

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: HRD-5KP
Product Type: Wireless Wall 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: JPZ0020

Underwriters Laboratories Inc. authorizes the above-named company to reproduce this Report provided it is reproduced in its entirety.

Underwriters Laboratories Inc. reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. Underwriters Laboratories Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from Underwriters Laboratories Inc. issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. This report shall not be used by the client to claim product endorsement by NVLAP or any agency of the US government.

Report Directory

1.0	<i>GENERAL - Product Description</i>	3
1.1	Device Configuration During Test	4
1.2	Deviations from ANSI C63.4	4
1.3	Device Modifications Necessary for Compliance	5
1.4	Test Summary	5
2.0	<i>EMISSIONS TEST REGULATIONS</i>	6
2.1	EUT OPERATION MODE - EMISSIONS TESTS	6
2.1.1	Conducted Emissions Tests	8
2.1.2	Cease Operation Within 5 Seconds	13
2.1.3	Radiated Emissions Test (10 Meter Semi-Anechoic Chamber)	16
2.1.4	Occupied Bandwidth	47
2.1.5	Fundamental Frequency and Spurious Emissions Measurement Limit Calculations	50
3	<i>SUMMARY:</i>	51

1.0 G E N E R A L - Product Description

Device Function: The HRD-5KP is a wall-mounted keypad. It contains a FM transceiver and an antenna, which is not accessible to the user. 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 HRD-5KP 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 replaced by the user since it is underneath the plastic enclosure, which is secured by several odd screws, unit labels that prevent the plastic from being pried open, and plastic snap features.

Analog Function: The HRD-5KP obtains power through standard household wiring. The power supply and voltage regulator produces 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 Wall Keypad	Lutron	HRD-5KP	N/A	JPZ0020
Cable	-----	Standard wire gauge	-----	-----

"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	✓	✓	✓

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: HRD-5KP
FCC ID: JPZ0020

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

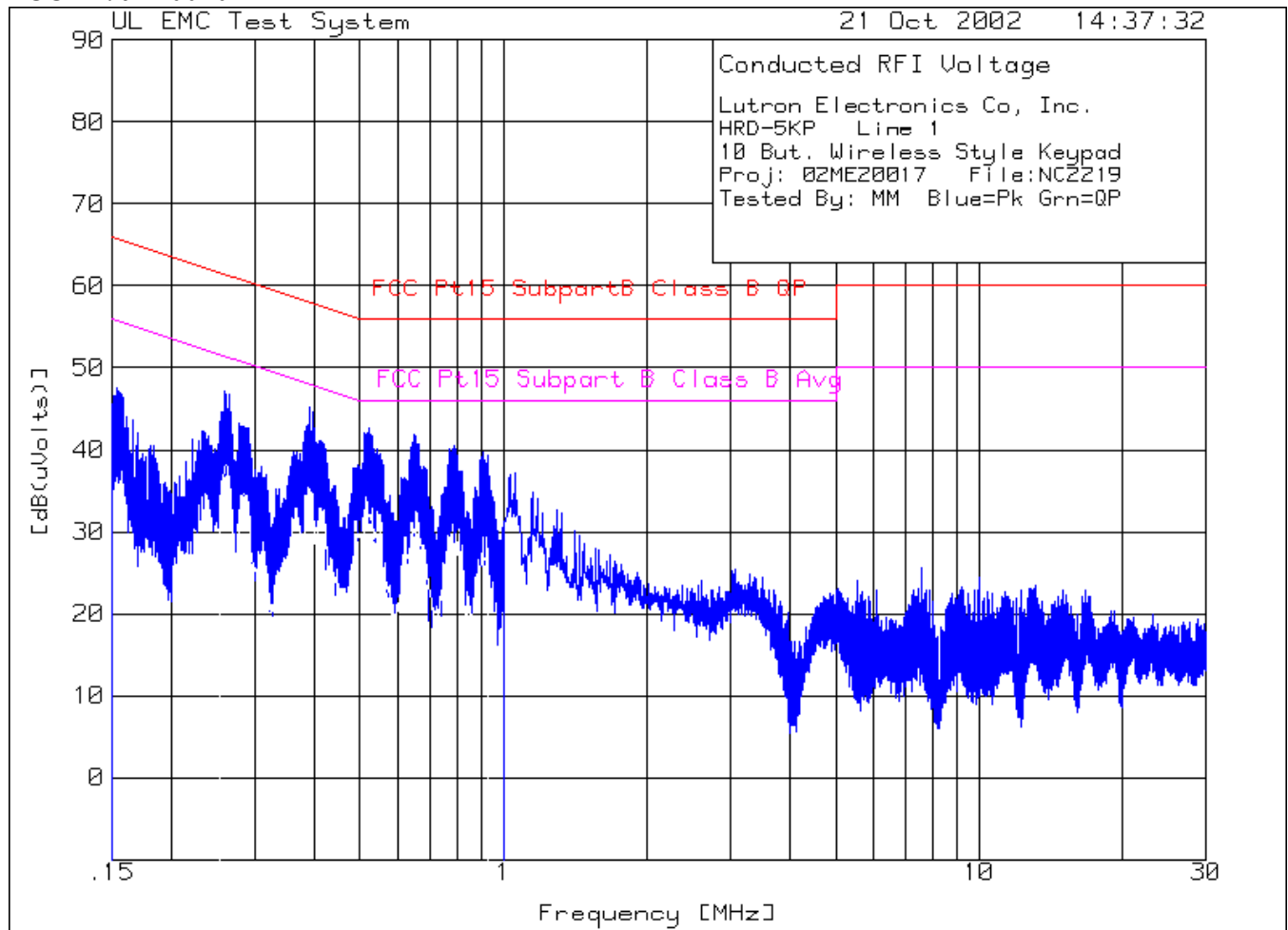
☒ 150kHz to 30MHz ☒ Voltage ☐ Current ☒ Mains ☐ I/O Lines

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:

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



Transmit at 437 MHz

File Number: NC2219
 Project Number: 02ME20017
 Model Number: HRD-5KP
 FCC ID: JPZ0020

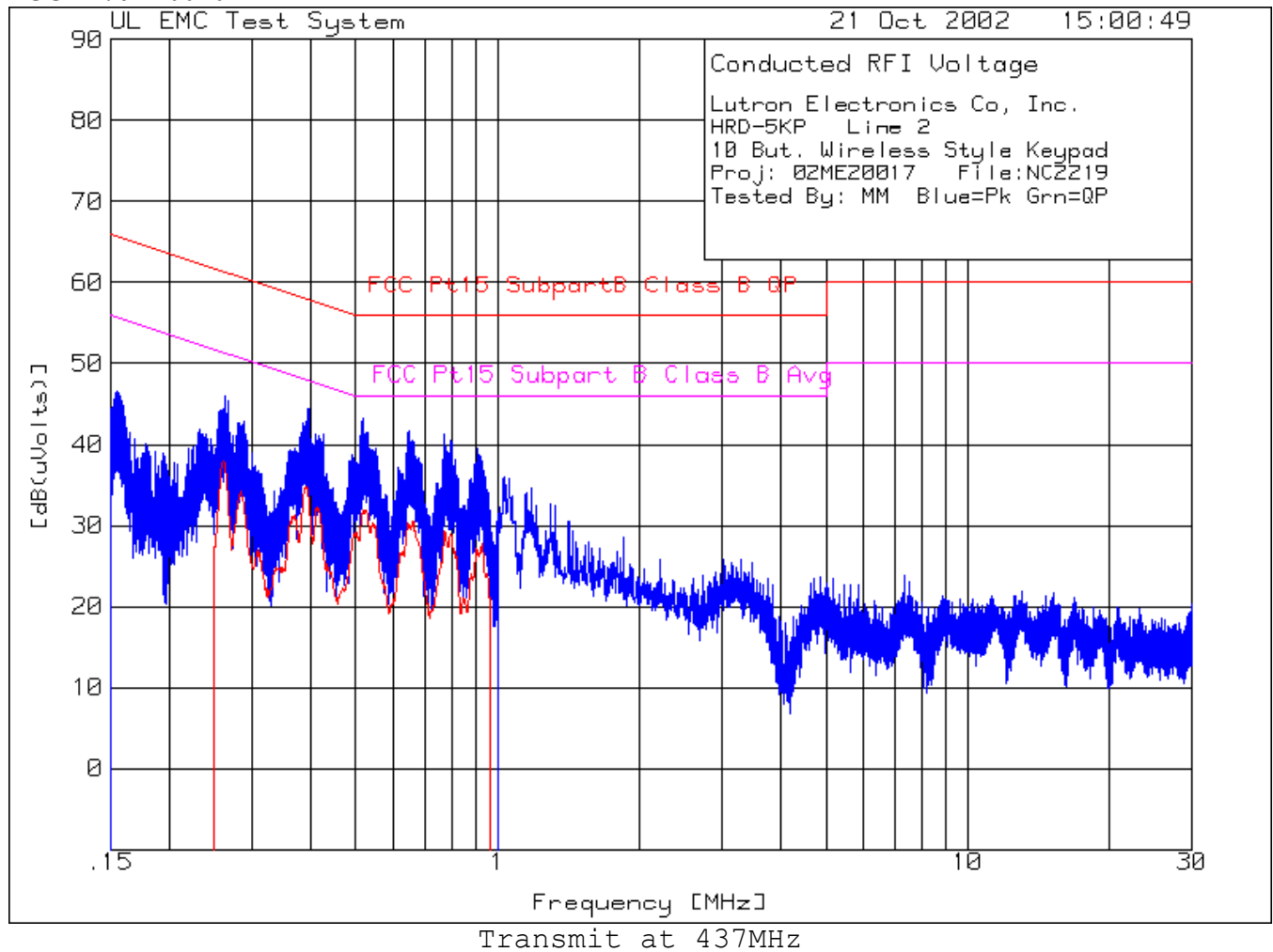
Issued: 11/5/02

Lutron Electronics Co, Inc.
 HRD-5KP Line 1
 10 But. Wireless Style Keypad
 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	.2607	27.9 avem	10.3	0	38.2	61.4	51.4
				Margin [dB]		-23.2	-13.2
2	.2857	24.31 avem	10.3	0	34.61	60.6	50.6
				Margin [dB]		-25.99	-15.99
3	.3897	24.6 avem	10.3	0	34.9	58.1	48.1
				Margin [dB]		-23.2	-13.2
4	.5237	21.83 avem	10.3	0	32.13	56	46
				Margin [dB]		-23.87	-13.87
5	.6627	20.2 avem	10.3	0	30.5	56	46
				Margin [dB]		-25.5	-15.5
6	.7947	19.15 avem	10.3	0	29.45	56	46
				Margin [dB]		-26.55	-16.55

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

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



File Number: NC2219
 Project Number: 02ME20017
 Model Number: HRD-5KP
 FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co, Inc.
 HRD-5KP Line 2
 10 But. Wireless Style Keypad
 Proj: 02ME20017 File:NC2219
 Tested By: MM Blue=Pk Grn=QP

