



Project: 04RT02176
File: MC1324
Report: 040031
Date: February, 246, 2004
Model: 85773
(B21W)

Test Report

On

Electromagnetic Compatibility Testing

Hunter Fan Company
Memphis, TN 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:	Hunter Fan Company 2500 Frisco Avenue Memphis, TN 38114 USA
Applicant Contact:	Mr. Chris Williams Safety and Test Engineer (901) 248-2342 (901) 248-2382 - FAX
Test Report Number:	040031
Test Report Date:	February 24, 2004
Product Type:	Remote Control for Ceiling Fan/Lamp
Model Number:	85773 (B21W)
Sample Serial Number:	Unserialized, production sample
Sample Tag Number:	0546317-001
EUT Category:	Transmitter - Low Powered
EUT Type:	Wall Mounted
Sample Receive Date:	January 2, 2004
Testing Start Date:	January 6, 2004
Date Testing Complete:	January 21, 2004

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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 1000 MHz 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.209 and 15.231	X	-	
2	Radiated Disturbance Emissions - Above 1 GHz 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.209 and 15.231	X	-	
3	Radiated Disturbance Emissions - Peak-to-Average Ratio 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.231	X	-	
4	Radiated Disturbance Emissions - Occupied Bandwidth 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.231	X	-	
5	Radiated Disturbance Emissions - Restricted Bands 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.205	X	-	

Remarks:

- 1) Device also complies with Canada RSS-210 requirements. All data was recorded on Industry Canada Registered Site IC-2953. Canadian Emissions designator L1D365K.
- 2) Device is exempt from routine RF exposure testing per FCC Part 2.1091.
- 3) Device contains an integrated antenna. It is not detachable or replaceable by the user.
- 4) All buttons cease transmission immediately upon release of button (i.e. less than 100 ms). This satisfies the 5 second maximum duration requirements of Part 15.231(a)(1).
- 5) The manufacturer made the following modification to comply:
 - a. Capacitor C12 changed from 33pf to 22pf
 - b. Resistor R3 changed from 75k Ω to 215 k Ω

Conclusion:

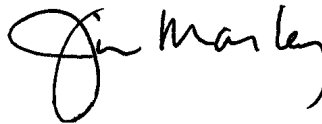
The tests listed in the Summary of Testing section of this report have been performed and the results recorded by Underwriters Laboratories Inc. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the 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	Transmitter	Hunter Fan Co.	85773	

* 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

EUT Internal Operating Frequencies:

Frequency (MHz)*	Description
350.0	Transmit Frequency

Power Interface:

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	12	-	-	DC	X	
1	12	-	-	DC	X	A fresh battery was installed prior to testing.

EUT Operation Modes:

Mode #	Description
1	A button was continuously depressed by a rubber band.

EUT Configuration Modes:

Mode #	Description
1	Device was placed onto a 1.5m x 1.0m x 80cm high wooden table. Device was positioned flat on the table.
2	Device was placed onto a 1.5m x 1.0m x 80cm high wooden table. Device was positioned on left side.
3	Device was placed onto a 1.5m x 1.0m x 80cm high wooden table. Device was positioned pointing straight up.

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. Test method is consistent with ANSI C63.4:2001.

Radiated Disturbance Limits for Manually Operated Transmitters - Section 15.231
at a measurement distance of 3 meters

Fundamental Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious	
	($\mu\text{V/m}$)	(dB $\mu\text{V/m}$)	($\mu\text{V/m}$)	(dB $\mu\text{V/m}$)
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, 350 MHz, Average field strength limit = 7500 $\mu\text{V/m}$ (77.5 dB $\mu\text{V/m}$).

Harmonic field strength limit = 750 $\mu\text{V/m}$ (57.5 dB $\mu\text{V/m}$).

Per 15.35(b) peak limit is 20 dB above average limit for each frequency.

Average is calculated by applied peak-to-average ratio from Test 3 of 10.3 dB to each peak measurement.

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 (Flat Orientation)	1
B	0	Enclosure	1	2 (Side Orientation)	1
C	0	Enclosure	1	3 (End Orientation)	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 - C	A	25	24	101	P	1/21/2004	

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

Comments:

Comment #	Description
1	Only the flat orientation was tested below 200 MHz. No significant emissions were observed in this range.
2	Highest Transmit Frequency was found in "end" orientation. Average field strength was 74.2 dBuV/m or 5129 uV/m.

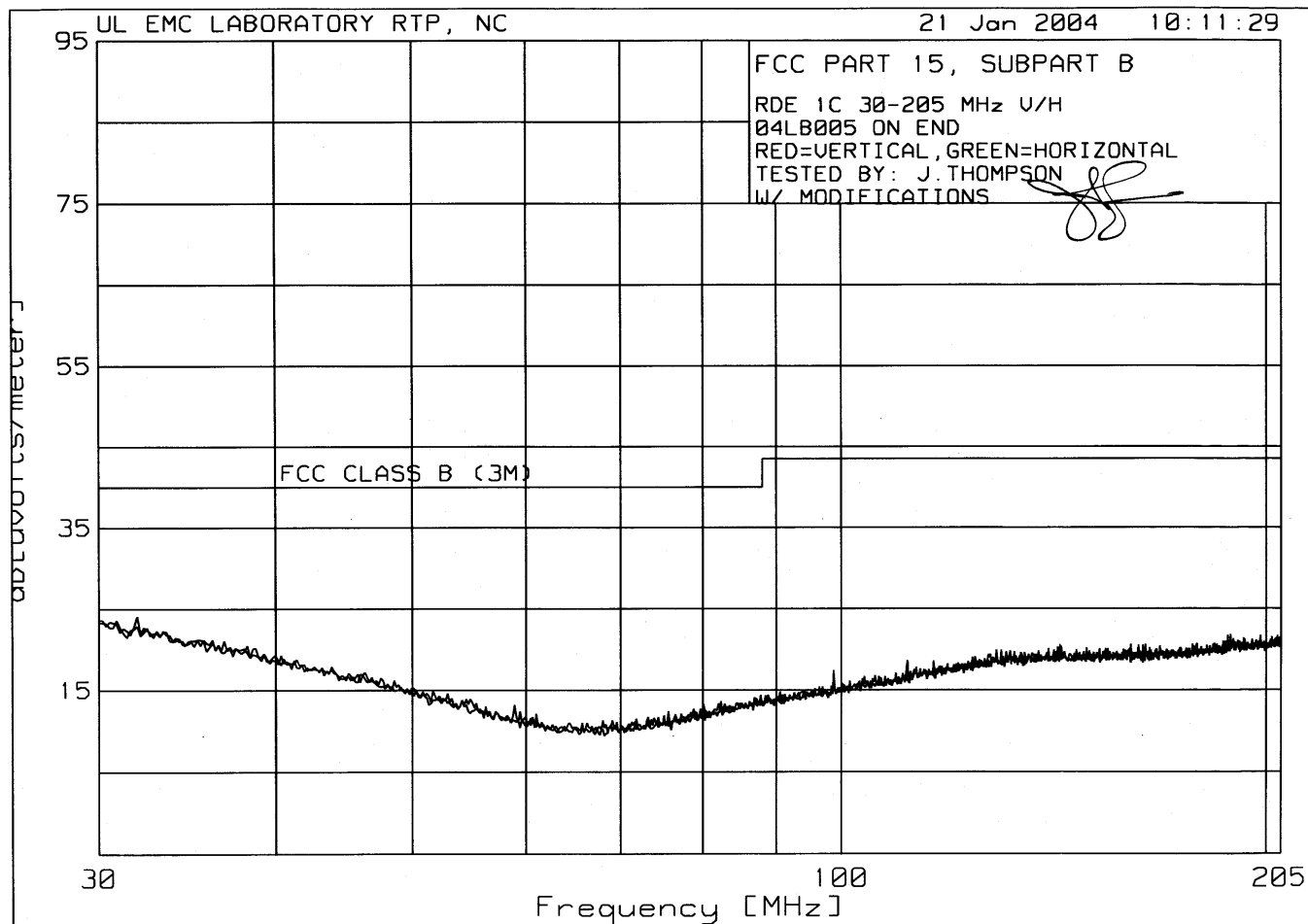
Test 1 - Test Equipment Used: Radiated Disturbance Emissions - 30 MHz to 1000 MHz

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
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
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
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/17/03	10/31/04
MG1131	Tape Measure, 15 m / 50 ft.	Lufkin	EL15CME	4/9/03	4/30/06
SAR002	Spectrum Analyzer / Receiver	Hewlett-Packard	8566B	12/2/03	12/31/04

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.

