



FCC 47 CFR PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 8

BLUETOOTH LOW ENERGY  
CERTIFICATION TEST REPORT

FOR

**Chamberlain Group Inc.**

Class 2 Permissive Change Report

BT LE Garage Door Sensor

MODEL NUMBER: 041D7924

REPORT NUMBER: 13N16052

ISSUE DATE: September 10, 2013

*Prepared for*  
**Chamberlain Group Inc.**  
845 Larch Av  
Elmhurst, IL 60126

*Prepared by*  
**UL LLC**  
333 Pfingsten Rd.  
Northbrook, IL 60062  
847-272-8800



NVLAP LAB CODE 100414-0

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Chamberlain Group Inc.  
845 Larch Av  
Elmhurst, IL 60126

**EUT DESCRIPTION:** BT LE Garage Door Sensor

**MODEL:** 041D7924

**SERIAL NUMBER:** prototype

**DATE TESTED:** September 09, 2013 – September 10, 2013

| APPLICABLE STANDARDS                                                                                                                                                       |              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| STANDARD                                                                                                                                                                   | TEST RESULTS |
| *CFR 47 Part 15 Subpart C                                                                                                                                                  | Pass         |
| *INDUSTRY CANADA RSS-210 Issue 8 Annex 8                                                                                                                                   | Pass         |
| *INDUSTRY CANADA RSS-GEN Issue 3                                                                                                                                           | Pass         |
| * Only Radiated Spurious Emissions Testing, Radiated Band edge Emissions and Peak power output tests were conducted. All other tests are not affected by the power change. |              |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Test Engineer:



Bartlomiej Mucha (Ext.41216)  
WiSE Staff Engineer  
Wireless, Interoperability, payment Security, & EMC  
Verification Services

Reviewer:



Michael Ferrer(Ext.41312)  
WiSE Project Lead  
Wireless, Interoperability, payment Security, & EMC  
Verification Services

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60062, USA

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/Standards/scopes/1004140.htm>

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned}\text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m}\end{aligned}$$

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is an Low Energy Blue Tooth transceiver. This device is identical to previously tested device except for power level output. Software setting was changed on this device from 4dBm power level to 0dBm power level to avoid potential chip non-linearity and saturation of the amplifier.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

| Frequency Range (MHz) | Mode         | Output Power (dBm) | Output Power (mW) | Comments             |
|-----------------------|--------------|--------------------|-------------------|----------------------|
| 2402 - 2480           | TX Modulated | 1.27               | 1.34              | Original Device      |
| 2402 - 2480           | TX Modulated | -2.02              | 0.63              | Reduced Power Device |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal PCB antenna with gain of less then 6dB. Based on Measured FS of fundamental emission (94.33dBuV/m @ 3m – 95.2dB = -0.97dBm EIRP) and measured output power the antenna gain is -2.27dBi.

### 5.4. SOFTWARE AND FIRMWARE

Device was programmed to transmit continuously by manufacturer on selected channels with 100% duty cycle. Power selection setting was at 0dBm

## WORST-CASE CONFIGURATION AND MODE

The EUT is normally installed on garage doors. The two possible orientations of the EUT are referred to as door opened and door closed. For radiated spurious emissions the EUT was tested in both orientations. Worst case orientation was found as door open position. All radiated spurious testing for Class 2 Permissive Change was done in door open position.

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

No Support Equipment required for testing

### I/O CABLES

No I/O cables

### TEST SETUP

Tested as stand-alone in both door open position.

## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

### Radiated Emissions – 10-Meter Chamber

| Description       | Manufacturer    | Model                         | Identifier     | Cal. Date | Cal. Due Date |
|-------------------|-----------------|-------------------------------|----------------|-----------|---------------|
| EMI Test Receiver | Rohde & Schwarz | ESU                           | EMC4323        | 20121227  | 20131231      |
| Spectrum Analyzer | Agilent         | E4446A                        | s/n MY45300099 | 20130129  | 20150129      |
| Antenna Array     | UL              | BOMS Assembly<br>(1GHz-40GHz) | EMC4276        | 20111227  | 20131231      |

### Antenna Port Conducted Emissions

| Description                       | Manufacturer | Model | Identifier | Cal Date | Cal Due Date |
|-----------------------------------|--------------|-------|------------|----------|--------------|
| Spectrum analyzer                 | Agilent      | PXA   | EMC4360    | 20121226 | 20131226     |
| Cable and Attenuator              | -            | -     | -          | *        | *            |
| * measured at the time of testing |              |       |            |          |              |

## 7. ANTENNA PORT TEST RESULTS

### 7.1. OUTPUT POWER

#### LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

#### TEST PROCEDURE

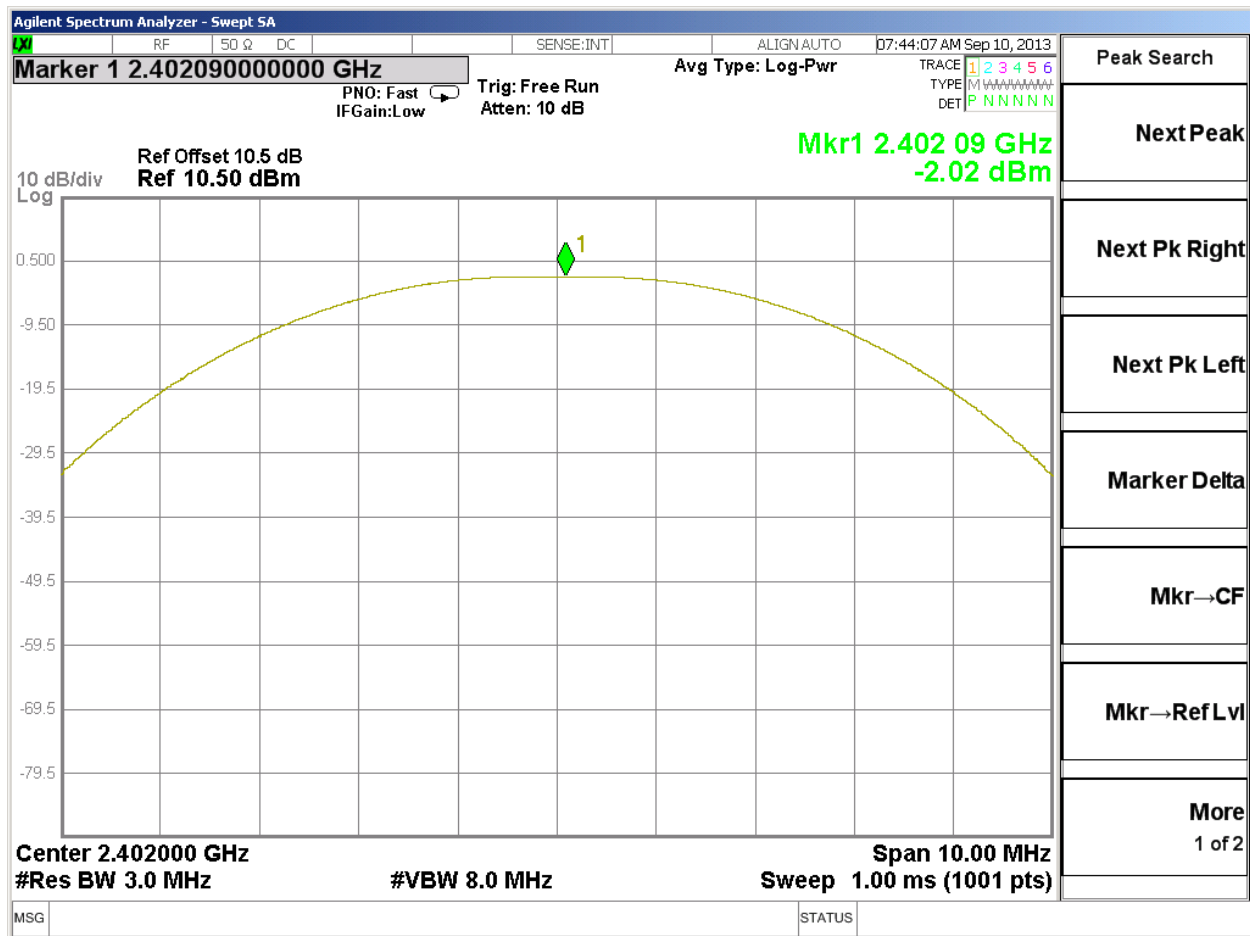
FCC KDB Publication "558074 D01 DTS Meas Guidance v03r01", using option 9.1.1 RBW greater or equal to DTS bandwidth.

