



**TEST REPORT NO. RSI-2709E**  
**ELECTROMAGNETIC EMISSION EVALUATION**  
**OF THE**  
**LUTRON ELECTRONICS**  
**MODEL #: HRD-5KP**  
**FCC PART 15, SUBPART B AND C**  
**29 MARCH 2005**

**PREPARED FOR:**

**Lutron Electronics**  
7200 Suter Road  
Coopersburg, PA 18036

**SUBMITTED BY:**

**Radiation Sciences Inc.**  
3131 Detwiler Road  
Harleysville, PA 19438

**PREPARED BY:**

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John Kavaluski  
EMC Test Engineer  
**Radiation Sciences Inc.**

**REVIEWED BY:**

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Daniel J. Signore  
President  
**Radiation Sciences Inc.**



**ADMINISTRATIVE DATA**

**TEST PERFORMED:**

Measurements of Radiated RF and Conducted Emissions.

**PURPOSE OF TEST:**

To evaluate the ElectroMagnetic Emission (EME) characteristics of the Equipment Under Test (EUT) with respect to Subpart B and C of Part 15 of the Federal Communications Commission (FCC) Rules for intentional and unintentional radiators.

**EQUIPMENT UNDER TEST (EUT):**

Model Number: **HRD-5KP**

Serial Number: 070002062092

**CONTRACT:**

Purchase Order Number: 56107

**TEST PERIOD:**

29 October 2004 and 23 March 2005

**TEST FACILITY:**

**Radiation Sciences Incorporated (RSI)**, EMC Test Laboratory, located at: 3131 Detwiler Road, Harleysville, Pennsylvania 19438.

**TEST PERSONNEL AND COORDINATORS:**

**Radiation Sciences Inc.**

John Kavaluski

**Lutron Electronics**

Mark Clouser



**SUMMARY OF TEST RESULTS**

The **Model #: HRD-5KP**, configured as described herein, **FULLY COMPLIES WITH THE REQUIREMENTS SET FORTH IN SUBPART B AND C OF PART 15 OF THE FEDERAL COMMUNICATIONS COMMISSION (FCC) RULES FOR INTENTIONAL AND UNINTENTIONAL RADIATORS.**



## 1.0 INTRODUCTION

This document is a report of tests to determine the EME characteristics of the **Model #: HRD-5KP**, presented by **Lutron Electronics** of Coopersburg, Pennsylvania.

The purpose of the testing was to evaluate the EMC characteristics of the test sample with respect to Subpart B and C of Part 15 of the **FCC** Rules for intentional and unintentional radiators.

All test procedures used meet the requirements of the American National Standards Institute Procedure C63:4: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz", dated 17 July 1992.



## 2.0 DESCRIPTION OF THE TEST SAMPLE:

The **Lutron Electronics HRD-5KP** is a wireless wall keypad operating between 431 and 437MHz. The keypad can be programmed to control any light or group of lights. The unit is powered by 115VAC and contains clock signals of 14.756 and 32.0MHz.

The “5” notation in the **5KP** Part Number denotes the number of buttons available in the device. The unit tested for **FCC** compliance was an **HRD-5KP**, which signifies that it was a 5-button/scene device. Depending on the configuration of the unit, this number can be substituted with other numeral designations.



**3.0 TEST INSTRUMENTATION**

| <b>RSI<br/>INV<br/>NO.</b> | <b>DESCRIPTION</b>  | <b>MANUFACTURER</b> | <b>MODEL #</b>   | <b>SERIAL #</b> | <b>CAL<br/>DUE<br/>DATE</b> |
|----------------------------|---------------------|---------------------|------------------|-----------------|-----------------------------|
| 32.1                       | SPEC. ANALY.        | H.P.                | 8566B            | 3638A08767      | 8/13/2005                   |
| 33.1                       | SPEC. ANALY. DISPLY | H.P.                |                  | 3701A22258      | 8/13/2005                   |
| 75                         | ANTENNA             | TENSOR              | 4108             | 204             | 6/11/2005                   |
| 80                         | ANTENNA             | AMP.RES.Assoc.      | AT1000           | 4094-025        | 6/14/2005                   |
| 177                        | COMPUTER            | H.P. (Disc Drive)   | 9122C            | 2804A8894       |                             |
| 236                        | LISN                | SOLAR               | 8012-50-R-12-BNC | 807-52          | 3/26/2005                   |
| 390                        | RECEIVER            | R & S               | ESH 3            | 861742/012      | 4/18/2005                   |
| 391                        | RECEIVER            | R & S               | ESVP             | 861744/015      | 6/15/2005                   |
| 474                        | TRANSFORMER         | G.E.                | 9T51B33G3        | NSN             |                             |
| 501                        | MINI MAST           | EMCO                | 2075-2           | 0002-2278       |                             |
| 502                        | TURNTABLE           | EMCO                | 2065-1.21        | 0001-2156       |                             |
| 503                        | CONTROLLER          | EMCO                | 2090             | 0001-1489       |                             |
| 701                        | 12 ft Cable RG-223  | PASTERNAK           | BNC TO BNC       | N/A             | 9/16/2005                   |
| 708                        | 40ft Cable RG-223   | PASTERNAK           | BNC TO BNC       | N/A             | 9/23/2005                   |

IF CAL DUE DATE = BLANK FIELD  
Calibration is not required for this item. Equipment  
not used to obtain a final reading (i.e. transmitting antenna).



#### **4.0 TEST RESULTS**

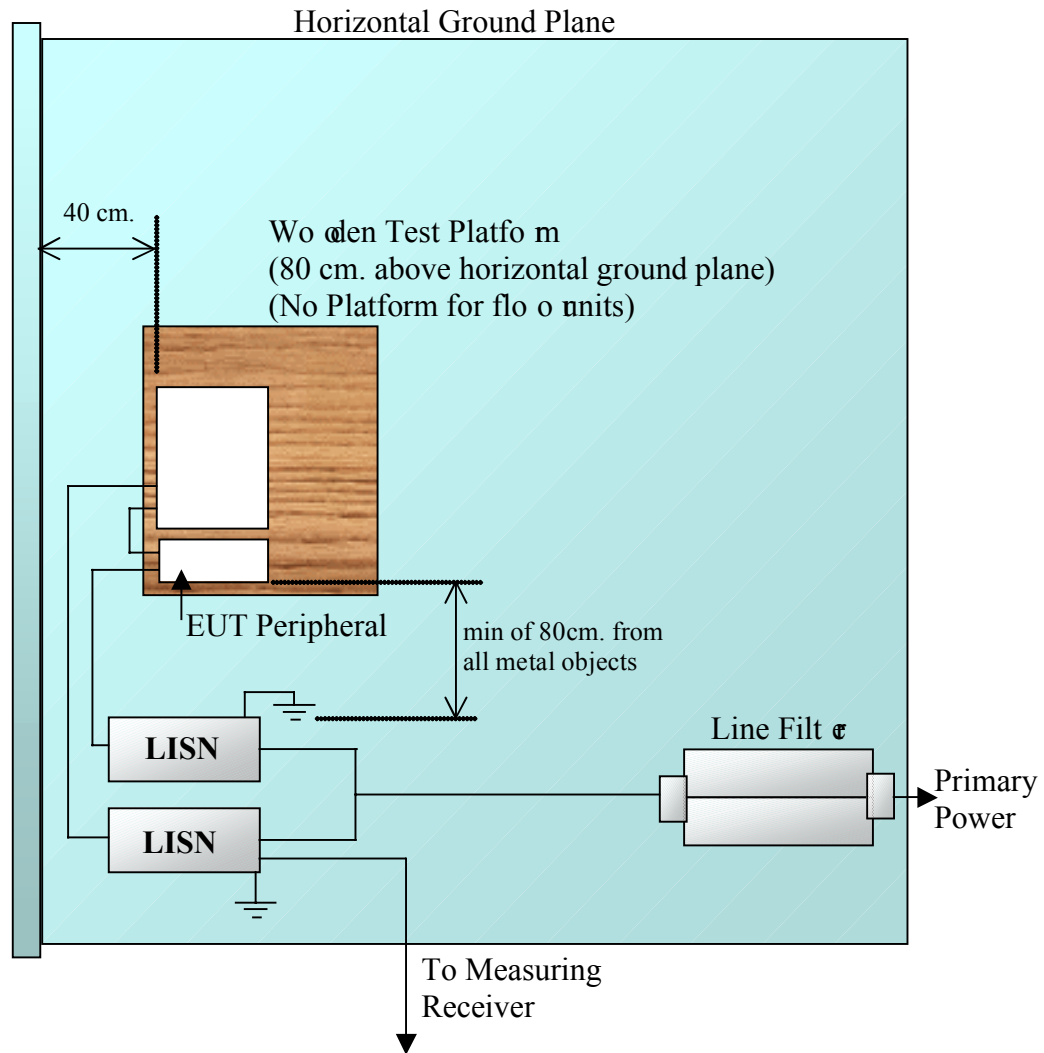
##### **4.1 Conducted Power Line Measurements, Paragraph 15.107**

Conducted power line measurements were recorded for the **Model HRD-5KP**.

