



Project: **05RT2219**
File: **MC1324**
Report: **050017**
Date: **February 14, 2005**
Model: **Transmitter and Receiver**
Model 27179
(FCC ID: IN2TX22, IC: 3558A-TX22)

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. 12 Laboratory Drive Research Triangle Park, NC 27709
Tests Performed For:	Hunter Fan Co 2500 Frisco Avenue Memphis, TN 38114 USA
Applicant Contact:	Mr. Robert Davis Safety and Test Engineer - International (901) 248-2212 (901) 248-2382 - FAX
Test Report Number:	050017
Test Report Date:	February 14, 2005
Product Type:	Ceiling Fan Remote Control Transmitter and Receiver
Model Number:	Transmitter and Receiver Model 27179
Sample Serial Number:	Unserialized, production sample
Sample Tag Number:	0644349-001
EUT Category:	Transmitter - Low Powered
EUT Type:	Wall Mounted
Sample Receive Date:	January 11, 2005
Testing Start Date:	January 24, 2005
Date Testing Complete:	January 27, 2005

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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 Canada RSS-210, Issue 5, Amend. 4 / Canada RSS-210 Issue 5, Amend. 4, Section 6.2.2(t1) and 6.1.1(e)	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 Canada RSS-210, Issue 5, Amend. 4 / Canada RSS-210 Issue 5, Amend. 4, Section 6.2.2(t1) and 6.1.1(e)	X	-	
3	Radiated Disturbance Emissions - Occupied Bandwidth 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.231 Canada RSS-210, Issue 5, Amend. 4 / Canada RSS-210 Issue 5, Amend. 4, Section 6.1.1(c)	X	-	
4	Radiated Disturbance Emissions - Peak-to-Average Ratio / Turn-off Delay 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.231 Canada RSS-210, Issue 5, Amend. 4 / Canada RSS-210 Issue 5, Amend. 4, Section 6.5	X	-	
5	Conducted Disturbance Emissions - Voltage 47 CFR Part 15, Subpart B / CISPR 22:1997 Class B Canada ICES-003 / Canada ICES-003, Class B	X	-	
6	Radiated Disturbance Emissions - Restricted Bands 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.205 Canada RSS-210, Issue 5, Amend. 4 / Canada RSS-210 Issue 5, Amend. 4, Section 6.2.2(t1)	X	-	

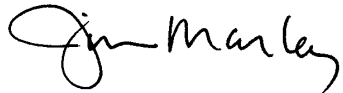
Remarks:

- 1) Modifications required to comply: None.
- 2) Transmitter is regarded as a composite device: Power supply is of linear design and is regarded as an incidental radiator. Transmitter is an intentional radiator.
- 3) Broadband emissions from transmitter power supply are disregarded as an incidental radiator.
- 4) Device is exempt from routine RF exposure testing per FCC Part 2.1093 and RSS-102, Issue 1. From Range Equation device is calculated to produce 0.7 μ W EIRP.
- 5) All data was recorded on Industry Canada Registered Site IC-2953. Canadian Emissions designator L1D4K08.
- 6) Device contains an integrated antenna. It is not detachable or replaceable by the user.
- 7) This device contains both manually activated transmissions and automatically activated transmissions.
 - a. All manually activated transmissions are found to cease in less than five seconds as required in Part 15.231(a)(1) and RSS-210 Section 6.1.1(a)(1).
 - b. All automatically activated transmissions are found to be less than five seconds in duration as required in Part 15.231 (a)(2) and RSS-210 Section 6.1.1(a)(2).

Conclusion:

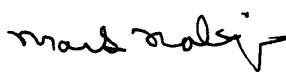
The tests listed in the Summary of Testing section of this report have been performed and the results recorded by Underwriters Laboratories Inc. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the 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 Number	Part Number	Comments
EUT	RF Remote	Hunter Fan	27179	86086-01	Transmitter and Receiver sold as bundled pair
ACC	Receiver/Fan/Lamp	Hunter Fan	27179	86088-01	

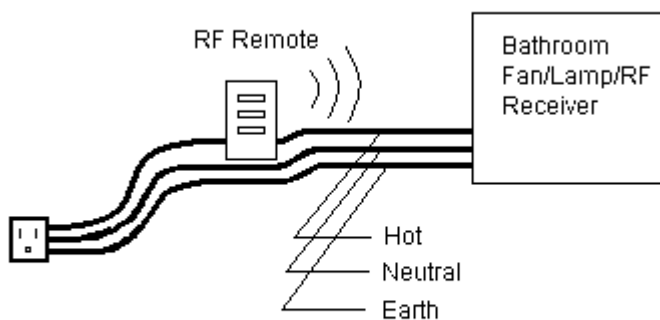
* Use = EUT - Equipment Under Test, ACC - Accessory (Not Subjected to Test), or SIM - Simulator (Not Subjected to Test)

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	Antenna	N/E	No	No	Antenna is internal to device.

* 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

Test Setup Block Diagram:



Note: RF Remote has no neutral or earth conductor.

EUT Internal Operating Frequencies:

Frequency (MHz)*	Description
350	Transmit Frequency
8	Clock

Power Interface:

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

EUT Operation Modes:

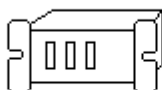
Mode #	Description
1	Lamp button continuously depressed with a rubber band. Fan on high.
2	Lamp button not depressed (ready to receive, but not receiving a signal). Fan and lamp on high.

EUT Configuration Modes (See Diagram Below for Clarification):

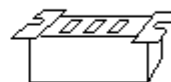
Mode #	Description
1	Transmitter connected to AC power and Fan/Lamp/Receiver unit. Transmitter in vertical orientation.
2	Transmitter connected to AC power and Fan/Lamp/Receiver unit. Transmitter in horizontal orientation.
3	Note: Transmitter not tested face upward, because it is a wall-mounted device.



EUT Vertical



EUT Horizontal



Not Considered

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

Test Requirement: 47 CFR Part 15, Subpart C
Canada RSS-210, Issue 5, Amendment 4

Test Specification: 47 CFR Part 15, Subpart C, Section 15.209 and 15.231
Canada RSS-210, Issue 5, Amendment 4, Section 6.2.2(t1) and 6.1.1(e)

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/RSS-210 Issue 5, Amendment 4 Section 6.1.1
at a measurement distance of 3 meters

Fundamental Frequency (MHz)	Field Strength of Fundamental (μ V/m) (dB μ V/m)		Field Strength of Spurious (μ V/m) (dB μ 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):

This product operates at:

 X 350 MHz

- At 350 MHz peak limit is 97.5 dBuV/m. Average limit is 77.5 dBuV/m.
- At harmonic (700 MHz) peak limit is 77.5 dBuV/m and average is 57.5 dBuV/m.

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 (Transmitting)	1 (EUT Vertical)	1
B	0	Enclosure	1 (Transmitting)	2 (EUT Horizontal)	1
C	0	Enclosure	2 (Not Transmitting)	1 (EUT Vertical)	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	30	24	100	P	1/25/05	
B	A	30	24	100	P	1/25/05	
C	A	30	24	100	P	1/25/05	1

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

Comments:

Comment #	Description
1	Demonstrates compliance of receiver to FCC Part 15 / ICES-003 Class B limits.

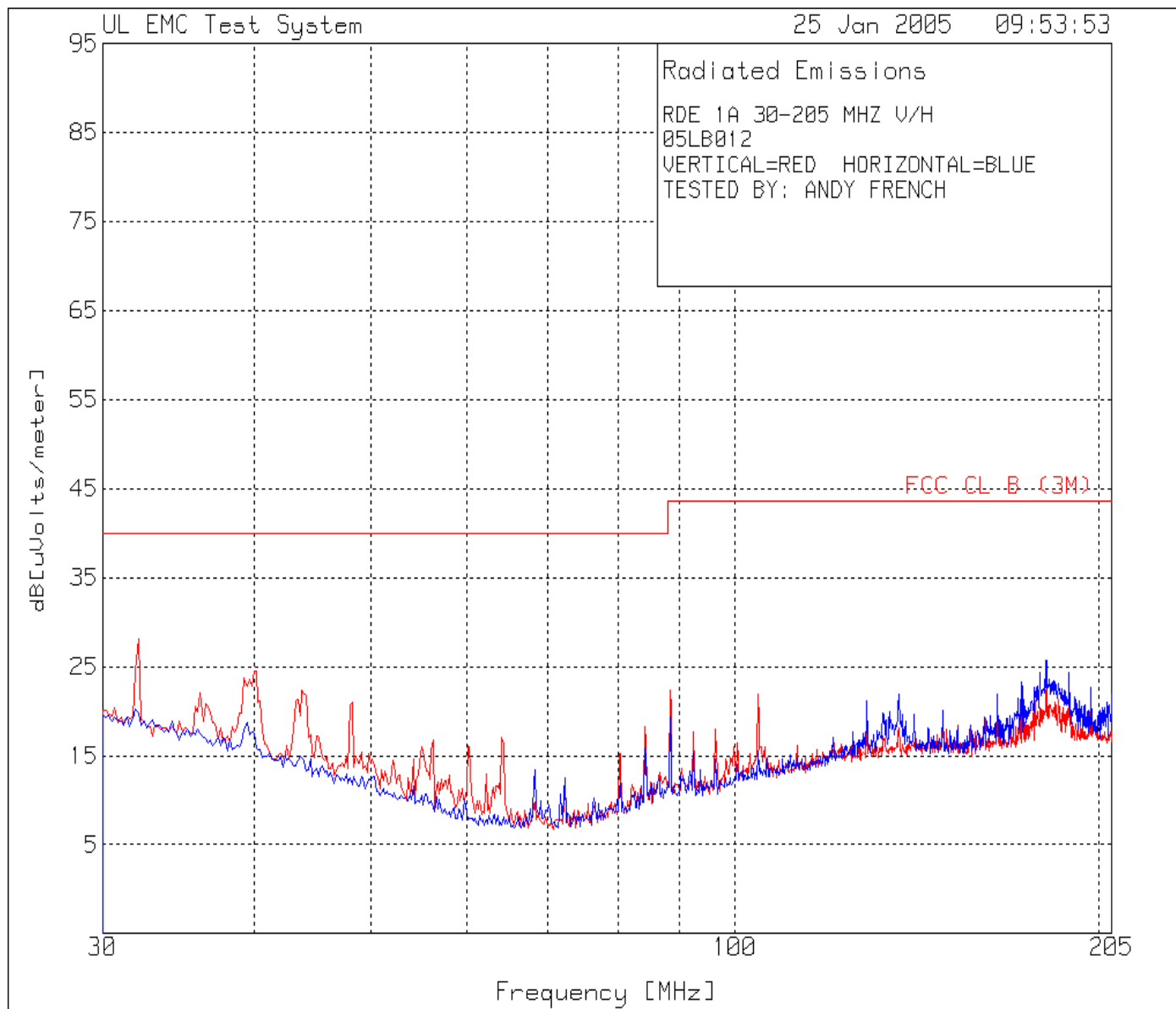
Test 1 - Test Equipment Used: Radiated Disturbance Emissions - 30 MHz to 1000 MHz

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0025	Biconical Antenna, 30 to 300 MHz	Schaffner, EMC	VBA6106A	3/22/04	3/31/05
AT0030	Log periodic Antenna, 200 MHz to 1000 MHz	Schaffner, EMC	3160-07	2/9/04	2/28/05
ATA084	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/11/04	3/31/05
ATA085	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/11/04	3/31/05
ATA106	19 ft, N - N	Amplifier Research	Low Loss coaxial cable	3/11/04	3/31/05
ATA124	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/11/04	3/31/05
ATA125	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/11/04	3/31/05
ATA132	45ft. N-Male to N-Male	UL	Coaxial Cable	3/11/04	3/31/05
ATA140	RG214 Ferrite Cable	EMC Eupen	N/A	3/11/04	3/31/05
ATA143	Cable, 6ft., N-male to N-male	Micro-Coax	N/A	8/25/04	2/28/05
ATA167	RG214 Ferrite Cable	EMC Eupen	N/A	3/11/04	3/31/05
ATA168	Cable, 6ft., N-male to N-male	Micro-Coax	N/A	1/9/04	1/31/05
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/14/04	10/31/05
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	12/02/04	12/31/05

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

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

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 1, Item A - EUT Vertical Orientation - Discrete Data:

Spurious Emissions (30 to 200 MHz):

No transmitter spurious emissions in this band.

Unintentional Emissions (30 to 200 MHz):

UL EMC Test System

25 Jan 2005 09:53:53

RDE 1A 30-205 MHZ V/H
05LB012
VERTICAL=RED HORIZONTAL=BLUE
TESTED BY: ANDY FRENCH

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
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Range: 1 30 - 205MHz -----

1	32.1021	39.27 pk	-28.7	17.5	28.07	40
		Height:101 Vert		Margin [dB]		-11.93
2	40.1602	39.24 pk	-28.7	13.9	24.44	40
		Height:101 Vert		Margin [dB]		-15.56
3	88.3333	42.23 pk	-28.5	8.7	22.43	43.5
		Height:101 Vert		Margin [dB]		-21.07
4	43.8388	38.53 pk	-28.6	12.5	22.43	40
		Height:101 Vert		Margin [dB]		-17.57

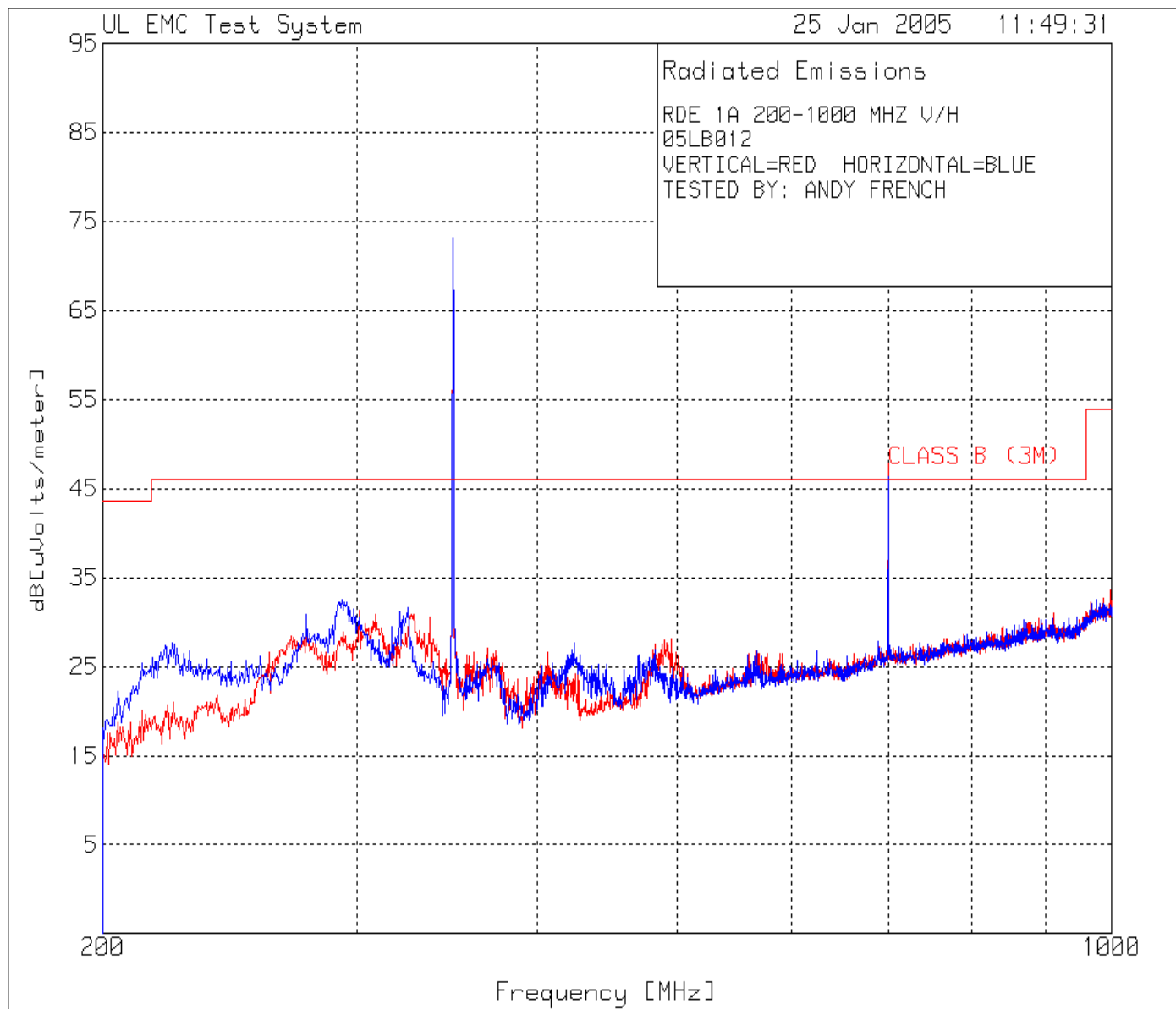
Range: 2 30 - 205MHz -----

5	181.001	39.13 pk	-28.3	14.9	25.73	43.5
		Height:99 Horz		Margin [dB]		-17.77
6	136.6817	36.46 pk	-28.5	14	21.96	43.5
		Height:248 Horz		Margin [dB]		-21.54

LIMIT 1: FCC CL B (3M)
LIMIT 2: NONE
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

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

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 1, Item A - EUT Vertical Orientation - Discrete Data:

Radiated Power and Spurious Emissions

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 Comm. (#)
A	P	H	3	350.0	84.9	-11.7	73.2	97.5	-24.3	63.7	77.5	-13.8	N	1
A	P	V	3	700.0	51.9	-4.0	47.9	77.5	-29.6	38.4	57.5	-19.1	N	2

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

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

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 Radiated Power. 63.7 dBuV/m at 3 meters = 1531.1 uV/m at 3 meters. From range equation this 0.703 uW EIRP.
2	Highest Radiated Spurious Emissions. 38.4 dBuV/m at 3 meters (700.0 MHz) = 83.18 uV/m at 3 meters.

