



Project: **04CA18700**  
File: **MC1002**  
Report: **040087**  
Date: **May 27, 2004**  
Model: **Tracer 4108**  
**(2.4 GHz bi-directional transceiver)**  
**FCC ID: HDCTRC4108L1**

# **Test Report**

## **On**

# **Electromagnetic Compatibility Testing**

**Adtran**  
**Huntsville, AL USA**

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## **Test Report Details:**

Tests Performed By: **Underwriters Laboratories Inc.  
12 Laboratory Drive  
Research Triangle Park, NC 27709**

Tests Performed For: **Adtran  
901 Explorer Blvd.  
Huntsville, AL USA**

Applicant Contact: **Mr. Derek Foster  
Compliance Engineer  
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Test Report Number: **040087**

Test Report Date: **May 27, 2004**

Product Type: **Point-to-Point RF link**

Model Number: **Tracer 2.4 GHz**

Sample Serial Number: **Unserialized sample**

Sample Tag Number: **0575627-001**

EUT Category: **Transmitter - Low Powered**

EUT Type: **Table Top**

Sample Receive Date: **April 28, 2004**

Testing Start Date: **May 12, 2004**

Date Testing Complete: **May 26, 2004**

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## **Summary of Testing:**

Test #	Test Name Test Requirement/Specification	Comply	Does Not Comply	See Remark
1	Conducted Emissions - Conducted Power and Spurious Emissions 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C - Section 15.247	X	-	
2	Occupied Bandwidth 47 CFR Part 15.247 / ANSI C63.4:2001	X	-	
3	Spectral Density - Digitally Modulated Spread Spectrum 47 CFR Part 15.247 / ANSI C63.4:2001	X	-	
4	Bandedge 47 CFR Part 15 Subpart C / 47 CFR Part 15.247	X	-	
5	Radiated Spurious Emissions 47 CFR Part 15.247 / ANSI C63.42:2001	X	-	
6	Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field 47 CFR Part 15, Subpart B / CISPR 22:1997 Class A	X	-	
7	Restricted Bands 47 CFR Part 15 Subpart C / 47 CFR Part 15.205	X	-	
8	Maximum Permissible Exposure 47 CFR Part 1 Subpart I / 47 CFR Part 1.1307	-	-	3

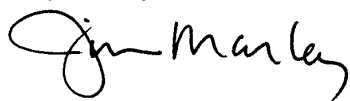
## **Remarks:**

- 1) Device contains a detachable antenna with a standard N-female connector. This device must be professionally installed, because the antenna does not contain a unique connector.
- 2) Device maximum conducted power is 109 mW. Output power must be set at end of attaching cable and reduced as necessary to remain compliant to limits in 15.247 when the intended antenna is taken into consideration.
- 3) Device antenna is must be installed with adequate precautions regarding RF exposure. Worst-case spacing to comply with uncontrolled/general exposure limit is 1.3 m.
- 4) Only high and low channel measurements are present (no middle channel), because this device only operates at two channels.
- 5) All testing was performed in an environmentally controlled facility with the following bounds: Temp 20 - 25°C, Relative Humidity 30 - 60%, Absolute Barometric Pressure 98 - 102 kPa.

## **Conclusion:**

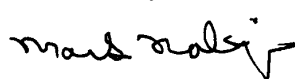
The tests listed in the Summary of Testing section of this report have been performed and the results recorded by Underwriters Laboratories Inc. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

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## **Test Facilities:**

### **Test Location A) 10-Meter Anechoic Chamber (Industry Canada - IC 2953, NVLAP - 200246-0, VCCI - R-722)**

Constructed by Lindgren RF Enclosures, this room consists of a 17.9 by 12 by 8.3 m (inside clearance) shielded room lined with TDK absorber material. The walls, floor (conducting ground plane) and ceiling are constructed of double sided galvanized sheet steel supported by 19 mm thick particle board. The interior walls and ceiling are covered with 10 by 10 cm, 4.6 mm thick ferrite tiles and partially covered with polystyrene absorber cones. Removable floor tiles and cones covering the floor between the EUT and antenna are provided when RF immunity testing is performed.

Room is provided with a 4.0 m diameter embedded turntable and a 1.2 by 2.1 m and 2.4 by 2.4 m double knife edge doors for access. Also, the room is fed electrical EUT power via permanently installed filters and is provided with a permanently mounted video surveillance camera. A remotely controllable antenna mast is located in the room for positioning the measuring antenna from 1 to 4 m above the ground plane.

### **Test Location B) Compact Anechoic Chamber**

Constructed by Lindgren RF Enclosures, this room consists of a 6 by 3 by 2.9 m (inside clearance) shielded room lined with TDK absorber material. The walls, floor, and ceiling are constructed of double sided galvanized sheet steel supported by 19 mm thick particle board. The interior walls and ceiling are covered with 10 by 10 cm, 4.6 mm thick ferrite tiles and partially covered with polystyrene absorber cones. Removable floor tiles and cones cover the floor between the EUT and antenna.

Room is provided with a 1.2 by 2.1 m double knife edge door for access. Also, the room is fed electrical EUT power via permanently installed filters and is provided with a video camera.

### **Test Location C) RF Shielded Room (VCCI - C-744, NVLAP - 200246-0)**

Constructed by Lindgren RF Enclosures, this room consists of a 7.3 by 4.3 by 2.7 m (inside clearance) shielded room. The walls, floor (conducting ground plane) and ceiling are constructed of double sided galvanized sheet steel supported by 19 mm thick particle board. Room is provided with a 1.2 by 2.1 m double knife edge door for access. Also, the room is fed electrical EUT power via permanently installed filters and is provided with a portable video surveillance camera.

### **Test Location D) Ground Reference Plane # 1 (VCCI - C-742, NVLAP - 200246-0)**

Horizontal floor ground reference plane constructed of double sided galvanized sheet steel supported by 19 mm particle board and measures 3.6 by 3.0 m. It is located and bonded next to one vertical wall of the Control Room and is, therefore, provided with a 3.0 by 3.6 m vertical ground reference plane constructed of the same material. Power filters and LISNs, when required, are placed on top of and bonded to the horizontal floor ground reference plane.

### **Test Location E) Ground Reference Plane # 2 (VCCI - C-743, NVLAP - 200246-0)**

Horizontal floor ground reference plane constructed of double sided galvanized sheet steel supported by 19 mm particle board and measures 4.3 by 5.2 m. It is located and bonded next to one vertical wall of the RFD Shielded Room and is, therefore, provided with a 4.3 by 2.8 m vertical ground reference plane constructed of the same material. Power filters and LISNs, when required, are placed on top of and bonded to the horizontal floor ground reference plane.

### **Test Location F) Ground Reference Plane # 3**

Horizontal floor ground reference plane constructed of galvanized sheet steel measuring 3.0 by 3.6 m x 2.5mm thick.

### **Test Location G) Ground Reference Plane # 4 (Automotive)**

Horizontal floor ground reference plane constructed of double-sided galvanized sheet steel supported by 19 mm particle board and measures 3.6 by 3.0 m.

### **Test Location I) Harmonic Current Test Area - Located in front of Standard Source Impedance Power Supply.**

### **Test Location J) Magnetic Field Ground Reference Plane**

Horizontal floor ground reference plane constructed of 1.5 mm thick aluminum measuring 3.6 by 2.4 m.

### **Test Location P) Ground Reference Plane # 5**

Horizontal floor ground reference plane constructed of double-sided galvanized sheet steel supported by 19 mm particle board and measures 3.6 by 3.0 m.

### **Test Location R) Ground Reference Plane # 6**

Ground reference plane constructed of galvanized sheet steel measuring 3.0 m x 3.6 m x 2.5 mm thick. CDNs, when required, are placed on top of and bonded to the horizontal floor ground reference plane.

### **Test Location Q) CISPR 12 Outdoor Site**

30 meter diameter non-reflective area located behind the UL-RTP EMC Lab. Test area is used for CISPR 12 testing.

### **Test Location X) Other - As described in the Comments Section of Test Results.**

**EUT Information:**

**Equipment Used During Test:**

Use*	Product Type	Manufacturer	Model	Comments
EUT	Transceiver	Adtran	Tracer 4108	
ACC	Parabolic Antenna	-	-	Highest gain antenna. 32.6 dBi gain.
ACC	Laptop Computer	IBM	Thinkpad T22	Used to attach to serial port. Laptop was placed into hibernate mode to reduce PC sourced emissions
SIM	T1 Resistor Terminations	-	-	T1 lines are terminated in characteristic impedance.
SIM	Alarm	-	-	Alarm lines were populated with wires and left open to simulate high impedance termination.

\* Use = EUT - Equipment Under Test, ACC - Accessory (Not Subjected to Test), or SIM - Simulator (Not Subjected to Test)

**Input/Output Ports:**

Port #	Name	Type*	Cable Max. >3m	Cable Shielded	Comments
0	Enclosure	N/E	No	No	
1	DC Input	DC	Yes	No	21 to 60 Volts.
2	Antenna	I/O	Yes	Yes	Low-loss coaxial cable used
3	T1	I/O	Yes	No	Eight ports populated with cables and resistor termination.
4	Serial	I/O	Yes	Yes	DB-25 shielded connector terminated in laptop.
5	Alarm	I/O	Yes	No	DC output alarm wired and left open to simulate high impedance load.
6	Earth	I/O	Yes	No	Safety Earth stud. Terminated by 12 guage wire.

\* AC = AC Power Port                      DC = DC Power Port                      N/E = Non-Electrical  
 I/O = Signal Input or Output Port (Not Involved in Process Control)  
 PMC = Process Measurement and Control Port

**EUT Internal Operating Frequencies:**

Frequency (MHz)*	Description
2.400	Lowest Frequency on 2.4 GHz ISM Band
2.42	Center Frequency of Lower Channel
2.46	Center Frequency of Upper Channel
2.4835	Highest Frequency of 2.4 GHz ISM Band

**Power Interface:**

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	21-60	-	-	DC	1	
1	28	-	-	DC	1	Benchtop DC supply used for power source.

**EUT Operation Modes:**

Mode #	Description
1	Transmit at full power on lower channel (Channel A).
2	Transmit at full power on higher channel (Channel B).

**EUT Configuration Modes:**

Mode #	Description
1	Transceiver is positioned on a 1m x 1.5m x 0.8m high wooden table. High-gain antenna, laptop, T1 terminators, and open alarm cables are attached. Antenna is positioned to propagate wave toward measurement antenna and parallel to the ground plane (not upward).

**Product Description:**

The Tracer 2.4 GHz repeater is a low-powered, bidirectional RF link designed to multiplex up to 8 T1/E1 lines and transmit the data to an identical unit on the other end. The device works as a digitally modulated spread spectrum device and operates on one of two channels. The lower channel is centered at 2.42 GHz and the higher channel is centered at 2.46 GHz. Of the two devices in the link one will transmit at the lower channel and the other at the higher channel.

## Test 1: Conducted Emissions - Conducted Power and Spurious Emissions

**Test Requirement:** 47 CFR Part 15, Subpart C

**Test Specification:** 47 CFR Part 15, Subpart C - Section 15.247

### Test Procedure:

The test was performed in accordance with the Test Requirement and Specification and configured as noted in the Test Setup. The EUT was placed inside the anechoic chamber with a fresh battery installed or operating at nominal voltage. Measurement was performed by connecting the output of the device to the input of the spectrum analyzer using a calibrated attenuator to reduce the input signal. An appropriate factor was added to spectrum analyzer reading for the attenuator. All peak emissions were verified to be below the limits below.

Radiated Disturbance Limits for Spread Spectrum Transmitters - Section 15.247

Fundamental Frequency (MHz)	Hopping Channels	Permissible Output Power		Permissible Spurious Emissions	
		(milliwatts)	(dBm)	(milliwatts)	(dBm)
902 – 928	25 to 49	250	24	2.5	4
	50 or more	1000	30	10	10
	Digital Modulation	1000	30	10	10
2400 – 2483	15 to 74	125	21	1.25	1
	75 or more	1000	30	10	10
	Digital Modulation	1000	30	10	10
5725 – 5850	75 or more	1000	30	10	10
	Digital Modulation	1000	30	10	10

Other than fixed point-to-point applications, power adjustment for antenna gain are as follows:

Gain of 6 dBi or less	No reduction is required
Gain greater than 6 dBi	Reduce the maximum output power by 1 dB for each 1 dB of antenna gain above 6 dBi

### Test Notes:

This device is considered a fixed point-to-point device per 15.247(b)(i) and are required to reduce output power by 1 dB for each 3 dB of antenna gain exceeding 6 dB of gain.

**Test Setup:** Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	2	Antenna	1 (Lower Channel)	1	1
B	2	Antenna	2 (Upper Channel)	1	1

**Test 1 - Results:** Conducted Emissions - Conducted Power and Spurious Emissions

**Test Results Summary:**

Test Item	Test Location	Pass/Fail (P/F)	Date Completed	Comment #
A	A	P	5/22/2004	
B	A	P	5/22/2004	

The EUT was considered to **Pass** the Requirements.