The test setup diagram is shown in Figure 1 and a photograph is shown in Figure 2.

The results of the line-to-ground radio noise voltage measurements are shown on graphs, Figures 3 and 4 for the phase and neutral lines, respectively. Figure 5 is a data sheet presenting average detector readings for those points on the graphs shown above the limit during the automated peak search.

**ALL LEVELS ARE BELOW THE APPLICABLE LIMITS AS SPECIFIED BY THE FCC IN PARAGRAPH 15.107.**



**Conducted Emissions Test Setup Diagram (Top View)**  
**Figure 1**



**Conducted Emissions Test Setup Photograph  
Figure 2**

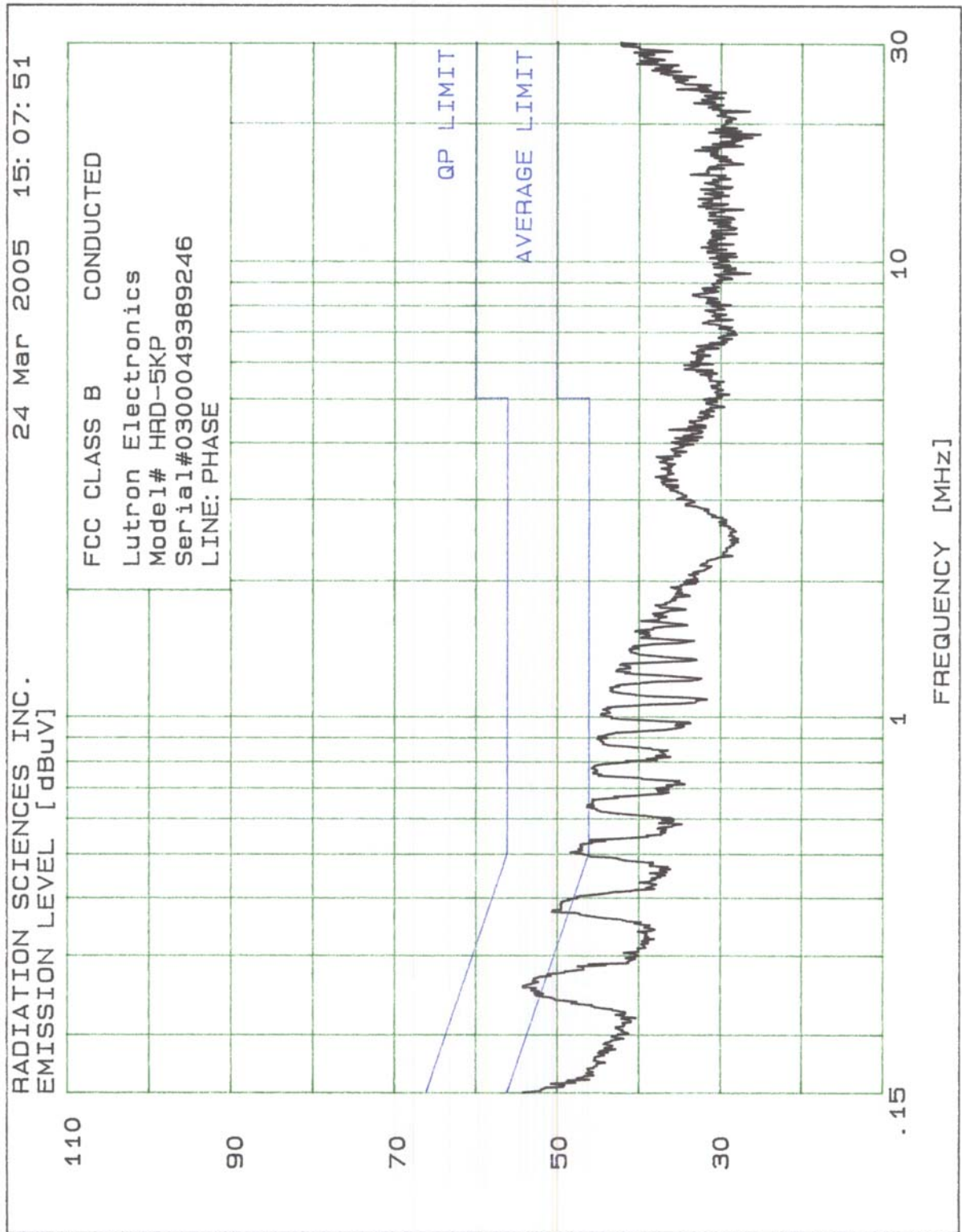


Figure 3

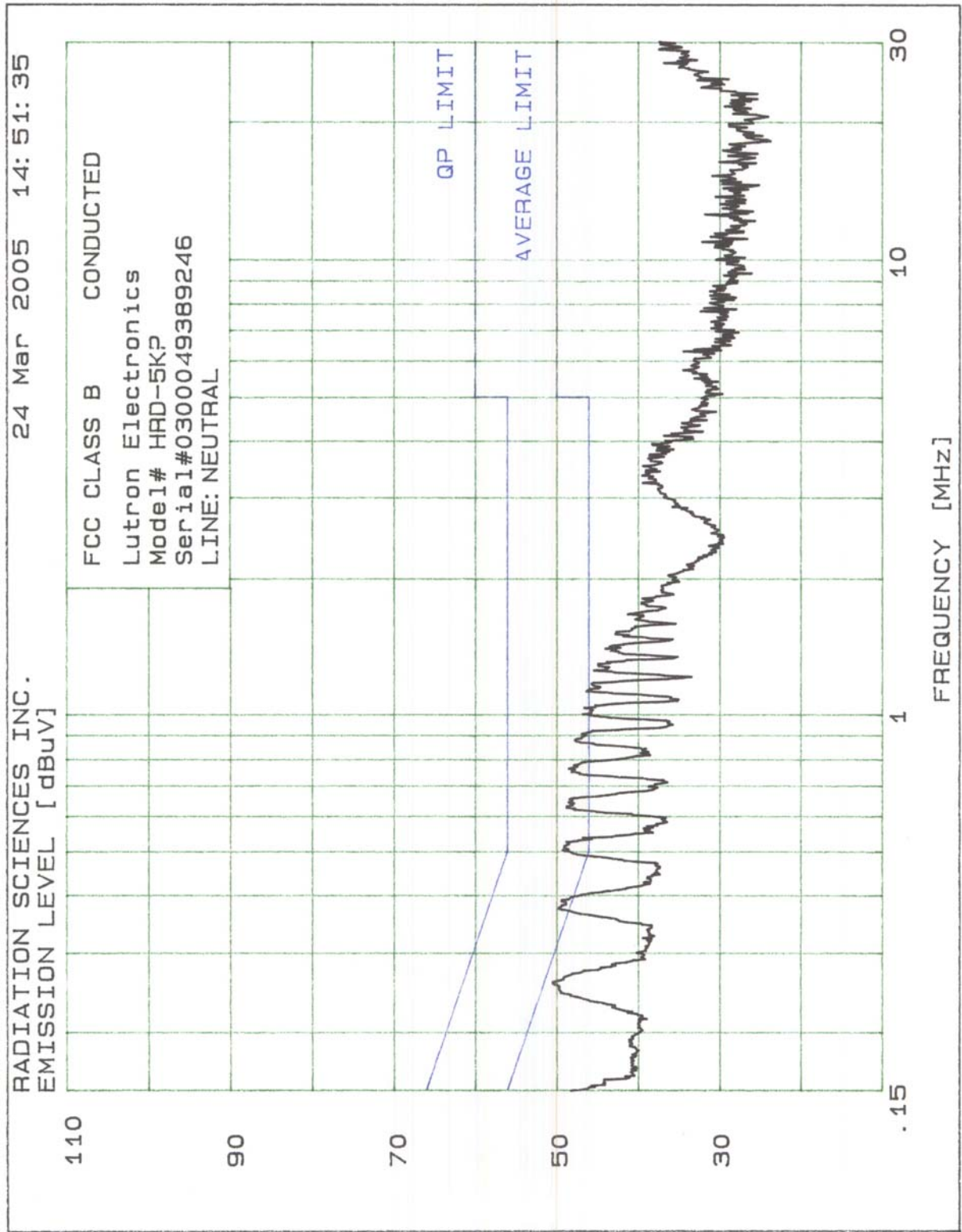


Figure 4

**Electromagnetic Emission Test**

|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|----------------------------------------------------|--------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------|-------------------------------|----------------|
| <b>E<br/>U<br/>T</b>                               | <b>Manufacturer:</b> Lutron    |                            | <b>Date:</b> 3/24/05                                                                                                                                                            |  | Test Code <b>CE</b>                                         |                               |                |
|                                                    | <b>Model #:</b> HRD-5KP        |                            | <b>Test Instruments:</b> RSI # 32.1, 33.1, 177, 236, 390, 494, 701,                                                                                                             |  | Technician                                                  |                               |                |
|                                                    | <b>Serial #:</b> 0300049389246 |                            | <b>Frequency Range:</b> .150-30MHz                                                                                                                                              |  | Test Engineer                                               |                               |                |
|                                                    | <b>Mode:</b> ON                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
| <b>Temperature:</b> 70 °F<br><b>Humidity:</b> 25 % |                                |                            | <b>Additional Info:</b>                                                                                                                                                         |  |                                                             | <b>Test Spec:</b> FCC Class B |                |
| <b>Radiated</b><br>Distance:<br>Antenna:           |                                |                            | <input type="checkbox"/> HORIZ. <input type="checkbox"/> BB <input type="checkbox"/> NB<br><input type="checkbox"/> VERT. <input type="checkbox"/> H <input type="checkbox"/> E |  | <b>Conducted</b><br>Line: <i>Phase/Neutral</i><br>Function: |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             | <input type="checkbox"/> BB   |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             | <input type="checkbox"/> NB   |                |
| <b>FREQ.</b>                                       | <b>QP IND. Level</b>           | <b>AVG IND. Level</b>      | <b>Correction Factors</b>                                                                                                                                                       |  | <b>QP Final Level</b>                                       | <b>AVG Final Level</b>        | <b>Remarks</b> |
|                                                    |                                |                            | <b>ANT.</b>                                                                                                                                                                     |  |                                                             |                               |                |
| <b>MHz</b>                                         | <b>dB<math>\mu</math>V</b>     | <b>dB<math>\mu</math>V</b> |                                                                                                                                                                                 |  | <b>dB<math>\mu</math>V</b>                                  | <b>dB<math>\mu</math>V</b>    |                |
| <b>.27</b>                                         |                                | 29.2                       |                                                                                                                                                                                 |  |                                                             | <b>29.2</b>                   | <b>Phase</b>   |
| <b>.38</b>                                         |                                | 31.3                       |                                                                                                                                                                                 |  |                                                             | <b>31.3</b>                   | ↓              |
