



# **CERTIFICATION TEST REPORT**

**Report Number. :** 12646381-E2V3

**Applicant :** APPLE, INC.  
1 APPLE PARK WAY  
CUPERTINO, CA 95014, U.S.A.

**Model :** A2178

**FCC ID :** BCG-A2178

**IC :** 579C-A2178

**EUT Description :** iPod touch

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C  
ISED RSS-247 ISSUE 2  
ISED RSS-GEN ISSUE 5

**Date Of Issue:**

May 01, 2019

**Prepared by:**

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NVLAP Lab code: 200065-0

## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	4/15/2019	Initial Issue	Chin Pang
V2	4/29/2019	Address TCB's Questions	Chin Pang
V3	5/01/2019	Address Section 6	Chin Pang

## TABLE OF CONTENTS

<b>REPORT REVISION HISTORY .....</b>	<b>2</b>
<b>TABLE OF CONTENTS .....</b>	<b>3</b>
<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>EUT DESCRIPTION .....</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. MEASUREMENT METHOD .....</b>	<b>14</b>
<b>7. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>15</b>
<b>8. ANTENNA PORT TEST RESULTS .....</b>	<b>16</b>
8.1. <i>ON TIME AND DUTY CYCLE .....</i>	<i>16</i>
8.2. <i>99% BANDWIDTH .....</i>	<i>17</i>
8.3. <i>6 dB BANDWIDTH .....</i>	<i>19</i>
8.4. <i>OUTPUT POWER .....</i>	<i>21</i>
8.5. <i>AVERAGE POWER .....</i>	<i>23</i>
8.6. <i>POWER SPECTRAL DENSITY .....</i>	<i>25</i>
8.7. <i>CONDUCTED SPURIOUS EMISSIONS .....</i>	<i>27</i>
<b>9. RADIATED TEST RESULTS .....</b>	<b>29</b>
9.1. <i>LIMITS AND PROCEDURE .....</i>	<i>29</i>
9.2. <i>TRANSMITTER ABOVE 1 GHz .....</i>	<i>30</i>
9.3. <i>Worst Case Below 1 GHz .....</i>	<i>40</i>
9.4. <i>Worst Case 18-26 GHz .....</i>	<i>42</i>

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<b>10. AC POWER LINE CONDUCTED EMISSIONS .....</b>	<b>44</b>
10.1.1. AC Power Line Host .....	45
10.1.2. AC Power Line Norm.....	47
<b>11. SETUP PHOTOS .....</b>	<b>49</b>

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE, INC.  
1 APPLE PARK WAY  
CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** iPod touch

**MODEL:** A2178

**SERIAL NUMBER:** CCQXW00TLQJ9(Conducted); CCQXW00LLQJ1(Radiated)

**DATE TESTED:** FEBRUARY 13, 2019 – MARCH 1, 2019

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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 the U.S. government.

Approved & Released For  
UL Verification Services Inc. By:



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Senior Engineer  
Consumer Technology Division  
UL Verification Services Inc.

Prepared By:



Tony Li  
Test Engineer  
Consumer Technology Division  
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## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, 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, and 47658 Kato Road, 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	47658 Kato Rd
<input checked="" type="checkbox"/> Chamber A (ISED:2324B-1)	<input type="checkbox"/> Chamber D (ISED:22541-1)	<input type="checkbox"/> Chamber I (ISED:2324A-5)
<input type="checkbox"/> Chamber B (ISED:2324B-2)	<input type="checkbox"/> Chamber E (ISED:22541-2)	<input type="checkbox"/> Chamber J (ISED:2324A-6)
<input type="checkbox"/> Chamber C (ISED:2324B-3)	<input type="checkbox"/> Chamber F (ISED:22541-3)	<input type="checkbox"/> Chamber K (ISED:2324A-1)
	<input type="checkbox"/> Chamber G (ISED:22541-4)	<input type="checkbox"/> Chamber L (ISED:2324A-3)
	<input type="checkbox"/> Chamber H (ISED:22541-5)	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

## 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

#### RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Final Voltage (dBuV)} = \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \text{LISN Insertion Loss.}$$

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

### 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	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. EUT DESCRIPTION

The EUT is an iPod touch with IEEE 802.11a/b/g/n/ac and Bluetooth Radio.

### 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	8.63	7.29

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)
2.4	0.20

### 5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 17.1.124

### 5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was investigated in three orthogonal orientations X, Y and Z and it was determined that X (Flatbed) orientation was the worst-case orientation.

Radiated band edge, harmonic, and spurious emissions from 1GHz to 18GHz were performed with the EUT was set to transmit at highest power on Low/Middle/High channels.

Radiated emissions below 30MHz, below 1GHz, 18-26GHz and power line conducted emissions were performed with the EUT transmits at the channel with the highest output power as worst-case scenario. There were no emissions found below 30MHz within 20dB of the limit

For below 1GHz tests were performed with EUT connected to AC power adapter as the worst case; and for above 1GHz, the worst-case configuration reported was tested with EUT only. For AC line conducted emission, test was investigated with AC power adapter and with laptop.



## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	Macbook Pro	C02P41RZG086	FCC DoC
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D292365CDYADHLH	NA

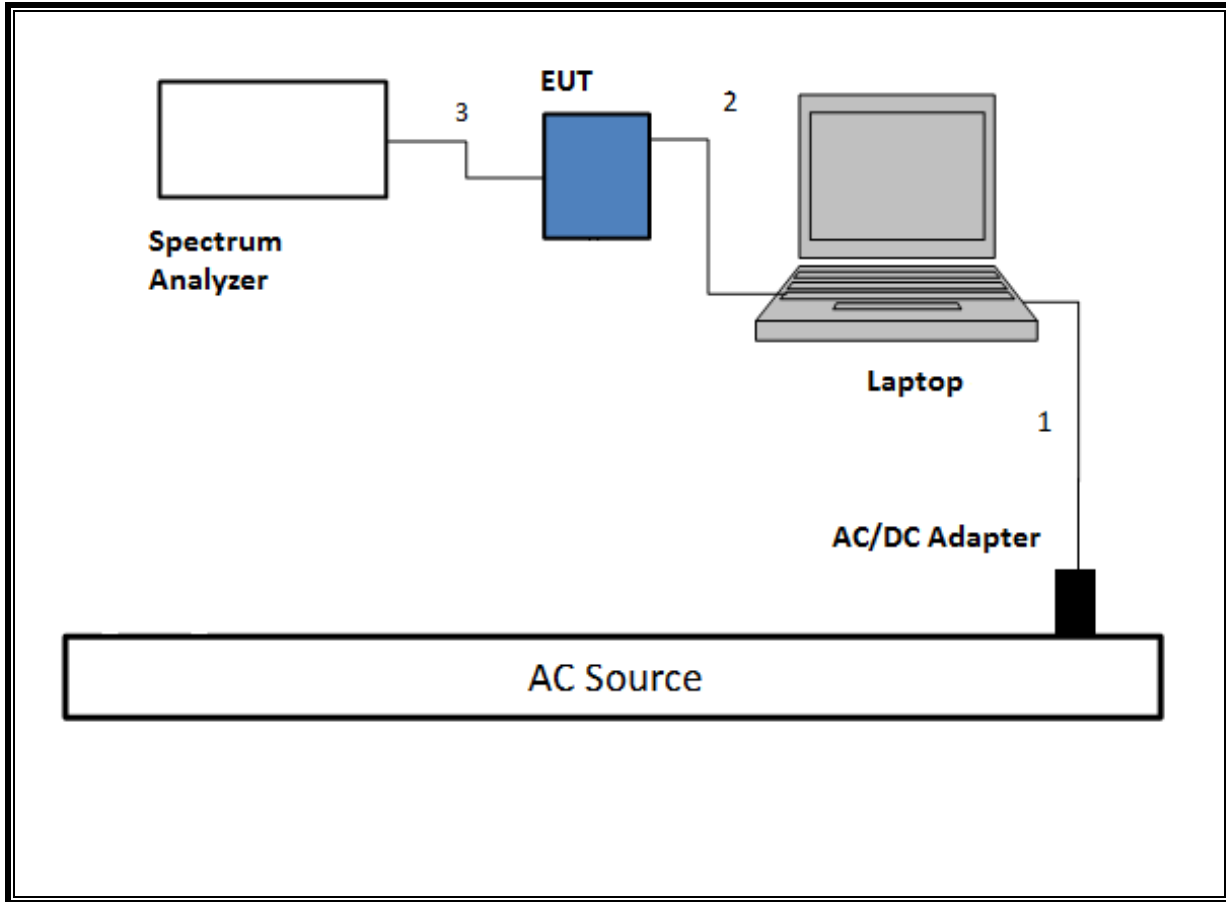
### I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	2	N/A

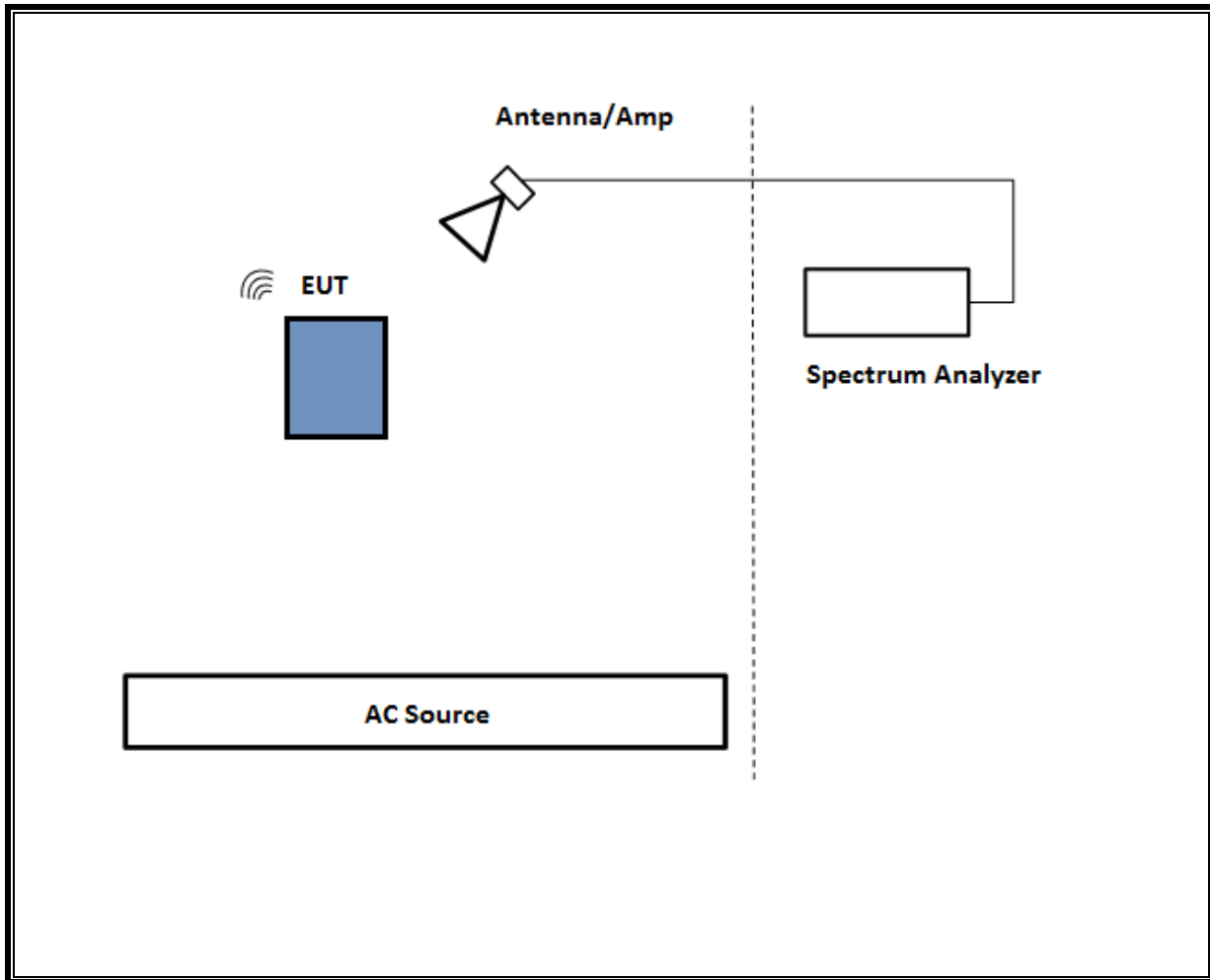
### TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