Unintentional Emissions (200-1000 MHz)

UL EMC Test System

25 Jan 2005 11:49:31

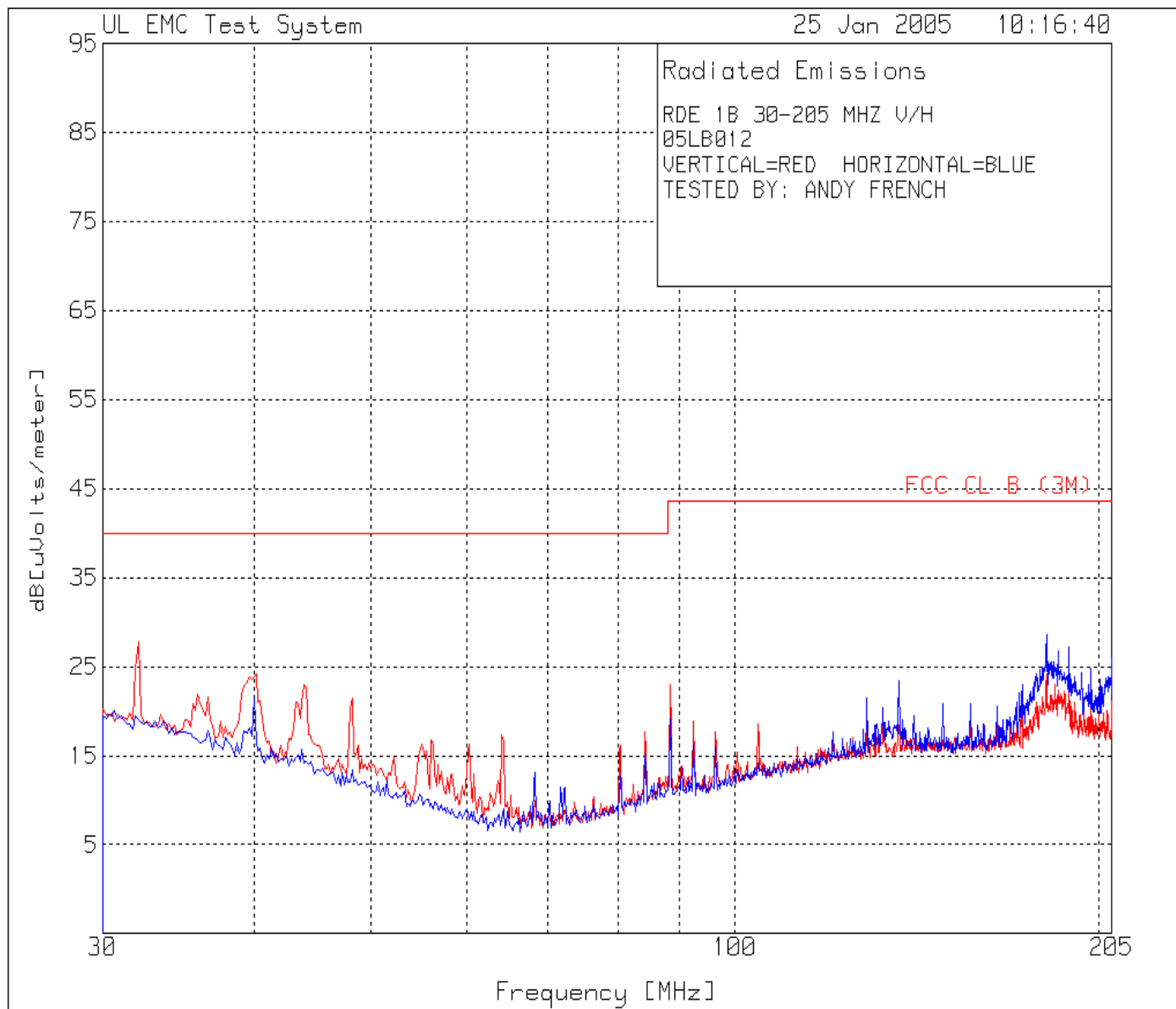
RDE 1A 200-1000 MHZ V/H
05LB012
VERTICAL=RED HORIZONTAL=BLUE
TESTED BY: ANDY FRENCH

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB [uVolts/meter]	Limit:1
1	424.1121	37.92 pk	-26.9	16.7	27.72	46
		Height:102 Horz		Margin [dB]		-18.28
2	292.8464	46.5 pk	-27.9	13.9	32.5	46
		Height:102 Horz		Margin [dB]		-13.5

LIMIT 1: CLASS B (3M)

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

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 1, Item B - EUT Horizontal Orientation - Discrete Data:

Spurious Emissions (30 to 200 MHz):

No transmitter spurious emissions in this band.

Unintentional Emissions (30 MHz to 1000 MHz):

UL EMC Test System

25 Jan 2005 10:16:40

RDE 1B 30-205 MHZ V/H
05LB012
VERTICAL=RED HORIZONTAL=BLUE
TESTED BY: ANDY FRENCH

Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
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Range: 1 30 - 205MHz -----

1	32.1021	38.98 pk	-28.7	17.5	27.78	40
		Height:101 Vert		Margin [dB]		-12.22
2	40.1602	39 pk	-28.7	13.9	24.2	40
		Height:101 Vert		Margin [dB]		-15.8
3	44.014	39.22 pk	-28.6	12.4	23.02	40
		Height:101 Vert		Margin [dB]		-16.98
4	88.3333	42.7 pk	-28.5	8.7	22.9	43.5
		Height:101 Vert		Margin [dB]		-20.6

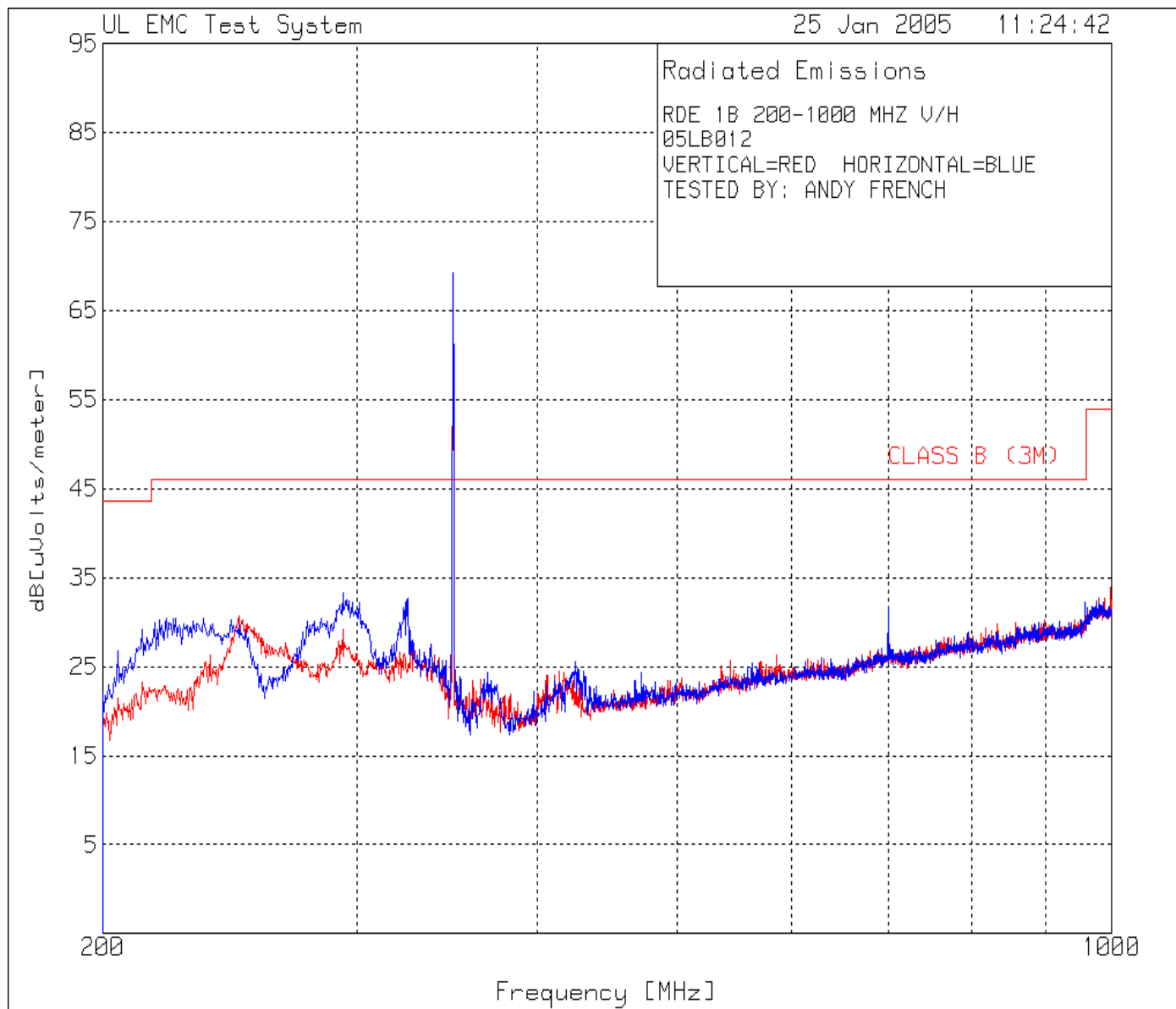
Range: 2 30 - 205MHz -----

5	181.001	42 pk	-28.3	14.9	28.6	43.5
		Height:99 Horz		Margin [dB]		-14.9
6	136.6817	37.97 pk	-28.5	14	23.47	43.5
		Height:248 Horz		Margin [dB]		-20.03

LIMIT 1: FCC CL B (3M)
LIMIT 2: NONE
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

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

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 1, Item B - EUT Horizontal Orientation - Discrete Data:

Radiated Power and Spurious Emissions (200-1000 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 Comm. (#)
B	P	V	3	350.0	81.0	-11.7	69.3	97.5	-27.7	59.8	77.5	-17.7	N	
B	P	H	3	700.0	35.8	-4.0	31.8	77.5	-45.7	22.3	57.5	-34.2	N	

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

** Average field strength = Peak field strength - Peak-to-Average ratio (9.5 dB). See Test 4 for details of Peak-to-Average Ratio

Sample Calculation: Corrected Value = Measured Value + Equip Correction

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

Unintentional Emissions (200-1000 MHz) :

UL EMC Test System

25 Jan 2005 11:24:42

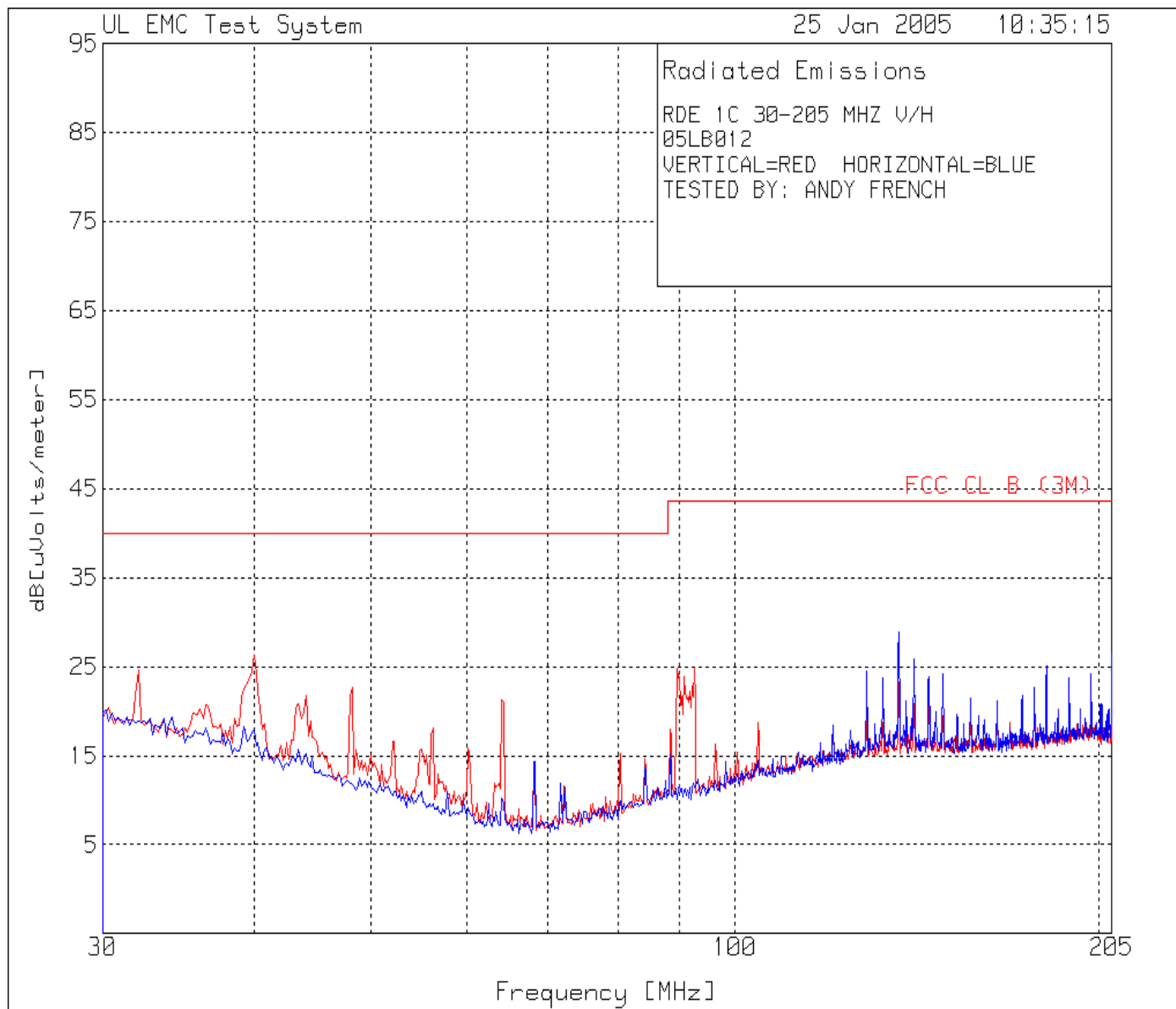
RDE 1B 200-1000 MHZ V/H
05LB012
VERTICAL=RED HORIZONTAL=BLUE
TESTED BY: ANDY FRENCH

Test No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
1	325.6628	45.46 pk	-27.6	14.8	32.66	46
		Height:101 Horz		Margin [dB]		-13.34
2	293.2466	47.25 pk	-27.9	13.9	33.25	46
		Height:101 Horz		Margin [dB]		-12.75

LIMIT 1: CLASS B (3M)

Test 1, Item C - Not Transmitting/Receiver - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 1, Item C - Not Transmitting/Receiver - Discrete Data:

Radiated Disturbance Emissions - 30 MHz to 1000 MHz

UL EMC Test System

25 Jan 2005 10:35:15

RDE 1C 30-205 MHZ V/H
05LB012
VERTICAL=RED HORIZONTAL=BLUE
TESTED BY: ANDY FRENCH

Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
=====						
Range: 1 30 - 205MHz -----						
1	39.985	40.92 pk	-28.7	14.1	26.32	40
		Height:102 Vert		Margin [dB]		-13.68
2	48.2182	40.51 pk	-28.6	10.7	22.61	40
		Height:102 Vert		Margin [dB]		-17.39
3	32.1021	35.84 pk	-28.7	17.5	24.64	40
		Height:102 Vert		Margin [dB]		-15.36
4	44.1892	38.08 pk	-28.6	12.3	21.78	40
		Height:102 Vert		Margin [dB]		-18.22
5	64.1592	44.23 pk	-28.5	5.6	21.33	40
		Height:102 Vert		Margin [dB]		-18.67
6	89.5596	44.45 pk	-28.5	8.9	24.85	43.5
		Height:102 Vert		Margin [dB]		-18.65
7	92.5375	43.89 pk	-28.5	9.4	24.79	43.5
		Height:102 Vert		Margin [dB]		-18.71

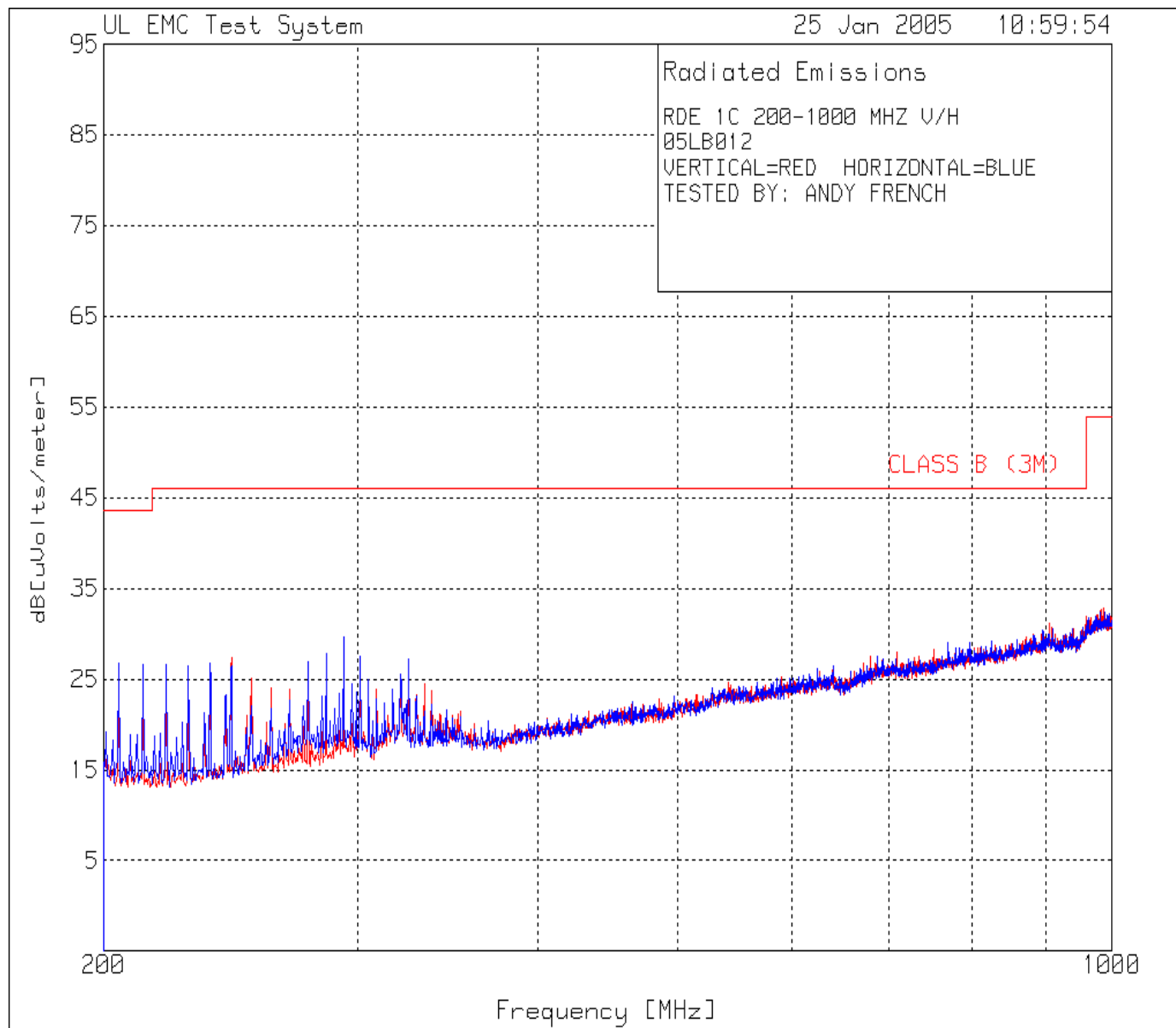
LIMIT 1: FCC CL B (3M)
LIMIT 2: NONE
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

Comments:

Comment #	Description
1	Highest Receiver Spurious: 39.985 MHz - 26.32 dBuV/m at 3 meters = 20.7 uV/m at 3 meters.

Test 1, Item C - Not Transmitting - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 1, Item C - Not Transmitting - Discrete Data:

Radiated Disturbance Emissions - 30 MHz to 1000 MHz

UL EMC Test System

25 Jan 2005 10:59:54

RDE 1C 200-1000 MHZ V/H
05LB012
VERTICAL=RED HORIZONTAL=BLUE
TESTED BY: ANDY FRENCH

Andy French

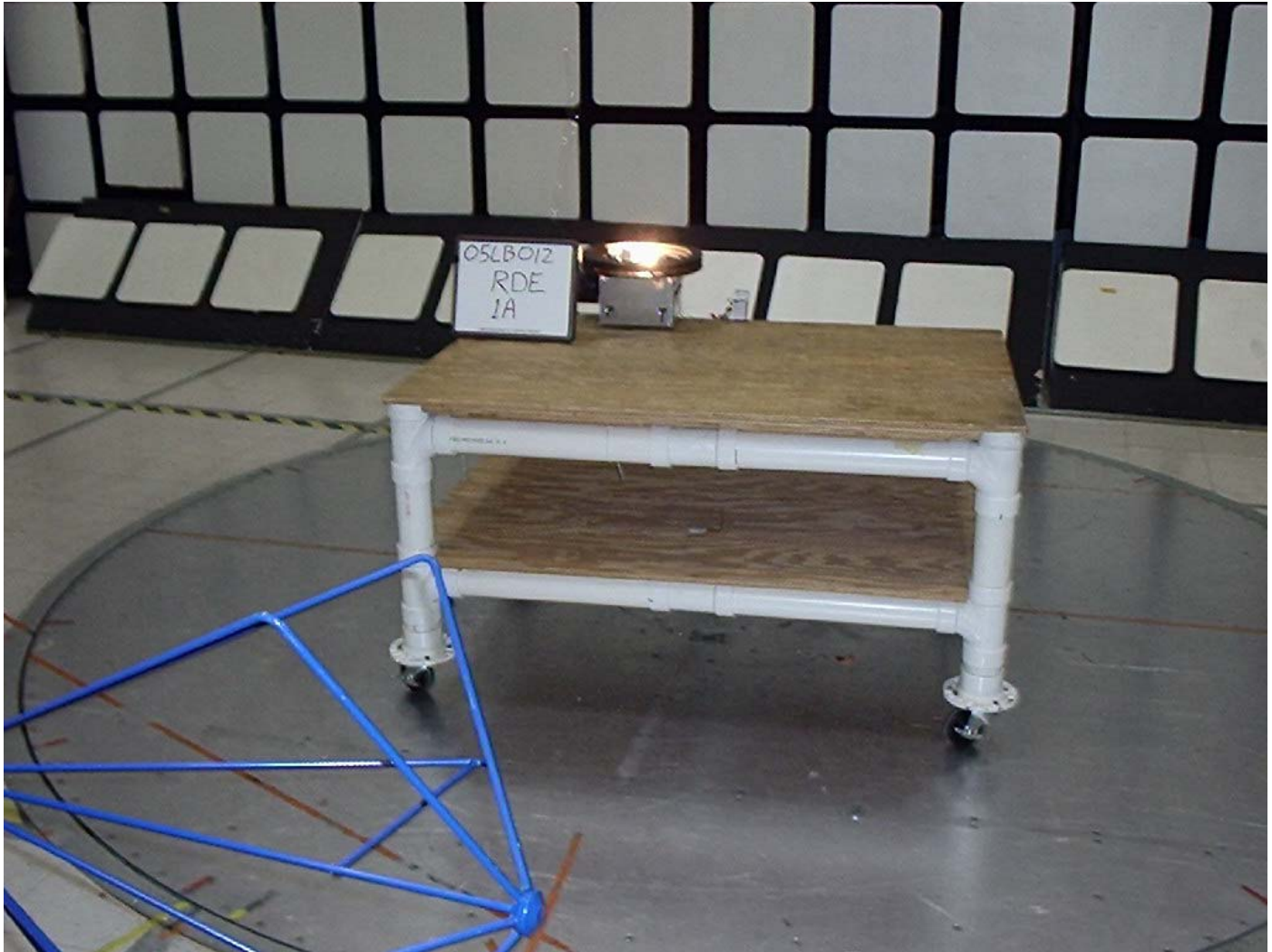
Test No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB [uVolts/meter]	Limit:1
=====						
Range: 3 200 - 1000MHz -----						
6	301.2506	37.31 pk	-27.8	13.9	23.41	46
		Height:248 Vert		Margin [dB]		-22.59
7	293.2466	37.26 pk	-27.9	13.9	23.26	46
		Height:248 Vert		Margin [dB]		-22.74

Range: 4 200 - 1000MHz -----						
1	293.2466	43.58 pk	-27.9	13.9	29.58	46
		Height:101 Horz		Margin [dB]		-16.42
2	301.2506	41.35 pk	-27.8	13.9	27.45	46
		Height:101 Horz		Margin [dB]		-18.55
3	285.2426	41.95 pk	-27.9	13.7	27.75	46
		Height:101 Horz		Margin [dB]		-18.25
4	325.6628	40.04 pk	-27.6	14.8	27.24	46
		Height:101 Horz		Margin [dB]		-18.76
5	277.2386	41.22 pk	-28	13.7	26.92	46
		Height:101 Horz		Margin [dB]		-19.08

LIMIT 1: CLASS B (3M)
LIMIT 2: NONE
LIMIT 3: NONE
LIMIT 4: NONE

Test 1, Item Worst-case orientation - Test Set-Up Photo:

Radiated Disturbance Emissions - 30 MHz to 1000 MHz



Test 1, Item Worst-case orientation - 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
Canada RSS-210, Issue 5, Amendment 4

Test Specification: 47 CFR Part 15, Subpart C, Section 15.209 and 15.231
Canada RSS-210, Issue 5, Amendment 4, Section 6.2.2(t1) and 6.1.1(e)

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/RSS-210 Issue 5, Amendment 4 Section 6.1.1

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):

This product operates at:

X 350 MHz

- At harmonics (1750, 2100, 2450, 3150, and 3500 MHz) peak limit is 77.5 dBuV/m and average is 57.5 dBuV/m.
- At harmonics in restricted bands (1050, 1400 and 2800 MHz) peak limit is 74.0 dBuV/m and avg limit is 54.0 dBuV/m.

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 (Transmitting)	1 (EUT Vertical)	1
B	0	Enclosure	1 (Transmitting)	2 (EUT Horizontal)	1
C	0	Enclosure	2 (Not Transmitting)	1 (EUT Vertical)	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	A	30	24.5	100	P	1/25/05	
B	A	30	24.5	100	P	1/25/05	
C	A	30	24.5	100	P	1/25/05	1

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

Comments:

Comment #	Description
1	Demonstrates compliance of receiver to FCC Class B limits.

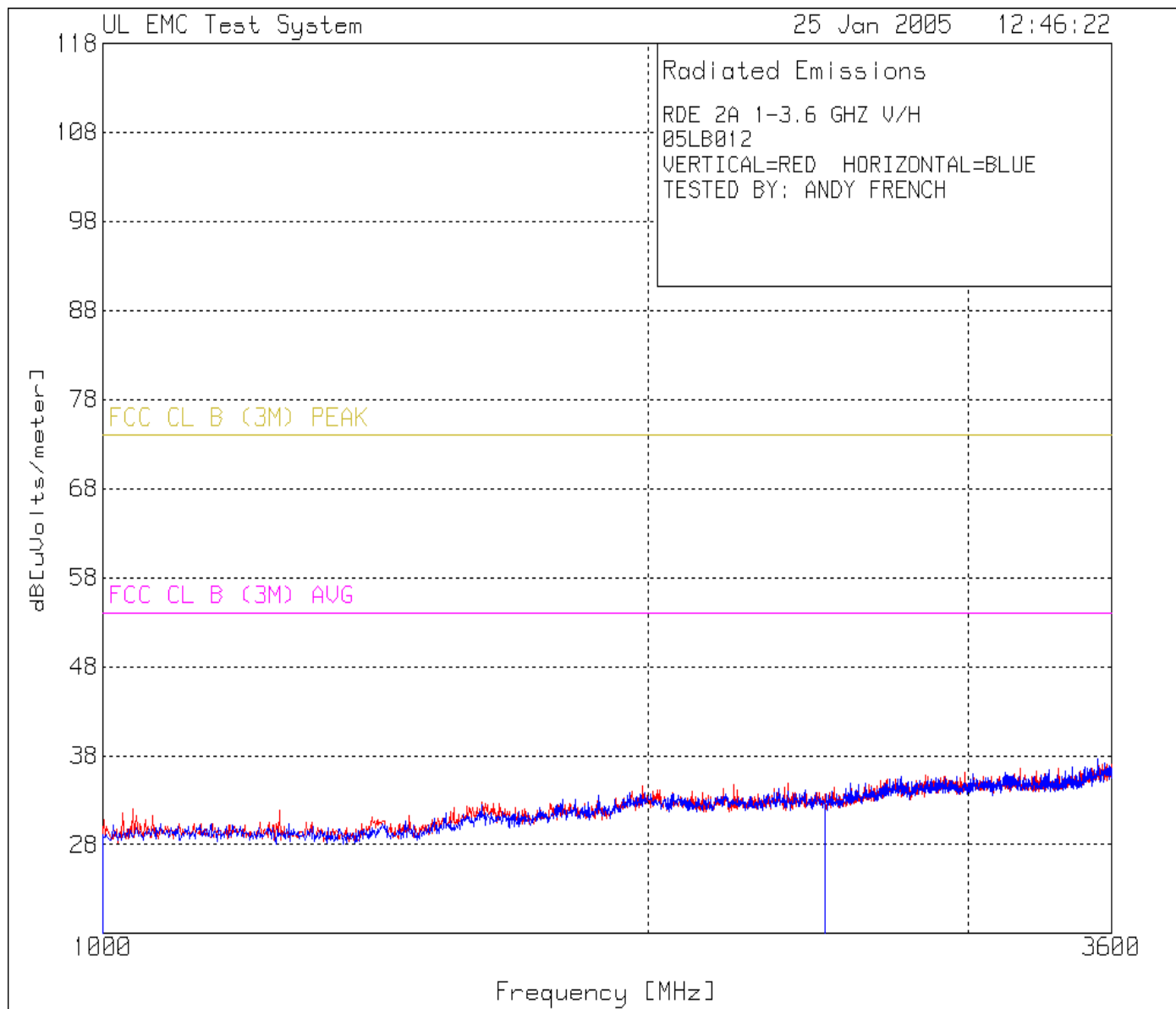
Test 2 - Test Equipment Used: Radiated Disturbance Emissions - Above 1 GHz

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0026	Horn Antenna, 1 to 18 GHz	EMC Test Systems	3115	6/8/04	6/31/05
ATA096	50 ft, N male - N male	Micro-Coax	Coaxial Cable	6/25/04	2/28/05
ATA143	Cable, 6ft., N-male to N-male	Micro-Coax	N/A	8/25/04	2/28/05
ATA152	27 ft. N male - N male low loss cable	Micro-Coax	UFB293C-0-3149-50504	2/21/04	2/29/05
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/14/04	10/31/05
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	12/02/04	12/31/05