| <b>.50</b>                                         |                                | 27.1                       |                                                                                                                                                                                 |  |                                                             | <b>27.1</b>                   |                |
| <b>.64</b>                                         |                                | 28.6                       |                                                                                                                                                                                 |  |                                                             | <b>28.6</b>                   |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
| <b>.25</b>                                         |                                | 32.5                       |                                                                                                                                                                                 |  |                                                             | <b>32.5</b>                   | <b>Neutral</b> |
| <b>.3819</b>                                       |                                | 31.6                       |                                                                                                                                                                                 |  |                                                             | <b>31.6</b>                   | ↓              |
| <b>.511</b>                                        |                                | 31.8                       |                                                                                                                                                                                 |  |                                                             | <b>31.8</b>                   |                |
| <b>.65</b>                                         |                                | 29.6                       |                                                                                                                                                                                 |  |                                                             | <b>29.6</b>                   |                |
| <b>.89</b>                                         |                                | 39.7                       |                                                                                                                                                                                 |  |                                                             | <b>39.7</b>                   |                |
| <b>1.009</b>                                       |                                | 26.9                       |                                                                                                                                                                                 |  |                                                             | <b>26.9</b>                   |                |
| <b>1.28</b>                                        |                                | 25.1                       |                                                                                                                                                                                 |  |                                                             | <b>25.1</b>                   |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |
|                                                    |                                |                            |                                                                                                                                                                                 |  |                                                             |                               |                |

**Figure 5**



#### **4.2 Radiated Emissions Measurements, §15.33, §15.35, §15.109, §15.205, §15.209, §15.231**

Radiated Emissions measurements were recorded for the test sample at a distance of 3 meters. Radiated Emissions were measured with the antenna in both the horizontal and vertical polarizations. The antenna was raised 1 to 4 meters in height and the Equipment Under Test (**EUT**) was rotated 360° to maximize the emission. No significant emission level changes occurred while positioning the **EUT** power cable.

For intentional radiators the field strength of emissions of the **EUT** were measured out to the tenth harmonic of the carrier frequency. The carrier frequency was set to 431, 434 and 437MHz.

An average factor of 20dB was applied to the level of the fundamental emission when compared to the **FCC** limit.

Figure 6 is a test setup diagram for Radiated Emissions and Figure 7 is a test setup photograph.

The test results for both unintentional and intentional Radiated Emissions testing are shown in the following figures:

Figure 8 Unintentional Radiated Emissions, data sheet, 431MHz Receive Mode

Figure 9 Unintentional Radiated Emissions, graph, 431MHz Receive Mode

Figure 10 Unintentional Radiated Emissions, data sheet, 437MHz Receive Mode

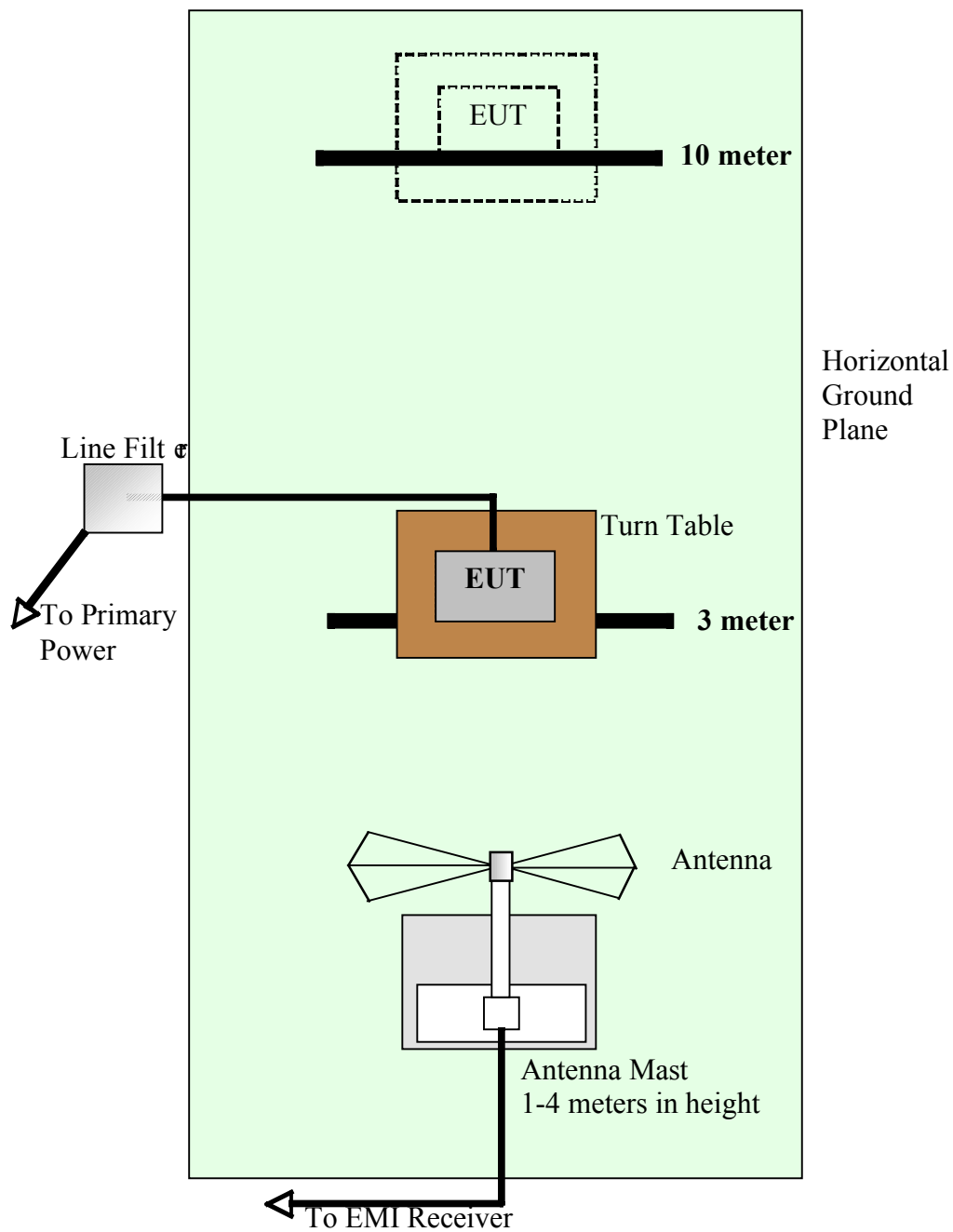
Figure 11 Unintentional Radiated Emissions, graph, 437MHz Receive Mode

