Underwriters Laboratories Inc.
1285 Walt Whitman Rd.
Melville, NY 11747

www.ul.com/emc
(631) 271-6200

| | |
|---|---|
| Job Number: | 1001354517 |
| Project Number: | 11CA14767 |
| File Number: | MC15896 |
| Date: | 2011-04-13 |
| Model: | LRF2-OCR2B-P-XX |
| FCC ID: JPZ0079 | IC ID: 2851A-JPZ0079 |

# Electromagnetic Compatibility Test Report

## For

# LUTRON ELECTRONICS INC

# Test Report Details

| | |
|---|---|
| Tests Performed By: | **Underwriters Laboratories Inc.<br>1285 Walt Whitman Rd.<br>Melville, NY 11747** |
| Tests Performed For: | **LUTRON ELECTRONICS INC<br>7200 SUTTER ROAD<br>COOPERBURG, PA 18036** |
| Applicant Contact:<br>Title:<br>Phone:<br>E-mail: | **Steve O'Donnell<br>Senior Technician<br>(610) 282-7342<br>ssodonnell@lutron.com** |
| Test Report Date: | **2011-04-13** |
| Product Type: | **Occupancy Sensor** |
| Product standards | **FCC Part 15, Subpart B, FCC Part 15 Subpart C, RSS-GEN, RSS-210** |
| Model Number: | **LRF2-OCR2B-P-XX** |
| Sample Serial Number: | **Non-serialized production unit** |
| EUT Category: | **Periodic Low Power Transmitter** |
| Testing Start Date: | **2011-03-28** |
| Date Testing Complete: | **2011-04-12** |
| **Overall Results:** | **Compliant** |

Underwriters Laboratories Inc. reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. Underwriters Laboratories Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from Underwriters Laboratories Inc. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or endorsement by NVLAP, NIST, A2LA, or any agency of the US government.

This report may contain test results that are not covered by the NVLAP or A2LA accreditation. The scope of accreditation is limited to the specific tests that are listed on the NVLAP and/or A2LA websites referenced at the end of this report.

# Report Directory

Report Revision History

| Revision Date | Description | Revised By | Revision Reviewed By |
|---|---|---|---|
| None | Original | - | - |

# 1.0 G E N E R A L - Product Description

## 1.1 Equipment Description

The Equipment Under Test (EUT) is a ceiling-mounted Occupancy and Vacancy Sensor which are wireless, battery-powered, passive infrared (PIR) devices that automatically control lights via RF communication with a dimming or switching device. These Sensors detect the heat from people moving within an area to determine when the space is occupied. The Sensors then transmit the appropriate commands to the associated dimming or switching device to turn the lights on or off automatically, providing both convenience and exceptional energy savings

Testing of the LRF-OCR2B-P-XX represents the following model numbers LRF2-VCR2B-P-XX where the XX is the color of the device. The difference between the LRF-OCR2B-P-XX and the LRF2-VCR2B-P-XX is the LRF-OCR2B-P-XX contains both an occupancy/vacancy sensor where the LRF2-VCR2B-P-XX is only a vacancy sensor.

Model number differences are for marketing or software purposes only that are not related to the transmitter.

Per FCC Part 2.1093 (C) this device is not required to undergo testing for radio-frequency radiation exposure.

Antenna description: Permanently attached to the RF circuit board and the transmit antenna type is a dipole antenna.

The EUT is only intended in being installed hanging from a ceiling and does not transmit at predetermined intervals.

## 1.2 Equipment Marking Plate

Not available at time of test.

### 1.3 Device Configuration During Test

#### 1.3.1 Equipment Used During Test:

| Use | Product Type | Manufacturer | Model | Comments |
|---|---|---|---|---|
| **EUT** | Transmitter | LUTRON ELECTRONICS INC | LRF2-OCR2B-P-XX | None |
| Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test) | | | | |

#### 1.3.2 Input/Output Ports:

| Port # | Name | Type* | Cable Max. >3m (Y/N) | Cable Shielded (Y/N) | Comments |
|---|---|---|---|---|---|
| 0 | Enclosure | N/E | — | — | None |
| 1 | Mains | DC | N/A | N/A | Powered by 3V Lithium-ion battery |

Note:
AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports

### 1.3.3 EUT Internal Operating Frequencies:

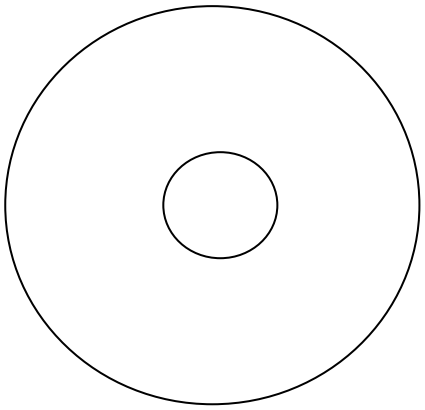
| Frequency (MHz) | Description |
|---|---|
| 0.038 | Low speed oscillator |
| 0.541 | Clock |
| 1 | SPI Interface |
| 8 | Clock |
| 26 | Oscillator |
| 431-437 | Carrier Frequency band |

### 1.3.4 Power Interface:

| Mode # /Rated | Voltage (V) | Current (A) | Power (W) | Frequency (DC/AC-Hz) | Phases (#) | Comments |
|---|---|---|---|---|---|---|
| 1 | 3 | - | - | DC | - | Li-ion Battery |

**1.4 Block Diagram:**

The diagram below illustrates the configuration of the equipment above.



### 1.5 EUT Configurations

| Mode # | Description |
|---|---|
| 1 | Stand-alone |

### 1.6 EUT Operation Modes

| Mode # | Description |
|---|---|
| 1 | Constant transmitting at 431MHz, packet mode |
| 2 | Constant transmitting at 437MHz, packet mode |
| 3 | 433MHz, normally operating |

## 2.0 Summary

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 applicant determined the list of tests performed were 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.

### 2.1 Deviations from standard test methods

| |
|---|
| None |

### 2.2 Device Modifications Necessary for Compliance

| |
|---|
| None |

### 2.3 Reference Standards

| Standard Number | Standard Name | Standard Date |
|---|---|---|
| 47 CFR Part 15, Subpart B | Code of Federal Regulations, Part 15, Radio Frequency Devices | 2011 |
| 47 CFR Part 15, Subpart C | Code of Federal Regulations, Part 15, Radio Frequency Devices | 2011 |
| RSS-GEN, Issue 3 | General Requirements and Information for the Certification of Radiocommunication Equipment | 2010 |
| RSS-210, Issue 8 | Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment | 2010 |

### 2.4 Results Summary

This product is considered a periodic transmitter with a verified receiver

| Requirement – Test | Result (Compliant / Non-Compliant)* |
|---|---|
| Conducted Emissions – Mains | Not Applicable, device is powered by battery only. |
| Cease Operation | Compliant |
| Occupied Bandwidth | Compliant |
| 99% Power Occupied Bandwidth | Compliant |
| Pulse Train - Averaging Factor | Compliant |
| Radiated Emissions - Intentional | Compliant |

Test Engineer:

Bob DeLisi (Ext.22452)
Senior Staff Engineer
International EMC Services
Conformity Assessment Services-

Reviewer:

Mike Antola(Ext.23053)
Senior Project Engineer
International EMC Services
Conformity Assessment Services

Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

## 3.0 Calibration of Equipment Used for Measurement

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or the manufacturers' recommendation, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST); therefore, all test data recorded in this report is traceable to NIST.

## 4.0 EMISSIONS TEST RESULTS

The emissions tests were performed according to following regulations:

---------- North America ----------

| | |
|---|---|
| Code of Federal Regulations Title 47 | Part 15, Subpart B, Radio Frequency Devices |
| Code of Federal Regulations Title 47 | Part 15, Subpart C, Radio Frequency Devices |
| Industry Canada | RSS-GEN, RSS-210 |

Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be verified at the time the test is conducted.

| | | | | | |
|---|---|---|---|---|---|
| Ambient Temperature, °C | 22.5 ± 2.5 | Relative Humidity, % | 45 ± 15 | Barometric Pressure, mBar | 950 ± 150 |

**Sample Calculations**
Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) - Gain (dB) + Cable Loss (dB)
Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)
Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

### 4.1 Test Conditions and Results – Occupied Bandwidth

| | |
|---|---|
| Test Description | Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard. |
| Basic Standard | FCC Part 15, Subpart C, 15.215; ANSI C63.10:2009, RSS-GEN |
| **Occupied Bandwidth Limits** | |
| 0.25% of Fundamental | |

**Table 1 Occupied Bandwidth Configuration Settings**

| Power Interface Mode | EUT Configurations Mode | EUT Operation Mode |
|---|---|---|
| 1 | 1 | 1 |
| 1 | 1 | 2 |
| Supplementary information: None | | |

**Table 2 Occupied Bandwidth Spectrum Analyzer Settings**

| Resolution Bandwidth (MHz) | Occupied Bandwidth Requirements | |
|---|---|---|
| | dBc | % |
| 10kHz | -20 | 99 |
| Supplementary information: None | | |

**Table 3 Occupied Bandwidth Test Equipment**

| Test Equipment Used | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal Date | Cal Due Date |
| Spectrum Analyzer | Agilent | E4446A | 70728 | 2001-02-04 | 2013-02-04 |
| Dipole Antenna | EMCO | 3121C | 3359 | 2010-12-08 | 2011-12-09 |
| Temp/Humidity/Pressure Meter | Cole Parmer | 99760-00 | 43734 | 2010-03-08 | 2012-03-08 |
| Multimeter | Fluke | 87V | 64386 | 2011-02-02 | 2012-02-29 |

