



Project: **03RT8964**
File: **MC1324**
Report: **030311A**
(Revised June 7, 2004)
Date: **September 30, 2003**
Model: **W72 and W73**
Ceiling Fan RF Remote

Test Report

On

Electromagnetic Compatibility Testing

Hunter Fan Co
Memphis, TN USA

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Test Report Details:

Tests Performed By: **Underwriters Laboratories Inc.
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Tests Performed For: **Hunter Fan Co
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Test Report Number: **030311A**

Test Report Date: **September 30, 2003 (Revised June 7, 2004)**

Product Type: **Ceiling Fan RF Remote**

Model Number: **W72 and W73**

Sample Serial Number: **unserialized, pre-production sample**

Sample Tag Number: **S03LB27687**

EUT Category: **Transmitter - Low Powered**

EUT Type: **Hand Held**

Sample Receive Date: **September 25, 2003**

Testing Start Date: **September 25, 2003**

Date Testing Complete: **September 29, 2003**

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Summary of Testing:

Test #	Test Name Test Requirement/Specification	Comply	Does Not Comply	See Remark
1	Radiated Disturbance Emissions - 30 MHz to 3.2 GHz 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.209 and 15.231	X		-
2	Radiated Disturbance Emissions - Peak-to-Average Ratio 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.231	N/A		N/A
3	Radiated Disturbance Emissions - Occupied Bandwidth 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.231	X		-
4	Radiated Disturbance Emissions - Restricted Bands 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.205	X		-

Remarks:

- 1) All tests are considered applicable to Canadian requirements as detailed in RSS-210. Emissions test site is registered by Industry Canada as IC-2953.
- 2) This device is a manually operated device. Device was observed to cease transmission immediately upon release of buttons. The word "immediately" represents no noticeable delay as observed with the human eye and can be considered no more than 200 ms. This complies with the 5 second maximum turn-off requirement.
- 3) Device contains an integrated antenna. This antenna is not detachable.
- 4) Per FCC Part 2.1093(c) this device is considered exempt from routine environmental evaluation for RF exposure.
- 5) The following modifications were determined to be required to comply:
 - a. $R1 = 270 \Omega$
 - b. $R2 = 510 \Omega$
 - c. $R3 = 91 \text{ k}\Omega$
 - d. $C2 = 10 \text{ pF}$
 - e. $C3 = 1.8 \text{ pF}$
- 6) Emissions Designator for Canada is L1D508k.

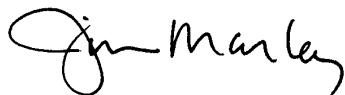
Report Revisions:

June 7, 2004 - Revised to correct sample received date. Revised to state that cease transmission time characterized as "immediately" complies with requirement of less than five seconds.

Conclusion:

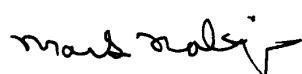
The tests listed in the Summary of Testing section of this report have been performed and the results recorded by Underwriters Laboratories Inc. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the 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 2.1m 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	Low-Powered Transmitter	Hunter Fan Co.	W73	Note: W72 transmitter is electrically identical to the W73. W72 eliminates one button.

* 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	

* 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

Product Description:

This product is a low-powered transmitter used to operate a ceiling fan to turn on/off, vary speed, and direction. This device can also control a lamp if included with the ceiling fan. The device operates at 303.5 MHz and is pulse modulated to send the appropriate action and security code to the ceiling fan receiver/controller. Additional information may be found in the FCC/Industry Canada filing exhibits.

EUT Internal Operating Frequencies:

Frequency (MHz)*	Description
303.5	Transmit Frequency

Frequency (MHz)*	Description

Power Interface:

Mode (#)	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Comments
Rated	12	-	-	DC	
1	12	-	-	DC	A fresh battery was installed at the start of testing.

EUT Operation Modes:

Mode #	Description
1	Transmitter is positioned flat. A small foam pad is placed under the unit to prevent sliding.
2	Transmitter is positioned on its side. A small foam pad is placed under the unit to prevent sliding.
3	Transmitter is positioned on its end (pointing upward). A small foam pad is placed under the unit to prevent sliding.

EUT Configuration Modes:

Mode #	Description
1	Transmitter is placed in the center of a 1.5m x 1.0m x 80cm high wooden table. A rubber band continuously depresses one of the buttons during the test

Test 1: Radiated Disturbance Emissions - 30 MHz to 1000 MHz

Test Requirement: 47 CFR Part 15, Subpart C

Test Specification: 47 CFR Part 15, Subpart C, Section 15.209 and 15.231

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 15.231
at a measurement distance of 3 meters

Fundamental Frequency (MHz)	Field Strength of Fundamental (μ V/m)	Field Strength of Fundamental ($\text{dB}\mu$ V/m)	Field Strength of Spurious (μ V/m)	Field Strength of Spurious ($\text{dB}\mu$ V/m)
40.66 to 40.70	2250	67.04	225	47.04
70 to 130	1250	61.94	125	41.94
130 to 174	1250 to 3750	61.94 to 71.48	125 to 375	41.94 to 51.48
174 to 260	3750	71.48	375	51.48
260 to 470	3750 to 12,500	71.48 to 81.93	375 to 1250	51.48 to 61.93
above 470	12,500	81.93	1250	61.93

** Linear Interpolations

Test Clarifications (Specific Limits for this transmit frequency):

- At fundamental frequency, 303.5 MHz, Average field strength limit = 5562 μ V/m (average) or 74.9 $\text{dB}\mu$ V/m (average).
- Harmonic field strength limit = 556.2 μ V/m (average) or 54.9 $\text{dB}\mu$ V/m (average).
- Harmonics falling within restricted bands must comply with General Limits in 15.209.
- Per 15.35(b) peak limit is 20 dB above average limit for each frequency.

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 (flat orientation)	1	1
B	0	Enclosure	2 (side orientation)	1	1
C	0	Enclosure	3 (end orientation)	1	1

Test 1 - Results: Radiated Disturbance Emissions - 30 MHz to 1000 MHz

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	36	24	101	P	11/10/03	
B	A	36	24	101	P	11/10/03	
C	A	36	24	101	P	11/10/03	

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

Comments:

Comment #	Description
1	Average field strengths are calculated by applying 10.9 dB reduction to peak measurements. Peak-to-average ratio is documented in Test 3.
2	Harmonics falling within restricted band are: 4th harmonic at 1214 MHz, 5th harmonic at 1517.5 MHz, 9th harmonic at 2731.5 MHz, and 10th harmonic at 3035 MHz.
3	Peak emissions from 30 to 200 MHz are measured in one orientation only. No measureable emission was observed in this band.

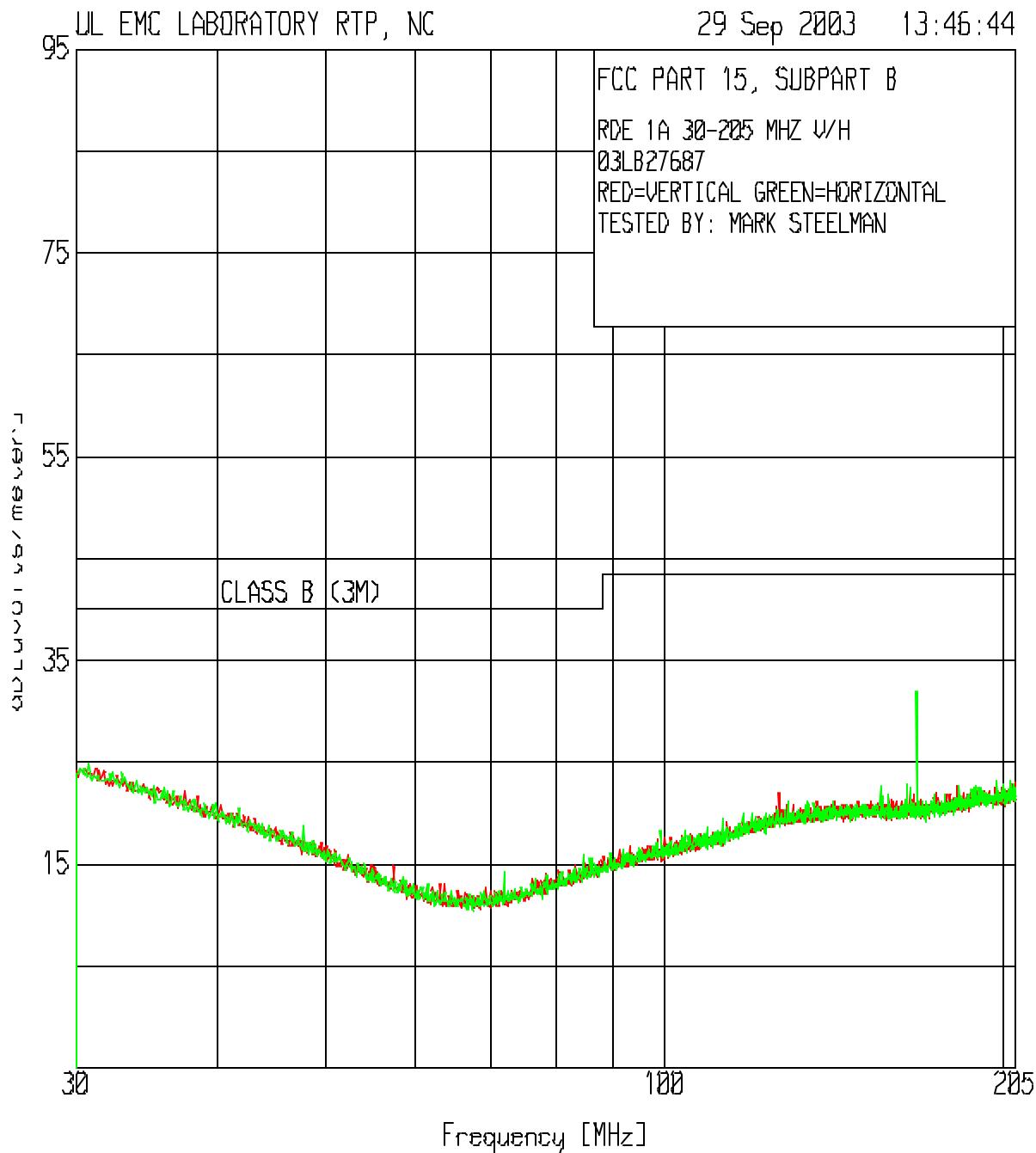
Test 1 - Test Equipment Used: Radiated Disturbance Emissions - 30 MHz to 1000 MHz