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

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

Radiated Disturbance Emissions - Above 1 GHz



Test 2, Item A - EUT Vertical Orientation - Discrete Data:

Radiated Disturbance Emissions - Above 1 GHz

UL EMC Test System

25 Jan 2005 12:46:22

RDE 2A 1-3.6 GHZ V/H
05LB012
VERTICAL=RED HORIZONTAL=BLUE
TESTED BY: ANDY FRENCH

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1 2
=====						
Range: 1 1000 - 2500MHz -----						
1	1198.198	38.77 pk	-33.1	24.5	30.17	54
		Height:101 Vert		Margin [dB]		-23.83
2	1872.372	38.1 pk	-32	26.8	32.9	54
		Height:101 Vert		Margin [dB]		-21.1
3	2481.982	37.27 pk	-31.7	28.3	33.87	54
		Height:150 Vert		Margin [dB]		-20.13

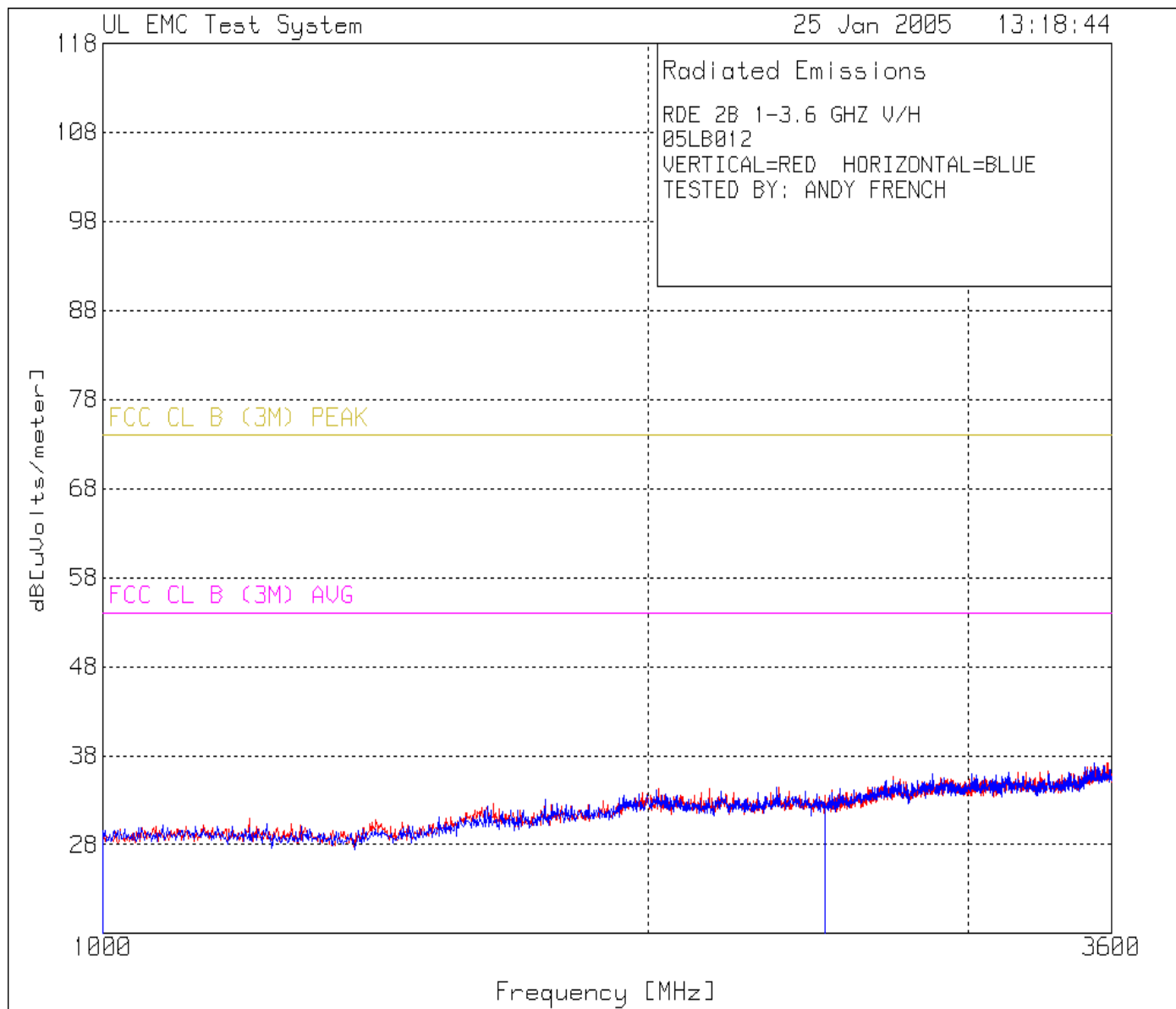
Range: 2 1000 - 2500MHz -----						
4	1393.393	37.51 pk	-32.6	24.9	29.81	54
		Height:149 Horz		Margin [dB]		-24.19
5	1821.321	38.26 pk	-31.8	26.6	33.06	54
		Height:149 Horz		Margin [dB]		-20.94
6	2438.438	37.57 pk	-31.6	28.2	34.17	54
		Height:100 Horz		Margin [dB]		-19.83

LIMIT 1: NONE
LIMIT 2: FCC CL B (3M) AVG
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

Note: With peak-to-average reduction of -9.5 dB applied, no spurious emissions observed above 1 GHz within 20 dB of the 15.231 limit or 15.209 general limit.

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

Radiated Disturbance Emissions - Above 1 GHz



Test 2, Item B - EUT Horizontal Orientation - Discrete Data:

Radiated Disturbance Emissions - Above 1 GHz

UL EMC Test System

25 Jan 2005 13:18:44

RDE 2B 1-3.6 GHZ V/H
05LB012
VERTICAL=RED HORIZONTAL=BLUE
TESTED BY: ANDY FRENCH

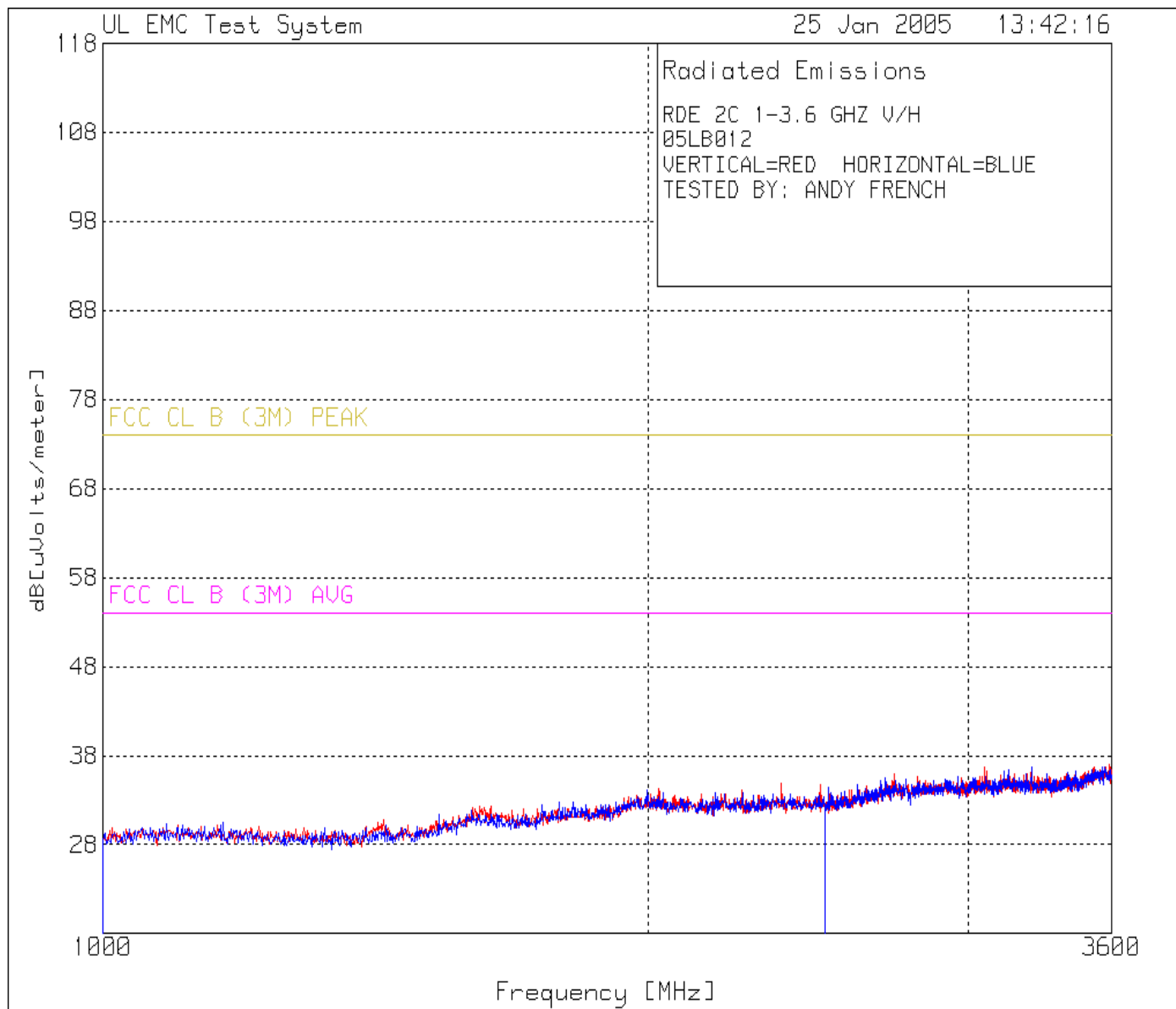
Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2
=====							
Range: 1 1000 - 2500MHz -----							
1	1204.204	39.62 pk	-33.1	24.5	31.02	54	
		Height:101 Vert		Margin [dB]			-22.98
2	1812.312	37.59 pk	-31.7	26.5	32.39	54	
		Height:101 Vert		Margin [dB]			-21.61
3	2297.297	37.53 pk	-31.9	27.9	33.53	54	
		Height:150 Vert		Margin [dB]			-20.47
Range: 2 1000 - 2500MHz -----							
4	1156.156	38.8 pk	-33.1	24.4	30.1	54	
		Height:150 Horz		Margin [dB]			-23.9
5	1630.631	38.52 pk	-31.9	25.7	32.32	54	
		Height:150 Horz		Margin [dB]			-21.68
6	2073.574	37.91 pk	-31.9	27.5	33.51	54	
		Height:100 Horz		Margin [dB]			-20.49

LIMIT 1: NONE
LIMIT 2: FCC CL B (3M) AVG
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

Note: With peak-to-average reduction of -9.5 dB applied, no spurious emissions observed above 1 GHz within 20 dB of the 15.231 limit or 15.209 general limit.

Test 2, Item C - Not Transmitting - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - Above 1 GHz



Test 2, Item C - Not Transmitting - Discrete Data:

Radiated Disturbance Emissions - Above 1 GHz

UL EMC Test System

25 Jan 2005 13:42:16

RDE 2C 1-3.6 GHZ V/H
05LB012
VERTICAL=RED HORIZONTAL=BLUE
TESTED BY: ANDY FRENCH

Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1 2
=====						
Range: 1 1000 - 2500MHz -----						
1	1418.919	38.23 pk	-32.6	24.9	30.53	54
		Height:101 Vert		Margin [dB]		-23.47
2	2205.706	37.64 pk	-31.8	27.8	33.64	54
		Height:101 Vert		Margin [dB]		-20.36
3	2487.988	38.14 pk	-31.7	28.3	34.74	54
		Height:150 Vert		Margin [dB]		-19.26

Range: 2 1000 - 2500MHz -----						
4	1207.207	38 pk	-33	24.5	29.5	54
		Height:100 Horz		Margin [dB]		-24.5
5	1746.246	38.21 pk	-31.9	26.2	32.51	54
		Height:100 Horz		Margin [dB]		-21.49
6	2340.841	37.53 pk	-31.8	28	33.73	54
		Height:100 Horz		Margin [dB]		-20.27

LIMIT 1: NONE
LIMIT 2: FCC CL B (3M) AVG
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

Test 3: Radiated Disturbance Emissions - Occupied Bandwidth

Test Requirement: 47 CFR Part 15, Subpart C
Canada RSS-210, Issue 5, Amendment 4

Test Specification: 47 CFR Part 15, Subpart C, Section 15.231
Canada RSS-210, Issue 5, Amendment 4, Section 6.1.1(c)

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 is initially set to a large value (e.g. 100 kHz) to obtain a field strength measurement encompassing all, or nearly all, of the transmit spectrum. The reference line is placed at a level 20 dB below this peak. Next the Resolution Bandwidth is reduced until the Resolution Bandwidth is 1% to 3% of the spectrum above the reference line. Then the left and right points of the signal on the reference line are marked. This is the 99% bandwidth.

Occupied Bandwidth Limit - Manually Operated Transmitter FCC Part 15, Section 15.231
and Canada RSS-210 Section 6.1.1(c)

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 (Transmitting)	1 (EUT Vertical)	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	X	30	24.5	100	P	1/25/05	1

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

Comments:

Comment #	Description

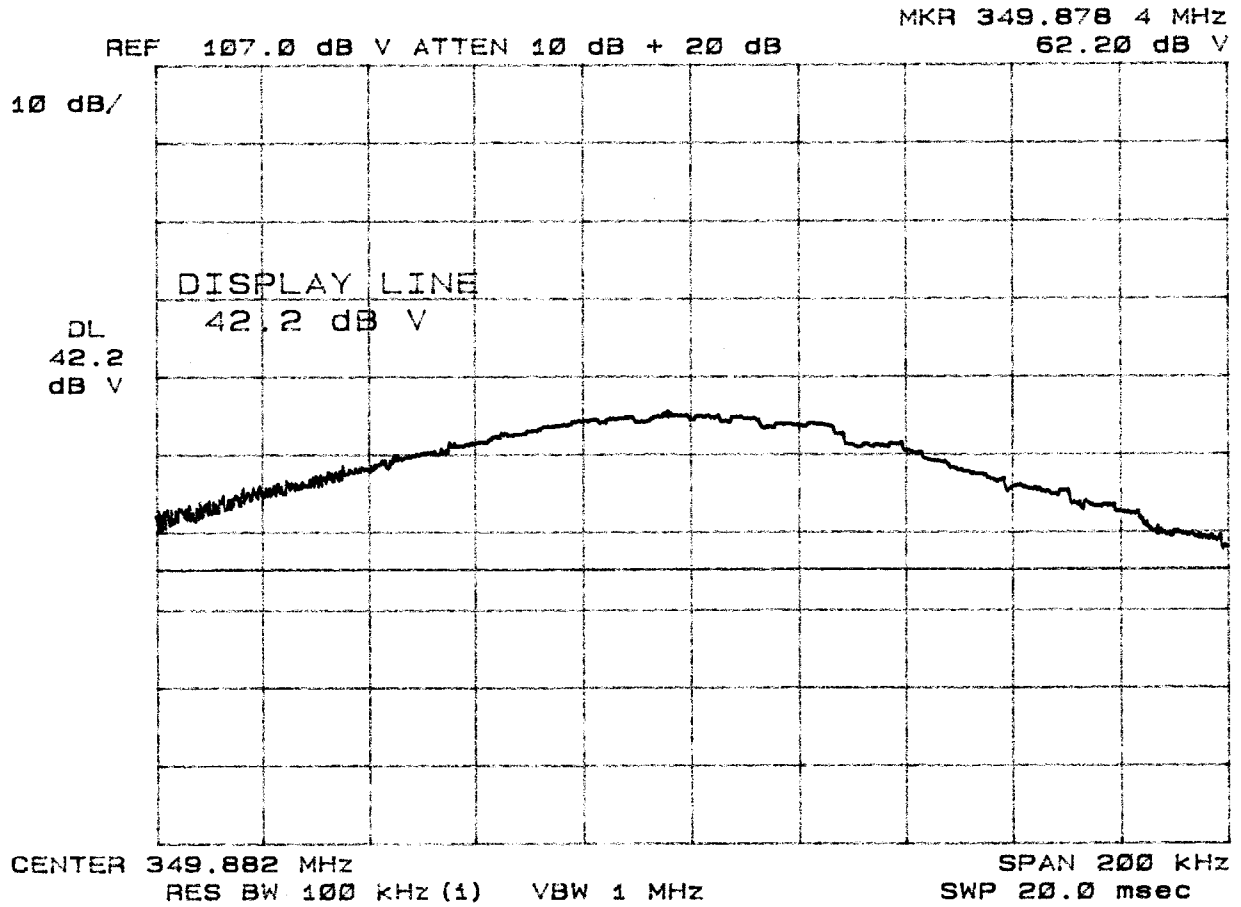
Test 3 - Test Equipment Used: Radiated Disturbance Emissions - Occupied Bandwidth