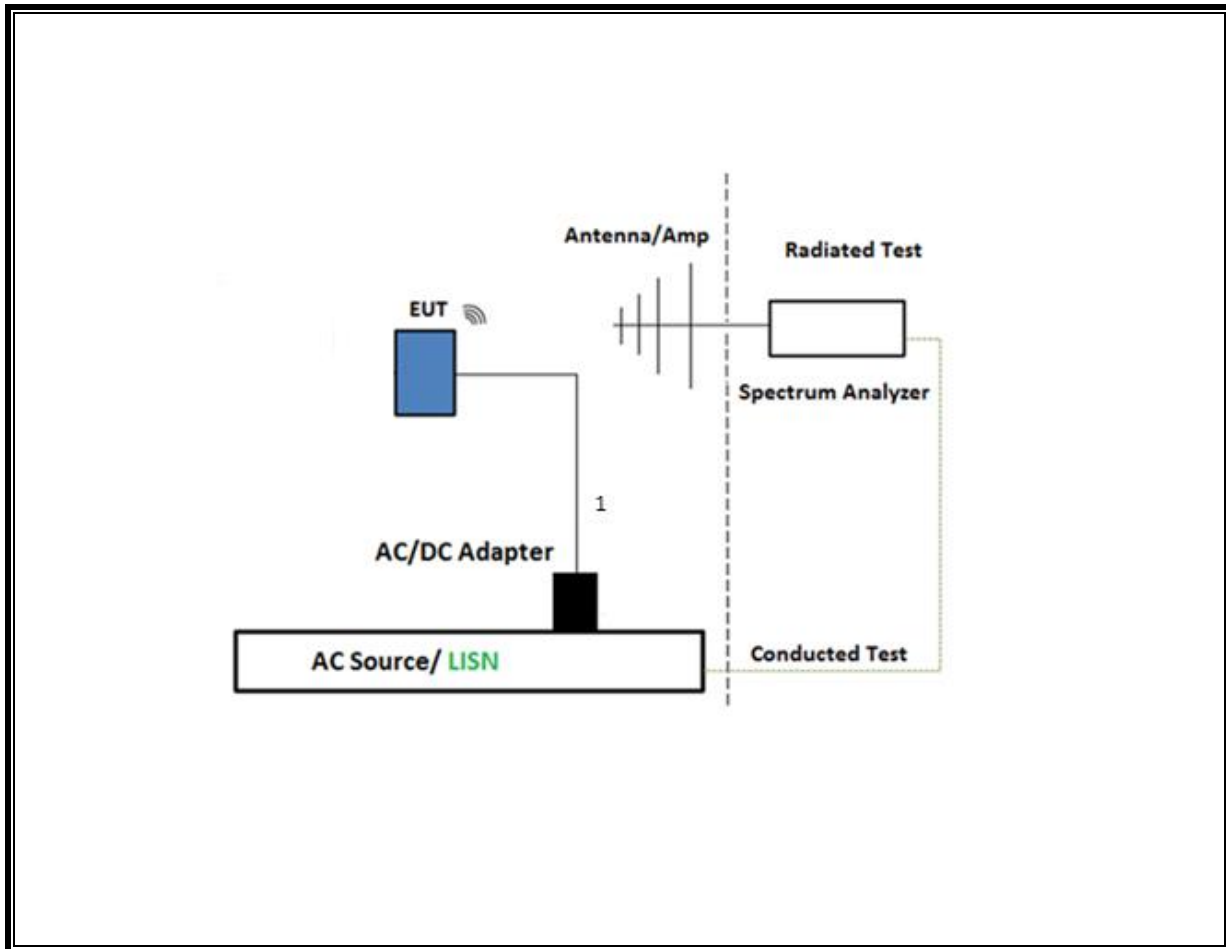
**SETUP DIAGRAM FOR CONDUCTED TESTS**



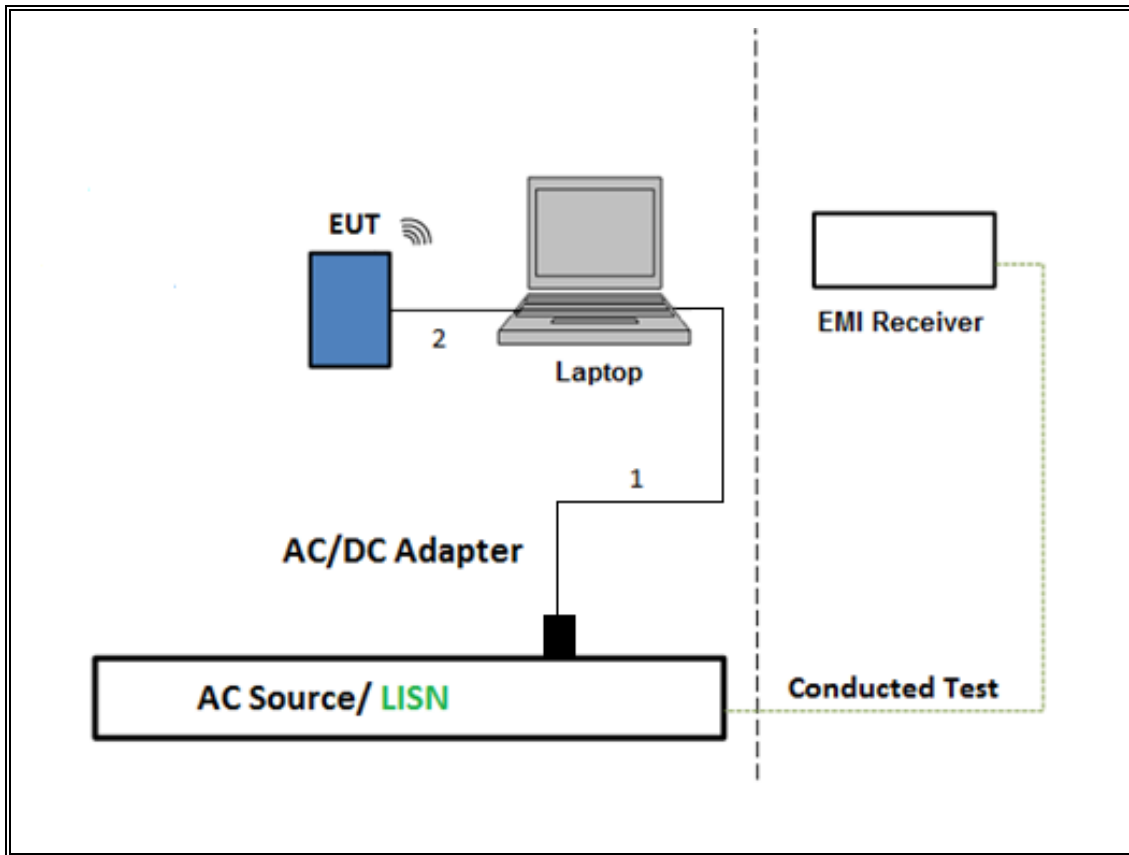
**SETUP DIAGRAM FOR RADIATED TESTS ABOVE 1GHz**



**SETUP DIAGRAM FOR BELOW 1GHz AND AC LINE CONDUCTED TEST**



**TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION**



## 6. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 558074 D01 v05, Section 6.

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW  $\geq$  DTS BW

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.1 Measurement using average power meter

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

Band-edge: ANSI C63.10 Subclause -11.13.3.2 Integration method -Peak detection

Band-edge: ANSI C63.10 Subclause -11.13.3.3 Integration method -Trace averaging with continuous transmission at full power

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

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

## 7. 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	ID Num	Cal Due	Last Cal
*Spectrum Analyzer, PXA, 3Hz to 50GHz w/Ext. Mixer	Agilent (Keysight) Technologies	N9030A	T342	02/22/2019	02/22/2018
Thermometer	Control Company	14-650-118, 15557603	T1817	05/01/2019	05/01/2018
Horn Antenna 1-18GHz	ETS-Lindgren	3117	T345	04/25/2019	04/25/2018
Horn Antenna 1-18GHz	ETS-Lindgren	3117	T120	07/02/2019	07/02/2018
Amplifier, 10KHz to 1GHz, 32dB	Sonoma Instrument Co.	310N	T286	06/04/2019	06/04/2018
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T1616	10/18/2019	10/18/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	T185	04/19/2019	04/19/2018
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	06/16/2019	06/16/2018
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25	T491	05/19/2019	05/19/2018
*Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	03/09/2019	03/09/2018
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T227	10/29/2019	10/29/2018
Power Sensor	Power Sensor	Keysight	T1226	02/06/2020	02/06/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T340	01/22/2020	01/22/2019
AC Line Conducted					
*EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	02/23/2019	
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2019	
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/19/2019	
UL AUTOMATION SOFTWARE					
Radiated Software	UL	UL EMC		Ver 9.5, April 26, 2016	
Conducted Software	UL	UL EMC		Ver 5.4, October 13, 2016	
AC Line Conducted Software	UL	UL EMC		Ver 9.5, May 26, 2015	

\*Testing is completed before equipment expiration date.

## 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME AND DUTY CYCLE

#### LIMITS

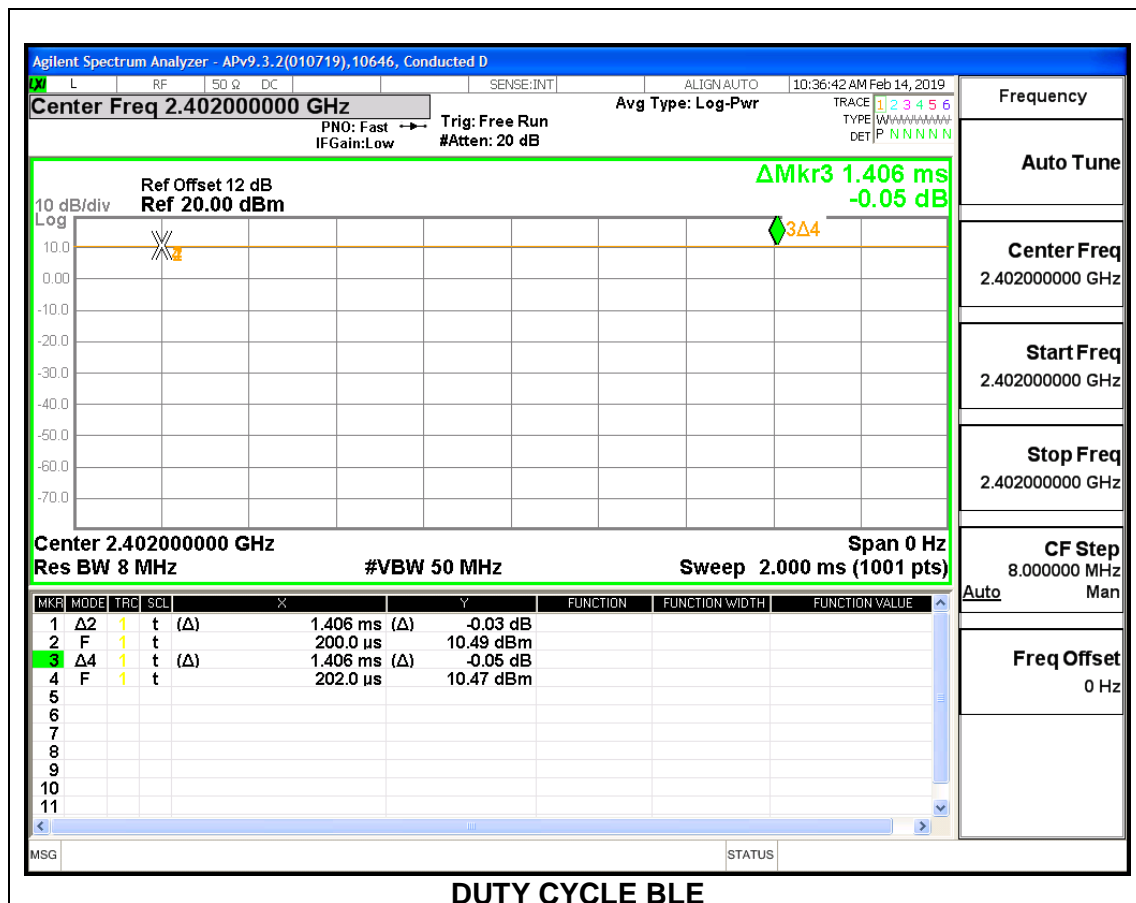
None; for reporting purposes only.

