



Project: 02RT3660
File: MC1324
Report: 020156
Date: March 14, 2002
Model: W-62 Ceiling Fan/Lamp Remote

Test Report

On

Electromagnetic Compatibility Testing

Hunter Fan Co
Memphis, TN

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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 Co 2500 Frisco Avenue Memphis, TN 38114
Applicant Contact:	Mr. Robert Davis Safety and Test Engineer - International (901) 248-2212 (901) 248-2382 - FAX
Test Report Number:	020156
Test Report Date:	March 14, 2002
Product Type:	Low-Power Transmitter
Model Number:	W-62
Sample Serial Number:	Non-serialized Sample
Sample Tag Number:	S02LB100
EUT Category:	Transmitter - Low Power
EUT Type:	Hand Held
Sample Receive Date:	February 12, 2002
Testing Start Date:	February 18, 2002
Date Testing Complete:	March 22, 2002

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Summary of Testing:

Test #	Test Name Test Requirement/Specification	Comply	Does Not Comply	See Remark
1	Radiated Disturbance Emissions - Occupied Bandwidth 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 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	X	-	1
3	Radiated Disturbance Emissions - 9 kHz to 30 MHz 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.209	X	-	
4	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	-	
5	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	-	
6	Radiated Disturbance Emissions - Restricted Bands 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.205	X	-	

Remarks:

- 1) Transmitter was observed to cease transmission within 0.5 seconds upon release of buttons.
- 2) Transmitter contains an antenna that is not removable.
- 3) Results can be considered applicable to Industry Canada standard RSS-210 Section 6.1 (Momentarily Operated Transmitters). All emissions data was collected on Alternative Measurement Site IC-2953.
- 4) All data was recorded using NVLAP accredited methods. See certificate on page 48.

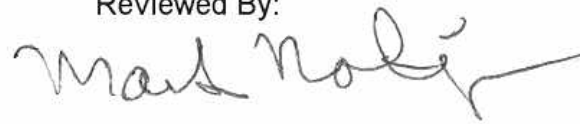
Conclusion:

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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Reviewed By:


Mark Nolting
EMC Engineer
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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 (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 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. 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) 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 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 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 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	Transmitter	Hunter Fan	W-62	

* 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
304	Transmit Frequency

* 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	6	-	-	DC	X	
1	6	-	-	DC	X	Powered by 4 AAA batteries. Fresh batteries were installed prior to testing.

EUT Operation Modes:

Mode #	Description
1	W-62 with button depressed (transmitting).
2	W-62 with no button depressed (ready, but not active).

EUT Configuration Modes:

Mode #	Description
1	W-62 alone on non-conductive table.

Test 1: 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 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 1 - 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	34.0	23.0	100.1	P	2/18/02	

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

Comments:

Comment #	Description

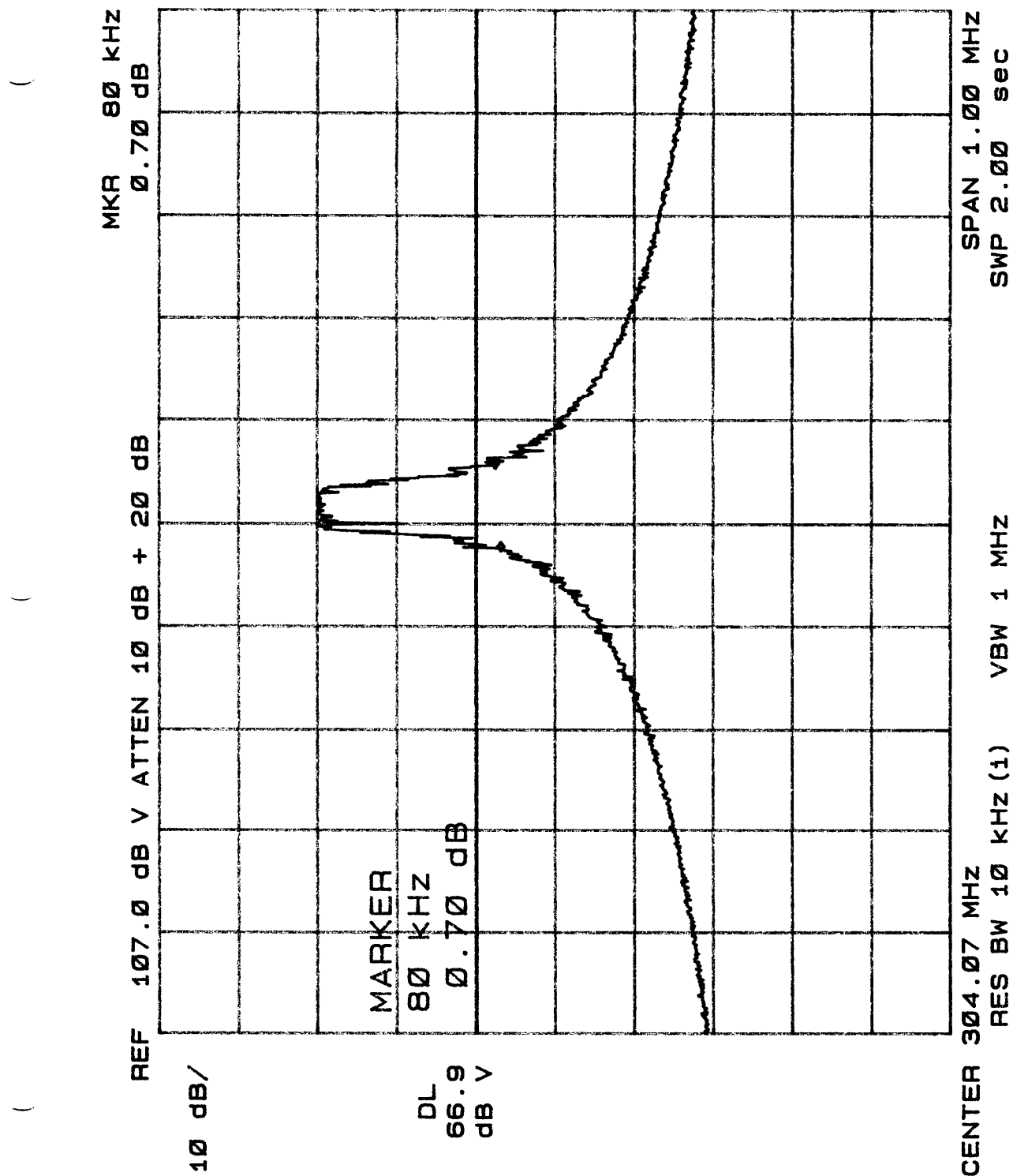
Test 1 - Test Equipment Used: Radiated Disturbance Emissions - Occupied Bandwidth

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	12/3/01	12/31/02

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.