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/14/04	10/31/05
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/2/04	2/28/05

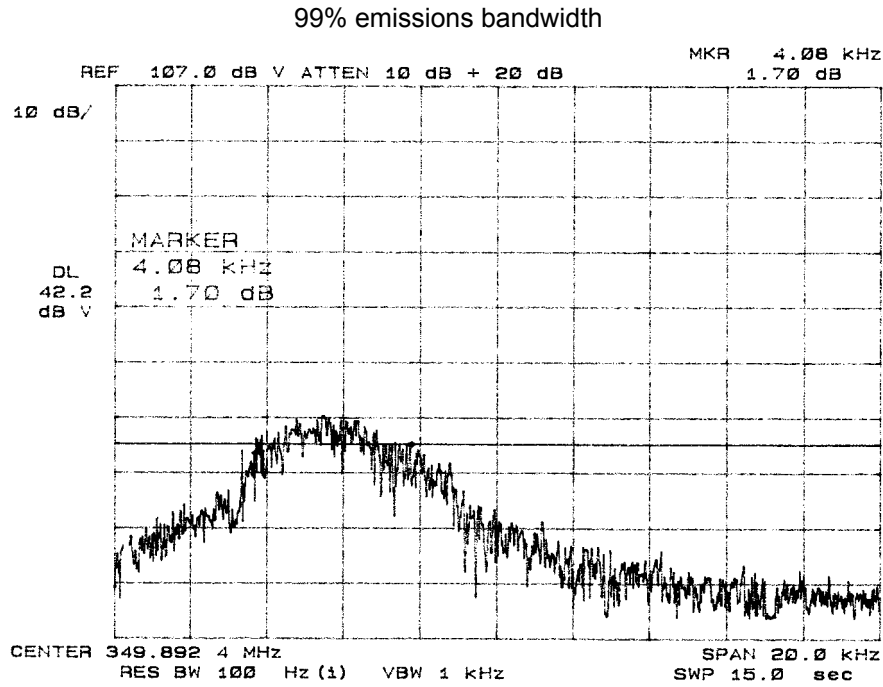
The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

Test 3, Item A:

Wide bandwidth measurement



Test 3, Item A:



:

Test Item (A-Z)	Center Frequency (MHz)	Occupied Bandwidth (MHz)	Bandwidth (% of Center Frequency)	Maximum Permitted Bandwidth (% of Center Frequency)	Pass/Fail (P/F)	Comment (#)
A	349.892	0.00408	0.0012%	0.25%	P	

Test 4: Radiated Disturbance Emissions - Peak-to-Average Ratio / Turn-off Delay

Test Requirement: 47 CFR Part 15, Subpart C
Canada RSS-210, Issue 5, Amendment 4

Test Specification: 47 CFR Part 15, Subpart C, Section 15.231
Canada RSS-210, Issue 5, Amendment 4, Section 6.5, 6.1.1(a)(1), and 6.1.1(a)(2)

Test Procedure:

Peak-to-Average Ratio: The test was performed in accordance with the Test Requirement and Specification and configured as noted in the Test Setup. This test is performed as a benchtop measurement by means of a small rod antenna attached to the spectrum analyzer input.

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 for this test, however the result of this test is used to calculate average values for the remaining measurements.

Turn-off Delay: Manually activated transmissions must not transmit more than 5 seconds beyond release of button. Automatically activated transmissions must not transmit longer than 5 seconds from beginning to end.

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 (Transmitting)	1 (EUT Vertical)	1

Test 4 - Results: Radiated Disturbance Emissions - Peak-to-Average Ratio / Turn-off Delay

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (°C)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	X	30	24.5	100	P	1/25/05	

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

Comments:

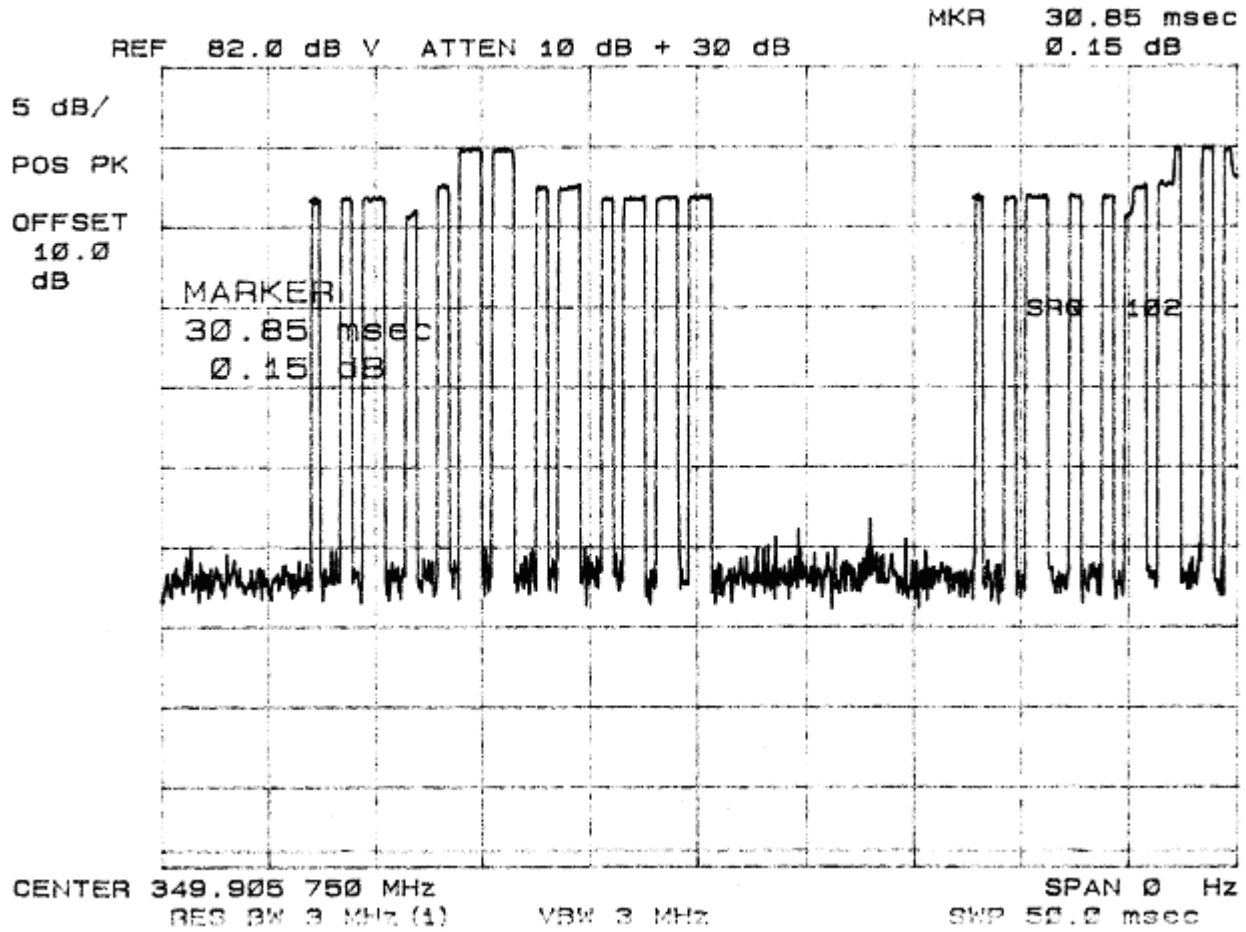
Comment #	Description

Test 4 - Test Equipment Used: Radiated Disturbance Emissions - Peak-to-Average Ratio / Turn-off Delay

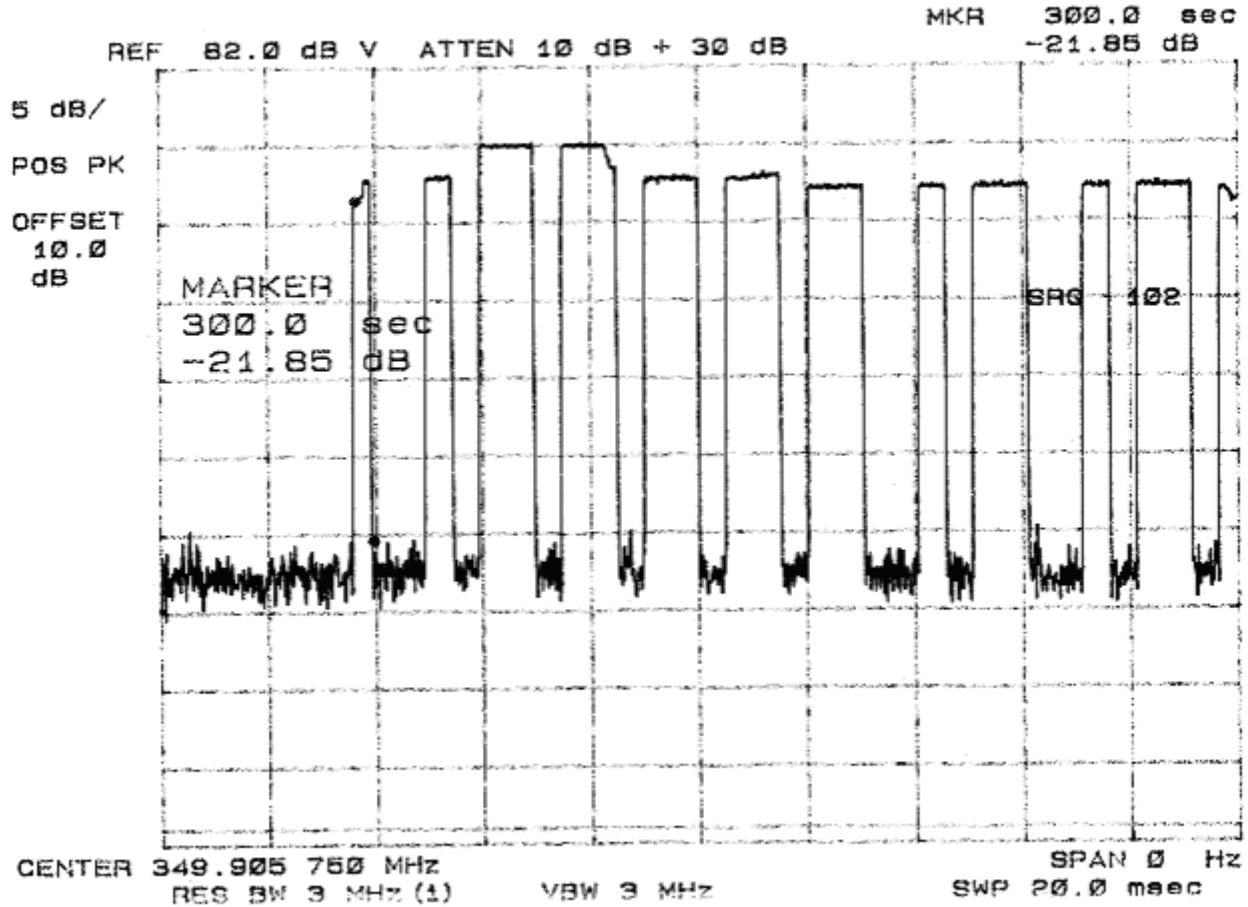
Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/14/04	10/31/05
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/2/04	2/28/05

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

Test 4, Full Cycle Duration:

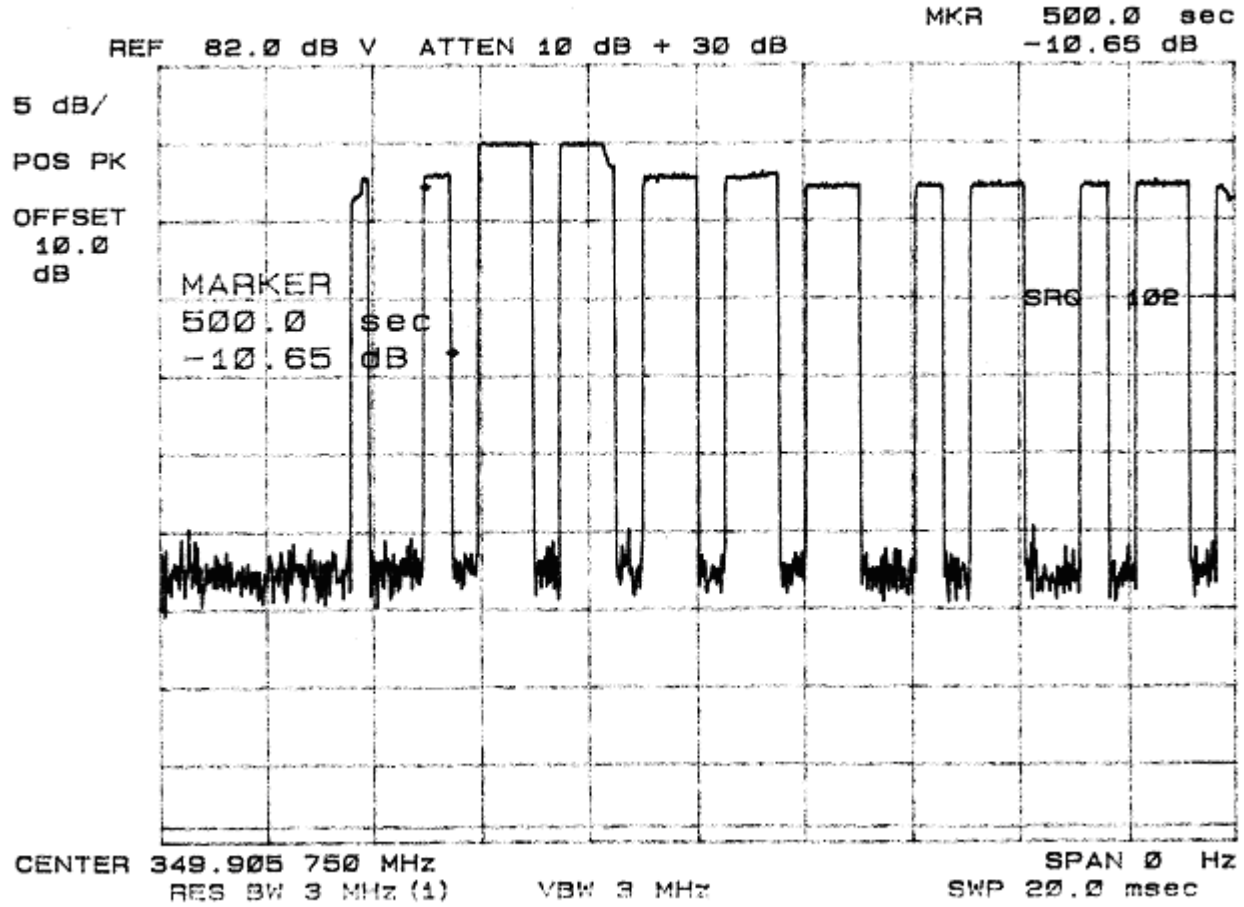


Test 4, Header Pulse Duration - Peak Plot:



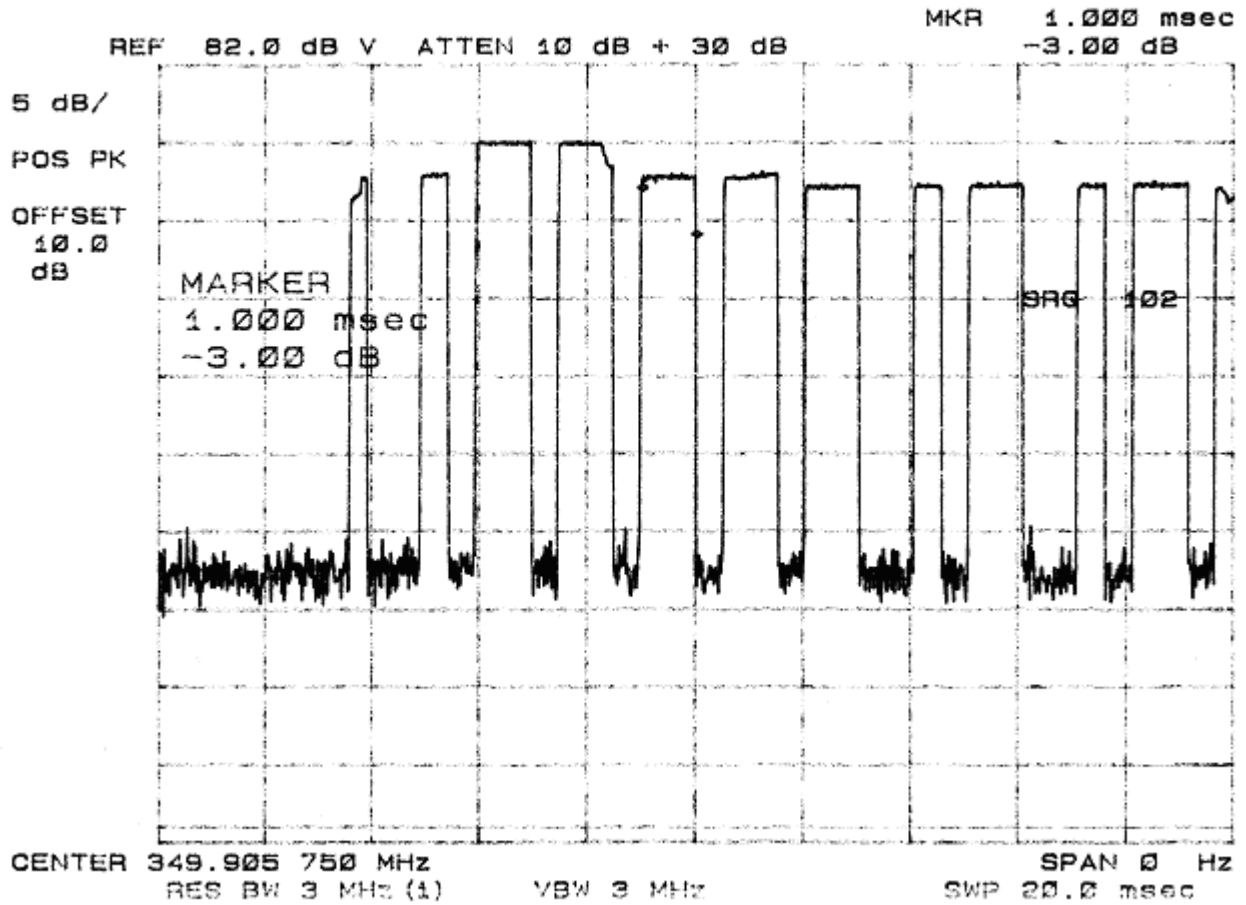
Note: Pen plotter does not print the character "μ". Header pulse duration is 300 microseconds.

Test 4, Short Pulse Duration - Peak Plot:



Note: Pen plotter does not print the character "μ". Short pulse duration is 500 microseconds.

Test 4, Long Pulse Duration - Peak Plot (Amplitude in dBuV):



Test 4, Peak-to-Average Calculation:

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	Header	1	0.30	0.30	1
A	Short	4	0.50	2.00	1
A	Long	8	1.00	8.00	1
			Total ON Time per period (ms)	10.30	
			Total Cycle Time (ms)*	30.85	
			Duty Cycle (fraction)	0.334	
			Duty Cycle (dB)**	-9.5	

* Or 100 milliseconds, whichever is less

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

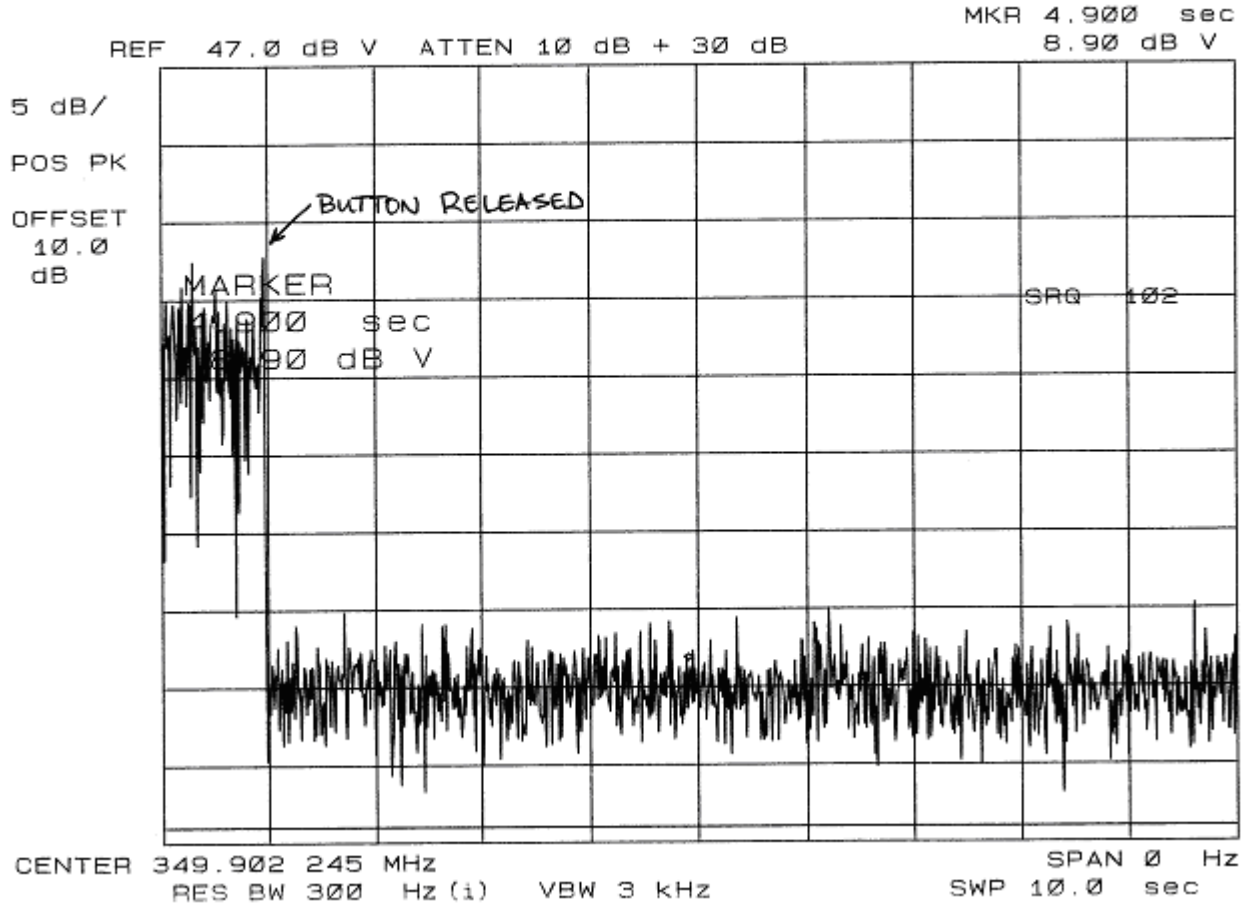
*** # = See Comment Number Under The Preceeding Test Comments Section.

Comments:

Comment #	Description
1	Worst-case addressing and button selection results in 8 long, 4 short, and 1 header pulse

Test 4, Turnoff Delay – “Lamp On/Off” Button:

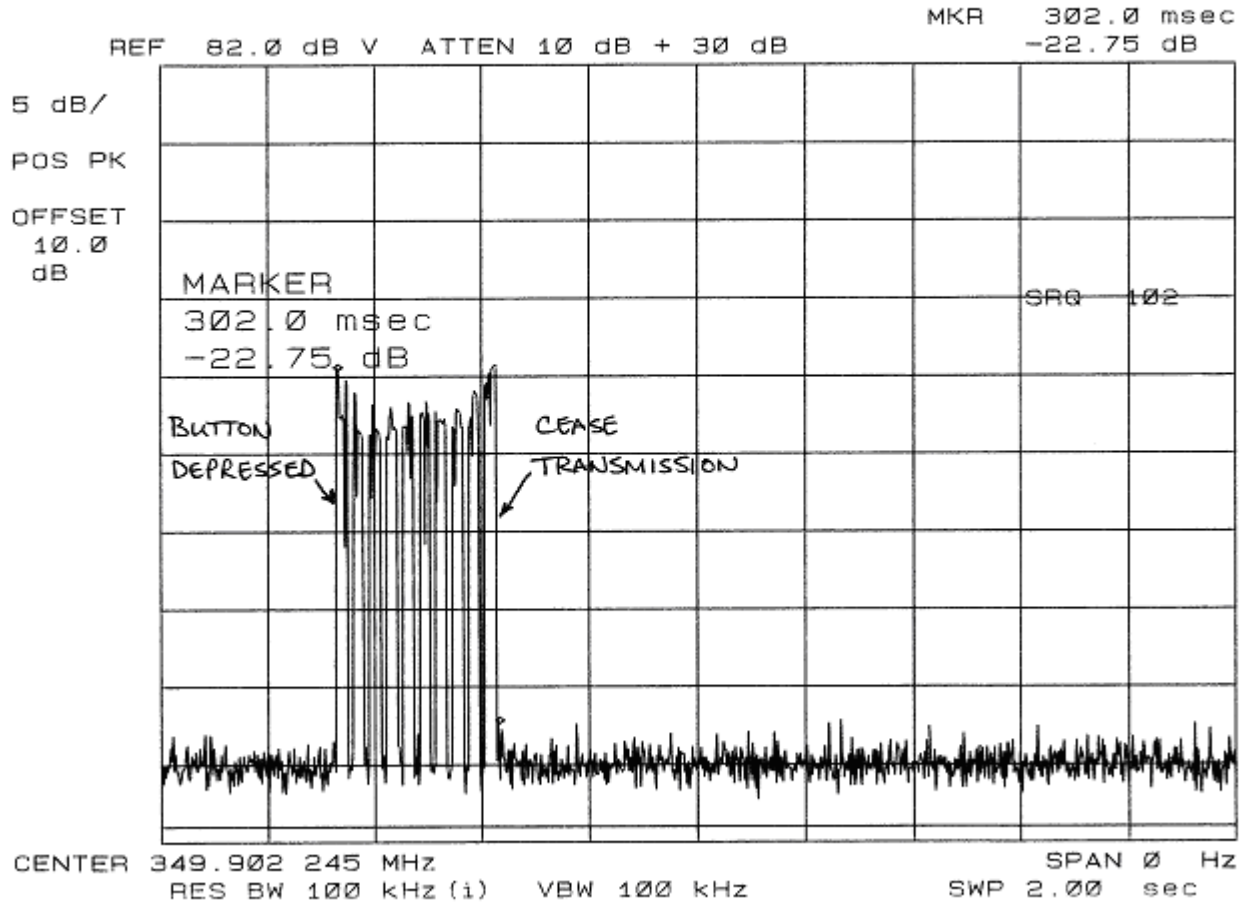
Radiated Disturbance Emissions - Peak-to-Average Ratio



Note: No delay. Transmission ceased immediately. This complies with the 5 second limit.

Test 4, Turnoff Delay – “Delay Off” Button:

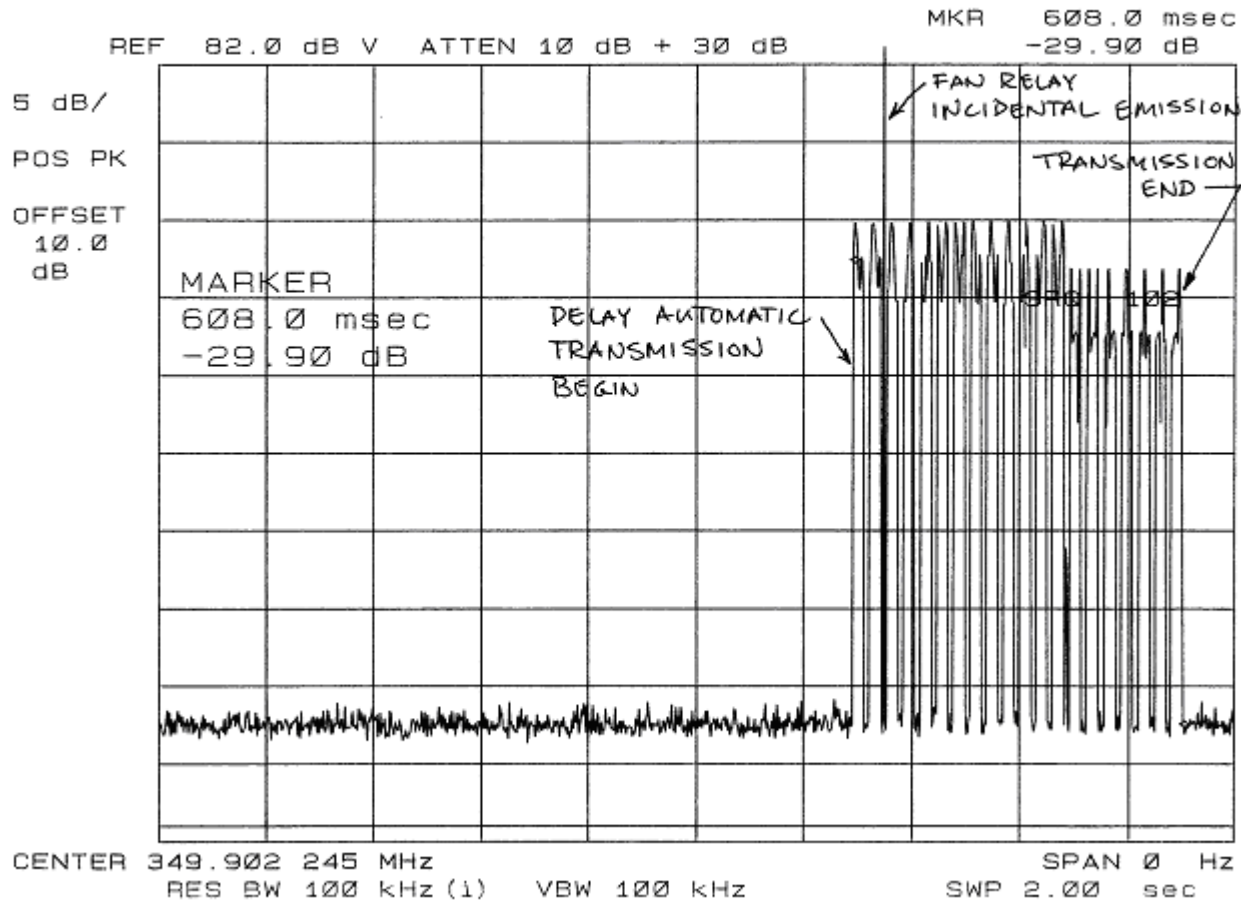
Radiated Disturbance Emissions - Peak-to-Average Ratio



Note: Transmissions ceases 302 ms after release of button. This complies with the 5 second limit.

