

Underwriters Laboratories Inc.  
1285 Walt Whitman Road  
Melville, New York 11747-3081  
(631) 271-6200

**Report of Measurements  
of Electromagnetic Compatibility Testing**

Test Report File No.: **NC2219** Date of issue: 11/5/02  
Applicant: Lutron Electronics Co. Inc.  
Model: HRT-10KP  
Product Type: Wireless Tabletop Keypad  
Power Supply: 120Vac, 60Hz  
Manufacturer: Same As Applicant  
License holder: Same As Applicant  
Address: 7200 Sutron Road  
Coopersburg, PA 18036  
Test Type:  **Compliance Investigation**  
 **Manufacturer's Specification**  
Test Project Number: 02ME20017  
References(s): FCC ID: JPZ0021

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## 1.0 GENERAL - Product Description

**Device Function:** The HRT-10KP is a tabletop keypad. It contains a FM transceiver and an antenna. It is used as part of an integrated lighting control system. The purpose of the RF communication is to transmit and receive command signals. Transmitted commands allow the triggering of system events. Received commands allow for updating of control indicator status.

**RF Function:** The receiver down converts a 431-437MHz-carrier frequency using a 420.3-426.3MHz voltage-controlled oscillator producing a 10.7MHz IF signal. The signal is further processed to decode data. The transmitter uses the voltage-controlled oscillator, which is frequency modulated, and power amplifier to produce the modulated carrier. The HRT-10KP contains a micro controller running at 32MHz to ensure that all transmissions stop within 5 seconds of a button release or within 5 seconds on the beginning of a transmission. A transmission shall automatically cease within 5 seconds after activation. The ceasing of the transmission is accomplished via the micro controller. Modulation is FM, sometimes referred to as Frequency Shift Keyed (FSK), data at 62.5kbps. The antenna is permanently attached and cannot be modified or easily replaced by the user since it is underneath the plastic enclosure. The unit label permanently seals the plastic enclosure and snap features in the plastic.

**Analog Function:** The HRT-10KP obtains power through a 120Vac to 9Vdc Class 2 transformer. The voltage is then linearly regulated down to a 5Vdc output, which is used to power all analog and micro controller activities.

## 1.1 Device Configuration During Test

The device under test was tested in normal orientation that represents the worst-case orientation.

The device was tested in two modes of operation:

1. Continuously transmitting an intentional radio frequency in Continuous Wave (CW).
2. Standby mode (Receive). The device is waiting to receive a signal source.

The manufacturer configured the device.

The device was powered with 120VAC, 60Hz.

Device	Manufacturer	Model Number	Serial Number	FCC ID
Wireless Tabletop Keypad	Lutron	HRT-10KP	N/A	JPZ0021
Class 2 Power Supply	Lutron	280903003CO	N/A	JPZ0021

"The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report"

## 1.2 Deviations from ANSI C63.4

- Not applicable, the ANSI C63.4 test measurements procedures were employed
- As described below:

### 1.3 Device Modifications Necessary for Compliance

- N/A
- As described below:

### 1.4 Test Summary

Test	Basic Standard	Considered	Tested	In Compliance
Conducted Voltage Emissions (Continuous Data Transmit Mode)	FCC Part 15 Subpart B, Class B, Paragraph 15.205	✓	✓	✓
Radiated Emissions	FCC Part 15 Subpart C, Class B, Intentional Radiators, Paragraph 15.209	✓	✓	✓
Radiated Emissions	FCC Part 15 Subpart B, Class B, Un-Intentional Radiators, Paragraph 15.109	✓	✓	✓
Cease Operation < 5 seconds	FCC Part 15 Subpart C, Paragraph 15.231	✓	✓	✓
Occupied Bandwidth	FCC Part 15 Subpart C, Paragraph 15.231	✓	✓	✓
Pulse Train Measurements Over One Complete Pulse Train	FCC Part 15 Subpart A, Paragraph 15.35	✓	✓	✓

## **2.0 EMISSIONS TEST REGULATIONS**

**FCC Part 15, Subpart B, Paragraph 15.107 & 15.109**

**FCC Part 15 Subpart C, Paragraph 15.205, 15.207, 15.209 & 15.231**

### **2.1 EUT OPERATION MODE - EMISSIONS TESTS**

- Standby
- Test program (H-Pattern)
- Test program (color bar)
- Test program (customer specific)
- Practice operation
- Normal operation Mode:
- As per manufacturer's instructions: Continuous Data Transmit for Conducted Emissions, Constant (Continuous) Wave Transmit and Receive modes for all other tests

File Number: NC2219  
Project Number: 02ME20017  
Model Number: HRT-10KP  
FCC ID: JPZ0021

Issued: 11/5/02

### 2.1.1 Conducted Emissions Tests

**Test Applicable**

**Test Not Applicable**

Temperature: 21.1°C  
Humidity: 40%RH  
Pressure: 1035milbar  
Date test performed: 18 Oct 02

Mode: "Continuous Data Transmit" @ 437 MHz was determined worst-case emissions.

**Frequency range on each side of line.**

**Measurement Point**

150kHz to 30MHz     Voltage  Current

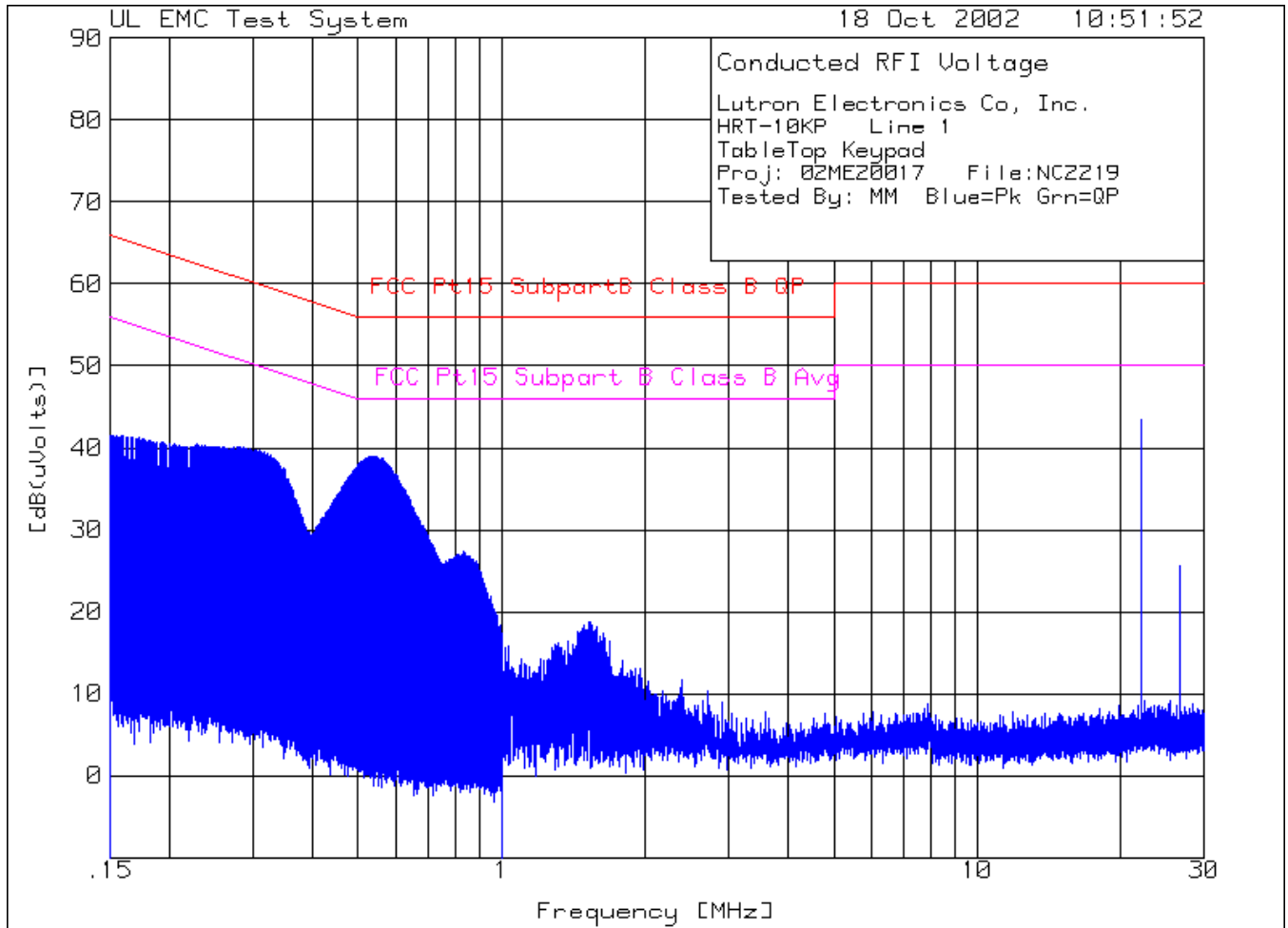
Mains     I/O Lines

**Test equipment used for conducted emissions:**

**ES126**    **Rhode & Schwartz**    **EMI Receiver**    **Equipment No.: ME5B-081**  
Range: 150KHz – 30MHz Last Calibration Date: 20 August 02 Calibration Due Date: 20 August 03

**Test Accessories for Conducted Emissions:**

<input checked="" type="checkbox"/> <b>11947A</b>	<b>Hewlett Packard</b>	<b>Transient Limiter</b>	<b>Equipment No.: ME5A-443</b>
Last Calibration Date: 16 Jan 02		Calibration Due Date: 16 Jan 03	
<input checked="" type="checkbox"/> <b>9252-50-R-24-BNC</b>	<b>Solar Electronics</b>	<b>LISN</b>	<b>Equipment No.: ME5A-637</b>
Last Calibration Date: 4 April 02		Calibration Due Date: 4 April 03	
<input checked="" type="checkbox"/> <b>Temp/Pressure</b>	<b>Oakton</b>	<b>Barometer</b>	<b>Equipment No.: ME4-263</b>
Range: 950-1045	Last Calibration Date: 2 April 02	Calibration Due Date: 2 April 03	
<input checked="" type="checkbox"/> <b>453320</b>	<b>Ex-Tech</b>	<b>Hydro-Thermometer</b>	<b>Equipment No.: ME4-264</b>
Range:0-80%	Last Calibration Date: 2 April 02	Calibration Due Date: 2 April 03	



Transmit @ 437 MHz



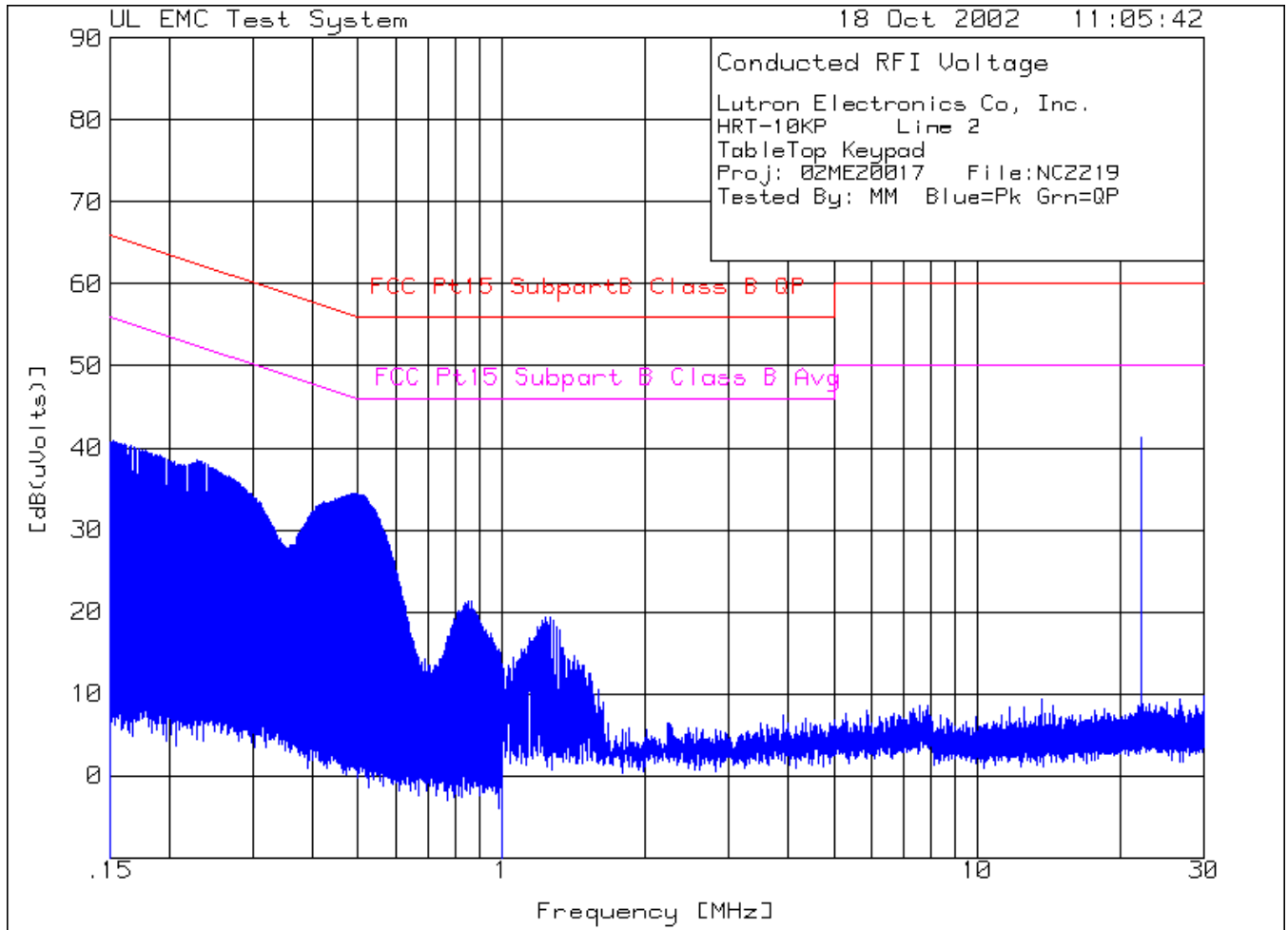
File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co, Inc.  
 HRT-10KP Line 1  
 Tabletop Keypad Tested @ 437 MHz  
 Proj: 02ME20017 File: NC2219  
 Tested By: MM Blue=Pk Grn=QP