Figure 12 Intentional Radiated Emissions, data sheet, 431MHz Transmit Mode

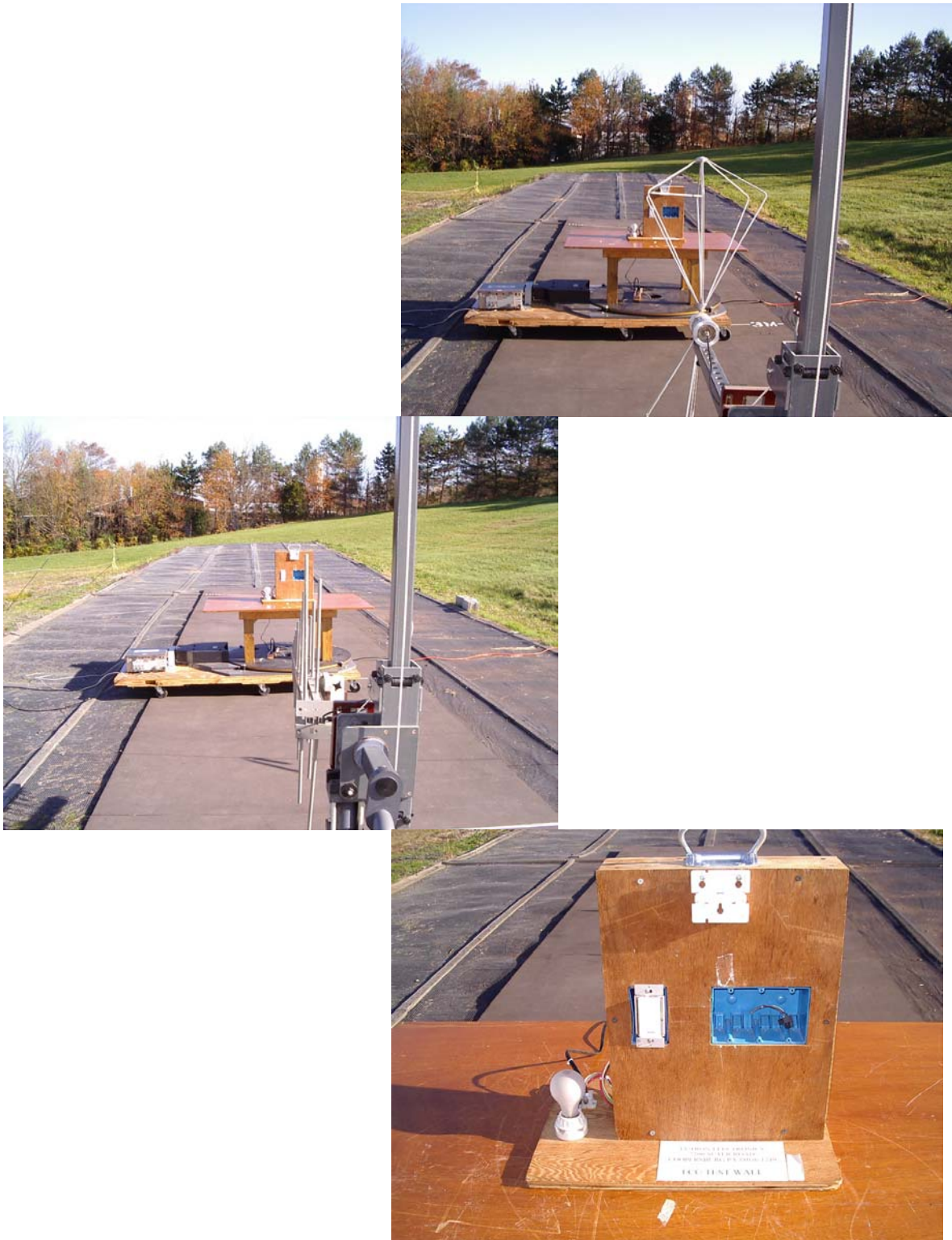
Figure 13 Intentional Radiated Emissions, data sheet, 434MHz Transmit Mode

Figure 14 Intentional Radiated Emissions, data sheet, 437MHz Transmit Mode

**ALL LEVELS COMPLY WITH THE APPLICABLE FCC LIMITS FOR RADIATED EMISSIONS PER THE APPLICABLE PARAGRAPHS.**



**Radiated Emissions Test Setup Diagram  
Figure 6**



**Radiated Emission Test Setup Photographs  
Figure 7**

**Electromagnetic Emission Test**

|                                                             |                                         |                                                                                                                                                                                                       |                                                               |                                        |                                                                  |                                                            |
|-------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|------------------------------------------------------------------|------------------------------------------------------------|
| <b>E<br/>U<br/>T</b>                                        | <b>Manufacturer:</b> Lutron Electronics |                                                                                                                                                                                                       | <b>Date:</b> 10/28/04                                         |                                        | Test Code <b>RE</b>                                              |                                                            |
|                                                             | <b>Model#:</b> HRD-5KP                  |                                                                                                                                                                                                       | <b>Test Instruments:</b> RSI # 75, 80,391,<br>708,501,502,503 |                                        | Technician                                                       |                                                            |
|                                                             | <b>Serial #:</b> 070002062092           |                                                                                                                                                                                                       |                                                               |                                        |                                                                  |                                                            |
|                                                             | <b>Mode:</b> Receive 431MHz             |                                                                                                                                                                                                       | <b>Frequency Range:</b> 30MHz – 1000MHz                       |                                        | Engineer                                                         |                                                            |
| <b>Temperature:</b> 52°F<br><b>Humidity:</b> 46%            |                                         | <b>Additional Info:</b>                                                                                                                                                                               |                                                               |                                        | <b>Test Spec:</b> FCC Part15, Class B<br>Unintentional Radiators |                                                            |
| <b>Radiated</b><br>Distance: 3 meter<br>Antenna: Bicon /Log |                                         | <input checked="" type="checkbox"/> HORIZ. <input type="checkbox"/> BB <input type="checkbox"/> NB<br><input checked="" type="checkbox"/> VERT. <input type="checkbox"/> H <input type="checkbox"/> E |                                                               | <b>Conducted</b><br>Line:<br>Function: |                                                                  | <input type="checkbox"/> BB<br><input type="checkbox"/> NB |
| <b>FREQ.</b>                                                | <b>IND.<br/>Level</b>                   | <b>Correction<br/>Factors</b>                                                                                                                                                                         |                                                               | <b>Final<br/>Level</b>                 | <b>Antenna<br/>Height</b>                                        | <b>EUT<br/>Azimuth</b>                                     |
|                                                             |                                         | <b>ANT.</b>                                                                                                                                                                                           | <b>Cable<br/>loss</b>                                         |                                        |                                                                  |                                                            |
| <b>MHz</b>                                                  | <b>dB<math>\mu</math>V</b>              | <b>dB</b>                                                                                                                                                                                             | <b>dB</b>                                                     | <b>dB<math>\mu</math>V/m</b>           | <b>Meters</b>                                                    | <b>Degree</b>                                              |
| <b>30.0</b>                                                 | 6.7                                     | 12.0                                                                                                                                                                                                  | 1.0                                                           | <b>19.7</b>                            | 1.0                                                              | 0.0                                                        |
| <b>32.0</b>                                                 | 12.5                                    | 12.5                                                                                                                                                                                                  | 1.0                                                           | <b>26</b>                              | 1.0                                                              | 90.0                                                       |
| <b>64.0</b>                                                 | 13.1                                    | 8.0                                                                                                                                                                                                   | 1.0                                                           | <b>22.1</b>                            | 1.5                                                              | 0.0                                                        |
| <b>128.0</b>                                                | 10.2                                    | 12.0                                                                                                                                                                                                  | 2.0                                                           | <b>24.2</b>                            | 1.0                                                              | 0.0                                                        |
| <b>160.0</b>                                                | 9.0                                     | 13.0                                                                                                                                                                                                  | 2.0                                                           | <b>24</b>                              | 1.0                                                              | 0.0                                                        |
| <b>200.0</b>                                                | 2.1                                     | 14.0                                                                                                                                                                                                  | 2.0                                                           | <b>18.1</b>                            | 1.0                                                              | 25.0                                                       |
| <b>200.0</b>                                                | -0.2                                    | 11.5                                                                                                                                                                                                  | 2.0                                                           | <b>13.3</b>                            | 2.0                                                              | 0.0                                                        |
| <b>300.0</b>                                                | -1.4                                    | 14.0                                                                                                                                                                                                  | 3.0                                                           | <b>15.6</b>                            | 2.0                                                              | 0.0                                                        |
| <b>431.0</b>                                                | -1.6                                    | 18.0                                                                                                                                                                                                  | 4.0                                                           | <b>20.4</b>                            | 2.0                                                              | 0.0                                                        |
| <b>500.0</b>                                                | -1.5                                    | 22.0                                                                                                                                                                                                  | 4.0                                                           | <b>24.5</b>                            | 2.0                                                              | 0.0                                                        |
| <b>700.0</b>                                                | -0.2                                    | 22.0                                                                                                                                                                                                  | 6.0                                                           | <b>27.8</b>                            | 2.0                                                              | 0.0                                                        |
| <b>1000</b>                                                 | -0.2                                    | 24.0                                                                                                                                                                                                  | 6.0                                                           | <b>29.8</b>                            | 2.02                                                             | 0.0                                                        |
| <b>30.0</b>                                                 | 4.0                                     | 13.0                                                                                                                                                                                                  | 1.0                                                           | <b>18</b>                              | 1.00                                                             | 0.0                                                        |
| <b>32.0</b>                                                 | 5.4                                     | 13.5                                                                                                                                                                                                  | 1.0                                                           | <b>19.9</b>                            | 3.35                                                             | 96.5                                                       |
| <b>64.0</b>                                                 | 10.0                                    | 9.0                                                                                                                                                                                                   | 1.0                                                           | <b>20</b>                              | 2.67                                                             | 202.6                                                      |
| <b>128.0</b>                                                | 7.9                                     | 12.0                                                                                                                                                                                                  | 2.0                                                           | <b>21.9</b>                            | 2.72                                                             | 0.0                                                        |
| <b>160.0</b>                                                | 3.5                                     | 12.5                                                                                                                                                                                                  | 2.0                                                           | <b>18</b>                              | 2.72                                                             | 0.0                                                        |
| <b>200.0</b>                                                | 3.6                                     | 14.0                                                                                                                                                                                                  | 2.0                                                           | <b>19.6</b>                            | 2.72                                                             | 0.0                                                        |
| <b>200.0</b>                                                | -0.2                                    | 12.0                                                                                                                                                                                                  | 2.0                                                           | <b>13.8</b>                            | 2.04                                                             | 180.0                                                      |
| <b>300.0</b>                                                | -1.1                                    | 16.0                                                                                                                                                                                                  | 3.0                                                           | <b>17.9</b>                            | 1.50                                                             | 180.0                                                      |
| <b>431.0</b>                                                | -1.6                                    | 17.5                                                                                                                                                                                                  | 4.0                                                           | <b>19.9</b>                            | 1.50                                                             | 180.0                                                      |
| <b>500.0</b>                                                | -1.1                                    | 18.0                                                                                                                                                                                                  | 4.0                                                           | <b>20.9</b>                            | 1.50                                                             | 180.0                                                      |
| <b>700.0</b>                                                | -0.2                                    | 22.0                                                                                                                                                                                                  | 6.0                                                           | <b>27.8</b>                            | 1.50                                                             | 180.0                                                      |
| <b>1000.0</b>                                               | -0.2                                    | 25.0                                                                                                                                                                                                  | 6.0                                                           | <b>30.8</b>                            | 1.00                                                             | 180.0                                                      |