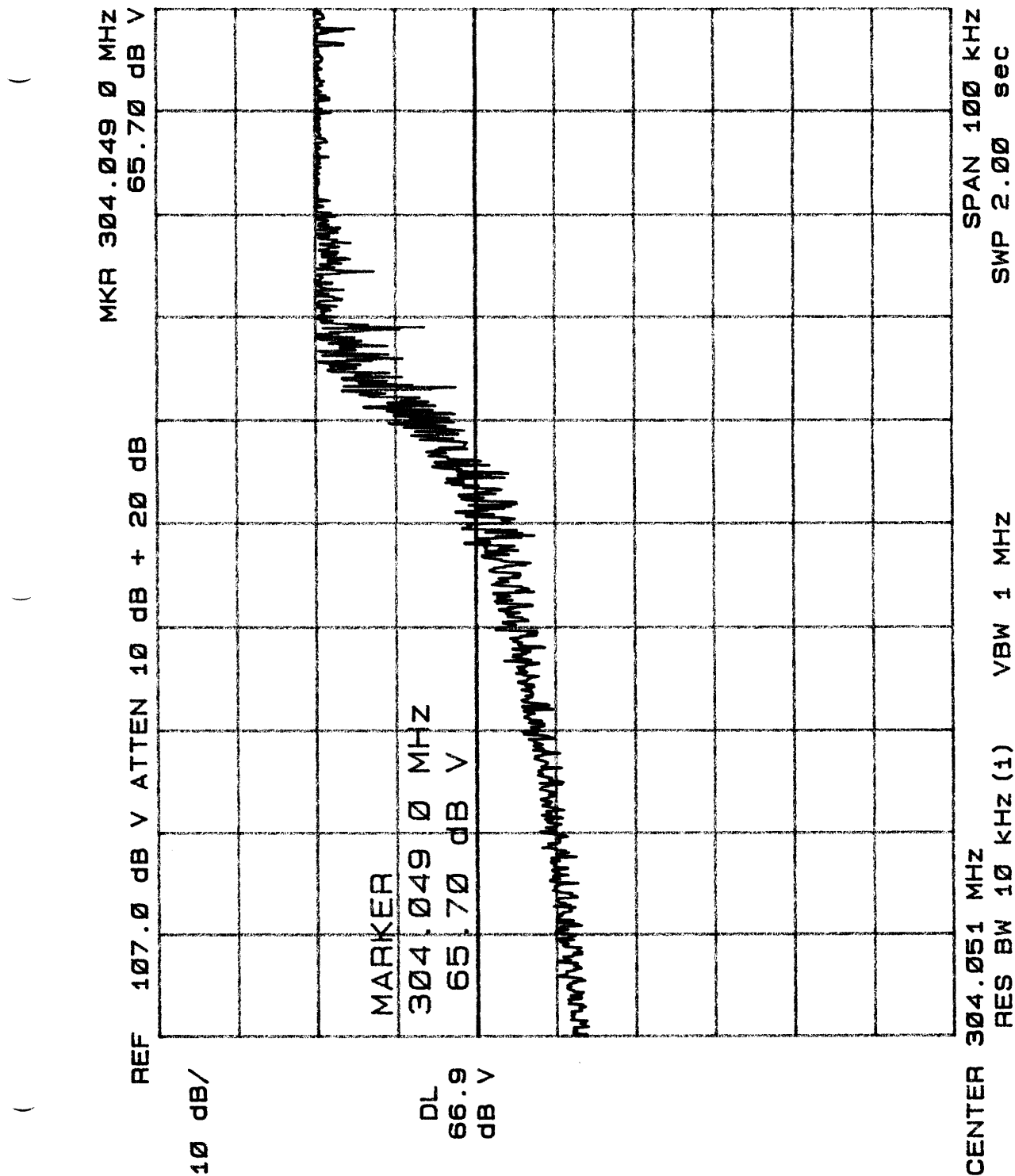
Bandwidth measured with a dipole antenna connected to spectrum analyzer.