#### RESULTS – NEW MEASUREMENT DATA

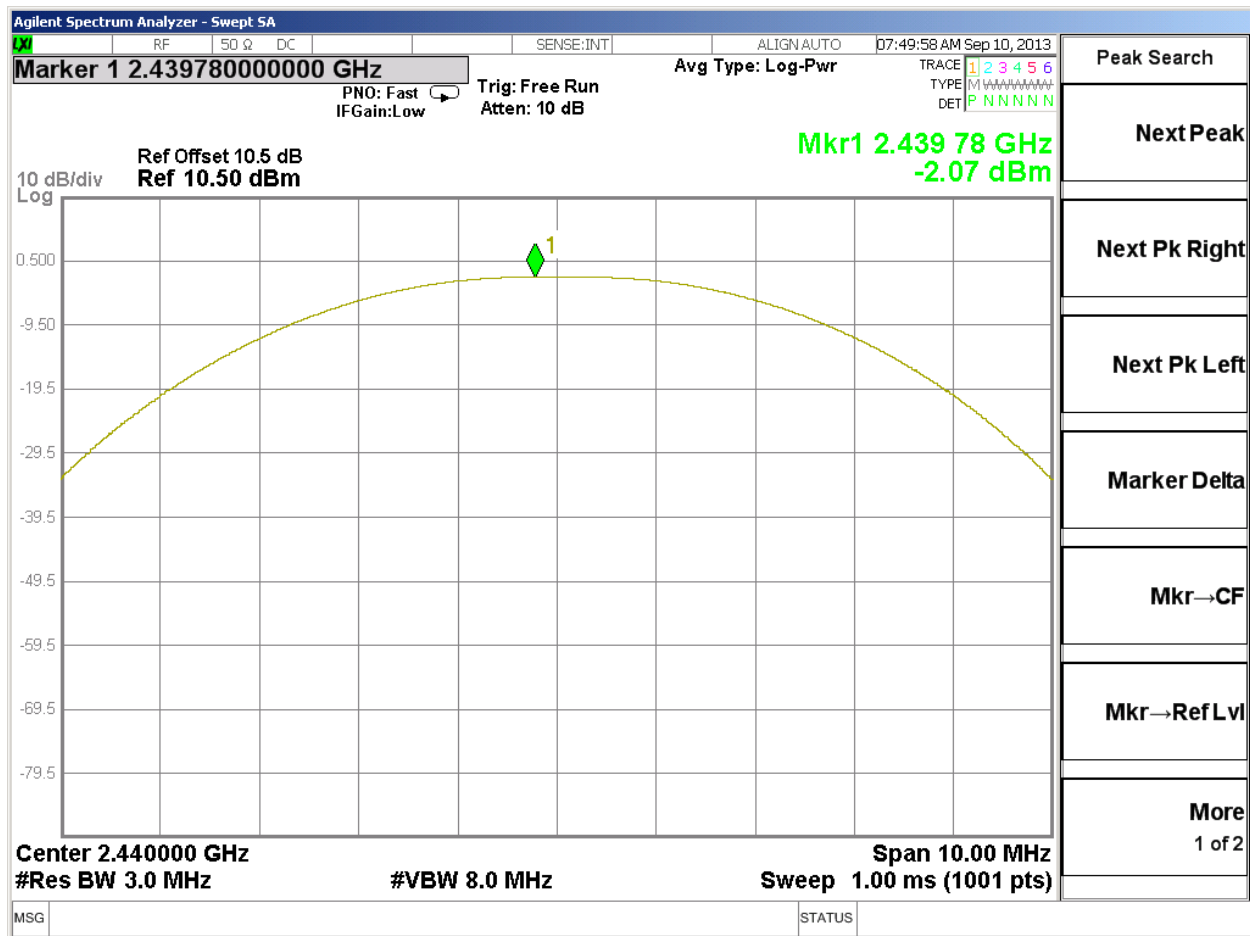
| Channel | Frequency<br>(MHz) | Peak Power<br>Reading<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|--------------------------------|----------------|----------------|
| Low     | 2402               | -2.020                         | 30             | -32.020        |
| Middle  | 2440               | -2.070                         | 30             | -32.070        |
| High    | 2480               | -2.450                         | 30             | -32.450        |