**Figure 8**

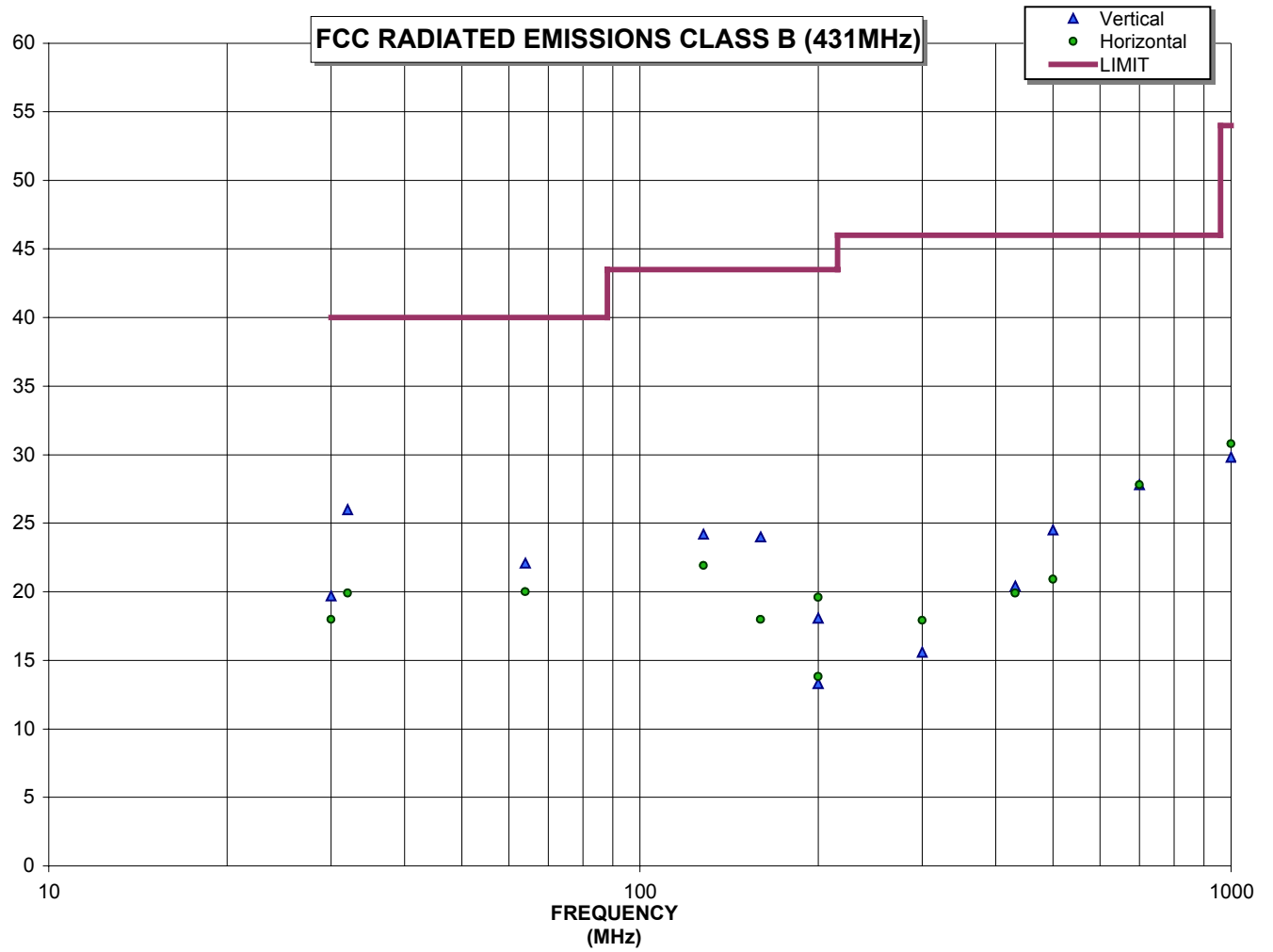


Figure 9



## Electromagnetic Emission Test

| E<br>U<br>T                                                 | <b>Manufacturer:</b> Lutron Electronics |  | <b>Date:</b> 10/28/04                                                                                                                                                                                 |               | Test Code <b>RE</b>                    |                                                                  |                                                            |                |                  |
|-------------------------------------------------------------|-----------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------|------------------------------------------------------------------|------------------------------------------------------------|----------------|------------------|
|                                                             | <b>Model#:</b> HRD-5KP                  |  | <b>Test Instruments:</b> RSI # 75, 80,391,<br>708,501,502,503                                                                                                                                         |               | Technician                             |                                                                  |                                                            |                |                  |
|                                                             | <b>Serial #:</b> 070002062092           |  |                                                                                                                                                                                                       |               | Engineer                               |                                                                  |                                                            |                |                  |
|                                                             | <b>Mode:</b> Receive 437MHz             |  | <b>Frequency Range:</b> 30MHz – 1000MHz                                                                                                                                                               |               |                                        |                                                                  |                                                            |                |                  |
| <b>Temperature:</b> 52°F<br><b>Humidity:</b> 46%            |                                         |  | <b>Additional Info:</b>                                                                                                                                                                               |               |                                        | <b>Test Spec:</b> FCC Part15, Class B<br>Unintentional Radiators |                                                            |                |                  |
| <b>Radiated</b><br>Distance: 3 meter<br>Antenna: Bicon /Log |                                         |  | <input checked="" type="checkbox"/> HORIZ. <input type="checkbox"/> BB <input type="checkbox"/> NB<br><input checked="" type="checkbox"/> VERT. <input type="checkbox"/> H <input type="checkbox"/> E |               | <b>Conducted</b><br>Line:<br>Function: |                                                                  | <input type="checkbox"/> BB<br><input type="checkbox"/> NB |                |                  |
| FREQ.                                                       | IND.<br>Level                           |  | Correction<br>Factors                                                                                                                                                                                 |               |                                        | Final<br>Level                                                   | Antenna<br>Height                                          | EUT<br>Azimuth | Remarks          |
| MHz                                                         | dBμV                                    |  | ANT.                                                                                                                                                                                                  | Cable<br>loss |                                        | dBμV/m                                                           | Meters                                                     | Degree         | Polarity/Antenna |
| 30.0                                                        | 6.7                                     |  | 12.0                                                                                                                                                                                                  | 1.0           |                                        | 19.7                                                             | 1.0                                                        | 0.0            | Vertical/Bicon   |
| 32.0                                                        | 12.5                                    |  | 12.5                                                                                                                                                                                                  | 1.0           |                                        | 26                                                               | 1.0                                                        | 290.0          |                  |
| 64.0                                                        | 15.1                                    |  | 8.0                                                                                                                                                                                                   | 1.0           |                                        | 24.1                                                             | 1.5                                                        | 18.0           |                  |
| 128.0                                                       | 10.0                                    |  | 12.0                                                                                                                                                                                                  | 2.0           |                                        | 24                                                               | 1.0                                                        | 0.0            |                  |
| 160.0                                                       | 4.0                                     |  | 13.0                                                                                                                                                                                                  | 2.0           |                                        | 19                                                               | 1.0                                                        | 0.0            |                  |
| 200.0                                                       | 2.4                                     |  | 14.0                                                                                                                                                                                                  | 2.0           |                                        | 18.4                                                             | 2.04                                                       | 90.0           | ↓                |
| 200.0                                                       | -1.1                                    |  | 11.5                                                                                                                                                                                                  | 2.0           |                                        | 12.4                                                             | 2.0                                                        | 0.0            | Vertical/LogP.   |
| 300.0                                                       | -1.1                                    |  | 14.0                                                                                                                                                                                                  | 3.0           |                                        | 15.9                                                             | 2.0                                                        | 0.0            |                  |
| 437.0                                                       | -1.6                                    |  | 18.0                                                                                                                                                                                                  | 4.0           |                                        | 20.4                                                             | 2.0                                                        | 0.0            |                  |
| 500.0                                                       | -1.6                                    |  | 22.0                                                                                                                                                                                                  | 4.0           |                                        | 24.4                                                             | 2.0                                                        | 0.0            |                  |
| 700.0                                                       | -0.2                                    |  | 22.0                                                                                                                                                                                                  | 6.0           |                                        | 27.8                                                             | 2.0                                                        | 0.0            |                  |
| 1000                                                        | -0.2                                    |  | 24.0                                                                                                                                                                                                  | 6.0           |                                        | 29.8                                                             | 2.02                                                       | 0.0            | ↓                |
| 30.0                                                        | 4.0                                     |  | 13.0                                                                                                                                                                                                  | 1.0           |                                        | 18                                                               | 3.35                                                       | 100            | Horiz./Bicon     |
| 32.0                                                        | 6.2                                     |  | 13.5                                                                                                                                                                                                  | 1.0           |                                        | 20.7                                                             | 3.35                                                       | 100            |                  |
| 64.0                                                        | 4.0                                     |  | 9.0                                                                                                                                                                                                   | 1.0           |                                        | 14                                                               | 3.35                                                       | 123.5          |                  |
| 128.0                                                       | 12.2                                    |  | 12.0                                                                                                                                                                                                  | 2.0           |                                        | 26.2                                                             | 2.72                                                       | 0.0            |                  |
| 160.0                                                       | 4.6                                     |  | 12.5                                                                                                                                                                                                  | 2.0           |                                        | 19.1                                                             | 2.72                                                       | 0.0            |                  |
| 200.0                                                       | 5.0                                     |  | 14.0                                                                                                                                                                                                  | 2.0           |                                        | 21                                                               | 2.72                                                       | 0.0            | ↓                |
| 200.0                                                       | -0.2                                    |  | 12.0                                                                                                                                                                                                  | 2.0           |                                        | 13.8                                                             | 2.04                                                       | 180.0          | Horiz./LogP.     |
| 300.0                                                       | -1.1                                    |  | 14.0                                                                                                                                                                                                  | 3.0           |                                        | 15.9                                                             | 1.50                                                       | 180.0          |                  |
| 437.0                                                       | -1.6                                    |  | 17.5                                                                                                                                                                                                  | 4.0           |                                        | 19.9                                                             | 1.50                                                       | 180.0          |                  |
| 500.0                                                       | -1.1                                    |  | 18.0                                                                                                                                                                                                  | 4.0           |                                        | 20.9                                                             | 1.50                                                       | 180.0          |                  |
| 700.0                                                       | -0.2                                    |  | 22.0                                                                                                                                                                                                  | 6.0           |                                        | 27.8                                                             | 1.50                                                       | 180.0          |                  |
| 1000.0                                                      | -0.2                                    |  | 25.0                                                                                                                                                                                                  | 6.0           |                                        | 30.8                                                             | 1.00                                                       | 180.0          | ↓                |

