

UNDERWRITERS LABORATORIES INC.

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Project: 99RT4117

File: MC1071

Report Number: 990155

March 09, 1999

Test Report

on

Electromagnetic Compatibility Testing

**Hunter Fan
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
2500 Frisco Avenue
Memphis, TN 38114 USA**

Applicant Contact: **Mr. E. Renz
Regulatory Engineer
(901) 743-1360**

Test Report Number: **990155**

Test Report Date: **March 09, 1999**

Product Type: **Ceiling Fan Controller**

Model Number: **84555**

Sample Serial Number: **-**

Sample Tag Number: **S99LB083**

EUT Category: **Motor Operated/Thermal Equipment**

EUT Type: **Table Top**

Sample Receive Date: **February 15, 1999**

Testing Start Date: **February 19, 1999**

Date Testing Complete: **February 19, 1999**

Underwriters Laboratories Inc. reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. Underwriters Laboratories Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from Underwriters Laboratories Inc. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or endorsement by NVLAP or any agency of the US government.

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Summary of Testing:

Test #	Test Name Test Requirement/Specification	Comply	Does Not Comply	See Remark
1	Conducted Disturbance Emissions - Voltage 47 CFR Part 15, Subpart B / 47 CFR Part 15, Subpart B, Class B	X	-	
2	Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field 47 CFR Part 15, Subpart B / 47 CFR Part 15, Subpart B, Class B	X	-	

Remarks:


1) None

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. 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.

Project Engineer:

Reviewed By:


Jim Marley
EMC Engineer


Wyatt Brannan
EMC Engineer

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 (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 1.5 m diameter embedded turntable and 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 permanently mounted video surveillance 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. Located 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. The horizontal and vertical planes are continuously bonded along their entire length. 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. Located 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. The horizontal and vertical planes are continuously bonded along their entire length. 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 double sided galvanized sheet steel supported by 19 mm particle board and measures 3.6 by 3.6 m. Power filters and LISNs, when required, are placed on top of and bonded to the horizontal floor ground reference plane.

Test location G) 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 H) Outdoor Ground Reference Plane

Horizontal floor ground reference plane constructed of 1.5 mm thick aluminum measuring 3.6 by 3 m and located next to the outside wall of the EMC lab rear entrance.

Test Location I) Harmonic Current Test Area

Located on Lab floor in front of Standard Source Impedance Power Supply.

Test Location X) Other

If needed, as described in the Comments Section of Test Results.

EUT Information:

Equipment Used During Test:

Use*	Product Type	Manufacturer	Model	Comments
EUT	Fan Controller	Hunter		
EUT	Remote	Hunter		

* 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	AC Mains	AC	No	No	
2	Fan Load	I/O	No	No	
3	Lamp Load	I/O	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
0	None provided.

* List all frequencies intentionally generated in the product above 9kHz.

Power Interface:

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	120	-	-	60	1	
1	120	-	-	60	1	

EUT Operation Modes:

Mode #	Description
1	EUT lamp control and fan control were set to worst-case settings (lamp on and fan speed high). Worst-case settings were determined by performing an initial scan with lamp on and off and fan control set to different speeds. Data presented was recorded in worst-case mode.

EUT Configuration Modes:

Mode #	Description
1	EUT on table with lamp and fan output wired to 100 W load. Remote control unit also on table.

Test 1: Conducted Disturbance Emissions - Voltage

Test Requirement: 47 CFR Part 15, Subpart B

Test Specification: 47 CFR Part 15, Subpart B, Class B

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 connected to the proper supply source via a Line Impedance Stabilization Network (LISN). The Measuring Receiver was connected to the Port under test via the LISN. A peak measurement was first made at the test point across the test frequency range over a one minute test period. Then, Quasi-Peak or Average measurements were taken and recorded under Discrete Data. This was repeated for each conductor of the test port except for equipment grounding.

Test Details:

Conducted Disturbance Emission Limits For
Mains Terminals of Class B Equipment

Frequency MHz	Quasi-Peak Limit μV	Quasi-Peak Limit dB μV
0.450 to 30	250	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	1	AC Mains	1	1	1

Test 1 - Results: Conducted Disturbance Emissions - Voltage

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	D	42.0	21.5	99.7	P	2/19/99	

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

Comments:

Comment #	Description

Test 1 - Test Equipment Used: Conducted Disturbance Emissions - Voltage

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
ATA001	Transient Limiter	Electro-Metrics	EM-7600	7/1/98	7/31/99
ATA012	24ft Cable, BNC - BNC	UL	RG-223	8/4/98	8/31/99
ATA027	LISN, 150 kHz to 30 MHz	Solar Electronics	9629-50-TS-25	4/7/98	4/30/99
ATA028	LISN, 150 kHz to 30 MHz	Solar Electronics	9629-50-TS-25	4/7/98	4/30/99
HI0020	Humidity/Temperature/Pressure Indicator	Control Company	17040-30	8/5/98	8/31/99
SA0004	EMI Receiver	Advantest	R3261C	8/12/98	8/31/99
ZPS004	60Hz Patch Panel	Gus Berthold Inc.	UL-EMC-RTP-1	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/NCSL Z540-1-1994.

