



# **CERTIFICATION TEST REPORT**

**Report Number. :** 11692709-E6V2

**Applicant :** QUALCOMM TECHNOLOGIES, INC.  
5770 MOREHOUSE DRIVE,  
SAN DIEGO, CA 92121, USA

**FCC ID :** J9C2NET2LTE  
**IC :** 2723A-2NET2LTE

**Model Number :** QCL-HUB-2.0-US

**EUT Description :** WIRELESS DATA HUB

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C  
INDUSTRY CANADA RSS - 247 ISSUE 2

**Date Of Issue:**

September 15, 2017

**Prepared by:**

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NVLAP LAB CODE 200065-0

Revision History

| Rev. | Issue Date | Revisions         | Revised By |
|------|------------|-------------------|------------|
| V1   | 08/08/17   | Initial Issue     | --         |
| V2   | 09/15/17   | Updated Section 8 | Eric Yu    |

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** QUALCOMM TECHNOLOGIES, INC.  
5770 MOREHOUSE DRIVE,  
SAN DIEGO, CA 92121 USA

**EUT DESCRIPTION:** WIRELESS DATA HUB

**SERIAL NUMBER:** QUALC001TN10M1RP74, QUALC001TN10M1RN3C

**DATE TESTED:** AUGUST 03 to SEPTEMBER 08, 2017

| APPLICABLE STANDARDS            |              |
|---------------------------------|--------------|
| STANDARD                        | TEST RESULTS |
| CFR 47 Part 15 Subpart C        | Pass         |
| INDUSTRY CANADA RSS-247 Issue 2 | Pass         |
| INDUSTRY CANADA RSS-GEN Issue 4 | 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  
PROGRAM MANAGER  
UL VERIFICATION SERVICES INC.

Prepared By:



TOM CHEN  
LABORATORY ENGINEER  
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, RSS-GEN Issue 4, and RSS-247 Issue 2.

## 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 checked="" type="checkbox"/> Chamber D(IC: 22541-1) |
| <input checked="" 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. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.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:

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

### 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

This EUT is a 2net2 device (LTE North American Version AT&T) that has the following radio modules:

- Wistron WWAN module, M14Q2FG.
- Qualcomm Unlicensed Module, QCA WCN 3660.

### 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  | 1.71               | 1.48              |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Monopole antenna with a maximum gain of 2.1dBi.

### 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was adb Ver.1.0.26, QPSR Ver.5.4



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## **5.5. WORST-CASE CONFIGURATION AND MODE**

The fundamental of the EUT was investigated in three orthogonal orientations X/Y/Z, it was determined that X orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation

Radiated emission below 1 GHz, above 18 GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

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

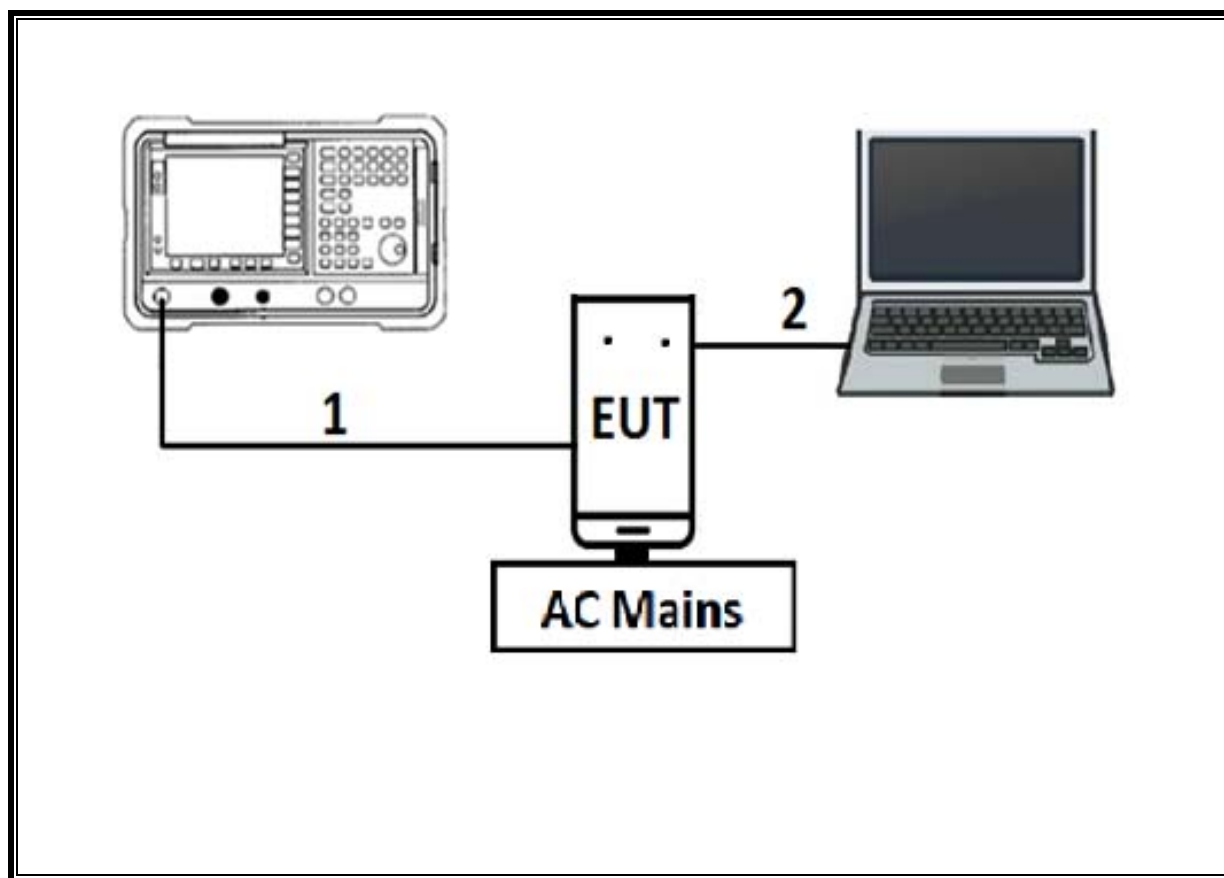
## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |                 |                |        |
|------------------------|--------------|-----------------|----------------|--------|
| Description            | Manufacturer | Model           | Serial Number  | FCC ID |
| AC Adapter             | HP           | PPP012D-S       | WCNXF0AAR4QOCS | N/A    |
| Laptop                 | HP           | EliteBook 6930p | 2CE00821BZ     | N/A    |

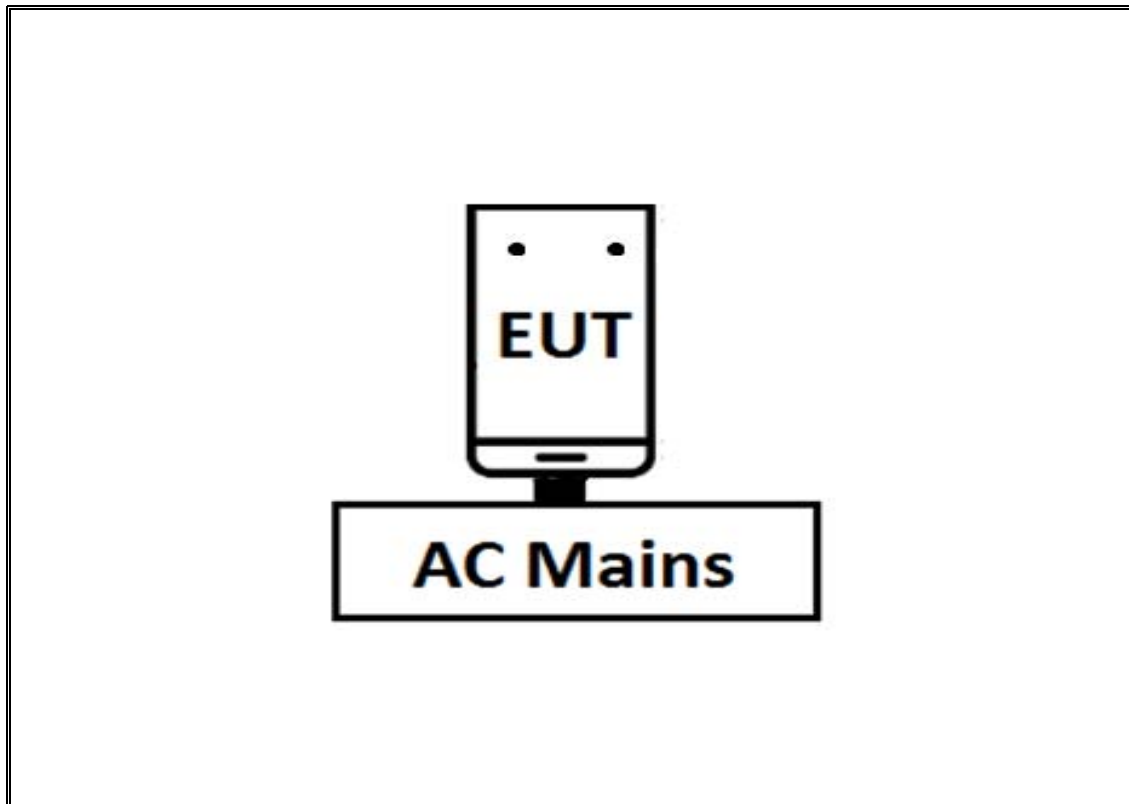
### I/O CABLES (CONDUCTED TEST)

| I/O Cable List |         |                      |                |             |                  |                      |
|----------------|---------|----------------------|----------------|-------------|------------------|----------------------|
| Cable No       | Port    | # of identical ports | Connector Type | Cable Type  | Cable Length (m) | Remarks              |
| 1              | Antenna | 1                    | RF             | Shielded    | 0.2              | To Spectrum Analyzer |
| 2              | USB     | 1                    | USB            | Un-shielded | 1m               | Laptop to EUT        |

**CONDUCTED TEST SETUP DIAGRAM**

**TEST SETUP**

**RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM**



## 6. TEST AND MEASUREMENT EQUIPMENT

| TEST EQUIPMENT LIST                                   |                                 |                         |       |            |
|-------------------------------------------------------|---------------------------------|-------------------------|-------|------------|
| Description                                           | Manufacturer                    | Model                   | Asset | Cal Due    |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz w/4dB Pad | Sunol Sciences Corp.            | JB3                     | T477  | 06/22/2018 |
| Antenna, Active Loop 9kHz-30MHz                       | ETS-Lindgren                    | 6502                    | T1683 | 02/17/2018 |
| Antenna, Horn 1-18GHz                                 | ETS-Lindgren                    | 3117                    | T712  | 01/30/2018 |
| Antenna, Horn 18-26.5GHz                              | ARA                             | MWH-1826/B              | T449  | 06/12/2018 |
| Power Meter, P-series single channel                  | Agilent (Keysight) Technologies | N1911A                  | T1264 | 07/08/2018 |
| Power Sensor, P – series, 50MHz to 18GHz, Wideband    | Agilent (Keysight) Technologies | N1921A                  | T413  | 06/20/2018 |
| Amplifier, 1-26.5GHz                                  | MITEQ                           | AFS42-00101800-25-S-42  | T1165 | 08/01/2018 |
| Amplifier, 1-26.5GHz                                  | Agilent (Keysight) Technologies | 8449B                   | T404  | 07/05/2018 |
| Amplifier, 10kHz-1GHz                                 | Agilent (Keysight) Technologies | 8447D                   | T15   | 08/26/2017 |
| Amplifier, 1-8 GHz                                    | MITEQ                           | AMF-4D-01000800-30-29P  | T1170 | 04/28/2018 |
| Spectrum Analyzer, PSA, 3Hz to 26.5GHz                | Agilent (Keysight) Technologies | E4440A                  | T908  | 04/13/2018 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz                  | Agilent (Keysight) Technologies | N9030A                  | T907  | 01/23/2018 |
| Spectrum Analyzer, PSA, 3Hz to 26.5GHz                | Agilent (Keysight) Technologies | E9030A                  | T905  | 01/11/2018 |
| LISN                                                  | FISCHER                         | FCC-LISN-50/250-25-2-01 | T1310 | 06/08/2018 |

| 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 6.8, June 08, 2017 |

## 7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 558074 D01 v04, Section 6.

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.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

## 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME, DUTY CYCLE

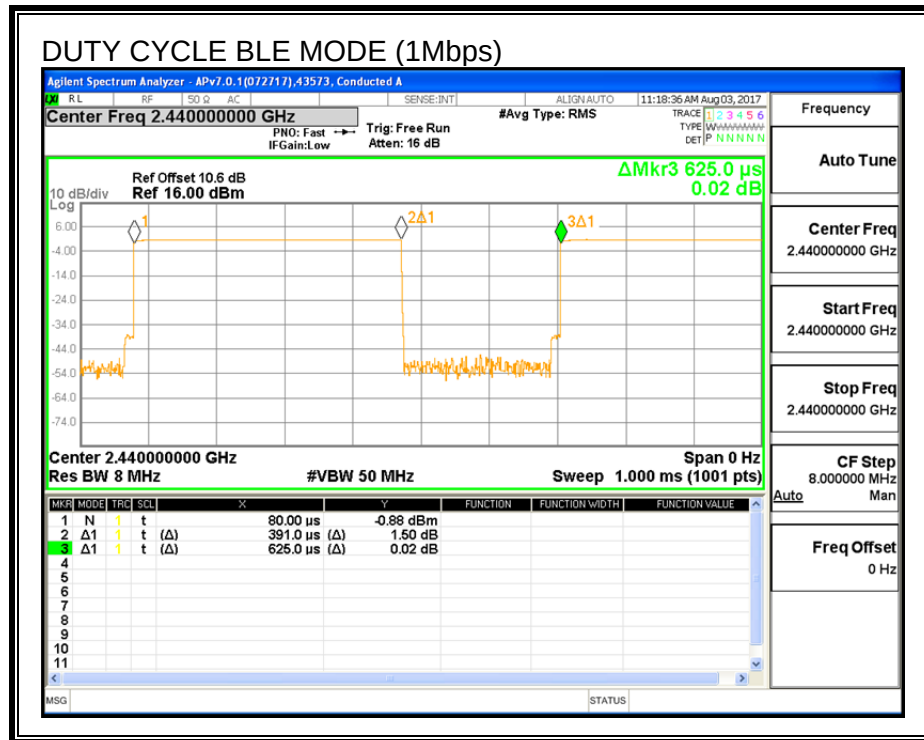
#### LIMITS

None; for reporting purposes only.