**Figure 10**

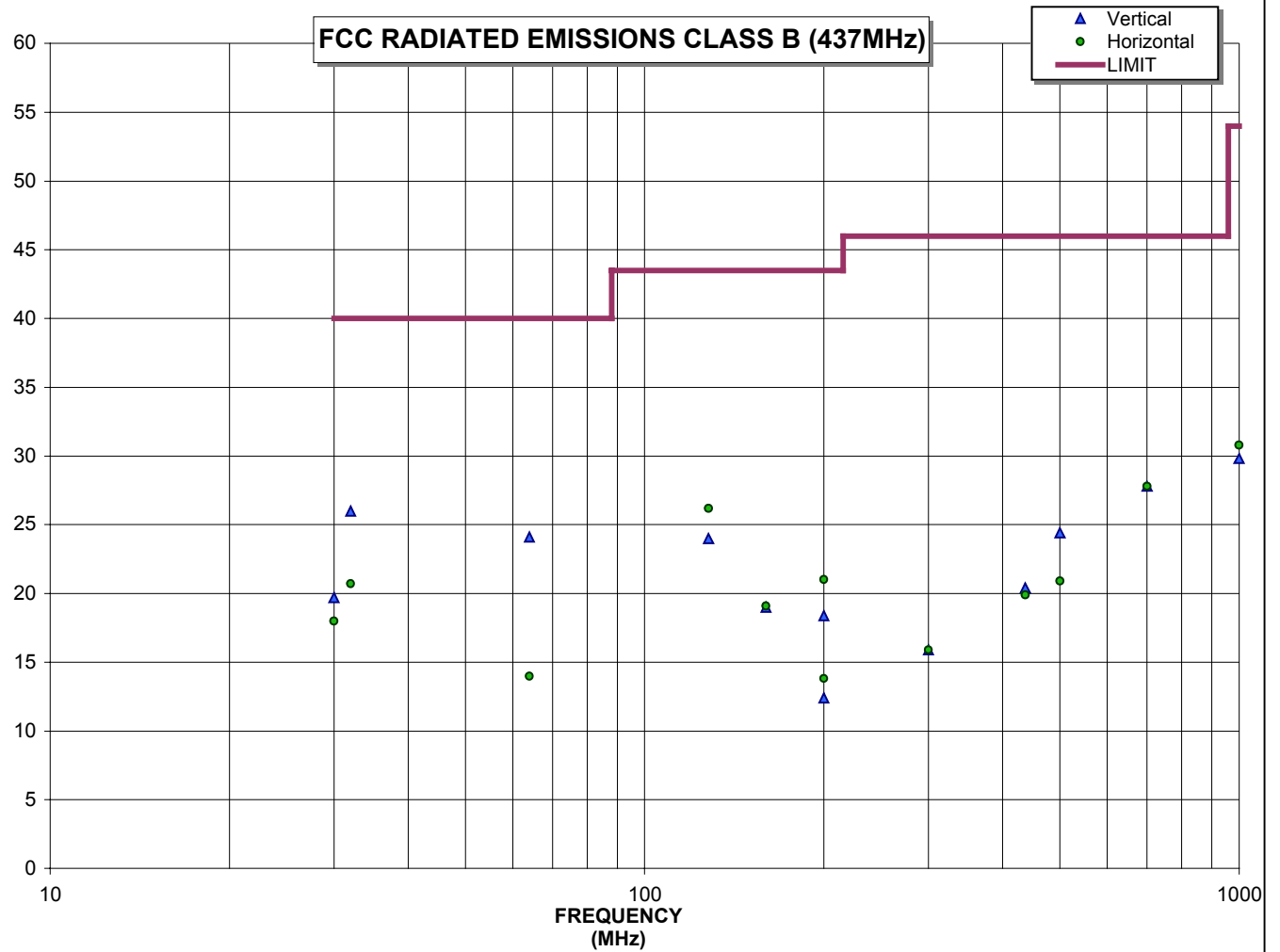


Figure 11



Company: Lutron Electronics  
Model #: HRD-5KP  
Fund. Freq.: 431MHz

Test Personnel: John Kavaluski  
Date: 10/28/04

**Radiated Emission for Intentional Radiators**

| Frequency<br>(MHz) | Polarity | Antenna<br>Height<br>(Meters) | Azimuth<br>(Degrees) | Indicated<br>Level<br>(dBuV) | Antenna<br>Factor<br>(dB) | Distance<br>Factor<br>1m to 3m<br>(dB) | Cable<br>Loss<br>(dB) | Averaging<br>Factor<br>(dB) | Field<br>Strength<br>@ 3m<br>(dBuV/m) | Limits<br>@ 3m<br>(dBuV/m) | Margin<br>(dB) |
|--------------------|----------|-------------------------------|----------------------|------------------------------|---------------------------|----------------------------------------|-----------------------|-----------------------------|---------------------------------------|----------------------------|----------------|
| 431                | Vert     | 1.00                          | 335                  | 63.3                         | 18.0                      | 0.0                                    | 4.0                   | -20.0                       | 65.3                                  | 80.3                       | -15.0          |
| 862                | Vert     | 1.00                          | 0                    | 30.0                         | 23.2                      | 0.0                                    | 5.0                   | -20.0                       | 38.2                                  | 61.9                       | -23.7          |
| 1293               | Vert     | 1.00                          | 135                  | 20.8                         | 25.0                      | 0.0                                    | 1.0                   | -20.0                       | 26.8                                  | 61.9                       | -35.1          |
| 1724               | Vert     | 1.00                          | 0                    | 19.8                         | 26.0                      | 0.0                                    | 1.0                   | -20.0                       | 26.8                                  | 54.0                       | -27.2          |
| 2155               | Vert     | 1.00                          | 0                    | 14.0                         | 28.3                      | 0.0                                    | 1.0                   | -20.0                       | 23.3                                  | 61.9                       | -38.6          |
| 2586               | Vert     | 1.00                          | 0                    | 19.1                         | 29.0                      | 0.0                                    | 1.0                   | -20.0                       | 29.1                                  | 61.9                       | -32.8          |
| 3017               | Vert     | 1.00                          | 0                    | 19.0                         | 30.3                      | 0.0                                    | 1.0                   | -20.0                       | 30.3                                  | 61.9                       | -31.6          |
| 3448               | Vert     | 1.00                          | 0                    | 19.0                         | 31.4                      | 0.0                                    | 1.0                   | -20.0                       | 31.4                                  | 54.0                       | -22.6          |
| 3879               | Vert     | 1.00                          | 0                    | 22.0                         | 32.6                      | 0.0                                    | 1.0                   | -20.0                       | 35.6                                  | 54.0                       | -18.4          |
| 4310               | Vert     | 1.00                          | 0                    | 22.0                         | 32.5                      | 0.0                                    | 1.0                   | -20.0                       | 35.5                                  | 54.0                       | -18.5          |
|                    |          |                               |                      |                              |                           |                                        |                       |                             |                                       |                            |                |
| 431                | Horiz    | 1.00                          | 335                  | 54.2                         | 17.3                      | 0.0                                    | 4.0                   | -20.0                       | 55.5                                  | 80.3                       | -24.8          |
| 862                | Horiz    | 1.00                          | 0                    | 29.1                         | 23.5                      | 0.0                                    | 5.0                   | -20.0                       | 37.6                                  | 61.9                       | -24.3          |
| 1293               | Horiz    | 1.00                          | 135                  | 26.0                         | 25.0                      | 0.0                                    | 1.0                   | -20.0                       | 32.0                                  | 61.9                       | -29.9          |
| 1724               | Horiz    | 1.00                          | 0                    | 21.0                         | 26.6                      | 0.0                                    | 1.0                   | -20.0                       | 28.6                                  | 54.0                       | -25.4          |
| 2155               | Horiz    | 1.00                          | 0                    | 19.0                         | 28.0                      | 0.0                                    | 1.0                   | -20.0                       | 28.0                                  | 61.9                       | -33.9          |
| 2586               | Horiz    | 1.00                          | 0                    | 19.5                         | 29.0                      | 0.0                                    | 1.0                   | -20.0                       | 29.5                                  | 61.9                       | -32.4          |
| 3017               | Horiz    | 1.00                          | 0                    | 19.0                         | 30.4                      | 0.0                                    | 1.0                   | -20.0                       | 30.4                                  | 61.9                       | -31.5          |
| 3448               | Horiz    | 1.00                          | 0                    | 18.0                         | 31.5                      | 0.0                                    | 1.0                   | -20.0                       | 30.5                                  | 54.0                       | -23.5          |
| 3879               | Horiz    | 1.00                          | 0                    | 20.0                         | 32.7                      | 0.0                                    | 1.0                   | -20.0                       | 33.7                                  | 54.0                       | -20.3          |
| 4310               | Horiz    | 1.00                          | 0                    | 22.0                         | 32.6                      | 0.0                                    | 1.0                   | -20.0                       | 35.6                                  | 54.0                       | -18.4          |