Radiated Disturbance Emissions - Occupied Bandwidth



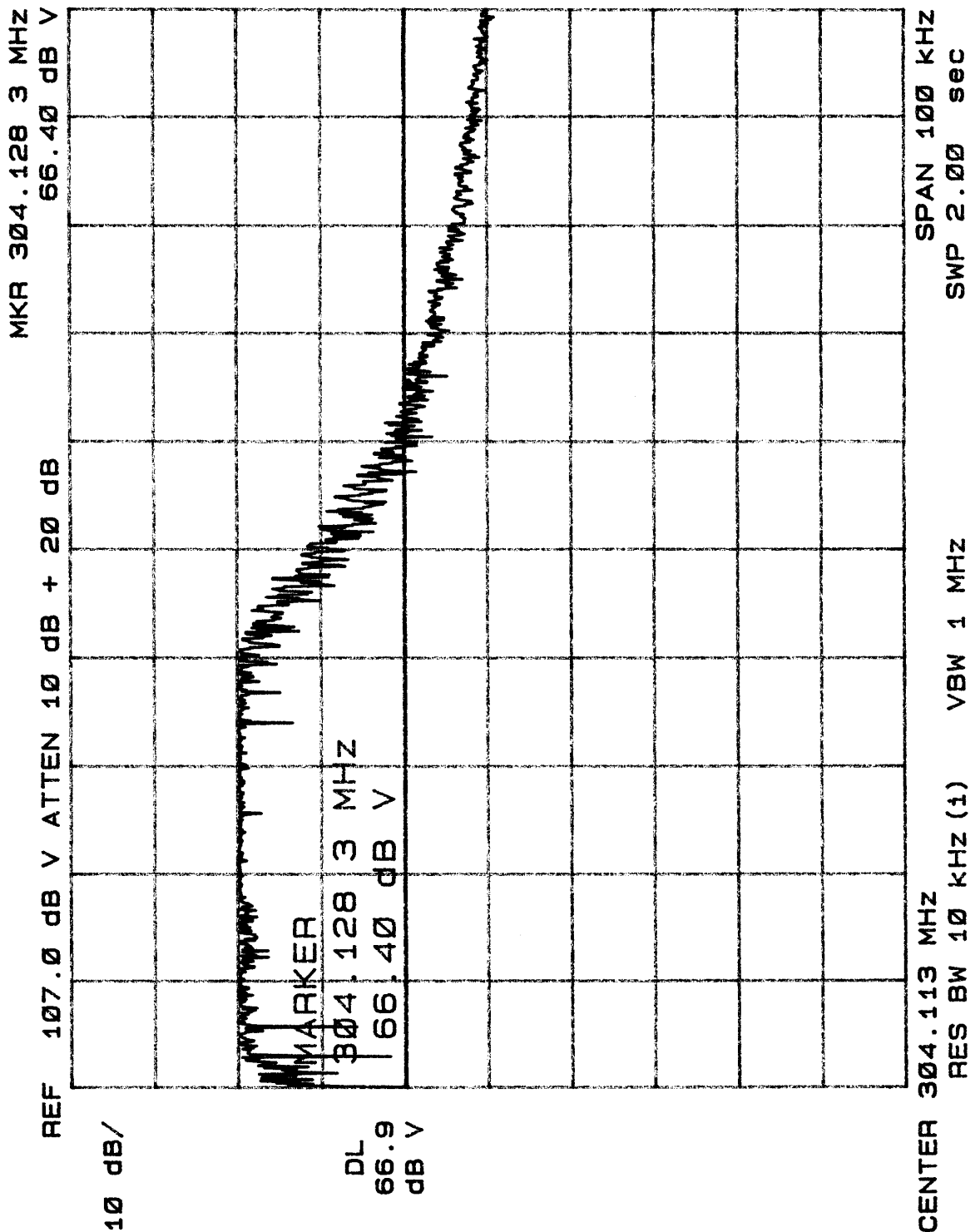
Test 1, Item Occupied BW - Left Edge - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - Occupied Bandwidth