#### ON TIME AND DUTY CYCLE RESULTS

| Mode        | ON Time<br>(msec) | Period<br>(msec) | Duty<br>Cycle x<br>(linear) | Duty<br>Cycle<br>(%) | Duty Cycle<br>Correction<br>Factor (dB) | 1/T<br>Minimum<br>VBW (kHz) |
|-------------|-------------------|------------------|-----------------------------|----------------------|-----------------------------------------|-----------------------------|
| BLE (1Mbps) | 0.391             | 0.625            | 0.6256                      | 62.56                | 2.04                                    | 0.255                       |

**DUTY CYCLE PLOT**





## 8.2. 6 dB BANDWIDTH

### LIMITS

FCC §15.247 (a) (2)

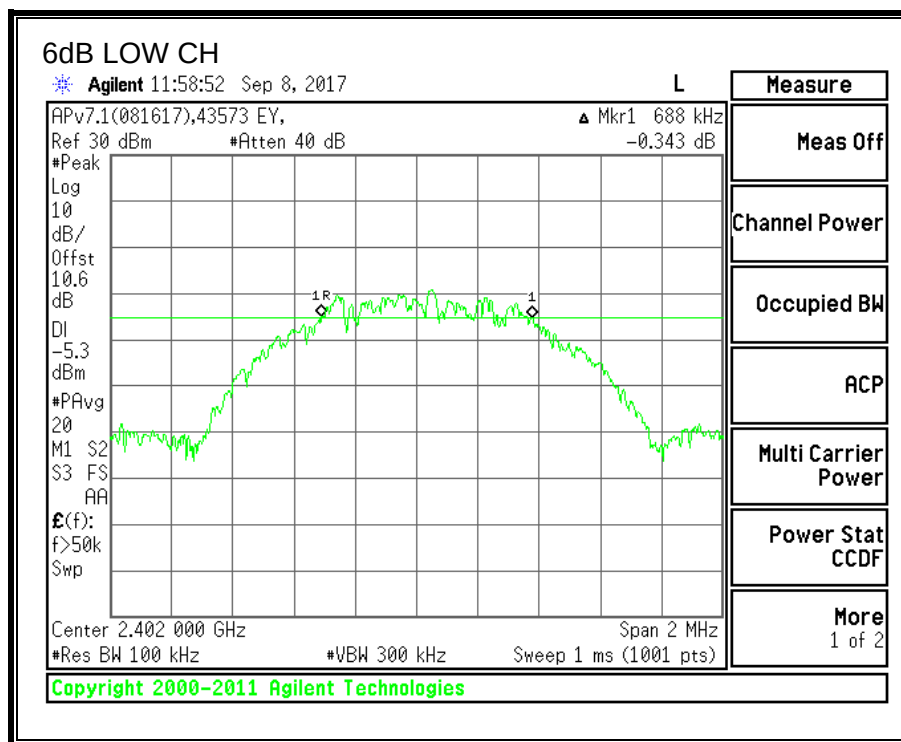
IC RSS-247 (5.2) (a)

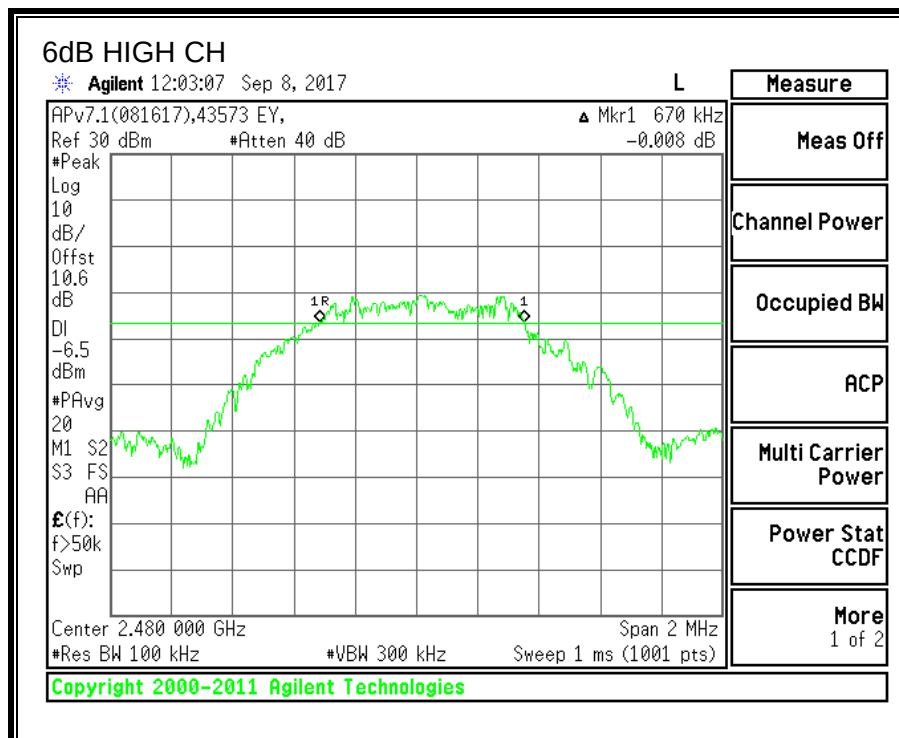
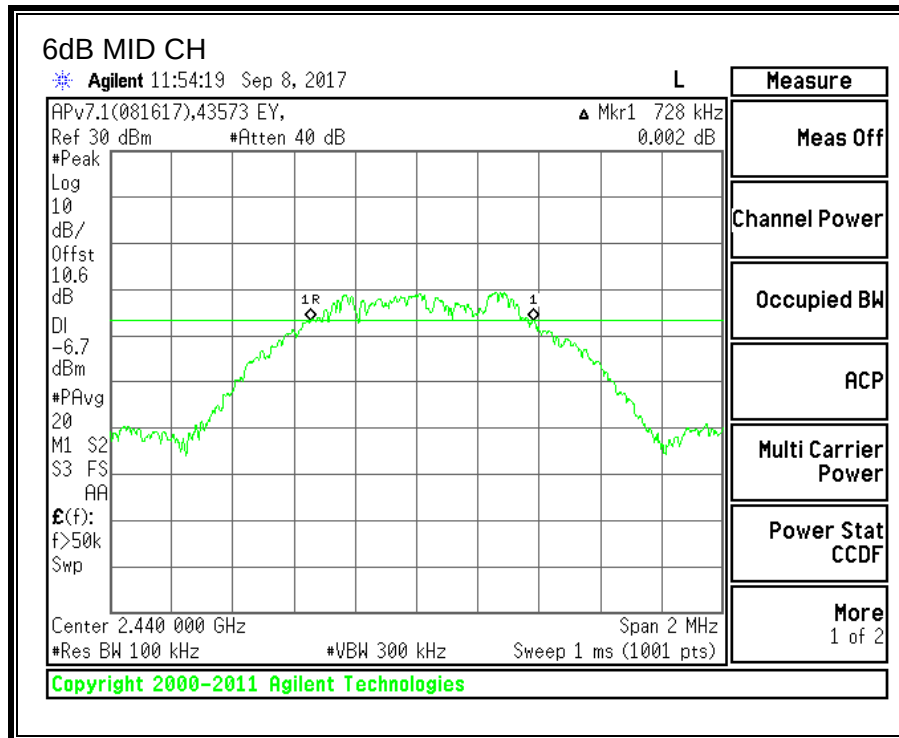
The minimum 6 dB bandwidth shall be at least 500 kHz.

### RESULTS

#### 6 dB BANDWIDTH

| Channel | Frequency | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) |
|---------|-----------|----------------------|---------------------|
| Low     | 2402      | 0.688                | 0.5                 |
| Middle  | 2440      | 0.728                | 0.5                 |
| High    | 2480      | 0.670                | 0.5                 |





### 8.3. 99% BANDWIDTH

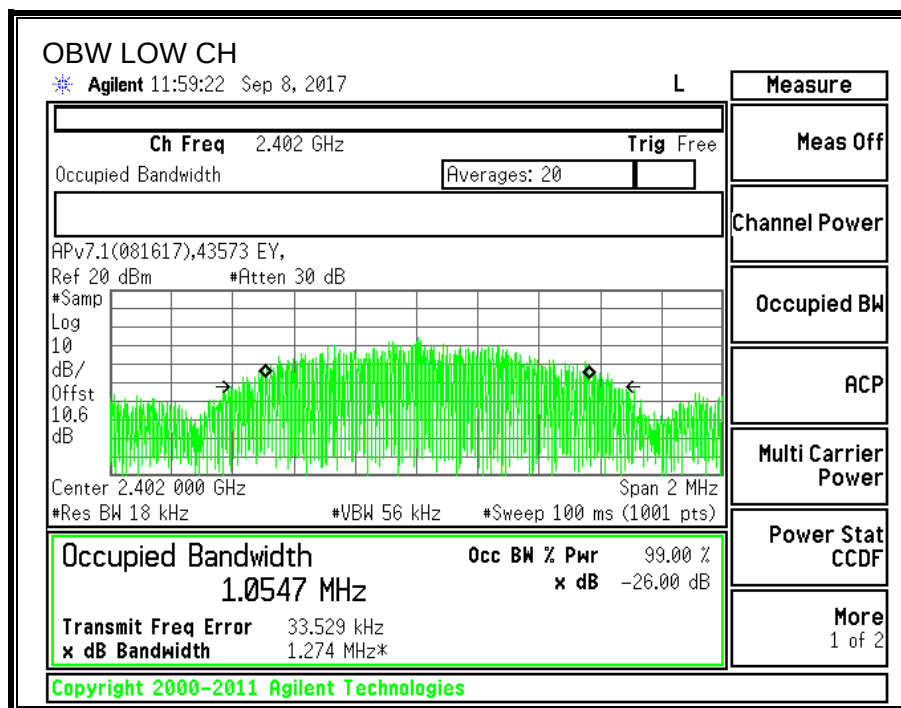
#### LIMITS

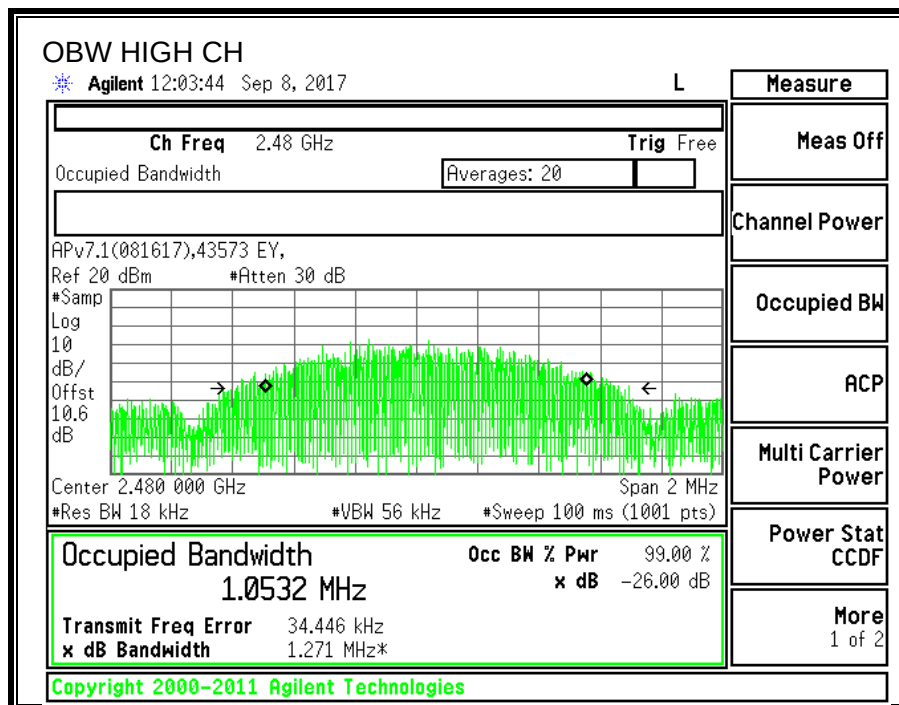
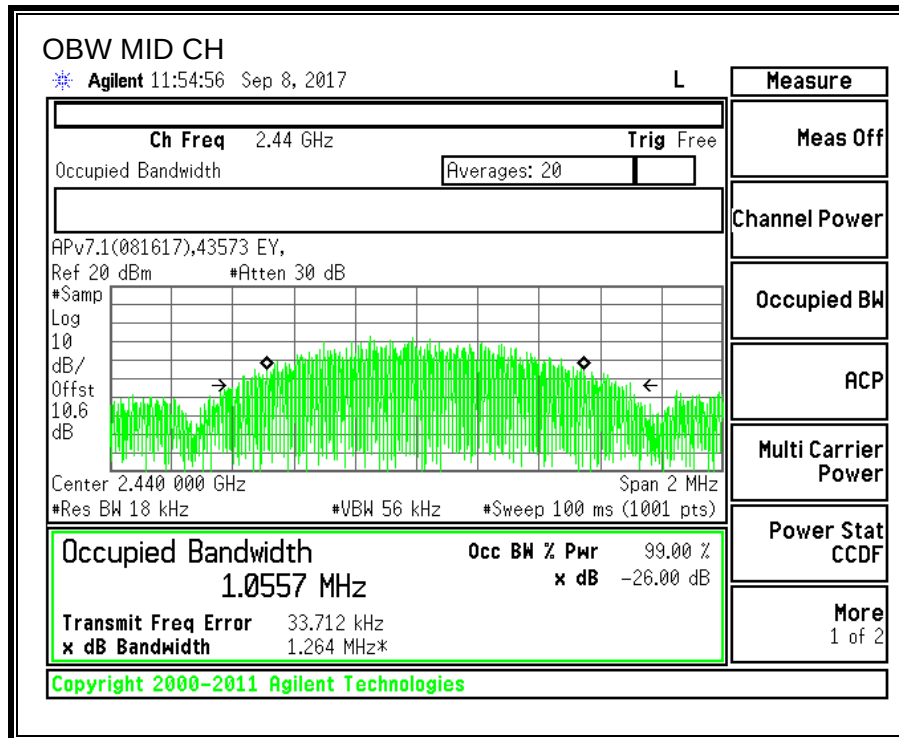
None; for reporting purposes only.