**Comments:**

Comment #	Description

**Test Equipment Used:**

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
ATA160	RF Attenuator, 30 dB	Weinshel	47-30-43	9/30/03	9/30/04
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	11/10/03	11/03/04
PAR001	RF Power Meter, 10 kHz to 10 GHz	Rohde & Schwarz	NRVD	2/5/04	2/28/05
PAR004	RF Power Meter Sensor Head, 10 kHz to 10 GHz	Rohde & Schwarz	NRV-Z51	2/5/04	2/28/05

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.



**Test 1, Item A - Conducted Power, Transmit Frequencies (Amplitude in dBuV):**

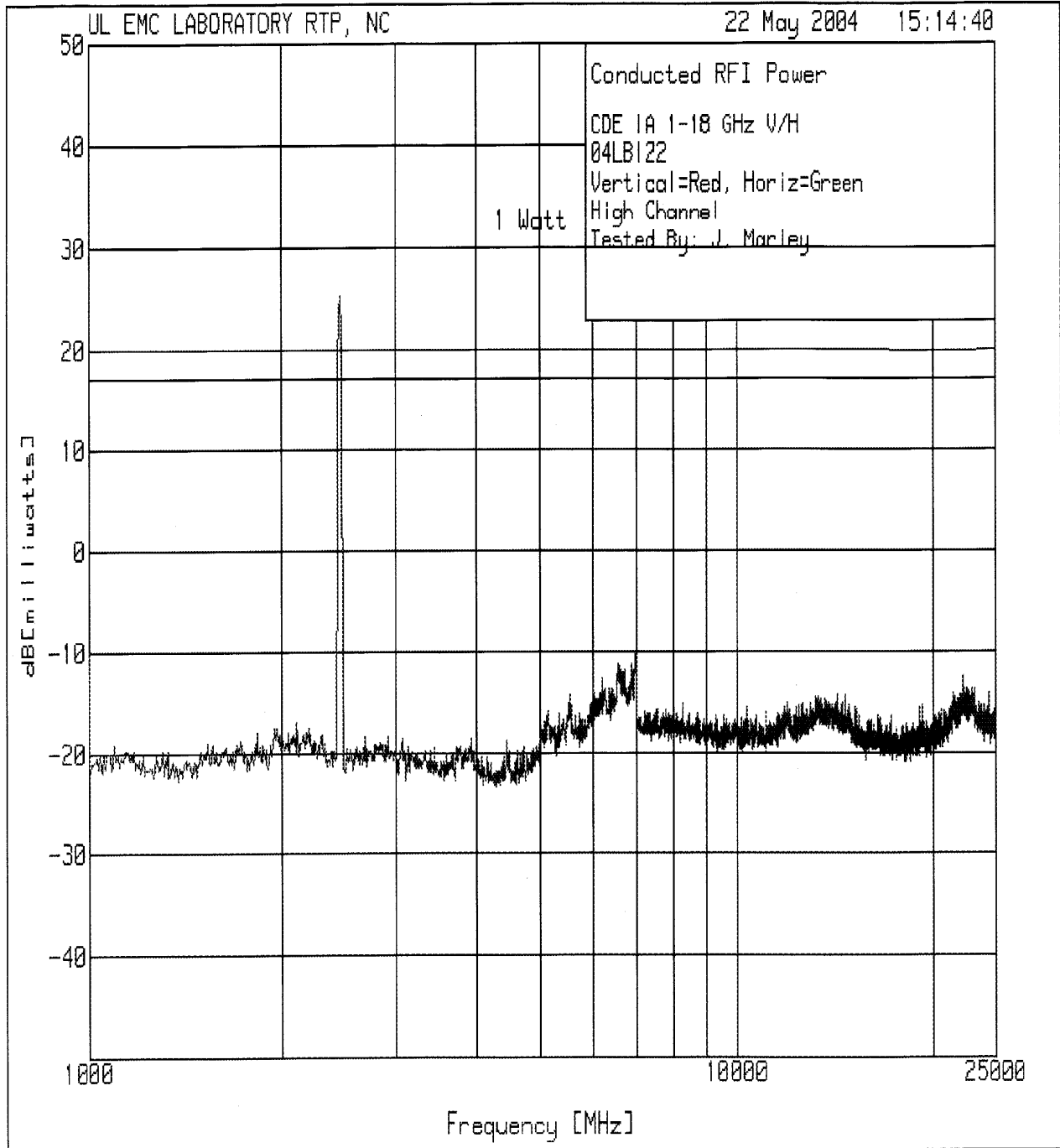
Conducted Emissions - Conducted Power

The following measurements were performed with the output of the EUT connected to the input of the power meter. A 50-ohm, 30 dB (nominal) attenuator is located between the power meter and the EUT output connector. Both low channel and high channel measurements are performed.

No.	Test Frequency [MHz]	Pwr Mtr Reading [dB(m)]	Attenuator Factor [dB]	Power Level [dBm]	Power Level [Watts]	Power Level [Watts]	Limit [Watts]
=====							
---- Low Channel -----							
1	2422.356	-9.26	29.6	20.34	0.108	1.0	
---- High Channel -----							
2	2422.356	-9.22	29.6	20.38	0.109	1.0	

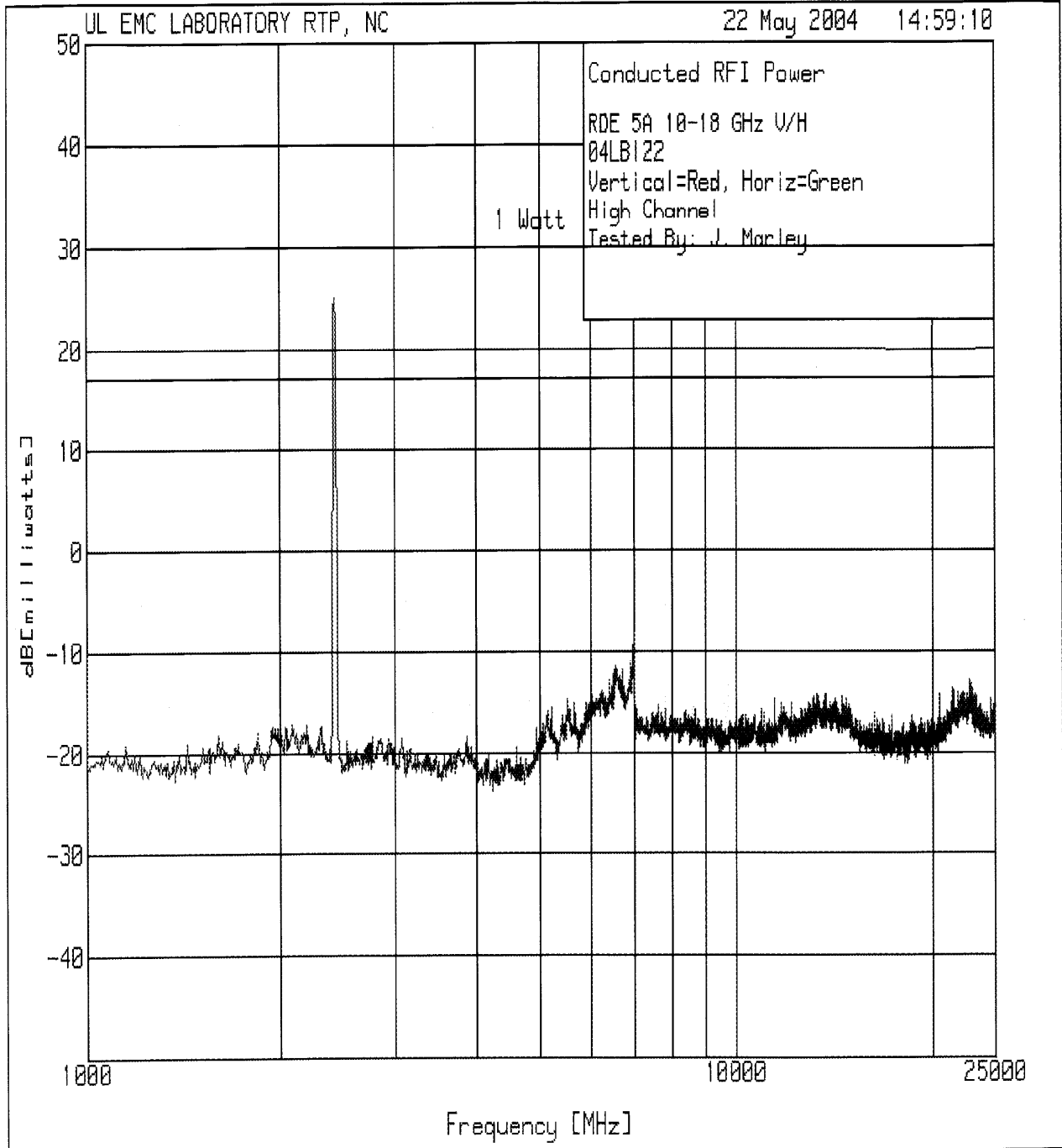
**Test 1, Item A - Peak Plot (Amplitude in dBuV):**

Conducted Emissions - Conducted Power and Spurious Emissions



**Test 1, Item B - Peak Plot (Amplitude in dBuV):**

Conducted Emissions - Conducted Power and Spurious Emissions



**Test 1, Item A - Discrete Data:**

Conducted Emissions - Conducted Power and Spurious Emissions

CDE 1A - 1-25 GHz V/H  
04LB122  
Vertical=Red, Horiz=Green  
Low Channel  
Tested By: J. Marley

Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Attenuator Factor [dB]	Unit Conv. Factor [dB]	Power Level [dBm]	Spurious Limit [dBm]
2	4852.963	55.94 pk	29.8	-107	-21.26	10
				Margin [dB]		-31.26
3	7253.563	59.61 pk	30.0	-107	-17.39	10
				Margin [dB]		-27.39
4	9657.164	59.21 pk	30.1	-107	-17.69	10
				Margin [dB]		-27.69
5	12090.77	60.14 pk	30.0	-107	-16.86	10
				Margin [dB]		-26.86
6	14491.37	60.64 pk	30.0	-107	-16.36	10
				Margin [dB]		-26.36
7	16777.94	60.27 pk	30.0	-107	-16.73	10
				Margin [dB]		-26.73
8	19310.58	59.07 pk	30.0	-107	-17.93	10
				Margin [dB]		-27.93
9	21705.18	61.15 pk	30.0	-107	-15.85	10
				Margin [dB]		-25.85
10	24285.82	60.52 pk	30.0	-107	-16.48	10
				Margin [dB]		-26.48

pk - Peak detector

**Test 1, Item B - Discrete Data:**

Conducted Emissions - Conducted Power and Spurious Emissions

CDE 1A - 1-25 GHz V/H  
04LB122  
Vertical=Red, Horiz=Green  
High Channel  
Tested By: J. Marley

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Attenuator Factor [dB]	Unit Conv. Factor [dB]	Power Level [dBm]	Spurious Limit [dBm]
2	4906.977	56.78 pk	29.8	-107	-20.42	10
				Margin [dB]		-30.42
3	7391.598	60.02 pk	30.0	-107	-16.98	10
				Margin [dB]		-26.98
4	9834.209	59.61 pk	30.1	-107	-17.29	10
				Margin [dB]		-27.29
5	12306.83	61.41 pk	30.0	-107	-15.59	10
				Margin [dB]		-25.59
6	14725.43	62.71 pk	30.0	-107	-14.29	10
				Margin [dB]		-24.29
7	17342.09	59.34 pk	30.0	-107	-17.66	10
				Margin [dB]		-27.66
8	19658.66	59.34 pk	30.0	-107	-17.66	10
				Margin [dB]		-27.66
9	22335.33	63.22 pk	30.0	-107	-13.78	10
				Margin [dB]		-23.78
10	24369.84	62.84 pk	30.0	-107	-14.16	10
				Margin [dB]		-24.16

pk - Peak detector

## Test 2: Occupied Bandwidth

**Test Requirement:** 47 CFR Part 15.247

**Test Specification:** ANSI C63.4:2001

### **Test Procedure:**

All testing was performed in UL's 10 meter semi-anechoic chamber. The chamber meets the FCC's site attenuation criteria for use as an alternative measurement site. The EUT was tested per ANSI C63.4:2001 as a conducted measurement. The output of the transmitter was connected to the input of the measurement spectrum analyzer via a calibrated attenuator.

The spectrum analyzer Resolution Bandwidth and Video Bandwidth were set to 10 kHz for the measurement. A plot of the spectrum analyzer display screen is produced with marker points displaying the center frequency and the left and right side points that are 20 dB below the field strength at the center frequency.