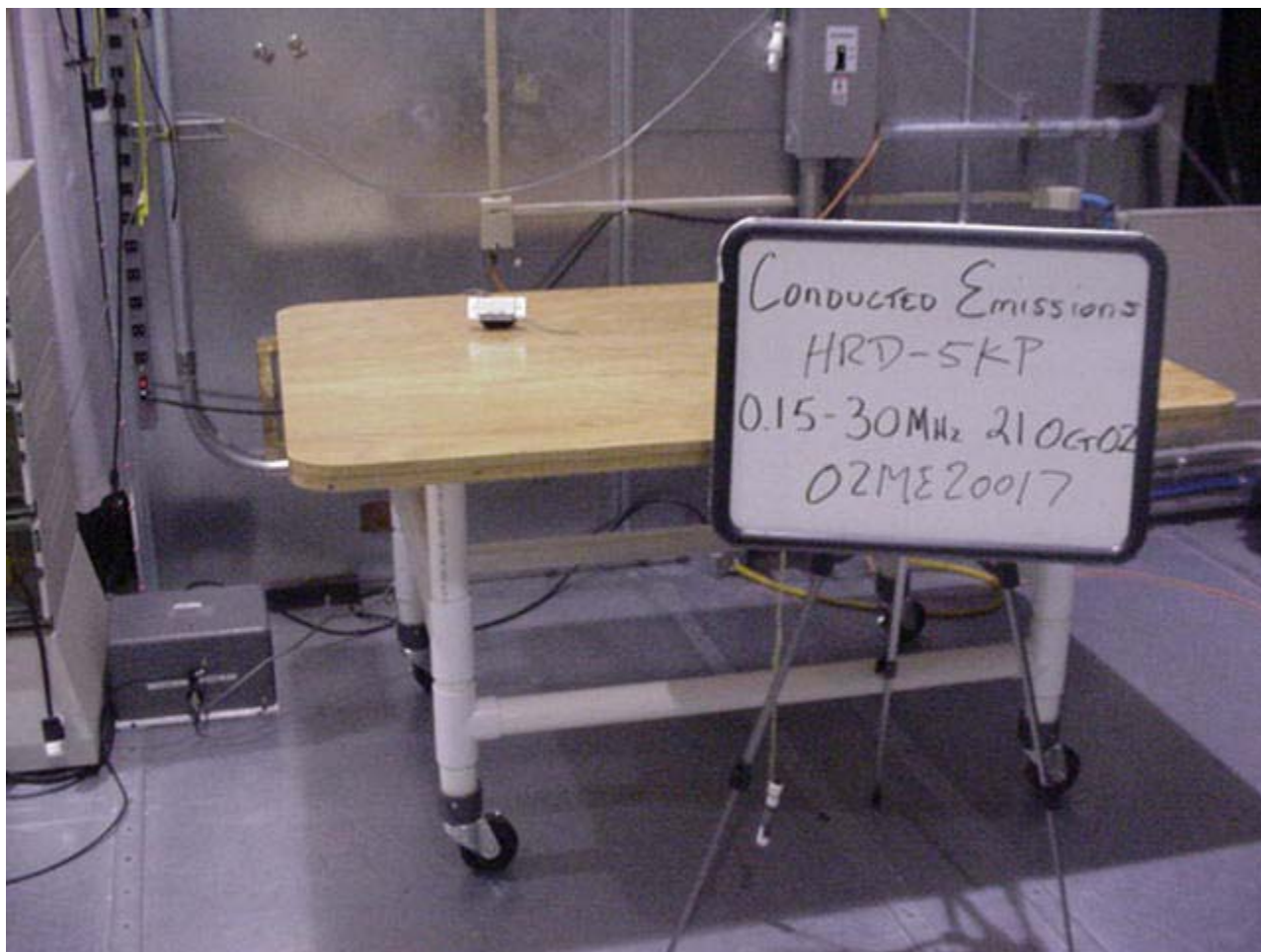
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1	2
=====							
Range: 1 .15 - 1MHz -----							
1	.2608	27.64	avem	10.3	0	37.94	61.4
					Margin [dB]	-23.46	-13.46
2	.3918	24.42	avem	10.3	0	34.72	58
					Margin [dB]	-23.28	-13.28
3	.5198	21.57	avem	10.3	0	31.87	56
					Margin [dB]	-24.13	-14.13
4	.6628	20.21	avem	10.3	0	30.51	56
					Margin [dB]	-25.49	-15.49
5	.7728	19.02	avem	10.3	0	29.32	56
					Margin [dB]	-26.68	-16.68
6	.9268	17.4	avem	10.3	0	27.7	56
					Margin [dB]	-28.3	-18.3

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

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

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



Conducted Emission Test Set-Up 0.150 to 30MHz

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

2.1.2 Cease Operation Within 5 Seconds

☒ Test Applicable ☐ Test Not Applicable

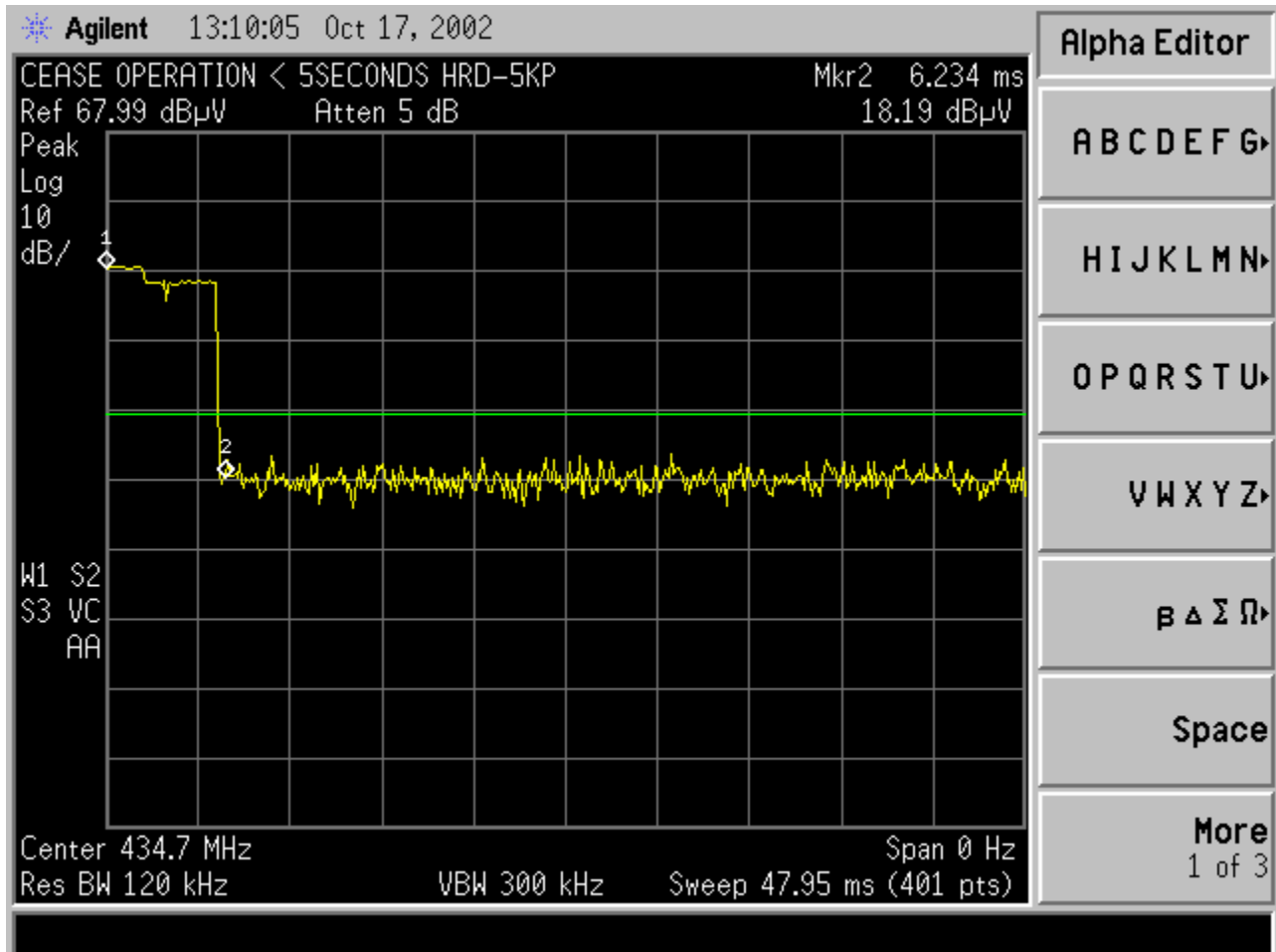
Temperature: 21.2°C
Humidity: 42%RH
Pressure: 1025 milbar
Date test performed: 17 October 2002

Test Procedure:

☒ This test is performed one time at any frequency band. A manual operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

☐ A transmitter activated automatically shall cease transmission within 5 seconds after activation.

E7402A	Agilent	EMC Analyzer	Equipment No.: 5B-123
Last Calibration Date: 17 Sept. 2002		Calibration Due Date: 17 September 2003	
☒ 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	



HRD-5KP < 5 Seconds (total activation time 6.234ms)

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



Test Set-Up Cease Operation < 5 seconds

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: HRD-5KP
FCC ID: JPZ0020

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:

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

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	

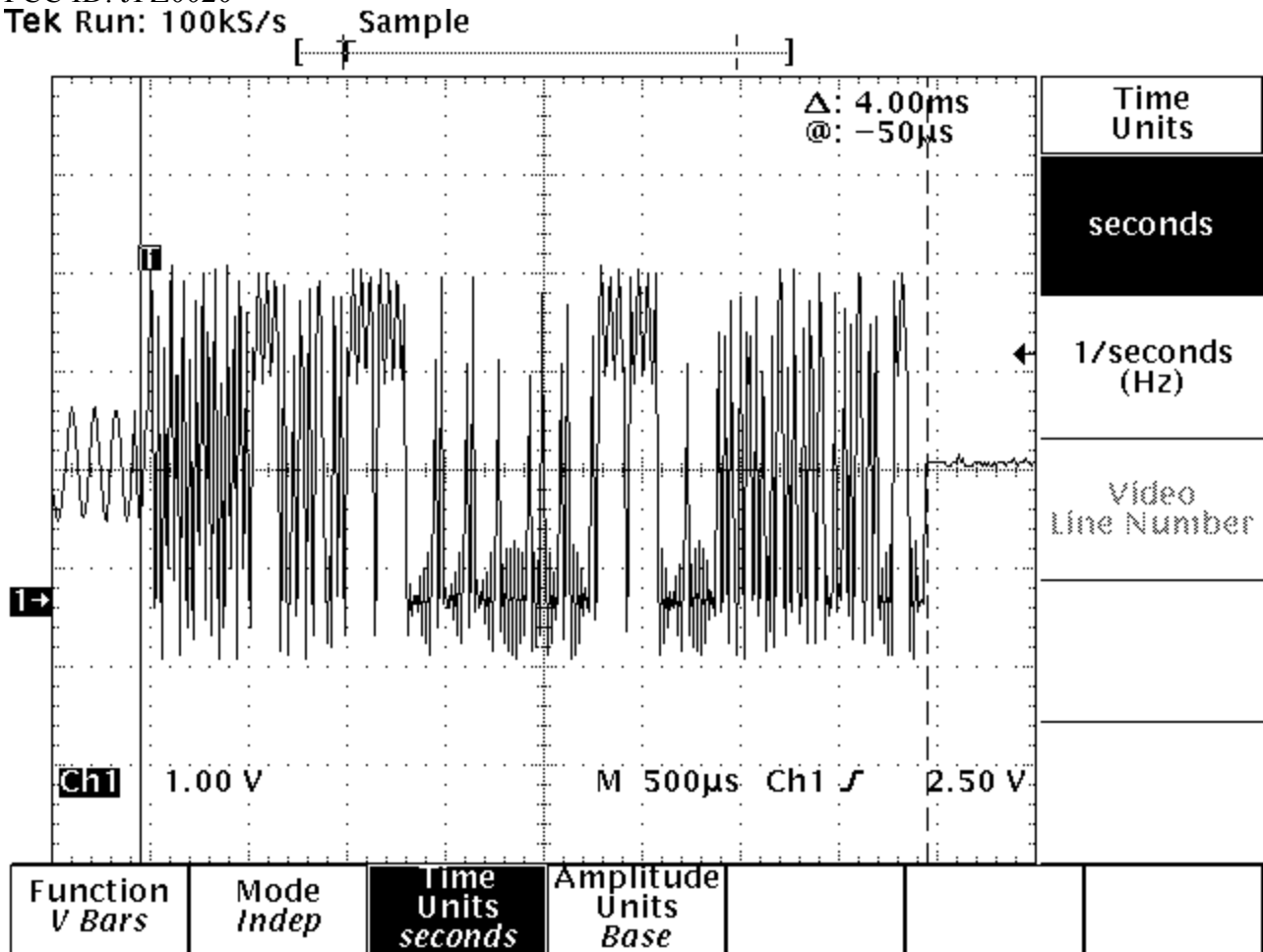
☒ 3146	EMCO	Log Periodic Antenna	Equipment No.: ME5-451
Last Calibration Date:15 Oct 02		Calibration Due Date: 15 Oct 03	

☒ 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	

File Number: NC2219
 Project Number: 02ME20017
 Model Number: HRD-5KP
 FCC ID: JPZ0020
Tek Run: 100kS/s