#### RESULTS

##### 99% BANDWIDTH

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low     | 2402            | 1.0547              |
| Middle  | 2440            | 1.0557              |
| High    | 2480            | 1.0532              |





## 8.4. OUTPUT POWER

### LIMITS

FCC §15.247 (b)

IC RSS-247 (5.4) (d)

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

### RESULTS

|                       |       |              |          |
|-----------------------|-------|--------------|----------|
| <b>TEST ENGINEER:</b> | 43573 | <b>Date:</b> | 08/03/17 |
|-----------------------|-------|--------------|----------|

### OUTPUT POWER

| Channel | Frequency (MHz) | Peak Power Reading (dBm) | Limit (dBm) | Margin (dB) |
|---------|-----------------|--------------------------|-------------|-------------|
| Low     | 2402            | 1.71                     | 30          | -28.290     |
| Middle  | 2440            | 0.70                     | 30          | -29.300     |
| High    | 2480            | 0.39                     | 30          | -29.610     |

## 8.5. POWER SPECTRAL DENSITY

### LIMITS

FCC §15.247 (e)

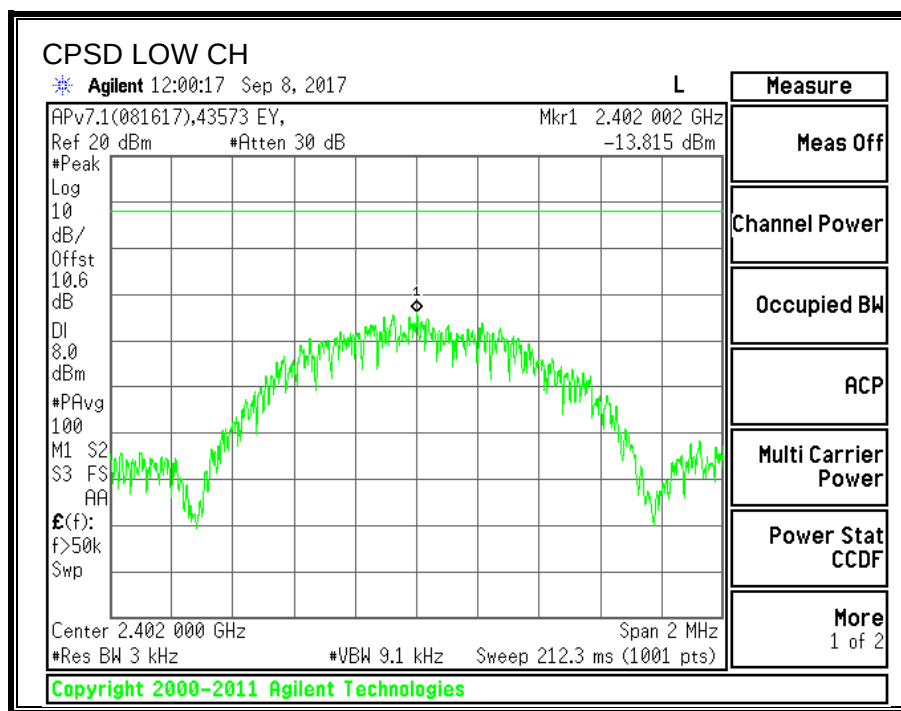
IC RSS-247 (5.2) (b)

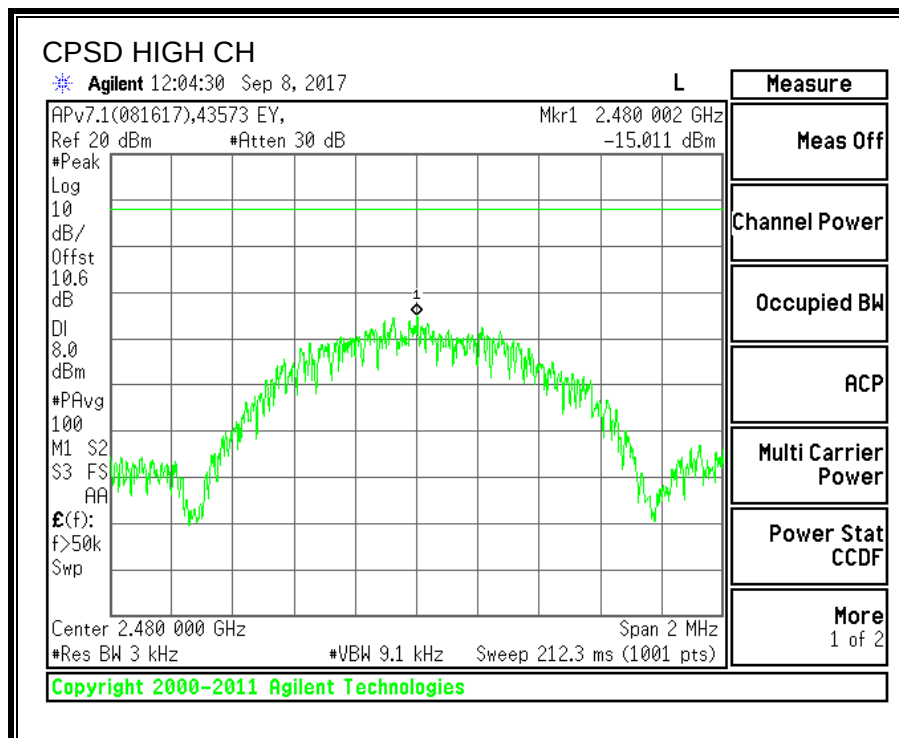
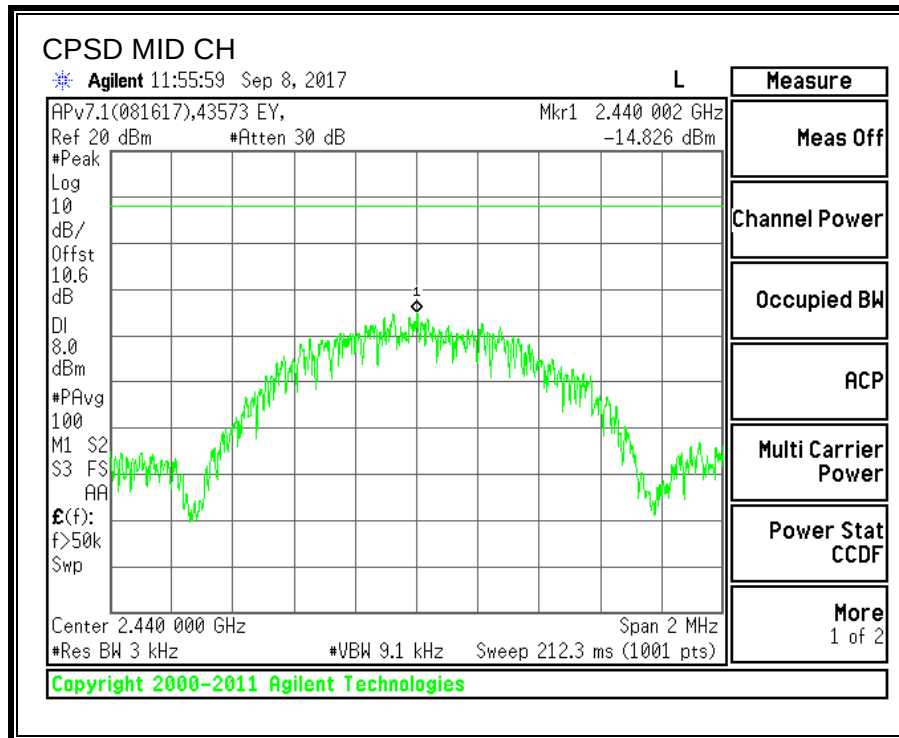
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### RESULTS

#### POWER SPECTRAL DENSITY

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Margin (dB) |
|---------|-----------------|----------------|------------------|-------------|
| Low     | 2402            | -13.815        | 8                | -21.815     |
| Middle  | 2440            | -14.826        | 8                | -22.826     |
| High    | 2480            | -15.011        | 8                | -23.011     |





## 8.6. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

### LIMITS

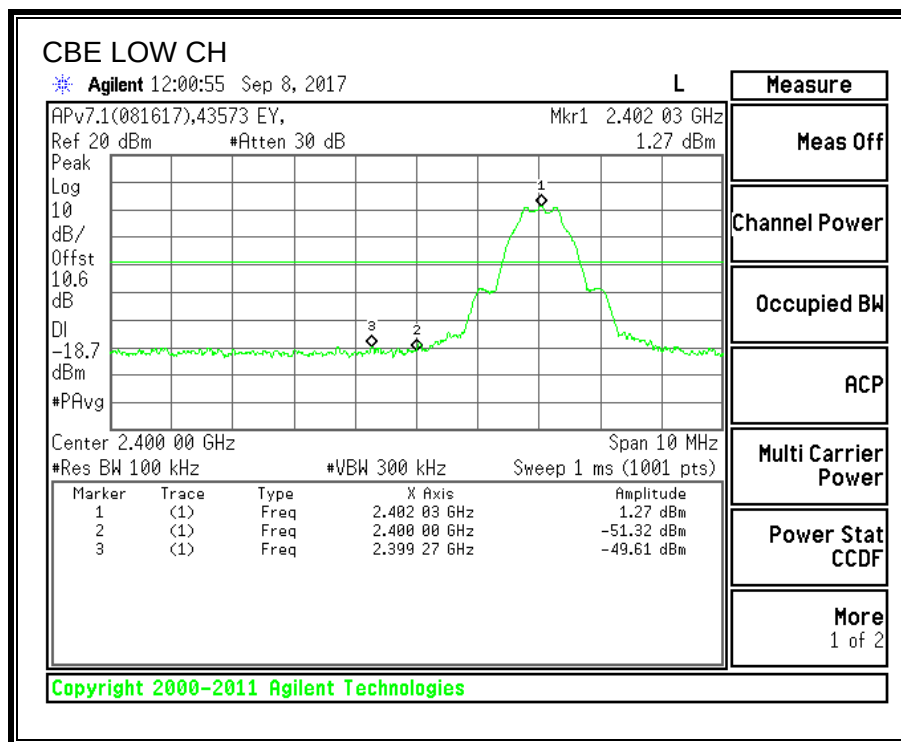
FCC §15.247 (d)

IC RSS-247 (5.5)

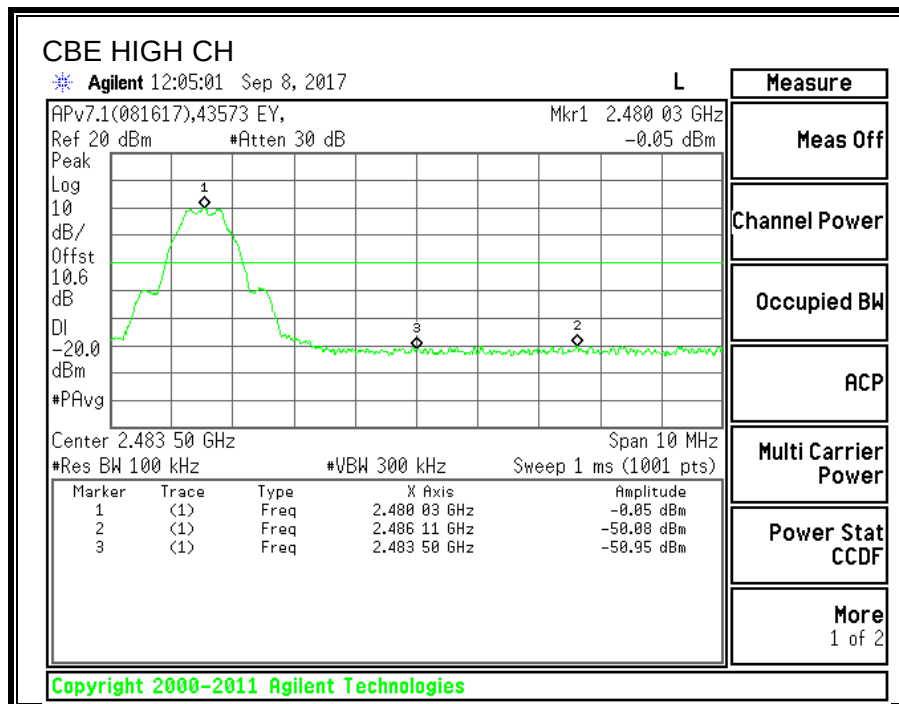
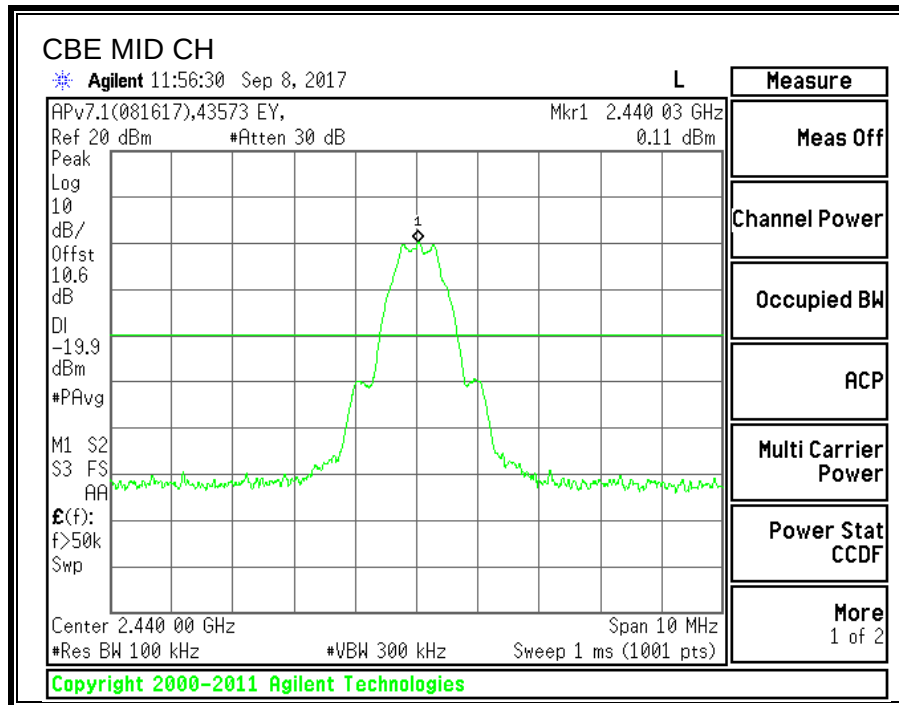
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