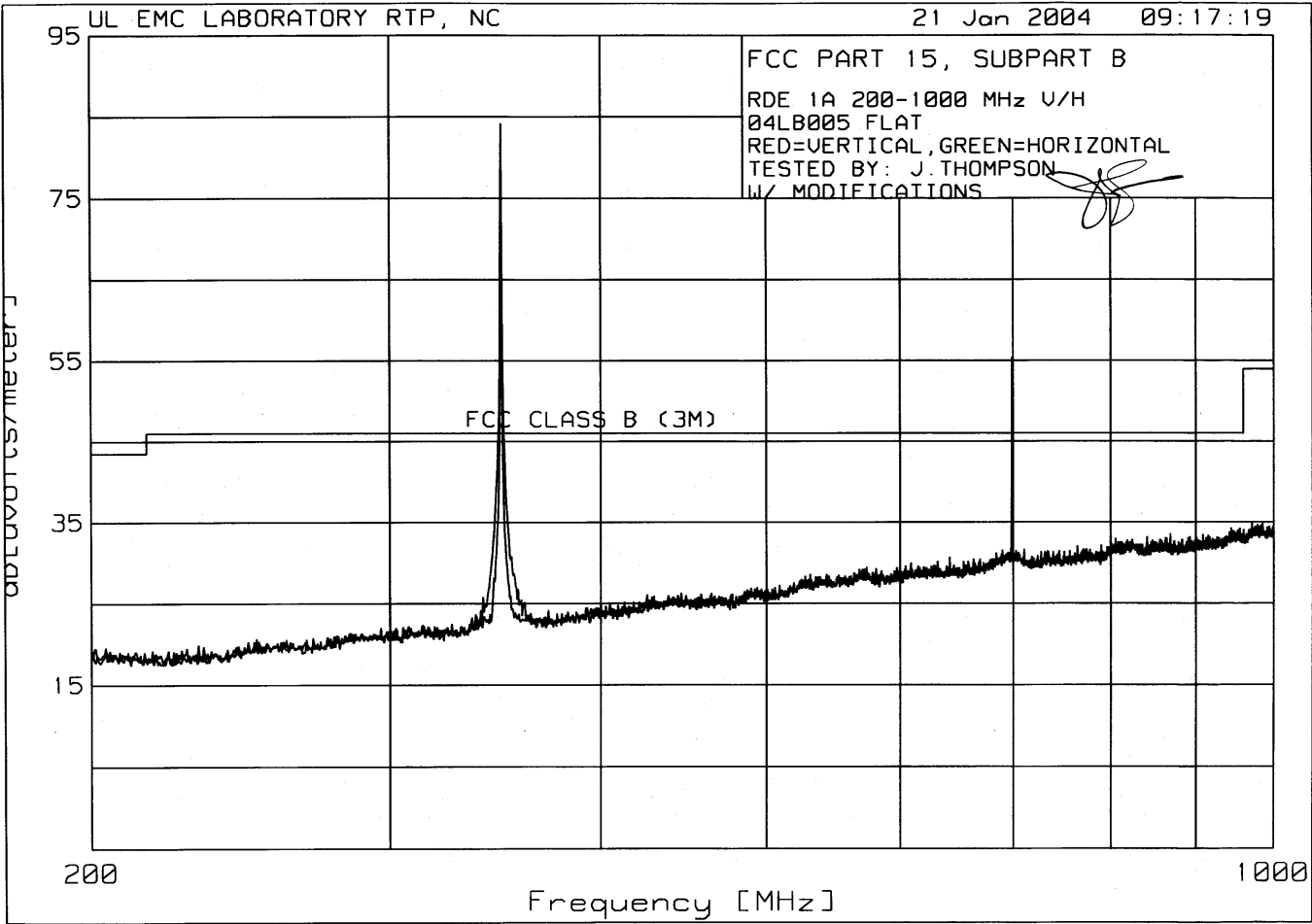
Test 1, Item A - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



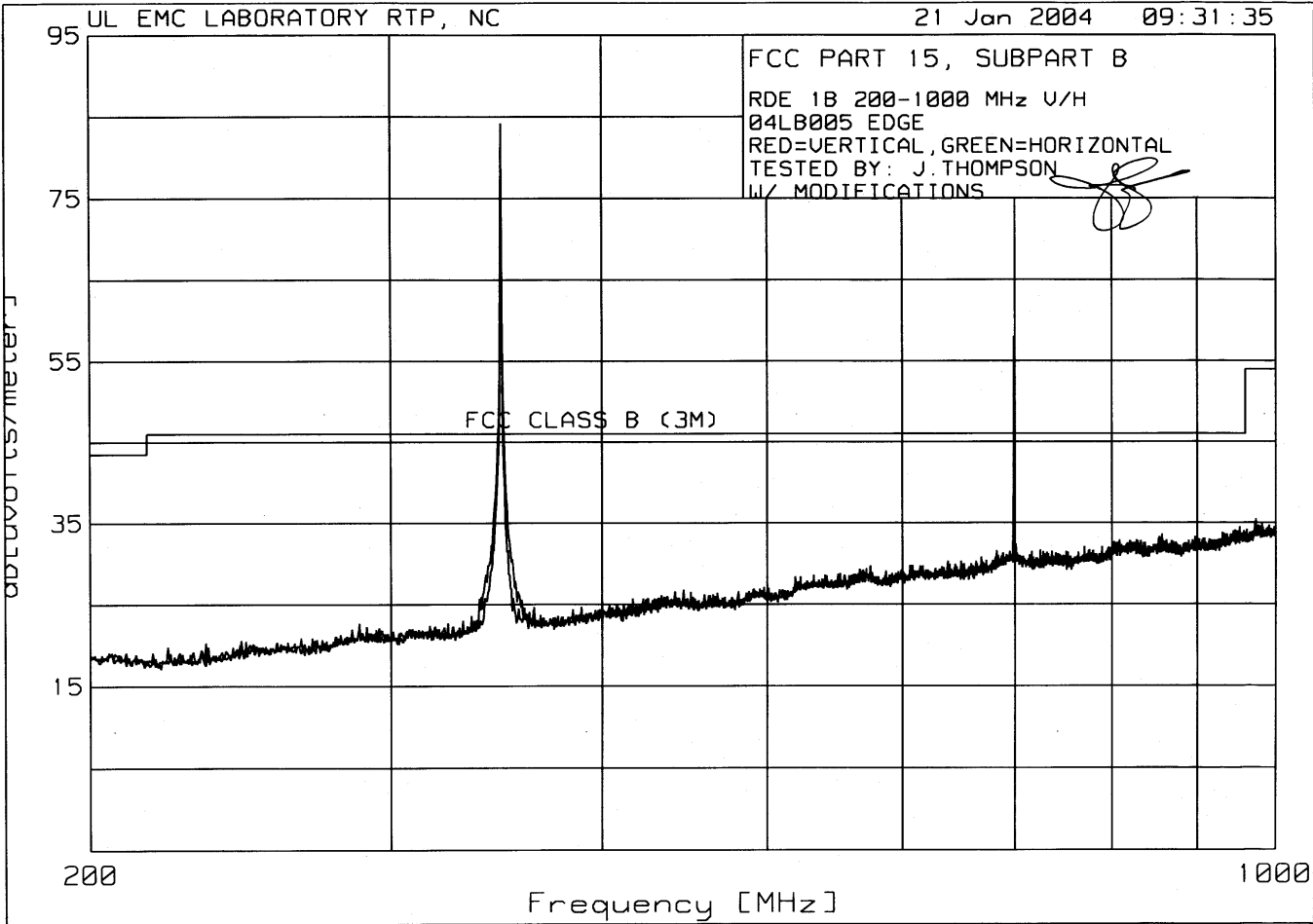
Test 1, Item A (Flat Orientation) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