**Figure 1 Test Setup for Occupied Bandwidth**

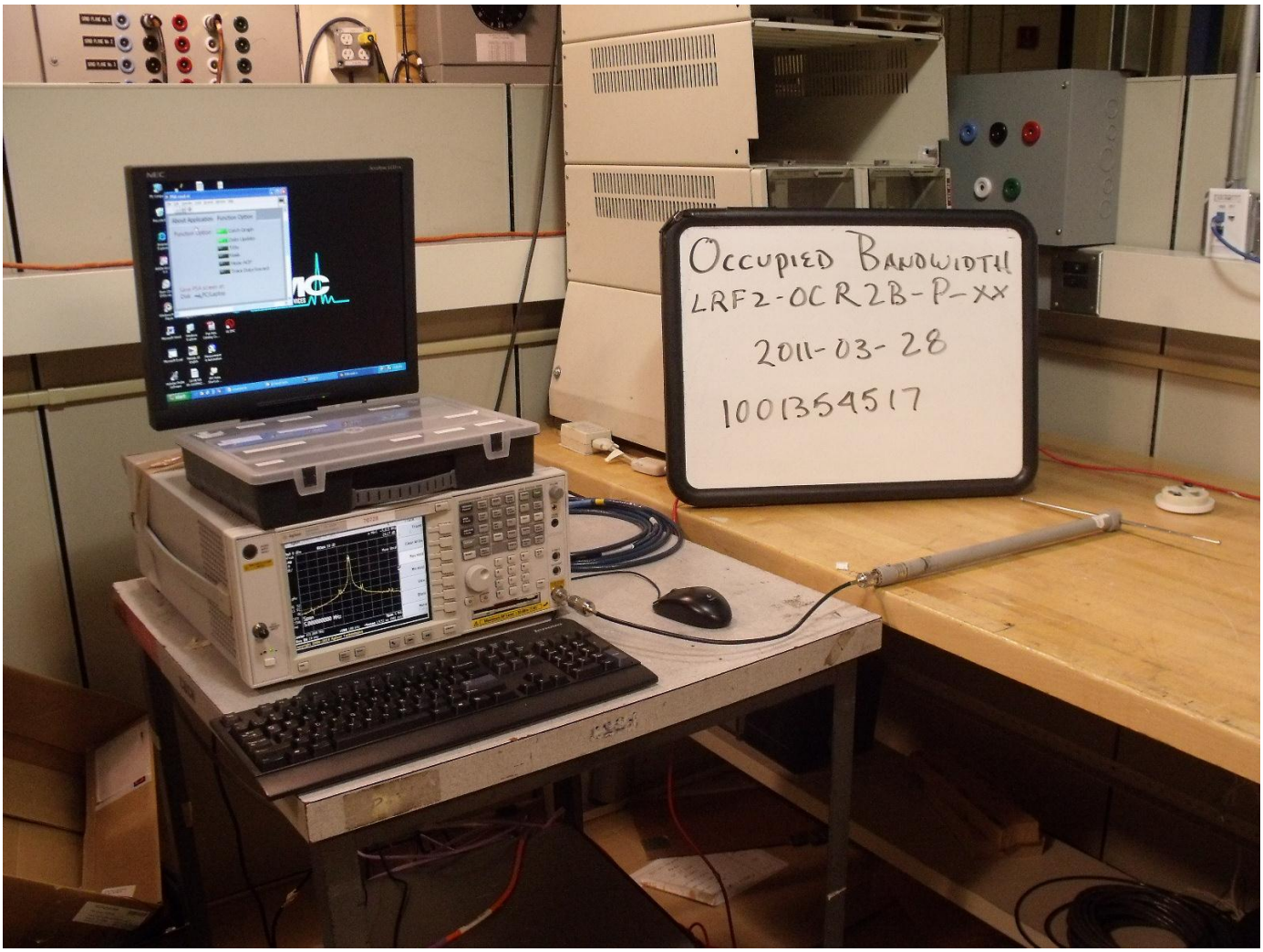
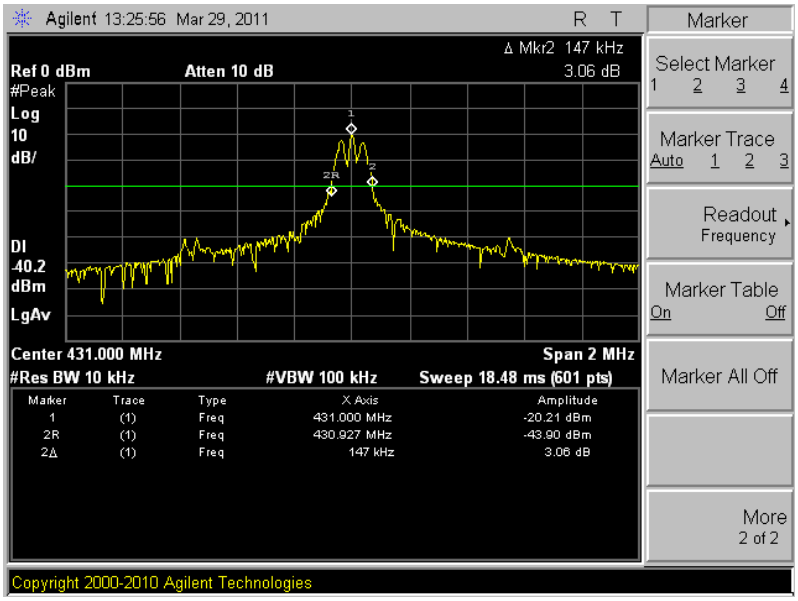
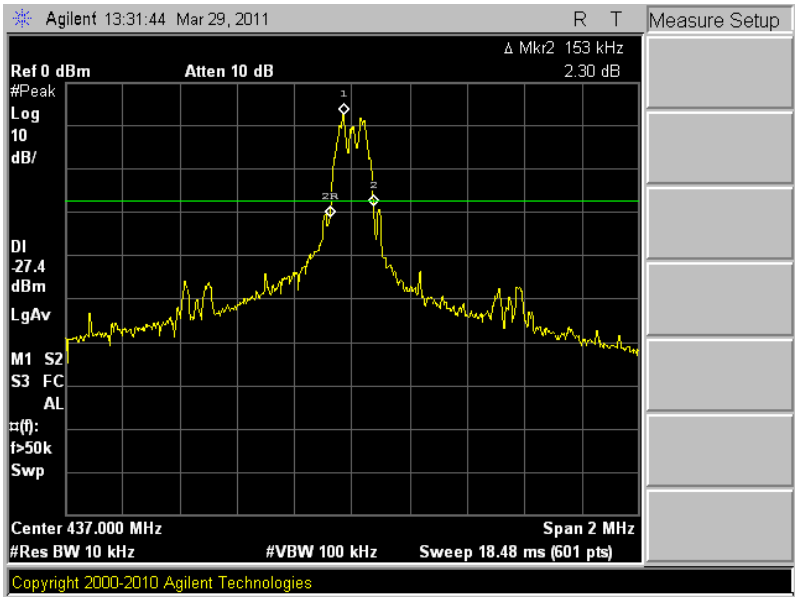


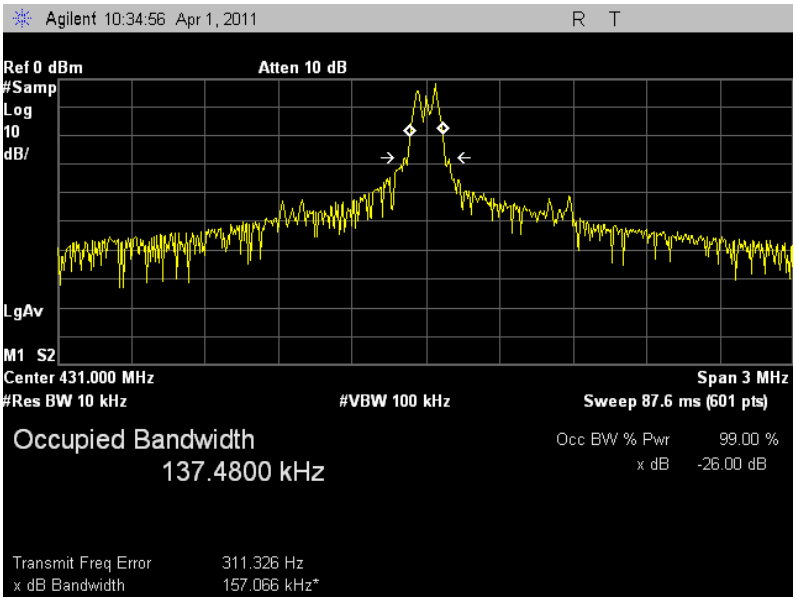
**Table 4 Occupied Bandwidth Test Data**

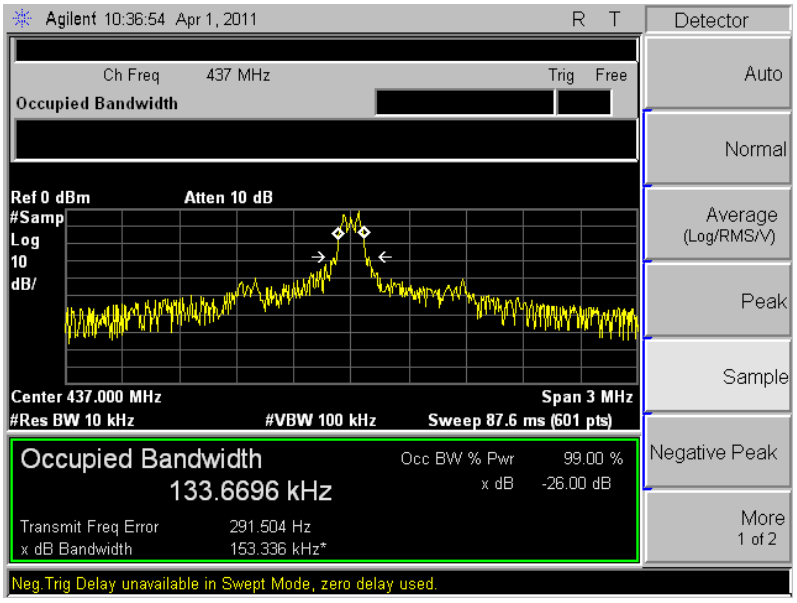
| Power Mode | Frequency (MHz) | 20dB OBW (kHz) | 99% OBW (kHz) | Limit (MHz) | Result |
|---|---|---|---|---|---|
| Battery | 431 | 147 | 137.5 | 1.08 | Pass |
| Battery | 437 | 153 | 133.7 | 1.09 | Pass |

**Figure 2 Occupied Bandwidth Graphs**




Agilent 10:34:56 Apr 1, 2011
R T
Ref 0 dBm
Atten 10 dB
#Samp
Log
10
dB/
LgAv
M1 S2
Center 431.000 MHz
Span 3 MHz
#Res BW 10 kHz
#VBW 100 kHz
Sweep 87.6 ms (601 pts)
Occupied Bandwidth
137.4800 kHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB
Transmit Freq Error 311.326 Hz
x dB Bandwidth 157.066 kHz*


Agilent 10:36:54 Apr 1, 2011
R T
Detector
Ch Freq 437 MHz
Trig Free
Occupied Bandwidth
Ref 0 dBm
Atten 10 dB
#Samp
Log
10
dB/
Center 437.000 MHz
Span 3 MHz
#Res BW 10 kHz
#VBW 100 kHz
Sweep 87.6 ms (601 pts)
Occupied Bandwidth
133.6696 kHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB
Transmit Freq Error 291.504 Hz
x dB Bandwidth 153.336 kHz*
Auto
Normal
Average
(Log/RMS/V)
Peak
Sample
Negative Peak
More
1 of 2
Neg.Trig Delay unavailable in Swept Mode, zero delay used.