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2
=====							
Range: 1 .15 - 1MHz -----							
1	.16811	30.91 pk	10.3	0	41.21	65.1	55.1
				Margin [dB]		-23.89	-13.89
2	.25864	29.81 pk	10.3	0	40.11	61.5	51.5
				Margin [dB]		-21.39	-11.39
3	.52659	28.71 pk	10.3	0	39.01	56	46
				Margin [dB]		-16.99	-6.99
4	.83882	16.49 pk	10.3	0	26.79	56	46
				Margin [dB]		-29.21	-19.21
-----							
Range: 2 1 - 30MHz -----							
5	1.54235	8.39 pk	10.4	0	18.79	56	46
				Margin [dB]		-37.21	-27.21
6	22.15472	32.22 pk	11.2	0	43.42	60	50
				Margin [dB]		-16.58	-6.58

LIMIT 1: FCC Pt15 SubpartB Class B QP  
 LIMIT 2: FCC Pt15 Subpart B Class B Avg



Transmit @ 437 MHz

File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co, Inc.  
 HRT-10KP Line 2  
 TableTop Keypad Tested @ 437 MHz  
 Proj: 02ME20017 File:NC2219  
 Tested By: MM Blue=Pk Grn=QP

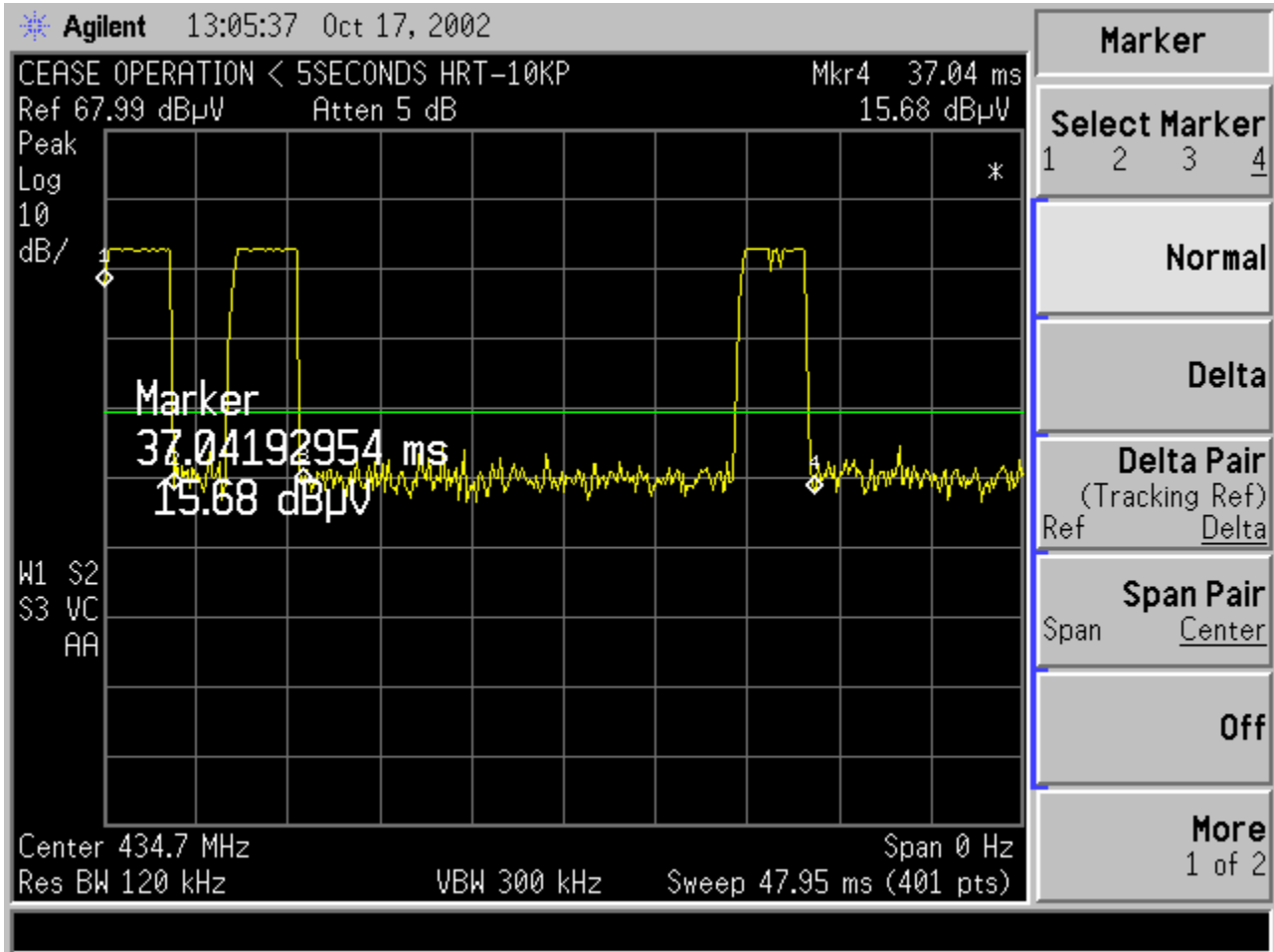
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1	2
=====							
Range: 1 .15 - 1MHz -----							
1	.16301	29.98 pk	10.3	0	40.28	65.3	55.3
				Margin [dB]		-25.02	-15.02
2	.22906	28.17 pk	10.3	0	38.47	62.5	52.5
				Margin [dB]		-24.03	-14.03
3	.45705	23.6 pk	10.3	0	33.9	56.7	46.7
				Margin [dB]		-22.8	-12.8
4	.5186	23.44 pk	10.3	0	33.74	56	46
				Margin [dB]		-22.26	-12.26
5	.86501	10.59 pk	10.3	0	20.89	56	46
				Margin [dB]		-35.11	-25.11
-----							
Range: 2 1 - 30MHz -----							
6	22.15182	30.09 pk	11.2	0	41.29	60	50
				Margin [dB]		-18.71	-8.71

LIMIT 1: FCC Pt15 SubpartB Class B QP  
 LIMIT 2: FCC Pt15 Subpart B Class B Avg  
 LIMIT 3: NONE  
 LIMIT 4: NONE  
 LIMIT 5: NONE  
 LIMIT 6: NONE



Conducted Emission Test Set-Up 0.150 to 30MHz





HRT-10 KP < 5 Seconds this depicts multiple transmit turn on

File Number: NC2219  
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Model Number: HRT-10KP  
FCC ID: JPZ0021

Issued: 11/5/02



Test Set-Up Cease Operation < 5 seconds

File Number: NC2219  
Project Number: 02ME20017  
Model Number: HRT-10KP  
FCC ID: JPZ0021

Issued: 11/5/02

### 2.1.3 Radiated Emissions Test (10 Meter Semi-Anechoic Chamber)

Test Applicable

Test Not Applicable

Temperature: 22.1°C  
Humidity: 44%RH  
Pressure: 1030milbar  
Date test performed: 16 Oct. 2002

The EUT (equipment under test) was tested in 3 orthogonal axes and the orientation depicted in the Radiated Emission test set-up was deemed worst case.

Mode: "Constant Wave Transmit"

Measurement distance:  3 intentional Radiator  10 meters un-intentional radiator

Frequency Range:  30MHz - 5000MHz  Electric Intentional @ low band 431MHz &  
High band 437MHz  
 30MHz - 2000MHz  Electric Unintentional @ low band 431MHz  
& High band 437MHz

#### Paragraph 15.35:

When the Radiated Limits are expressed in terms of the average value of the emissions, and pulse operation is employed, the pulse measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds (100ms) or in cases where the pulse train exceeds 0.1seconds the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.



File Number: NC2219  
Project Number: 02ME20017  
Model Number: HRT-10KP  
FCC ID: JPZ0021

Issued: 11/5/02

**Test equipment used for final radiated emissions tests:**

**HP 8574A**                      **Hewlett-Packard**                      **EMI Receiver,**                      **Equipment No.: ME5A-461**  
Range:30-1000MHz      Last Calibration Date:25 Jan 02                      Calibration Due Date: 25 Jan 03

**Consisting of:**

<b>HP - 8566B</b>	<b>Hewlett-Packard</b>	<b>Spectrum Analyzer,</b>
	<b>Resolution BW:</b>	<b>100kHz</b>
		<b>9kHz to 30 MHz</b>
		<b>30MHz to 1000 MHz</b>
	<b>Video BW:</b>	<b>100kHz</b>
		<b>9kHz to 30 MHz</b>
		<b>30MHz TO 1000MHz</b>
		<b>1MHz</b>
		<b>30MHz TO 1000MHz</b>
<b>HP - 85662A</b>	<b>Hewlett-Packard</b>	<b>Analyzer Display</b>
<b>HP - 85650A</b>	<b>Hewlett-Packard</b>	<b>Quasi-Peak Adapter,</b>
	<b>Quasi Peak BW:</b>	<b>200Hz</b>
		<b>9kHz to 150kHz</b>
		<b>150kHz to 30MHz</b>
		<b>30 to 1000 MHz</b>
		<b>120kHz</b>
<b>HP - 85685A</b>	<b>Hewlett-Packard</b>	<b>Preselector</b>

**For Measurements above 1GHz:**

**HP - 8566B**                      **Hewlett-Packard**                      **Spectrum Analyzer,**                      **Equipment No.: ME5A-461**  
**Resolution BW: 1MHz**  
**Video BW: 1MHz**

Range: 1- 2 GHz      Last Calibration Date:30 April 02      Calibration Due Date: 30 April 03

**HP - 85662A**                      **Hewlett-Packard**                      **Analyzer Display**                      **Equipment No. ME5A-461**  
Last Calibration Date:30 April 02                      Calibration Due Date: 30 April 03

**Test Accessories for Radiated Emissions:**

**94455-1**                      **Ailtech**                      **Biconnical Antenna**                      **Equipment No.: ME5-439**  
Last Calibration Date:16 Oct 02                      Calibration Due Date: 16 Oct 03

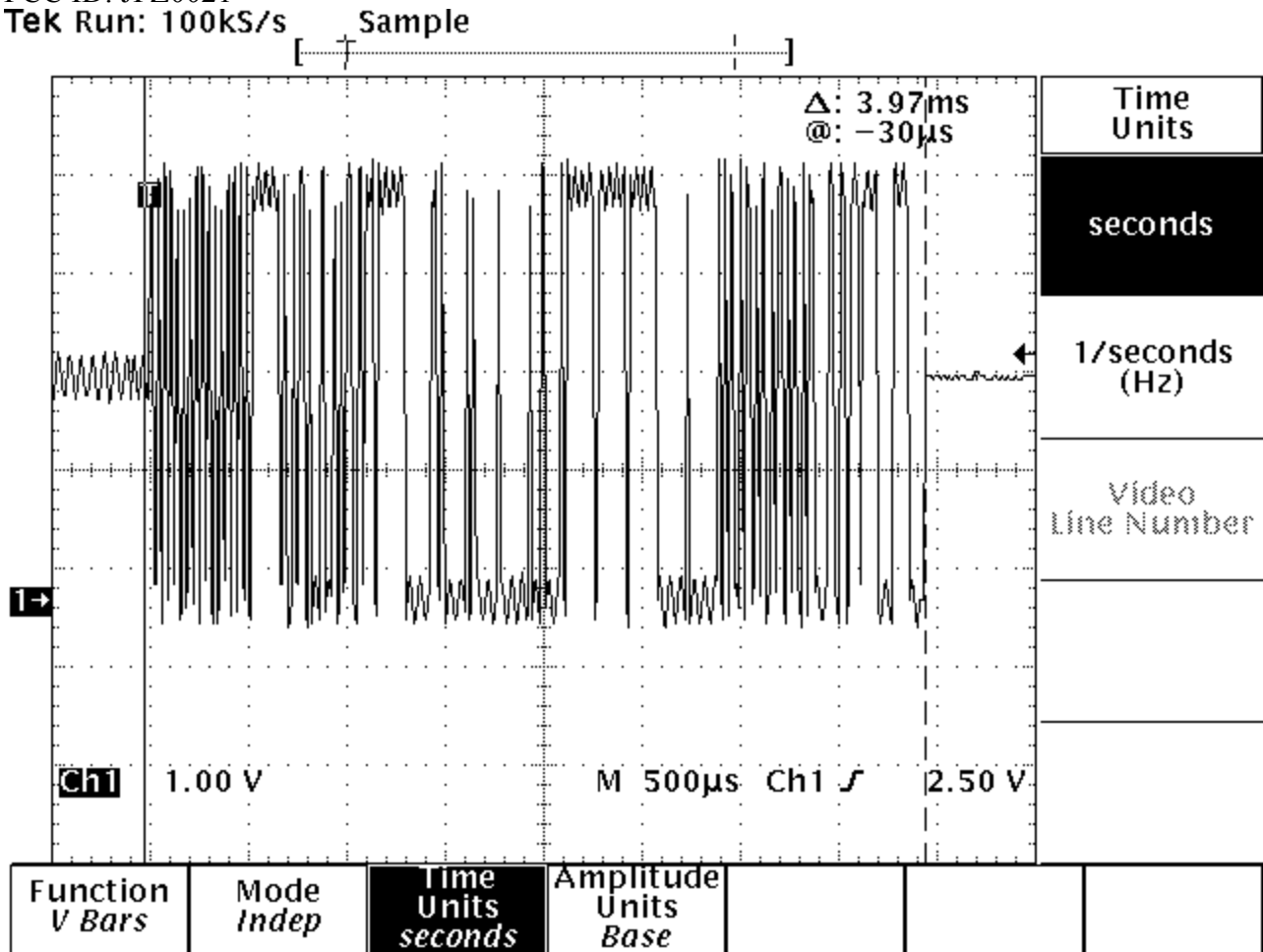
**3146**                      **EMCO**                      **Log Periodic Antenna**                      **Equipment No.: ME5-451**  
Last Calibration Date:15 Oct 02                      Calibration Due Date: 15 Oct 03