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0025	Biconical Antenna, 30 to 300 MHz	Schaffner, EMC	VBA6106A	4/8/03	4/30/04
AT0030	Log periodic Antenna, 200 MHz to 1000 MHz	Schaffner, EMC	3160-07	1/13/03	1/31/04
ATA061	Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/20/03	3/31/04
ATA084	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/19/03	3/31/04
ATA085	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/19/03	3/31/04
ATA095	6 ft, N male - N male	Micro-Coax	Coaxial Cable	9/30/03	3/31/04
ATA096	50 ft, N male - N male	Micro-Coax	Coaxial Cable	9/30/03	3/31/04
ATA108	10 m, N male - N male	UL	RG214	3/19/03	3/31/04
ATA110	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/19/03	3/31/04
ATA124	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/20/03	3/31/04
ATA140	RG214 Ferrite Cable	EMC Eupen	N/A	3/19/03	3/31/04
ATA143	6ft., N-male to N-male	Micro-Coax	Coaxial Cable	3/19/03	3/31/04
SAR002	Spectrum Analyzer / Receiver	Hewlett-Packard	8566B	11/21/02	11/30/03
AT0026	Horn Antenna, 1 to 18 GHz	EMC Test Systems	3115	5/8/03	5/31/04
ATA096	50 ft, N male - N male	Micro-Coax	Coaxial Cable	9/30/03	3/31/04
ATA143	6ft., N-male to N-male	Micro-Coax	Coaxial Cable	3/19/03	3/31/04
ATA144	Amplifier, 0.1 to 18 GHz	Miteq	AFS42-00101800-2	3/20/03	3/31/04
ATA153	27 ft. N male - N male low loss cable	Micro-Coax	UFB293C-0-3149-50504	2/21/03	2/28/04

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.

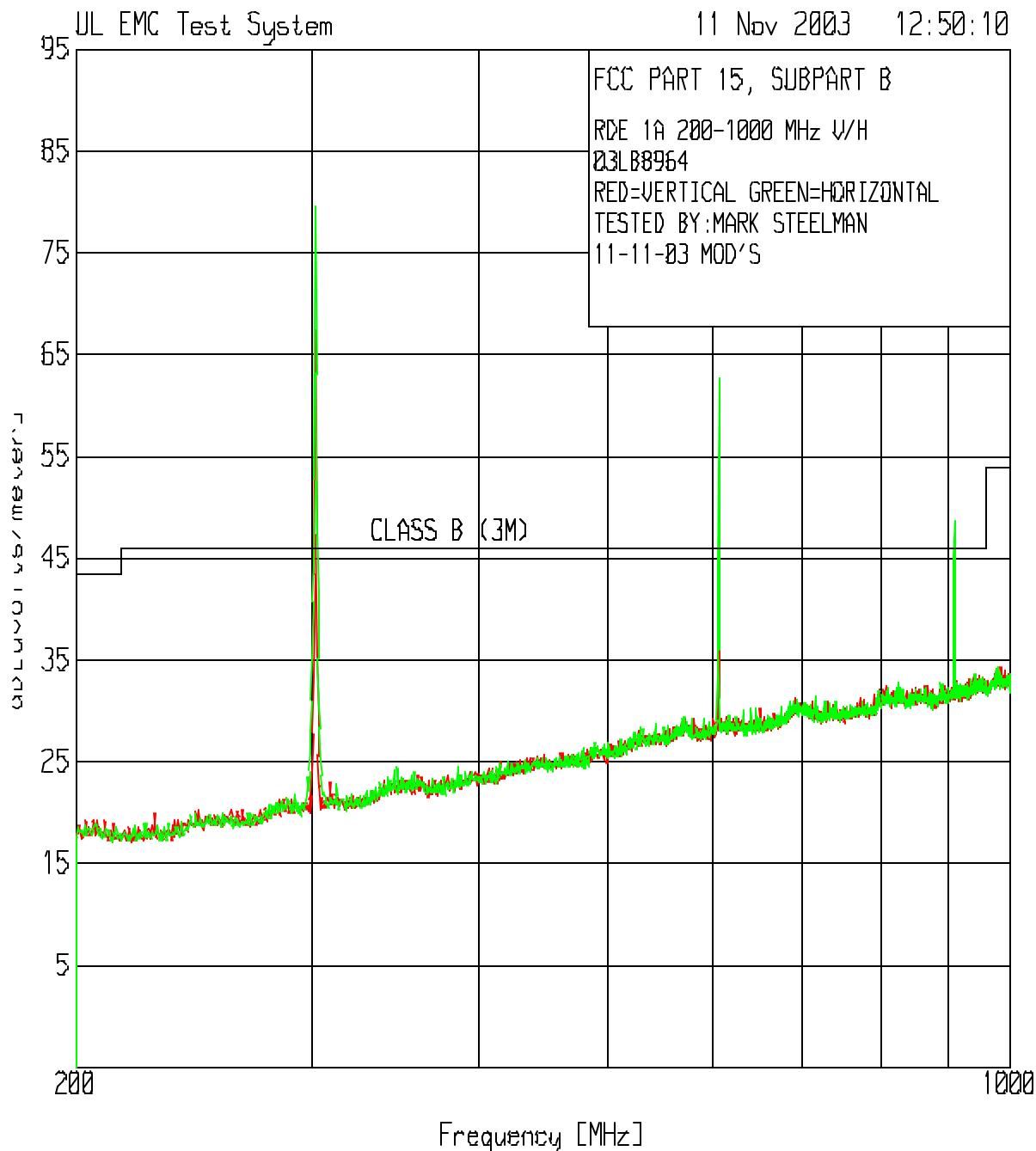
Test 1, Item A (flat) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