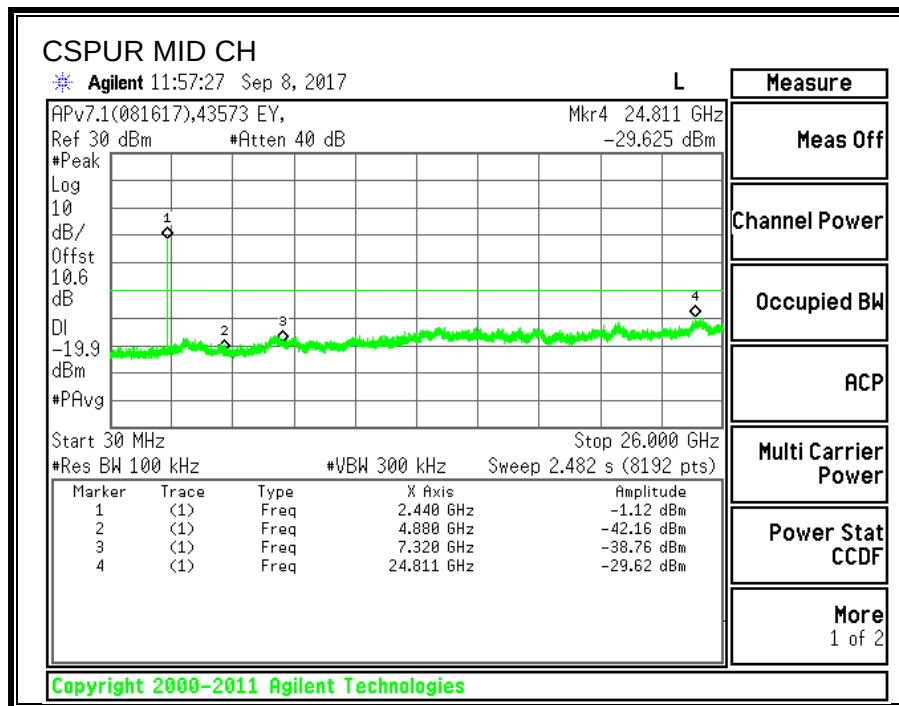
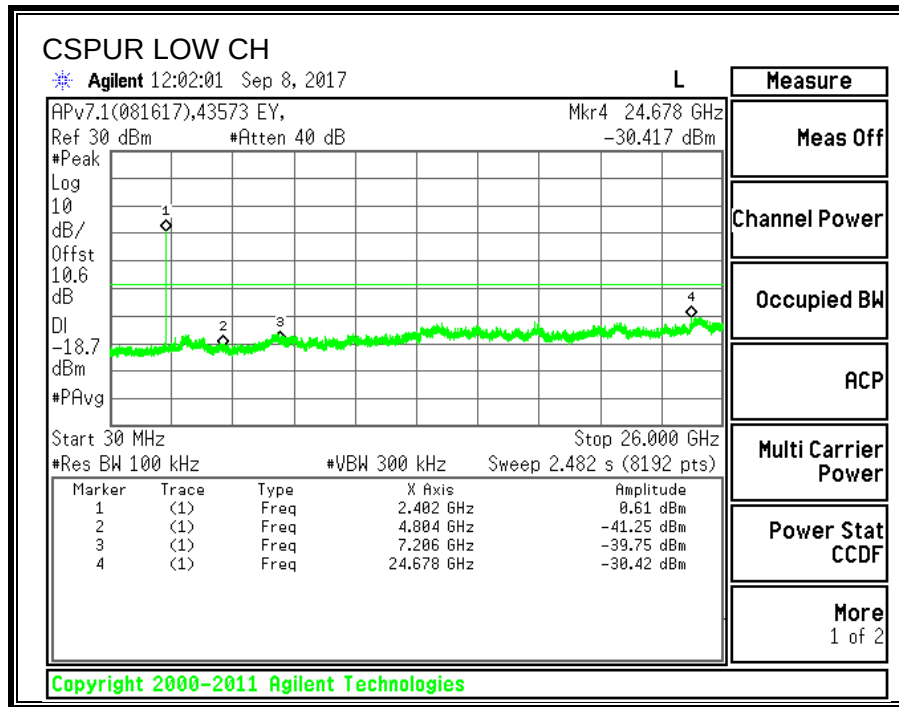
### RESULTS

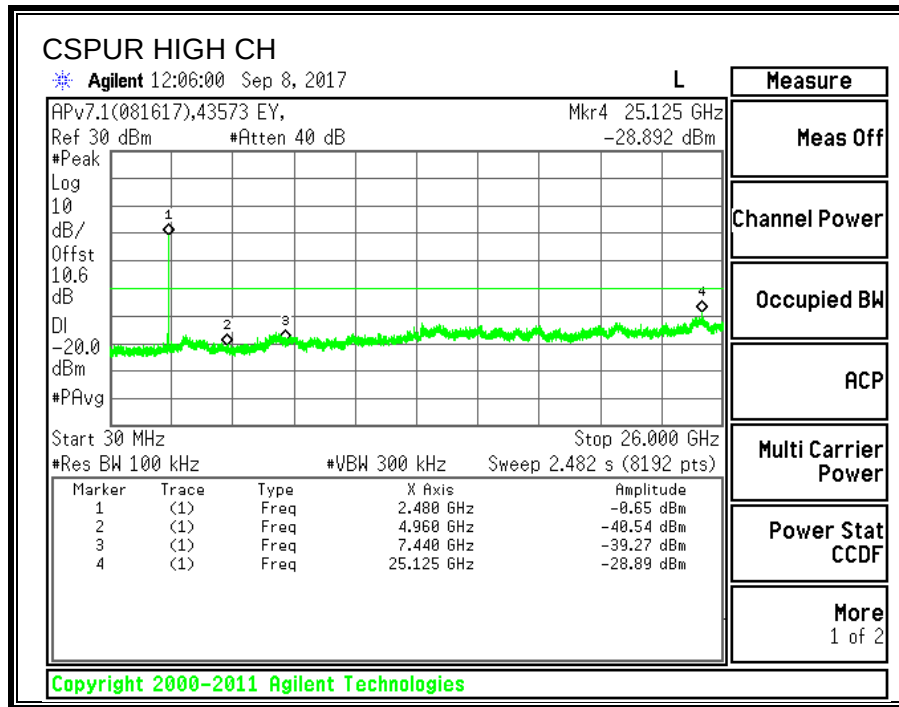
#### CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS











## 9. RADIATED TEST RESULTS

### 9.1. LIMITS AND PROCEDURE

#### LIMITS

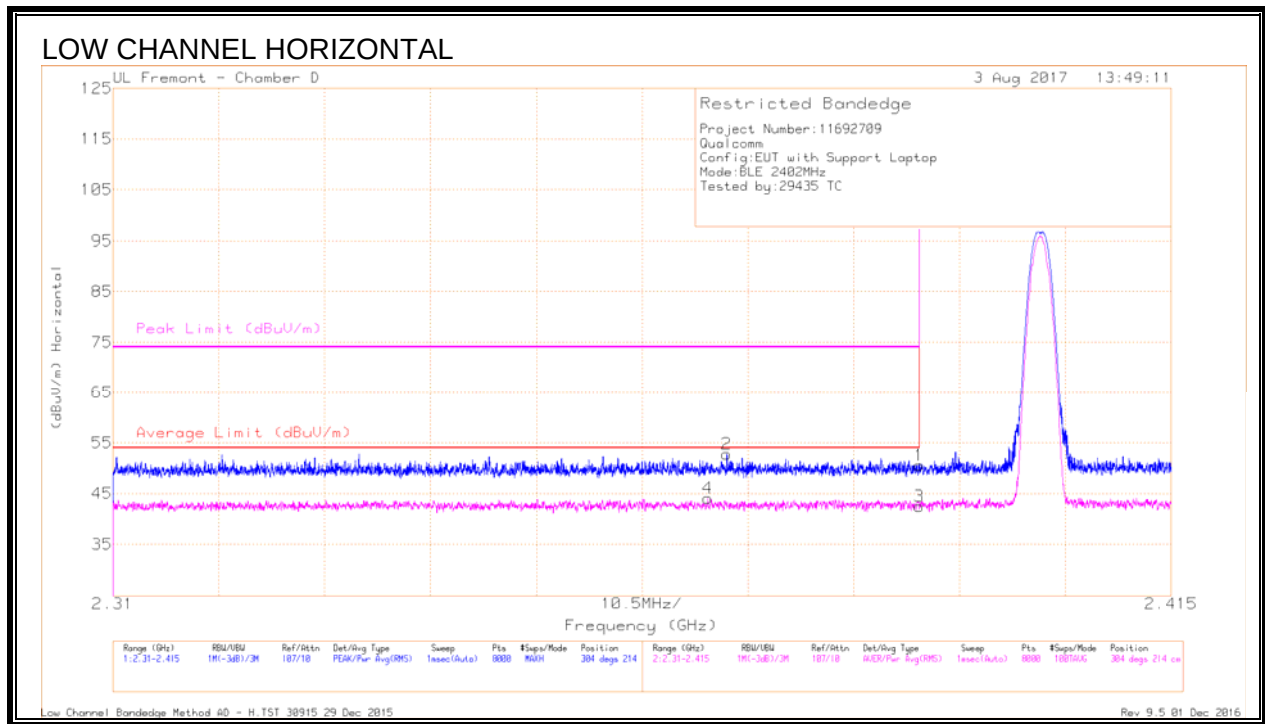
FCC §15.205 and §15.209  
IC RSS-GEN, Section 8.9 and 8.10.

| 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 BANDEDGE (LOW CHANNEL)



#### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | Af T711 (dB/m) | Amp/Ch/Fltr/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Altitude (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|----------------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|-----------------|-------------|----------|
| 1      | * 2.39          | 39.16                | Pk  | 32.1           | -20.7                | 0            | 50.56                      | -                      | -           | 74                  | -23.44         | 304             | 214         | H        |
| 2      | * 2.371         | 41.56                | Pk  | 32.1           | -20.9                | 0            | 52.76                      | -                      | -           | 74                  | -21.24         | 304             | 214         | H        |
| 3      | * 2.39          | 29.06                | RMS | 32.1           | -20.7                | 2.04         | 42.5                       | 54                     | -11.5       | -                   | -              | 304             | 214         | H        |
| 4      | * 2.369         | 30.82                | RMS | 32.1           | -20.9                | 2.04         | 44.06                      | 54                     | -9.94       | -                   | -              | 304             | 214         | H        |

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

Pk - Peak detector

RMS - RMS detection



## Trace Markers

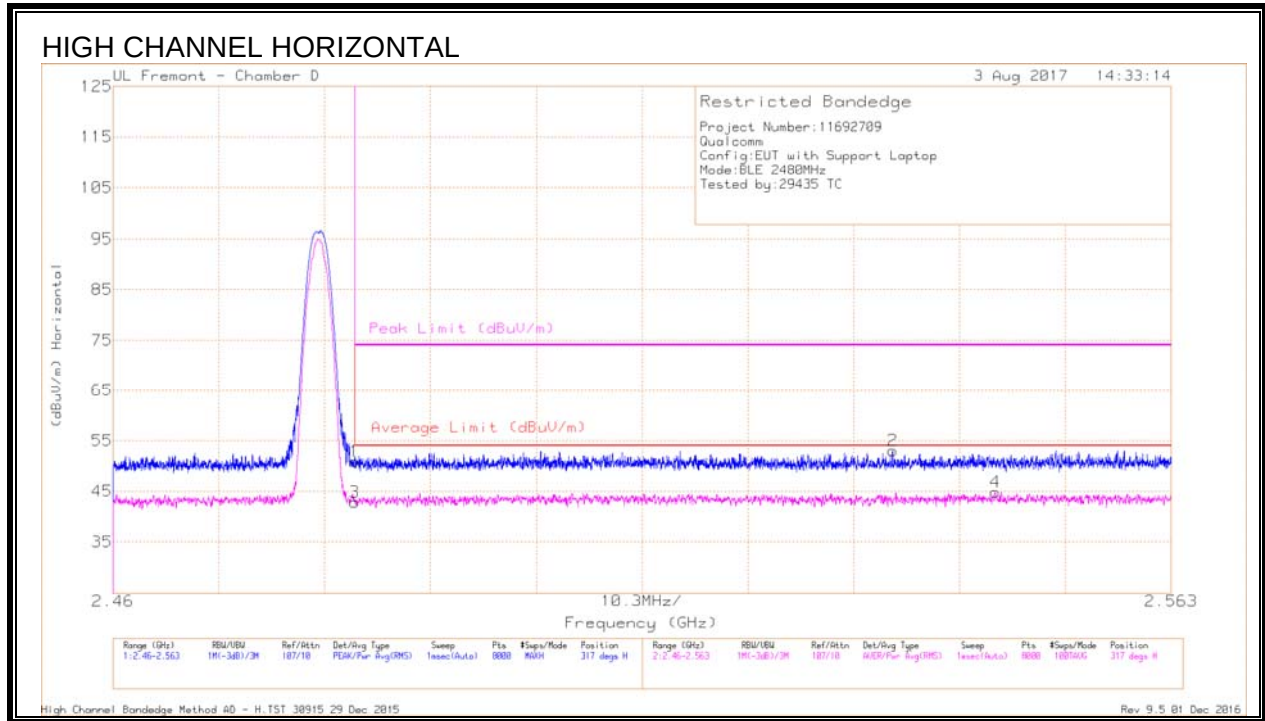
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T711 (dB/m) | Amp/Cb/Ftr/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Altitude (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|---------------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|-----------------|-------------|----------|
| 1      | * 2.39          | 38.18                | Pk  | 32.1           | -20.7               | 0            | 49.58                      | -                      | -           | 74                  | -24.42         | 184             | 159         | V        |
| 2      | * 2.37          | 41.85                | Pk  | 32.1           | -20.9               | 0            | 53.05                      | -                      | -           | 74                  | -20.95         | 184             | 159         | V        |
| 3      | * 2.39          | 28.87                | RMS | 32.1           | -20.7               | 2.04         | 42.31                      | 54                     | -11.69      | -                   | -              | 184             | 159         | V        |
| 4      | * 2.374         | 31.08                | RMS | 32.1           | -20.8               | 2.04         | 44.42                      | 54                     | -9.58       | -                   | -              | 184             | 159         | V        |