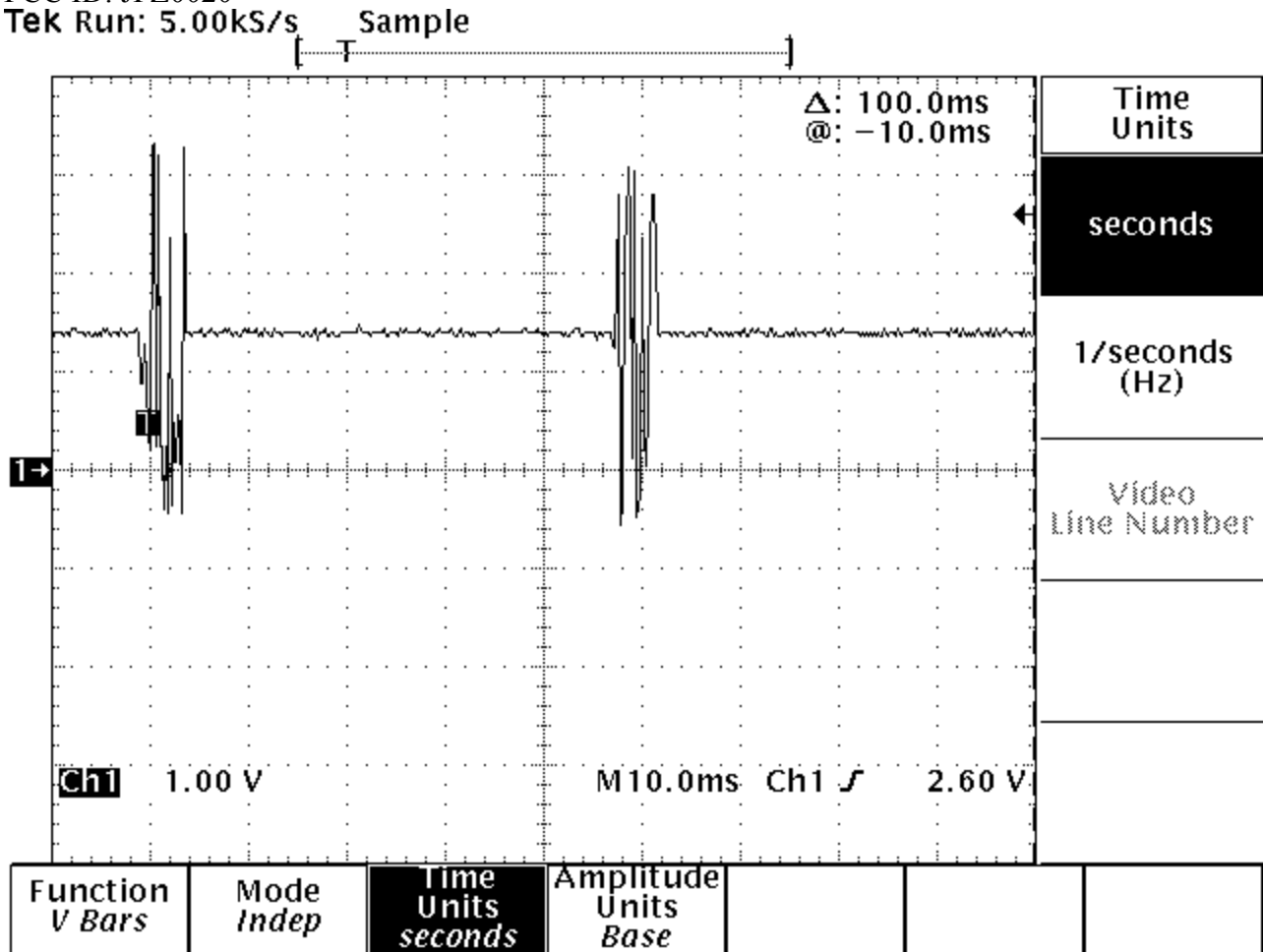
Issued: 11/5/02



HRD-5KP One Complete Pulse Train 8ms expanded view profile

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020
Tek Run: 5.00kS/s

Issued: 11/5/02



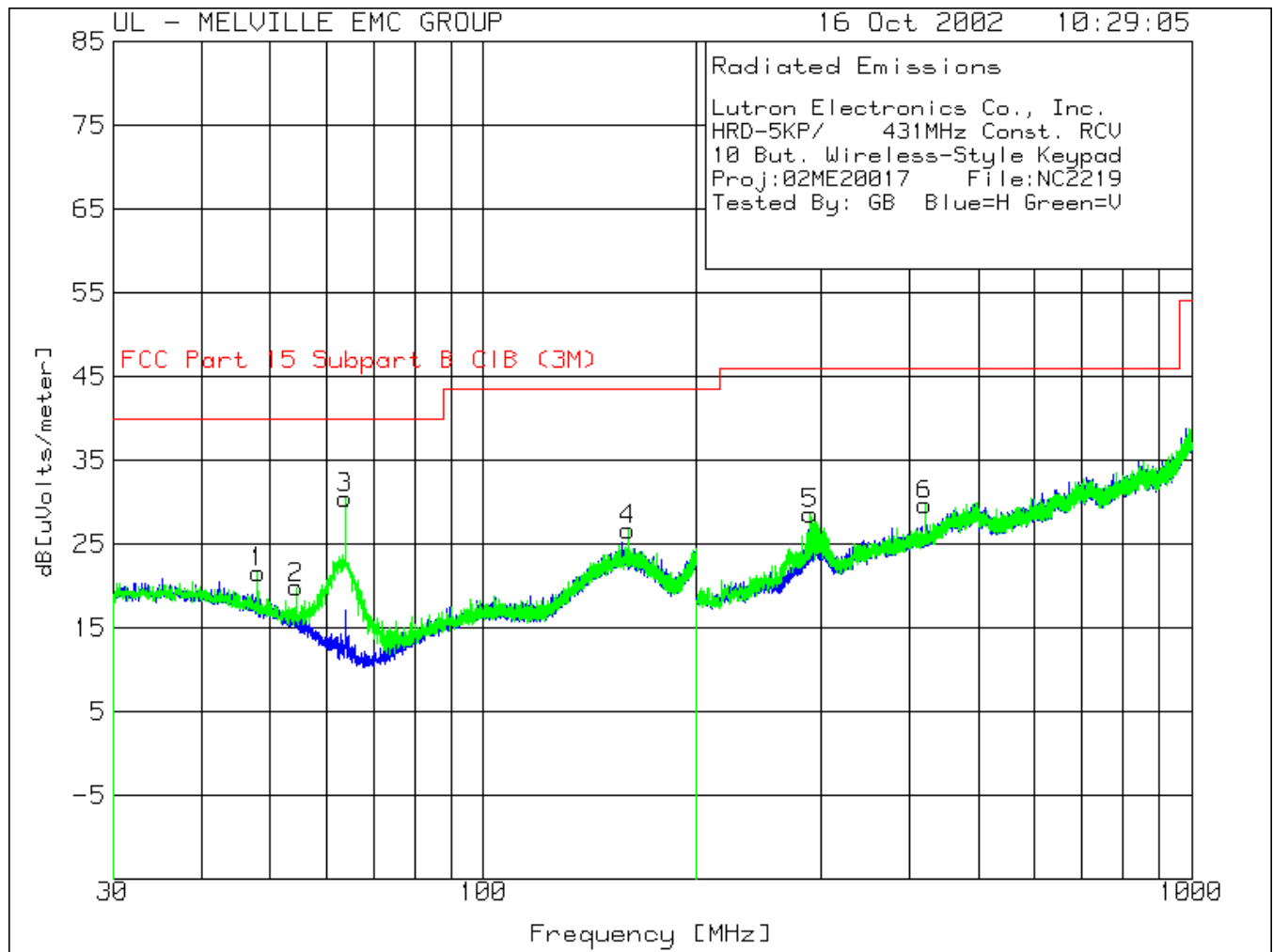
HRD-5KP One Complete Pulse Train < 100ms wide profile

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



Pulse Train Test Set-Up



431MHz Receive Mode

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP/ 431MHz Const. RCV
10 But. Wireless-Style 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	48.0065	8.39 pk	1.01	12.2	21.6	40
	Azimuth:258	Height:100	Vert	Margin [dB]		-18.4
2	54.3767	8.45 pk	1.05	10.3	19.8	40
	Azimuth:309	Height:100	Vert	Margin [dB]		-20.2
3	63.8046	22.78 pk	1.12	6.6	30.5	40
	Azimuth:105	Height:100	Vert	Margin [dB]		-9.5
4	159.9525	8 pk	1.8	16.9	26.7	43.5
	Azimuth:0	Height:100	Vert	Margin [dB]		-16.8

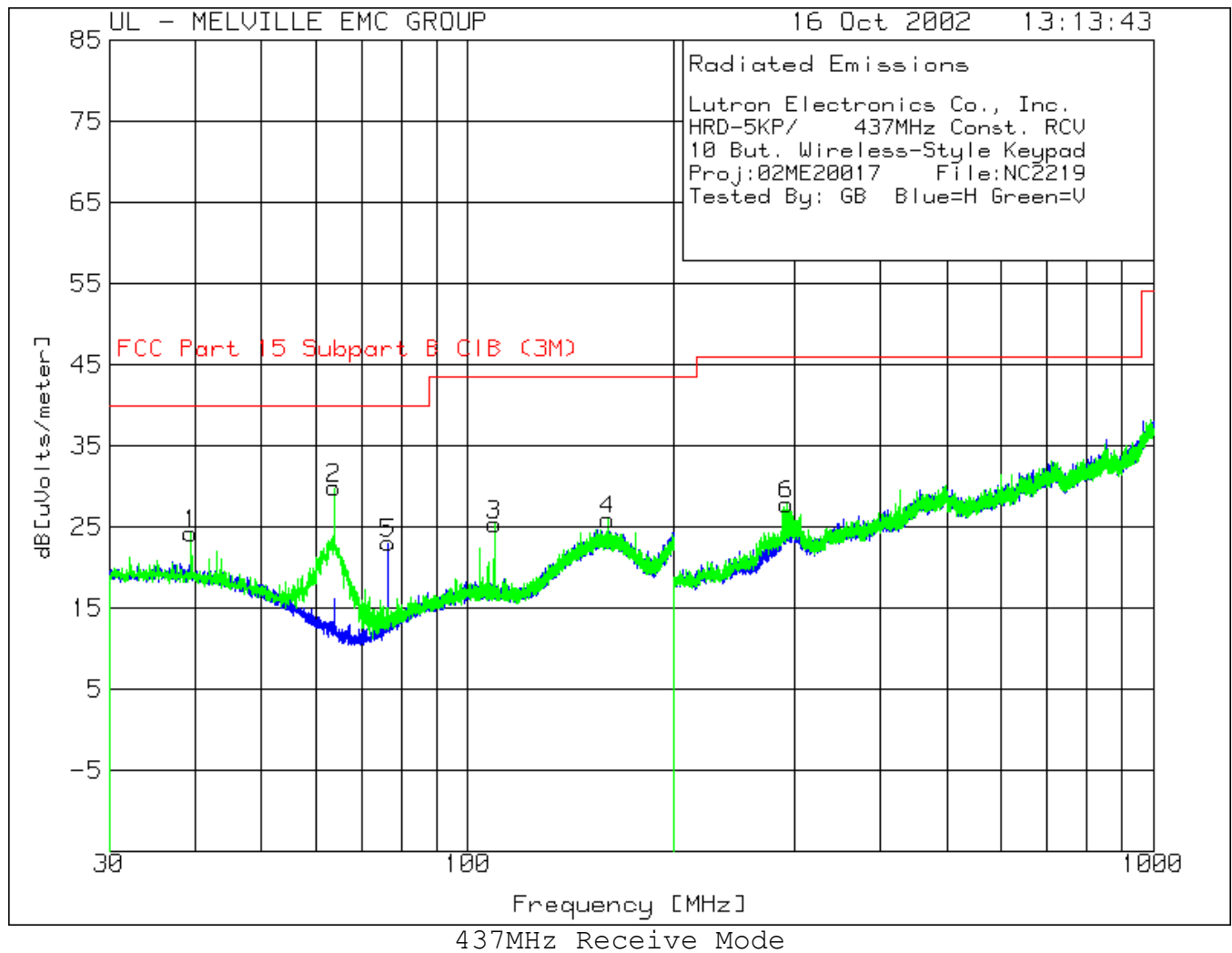
Range: 4 200 - 1000MHz -----						
5	289.3922	10.53 pk	2.29	15.78	28.6	46
	Azimuth:330	Height:100	Vert	Margin [dB]		-17.4
6	420.0833	10.5 pk	3.1	16.1	29.7	46
	Azimuth:340	Height:100	Vert	Margin [dB]		-16.3

