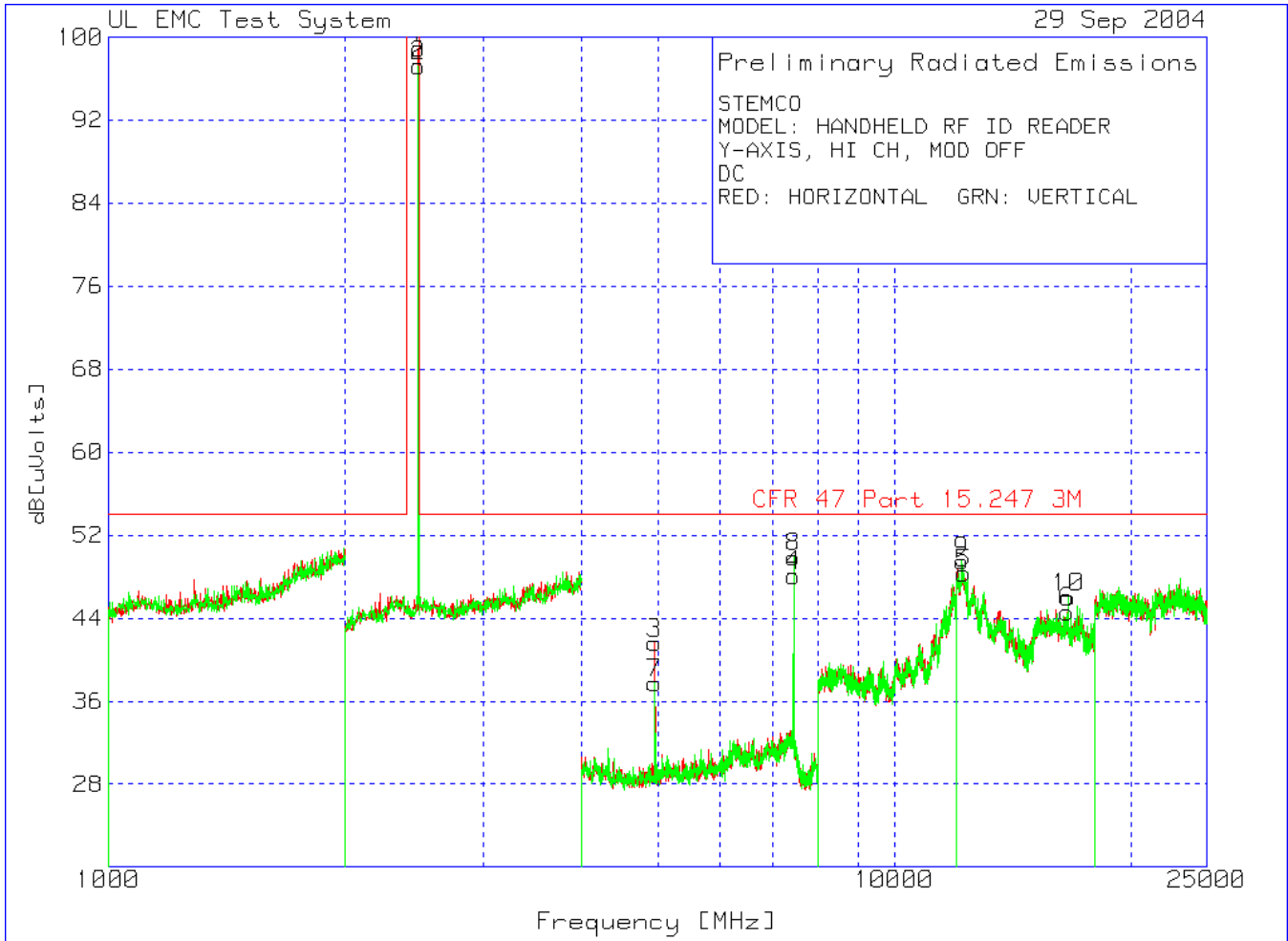
LIMIT 1: CFR 47 Part 15.247 3M

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

* - Emission not in restricted band

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 1.5 meters
EUT Position: Y- Axis

1000MHz – 25000MHz, High Channel, No Modulation



STEMCO
 MODEL: HANDHELD RF ID READER
 Y-AXIS, HI CH, MOD OFF
 DC
 RED: HORIZONTAL GRN: VERTICAL

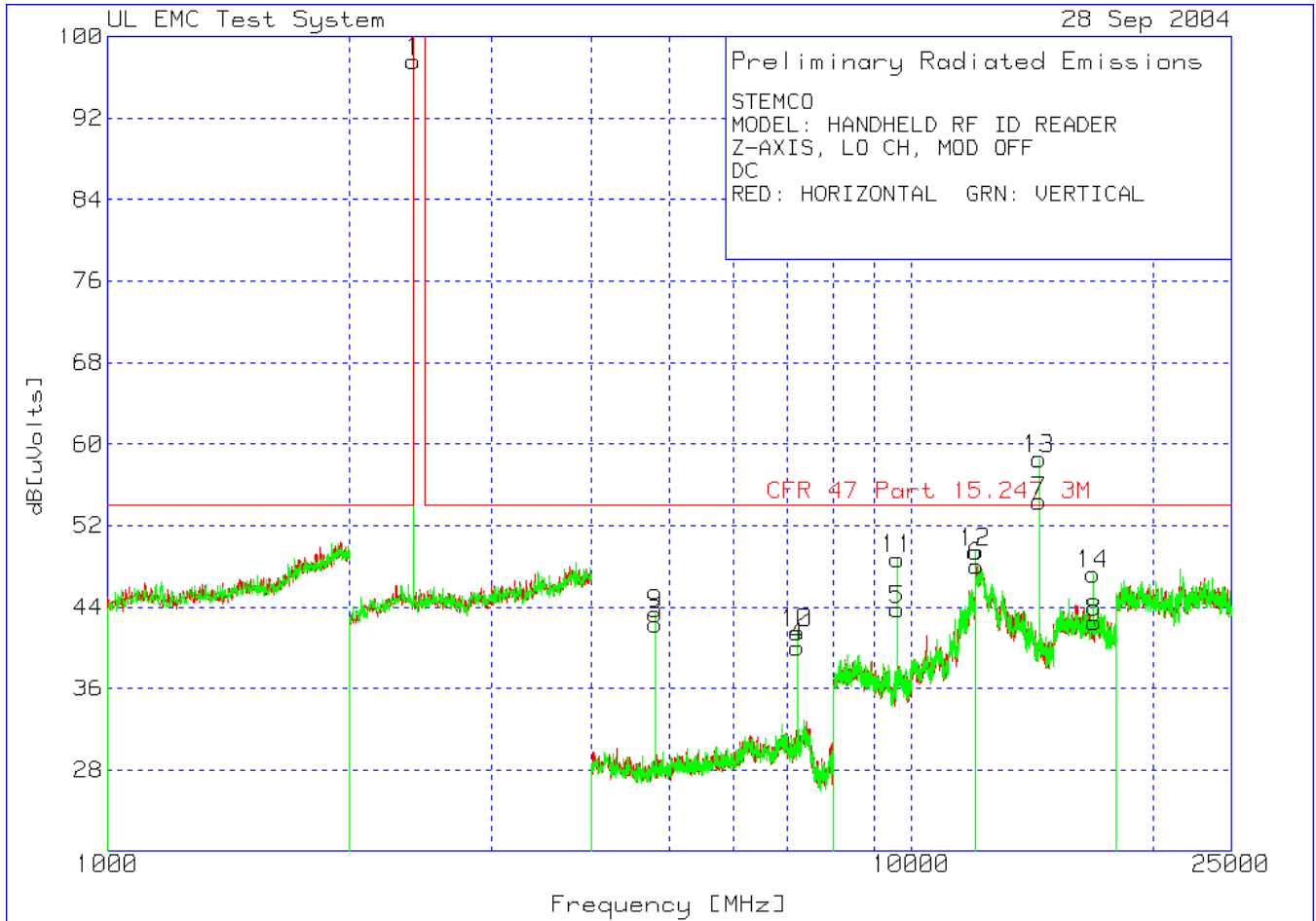
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2480.962	73.64 pk Height:100	3.3 Horz	22	98.94	999 -900.06
2	2480.962	71.94 pk Height:100	3.3 Vert	22	97.24	999 -901.76
3	4960.961	65.39 pk Height:150	-51.6 Horz	27.8	41.59	54 -12.41
4	7443.443	64.5 pk Height:100	-46.9 Horz	30.5	48.1	54 -5.9
5	12252.252	49.63 pk Height:100	-40.7 Horz	39.4	48.33	54 -5.67
6	16594.595	46.7 pk Height:100	-41.9 Horz	39.8	44.6	54 -9.4
7	4960.961	61.53 pk Height:100	-51.6 Vert	27.8	37.73	54 -16.27
8	7443.443	66.27 pk Height:150	-46.9 Vert	30.5	49.87	54 -4.13
9	12198.198	51.38 pk Height:150	-41.3 Vert	39.4	49.48	54 -4.52
10	16648.649	48.1 pk Height:100	-42 Vert	39.9	46	54 -8

LIMIT 1: CFR 47 Part 15.247 3M

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 1.5 meters
EUT Position: Z – Axis

1000MHz – 25000MHz, Low Channel, No Modulation



STEMCO
 MODEL: HANDHELD RF ID READER
 Z-AXIS, LO CH, MOD OFF
 DC
 RED: HORIZONTAL GRN: VERTICAL

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2400.802	72.5 pk	3.3	21.8	97.6	999
		Height:150	Horz	Margin [dB]		-901.4
2	2400.802	82.6 pk	3.3	21.8	107.7	999
		Height:100	Vert	Margin [dB]		-891.3
3	4800.801	66.13 pk	-51.5	27.7	42.33	54
		Height:149	Horz	Margin [dB]		-11.67
4	7203.203	57.53 pk	-47.2	29.7	40.03	54
		Height:100	Horz	Margin [dB]		-13.97
5	9605.606	56.88 pk	-49.5	36.4	43.78	54
		Height:150	Horz	Margin [dB]		-10.22
6	12036.036	50.53 pk	-41.9	39.4	48.03	54
		Height:100	Horz	Margin [dB]		-5.97
7	14408.408	57.3 pk	-42.7	39.8	54.4	54
		Height:149	Horz	Margin [dB]		.4
8	16864.865	44.41 pk	-42.1	40.2	42.51	54
		Height:100	Horz	Margin [dB]		-11.49
9	4800.801	67.13 pk	-51.5	27.7	43.33	54
		Height:149	Vert	Margin [dB]		-10.67
10	7203.203	59 pk	-47.2	29.7	41.5	54
		Height:100	Vert	Margin [dB]		-12.5
11	9605.606	61.83 pk	-49.5	36.4	48.73	54
		Height:149	Vert	Margin [dB]		-5.27
12	12000	51.22 pk	-41.2	39.4	49.42	54
		Height:150	Vert	Margin [dB]		-4.58
13	14408.408	61.46 pk	-42.7	39.8	58.56	54
		Height:150	Vert	Margin [dB]		*4.56
14	16810.811	49.13 pk	-42	40.1	47.23	54
		Height:150	Vert	Margin [dB]		-6.77