#### PROCEDURE

#### 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/B Minimum VBW (kHz)
<b>2.4GHz Band</b>						
BLE	1.406	1.406	1.000	100%	0.00	0.010

#### DUTY CYCLE PLOTS





## **8.2. 99% BANDWIDTH**

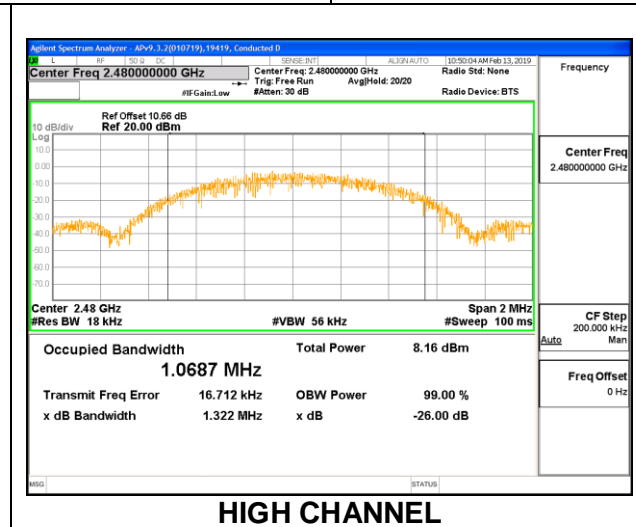
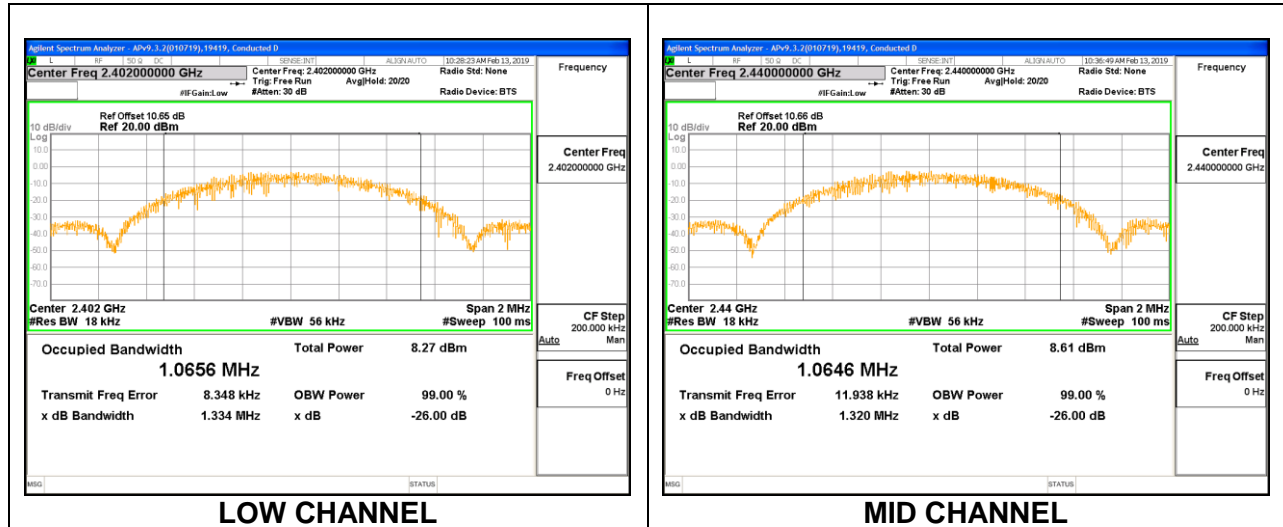
### **LIMITS**

None; for reporting purposes only.

### **RESULTS**

**BLE**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0656
Middle	2440	1.0646
High	2480	1.0687



### **8.3. 6 dB BANDWIDTH**

#### **LIMITS**

FCC §15.407 (e)

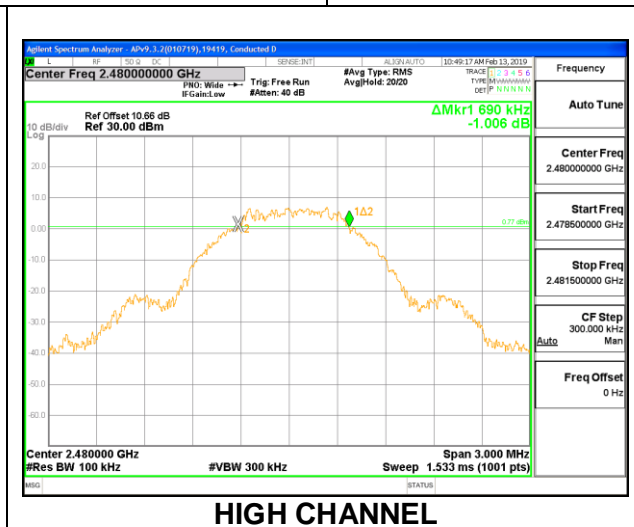
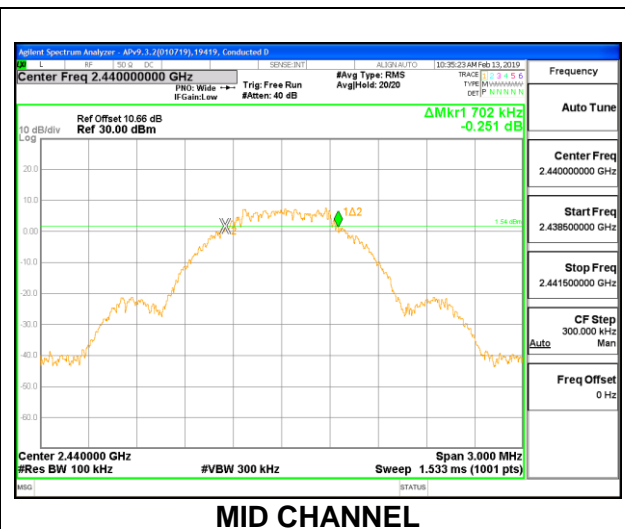
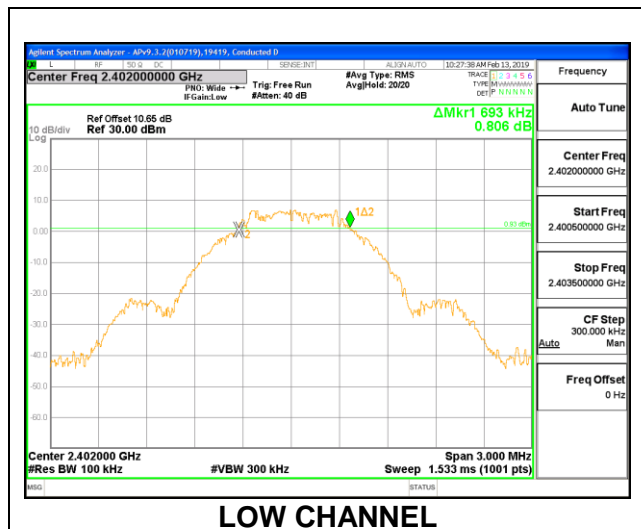
RSS-247 5.2 (a)

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

#### **RESULTS**

**BLE**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.693	0.5
Middle	2440	0.702	0.5
High	2480	0.690	0.5



## **8.4. OUTPUT POWER**

### **LIMITS**

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

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

### **TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.65 dB (including 10 dB pad and 0.65 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

### **RESULTS**

**BLE**

<b>Tested By:</b>	19419
<b>Date:</b>	2/18/2019

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Power Reading (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
Low	2402	8.140	30	-21.86
Middle	2440	8.410	30	-21.59
High	2480	8.630	30	-21.37

## **8.5. AVERAGE POWER**

### **LIMITS**

None; for reporting purposes only.

### **TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.65dB (including 10 dB pad and 0.65 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

### **RESULTS**

**BLE**

<b>Tested By:</b>	19419
<b>Date:</b>	2/18/2019

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>AV power (dBm)</b>
Low	2402	8.01
Middle	2440	8.29
High	2480	8.45



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## **8.6. POWER SPECTRAL DENSITY**

### **LIMITS**

FCC §15.247 (e)

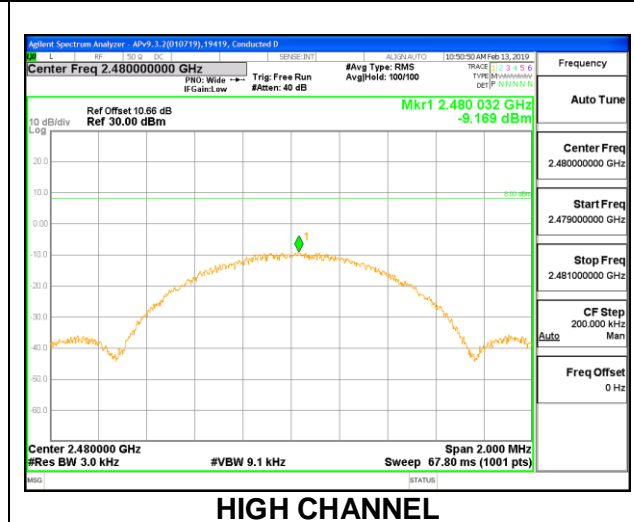
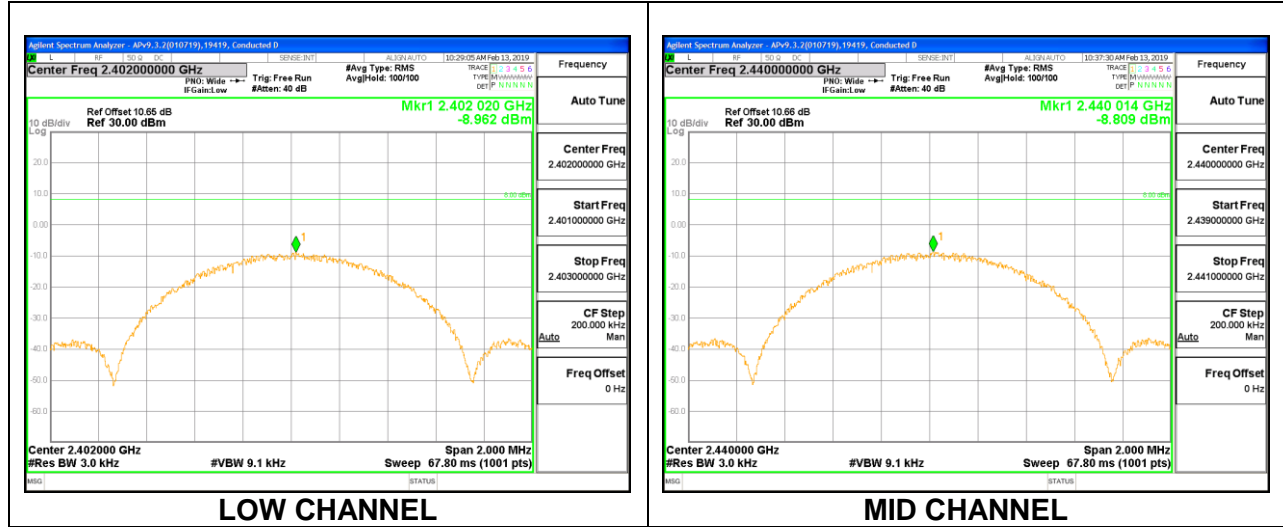
RSS-247 (5.2) (b)