### 4.2 Test Conditions and Results – Cease Operation

| | |
|---|---|
| Test Description | Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency. |
| Basic Standard | FCC Part 15, Subpart C, 15.215; ANSI C63.10:2009, RSS-GEN |
| **Cease Operation Limits** | |
| The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin. | |

**Table 5 Cease Operation Configuration Settings**

| Power Interface Mode | EUT Configurations Mode | EUT Operation Mode |
|---|---|---|
| 1 | 1 | 3 |
| Supplementary information: None | | |

**Table 6 Cease Operation Test Equipment**

| Test Equipment Used | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal Date | Cal Due Date |
| Spectrum Analyzer | Agilent | E4446A | 70728 | 2001-02-04 | 2013-02-04 |
| Dipole Antenna | EMCO | 3121C | 3359 | 2010-12-08 | 2011-12-09 |
| Temp/Humidity/Pressure Meter | Cole Parmer | 99760-00 | 43734 | 2010-03-08 | 2012-03-08 |
| Multimeter | Fluke | 87V | 64386 | 2011-02-02 | 2012-02-29 |

**Figure 3 Test Setup for Cease Operation**

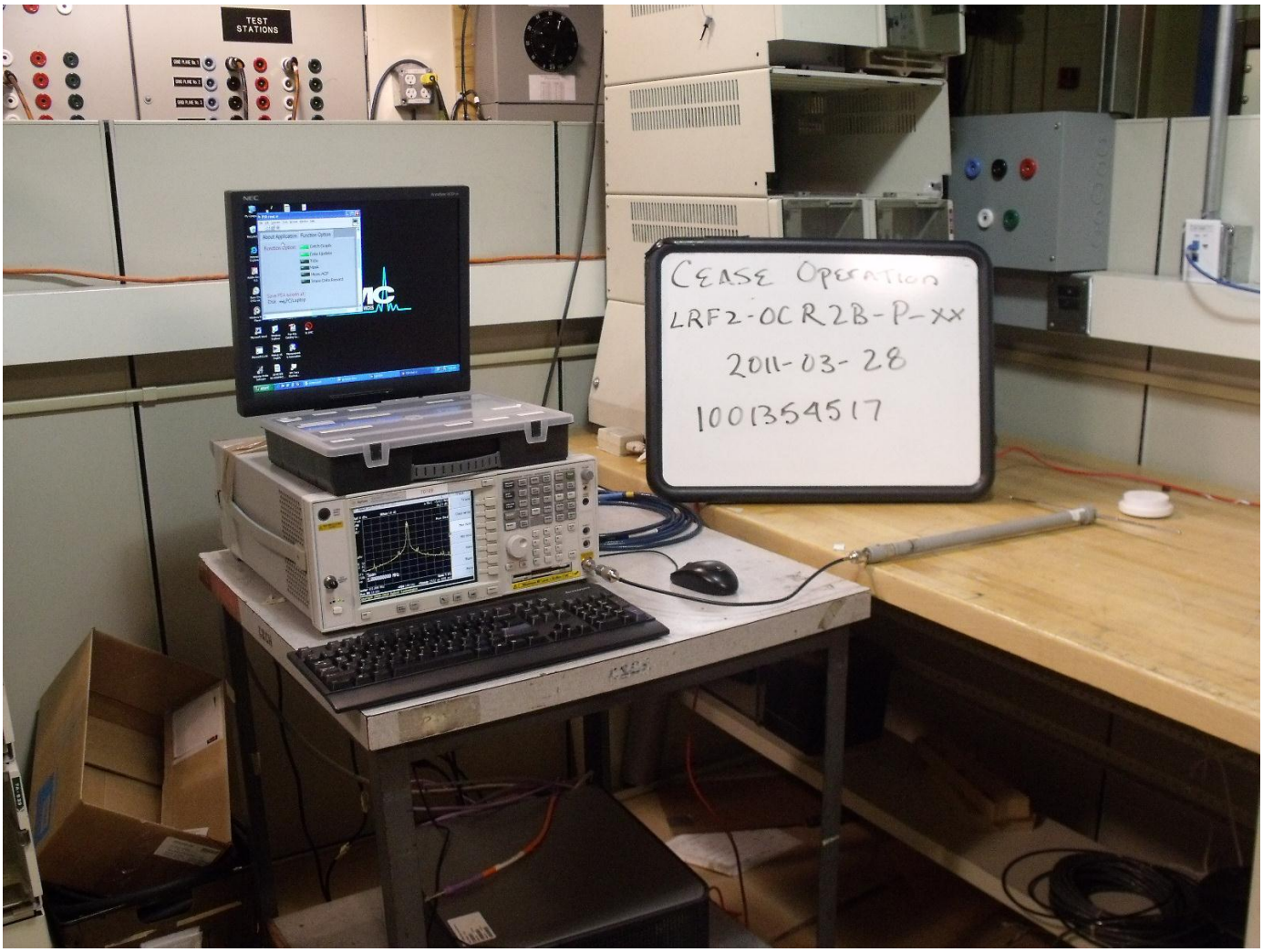
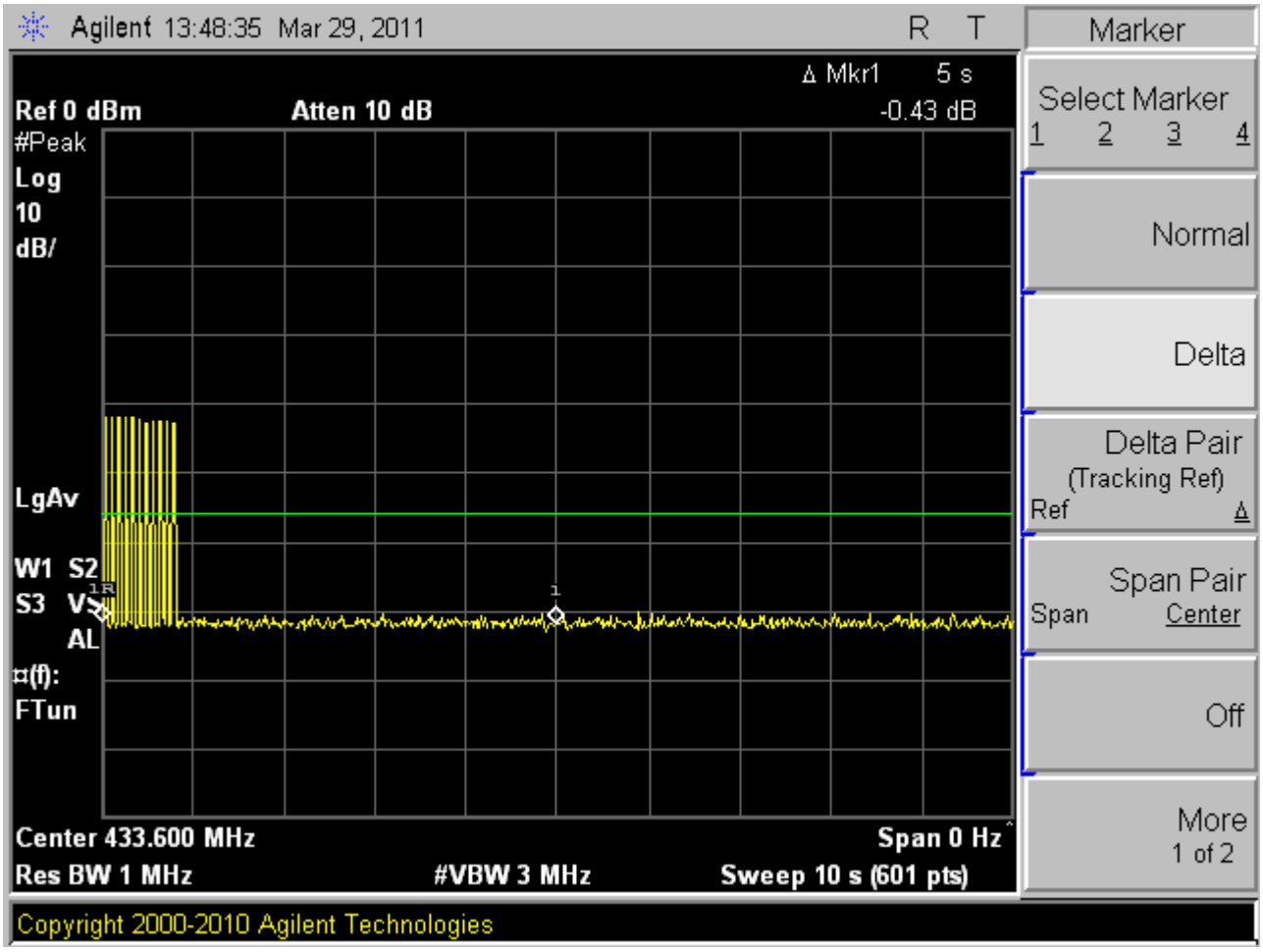


**Figure 4 Cease Operation Graph**



### 4.3 Test Conditions and Results – Pulse Train

| | |
|---|---|
| Test Description | Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency. |
| Basic Standard | FCC Part 15 Subpart A, 15.35, ANSI C63.10:2009 |
| **Pulse Train Limits** | |
| There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results. | |

**Table 7 Pulse Train Configuration Settings**

| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---|---|---|
| 1 | 1 | 3 |
| Supplementary information: None | | |

**Table 8 Pulse Train Calculation**

| Pulse Width (mS) | Total Transmission time or 100ms which ever is lesser | Average Correction Factor (dB) $20\log\left(\frac{PulseWidth}{TotalTransmissionTime}\right)$ |
|---|---|---|
| 1@4.333 +1@4.667 = 9 | 100 | -20.9 |

**Table 9 Pulse Train Test Equipment**

| Test Equipment Used | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal Date | Cal Due Date |
| Spectrum Analyzer | Agilent | E4446A | 70728 | 2001-02-04 | 2013-02-04 |
| Dipole Antenna | EMCO | 3121C | 3359 | 2010-12-08 | 2011-12-09 |
| Temp/Humidity/Pressure Meter | Cole Parmer | 99760-00 | 43734 | 2010-03-08 | 2012-03-08 |
| Multimeter | Fluke | 87V | 64386 | 2011-02-02 | 2012-02-29 |