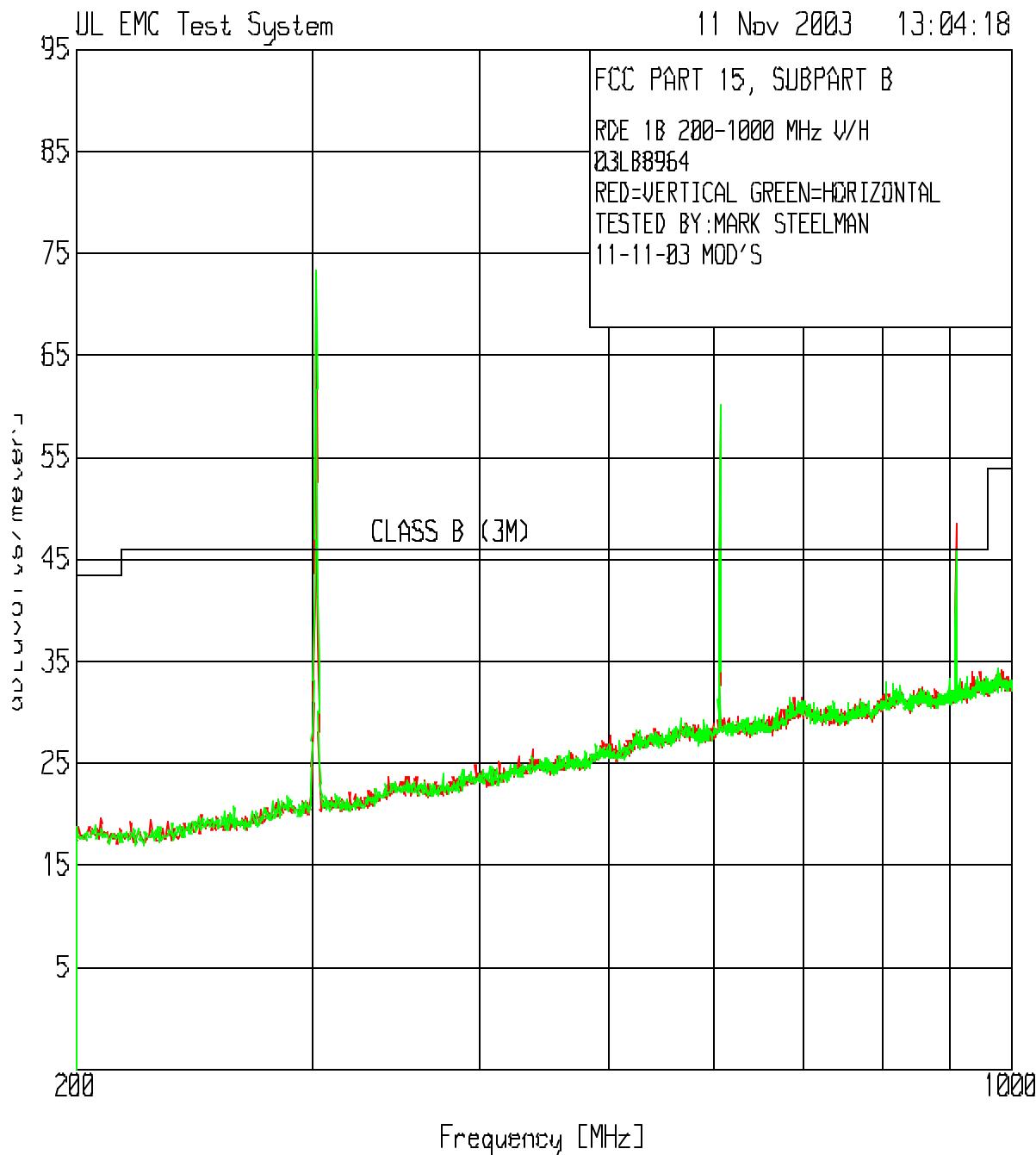
Test 1, Item A (flat) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



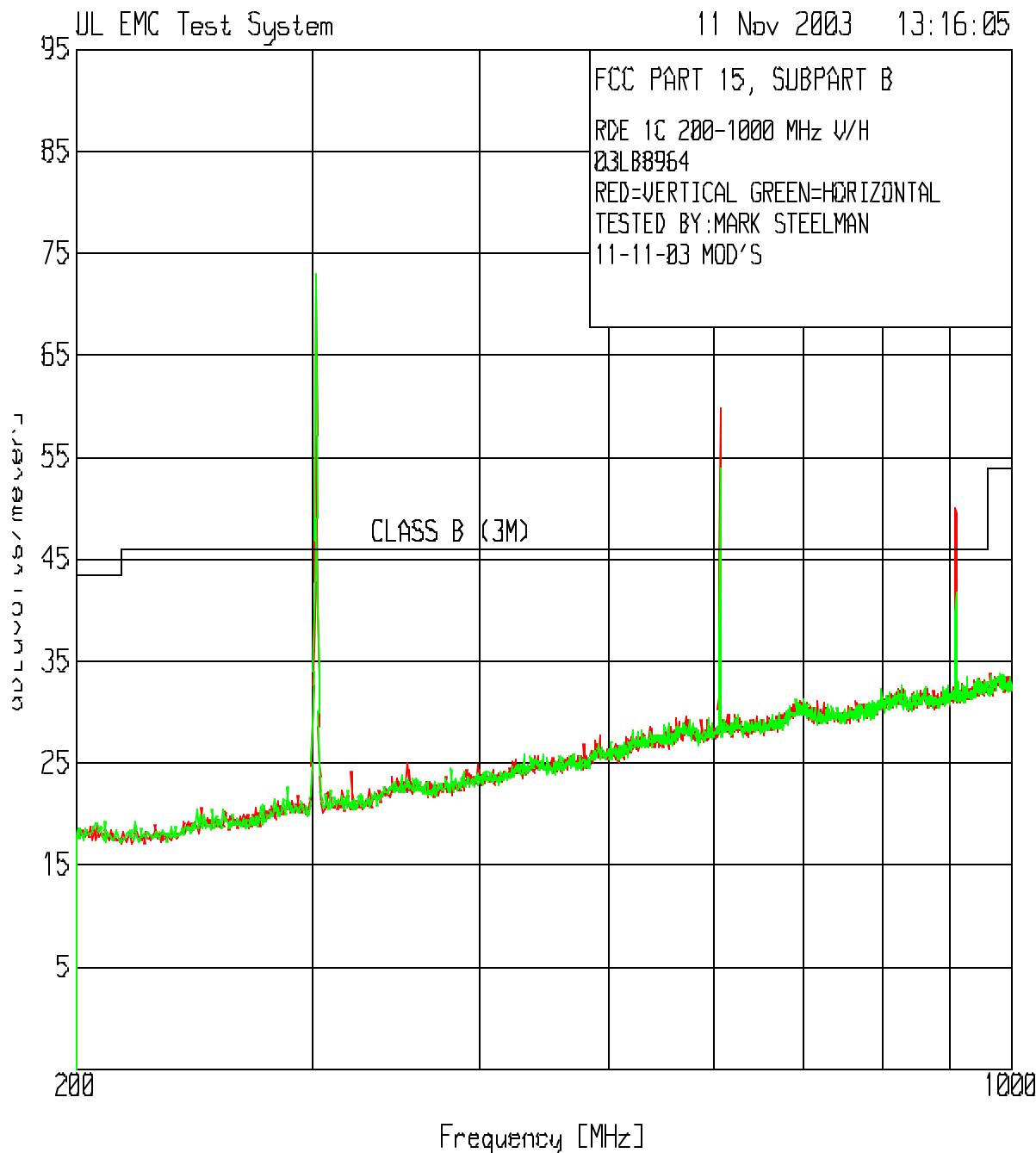
Test 1, Item B (side) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



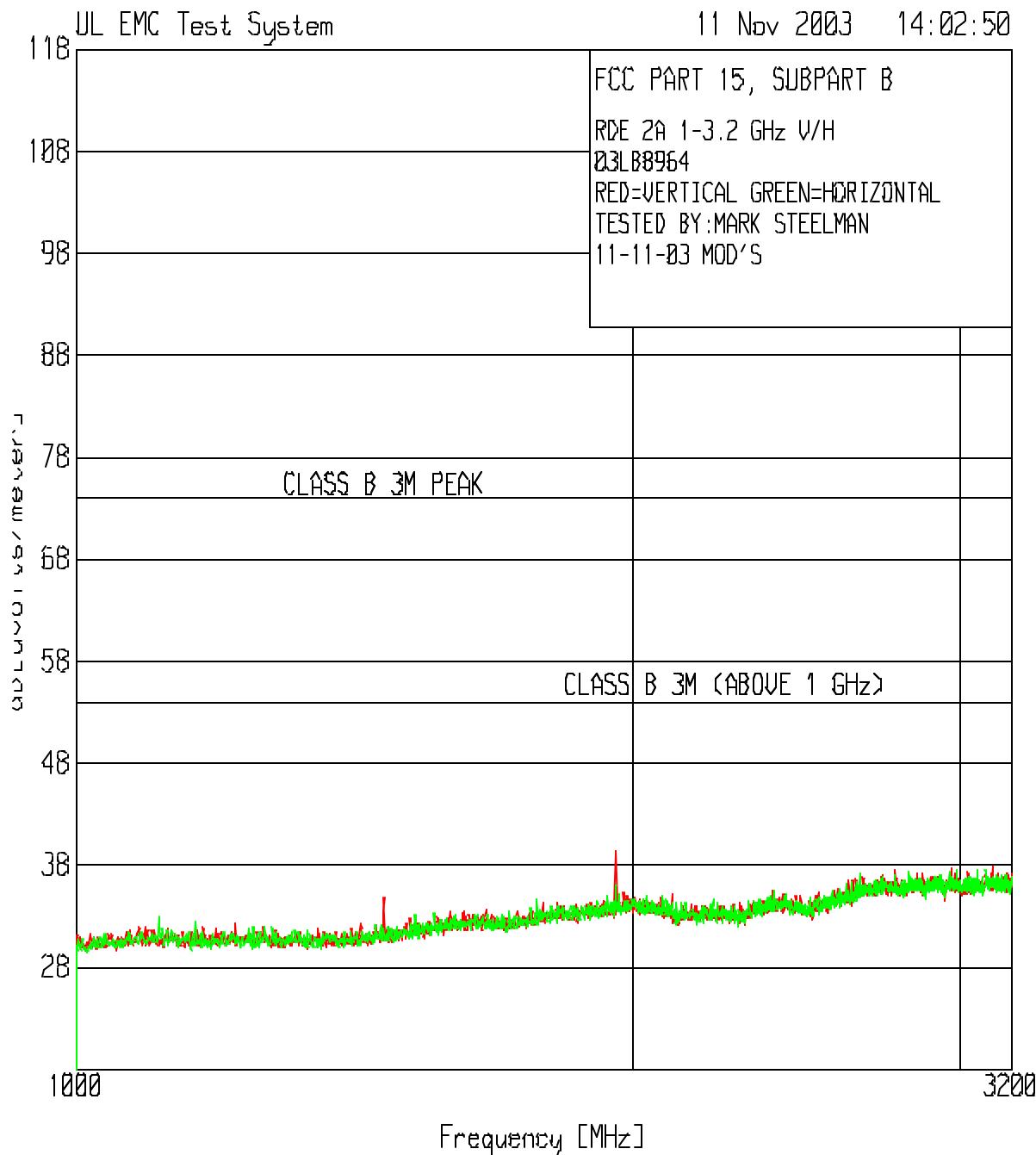
Test 1, Item C (end) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