## OUTPUT POWER

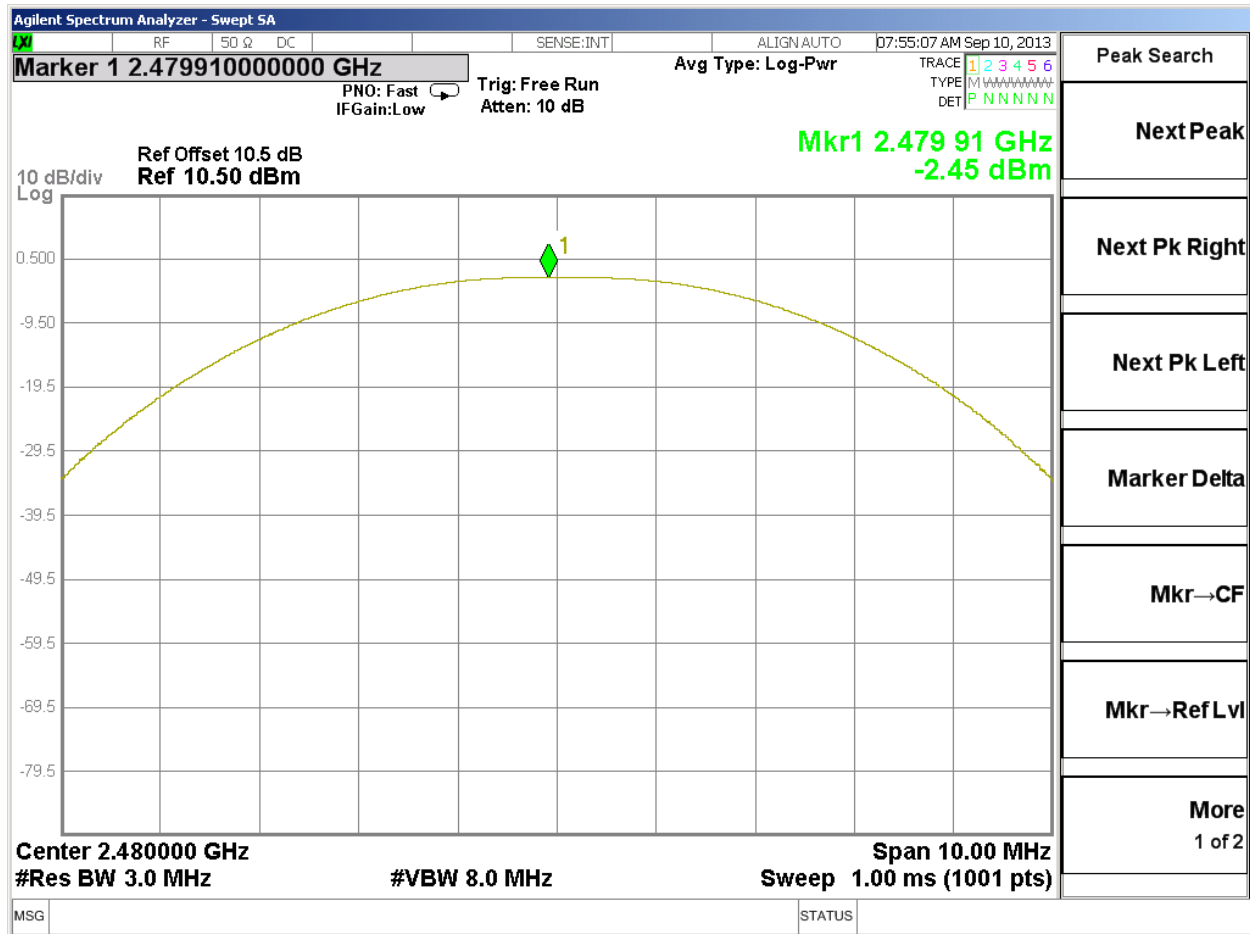
Low Channel



Middle Channel



## High Channel



## RADIATED TEST RESULTS

### 7.2. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

| Frequency Range (MHz) | Field Strength Limit (uV/m) at 3 m | Field Strength Limit (dBuV/m) at 3 m |
|-----------------------|------------------------------------|--------------------------------------|
| 30 - 88               | 100                                | 40                                   |
| 88 - 216              | 150                                | 43.5                                 |
| 216 - 960             | 200                                | 46                                   |
| Above 960             | 500                                | 54                                   |

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4:2003. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz (band-edge only) the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 3 kHz (pulse on-time is 400uS) for average measurements. There were no harmonics measured above 1GHz and compliance is based on peak pre-scan data.

The spectrum from 30 MHz to 25 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

### 7.3. TX ABOVE 1 GHz FOR BLUETOOTH LOW ENERGY MODE IN THE 2.4 GHz BAND

#### RESTRICTED BANDEDGE (DOOR OPEN, LOW CHANNEL, HORIZONTAL)



| Marker No. | Test Frequency (GHz) | Meter Reading dBuV | Detector | AF dB/m | CF dB | Level dBuV/m | Limit | Margin (dB) | Height [cm] | Polarity |
|------------|----------------------|--------------------|----------|---------|-------|--------------|-------|-------------|-------------|----------|
| 1          | 2.3805               | 27.62              | PK       | 21.8    | 4.3   | 53.72        | 74    | -20.28      | 99          | H        |
| 2          | 2.3864               | 27.23              | PK       | 21.8    | 4.42  | 53.45        | 74    | -20.55      | 99          | H        |
| 3          | 2.390                | 26.04              | PK       | 21.8    | 4.48  | 52.32        | 74    | -21.68      | 99          | H        |
| 4          | 2.4017               | 67.76              | PK       | 21.8    | 4.27  | 93.83        | n/a   | n/a         | 99          | H        |
| Marker No. | Test Frequency (GHz) | Meter Reading dBuV | Detector | AF dB/m | CF dB | Level dBuV/m | Limit | Margin (dB) | Height [cm] | Polarity |
| 5          | 2.3802               | 16.69              | LinAV    | 21.8    | 4.3   | 42.79        | 54    | -11.21      | 99          | H        |
| 6          | 2.3867               | 16.84              | LinAV    | 21.8    | 4.42  | 43.06        | 54    | -10.94      | 99          | H        |
| 7          | 2.390                | 16.82              | LinAV    | 21.8    | 4.48  | 43.1         | 54    | -10.9       | 99          | H        |
| 8          | 2.402                | 67.16              | LinAV    | 21.8    | 4.26  | 93.22        | n/a   | n/a         | 99          | H        |

PK - Peak detector  
LnAv - Linear Average detector  
AF - Antenna Factor, CF - Cable Factor