**Figure 5 Test Setup for Pulse Train**

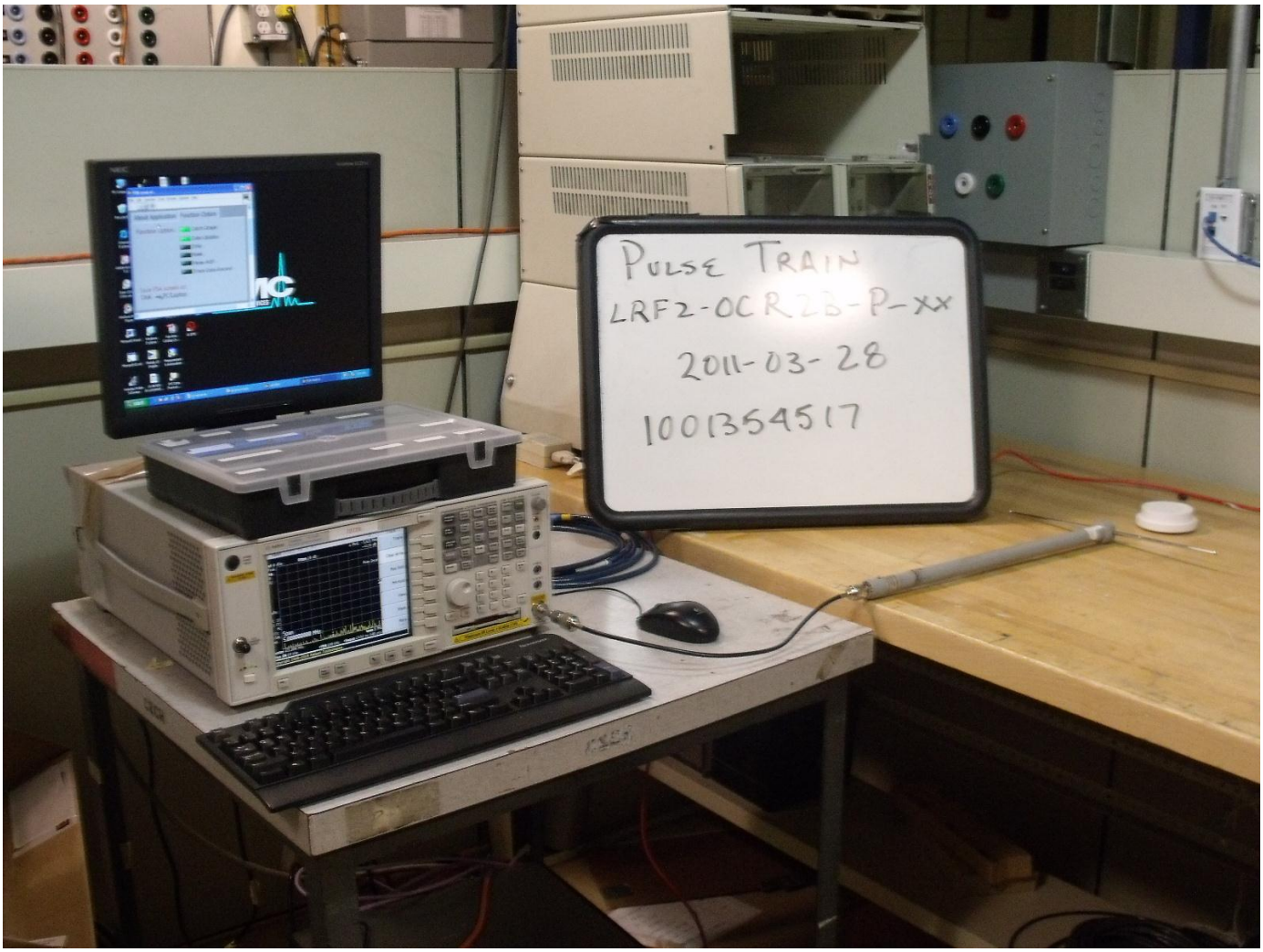
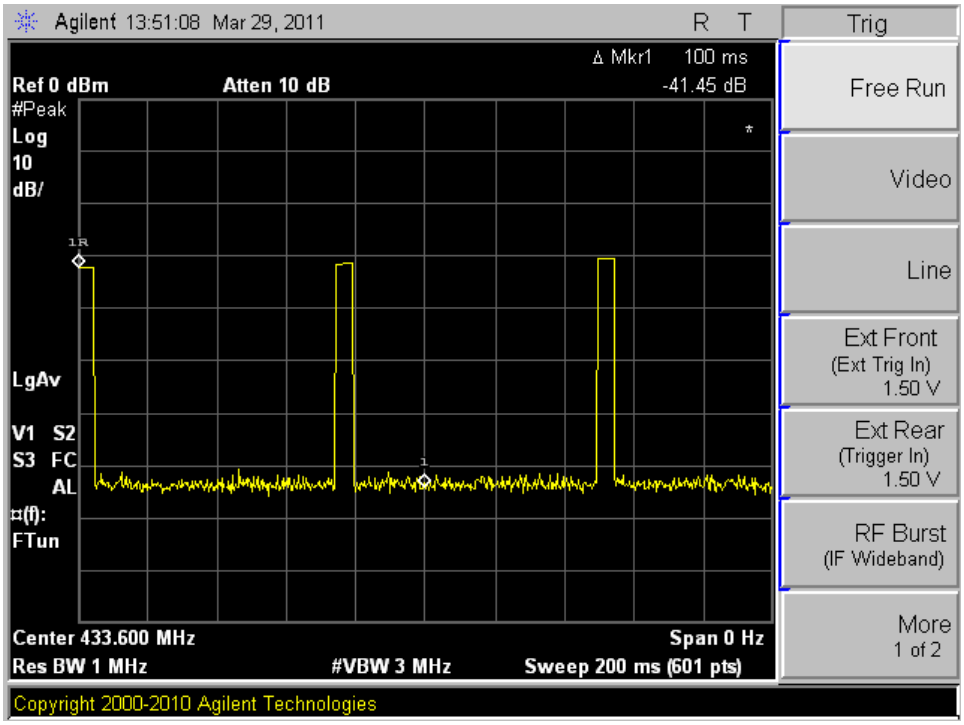
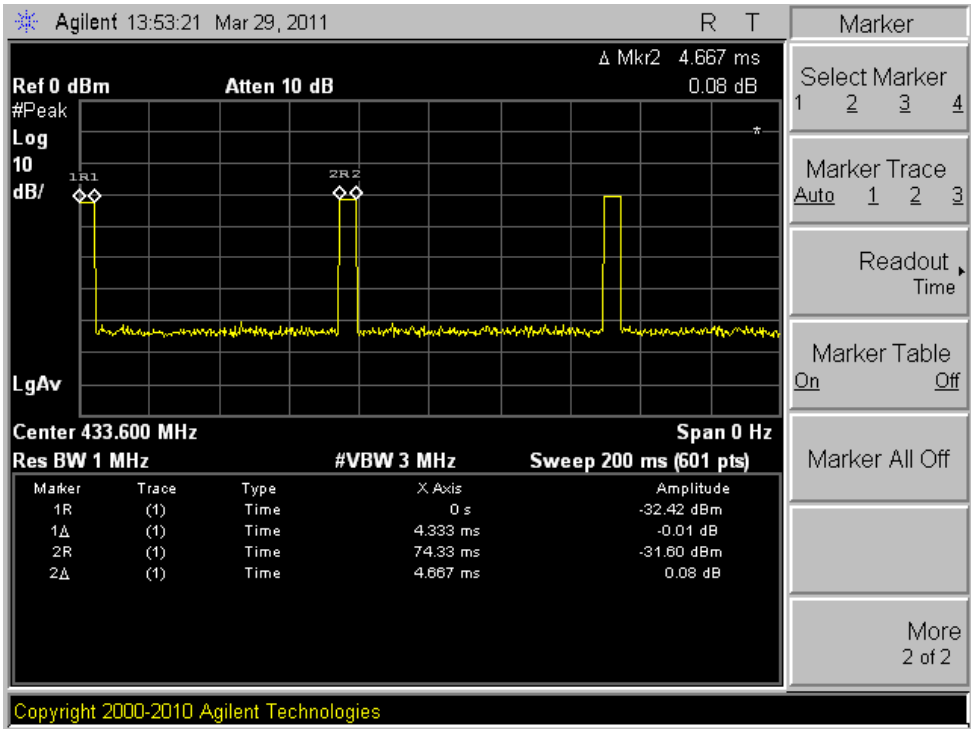


**Figure 6 Pulse Train Graph**



## 4.4 Test Conditions and Results – RADIATED EMISSIONS (Intentional)

| | |
|---|---|
| Test Description | Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meters. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. |

| | | |
|---|---|---|
| Basic Standard | FCC Part 15, Subpart C, 15.209, 15.231; RSS-210 | |
| UL LPG | 80-EM-S0029 | |
| | Frequency range | Measurement Point |
| Fully configured sample scanned over the following frequency range | 30 MHz – 1GHz | (3 meter measurement distance) |
| Fully configured sample scanned over the following frequency range | 1GHz – 5 GHz | (3 meter measurement distance) |

**Limits**

| Frequency (MHz) | Limit (dBµV/m) | | |
|---|---|---|---|
| | Quasi-Peak | Average | |
| | General Emissions | Fundamental | Spurious |
| 0.009 – 0.490 | 128.5 – 93.8 | - | - |
| 0.490 – 1.705 | 73.8 – 63 | - | - |
| 1.705 – 30 | 69.5 | - | - |
| 30 – 88 | 40 | - | - |
| 88 – 216 | 43.5 | - | - |
| 216-960 | 46 | - | - |
| 960-1000 | 54 | - | - |
| 1000-5000 | - | - | 54 |
| 431 | - | 80.7 | - |
| 437 | - | 80.9 | - |
| Harmonics of the Fundamental 431 | - | - | 60.7 |
| Harmonics of the Fundamental 437 | - | - | 60.9 |

Supplementary information: Spurious limits are only applied against products of the transmitter. All other emissions must meet the general limits. Emissions of clocks related to the transmit frequencies and associated harmonics below 30MHz do not fall in restricted bands.

**Table 10 Radiated Emissions EUT Configuration Settings**

| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---|---|---|
| 1 | 1 | 1 |
| 1 | 1 | 2 |
| Supplementary information:None | | |