**Temp/Pressure**                      **Oakton**                      **Barometer**                      **Equipment No.: ME4-263**  
Range:950-1045      Last Calibration Date: 2 April 02      Calibration Due Date:2 April 03

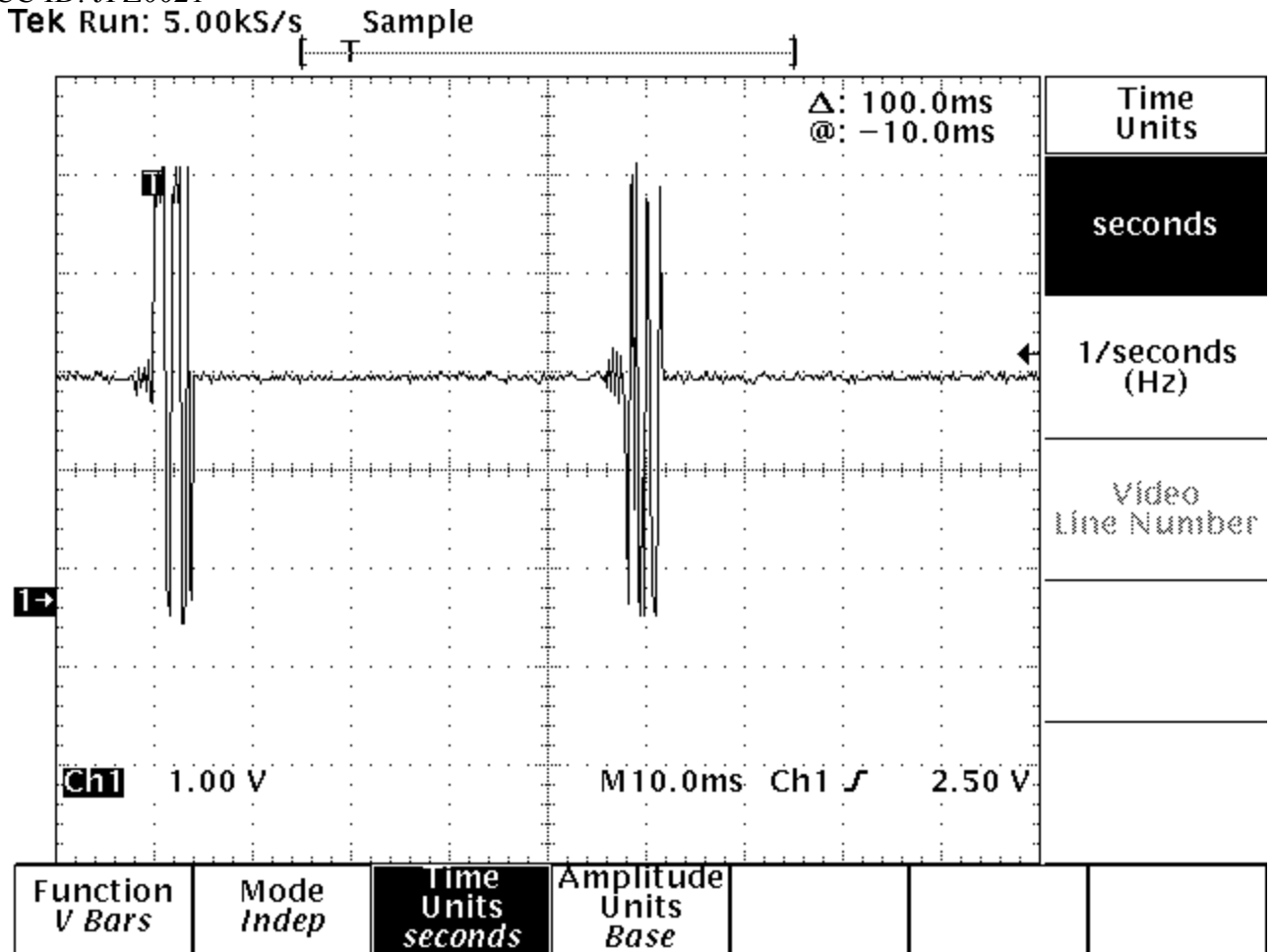
**453320**                      **Ex-Tech**                      **Hydro-Thermometer**                      **Equipment No.: ME4-264**  
Range:0-80%      Last Calibration Date:2 April 02      Calibration Due Date:2 April 03

File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021  
 Tek Run: 100kS/s

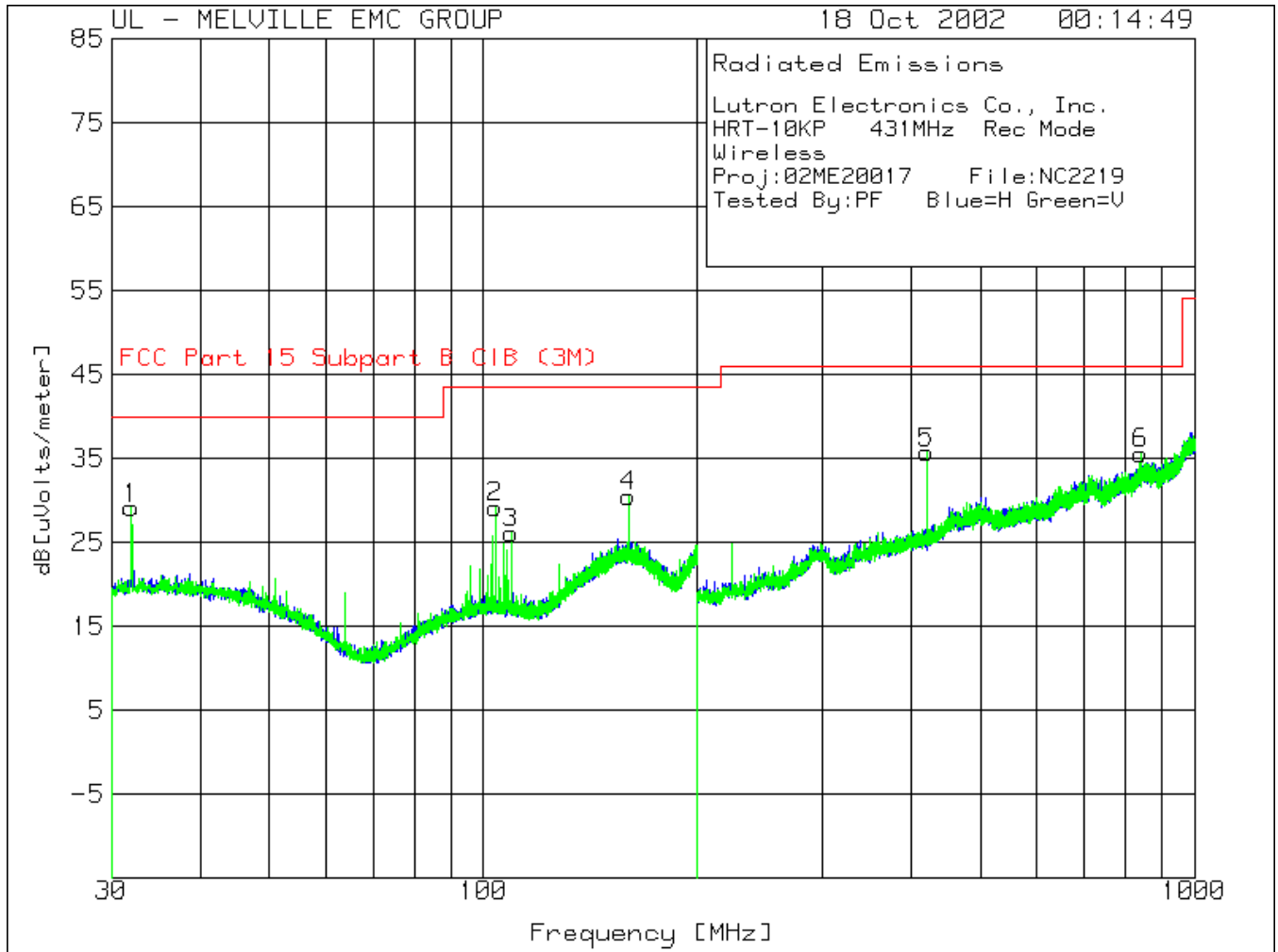
Issued: 11/5/02



HRT-10KP One Complete Pulse Train 3.97ms expanded view profile



HRT-10KP One Complete Pulse Train < 100ms wide profile



Receive Mode at 431 MHz

File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 431MHz Rec Mode  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By:PF Blue=H Green=V

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
Range: 2 30 - 200MHz -----						
1	31.9535	14.24 pk	.86	14	29.1	40
	Azimuth:341	Height:101 Vert		Margin [dB]		-10.9
2	103.8521	16.48 pk	1.42	11.3	29.2	43.5
	Azimuth:20	Height:101 Vert		Margin [dB]		-14.3
3	109.4154	13.66 pk	1.46	10.98	26.1	43.5
	Azimuth:267	Height:101 Vert		Margin [dB]		-17.4
4	160.0162	11.81 pk	1.8	16.89	30.5	43.5
	Azimuth:156	Height:101 Vert		Margin [dB]		-13
Range: 4 200 - 1000MHz -----						
5	420.0833	16.5 pk	3.1	16.1	35.7	46
	Azimuth:100	Height:100 Vert		Margin [dB]		-10.3
6	840.1332	8.1 pk	4.29	23.21	35.6	46
	Azimuth:226	Height:100 Vert		Margin [dB]		-10.4

LIMIT 1: FCC Part 15 Subpart B ClB (3M)  
 pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 tm - Trace Math Result

File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

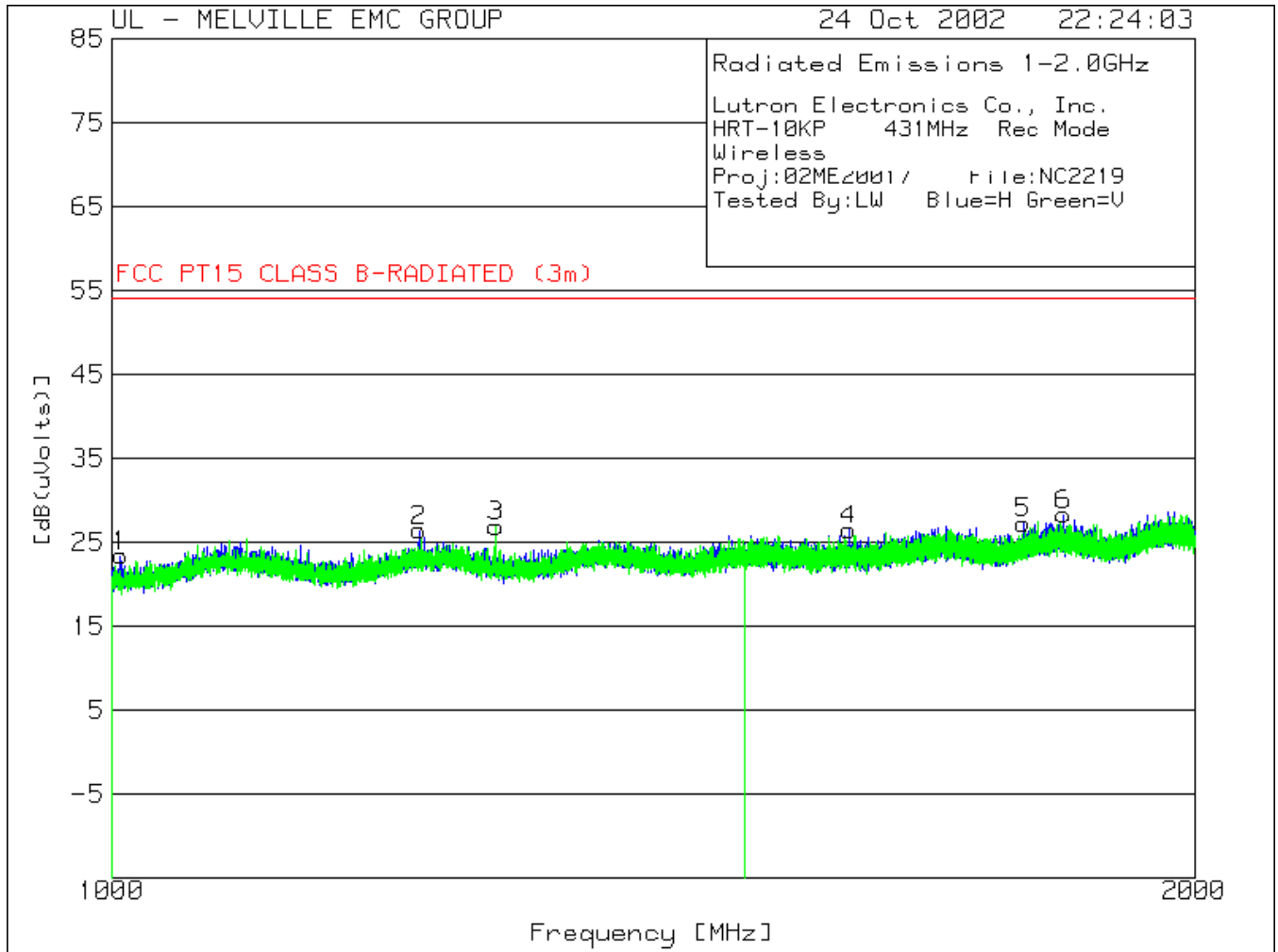
Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 431MHz Rec Mode  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By:PF Blue=H Green=V

