



# **CERTIFICATION TEST REPORT**

**Report Number. :** 11888590-E1V2

**Applicant :** CROSBY ENGINEERING SERVICES  
1120 LARKIN VALLEY RD  
WATSONVILLE, CA 95076

**Model :** MWM-EH3

**FCC ID :** Q3E-MWM-EH3

**EUT Description :** MwM Ear Hat

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C

**Date Of Issue:**

October 16, 2017

**Prepared by:**

UL Verification Services Inc.  
47173 Benicia Street  
Fremont, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888



NVLAP LAB CODE 200065-0

Revision History

| Rev. | Issue Date | Revisions   | Revised By |
|------|------------|---|------------|
| V1   | 09/22/17   | Initial Issues                                    | --         |
| V2   | 10/16/17   | Updated Section 6. TEST AND MEASUREMENT EQUIPMENT | --         |

## TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>1. ATTESTATION OF TEST RESULTS .....</b>                                   | <b>5</b>  |
| <b>2. TEST METHODOLOGY .....</b>  | <b>6</b>  |
| <b>3. FACILITIES AND ACCREDITATION .....</b>                                  | <b>6</b>  |
| <b>4. CALIBRATION AND UNCERTAINTY .....</b>                                   | <b>7</b>  |
| 4.1. <i>MEASURING INSTRUMENT CALIBRATION .....</i>                            | <i>7</i>  |
| 4.2. <i>SAMPLE CALCULATION .....</i>  | <i>7</i>  |
| 4.3. <i>MEASUREMENT UNCERTAINTY.....</i>                                      | <i>7</i>  |
| <b>5. EQUIPMENT UNDER TEST.....</b>   | <b>8</b>  |
| 5.1. <i>DESCRIPTION OF EUT .....</i>  | <i>8</i>  |
| 5.2. <i>MAXIMUM OUTPUT POWER.....</i>   | <i>8</i>  |
| 5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS .....</i>                           | <i>8</i>  |
| 5.4. <i>SOFTWARE AND FIRMWARE.....</i>  | <i>8</i>  |
| 5.5. <i>WORST-CASE CONFIGURATION AND MODE.....</i>                            | <i>8</i>  |
| 5.6. <i>DESCRIPTION OF TEST SETUP.....</i>                                    | <i>9</i>  |
| <b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>                                | <b>11</b> |
| <b>7. SUMMARY TABLE .....</b>   | <b>12</b> |
| <b>8. ANTENNA PORT TEST RESULTS.....</b>                                      | <b>13</b> |
| 8.1. <i>MEASUREMENT METHODS .....</i>   | <i>13</i> |
| 8.2. <i>ON TIME, DUTY CYCLE .....</i>   | <i>14</i> |
| 8.3. <i>6 dB BANDWIDTH.....</i>   | <i>16</i> |
| 8.4. <i>OUTPUT POWER.....</i>   | <i>18</i> |
| 8.5. <i>POWER SPECTRAL DENSITY .....</i>                                      | <i>20</i> |
| 8.6. <i>CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS.....</i>                    | <i>22</i> |
| <b>9. RADIATED TEST RESULTS.....</b>  | <b>26</b> |
| 9.1. <i>LIMITS.....</i>   | <i>26</i> |
| 9.2. <i>TRANSMITTER ABOVE 1 GHz.....</i>                                      | <i>27</i> |
| 9.2.1. <i>RESTRICTED BANDEDGE (LOW CHANNEL).....</i>                          | <i>27</i> |
| 9.2.2. <i>AUTHORIZED BANDEDGE (HIGH CHANNEL).....</i>                         | <i>29</i> |
| 9.3. <i>SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION).....</i>   | <i>37</i> |
| 9.4. <i>SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION).....</i> | <i>38</i> |

10. SETUP PHOTOS .....42

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** CROSBY ENGINEERING SERVICES  
1120 LARKIN VALLEY RD  
WATSONVILLE, CA 95076

**EUT DESCRIPTION:** Mwm Ear Hat

**SERIAL NUMBER:** 001 (Radiated), 002 (Conducted)

**DATE TESTED:** SEPTEMBER 12-22, 2017

| APPLICABLE STANDARDS     |              |
|--------------------------|--------------|
| STANDARD                 | TEST RESULTS |
| CFR 47 Part 15 Subpart C | Pass         |

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.

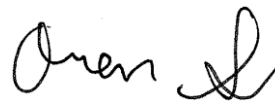
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. 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.

Approved & Released For  
UL Verification Services Inc. By:



FRANK IBRAHIM  
WiSE PROJECT LEAD  
UL VERIFICATION SERVICES INC.

Prepared By:



OREN STOELTING  
WiSE LAB TECHNICIAN  
UL VERIFICATION SERVICES INC.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 558074 D01 v04, ANSI C63.10-2013.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street                                       | 47266 Benicia Street                            |
|--|---|
| <input checked="" type="checkbox"/> Chamber A(IC: 2324B-1) | <input type="checkbox"/> Chamber D(IC: 22541-1) |
| <input type="checkbox"/> Chamber B(IC: 2324B-2)            | <input type="checkbox"/> Chamber E(IC: 22541-2) |
| <input type="checkbox"/> Chamber C(IC: 2324B-3)            | <input type="checkbox"/> Chamber F(IC: 22541-3) |
|  | <input type="checkbox"/> Chamber G(IC: 22541-4) |
|  | <input type="checkbox"/> Chamber H(IC: 22541-5) |

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. Chambers A through C is covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under Industry Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

## 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:

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

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Parameter   | Uncertainty |
|---|-------------|
| Worst Case Conducted Disturbance, 9KHz to 0.15 MHz  | 3.84 dB     |
| Worst Case Conducted Disturbance, 0.15 to 30 MHz    | 3.65 dB     |
| Worst Case Radiated Disturbance, 9KHz to 30 MHz     | 3.15 dB     |
| Worst Case Radiated Disturbance, 30 to 1000 MHz     | 5.36 dB     |
| Worst Case Radiated Disturbance, 1000 to 18000 MHz  | 4.32 dB     |
| Worst Case Radiated Disturbance, 18000 to 26000 MHz | 4.45 dB     |
| Worst Case Radiated Disturbance, 26000 to 40000 MHz | 5.24 dB     |

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is the children hat with controllable flashing ears unit which is operated by 2 x AAA Cells (3.2Vdc max).

### 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) |
|-----------------------|------|--------------------|-------------------|
| 2402 - 2480           | BLE  | 0.44               | 1.11              |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an inverted antenna, with the maximum gain:

| Frequency Band (GHz) | Antenna Gain (dBi) |
|----------------------|--------------------|
| 2402-2480            | 1.00               |

### 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was: 3.2  
The test utility software used during testing was 1.0

### 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 30 MHz, 30 to 1000 MHz and above 18 GHz were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The radiated unit was tested in its intended upright configuration.

Worst-case data rate as provided by the client was 1 Mbps.

The EUT was operated by 2 x AAA cells, 3.2VDC max, therefore; no AC line conducted emissions test was needed.



## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |                 |                              |        |
|------------------------|--------------|-----------------|------------------------------|--------|
| Description            | Manufacturer | Model           | Serial Number                | FCC ID |
| Laptop                 | Dell         | M6600           | CN-04YY4M-75900-194-0002-A00 | NA     |
| Infrared Emitter       | Metro Mini   | ATmega328-16MHz | NA                           | NA     |

The laptop and infrared emitter are used to transmit commands to the unit, but are disconnected during testing.

### I/O CABLES (CONDUCTED TEST)

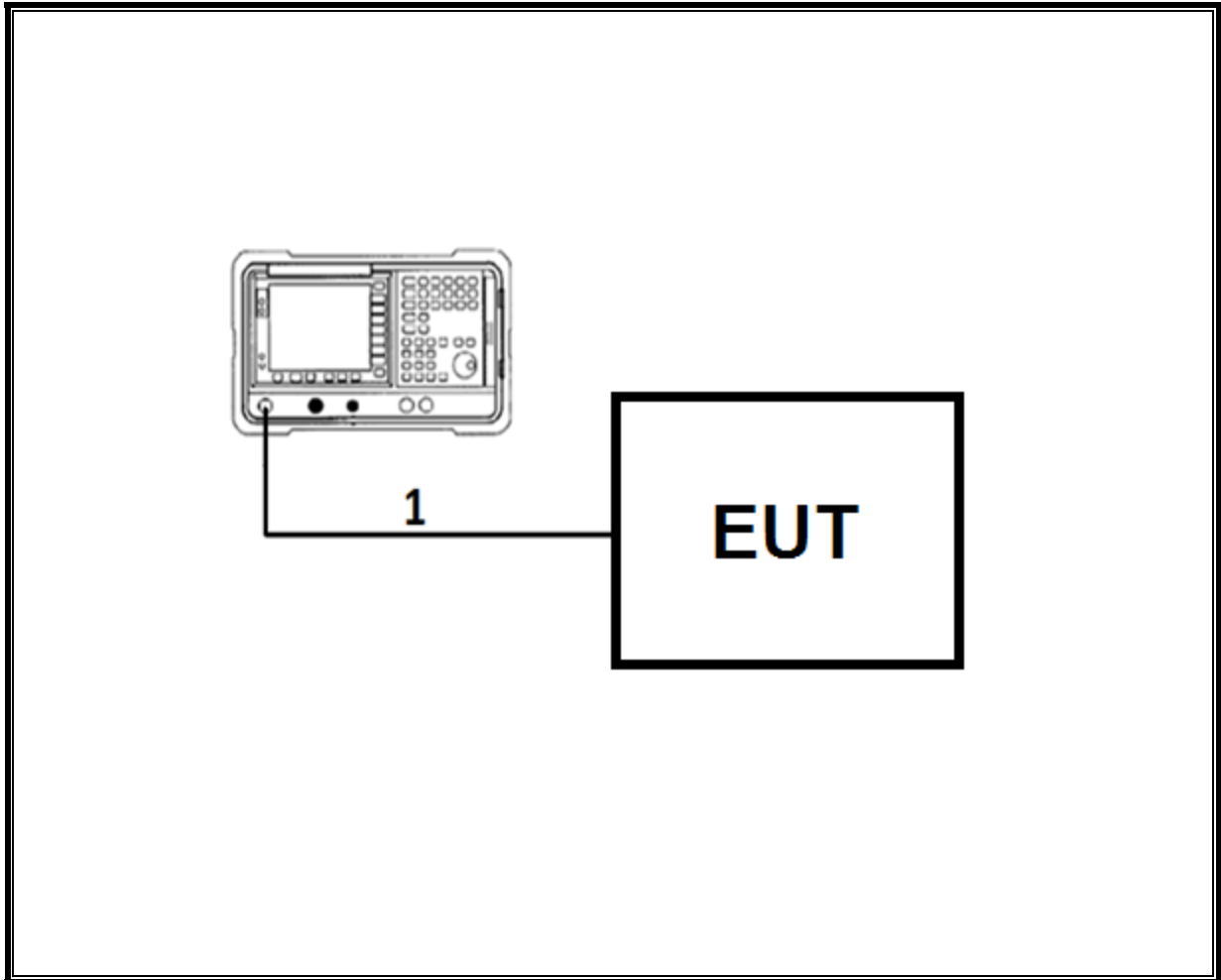
| I/O Cable List |         |                      |                |            |                  |                      |
|----------------|---------|----------------------|----------------|------------|------------------|----------------------|
| Cable No       | Port    | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks              |
| 1              | Antenna | 1                    | RF             | Shielded   | 0.1              | To Spectrum Analyzer |

### I/O CABLES (RADIATED)

The EUT is a standalone battery powered unit for radiated testing.

**TEST SETUP**

**CONDUCTED TEST SETUP DIAGRAM**



## 6. TEST AND MEASUREMENT EQUIPMENT

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

| Test Equipment List                         |                 |                         |          |          |          |
|---|-----------------|-------------------------|----------|----------|----------|
| Description                                 | Manufacturer    | Model                   | T Number | Cal Date | Cal Due  |
| Amplifier, 1 to 18 GHz                      | Miteq           | AFS43-00101800-25-S-42  | 493      | 02/15/17 | 02/15/18 |
| Amplifier, 1 to 8 GHz                       | Miteq           | AMF-4D-01000800-30-29P  | 1170     | 04/28/17 | 04/28/18 |
| Amplifier, 10KHz to 1GHz, 32dB              | Keysight        | 8447D                   | 300      | 11/10/16 | 11/10/17 |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz | Sunol Sciences  | JB3                     | 130      | 09/23/17 | 09/23/18 |
| PXA Spectrum Analyzer, 3Hz to 44GHz         | Agilent         | N9030A                  | 1466     | 04/11/17 | 04/11/18 |
| EMI Receiver                                | Rohde & Schwarz | ESR-EMI                 | 1436     | 01/06/17 | 01/06/18 |
| LISN  | FISCHER         | FCC-LISN-50/250-25-2-01 | 1310     | 06/08/17 | 06/08/18 |
| 18 - 26.5 GHz Horn Antenna                  | Seavey Division | MWH-1826/B              | 449      | 06/12/17 | 06/12/18 |
| Antenna, Active Loop 9kHz – 30MHz           | ETS-Lindgren    | 6502                    | 1683     | 02/17/17 | 02/17/18 |
| Pre-Amp 1-26.5 GHz                          | Agilent         | 8449B                   | 404      | 07/05/17 | 07/05/18 |
| Spectrum Analyzer                           | Agilent         | 8564E                   | 106      | 09/07/17 | 09/07/16 |

| Test Software List    |              |        |                          |
|-----------------------|--------------|--------|--------------------------|
| Description           | Manufacturer | Model  | Version                  |
| Radiated Software     | UL           | UL EMC | Ver 9.5, Apr 26, 2016    |
| Antenna Port Software | UL           | UL RF  | Ver 5.1.1, July 15, 2016 |

## 7. SUMMARY TABLE

| FCC Part Section          | Test Description                        | Test Limit | Test Condition | Test Result |
|---------------------------|---|------------|----------------|-------------|
| 15.247 (a)(2)             | Occupied Band width (6dB)               | >500KHz    | Conducted      | Pass        |
| 2.1051, 15.247 (d)        | Band Edge / Conducted Spurious Emission | -20dBc     |                | Pass        |
| 15.247                    | TX conducted output power               | <30dBm     |                | Pass        |
| 15.247                    | PSD                                     | <8dBm      |                | Pass        |
| 15.205, 15.209, 15.247(d) | Radiated Spurious Emission              | < 54dBuV/m | Radiated       | Pass        |

---

## 8. ANTENNA PORT TEST RESULTS

### 8.1. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v04, Section 8.1.

Output Power: KDB 558074 D01 v04, Section 9.1.1.