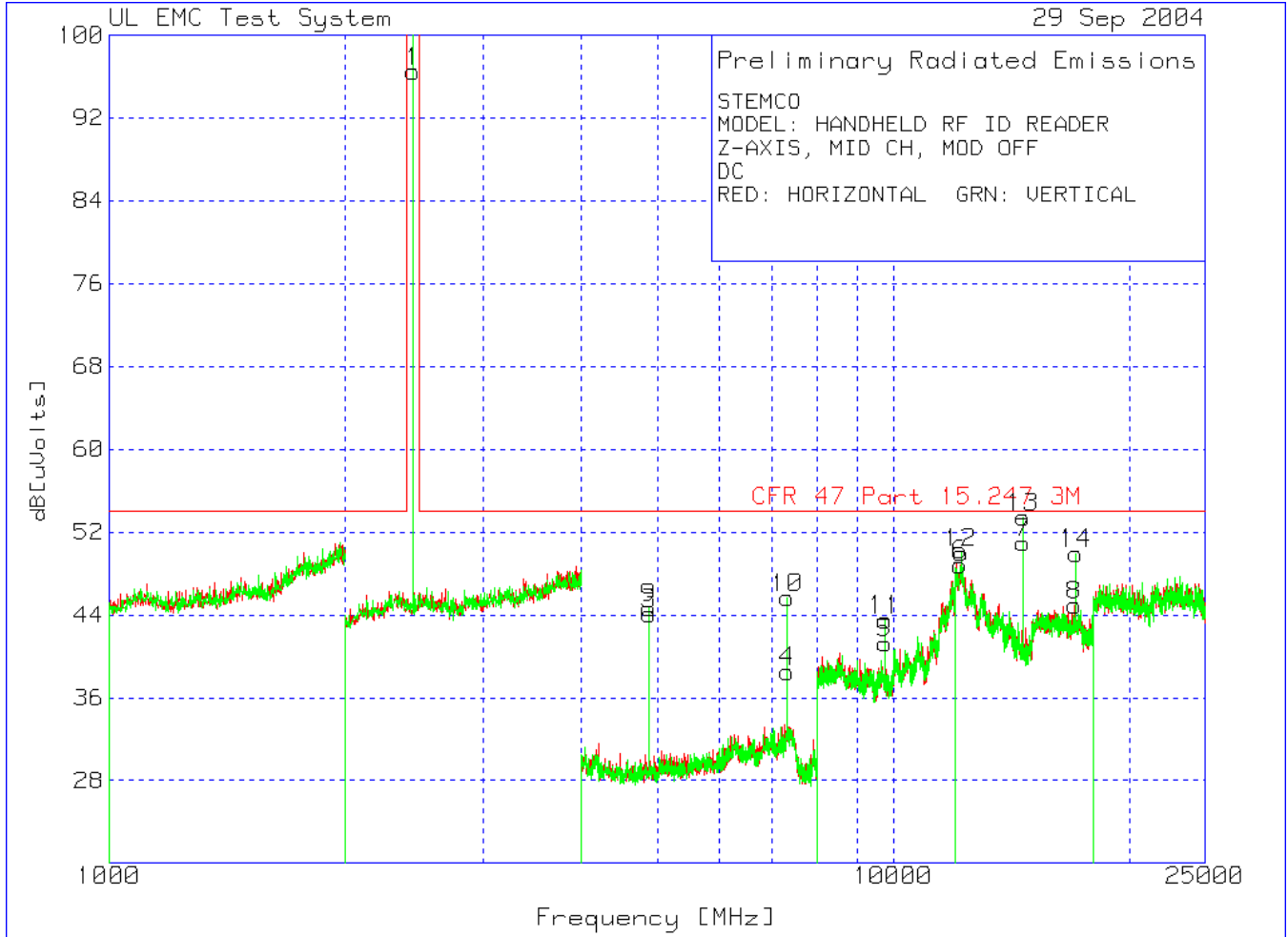
LIMIT 1: CFR 47 Part 15.247 3M

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

* - Emission not in restricted band

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 1.5 meters
EUT Position: Z - Axis

1000MHz – 25000MHz, Middle Channel, No Modulation



STEMCO
 MODEL: HANDHELD RF ID READER
 Z-AXIS, MID CH, MOD OFF
 DC
 RED: HORIZONTAL GRN: VERTICAL

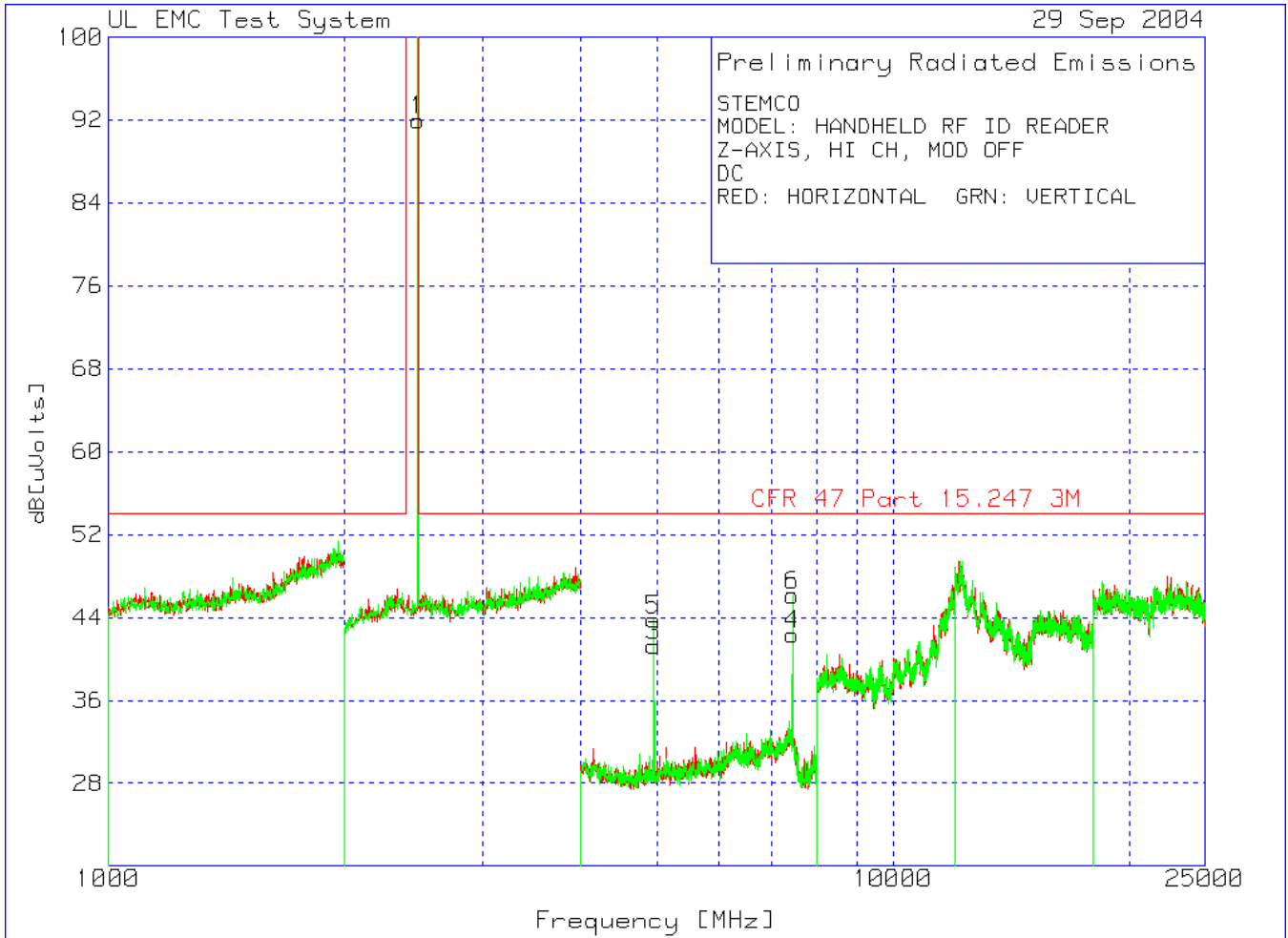
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2440.882	71.3 pk	3.3	21.9	96.5	999
		Height:150	Horz	Margin [dB]		-902.5
2	2440.882	82.21 pk	3.3	21.9	107.41	999
		Height:100	Vert	Margin [dB]		-891.59
3	4880.881	67.8 pk	-51.4	27.7	44.1	54
		Height:100	Horz	Margin [dB]		-9.9
4	7327.327	54.93 pk	-47.1	30.7	38.53	54
		Height:100	Horz	Margin [dB]		-15.47
5	9765.766	55.13 pk	-50.3	36.4	41.23	54
		Height:149	Horz	Margin [dB]		-12.77
6	12168.168	51.13 pk	-41.7	39.4	48.83	54
		Height:150	Horz	Margin [dB]		-5.17
7	14648.649	53.35 pk	-42.2	39.8	50.95	54
		Height:150	Horz	Margin [dB]		-3.05
8	17057.057	46.63 pk	-42.1	40.4	44.93	54
		Height:150	Horz	Margin [dB]		-9.07
9	4880.881	68.36 pk	-51.4	27.7	44.66	54
		Height:150	Vert	Margin [dB]		-9.34
10	7327.327	62.06 pk	-47.1	30.7	45.66	54
		Height:150	Vert	Margin [dB]		-8.34
11	9765.766	57.41 pk	-50.3	36.4	43.51	54
		Height:150	Vert	Margin [dB]		-10.49
12	12204.204	51.78 pk	-41.2	39.4	49.98	54
		Height:150	Vert	Margin [dB]		-4.02
13	14648.649	55.83 pk	-42.2	39.8	53.43	54
		Height:150	Vert	Margin [dB]		-.57
14	17093.093	51.54 pk	-41.9	40.3	49.94	54
		Height:150	Vert	Margin [dB]		-4.06

LIMIT 1: CFR 47 Part 15.247 3M

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

Preliminary Peak Scan
Azimuth: 0 to 360 Degrees
Antenna Height: 1 and 1.5 meters
EUT Position: Z – Axis

1000MHz – 25000MHz, High Channel, No Modulation



STEMCO
 MODEL: HANDHELD RF ID READER
 Z-AXIS, HI CH, MOD OFF
 DC
 RED: HORIZONTAL GRN: VERTICAL

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2480.962	66.68 pk Height:150 Horz	3.3	22	91.98	999 -907.02
3	4960.961	65.04 pk Height:150 Horz	-51.6	27.8	41.24	54 -12.76
4	7443.443	58.74 pk Height:100 Horz	-46.9	30.5	42.34	54 -11.66
2	2480.962	78.12 pk Height:100 Vert	3.3	22	103.42	999 -895.58
5	4960.961	67.57 pk Height:150 Vert	-51.6	27.8	43.77	54 -10.23
6	7443.443	62.55 pk Height:100 Vert	-46.9	30.5	46.15	54 -7.85

LIMIT 1: CFR 47 Part 15.247 3M

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

**Final Maximized (Azimuth, Height),
Worst Case (Antenna Polarization, EUT Axis)
Restricted Bands Peak Data
Using VBW=10Hz per DA 00-705**

Channel: Low

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
=====					
X-AXIS					
12005.644	50.6 pk	-41.3	39.4	48.7	54
Azimuth: 91	Height:186	Horz	Margin [dB]:	-5.3	
Y-AXIS					
12005.644	51.93 pk	-41.3	39.4	50.03	54
Azimuth: 352	Height:152	Vert	Margin [dB]:	-3.97	

Channel: Middle

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
=====					
X-AXIS					
4883.3076	71.45 pk	-51.4	27.7	47.75	54
Azimuth: 9	Height:113	Horz	Margin [dB]:	-6.25	
Z-AXIS					
4883.3171	67.01 pk	-51.4	27.7	43.31	54
Azimuth: 184	Height:117	Vert	Margin [dB]:	-10.69	
Z-AXIS					
7324.9449	62.63 pk	-47.1	30.6	46.13	54
Azimuth: 30	Height:156	Vert	Margin [dB]:	-7.87	
X-AXIS					
7324.9624	65.15 pk	-47.1	30.6	48.65	54
Azimuth: 309	Height:99	Horz	Margin [dB]:	-5.35	
Y-AXIS					
12208.307	49.67 pk	-41.2	39.4	47.87	54
Azimuth: 2	Height:144	Horz	Margin [dB]:	-6.13	
Z-AXIS					
12208.307	49.93 pk	-41.2	39.4	48.13	54
Azimuth: 197	Height:106	Vert	Margin [dB]:	-5.87	