Test 4, Turnoff Delay – “Delay Off” Button Automatically Activated Transmission:

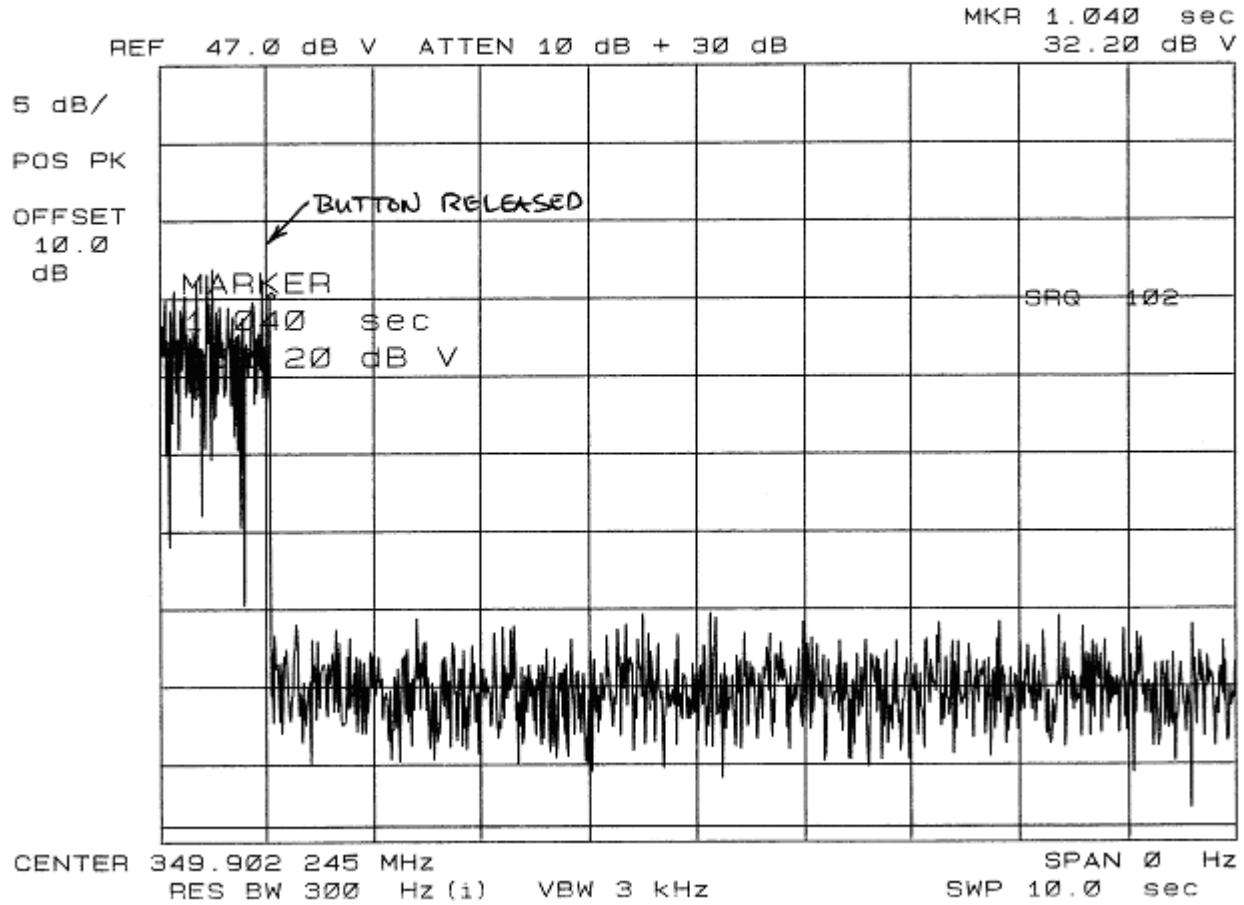
Radiated Disturbance Emissions - Peak-to-Average Ratio



Note: Automatically activated transmissions lasts 608 ms in duration. This complies with the 5 second limit.

Test 4, Turnoff Delay – “Fan On/Off” Button - Peak Plot (Amplitude in dBuV):

Radiated Disturbance Emissions - Peak-to-Average Ratio



Note: No delay. Transmission ceased immediately. This complies with the 5 second limit.

Test 5: Conducted Disturbance Emissions - Voltage

Test Requirement: 47 CFR Part 15, Subpart B
Canada ICES-003

Test Specification: CISPR 22:1997 Class B
Canada ICES-003

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.

Conducted Disturbance Emission Limits For
Mains Terminals of Class B Equipment

Frequency MHz	Quasi-Peak Limit dB μ V	Average Limit dB μ V
0.15 - 0.50	66 to 56*	56 to 46*
0.50 - 5	56	46
5 - 30	60	50

* Limit decreases linearly with the logarithm of the 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	1	AC Mains	1 (Transmitting)	1 (EUT Vertical)	1
B	1	AC Mains	2 (Not transmitting/receiver)	1 (EUT Vertical)	1

Test 5 - 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	32	24	100	P	1/25/05	1
B	D	32	24	100	P	1/25/05	1

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

Comments:

Comment #	Description
1	Broadband emissions from transmitter power supply are disregarded as an incidental radiator.

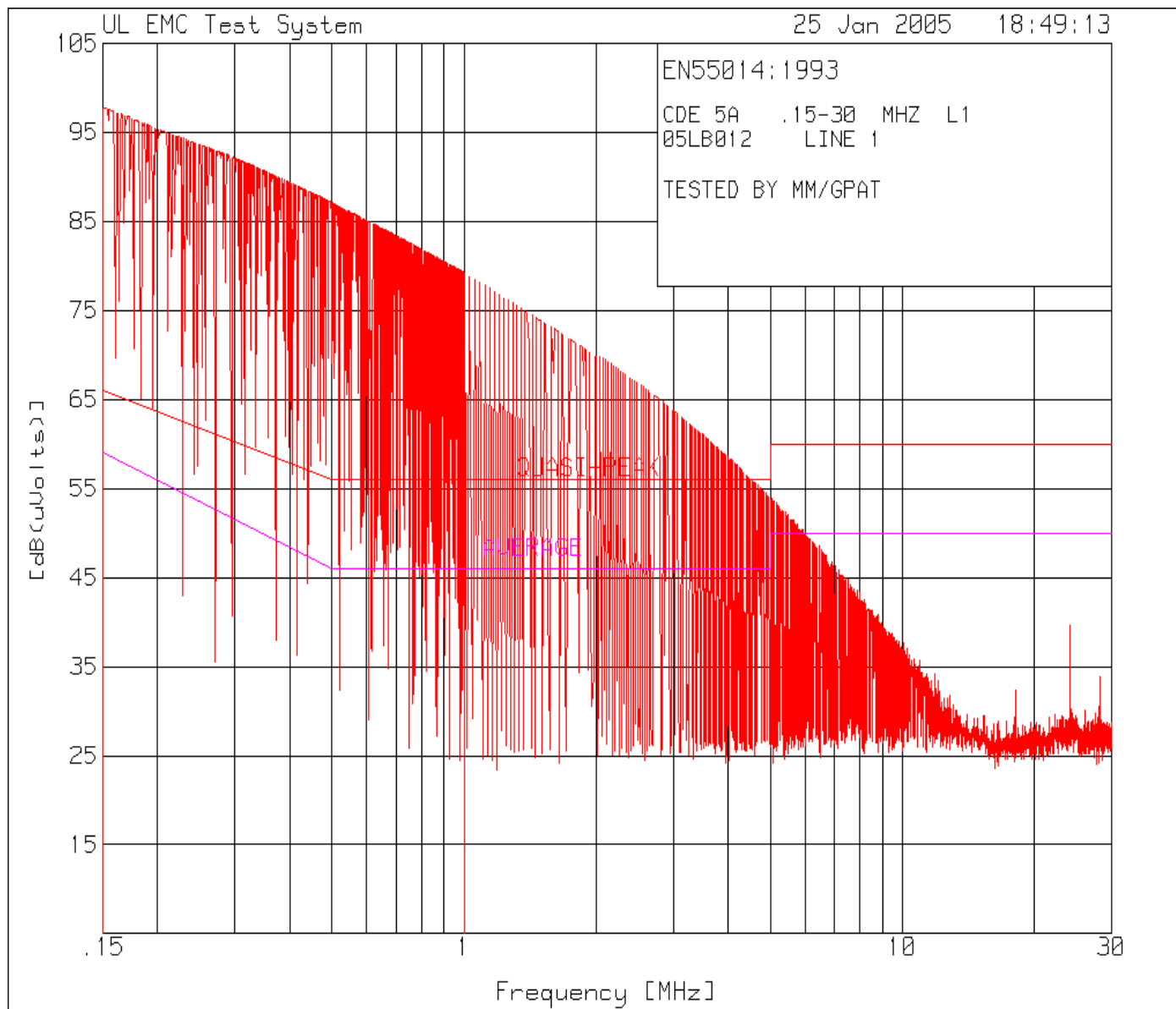
Test 5 - Test Equipment Used: Conducted Disturbance Emissions - Voltage

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
ATA001	Transient Limiter, 0.009 to 100 MHz	Electro-Metrics	EM-7600	9/9/04	9/30/05
ATA013	20 ft Cable, BNC - BNC	UL	RG-223	2/18/04	2/28/05
ATA064	LISN, 150 kHz to 30 MHz	Solar Electronics	9629-50-TS-25-BNC	4/30/04	4/30/05
ATA065	LISN, 150 kHz to 30 MHz	Solar Electronics	9629-50-TS-25-BNC	4/23/04	4/30/05
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/14/04	10/31/05
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	12/02/04	12/31/05

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

Test 5, Item A - RF Active - Line Conductor - Peak Plot:

Conducted Disturbance Emissions - Voltage



Note: All significant emissions shown below 15 MHz are determined to be incidental emissions from rectifier turn on of linear 60 Hz power circuit. This is considered to be an incidental emission, not unintentional emissions from a digital device, and therefore not subject to FCC Part 15 limits.

Test 5, Item A - RF Active - Line Conductor - Frequency Table:

Conducted Disturbance Emissions - Voltage

CDE 5A .15-30 MHZ L1							
05LB012 LINE 1							
Test Frequency [MHz]	Meter Reading [dB (uV)]	Cable/Filter Factor [dB]	LISN Factor [dB]	Level [dB (uV)]	Limit:1	2	
.15	87.14 pk	10.5	.1	97.74	66	59	*
			Margin [dB]		31.74	38.74	
.20871	84.44 pk	10.5	.1	95.04	63.3	55.4	*
			Margin [dB]		31.74	39.64	
.37634	79.41 pk	10.5	.1	90.01	58.4	49.1	*
			Margin [dB]		31.61	40.91	
.61885	74.15 pk	10.5	.1	84.75	56	46	*
			Margin [dB]		28.75	38.75	
1.75438	61.14 pk	10.5	.1	71.74	56	46	*
			Margin [dB]		15.74	25.74	
3.13257	52.33 pk	10.6	.1	63.03	56	46	*
			Margin [dB]		7.03	17.03	
6.00502	39.2 pk	10.6	.1	49.9	60	50	*
			Margin [dB]		-10.1	-.1	
7.7604	32.98 pk	10.7	.1	43.78	60	50	*
			Margin [dB]		-16.22	-6.22	
24.0013	28.8 pk	10.8	.2	39.8	60	50	**
			Margin [dB]		-20.2	-10.2	

CDE 5A .15-30 MHZ L1							
05LB012 LINE 1							
Test Frequency [MHz]	Meter Reading [dB (uV)]	Cable/Filter Factor [dB]	LISN Factor [dB]	Level [dB (uV)]	Limit:1	2	
.151	78.59 qp	10.5	.1	89.19	65.9	58.9	*
			Margin [dB]:		23.29	30.29	

LIMIT 1: QUASI-PEAK

LIMIT 2: AVERAGE

* Emissions from linear power circuit regarded as incidental radiator. Limit does not apply

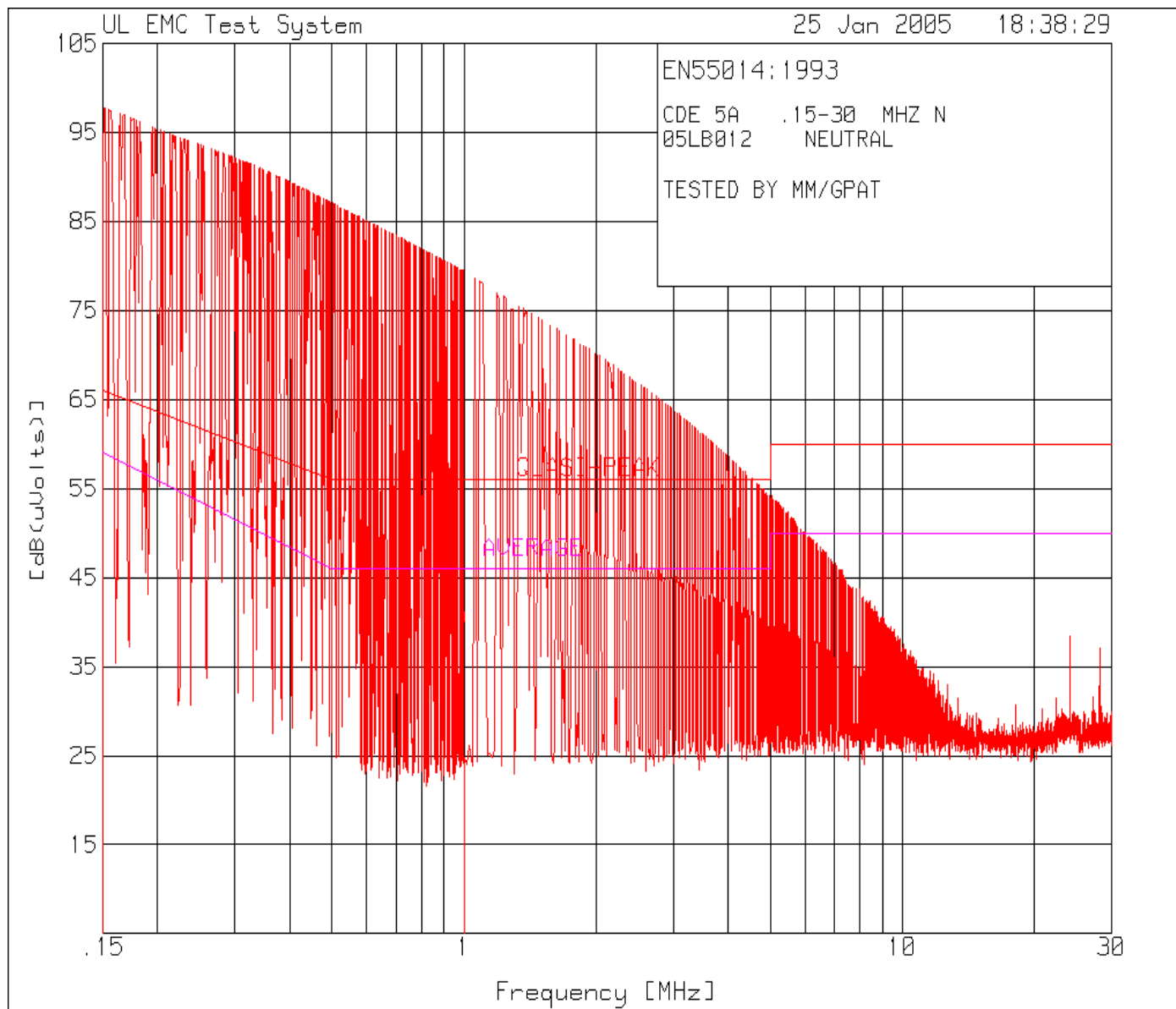
** Worst Case Conducted Emissions observed
39.8 dBuV = 97.7 uV @ 24.0013 MHz

pk - Peak detector

qp - Quasi-Peak detector

Test 5, Item A - RF Active - Neutral Conductor - Peak Plot:

Conducted Disturbance Emissions - Voltage



Note: All significant emissions shown below 15 MHz are determined to be incidental emissions from rectifier turn on of linear 60 Hz power circuit. This is considered to be an incidental emission, not unintentional emissions from a digital device, and therefore not subject to FCC Part 15 limits.

