



A Smarter Vision®

**Technical Report to the FCC and Industry Canada Regarding  
Gentex Corporation - HomeLink® V**

**Model: UAHL5B  
FCC ID: NZLUAHL5B  
IC: 4112A-UAHL5B**

**Emission Designator: 52K0L1D  
12/10/15**

A report concerning approval for Gentex Corporation HomeLink® model UAHL5B  
Please issue grant immediately upon review.

Measurements Made by:

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## **1. General Information**

### **1.1. Product Description**

The Gentex Corporation HomeLink® HLV Universal Garage Door Opener is a low-power transceiver OEM device that is installed into the rearview mirror of the automobile. The installation is provided by trained technicians during the course of the manufacture of the automobile. It is powered by the 12 Volt system of the automobile.

This Universal Garage Door Opener has the capability to

1. Learn the frequency and bit code format of the user's existing garage door remote control devices and
2. Reproduce and transmit the frequency and bit code format to remotely operate the user's garage door.

The unit is designed for the periodic operation of a control signal, which typically activates a garage door opener receiver.

The unit is supplied to the automobile manufacturer without harness. For testing purposes a typical assembly and 2-conductor cable harness were used to power to the unit.

The unit is only operational when the user depresses the control button. It becomes inactive after release of the control button.

The three-button HomeLink® unit replaces up to three hand-held transmitters. In addition to the typical operation of the garage door, the unit will learn the radio frequency codes of other transmitter types to activate entry door locks, estate gates, security systems, and home or office lighting.

The antenna system is an integral part of the unit. It cannot be altered nor replaced by the user. Service of this system is only available from the Automobile Manufacturer's Dealerships and Gentex Corporation.

### **1.2. Related Grants**

This device will have functionality that is covered under CFR 47 15.247. The device will have FCC ID # of NZLUAHL5B and IC ID # of 4112A-UAHL5B under both rule parts. A separate report is submitted for functionality covered under CFR 47 15.247.

### **1.3. Test Methodology**

Radiated Emissions testing was performed according to ANSI C63.10-2013. The power source for this product is a 12V automotive vehicle battery, thus conducted emissions measurements are not required.

The unit is supplied to the automobile manufacturer without harness. For testing purposes a 2-conductor cable harness was used to interface to the unit.



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## 1.4. Test Facility

The Open Area Test Site where these measurements were taken is located on the grounds of Gentex Corporation's Technical Campus, in the city of Holland, county of Ottawa, state of Michigan, United States of America.

The site is a fully enclosed 10m weather-protected OATS. All structure materials above the conducting ground-plane are non-metallic and consist of wood, laminated lumber, fiberglass, glue, plastic, or fiberglass reinforced plastic. For radiated measurements above 1 GHz, a 2.4m x 2.4m area of RF absorbing material is placed between the antenna and EUT in accordance with ANSI C63.4-2009 Section 5.5.

The site contains a 15-foot diameter turntable capable of supporting large cars and light trucks under test. Tabletop testing was conducted on a smaller 3m turntable described in the site recertification report. The test site has been fully described in a reports filled with the FCC and Industry Canada. The report filed with the FCC is dated February 11, 2015, was accepted by the FCC in a letter dated April 08, 2015. The report filled with Industry Canada, dated February 11, 2015, was accepted via a letter dated February 11, 2015. Our OATS is registered with the IC under file number IC# 4112A, and accredited to ANSI C63.4 (2009).

Corporate Mailing/Shipping Address  
Gentex Corporation  
600 N. Centennial Street  
Zeeland, MI 49464

Site Address  
Gentex Corporation  
864 E. 24<sup>th</sup> Street  
Holland, MI 49423

## 1.5. Accreditation

The Gentex Corporate EMC Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA). Our laboratory scope and accreditation certificate #[2529.01](#) are available from their web site [www.a2la.org](http://www.a2la.org). Our scope of accreditation covers ANSI C63.4-2009 Radiated Emissions at 3m, FCC 47 CFR Part 15, and IC RSS-210.

## 2. Product Labeling

### 2.1. Identifiers

The FCC Identifier assigned is FCC ID: NZLUAHL5B. The Industry Canada certification number is 4112A-UAHL5B. These identifiers will be labeled on the product housing.

The label will be imprinted on the exterior of the mirror housing using molding tool that will permanently affix the label.

Because of the small size of the device and because the installation is inside a portion of the automobile, the following statements will appear in the user's manual. Refer to attachment "Users Manual.pdf" for the entire text of the user's manual.

"This device complies with FCC rules Part 15 and with Industry Canada RSS-210. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference,
- (2) This device must accept any interference that may be received including interference that may cause undesired operation.



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WARNING: The transmitter has been tested and complies with FCC and Industry Canada rules. Changes or modifications not expressly approved by the party responsible for the compliance could void the user's authority to operate the device."

The term "IC:" before the certification/registration number only signifies that Industry Canada technical specifications were met.

IC: 4112A-UAHL5B      FCC ID: NZLUAHL5B

## 2.2. Label Drawing and Location on Product

The label drawing is included in the "Label.pdf" attachment.

A diagram showing the location of the label on the assembly is included in the "Label Location.pdf" attachment.

## 3. Test Configuration

Radiated Emission measurements presented in the report were made in accordance with ANSI C63.10-2013. The EUT was placed on a 1 x 1.5m non-metallic table elevated 80cm above a conducting ground plane for measurements below 1GHz and elevated to 1.5m for measurements above 1GHz. The harness was run straight down from the center of the turntable to a power supply sitting at the base of the table.

For radiated measurements above 1 GHz, a 2.4m x 2.4m area of RF absorbing material is placed between the antenna and EUT in accordance with ANSI C63.4-2009 Section 5.5.

## 4. Block Diagram

For system block diagram please refer to attachment named "Block Diagram.pdf"

## 5. Conducted Emissions Measurements

Conducted Measurements are not required for this product.

## 6. Radiated Emissions Data

### 6.1. Summary of Results

| Measurement  |              | Margin   | Frequency - Duty Cycle   |
|--|--------------|----------|--------------------------|
| Worst Case Peak Emission                             | 89.03 dBuV/m | 11.7 dB  | 430MHz - 30%             |
| Worst Case Average Emission                          | 76.8 dBuV/m  | 1.4 dB   | 365MHz - 80%             |
| Worst Case Harmonic                                  | 52.6 dBuV/m  | 1.4 dB   | 2580MHz - (430MHz - 50%) |
| Worst Case Restricted Band Emission                  | 52.6 dBuV/m  | 1.4 dB   | 2580MHz - (430MHz - 50%) |
| Maximum Occupied BW                                  | 52kHz        | 668kHz   | 288MHz - 80%             |
| Worst case Digital Emission                          | 34.26 dBuV/m | 5.74 dB  | 58MHz - (288MHz)         |
| Worst Case Receiver Spurious Emission                | 128.65 uV/m  | 71.35 uV | 379MHz                   |
| Delta of Field Strength with Supply Voltage of 6-18V | 0.37 dB      | N/A      | 430MHz - 30%             |

- This module exhibits pulsed operation characteristics.
- The device does not operate when the input voltage is below 7V and power reduced to 88.87 dBuV/m at 7V.
- The device was found to be incapable of operating in restricted bands.
- The device deactivated immediately after the activation button is depressed. Less than 5 sec.

## 6.2. Test Equipment Setup and Procedure

### 6.2.1. Test Equipment Used

| Description  | Model # | ID Number   | Last Cal Date | Cal Due |
|--|---------|---|---------------|---------|
| EMCO<br>Biconical<br>Antenna<br>[20-300 MHz]           | 3110B   | H6189   | 3/27/15       | 3/27/18 |
| EMCO LPA<br>Antenna<br>[200-2000MHz]                   | 3148    | H6193   | 3/27/15       | 3/27/18 |
| Electro-metrics<br>Double Ridged<br>Guide<br>[1-18GHz] | RGA-60  | H8132   | 9/5/13        | 9/5/16  |
| Rohde &<br>Schwarz EMI<br>Receiver                     | ESR26   | 6595  | 5/13/15       | 6/13/16 |
| Cables,<br>attenuator and<br>port feed<br>through      | various | 3M Port<br>Combo (CBL<br>63, CBL 64,<br>CBL 71,<br>EL459) | 4/30/15       | 4/30/16 |