Power Spectral Density: KDB 558074 D01 v04, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

Band-edge: KDB 558074 D01 v04, Section 12.1.

## 8.2. ON TIME, DUTY CYCLE

### LIMITS

None; for reporting purposes only.

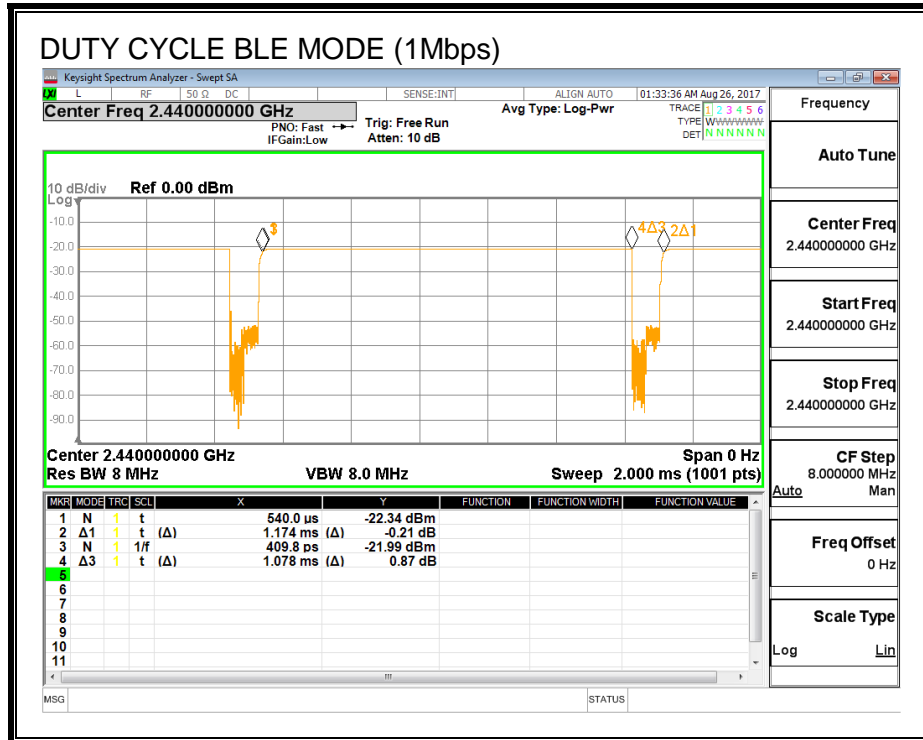
### PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

### ON TIME AND DUTY CYCLE RESULTS

| Mode        | ON Time B (msec) | Period (msec) | Duty Cycle x (linear) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | 1/T Minimum VBW (kHz) |
|-------------|------------------|---------------|-----------------------|----------------|-----------------------------------|-----------------------|
| BLE (1Mbps) | 1.078            | 1.174         | .9182                 | 91.82%         | 0.37                              | 0.928                 |

**DUTY CYCLE PLOT**



### 8.3. 6 dB BANDWIDTH

#### LIMITS

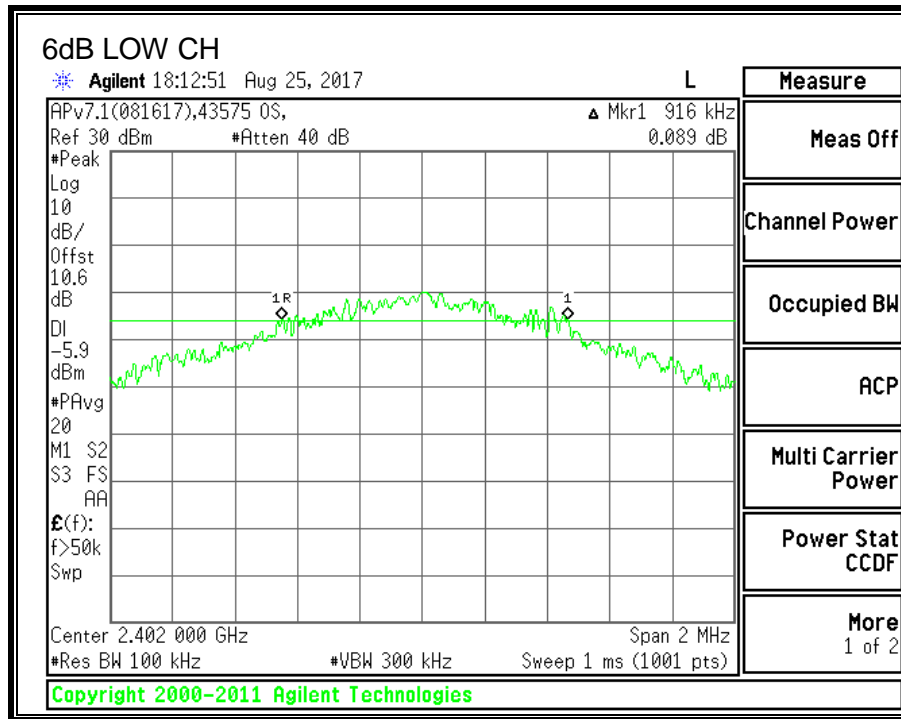
FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

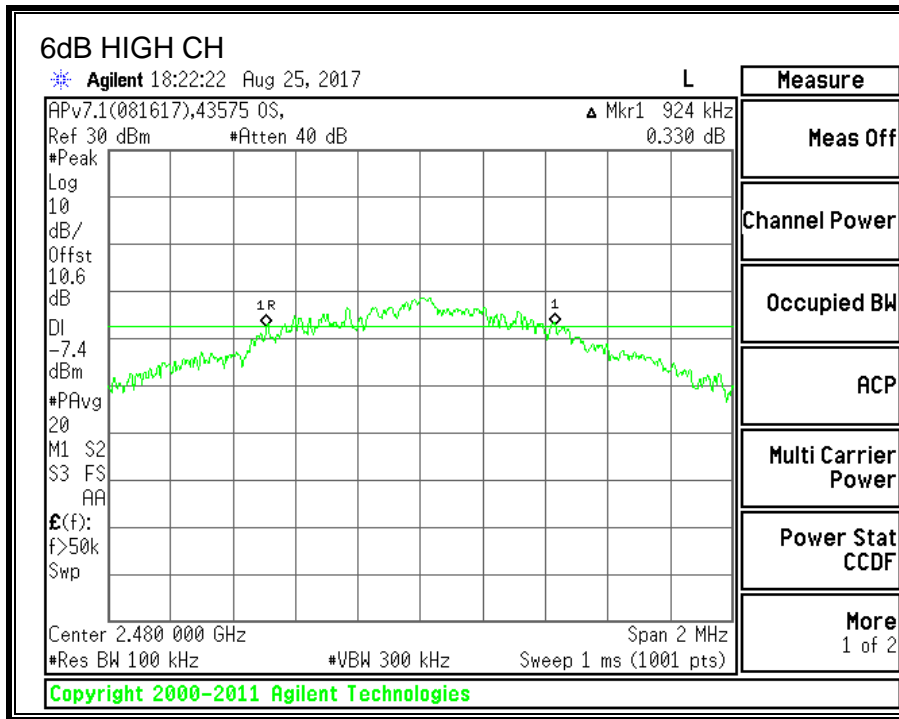
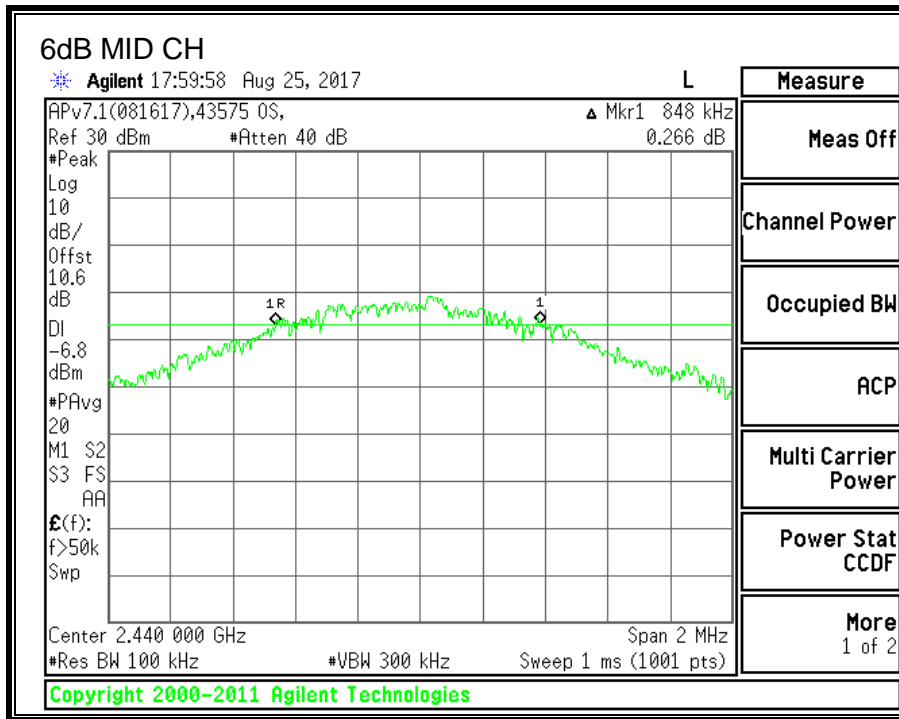
#### RESULTS

##### 6 dB BANDWIDTH (1Mbps)

| Channel | Frequency | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) |
|---------|-----------|----------------------|---------------------|
| Low     | 2402      | 0.916                | 0.5                 |
| Middle  | 2440      | 0.848                | 0.5                 |
| High    | 2480      | 0.924                | 0.5                 |







### 8.4. OUTPUT POWER

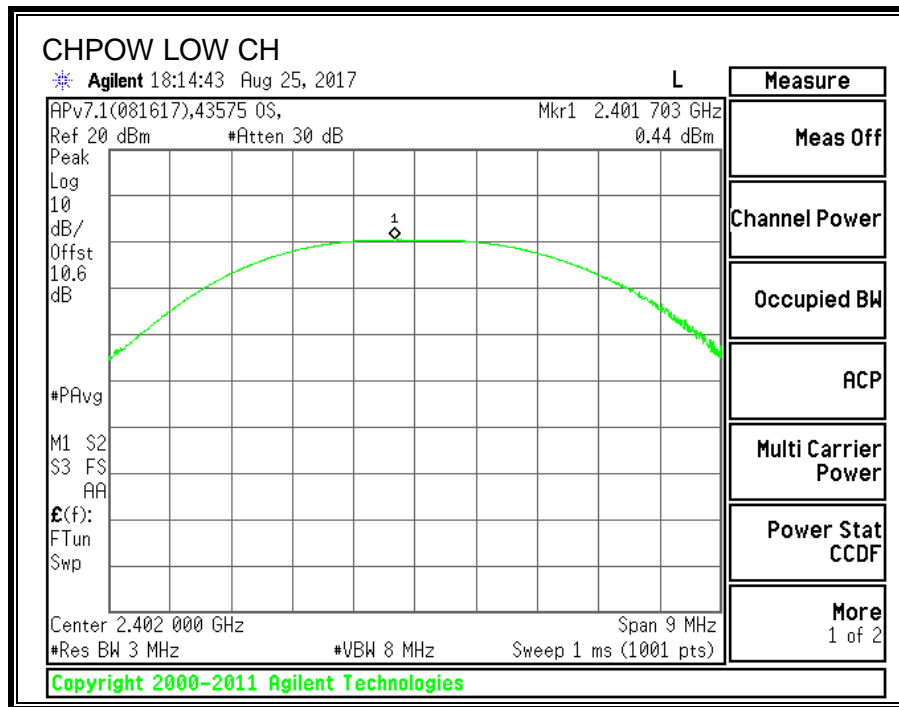
#### LIMITS

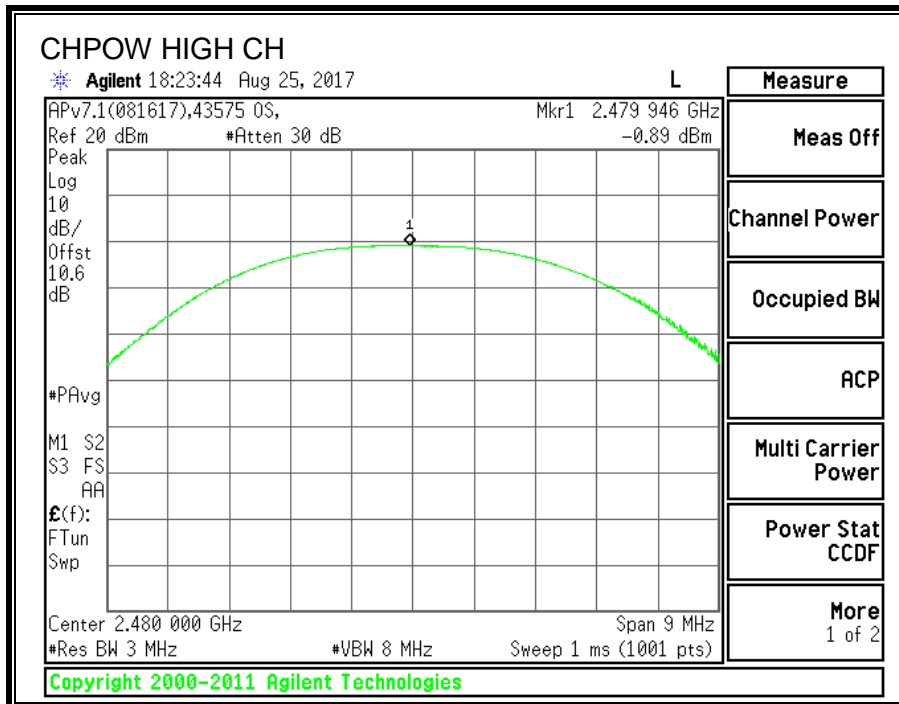
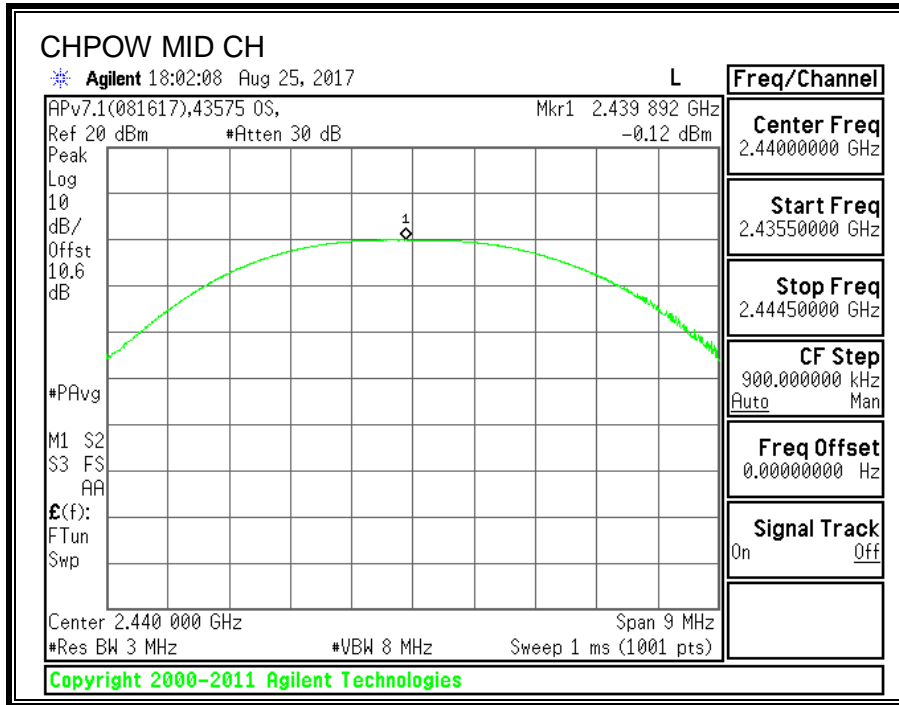
FCC §15.247 (b)