Channel: High

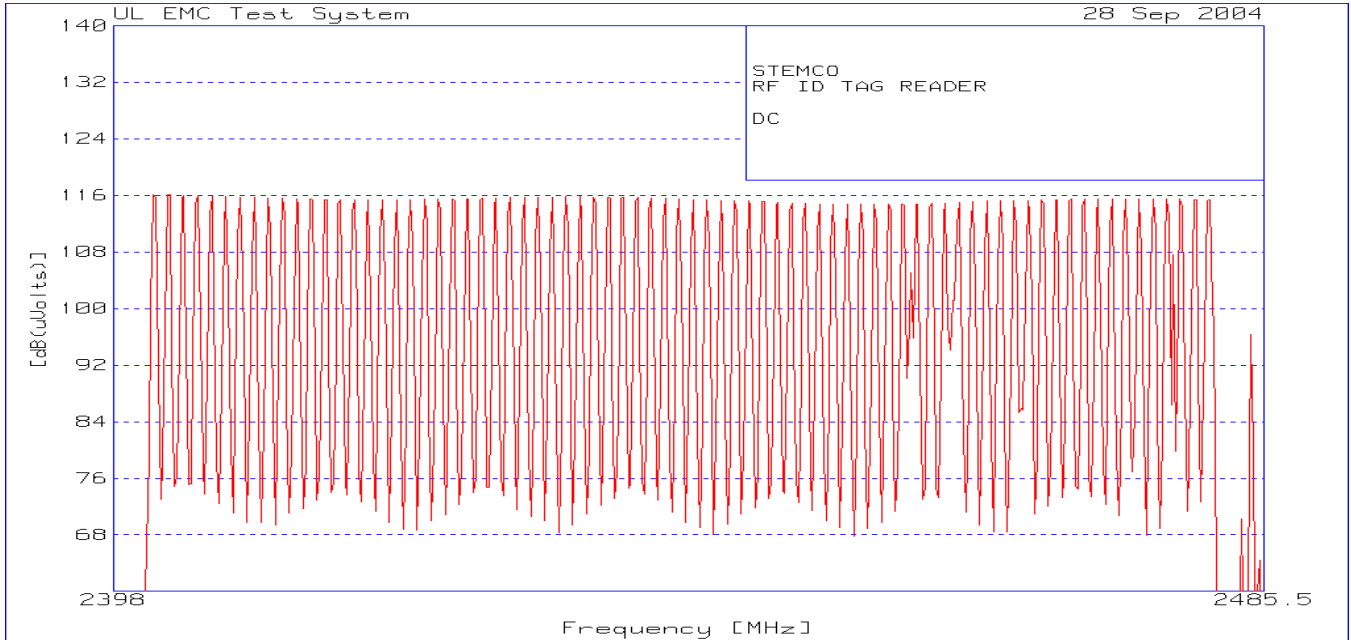
Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
=====					
X-AXIS					
12405.613	52.61 pk	-43.8	39.4	48.21	54
Azimuth: 82	Height:180	Horz	Margin [dB]:	-5.79	
Y-AXIS					
12405.613	50.5 pk	-43.8	39.4	46.1	54
Azimuth: 181	Height:99	Vert	Margin [dB]:	-7.9	
Y-AXIS					
7443.3577	65.4 pk	-46.9	30.5	49	54
Azimuth: 176	Height:112	Vert	Margin [dB]:	-5	
X-AXIS					
7443.3567	66.63 pk	-46.9	30.5	50.23	54
Azimuth: 329	Height:103	Horz	Margin [dB]:	-3.77	

LIMIT 1: CFR 47 Part 15.247 3M

**UNDERWRITERS LABORATORIES INC.
Carrier Frequency Separation and
Number of Hopping Frequencies**

Date Tested: September 28, 2004

Manufacturer : Stemco LLC
Equipment Under Test : 800 RFID Tag Reader / Writer
Requirement : 15.247(a)(1) and 15.247(a)(1)(iii)
Bandwidth : RBW=VBW=100kHz



List of Hopping Channels and Frequency of Each Channel

2400.9810	2421.3217	2441.6624	2462.0031
2402.0331	2422.3738	2442.7145	2463.0552
2403.0852	2423.4259	2443.7666	2464.1073
2404.1373	2424.4780	2444.8187	2465.1594
2405.1894	2425.5301	2445.8708	2466.2115
2406.4168	2426.5822	2446.9229	2467.2636
2407.4690	2427.6343	2447.9750	2468.3158
2408.5211	2428.6818	2449.0271	2469.3679
2409.5732	2429.9139	2450.0792	2470.4200
2410.6253	2430.9660	2451.3067	2471.4721
2411.6774	2432.0181	2452.3588	2472.5242
2412.7295	2433.0702	2453.4109	2473.7516
2413.7816	2434.1223	2454.4630	2474.8037
2414.8337	2435.1744	2455.5151	2475.8558
2415.8858	2436.2265	2456.5672	2476.9080
2417.1133	2437.2786	2457.6193	2477.9601
2418.1654	2438.3307	2458.6714	2479.0122
2419.2175	2439.5582	2459.7236	2480.0643
2420.2696	2440.6103	2460.7757	2481.1164

UNDERWRITERS LABORATORIES INC.
Channel Bandwidth

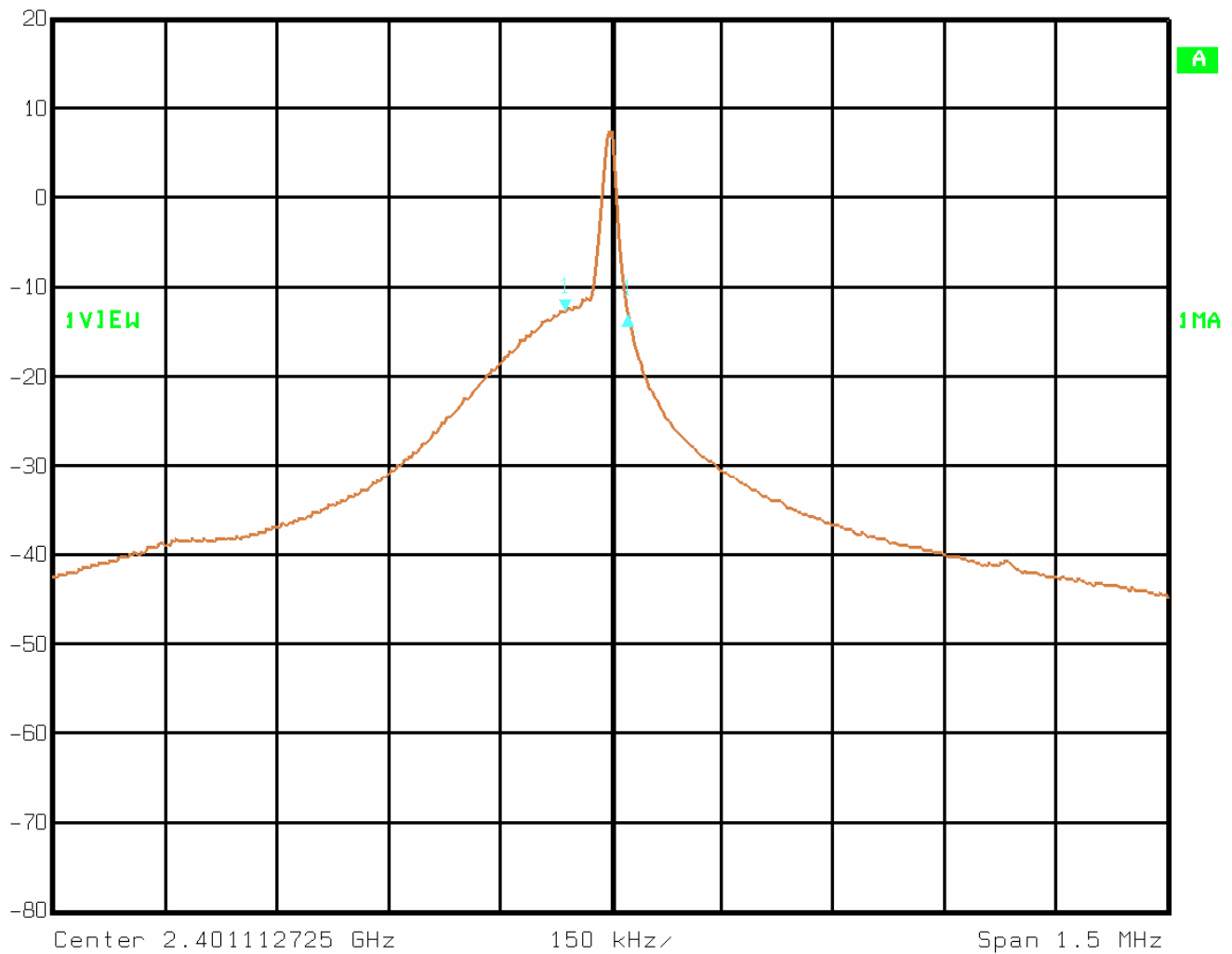
Date Tested: September 28, 2004

Manufacturer : Stemco LLC
Equipment Under Test : 800 RFID Tag Reader / Writer
Requirement : 15.247(a)(1)

Low Channel Bandwidth



Ref Lvl	Delta 1 [T1]	RBW	10 kHz	RF Att	30 dB
20 dBm	-0.15 dB	VBW	10 kHz		
	84.16833667 kHz	SWT	100 ms	Unit	dBm

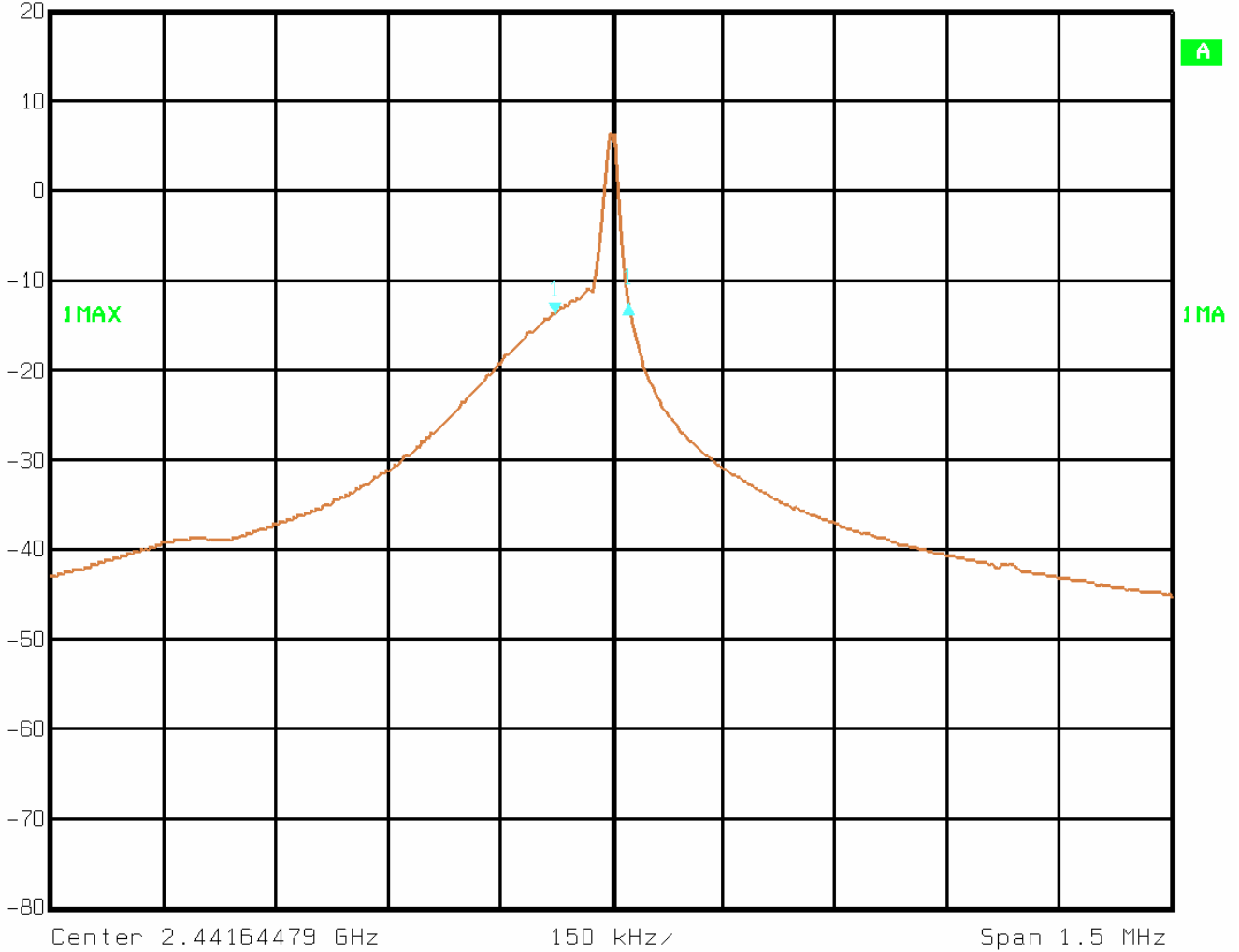


Date: 09.APR.1980 08:31:03

Middle Channel Bandwidth



Ref Lvl	Delta 1 [T1]	RBW	10 kHz	RF Att	30 dB
20 dBm	1.15 dB	VBW	10 kHz		
	99.19839679 kHz	SWT	100 ms	Unit	dBm