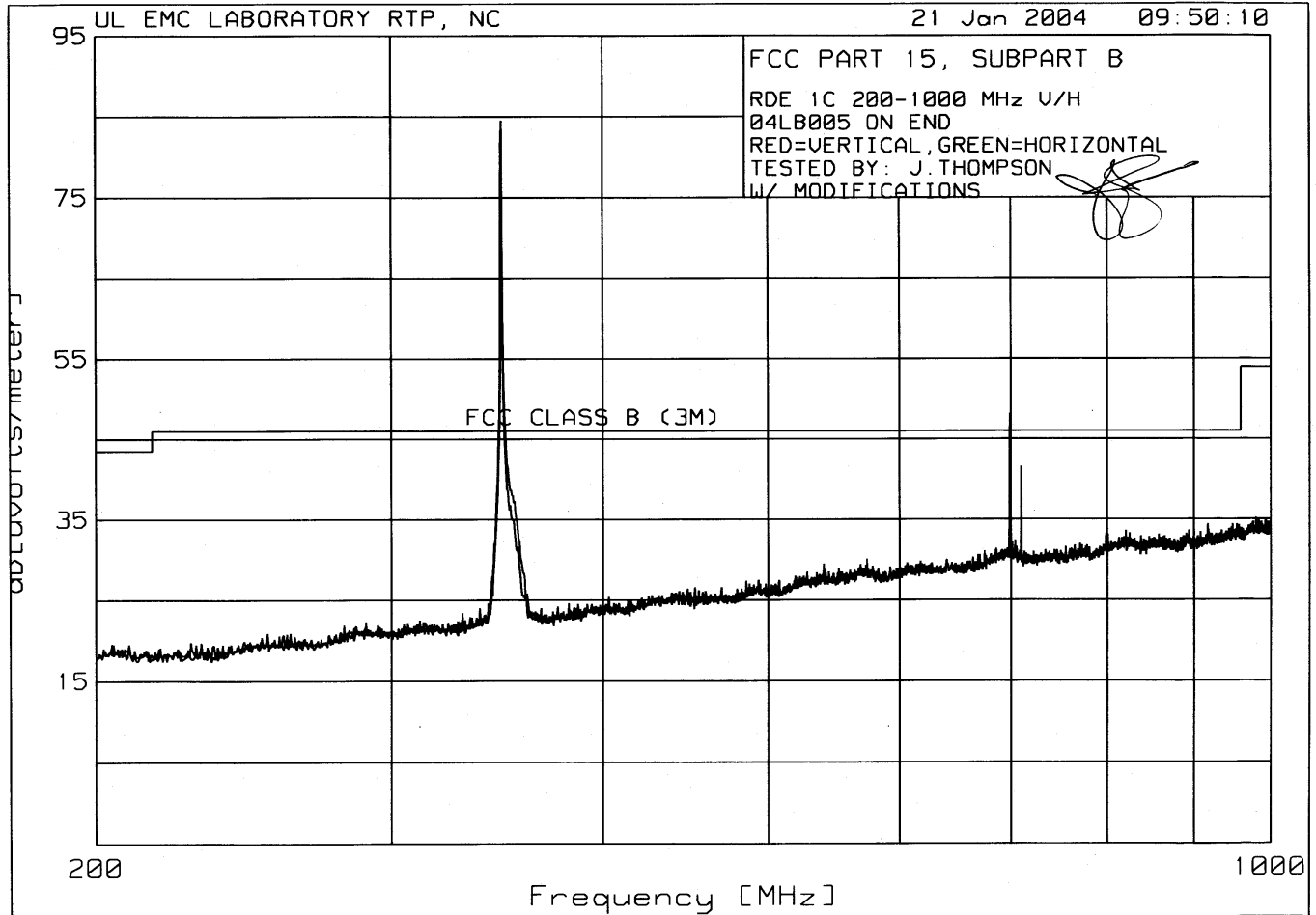
Test 1, Item B (Side Orientation) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



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

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 1, All Items - Discrete Data: 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 - Peak (dBuV)	Equip Correction (dB/m)	Corrected Value - Peak (dBuV/m)	Specified Limit - Peak (dBuV/m)	Spec Margin - Peak (dB)	Corrected Value - Average (dBuV/m)	Specified Limit - Average (dBuV/m)	Spec Margin - Average (dB)	Restricted Band? (Y/N)	See Comment on Page 8 (#)
Flat Orientation														
A	P	H	3	350.0	95.5	-11.3	84.2	97.5	-13.3	73.9	77.5	-3.6	N	
A	P	H	3	700.0	58.9	-3.5	55.4	77.5	-22.1	45.1	57.5	-12.4	N	
Side Orientation														
B	P	V	3	350.0	91.8	-11.3	80.5	97.5	-17.0	70.2	77.5	-7.3	N	
B	P	H	3	700.0	61.5	-3.5	58.0	77.5	-19.5	47.7	57.5	-9.8	N	3
End Orientation														
C	P	H	3	350.0	95.8	-11.3	84.5	97.5	-13.0	74.2	77.5	-3.2	N	2
C	P	H	3	700.0	51.6	-3.5	48.1	77.5	-29.4	37.8	57.5	-19.7	N	

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

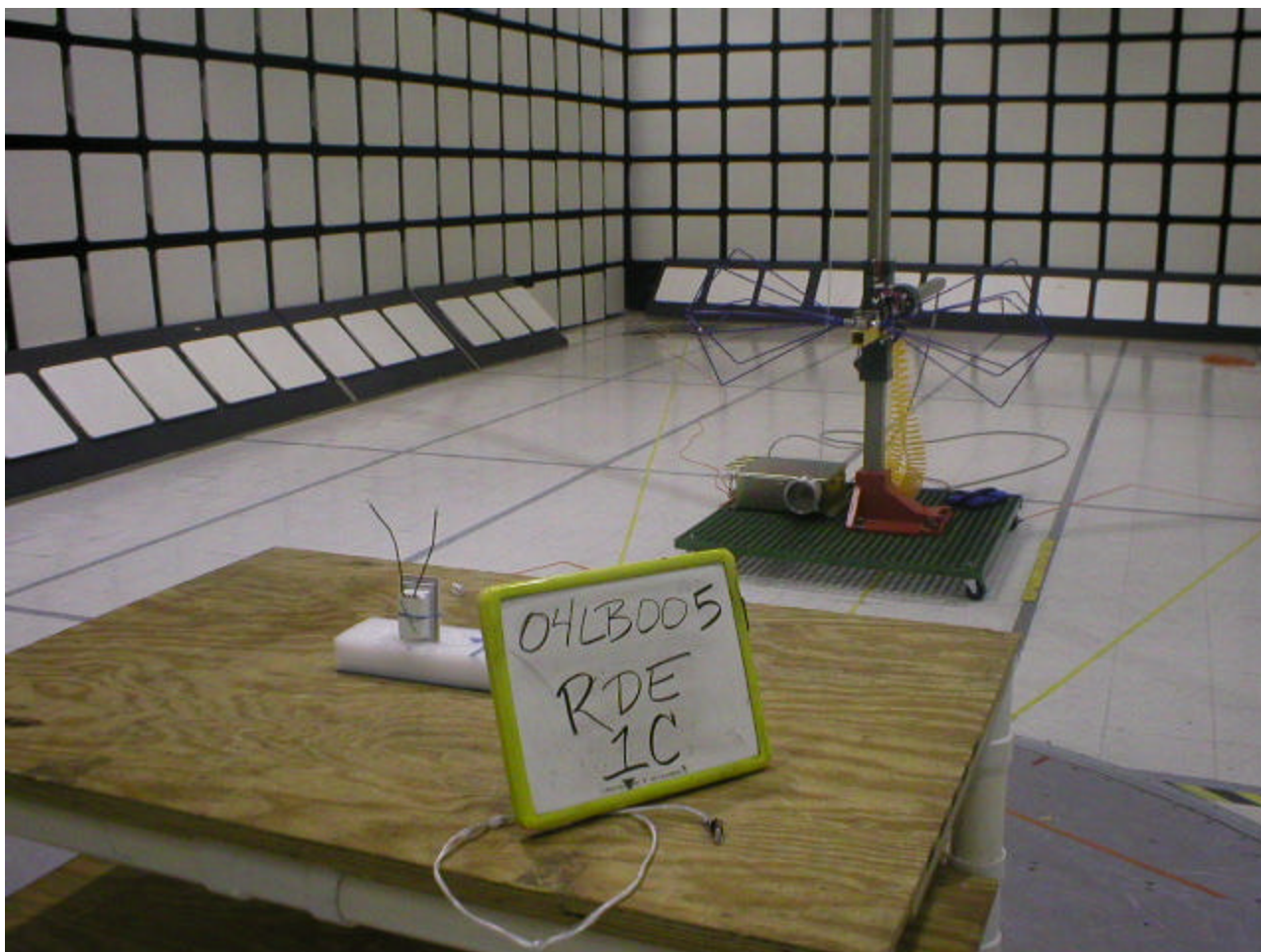
** The Specified Limit is for the type measurement indicated. When Peak data is indicated, the tightest limit applicable is indicated.