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

#### RESULTS

| Channel | Frequency (MHz) | Peak Power Reading (dBm) | Limit (dBm) | Margin (dB) |
|---------|-----------------|--------------------------|-------------|-------------|
| Low     | 2402            | 0.44                     | 30          | -29.56      |
| Middle  | 2440            | -0.12                    | 30          | -30.12      |
| High    | 2480            | -0.89                    | 30          | -30.89      |





## 8.5. POWER SPECTRAL DENSITY

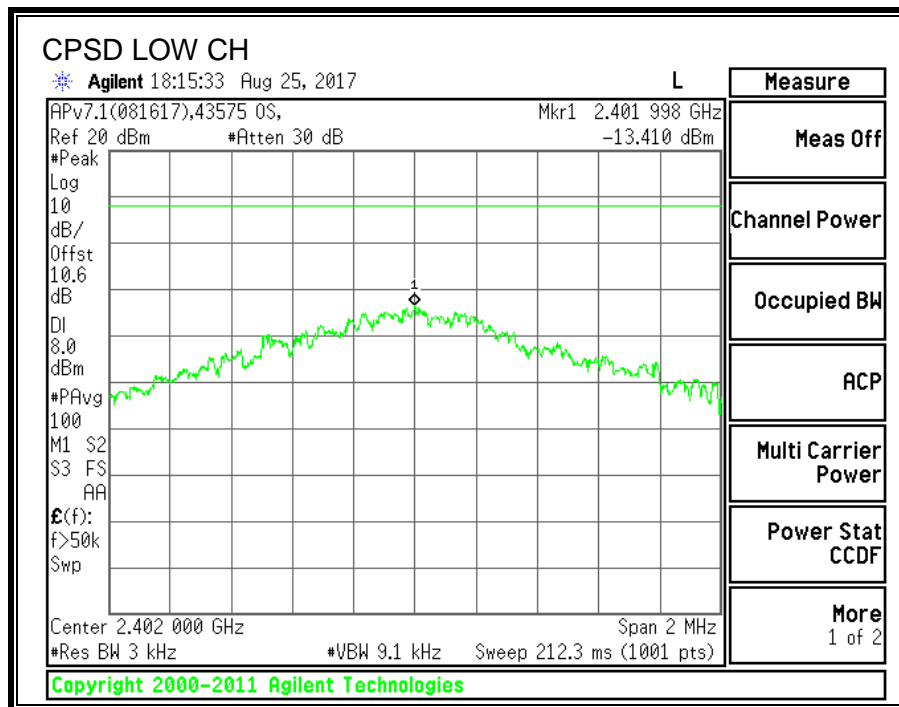
### LIMITS

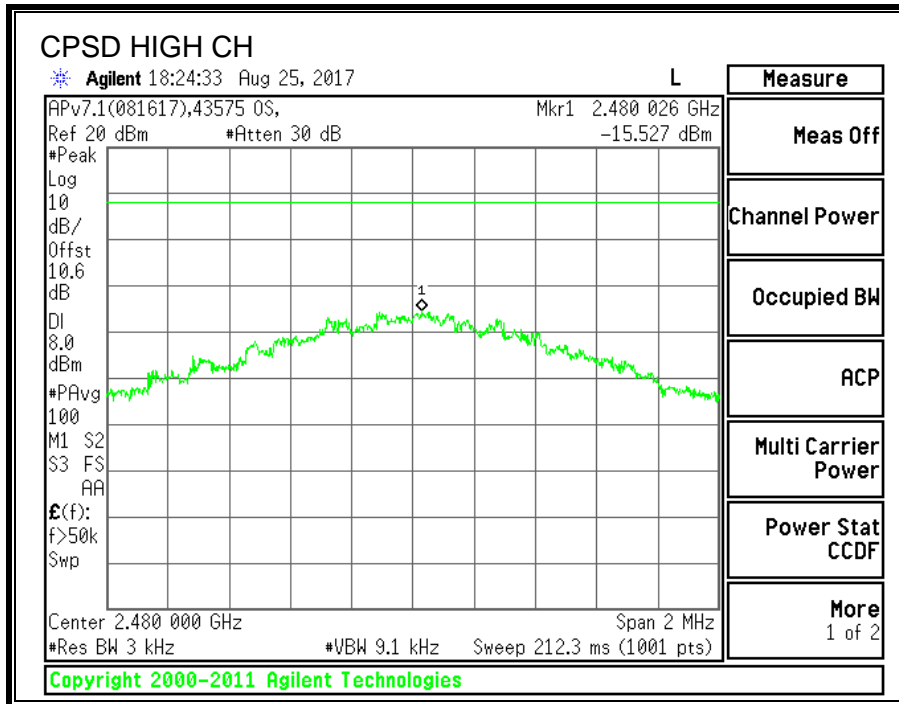
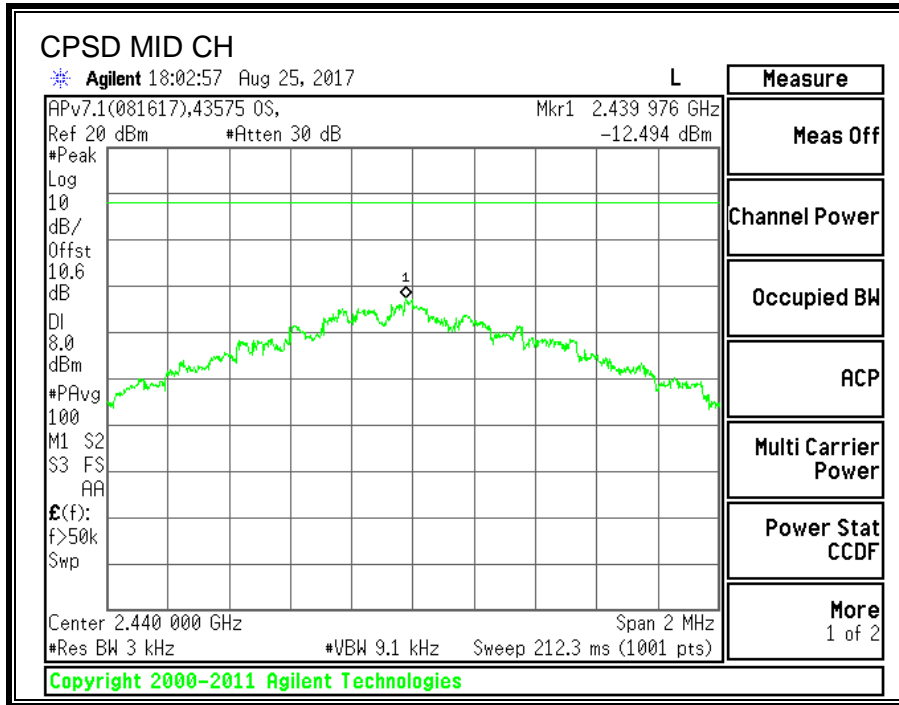
FCC §15.247 (e)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### RESULTS

| Channel | Frequency (MHz) | PSD (dBm) | Limit (dBm) | Margin (dB) |
|---------|-----------------|-----------|-------------|-------------|
| Low     | 2402            | -13.410   | 8           | -21.410     |
| Middle  | 2440            | -12.494   | 8           | -20.494     |
| High    | 2480            | -15.527   | 8           | -23.527     |





## 8.6. CONDUCTED BANDEGE AND SPURIOUS EMISSIONS

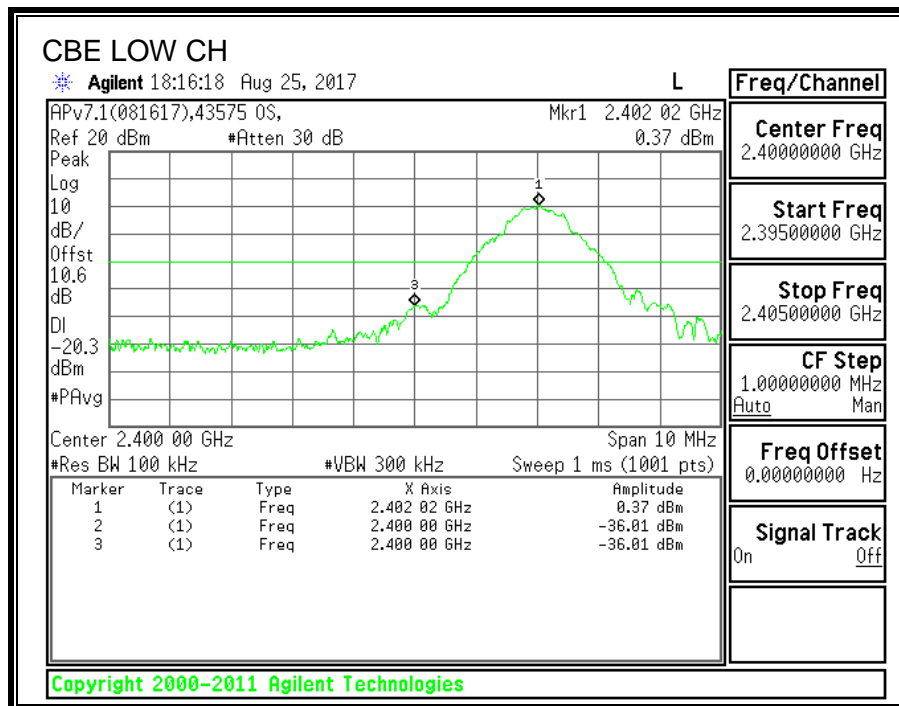
### LIMITS

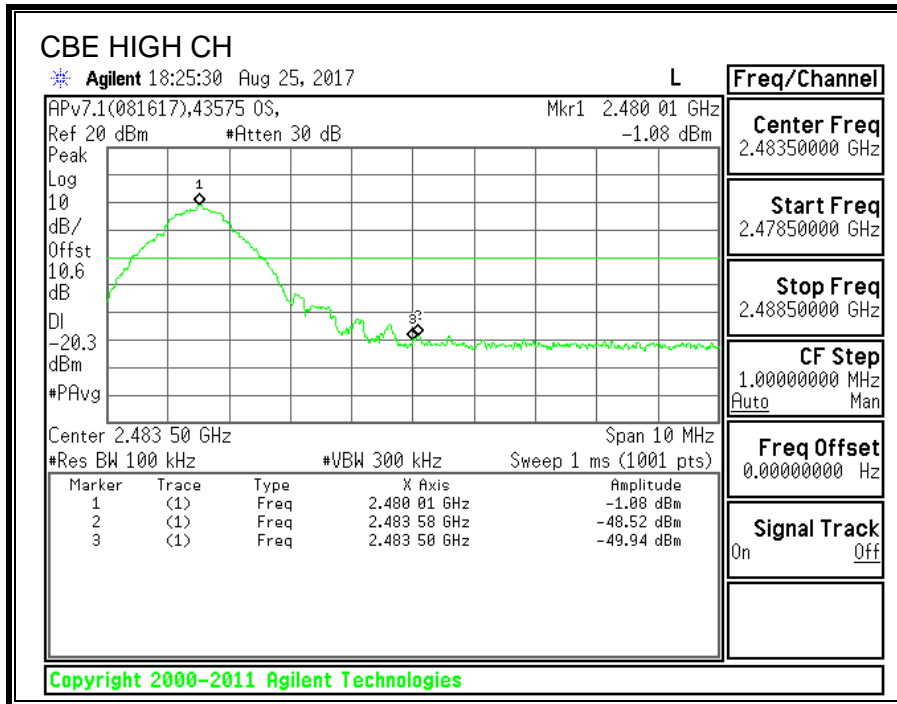
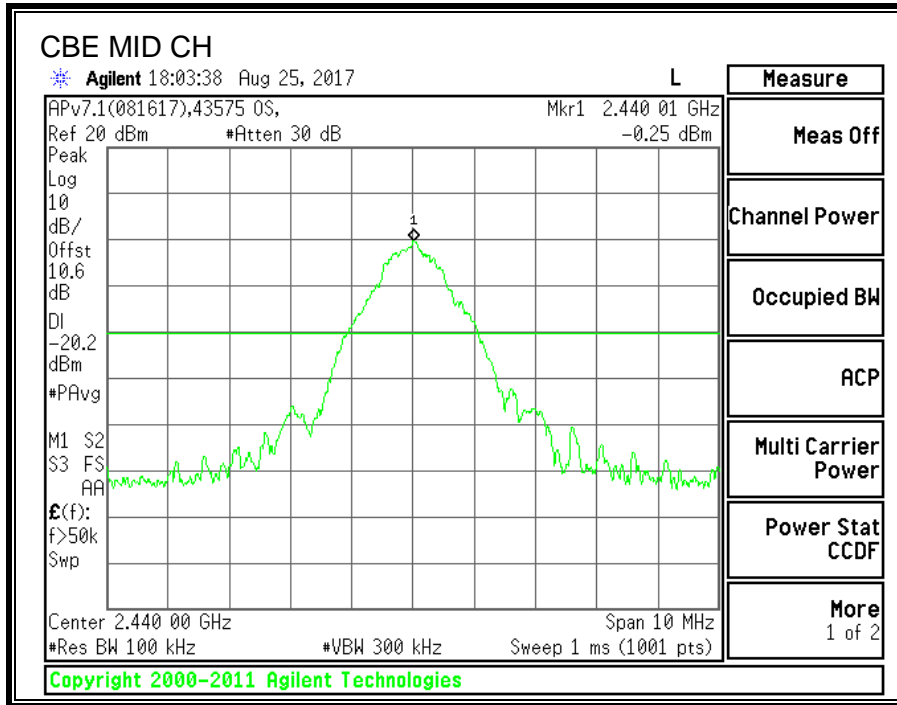
FCC §15.247 (d)