#### EMI Receiver Settings Emissions:

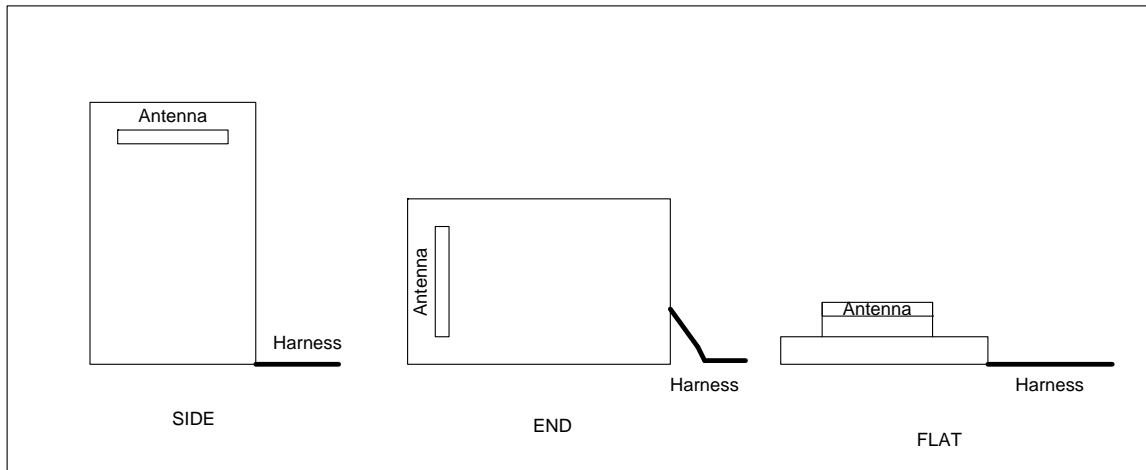
Detector Function: Peak  
Resolution Bandwidth: 120 kHz (below 1GHz)  
1MHz (above 1GHz)

#### EMI Receiver (in Spectrum Analyzer mode) Settings Occupied Bandwidth:

Detector: Peak  
Resolution Bandwidth: 3 MHz (to determine peak level)  
10 kHz (to determine occupied bandwidth)  
Video Bandwidth: 3 MHz (to determine peak level)  
30 kHz (to determine occupied bandwidth)

For the testing, the EUT was placed at the center of a non-conducting table 80cm above the ground plane pursuant to ANSI C63.10-2013 for stand-alone equipment. The 2-conductor harness was run straight down from the center of the turntable to a power supply sitting at the base of the table.

Equipment is placed in one of the three orthogonal orientations, End, Side, and Flat. These orientations are described below in Figure 6.2.1.



**Figure 6.2.1 EUT Orthogonal Orientations**

While in the prescribed orientation, the vertical antenna positioner sweeps in elevation from 1 to 4m in height until the operator finds the peak. The 3m turntable is then rotated through 360 degrees until a peak is found. The table is stopped at the peak location and the peak in elevation re-verified. Procedure is repeated for applicable orientations/measurement antenna polarizations.

### **6.3. Measured Data – See Appendix A**

## **7. Verification of Non-Operation in Restricted Bands**

An exercise was undergone by the product Software Design team to verify that the device was not able to learn and thereby transmit in a restricted band. During this exercise it was found that the device firmware prevents the device from learning any frequency within 1MHz of any restricted band listed in RSS-210 Issue 8, Table 1 and 47 CFR 15.205.

This exercise is described as follows:

### **HomeLink Operating Frequencies**

HomeLink is designed to transmit from 286 – 440 MHz, with the exception of two regions:

- 321 – 336.4 MHz
- 398.9 – 411 MHz

HomeLink will only transmit at frequencies it is able to train to, therefore to verify HomeLink does not **transmit** outside the designated regions, it must be verified that HomeLink does not **train** to signals outside the designated regions.



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To verify this, the Agilent E4421B signal generator was set up to output a 400 Hz square wave with 100% modulation depth and amplitude -5.00 dBm. It was then verified that HomeLink would train to this signal only when it was transmitted at the proper frequencies. Specifically, the various frequencies in the vicinity of the banned region boundaries were tested, and verified that HomeLink trained when it saw a signal at a valid frequency, and did not train when it saw a signal at a banned frequency. In the instances where HomeLink trained to a valid frequency, it was then verified that HomeLink transmitted at that same frequency.

One thing that should be noted: HomeLink margin of error is approximately 100 kHz. Therefore the HomeLink may not adhere to the specified limits with absolute precision. This is why the FCC banned frequencies are guard-banded by 1MHz. For example, the FCC bans transmissions below 285MHz. By setting HomeLink's lower limit to 286 MHz, it guarantees that HomeLink will not operate below 285 MHz, and in all likelihood, HomeLink will not operate below 285.8MHz.

In addition to the banned frequencies, there also exists certain "harmonic avoidance frequency regions" which HomeLink will train to, but will shift the transmit frequency so as not to generate harmonics at particular frequencies. All these frequency regions are listed below, and the table on the following pages shows the exact frequencies tested.

| FCC Banned Regions  | Harmonic Avoidance Regions  |
|---|---|
| (HomeLink does not train to the following frequencies)<br>240 – 285 MHz<br>322 – 335.4 MHz<br>399.9 – 410 MHz | (HomeLink trains to the following frequencies but transmits on the edges of these bands)<br>303.5 MHz – 307.5 MHz |

| Frequency (MHz) | Part 15 Status              | Result          | Pass/Fail | Comments                       |
|-----------------|-----------------------------|-----------------|-----------|--------------------------------|
| 285.0           | banned                      | would not train | Pass      |                                |
| 285.5           | allowed (guard band region) | would not train | Pass      |                                |
| 286.0           | allowed (guard band region) | trained         | Pass      |                                |
| 287.0           | allowed                     | trained         | Pass      |                                |
| 303.5           | allowed                     | trained         | Pass      |                                |
| 304.0           | allowed                     | trained         | Pass      | Frequency shifted to 303.5 MHz |
| 304.5           | allowed                     | trained         | Pass      | Frequency shifted to 303.5 MHz |
| 305.0           | allowed                     | trained         | Pass      | Frequency shifted to 303.5 MHz |
| 305.5           | allowed                     | trained         | Pass      | Frequency shifted to 303.5 MHz |
| 306.0           | allowed                     | trained         | Pass      | Frequency shifted to 307.5 MHz |
| 306.5           | allowed                     | trained         | Pass      | Frequency shifted to 307.5 MHz |
| 307.0           | allowed                     | trained         | Pass      | Frequency shifted to 307.5 MHz |
| 307.5           | allowed                     | trained         | Pass      |                                |
| 319.0           | allowed                     | trained         | Pass      |                                |
| 320.0           | allowed                     | trained         | Pass      |                                |
| 320.5           | allowed                     | trained         | Pass      |                                |



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| Frequency (MHz) | Part 15 Status              | Result          | Pass/Fail | Comments   |
|-----------------|-----------------------------|-----------------|-----------|--|
| 321.0           | allowed (guard band region) | trained         | Pass      |  |
| 322.0           | banned                      | would not train | Pass      |  |
| 323.0           | banned                      | would not train | Pass      |  |
| 324.0           | banned                      | would not train | Pass      |  |
| 325.0           | banned                      | would not train | Pass      |  |
| 326.0           | banned                      | would not train | Pass      |  |
| 327.0           | banned                      | would not train | Pass      |  |
| 328.0           | banned                      | would not train | Pass      |  |
| 329.0           | banned                      | would not train | Pass      |  |
| 330.0           | banned                      | would not train | Pass      |  |
| 331.0           | banned                      | would not train | Pass      |  |
| 332.0           | banned                      | would not train | Pass      |  |
| 333.0           | banned                      | would not train | Pass      |  |
| 334.0           | banned                      | would not train | Pass      |  |
| 335.0           | banned                      | would not train | Pass      |  |
| 336.0           | allowed (guard band region) | would not train | Pass      |  |
| 337.0           | allowed (guard band region) | trained         | Pass      |  |
| 338.0           | allowed                     | trained         | Pass      |  |
| 398.0           | allowed                     | trained         | Pass      |  |
| 399.0           | allowed (guard band region) | would not train | Pass      | While this is a valid frequency, HomeLink guardbands this region to ensure it doesn't train to 399.9 MHz |
| 399.5           | allowed (guard band region) | would not train | Pass      | While this is a valid frequency, HomeLink guardbands this region to ensure it doesn't train to 399.9 MHz |
| 400.0           | banned                      | would not train | Pass      |  |
| 401.0           | banned                      | would not train | Pass      |  |
| 402.0           | banned                      | would not train | Pass      |  |
| 403.0           | banned                      | would not train | Pass      |  |
| 404.0           | banned                      | would not train | Pass      |  |
| 405.0           | banned                      | would not train | Pass      |  |
| 406.0           | banned                      | would not train | Pass      |  |
| 407.0           | banned                      | would not train | Pass      |  |
| 408.0           | banned                      | would not train | Pass      |  |
| 409.0           | banned                      | would not train | Pass      |  |
| 410.0           | banned                      | would not train | Pass      |  |
| 410.5           | allowed (guard band region) | would not train | Pass      |  |
| 411.0           | allowed (guard band region) | would not train | Pass      |  |
| 411.5           | allowed                     | trained         | Pass      |  |



| Frequency (MHz) | Part 15 Status | Result          | Pass/Fail | Comments                             |
|-----------------|----------------|-----------------|-----------|--------------------------------------|
| 412.0           | allowed        | trained         | Pass      |                                      |
| 439.0           | allowed        | trained         | Pass      |                                      |
| 440.0           | allowed        | trained         | Pass      |                                      |
| 440.5           | allowed        | would not train | Pass      | HomeLink only operates up to 440 MHz |
| 441.0           | allowed        | would not train | Pass      | HomeLink only operates up to 440 MHz |
| 442.0           | allowed        | would not train | Pass      | HomeLink only operates up to 440 MHz |

## 8. Verification of De-activation after 5 seconds

An exercise was undergone by the product Software Design team to verify that the device was deactivated appropriately. This device stops transmitting after 1.099s once the activation button is released.