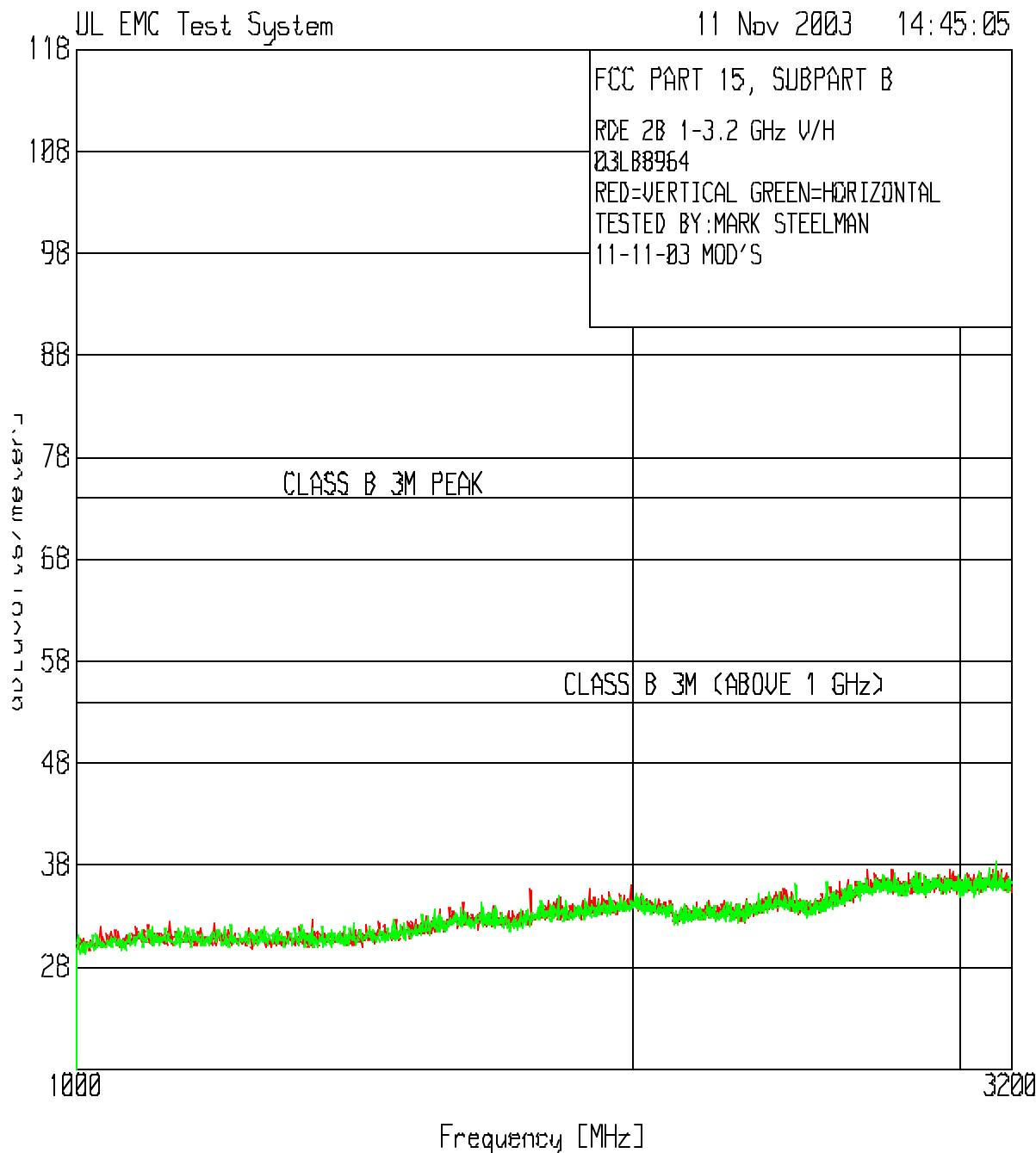
Test 2, Item A (flat) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - Above 1 GHz



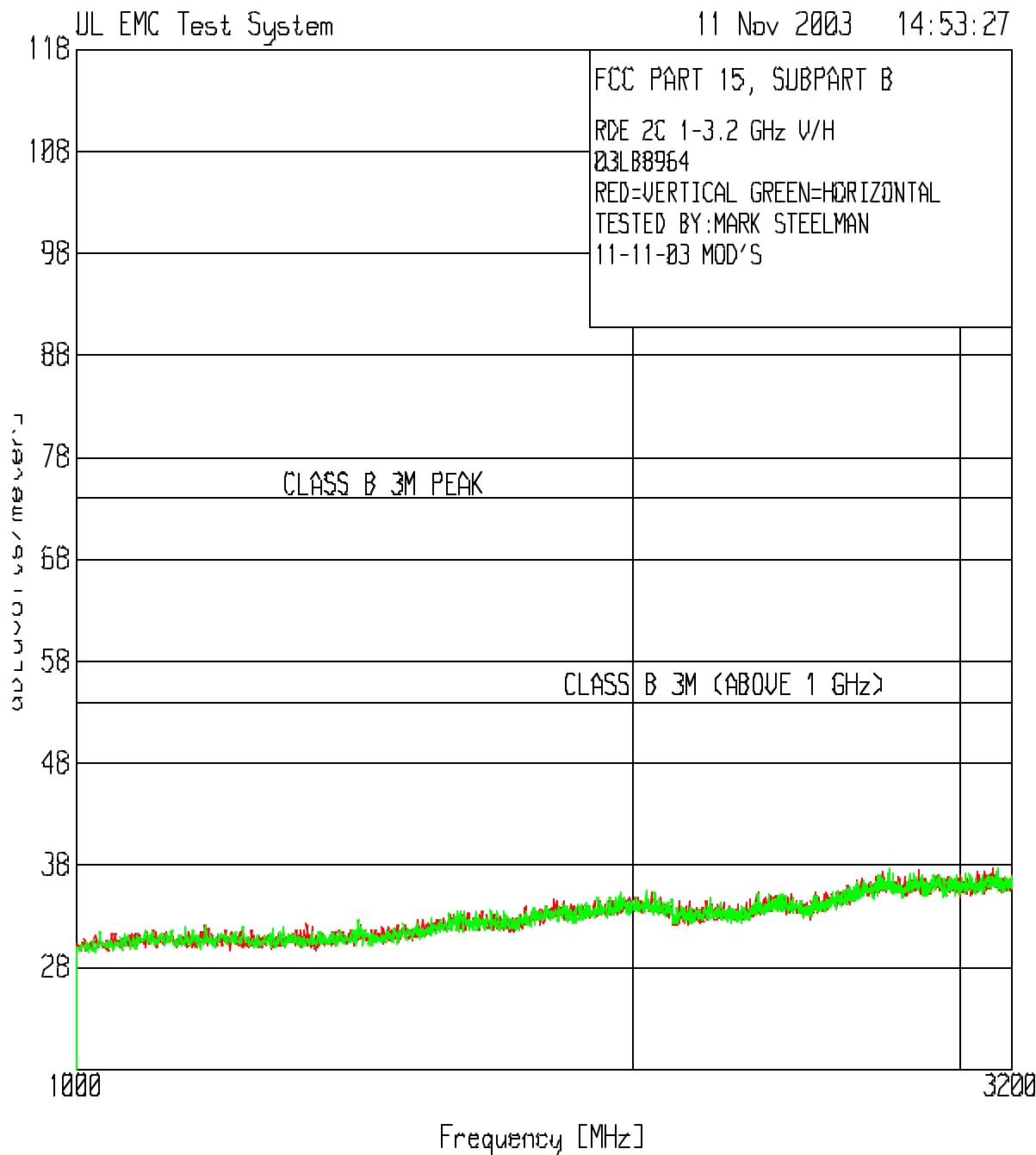
Test 2, Item B (side) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - Above 1 GHz