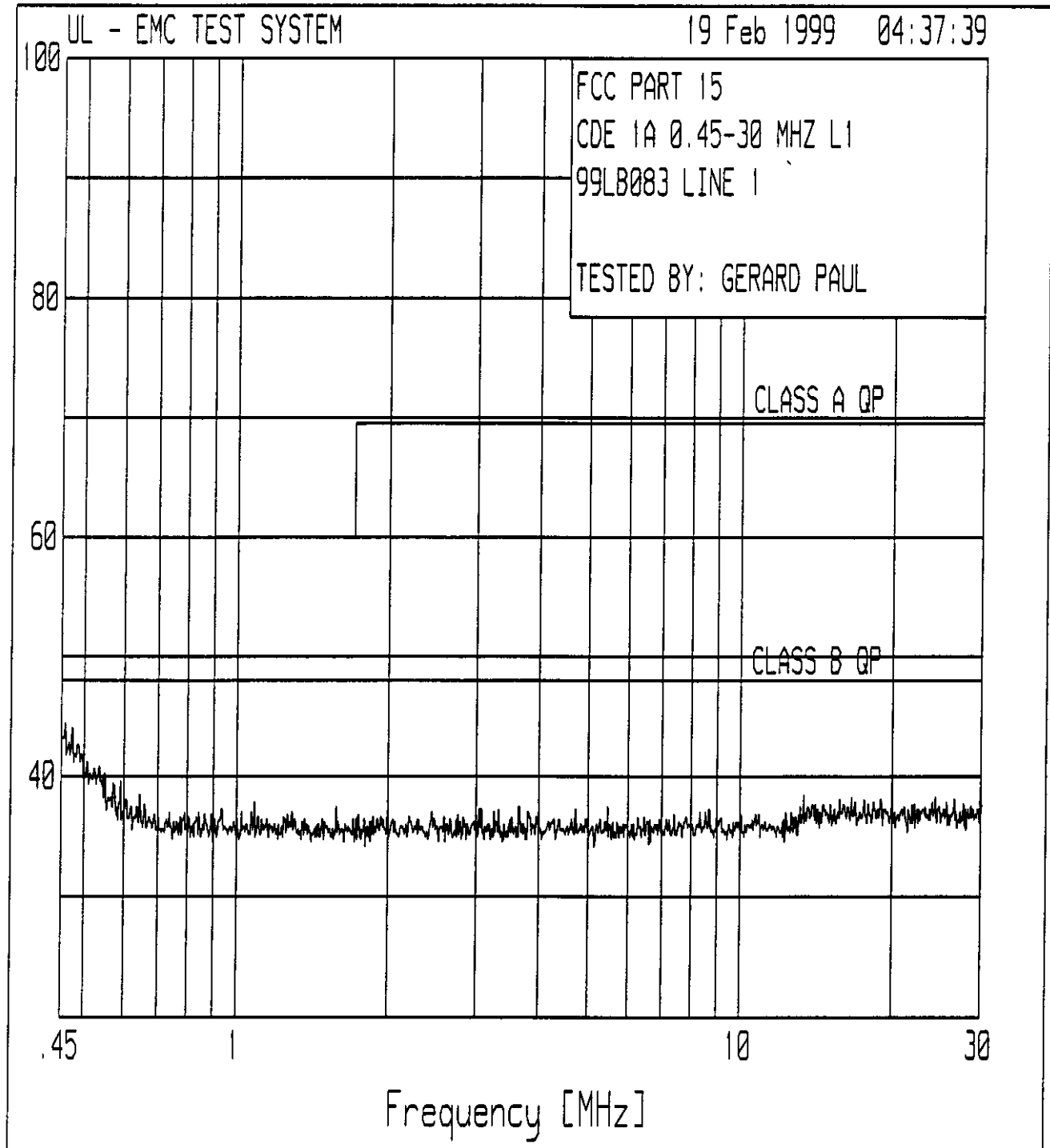
Test 1 - Discrete Data: Conducted Disturbance Emissions - Voltage