## 9. Formulas and Sample Calculations

### 9.1. Adjustment to account for duty cycle

The EMI Receiver used for making the measurements in this report automatically corrects for cable correction and antenna factors using values stored in memory taken from the most recent calibration (in the case of antenna factors) and periodic cable loss measurements.

Formula 1:  $FS \text{ (dBuV/m)} = M \text{ (dBuV)} + AF \text{ (dB/m)} + CF \text{ (dB)}$

The presented field strength is computed by the EMI Receiver by taking the measured level and adding to it the antenna factor and cable loss corrections. The measurement presented in gathered using the EMI Receiver's peak-hold capability.

Formula 2:  $\text{Average Level (dBuV/m)} = \text{Peak Level (dBuV/m)} + \text{duty cycle factor (dB)}$ .

The peak measurement is adjusted to an average level by a duty cycle described below.

The duty cycle factor to apply is determined for the duty cycles of 30%, 50%, and 80% as follows:

For 30% (0.30):                      duty cycle factor (dB) =  $20 * \log (0.3) = -10.46$   
 For 50% (0.50):                      duty cycle factor (dB) =  $20 * \log (0.5) = -6.02$   
 For 80% (0.80):                      duty cycle factor (dB) =  $20 * \log (0.8) = -1.94$

Example calculation:

With the EUT programmed with a 30% duty cycle a measurement of 74 dBuV/m is taken (about 5000 uV/m), the adjusted level would be:

$$74 + (-10.46) = 63.54 \text{ dBuV/m} \quad (\text{example})$$

## 9.2. Calculation of IC Limits from Table 4, RSS-210 and 47 CFR Part 15.231

The prescribed limit in the range of 260 MHz to 470 MHz is stated as a linear interpolation between 3750 uV/m and 12500 uV/m. The equation used to calculate the limit using this criteria is:

$$\text{FCC limit} = 41.67 * f - 7083.33$$

(Where 'f' is the measurement frequency in MHz.)

The limit is dBuV/m is then:

$$\text{dB limit} = 20 * \log_{10} (\text{FCC limit uV/m}) = 20 * \log_{10} (41.67 * f - 7083.33)$$

(Log10 is used to indicated the use of a base 10 logarithm)

This results in the following limits for the fundamentals:

|        |                            |               |
|--------|----------------------------|---------------|
| 288MHz | $20 * \log_{10} (4917.6)$  | = 73.8 dBuV/m |
| 310MHz | $20 * \log_{10} (5834.4)$  | = 75.3 dBuV/m |
| 390MHz | $20 * \log_{10} (9168.0)$  | = 79.2 dBuV/m |
| 433MHz | $20 * \log_{10} (10959.8)$ | = 80.8 dBuV/m |

## 10. Other Attachments and Description

### 10.1. User Manual

Please refer to attachment "User\_manual.pdf".

### 10.2. Schematics / Tuning Information

For schematics please refer to exhibit "Schematics.pdf".

### 10.3. Emission Designation

According to TRC-43, the emission designation for this product is 52K0L1D. Where "52K" is the highest measured occupied bandwidth, "L" indicates the device uses pulse width modulation, "1" indicates the modulation as being single channel, digital information and "D" indicates that data is being transmitted.

### 10.4. Theory of Operation

Please refer to attachment "Theory of operation"

### 10.5. Label Drawing and Location on Complete Assembly

For a drawing of the label and the position of the label on the finished assembly refer to "Label Location".



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## **10.6. Photos**

For interior photos, refer to exhibit "Interior Photographs".

For exterior photos, refer to exhibit "Exterior Photographs".

For test setup photos, refer to exhibit "Test Setup Photographs".

## Appendix A

### A. Measurements of Fundamentals and Harmonics

Measurements described in this section were taken according to ANSI C63.4-2009 on the Gentex Corporation 3m test table.

#### 1. DUT Tuned to Fund 288MHz

| Frequency<br>(MHz) | Orientation<br>(Flat/End/Side) | Measurement<br>Polarization<br>(H/V) | Duty Cycle<br>(%) | Measurement* | FCC<br>Peak<br>Limit<br>(dBuV/m) | Margin-<br>Peak<br>(dB) | Duty Cycle<br>Correction<br>(dB) | Average<br>Level<br>(dBuV/m) | FCC<br>Average<br>Limit<br>(dBuV/m) | Margin-<br>Average<br>(dB) |
|--------------------|--------------------------------|--------------------------------------|-------------------|--------------|----------------------------------|-------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------|
| 288                | End                            | V                                    | 30                | 81.05        | 93.8                             | <b>12.8</b>             | -10.5                            | 70.6                         | 73.8                                | 3.2                        |
| 288                | End                            | H                                    | 50                | 78.03        | 93.8                             | 15.8                    | -6.0                             | 72.0                         | 73.8                                | 1.8                        |
| 288                | End                            | H                                    | 80                | 74.33        | 93.8                             | 19.5                    | -1.9                             | 72.4                         | 73.8                                | <b>1.4</b>                 |

\* Measurements include Cable corrections and Antenna Factors

#### 2. DUT Tuned to Fund 310MHz

| Frequency<br>(MHz) | Orientation<br>(Flat/End/Side) | Measurement<br>Polarization<br>(H/V) | Duty Cycle<br>(%) | Measurement* | FCC<br>Peak<br>Limit<br>(dBuV/m) | Margin-<br>Peak<br>(dB) | Duty Cycle<br>Correction<br>(dB) | Average<br>Level<br>(dBuV/m) | FCC<br>Average<br>Limit<br>(dBuV/m) | Margin-<br>Average<br>(dB) |
|--------------------|--------------------------------|--------------------------------------|-------------------|--------------|----------------------------------|-------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------|
| 310                | Side                           | V                                    | 30                | 77.35        | 95.3                             | <b>18.0</b>             | -10.5                            | 66.9                         | 75.3                                | 8.4                        |
| 310                | Side                           | H                                    | 50                | 75.15        | 95.3                             | 20.2                    | -6.0                             | 69.1                         | 75.3                                | 6.2                        |
| 310                | Side                           | H                                    | 80                | 71.89        | 95.3                             | 23.4                    | -1.9                             | 70.0                         | 75.3                                | <b>5.4</b>                 |

\* Measurements include Cable corrections and Antenna Factors

### 3. DUT Tuned to Fund 365MHz

| Frequency<br>(MHz) | Orientation<br>(Flat/End/Side) | Measurement<br>Polarization<br>(H/V) | Duty Cycle<br>(%) | Measurement* | FCC<br>Peak<br>Limit<br>(dBuV/m) | Margin-<br>Peak<br>(dB) | Duty Cycle<br>Correction<br>(dB) | Average<br>Level<br>(dBuV/m) | FCC<br>Average<br>Limit<br>(dBuV/m) | Margin-<br>Average<br>(dB) |
|--------------------|--------------------------------|--------------------------------------|-------------------|--------------|----------------------------------|-------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------|
| 365                | Flat                           | V                                    | 30                | 85.15        | 98.2                             | <b>13.0</b>             | -10.5                            | 74.7                         | 78.2                                | 3.5                        |
| 365                | Flat                           | V                                    | 50                | 81.94        | 98.2                             | 16.3                    | -6.0                             | 75.9                         | 78.2                                | 2.3                        |
| 365                | Flat                           | V                                    | 80                | 78.77        | 98.2                             | 19.4                    | -1.9                             | 76.8                         | 78.2                                | <b>1.4</b>                 |