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**

**BLE**

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-8.962	8	-16.96
Middle	2440	-8.809	8	-16.81
High	2480	-9.169	8	-17.17



## **8.7. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

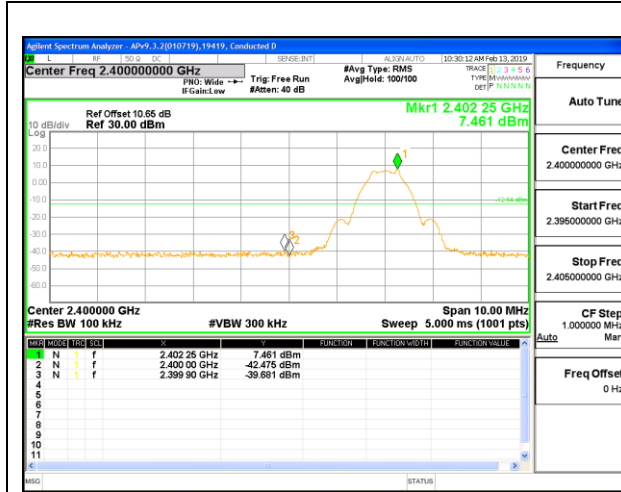
FCC §15.247 (d)

RSS-247 5.5

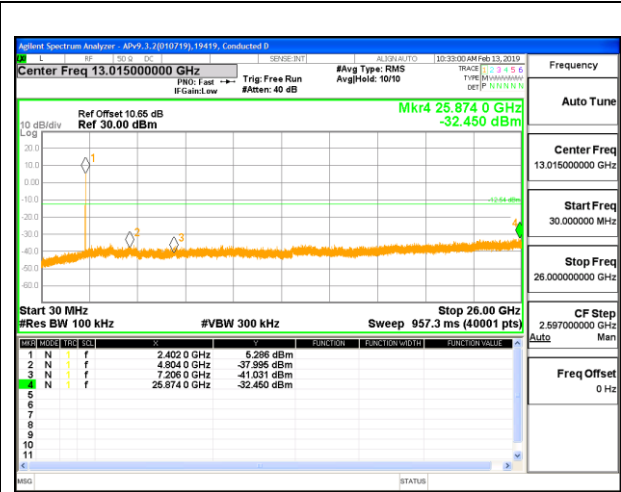
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

### **RESULTS**

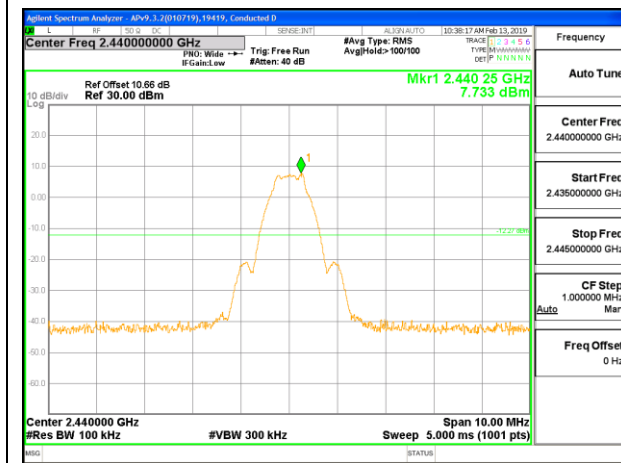
**BLE**



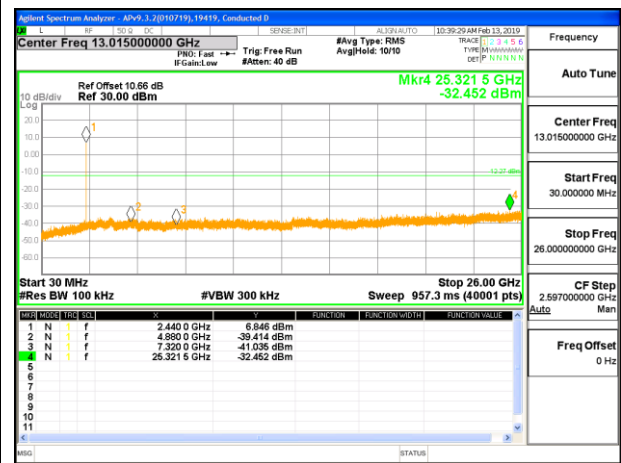
**LOW CHANNEL BANDEDGE**



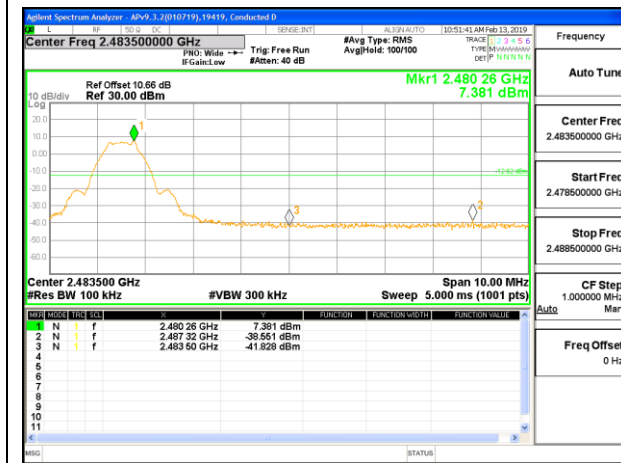
**OUT-OF-BAND LOW CHANNEL**



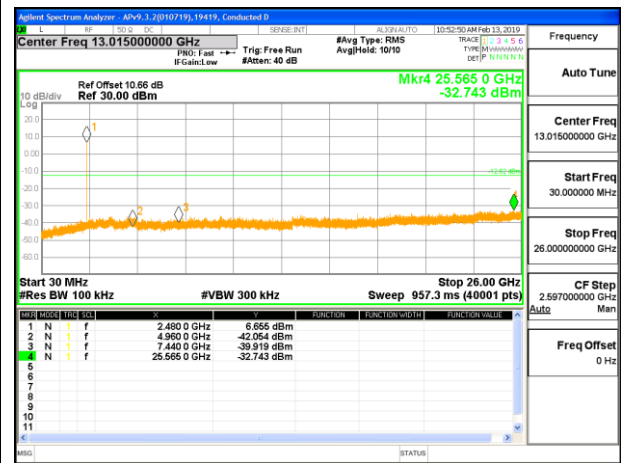
**IN-BAND REFERENCE LEVEL**



**OUT-OF-BAND MID CHANNEL**



**HIGH CHANNEL BANDEDGE**



**OUT-OF-BAND HIGH CHANNEL**

## 9. RADIATED TEST RESULTS

### 9.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

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

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

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

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

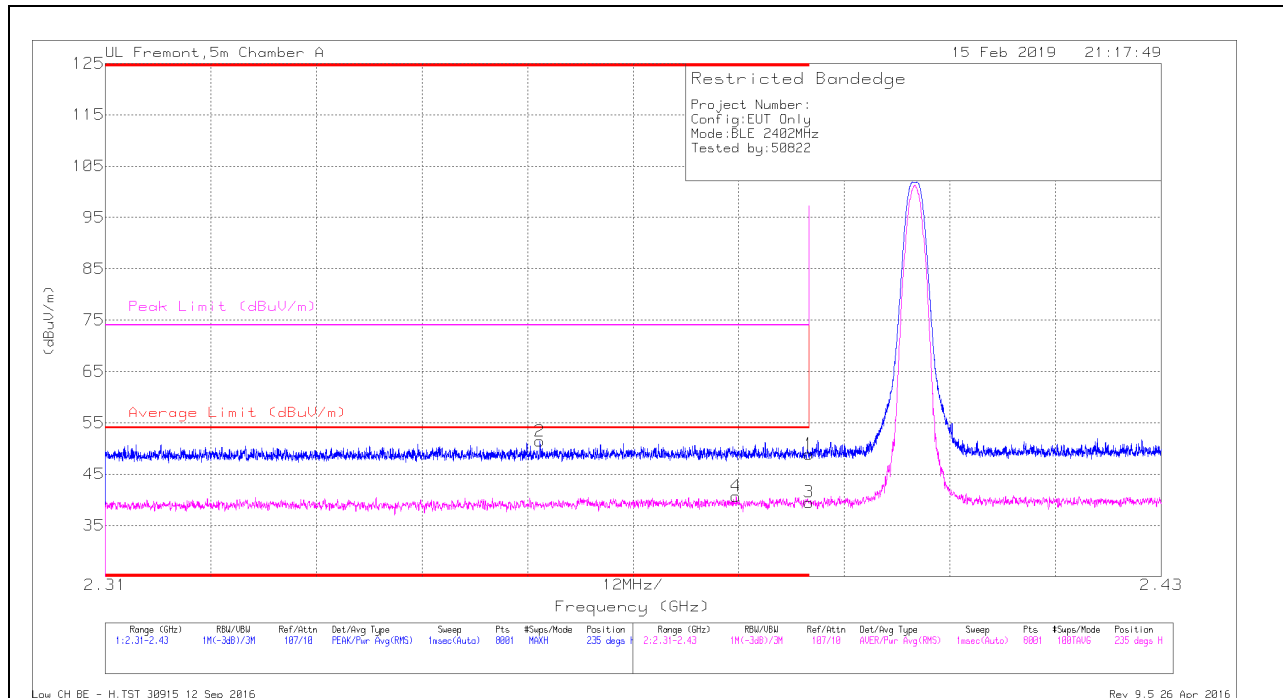
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 9.2. TRANSMITTER ABOVE 1 GHz

### BLE

### BANDEGE (LOW CHANNEL)

### HORIZONTAL RESULT



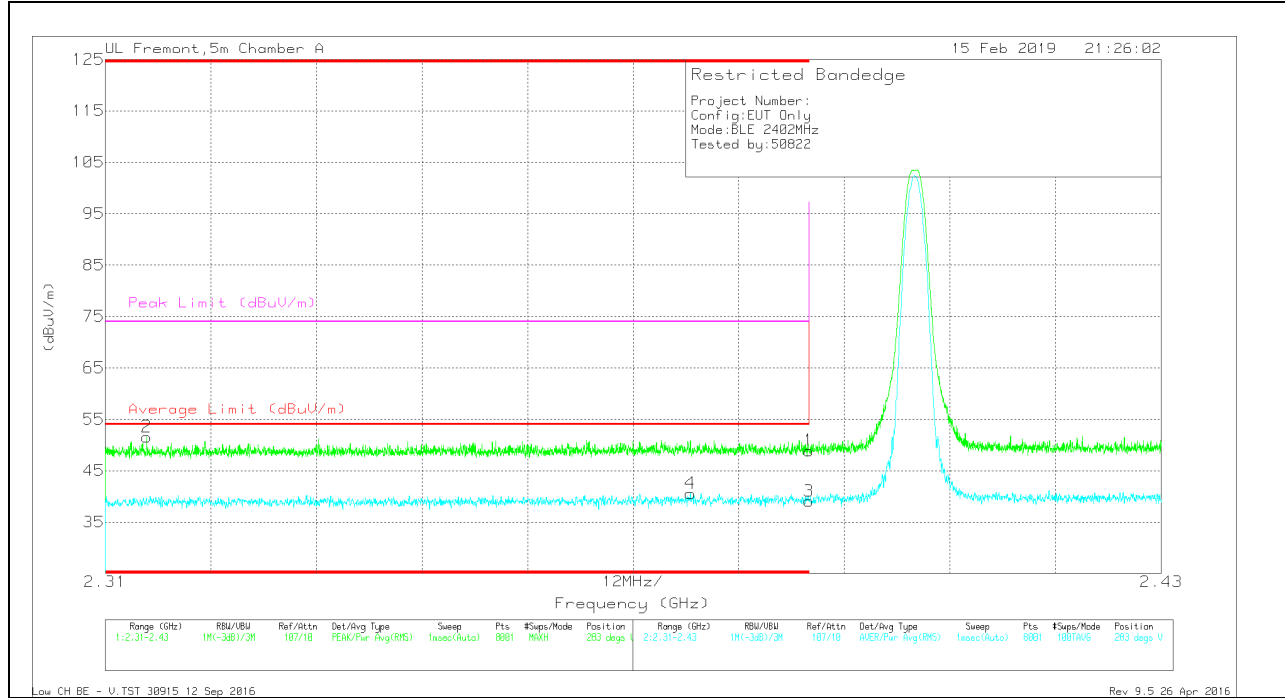
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/Fltr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.88	Pk	32	-23	48.88	-	-	74	-25.12	235	211	H
2	* 2.359	42.61	Pk	31.8	-23	51.41	-	-	74	-22.59	235	211	H
3	* 2.39	30.51	RMS	32	-23	39.51	54	-14.49	-	-	235	211	H
4	* 2.382	31.71	RMS	32	-23	40.71	54	-13.29	-	-	235	211	H