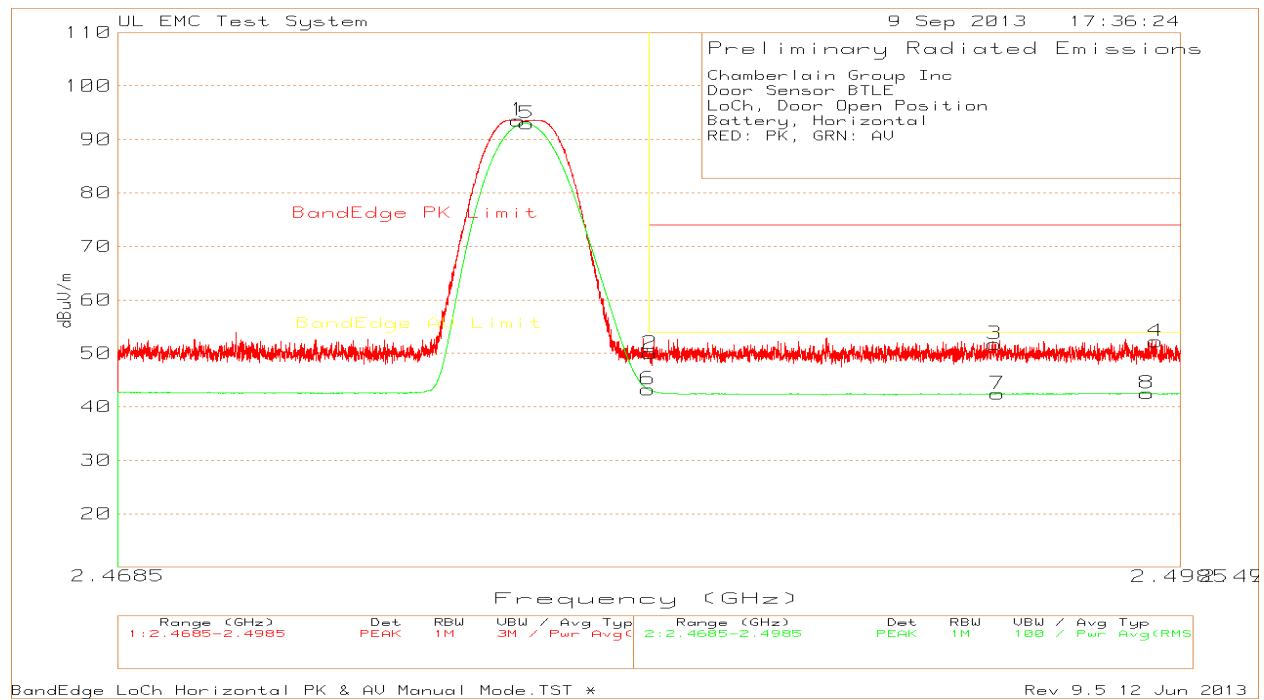
**RESTRICTED BANDEDGE (DOOR OPEN, LOW CHANNEL, VERTICAL)**



| Marker No. | Test Frequency (GHz) | Meter Reading dBuV | Detector | AF dB/m | CF dB | Level dBuV/m | Limit | Margin (dB) | Height [cm] | Polarity |
|------------|----------------------|--------------------|----------|---------|-------|--------------|-------|-------------|-------------|----------|
| 1          | 2.3817               | 26.3               | PK       | 21.8    | 4.34  | 52.44        | 74    | -21.56      | 100         | V        |
| 2          | 2.39                 | 28                 | PK       | 21.8    | 4.48  | 54.28        | 74    | -19.72      | 100         | V        |
| 3          | 2.4017               | 50.91              | PK       | 21.8    | 4.27  | 76.98        | n/a   | n/a         | 100         | V        |
| Marker No. | Test Frequency (GHz) | Meter Reading dBuV | Detector | AF dB/m | CF dB | Level dBuV/m | Limit | Margin (dB) | Height [cm] | Polarity |
| 4          | 2.3814               | 16.78              | LinAV    | 21.8    | 4.33  | 42.91        | 54    | -11.09      | 100         | V        |
| 5          | 2.39                 | 16.85              | LinAV    | 21.8    | 4.48  | 43.13        | 54    | -10.87      | 100         | V        |
| 6          | 2.402                | 50.03              | LinAV    | 21.8    | 4.26  | 76.09        | n/a   | n/a         | 100         | V        |

PK - Peak detector  
LnAv - Linear Average detector  
AF - Antenna Factor, CF - Cable Factor

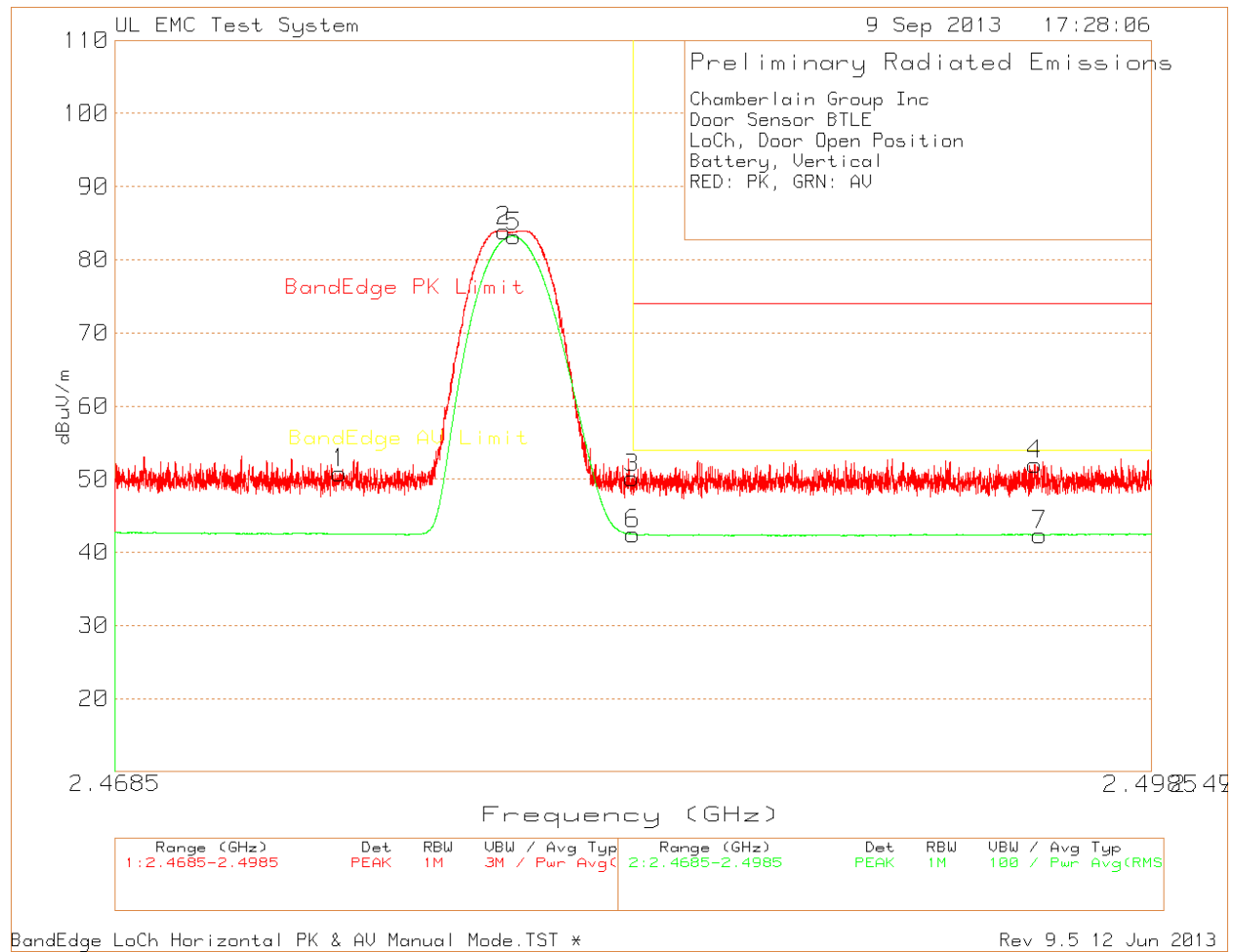
**RESTRICTED BANDEDGE (DOOR OPEN (worst case), HIGH CHANNEL, HORIZONTAL)**