\* Measurements include Cable corrections and Antenna Factors

### 4. DUT Tuned to Fund 430MHz

| Frequency<br>(MHz) | Orientation<br>(Flat/End/Side) | Measurement<br>Polarization<br>(H/V) | Duty Cycle<br>(%) | Measurement* | FCC<br>Peak<br>Limit<br>(dBuV/m) | Margin-<br>Peak<br>(dB) | Duty Cycle<br>Correction<br>(dB) | Average<br>Level<br>(dBuV/m) | FCC<br>Average<br>Limit<br>(dBuV/m) | Margin-<br>Average<br>(dB) |
|--------------------|--------------------------------|--------------------------------------|-------------------|--------------|----------------------------------|-------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------|
| 430                | Side                           | V                                    | 30                | 89.03        | 100.7                            | <b>11.7</b>             | -10.5                            | 78.6                         | 80.7                                | 2.1                        |
| 430                | Side                           | V                                    | 50                | 85.24        | 100.7                            | 15.5                    | -6.0                             | 79.2                         | 80.7                                | <b>1.5</b>                 |
| 430                | Side                           | V                                    | 80                | 80.13        | 100.7                            | 20.6                    | -1.9                             | 78.2                         | 80.7                                | 2.5                        |

\* Measurements include Cable corrections and Antenna Factors

#### 4. DUT Tuned to Har\_288MHz

| Frequency<br>(MHz) | Orientation<br>(Flat/End/Side) | Measurement<br>Polarization<br>(H/V) | Duty Cycle<br>(%) | Measurement*<br>(dBuV/m) | FCC<br>Peak<br>Limit<br>(dBuV/m) | Margin-<br>Peak<br>(dB) | Duty Cycle<br>Correction<br>(dB) | Average<br>Level<br>(dBuV/m) | FCC<br>Average<br>Limit<br>(dBuV/m) | Margin-<br>Average<br>(dB) |
|--------------------|--------------------------------|--------------------------------------|-------------------|--------------------------|----------------------------------|-------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------|
| 576                | End                            | H                                    | 30                | 45.86                    | 73.8                             | 27.9                    | -10.5                            | 35.4                         | 53.8                                | 18.4                       |
| 576                | End                            | H                                    | 50                | 45.72                    | 73.8                             | 28.1                    | -6.0                             | 39.7                         | 53.8                                | 14.1                       |
| 576                | End                            | H                                    | 80                | 44.64                    | 73.8                             | 29.2                    | -1.9                             | 42.7                         | 53.8                                | 11.1                       |
| 864                | End                            | V                                    | 30                | 52.93                    | 73.8                             | 20.9                    | -10.5                            | 42.5                         | 53.8                                | 11.4                       |
| 864                | End                            | V                                    | 50                | 53.97                    | 73.8                             | 19.9                    | -6.0                             | 47.9                         | 53.8                                | 5.9                        |
| 864                | End                            | V                                    | 80                | 52.64                    | 73.8                             | 21.2                    | -1.9                             | 50.7                         | 53.8                                | 3.1                        |
| 1152               | End                            | V                                    | 30                | 42.65                    | 74.0                             | 31.4                    | -10.5                            | 32.2                         | 54.0                                | 21.8                       |
| 1152               | End                            | V                                    | 50                | 40.89                    | 74.0                             | 33.1                    | -6.0                             | 34.9                         | 54.0                                | 19.1                       |
| 1152               | End                            | V                                    | 80                | 40.39                    | 74.0                             | 33.6                    | -1.9                             | 38.5                         | 54.0                                | 15.5                       |
| 1440               | Side                           | H                                    | 30                | 46.05                    | 74.0                             | 28.0                    | -10.5                            | 35.6                         | 54.0                                | 18.4                       |
| 1440               | Side                           | H                                    | 50                | 44.91                    | 74.0                             | 29.1                    | -6.0                             | 38.9                         | 54.0                                | 15.1                       |
| 1440               | Side                           | H                                    | 80                | 42.48                    | 74.0                             | 31.5                    | -1.9                             | 40.5                         | 54.0                                | 13.5                       |
| 1728               | Side                           | H                                    | 30                | 55.07                    | 74.0                             | 18.9                    | -10.5                            | 44.6                         | 54.0                                | 9.4                        |
| 1728               | Side                           | H                                    | 50                | 53.26                    | 74.0                             | 20.7                    | -6.0                             | 47.2                         | 54.0                                | 6.8                        |
| 1728               | Side                           | H                                    | 80                | 50.26                    | 74.0                             | 23.7                    | -1.9                             | 48.3                         | 54.0                                | 5.7                        |
| 2016               | Side                           | H                                    | 30                | 51.94                    | 73.8                             | 21.9                    | -10.5                            | 41.5                         | 53.8                                | 12.4                       |
| 2016               | Side                           | H                                    | 50                | 50.51                    | 73.8                             | 23.3                    | -6.0                             | 44.5                         | 53.8                                | 9.3                        |
| 2016               | Side                           | H                                    | 80                | 48                       | 73.8                             | 25.8                    | -1.9                             | 46.1                         | 53.8                                | 7.8                        |
| 2304               | End                            | V                                    | 30                | 57.8                     | 74.0                             | <b>16.2</b>             | -10.5                            | 47.3                         | 54.0                                | 6.7                        |
| 2304               | End                            | V                                    | 50                | 55.53                    | 74.0                             | 18.5                    | -6.0                             | 49.5                         | 54.0                                | 4.5                        |
| 2304               | End                            | V                                    | 80                | 52.99                    | 74.0                             | 21.0                    | -1.9                             | 51.1                         | 54.0                                | <b>2.9</b>                 |
| 2592               | Side                           | H                                    | 30                | 49.74                    | 74.0                             | 24.3                    | -10.5                            | 39.3                         | 54.0                                | 14.7                       |
| 2592               | Side                           | H                                    | 50                | 49.56                    | 74.0                             | 24.4                    | -6.0                             | 43.5                         | 54.0                                | 10.5                       |
| 2592               | Side                           | H                                    | 80                | 47.88                    | 74.0                             | 26.1                    | -1.9                             | 45.9                         | 54.0                                | 8.1                        |
| 2880               | End                            | H                                    | 30                | 56.95                    | 74.0                             | 17.1                    | -10.5                            | 46.5                         | 54.0                                | 7.5                        |
| 2880               | End                            | H                                    | 50                | 54.6                     | 74.0                             | 19.4                    | -6.0                             | 48.6                         | 54.0                                | 5.4                        |
| 2880               | End                            | H                                    | 80                | 52.36                    | 74.0                             | 21.6                    | -1.9                             | 50.4                         | 54.0                                | 3.6                        |