Test 2, Item C (end) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - Above 1 GHz



Test 1, Frequency Table: Radiated Disturbance Emissions - 30 MHz to 1000 MHz

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 (#)***
Flat Orientation										
A	P	H	3	303.5	93.2	-13.7	79.5	94.9	-15.4	
A	A	H	3	303.5	-	-	68.6	74.9	-6.3	1
A	P	H	3	607.0	68.5	-5.8	62.7	74.9	-12.2	
A	A	H	3	607.0	-	-	51.8	54.9	-3.1	2
A	P	H	3	910.5	51.1	-2.5	48.6	75.9	-27.3	
A	A	H	3	910.5	-	-	37.7	54.9	-17.2	
A	P	H	3	1214.0	39.9	-7.6	32.3	74.0	-41.7	Restr. Band
A	A	H	3	1214.0	-	-	21.4	54.0	-32.6	Restr. Band
A	P	H	3	1517.5	38.1	-6.0	32.1	74.0	-41.9	Restr. Band
A	A	H	3	1517.5	-	-	21.2	54.0	-31.8	Restr. Band
A	P	H	3	1821.0	38.7	-4.4	34.3	74.9	-39.7	
A	A	H	3	1821.0	-	-	23.4	54.9	-29.6	
A	P	H	3	2124.5	37.8	-3.8	34.0	74.9	-40.0	
A	A	H	3	2124.5	-	-	22.9	54.9	-30.9	
A	P	H	3	2428.0	37.3	-3.2	34.1	74.9	-39.9	
A	A	H	3	2428.0	-	-	23.2	54.9	-30.8	
A	P	H	3	2731.5	38.3	-2.2	36.1	74.0	-37.9	Restr. Band
A	A	H	3	2731.5	-	-	25.2	54.0	-28.8	Restr. Band
A	P	H	3	3035.0	39.2	-1.9	37.3	74.0	-36.7	Restr. Band
A	A	H	3	3035.0	-	-	26.4	54.0	-27.6	Restr. Band

* 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)

Comments:

Comment #	Description
1	Highest Emissions (transmit frequency) is 68.6 dBuV/m @ 3 meters. This is equal to 2691 uV/m in linear units.
2	Highest Spurious Emission was measured at 607 MHz is 51.8 dBuV/m @ 3 meters. This is equal to 389 dBuV/m in linear units.

Test 1, Frequency Table: Radiated Disturbance Emissions - 30 MHz to 1000 MHz

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 (#)***
Side Orientation										
B	P	H	3	303.5	87.0	-13.7	73.3	94.9	-21.6	
B	A	H	3	303.5	-	-	62.4	74.9	-12.5	
B	P	H	3	607.0	65.9	-5.8	60.1	74.9	-14.8	
B	A	H	3	607.0	-	-	49.2	54.9	-5.7	
B	P	V	3	910.5	51.0	-2.5	48.5	75.9	-27.4	
B	A	V	3	910.5	-	-	37.6	54.9	-17.3	

Note: No measurable emissions were observed within 20 dB of the designated limit above 1 GHz.

* 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 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 (#)***
End Orientation										
C	P	H	3	303.5	86.6	-13.7	72.9	94.9	-22.0	
C	A	H	3	303.5	-	-	62.0	74.9	-12.9	
C	P	V	3	607.0	65.6	-5.8	59.8	74.9	-15.1	
C	A	V	3	607.0	-	-	48.9	54.9	-6.0	
C	P	V	3	910.5	52.5	-2.4	50.1	75.9	-25.8	
C	A	V	3	910.5	-	-	39.2	54.9	-15.7	

Note: No measurable emissions were observed within 20 dB of the designated limit above 1 GHz.

* 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.

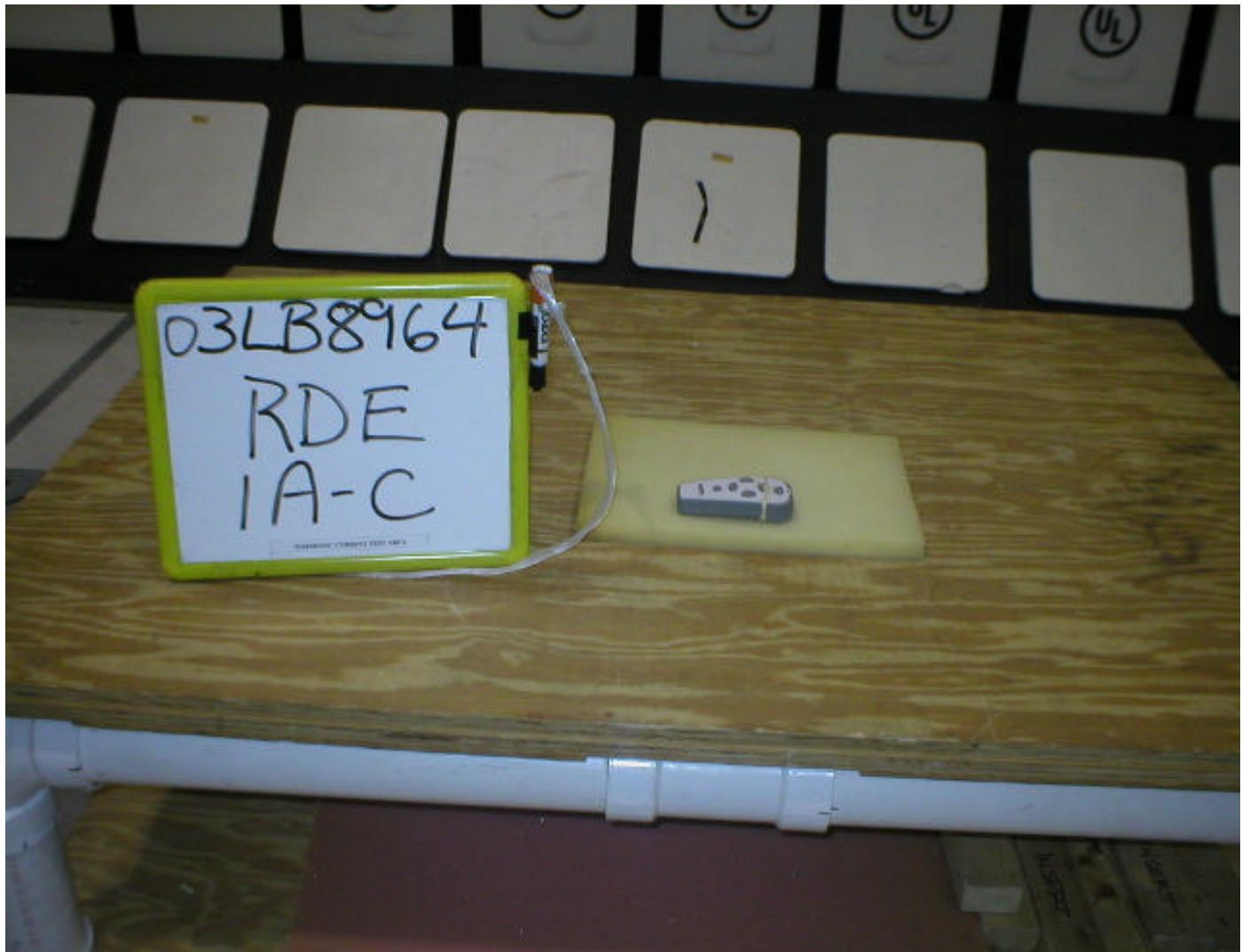
*** # = See Comment Number Under This Test's Comments Section.

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 1, Test Set-Up Photo:

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 2: Radiated Disturbance Emissions - Peak-to-Average Ratio

Test Requirement: 47 CFR Part 15, Subpart C

Test Specification: 47 CFR Part 15, Subpart C, Section 15.231

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 on 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.

The measurement spectrum analyzer is centered on the EUT's transmit frequency and span is reduced to 0 Hz to obtain a time domain measurement. The period of one complete transmit cycle is recorded. Next each button on the transmitter is depressed in sequence to determine which button produces the largest duty cycle. Address switches are also set to produce the largest number of long pulses. The duration of each length pulse in the cycle is recorded and the percentage of time the EUT is transmitting is calculated.