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
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP/ 437MHz Const. RCV
10 But. Wireless-Style Keypad
Proj:02ME20017 File:NC2219
Tested By: GB Blue=H Green=V

Test No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
=====						
Range: 1 30 - 200MHz -----						
5	76.5026	14.42 pk	1.25	7.33	23	40
	Azimuth:242	Height:200	Horz	Margin [dB]		-17

Range: 2 30 - 200MHz -----						
1	39.4279	9.5 pk	.9	13.8	24.2	40
	Azimuth:255	Height:101	Vert	Margin [dB]		-15.8
2	63.7622	22.08 pk	1.12	6.6	29.8	40
	Azimuth:204	Height:101	Vert	Margin [dB]		-10.2
3	109.2456	12.83 pk	1.46	11.01	25.3	43.5
	Azimuth:20	Height:101	Vert	Margin [dB]		-18.2
4	159.9525	7.2 pk	1.8	16.9	25.9	43.5
	Azimuth:306	Height:101	Vert	Margin [dB]		-17.6

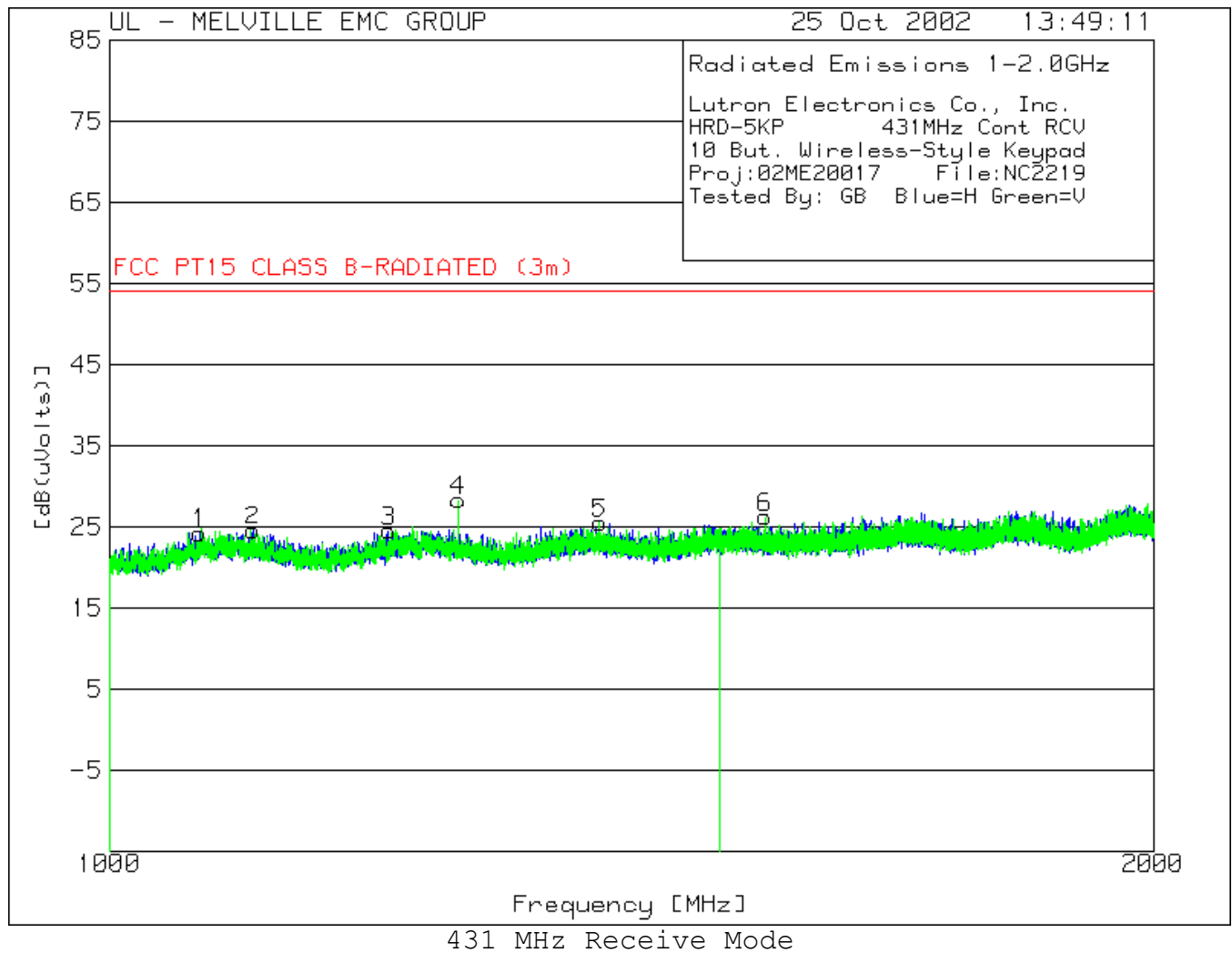
Range: 4 200 - 1000MHz -----						
6	292.0566	9.51 pk	2.29	16	27.8	46
	Azimuth:90	Height:101	Vert	Margin [dB]		-18.2

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
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP 431MHz Cont RCV
10 But. Wireless-Style Keypad
Proj:02ME20017 File:NC2219
Tested By: GB Blue=H Green=V

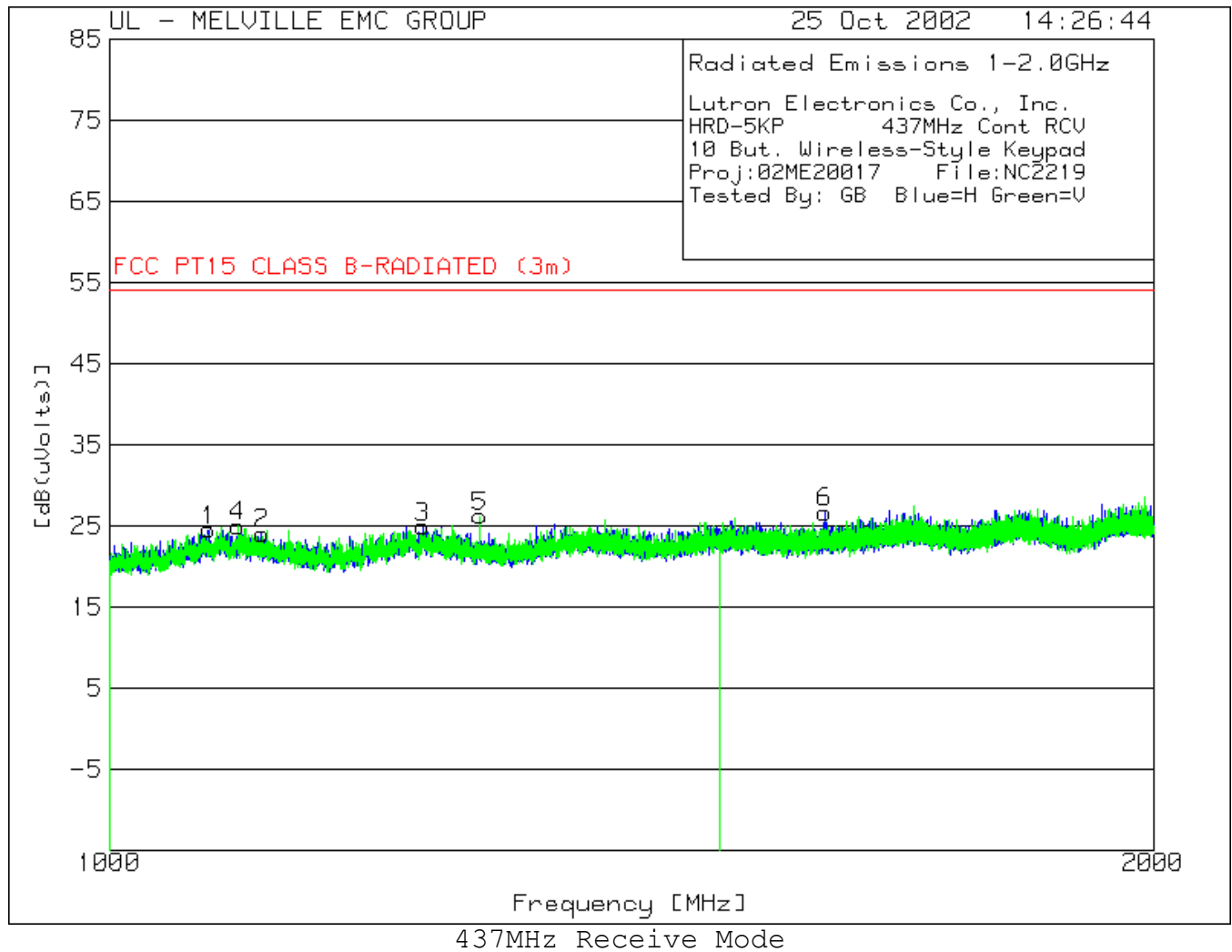
No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1
=====						
Range: 1 1000 - 1500MHz -----						
1	1061.699	32.71 pk	-33.53	25.12	24.3	54
	Azimuth:352	Height:200	Horz	Margin [dB]		-29.7
2	1100.167	32.77 pk	-33.43	25.26	24.6	54
	Azimuth:33	Height:101	Horz	Margin [dB]		-29.4
3	1203.497	32.02 pk	-33.15	25.63	24.5	54
	Azimuth:156	Height:200	Horz	Margin [dB]		-29.5
Range: 3 1000 - 1500MHz -----						
4	1260.866	35.46 pk	-33	25.84	28.3	54
	Azimuth:167	Height:100	Vert	Margin [dB]		-25.7
5	1384.679	31.88 pk	-32.66	26.28	25.5	54
	Azimuth:16	Height:100	Vert	Margin [dB]		-28.5
Range: 4 1500 - 2000MHz -----						
6	1545.523	31.5 pk	-32.2	26.9	26.2	54
	Azimuth:102	Height:200	Vert	Margin [dB]		-27.8

LIMIT 1: FCC PT15 CLASS B-RADIATED (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
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

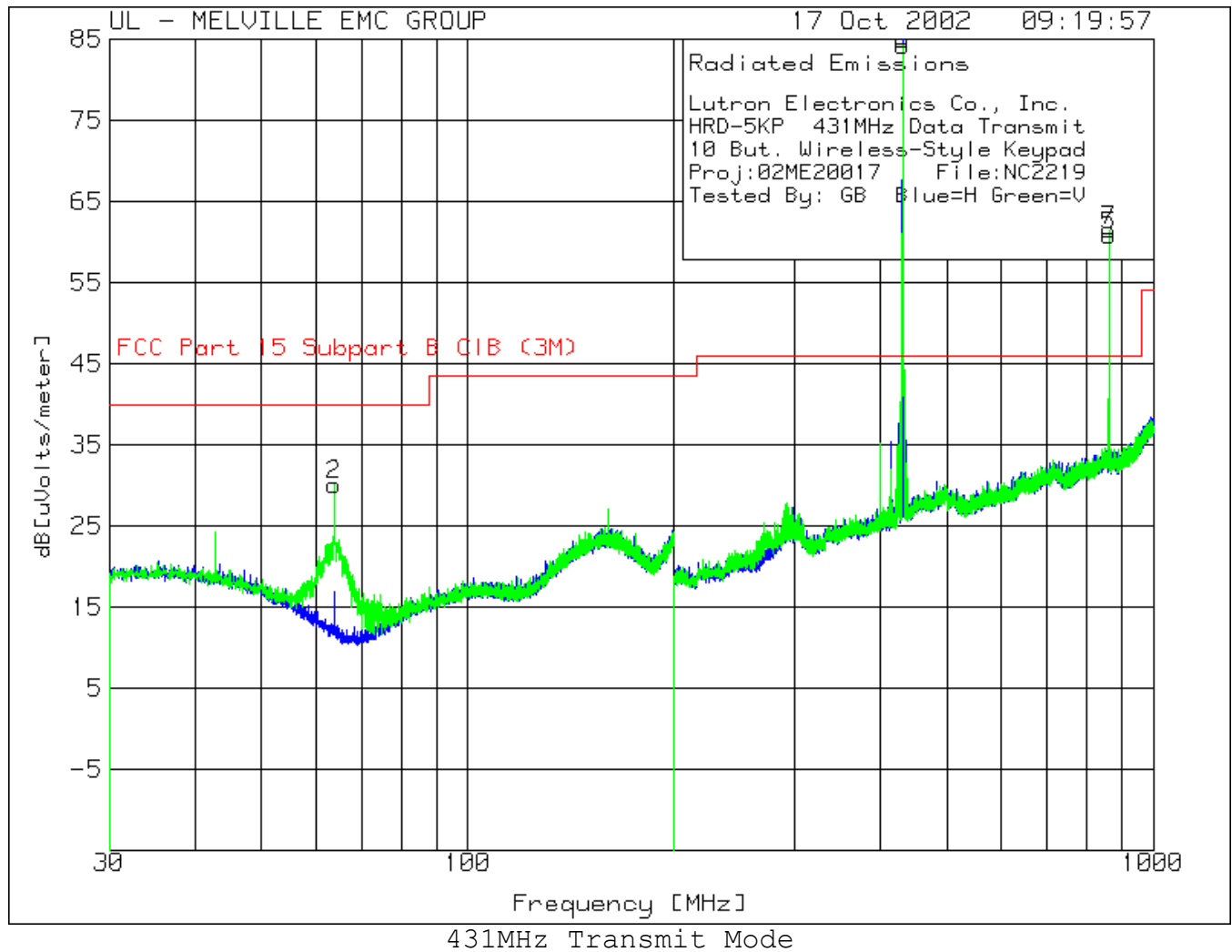
Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP 437MHz Cont RCV
10 But. Wireless-Style Keypad
Proj:02ME20017 File:NC2219
Tested By: GB Blue=H Green=V