\* Measurements include Cable corrections and Antenna Factors

## 5. DUT Tuned to Har\_310MHz

| Frequency<br>(MHz) | Orientation<br>(Flat/End/Side) | Measurement<br>Polarization<br>(H/V) | Duty Cycle<br>(%) | Measurement*<br>(dBuV/m) | FCC<br>Peak<br>Limit<br>(dBuV/m) | Margin-<br>Peak<br>(dB) | Duty Cycle<br>Correction<br>(dB) | Average<br>Level<br>(dBuV/m) | FCC<br>Average<br>Limit<br>(dBuV/m) | Margin-<br>Average<br>(dB) |
|--------------------|--------------------------------|--------------------------------------|-------------------|--------------------------|----------------------------------|-------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------|
| 620                | End                            | V                                    | 30                | 46.48                    | 75.3                             | 28.8                    | -10.5                            | 36.0                         | 55.3                                | 19.3                       |
| 620                | End                            | V                                    | 50                | 44.14                    | 75.3                             | 31.2                    | -6.0                             | 38.1                         | 55.3                                | 17.2                       |
| 620                | End                            | V                                    | 80                | 43.07                    | 75.3                             | 32.2                    | -1.9                             | 41.1                         | 55.3                                | 14.2                       |
| 930                | Side                           | V                                    | 30                | 52.03                    | 74.0                             | 22.0                    | -10.5                            | 41.6                         | 54.0                                | 12.4                       |
| 930                | Side                           | V                                    | 50                | 52.2                     | 74.0                             | 21.8                    | -6.0                             | 46.2                         | 54.0                                | 7.8                        |
| 930                | Side                           | V                                    | 80                | 52                       | 74.0                             | 22.0                    | -1.9                             | 50.1                         | 54.0                                | 3.9                        |
| 1240               | End                            | V                                    | 30                | 44.71                    | 74.0                             | 29.3                    | -10.5                            | 34.3                         | 54.0                                | 19.7                       |
| 1240               | End                            | H                                    | 50                | 41.69                    | 74.0                             | 32.3                    | -6.0                             | 35.7                         | 54.0                                | 18.3                       |
| 1240               | End                            | H                                    | 80                | 41.14                    | 74.0                             | 32.9                    | -1.9                             | 39.2                         | 54.0                                | 14.8                       |
| 1550               | Flat                           | H                                    | 30                | 47.28                    | 74.0                             | 26.7                    | -10.5                            | 36.8                         | 54.0                                | 17.2                       |
| 1550               | Flat                           | H                                    | 50                | 45.699                   | 74.0                             | 28.3                    | -6.0                             | 39.7                         | 54.0                                | 14.3                       |
| 1550               | Flat                           | H                                    | 80                | 44.51                    | 74.0                             | 29.5                    | -1.9                             | 42.6                         | 54.0                                | 11.4                       |
| 1860               | Side                           | H                                    | 30                | 54.28                    | 75.3                             | 21.0                    | -10.5                            | 43.8                         | 55.3                                | 11.5                       |
| 1860               | Side                           | H                                    | 50                | 52.83                    | 75.3                             | 22.5                    | -6.0                             | 46.8                         | 55.3                                | 8.5                        |
| 1860               | Side                           | H                                    | 80                | 50.67                    | 75.3                             | 24.6                    | -1.9                             | 48.7                         | 55.3                                | 6.6                        |
| 2170               | Side                           | H                                    | 30                | 53.3                     | 74.0                             | 20.7                    | -10.5                            | 42.8                         | 54.0                                | 11.2                       |
| 2170               | Side                           | H                                    | 50                | 51.43                    | 74.0                             | 22.6                    | -6.0                             | 45.4                         | 54.0                                | 8.6                        |
| 2170               | Side                           | H                                    | 80                | 49.81                    | 74.0                             | 24.2                    | -1.9                             | 47.9                         | 54.0                                | 6.1                        |
| 2480               | Side                           | V                                    | 30                | 61.44                    | 74.0                             | <b>12.6</b>             | -10.5                            | 51.0                         | 54.0                                | 3.0                        |
| 2480               | Side                           | V                                    | 50                | 58.24                    | 74.0                             | 15.8                    | -6.0                             | 52.2                         | 54.0                                | <b>1.8</b>                 |
| 2480               | Side                           | V                                    | 80                | 53.79                    | 74.0                             | 20.2                    | -1.9                             | 51.9                         | 54.0                                | 2.1                        |
| 2790               | Side                           | H                                    | 30                | 49.74                    | 74.0                             | 24.3                    | -10.5                            | 39.3                         | 54.0                                | 14.7                       |
| 2790               | Side                           | H                                    | 50                | 49.76                    | 74.0                             | 24.2                    | -6.0                             | 43.7                         | 54.0                                | 10.3                       |
| 2790               | Side                           | H                                    | 80                | 45.48                    | 74.0                             | 28.5                    | -1.9                             | 43.5                         | 54.0                                | 10.5                       |
| 3100               | End                            | V                                    | 30                | 57.24                    | 75.3                             | 18.1                    | -10.5                            | 46.8                         | 55.3                                | 8.5                        |
| 3100               | End                            | V                                    | 50                | 54.85                    | 75.3                             | 20.5                    | -6.0                             | 48.8                         | 55.3                                | 6.5                        |
| 3100               | End                            | V                                    | 80                | 52.97                    | 75.3                             | 22.3                    | -1.9                             | 51.0                         | 55.3                                | 4.3                        |

\* Measurements include Cable corrections and Antenna Factors

## 6. DUT Tuned to Har\_365MHz

| Frequency<br>(MHz) | Orientation<br>(Flat/End/Side) | Measurement<br>Polarization<br>(H/V) | Duty Cycle<br>(%) | Measurement*<br>(dBuV/m) | FCC<br>Peak<br>Limit<br>(dBuV/m) | Margin-<br>Peak<br>(dB) | Duty Cycle<br>Correction<br>(dB) | Average<br>Level<br>(dBuV/m) | FCC<br>Average<br>Limit<br>(dBuV/m) | Margin-<br>Average<br>(dB) |
|--------------------|--------------------------------|--------------------------------------|-------------------|--------------------------|----------------------------------|-------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------|
| 730                | End                            | V                                    | 30                | 55.26                    | 78.2                             | 22.9                    | -10.5                            | 44.8                         | 58.2                                | 13.4                       |
| 730                | End                            | V                                    | 50                | 52.16                    | 78.2                             | 26.0                    | -6.0                             | 46.1                         | 58.2                                | 12.1                       |
| 730                | End                            | V                                    | 80                | 50.12                    | 78.2                             | 28.1                    | -1.9                             | 48.2                         | 58.2                                | 10.0                       |
| 1095               | End                            | V                                    | 30                | 50.32                    | 74.0                             | 23.7                    | -10.5                            | 39.9                         | 54.0                                | 14.1                       |
| 1095               | End                            | V                                    | 50                | 46.7                     | 74.0                             | 27.3                    | -6.0                             | 40.7                         | 54.0                                | 13.3                       |
| 1095               | End                            | V                                    | 80                | 44.42                    | 74.0                             | 29.6                    | -1.9                             | 42.5                         | 54.0                                | 11.5                       |
| 1460               | End                            | V                                    | 30                | 46.77                    | 74.0                             | 27.2                    | -10.5                            | 36.3                         | 54.0                                | 17.7                       |
| 1460               | End                            | V                                    | 50                | 44.92                    | 74.0                             | 29.1                    | -6.0                             | 38.9                         | 54.0                                | 15.1                       |
| 1460               | End                            | V                                    | 80                | 43.79                    | 74.0                             | 30.2                    | -1.9                             | 41.9                         | 54.0                                | 12.1                       |
| 1825               | End                            | V                                    | 30                | 53.2                     | 74.0                             | 20.8                    | -10.5                            | 42.7                         | 54.0                                | 11.3                       |
| 1825               | End                            | V                                    | 50                | 52.19                    | 74.0                             | 21.8                    | -6.0                             | 46.2                         | 54.0                                | 7.8                        |
| 1825               | End                            | V                                    | 80                | 49.76                    | 74.0                             | 24.2                    | -1.9                             | 47.8                         | 54.0                                | 6.2                        |
| 2190               | Side                           | H                                    | 30                | 58.68                    | 74.0                             | 15.3                    | -10.5                            | 48.2                         | 54.0                                | 5.8                        |
| 2190               | Side                           | H                                    | 50                | 55.94                    | 74.0                             | 18.1                    | -6.0                             | 49.9                         | 54.0                                | 4.1                        |
| 2190               | Side                           | H                                    | 80                | 53.68                    | 74.0                             | 20.3                    | -1.9                             | 51.7                         | 54.0                                | 2.3                        |
| 2555               | Side                           | H                                    | 30                | 53.49                    | 74.0                             | 20.5                    | -10.5                            | 43.0                         | 54.0                                | 11.0                       |
| 2555               | Side                           | H                                    | 50                | 52.34                    | 74.0                             | 21.7                    | -6.0                             | 46.3                         | 54.0                                | 7.7                        |
| 2555               | Side                           | H                                    | 80                | 49.35                    | 74.0                             | 24.7                    | -1.9                             | 47.4                         | 54.0                                | 6.6                        |
| 2920               | Side                           | H                                    | 30                | 59.75                    | 74.0                             | <b>14.3</b>             | -10.5                            | 49.3                         | 54.0                                | 4.7                        |
| 2920               | Side                           | H                                    | 50                | 57.74                    | 74.0                             | 16.3                    | -6.0                             | 51.7                         | 54.0                                | 2.3                        |
| 2920               | Side                           | H                                    | 80                | 53.77                    | 74.0                             | 20.2                    | -1.9                             | 51.8                         | 54.0                                | <b>2.2</b>                 |
| 3285               | Flat                           | H                                    | 30                | 50.49                    | 74.0                             | 23.5                    | -10.5                            | 40.0                         | 54.0                                | 14.0                       |
| 3285               | Flat                           | H                                    | 50                | 49.35                    | 74.0                             | 24.7                    | -6.0                             | 43.3                         | 54.0                                | 10.7                       |
| 3285               | Flat                           | H                                    | 80                | 49.66                    | 74.0                             | 24.3                    | -1.9                             | 47.7                         | 54.0                                | 6.3                        |
| 3650               | Flat                           | H                                    | 30                | 55.54                    | 74.0                             | 18.5                    | -10.5                            | 45.1                         | 54.0                                | 8.9                        |
| 3650               | Flat                           | H                                    | 50                | 55.16                    | 74.0                             | 18.8                    | -6.0                             | 49.1                         | 54.0                                | 4.9                        |
| 3650               | Flat                           | H                                    | 80                | 52.9                     | 74.0                             | 21.1                    | -1.9                             | 51.0                         | 54.0                                | 3.0                        |