**Figure 12**



Company: Lutron Electronics  
Model # HRD-5KP  
Fund. Freq.: 434MHz

Test Personnel: John Kavaluski  
Date: 10/28/04

**Radiated Emission for Intentional Radiators**

| Frequency<br>(MHz) | Polarity | Antenna<br>Height<br>(Meters) | Azimuth<br>(Degrees) | Indicated<br>Level<br>(dBuV) | Antenna<br>Factor<br>(dB) | Distance<br>Factor<br>1m to 3m<br>(dB) | Cable<br>Loss<br>(dB) | Averaging<br>Factor<br>(dB) | Field<br>Strength<br>@ 3m<br>(dBuV/m) | Limits<br>@ 3m<br>(dBuV/m) | Margin<br>(dB) |
|--------------------|----------|-------------------------------|----------------------|------------------------------|---------------------------|----------------------------------------|-----------------------|-----------------------------|---------------------------------------|----------------------------|----------------|
| 434                | Vert     | 1.00                          | 335                  | 67.8                         | 18.0                      | 0.0                                    | 4.0                   | -20.0                       | 69.8                                  | 80.3                       | -10.5          |
| 868                | Vert     | 1.00                          | 0                    | 19.1                         | 23.2                      | 0.0                                    | 5.0                   | -20.0                       | 27.3                                  | 61.9                       | -34.6          |
| 1302               | Vert     | 1.00                          | 135                  | 22.0                         | 25.0                      | 0.0                                    | 1.0                   | -20.0                       | 28.0                                  | 61.9                       | -33.9          |
| 1736               | Vert     | 1.00                          | 0                    | 22.0                         | 26.0                      | 0.0                                    | 1.0                   | -20.0                       | 29.0                                  | 54.0                       | -25.0          |
| 2170               | Vert     | 1.00                          | 0                    | 16.0                         | 28.3                      | 0.0                                    | 1.0                   | -20.0                       | 25.3                                  | 61.9                       | -36.6          |
| 2604               | Vert     | 1.00                          | 0                    | 17.2                         | 29.0                      | 0.0                                    | 1.0                   | -20.0                       | 27.2                                  | 61.9                       | -34.7          |
| 3038               | Vert     | 1.00                          | 0                    | 16.9                         | 30.3                      | 0.0                                    | 1.0                   | -20.0                       | 28.2                                  | 61.9                       | -33.7          |
| 3472               | Vert     | 1.00                          | 0                    | 15.7                         | 31.4                      | 0.0                                    | 1.0                   | -20.0                       | 28.1                                  | 54.0                       | -25.9          |
| 3909               | Vert     | 1.00                          | 0                    | 17.6                         | 32.6                      | 0.0                                    | 1.0                   | -20.0                       | 31.2                                  | 54.0                       | -22.8          |
| 4340               | Vert     | 1.00                          | 0                    | 19.0                         | 32.5                      | 0.0                                    | 1.0                   | -20.0                       | 32.5                                  | 54.0                       | -21.5          |
|                    |          |                               |                      |                              |                           |                                        |                       |                             |                                       |                            |                |
| 434                | Horiz    | 1.00                          | 335                  | 54.1                         | 17.3                      | 0.0                                    | 4.0                   | -20.0                       | 55.4                                  | 80.3                       | -24.9          |
| 868                | Horiz    | 1.00                          | 0                    | 23.9                         | 23.5                      | 0.0                                    | 5.0                   | -20.0                       | 32.4                                  | 61.9                       | -29.5          |
| 1302               | Horiz    | 1.00                          | 135                  | 11.1                         | 25.0                      | 0.0                                    | 1.0                   | -20.0                       | 17.1                                  | 61.9                       | -44.8          |
| 1736               | Horiz    | 1.00                          | 0                    | 16.0                         | 26.6                      | 0.0                                    | 1.0                   | -20.0                       | 23.6                                  | 54.0                       | -30.4          |
| 2170               | Horiz    | 1.00                          | 0                    | 15.5                         | 28.0                      | 0.0                                    | 1.0                   | -20.0                       | 24.5                                  | 61.9                       | -37.4          |
| 2604               | Horiz    | 1.00                          | 0                    | 20.1                         | 29.0                      | 0.0                                    | 1.0                   | -20.0                       | 30.1                                  | 61.9                       | -31.8          |
| 3038               | Horiz    | 1.00                          | 0                    | 16.0                         | 30.4                      | 0.0                                    | 1.0                   | -20.0                       | 27.4                                  | 61.9                       | -34.5          |
| 3472               | Horiz    | 1.00                          | 0                    | 15.3                         | 31.5                      | 0.0                                    | 1.0                   | -20.0                       | 27.8                                  | 54.0                       | -26.2          |
| 3909               | Horiz    | 1.00                          | 0                    | 17.6                         | 32.7                      | 0.0                                    | 1.0                   | -20.0                       | 31.3                                  | 54.0                       | -22.7          |
| 4340               | Horiz    | 1.00                          | 0                    | 20.1                         | 32.6                      | 0.0                                    | 1.0                   | -20.0                       | 33.7                                  | 54.0                       | -20.3          |