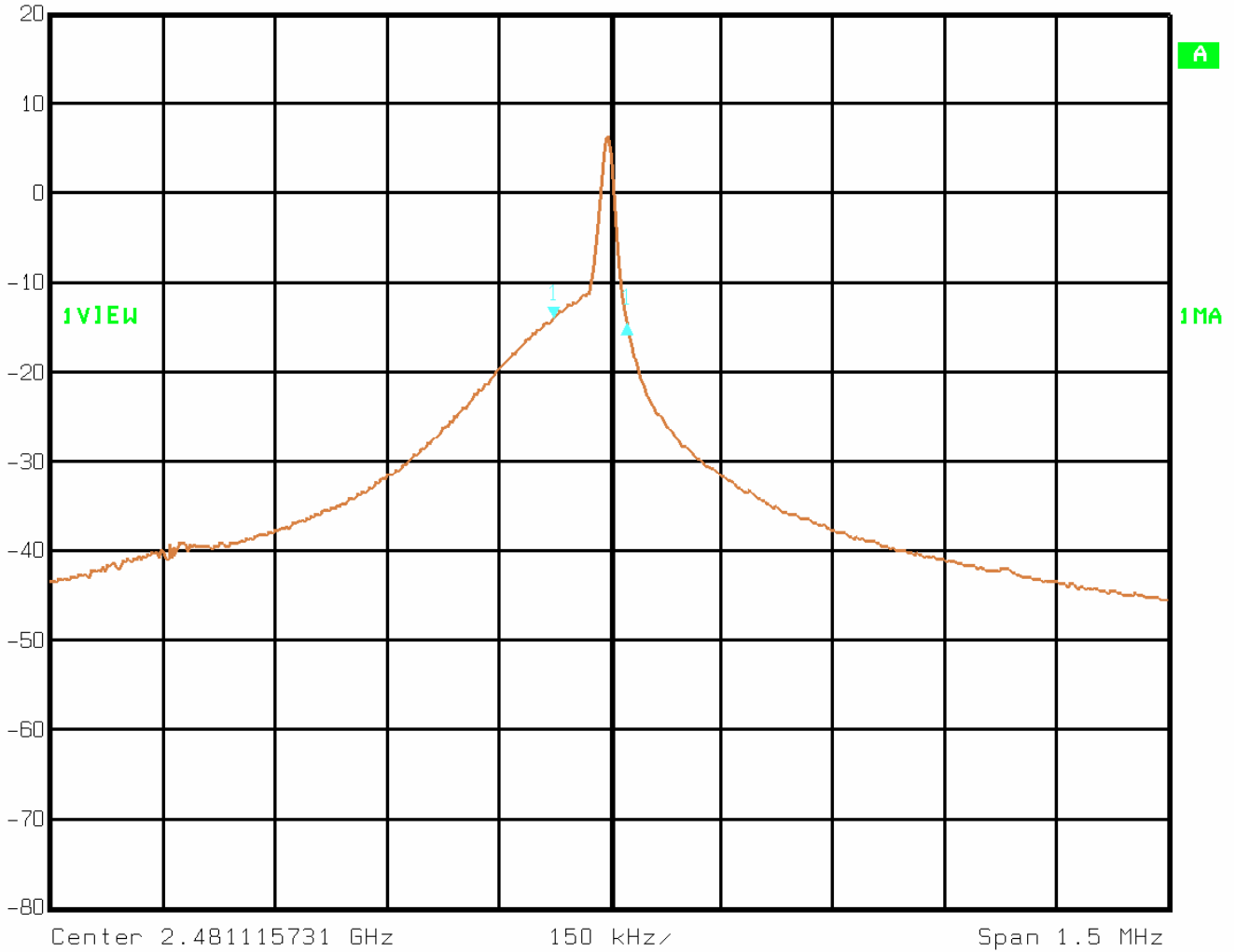


Date: 09.APR.1980 08:35:56

High Channel Bandwidth



Delta 1 [T1]	RBW	10 kHz	RF Att	30 dB
Ref Lvl	-0.67 dB	VBW	10 kHz	
20 dBm	99.19839679 kHz	SWT	100 ms	Unit dBm



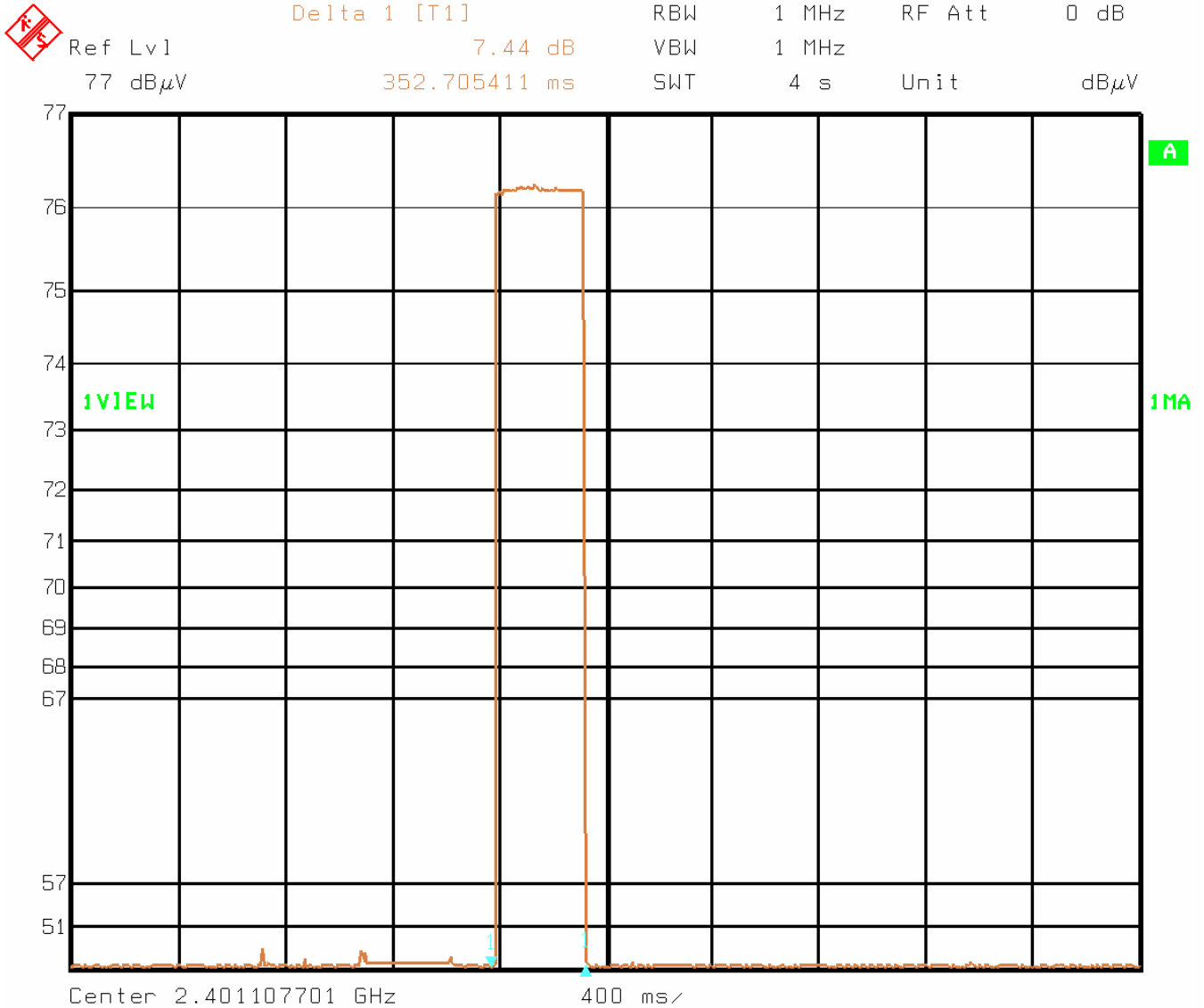
Date: 09.APR.1980 08:39:01

UNDERWRITERS LABORATORIES INC.
Average Channel Occupancy Time

Date Tested: November 24, 2004

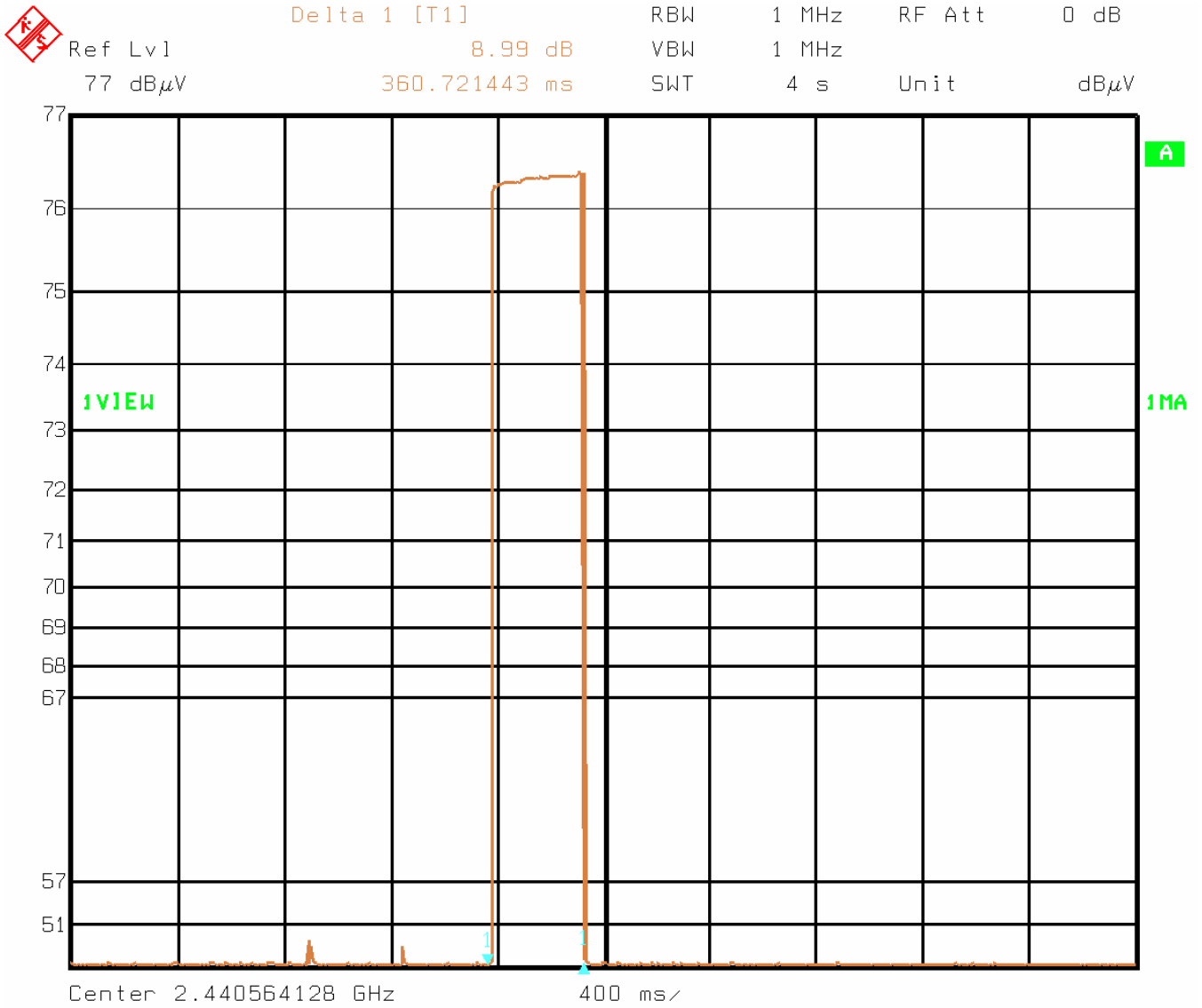
Manufacturer : Stemco LLC
Equipment Under Test : 800 RFID Tag Reader / Writer
Requirement : 15.247(a)(1)(iii)