Test No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1
=====						
Range: 1 1000 - 1500MHz -----						
1	1068.193	32.87 pk	-33.52	25.15	24.5	54
	Azimuth:355	Height:199	Horz	Margin [dB]		-29.5
2	1106.411	32.23 pk	-33.41	25.28	24.1	54
	Azimuth:33	Height:100	Horz	Margin [dB]		-29.9
3	1231.474	32.25 pk	-33.08	25.73	24.9	54
	Azimuth:223	Height:199	Horz	Margin [dB]		-29.1
Range: 2 1500 - 2000MHz -----						
6	1608.468	31.52 pk	-32	27.18	26.7	54
	Azimuth:137	Height:200	Horz	Margin [dB]		-27.3
Range: 3 1000 - 1500MHz -----						
4	1089.176	33.24 pk	-33.46	25.22	25	54
	Azimuth:103	Height:100	Vert	Margin [dB]		-29
5	1278.768	33.25 pk	-32.95	25.9	26.2	54
	Azimuth:183	Height:100	Vert	Margin [dB]		-27.8

LIMIT 1: FCC PT15 CLASS B-RADIATED (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
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP 431MHz Data Transmit
10 But. Wireless-Style Keypad
Proj:02ME20017 File:NC2219
Tested By: GB Blue=H Green=V

Test No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level	Limit:1 dB[uVolts/meter]	Limit2
----------	-----------------	-------------------------	-----------------------	------------------------	-------	--------------------------	--------

=====

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

2	63.8896	22.4 pk	1.12	6.58	30.1	N/A	40
	Azimuth:96	Height:100	Vert	Margin [dB]			-9.9

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

4	430.8743	65.29 pk	3.17	16.44	84.9	80.7	
	Azimuth:358	Height:199	Horz	Margin [dB]		4.2	
5	861.3156	33.26 pk	4.41	23.13	60.8	60.7	
	Azimuth:341	Height:100	Horz	Margin [dB]		0.1	

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

6	430.741	64.6 pk	3.16	16.44	84.2	80.7	
	Azimuth:201	Height:200	Vert	Margin [dB]		3.5	
7	861.3156	33.96 pk	4.41	23.13	61.5	60.7	
	Azimuth:287	Height:100	Vert	Margin [dB]		0.8	

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: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP 431MHz Data Transmit
10 But. Wireless-Style Keypad
Proj:02ME20017 File:NC2219
Tested By: GB Blue=H Green=V

Test	Meter	Gain/Loss	Transducer	Level	Limit:1	Limit2			
Frequency [MHz]	Reading [dB (uV)]	Factor [dB]	Factor [dB]	dB[uVolts/meter]					
=====									
Range: 3 200 - 1000MHz									
430.9904	*44.67 av	3.17	16.45	*64.29	80.7				
Azimuth: 60	Height:102	Horz	Margin [dB]:	-16.41					
861.9887	32.39 av	4.41	23.1	59.9	60.7				
Azimuth: 80	Height:119	Horz	Margin [dB]:	-0.8					

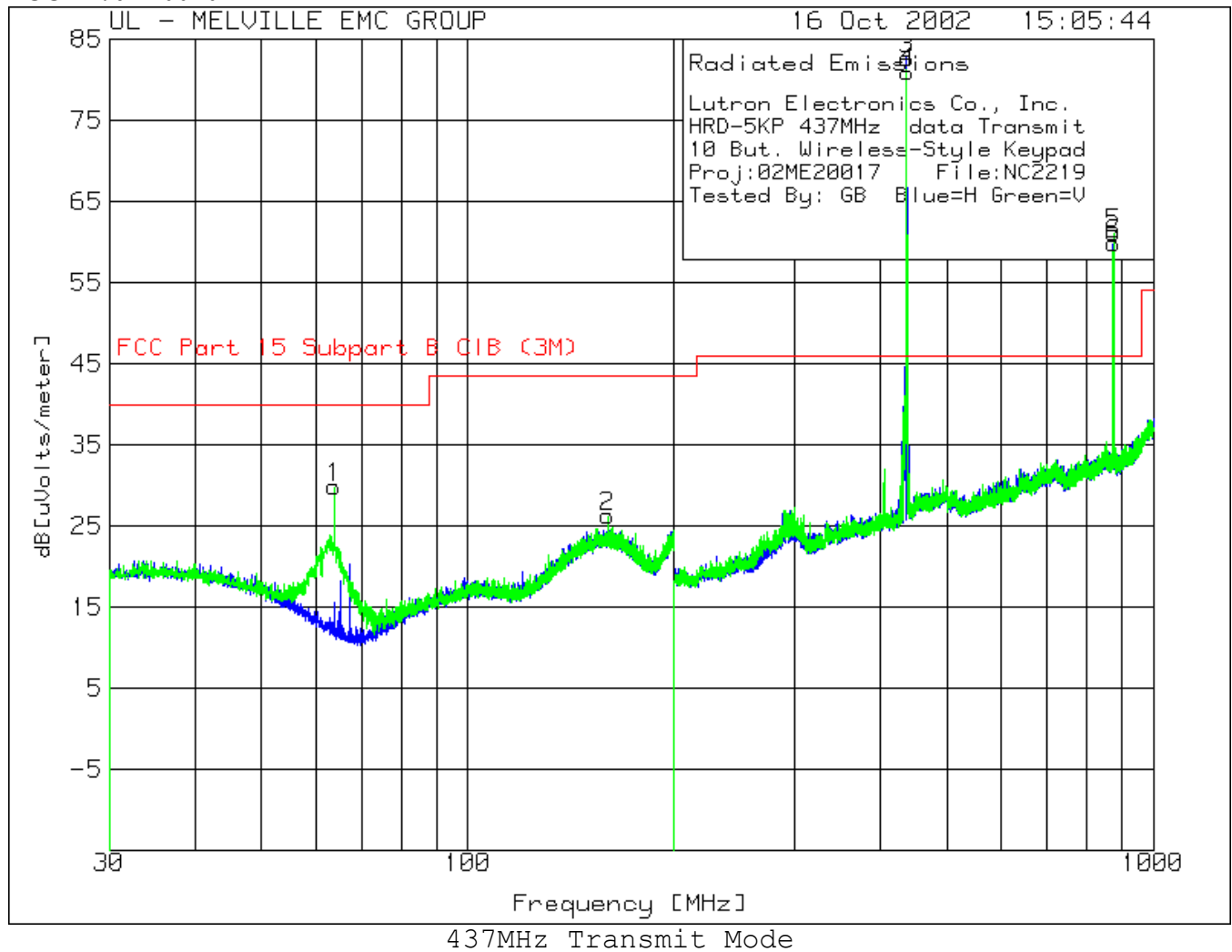
LIMIT 1: FCC Part 15 Subpart C-Section 15.231
LIMIT 2: FCC Part 15 Subpart B ClB (3M)

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

*** Duty Cycle correction factor of -21.9 added to Average level.**

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



File Number: NC2219
 Project Number: 02ME20017
 Model Number: HRD-5KP
 FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
 HRD-5KP 437MHz data Transmit
 10 But. Wireless-Style Keypad
 Proj:02ME20017 File:NC2219
 Tested By: GB Blue=H Green=V

	Test	Meter	Gain/Loss	Transducer	Level	Limit:1	Limit2
No.	Frequency [MHz]	Reading [dB (uV)]	Factor [dB]	Factor [dB]	dB[uVolts/meter]		
=====							
Range: 2 30 - 200MHz -----							
1	63.7622	22.08 pk	1.12	6.6	29.8	N/A	40
	Azimuth:21	Height:100	Vert	Margin [dB]			-10.2
2	159.995	7.51 pk	1.8	16.89	26.2	N/A	43.5
	Azimuth:75	Height:100	Vert	Margin [dB]			-17.3

Range: 3 200 - 1000MHz -----							
3	436.8693	62.56 pk	3.2	16.84	82.6	80.9	
	Azimuth:168	Height:100	Horz	Margin [dB]			1.7
6	873.9717	31.95 pk	4.45	23.4	59.8	60.9	
	Azimuth:44	Height:100	Horz	Margin [dB]			1.1

Range: 4 200 - 1000MHz -----							
4	436.8693	60.86 pk	3.2	16.84	80.9	80.9	
	Azimuth:171	Height:101	Vert	Margin [dB]			0.0
5	874.5046	33.19 pk	4.46	23.45	61.1	60.9	
	Azimuth:212	Height:101	Vert	Margin [dB]			0.2

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: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP 437MHz data Transmit
10 But. Wireless-Style 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	Limit2
=====						
Range: 3 200 - 1000MHz						
873.9797	31.19 av	4.45	23.4	59.04	60.9	
Azimuth: 72 Height:100 Horz			Margin [dB]: -1.86			
437.03	*42.67 av	3.2	16.85	*62.72	80.9	
Azimuth: 179 Height:121 Horz			Margin [dB]: -18.18			
Range: 4 200 - 1000MHz						
873.9795	31.95 av	4.45	23.4	59.8	60.9	
Azimuth: 66 Height:136 Vert			Margin [dB]: -1.1			
437.03	*48.32av	3.2	16.85	*68.37	80.9	
Azimuth: 137 Height:101 Vert			Margin [dB]: -12.53			