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
=====					
Range: 2 30 - 200MHz					
31.9161	10.45 qp	.86	14	25.31	40
Azimuth: 200		Height:107 Vert	Margin [dB]:		-14.69
103.9619	6.25 qp	1.42	11.3	18.97	43.5
Azimuth: 15		Height:269 Vert	Margin [dB]:		-21.03
159.9369	2.31 qp	1.8	16.9	21.01	43.5
Azimuth: 23		Height:126 Vert	Margin [dB]:		-22.49
Range: 3 200 - 1000MHz					
420.2258	16.47 qp	3.1	16.11	35.68	46
Azimuth: 277		Height:100 Vert	Margin [dB]:		-10.32
Range: 4 200 - 1000MHz					
840.5698	.35 qp	4.3	23.23	27.88	46
Azimuth: 275		Height:103 Vert	Margin [dB]:		-18.12

LIMIT 1: FCC Part 15 Subpart B ClB (3M)

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



Receive Mode at 431 MHz

File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

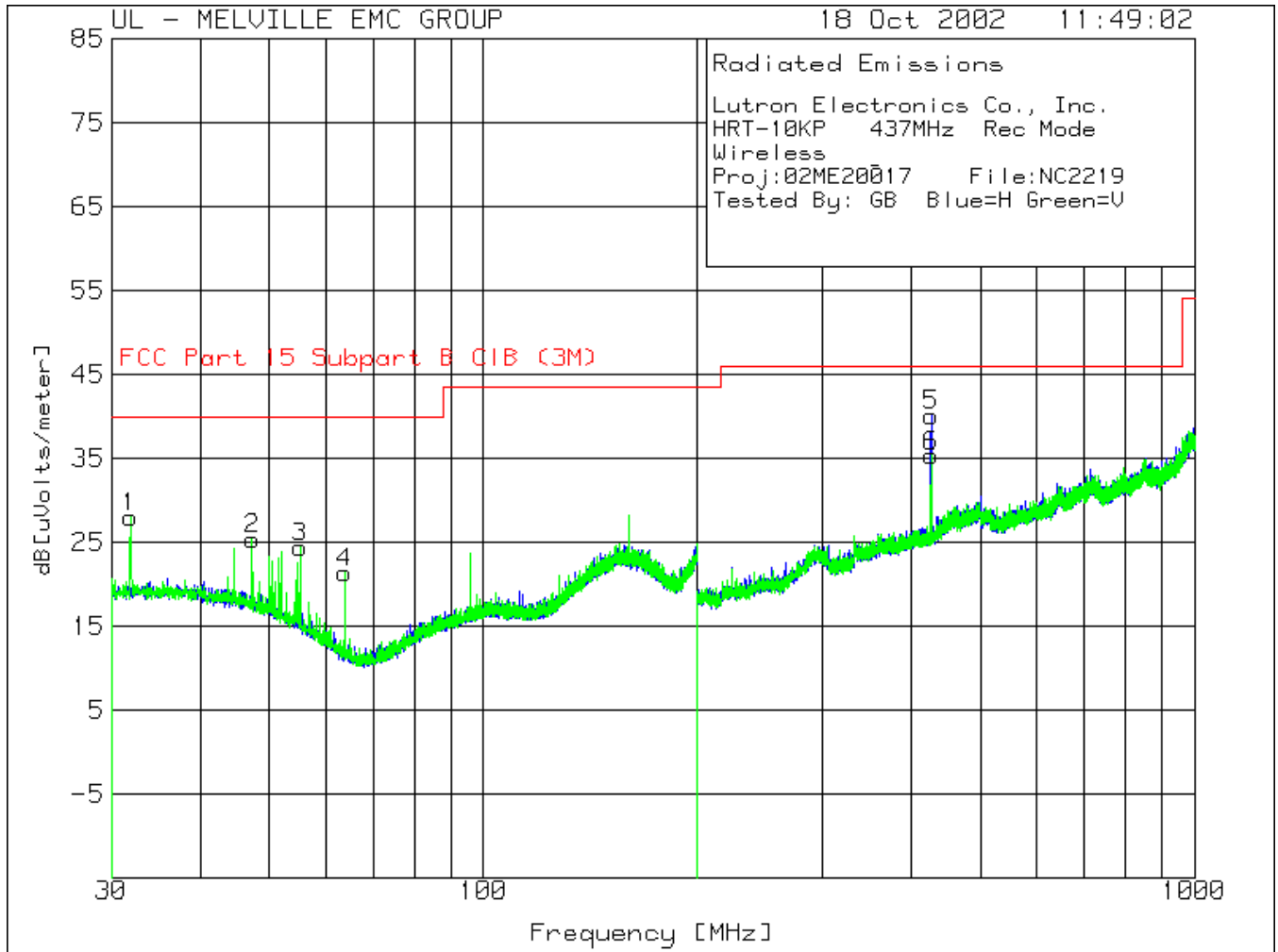
Lutron Electronics Co., Inc.  
 HRT-10KP 431 MHz Rec Mode  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By:LW Blue=H Green=V

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1
=====						
Range: 1 1000 - 1500MHz -----						
1	1005.662	32.16 pk	-33.68	24.92	23.4	54
	Azimuth:329	Height:99	Horz	Margin [dB]		-30.6
2	1217.236	33.83 pk	-33.11	25.68	26.4	54
	Azimuth:61	Height:99	Horz	Margin [dB]		-27.6
-----						
Range: 2 1500 - 2000MHz -----						
4	1603.285	31.37 pk	-32.02	27.15	26.5	54
	Azimuth:220	Height:200	Horz	Margin [dB]		-27.5
5	1792.557	30.72 pk	-31.41	27.99	27.3	54
	Azimuth:89	Height:200	Horz	Margin [dB]		-26.7
6	1839.266	31.37 pk	-31.26	28.19	28.3	54
	Azimuth:13	Height:200	Horz	Margin [dB]		-25.7
-----						
Range: 3 1000 - 1500MHz -----						
3	1278.851	33.95 pk	-32.95	25.9	26.9	54
	Azimuth:59	Height:100	Vert	Margin [dB]		-27.1

LIMIT 1: FCC PT15 CLASS B-RADIATED (3m)

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 tm - Trace Math Result





Receive Mode at 437 MHz

File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 437MHz Rec Mode  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By: GB Blue=H Green=V

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
Range: 2 30 - 200MHz -----						
1	31.8686	13.14 pk	.86	14	28	40
	Azimuth:306	Height:100 Vert		Margin [dB]		-12
2	47.2845	11.99 pk	1.01	12.4	25.4	40
	Azimuth:230	Height:300 Vert		Margin [dB]		-14.6
3	55.2685	13.39 pk	1.06	9.95	24.4	40
	Azimuth:20	Height:100 Vert		Margin [dB]		-15.6
4	63.8046	13.68 pk	1.12	6.6	21.4	40
	Azimuth:230	Height:100 Vert		Margin [dB]		-18.6
Range: 3 200 - 1000MHz -----						
5	426.0783	20.76 pk	3.14	16.2	40.1	46
	Azimuth:233	Height:100 Horz		Margin [dB]		-5.9
Range: 4 200 - 1000MHz -----						
6	426.0783	15.96 pk	3.14	16.2	35.3	46
	Azimuth:264	Height:299 Vert		Margin [dB]		-10.7

LIMIT 1: FCC Part 15 Subpart B ClB (3M)  
 LIMIT 2: NONE  
 LIMIT 3: NONE  
 LIMIT 4: NONE  
 LIMIT 5: NONE  
 LIMIT 6: NONE

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 tm - Trace Math Result

File Number: NC2219  
 Project Number: 02ME20017  
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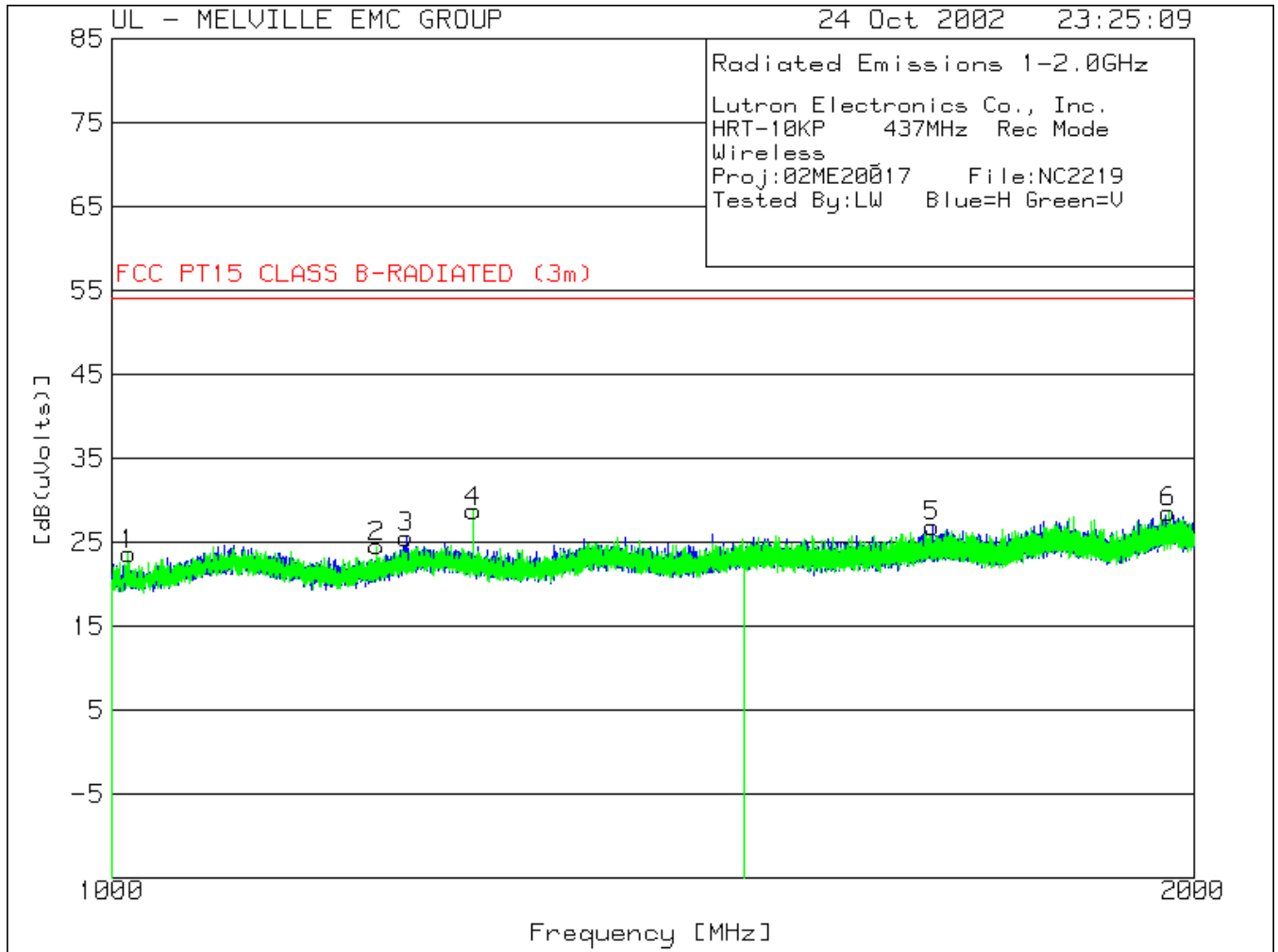
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Lutron Electronics Co., Inc.  
 HRT-10KP 437MHz Rec Mode  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By: GB Blue=H Green=V

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
Range: 2 30 - 200MHz					
31.9359	9.98 qp	.86	14	24.84	40
Azimuth: 249 Height:111 Vert				Margin [dB]:	-15.16
47.2	6.34 qp	1.01	12.42	19.77	40
Azimuth: 15 Height:134 Vert				Margin [dB]:	-20.23
54.9391	5.29 qp	1.06	10.09	16.44	40
Azimuth: 18 Height:114 Vert				Margin [dB]:	-23.56
63.9199	10.69 qp	1.12	6.56	18.37	40
Azimuth: 332 Height:113 Vert				Margin [dB]:	-21.63
Range: 3 200 - 1000MHz					
426.2199	17.55 qp	3.14	16.21	36.9	46
Azimuth: 207 Height:239 Horz				Margin [dB]:	-9.1
Range: 4 200 - 1000MHz					
426.2209	15.31 qp	3.14	16.21	34.66	46
Azimuth: 261 Height:267 Vert				Margin [dB]:	-11.34