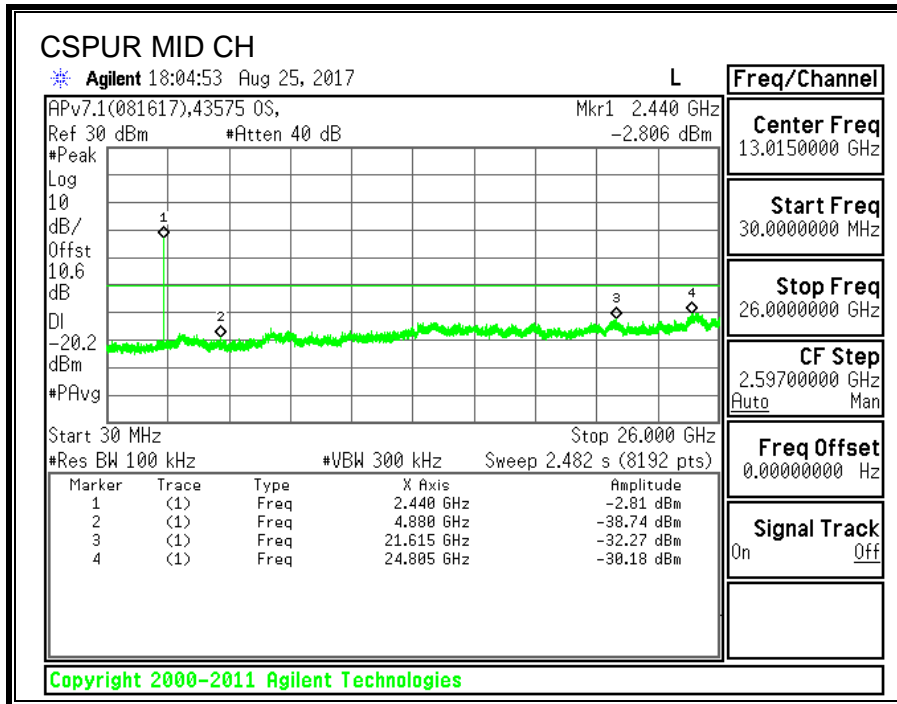
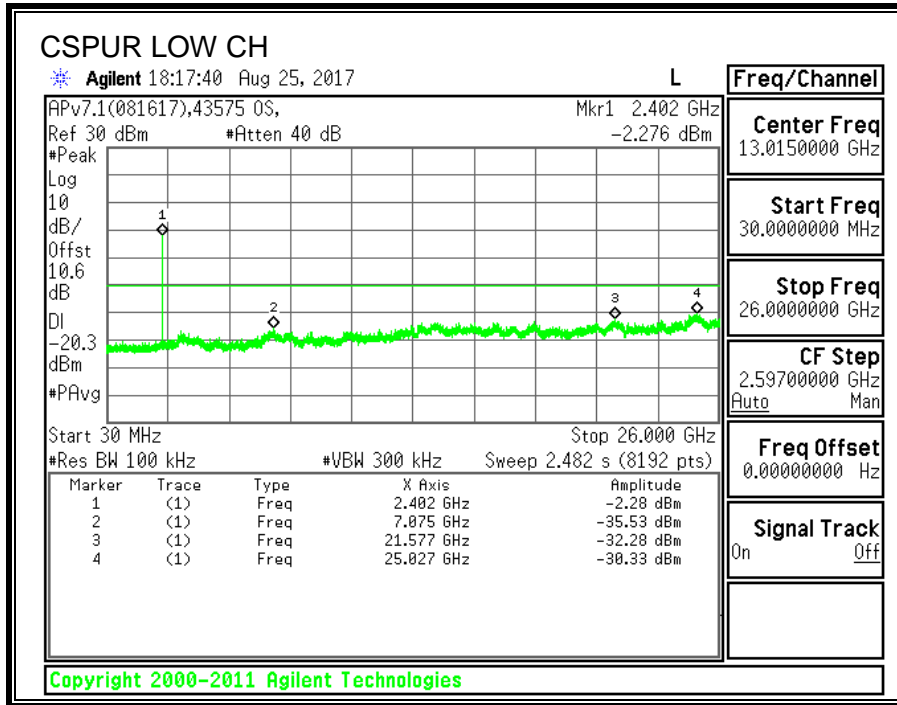
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

### RESULTS

#### CONDUCTED BANDEGE AND SPURIOUS EMISSIONS

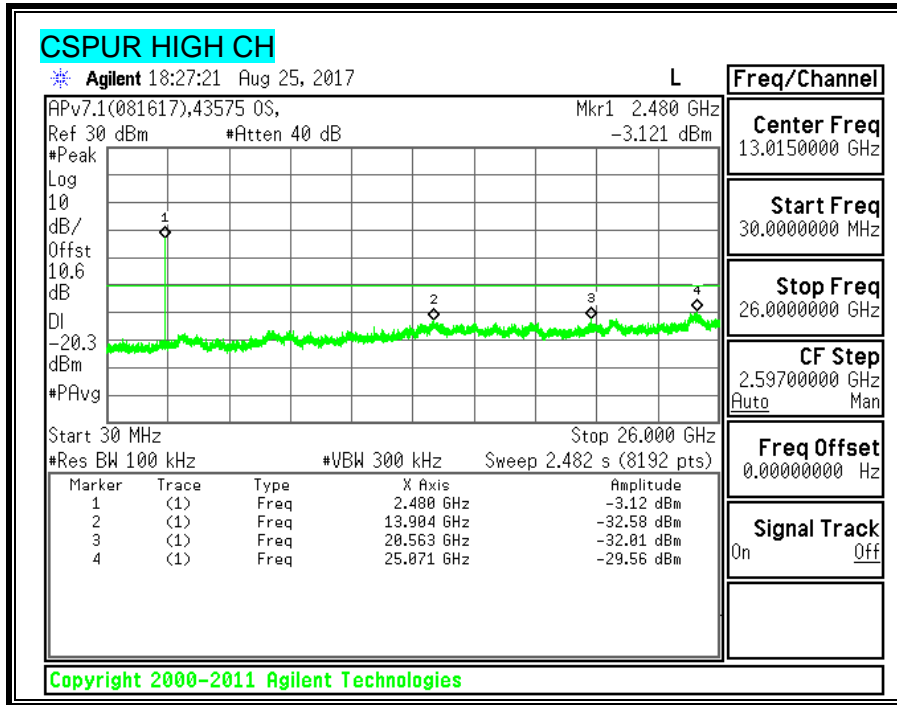








Display should be -20.3dB



## 9. RADIATED TEST RESULTS

### 9.1. LIMITS

#### LIMITS

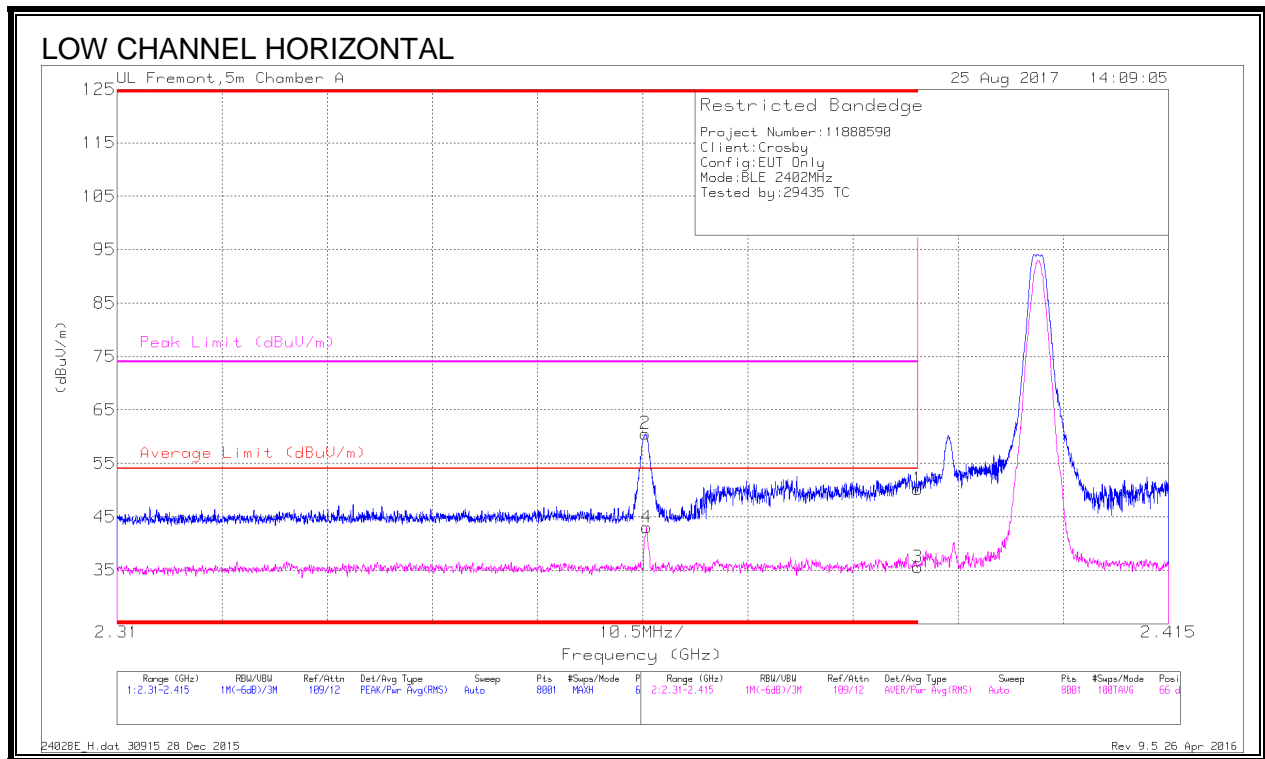
FCC §15.205 and §15.209

| Frequency Range (MHz) | Field Strength Limit (uV/m) at 3 m | Field Strength Limit (dBuV/m) at 3 m |
|-----------------------|------------------------------------|--------------------------------------|
| 0.009-0.490           | 2400/F(kHz) @ 300 m                | -                                    |
| 0.490-1.705           | 24000/F(kHz) @ 30 m                | -                                    |
| 1.705 - 30            | 30 @ 30m                           | -                                    |
| 30 - 88               | 100                                | 40                                   |
| 88 - 216              | 150                                | 43.5                                 |
| 216 - 960             | 200                                | 46                                   |
| Above 960             | 500                                | 54                                   |

#### RESULTS

## 9.2. TRANSMITTER ABOVE 1 GHz

### 9.2.1. RESTRICTED BANDEGE (LOW CHANNEL)



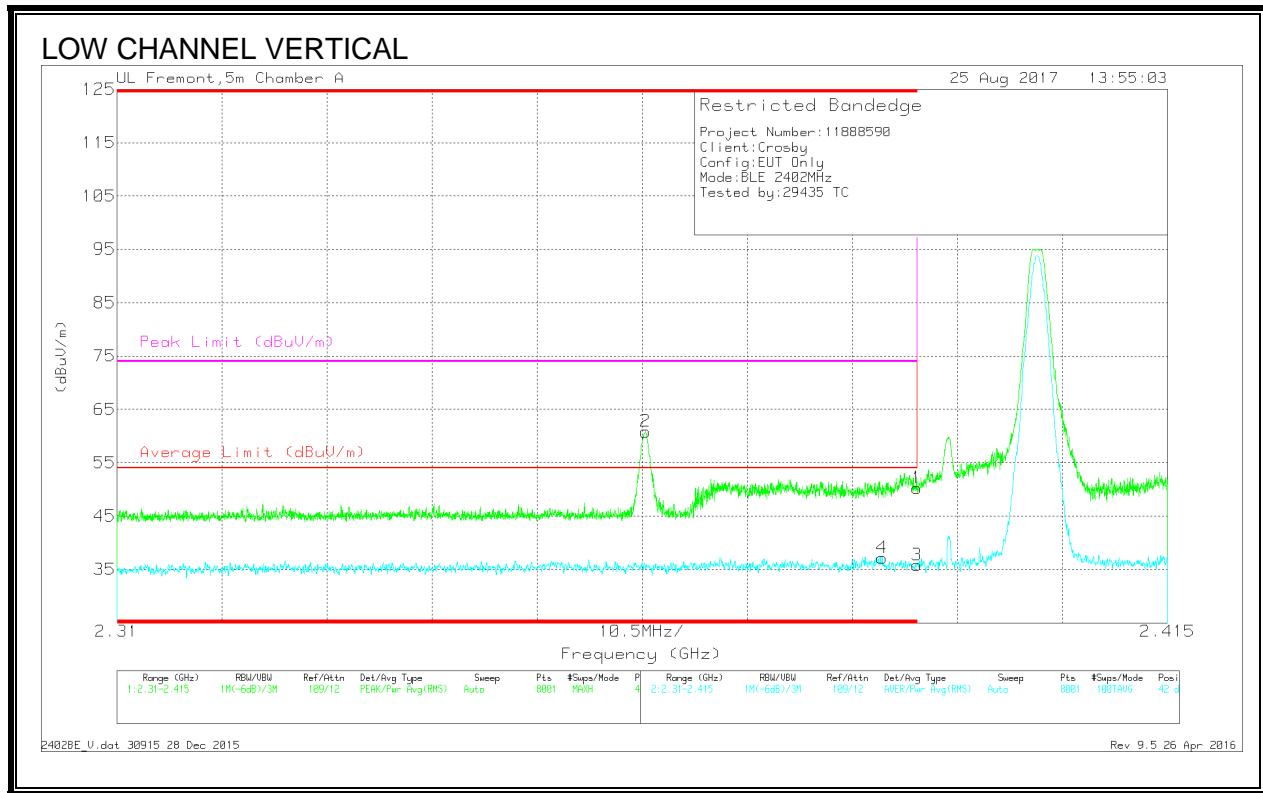
#### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dBm) | Amp/CbW/Fltr/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|-----------------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.39          | 41.6                 | Pk  | 31.8          | -23.2                 | 0            | 50.2                       | -                      | -           | 74                  | -23.8          | 66             | 214         | H        |
| 2      | * 2.363         | 52.17                | Pk  | 31.6          | -23.2                 | 0            | 60.57                      | -                      | -           | 74                  | -13.43         | 66             | 214         | H        |
| 3      | * 2.39          | 26.57                | RMS | 31.8          | -23.2                 | .37          | 35.54                      | 54                     | -18.46      | -                   | -              | 66             | 214         | H        |
| 4      | * 2.363         | 34.26                | RMS | 31.6          | -23.2                 | .37          | 43.03                      | 54                     | -10.97      | -                   | -              | 66             | 214         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection



Trace Markers

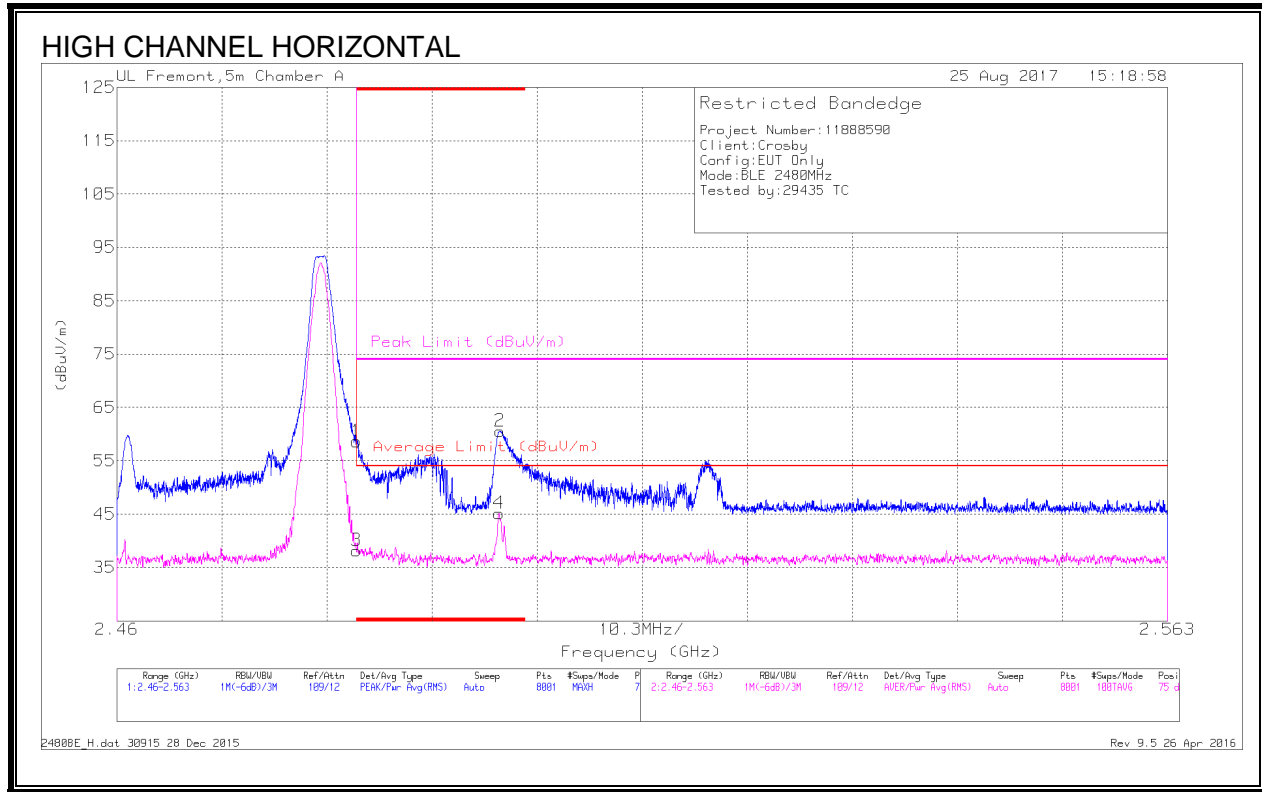
| Marker | Frequenc<br>y (GHz) | Meter<br>Reading<br>(dBuV) | Det | AF T862 (dB/m) | Amp/Cb/Filt/Pad<br>(dB) | DC Corr (dB) | Correcte<br>d Reading<br>(dBuV/m) | Average Limit<br>(dBuV/m) | Margin<br>(dB) | Peak Limit (dBuV/m) | PK<br>Margin<br>(dB) | Azimuth<br>(Degs) | Height<br>(cm) | Polarity |
|--------|---------------------|----------------------------|-----|----------------|-------------------------|--------------|-----------------------------------|---------------------------|----------------|---------------------|----------------------|-------------------|----------------|----------|
| 1      | * 2.39              | 41.66                      | Pk  | 31.8           | -23.2                   | 0            | 50.26                             | -                         | -              | 74                  | -23.74               | 42                | 102            | V        |
| 2      | * 2.363             | 52.44                      | Pk  | 31.6           | -23.2                   | 0            | 60.84                             | -                         | -              | 74                  | -13.16               | 42                | 102            | V        |
| 3      | * 2.39              | 27.22                      | RMS | 31.8           | -23.2                   | .37          | 36.19                             | 54                        | -17.81         | -                   | -                    | 42                | 102            | V        |
| 4      | * 2.386             | 28.55                      | RMS | 31.8           | -23.2                   | .37          | 37.52                             | 54                        | -16.48         | -                   | -                    | 42                | 102            | V        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

**9.2.2. AUTHORIZED BANDEDGE (HIGH CHANNEL)**



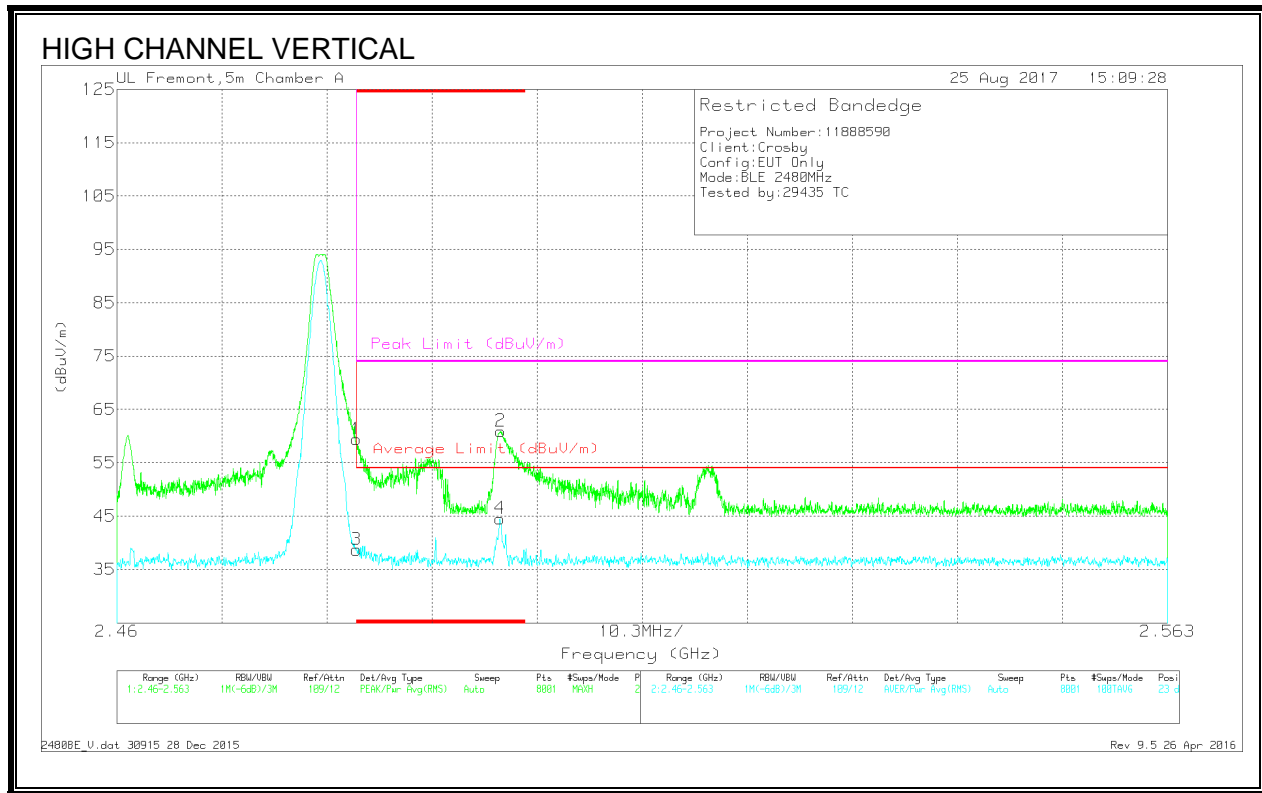
Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dBm) | Amp/Cb/Fit/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|---------------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.484         | 49.45                | Pk  | 32.3          | -23.1               | 0            | 53.65                      | -                      | -           | 74                  | -15.35         | 75             | 212         | H        |
| 2      | * 2.498         | 51.37                | Pk  | 32.4          | -23.2               | 0            | 60.57                      | -                      | -           | 74                  | -13.43         | 75             | 212         | H        |
| 3      | * 2.484         | 28.61                | RMS | 32.3          | -23.1               | .37          | 38.18                      | 54                     | -15.82      | -                   | -              | 75             | 212         | H        |
| 4      | * 2.497         | 35.59                | RMS | 32.4          | -23.2               | .37          | 45.16                      | 54                     | -8.84       | -                   | -              | 75             | 212         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection



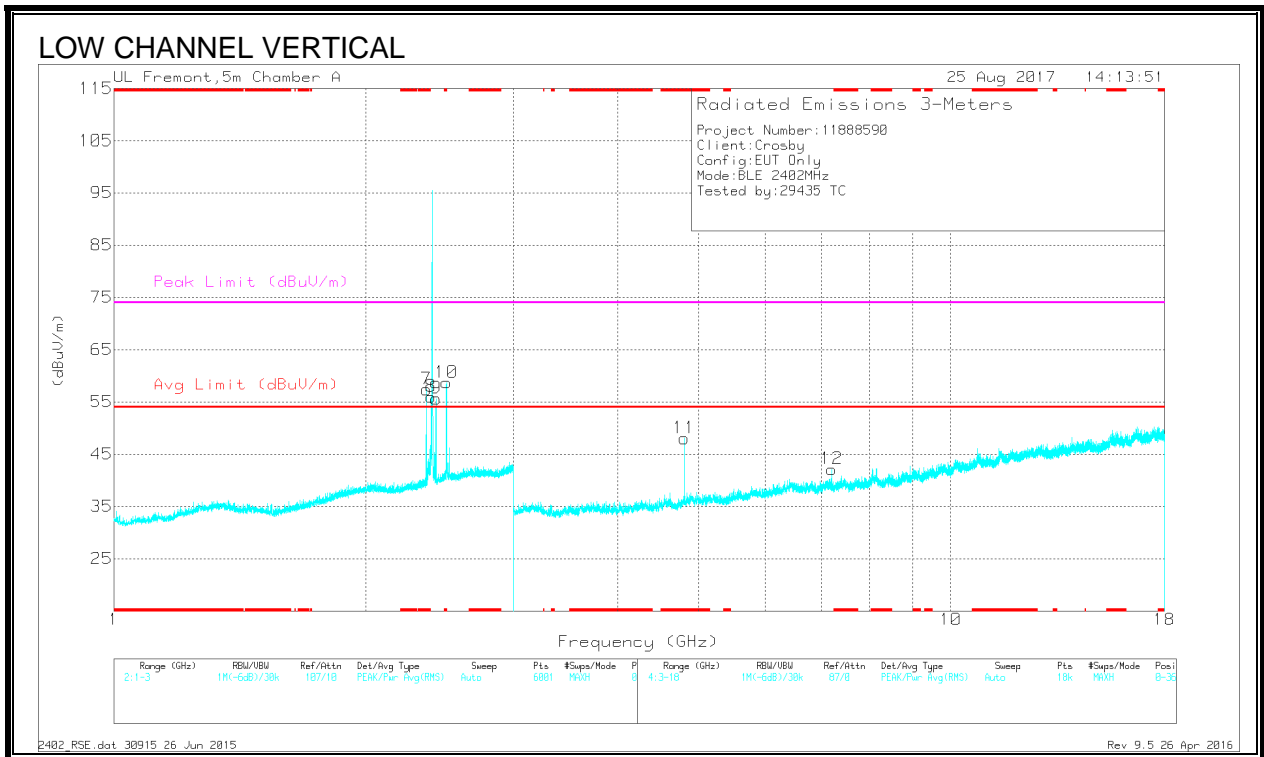
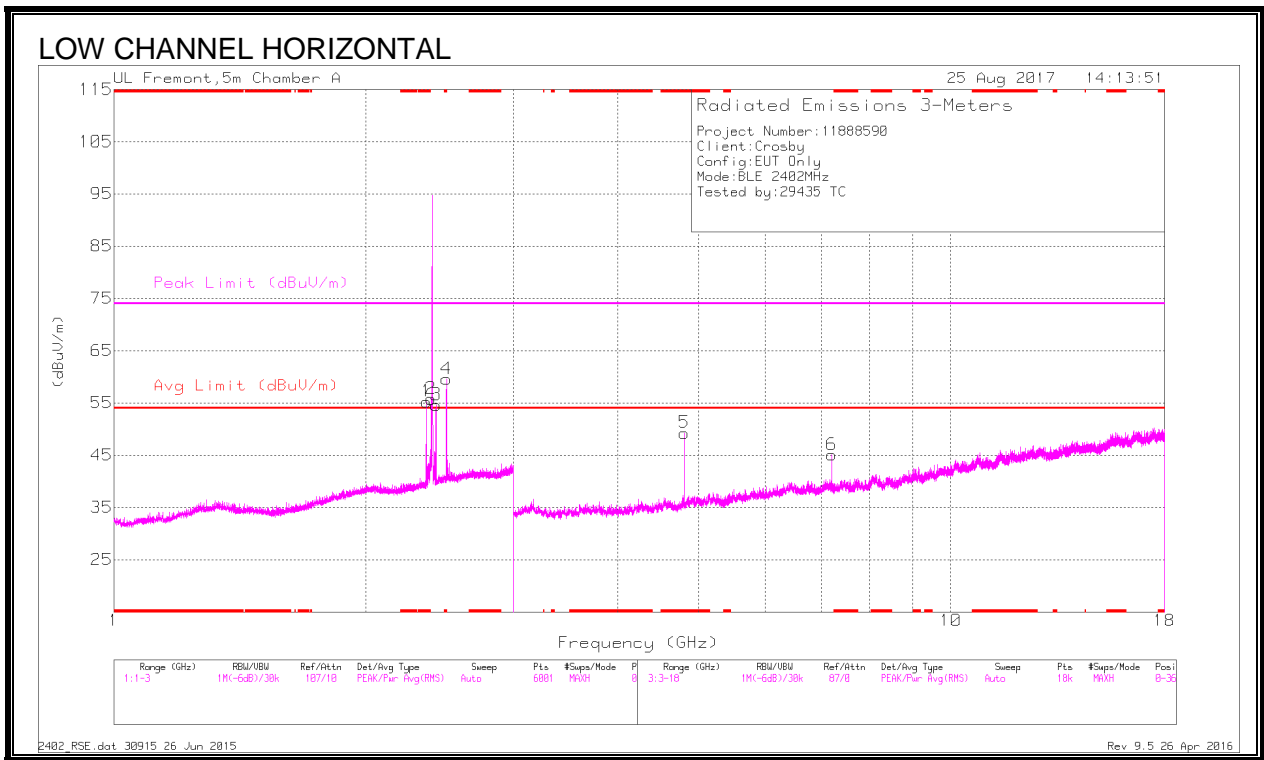
Trace Markers