Test 5, Item A - RF Active - Neutral Conductor - Frequency Table:

Conducted Disturbance Emissions - Voltage

CDE 5A .15-30 MHZ N
05LB012 NEUTRAL

Test Frequency [MHz]	Meter Reading [dB (uV)]	Cable/Filter Factor [dB]	LISN Factor [dB]	Level [dB (uV)]	Limit:1	2	
.15681	86.89 pk	10.5	.1	97.49	65.6	58.5	*
			Margin [dB]		31.89	38.99	
.35932	79.93 pk	10.5	.1	90.53	58.7	49.6	*
			Margin [dB]		31.83	40.93	
.58651	74.64 pk	10.5	.1	85.24	56	46	*
			Margin [dB]		29.24	39.24	
.80434	71.38 pk	10.5	0	81.88	56	46	*
			Margin [dB]		25.88	35.8	
1.1886	66.49 pk	10.5	0	76.99	56	46	*
			Margin [dB]		20.99	30.99	
2.10256	58.86 pk	10.5	.1	69.46	56	46	*
			Margin [dB]		13.46	23.46	
5.64345	40.88 pk	10.6	.1	51.58	60	50	*
			Margin [dB]		-8.42	1.58	
9.00803	29.7 pk	10.7	.1	40.5	60	50	*
			Margin [dB]		-19.5	-9.5	
24.0013	27.2 pk	10.8	.2	38.2	60	50	
			Margin [dB]		-21.8	-11.8	

CDE 5A .15-30 MHZ L1
05LB012 LINE 1

Test Frequency [MHz]	Meter Reading [dB (uV)]	Cable/Filter Factor [dB]	LISN Factor [dB]	Level [dB (uV)]	Limit:1	2	
.1568	78.93 qp	10.5	.1	89.53	65.9	58.5	*
			Margin [dB]:		23.93	31.03	

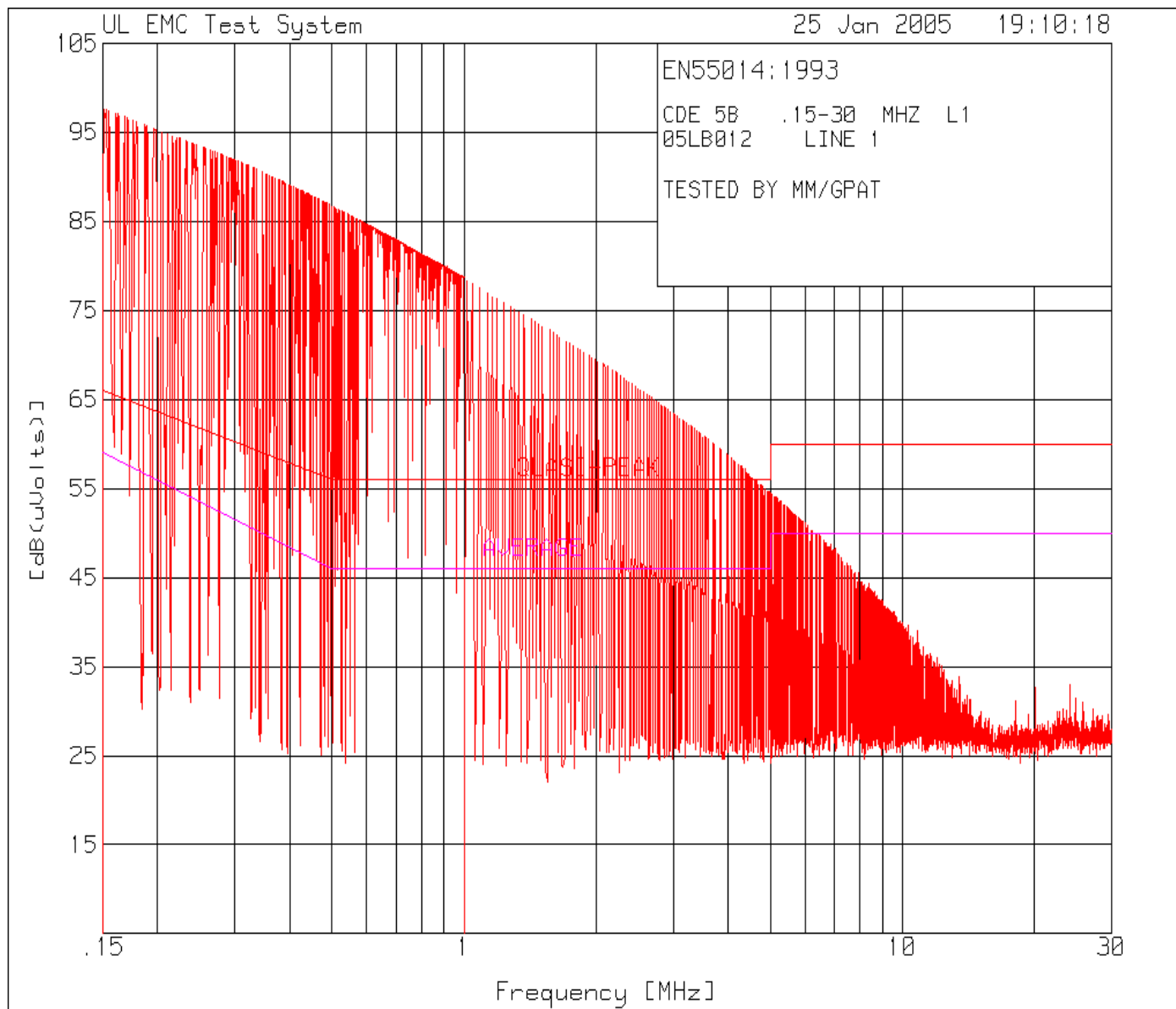
LIMIT 1: QUASI-PEAK
LIMIT 2: AVERAGE

* Emissions from linear power circuit regarded
as incidental radiator. Limit does not apply

pk - Peak detector
qp - Quasi-Peak detector
av - Average detector

Test 5, Item B - Not Transmitting, Line - Peak Plot:

Conducted Disturbance Emissions - Voltage



Note: All significant emissions shown below 15 MHz are determined to be incidental emissions from rectifier turn on of linear 60 Hz power circuit. This is considered to be an incidental emission, not unintentional emissions from a digital device, and therefore not subject to FCC Part 15 limits.

Test 5, Item B - Not Transmitting, Line - Frequency Table:

Conducted Disturbance Emissions - Voltage

CDE 5B	.15-30	MHZ	L1				
05LB012	LINE	1					
Test Frequency [MHz]	Meter Reading [dB (uV)]	Cable/Filter Factor [dB]	LISN Factor [dB]	Level [dB (uV)]	Limit:1	2	
.15085	87.01 pk	10.5	.1	97.61	66	58.9	*
			Margin [dB]		31.61	38.71	
.18659	85.24 pk	10.5	.1	95.84	64.2	56.6	*
			Margin [dB]		31.64	39.24	
.46654	76.93 pk	10.5	.1	87.53	56.6	46.7	*
			Margin [dB]		30.93	40.83	
.84944	70.14 pk	10.5	0	80.64	56	46	*
			Margin [dB]		24.64	34.64	
1.56579	62.19 pk	10.5	.1	72.79	56	46	*
			Margin [dB]		16.79	26.79	
4.85894	44.26 pk	10.6	.1	54.96	56	46	*
			Margin [dB]		-1.04	8.96	
8.61633	32.59 pk	10.7	.1	43.39	60	50	*
			Margin [dB]		-16.61	-6.61	

CDE 5B	.15-30	MHZ	L1				
05LB012	LINE	1					
Test Frequency [MHz]	Meter Reading [dB (uV)]	Cable/Filter Factor [dB]	LISN Factor [dB]	Level [dB (uV)]	Limit:1	2	
.1509	78.75 qp	10.5	.1	89.35	66	58.9	*
			Margin [dB]:		23.35	30.45	

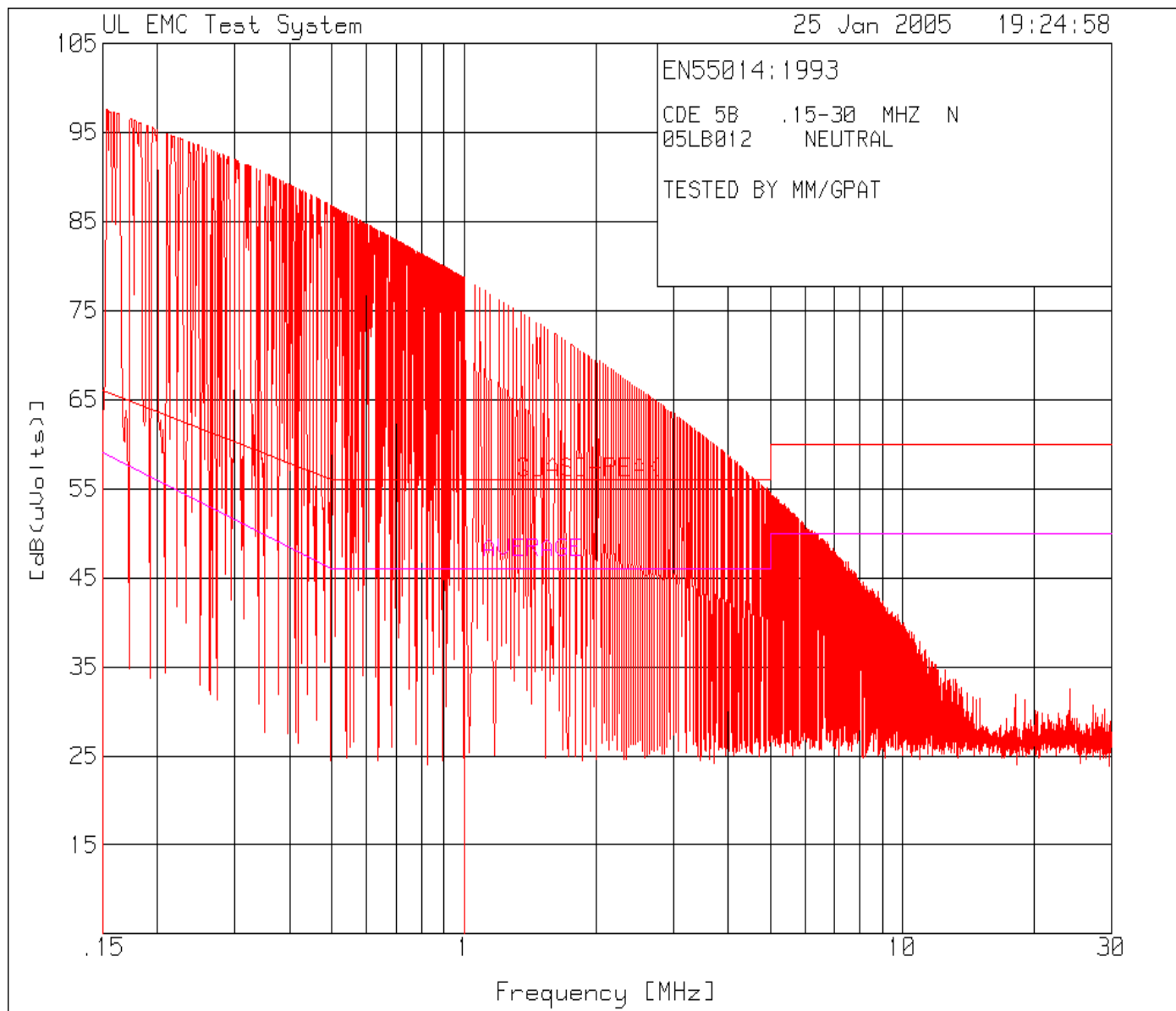
LIMIT 1: QUASI-PEAK
LIMIT 2: AVERAGE

* Emissions from linear power circuit regarded as incidental radiator. Limit does not apply.

pk - Peak detector
qp - Quasi-Peak detector

Test 5, Item B - Not Transmitting, Neutral - Peak Plot:

Conducted Disturbance Emissions - Voltage



Note: All significant emissions shown below 15 MHz are determined to be incidental emissions from rectifier turn on of linear 60 Hz power circuit. This is considered to be an incidental emission, not unintentional emissions from a digital device, and therefore not subject to FCC Part 15 limits.

Test 5, Item B - Not Transmitting - Neutral - Frequency Table:

Conducted Disturbance Emissions - Voltage

CDE 5B .15-30 MHZ N							
05LB012 NEUTRAL							
Test Frequency [MHz]	Meter Reading [dB (uV)]	Cable/Filter Factor [dB]	LISN Factor [dB]	Level [dB (uV)]	Limit:1	2	
=====							
.15255	86.93 pk	10.5	.1	97.53	65.9	58.8	*
			Margin [dB]		31.63	38.73	
.18319	85.45 pk	10.5	.1	96.05	64.3	56.8	*
			Margin [dB]		31.75	39.25	
.57545	74.58 pk	10.5	.1	85.18	56	46	*
			Margin [dB]		29.18	39.18	
2.72637	54.23 pk	10.6	.1	64.93	56	46	*
			Margin [dB]		8.93	18.93	
5.41022	42.34 pk	10.6	.1	53.04	60	50	*
			Margin [dB]		-6.96	3.04	
6.49101	38.72 pk	10.6	.1	49.42	60	50	*
			Margin [dB]		-10.58	-1.58	
8.26816	33.26 pk	10.7	.1	44.06	60	50	*
			Margin [dB]		-15.94	-5.94	

CDE 5B .15-30 MHZ N							
05LB012 NEUTRAL							
Test Frequency [MHz]	Meter Reading [dB (uV)]	Cable/Filter Factor [dB]	LISN Factor [dB]	Level [dB (uV)]	Limit:1	2	
=====							
.1526	78.74 qp	10.5	.1	89.34	65.9	58.8	*
			Margin [dB]:		23.44	30.54	

LIMIT 1: QUASI-PEAK
LIMIT 2: AVERAGE

* Emissions from linear power circuit regarded
as incidental radiator. Limit does not apply

pk - Peak detector
qp - Quasi-Peak detector
av - Average detector

Test 5, Item A - Worst-case Emissions arrangement - Test Set-Up Photo:

Conducted Disturbance Emissions - Voltage



Test 6: Radiated Disturbance Emissions - Restricted Bands

Test Requirement: 47 CFR Part 15, Subpart C
Canada RSS-210, Issue 5, Amendment 4

Test Specification: 47 CFR Part 15, Subpart C, Section 15.205
Canada RSS-210, Issue 5, Amendment 4, Section 6.2.2(t1)

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 and RSS-210 Issue 5, Amendment 4 Section 6.2.2(t1).

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

Test Results Summary:

All spurious emissions, including harmonics falling within restricted bands were observed to meet the general limits of 15.209 and RSS-210 Issue 5, Amendment 4, Section 6.2.2(t1).

Accreditation Certificates:

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

ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation

Revised Scope 12/10/2004
ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS
NVLAB LAB CODE 200246-0

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UNDERWRITERS LABORATORIES, INC.
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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)

June 30, 2005

Effective through

For the National Institute of Standards and Technology

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

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Scope of Accreditation

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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) & EN 61000-3-3, A1 (2001): 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, Edition 2.1 (2001) including Amds. 1 & 2 and EN 61000-4-2: Electrostatic Discharge Immunity Test
12/I02	IEC 61000-4-3, Edition 2.0 (2002-03) and EN 61000-4-3: Radiated Radio-Frequency Electromagnetic Field Immunity Test

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NVLAP Code Designation / Description

12/I03	IEC 61000-4-4 (1995) + Amd. 1 (2000) & Amd. 2 (2001) and EN 61000-4-4: Electrical Fast Transient/Burst Immunity Test
12/I04	IEC 61000-4-5, Edition 1.1 (2001-04) and EN 61000-4-5: Surge Immunity Test
12/I05	IEC 61000-4-6, Edition 2.0 (2003-05) and EN 61000-4-6: Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields
12/I06	IEC 61000-4-8, Edition 1.1 (2001) and EN 61000-4-8: Power Frequency Magnetic Field Immunity Test
12/I07	IEC 61000-4-11, Edition 1.1 (2001-03) and EN 61000-4-11: Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests

Safety Test Methods:

12/T41a	AS/NZS 60950 (2000): Safety of Information Technology Equipment (including Amdt1)
12/T50	AS/NZS 3260 (1993) + Supplement 1 (1996): 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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June 30, 2005

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ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS
NVLAB LAB CODE 200246-0

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NVLAP Code Designation / Description

12/76200a	SBC-TP-76200, Issue 4 (May 2003): Network Equipment Power, Grounding, Environmental, and Physical Design Requirements (sections: 6.1B, 7.1, 7.2, 7.3, 7.4, and 10.1 - 10.4B)
12/GR63a	GR-63-CORE, Issue 2 (April 2002): NEBS (TM) Requirements: Physical Protection (sections: 2, 3, 4.1, 4.2.3, 4.3, 4.4.1, 4.4.3, 4.4.4, 4.5, 4.6, and 4.7)

June 30, 2005

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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 • 1 meter measurement distance	+/- 3.8 dB +/- 2.3 dB	Volts/meter Volts/meter
Conducted Disturbance Emissions (9 kHz – 30 MHz):	+/- 3.4 dB	Volts
Electrostatic Discharge	+/- 2.2 %	Volts
Radiated RF Immunity (Chamber):	+/- 2.7 dB	Volts/meter
Electrical Fast Transients/Bursts Immunity	+/- 4.6 %	Volts
Surge Immunity	+/- 4.6 %	Volts
Conducted RF Immunity	+/- 2.8 dB	Volts
Power Frequency Magnetic Field Immunity	+/-13.6 %	Amps/meter
Voltage Dips and Short Interrupts	+/-4.2 %	Volts
Radiated RF Immunity (Tri-plate)	+/-3.2 %	Volts/meter
Disturbance Power (30 – 300 MHz)	+/-3.5%	Volts

CISPR 16-4:2000 Statement

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

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