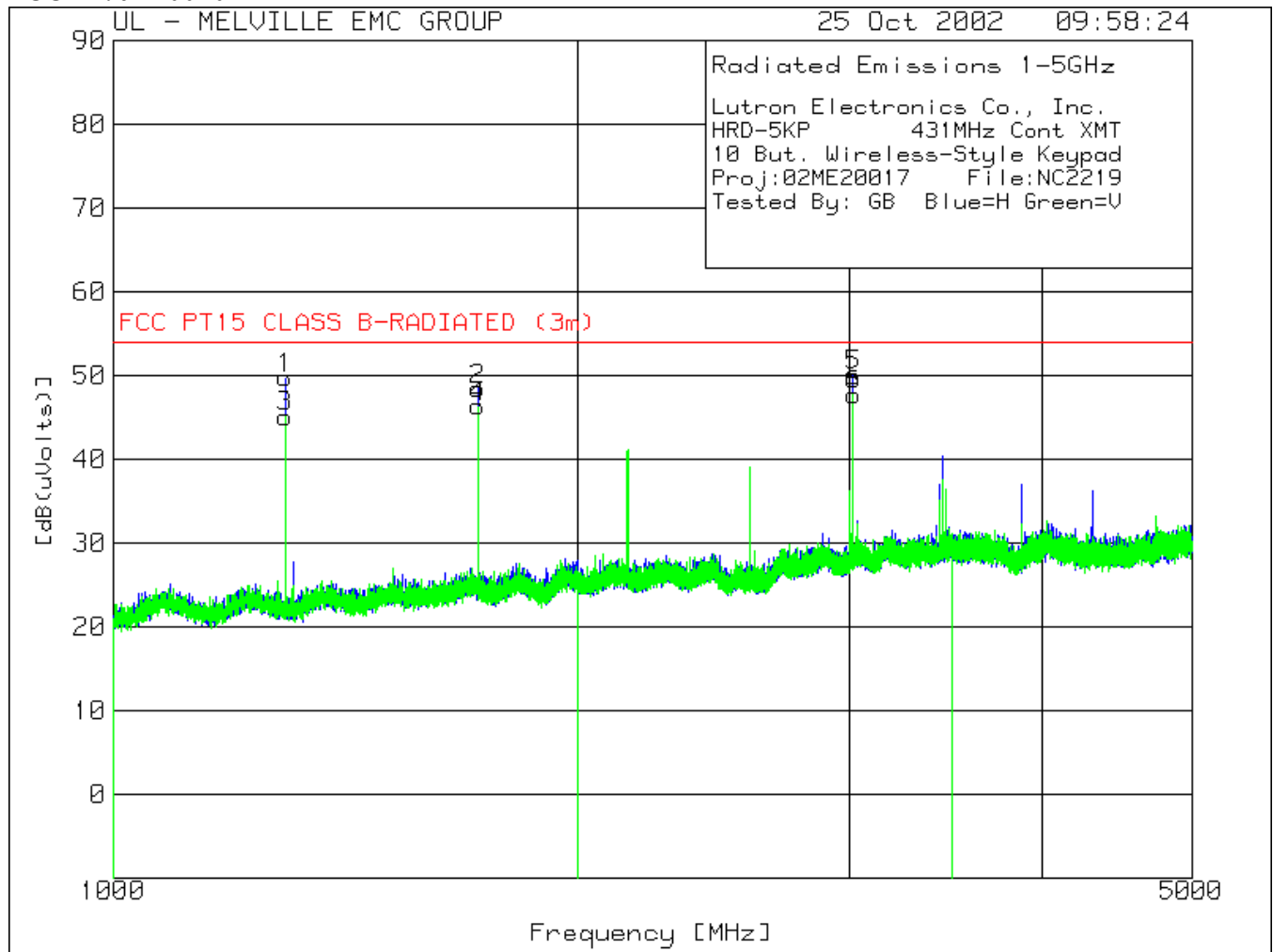
LIMIT 1: FCC Part 15 Subpart C-Section 15.231
LIMIT 2: FCC Part 15 Subpart B ClB (3M)

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

*** Duty Cycle correction factor of -21.9 added to Average level.**

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP 431MHz Cont XMT
10 But. Wireless-Style Keypad
Proj:02ME20017 File:NC2219
Tested By: GB Blue=H Green=V

Test No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1
=====						
Range: 1 1000 - 2000MHz -----						
1	1292.756	56.66 pk	-32.91	25.95	49.7	60.7
	Azimuth:76	Height:101	Horz	Margin [dB]		-11
2	1724.063	52.34 pk	-31.63	27.69	48.4	60.7
	Azimuth:310	Height:199	Horz	Margin [dB]		-12.3
Range: 2 2000 - 3500MHz -----						
5	3016.86	47.59 pk	-29.13	31.54	50	60.7
	Azimuth:146	Height:100	Horz	Margin [dB]		-10.7
Range: 5 1000 - 2000MHz -----						
3	1292.756	52.06 pk	-32.91	25.95	45.1	60.7
	Azimuth:358	Height:100	Vert	Margin [dB]		-15.6
4	1724.063	50.24 pk	-31.63	27.69	46.3	60.7
	Azimuth:154	Height:100	Vert	Margin [dB]		-14.4
Range: 6 2000 - 3500MHz -----						
6	3016.86	45.29 pk	-29.13	31.54	47.7	60.7
	Azimuth:10	Height:199	Vert	Margin [dB]		-13.0

LIMIT 1: FCC Part 15 Subpart C-Section 15.231

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: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP 431MHz Cont XMT
10 But. Wireless-Style Keypad
Proj:02ME20017 File:NC2219
Tested By: GB Blue=H Green=V

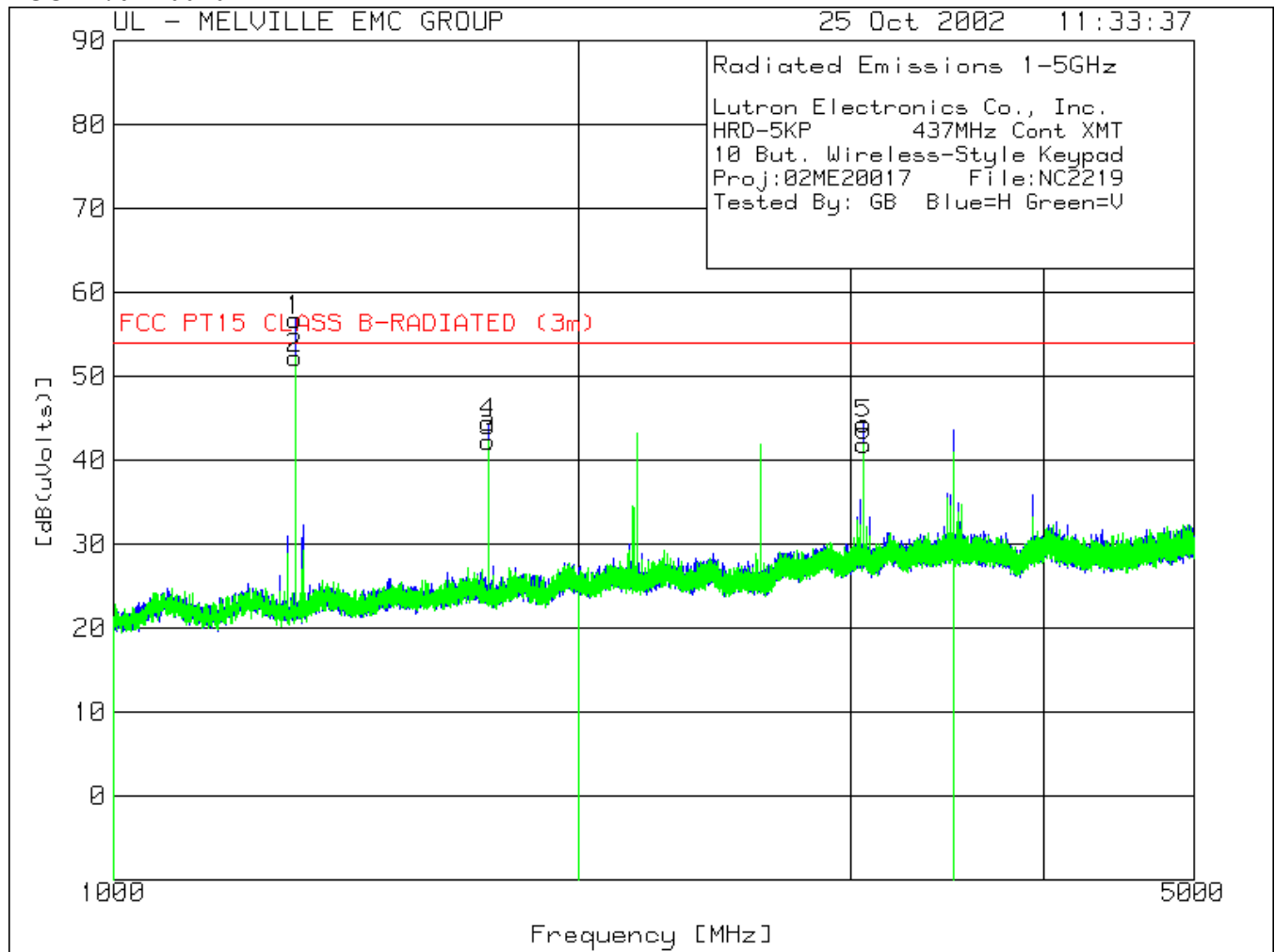
Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1
=====					
Range: 1 1000 - 2000MHz					
1292.982	50.34 av	-32.91	25.95	43.38	60.7
Azimuth: 81	Height:131	Horz	Margin [dB]:		-17.38
1723.966	47.92 av	-31.63	27.69	43.98	60.7
Azimuth: 216	Height:122	Horz	Margin [dB]:		-16.72
Range: 2 2000 - 3500MHz					
3016.92	40.62 av	-29.13	31.54	43.03	60.7
Azimuth: 18	Height:151	Horz	Margin [dB]:		-17.67
Range: 5 1000 - 2000MHz					
1292.998	51.19 pk	-32.91	25.95	44.23	60.7
Azimuth: 0	Height:120	Vert	Margin [dB]:		-16.47
1723.977	48.12 av	-31.63	27.69	44.18	60.7
Azimuth: 40	Height:188	Vert	Margin [dB]:		-16.52
Range: 6 2000 - 3500MHz					
3016.94	48.2 av	-29.13	31.54	50.61	60.7
Azimuth: 0	Height:188	Vert	Margin [dB]:		-10.09

LIMIT 1: FCC Part 15 Subpart C-Section 15.231

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

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP 437MHz Cont XMT
10 But. Wireless-Style Keypad
Proj:02ME20017 File:NC2219
Tested By: GB Blue=H Green=V

Test No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1
=====						
Range: 1 1000 - 2000MHz -----						
1	1310.741	63.54 pk	-32.86	26.02	56.7	60.9
	Azimuth:97	Height:100	Horz	Margin [dB]		-4.2
4	1748.043	48.17 pk	-31.56	27.79	44.4	60.9
	Azimuth:347	Height:200	Horz	Margin [dB]		-16.5
Range: 2 2000 - 3500MHz -----						
5	3058.824	41.6 pk	-28.95	31.65	44.3	60.9
	Azimuth:228	Height:199	Horz	Margin [dB]		-16.6
Range: 5 1000 - 2000MHz -----						
2	1310.741	59.04 pk	-32.86	26.02	52.2	60.9
	Azimuth:95	Height:199	Vert	Margin [dB]		-8.7
3	1748.043	46.07 pk	-31.56	27.79	42.3	60.9
	Azimuth:202	Height:100	Vert	Margin [dB]		-18.6
Range: 6 2000 - 3500MHz -----						
6	3058.824	39.1 pk	-28.95	31.65	41.8	60.9
	Azimuth:260	Height:199	Vert	Margin [dB]		-19.1

LIMIT 1: FCC Part 15 Subpart C-Section 15.231

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: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

Lutron Electronics Co., Inc.
HRD-5KP 437MHz Cont XMT
10 But. Wireless-Style 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					
1310.98	60.67 av	-32.86	26.02	53.83	60.9
Azimuth: 75 Height:132 Horz				Margin [dB]:	-7.07
1747.956	47.77 av	-31.56	27.79	44	60.9
Azimuth: 334 Height:199 Horz				Margin [dB]:	-16.9
Range: 2 2000 - 3500MHz					
3058.932	42.32 av	-28.95	31.65	45.02	60.9
Azimuth: 246 Height:172 Horz				Margin [dB]:	-15.88
Range: 5 1000 - 2000MHz					
1310.976	62.72 av	-32.86	26.02	55.88	60.9
Azimuth: 97 Height:119 Vert				Margin [dB]:	-5.02
1747.96	44.48 av	-31.56	27.79	40.71	60.9
Azimuth: 226 Height:167 Vert				Margin [dB]:	-20.19
Range: 6 2000 - 3500MHz					
3058.98	36.38 av	-28.95	31.65	39.08	60.9
Azimuth: 246 Height:146 Vert				Margin [dB]:	-21.82