| Marker | Frequenc<br>y<br>(GHz) | Meter<br>Reading<br>(dBuV) | Det | AF T862 (dB/m) | Amp/Cb/Filt/Pad<br>(dB) | DC Corr (dB) | Correcte<br>d<br>Reading<br>(dBuV/m) | Average Limit<br>(dBuV/m) | Margin<br>(dB) | Peak Limit (dBuV/m) | PK<br>Margin<br>(dB) | Azimuth<br>(Degs) | Height<br>(cm) | Polarity |
|--------|------------------------|----------------------------|-----|----------------|-------------------------|--------------|--------------------------------------|---------------------------|----------------|---------------------|----------------------|-------------------|----------------|----------|
| 1      | * 2.484                | 50.19                      | Pk  | 32.3           | -23.1                   | 0            | 59.39                                | -                         | -              | 74                  | -14.61               | 23                | 101            | V        |
| 2      | * 2.498                | 51.73                      | Pk  | 32.4           | -23.2                   | 0            | 60.93                                | -                         | -              | 74                  | -13.07               | 23                | 101            | V        |
| 3      | * 2.484                | 29.14                      | RMS | 32.3           | -23.1                   | .37          | 38.71                                | 54                        | -15.29         | -                   | -                    | 23                | 101            | V        |
| 4      | * 2.498                | 34.98                      | RMS | 32.4           | -23.2                   | .37          | 44.55                                | 54                        | -9.45          | -                   | -                    | 23                | 101            | V        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

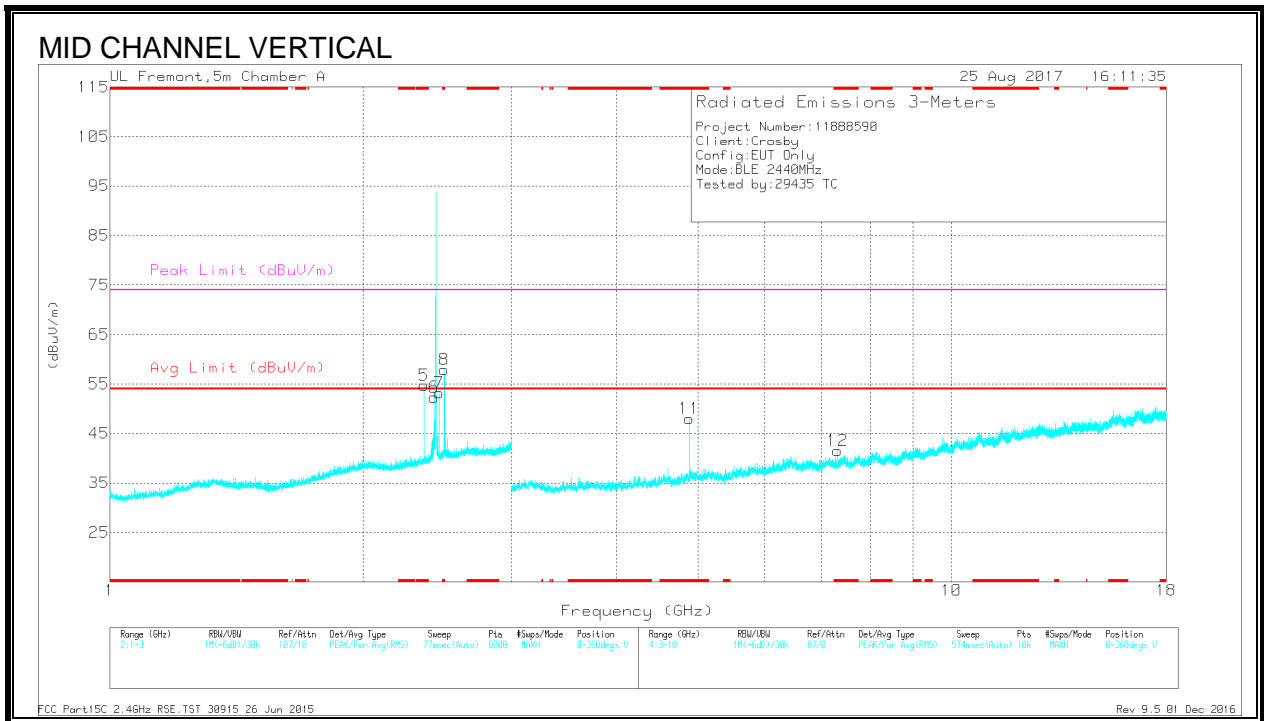
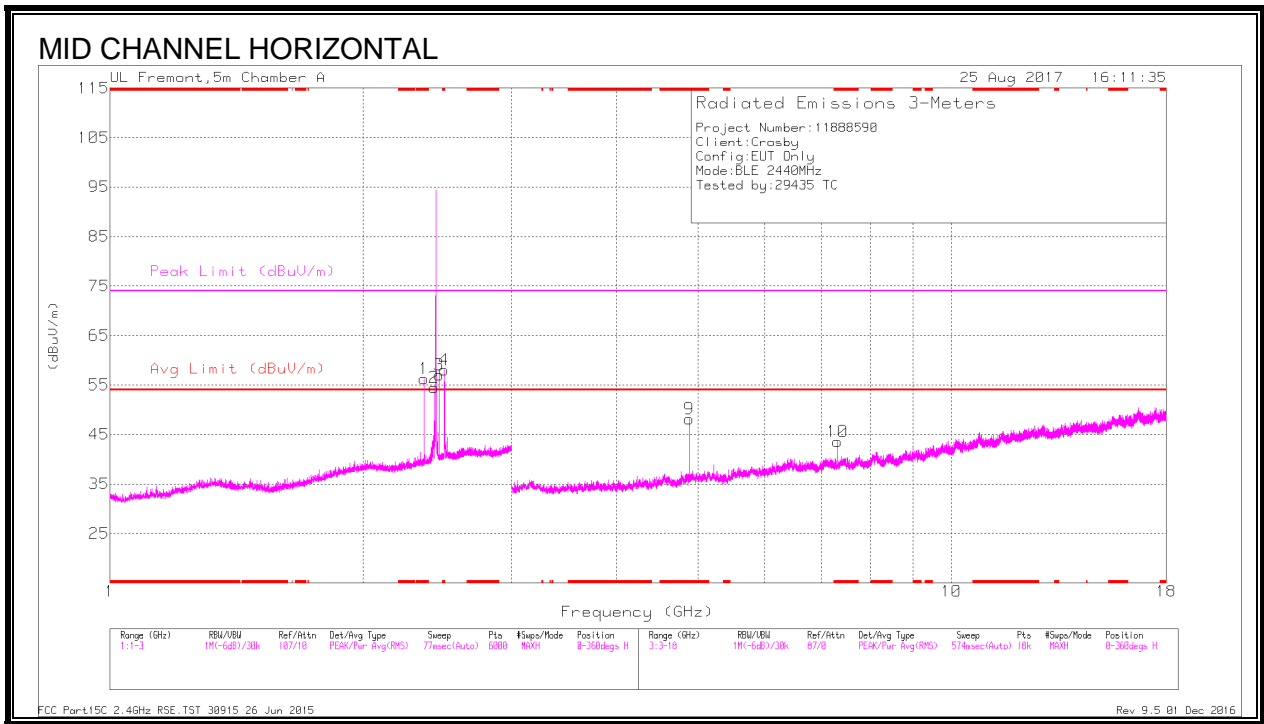


Radiated Emissions

| Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T862 (dB/m) | Amp/Cbl/Filtr/ Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|-----------------|----------------------|------|----------------|-------------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| * 2.363         | 52.37                | PK2  | 31.6           | -23.2                   | 0            | 60.77                      | -                  | -           | 74                  | -13.23         | 72             | 245         | H        |
| * 2.363         | 31.4                 | MAv1 | 31.6           | -23.2                   | .37          | 40.17                      | 54                 | -13.83      | -                   | -              | 72             | 245         | H        |
| * 2.498         | 52                   | PK2  | 32.4           | -23.2                   | 0            | 61.2                       | -                  | -           | 74                  | -12.8          | 73             | 170         | H        |
| * 2.498         | 32.74                | MAv1 | 32.4           | -23.2                   | .37          | 42.31                      | 54                 | -11.69      | -                   | -              | 73             | 170         | H        |
| * 2.363         | 51.67                | PK2  | 31.6           | -23.2                   | 0            | 60.07                      | -                  | -           | 74                  | -13.93         | 38             | 108         | V        |
| * 2.363         | 30.83                | MAv1 | 31.6           | -23.2                   | .37          | 39.6                       | 54                 | -14.4       | -                   | -              | 38             | 108         | V        |
| * 2.498         | 51.24                | PK2  | 32.4           | -23.2                   | 0            | 60.44                      | -                  | -           | 74                  | -13.56         | 34             | 103         | V        |
| * 2.498         | 31.59                | MAv1 | 32.4           | -23.2                   | .37          | 41.16                      | 54                 | -12.84      | -                   | -              | 34             | 103         | V        |
| * 4.805         | 46.25                | PK2  | 34.2           | -27.7                   | 0            | 52.75                      | -                  | -           | 74                  | -21.25         | 44             | 232         | H        |
| * 4.804         | 39.89                | MAv1 | 34.2           | -27.7                   | .37          | 46.76                      | 54                 | -7.24       | -                   | -              | 44             | 232         | H        |
| * 4.804         | 45.52                | PK2  | 34.2           | -27.7                   | 0            | 52.02                      | -                  | -           | 74                  | -21.98         | 286            | 141         | V        |
| * 4.804         | 38.97                | MAv1 | 34.2           | -27.7                   | .37          | 45.84                      | 54                 | -8.16       | -                   | -              | 286            | 141         | V        |

\* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band  
 PK2 - KDB558074 Method: Maximum Peak  
 MAv1 - KDB558074 Option 1 Maximum RMS Average

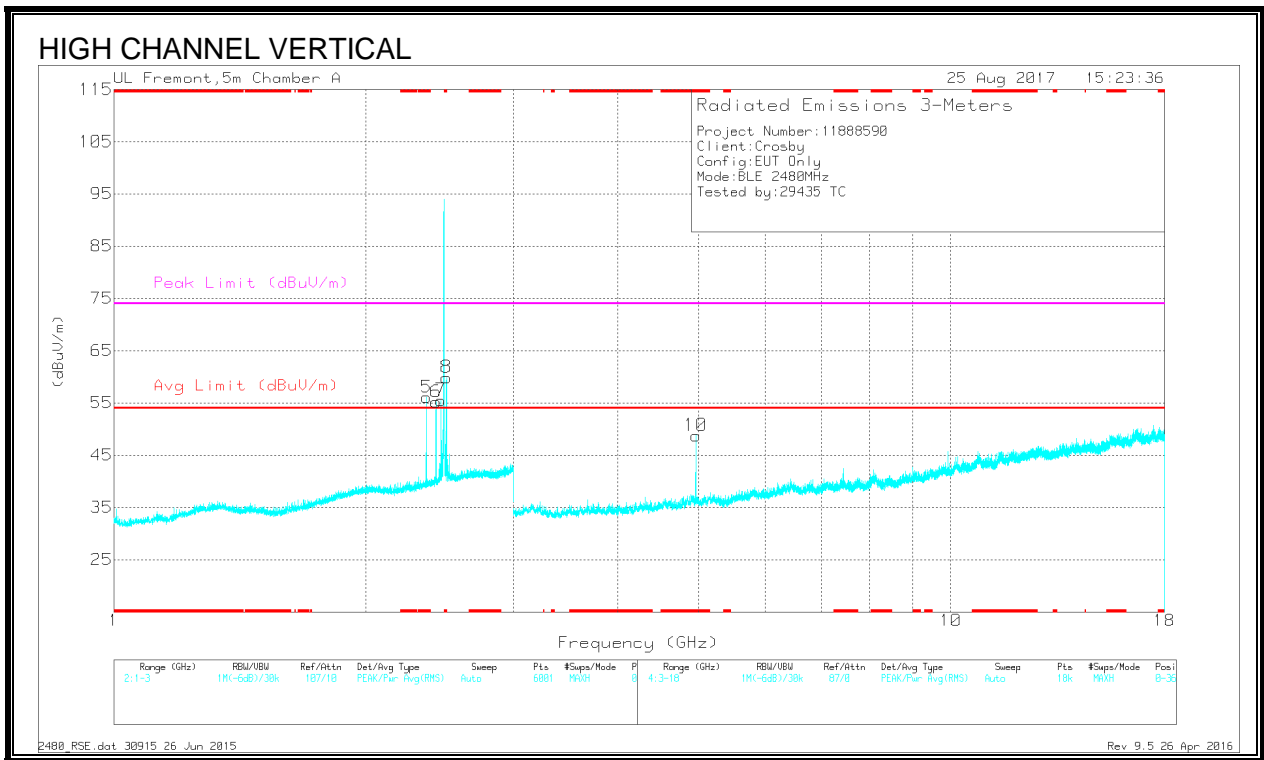
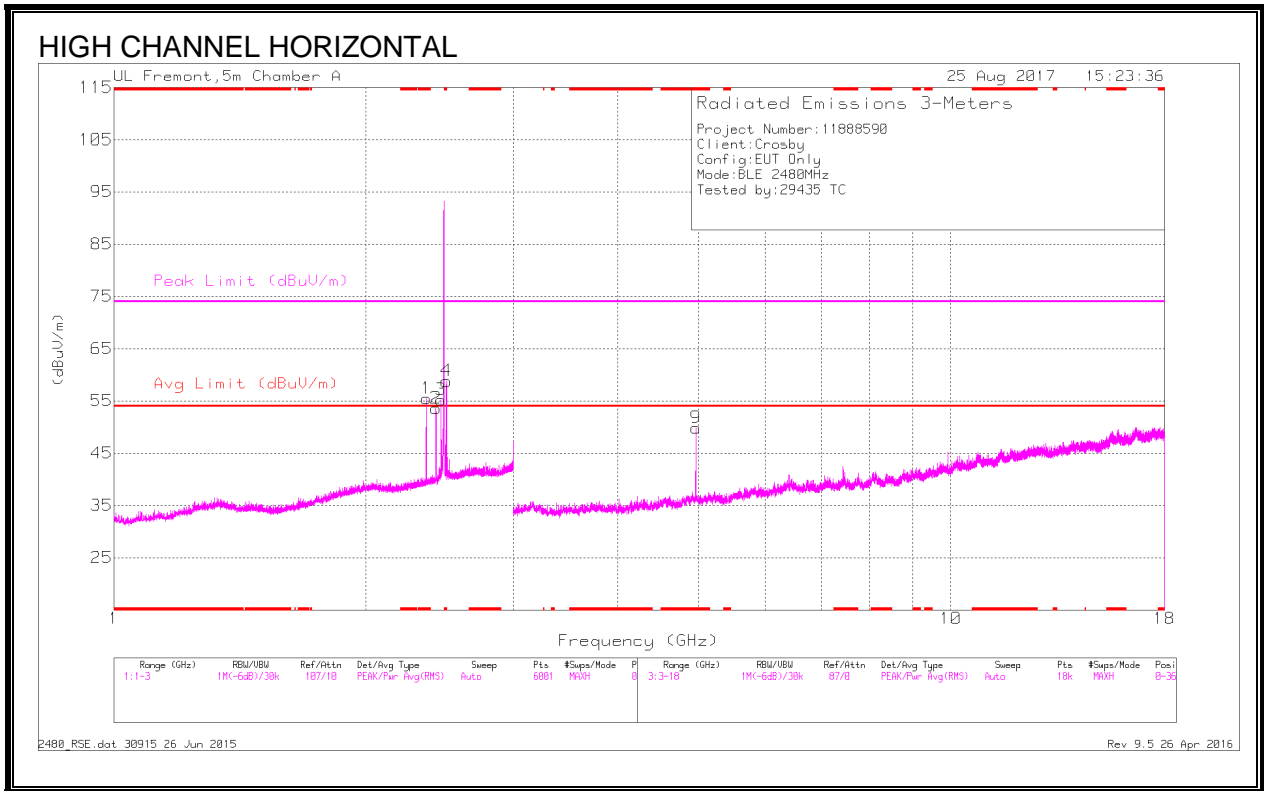