LIMIT 1: FCC Part 15 Subpart B ClB (3M)  
 LIMIT 2: NONE

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



Receive Mode at 437 MHz

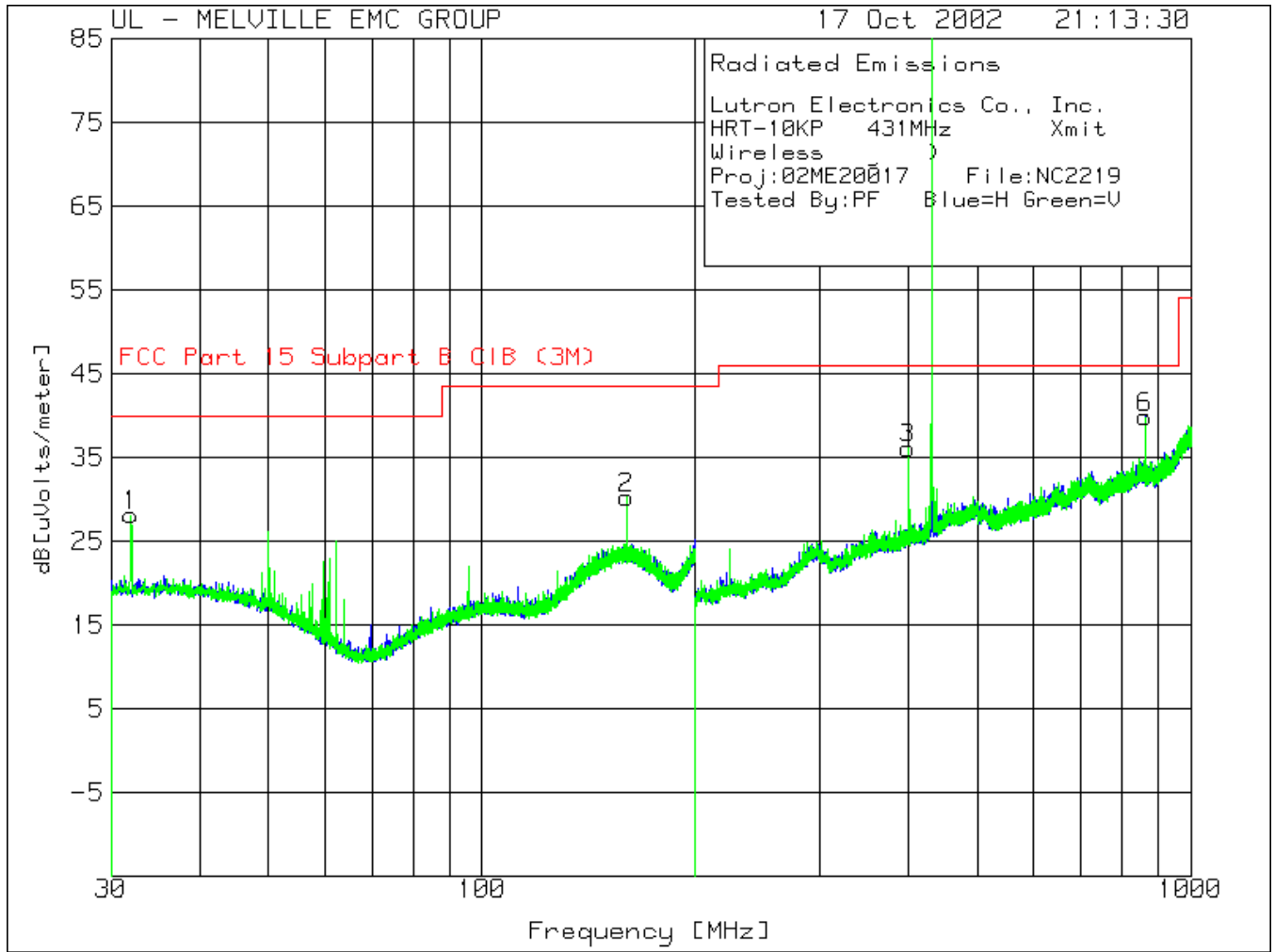
File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 437MHz Rec Mode  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By:LW Blue=H Green=V

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1
Range: 1 1000 - 1500MHz -----						
3	1208.077	33.09 pk	-33.14	25.65	25.6	54
	Azimuth:140	Height:100	Horz	Margin [dB]		-28.4
Range: 2 1500 - 2000MHz -----						
5	1691.707	31.1 pk	-31.74	27.54	26.9	54
	Azimuth:196	Height:100	Horz	Margin [dB]		-27.1
Range: 3 1000 - 1500MHz -----						
1	1010.824	32.33 pk	-33.67	24.94	23.6	54
	Azimuth:35	Height:199	Vert	Margin [dB]		-30.4
2	1185.179	32.13 pk	-33.2	25.57	24.5	54
	Azimuth:88	Height:100	Vert	Margin [dB]		-29.5
4	1260.866	35.86 pk	-33	25.84	28.7	54
	Azimuth:43	Height:100	Vert	Margin [dB]		-25.3
Range: 4 1500 - 2000MHz -----						
6	1968.59	30.69 pk	-30.85	28.76	28.6	54
	Azimuth:14	Height:200	Vert	Margin [dB]		-25.4

LIMIT 1: FCC PT15 CLASS B-RADIATED (3m)  
 pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 tm - Trace Math Result



File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 431MHz Constant Xmit  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By:PF Blue=H Green=V

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level	Limit:1 dB[uVolts/meter]	Limit 2
=====							
Range: 2 30 - 200MHz -----							
1	31.9535	13.24 pk	.86	14	28.1	N/A	40
	Azimuth:332	Height:100 Vert		Margin [dB]			-11.9
2	159.995	11.51 pk	1.8	16.89	30.2	N/A	43.5
	Azimuth:127	Height:100 Vert		Margin [dB]			-13.3
-----							
Range: 3 200 - 1000MHz -----							
5	430.8743	68.79 pk	3.17	16.44	88.4	80.7	N/A
	Azimuth:348	Height:200 Horz		Margin [dB]		7.7	
-----							
Range: 4 200 - 1000MHz -----							
3	398.9009	17.07 pk	2.93	16.1	36.1	N/A	46
	Azimuth:201	Height:100 Vert		Margin [dB]			-9.9
4	430.8077	68.99 pk	3.17	16.44	88.6	80.7	N/A
	Azimuth:76	Height:100 Vert		Margin [dB]		7.9	
6	861.4488	12.26 pk	4.41	23.13	39.8	60.7	N/A
	Azimuth:331	Height:100 Vert		Margin [dB]		-20.9	

LIMIT 1: FCC Part 15 Subpart C-Section 15.231  
 LIMIT 2: FCC Part 15 Subpart B ClB (3M)

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 tm - Trace Math Result

File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 431MHz Constant Xmit  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By:PF Blue=H Green=V

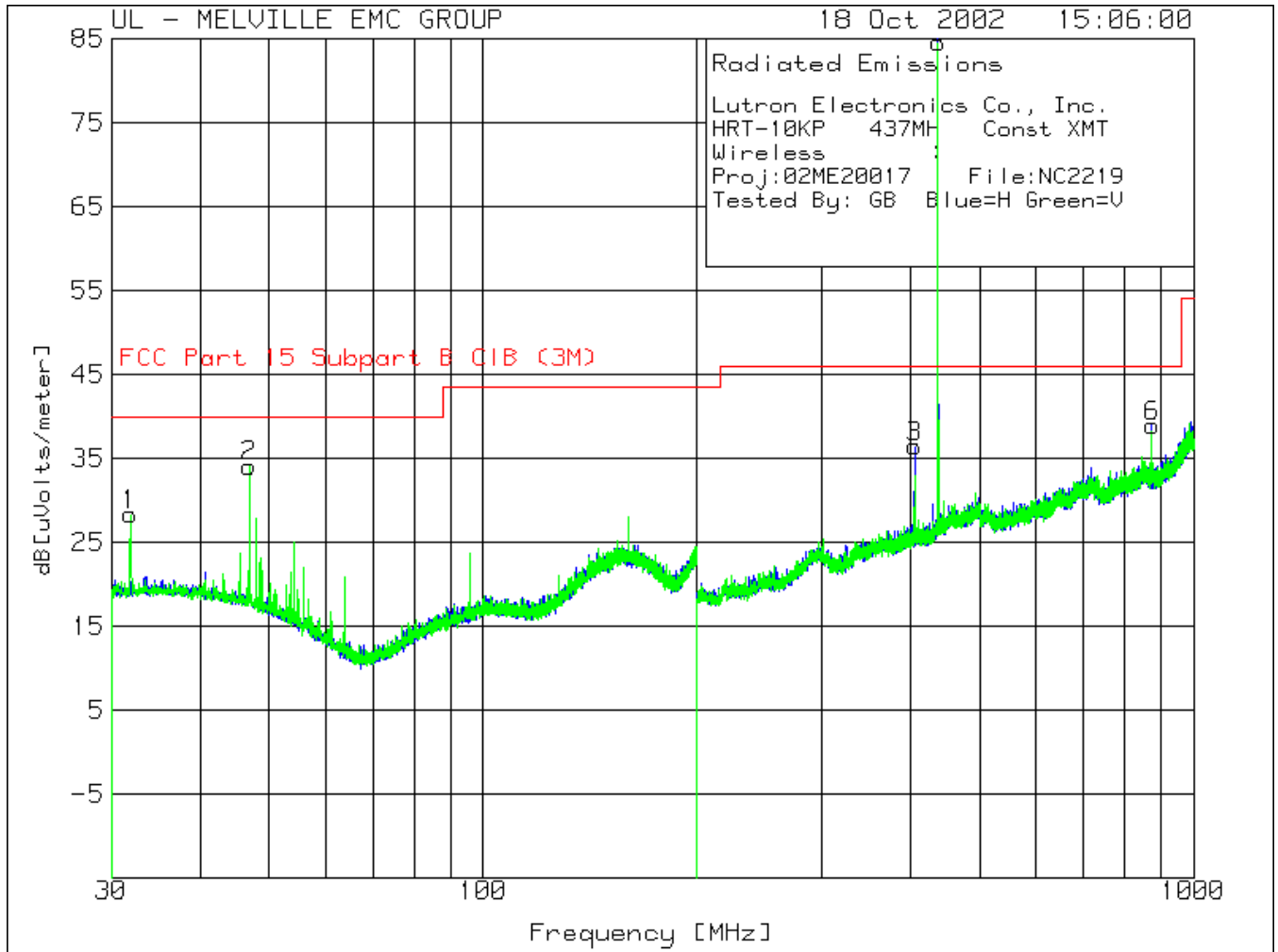
Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level	Limit:1 dB[uVolts/meter]	Limit 2
=====						
Range: 3 200 - 1000MHz						
430.97	*46.75 av	3.17	16.45	*66.37	80.7	N/A
Azimuth: 186		Height:199	Horz	Margin [dB]:	-14.33	
Range: 4 200 - 1000MHz						
398.9816	-28.4 av	2.93	16.1	-9.37	60.7	
Azimuth: 187		Height:105	Vert	Margin [dB]:	-70.07	N/A
430.9774	*40.97 av	3.17	16.45	*60.59	80.7	N/A
Azimuth: 37		Height:102	Vert	Margin [dB]:	-30.11	
861.9808	-30.75 av	4.41	23.1	-3.24	60.7	N/A
Azimuth: 295		Height:154	Vert	Margin [dB]:	-63.94	

LIMIT 1: FCC Part 15 Subpart B ClB (3M)  
 LIMIT 2: FCC Part 15 Subpart C-Section 15.231

**\* Duty Cycle correction factor of -22.0dB added to Average level.**

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





File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 437MHz Const XMT  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By: GB Blue=H Green=V

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level	Limit:1 dB[uVolts/meter]	Limit 2
-----	----------------------	------------------------	-----------------------	------------------------	-------	--------------------------	---------

=====  
 Range: 2 30 - 200MHz -----

1	31.8686	13.44 pk	.86	14	28.3	N/A	40
	Azimuth:207	Height:101	Vert	Margin [dB]			-11.7
2	46.9023	20.59 pk	1.01	12.5	34.1	N/A	40
	Azimuth:53	Height:101	Vert	Margin [dB]			-5.9

Range: 3 200 - 1000MHz -----

3	404.7627	17.19 pk	2.97	16.24	36.4	N/A	46
	Azimuth:158	Height:101	Horz	Margin [dB]			-9.6
4	436.7361	66.86 pk	3.2	16.84	86.9	80.9	N/A
	Azimuth:127	Height:199	Horz	Margin [dB]		6.0	
6	873.9717	11.05 pk	4.45	23.4	38.9	60.9	N/A
	Azimuth:185	Height:101	Horz	Margin [dB]		-22.0	

Range: 4 200 - 1000MHz -----

5	436.7361	64.46 pk	3.2	16.84	84.5	80.9	N/A
	Azimuth:159	Height:200	Vert	Margin [dB]		4.0	

LIMIT 1: FCC Part 15 Subpart C-Section 15.231  
 LIMIT 2: FCC Part 15 Subpart B ClB (3M)