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, All Items - Test Set-Up Photo:

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 2: Radiated Disturbance Emissions - Above 1 GHz

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. Test method is consistent with ANSI C63.4:2001.

Radiated Disturbance Limits for Manually Operated Transmitters - Section 15.231
at a measurement distance of 3 meters

Frequency Range MHz	Field Strength of Fundamental $\mu\text{V/m}$ (dB $\mu\text{V/m}$)		Field Strength of Fundamental $\mu\text{V/m}$ (dB $\mu\text{V/m}$)	
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):

Harmonic field strength limit = 750 $\mu\text{V/m}$ (57.5 dB $\mu\text{V/m}$).

Per 15.35(b) peak limit is 20 dB above average limit for each frequency.

Average is calculated by applied peak-to-average ratio from Test 3 of 10.3 dB to each peak measurement.

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 (Flat Orientation)	1
B	0	Enclosure	1	2 (Side Orientation)	1
C	0	Enclosure	1	3 (End Orientation)	1

Test 2 - Results: Radiated Disturbance Emissions - Above 1 GHz

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A - C	A	28	24.0	101.0	P	1/21/2004	1

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

Comments:

Comment #	Description
1	See Test 1 for Setup Photo.
2	Highest Spurious Emissions was found at 1050 MHz in "end" orientation. Average field strength was 52.1 dBuV/m or 402.7 uV/m.

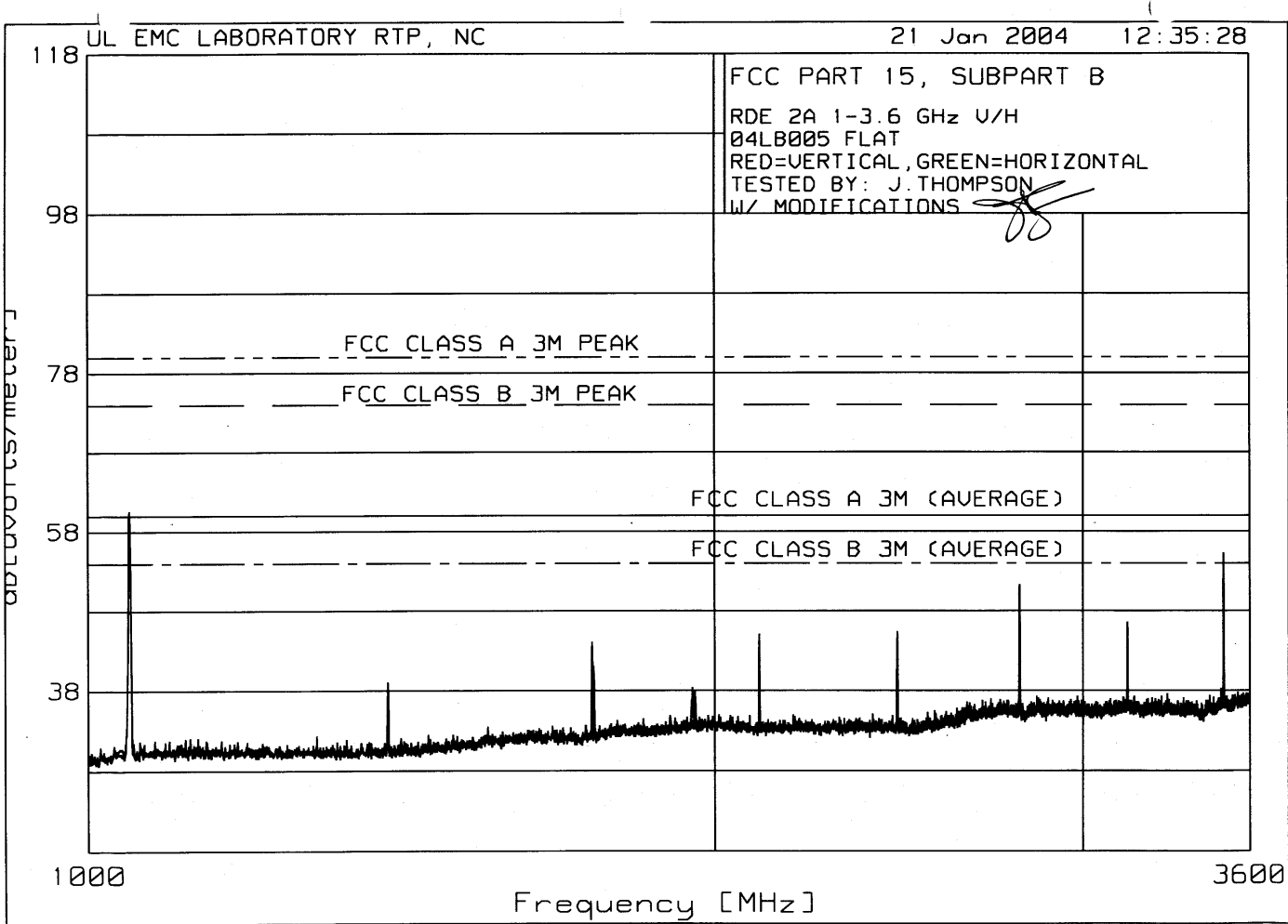
Test 2 - Test Equipment Used: Radiated Disturbance Emissions - Above 1 GHz

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
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
ATA152	27 ft. N male - N male low loss cable	Micro-Coax	UFB293C-0-3149-50504	8/21/03	2/29/04
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/17/03	10/31/04
SAR002	Spectrum Analyzer / Receiver	Hewlett-Packard	8566B	12/2/03	12/31/04

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.