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

Pk - Peak detector

RMS - RMS detection

## 9.2.2. AUTHORIZED BANDEDGE (HIGH CHANNEL)



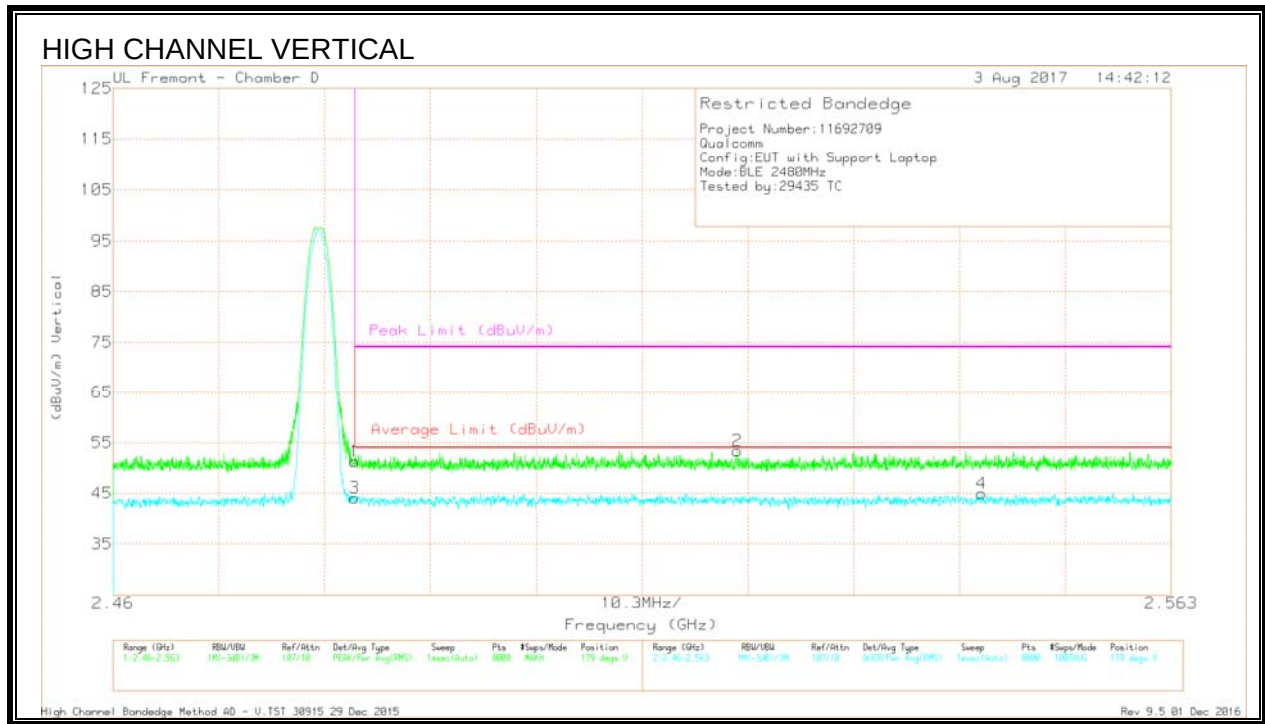
### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T711 (dB/m) | Amp/Ch/Flt/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Altitude (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|---------------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|-----------------|-------------|----------|
| 1      | * 2.484         | 39.25                | Pk  | 32.5           | -20.8               | 0            | 50.95                      | -                      | -           | 74                  | -23.05         | 317             | 334         | H        |
| 3      | * 2.484         | 29.15                | RMS | 32.5           | -20.8               | 2.04         | 42.89                      | 54                     | -11.11      | -                   | -              | 317             | 334         | H        |
| 2      | 2.536           | 41.14                | Pk  | 32.6           | -20.7               | 0            | 53.04                      | -                      | -           | 74                  | -20.96         | 317             | 334         | H        |
| 4      | 2.546           | 30.81                | RMS | 32.6           | -20.6               | 2.04         | 44.85                      | 54                     | -9.15       | -                   | -              | 317             | 334         | H        |

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

Pk - Peak detector

RMS - RMS detection



## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T711 (dB/m) | Amp/Cb/FHz/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Altitude (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|---------------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|-----------------|-------------|----------|
| 1      | * 2.484         | 39.55                | Pk  | 32.5           | -20.8               | 0            | 51.25                      | -                      | -           | 74                  | -22.75         | 179             | 194         | V        |
| 3      | * 2.484         | 30.37                | RMS | 32.5           | -20.8               | 2.04         | 44.11                      | 54                     | -9.89       | -                   | -              | 179             | 194         | V        |
| 2      | 2.521           | 41.54                | Pk  | 32.6           | -20.7               | 0            | 53.44                      | -                      | -           | 74                  | -20.56         | 179             | 194         | V        |
| 4      | 2.545           | 30.89                | RMS | 32.6           | -20.6               | 2.04         | 44.93                      | 54                     | -9.07       | -                   | -              | 179             | 194         | V        |

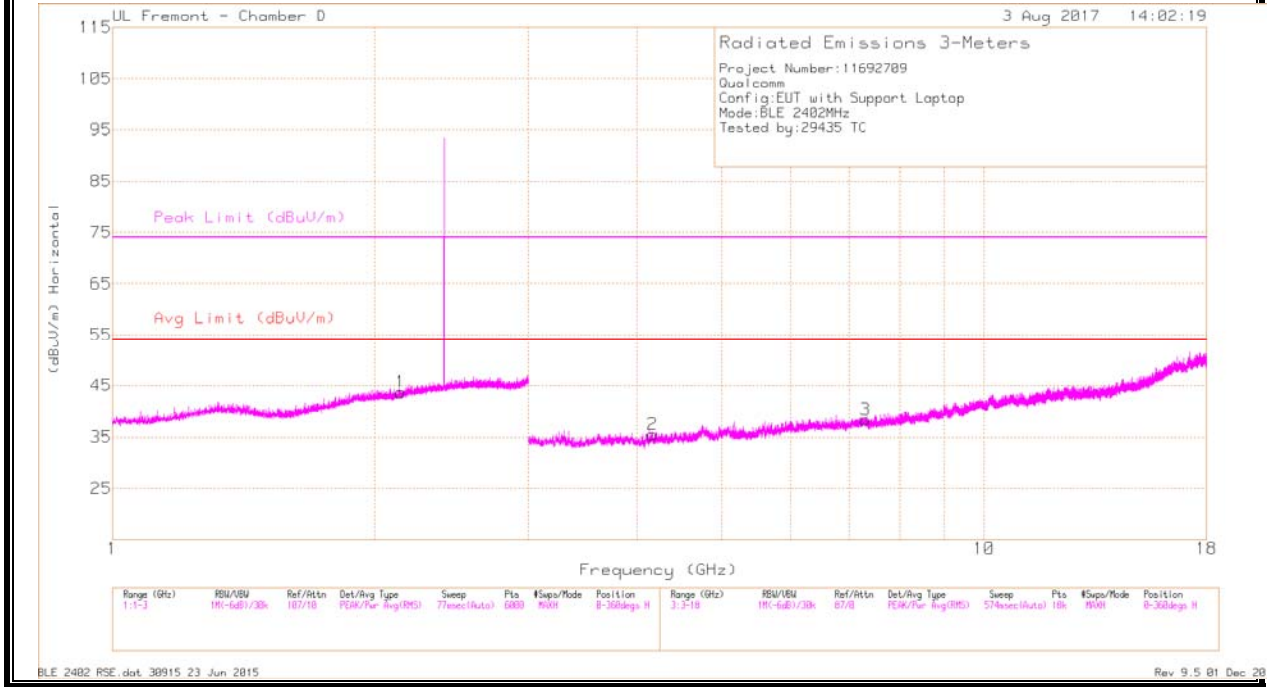
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

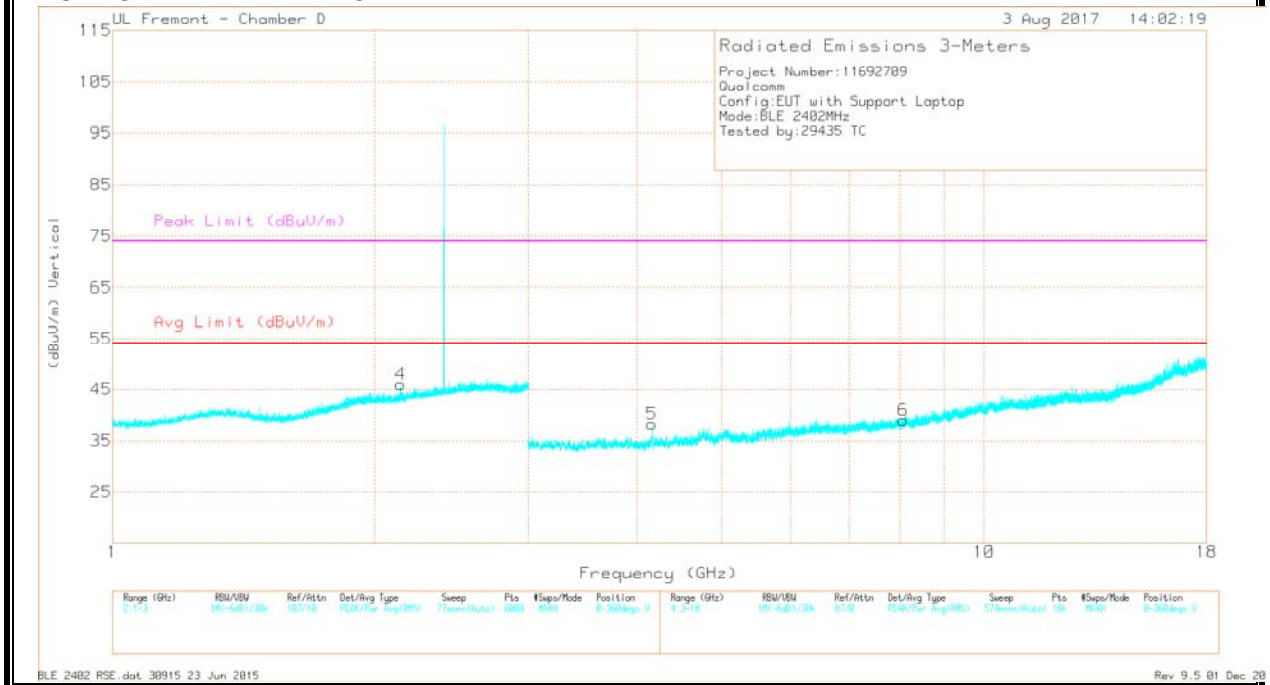
RMS - RMS detection



## LOW CHANNEL HORIZONTAL



## LOW CHANNEL VERTICAL



## Radiated Emissions

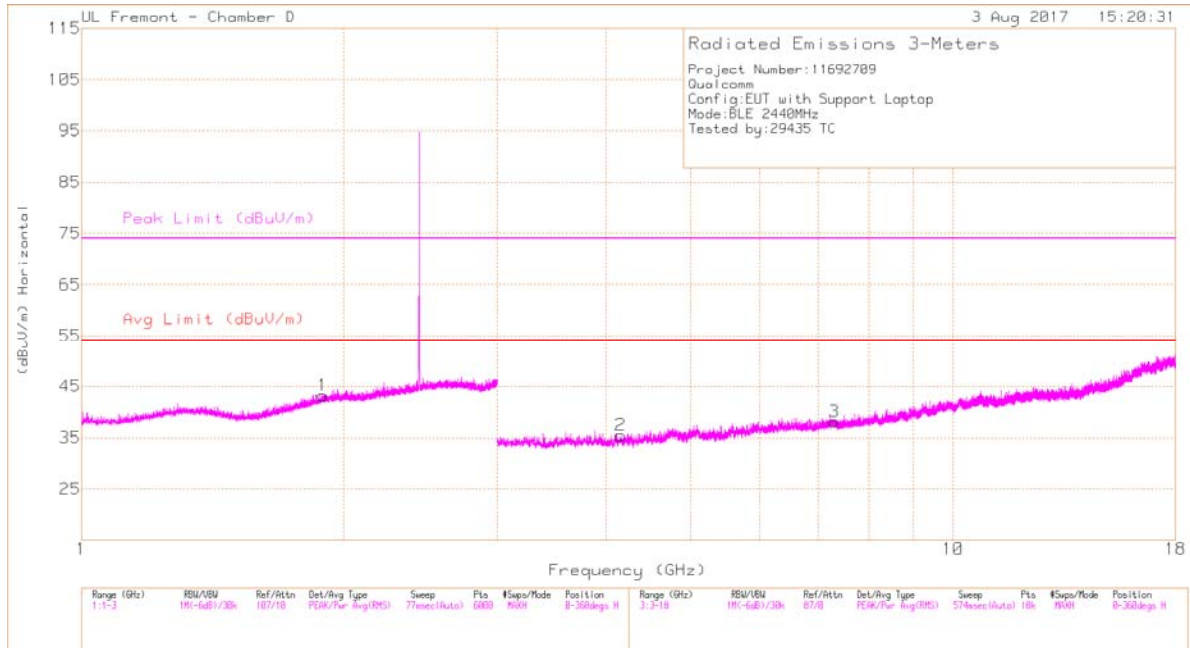
| Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T711 (dB/m) | Amp/Cbl/Ftr/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|-----------------|----------------------|------|----------------|----------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| * 4.168         | 37.18                | PK2  | 33.3           | -28.1                | 0            | 42.38                      | -                  | -           | 74                  | -31.62         | 235            | 187         | H        |
| * 4.168         | 25.26                | MAV1 | 33.3           | -28.1                | 2.04         | 32.5                       | 54                 | -21.5       | -                   | -              | 235            | 187         | H        |
| * 7.309         | 33.99                | PK2  | 35.5           | -25.1                | 0            | 44.39                      | -                  | -           | 74                  | -29.61         | 269            | 207         | H        |
| * 7.307         | 23.56                | MAV1 | 35.5           | -24.9                | 2.04         | 36.2                       | 54                 | -17.8       | -                   | -              | 269            | 207         | H        |
| * 4.159         | 37.45                | PK2  | 33.3           | -28                  | 0            | 42.75                      | -                  | -           | 74                  | -31.25         | 235            | 237         | V        |
| * 4.158         | 26.71                | MAV1 | 33.3           | -28                  | 2.04         | 34.05                      | 54                 | -19.95      | -                   | -              | 235            | 237         | V        |
| * 8.074         | 33.45                | PK2  | 35.6           | -23.8                | 0            | 45.25                      | -                  | -           | 74                  | -28.75         | 266            | 273         | V        |
| * 8.074         | 22.65                | MAV1 | 35.6           | -23.8                | 2.04         | 36.49                      | 54                 | -17.51      | -                   | -              | 266            | 273         | V        |
| 2.142           | 40.41                | PK2  | 31.3           | -20.9                | 0            | 50.81                      | -                  | -           | 74                  | -23.19         | 269            | 239         | V        |
| 2.142           | 28.71                | MAV1 | 31.3           | -20.9                | 2.04         | 41.15                      | -                  | -           | -                   | -              | 269            | 239         | V        |
| 2.143           | 39.57                | PK2  | 31.3           | -20.9                | 0            | 49.97                      | -                  | -           | 74                  | -24.03         | 317            | 225         | H        |
| 2.143           | 28.52                | MAV1 | 31.3           | -20.9                | 2.04         | 40.96                      | -                  | -           | -                   | -              | 317            | 225         | H        |