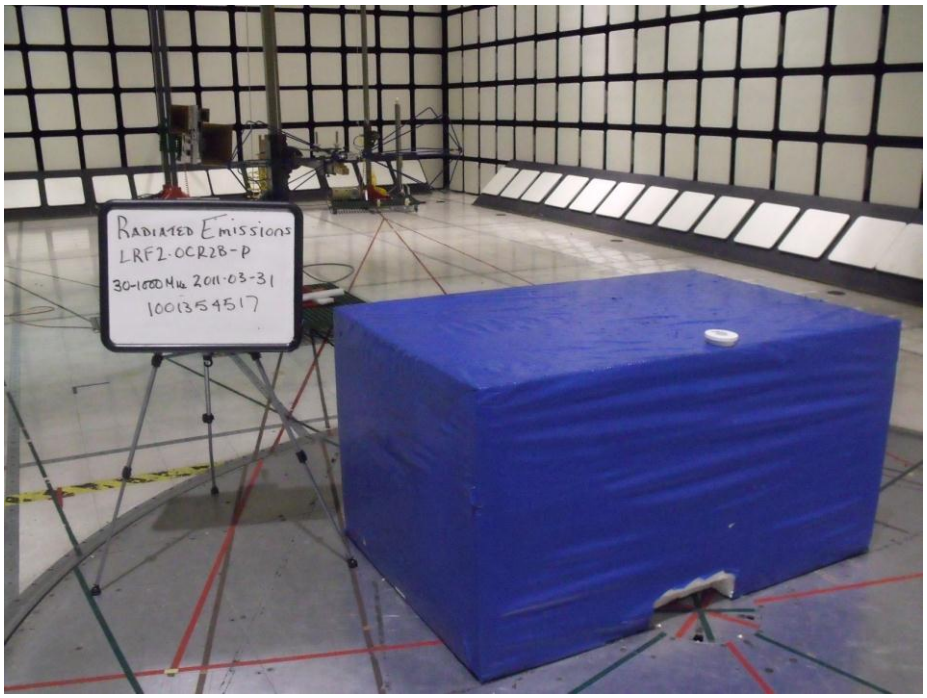
**Table 11 Radiated Emissions Test Equipment**

| Test Equipment Used | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal Date | Cal Due Date |
| 30-1000MHz | | | | | |
| EMI Receiver | Rohde & Schwarz | ESIB40 | 34968 | 2011-03-01 | 2012-03-01 |
| Bicon Antenna | Schaffner | VBA6106A | 43441 | 2010-09-09 | 2011-09-09 |
| Log-P Antenna | Schaffner | UPA6109 | 44067 | 2010-04-26 | 2011-04-26 |
| Switch Driver | HP | 11713A | ME7A-627 | N/A | N/A |
| System Controller | Sunol Sciences | SC99V | 44396 | N/A | N/A |
| Camera Controller | Panasonic | WV-CU254 | 44395 | N/A | N/A |
| RF Switch Box | UL | 1 | 44398 | N/A | N/A |
| Measurement Software | UL | Version 9.3 | 44740 | N/A | N/A |
| Temp/Humidity/Pressure Meter | Cole Parmer | 99760-00 | 4268 | 2010-12-07 | 2012-12-07 |
| Multimeter | Fluke | 87V | 64386 | 2011-02-01 | 2012-02-29 |
| Above 1GHz (Band Optimized System) | | | | | |
| Spectrum Analyzer | Rohde & Schwarz | ESIB40 | 34968 | 2011-03-01 | 2012-03-01 |
| Horn Antenna (1-2 GHz) | ETS | 3161-01 | 51442 | 2008-03-28 | See * below |
| Horn Antenna (2-4 GHz) | ETS | 3161-02 | 48107 | 2007-09-27 | See * below |
| Horn Antenna (4-8 GHz) | ETS | 3161-03 | 48106 | 2007-09-27 | See * below |
| Signal Path Controller | HP | 11713A | 50250 | N/A | N/A |
| Gain Controller | HP | 11713A | 50251 | N/A | N/A |
| RF Switch / Preamp Fixture | UL | BOMS1 | 50249 | N/A | N/A |
| System Controller | UL | BOMS2 | 50252 | N/A | N/A |
| Measurement Software | UL | Version 9.3 | 44740 | N/A | N/A |
| Temp/Humidity/Pressure Meter | Cole Parmer | 99760-00 | 4268 | 2010-12-07 | 2012-12-07 |
| Multimeter | Fluke | 87V | 64386 | 2011-02-01 | 2012-02-29 |

| Test Equipment Used | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal Date | Cal Due Date |

* - Note: As allowed by the calibration standard ANSI C63.4 Section 4.4.2, standard gain horns need only a one-time calibration. Only if physical damage occurs will the horn antenna require re-calibration.
* Gain standard horn antennas (sometimes called standard gain horn antennas) need not be calibrated beyond that which is provided by the manufacturer unless they are damaged or deterioration is suspected, or they are used at a distance closer than $2D^2/\lambda$. Gain standard horn antennas have gains that are fixed by their dimensions and dimensional tolerances.