No limit is expressed in Section 15.231 for this test, however the result of this test is used to calculate average values for emissions measurements.

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 2 - Results: Radiated Disturbance Emissions - Peak-to-Average Ratio

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	39	22	100	NA	9/29/03	

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

Comments:

Comment #	Description

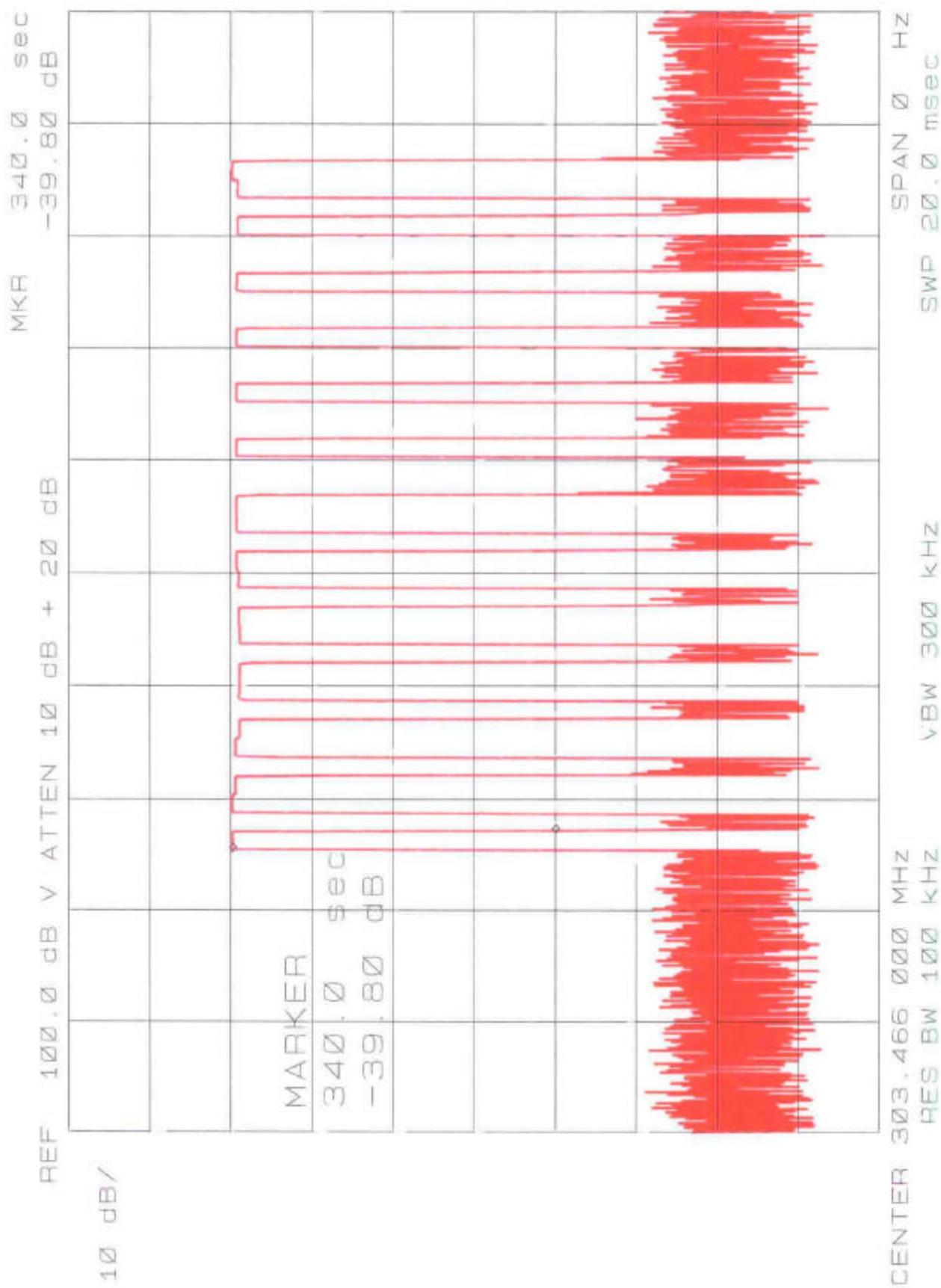
Test Equipment Used:

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0025	Biconical Antenna, 30 to 300 MHz	Schaffner, EMC	VBA6106A	4/8/03	4/30/04
AT0030	Log periodic Antenna, 200 MHz to 1000 MHz	Schaffner, EMC	3160-07	1/13/03	1/31/04
ATA061	Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/20/03	3/31/04
ATA084	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/19/03	3/31/04
ATA085	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/19/03	3/31/04
ATA095	6 ft, N male - N male	Micro-Coax	Coaxial Cable	9/30/03	3/31/04
ATA096	50 ft, N male - N male	Micro-Coax	Coaxial Cable	9/30/03	3/31/04
ATA108	10 m, N male - N male	UL	RG214	3/19/03	3/31/04
ATA124	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/20/03	3/31/04
ATA140	RG214 Ferrite Cable	EMC Eupen	N/A	3/19/03	3/31/04
ATA143	6ft., N-male to N-male	Micro-Coax	Coaxial Cable	3/19/03	3/31/04
SAR002	Spectrum Analyzer / Receiver	Hewlett-Packard	8566B	11/21/02	11/30/03

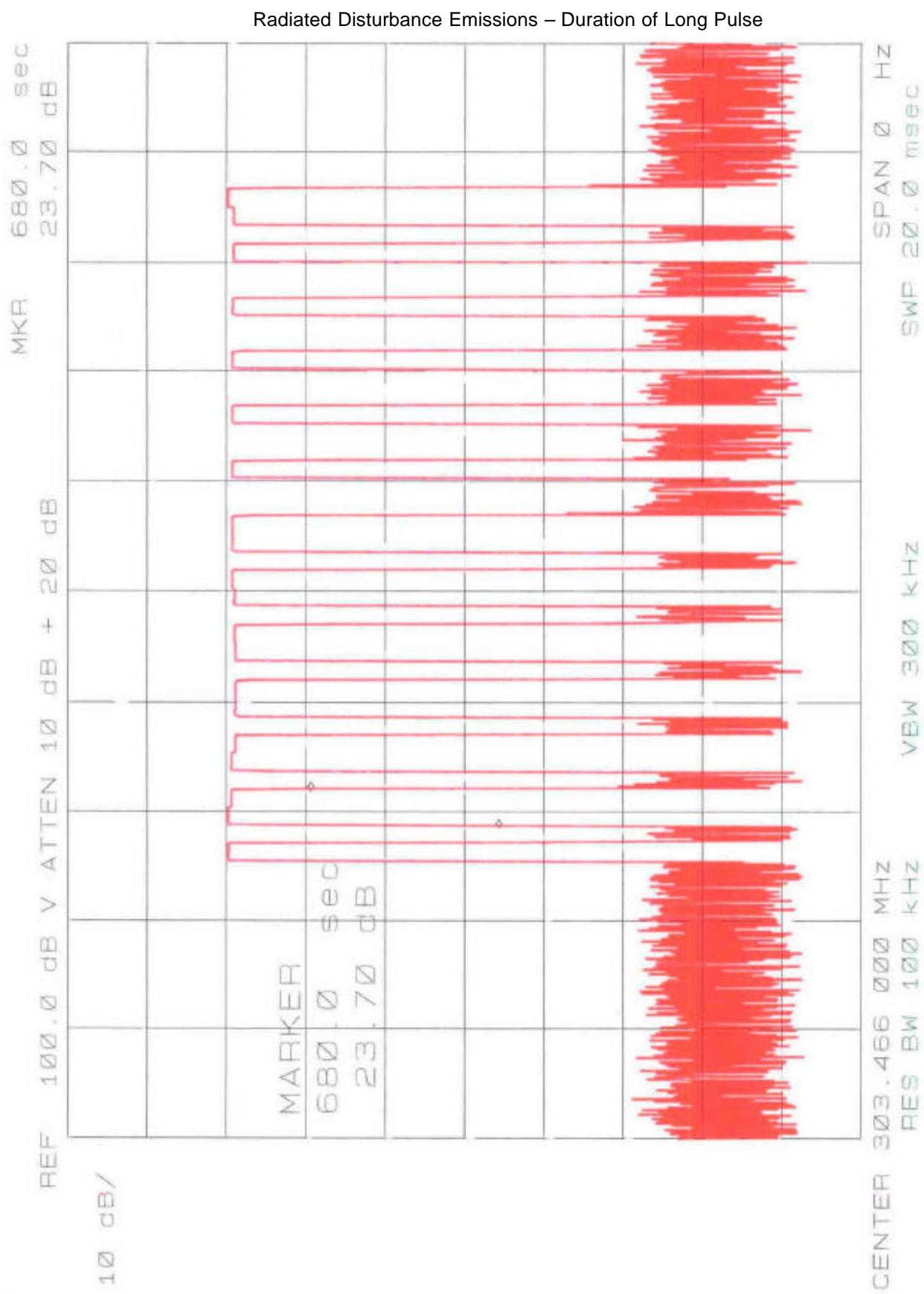
The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