LIMIT 1: FCC Part 15 Subpart C-Section 15.231

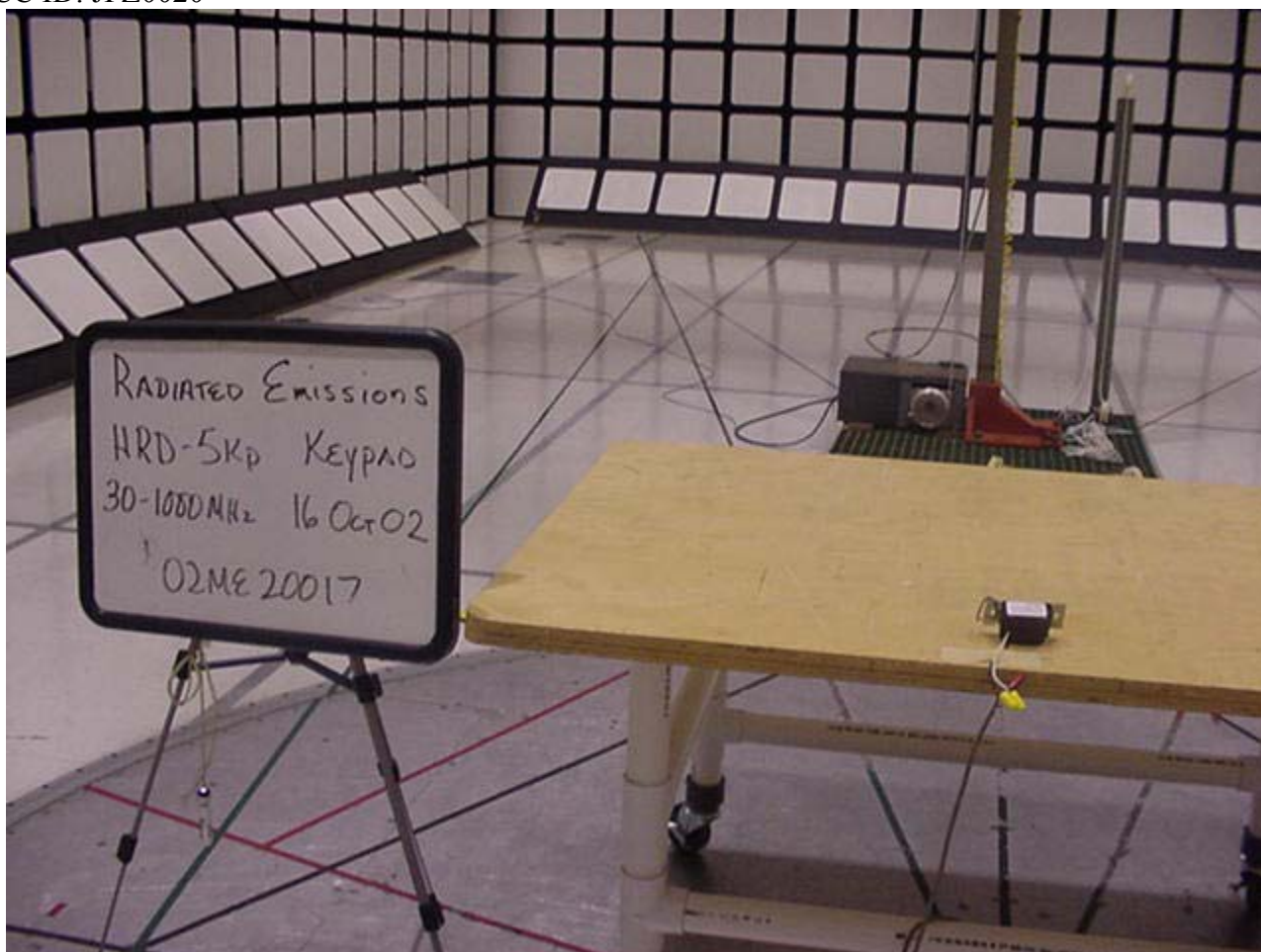
pk - Peak detector
qp - Quasi-Peak detector
av - Average detector
avlg - Average log detector

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



Radiated Emission Test-Set-Up



Radiated Emission Test-Set-Up 30-1000MHz

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

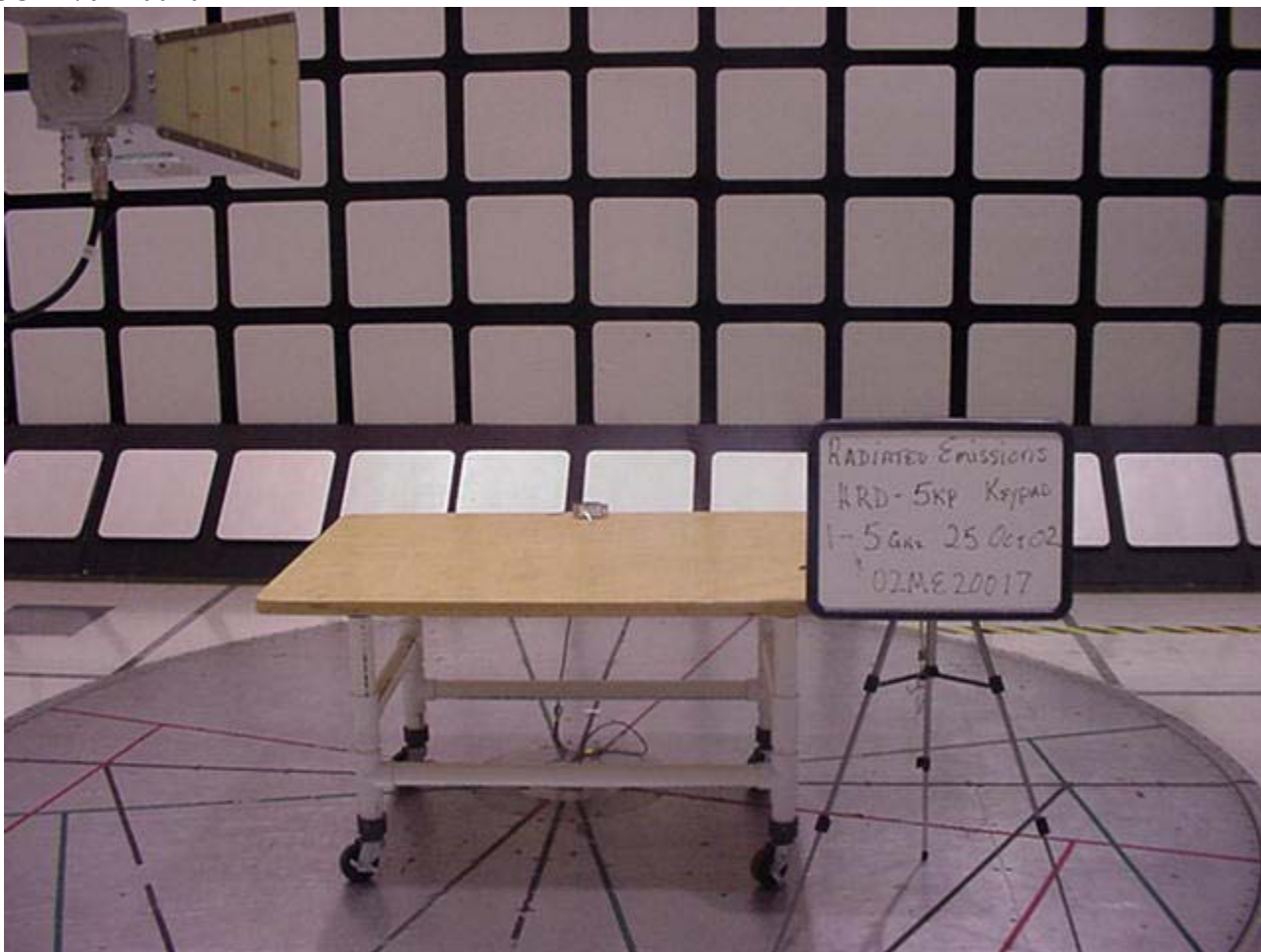
Issued: 11/5/02



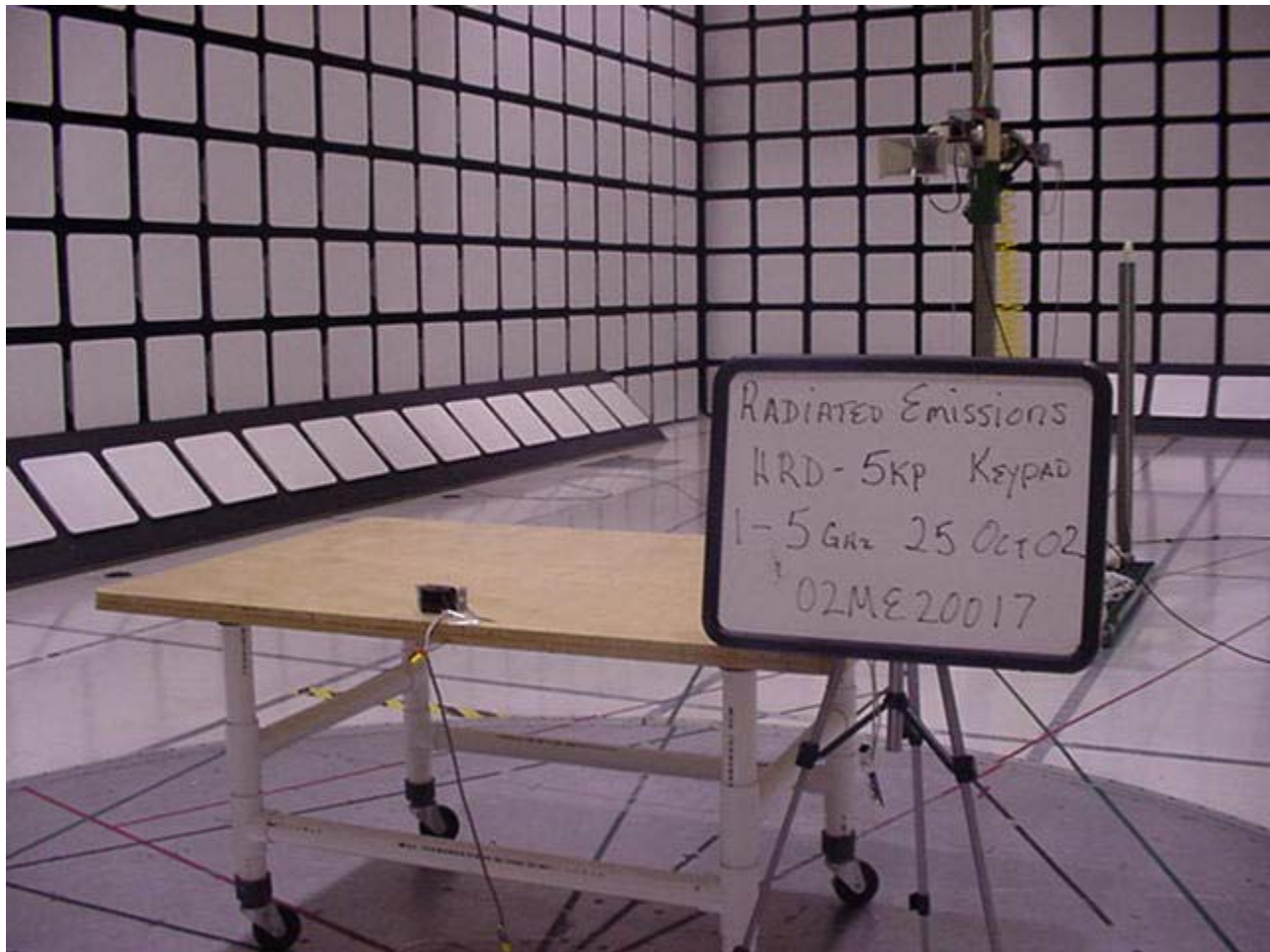
Radiated Emission Test-Set-Up 1000-5000MHz

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



Radiated Emission Test-Set-Up 1000-5000MHz



Radiated Emission Test-Set-Up 1000-5000MHz

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

2.1.4 Occupied Bandwidth

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.