**Figure 7 Test setup for Radiated Emissions**



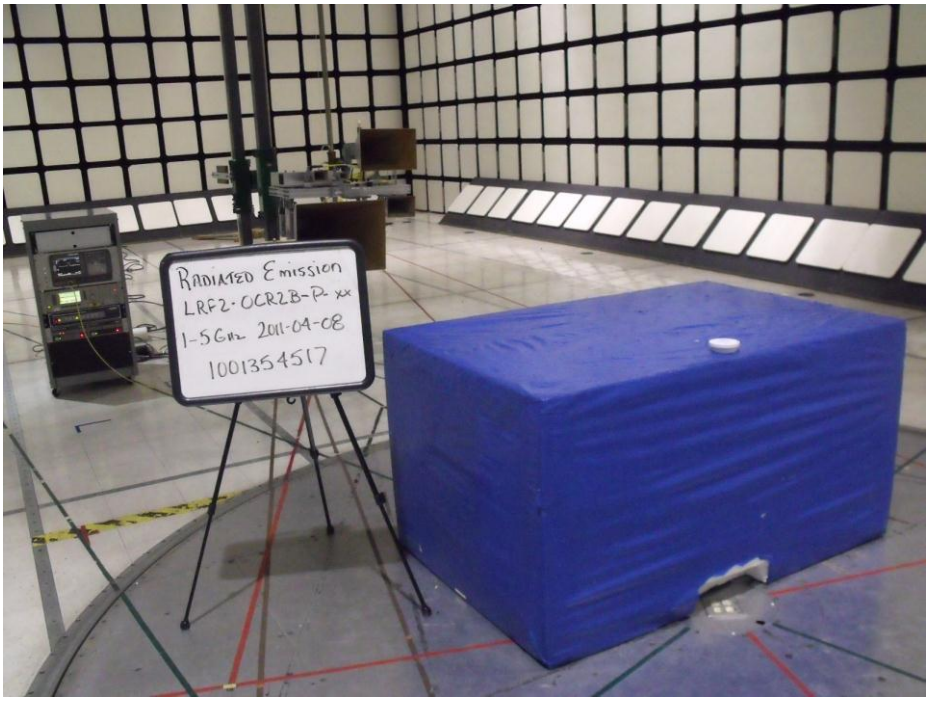



**Figure 8 Radiated Emissions Graph**

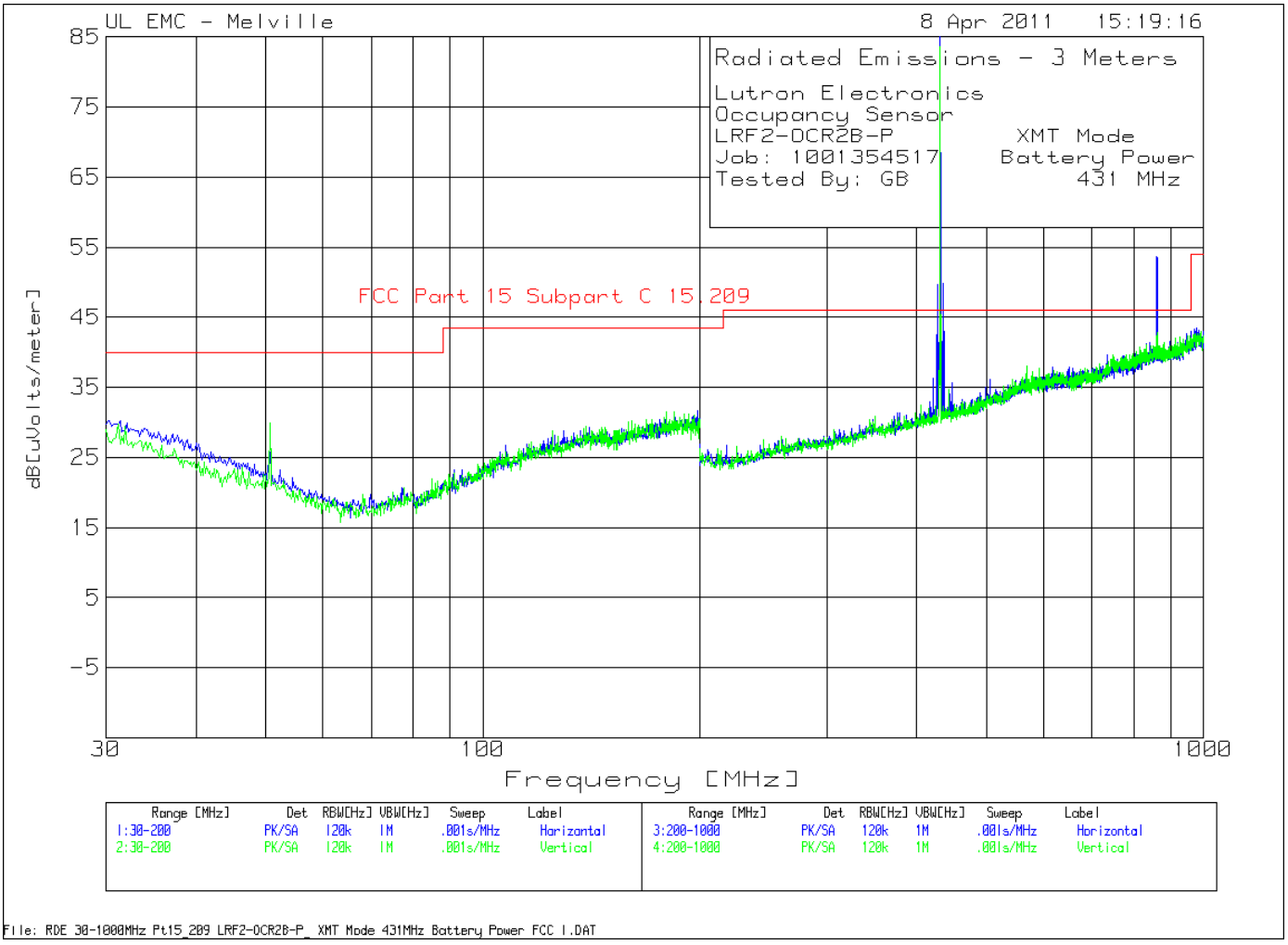


**Table 12 Radiated Emissions Data Points**

| LRF2-OCR2B-P XMT Mode | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Job: 1001354517 Battery Power | | | | | | | | | | | | | | |
| Tested By: GB 431 MHz | | | | | | | | | | | | | | |
| Test Frequency [MHz] | Meter Reading [dB(uV)] | Detector Type | Gain/Loss Factor [dB] | Transducer Factor [dB] | Level dB[uVolts/meter] | DCF [dB] | Corrected Level dB[uVolts/meter] | Limit 1 | Margin 1[dB] | Limit 2 | Margin 2[dB] | Azimuth [degs] | Height [cm] | Polarity |
| Horizontal 200 - 1000MHz | | | | | | | | | | | | | | |
| 431.0378 | 77.6 | PK | 2.3 | 16.8 | 96.7 | -20.9 | 75.8 | - | - | 80.7 | -4.9 | 343 | 214 | Horz |
| 862.0752 | 28.37 | PK | 3.4 | 23.1 | 54.87 | -20.9 | 33.97 | - | - | 60.7 | -26.73 | 142 | 101 | Horz |
| 427.8 | 7.17 | QP | 2.3 | 16.7 | 26.17 | - | - | 46 | -19.83 | - | - | 53 | 326 | Horz |
| 432.5 | 16.48 | QP | 2.3 | 16.9 | 35.68 | - | - | 46 | -10.32 | - | - | 184 | 178 | Horz |
| 435 | 8.13 | QP | 2.3 | 16.9 | 27.33 | - | - | 46 | -18.67 | - | - | 292 | 112 | Horz |
| 426.5 | 7.23 | QP | 2.3 | 16.7 | 26.23 | - | - | 46 | -19.77 | - | - | 67 | 204 | Horz |
| 437.3 | 7.23 | QP | 2.3 | 16.9 | 26.43 | - | - | 46 | -19.57 | - | - | 189 | 161 | Horz |
| | | | | | | | | | | | | | | |
| Vertical 200 - 1000MHz | | | | | | | | | | | | | | |
| 431.0419 | 67.38 | PK | 2.3 | 16.4 | 86.08 | -20.9 | 65.18 | - | - | 80.7 | -15.52 | 79 | 125 | Vert |
| 862.0752 | 22.71 | PK | 3.4 | 23.1 | 49.21 | -20.9 | 28.31 | - | - | 60.7 | -32.39 | 77 | 201 | Vert |
| | | | | | | | | | | | | | | |
| LIMIT 1: FCC Part 15 Subpart C 15.209 | | | | | | | | | | | | | | |
| LIMIT 2: FCC Part 15 Subart C 15.231 | | | | | | | | | | | | | | |
| LIMIT 3: NONE | | | | | | | | | | | | | | |
| LIMIT 4: NONE | | | | | | | | | | | | | | |
| LIMIT 5: NONE | | | | | | | | | | | | | | |
| LIMIT 6: NONE | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| PK - Peak detector (maximized) | | | | | | | | | | | | | | |
| QP - Quasi-Peak detector | | | | | | | | | | | | | | |
| LnAv - Linear Average detector | | | | | | | | | | | | | | |
| LgAv - Log Average detector | | | | | | | | | | | | | | |
| Av - Average detector | | | | | | | | | | | | | | |
| CAV - CISPR Average detector | | | | | | | | | | | | | | |
| RMS - RMS detection | | | | | | | | | | | | | | |
| CRMS - CISPR RMS detection | | | | | | | | | | | | | | |

**Figure 9 Radiated Emissions Graph**

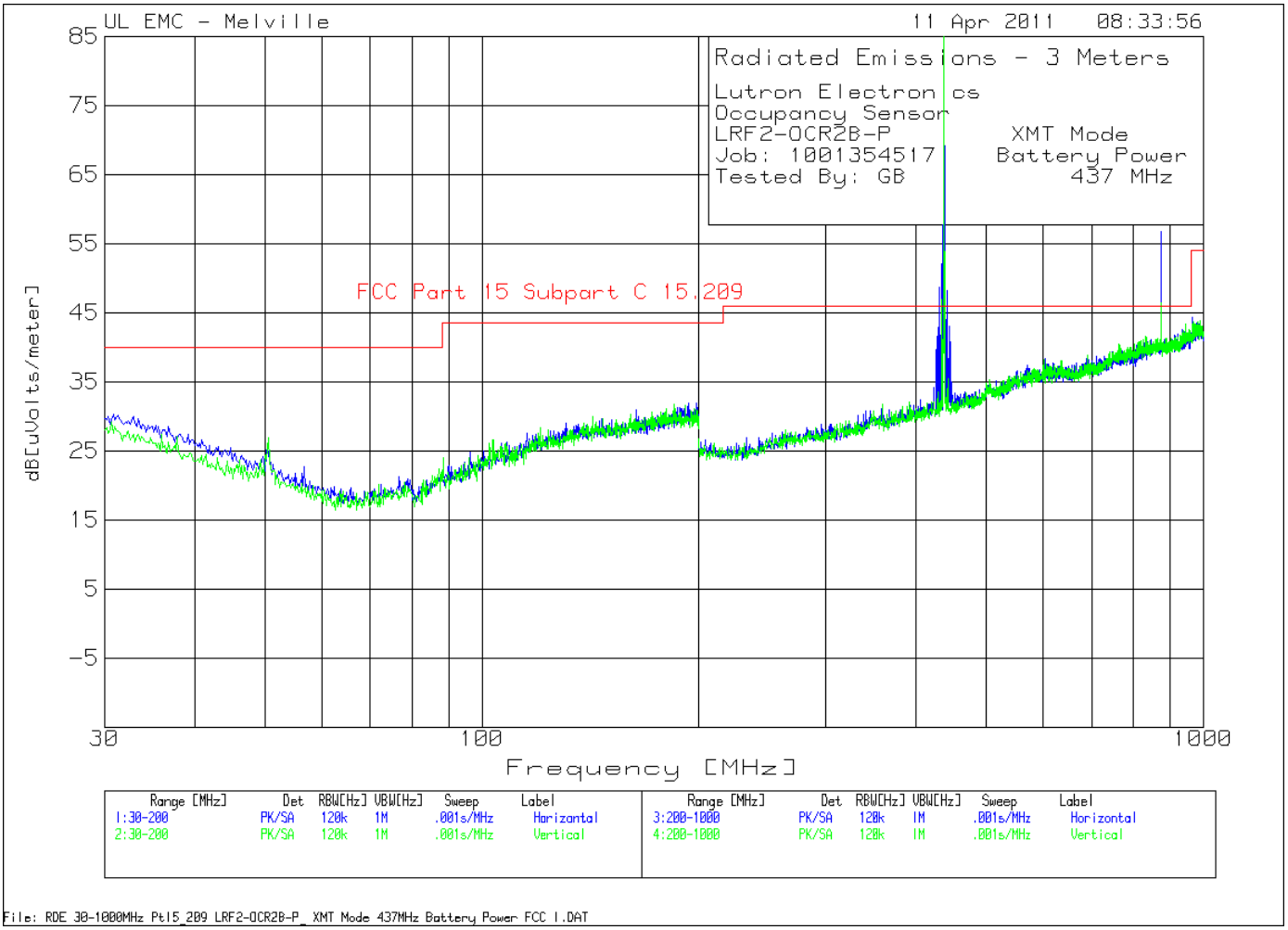


**Table 13 Radiated Emissions Data Points**

| Lutron Electronics | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Occupancy Sensor | | | | | | | | | | | | | | |
| LRF2-OCR2B-P XMT Mode | | | | | | | | | | | | | | |
| Job: 1001354517 Battery Power | | | | | | | | | | | | | | |
| Tested By: GB 437 MHz | | | | | | | | | | | | | | |
| Test Frequency [MHz] | Meter Reading [dB(uV)] | Detector Type | Gain/Loss Factor [dB] | Transducer Factor [dB] | Level dB[uVolts/meter] | DCF [dB] | Level dB[uVolts/meter] | Limit 1 | Margin 1[dB] | Limit 2 | Margin 2[dB] | Azimuth [degs] | Height [cm] | Polarity |
| Horizontal 200 - 1000MHz | | | | | | | | | | | | | | |
| 436.9649 | 80.24 | PK | 2.3 | 16.9 | 99.44 | -20.9 | 78.54 | - | - | 80.9 | -2.36 | 246 | 218 | Horz |
| 435 | 15.54 | QP | 2.3 | 16.9 | 34.74 | - | - | 46 | -11.26 | - | - | 107 | 217 | Horz |
| 433.3 | 9.64 | QP | 2.3 | 16.9 | 28.84 | - | - | 46 | -17.16 | - | - | 184 | 239 | Horz |
| 439 | 10.92 | QP | 2.3 | 17 | 30.22 | - | - | 46 | -15.78 | - | - | 201 | 155 | Horz |
| 441 | 8.52 | QP | 2.3 | 17 | 27.82 | - | - | 46 | -18.18 | - | - | 328 | 153 | Horz |
| 874 | 31.31 | PK | 3.4 | 23 | 57.71 | -20.9 | 36.81 | - | - | 60.9 | -24.09 | 28 | 163 | Horz |
| 431 | 8.46 | QP | 2.3 | 16.8 | 27.56 | - | - | 46 | -18.44 | - | - | 121 | 195 | Horz |
| 428.5 | 8.24 | QP | 2.3 | 16.7 | 27.24 | - | - | 46 | -18.76 | - | - | 75 | 100 | Horz |
| 429.7 | 7.96 | QP | 2.3 | 16.8 | 27.06 | - | - | 46 | -18.94 | - | - | 357 | 365 | Horz |
| 442 | 9.68 | QP | 2.4 | 17 | 29.08 | - | - | 46 | -16.92 | - | - | 112 | 186 | Horz |
| 443.7 | 8.41 | QP | 2.4 | 17.1 | 27.91 | - | - | 46 | -18.09 | - | - | 236 | 240 | Horz |
| 444.5 | 7.96 | QP | 2.4 | 17.1 | 27.46 | - | - | 46 | -18.54 | - | - | 327 | 391 | Horz |
| 446.2 | 7.96 | QP | 2.4 | 17.1 | 27.46 | - | - | 46 | -18.54 | - | - | 174 | 132 | Horz |
| | | | | | | | | | | | | | | |
| Vertical 200 - 1000MHz | | | | | | | | | | | | | | |
| 434.1 | 8.52 | QP | 2.3 | 16.5 | 27.32 | - | - | 46 | -18.68 | - | - | 159 | 239 | Vert |
| 434.3 | 8.19 | QP | 2.3 | 16.5 | 26.99 | - | - | 46 | -19.01 | - | - | 168 | 353 | Vert |
| 437.0415 | 71.01 | PK | 2.3 | 16.6 | 89.91 | -20.9 | 69.01 | - | - | 80.9 | -11.89 | 151 | 218 | Vert |
| 438 | 13.47 | QP | 2.3 | 16.6 | 32.37 | - | - | 46 | -13.63 | - | - | 58 | 106 | Vert |
| 873.9248 | 25.16 | PK | 3.4 | 23.2 | 51.76 | -20.9 | 30.86 | - | - | 60.9 | -30.04 | 160 | 123 | Vert |
| | | | | | | | | | | | | | | |
| LIMIT 1: FCC Part 15 Subpart C 15.209 | | | | | | | | | | | | | | |
| LIMIT 2: FCC Part 15 Subart C15.231 | | | | | | | | | | | | | | |
| LIMIT 3: NONE | | | | | | | | | | | | | | |
| LIMIT 4: NONE | | | | | | | | | | | | | | |
| LIMIT 5: NONE | | | | | | | | | | | | | | |
| LIMIT 6: NONE | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| PK - Peak detector (maximized) | | | | | | | | | | | | | | |
| QP - Quasi-Peak detector | | | | | | | | | | | | | | |
| LnAv - Linear Average detector | | | | | | | | | | | | | | |
| LgAv - Log Average detector | | | | | | | | | | | | | | |
| Av - Average detector | | | | | | | | | | | | | | |
| CAV - CISPR Average detector | | | | | | | | | | | | | | |
| RMS - RMS detection | | | | | | | | | | | | | | |
| CRMS - CISPR RMS detection | | | | | | | | | | | | | | |