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

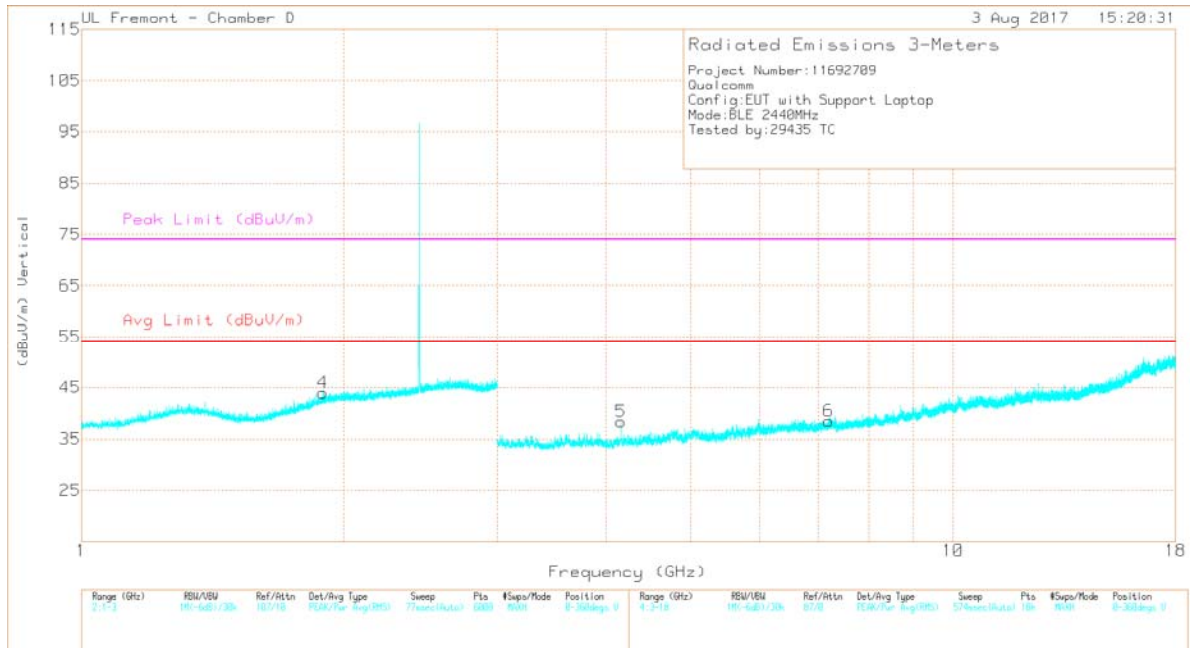
PK2 - KDB558074 Method: Maximum Peak

MAV1 - KDB558074 Option 1 Maximum RMS Average

## MID CHANNEL HORIZONTAL



## MID CHANNEL VERTICAL



## Radiated Emissions

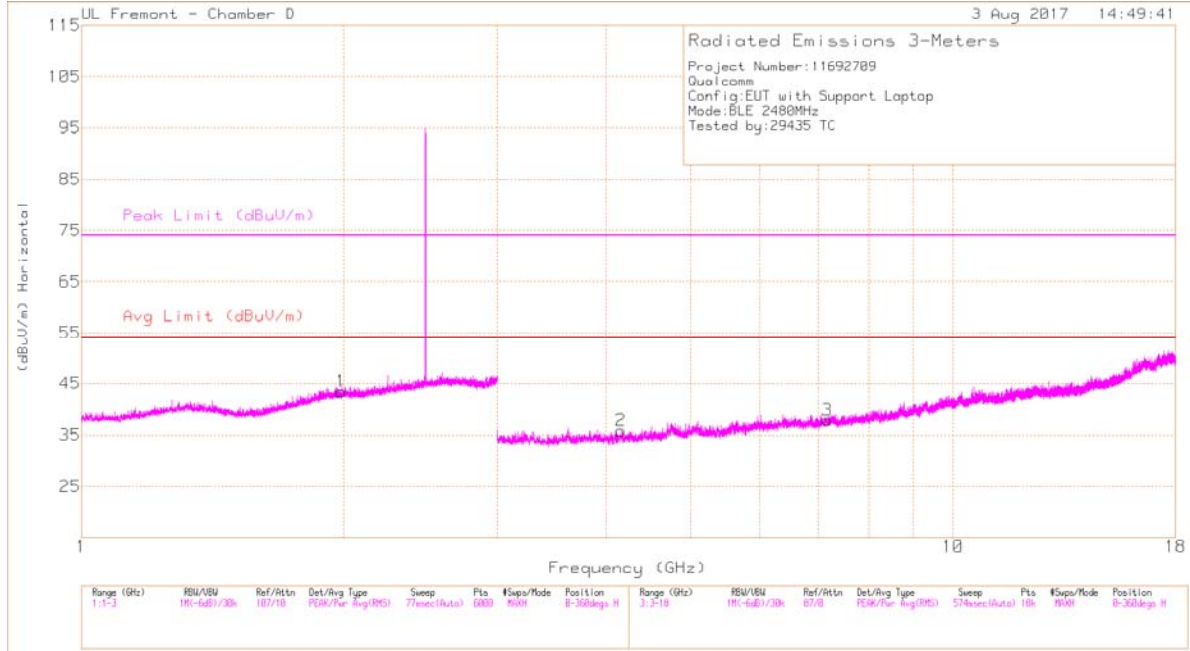
| Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T711 (dB/m) | Amp/Cbl/Ftr/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|-----------------|----------------------|------|----------------|----------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| * 4.156         | 37.19                | PK2  | 33.3           | -28.1                | 0            | 42.39                      | -                  | -           | 74                  | -31.61         | 221            | 180         | H        |
| * 4.157         | 26.4                 | MAV1 | 33.3           | -28.1                | 2.04         | 33.64                      | 54                 | -20.36      | -                   | -              | 221            | 180         | H        |
| * 7.306         | 34.64                | PK2  | 35.5           | -24.8                | 0            | 45.34                      | -                  | -           | 74                  | -28.66         | 171            | 214         | H        |
| * 7.307         | 23.56                | MAV1 | 35.5           | -24.9                | 2.04         | 36.2                       | 54                 | -17.8       | -                   | -              | 171            | 214         | H        |
| * 4.16          | 36.94                | PK2  | 33.3           | -28                  | 0            | 42.24                      | -                  | -           | 74                  | -31.76         | 103            | 194         | V        |
| * 4.16          | 26.44                | MAV1 | 33.3           | -28                  | 2.04         | 33.78                      | 54                 | -20.22      | -                   | -              | 103            | 194         | V        |
| 1.89            | 39.97                | PK2  | 31.2           | -21.4                | 0            | 49.77                      | -                  | -           | 74                  | -24.23         | 262            | 146         | V        |
| 1.891           | 28.62                | MAV1 | 31.2           | -21.4                | 2.04         | 40.46                      | -                  | -           | -                   | -              | 262            | 146         | V        |
| 1.892           | 28.04                | MAV1 | 31.2           | -21.4                | 2.04         | 39.88                      | -                  | -           | -                   | -              | 222            | 116         | H        |
| 1.894           | 40.09                | PK2  | 31.3           | -21.3                | 0            | 50.09                      | -                  | -           | 74                  | -23.91         | 222            | 116         | H        |
| 7.195           | 34.61                | PK2  | 35.5           | -25.1                | 0            | 45.01                      | -                  | -           | 74                  | -28.99         | 107            | 141         | V        |
| 7.195           | 22.85                | MAV1 | 35.5           | -25.1                | 2.04         | 35.29                      | -                  | -           | -                   | -              | 107            | 141         | V        |

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

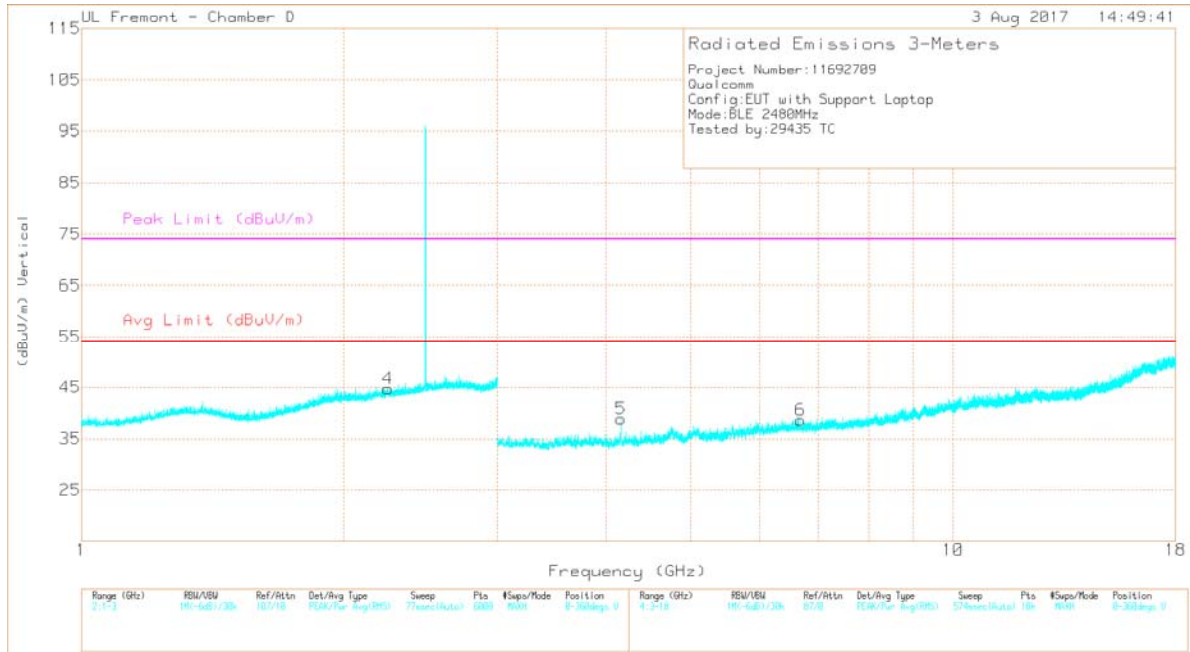
PK2 - KDB558074 Method: Maximum Peak

MAV1 - KDB558074 Option 1 Maximum RMS Average

## HIGH CHANNEL HORIZONTAL



## HIGH CHANNEL VERTICAL



## Radiated Emissions

| Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T711 (dB/m) | Amp/Cbl/Ftr/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 |
|-----------------|----------------------|------|----------------|----------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| * 2.247         | 39.99                | PK2  | 31.7           | -21                  | 0            | 50.69                      | -                  | -           | 74                  | -23.31         | 309            | 219         | V        |
| * 2.248         | 28.42                | MAV1 | 31.7           | -21                  | 2.04         | 41.16                      | 54                 | -12.84      | -                   | -              | 309            | 219         | V        |
| * 4.157         | 37.32                | PK2  | 33.3           | -28                  | 0            | 42.62                      | -                  | -           | 74                  | -31.38         | 255            | 247         | H        |
| * 4.158         | 26.29                | MAV1 | 33.3           | -28                  | 2.04         | 33.63                      | 54                 | -20.37      | -                   | -              | 255            | 247         | H        |
| * 4.158         | 37.38                | PK2  | 33.3           | -28                  | 0            | 42.68                      | -                  | -           | 74                  | -31.32         | 231            | 255         | V        |
| * 4.157         | 25.79                | MAV1 | 33.3           | -28                  | 2.04         | 33.13                      | 54                 | -20.87      | -                   | -              | 231            | 255         | V        |
| 1.986           | 28.46                | MAV1 | 31.4           | -21.4                | 2.04         | 40.5                       | -                  | -           | -                   | -              | 93             | 176         | H        |
| 1.989           | 39.82                | PK2  | 31.4           | -21.4                | 0            | 49.82                      | -                  | -           | 74                  | -24.18         | 93             | 176         | H        |
| 6.682           | 34.9                 | PK2  | 35.6           | -26.1                | 0            | 44.4                       | -                  | -           | 74                  | -29.6          | 171            | 299         | V        |
| 6.682           | 23.94                | MAV1 | 35.6           | -26.1                | 2.04         | 35.48                      | -                  | -           | -                   | -              | 171            | 299         | V        |
| 7.17            | 34.26                | PK2  | 35.5           | -25.1                | 0            | 44.66                      | -                  | -           | 74                  | -29.34         | 315            | 210         | H        |
| 7.17            | 23.37                | MAV1 | 35.5           | -25.1                | 2.04         | 35.81                      | -                  | -           | -                   | -              | 315            | 210         | H        |

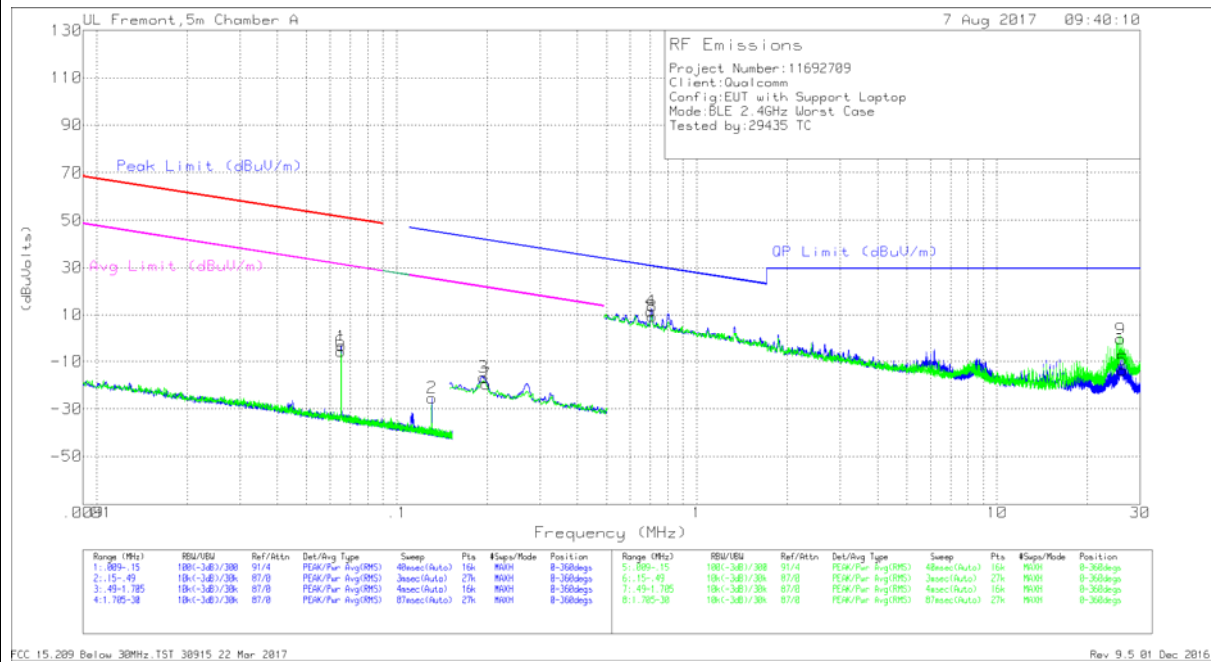
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAV1 - KDB558074 Option 1 Maximum RMS Average