| Marker No. | Test Frequency (GHz) | Meter Reading dBuV | Detector | AF dB/m | CF dB | Level dBuV/m | Limit | Margin (dB) | Height [cm] | Polarity |
|------------|----------------------|--------------------|----------|---------|-------|--------------|-------|-------------|-------------|----------|
| 1          | 2.4798               | 67.83              | PK       | 22      | 3.77  | 93.6         | n/a   | n/a         | 99          | H        |
| 2          | 2.4835               | 24.12              | PK       | 22.1    | 3.77  | 49.99        | 74    | -24.01      | 99          | H        |
| 3          | 2.4933               | 25.79              | PK       | 22.1    | 3.86  | 51.75        | 74    | -22.25      | 99          | H        |
| 4          | 2.4978               | 26.19              | PK       | 22.1    | 3.93  | 52.22        | 74    | -21.78      | 99          | H        |
| Marker No. | Test Frequency (GHz) | Meter Reading dBuV | Detector | AF dB/m | CF dB | Level dBuV/m | Limit | Margin (dB) | Height [cm] | Polarity |
| 5          | 2.4801               | 67.21              | LinAV    | 22      | 3.77  | 92.98        | n/a   | n/a         | 99          | V        |
| 6          | 2.4835               | 17.41              | LinAV    | 22.1    | 3.77  | 43.28        | 54    | -10.72      | 99          | V        |
| 7          | 2.4934               | 16.47              | LinAV    | 22.1    | 3.86  | 42.43        | 54    | -11.57      | 99          | V        |
| 8          | 2.4976               | 16.52              | LinAV    | 22.1    | 3.93  | 42.55        | 54    | -11.45      | 99          | V        |

PK - Peak detector  
LnAv - Linear Average detector  
AF - Antenna Factor, CF - Cable Factor

**RESTRICTED BANDEDGE (DOOR OPEN (worst case), HIGH CHANNEL, VERTICAL)**

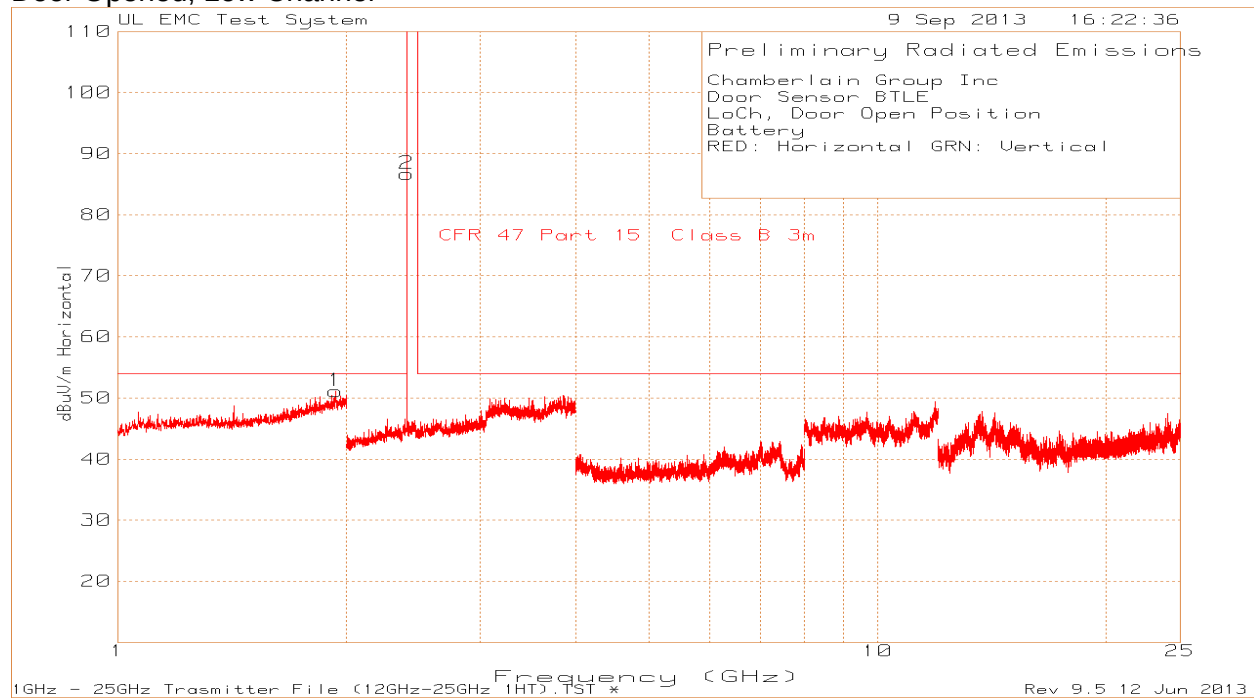


| Marker No. | Test Frequency (GHz) | Meter Reading dBuV | Detector | AF dB/m | CF dB | Level dBuV/m | Limit | Margin (dB) | Height [cm] | Polarity |
|------------|----------------------|--------------------|----------|---------|-------|--------------|-------|-------------|-------------|----------|
| 1          | 2.475                | 25                 | PK       | 22      | 3.81  | 50.81        | n/a   | n/a         | 165         | V        |
| 2          | 2.4798               | 58.14              | PK       | 22      | 3.77  | 83.91        | n/a   | n/a         | 165         | V        |
| 3          | 2.4835               | 24.26              | PK       | 22.1    | 3.77  | 50.13        | 74    | -23.87      | 165         | V        |
| 4          | 2.4951               | 26.02              | PK       | 22.1    | 3.89  | 52.01        | 74    | -21.99      | 165         | V        |
| Marker No. | Test Frequency (GHz) | Meter Reading dBuV | Detector | AF dB/m | CF dB | Level dBuV/m | Limit | Margin (dB) | Height [cm] | Polarity |
| 5          | 2.4801               | 57.42              | LinAV    | 22      | 3.77  | 83.19        | n/a   | n/a         | 165         | V        |
| 6          | 2.4835               | 16.64              | LinAV    | 22.1    | 3.77  | 42.51        | 54    | -11.49      | 165         | V        |
| 7          | 2.4953               | 16.42              | LinAV    | 22.1    | 3.89  | 42.41        | 54    | -11.59      | 165         | V        |