**Figure 10 Radiated Emissions Graph**

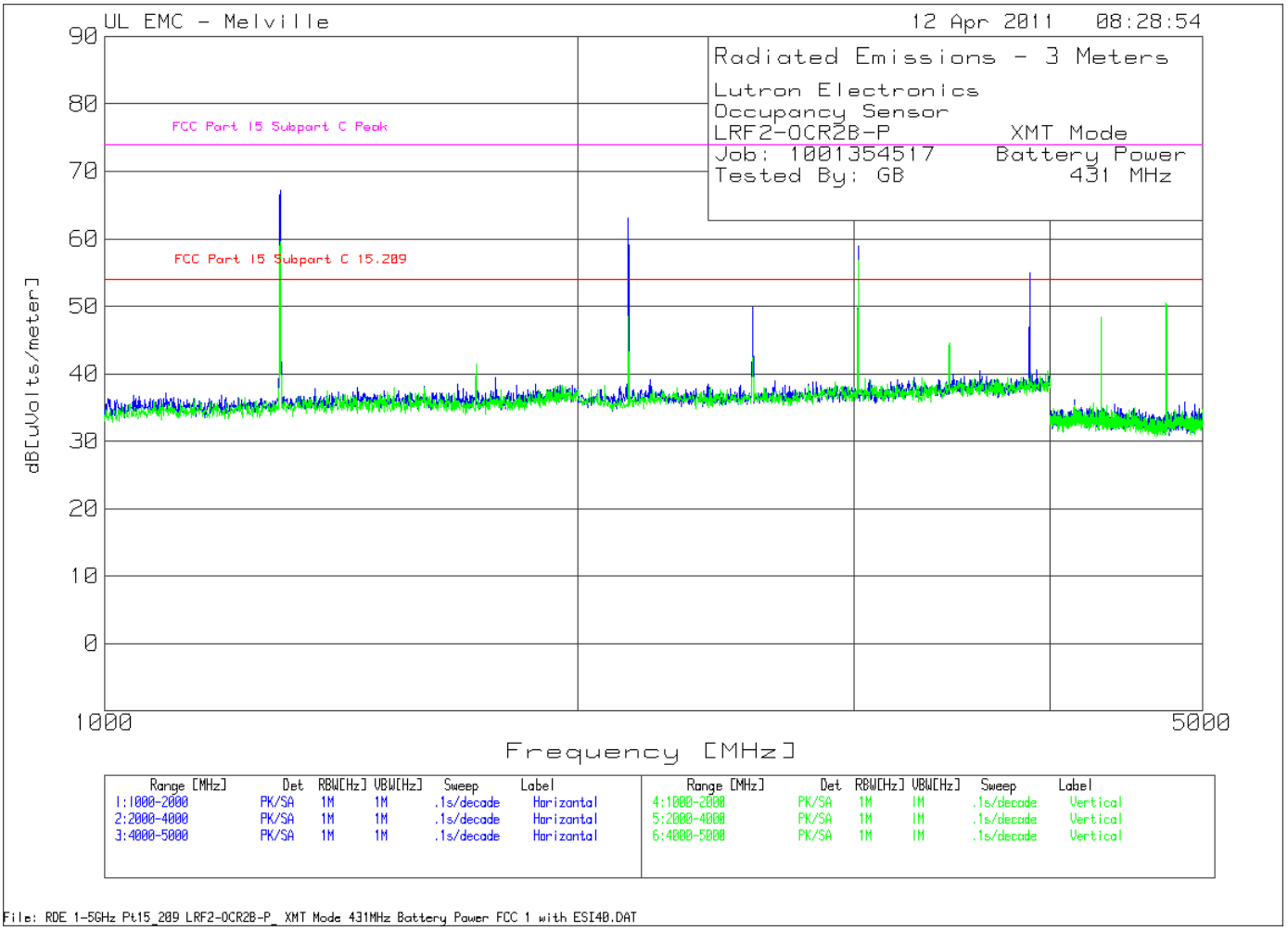


**Table 14 Radiated Emissions Data Points**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lutron Electronics | | | | | | | | | | | | | |
| Occupancy Sensor | | | | | | | | | | | | | |
| LRF2-OCR2B-P XMT Mode | | | | | | | | | | | | | |
| Job: 1001354517 Battery Power | | | | | | | | | | | | | |
| Tested By: GB 431 MHz | | | | | | | | | | | | | |
| Test | Meter | Detector | Gain/Loss | Transducer | Peak Level | DCF | Corrected Level | Limit 1 | Margin 1[dB] | Limit 2 | Margin 2[dB] | Azimuth [degs] | Height [cm] | Polarity |
| Frequency | Reading | Type | Factor | Factor | dB[uVolts/ meter] | [dB] | dB[uVolts/ meter] | | | | | | | |
| [MHz] | [dB(uV)] | | [dB] | [dB] | | | | | | | | | | |
| Horizontal 1000 - 2000MHz | | | | | | | | | | | | | | |
| 1293.045 | 91.7 | PK | -44.41 | 20.5 | 67.79 | -20.9 | 46.89 | 54 | -7.11 | 74 | -6.21 | 71 | 266 | Horz |
| 1724.09 | 85.72 | PK | -44.13 | 20.8 | 62.39 | -20.9 | 41.49 | 54 | -12.51 | 74 | -11.61 | 241 | 174 | Horz |
| | | | | | | | | | | | | | | |
| Horizontal 2000 - 4000MHz | | | | | | | | | | | | | | |
| 2155.047 | 88.34 | PK | -43.39 | 21.4 | 66.35 | -20.9 | 45.45 | 54 | -8.55 | 74 | -7.65 | 292 | 263 | Horz |
| 2585.935 | 86.41 | PK | -42.47 | 21.3 | 65.24 | -20.9 | 44.34 | 54 | -9.66 | 74 | -8.76 | 132 | 186 | Horz |
| 3017.236 | 85.84 | PK | -41.97 | 21.5 | 65.37 | -20.9 | 44.47 | 54 | -9.53 | 74 | -8.63 | 70 | 284 | Horz |
| 3017.01 | 84.94 | PK | -41.97 | 21.5 | 64.47 | -20.9 | 43.57 | 54 | -10.43 | 74 | -9.53 | 67 | 349 | Horz |
| 3878.987 | 80.7 | PK | -41.92 | 22.6 | 61.38 | -20.9 | 40.48 | 54 | -13.52 | 74 | -12.62 | 107 | 376 | Horz |
| | | | | | | | | | | | | | | |
| Horizontal 4000 - 5000MHz | | | | | | | | | | | | | | |
| 4309.714 | 76.55 | PK | -51.73 | 27.7 | 52.52 | -20.9 | 31.62 | 54 | -22.38 | 74 | -21.48 | 116 | 317 | Horz |
| 4740.573 | 85.78 | PK | -52.59 | 27.2 | 60.39 | -20.9 | 39.49 | 54 | -14.51 | 74 | -13.61 | 119 | 169 | Horz |
| | | | | | | | | | | | | | | |
| Vertical 1000 - 2000MHz | | | | | | | | | | | | | | |
| 1293.185 | 85.2 | PK | -44.4 | 20.5 | 61.3 | -20.9 | 40.4 | 54 | -13.6 | 74 | -12.7 | 295 | 301 | Vert |
| 1724.157 | 81.79 | PK | -44.13 | 20.8 | 58.46 | -20.9 | 37.56 | 54 | -16.44 | 74 | -15.54 | 116 | 379 | Vert |
| | | | | | | | | | | | | | | |
| Vertical 2000 - 4000MHz | | | | | | | | | | | | | | |
| 2155.157 | 77.69 | PK | -43.38 | 21 | 55.31 | -20.9 | 34.41 | 54 | -19.59 | 74 | -18.69 | 195 | 307 | Vert |
| 2586.278 | 85.46 | PK | -42.48 | 21.5 | 64.48 | -20.9 | 43.58 | 54 | -10.42 | 74 | -9.52 | 174 | 321 | Vert |
| 3017.015 | 81.34 | PK | -41.97 | 21.7 | 61.07 | -20.9 | 40.17 | 54 | -13.83 | 74 | -12.93 | 190 | 312 | Vert |
| 3448.028 | 70.36 | PK | -41.73 | 22.2 | 50.83 | -20.9 | 29.93 | 54 | -24.07 | 74 | -23.17 | 133 | 392 | Vert |
| 3883.803 | 58.9 | PK | -41.88 | 22.6 | 39.62 | -20.9 | 18.72 | 54 | -35.28 | 74 | -34.38 | 213 | 352 | Vert |
| | | | | | | | | | | | | | | |
| Vertical 4000 - 5000MHz | | | | | | | | | | | | | | |
| 4310.112 | 78.99 | PK | -51.73 | 27.8 | 55.06 | -20.9 | 34.16 | 54 | -19.84 | 74 | -18.94 | 101 | 344 | Vert |
| 4740.775 | 85.12 | PK | -52.59 | 27.1 | 59.63 | -20.9 | 38.73 | 54 | -15.27 | 74 | -14.37 | 145 | 139 | Vert |
| | | | | | | | | | | | | | | |
| Note: Limit 1 applied against the corrected level and Limit 2 applied against the Peak Level | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| LIMIT 1: FCC Part 15 Subpart C 15.209 | | | | | | | | | | | | | | |
| LIMIT 2: FCC Part 15 Subpart C Peak | | | | | | | | | | | | | | |
| LIMIT 3: NONE | | | | | | | | | | | | | | |
| LIMIT 4: NONE | | | | | | | | | | | | | | |
| LIMIT 5: NONE | | | | | | | | | | | | | | |
| LIMIT 6: NONE | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| PK - Peak detector (Maximized) | | | | | | | | | | | | | | |
| QP - Quasi-Peak detector | | | | | | | | | | | | | | |
| LnAv - Linear Average detector | | | | | | | | | | | | | | |
| LgAv - Log Average detector | | | | | | | | | | | | | | |
| Av - Average detector | | | | | | | | | | | | | | |
| CAV - CISPR Average detector | | | | | | | | | | | | | | |
| RMS - RMS detection | | | | | | | | | | | | | | |
| CRMS - CISPR RMS detection | | | | | | | | | | | | | | |