## 7. DUT Tuned to Har\_430MHz

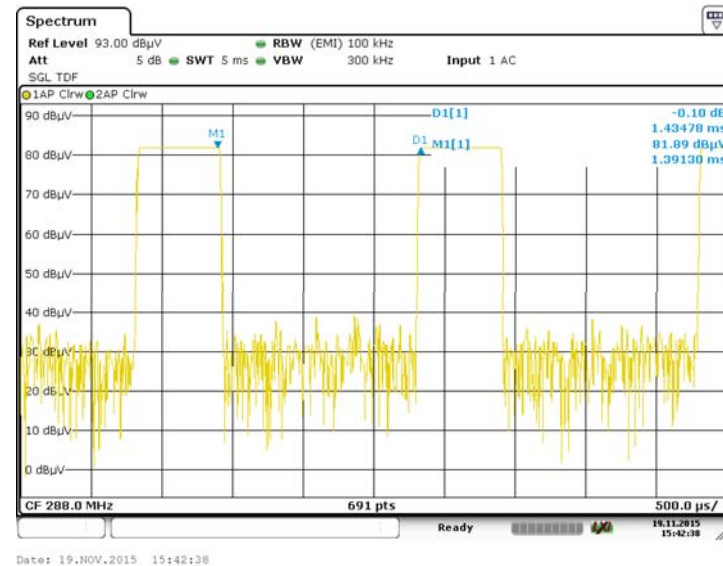
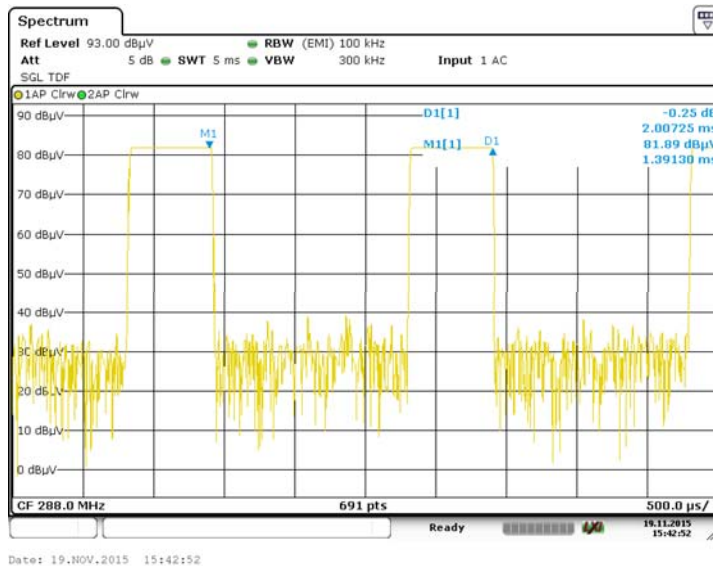
| Frequency<br>(MHz) | Orientation<br>(Flat/End/Side) | Measurement<br>Polarization<br>(H/V) | Duty Cycle<br>(%) | Measurement*<br>(dBuV/m) | FCC<br>Peak<br>Limit<br>(dBuV/m) | Margin-<br>Peak<br>(dB) | Duty Cycle<br>Correction<br>(dB) | Average<br>Level<br>(dBuV/m) | FCC Limit<br>(dBuV/m) | Margin<br>(dB) |
|--------------------|--------------------------------|--------------------------------------|-------------------|--------------------------|----------------------------------|-------------------------|----------------------------------|------------------------------|-----------------------|----------------|
| 860                | End                            | V                                    | 30                | 54.17                    | 80.8                             | 26.6                    | -10.5                            | 43.7                         | 60.8                  | 17.1           |
| 860                | End                            | V                                    | 50                | 51.92                    | 80.8                             | 28.9                    | -6.0                             | 45.9                         | 60.8                  | 14.9           |
| 860                | End                            | V                                    | 80                | 50.36                    | 80.8                             | 30.4                    | -1.9                             | 48.4                         | 60.8                  | 12.4           |
| 1290               | End                            | V                                    | 30                | 48.63                    | 74.0                             | 25.4                    | -10.5                            | 38.2                         | 54.0                  | 15.8           |
| 1290               | End                            | V                                    | 50                | 46.22                    | 74.0                             | 27.8                    | -6.0                             | 40.2                         | 54.0                  | 13.8           |
| 1290               | End                            | V                                    | 80                | 44.14                    | 74.0                             | 29.9                    | -1.9                             | 42.2                         | 54.0                  | 11.8           |
| 1720               | Side                           | H                                    | 30                | 53.92                    | 74.0                             | 20.1                    | -10.5                            | 43.5                         | 54.0                  | 10.5           |
| 1720               | Side                           | H                                    | 50                | 51.19                    | 74.0                             | 22.8                    | -6.0                             | 45.2                         | 54.0                  | 8.8            |
| 1720               | Side                           | H                                    | 80                | 48.42                    | 74.0                             | 25.6                    | -1.9                             | 46.5                         | 54.0                  | 7.5            |
| 2150               | Side                           | H                                    | 30                | 53.24                    | 80.8                             | 27.6                    | -10.5                            | 42.8                         | 60.8                  | 18.0           |
| 2150               | Side                           | H                                    | 50                | 50.14                    | 80.8                             | 30.7                    | -6.0                             | 44.1                         | 60.8                  | 16.7           |
| 2150               | Side                           | H                                    | 80                | 49.35                    | 80.8                             | 31.5                    | -1.9                             | 47.4                         | 60.8                  | 13.4           |
| 2580               | End                            | V                                    | 30                | 61.41                    | 74.0                             | 12.6                    | -10.5                            | 51.0                         | 54.0                  | 3.0            |
| 2580               | End                            | V                                    | 50                | 58.64                    | 74.0                             | 15.4                    | -6.0                             | 52.6                         | 54.0                  | 1.4            |
| 2580               | End                            | V                                    | 80                | 54.12                    | 74.0                             | 19.9                    | -1.9                             | 52.2                         | 54.0                  | 1.8            |
| 3010               | Side                           | H                                    | 30                | 50.59                    | 74.0                             | 23.4                    | -10.5                            | 40.1                         | 54.0                  | 13.9           |
| 3010               | Side                           | H                                    | 50                | 49.28                    | 74.0                             | 24.7                    | -6.0                             | 43.3                         | 54.0                  | 10.7           |
| 3010               | Side                           | H                                    | 80                | 48.52                    | 74.0                             | 25.5                    | -1.9                             | 46.6                         | 54.0                  | 7.4            |
| 3440               | End                            | V                                    | 30                | 57.12                    | 74.0                             | 16.9                    | -10.5                            | 46.7                         | 54.0                  | 7.3            |
| 3440               | End                            | V                                    | 50                | 56                       | 74.0                             | 18.0                    | -6.0                             | 50.0                         | 54.0                  | 4.0            |
| 3440               | End                            | V                                    | 80                | 52.92                    | 74.0                             | 21.1                    | -1.9                             | 51.0                         | 54.0                  | 3.0            |
| 3870               | End                            | V                                    | 30                | 53.78                    | 74.0                             | 20.2                    | -10.5                            | 43.3                         | 54.0                  | 10.7           |
| 3870               | End                            | V                                    | 50                | 52.02                    | 74.0                             | 22.0                    | -6.0                             | 46.0                         | 54.0                  | 8.0            |
| 3870               | End                            | V                                    | 80                | 51.52                    | 74.0                             | 22.5                    | -1.9                             | 49.6                         | 54.0                  | 4.4            |
| 4300               | Side                           | H                                    | 30                | 56.84                    | 74.0                             | 17.2                    | -10.5                            | 46.4                         | 54.0                  | 7.6            |
| 4300               | Side                           | H                                    | 50                | 55.78                    | 74.0                             | 18.2                    | -6.0                             | 49.8                         | 54.0                  | 4.2            |
| 4300               | Side                           | H                                    | 80                | 53.34                    | 74.0                             | 20.7                    | -1.9                             | 51.4                         | 54.0                  | 2.6            |