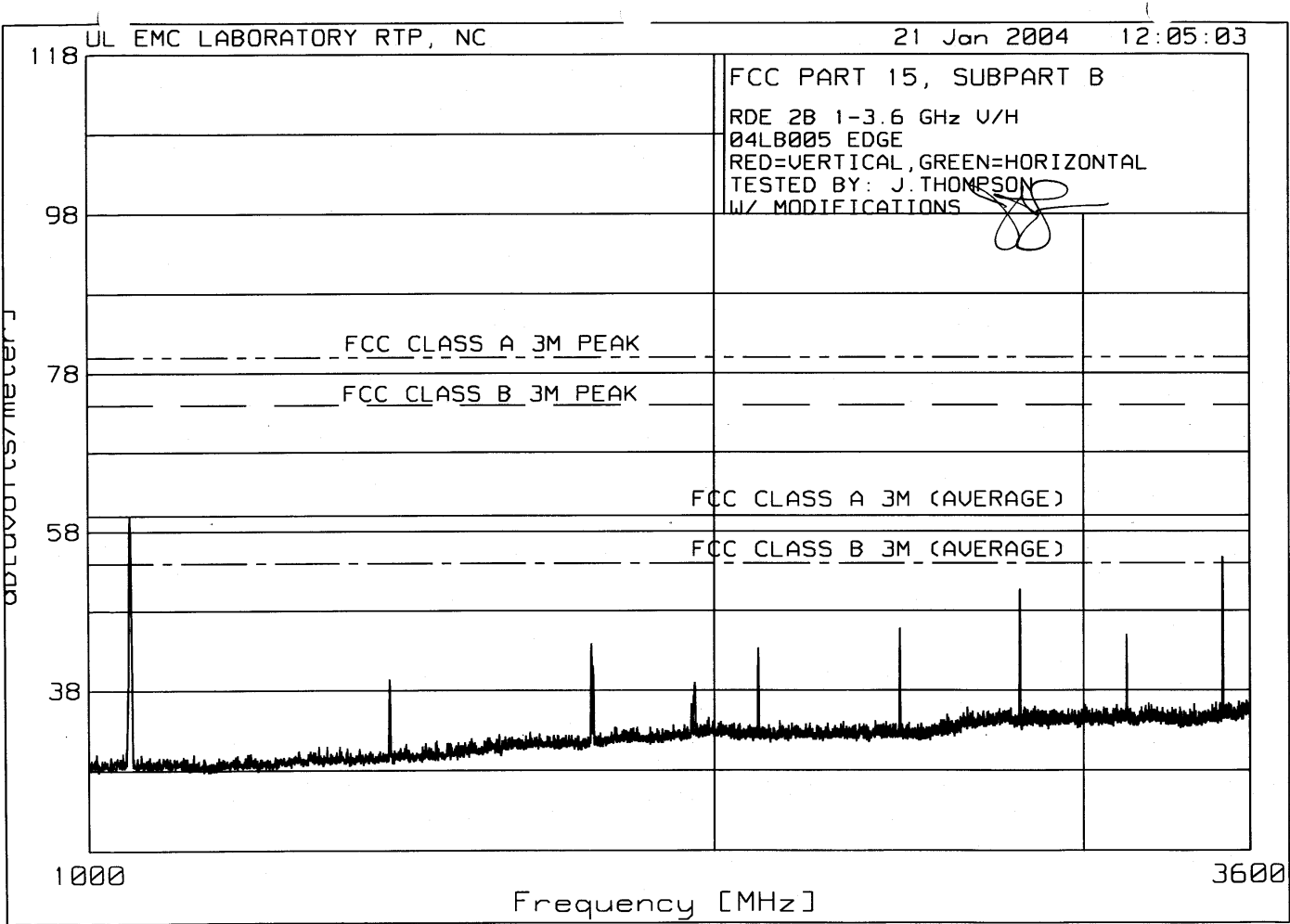
Test 2, Item A (Flat Orientation) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - Above 1 GHz



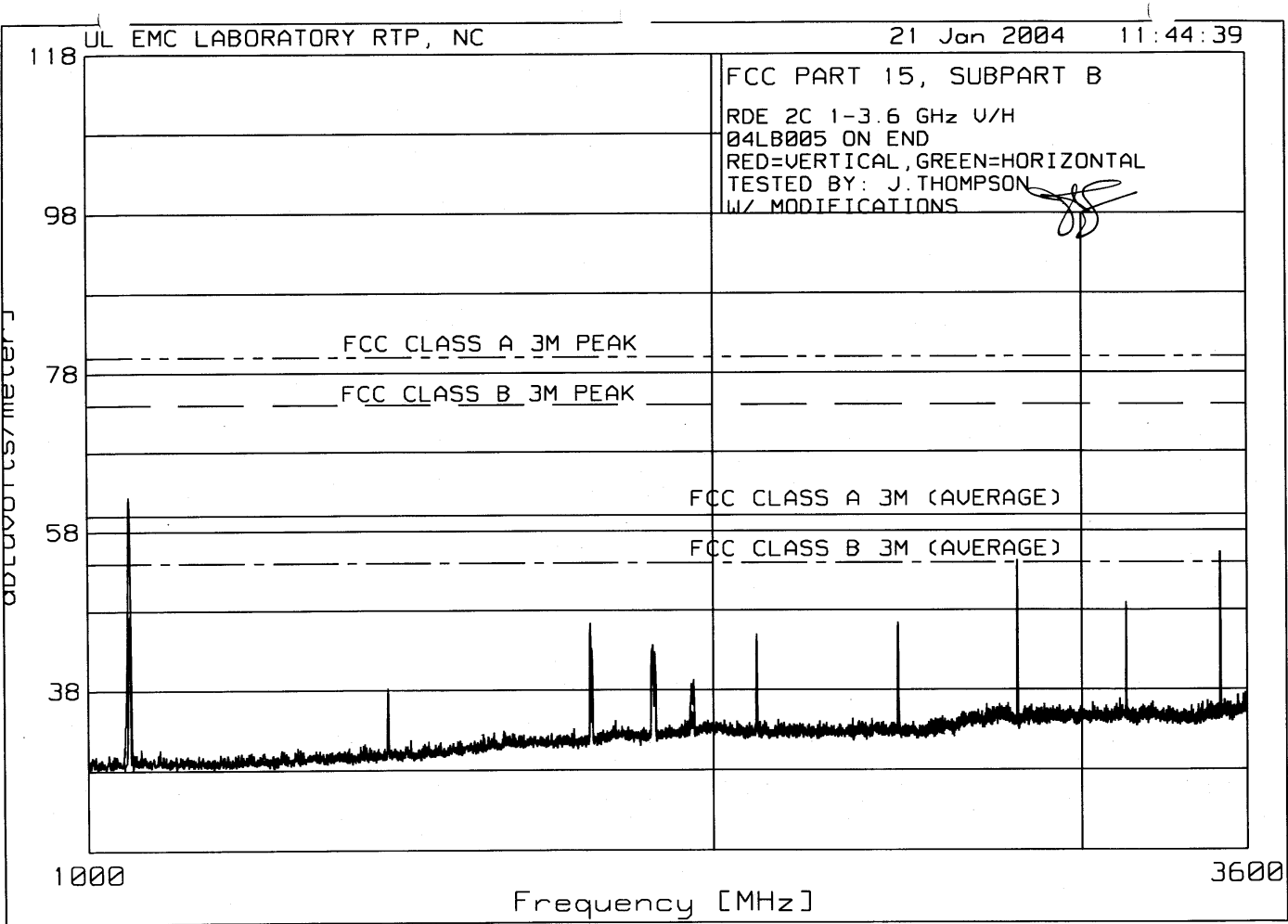
Test 2, Item B (Side Orientation) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - Above 1 GHz



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

Radiated Disturbance Emissions - Above 1 GHz



Test 2, All Items - Frequency Table: Radiated Disturbance Emissions - Above 1 GHz