**Figure 11 Radiated Emissions Graph**

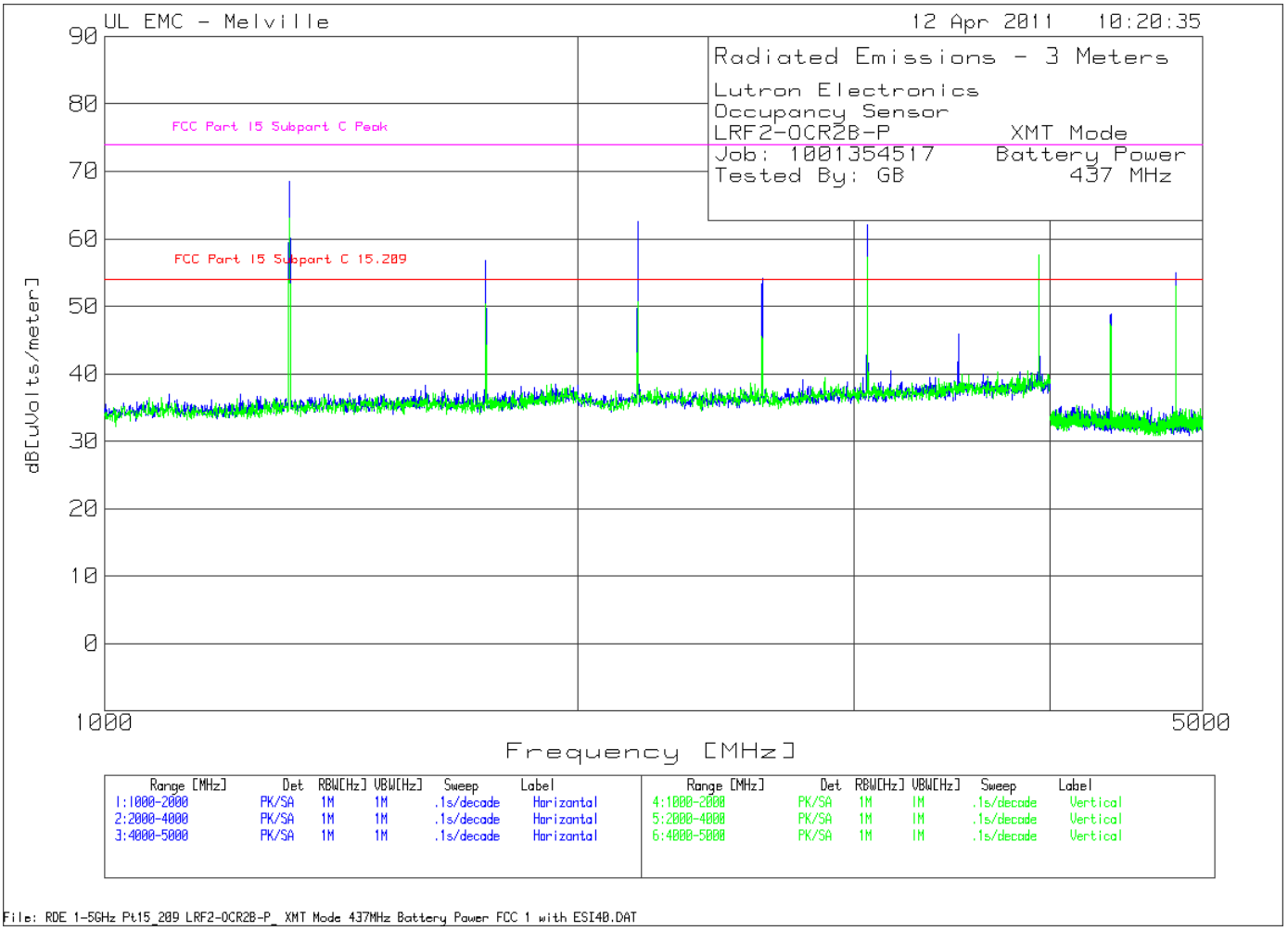


**Table 15 Radiated Emissions Data Points**

| Lutron Electronics | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Occupancy Sensor | | | | | | | | | | | | | | |
| LRF2-OCR2B-P XMT Mode | | | | | | | | | | | | | | |
| Job: 1001354517 Battery Power | | | | | | | | | | | | | | |
| Tested By: GB 437 MHz | | | | | | | | | | | | | | |
| Test | Meter | Detector | Gain/Loss | Transducer | Peak Level | DCF | Corrected Level | Limit 1 | Margin 1[dB] | Limit 2 | Margin 2[dB] | Azimuth [degs] | Height [cm] | Polarity |
| Frequency | Reading | Type | Factor | Factor | dB[uVolts/ meter] | [dB] | dB[uVolts/ meter] | | | | | | | |
| [MHz] | [dB(uV)] | | [dB] | [dB] | | | | | | | | | | |
| Horizontal 1000 - 2000MHz | | | | | | | | | | | | | | |
| 1311.107 | 96.79 | PK | -44.35 | 20.5 | 72.94 | -20.9 | 52.04 | 54 | -1.96 | 74 | -1.06 | 43 | 389 | Horz |
| 1748.055 | 92.43 | PK | -44.14 | 20.8 | 69.09 | -20.9 | 48.19 | 54 | -5.81 | 74 | -4.91 | 29 | 340 | Horz |
| | | | | | | | | | | | | | | |
| Horizontal 2000 - 4000MHz | | | | | | | | | | | | | | |
| 2184.887 | 89.02 | PK | -43.19 | 21.5 | 67.33 | -20.9 | 46.43 | 54 | -7.57 | 74 | -6.67 | 276 | 328 | Horz |
| 2622.215 | 87.5 | PK | -42.49 | 21.4 | 66.41 | -20.9 | 45.51 | 54 | -8.49 | 74 | -7.59 | 58 | 324 | Horz |
| 3059.246 | 86.61 | PK | -41.91 | 21.6 | 66.3 | -20.9 | 45.4 | 54 | -8.6 | 74 | -7.7 | 70 | 198 | Horz |
| 3496.102 | 76.21 | PK | -41.73 | 22.2 | 56.68 | -20.9 | 35.78 | 54 | -18.22 | 74 | -17.32 | 25 | 379 | Horz |
| 3933.145 | 83.93 | PK | -41.7 | 22.7 | 64.93 | -20.9 | 44.03 | 54 | -9.97 | 74 | -9.07 | 344 | 391 | Horz |
| | | | | | | | | | | | | | | |
| Horizontal 4000 - 5000MHz | | | | | | | | | | | | | | |
| 4370.105 | 81.05 | PK | -51.65 | 27.6 | 57 | -20.9 | 36.1 | 54 | -17.9 | 74 | -17 | 4 | 284 | Horz |
| 4807.215 | 86.87 | PK | -52.55 | 27.1 | 61.42 | -20.9 | 40.52 | 54 | -13.48 | 74 | -12.58 | 116 | 396 | Horz |
| | | | | | | | | | | | | | | |
| Vertical 1000 - 2000MHz | | | | | | | | | | | | | | |
| 1311.035 | 91.08 | PK | -44.35 | 20.5 | 67.23 | -20.9 | 46.33 | 54 | -7.67 | 74 | -6.77 | 332 | 398 | Vert |
| 1747.985 | 83.99 | PK | -44.14 | 20.8 | 60.65 | -20.9 | 39.75 | 54 | -14.25 | 74 | -13.35 | 86 | 178 | Vert |
| | | | | | | | | | | | | | | |
| Vertical 2000 - 4000MHz | | | | | | | | | | | | | | |
| 2185.007 | 86.54 | PK | -43.19 | 21.2 | 64.55 | -20.9 | 43.65 | 54 | -10.35 | 74 | -9.45 | 61 | 323 | Vert |
| 2622.154 | 86.44 | PK | -42.49 | 21.4 | 65.35 | -20.9 | 44.45 | 54 | -9.55 | 74 | -8.65 | 5 | 190 | Vert |
| 3058.714 | 83.86 | PK | -41.89 | 21.8 | 63.77 | -20.9 | 42.87 | 54 | -11.13 | 74 | -10.23 | 156 | 363 | Vert |
| 3480.053 | 59.71 | PK | -41.81 | 22.3 | 40.2 | -20.9 | 19.3 | 54 | -34.7 | 74 | -33.8 | 175 | 301 | Vert |
| 3933.276 | 80.84 | PK | -41.7 | 22.7 | 61.84 | -20.9 | 40.94 | 54 | -13.06 | 74 | -12.16 | 355 | 307 | Vert |
| | | | | | | | | | | | | | | |
| Vertical 4000 - 5000MHz | | | | | | | | | | | | | | |
| 4370.107 | 77.95 | PK | -51.65 | 27.7 | 54 | -20.9 | 33.1 | 54 | -20.9 | 74 | -20 | 151 | 343 | Vert |
| 4807.007 | 86.9 | PK | -52.55 | 27.3 | 61.65 | -20.9 | 40.75 | 54 | -13.25 | 74 | -12.35 | 140 | 385 | Vert |
| | | | | | | | | | | | | | | |
| Note: Limit 1 applied against the corrected level and Limit 2 applied against the Peak Level | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| LIMIT 1: FCC Part 15 Subpart C 15.209 | | | | | | | | | | | | | | |
| LIMIT 2: FCC Part 15 Subpart C Peak | | | | | | | | | | | | | | |
| LIMIT 3: NONE | | | | | | | | | | | | | | |
| LIMIT 4: NONE | | | | | | | | | | | | | | |
| LIMIT 5: NONE | | | | | | | | | | | | | | |
| LIMIT 6: NONE | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| PK - Peak detector (maximized) | | | | | | | | | | | | | | |
| QP - Quasi-Peak detector | | | | | | | | | | | | | | |
| LnAv - Linear Average detector | | | | | | | | | | | | | | |
| LgAv - Log Average detector | | | | | | | | | | | | | | |
| Av - Average detector | | | | | | | | | | | | | | |
| CAV - CISPR Average detector | | | | | | | | | | | | | | |
| RMS - RMS detection | | | | | | | | | | | | | | |
| CRMS - CISPR RMS detection | | | | | | | | | | | | | | |

## Appendix A

**Accreditations and Authorizations**

NVLAP Lab code: 100255-0

NVLAP: The National Institute of Standards and Technology (NIST) administers the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP is comprised of laboratory accreditation programs (LAPs) which are established on the basis of requests and demonstrated need. Each LAP includes specific calibration and/or test standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration. NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests. Accreditation criteria are established in accordance with the U.S. Code of Federal Regulations (CFR, Title 15, Part 285), NVLAP Procedures and General Requirements, and encompass the requirements of ISO/IEC 17025. For a full scope listing see http://ts.nist.gov/ts/htdocs/210/214/scopes/1002550.htm

FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland (Ref. No. 91040).

Industry Canada Industrie Canada

Industry of Canada: Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3. File #: IC 2181

VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.: (Radiated Emissions) R-797, G-226 (Conducted Emissions) C-832, C-83400, and C-81879 and (Conducted Emissions - Telecommunications Ports) T-1582 and T-1583.

ICASA: ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).

NIST/CAB: Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 2004/108/EC, Annex III (2-3). Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.
NIST/CAB: Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).
NIST/CAB: Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22), IEC 61000-4-2, -4-3, -4-4, -4-5, and -4-6

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