Limits - FCC Part 15.247 - Digitally Modulated Spread Spectrum

6dB Occupied Bandwidth
> 500 kHz

### **Test Deviations:**

None

**Test Setup:** Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	2	Antenna	2 (Upper Channel)	1	1

**Test 2 - Results:** Occupied Bandwidth

**Test Results Summary:**

Test Item	Test Location	Pass/Fail (P/F)	Date Completed	Comment #
A	A	P	5/22/2004	

The EUT was considered to **Pass** the Requirements.

**Comments:**

Comment #	Description
1	Bandwidth measurement presented at high channel. Low channel is similar.

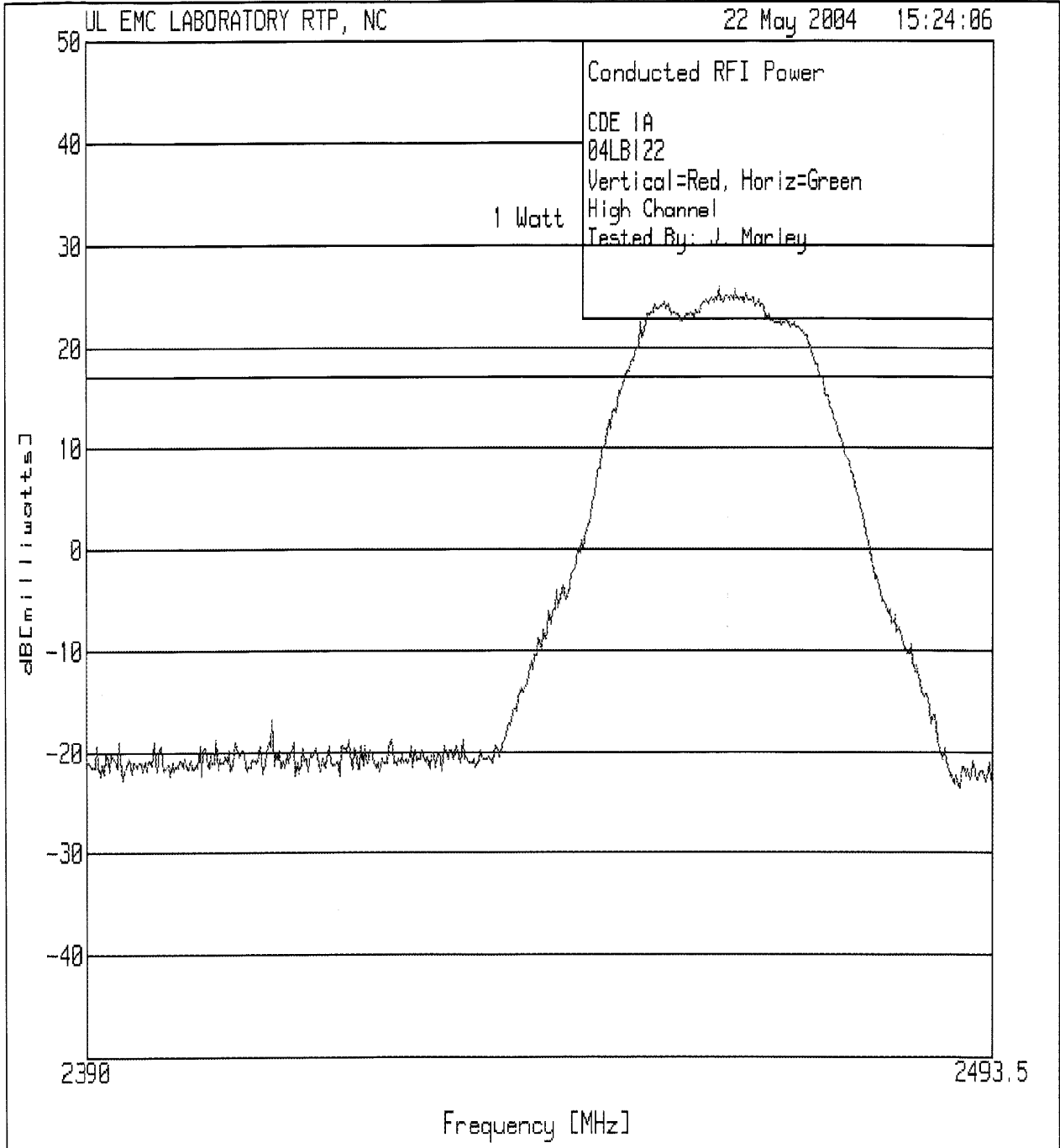
**Test Equipment Used:**

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
ATA160	RF Attenuator, 30 dB	Weinshel	47-30-43	9/30/03	9/30/04
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	11/10/03	11/03/04

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

**Test 2, Item A - Peak Plot (Amplitude in dBuV):**

Occupied Bandwidth





**Test 2, Item A - Discrete Data:**

Occupied Bandwidth

CDE 2A - 1-25 GHz V/H  
04LB122  
Vertical=Red, Horiz=Green  
High Channel  
Tested By: J. Marley

Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Attenuator Factor [dB]	Unit Conv. Factor [dB]	Power Level [dBm]
** Peak Frequency **					
1	2461.766	102.16 pk	29.6	-107	24.86
** -20 dB Frequency Low **					
2	2447.454	81.49 pk	29.6	-107	4.09
** -20 dB Frequency High **					
3	2477.944	81.89 pk	29.6	-107	4.49
20 dB Bandwidth = 2477.944 - 2447.454 = 30.490 MHz					
** - 6 dB Frequency Low **					
4	2452.017	95.74 pk	29.6	-107	18.34
** - 6 dB Frequency High **					
5	2472.759	95.87 pk	29.6	-107	18.47
6 dB Bandwidth = 2472.759 - 2452.017 = 20.742 MHz					

### Test 3: Spectral Density - Digitally Modulated Spread Spectrum

**Test Requirement:** 47 CFR Part 15.247

**Test Specification:** ANSI C63.4:2001

**Test Procedure:**

Testing is performed with a measurement spectrum analyzer connected directly from the output stage of the antenna to the antenna. An impedance matching network is installed if needed.

The spectrum analyzer Resolution Bandwidth was set to 3 kHz and Video Bandwidth 30 kHz or greater for the measurement. A plot of the spectrum analyzer display screen is produced with marker points displaying the highest peak emission. This is verified to be less than 8 dBm.

Limits - FCC Part 15.247(d)

Spectral Density
< 8dBm / 3 kHz

**Test Deviations:**

None

**Test Setup:** Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	2	Antenna	1 (Lower Channel)	1	1

**Test 3 - Results:** Spectral Density - Digitally Modulated Spread Spectrum

**Test Results Summary:**

Test Item	Test Location	Pass/Fail (P/F)	Date Completed	Comment #
A	A	P	5/22/2004	

The EUT was considered to **Pass** the Requirements.

**Comments:**

Comment #	Description
1	Measurement was performed at 5 kHz RBW.

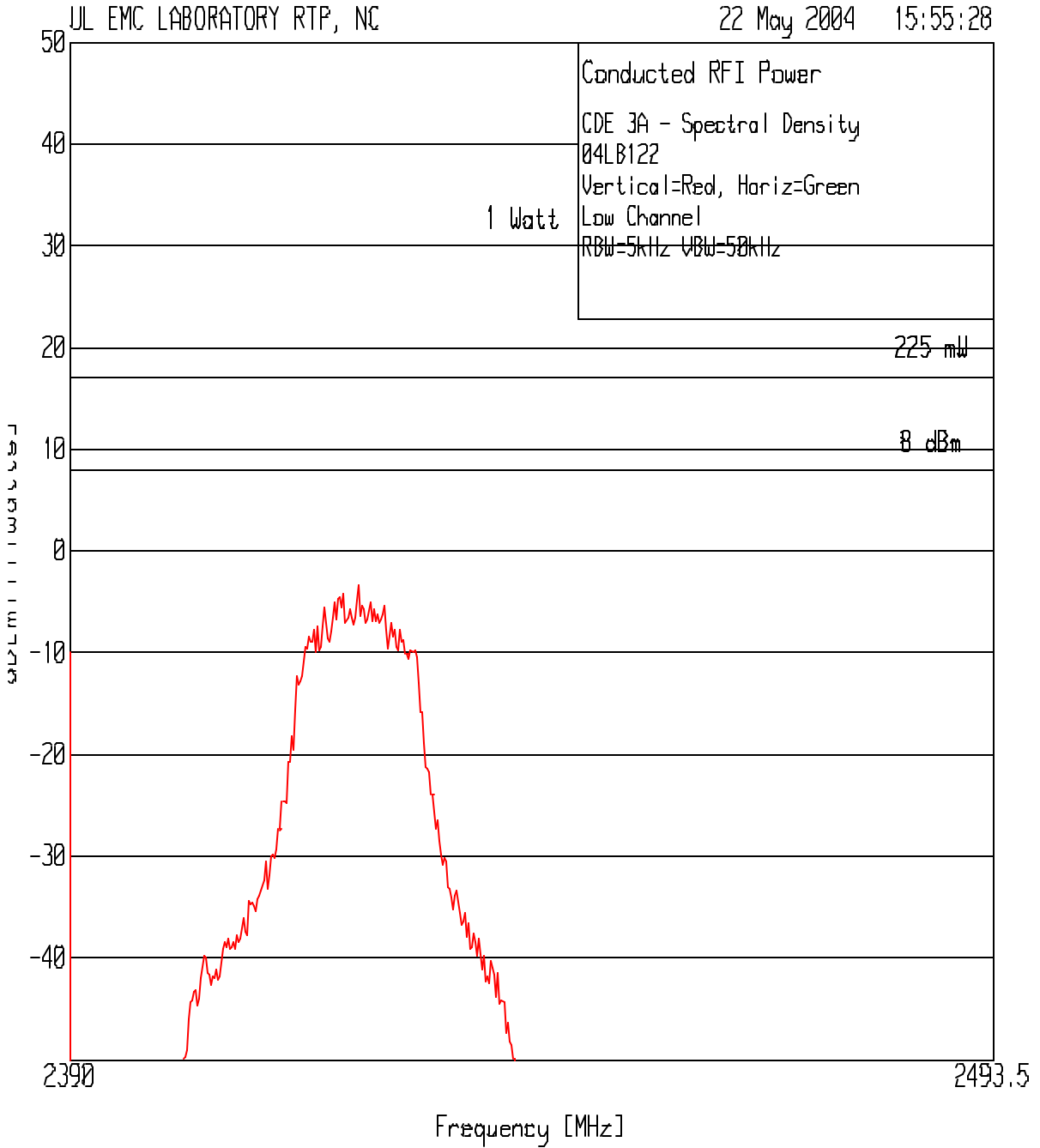
**Test Equipment Used:**

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
ATA160	RF Attenuator, 30 dB	Weinshel	47-30-43	9/30/03	9/30/04
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	11/10/03	11/03/04

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

**Test 3, Item A - Peak Plot (Amplitude in dBuV):**

Spectral Density - Digitally Modulated Spread Spectrum



**Test 3, Item A - Discrete Data:**

Spectral Density - Digitally Modulated Spread Spectrum

CDE 3A - Spectral Density  
04LB122  
Vertical=Red, Horiz=Green  
Low Channel  
RBW=5kHz VBW=50kHz

No.	Test Frequency [MHz]	Meter Reading [dBuV]	Gain/Loss Factor [dB]	Unit Conv. Factor [dBm/uV]	Power Level [dBm]	Spec Dens Limit [dBm/3kHz BW]
1	2421.942	73.61 pk	29.6	-107 Margin [dB]	-3.79	8 -11.79

pk - Peak detector

## Test 4: Bandedge

**Test Requirement:** 47 CFR Part 15 Subpart C

**Test Specification:** 47 CFR Part 15.247

### **Test Procedure:**

All testing was performed as a conducted measurement. The output of the EUT is connected to the input of a spectrum analyzer. A 50-ohm, 30 dB (nominal) attenuator is used to reduce the signal.

The spectrum analyzer Resolution Bandwidth and Video Bandwidth were set to 1 MHz for the measurement. A plot of the spectrum analyzer display screen is produced with marker points displaying the intended signal along with the -20 dB frequency and the signal strength at the band edges.

Limits - FCC Part 15.247

Bandedge frequencies	Criteria
2400 (Lower Edge)	Outside occupied BW (low channel)
2483.5 (Upper Edge)	Outside occupied BW (high channel)

### **Test Deviations:**

None

**Test Setup:** Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	0	Enclosure	2 (High Channel)	1	1
B	0	Enclosure	1 (Low Channel)	1	1

**Test 4 - Results:** Bandedge

**Test Results Summary:**

Test Item	Test Location	Pass/Fail (P/F)	Date Completed	Comment #
A	A	P	5/22/2004	
B	A	P	5/22/2004	

The EUT was considered to **Pass** the Requirements.