Low Channel Occupancy Time Plot



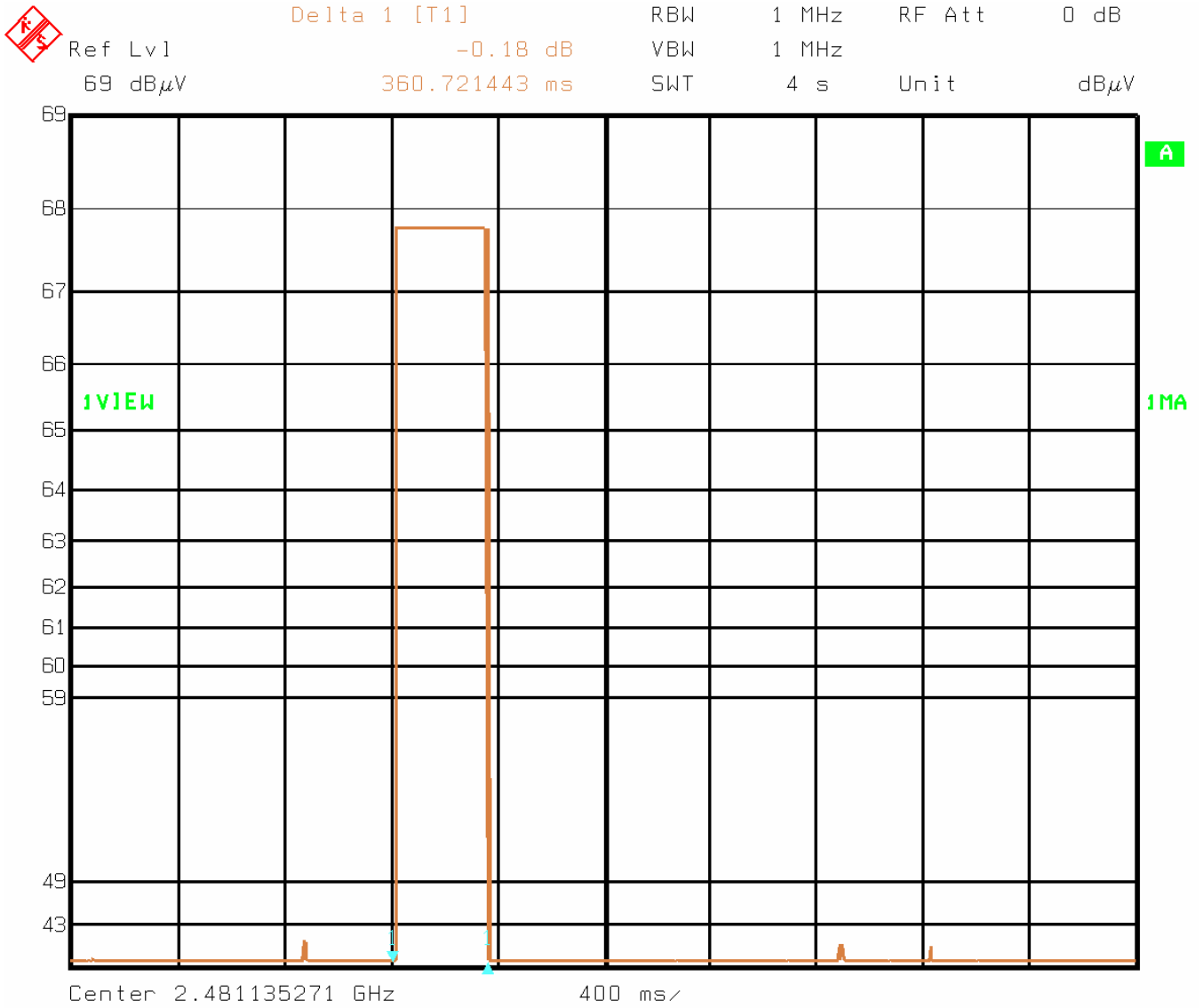
Pulse on-time: 352.71mS

Middle Channel Occupancy Time Plot



Pulse on-time: 360.72mS

High Channel Occupancy Time Plot



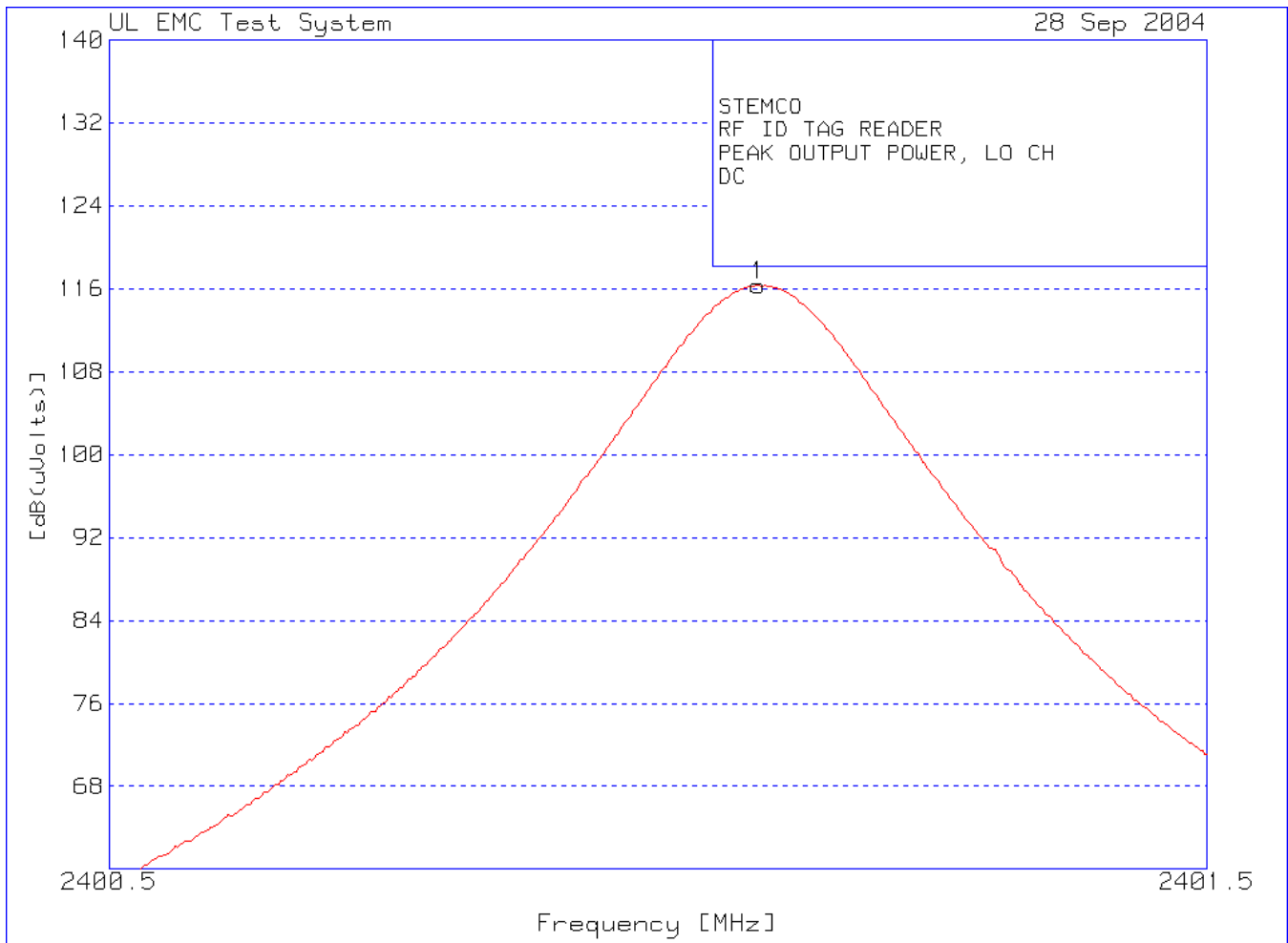
Pulse on-time: 360.72mS

**UNDERWRITERS LABORATORIES INC.
RF Conducted Peak Power**

Date Tested: 28 September 2004

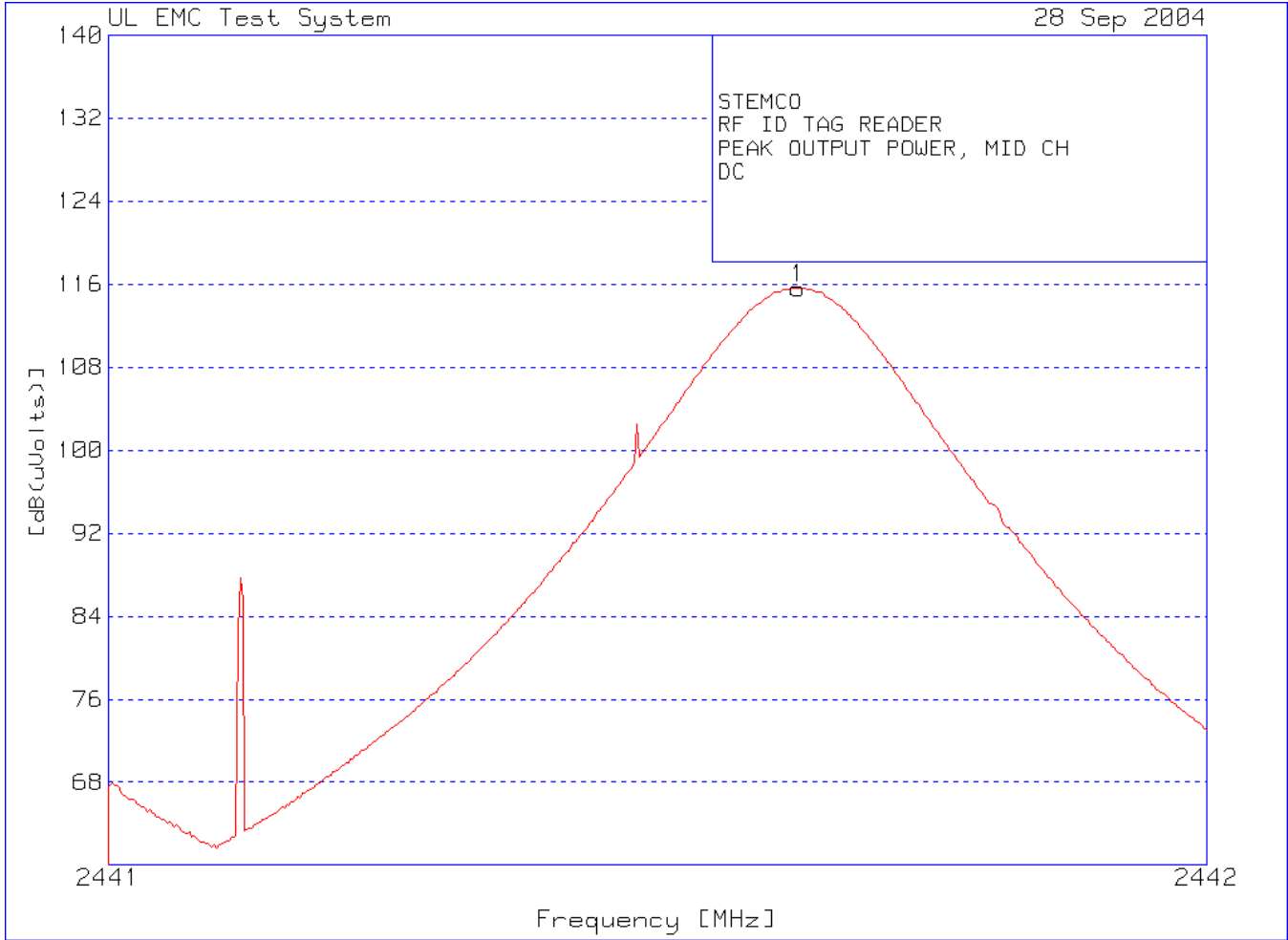
Manufacturer : Stemco LLC
Equipment Under Test : 800 RFID Tag Reader / Writer
Requirement : 15.247(b)(1)
Bandwidth : RBW=VBW=1MHz

Low Channel Maximum Power Plot and Data



Measured Power: 116.31 dBuV
dBuV to dBm conversion: dBuV-107=dBm
dBm to Watts conversion: $(10^{(dBm/10)}) \times 10^{-3} = \text{Watts} = 0.00853 \text{ Watts}$