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

Pk - Peak detector

RMS - RMS detection

### VERTICAL RESULT

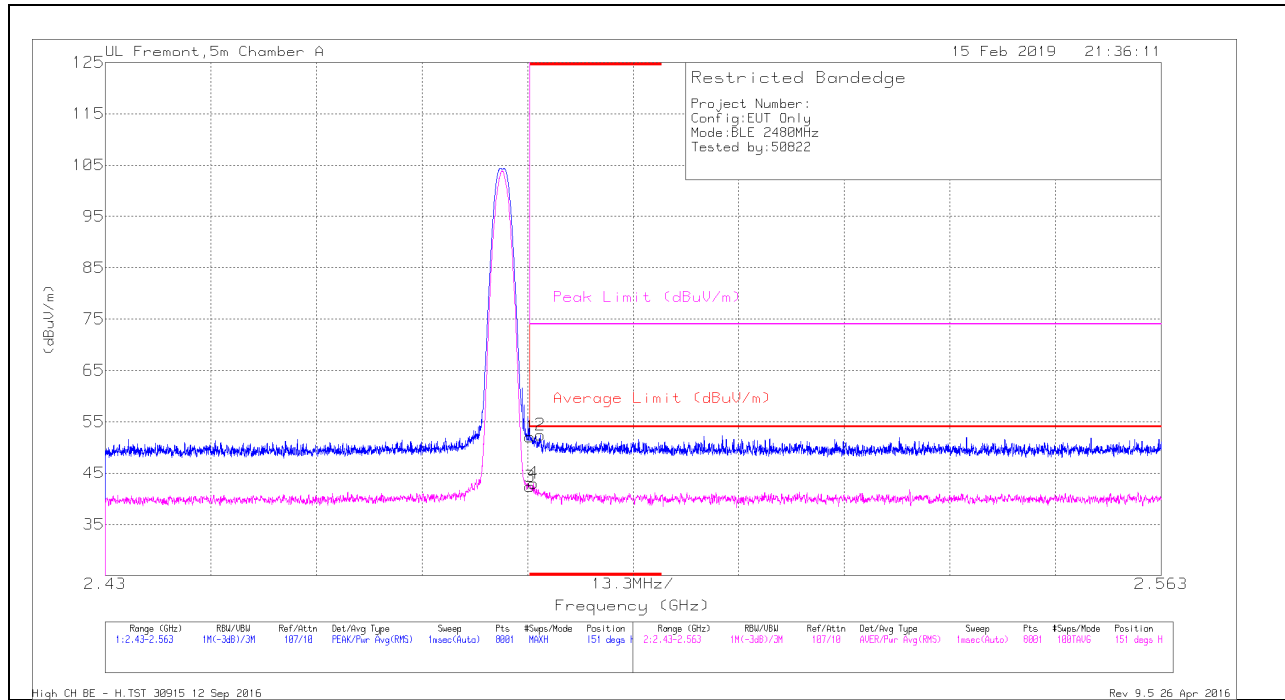


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.92	Pk	32	-23	48.92	-	-	74	-25.08	283	383	V
2	* 2.315	42.78	Pk	31.8	-23	51.58	-	-	74	-22.42	283	383	V
3	* 2.39	30.08	RMS	32	-23	39.08	54	-14.92	-	-	283	383	V
4	* 2.377	31.5	RMS	32	-22.9	40.6	54	-13.4	-	-	283	383	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 RMS - RMS detection

**BANEDGE (HIGH CHANNEL)**

**HORIZONTAL RESULT**



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT345 (dB/m)	Amp/Cbl/Fitr/Pad (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	42.32	Pk	32.4	-22.7	52.02	-	-	74	-21.98	151	282	H
2	* 2.485	42.73	Pk	32.4	-22.7	52.43	-	-	74	-21.57	151	282	H
3	* 2.484	32.69	RMS	32.4	-22.7	42.39	54	-11.61	-	-	151	282	H
4	* 2.484	33.31	RMS	32.4	-22.7	43.01	54	-10.99	-	-	151	282	H

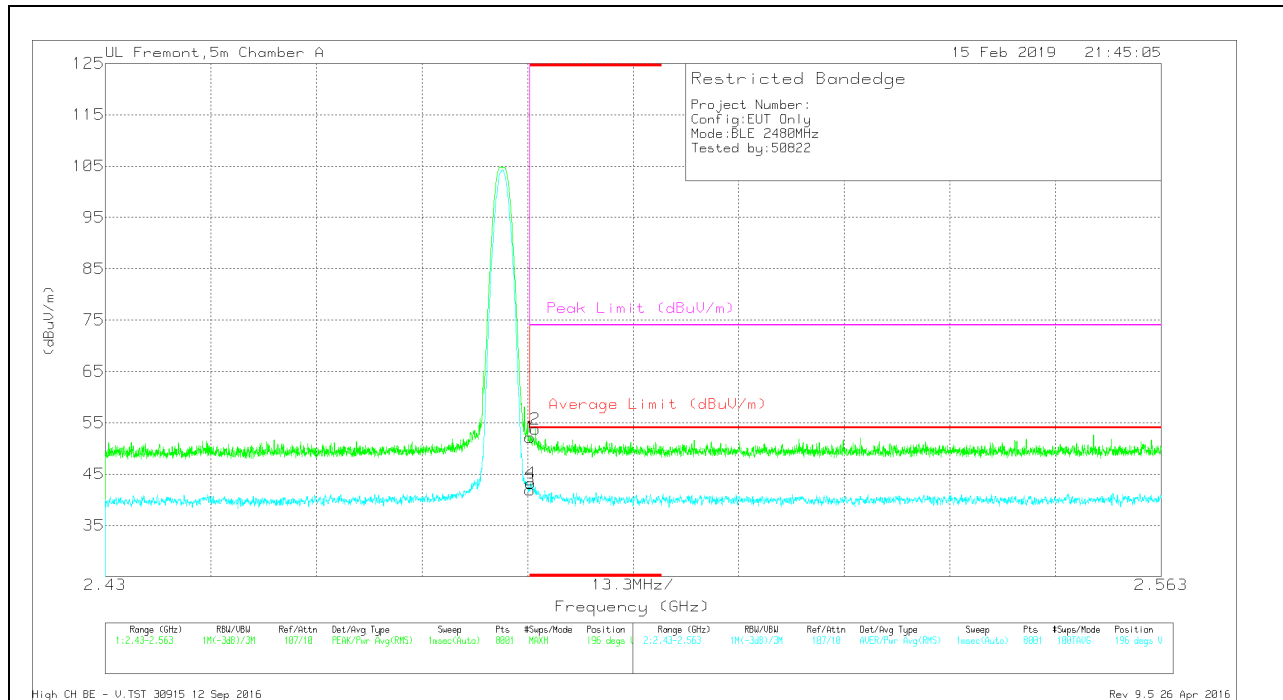
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection



### VERTICAL RESULT

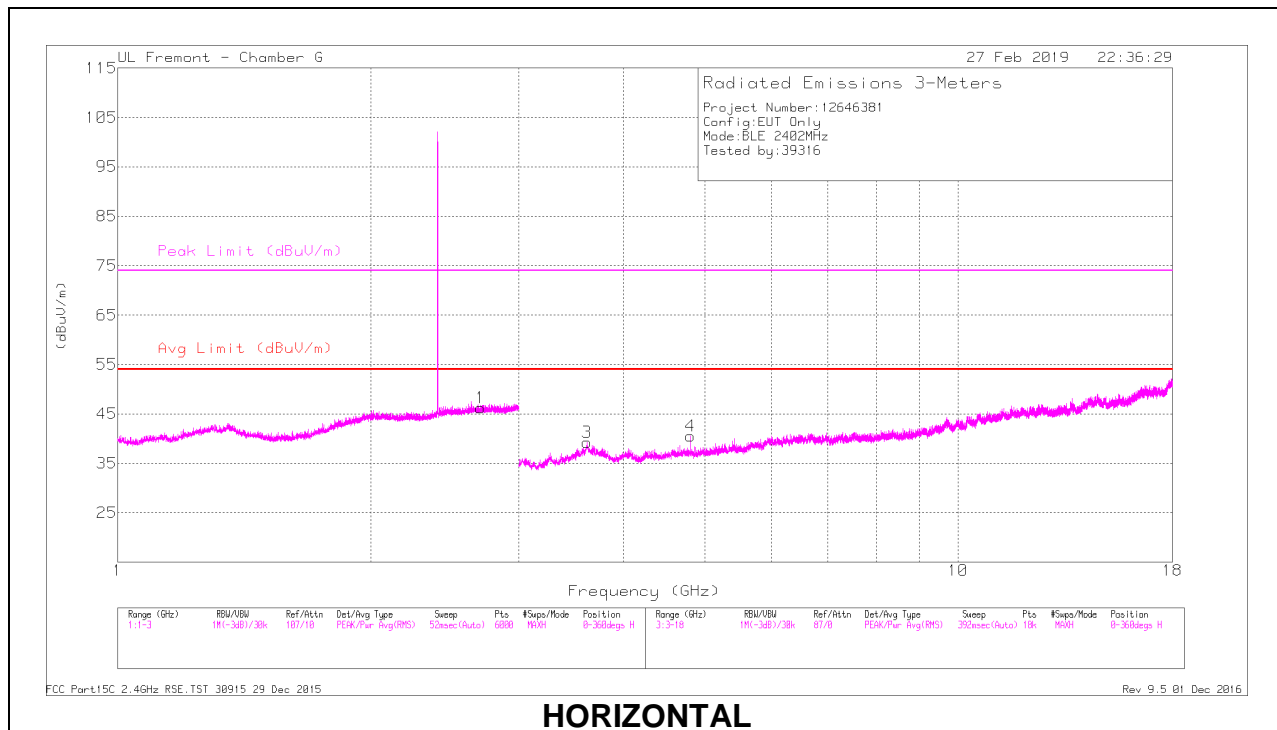


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	42.47	Pk	32.4	-22.7	52.17	-	-	74	-21.83	196	394	V
2	* 2.484	44.03	Pk	32.4	-22.7	53.73	-	-	74	-20.27	196	394	V
3	* 2.484	32.24	RMS	32.4	-22.7	41.94	54	-12.06	-	-	196	394	V
4	* 2.484	33.52	RMS	32.4	-22.7	43.22	54	-10.78	-	-	196	394	V