**Comments:**

Comment #	Description

**Test Equipment Used:**

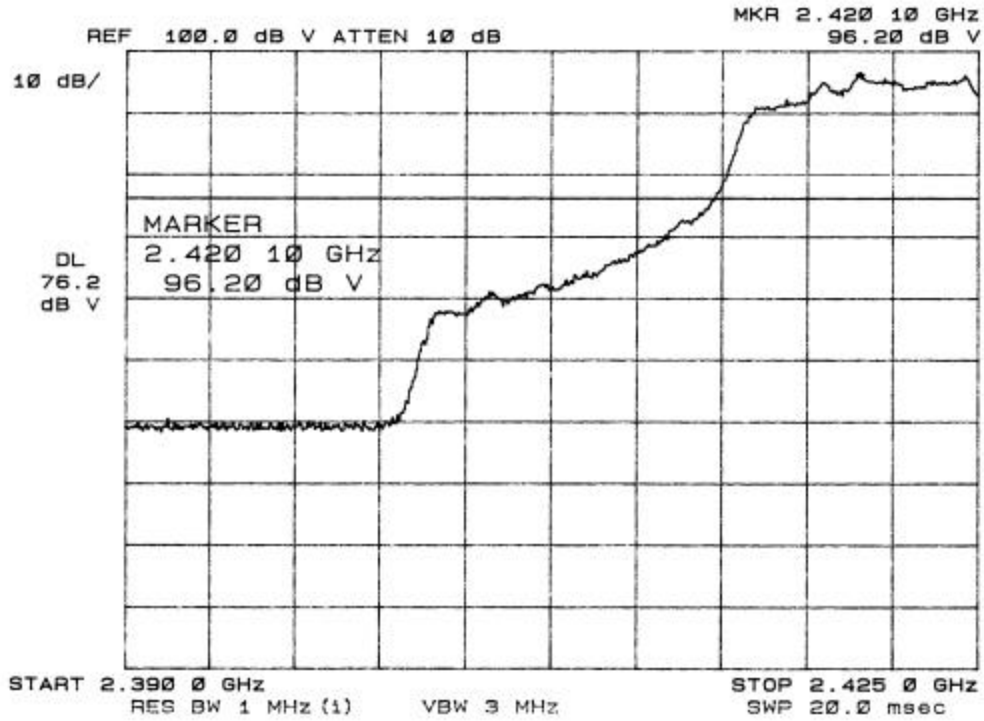
Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
ATA160	RF Attenuator, 30 dB	Weinshel	47-30-43	9/30/03	9/30/04
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/2/04	2/28/05

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NC SL Z540-1-1994.

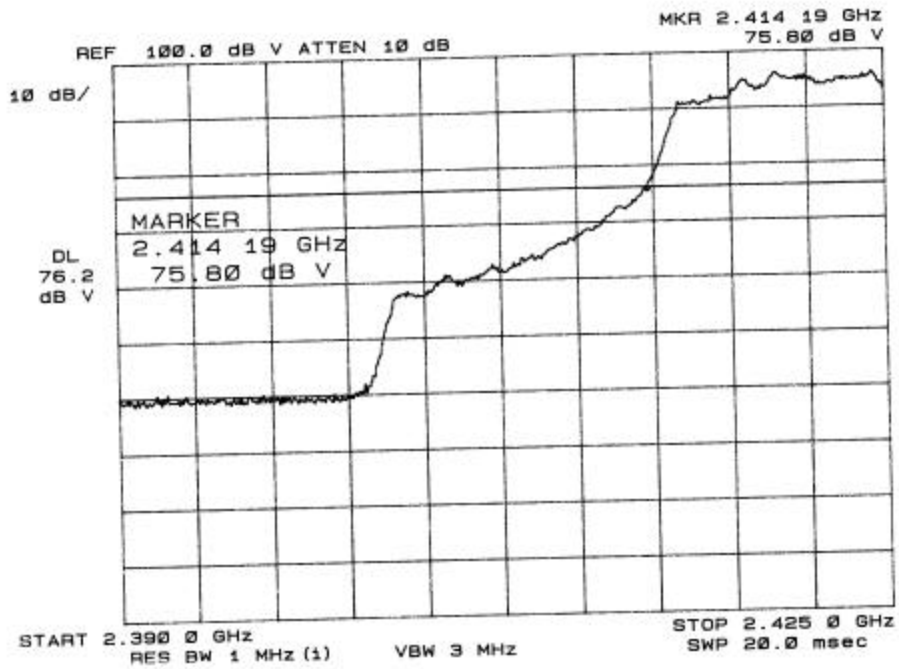
**Test 4, Item A - Peak Plot (Amplitude in dBuV):**

Bandedge

Low Channel - Peak Frequency



Low Channel - Minus 20 dB Frequency

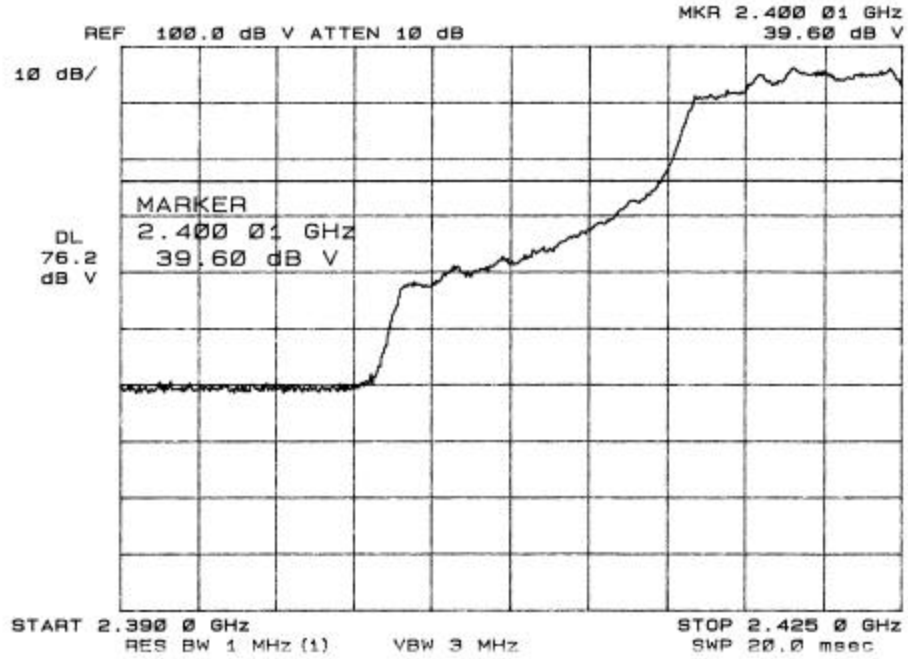




**Test 4, Item A - Peak Plot (Amplitude in dBuV):**

Bandedge

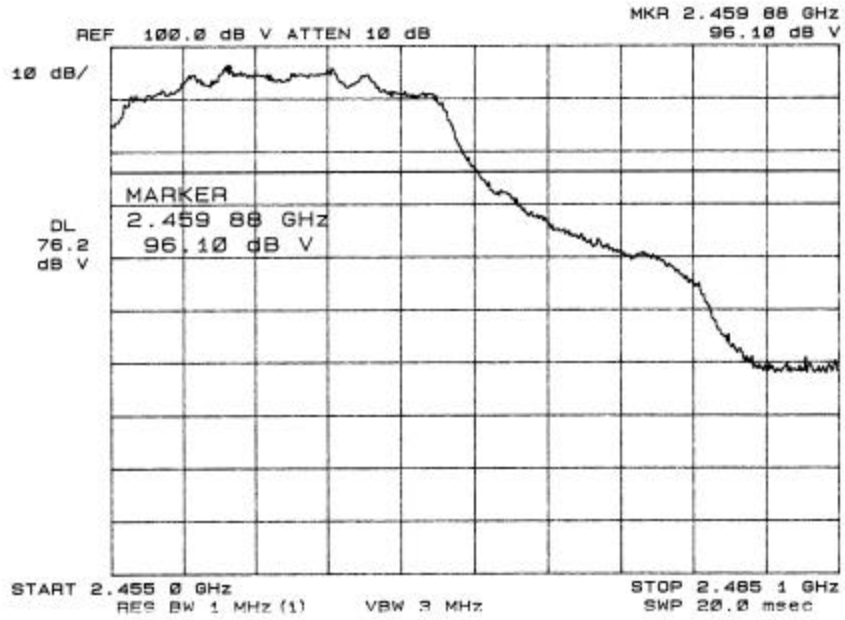
Low Channel - Lower Band edge (2400 MHz)



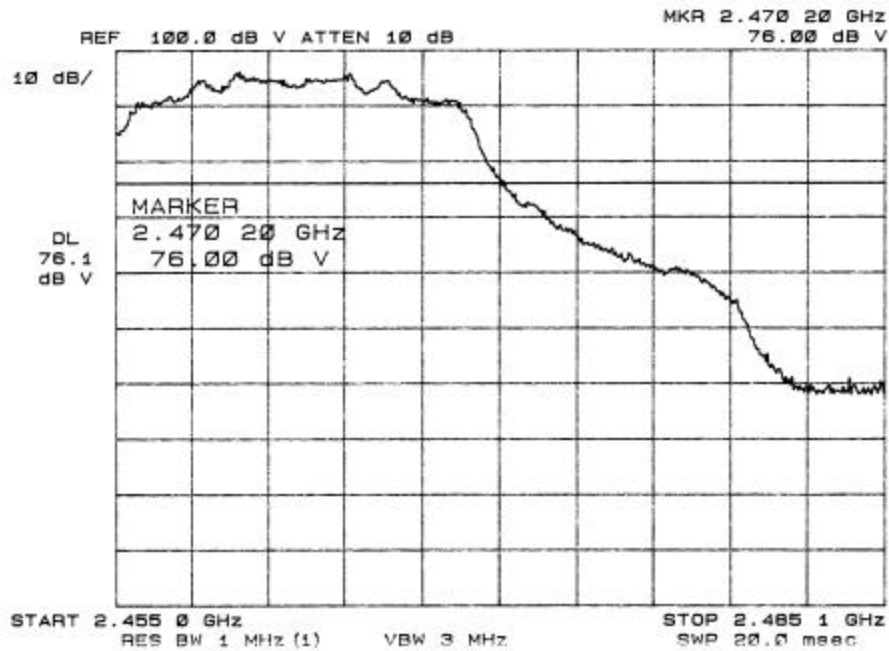
**Test 4, Item A - Peak Plot (Amplitude in dBuV):**

Bandedge

High Channel - Peak Frequency



High Channel - Minus 20 dB Frequency



**Test 4, Item A - Peak Plot (Amplitude in dBuV):**

Bandedge

High Channel - Upper Band edge (2483.5 MHz)



## Test 5: Radiated Spurious Emissions

**Test Requirement:** 47 CFR Part 15.247

**Test Specification:** ANSI C63.42:2001

### **Test Procedure:**

The test was performed in accordance with the Test Requirement and Specification and configured as noted in the Test Setup. The EUT was placed inside the anechoic chamber with a fresh battery installed. A peak measurement was first made by scanning the entire test frequency range and maximizing the EUT emissions by rotating the EUT and raising the antenna height from 1 to 4 meters above the ground reference plane. Then, a measurement was taken for all peak emissions to verify each were below the Test Limits.

Radiated Disturbance Limits for Manually Operated Transmitters - Section 15.247  
at a measurement distance of 3 meters

Power of Fundamental (mW)		Field Strength of Spurious* (dBm)	
(mW)	(dBm)	(mW)	(dBm)
1000	30	10	10

\* Spurious emissions inside restricted band must comply with general limits of 54 dBuV/m (average) at 3 meters. Harmonics at 2, 3, 5, 6, 8, and 9 times the transmit frequencies lie either wholly or partially within restricted bands. Harmonics at 4, 7, and 10 times the fundamental frequency do not lie within restricted bands. All spurious emissions are compared with general limits for convenience.

### **Test Deviations:**

None

**Test Setup:** Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	0	Enclosure	1 (Low Channel)	1	1
B	0	Enclosure	2 (High Channel)	1	1

**Test 5 - Results:** Radiated Spurious Emissions

**Test Results Summary:**

Test Item	Test Location	Pass/Fail (P/F)	Date Completed	Comment #
A	A	P	5/22/2004	
B	A	P	5/22/2004	

The EUT was considered to **Pass** the Requirements.

**Comments:**

Comment #	Description
1	Notch band not shown on plot.
2	1 GHz to 4 GHz shown lower channel only. Upper channel performs similarly. No significant spurious emissions are observed in this range.
3	Worst-case spurious emissions measured at 4924.0 MHz. Emission of 51.8 dBuV/m @ 3 meters (or 389 uV/m).