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

#### HORIZONTAL AND VERTICAL PLOTS



NOTE: KDB 414788 OATS and Chamber Correlation Justification

- Based on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.
- OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

#### Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Loop Antenna (dB/m) | Cbl (dB) | Dist Corr 300 m | 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) |
|--------|-----------------|----------------------|-----|---------------------|----------|-----------------|------------------------------|---------------------|-------------|--------------------|-------------|---------------------|-------------|--------------------|-------------|----------------|
| 6      | .06516          | 62.37                | Pk  | 11.9                | .1       | -80             | -5.63                        | 51.31               | -56.94      | 31.31              | -36.94      | -                   | -           | -                  | -           | 0-360          |
| 1      | .06525          | 64.55                | Pk  | 11.9                | .1       | -80             | -3.45                        | 51.29               | -54.74      | 31.29              | -34.74      | -                   | -           | -                  | -           | 0-360          |
| 2      | .13084          | 42.93                | Pk  | 11.6                | .1       | -80             | -25.37                       | -                   | -           | -                  | -           | 45.29               | -70.66      | 25.29              | -50.66      | 0-360          |
| 3      | .19458          | 51.62                | Pk  | 11.6                | .1       | -80             | -16.68                       | -                   | -           | -                  | -           | 41.84               | -58.52      | 21.84              | -38.52      | 0-360          |
| 7      | .19826          | 48.83                | Pk  | 11.6                | .1       | -80             | -19.47                       | -                   | -           | -                  | -           | 41.67               | -61.14      | 21.67              | -41.14      | 0-360          |

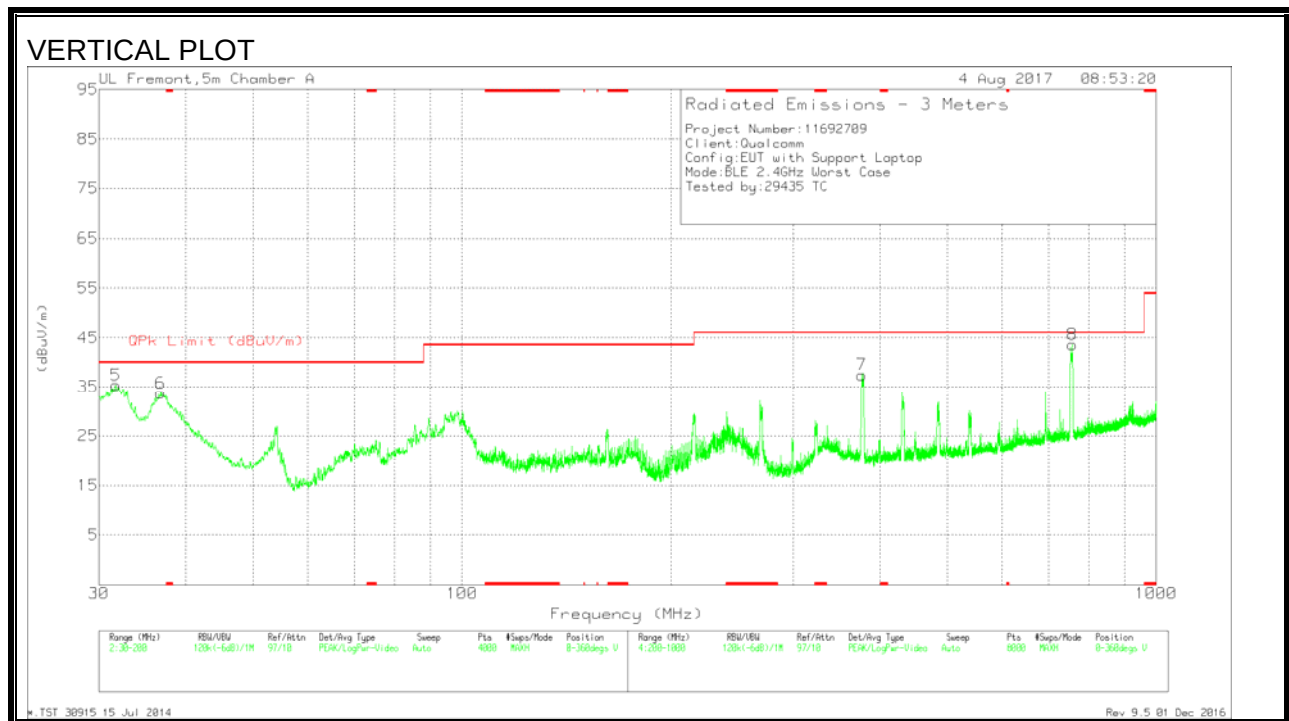
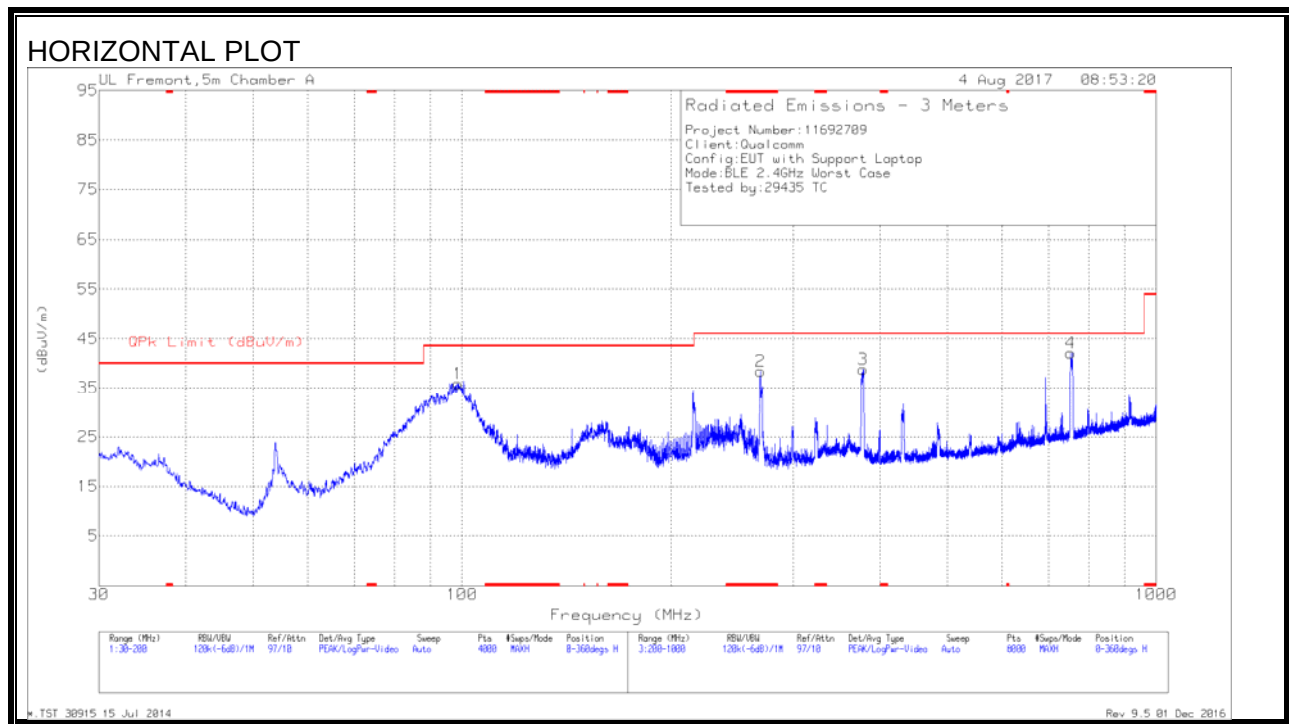
#### Pk - Peak detector

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Loop Antenna (dB/m) | Cbl (dB) | Dist Corr 30m | Corrected Reading (dBuVolts) | QP Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) |
|--------|-----------------|----------------------|-----|---------------------|----------|---------------|------------------------------|-------------------|-------------|----------------|
| 4      | .7025           | 39.92                | Pk  | 11.6                | .1       | -40           | 11.62                        | 30.68             | -19.06      | 0-360          |
| 8      | .70812          | 37.8                 | Pk  | 11.6                | .1       | -40           | 9.5                          | 30.61             | -21.11      | 0-360          |
| 9      | 25.77337        | 29.99                | Pk  | 8.9                 | .7       | -40           | -41                          | 29.5              | -29.91      | 0-360          |
| 5      | 26.18366        | 16.6                 | Pk  | 8.9                 | .8       | -40           | -13.7                        | 29.5              | -43.2       | 0-360          |

#### Pk - Peak detector



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





## Radiated Emissions

| 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 |
|--------|-----------------|----------------------|-----|----------------|----------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 2      | * 269.109       | 50.86                | Pk  | 17.1           | -29.5          | 38.46                      | 46.02              | -7.56       | 0-360          | 101         | H        |
| 5      | 31.9241         | 33.73                | Pk  | 23.2           | -31.2          | 25.73                      | 40                 | -14.27      | 14             | 396         | V        |
|        | 31.9241         | 29.56                | Qp  | 23.2           | -31.2          | 21.56                      | 40                 | -18.44      | 14             | 396         | V        |
| 6      | 36.823          | 44.68                | Pk  | 20.2           | -31.2          | 33.68                      | 40                 | -6.32       | 0-360          | 100         | V        |
| 1      | 98.7875         | 53.04                | Pk  | 13.8           | -30.6          | 36.24                      | 43.52              | -7.28       | 340            | 260         | H        |
|        | 98.7875         | 46.01                | Qp  | 13.8           | -30.6          | 29.21                      | 43.52              | -14.31      | 340            | 260         | H        |
| 7      | 376.723         | 47.57                | Pk  | 19             | -29.1          | 37.47                      | 46.02              | -8.55       | 0-360          | 200         | V        |
| 3      | 378.0231        | 48.89                | Pk  | 19             | -29.1          | 38.79                      | 46.02              | -7.23       | 0-360          | 101         | H        |
| 4      | 752.7201        | 46.24                | Pk  | 24.8           | -28.1          | 42.94                      | 46.02              | -3.08       | 144            | 255         | H        |
|        | 752.7201        | 41.5                 | Qp  | 24.8           | -28.1          | 38.2                       | 46.02              | -7.82       | 144            | 255         | H        |
| 8      | 757.1937        | 28.58                | Pk  | 24.8           | -28            | 25.38                      | 46.02              | -20.64      | 284            | 400         | V        |
|        | 757.1937        | 24.29                | Qp  | 24.8           | -28            | 21.09                      | 46.02              | -24.93      | 284            | 400         | V        |