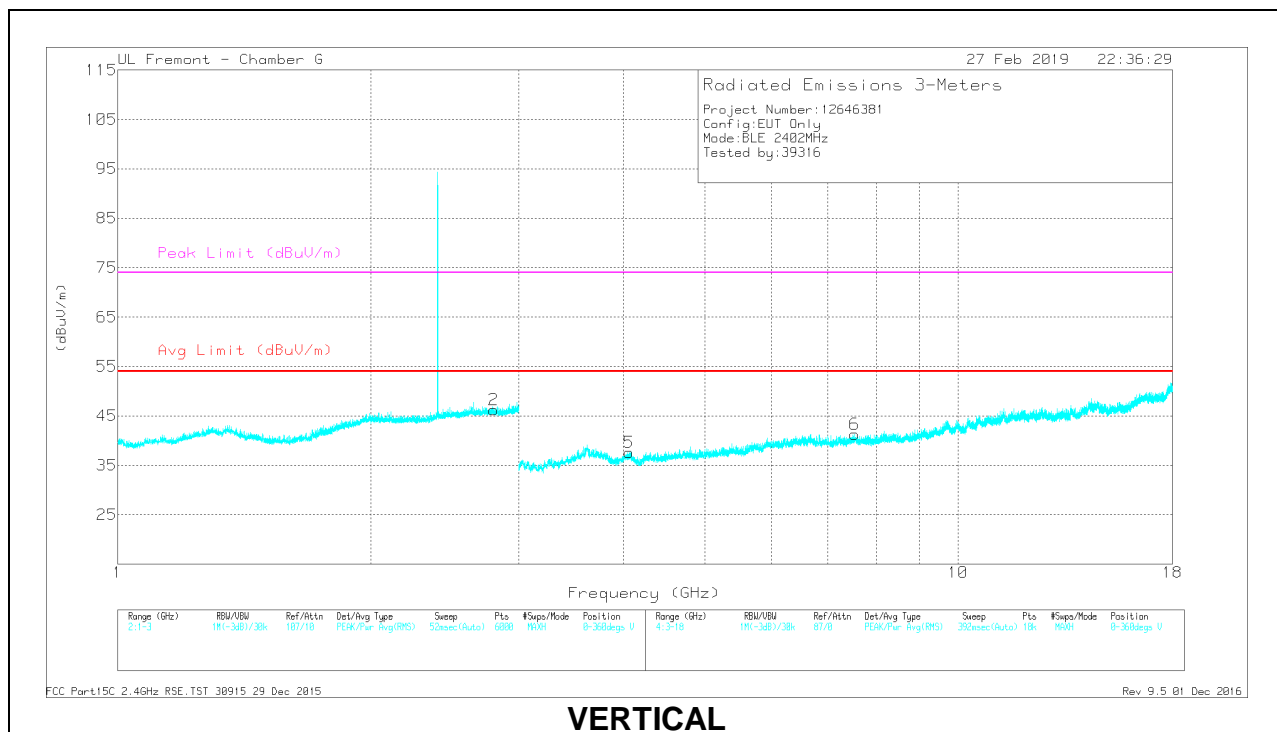
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 RMS - RMS detection

**HARMONICS AND SPURIOUS EMISSIONS**

**LOW CHANNEL RESULTS**



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

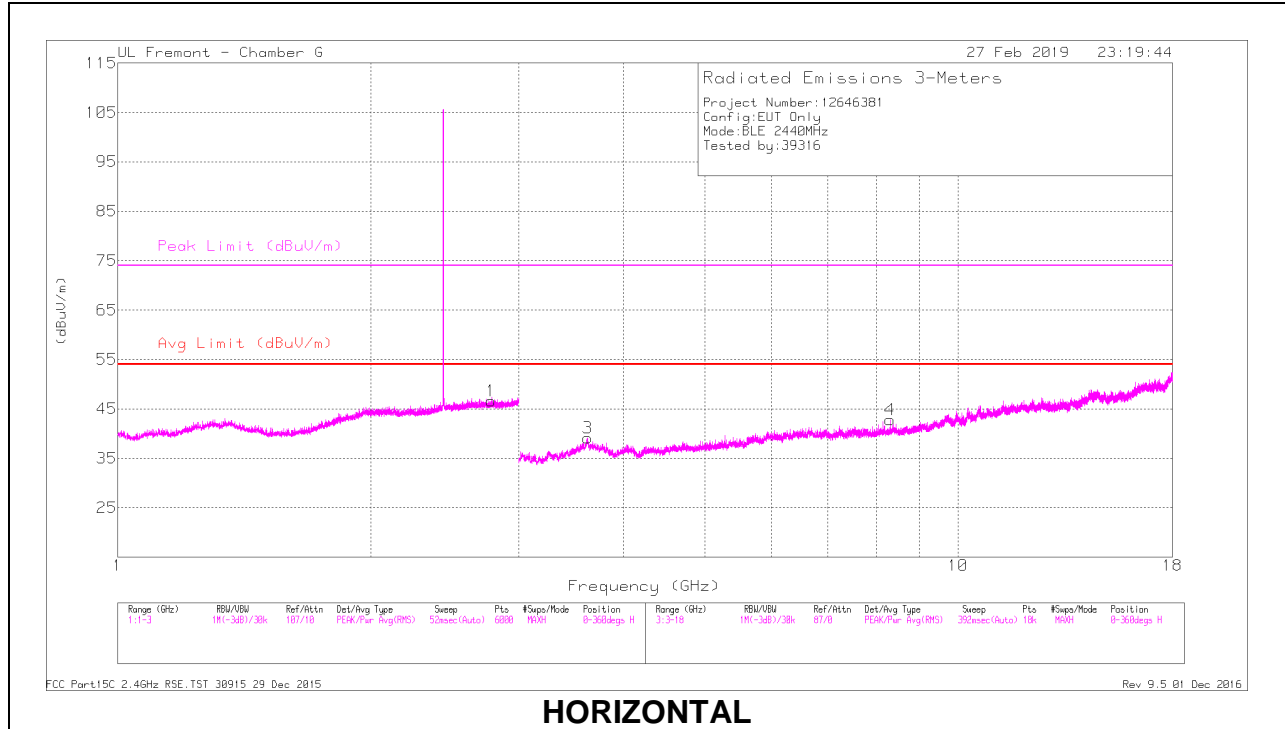
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cb/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.701	42.94	PK2	32.6	-22.1	53.44	-	-	74	-20.56	310	215	H
	* 2.701	31.3	MAv1	32.6	-22.1	41.8	54	-12.2	-	-	310	215	H
2	* 2.803	43.37	PK2	32.8	-22.1	54.07	-	-	74	-19.93	83	399	V
	* 2.801	31.39	MAv1	32.8	-22.1	42.09	54	-11.91	-	-	83	399	V
3	* 3.622	41.07	PK2	35.7	-30.1	46.67	-	-	74	-27.33	136	278	H
	* 3.621	30.24	MAv1	35.7	-30.2	35.74	54	-18.26	-	-	136	278	H
4	* 4.805	42.74	PK2	34.3	-29.8	47.24	-	-	74	-26.76	112	119	H
	* 4.804	32.56	MAv1	34.3	-29.8	37.06	54	-16.94	-	-	112	119	H
5	* 4.062	41.06	PK2	33.7	-29.6	45.16	-	-	74	-28.84	229	222	V
	* 4.062	29.16	MAv1	33.7	-29.6	33.26	54	-20.74	-	-	229	222	V
6	* 7.529	38.62	PK2	36.1	-26.8	47.92	-	-	74	-26.08	117	164	V
	* 7.529	27.88	MAv1	36.1	-26.8	37.18	54	-16.82	-	-	117	164	V

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

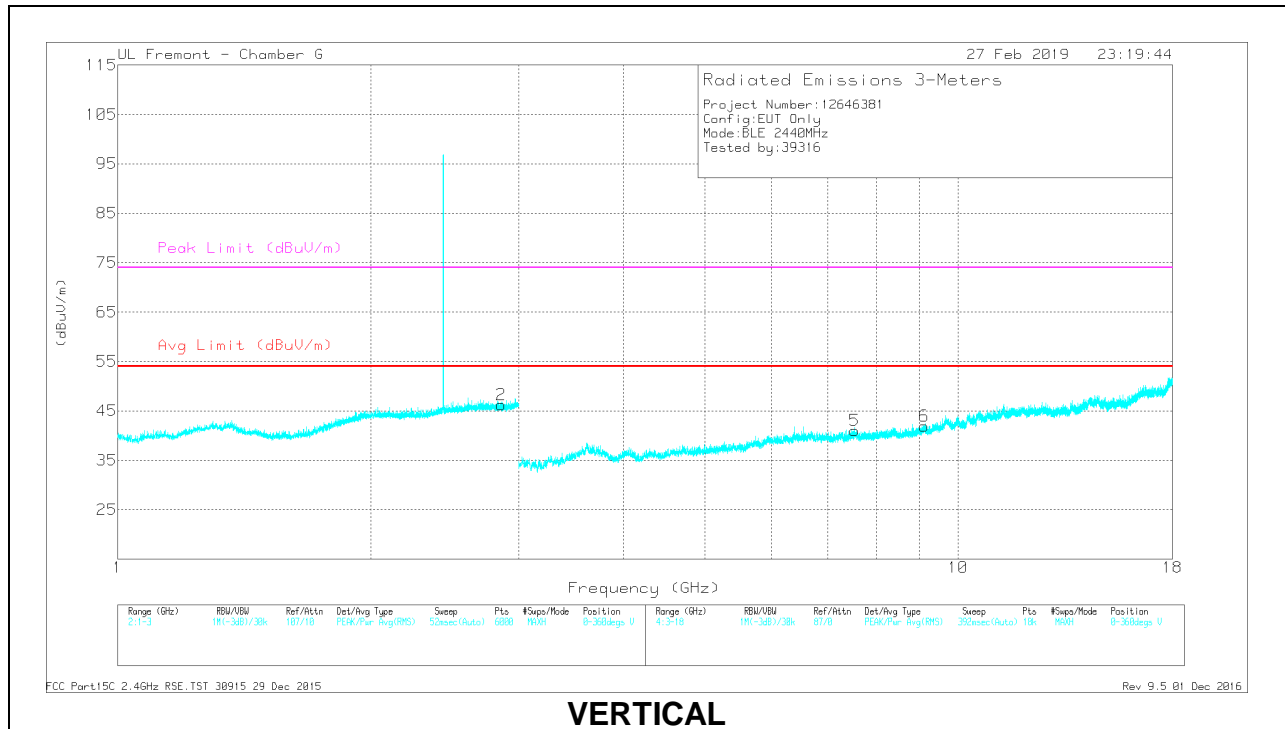
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