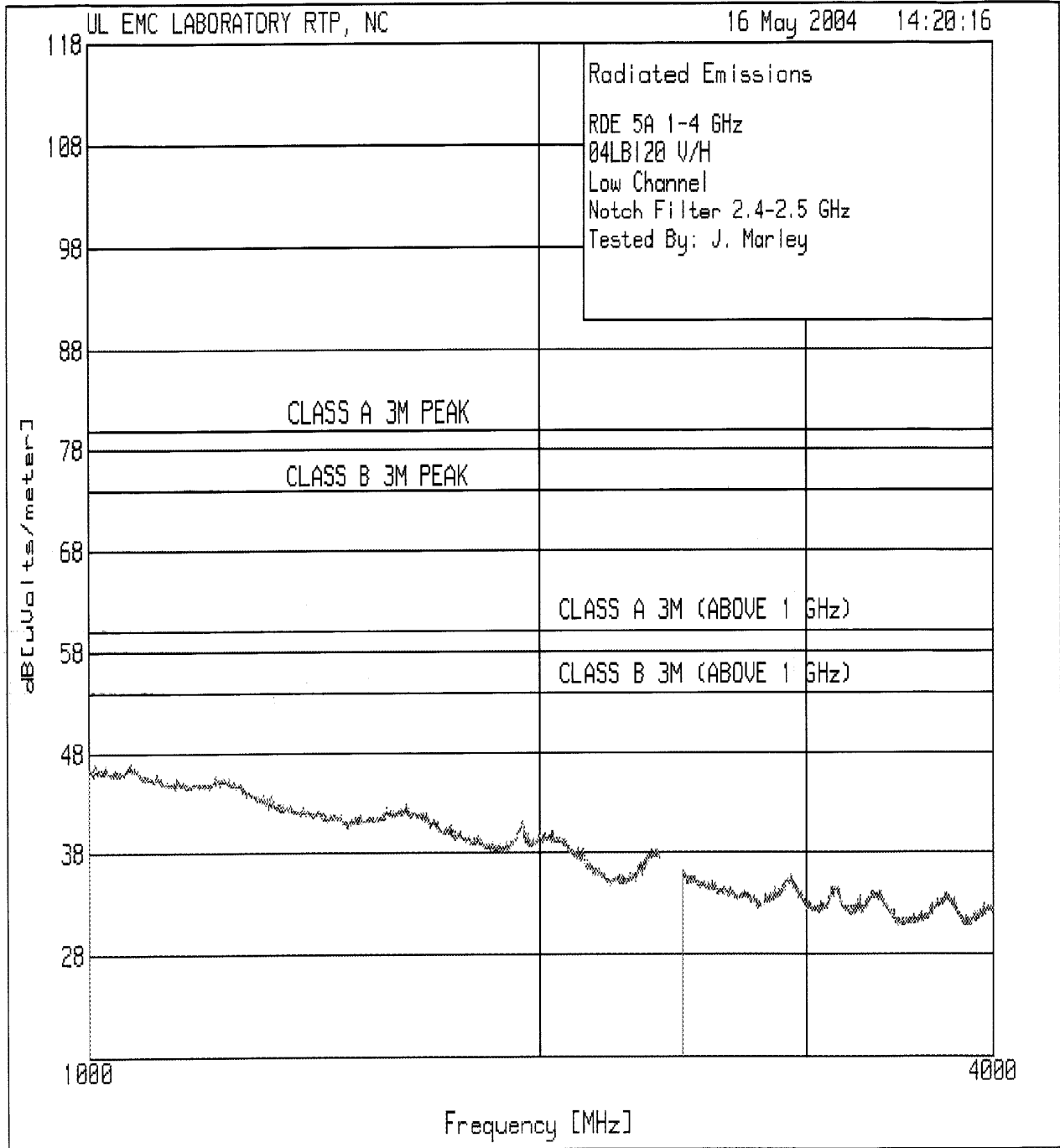
**Test Equipment Used:**

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0026	Horn Antenna, 1 to 18 GHz	EMC Test Systems	3115	5/8/03	5/31/04
AT0044	ETS 3160-09 (s/n 1238) & ETS 3160-010 (s/n 1190) horn antennas;	See Description	18-40GHz Antenna System	7/31/03	7/31/04
ATA096	50 ft, N male - N male	Micro-Coax	Coaxial Cable	3/11/04	3/31/05
ATA144	Amplifier, 0.1 to 18 GHz	Miteq	AFS42-00101800-2	3/11/04	3/31/05
ATA152	27 ft. N male - N male low loss cable	Micro-Coax	UFB293C-0-3149-50504	2/21/04	2/29/05
ATA163	High Pass Filter, 3.6 GHz cutoff frequency, N-male to N-female	UL	N/A	5/7/03	5/31/04
ATA168	Cable, 6ft., N-male to N-male	Micro-Coax	N/A	1/9/04	1/31/05
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	11/10/03	11/03/04
ZATA31	Tunable Notch Filter (Note: Insertion Loss measured before each use)	Eastern Wireless	EWT-14-0002	N/A	N/A

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NC SL Z540-1-1994.

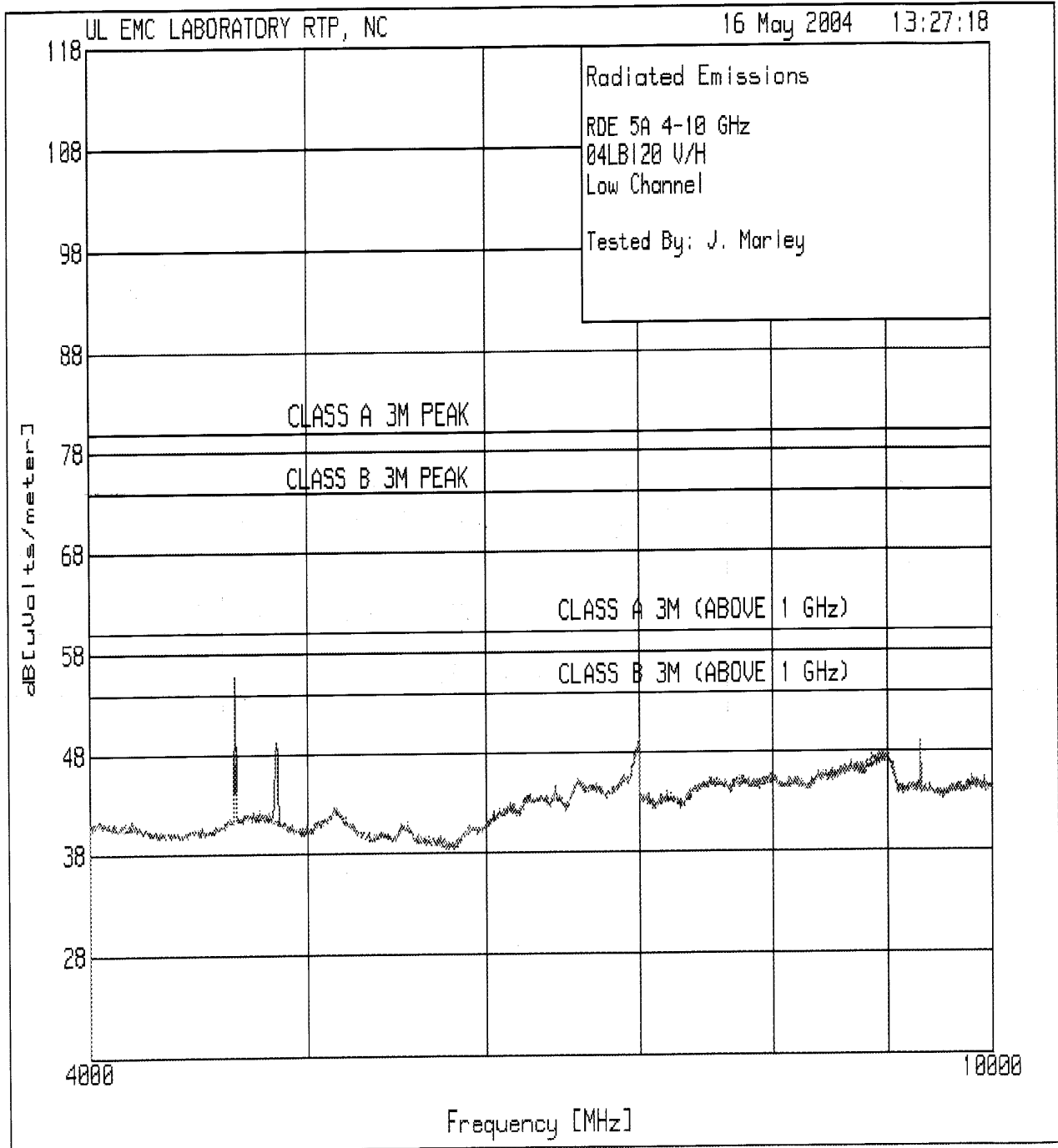
**Test 5, Item A - Peak Plot (Amplitude in dBuV/m):**

Radiated Spurious Emissions - 1-4 GHz



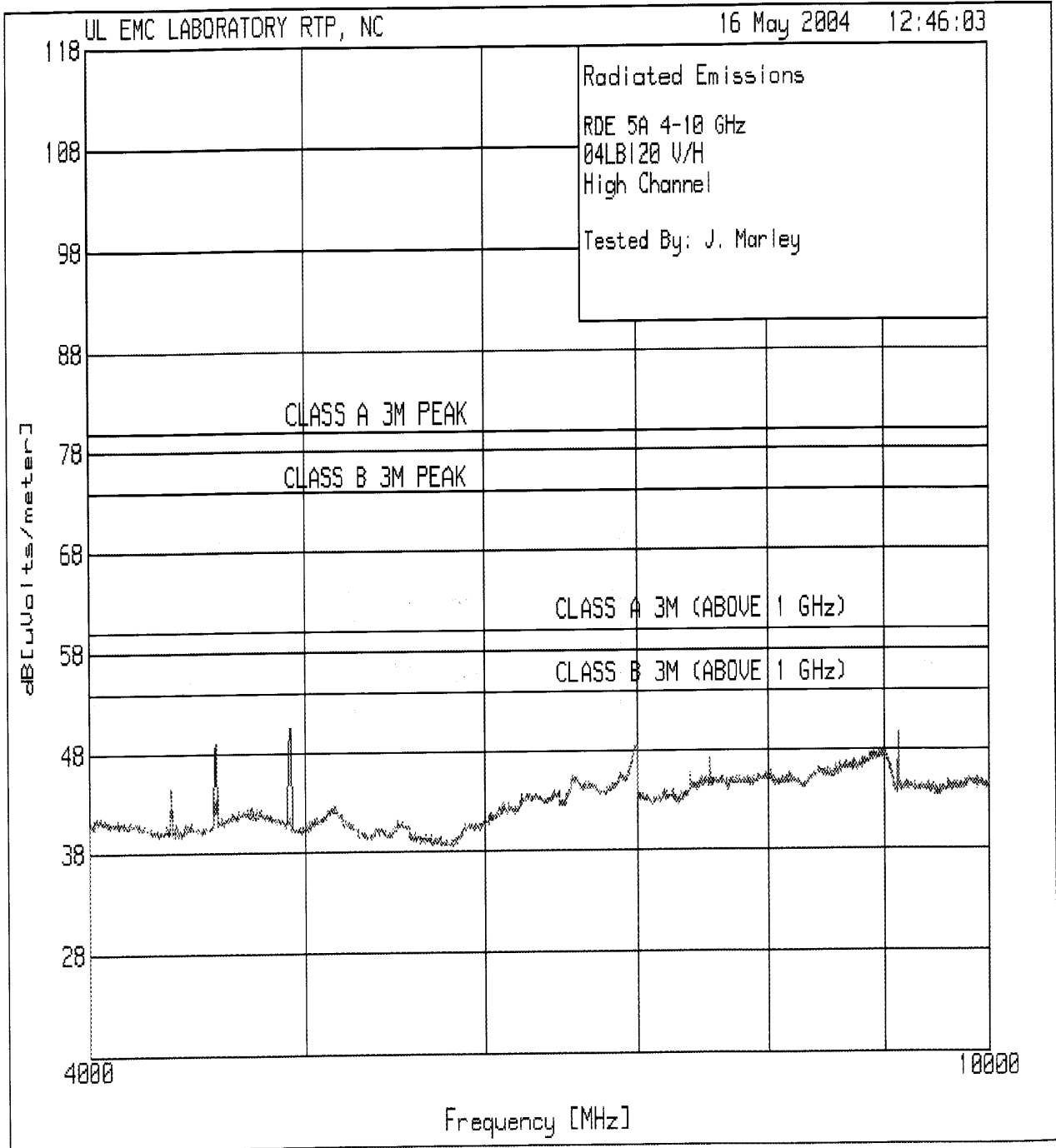
**Test 5, Item A - Peak Plot, Low Channel (Amplitude in dBuV/m):**