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

Peak-to-Average Ratio – Duration of Short Pulse

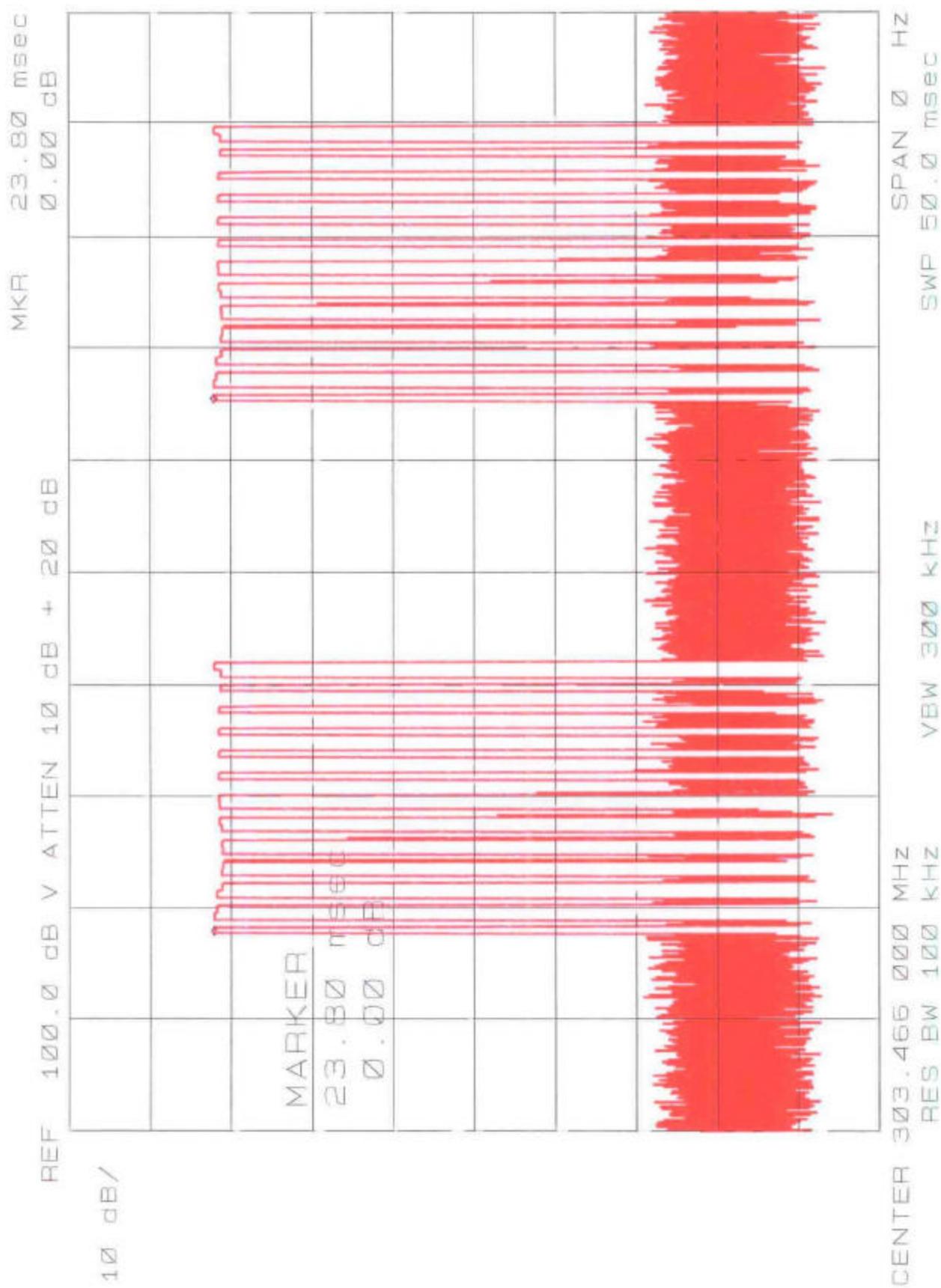


Test 2, Peak Plot (Amplitude in dBuV):



Test 2, Peak Plot (Amplitude in dBuV):

Radiated Disturbance Emissions – Duration of 1 period or 100 ms (whichever is less)



Test 2, Calculation: Radiated Disturbance Emissions - Peak-to-Average Ratio

Test Item (A-Z)	Total ON time per transmission (mS)	Total Period of transmission (mS)*	Duty Cycle (ON time / total period)	Peak-to-Average Ratio (dB)**	See Comment (#)***
A	0.34 ms x 6 short + 0.68 ms x 7 long	23.8	28.60%	-10.9	1

* Or 100 milliseconds, whichever is less

** Peak-to-Average Ratio = $20 * \log (\text{Duty Cycle})$

Comments:

Comment #	Description
1	13 pulses are always produced. The DIP switch address was set to produce the largest number of "long" pulses possible.

Test 3: Radiated Disturbance Emissions - Occupied Bandwidth

Test Requirement: 47 CFR Part 15, Subpart C

Test Specification: 47 CFR Part 15, Subpart C, Section 15.231

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 C63.4:1992 test method placed on a non-conductive 1m x 1.5m table 80 cm above the ground plane. The receive antenna used was a log-periodic antenna mounted on an antenna mast. The turntable was rotated from 0° to 360° to determine the worst-case emissions angle for the transmit frequency. The antenna mast was raised and lowered between 1 and 4 meters above the ground plane to determine the worst-case height.

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.

Occupied Bandwidth Limit - Manually Operated Transmitter Section 15.231

Transmit Frequency MHz	Bandwidth Limit (% of fundamental)
70 to 900	.25%
Above 900	.50%

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 3 - Results: Radiated Disturbance Emissions - Occupied Bandwidth

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	39	22	100	P	9/29/03	

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

Comments:

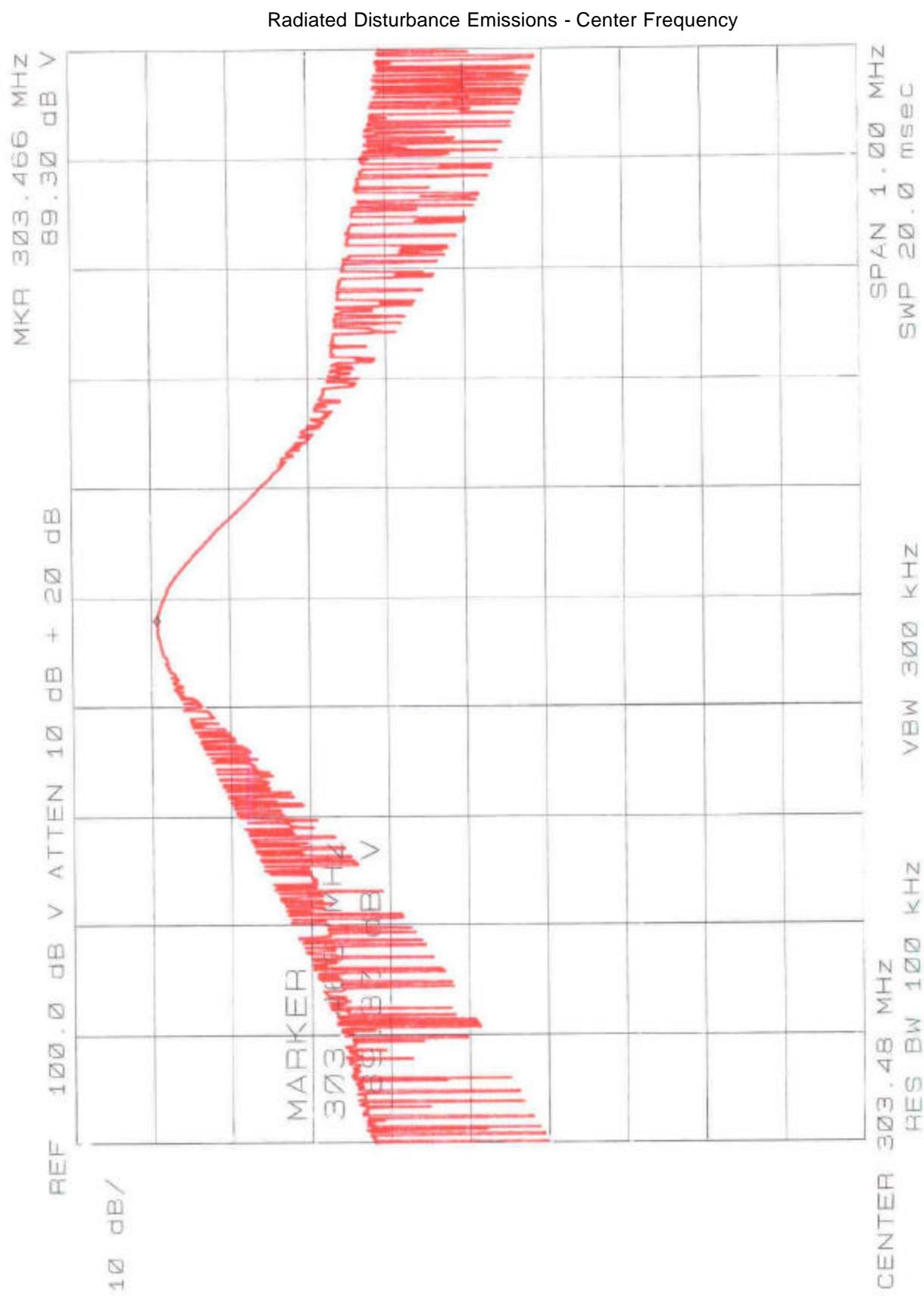
Comment #	Description

Test Equipment Used:

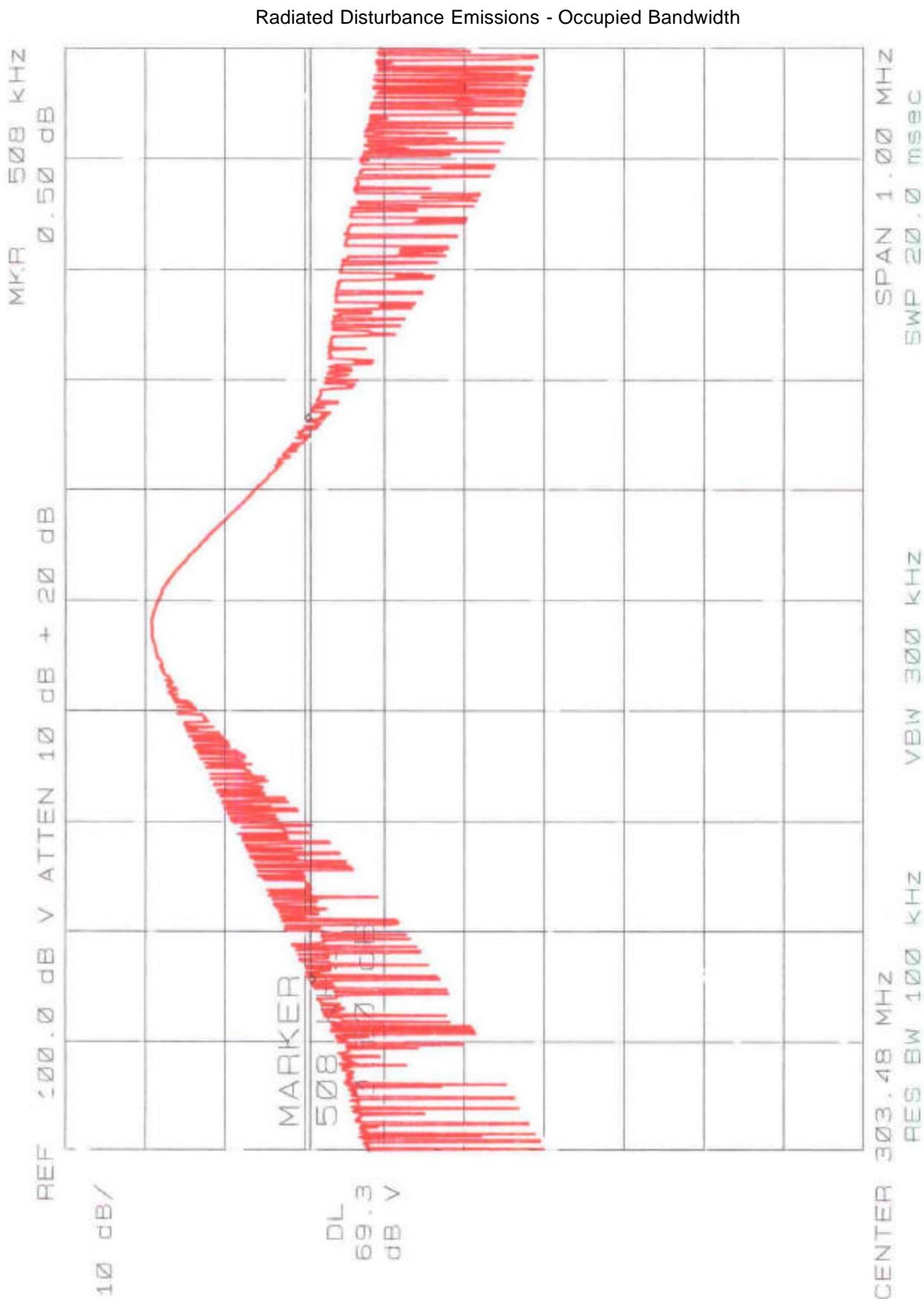
Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0025	Biconical Antenna, 30 to 300 MHz	Schaffner, EMC	VBA6106A	4/8/03	4/30/04
AT0030	Log periodic Antenna, 200 MHz to 1000 MHz	Schaffner, EMC	3160-07	1/13/03	1/31/04
ATA061	Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/20/03	3/31/04
ATA084	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/19/03	3/31/04
ATA085	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/19/03	3/31/04
ATA095	6 ft, N male - N male	Micro-Coax	Coaxial Cable	9/30/03	3/31/04
ATA096	50 ft, N male - N male	Micro-Coax	Coaxial Cable	9/30/03	3/31/04
ATA108	10 m, N male - N male	UL	RG214	3/19/03	3/31/04
ATA124	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/20/03	3/31/04
ATA140	RG214 Ferrite Cable	EMC Eupen	N/A	3/19/03	3/31/04
ATA143	6ft., N-male to N-male	Micro-Coax	Coaxial Cable	3/19/03	3/31/04
SAR002	Spectrum Analyzer / Receiver	Hewlett-Packard	8566B	11/21/02	11/30/03

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, Peak Plot (Amplitude in dBuV):



Test 3, Peak Plot (Amplitude in dBuV):



Test 3, Item A - Discrete Data: Radiated Disturbance Emissions - Occupied Bandwidth

Test Item (A-Z)	Center Frequency (MHz)	Measured Bandwidth (MHz)	Bandwidth (% of Center Frequency)	Maximum Permitted Bandwidth (% of Center Frequency)	Pass/Fail (P/F)	See Comment (#)*
A	303.47	0.508	0.167	0.25	P	

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

Test 4: Radiated Disturbance Emissions - Restricted Bands

Test Requirement: 47 CFR Part 15, Subpart C

Test Specification: 47 CFR Part 15, Subpart C, Section 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 4 - Results: Radiated Disturbance Emissions - Restricted Bands

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	NA	NA	NA	P	9/29/03	1

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

Comments:

Comment #	Description
1	Compliance with general limits in restricted bands is determined from results in Test 1.

Accreditation Certificates:

NVLAP[®]
National Institute
of Standards and Technology

Scope of Accreditation

ISO/IEC 17025:1999
ISO 9002:1994

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**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE: 200246-0

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

June 30, 2004

C.D. Laison

For the National Institute of Standards and Technology

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National Institute
of Standards and Technology

Scope of Accreditation

ISO/IEC 17025:1999
ISO 9002:1994

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**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE: 200246-0

UNDERWRITERS LABORATORIES, INC.

NVLAP Code Designation / Description

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
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

June 30, 2004

C.D. Laison

For the National Institute of Standards and Technology

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Scope of Accreditation

ISO/IEC 17025:1999
ISO 9002:1994

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**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE: 200246-0

UNDERWRITERS LABORATORIES, INC.

NVLAP Code Designation / Description

Safety Test Methods:

12/T06	IEC 61000-4-8 (1993): Power Frequency Magnetic Field Immunity Test
12/T07	IEC 61000-4-11 (1994): Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests

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

June 30, 2004

C.D. Laison

For the National Institute of Standards and Technology

Measurement Uncertainty Statement

Test	Expanded Estimate of Uncertainty ($k = 2$, for 95% of a normal distribution)	Units
Radiated Disturbance Emissions:		
• 3 and 10 meter measurement distances	+/- 3.8 dB	Volts/meter
• 1 meter measurement distance	+/- 2.3 dB	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_{cisp} 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.