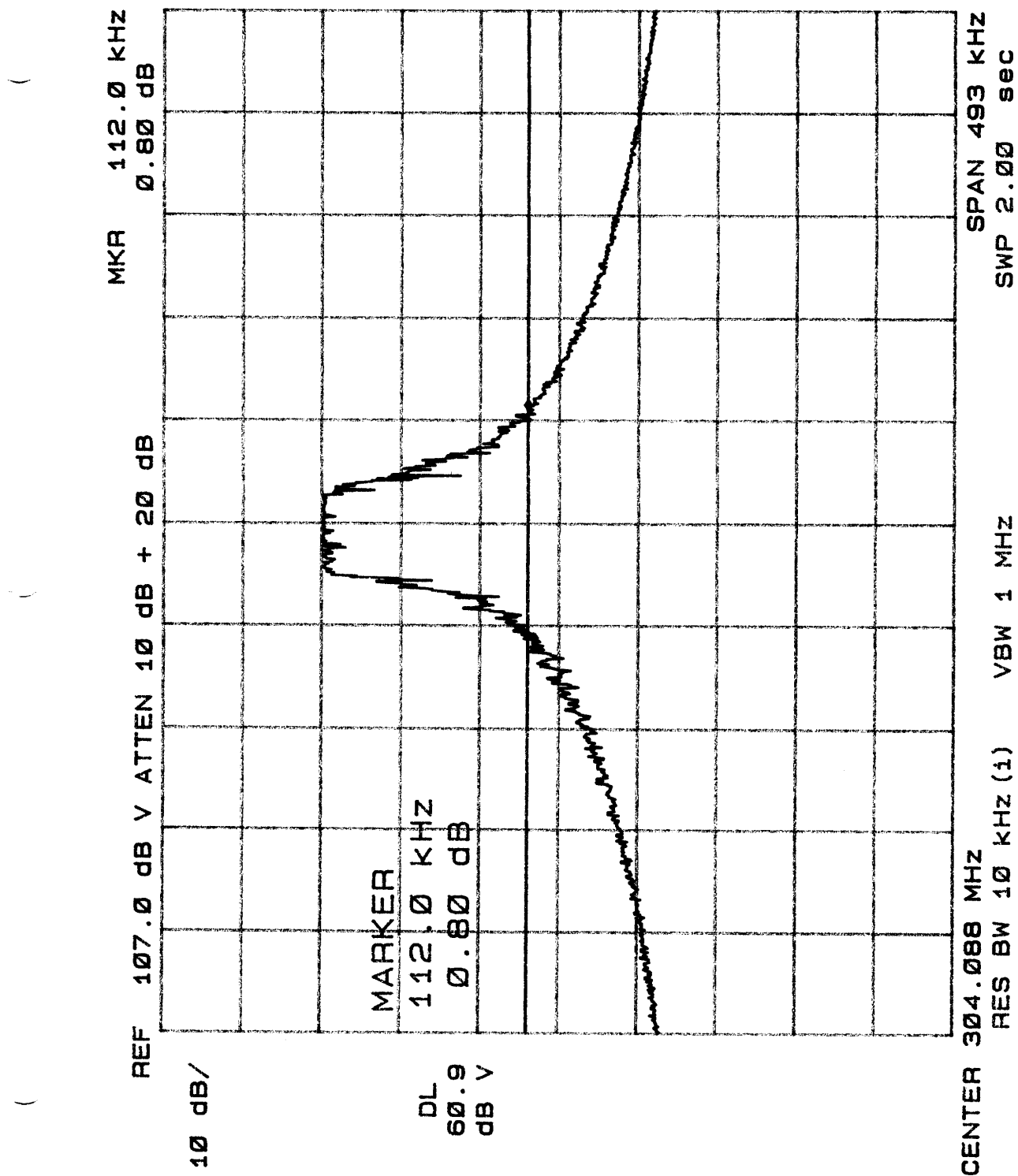
Test 1, Item Occupied BW - Right Edge - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - Occupied Bandwidth



Test 1, Item Occupied BW - 26 dB points - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - Occupied Bandwidth



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.

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 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	34.0	23.0	100.1	P	2/18/02	

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

Comments:

Comment #	Description

Peak-to-Average Calculation:

A single emissions burst was observed to consist of 17 pulses. The worst-case emission (combination of fan speed, direction, lamp brightness, and address) was determined to be 13 long pulses and 4 short pulses.

$$\begin{array}{rcl} \text{Long Pulse Duration} & = & 0.64 \text{ ms} \times 13 \text{ pulses (max)} = 8.32 \text{ ms} \\ \text{Short Pulse Duration} & = & 0.32 \times 4 \text{ pulses} = \quad + \quad 1.28 \text{ ms} \\ \text{Total "On" time per period} & = & 9.60 \text{ ms} \end{array}$$

$$\text{Duty Cycle} = \frac{(\text{Total "On" time per period})}{(\text{Total cycle time})} = \frac{9.60 \text{ ms}}{28.2 \text{ ms}} = .3404$$

$$\text{-or- (in dB)} = 20 (\log 0.3404) \text{ dB} = 9.4 \text{ dB}$$

Test 2 - Test Equipment Used:

Radiated Disturbance Emissions - Peak-to-Average Ratio

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	12/3/01	12/31/02

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.

Peak-to-Average Ratio measured with a dipole antenna connected to analyzer.