Radiated Spurious Emissions - 4-10 GHz



**Test 5, Item B - Peak Plot, High Channel (Amplitude in dBuV/m):**

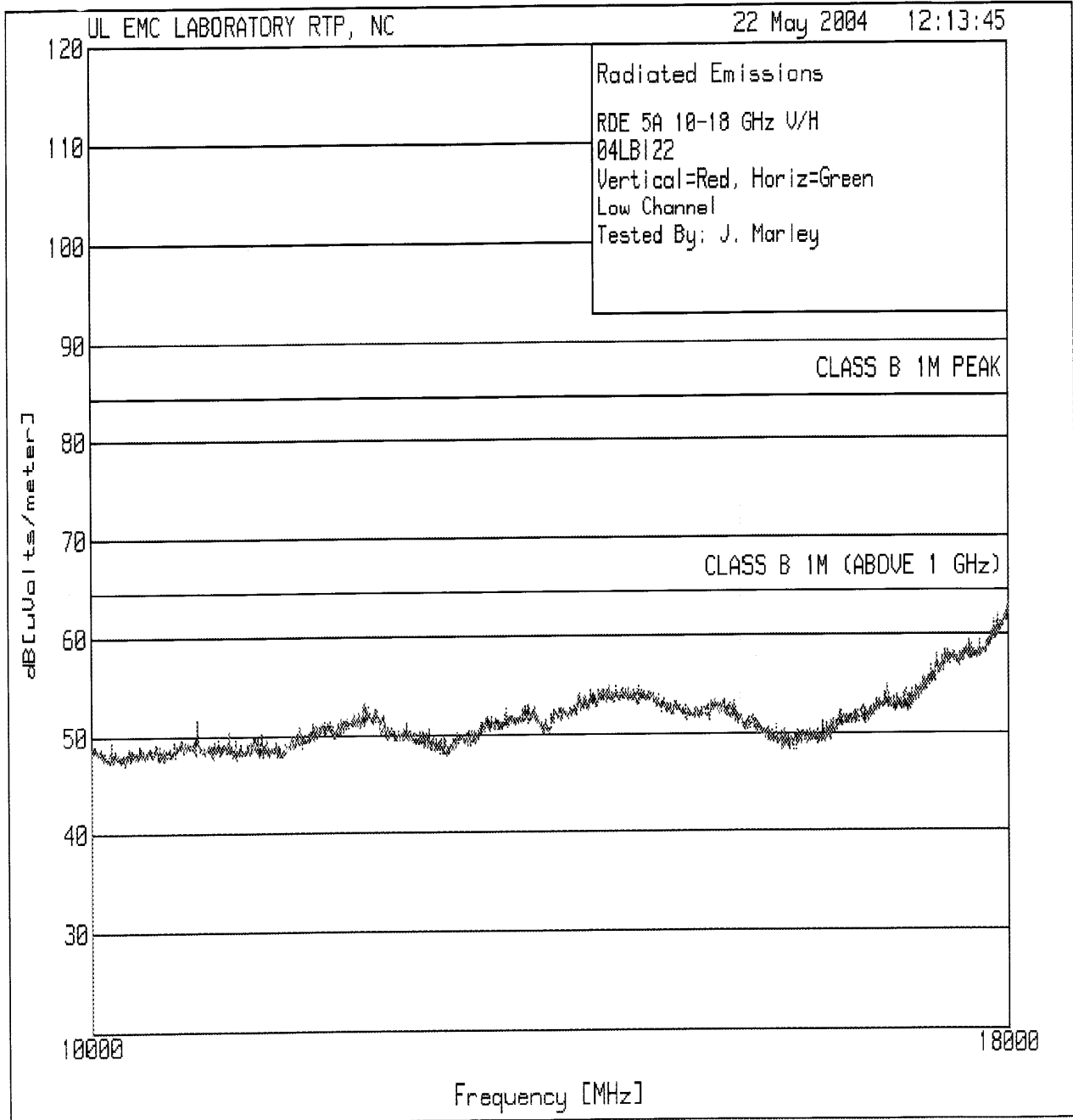
Radiated Spurious Emissions - 4-10 GHz





**Test 5, Item A - Peak Plot, Low Channel (Amplitude in dBuV/m):**

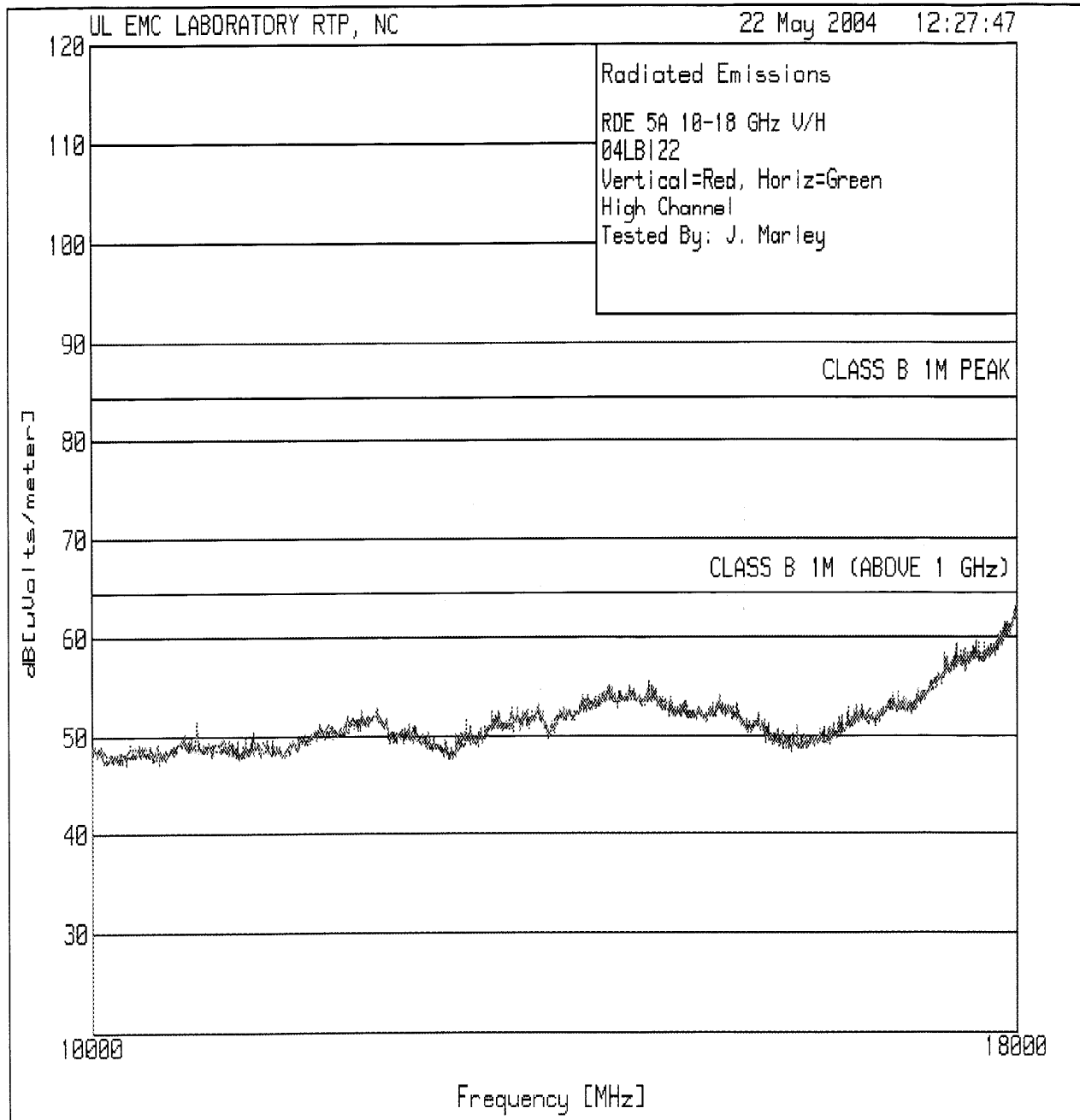
Radiated Spurious Emissions - 10-18 GHz



Note: Measurements above 10 GHz were performed at 1 meter distance. Three meter limit is adjusted upward by 9.54 dB (1/r) from 54 dBuV/m to 63.5 dBuV/m.

**Test 5, Item B - Peak Plot, High Channel (Amplitude in dBuV/m):**

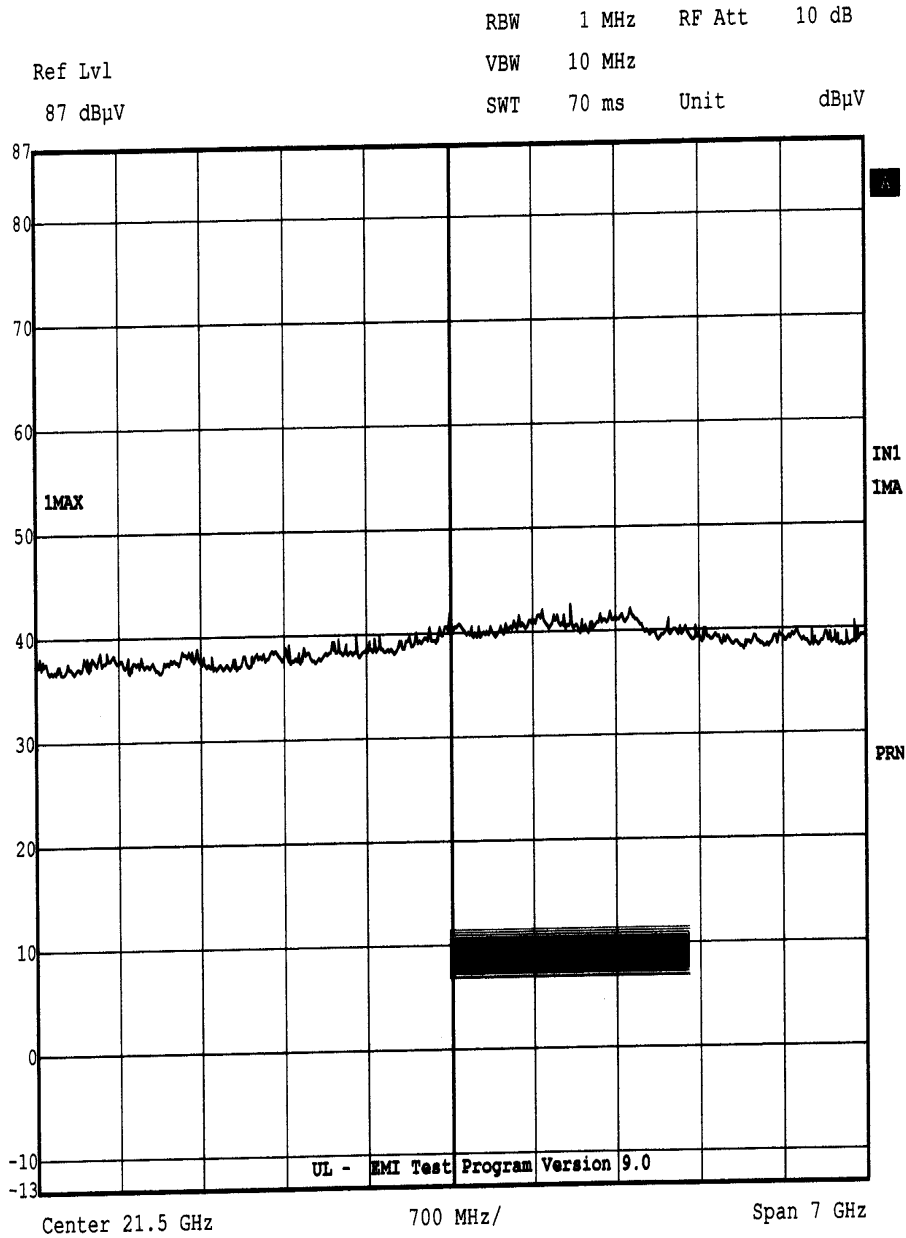
Radiated Spurious Emissions - 10-18 GHz



Note: Measurements above 10 GHz were performed at 1 meter distance. Three meter limit is adjusted upward by 9.54 dB (1/r) from 54 dBuV/m to 63.5 dBuV/m.