Test Item (A-Z)	Detector Type* (P/Q/A)	Antenna Polarity (H/V)	Antenna Distance (m)	Measured Frequency (MHz)	Measured Value - Peak (dBuV)	Equip Correction (dB/m)	Corrected Value - Peak (dBuV/m)	Specified Limit - Peak (dBuV/m)	Spec Margin - Peak (dB)	Corrected Value - Average (dBuV/m)	Specified Limit - Average (dBuV/m)	Spec Margin - Average (dB)	Restricted Band? (Y/N)	See Comment on Page 17 (#)
Flat Orientation														
A	P	V	3	1050.0	69.1	-8.5	60.6	74.0	-13.4	50.3	54.0	-3.7	Y	
A	P	V	3	1400.0	45.8	-6.7	39.1	74.0	-34.9	28.8	54.0	-25.2	Y	
A	P	V	3	1750.0	48.9	-4.8	44.1	77.5	-33.4	33.8	57.5	-23.7	N	
A	P	V	3	2100.0	49.0	-3.9	45.1	77.5	-32.4	34.8	57.5	-22.7	N	
A	P	H	3	2450.0	48.6	-3.2	45.4	77.5	-32.1	35.1	57.5	-22.4	N	
A	P	V	3	2800.0	53.5	-2.2	51.3	74.0	-22.7	41.0	54.0	-13.0	Y	
A	P	V	3	3150.0	48.1	-1.5	46.6	77.5	-30.9	36.3	57.5	-21.2	N	
A	P	V	3	3500.0	55.4	-0.1	55.3	77.5	-22.2	45.0	57.5	-12.5	N	
Side Orientation														
B	P	H	3	1050.0	68.5	-8.5	60.0	74.0	-14.0	49.7	54.0	-4.3	Y	
B	P	V	3	1400.0	46.1	-6.7	39.4	74.0	-34.6	29.1	54.0	-24.9	Y	
B	P	V	3	1750.0	47.1	-4.8	42.3	77.5	-35.2	32.0	57.5	-25.5	N	
B	P	H	3	2100.0	47.2	-3.9	43.3	77.5	-34.2	33.0	57.5	-24.5	N	
B	P	H	3	2450.0	49.0	-3.2	45.8	77.5	-31.7	35.5	57.5	-22.0	N	
B	P	V	3	2800.0	52.9	-2.2	50.7	74.0	-23.3	40.4	54.0	-13.6	Y	
B	P	V	3	3150.0	46.5	-1.5	45.0	77.5	-32.5	34.7	57.5	-22.8	N	
B	P	H	3	3500.0	54.9	-0.1	54.8	77.5	-22.7	44.5	57.5	-13.0	N	
End Orientation														
C	P	V	3	1050.0	70.9	-8.5	62.4	74.0	-11.6	52.1	54.0	-1.9	Y	2
C	P	V	3	1400.0	45.0	-6.7	38.3	74.0	-35.7	28.0	54.0	-26.0	Y	
C	P	V	3	1750.0	51.2	-4.8	46.4	77.5	-31.1	36.1	57.5	-21.4	N	
C	P	H	3	2100.0	48.9	-3.9	45.0	77.5	-32.5	34.7	57.5	-22.8	N	
C	P	H	3	2450.0	49.7	-3.2	46.5	77.5	-31.0	36.2	57.5	-21.3	N	
C	P	H	3	2800.0	56.5	-2.2	54.3	74.0	-19.7	44.0	54.0	-10.0	Y	
C	P	H	3	3150.0	50.5	-1.5	49.0	77.5	-28.5	38.7	57.5	-18.8	N	
C	P	H	3	3500.0	55.4	-0.1	55.3	77.5	-22.2	45.0	57.5	-12.5	N	

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

Sample Calculation: Corrected Value = Measured Value + Equip Correction

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

Test 3: 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. The duration of each 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 the remaining 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 3 - Results: Radiated Disturbance Emissions - Peak-to-Average Ratio

Test Results Summary:

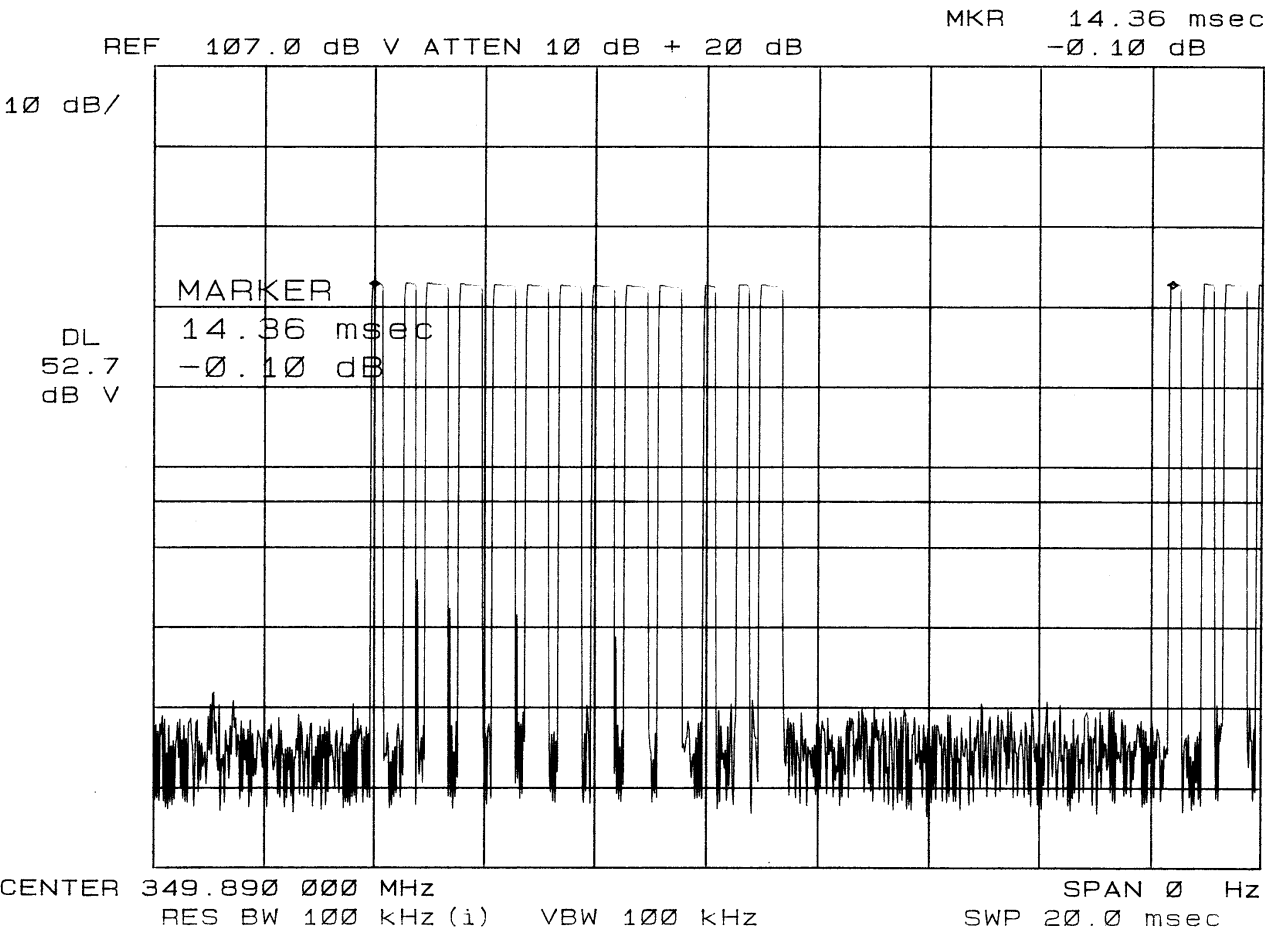
Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	40	23	100	P	1/5/2004	