Test Item	Type* (P/Q/A)	Measured Conductor	Measured Frequency (MHz)	Measured Value (dBµV)	Equipment Correction (dB)	Corrected Value (dBµV)	Specified Limit (dBµV)	Spec Margin (dB)	See Comment #
A	P	L1	0.4581	34.2	10.2	44.4	48.0	-3.6	
A	P	L1	0.5346	30.6	10.2	40.8	48.0	-7.2	
A	P	L1	0.6434	28.2	10.2	38.4	48.0	-9.6	
A	P	L1	4.7159	26.9	10.3	37.2	48.0	-10.8	
A	P	L1	13.3637	27.8	10.6	38.4	48.0	-9.6	
A	P	L1	23.7599	26.5	10.7	37.2	48.0	-10.8	
A	P	N	0.4540	37.4	10.2	47.6	48.0	-0.4	
A	P	N	0.5145	35.8	10.2	46.0	48.0	-2.0	
A	P	N	0.6051	33.2	10.2	43.4	48.0	-4.6	
A	P	N	3.2977	26.9	10.3	37.2	48.0	-10.8	
A	P	N	13.4672	26.8	10.6	37.4	48.0	-10.6	
A	P	N	24.0676	28.6	10.8	39.4	48.0	-8.6	
A	Q	L1	0.4512	25.0	10.2	35.2	48.0	-12.8	
A	Q	N	0.4512	32.0	10.2	42.2	48.0	-5.8	

* P = Peak, Q = Quasi-Peak, A = Average.
 Sample Calculation: Corrected Value = Measured Value + Equipment Correction (LISN Factor + Cable Loss)

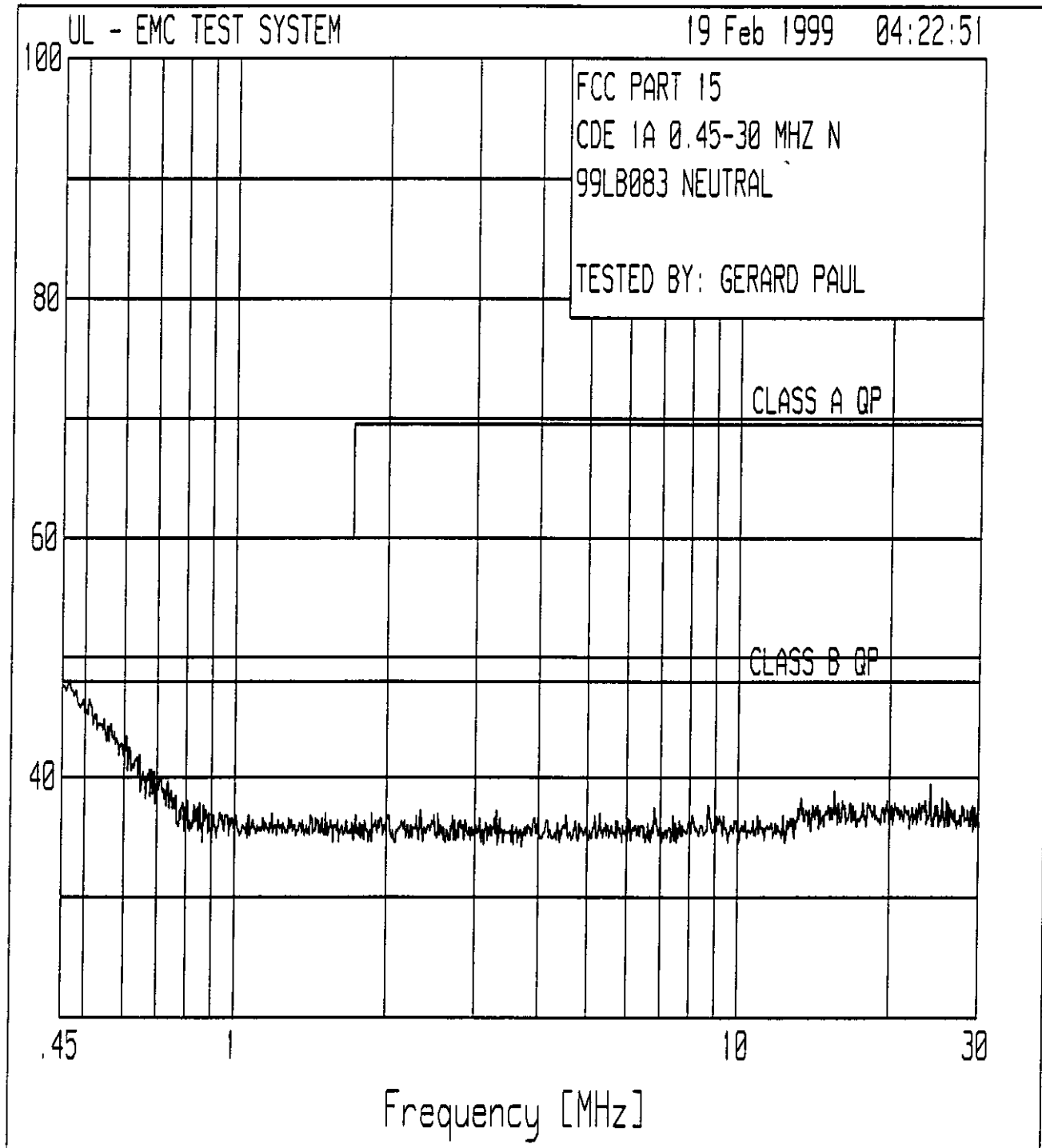
Test 1 Item A - Peak Plot:

Conducted Disturbance Emissions - Voltage



Test 1 Item A - Peak Plot:

Conducted Disturbance Emissions - Voltage



Test 2: Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field

Test Requirement: 47 CFR Part 15, Subpart B

Test Specification: 47 CFR Part 15, Subpart B, Class B

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.

Test Details:

Radiated Disturbance Limits for Class B Equipment
at a measuring distance of 3m.

Frequency Range MHz	Quasi-Peak Limits $\mu\text{V/m}$	Quasi-Peak Limits $\text{dB}\mu\text{V/m}$
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46
Above 960	500	54

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 - 30 to 1000 MHz Electric Field

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	46.8	20.6	99.6	P	2/19/99	

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

Comments:

Comment #	Description

Test 2 - Test Equipment Used: Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0004	Log Periodic Antenna, 200 to 1000 MHz	Electro-Metrics	EM-6950	4/21/98	4/30/99
ATA034	52ft Cable, N - N	UL	HELIAX	8/6/98	8/31/99
ATA038	33ft Cable, N - N	EMC Technologist	RG-214	7/2/98	7/31/99
MG0556	15M Tape Measure	Lufkin	530-15CM	5/7/98	5/31/99
PG0183	Pressure Indicator	Meriam	A0060IH	5/6/98	5/31/99
RTP024	Biconical Antenna	Electro-Metrics	EM-6912A	1/16/99	1/31/00
SAR001	EMI Receiver	Hewlett Packard	8572A	10/13/98	10/31/99
TE0195	Temperature/Humidity Indicator	Vaisala	HM34	8/5/98	8/31/99
ZPS004	60Hz Patch Panel	Gus Berthold Inc.	UL-EMC-RTP-1	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/NCSL Z540-1-1994.