Middle Channel Maximum Power Plot and Data

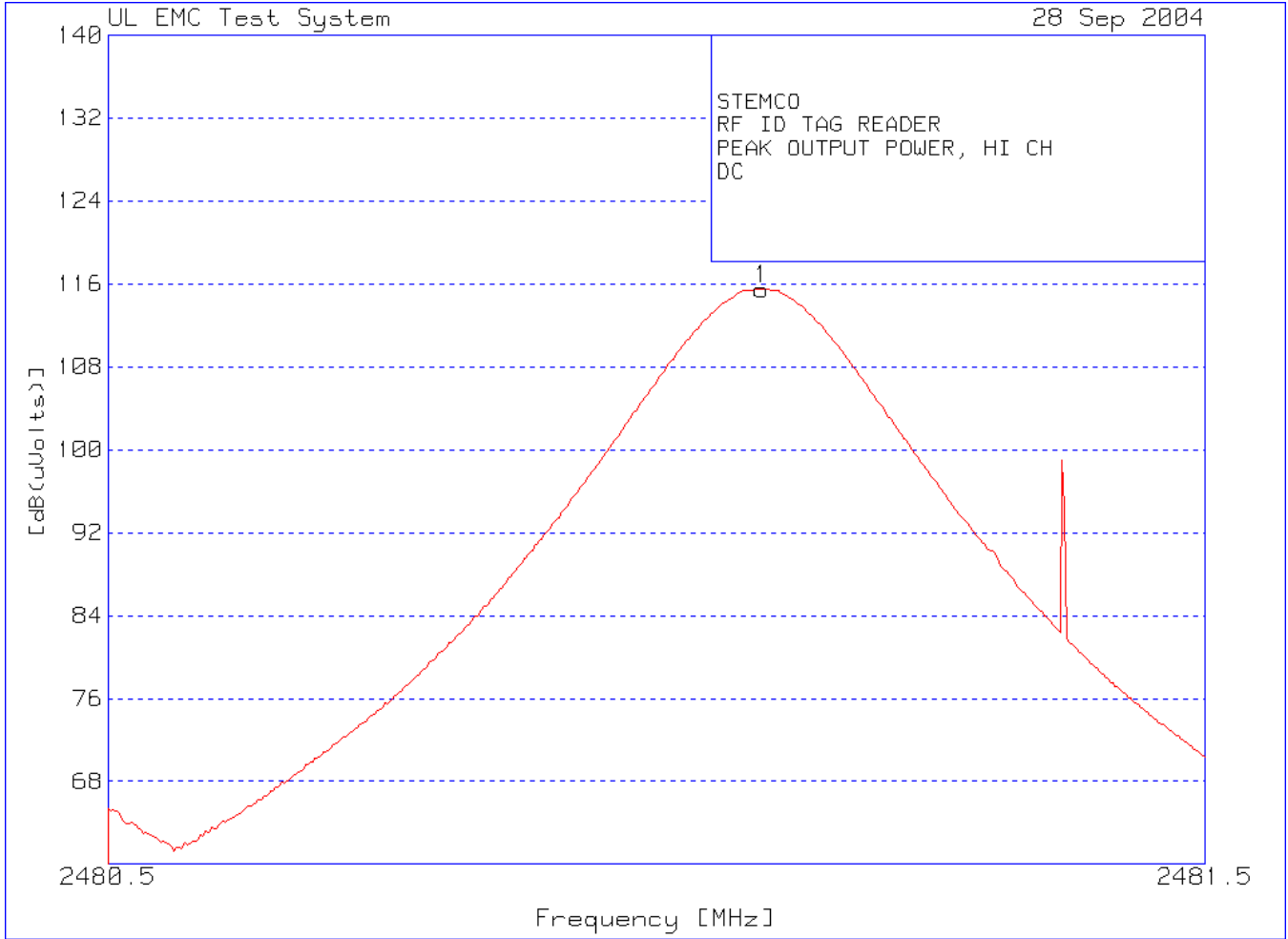


Measured Power: 115.61 dBuV

dBuV to dBm conversion: dBuV-107=dBm

dBm to Watts conversion: $(10^{(dBm/10)}) \times 10^{-3} = \text{Watts} = 0.00726 \text{ Watts}$

High Channel Maximum Power Plot and Data



Measured Power: 115.48 dBuV

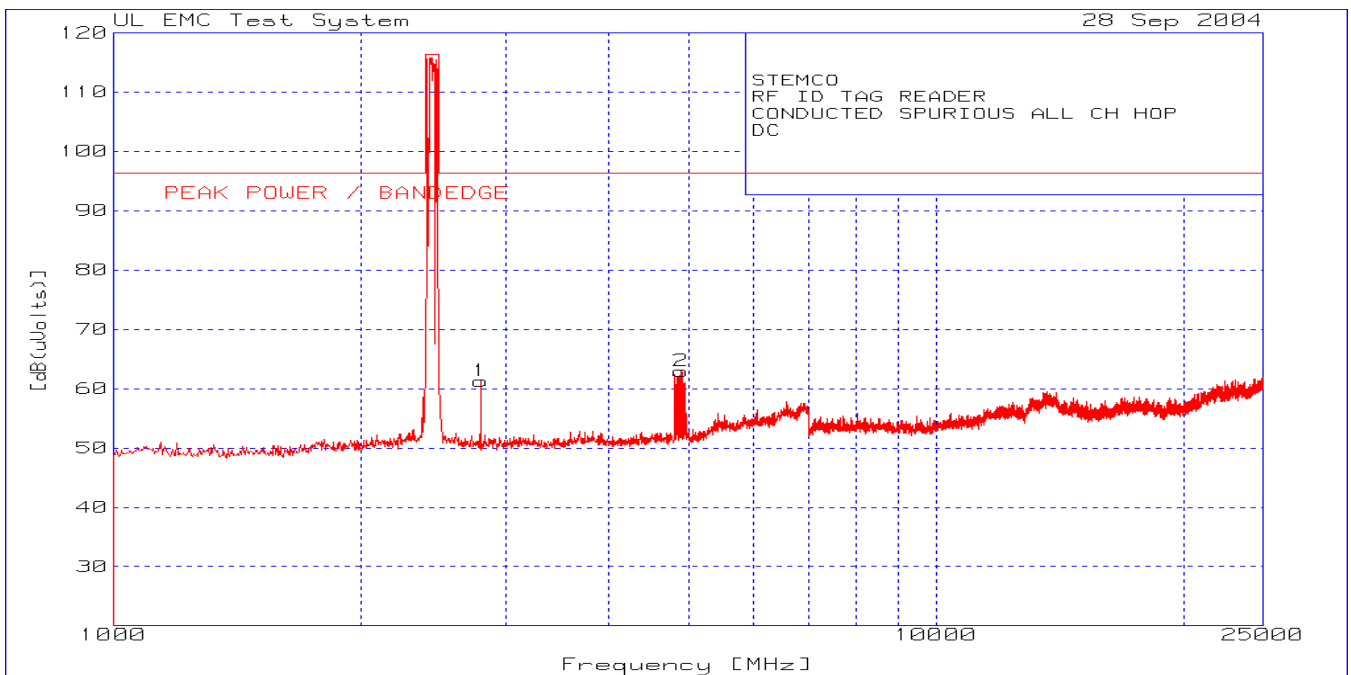
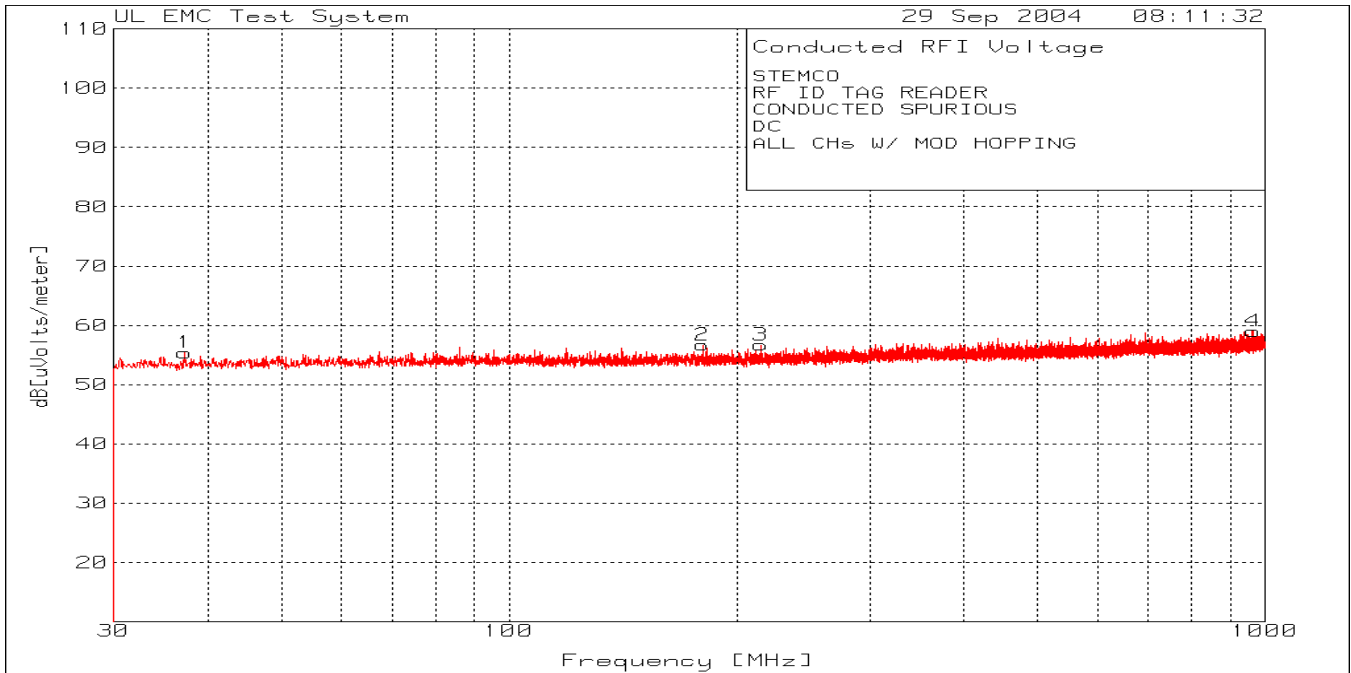
dBuV to dBm conversion: dBuV-107=dBm

dBm to Watts conversion: $(10^{(dBm/10)}) \times 10^{-3} = \text{Watts} = 0.00705 \text{ Watts}$

UNDERWRITERS LABORATORIES INC.
Antenna Terminal Spurious Emissions

Date Tested: 28 September 2004

Manufacturer : Stemco LLC
Equipment Under Test : 800 RFID Tag Reader / Writer
Requirement : 15.247(d)
Bandwidth : RBW=VBW=100kHz