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

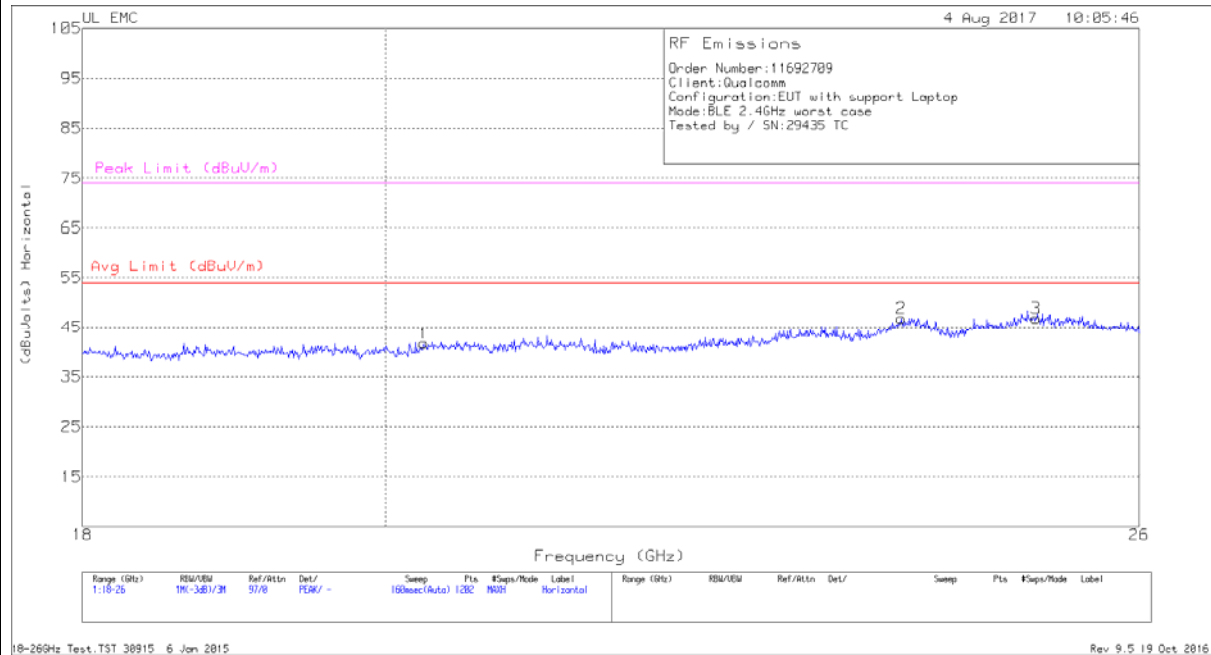
Pk - Peak detector

Qp - Quasi-Peak detector

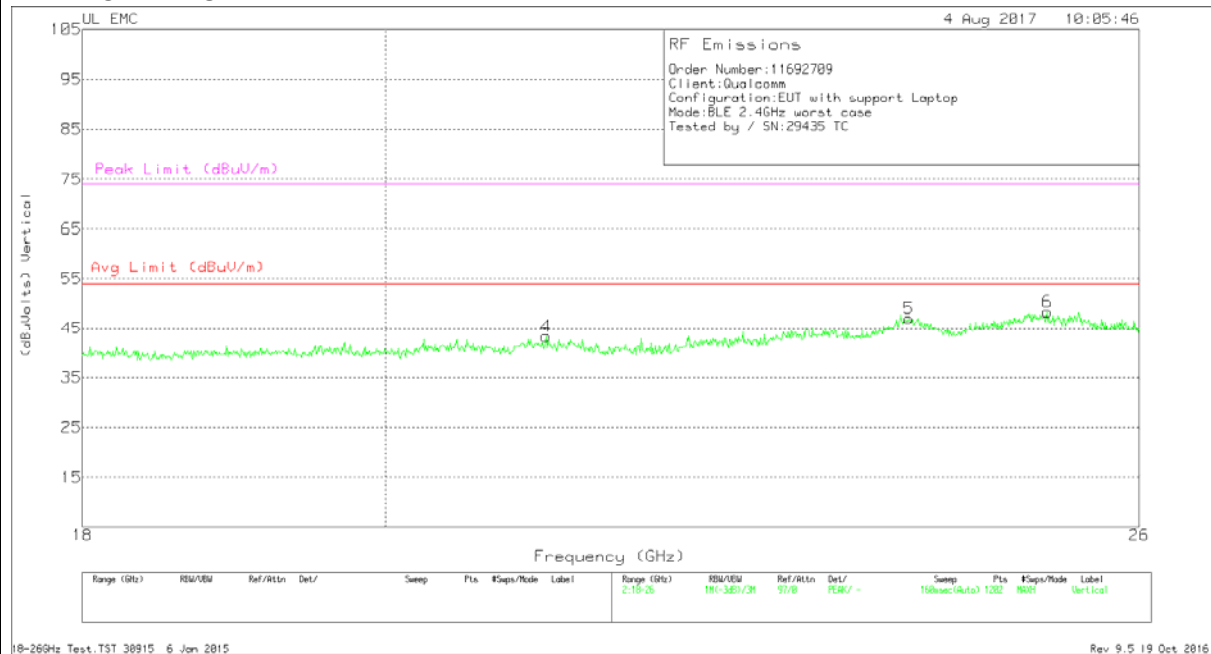
## 9.5. WORST-CASE 18 to 26 GHz

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

#### HORIZONTAL PLOT



#### VERTICAL PLOT



## DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | T449 AF (dB/m) | Amp/Cbl (dB) | Dist Corr (dB) | Corrected Reading (dBuVolts) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) |
|--------|-----------------|----------------------|-----|----------------|--------------|----------------|------------------------------|--------------------|-------------|---------------------|----------------|
| 1      | 20.271          | 40.37                | Pk  | 32.8           | -22          | -9.5           | 41.667                       | 54                 | -12.333     | 74                  | -32.333        |
| 2      | 23.935          | 42.43                | Pk  | 33.9           | -20          | -9.5           | 46.833                       | 54                 | -7.1667     | 74                  | -27.167        |
| 3      | 25.081          | 42.33                | Pk  | 34.3           | -20.3        | -9.5           | 46.8333                      | 54                 | -7.1667     | 74                  | -27.167        |
| 4      | 21.151          | 41.33                | Pk  | 33.1           | -21.6        | -9.5           | 43.3333                      | 54                 | -10.667     | 74                  | -30.667        |
| 5      | 23.995          | 42.8                 | Pk  | 33.9           | -20.2        | -9.5           | 47                           | 54                 | -7          | 74                  | -27            |
| 6      | 25.181          | 44.03                | Pk  | 34.3           | -20.5        | -9.5           | 48.333                       | 54                 | -5.667      | 74                  | -25.667        |

Pk - Peak detector

## 10. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

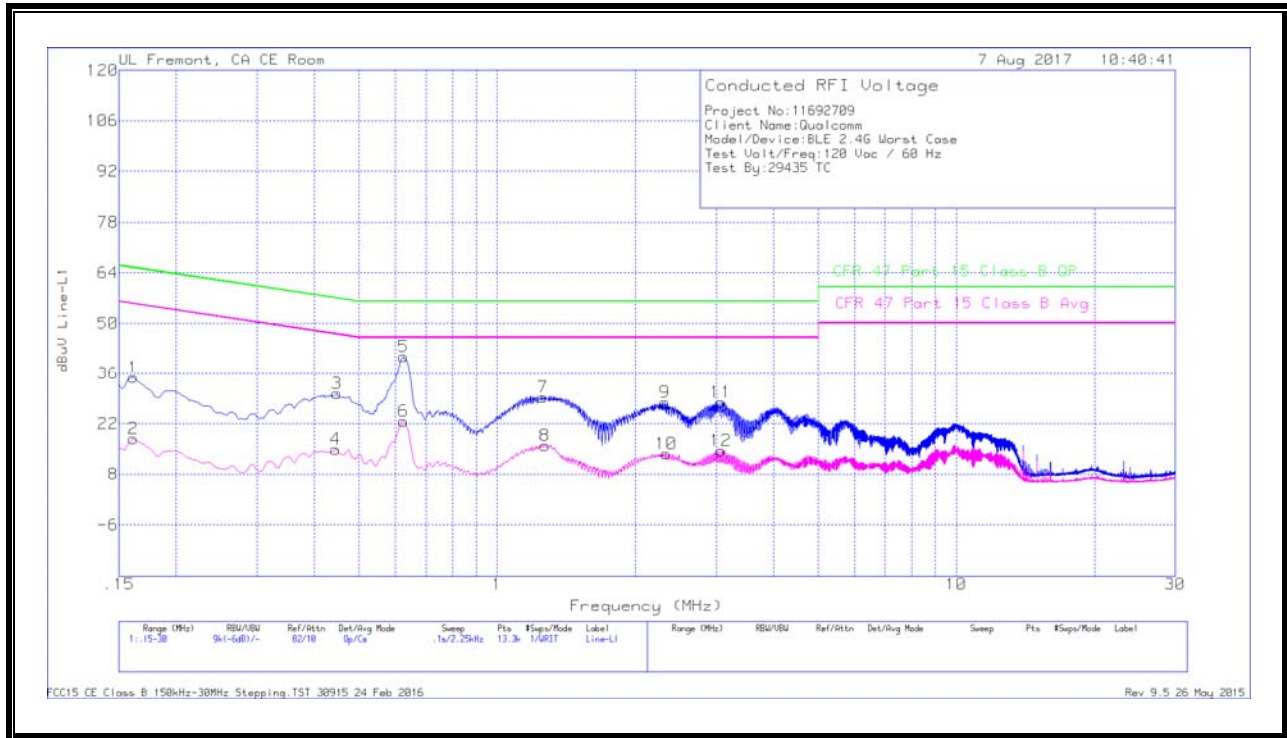
FCC §15.207 (a)  
RSS-Gen 8.8

| Frequency of Emission (MHz) | Conducted Limit (dB $\mu$ V) |            |
|-----------------------------|------------------------------|------------|
|                             | Quasi-peak                   | Average    |
| 0.15-0.5                    | 66 to 56 *                   | 56 to 46 * |
| 0.5-5                       | 56                           | 46         |
| 5-30                        | 60                           | 50         |

\*Decreases with the logarithm of the frequency.

### RESULTS

## LINE 1 RESULTS



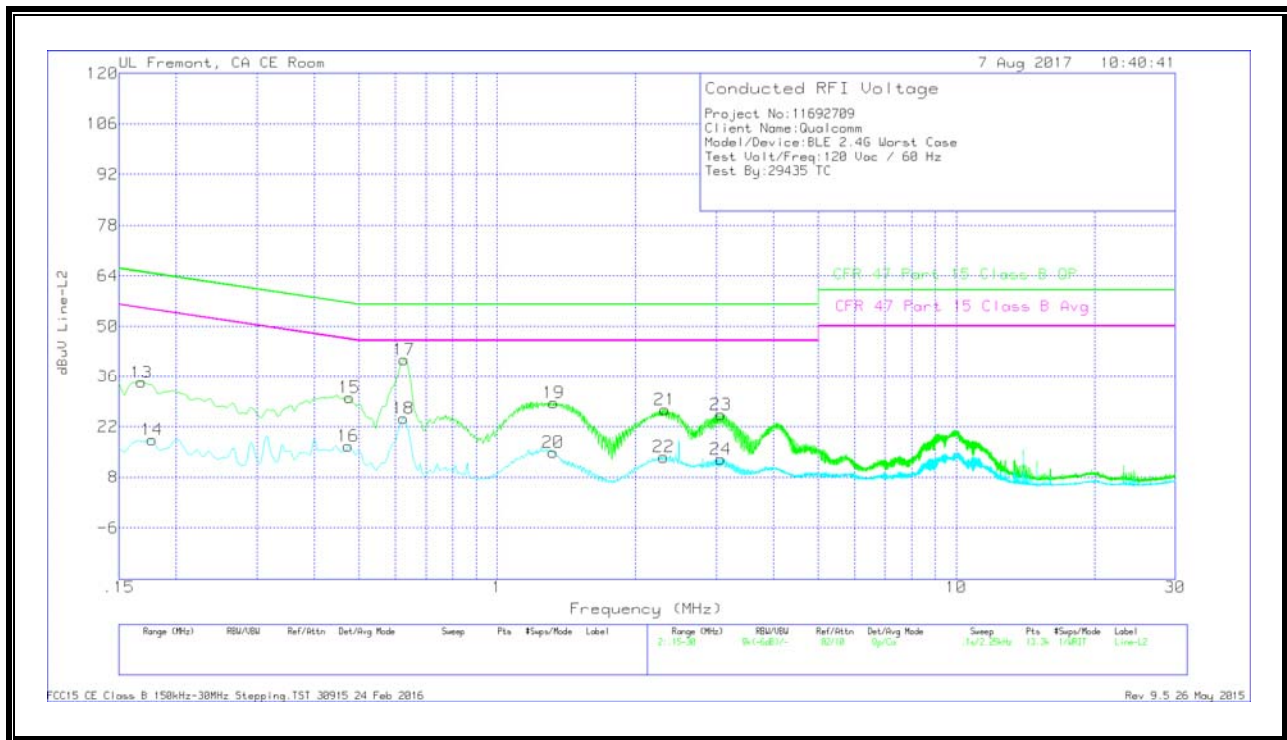
## WORST EMISSIONS

| Range 1: Line-L1 .15 - 30MHz |                 |                      |     |         |                 |              |                        |                           |                |                            |                       |  |
|------------------------------|-----------------|----------------------|-----|---------|-----------------|--------------|------------------------|---------------------------|----------------|----------------------------|-----------------------|--|
| Marker                       | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L1 | LC Cables C1&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR) Margin (dB) |  |
| 1                            | .16125          | 24.58                | Qp  | .1      | .1              | 10.1         | 34.88                  | 65.4                      | -30.52         | -                          | -                     |  |
| 2                            | .16125          | 7.49                 | Ca  | .1      | .1              | 10.1         | 17.79                  | -                         | -              | 55.4                       | -37.61                |  |
| 3                            | .447            | 20.09                | Qp  | 0       | .1              | 10.1         | 30.29                  | 56.93                     | -26.64         | -                          | -                     |  |
| 4                            | .44475          | 4.77                 | Ca  | 0       | .1              | 10.1         | 14.97                  | -                         | -              | 46.97                      | -32                   |  |
| 5                            | .62475          | 30.61                | Qp  | 0       | .1              | 10.1         | 40.81                  | 56                        | -15.19         | -                          | -                     |  |
| 6                            | .62475          | 12.53                | Ca  | 0       | .1              | 10.1         | 22.73                  | -                         | -              | 46                         | -23.27                |  |
| 7                            | 1.257           | 19.14                | Qp  | 0       | .1              | 10.1         | 29.34                  | 56                        | -26.66         | -                          | -                     |  |
| 8                            | 1.2705          | 5.7                  | Ca  | 0       | .1              | 10.1         | 15.9                   | -                         | -              | 46                         | -30.1                 |  |
| 9                            | 2.32125         | 17.79                | Qp  | 0       | .1              | 10.1         | 27.99                  | 56                        | -28.01         | -                          | -                     |  |
| 10                           | 2.3325          | 3.41                 | Ca  | 0       | .1              | 10.1         | 13.61                  | -                         | -              | 46                         | -32.39                |  |
| 11                           | 3.06825         | 17.7                 | Qp  | 0       | .1              | 10.1         | 27.9                   | 56                        | -28.1          | -                          | -                     |  |
| 12                           | 3.06938         | 4.28                 | Ca  | 0       | .1              | 10.1         | 14.48                  | -                         | -              | 46                         | -31.52                |  |

Qp - Quasi-Peak detector

Ca - CISPR average detection

## LINE 2 RESULTS



## WORST EMISSIONS

| Range 2: Line-L2 .15 - 30MHz |                 |                      |     |         |                 |              |                        |                           |                |                            |                       |
|------------------------------|-----------------|----------------------|-----|---------|-----------------|--------------|------------------------|---------------------------|----------------|----------------------------|-----------------------|
| Marker                       | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L2 | LC Cables C2&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR) Margin (dB) |
| 13                           | .168            | 24.26                | Qp  | 0       | 0               | 10.1         | 34.36                  | 65.06                     | -30.7          | -                          | -                     |
| 14                           | .177            | 8.22                 | Ca  | 0       | .1              | 10.1         | 18.42                  | -                         | -              | 54.63                      | -36.21                |
| 15                           | .47625          | 19.89                | Qp  | 0       | .1              | 10.1         | 30.09                  | 56.4                      | -26.31         | -                          | -                     |
| 16                           | .474            | 6.43                 | Ca  | 0       | .1              | 10.1         | 16.63                  | -                         | -              | 46.44                      | -29.81                |
| 17                           | .627            | 30.63                | Qp  | 0       | .1              | 10.1         | 40.83                  | 56                        | -15.17         | -                          | -                     |
| 18                           | .62475          | 14.08                | Ca  | 0       | .1              | 10.1         | 24.28                  | -                         | -              | 46                         | -21.72                |
| 19                           | 1.32675         | 18.4                 | Qp  | 0       | .1              | 10.1         | 28.6                   | 56                        | -27.4          | -                          | -                     |
| 20                           | 1.3245          | 4.71                 | Ca  | 0       | .1              | 10.1         | 14.91                  | -                         | -              | 46                         | -31.09                |
| 21                           | 2.32125         | 16.49                | Qp  | 0       | .1              | 10.1         | 26.69                  | 56                        | -29.31         | -                          | -                     |
| 22                           | 2.3055          | 3.39                 | Ca  | 0       | .1              | 10.1         | 13.59                  | -                         | -              | 46                         | -32.41                |
| 23                           | 3.06825         | 15.16                | Qp  | 0       | .1              | 10.1         | 25.36                  | 56                        | -30.64         | -                          | -                     |
| 24                           | 3.0705          | 2.76                 | Ca  | 0       | .1              | 10.1         | 12.96                  | -                         | -              | 46                         | -33.04                |

Qp - Quasi-Peak detector

Ca - CISPR average detection