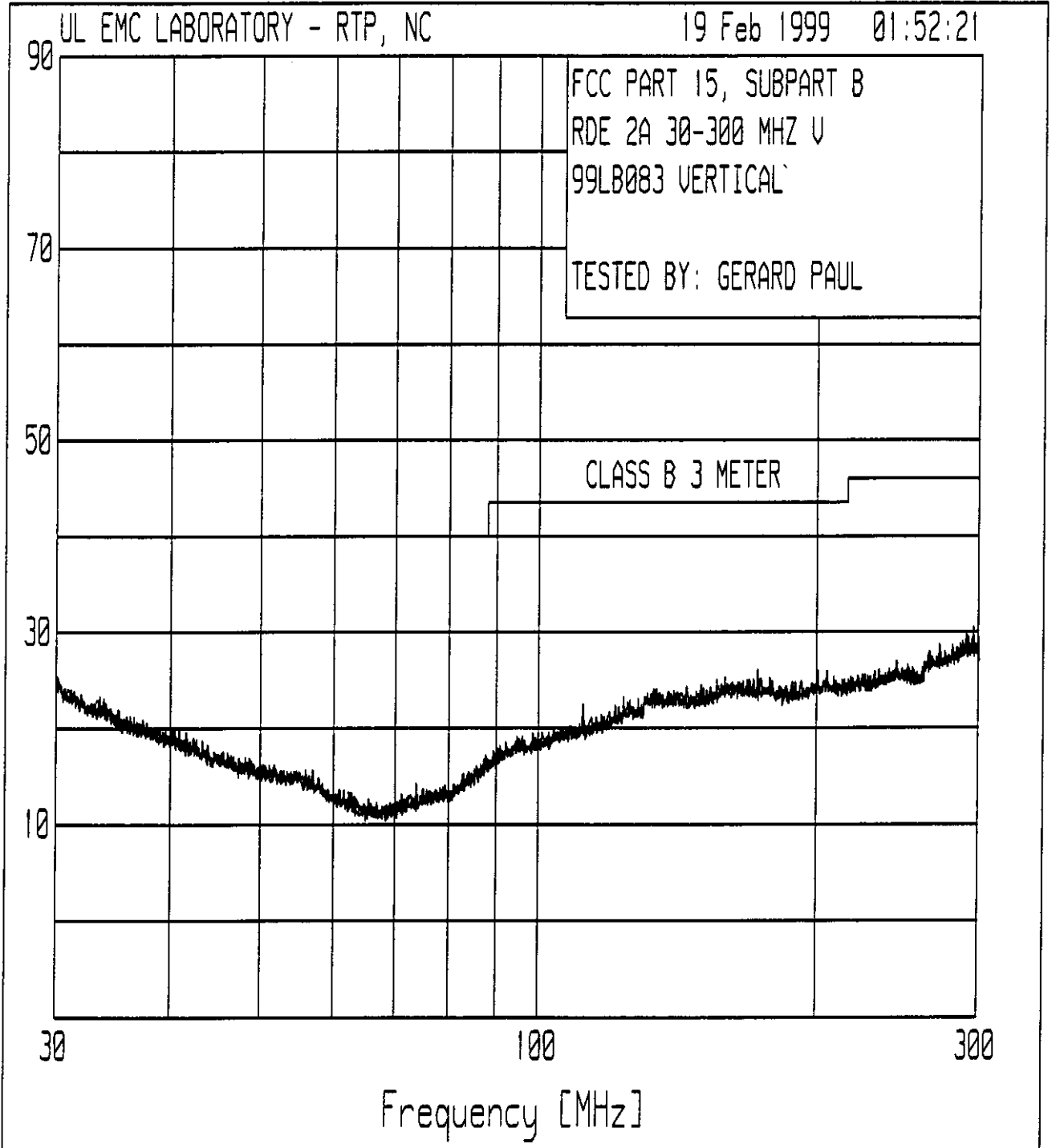
Test 2 - Discrete Data: Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field

Test Item	Type* (P/Q/A)	Antenna Polarity (H/V)	Antenna Distance (m)	Measured Frequency (MHz)	Measured Value (dB μ V/m)	Equipment Correction (dB)	Corrected Value (dB μ V/m)	Specified Limit (dB μ V/m)	Spec Margin (dB)	See Comment #
A	P	V	3	30.1369	6.4	18.2	24.6	40.0	-15.4	
A	P	V	3	111.6260	7.7	14.8	22.5	43.5	-21.0	
A	P	V	3	123.4551	6.4	16.8	23.2	43.5	-20.3	
A	P	V	3	158.5043	6.2	18.2	24.4	43.5	-19.1	
A	P	V	3	244.0680	6.8	20.1	26.9	46.0	-19.1	
A	P	V	3	292.0795	7.6	22.0	29.6	46.0	-16.4	
A	P	V	3	351.4195	11.9	18.7	30.6	46.0	-15.4	
A	P	V	3	421.9318	8.3	19.7	28.0	46.0	-18.0	
A	P	V	3	463.1016	11.2	20.4	31.6	46.0	-14.4	
A	P	V	3	589.9606	8.1	22.5	30.6	46.0	-15.4	
A	P	V	3	735.1983	8.6	24.5	33.1	46.0	-12.9	
A	P	V	3	902.3412	8.9	27.0	35.9	46.0	-10.1	
A	P	H	3	30.8900	6.7	19.3	26.0	40.0	-14.0	
A	P	H	3	45.4031	7.9	12.7	20.6	40.0	-19.4	
A	P	H	3	110.3116	6.7	13.8	20.5	43.5	-23.0	
A	P	H	3	131.5602	7.2	16.3	23.5	43.5	-20.0	
A	P	H	3	262.0265	7.6	20.1	27.7	46.0	-18.3	
A	P	H	3	299.7760	7.4	23.6	31.0	46.0	-15.0	
A	P	H	3	349.0553	13.4	18.5	31.9	46.0	-14.1	
A	P	H	3	463.1016	15.1	20.8	35.9	46.0	-10.1	
A	P	H	3	519.9194	9.1	23.0	32.1	46.0	-13.9	
A	P	H	3	581.7840	8.6	22.9	31.5	46.0	-14.5	
A	P	H	3	658.0991	8.8	24.0	32.8	46.0	-13.2	
A	P	H	3	929.6618	9.6	27.5	37.1	46.0	-8.9	