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 tm - Trace Math Result

File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

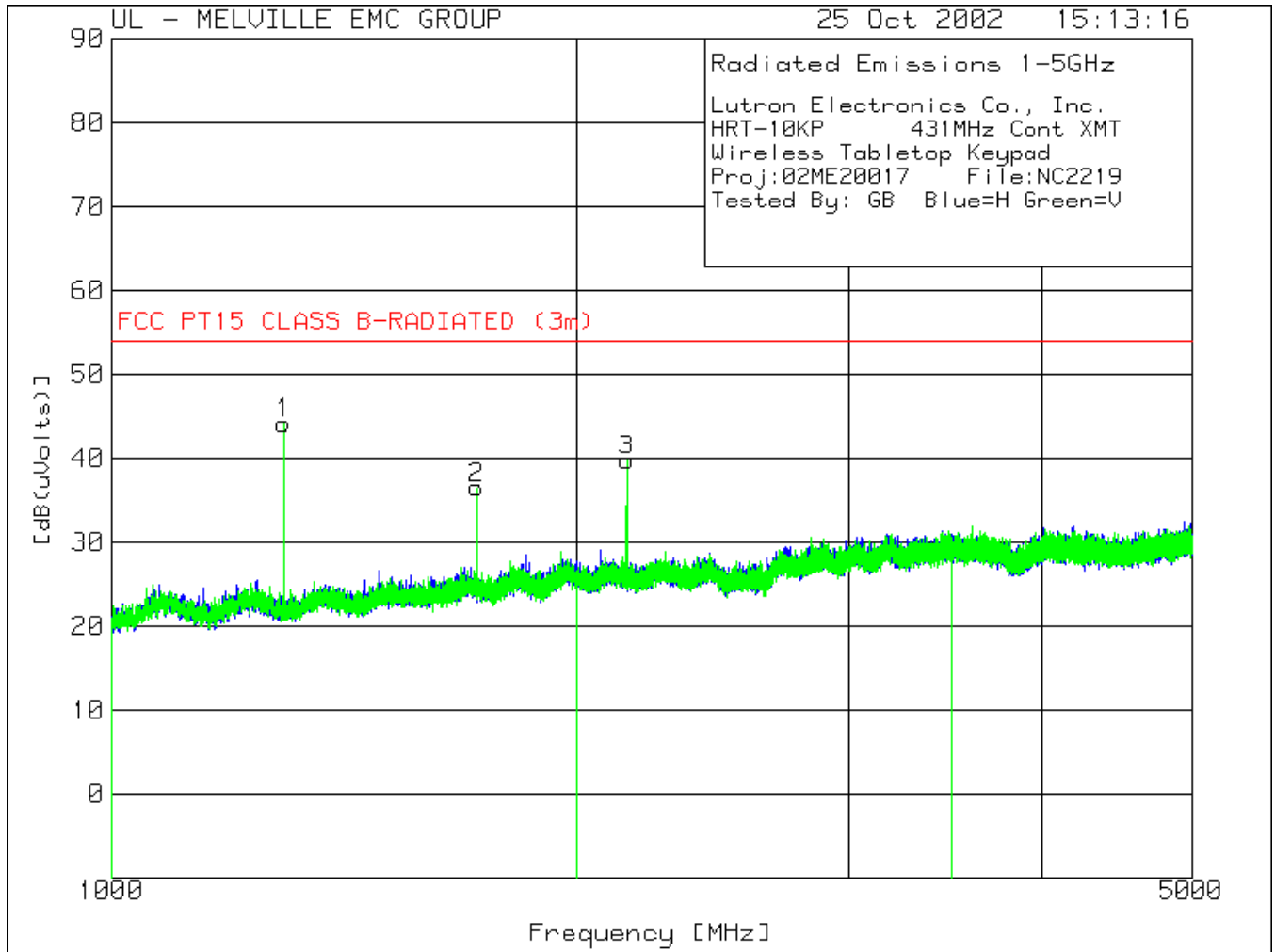
Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 437MHz Const XMT  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By: GB Blue=H Green=V

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level	Limit:1 dB[uVolts/meter]	Limit 2
47.9291	3.92 av	1.01	12.2	17.13	60.9	N/A
Azimuth: 283		Height:395 Vert		Margin [dB]:		-43.77
Range: 3 200 - 1000MHz						
404.96	13.32 av	2.97	16.25	32.54	60.9	N/A
Azimuth: 186		Height:227 Horz		Margin [dB]:		-28.36
436.9215	*45.42 av	3.2	16.85	*65.47	80.9	N/A
Azimuth: 202		Height:200 Horz		Margin [dB]:		-15.25
873.9399	7.42 av	4.45	23.4	35.27	60.9	N/A
Azimuth: 220		Height:101 Horz		Margin [dB]:		-25.45
Range: 4 200 - 1000MHz						
436.9225	*41.83 av	3.2	16.85	*61.88	80.9	N/A
Azimuth: 101		Height:112 Vert		Margin [dB]:		-18.84

LIMIT 1: FCC Part 15 Subpart C-Section 15.231  
 LIMIT 2: FCC Part 15 Subpart B ClB (3M)LIMIT  
 pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - Average log detector

**\*Duty Cycle correction factor of -22.0db added to Average level.**



File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 431MHz Cont XMT  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By: GB Blue=H Green=V

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1
Range: 5 1000 - 2000MHz -----						
1	1292.923	51.16 pk	-32.91	25.95	44.2	60.7
	Azimuth:142	Height:100 Vert		Margin [dB]		-16.5
2	1724.063	40.44 pk	-31.63	27.69	36.5	60.7
	Azimuth:123	Height:100 Vert		Margin [dB]		-24.2
Range: 6 2000 - 3500MHz -----						
3	2154.74	41.02 pk	-30.65	29.43	39.8	60.7
	Azimuth:352	Height:101 Vert		Margin [dB]		-20.9

LIMIT 1: FCC Part 15 Subpart C-Section 15.231  
 LIMIT 2: NONE

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 tm - Trace Math Result

File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

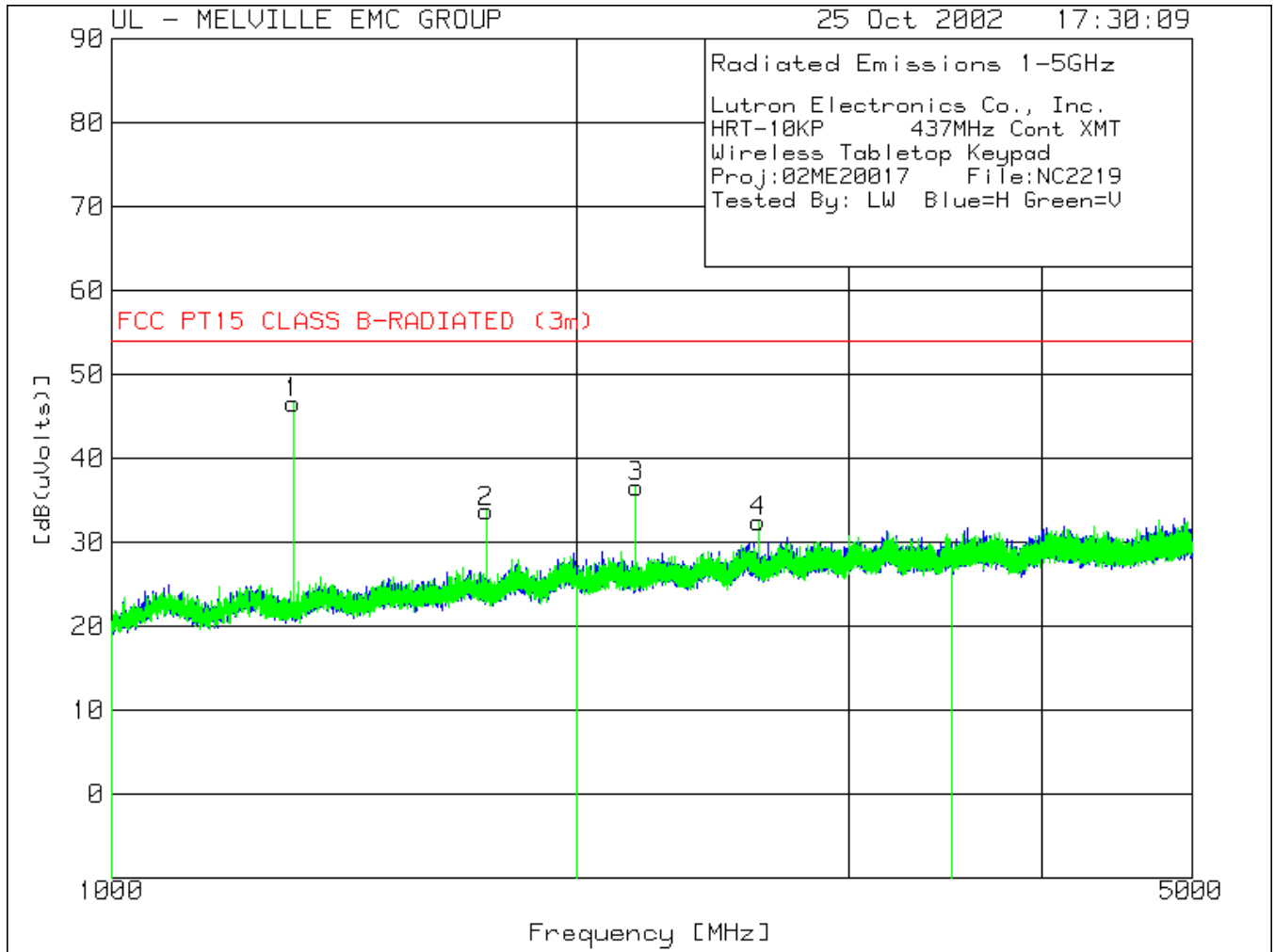
Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 431MHz Cont XMT  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By: GB Blue=H Green=V

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1
Range: 1 1000 - 2000MHz					
1292.998	48.12 av	-32.91	25.95	41.16	60.7
Azimuth: 166		Height:110	Horz	Margin [dB]:	-19.54
1724.005	33.42 av	-31.63	27.69	29.48	60.7
Azimuth: 84		Height:100	Horz	Margin [dB]:	-31.22
Range: 2 2000 - 3500MHz					
2154.998	34.23 av	-30.65	29.43	33.01	60.7
Azimuth: 130		Height:103	Horz	Margin [dB]:	-27.69
Range: 5 1000 - 2000MHz					
1293	52 av	-32.91	25.95	45.04	60.7
Azimuth: 185		Height:109	Vert	Margin [dB]:	-15.66
1724.009	40.14 av	-31.63	27.69	36.2	60.7
Azimuth: 0		Height:104	Vert	Margin [dB]:	-24.5
Range: 6 2000 - 3500MHz					
2155	41.07 av	-30.65	29.43	39.85	60.7
Azimuth: 206		Height:103	Vert	Margin [dB]:	-20.85

LIMIT 1: FCC Part 15 Subpart C-Section 15.231  
 LIMIT 2: NONE

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



File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 437MHz Cont XMT  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By: LW Blue=H Green=V

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1
Range: 5 1000 - 2000MHz -----						
1	1310.741	53.44 pk	-32.86	26.02	46.6	60.9
	Azimuth:174	Height:101 Vert		Margin [dB]		-14.3
2	1748.043	37.47 pk	-31.56	27.79	33.7	60.9
	Azimuth:16	Height:101 Vert		Margin [dB]		-27.2
Range: 6 2000 - 3500MHz -----						
3	2184.526	37.7 pk	-30.63	29.53	36.6	60.9
	Azimuth:124	Height:101 Vert		Margin [dB]		-24.3
4	2621.768	31.81 pk	-30.13	30.82	32.5	60.9
	Azimuth:236	Height:101 Vert		Margin [dB]		-28.4

LIMIT 1: FCC Part 15 Subpart C-Section 15.231  
 LIMIT 2: NONE

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 tm - Trace Math Result



File Number: NC2219  
 Project Number: 02ME20017  
 Model Number: HRT-10KP  
 FCC ID: JPZ0021

Issued: 11/5/02

Lutron Electronics Co., Inc.  
 HRT-10KP 437MHz Cont XMT  
 Wireless Tabletop Keypad  
 Proj:02ME20017 File:NC2219  
 Tested By: LW Blue=H Green=V

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1
Range: 1 1000 - 2000MHz					
1311.008	50.31 av	-32.86	26.02	43.47	60.9
Azimuth: 176		Height:110	Horz	Margin [dB]:	-17.43
1748.014	30.2 av	-31.56	27.79	26.43	60.9
Azimuth: 41		Height:101	Horz	Margin [dB]:	-34.47
Range: 2 2000 - 3500MHz					
2185.005	34.38 av	-30.63	29.53	33.28	60.9
Azimuth: 115		Height:149	Horz	Margin [dB]:	-27.62
2622.001	28.64 av	-30.13	30.82	29.33	60.9
Azimuth: 124		Height:140	Horz	Margin [dB]:	-31.57
Range: 5 1000 - 2000MHz					
1311.009	53.2 av	-32.86	26.02	46.36	60.9
Azimuth: 67		Height:114	Vert	Margin [dB]:	-14.54
1748.0014	36.27 av	-31.56	27.79	32.5	60.9
Azimuth: 0		Height:101	Vert	Margin [dB]:	-28.4
Range: 6 2000 - 3500MHz					
2184.9944	37.77 av	-30.63	29.53	36.67	60.9
Azimuth: 209		Height:130	Vert	Margin [dB]:	-24.23
2621.997	31.47 av	-30.13	30.82	32.16	60.9
Azimuth: 191		Height:107	Vert	Margin [dB]:	-28.74