Radiated Emissions

| Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T862 (dB/m) | Amp/Cbl/Filtr/ Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|-----------------|----------------------|------|----------------|-------------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| * 2.363         | 52.48                | PK2  | 31.6           | -23.2                   | 0            | 60.88                      | -                  | -           | 74                  | -13.12         | 82             | 211         | H        |
| * 2.363         | 31.76                | MAv1 | 31.6           | -23.2                   | .37          | 40.53                      | 54                 | -13.47      | -                   | -              | 82             | 211         | H        |
| * 2.497         | 52.04                | PK2  | 32.4           | -23.2                   | 0            | 61.24                      | -                  | -           | 74                  | -12.76         | 80             | 243         | H        |
| * 2.497         | 32.53                | MAv1 | 32.4           | -23.2                   | .37          | 42.1                       | 54                 | -11.9       | -                   | -              | 80             | 243         | H        |
| * 2.363         | 52.04                | PK2  | 31.6           | -23.2                   | 0            | 60.44                      | -                  | -           | 74                  | -13.56         | 42             | 119         | V        |
| * 2.363         | 30.83                | MAv1 | 31.6           | -23.2                   | .37          | 39.6                       | 54                 | -14.4       | -                   | -              | 42             | 119         | V        |
| * 2.498         | 50.77                | PK2  | 32.4           | -23.2                   | 0            | 59.97                      | -                  | -           | 74                  | -14.03         | 33             | 107         | V        |
| * 2.497         | 31.16                | MAv1 | 32.4           | -23.2                   | .37          | 40.73                      | 54                 | -13.27      | -                   | -              | 33             | 107         | V        |
| * 4.879         | 44.56                | PK2  | 34.1           | -27.3                   | 0            | 51.36                      | -                  | -           | 74                  | -22.64         | 58             | 243         | H        |
| * 4.88          | 38.26                | MAv1 | 34.1           | -27.3                   | .37          | 45.43                      | 54                 | -8.57       | -                   | -              | 58             | 243         | H        |
| * 7.321         | 38.49                | PK2  | 35.7           | -24                     | 0            | 50.19                      | -                  | -           | 74                  | -23.81         | 217            | 295         | H        |
| * 7.321         | 29.25                | MAv1 | 35.7           | -24                     | .37          | 41.32                      | 54                 | -12.68      | -                   | -              | 217            | 295         | H        |

\* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band  
 PK2 - KDB558074 Method: Maximum Peak  
 MAv1 - KDB558074 Option 1 Maximum RMS Average

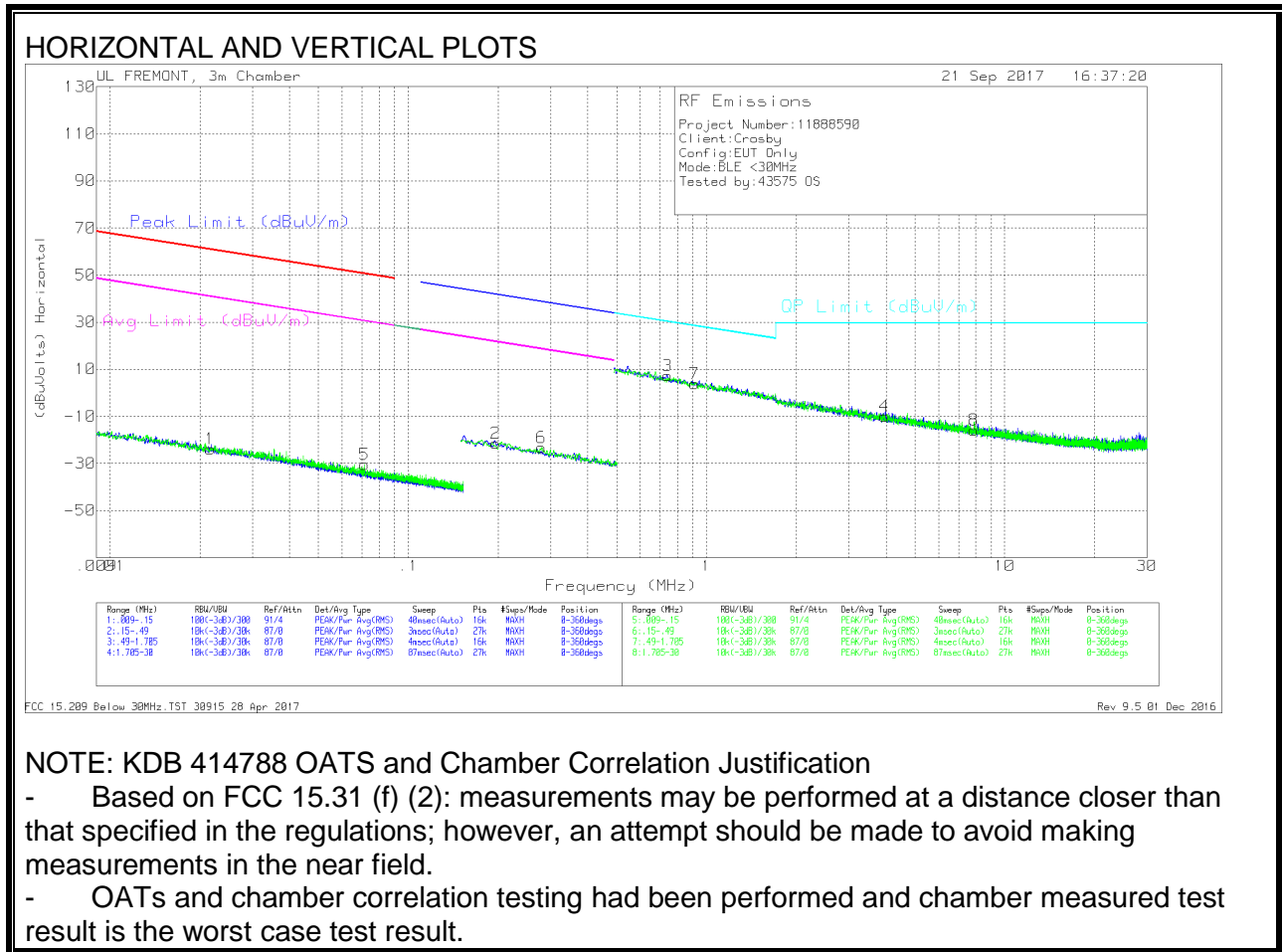


Radiated Emissions

| Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T862 (dB/m) | Amp/Cbl/Filtr/ Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|-----------------|----------------------|------|----------------|-------------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| * 2.363         | 51.88                | PK2  | 31.6           | -23.2                   | 0            | 60.28                      | -                  | -           | 74                  | -13.72         | 63             | 217         | H        |
| * 2.363         | 31.72                | MAv1 | 31.6           | -23.2                   | .37          | 40.49                      | 54                 | -13.51      | -                   | -              | 63             | 217         | H        |
| * 2.498         | 51.62                | PK2  | 32.4           | -23.2                   | 0            | 60.82                      | -                  | -           | 74                  | -13.18         | 57             | 243         | H        |
| * 2.498         | 33.51                | MAv1 | 32.4           | -23.2                   | .37          | 43.08                      | 54                 | -10.92      | -                   | -              | 57             | 243         | H        |
| * 2.363         | 51.74                | PK2  | 31.6           | -23.2                   | 0            | 60.14                      | -                  | -           | 74                  | -13.86         | 37             | 115         | V        |
| * 2.363         | 30.42                | MAv1 | 31.6           | -23.2                   | .37          | 39.19                      | 54                 | -14.81      | -                   | -              | 37             | 115         | V        |
| * 2.498         | 51.9                 | PK2  | 32.4           | -23.2                   | 0            | 61.1                       | -                  | -           | 74                  | -12.9          | 22             | 101         | V        |
| * 2.498         | 33.78                | MAv1 | 32.4           | -23.2                   | .37          | 43.35                      | 54                 | -10.65      | -                   | -              | 22             | 101         | V        |
| * 4.96          | 47.43                | PK2  | 34.2           | -27.9                   | 0            | 53.73                      | -                  | -           | 74                  | -20.27         | 45             | 225         | H        |
| * 4.96          | 41.33                | MAv1 | 34.2           | -27.9                   | .37          | 48                         | 54                 | -6          | -                   | -              | 45             | 225         | H        |
| * 4.96          | 48.83                | PK2  | 34.2           | -27.9                   | 0            | 55.13                      | -                  | -           | 74                  | -18.87         | 222            | 400         | V        |
| * 4.96          | 42.75                | MAv1 | 34.2           | -27.9                   | .37          | 49.42                      | 54                 | -4.58       | -                   | -              | 222            | 400         | V        |

\* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band  
 PK2 - KDB558074 Method: Maximum Peak  
 MAv1 - KDB558074 Option 1 Maximum RMS Average