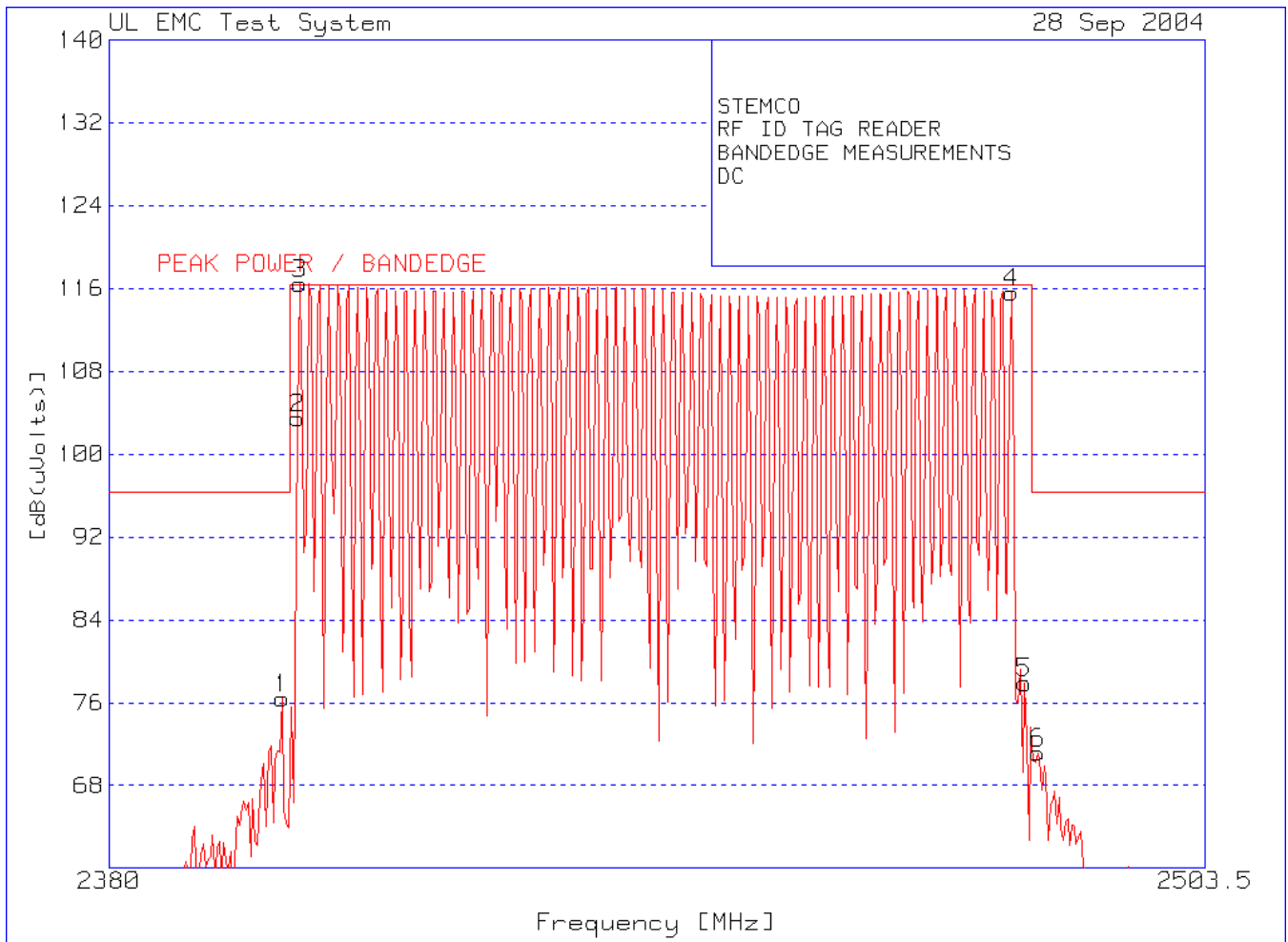


UNDERWRITERS LABORATORIES INC.
Band Edge

Date Tested: September 28, 2004

Manufacturer : Stemco LLC
Equipment Under Test : 800 RFID Tag Reader / Writer
Requirement : 15.247(d)
Bandwidth : RBW=VBW=100kHz

Conducted Measurement of all channels hopping



STEMCO
 RF ID TAG READER
 BANDEDGE MEASUREMENTS
 DC

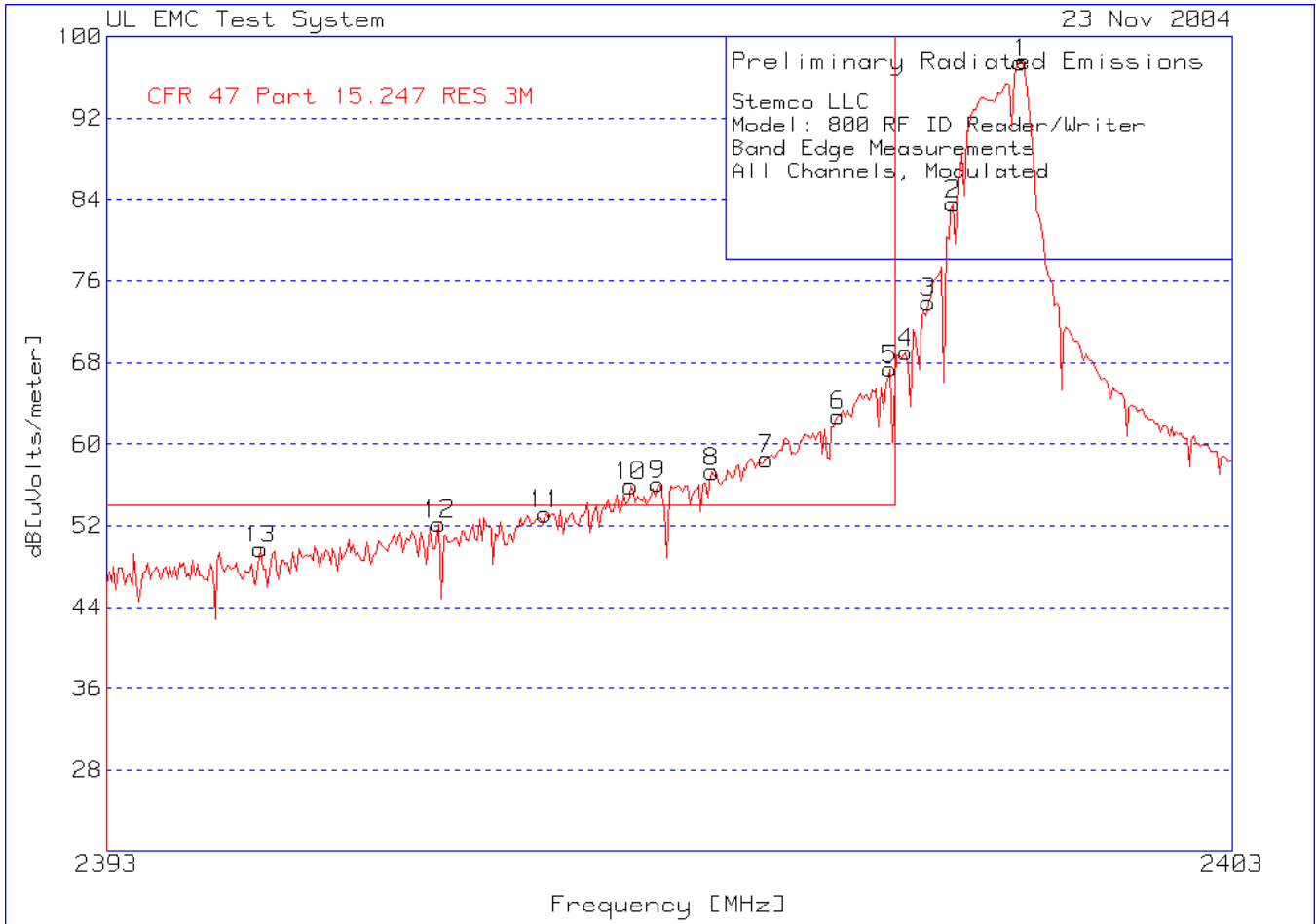
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1
1	2399.057	74.61 pk	1.8	0	76.41	96.3
				Margin [dB]		-19.89
2	2400.79	101.67 pk	1.8	0	103.47	116.3
				Margin [dB]		-12.83
3	2401.037	114.66 pk	1.8	0	116.46	116.3
				Margin [dB]		.16
4	2481.225	113.62 pk	2	0	115.62	116.3
				Margin [dB]		-.68
5	2482.71	75.93 pk	2	0	77.93	116.3
				Margin [dB]		-38.37
6	2484.195	69.15 pk	2	0	71.15	96.3
				Margin [dB]		-25.15

LIMIT 1: PEAK POWER / BANDEDGE

pk - Peak detector
 qp - Quasi-Peak detector
 av - Average detector

Date Tested: November 23, 2004

Radiated Low Channel Band Edge Measurements Single Channel Modulated



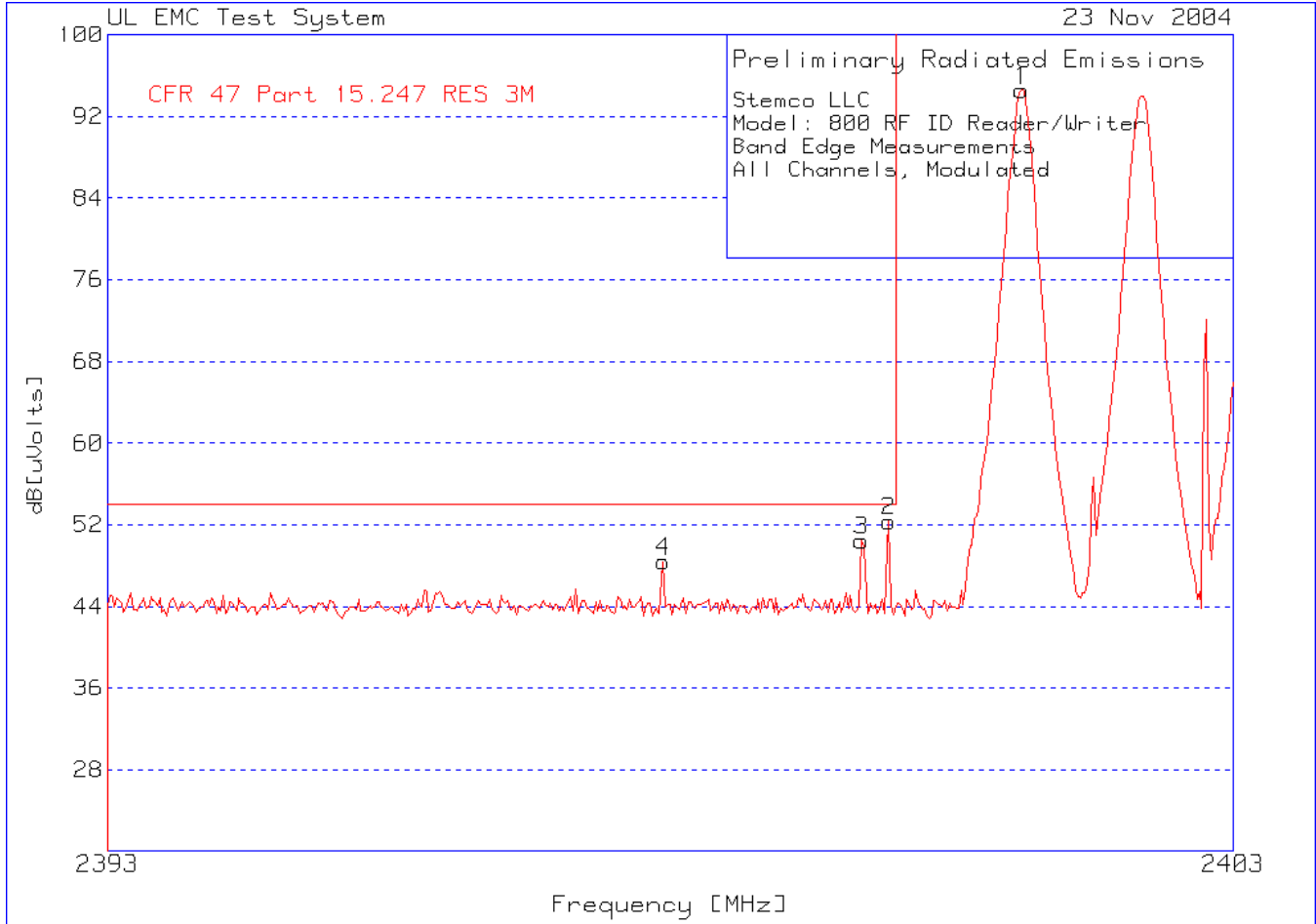
Frequencies below 2400MHz are not in restricted band, therefore 20dB below the maximum peak level limit applies. No emissions were observed below 2394MHz including restricted band 2310MHz – 2390MHz.