### MID CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

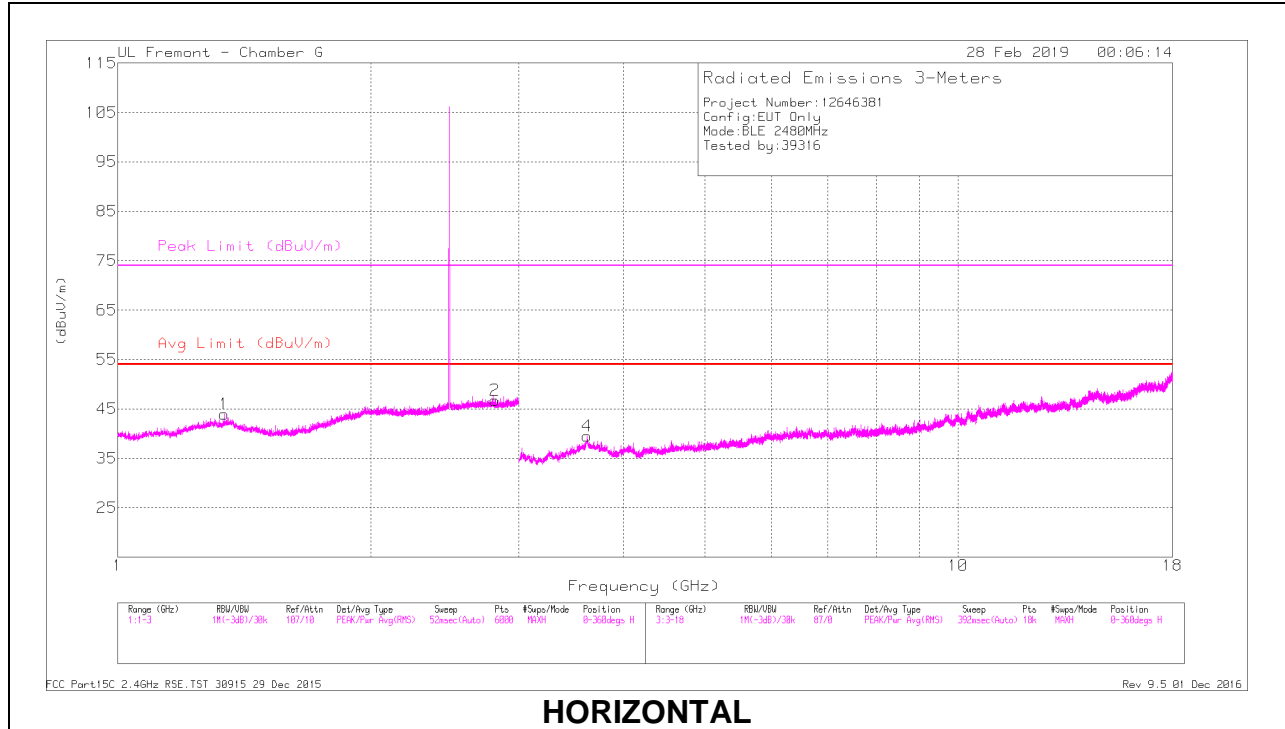
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cb/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.781	42.38	PK2	32.8	-22.1	53.08	-	-	74	-20.92	82	118	H
	* 2.782	30.45	MAv1	32.8	-22.1	41.15	54	-12.85	-	-	82	118	H
2	* 2.861	42.77	PK2	32.7	-22	53.47	-	-	74	-20.53	32	105	V
	* 2.861	30.4	MAv1	32.7	-22	41.1	54	-12.9	-	-	32	105	V
3	* 3.624	41.83	PK2	35.6	-30.1	47.33	-	-	74	-26.67	74	156	H
	* 3.624	29.75	MAv1	35.5	-30.1	35.15	54	-18.85	-	-	74	156	H
4	* 8.304	38.74	PK2	36.1	-27	47.84	-	-	74	-26.16	341	185	H
	* 8.301	27.3	MAv1	36.1	-27.1	36.3	54	-17.7	-	-	341	185	H
5	* 7.53	39.03	PK2	36.1	-26.8	48.33	-	-	74	-25.67	210	202	V
	* 7.529	27.27	MAv1	36.1	-26.8	36.57	54	-17.43	-	-	210	202	V
6	* 9.126	38.04	PK2	36.5	-25.4	49.14	-	-	74	-24.86	95	245	V
	* 9.126	26.94	MAv1	36.5	-25.4	38.04	54	-15.96	-	-	95	245	V

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

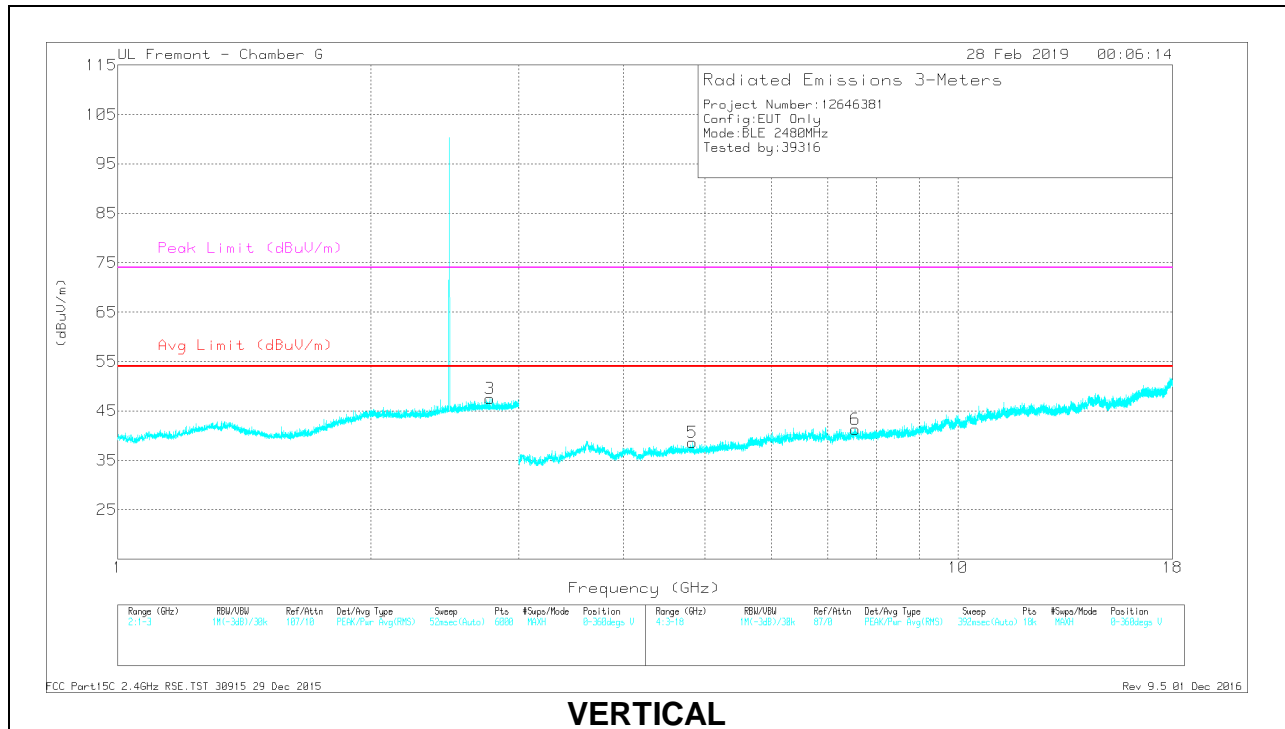
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

### RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cb/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.339	43.94	PK2	29.9	-23.7	50.14	-	-	74	-23.86	300	278	H
	* 1.339	31.83	MAv1	29.9	-23.7	38.03	54	-15.97	-	-	300	278	H
2	* 2.81	42.88	PK2	32.8	-22.1	53.58	-	-	74	-20.42	93	109	H
	* 2.809	31.18	MAv1	32.8	-22.1	41.88	54	-12.12	-	-	93	109	H
3	* 2.773	42.84	PK2	32.7	-22.1	53.44	-	-	74	-20.56	134	172	V
	* 2.776	31.6	MAv1	32.7	-22.1	42.2	54	-11.8	-	-	134	172	V
4	* 3.619	41.16	PK2	35.7	-30.2	46.66	-	-	74	-27.34	143	212	H
	* 3.619	29.97	MAv1	35.7	-30.2	35.47	54	-18.53	-	-	143	212	H
5	* 4.827	39.63	PK2	34.3	-29.7	44.23	-	-	74	-29.77	163	271	V
	* 4.826	28.77	MAv1	34.3	-29.7	33.37	54	-20.63	-	-	163	271	V
6	* 7.551	39.17	PK2	36.1	-26.7	48.57	-	-	74	-25.43	312	138	V
	* 7.549	27.75	MAv1	36.1	-26.7	37.15	54	-16.85	-	-	312	138	V

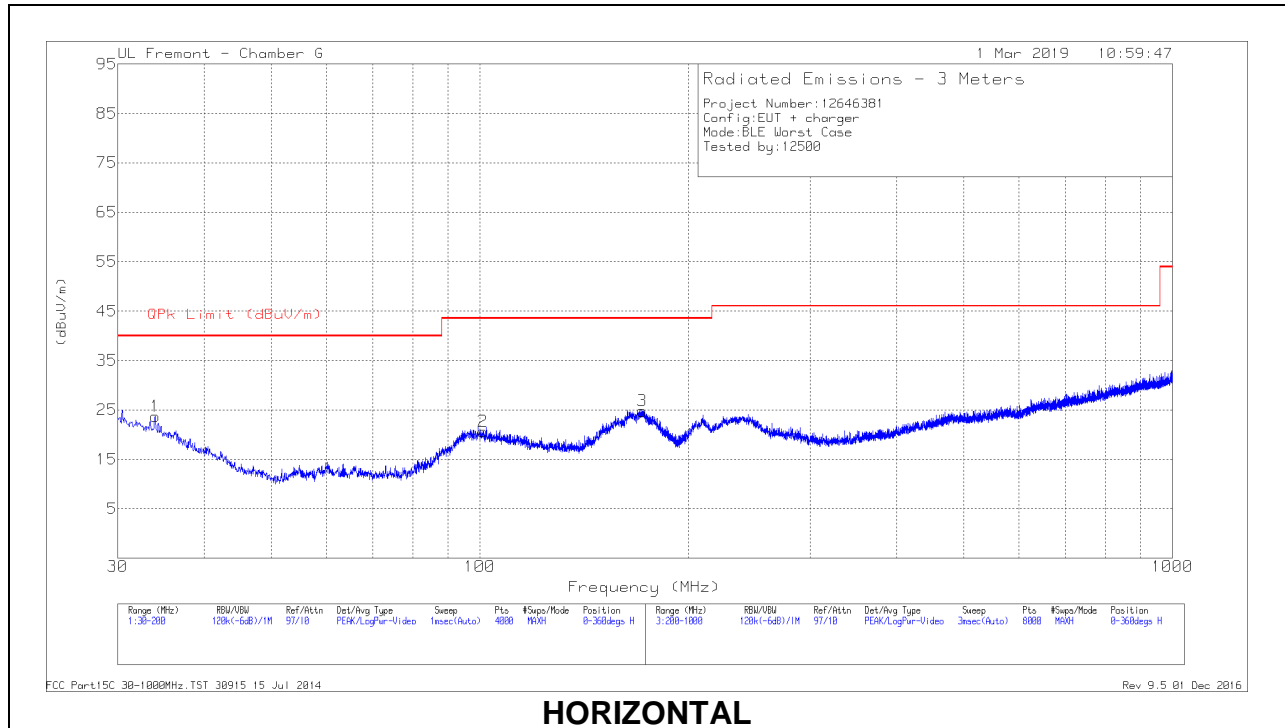
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

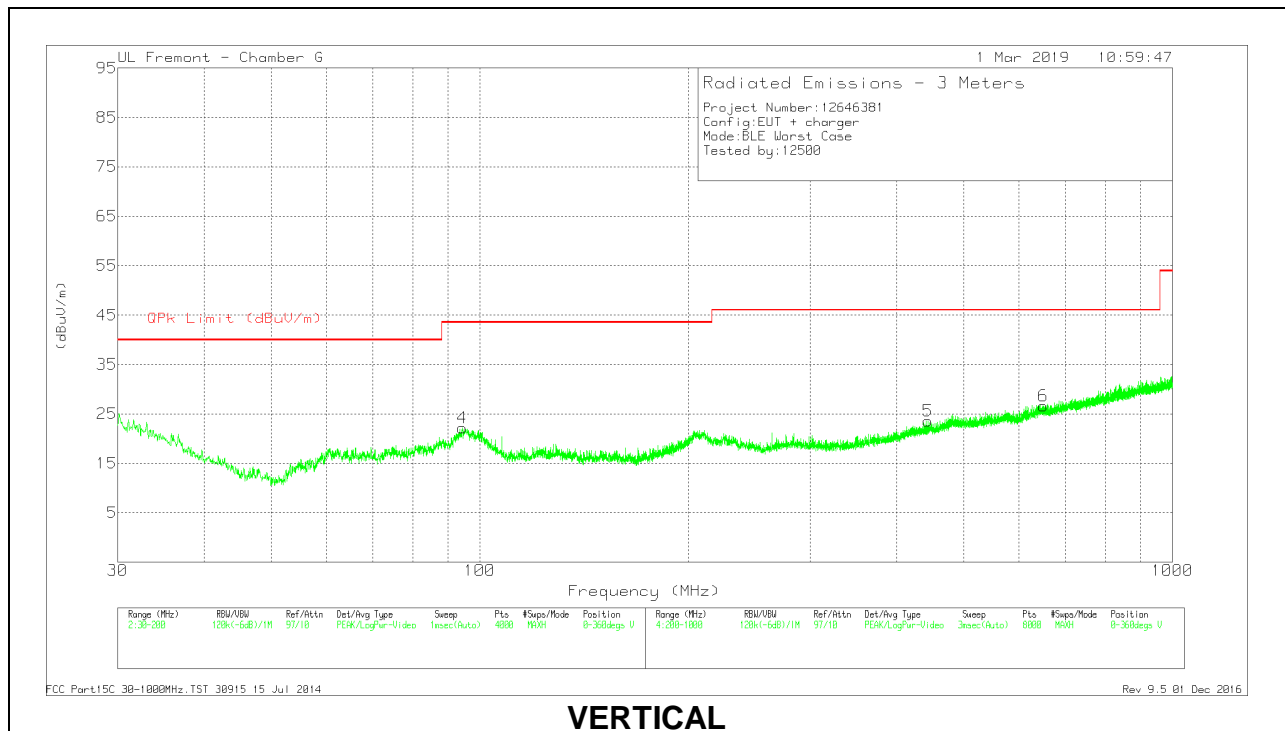
MAv1 - KDB558074 Option 1 Maximum RMS Average