**Test 5, Item A - Peak Plot (Amplitude in dBuV/m):**

**Radiated Spurious Emissions**

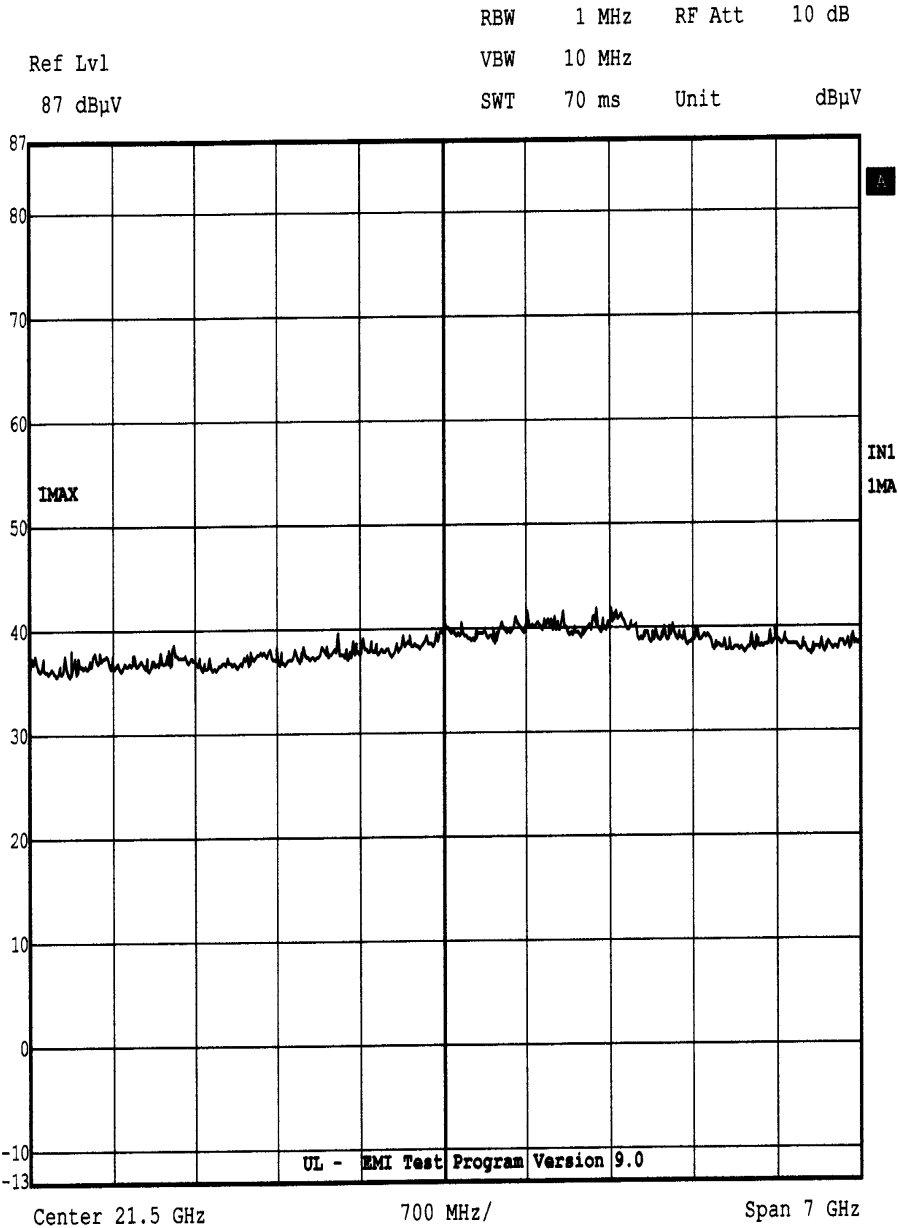


Date: 22.MAY.2004 14:47:45

Note: Measurements above 10 GHz were performed at 1 meter distance. Three meter limit is adjusted upward by 9.54 dB (1/r). Measurements above 18 GHz were performed with the receiver located inside the measurement chamber. Peak plot for this range is not adjusted for antenna, cable, and amplifier gain.

**Test 5, Item B - Peak Plot (Amplitude in dBuV/m):**

**Radiated Spurious Emissions**



Date: 22.MAY.2004 14:52:19

Note: Measurements above 10 GHz were performed at 1 meter distance. Three meter limit is adjusted upward by 9.54 dB (1/r). Measurements above 18 GHz were performed with the receiver located inside the measurement chamber. Peak plot for this range is not adjusted for antenna, cable, and amplifier gain.

**Test 5, All Items - Discrete Data:** Radiated Spurious Emissions

Test Item (A-Z)	Detector Type* (P/Q/A)	Antenna Polarity (H/V)	Antenna Distance (m)	Measured Frequency (MHz)	Measured Value (dBuV)	Equip Correction (dB/m)	Corrected Value (dBuV/m)	Specified Limit** (dBuV/m)	Spec Margin (dB)	See Comment (#)***
Low Channel										
A	P	V	3	4642.643	34.7	17.5	52.2	74.0	-21.8	
A	A	V	3	4644.000	32.2	17.5	49.7	54.0	-4.3	
A	P	V	3	4840.841	39.6	17.1	56.7	74.0	-17.3	
A	A	V	3	4843.000	25.3	17.1	42.4	54.0	-11.6	
A	P	V	3	6426.426	26.7	19.1	45.8	54.0	-8.2	
A	P	V	3	7585.586	21.5	23.8	45.3	54.0	-8.7	
A	P	V	3	9291.291	24.1	25.1	49.2	54.0	-4.8	
A	P	V	3	10680.681	30.2	19.4	49.6	63.5	-13.9	
A	P	V	3	12082.082	30.0	20.7	50.7	63.5	-12.8	
A	P	V	3	14540.541	30.6	22.5	53.1	63.5	-10.4	
A	P	V	3	16958.959	28.1	26.5	54.6	63.5	-8.9	
High Channel										
A	P	V	3	4360.360	26.4	18.0	44.4	74.0	-29.7	
A	A	V	3	4360.360	24.4	18.0	42.4	54.0	-11.6	
A	P	V	3	4564.565	31.5	17.4	48.9	74.0	-25.1	
A	A	V	3	4564.565	25.1	17.4	42.5	54.0	-11.5	
A	P	V	3	4924.925	33.4	17.0	50.4	74.0	-23.6	
A	A	V	3	4924.925	34.8	17.0	51.8	54.0	-2.2	3
A	P	V	3	9129.129	24.6	25.0	49.6	74.0	-24.4	
A	A	V	3	9129.129	26.0	25.0	51.0	54.0	-3.0	
A	P	H	3	7387.387	22.2	23.5	45.7	54.0	-8.3	
A	P	H	3	7537.538	23.4	23.7	47.1	54.0	-7.0	
A	P	V	3	12298.298	31.0	19.9	50.9	63.5	-12.6	
A	P	V	3	14748.749	30.3	22.1	52.4	63.5	-11.1	
A	P	V	3	17199.199	29.0	29.3	58.3	63.5	-5.2	

\* P = Peak, Q = Quasi-Peak, A = Average.

\*\* The Specified Limit is for the type measurement indicated. When Peak data is indicated, the tightest limit applicable is indicated.

\*\*\* # = See Comment Number Under This Test's Comments Section.

Sample Calculation: Corrected Value = Measured Value + Equip Correction

Sample Calculation: Equip Correction = Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB, if used)

## Test 6: Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field

**Test Requirement:** 47 CFR Part 15, Subpart B

**Test Specification:** CISPR 22:1997 Class A

### **Test Procedure:**

The test was performed in accordance with the Test Requirement and Specification and configured as noted in the Test Setup. The EUT was placed inside the anechoic chamber and connected to the proper power supply source. A peak measurement was first made by scanning the entire test frequency range and maximizing the EUT emissions by rotating the EUT and raising the antenna height from 1 to 4 meters above the ground reference plane. Then, a measurement was taken for all peak emissions to verify each were below the Test Limits. In each case, all cables and equipment were adjusted and EUT orientation and antenna height were varied for maximum emissions.

Radiated Disturbance Limits for Class A Equipment  
at a measuring distance of 10m.

Frequency Range MHz	Quasi-Peak Limits dB $\mu$ V/m
30 to 230	40
230 to 1000	47

### **Test Deviations:**

None

**Test Setup:** Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	0	Enclosure	1 (Lower Channel)	1	1

**Test 6 - Results:** Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field

**Test Results Summary:**

Test Item	Test Location	Pass/Fail (P/F)	Date Completed	Comment #
A	A	P	5/26/2004	

The EUT was considered to **Pass** the Requirements.

**Comments:**

Comment #	Description
1	Emissions in this range were performance while transmitting on lower channel only. Measurements are intended to demonstrate compliance of Part 15 Subpart B of digital components within the device.

**Test 6 - Test Equipment Used:** Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field

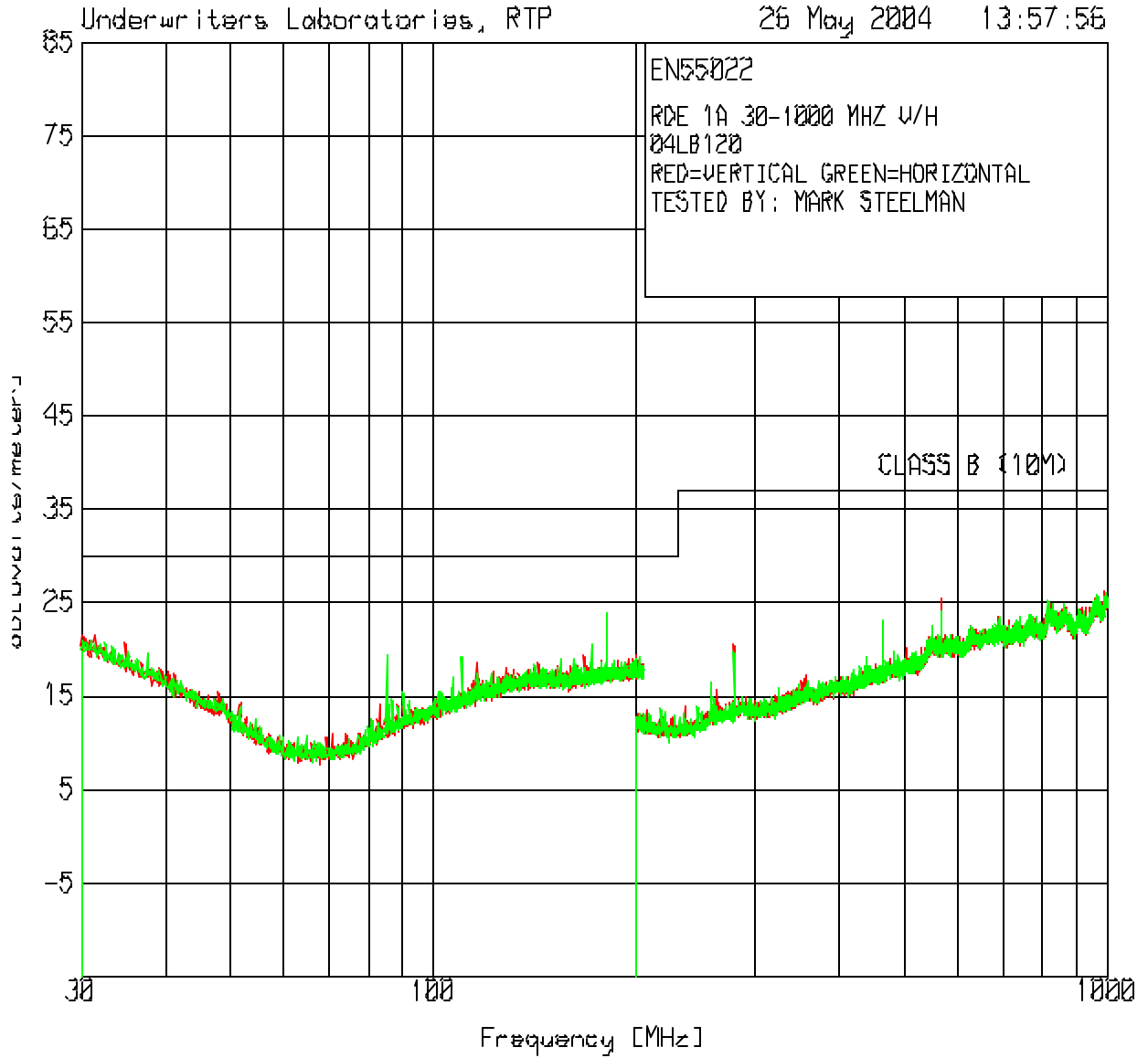
Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0025	Biconical Antenna, 30 to 300 MHz	Schaffner, EMC	VBA6106A	3/22/04	3/31/05
AT0030	Log periodic Antenna, 200 MHz to 1000 MHz	Schaffner, EMC	3160-07	2/9/04	2/28/05
ATA084	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/11/04	3/31/05
ATA085	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/11/04	3/31/05
ATA106	19 ft, N - N	Amplifier Research	Low Loss coaxial cable	3/11/04	3/31/05
ATA124	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/11/04	3/31/05
ATA125	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/11/04	3/31/05
ATA132	45ft. N-Male to N-Male	UL	Coaxial Cable	3/11/04	3/31/05
ATA140	RG214 Ferrite Cable	EMC Eupen	N/A	3/11/04	3/31/05
ATA143	Cable, 6ft., N-male to N-male	Micro-Coax	N/A	3/11/04	3/31/05
ATA167	RG214 Ferrite Cable	EMC Eupen	N/A	3/11/04	3/31/05
ATA168	Cable, 6ft., N-male to N-male	Micro-Coax	N/A	1/9/04	1/31/05
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/17/03	10/31/04
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/2/04	2/28/05

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NC SL Z540-1-1994.