LIMIT 1: FCC Part 15 Subpart C-Section 15.231  
 LIMIT 2: NONE

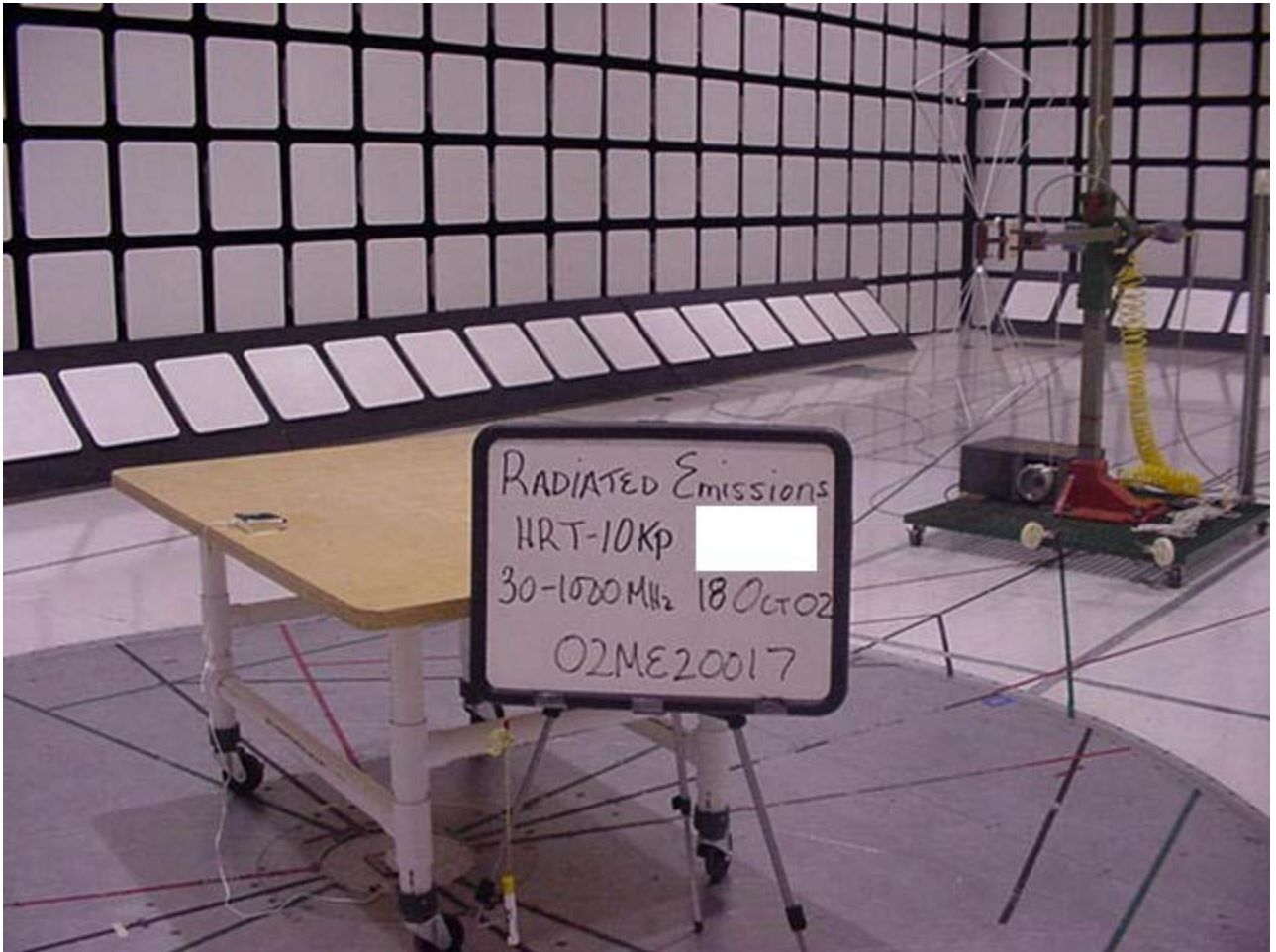
pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - Average log detector



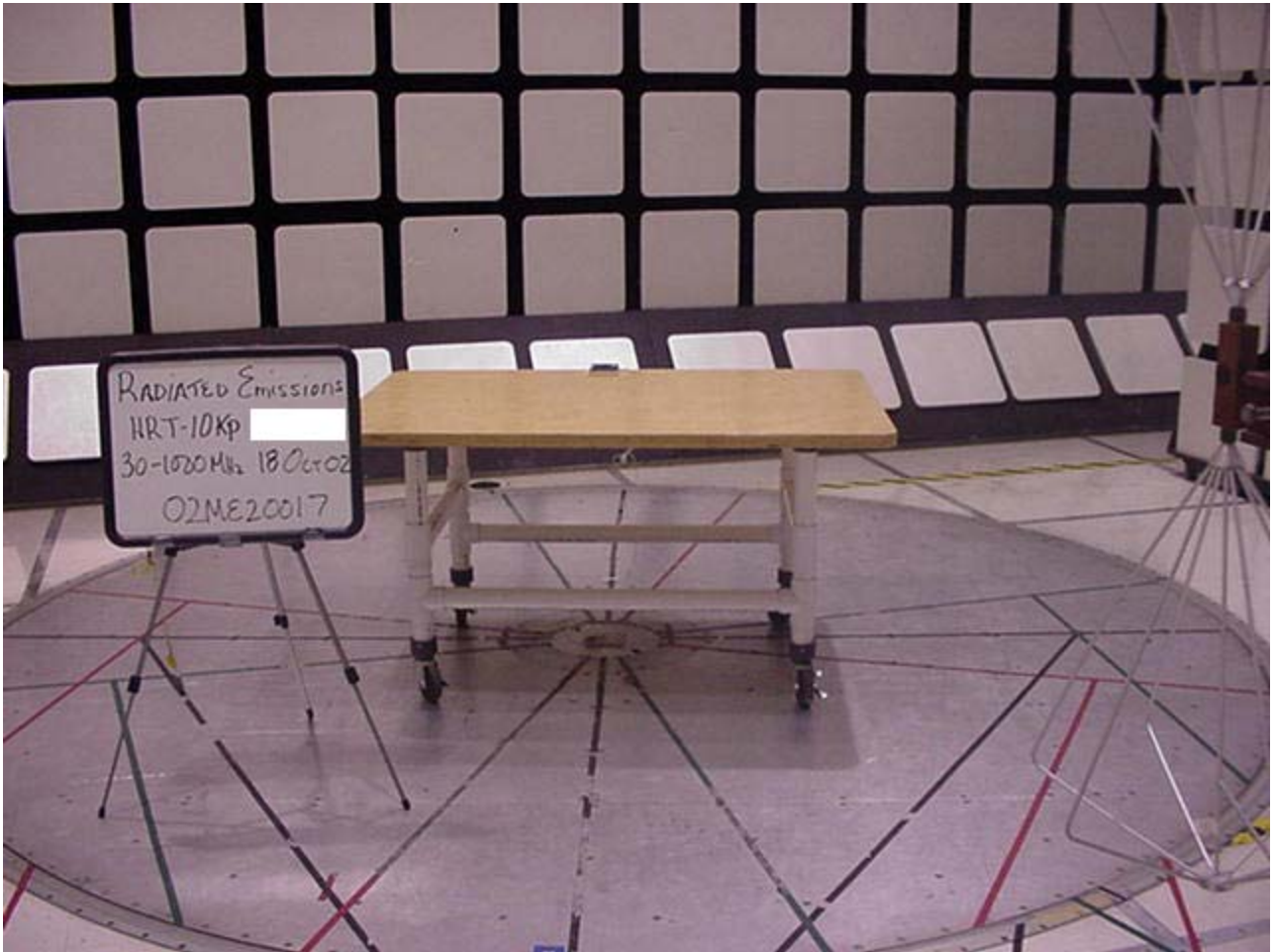
Pulse Train Test Set-Up



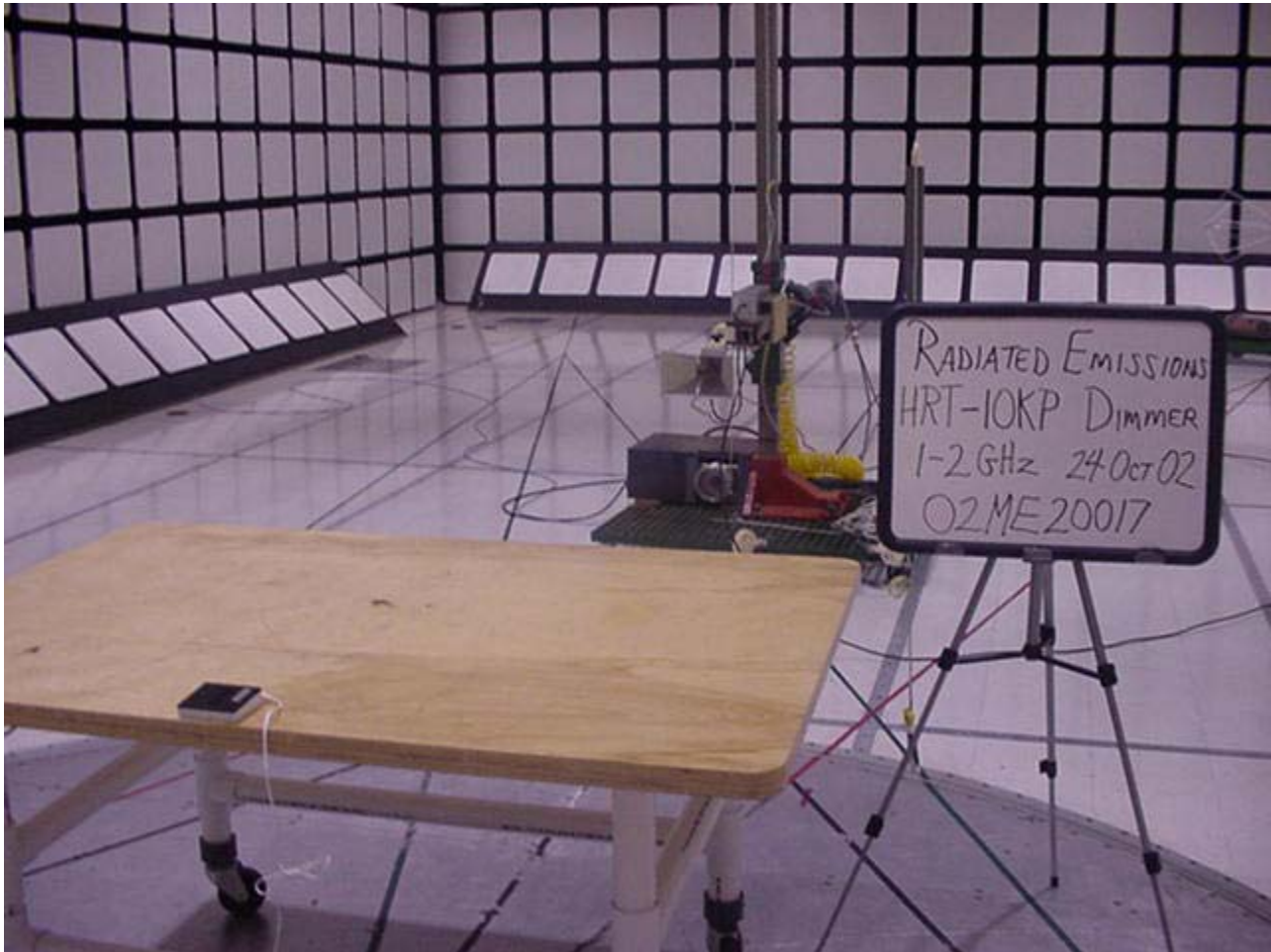
Radiated Emission Test Set-Up 30-1000MHz Front View



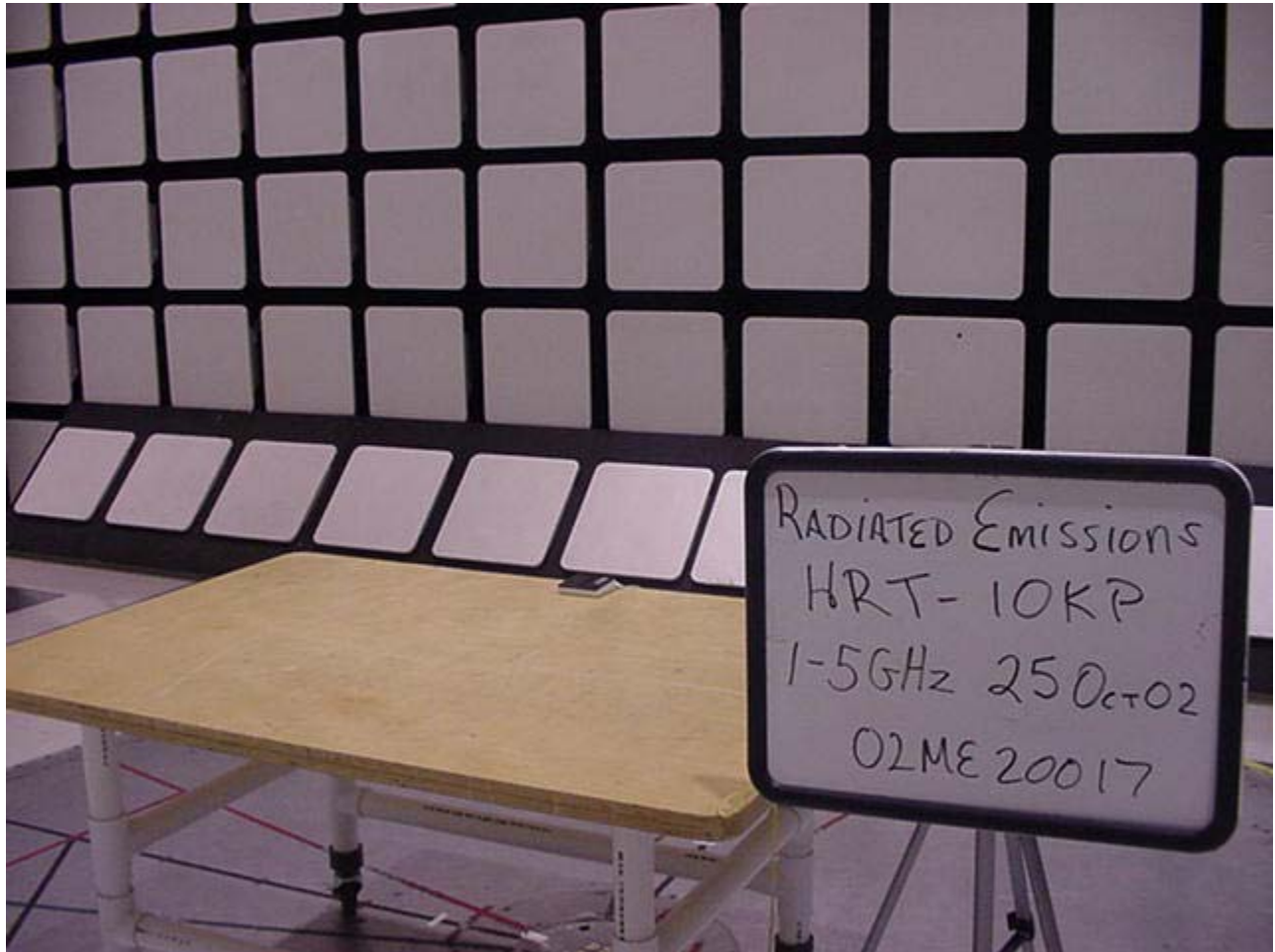
Radiated Emission Test Set-Up 30-1000MHz Front View



Radiated Emission Test Set-Up 30-1000MHz Front View



Radiated Emission Test Set-Up 1 to 2GHz



Radiated Emission Test Set-Up 1 to 5GHz

File Number: NC2219  
Project Number: 02ME20017  
Model Number: HRT-10KP  
FCC ID: JPZ0021

Issued: 11/5/02

### 2.1.4 Occupied Bandwidth:

Test Applicable       Test Not Applicable

Temperature:            20.8 °C  
Humidity:                69%RH  
Pressure:                1040mbar  
Date test performed: 24 Oct 2002

The bandwidth of the emissions shall be no wider than 0.25% of the center frequency for the devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier at a distance of 100cm.