### 9.3. SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



#### Trace Markers

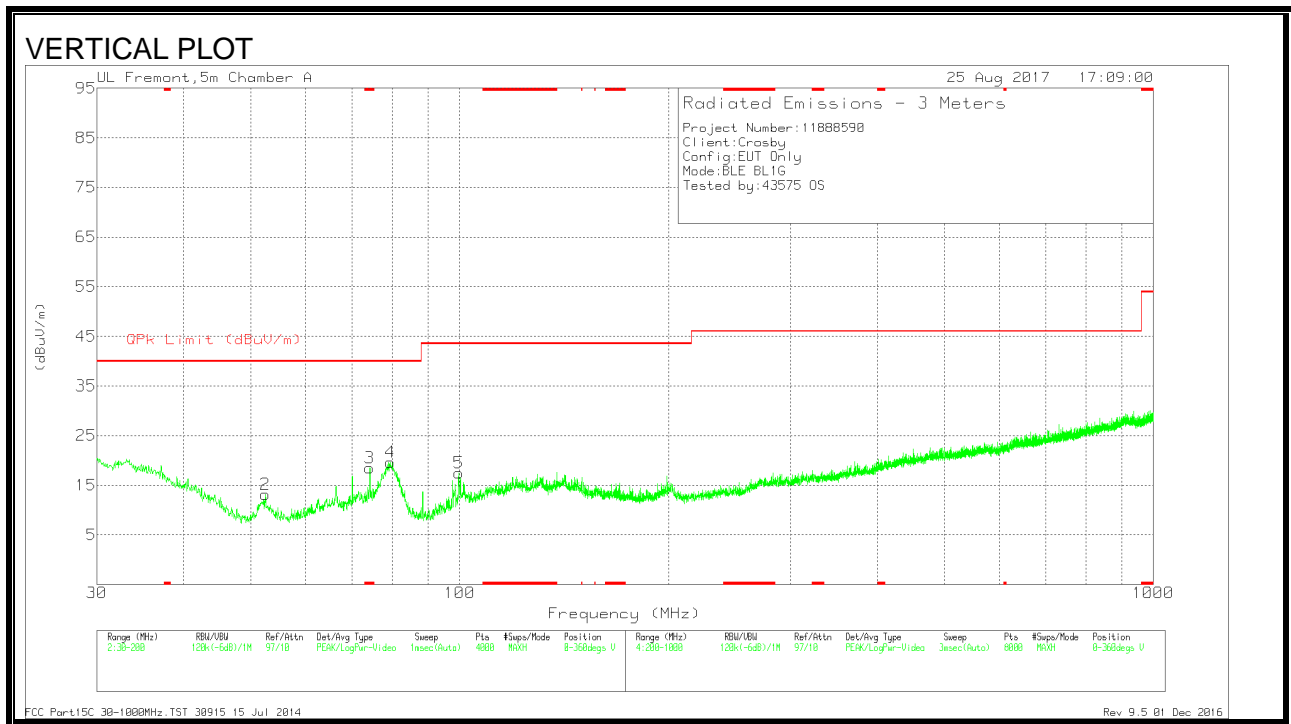
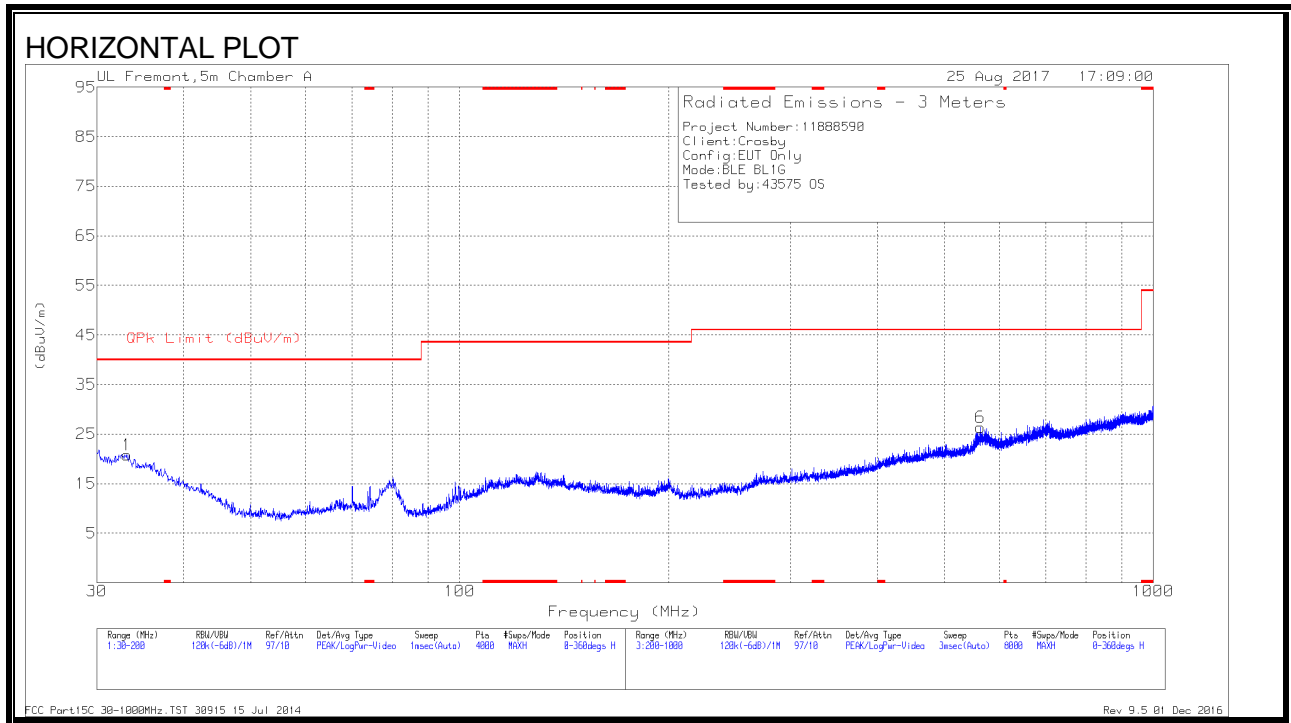
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Loop Antenna (dB/m) | Cbl (dB) | Dist Corr 300m | Corrected Reading (dBuVolts) | Peak Limit (dBuV/m) | Margin (dB) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Avg Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) |
|--------|-----------------|----------------------|-----|---------------------|----------|----------------|------------------------------|---------------------|-------------|--------------------|-------------|---------------------|-------------|--------------------|-------------|----------------|
| 1      | .0217           | 39.76                | Pk  | 15.1                | 1.4      | -80            | -23.74                       | 60.86               | -84.6       | 40.86              | -64.6       | -                   | -           | -                  | -           | 0-360          |
| 5      | .07115          | 36.26                | Pk  | 12                  | 1.4      | -80            | -30.34                       | 50.54               | -80.88      | 30.54              | -60.88      | -                   | -           | -                  | -           | 0-360          |
| 2      | 1.9635          | 45.66                | Pk  | 11.6                | 1.5      | -80            | -21.34                       | -                   | -           | -                  | -           | 41.76               | -63.1       | 21.76              | -43.1       | 0-360          |
| 6      | 2.7961          | 43.63                | Pk  | 11.5                | 1.5      | -80            | -23.37                       | -                   | -           | -                  | -           | 38.68               | -62.05      | 18.68              | -42.05      | 0-360          |

#### Pk - Peak detector

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Loop Antenna (dB/m) | Cbl (dB) | Dist Corr 30m | Corrected Reading (dBuVolts) | Peak Limit (dBuV/m) | Margin (dB) | Avg Limit (dBuV/m) | Margin (dB) | OP Limit (dBuV/m) | Margin (dB) | OP Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) |
|--------|-----------------|----------------------|-----|---------------------|----------|---------------|------------------------------|---------------------|-------------|--------------------|-------------|-------------------|-------------|-------------------|-------------|----------------|
| 3      | .74008          | 34.28                | Pk  | 11.5                | 1.5      | -40           | 7.28                         | -                   | -           | -                  | -           | -                 | -           | 30.23             | -22.95      | 0-360          |
| 7      | .9102           | 30.83                | Pk  | 11.5                | 1.5      | -40           | 3.83                         | -                   | -           | -                  | -           | -                 | -           | 28.44             | -24.61      | 0-360          |
| 4      | 3.94982         | 16.89                | Pk  | 11.6                | 1.5      | -40           | -10.01                       | -                   | -           | -                  | -           | -                 | -           | 29.5              | -39.51      | 0-360          |
| 8      | 7.88401         | 11.48                | Pk  | 11.1                | 1.5      | -40           | -15.92                       | -                   | -           | -                  | -           | -                 | -           | 29.5              | -45.42      | 0-360          |

#### Pk - Peak detector

### 9.4. SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AF T130 (dB/m) | Amp/Cbl (dB/m) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|----------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 3      | * 74.2114       | 36.84                | Pk  | 12.4           | -30.8          | 18.44                      | 40                 | -21.56      | 0-360          | 100         | V        |
| 1      | 33.1246         | 28.39                | Pk  | 23.6           | -31.2          | 20.79                      | 40                 | -19.21      | 0-360          | 300         | H        |
| 2      | 52.4883         | 32.83                | Pk  | 11.2           | -30.9          | 13.13                      | 40                 | -26.87      | 0-360          | 100         | V        |
| 4      | 79.4828         | 38.47                | Pk  | 11.9           | -30.7          | 19.67                      | 40                 | -20.33      | 0-360          | 100         | V        |
| 5      | 99.6755         | 33.94                | Pk  | 14.1           | -30.6          | 17.44                      | 43.52              | -26.08      | 0-360          | 100         | V        |
| 6      | 563.2472        | 32.44                | Pk  | 22.6           | -28.7          | 26.34                      | 46.02              | -19.68      | 0-360          | 300         | H        |

Pk - Peak detector

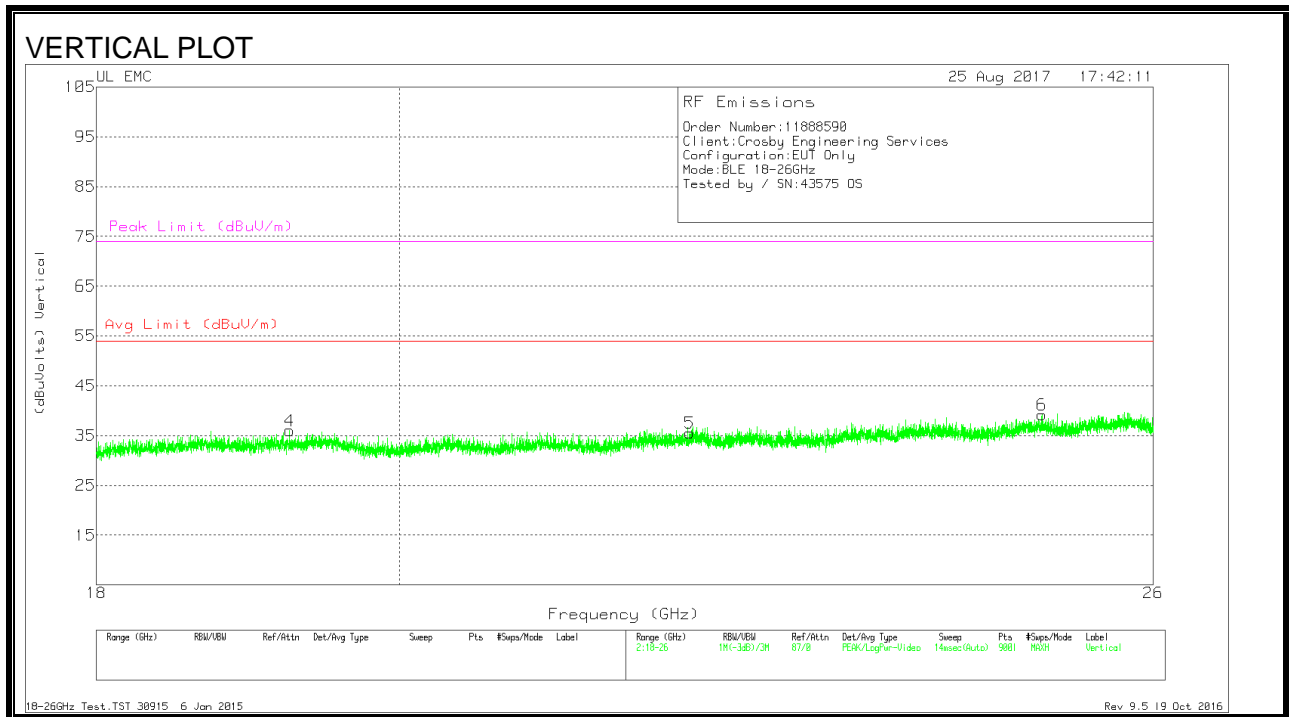
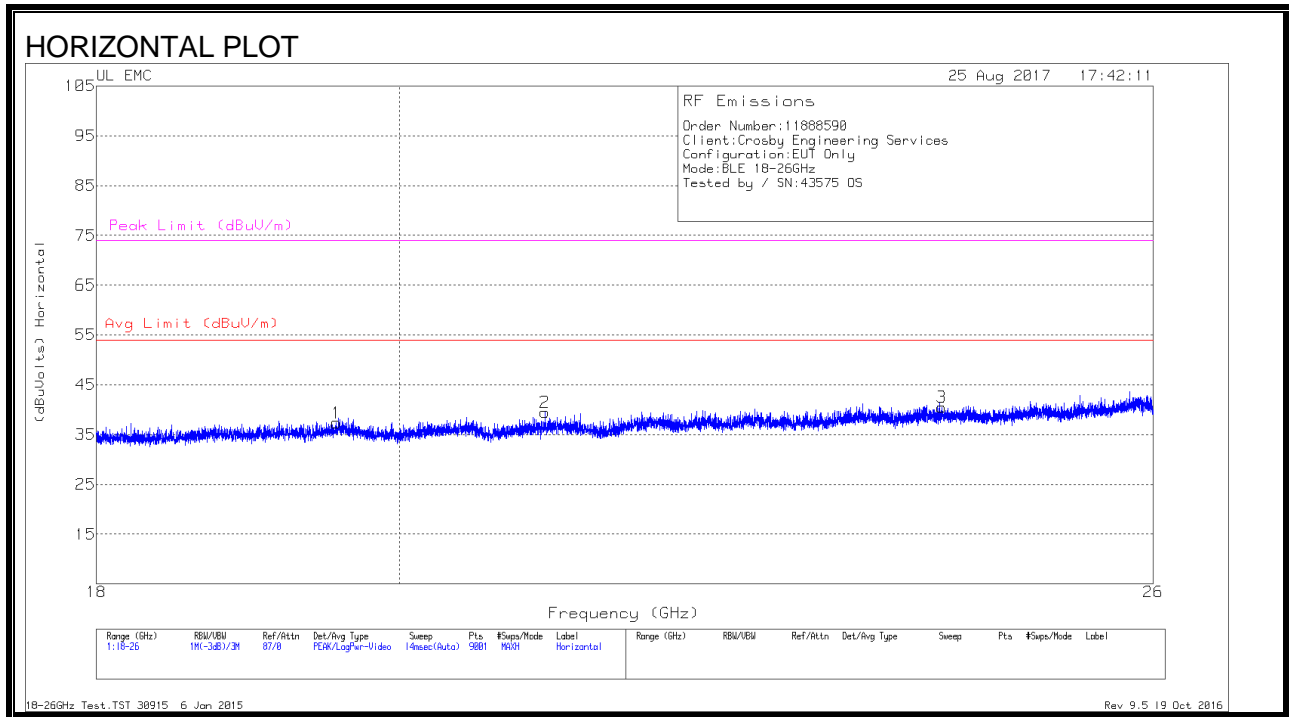
Radiated Emissions

| Frequency (MHz) | Meter Reading (dBuV) | Det | AF T130 (dB/m) | Amp/Cbl (dB/m) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|-----------------|----------------------|-----|----------------|----------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 33.1409         | 23.44                | Qp  | 23.6           | -31.2          | 15.84                      | 40                 | -24.16      | 347            | 363         | H        |

Qp - Quasi-Peak detector

## 9.5. SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION)

### SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL)





**DATA**

| Marker | Frequenc<br>y<br>(GHz) | Meter<br>Reading<br>(dBuV) | Det | T449 AF<br>(dB/m) | Amp/Cbl (dB) | Dist Corr<br>(dB) | Corrected<br>Reading<br>(dBuVolts<br>) | Avg Limit<br>(dBuV/m) | Margin<br>(dB) | Peak Limit<br>(dBuV/m) | PK<br>Margin<br>(dB) |
|--------|------------------------|----------------------------|-----|-------------------|--------------|-------------------|--|-----------------------|----------------|------------------------|----------------------|
| 1      | 19.567                 | 36.07                      | Pk  | 32.7              | -21.9        | -9.5              | 37.37                                  | 54                    | -16.63         | 74                     | -36.63               |
| 2      | 21.041                 | 37.58                      | Pk  | 33.2              | -21.8        | -9.5              | 39.48                                  | 54                    | -14.52         | 74                     | -34.52               |
| 3      | 24.155                 | 36.38                      | Pk  | 33.9              | -20.3        | -9.5              | 40.48                                  | 54                    | -13.52         | 74                     | -33.52               |
| 4      | 19.252                 | 34.5                       | Pk  | 32.6              | -21.6        | -9.5              | 36                                     | 54                    | -18            | 74                     | -38                  |
| 5      | 22.129                 | 32.61                      | Pk  | 33.4              | -21          | -9.5              | 35.51                                  | 54                    | -18.49         | 74                     | -38.49               |
| 6      | 25.012                 | 34.59                      | Pk  | 34.4              | -20.3        | -9.5              | 39.19                                  | 54                    | -14.81         | 74                     | -34.81               |

Pk - Peak detector