**Figure 13**



Company: Lutron Electronics  
Model # HRD-5KP  
Fund. Freq.: 437MHz

Test Personnel: John Kavaluski  
Date: 10/28/04

**Radiated Emission for Intentional Radiators**

| Frequency<br>(MHz) | Polarity | Antenna<br>Height<br>(Meters) | Azimuth<br>(Degrees) | Indicated<br>Level<br>(dBuV) | Antenna<br>Factor<br>(dB) | Distance<br>Factor<br>1m to 3m<br>(dB) | Cable<br>Loss<br>(dB) | Averaging<br>Factor<br>(dB) | Field<br>Strength<br>@ 3m<br>(dBuV/m) | Limits<br>@ 3m<br>(dBuV/m) | Margin<br>(dB) |
|--------------------|----------|-------------------------------|----------------------|------------------------------|---------------------------|----------------------------------------|-----------------------|-----------------------------|---------------------------------------|----------------------------|----------------|
| 437                | Vert     | 1.00                          | 335                  | 66.2                         | 18.0                      | 0.0                                    | 4.0                   | -20.0                       | 68.2                                  | 80.3                       | -12.1          |
| 874                | Vert     | 1.00                          | 0                    | 50.0                         | 23.2                      | 0.0                                    | 5.0                   | -20.0                       | 58.2                                  | 61.9                       | -3.7           |
| 1311               | Vert     | 1.00                          | 135                  | 22.8                         | 25.0                      | 0.0                                    | 1.0                   | -20.0                       | 28.8                                  | 61.9                       | -33.1          |
| 1748               | Vert     | 1.00                          | 0                    | 22.6                         | 26.0                      | 0.0                                    | 1.0                   | -20.0                       | 29.6                                  | 54.0                       | -24.4          |
| 2185               | Vert     | 1.00                          | 0                    | 15.4                         | 28.3                      | 0.0                                    | 1.0                   | -20.0                       | 24.7                                  | 61.9                       | -37.2          |
| 2622               | Vert     | 1.00                          | 0                    | 16.7                         | 29.0                      | 0.0                                    | 1.0                   | -20.0                       | 26.7                                  | 61.9                       | -35.2          |
| 3059               | Vert     | 1.00                          | 0                    | 16.0                         | 30.3                      | 0.0                                    | 1.0                   | -20.0                       | 27.3                                  | 61.9                       | -34.6          |
| 3496               | Vert     | 1.00                          | 0                    | 15.2                         | 31.4                      | 0.0                                    | 1.0                   | -20.0                       | 27.6                                  | 54.0                       | -26.4          |
| 3933               | Vert     | 1.00                          | 0                    | 17.8                         | 32.6                      | 0.0                                    | 1.0                   | -20.0                       | 31.4                                  | 54.0                       | -22.6          |
| 4370               | Vert     | 1.00                          | 0                    | 19.6                         | 32.5                      | 0.0                                    | 1.0                   | -20.0                       | 33.1                                  | 54.0                       | -20.9          |
|                    |          |                               |                      |                              |                           |                                        |                       |                             |                                       |                            |                |
| 431                | Horiz    | 1.00                          | 135                  | 51.3                         | 17.3                      | 0.0                                    | 4.0                   | -20.0                       | 52.6                                  | 80.3                       | -27.7          |
| 874                | Horiz    | 1.00                          | 0                    | 52.0                         | 23.5                      | 0.0                                    | 5.0                   | -20.0                       | 60.5                                  | 61.9                       | -1.4           |
| 1311               | Horiz    | 1.00                          | 0                    | 22.5                         | 25.0                      | 0.0                                    | 1.0                   | -20.0                       | 28.5                                  | 61.9                       | -33.4          |
| 1748               | Horiz    | 1.00                          | 0                    | 15.7                         | 26.6                      | 0.0                                    | 1.0                   | -20.0                       | 23.3                                  | 54.0                       | -30.7          |
| 2185               | Horiz    | 1.00                          | 0                    | 17.7                         | 28.0                      | 0.0                                    | 1.0                   | -20.0                       | 26.7                                  | 61.9                       | -35.2          |
| 2622               | Horiz    | 1.00                          | 0                    | 16.3                         | 29.0                      | 0.0                                    | 1.0                   | -20.0                       | 26.3                                  | 61.9                       | -35.6          |
| 3059               | Horiz    | 1.00                          | 0                    | 16.0                         | 30.4                      | 0.0                                    | 1.0                   | -20.0                       | 27.4                                  | 61.9                       | -34.5          |
| 3496               | Horiz    | 1.00                          | 0                    | 15.0                         | 31.5                      | 0.0                                    | 1.0                   | -20.0                       | 27.5                                  | 54.0                       | -26.5          |
| 3933               | Horiz    | 1.00                          | 0                    | 16.9                         | 32.7                      | 0.0                                    | 1.0                   | -20.0                       | 30.6                                  | 54.0                       | -23.4          |
| 4370               | Horiz    | 1.00                          | 0                    | 18.8                         | 32.6                      | 0.0                                    | 1.0                   | -20.0                       | 32.4                                  | 54.0                       | -21.6          |

**Figure 14**



#### **4.3 Bandwidth Measurements, Paragraph 15.231**

Bandwidth measurements were made at the three transmit frequencies of 431, 434, and 437MHz.

The requirement states that the bandwidth shall be no wider than .25% of the center frequency at the 20dB down points. Results of testing are shown in Figures 15, 16, and 17.

**THE BANDWIDTH MEASUREMENTS COMPLIED WITH THE FCC REQUIREMENTS SET FORTH IN PARAGRAPH 15.231.**



Model # HRD-5KP  
Fund. Freq.: 431MHz

Test Personnel: J Kavalusky  
Date: 10/28/04

**Bandwidth of Fundamental Frequency**

|                  | Frequency<br>(MHz) | Measurement<br>(dBuV/m) |
|------------------|--------------------|-------------------------|
| Center Frequency | 431.0              | 91.15                   |
| 20 dB down       | 431.016            | 71.15                   |
| 20 dB down       | 430.980            | 71.25                   |

The bandwidth is 36KHz

Allowable Bandwidth: 0.25% of Fundamental Frequency  
For 431MHz:  $\pm 0.5388\text{MHz}$

**Figure 15**



Company: Lutron Electronics  
Model # HRD-5KP  
Fund. Freq.: 434MHz

Test Personnel: J Kavalusky  
Date: 10/28/04

### **Bandwidth of Fundamental Frequency**

|                  | Frequency<br>(MHz) | Measurement<br>(dBuV/m) |
|------------------|--------------------|-------------------------|
| Center Frequency | 434.0              | 82.2                    |
| 20 dB down       | 434.014            | 62.0                    |
| 20 dB down       | 433.980            | 62.0                    |

The bandwidth is 34KHz

Allowable Bandwidth: 0.25% of Fundamental Frequency  
For 434MHz:  $\pm 0.5425\text{MHz}$

**Figure 16**



Company: Lutron Electronics  
Model # HRD-5KP  
Fund. Freq.: 437MHz

Test Personnel: J Kavalusky  
Date: 10/28/04

### **Bandwidth of Fundamental Frequency**

|                  | Frequency<br>(MHz) | Measurement<br>(dBuV/m) |
|------------------|--------------------|-------------------------|
| Center Frequency | 437.0              | 92.6                    |
| 20 dB down       | 437.014            | 72.75                   |
| 20 dB down       | 436.979            | 72.40                   |

The bandwidth is 35KHz

Allowable Bandwidth: 0.25% of Fundamental Frequency  
For 437MHz:  $\pm 0.5463\text{MHz}$

**Figure 17**



## **5.0 CONCLUSIONS**

The evaluation of the **Lutron Electronics Model #: HRD 5KP**, configured as described herein, indicated that the unit complies with the requirements set forth in Subpart B and C of Part 15 of the **FCC Rules** for unintentional and intentional radiators.

1. The **EUT** meets the Conducted Emissions limits set forth in §15.107
2. The **EUT** meets the Radiated Emissions limits for unintentional radiators set forth in §15.109.
3. The **EUT** meets the Radiated Emissions limits for intentional radiators set forth in §15.205, §15.209, and §15.231 (c).