For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Mode: “ Constant (Continuous) Transmit”

Frequency range:

431MHz and 437MHz

Bandwidth = 0.25% of 431MHz = 1.0775MHz

Bandwidth = 0.25% of 437MHz = 1.0925MHz

#### Test equipment used for Occupied Bandwidth Measurements:

**ESI**                                      **Rhode & Swartz**                                      **EMI Test Receiver,**                                      **Equipment No.: 5B-081**  
Range: 20Hz -26.5GHz      Last Calibration Date: 20 August 02      Calibration Due Date: 20 August 03

#### Consisting of:

<b>HP - 8566B</b>	<b>Hewlett-Packard</b>	<b>Spectrum Analyzer,</b>
	<b>Resolution BW: 1MHz</b>	
	<b>Video BW: 1MHz</b>	
<b>HP - 85662A</b>	<b>Hewlett-Packard</b>	<b>Analyzer Display</b>
<b>HP - 85650A</b>	<b>Hewlett-Packard</b>	<b>Quasi-Peak Adapter,</b>
	<b>BW: 120kHz</b>	
<b>HP - 85685A</b>	<b>Hewlett-Packard</b>	<b>Preselector</b>

**3121C**                                      **The Electro Mechanics**                                      **Dipole ANTenna**                                      **Equipment No.:**

Last Calibration Date: 10 Dec.01      Calibration Due Date: 10 DEC 02

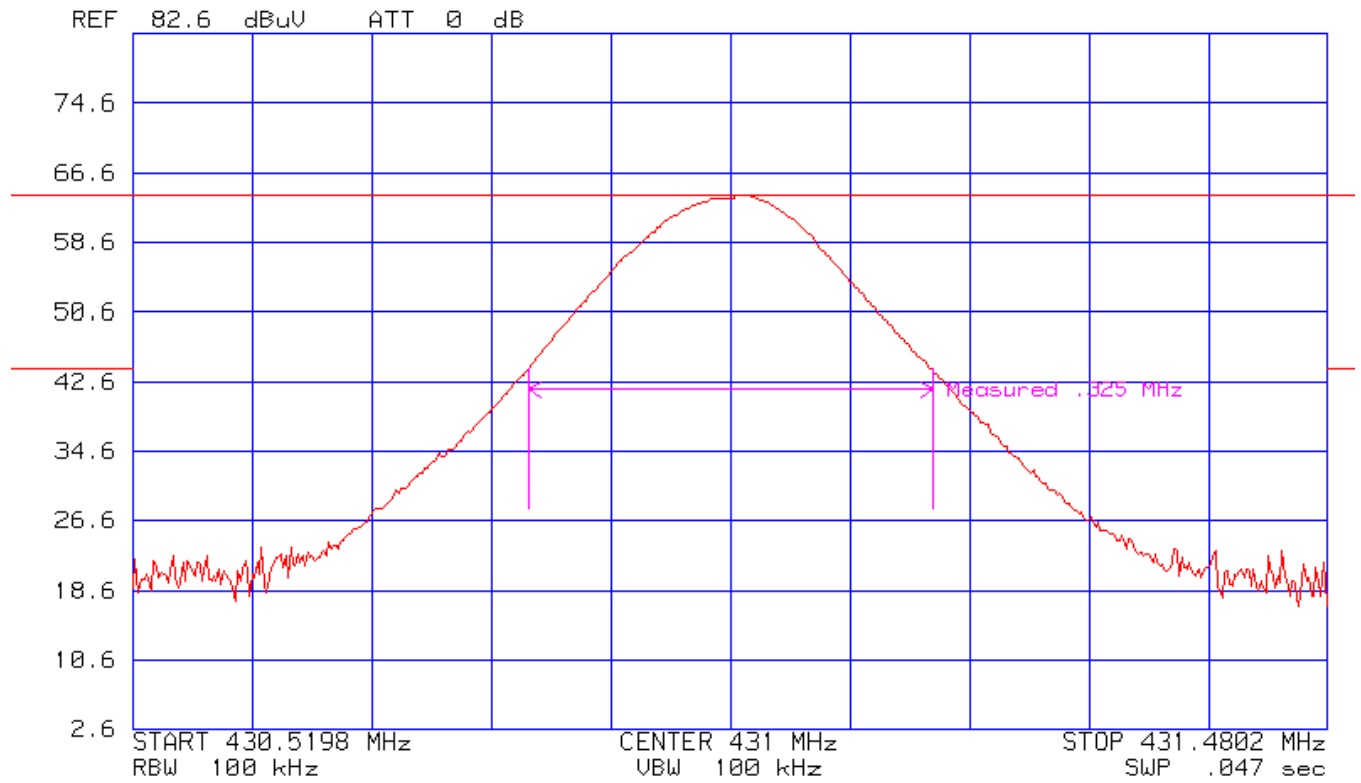
**Temp/Pressure**                                      **Oakton**                                      **Barometer**                                      **Equipment No.: ME4-263**

Range: 950-1045                                      Last Calibration Date: 2 April 02                                      Calibration Due Date: 2 April 03

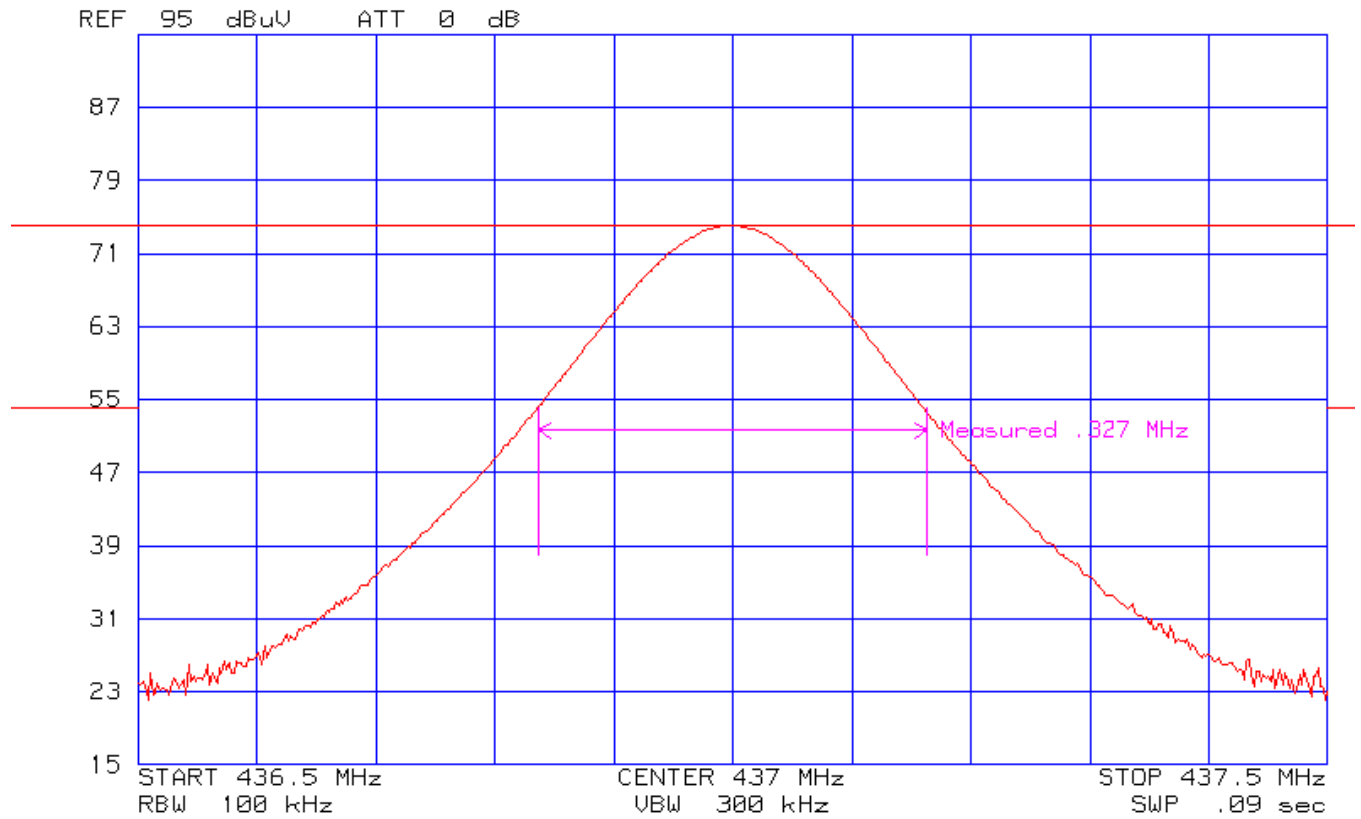
**453320**                                      **Ex-Tech**                                      **Hydro-Thermometer**                                      **Equipment No.: ME4-264**

Range: 0-80%                                      Last Calibration Date: 2 April 02                                      Calibration Due Date: 2 April 03





431MHz Occupied Bandwidth @ 20 db = 0.325MHz



437MHz Occupied Bandwidth @ 20 db = 0.327MHz



Occupied Bandwidth Test Set-Up HRT-10KP

## 2.1.5 Fundamental Frequency and Spurious Emissions Measurement Limit Calculations

Limit Calculation:

Fundamental Frequency is 431MHz

From table in section 15.231

$$\text{Limit} = 41.6667(431) - 7083.3333$$

$$\text{Limit} = 10846.3\mu\text{V}$$

$$\text{Limit} = \text{Log } 10846.3(20)$$

$$\text{Limit} = 80.7\text{dBuV}$$

$$\text{Limit for Spurious Emissions} = 20\text{dB lower than fundamental} = 60.7\text{dBuV/m}$$

Fundamental Frequency is 437MHz

From table in section 15.231

$$\text{Limit} = 41.6667(437) - 7083.3333$$

$$\text{Limit} = 11125.018\mu\text{V}$$

$$\text{Limit} = \text{Log } 11125.018 (20)$$

$$\text{Limit} = 80.9\text{dBuV}$$

$$\text{Limit for Spurious Emissions} = 20\text{dB lower than fundamental} = 60.9\text{dBuV/m}$$

### ***Radiated Emissions Limit conversion from $\mu\text{V/m}$ to $\text{dB}\mu\text{V/m}$ (accordance with paragraph 15.109)***

$$\text{Radiated Emissions Limit (dB}\mu\text{V/m)} = 20 * \log (\mu\text{V/m})$$

$$\text{Radiated Emissions Limit (dB}\mu\text{V/m)} = 20 * \log (90)$$

$$\text{Radiated Emissions Limit (dB}\mu\text{V/m)} = 39.1$$

### ***Radiated Emissions test data obtained during measurements.***

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{Measured field strength(dB}\mu\text{V/m)} + \text{Antenna Factor(dB)} + \text{Cable Factor(dB)}$$

$$\text{Field Strength (dB}\mu\text{V/m)} = 19.7\text{dB}\mu\text{V/m} + 12.5\text{dB} + 0.3\text{dB}$$

$$\text{Field Strength (dB}\mu\text{V/m)} = 32.5$$

### **Duty Cycle factor calculation.**

Total number of pulses counted in 100ms.

Total time on = 3.97ms

$$\text{Duty cycle correction factor} = 20 \log (3.97\text{ms} / 50\text{ms})$$

$$= 20 \log (0.0794)$$

$$= - 22.0\text{dB}$$

The correction factor is added to the measured field strength in dBuV/m

### 3.0 SUMMARY:

The equipment under test has

met the technical requirements as defined under section(s)  2.0 and  3.0

not met the technical requirements as defined under section(s)  2.0 and  3.0

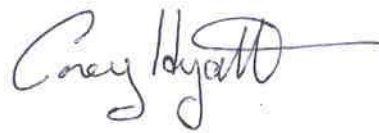
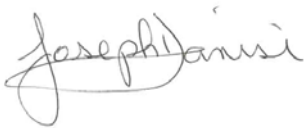
Test Start Date: 15 October 2002

Test Completion Date: 29 October 2002

#### - UNDERWRITERS LABORATORIES, INC. -

Project Engineer

Reviewer



Joseph Danisi (Ext.23055)  
Senior Engineering Associate  
International EMC Services  
Conformity Assessment Services-3014AMEL

Corey Hyatt (Ext.22511)  
Associate Manager  
International EMC Services  
Conformity Assessment Services -3014AMEL