\* Measurements include Cable corrections and Antenna Factors

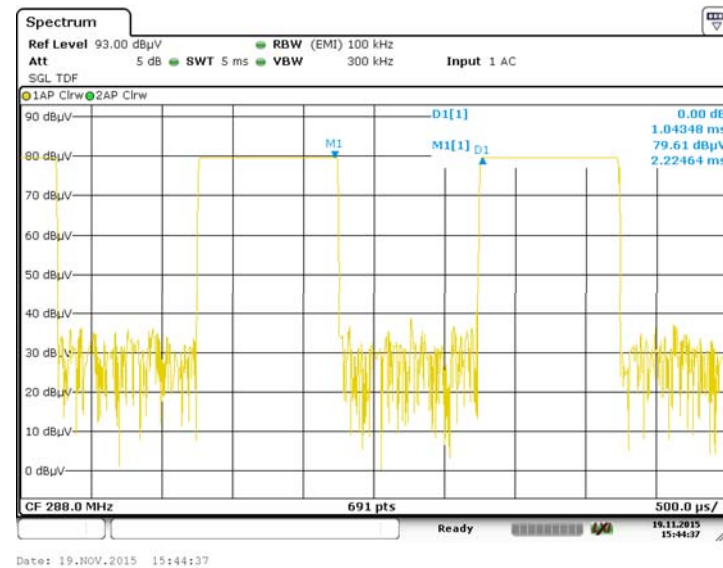
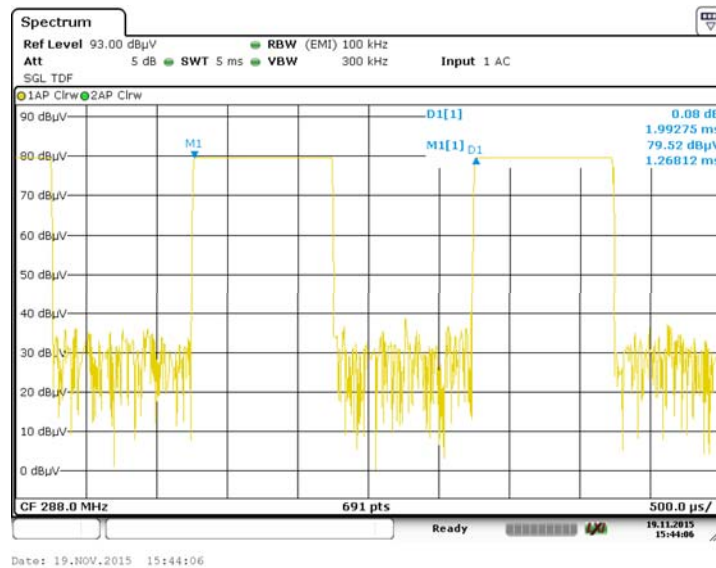
## 8. Pulsed Operation

The Homelink® transmitter tested here transmits pulses using amplitude modulation with varying duty cycle. Verification of pulse operation at 30, 50 and 80% duty cycles is provided here. Measurements were taken at 365 MHz with the span set to zero on the R&S ESR26 EMI Receiver. The duty cycle is 500Hz.

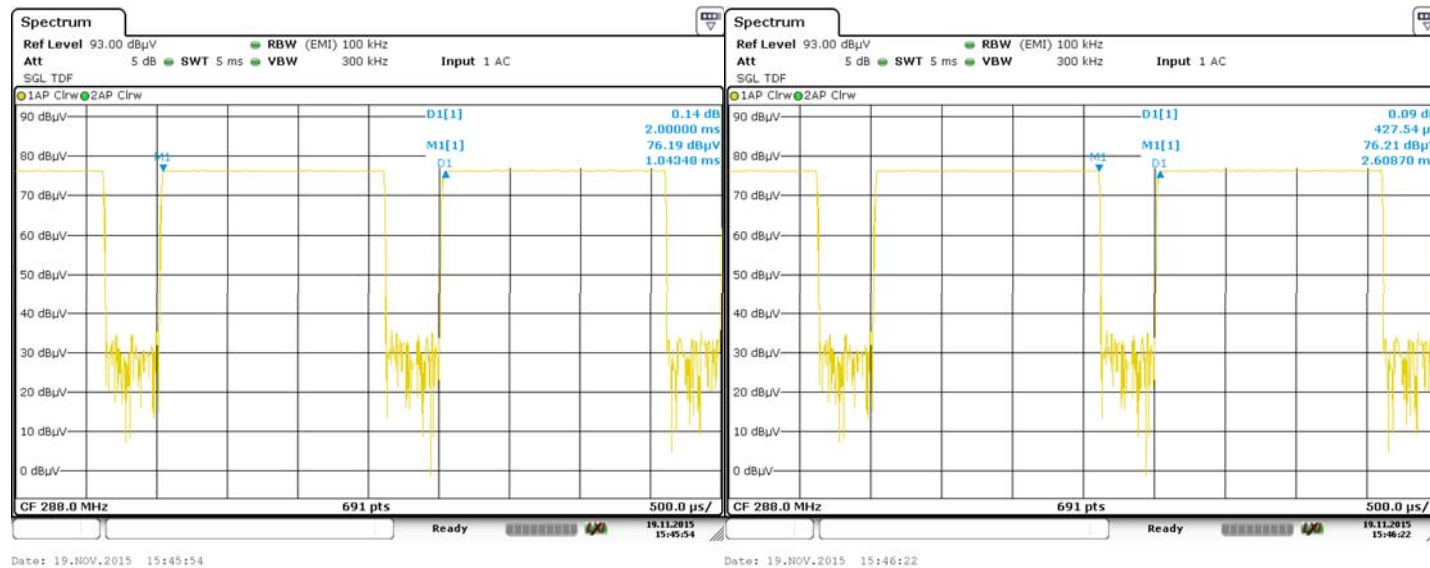
### a. 30% Duty Cycle



## b. 50% Duty Cycle



### c. 80% Duty Cycle



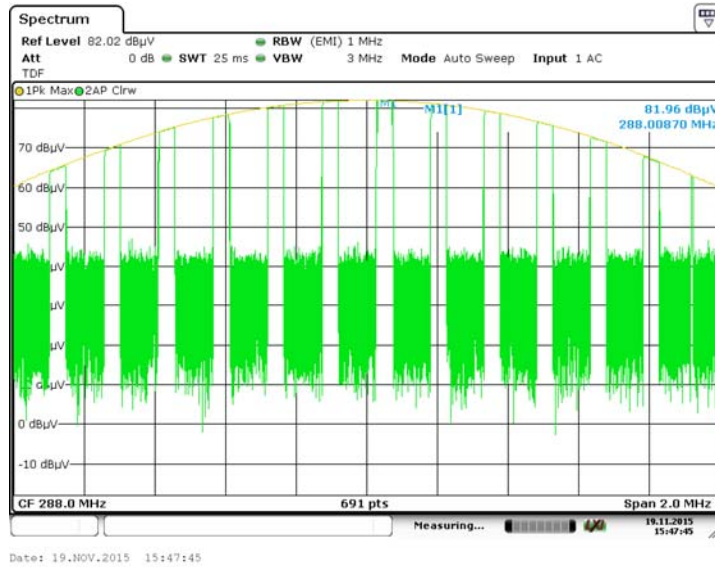
## 9. Occupied Bandwidth

Occupied bandwidth measurements were taken at 288, 310, 365 and 430MHz. The occupied bandwidth was determined using the 20dB measurement method.

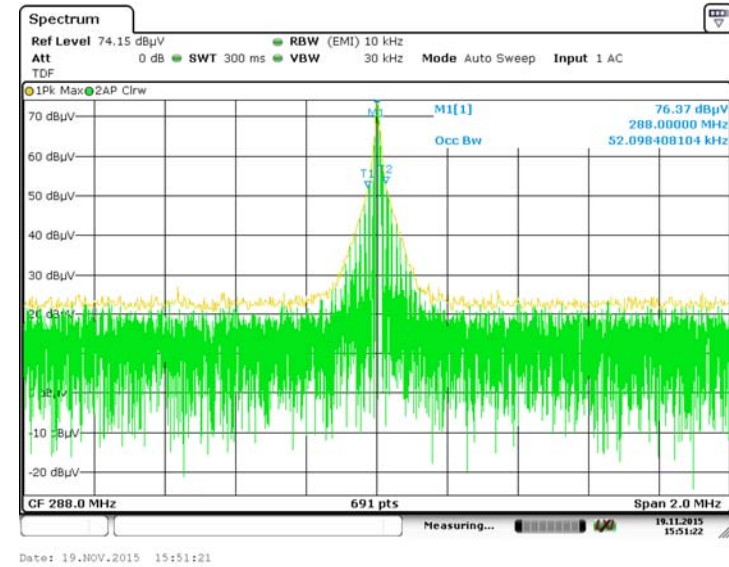
### a. Occupied Bandwidth Measurement

| Frequency (MHz) | Duty Cycle (%) | Occupied Bandwidth (kHz) | Limit (kHz) | Margin        |
|-----------------|----------------|--------------------------|-------------|---------------|
| 288             | 30             | 49                       | 720         | 671.00        |
|                 | 50             | 49                       | 720         | 671.00        |
|                 | 80             | 52                       | 720         | <b>668.00</b> |
| 310             | 30             | 55                       | 775         | 720.00        |
|                 | 50             | 55                       | 775         | 720.00        |
|                 | 80             | 58                       | 775         | 717.12        |
| 365             | 30             | 49                       | 1045        | 996.00        |
|                 | 50             | 49                       | 1045        | 996.00        |
|                 | 80             | 52                       | 1045        | 993.00        |
| 433             | 30             | 55                       | 1045        | 990.00        |
|                 | 50             | 52                       | 1045        | 993.00        |
|                 | 80             | 49                       | 1045        | 996.00        |