PK - Peak detector  
LnAv - Linear Average detector  
AF - Antenna Factor, CF - Cable Factor

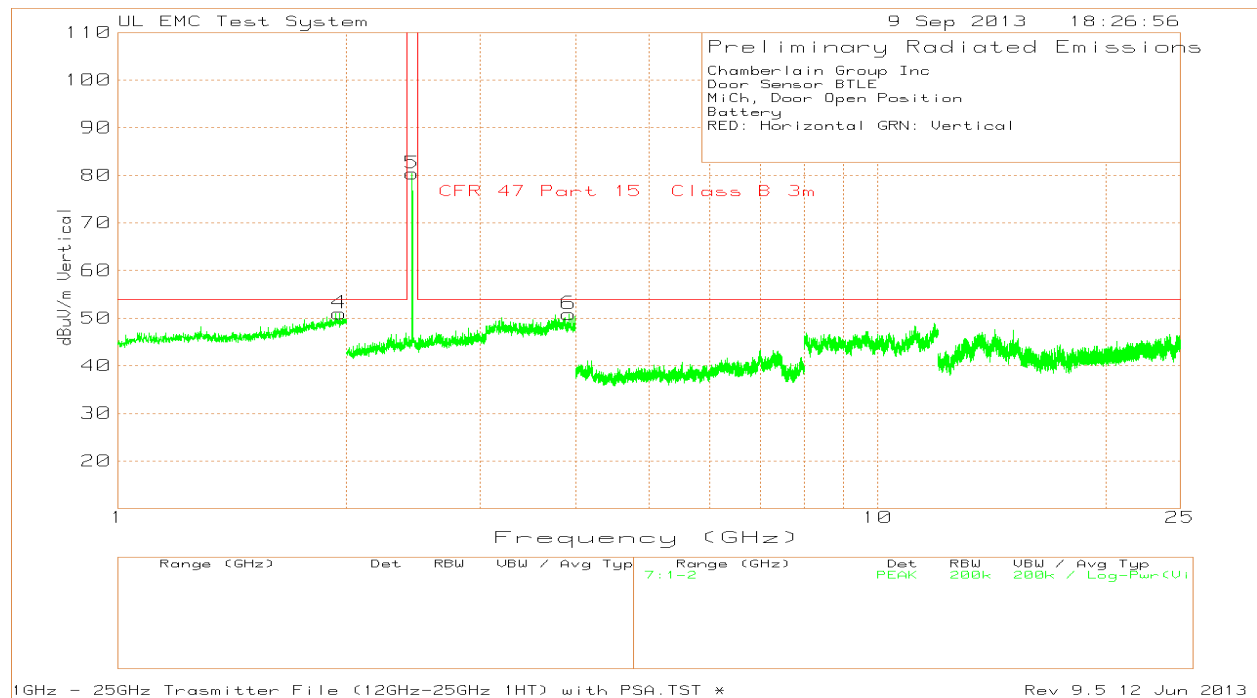
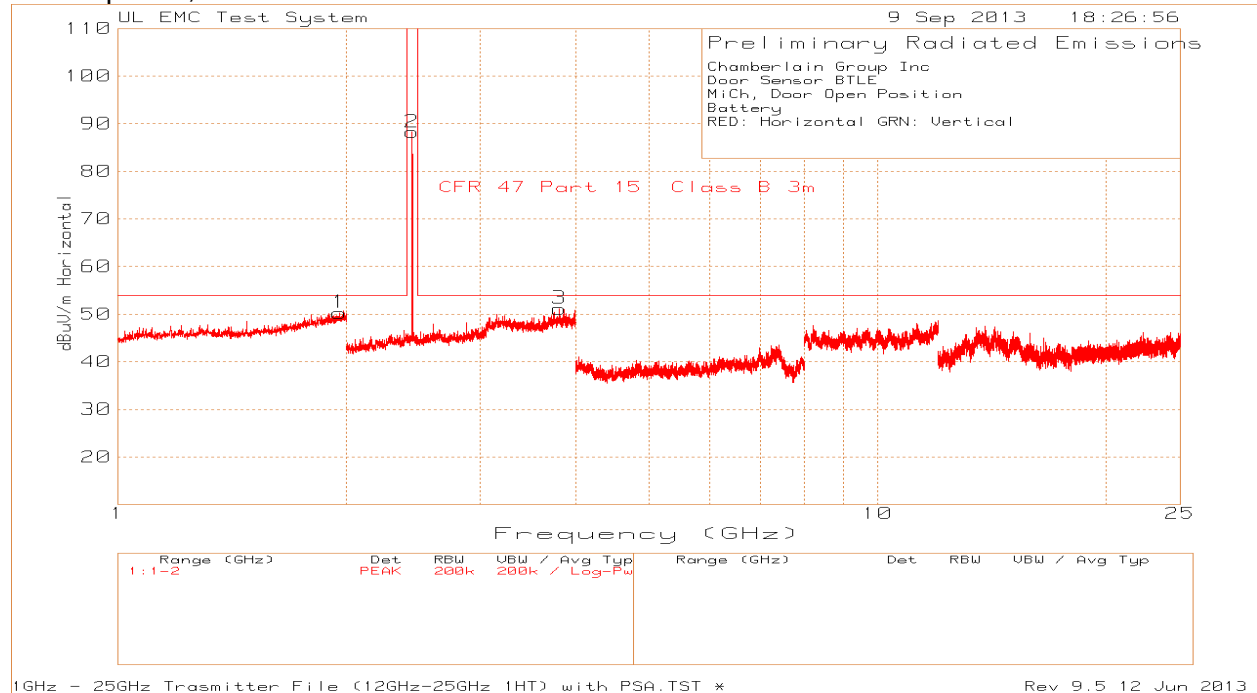
## HARMONICS AND SPURIOUS EMISSIONS