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

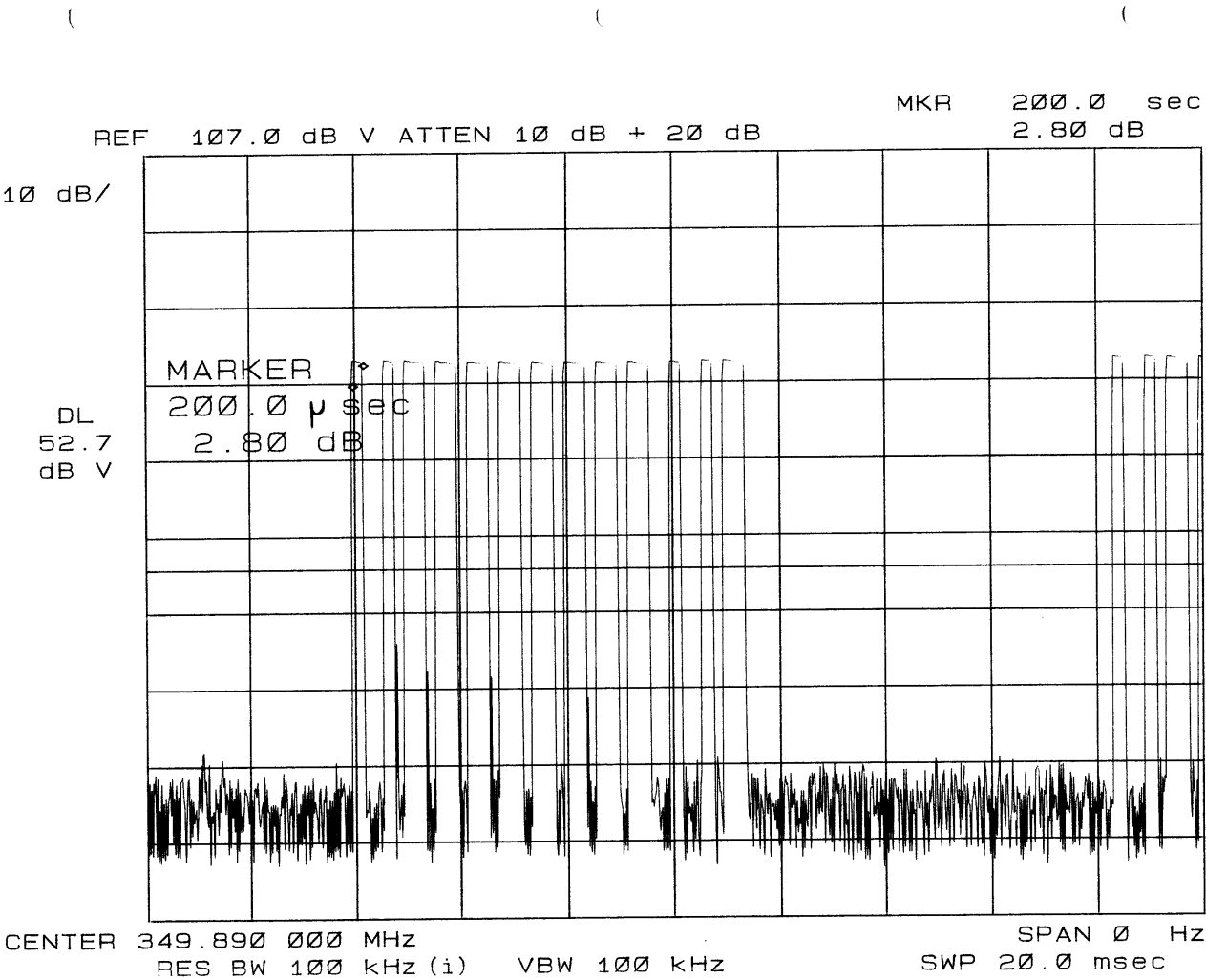
Comments:

Comment #	Description
1	See Test 1 for equipment list.

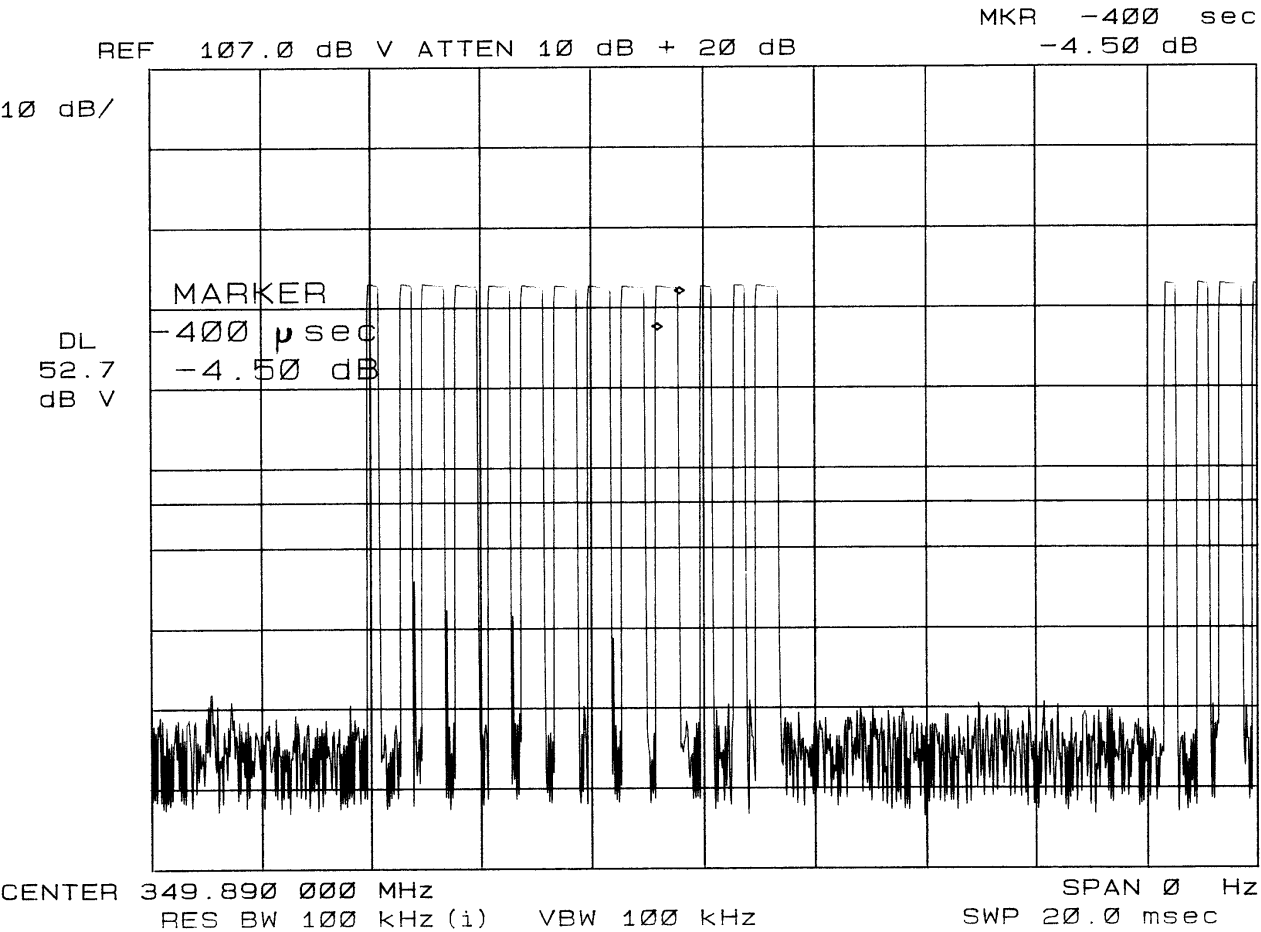
Test 3, Duration - One Cycle:



Test 3, Duration - Short Pulse:



Test 3, Duration - Long Pulse:



Test 3, All Items - Discrete Data: Radiated Disturbance Emissions - Peak-to-Average Ratio

Test Item (A-Z)	Name of Pulse (short, long, header, etc)	Number of Pulses (#)	Duration of Each Pulse (ms)	Total ON Time for Pulse Type (# x duration)	See Comment (#)***
A	Short	4	.200	0.80	
A	Long	9	.400	3.60	
			Total ON Time per period (ms)	4.4	
			Total Cycle Time (ms)*	14.36	
			Duty Cycle (fraction)	0.306	
			Duty Cycle (dB)**	-10.3	

* Or 100 milliseconds, whichever is less

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

*** # = See Comment Number Under The Preceeding Test Comments Section.

Test 4: 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 C63.4:2001 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 greater than 5% of permitted bandwidth for the measurement per ANSI C63.4:2001. 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 4 - Results: Radiated Disturbance Emissions - Occupied Bandwidth

Test Results Summary:

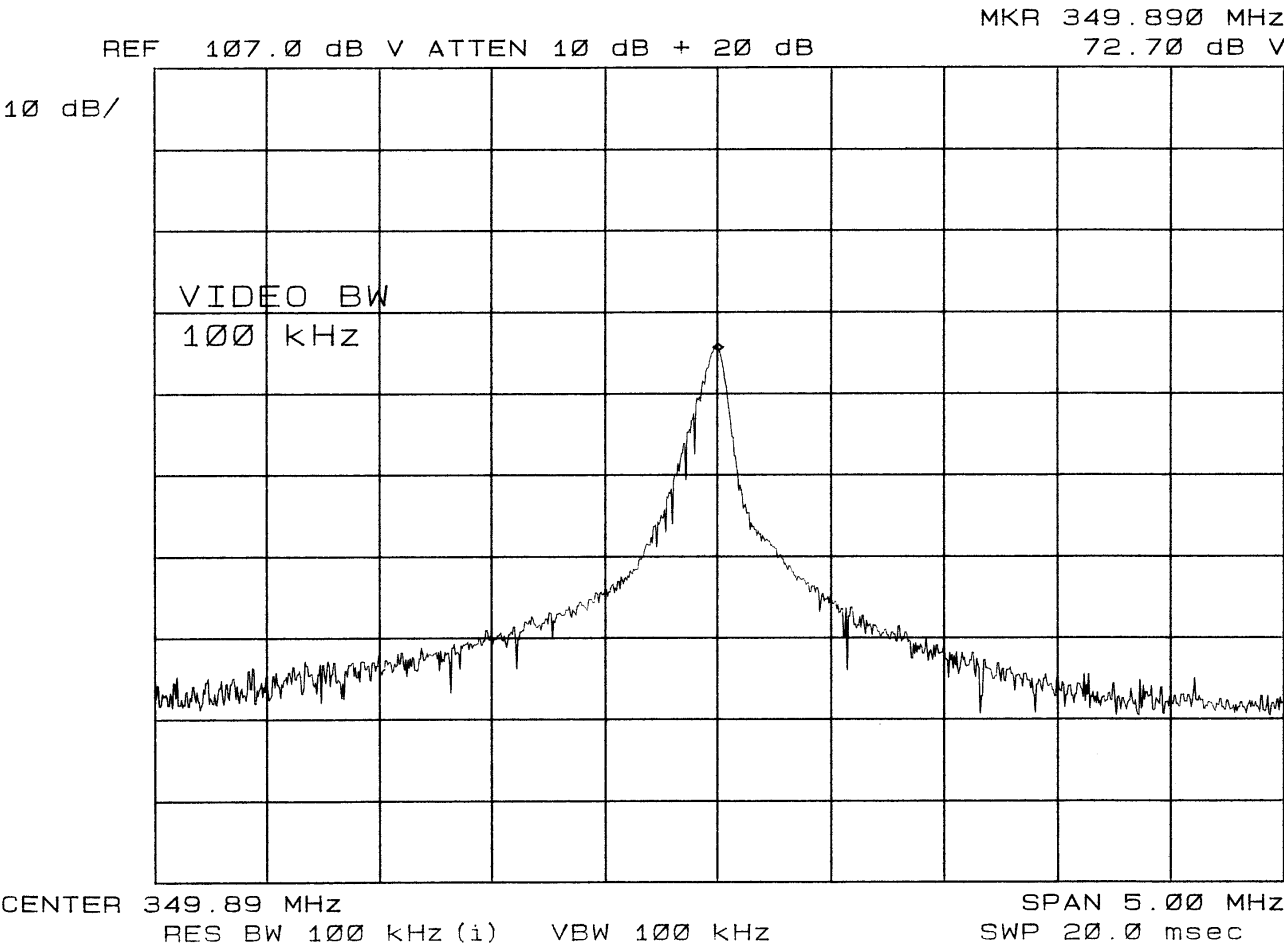
Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	39	23.5	100.1	P	1/5/2004	

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

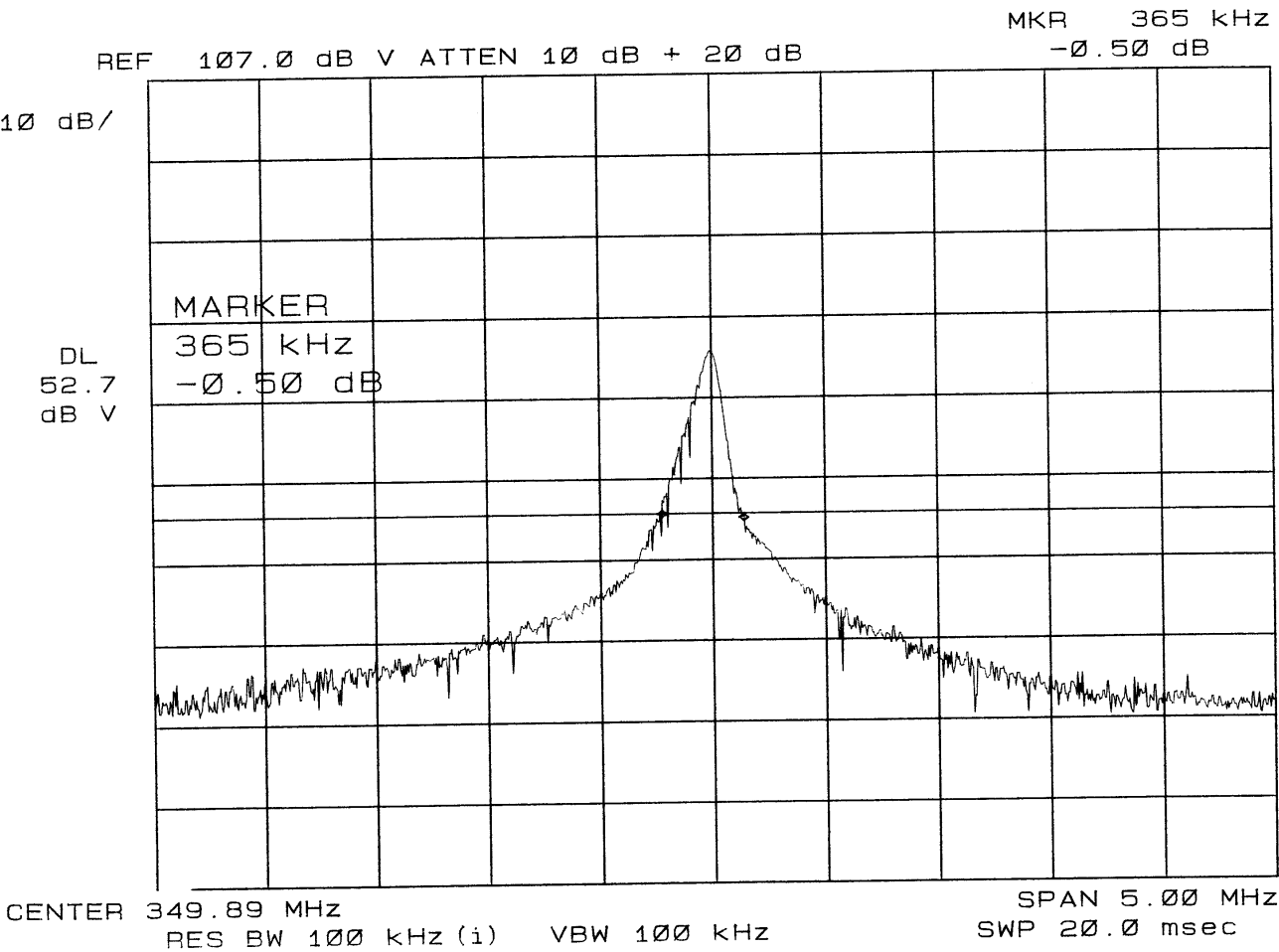
Comments:

Comment #	Description
1	See Test 1 for equipment list.

Test 4, Center Frequency - Peak Plot:



Test 4, Occupied Bandwidth - Peak Plot:



Test 4, All Items - Discrete Data: Radiated Disturbance Emissions - Occupied Bandwidth

Test Item (A-Z)	Center Frequency (MHz)	Occupied Bandwidth (MHz)	Bandwidth (% of Center Frequency)	Maximum Permitted Bandwidth (% of Center Frequency)	Pass/Fail (P/F)	See Comment (#)*
A	349.890	0.365	0.105%	0.25%	P	

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

Test 5: 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 5 - 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	-	-	-	-	P	1/21/04	1, 2

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

Comments:

Comment #	Description
1	Harmonics at 1050 MHz, 1400 MHz, and 2800 MHz fall within restricted bands.
2	Restricted Band compliance is determined from examining results from Tests 1 and 2. All harmonics falling within restricted bands comply with general limits in 15.209.

Accreditation Certificates:

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ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation

Revised Scope 12/17/2003
**ELECTROMAGNETIC COMPATIBILITY
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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.

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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

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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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NVLAP Code Designation / Description

12/7620a 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)

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Measurement Uncertainty Statement

Test	Expanded Estimate of Uncertainty	Units
	(k = 2, for 95% of a normal distribution)	
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_{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.