* P = Peak, Q = Quasi-Peak, A = Average.
 Sample Calculation: Corrected Value = Measured Value + Equipment Correction (Antenna Factor + Cable Loss)

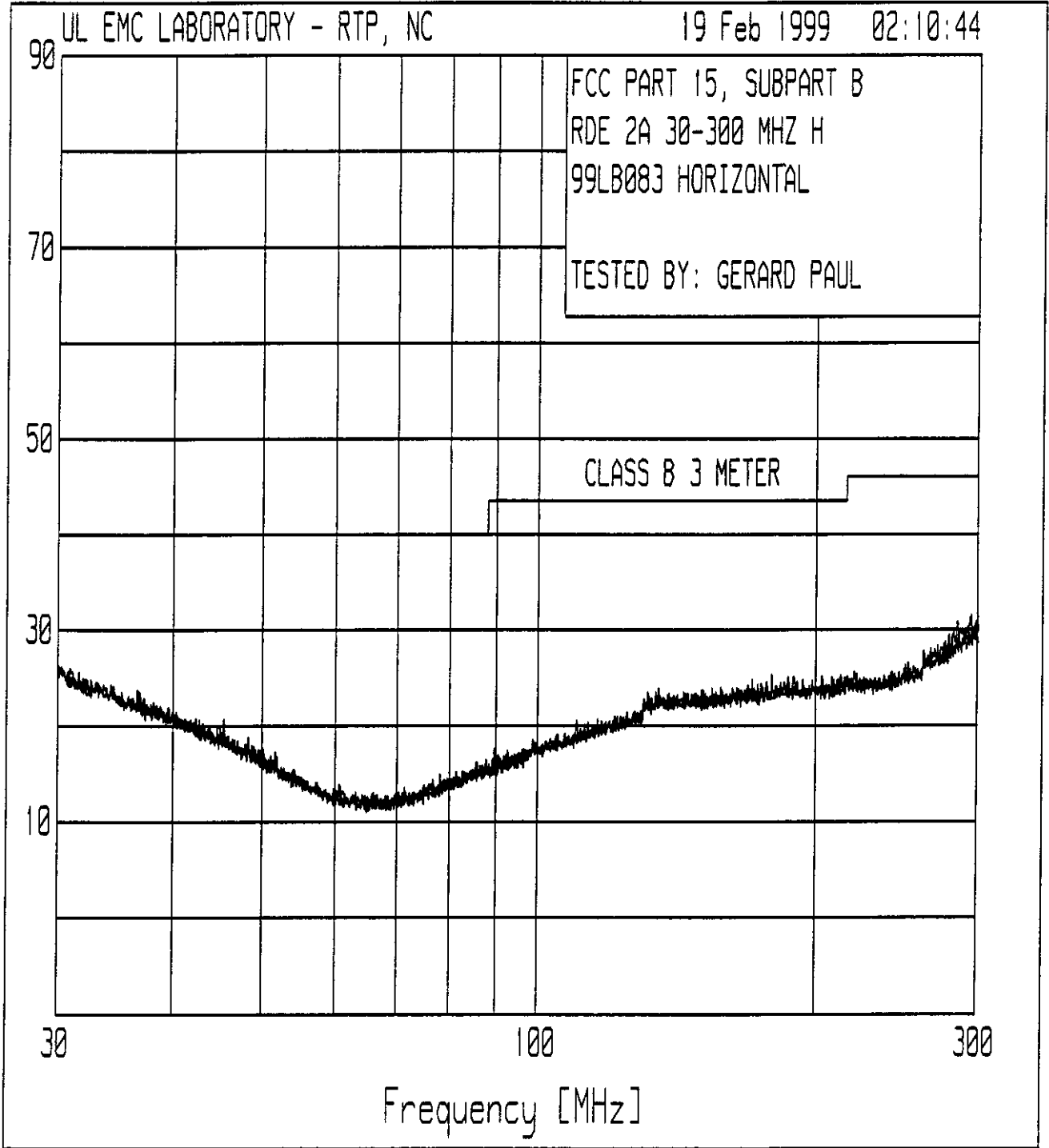
Test 2 Item A - Peak Plot:

Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field



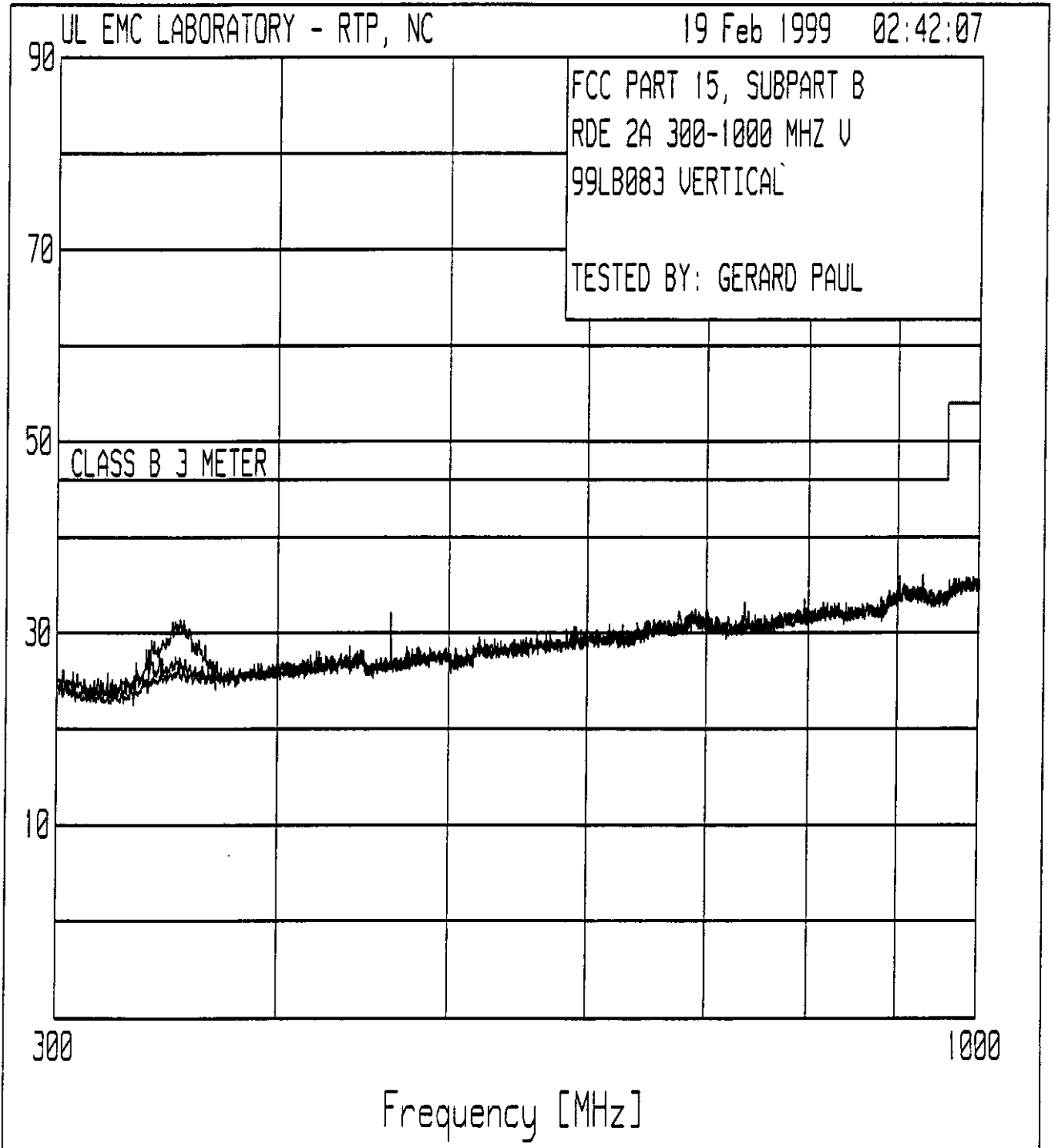
Test 2 Item A - Peak Plot:

Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field



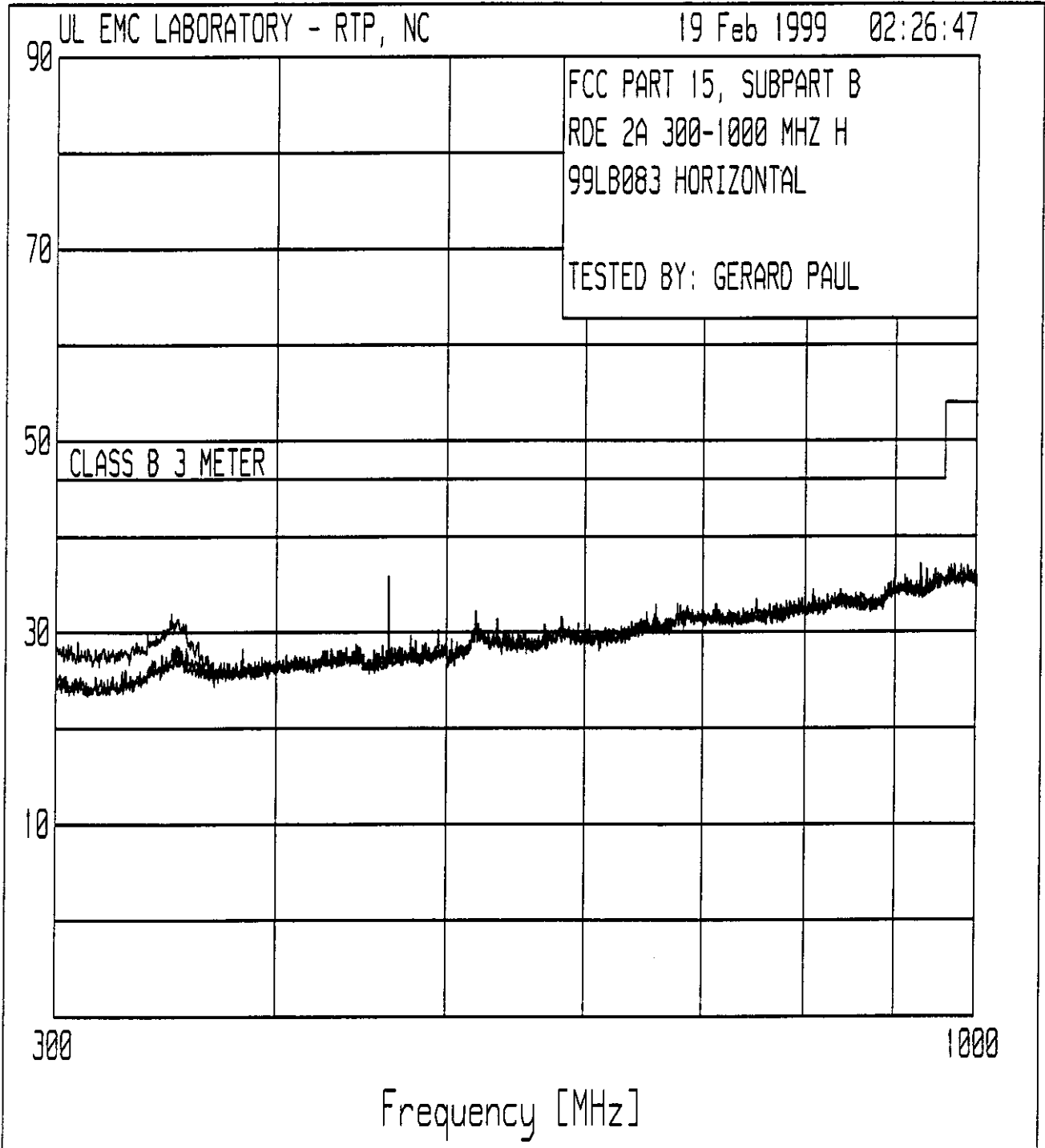
Test 2 Item A - Peak Plot:

Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field



Test 2 Item A - Peak Plot:

Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field



Appendix A: NVLAP Accreditation Certificate

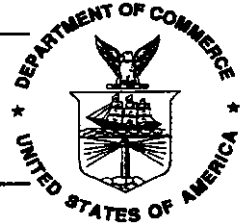
National Institute
of Standards and Technology



National Voluntary
Laboratory Accreditation Program

ISO/IEC GUIDE 25:1990
ISO 9002:1987

Scope of Accreditation



Page: 1 of 1

**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE 200246-0

UNDERWRITERS LABORATORIES, INC.

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Research Triangle Park, NC 27709
Mr. James R. Beyreis
Phone: 847-272-8800 Fax: 847-272-8129

NVLAP Code Designation / Description

International Special Committee on Radio Interference (CISPR) Methods

12/CIS22 IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment

Federal Communications Commission (FCC) Methods

12/F01 FCC Method - 47 CFR Part 15 - Digital Devices
12/F01a Conducted Emissions, Power Lines, 450 KHz to 30 MHz
12/F01b Radiated Emissions

Australian Standards referred to by clauses in AUSTEL Technical Standards

12/T51 AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment

June 30, 1999

Effective through

A handwritten signature in black ink, appearing to read 'James R. Beyreis', is written over a horizontal line.

For the National Institute of Standards and Technology