### Door Opened, Low Channel



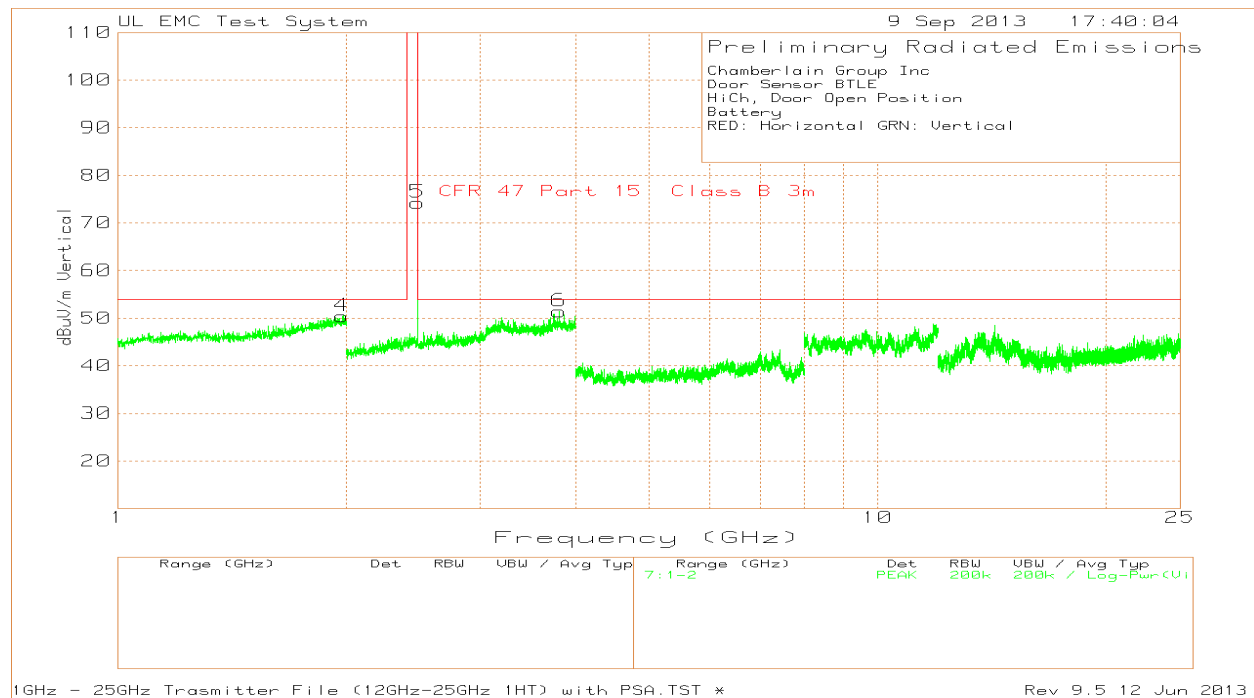
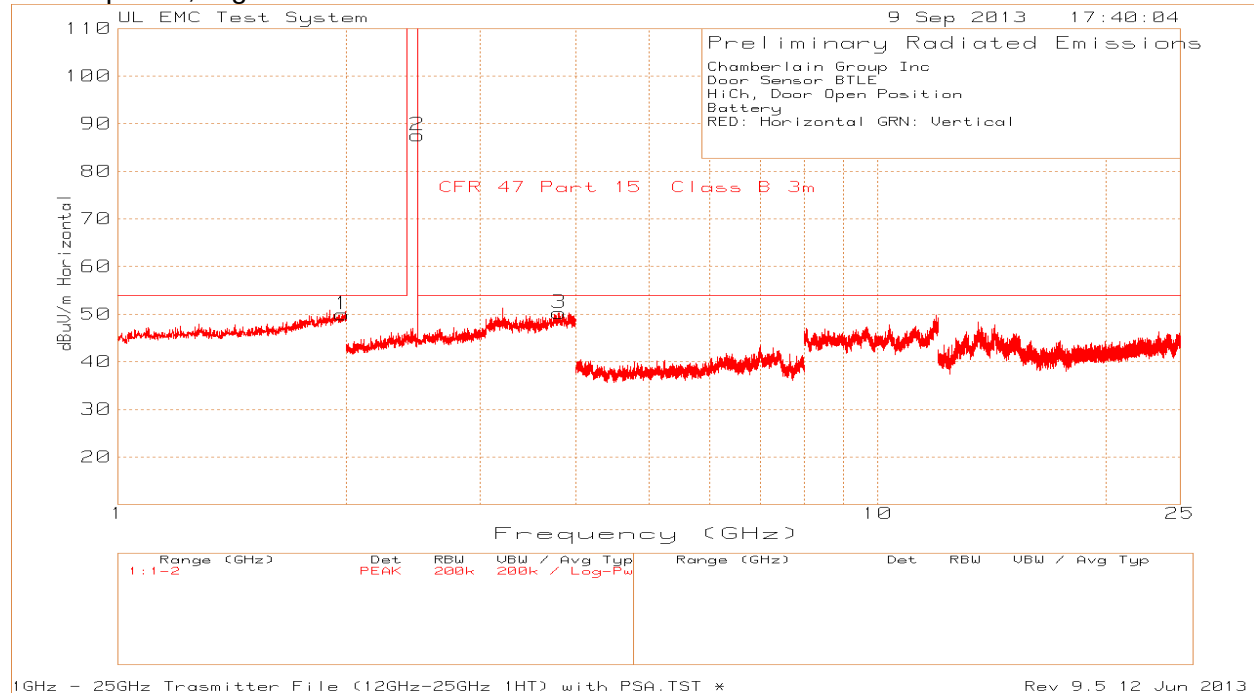
Based on peak pre-scan data there is no spurious emissions recorded above the noise floor.

# Door Opened, Middle Channel



Based on peak pre-scan data there is no spurious emissions recorded above the noise floor.