**b. Example of Occupied Bandwidth measurement**



**Measuring Peak Reference Level – 288MHz**



**Measuring Occupied Bandwidth at -20dB – 288MHz**

## 10. Summary of Emissions Measurements Taken on OATS

| Transmitting Frequency (MHz) | Frequency (MHz) | DUT Orientation | Antenna Polarization | Field Strength (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|------------------------------|-----------------|-----------------|----------------------|-------------------------|----------------|-------------|
| 288                          | 58              | End             | H                    | 34.26                   | 40             | 5.74        |
|                              | 89              | Side            | V                    | 33.56                   | 40             | 6.44        |
| 310                          | 50              | Side            | V                    | 33.24                   | 40             | 6.76        |
|                              | 89              | Flat            | V                    | 32.14                   | 40             | 7.86        |
|                              | 94              | Flat            | V                    | 33.26                   | 40             | 6.74        |
|                              | 99              | Flat            | V                    | 33.78                   | 40             | 6.22        |
| 365                          | 55              | End             | H                    | 32.74                   | 40             | 7.26        |
|                              | 56              | End             | V                    | 33.65                   | 40             | 6.35        |
|                              | 89              | Flat            | H                    | 34.16                   | 40             | 5.84        |
|                              | 99              | End             | V                    | 33.26                   | 40             | 6.74        |
| 433                          | 89              | End             | V                    | 33.65                   | 40             | 6.35        |
|                              | 94              | End             | V                    | 34.16                   | 40             | 5.84        |
|                              | 99              | Side            | H                    | 33.88                   | 40             | 6.12        |

Measurements were made using a peak detector with Resolution BW of 120 kHz and Video BW of 300 kHz. Cable losses and correction factors are included in measurement.

## 11. Receiver Spurious Emissions

The receiver circuit spurious emissions were measured in accordance to Industry Canada RSS-GEN Issue 2 Section 4.10 and ANSI C63.4-2009.

The band midpoint over which the receiver is designed to operate is 368MHz. The Homelink 5 is supplied with commands to place it into diagnostic / manufacturing mode, and tune the receiver to the midpoint frequency.

The search for spurious emissions was conducted over a range of 286MHz (The lowest oscillator frequency used by the receiver) to 1350 MHz (3 times the highest tunable frequency of 450MHz).

To determine the orientation of the device at which the worst case emissions would occur, exploratory measurements were taken using a diagnostic command to transmit at the midpoint frequency of 368 MHz. The device was then set to receive using a manufacturing diagnostic command. Refer to setup photograph. The device under test is on its side, with the antenna in horizontal polarization.



Measurements from 286MHz to 1 GHz were made with the receiver using the peak detection method. The resolution bandwidth setting was 120 kHz. **At the fundamental frequency, 365 MHz, the receiver spurious emissions measurement was 128.65uV/m at 3m. Remaining 71.35uV/m below the limit.**

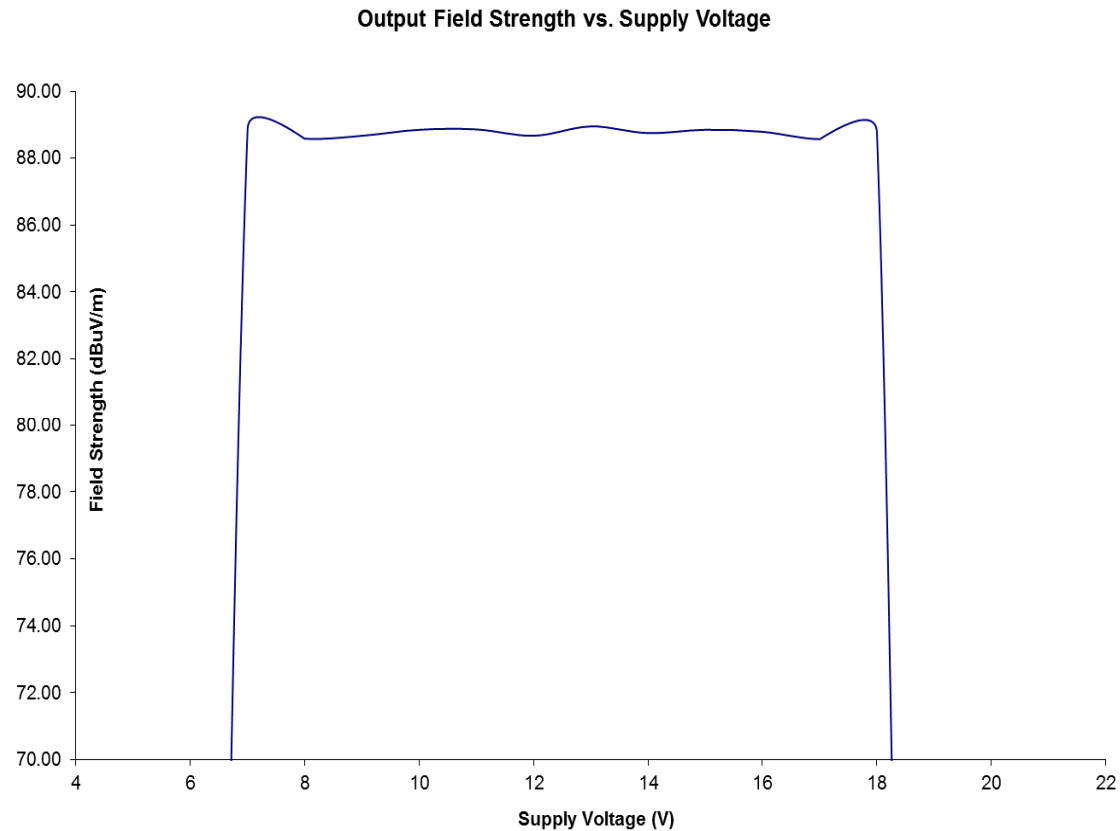
| Frequency (MHz) | DUT Orientation | Antenna Polarization | Field Strength (uV/m) | Limit (uV/m) | Margin (uV/m) |
|-----------------|-----------------|----------------------|-----------------------|--------------|---------------|
| 296             | End             | H                    | 124.11                | 200          | 75.89         |
| 323             | End             | H                    | 125.34                | 200          | 74.66         |
| 377             | End             | H                    | 126.35                | 200          | 73.65         |
| 379             | End             | H                    | 128.65                | 200          | 71.35         |
| 649             | End             | H                    | 126.95                | 200          | 73.05         |
| 999             | End             | H                    | 134.26                | 500          | 365.74        |
| 1000            | End             | H                    | 145.26                | 500          | 354.74        |
| 1037            | End             | H                    | 147.28                | 500          | 352.72        |
| 1040            | End             | H                    | 151.32                | 500          | 348.68        |
| 1110            | End             | H                    | 189.35                | 500          | 310.65        |
| 1155            | End             | H                    | 195.26                | 500          | 304.74        |
| 1195            | End             | H                    | 213.22                | 500          | 286.78        |
| 1199            | End             | H                    | 245.26                | 500          | 254.74        |
| 1350            | End             | H                    | 255.26                | 500          | 244.74        |

Ambient

## 12. Variation of Supply Voltage

Measurements of the variation in output field strength due to variation in the supply voltage were taken in accordance with 15.231(e). The DUT was configured to transmit at the peak frequency, 430MHz, 30% Duty Cycle. Values presented are not corrected for duty cycle.

### a. Plot of output power over supply voltage



## b. Output Power as a Function of Supply Voltage

| Voltage | Field Strength (dBuV/m) | Frequency (MHz) |
|---------|-------------------------|-----------------|
| 6       |                         |                 |
| 7       | 88.87                   | 430             |
| 8       | 88.58                   | 430             |
| 9       | 88.67                   | 430             |
| 10      | 88.85                   | 430             |
| 11      | 88.86                   | 430             |
| 12      | 88.67                   | 430             |
| 13      | 88.95                   | 430             |
| 14      | 88.75                   | 430             |
| 15      | 88.85                   | 430             |
| 16      | 88.79                   | 430             |
| 17      | 88.57                   | 430             |
| 18      | 88.77                   | 430             |
| 19      |                         |                 |
| 20      |                         |                 |