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB [uVolts/meter]	Limit:1
1	2401.116	72.37 pk Height:100	3.3 Horz	21.8	97.47	
				Margin [dB]		
2	2400.515	58.49 pk Height:100	3.3 Horz	21.8	83.59	
				Margin [dB]		
3	2400.295	48.81 pk Height:100	3.3 Horz	21.8	73.91	
				Margin [dB]		
4	2400.094	43.9 pk Height:100	3.3 Horz	21.8	69	
				Margin [dB]		
5	2399.954	42.27 pk Height:100	3.3 Horz	21.8	67.37	54
				Margin [dB]		13.37
6	2399.493	37.71 pk Height:100	3.3 Horz	21.8	62.81	54
				Margin [dB]		8.81
7	2398.852	33.44 pk Height:100	3.3 Horz	21.8	58.54	54
				Margin [dB]		4.54
8	2398.371	32.2 pk Height:100	3.3 Horz	21.8	57.3	54
				Margin [dB]		3.3
9	2397.89	30.96 pk Height:100	3.3 Horz	21.8	56.06	54
				Margin [dB]		2.06
10	2397.649	30.81 pk Height:100	3.3 Horz	21.8	55.91	54
				Margin [dB]		1.91
11	2396.888	28.04 pk Height:100	3.3 Horz	21.8	53.14	54
				Margin [dB]		-.86
12	2395.946	27.06 pk Height:100	3.3 Horz	21.8	52.16	54
				Margin [dB]		-1.84
13	2394.363	24.6 pk Height:100	3.3 Horz	21.8	49.7	54
				Margin [dB]		-4.3

LIMIT 1: CFR 47 Part 15.247 RES 3M

pk - Peak detector

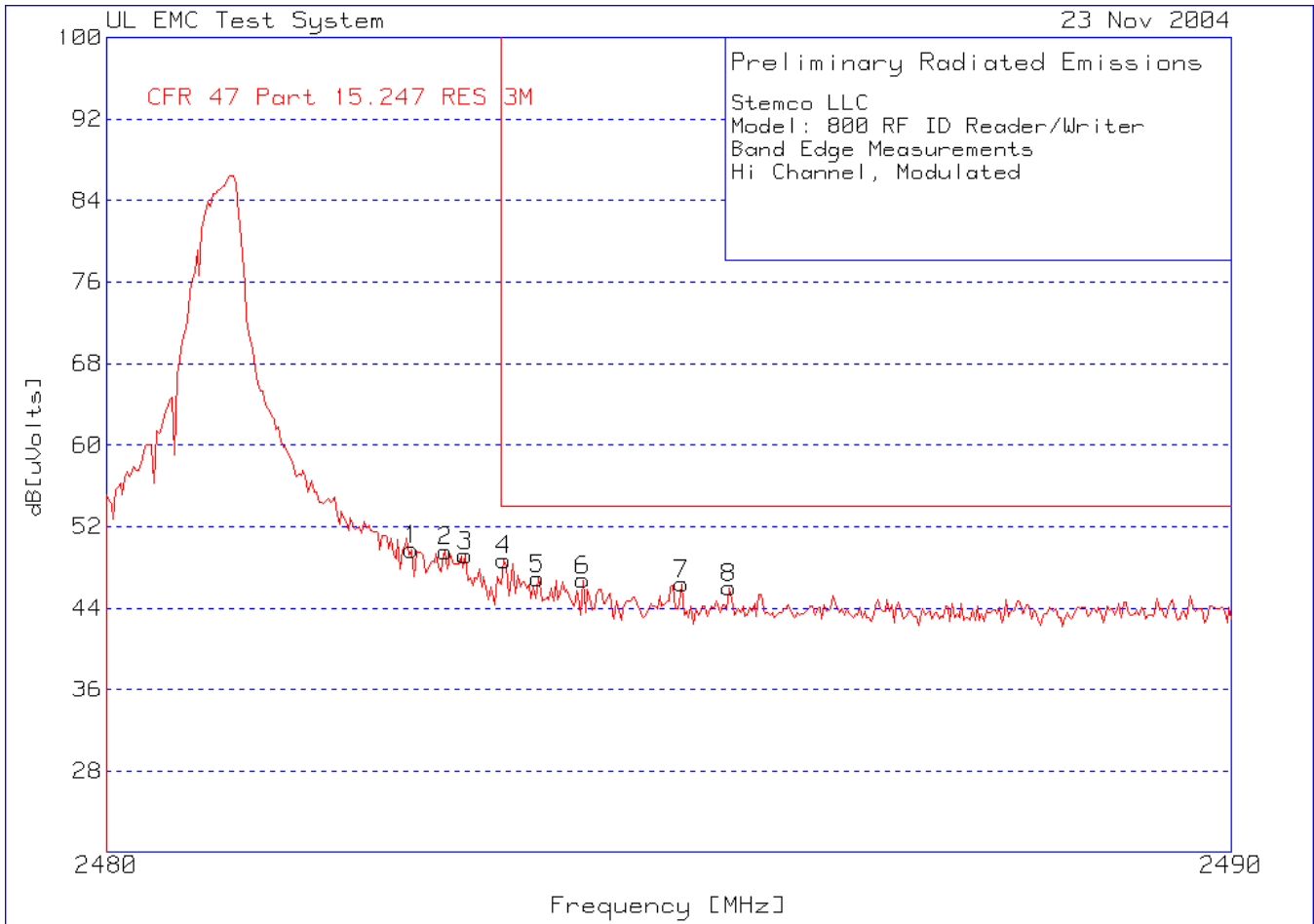
All Channels Hopping, Modulated



Test No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2401.116	69.48 pk	3.3	21.8	94.58	
		Height:100	Horz	Margin [dB]		
2	2399.934	27.24 pk	3.3	21.8	52.34	54
		Height:100	Horz	Margin [dB]		-1.66
3	2399.693	25.36 pk	3.3	21.8	50.46	54
		Height:100	Horz	Margin [dB]		-3.54
4	2397.93	23.31 pk	3.3	21.8	48.41	54
		Height:100	Horz	Margin [dB]		-5.59

LIMIT 1: CFR 47 Part 15.247 RES 3M
pk - Peak detector

Radiated High Channel Band Edge Measurements Single Channel Modulated



Frequencies above 2483.5MHz are in restricted band, therefore general limit applies.

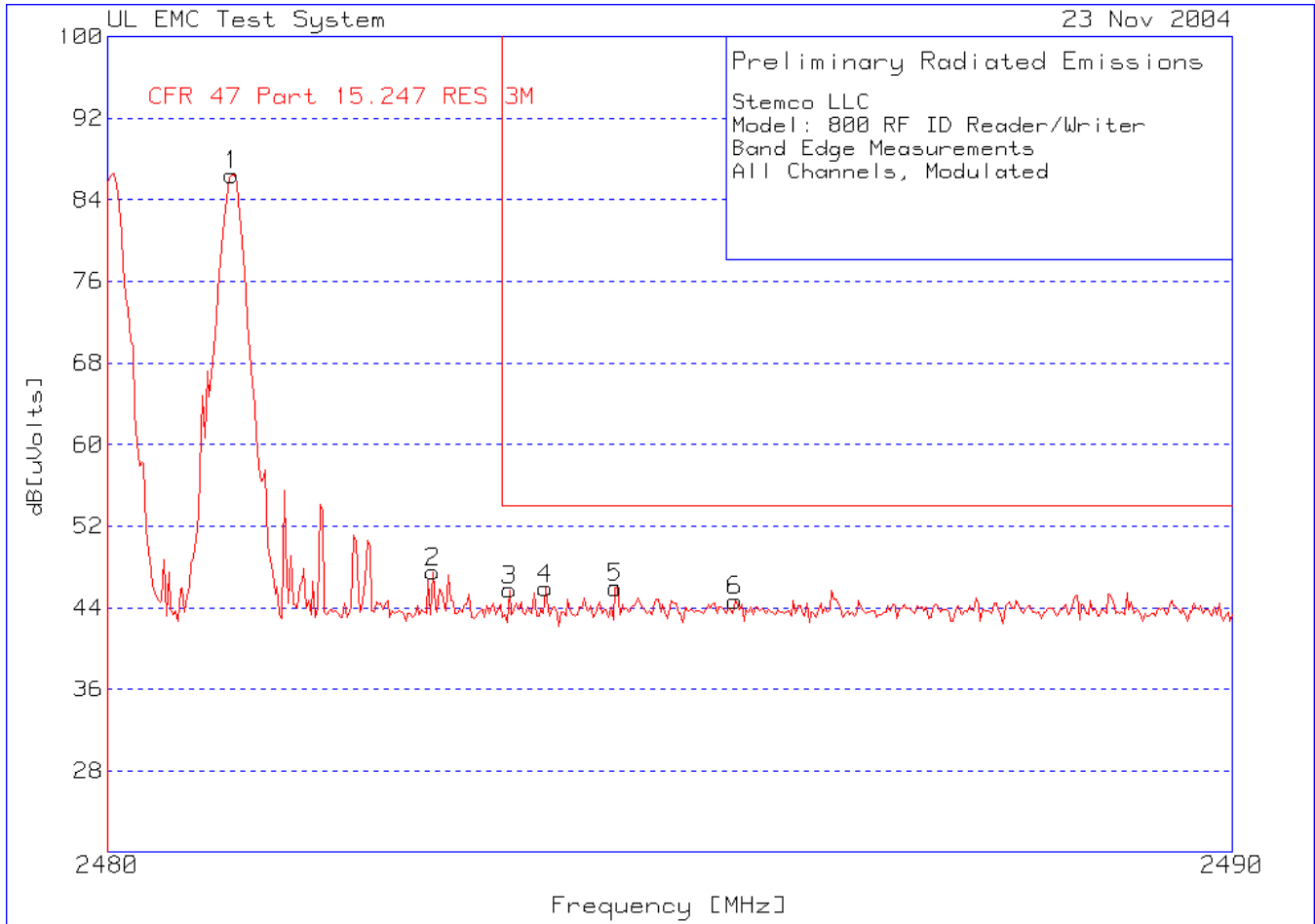
Stemco LLC
 Model: 800 RF ID Reader/Writer
 Band Edge Measurements
 Hi Channel, Modulated

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2482.705	24.45 pk Height:100	3.3	22	49.75	999
			Horz	Margin [dB]		-949.25
2	2483.006	24.29 pk Height:100	3.3	22	49.59	999
			Horz	Margin [dB]		-949.41
3	2483.186	23.89 pk Height:100	3.3	22	49.19	999
			Horz	Margin [dB]		-949.81
4	2483.527	23.31 pk Height:100	3.3	22.1	48.71	54
			Horz	Margin [dB]		-5.29
5	2483.828	21.51 pk Height:100	3.3	22.1	46.91	54
			Horz	Margin [dB]		-7.09
6	2484.228	21.36 pk Height:100	3.3	22.1	46.76	54
			Horz	Margin [dB]		-7.24
7	2485.11	20.99 pk Height:100	3.3	22.1	46.39	54
			Horz	Margin [dB]		-7.61
8	2485.531	20.62 pk Height:100	3.3	22.1	46.02	54
			Horz	Margin [dB]		-7.98

LIMIT 1: CFR 47 Part 15.247 RES 3M

pk - Peak detector

All Channels Hopping, Modulated



Test No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts]	Limit:1
1	2481.102	61.12 pk	3.3	22	86.42	999
		Height:100	Horz	Margin [dB]		-912.58
2	2482.886	22.22 pk	3.3	22	47.52	999
		Height:100	Horz	Margin [dB]		-951.48
3	2483.567	20.37 pk	3.3	22.1	45.77	54
		Height:100	Horz	Margin [dB]		-8.23
4	2483.888	20.51 pk	3.3	22.1	45.91	54
		Height:100	Horz	Margin [dB]		-8.09
5	2484.509	20.58 pk	3.3	22.1	45.98	54
		Height:100	Horz	Margin [dB]		-8.02
6	2485.571	19.28 pk	3.3	22.1	44.68	54
		Height:100	Horz	Margin [dB]		-9.32

LIMIT 1: CFR 47 Part 15.247 RES 3M
pk - Peak detector

APPENDIX C**Sample Calculations of Field Strengths****Basic Equation:**

The field strength is calculated by adding the Meter Reading, Cable Set Gain/Loss and Transducer (Antenna or LISN) Factor. The basic equation is as follows:

$$FS = MR + GL + TF$$

Where:

FS = Calculated Field Strength in dB(uV)/meter

MR = Meter Reading of receiver amplitude in dB(uV)

GL = Gain/Loss factor of cable set in dB

A negative Gain/Loss indicates signal amplification (gain)

A positive Gain/Loss indicates signal attenuation (loss)

TF = Transducer Factor of antenna or LISN in dB

Sample Calculation:

The measured receiver amplitude is 52.7 dB(uV).

The gain/loss factor is -30.2 dB (indicating a preamplifier is included in the cable set).

The transducer factor (antenna factor) is 6.6 dB.

These factors are added ($52.7 + (-30.2) + 6.6$) resulting in a calculated field strength of 29.1 dB(uV)/meter.