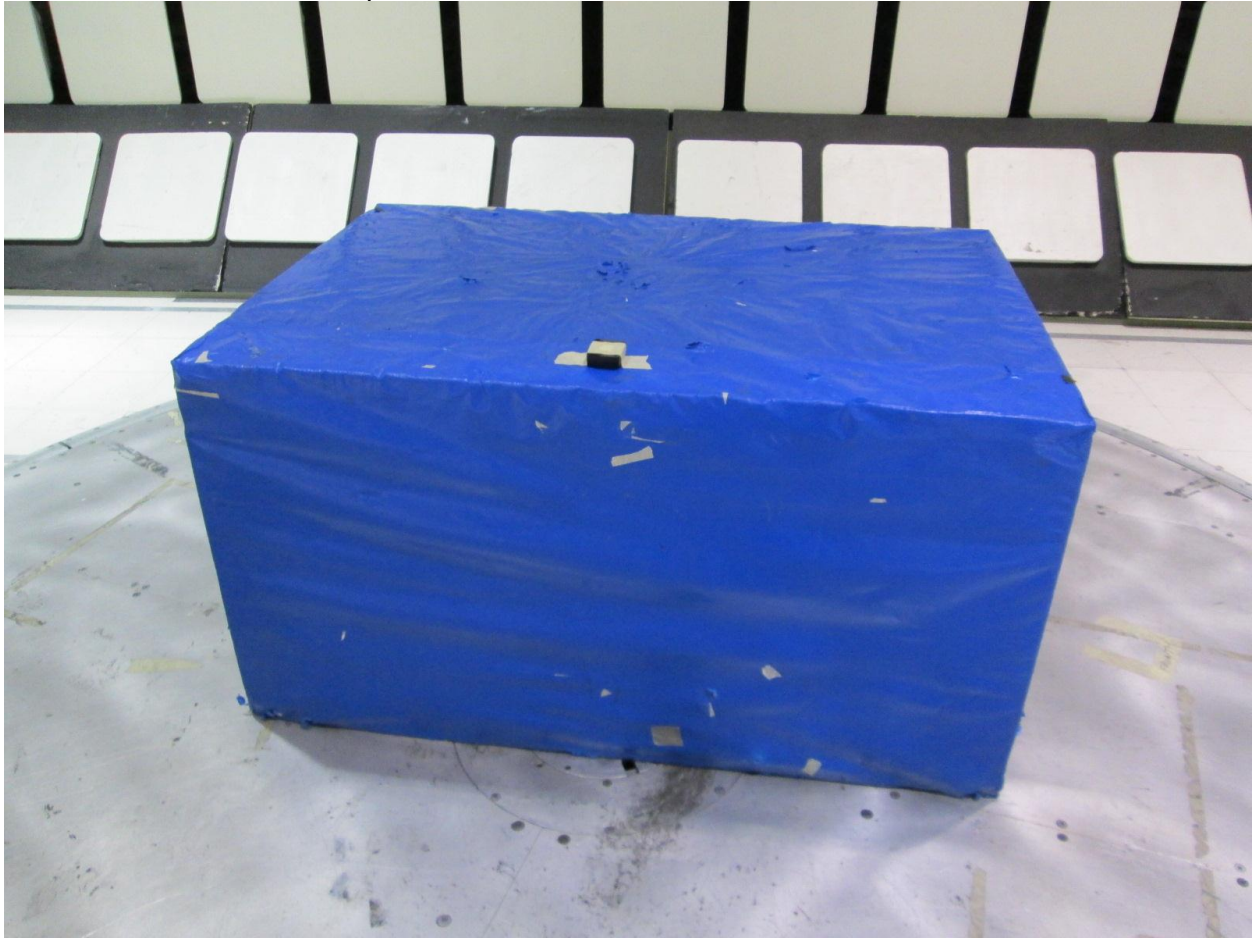
## Door Opened, High Channel



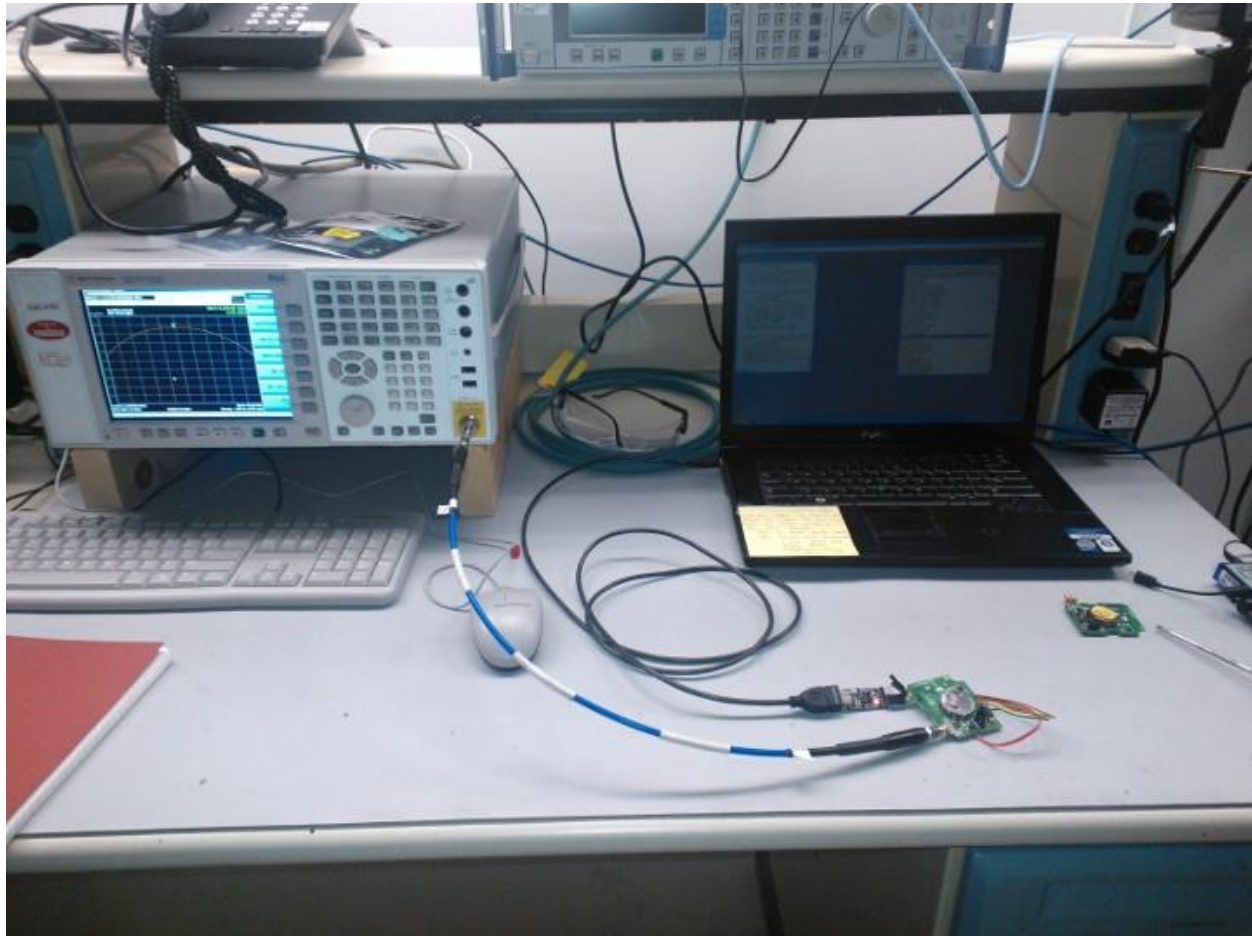
Based on peak pre-scan data there is no spurious emissions recorded above the noise floor.

## 8. SETUP PHOTOS

Radiated Emissions Door Open Position



## Antenna Port Measurements



## END OF REPORT