**Test 6, Item A - Peak Plot (Amplitude in dBuV):**

Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field



**Test 6, Item A - Discrete Data:**

Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field

RDE 1A 30-1000 MHZ V/H  
04LB120  
RED=VERTICAL GREEN=HORIZONTAL  
TESTED BY: MARK STEELMAN

Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Antenna Factor [dB]	Field Strength [dBuV/m]	General Limit 15.209 [dBuV/m]
1	85.1849	39 pk Height:248	-28.3 Horz	8.7 Margin [dB]	19.4	30 -10.6
2	110.4598	35.1 pk Height:248	-28.5 Horz	12.5 Margin [dB]	19.1	30 -10.9
3	180.7746	37.1 pk Height:101	-28.2 Horz	15 Margin [dB]	23.9	30 -6.1
4	280.1399	36.3 pk Height:397	-28.9 Vert	12.9 Margin [dB]	20.3	37 -16.7
5	567.5244	33.4 pk Height:101	-27.5 Vert	19.6 Margin [dB]	25.5	37 -11.5
6	464.2018	34.3 pk Height:100	-27.9 Horz	16.7 Margin [dB]	23.1	37 -13.9

Pk - Peak detector  
qp - Quasi-Peak detector  
av - Average detector

## Test 7: Restricted Bands

**Test Requirement:** 47 CFR Part 15 Subpart C

**Test Specification:** 47 CFR Part 15.205

### Test Procedure:

The EUT is verified to produce only spurious emissions in the bands listed below. Where spurious emissions exist they must comply with the general limits from 47 CFR Part 15, Section 15.209.

Results from measurements are examined to ensure that no spurious emission in a restricted band (below) exceeds the general limits in Section 15.209. The restricted bands from Section 15.205 are:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	608 - 614	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	960 - 1240	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	1300 - 1427	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1435 - 1626.5	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1645.5 - 1646.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1660 - 1710	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1718.8 - 1722.2	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	2200 - 2300	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2310 - 2390	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2483.5 - 2500	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2655 - 2900	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	3260 - 3267	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3332 - 3339	23.6 - 24.0
12.29 - 12.293	127.72 - 167.17	3345.8 - 3358	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3600 - 4400	36.43 - 36.5
12.57675 - 12.57725	332-335.4		Above 38.6
13.36 - 13.41	399.9 - 410		

All spurious emissions, including harmonics falling within restricted bands were observed to meet the general limits of 15.209.

### Test Deviations:

None

**Test Setup:** Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	0	Enclosure	1	1	1

**Test 7 - Results:** Restricted Bands

See Radiated Spurious Emissions results from Test 5 for test data.

The EUT was considered to **Pass** the Requirements.

**Comments:**

Comment #	Description
1	All spurious emissions were found to comply with the general limits of 15.209.

## Test 8: Maximum Permissible Exposure

**Test Requirement:** 47 CFR Part 1

**Test Specification:** 47 CFR Part 1, Section 1.1307

### Test Procedure:

Maximum Permissible Exposure limits are as follows:

#### FCC Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm <sup>2</sup> )	Averaging Time  E <sup>2</sup>  ,  H <sup>2</sup>  , or S (minutes)
0.3 – 3.0	614	1.63	(100)*	6
3.0 - 30	1824/f	4.89/f	(900/f <sup>2</sup> )*	6
30 - 300	61.4	0.163	1.0	6
300 – 1500	-	-	f/300	6
1500 – 100,000	-	-	5.0	6

\* Plane-wave equivalent power density

#### FCC Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm <sup>2</sup> )	Averaging Time  E <sup>2</sup>  ,  H <sup>2</sup>  , or S (minutes)
0.3 - 1.34	614	1.63	(100)*	30
1.34 - 30	824/f	2.19/f	(180/f <sup>2</sup> )*	30
30 - 300	27.5	0.073	0.2	30
300 – 1500	-	-	f/1500	30
1500 – 100,000	-	-	1.0	30

\*Plane-wave equivalent power density

**Test Details:** This device is considered to possibly be located in either environment. See calculation for assumptions.

**Background:** Per the following guidance from OET Bulletin 65 Supplement C required minimum spacings are provided to the professional installer.

Transmitter or Device Type <sup>18</sup>	Output <sup>19</sup>	Applicable Methods to Ensure Compliance <sup>20</sup>
Transmitters using indoor antennas that operate at 20 cm or more from nearby persons	>2.5 W at 915 MHz	If the MPE distance is greater than that required for normal operation of the device, operating instructions, warning instructions and/or warning labels may be used to ensure compliance by indicating the minimal separation distance to comply with MPE limits.  If the antennas are professionally installed to ensure compliance, warning instructions and warning labels are not necessary.
	=< 2.5 W at 915 MHz or =< 4 W at 2450 MHz	Transmitters operating at 2.5 W EIRP (1.5 W ERP) or less at 915 MHz, or at 4 W EIRP (2.4 W ERP) or less at 2450 MHz, generally are not expected to exceed MPE limits when nearby persons are 20 cm or more from most antennas. Therefore, special instructions and warnings are normally not necessary to ensure compliance.

**MPE Calculation with highest EIRP:**

Assuming the highest gain antenna intended for use (32.6 dBi gain) and the Tracer 4108 is outputting at highest measured power continuously and no cable loss to the antenna, then the threshold for meeting MPE requirements in an uncontrolled environment is calculated to be 1.3 m. It is recommended that a greater distance be specified as a margin of safety to account for equipment and measurement uncertainties.

A caution statement must be provided to the installer to ensure that limits are not exceeded in the uncontrolled environment.

$$S = \text{EIRP} / (4 * \text{Pi} * R^2),$$

Power Density =  $\text{EIRP} / (4 * \text{Pi} * R^2),$   
 where EIRP = Output Power \* Antenna Gain

**Maximum Power Density Calculation  
 At 1.3 m spacing**

Operating Frequency	2420MHz		
Output Power (Max Avg)	.109Watts		
Antenna Gain	32.6dB	or (linear)	1819.701(unitless)
Separation Distance	1.3m	-or-	51.18inches

Peak Power Density                      9.339W/m<sup>2</sup>                      - or -                      0.9339mW/cm<sup>2</sup>

Exposure % (over 6 min timespan for uncontrolled)	100%
--	------

Transmit Duty Cycle (Peak-to-Average Ratio)	100%
--	------

Average Power Density                      **9.9339W/m<sup>2</sup>**                      - or -                      **0.9339mW/cm<sup>2</sup>**

Limit for **Uncontrolled**

Exposure at Operating Frequency                      **10W/m<sup>2</sup>**                      - or -                      **1mW/cm<sup>2</sup>**

**Accreditation Certificates:**

National Institute of Standards and Technology **NVLAP** National Voluntary Laboratory Accreditation Program

ISO/IEC 17025:1999  
ISO 9002:1994

**Scope of Accreditation**

Revised Scope 12/17/2003  
**ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS** NVLAP LAB CODE 200246-0

Page: 1 of 4

**UNDERWRITERS LABORATORIES, INC.**  
12 Laboratory Drive  
Research Triangle Park, NC 27709  
Mr. Rick A. Titus  
Phone: 847-272-8800 x43281 Fax: 847-509-6321  
E-Mail: Rick.A.Titus@us.ul.com  
URL: http://www.ul.com

**NVLAP Code Designation / Description**

**Emissions Test Methods:**

12/CIS14 CISPR 14-1 (March 30, 2000): Limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus - Part 1: Emissions

12/CIS14a EN 55014-1 (1993) with Amendments A1 (1997) & A2 (1999)

12/CIS14b AS/NZS 1044 (1995)

12/CIS14c CNS 13783-1

12/CIS22 IEC/CISPR 22 (1997) and EN 55022 (1998): Limits and methods of measurement of radio disturbance characteristics of information technology equipment

12/CIS22a IEC/CISPR 22 (1993): Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1:1995, and Amendment 2:1996.

June 30, 2004  
Effective through

*R. Titus*  
For the National Institute of Standards and Technology

National Institute of Standards and Technology **NVLAP** National Voluntary Laboratory Accreditation Program

ISO/IEC 17025:1999  
ISO 9002:1994

**Scope of Accreditation**

Revised Scope 12/17/2003  
**ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS** NVLAP LAB CODE 200246-0

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**UNDERWRITERS LABORATORIES, INC.**

**NVLAP Code Designation / Description**

12/CIS22b CNS 13438 (1997): Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment

12/EM02a IEC 61000-3-2, Edition 2.1 (2001-10), EN 61000-3-2 (2000), and AS/NZS 2279.1 (2000): Electromagnetic compatibility (EMC) Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A)

12/EM03b IEC 61000-3-3, Edition 1.1 (2002-03) and EN 61000-2-2/A1 (2: EMC - Part 3-3: Limits - Limitations of voltage changes, voltage fluctuations and flicker, in public low-voltage supply-systems, for equipment with rated current <=16 A per phase and not subject to conditional connections

12/FCC15b ANSI C63.4 (2001) with FCC Method - 47 CFR Part 15, Subpart B: Unintentional Radiators

12/T51 AS/NZS CISPR 22 (2002) and AS/NZS 3548 (1997): Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment

**Immunity Test Methods:**

12/I01 IEC 61000-4-2 (1995) and Amendment 1 (1998) and EN 61000-4-2: Electrostatic Discharge Immunity Test

12/I02 IEC 61000-4-3 (1995) and Amendment 1 (1998) and EN 61000-4-3: Radiated, Radio-Frequency Electromagnetic Field Immunity Test

June 30, 2004  
Effective through

*R. Titus*  
For the National Institute of Standards and Technology

National Institute of Standards and Technology **NVLAP** National Voluntary Laboratory Accreditation Program

ISO/IEC 17025:1999  
ISO 9002:1994

**Scope of Accreditation**

Revised Scope 12/17/2003  
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12/I03 IEC 61000-4-4 (1995) and EN 61000-4-4: Electrical Fast Transient/Burst Immunity Test

12/I04 IEC 61000-4-5 (1995) and EN 61000-4-5: Surge Immunity Test

12/I05 IEC 61000-4-6 (1996) and EN 61000-4-6: Immunity to Conducted Disturbances, Induced Radio-Frequency Fields

12/I06 IEC 61000-4-8 (1993): Power Frequency Magnetic Field Immunity Test

12/I07 IEC 61000-4-11 (1994): Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests

**Safety Test Methods:**

12/T41 AC/ACIF S001:2001: Safety Requirements for Customer Equipment

12/T50 AS/NZS 3260: Safety of Information Technology Equipment Including Electrical Business Equipment

**Telecommunications Test Methods:**

12/I089d GR-1089-CORE, Issue 3 (April 2002): EMC and Electrical Safety - Generic Criteria for Network Telecommunications Equipment (sections: 2.1.2.1, 2.1.2.2, 2.1.4, 2.2, 3.2, 3.3, 4.6.2, 4.6.5, 4.6.7 - 4.6.17, 4.7, 5.2, 5.3.1, 5.4, 6, 7.2 - 7.7, 8, and 9.2 - 9.12)

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Revised Scope 12/17/2003  
**ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS** NVLAP LAB CODE 200246-0

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**UNDERWRITERS LABORATORIES, INC.**

**NVLAP Code Designation / Description**

12/76200a SBC-TP-76200, Issue 4 (May 2003): Network Equipment Power, Grounding, Environmental, and Physical Design Requirements (sections: 6.1B, 7.1, 7.2, 7.3, 7.4, and 10.1 - 10.4B)

12/GR63a GR-63-CORE, Issue 2 (April 2002): NEBS (TM) Requirements: Physical Protection (sections: 2, 3, 4.1, 4.2.3, 4.3, 4.4.1, 4.4.3, 4.4.4, 4.5, 4.6, and 4.7)

June 30, 2004  
Effective through

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**Measurement Uncertainty Statement**

Test	Expanded Estimate of Uncertainty (k = 2, for 95% of a normal distribution)	Units
Radiated Disturbance Emissions: <ul style="list-style-type: none"> <li>• 3 and 10 meter measurement distances</li> <li>• 1 meter measurement distance</li> </ul>	+/- 3.8 dB  +/- 2.3 dB	Volts/meter  Volts/meter
Conducted Disturbance Emissions (9 kHz – 30 MHz):	+/- 3.4 dB	Volts
Electrostatic Discharge	+/- 2.2 %	Volts
Radiated RF Immunity (Chamber):	+/- 2.7 dB	Volts/meter
Electrical Fast Transients/Bursts Immunity	+/- 4.6 %	Volts
Surge Immunity	+/- 4.6 %	Volts
Conducted RF Immunity	+/- 2.8 dB	Volts
Power Frequency Magnetic Field Immunity	+/-13.6 %	Amps/meter
Voltage Dips and Short Interrupts	+/-4.2 %	Volts
Radiated RF Immunity (Tri-plate)	+/-3.2 %	Volts/meter
Disturbance Power (30 – 300 MHz)	+/-3.5%	Volts

**CISPR 16-4:2000 Statement**

The UL-RTP estimate of expanded measurement uncertainty listed above for Conducted Disturbance (+/- 3.4 dB), Disturbance Power (+/- 3.5 dB), and Radiated Disturbance (+/-3.8 dB) are less than the Values of  $U_{CISPR}$  as listed in Table 1 of CISPR 16-4. Therefore:

- Compliance is deemed to occur if no measured disturbance reported exceeds the disturbance limits.
- Non-compliance is deemed to occur if any measured disturbance reported exceeds the disturbance limits.