☒ 431MHz and 437MHz

Bandwidth = 0.25% of 431MHz = 1.0775MHz

Bandwidth = 0.25% of 437MHz = 1.09255MHz

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			

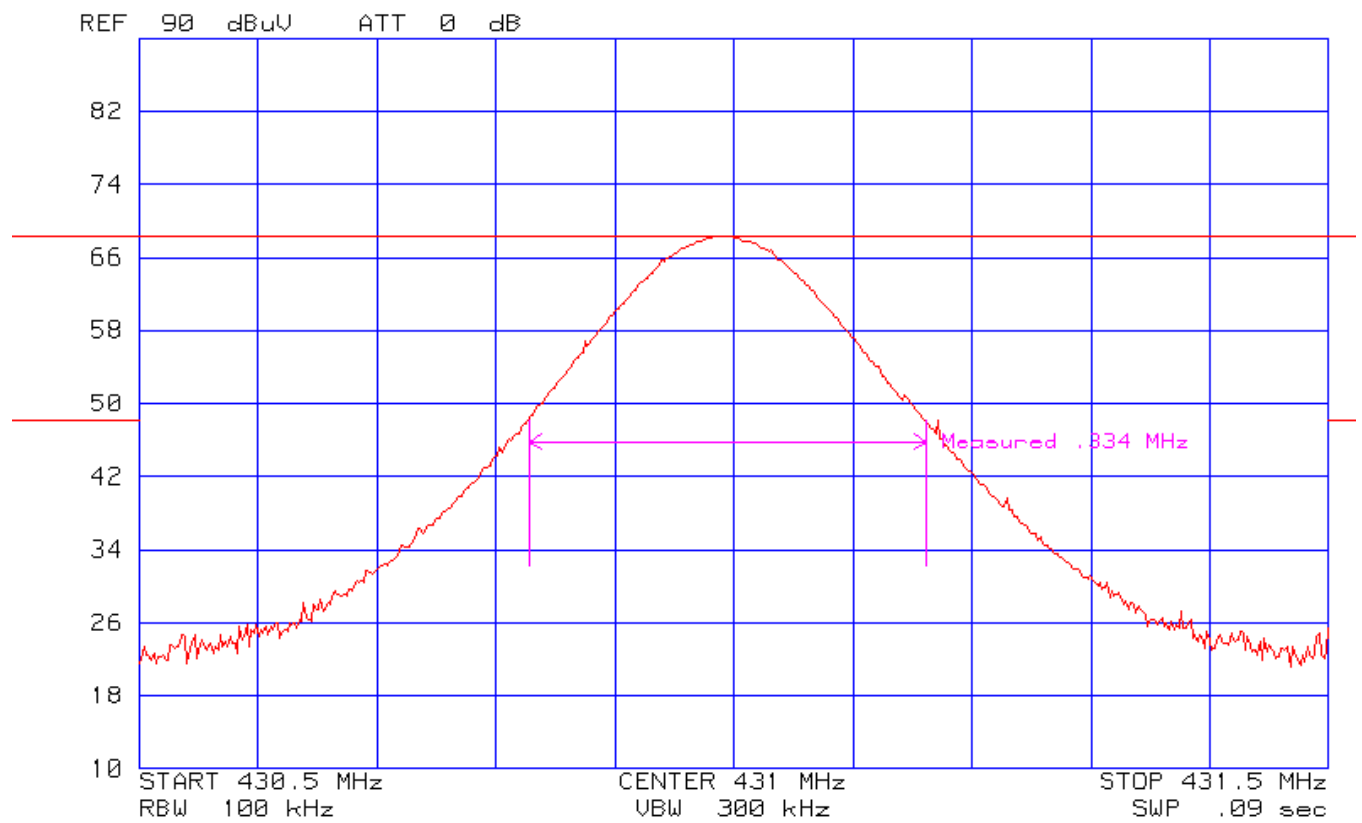
Consisting of:

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

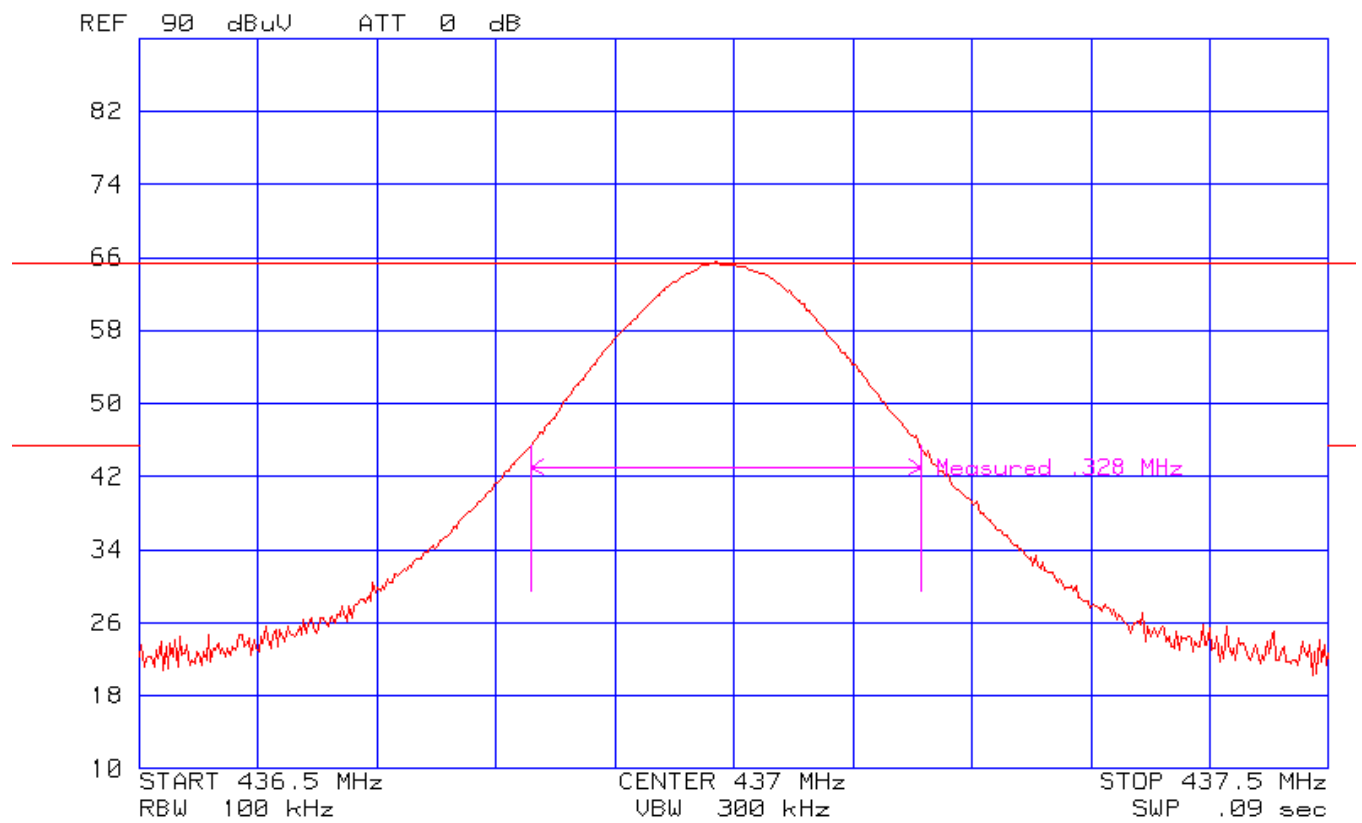
☒ 3121C	The Electro Mechanics	Dipole Antenna	Equipment No.:
Last Calibration Date: 10 Dec. 01 Calibration Due Date: 10 DEC 02			

☒ 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	



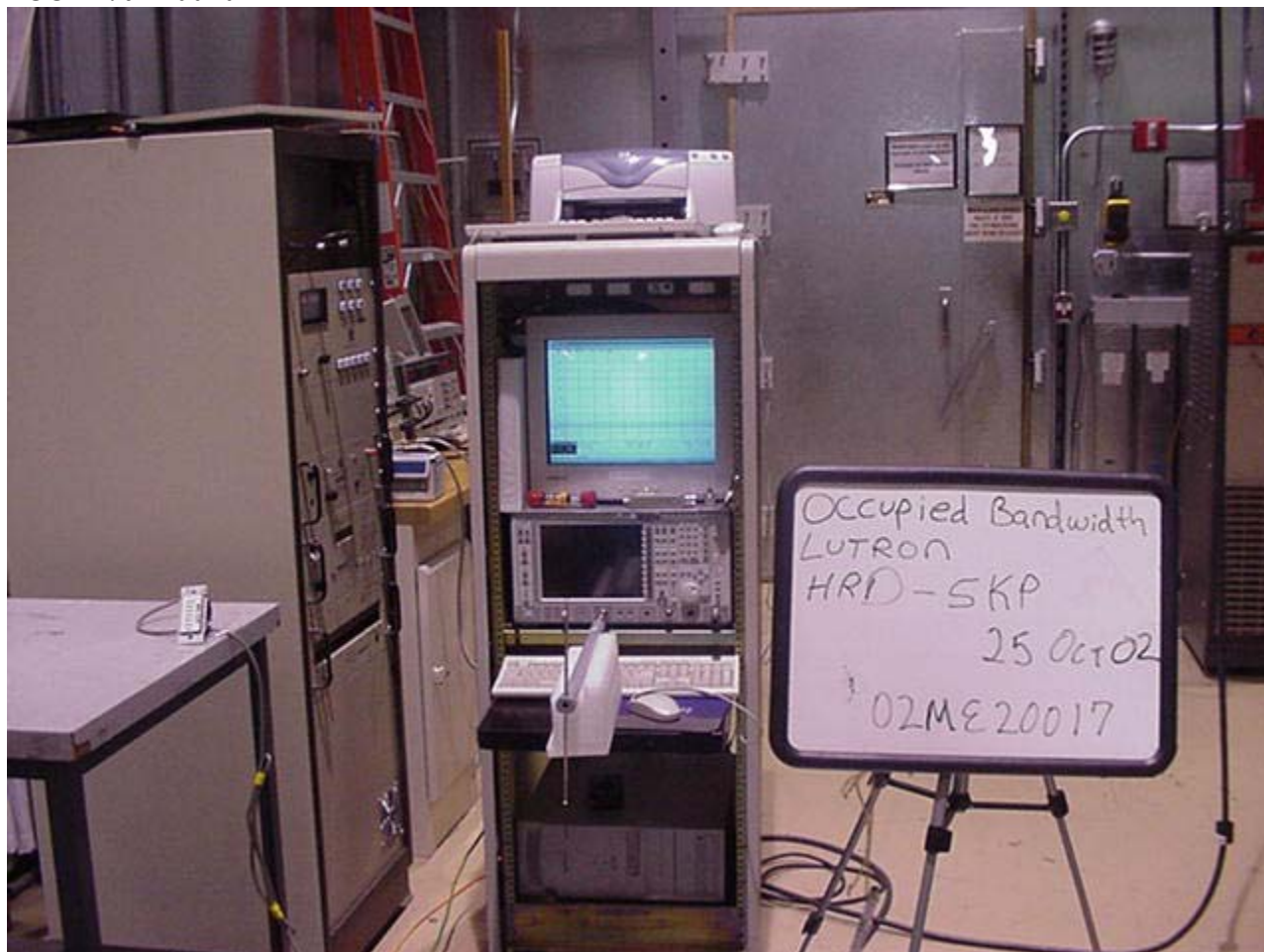
431MHz Occupied Bandwidth @ 20 db = 0.334MHz



437MHz Occupied Bandwidth @ 20 db = 0.328MHz

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02



Occupied Bandwidth Test Set-Up HRD-5KP

2.1.5 Fundamental Frequency and Spurious Emissions Measurement Limit Calculations

Limit Calculation

Fundamental Frequency is 431MHz

From table in section 15.231

Limit = $41.6667(431) - 7083.3333$

Limit = 10846.3uV

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

Limit = 80.7dBuV

Limit for Spurious Emissions = 20dB lower then fundamental = 60.7dBuV/m

Fundamental Frequency is 437MHz

From table in section 15.231

Limit = $41.6667(437) - 7083.3333$

Limit = 11125.018uV

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

Limit = 80.9dBuV

Limit for Spurious Emissions = 20dB lower then fundamental = 60.9dBuV/m

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

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

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

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

Radiated Emissions test data obtained during measurements.

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

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

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

Duty Cycle factor calculation.

Total number of pulses counted in 100ms.

Total time on = 4ms

Duty cycle correction factor = $20 \log (4\text{ms} / 50\text{ms})$
= $20 \log (0.08)$
= - 21.9

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

File Number: NC2219
Project Number: 02ME20017
Model Number: HRD-5KP
FCC ID: JPZ0020

Issued: 11/5/02

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: 10/16/02

Test Completion Date: 10/28/02

- 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