### 9.3. Worst Case Below 1 GHz

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



**HORIZONTAL**



**VERTICAL**



**Below 1GHz Data**

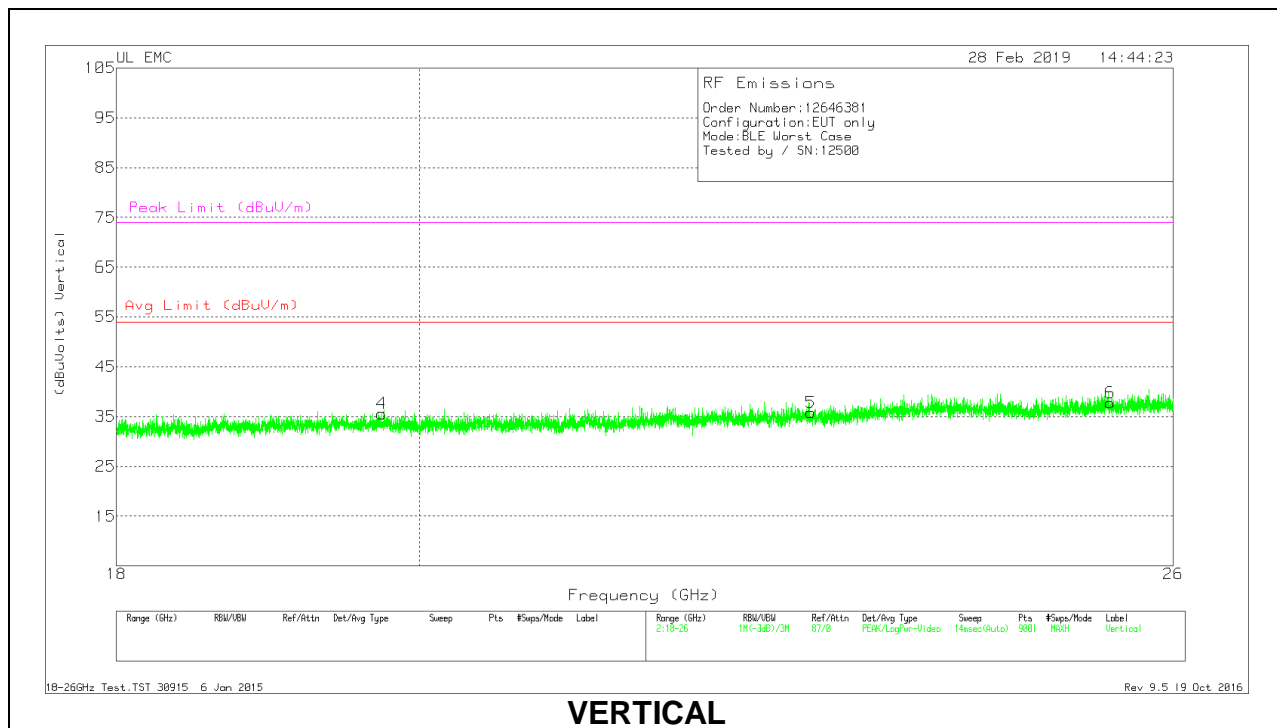
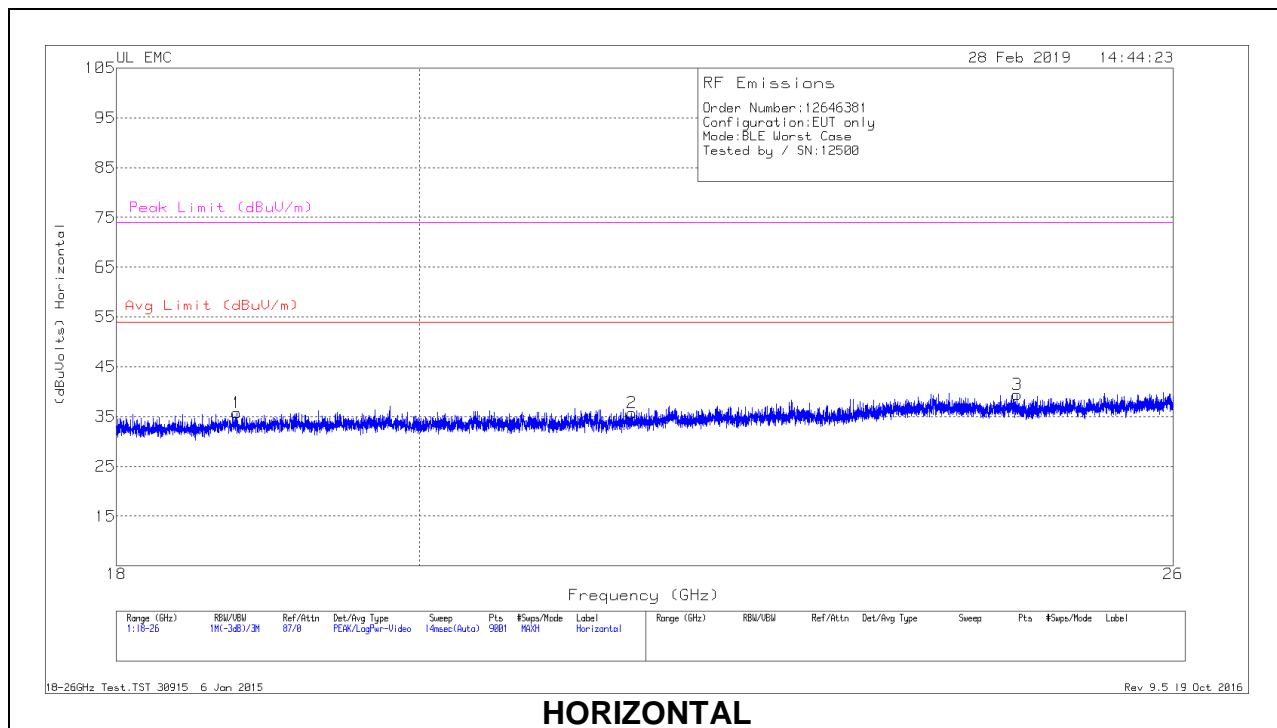
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T185 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	33.7437	23.33	Qp	24.4	-31.2	16.53	40	-23.47	337	107	H
1	100.9858	31.91	Qp	16.2	-30.4	17.71	43.52	-25.81	68	174	H
4	* 171.5296	33.99	Qp	17.4	-29.8	21.59	43.52	-21.93	161	180	H
2	94.3269	36.14	Qp	14.5	-30.5	20.14	43.52	-23.38	76	116	V
5	443.9615	22.36	Qp	22.6	-28.1	16.86	46.02	-29.16	110	295	V
6	650.4852	22.13	Qp	25.7	-27.4	20.43	46.02	-25.59	229	145	V

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

Qp - Quasi-Peak detector

### 9.4. Worst Case 18-26 GHz

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



**18 – 26GHz DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T447 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	18.77	37.86	Pk	32.4	-25	-9.5	35.76	54	-18.24	74	-38.24
2	21.535	37.32	Pk	33.1	-25.2	-9.5	35.72	54	-18.28	74	-38.28
3	24.624	38.84	Pk	34.4	-24.3	-9.5	39.44	54	-14.56	74	-34.56
4	19.74	37.28	Pk	32.7	-24.9	-9.5	35.58	54	-18.42	74	-38.42
5	22.921	36.82	Pk	33.6	-25.1	-9.5	35.82	54	-18.18	74	-38.18
6	25.435	37.04	Pk	34.5	-24.3	-9.5	37.74	54	-16.26	74	-36.26

Pk - Peak detector

## 10. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of emission (MHz)	Conducted limit (dBµV)	
	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.

### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

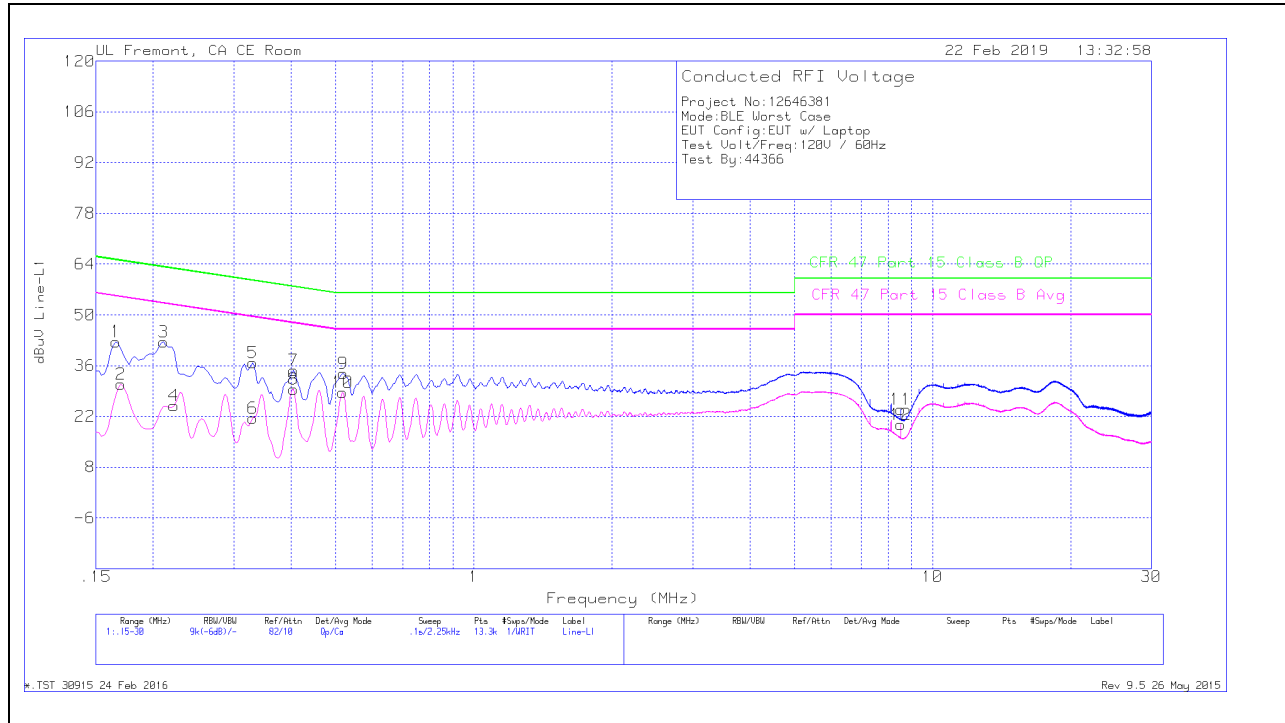
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines

### RESULTS

### 10.1.1. AC Power Line Host

### LINE 1 RESULTS



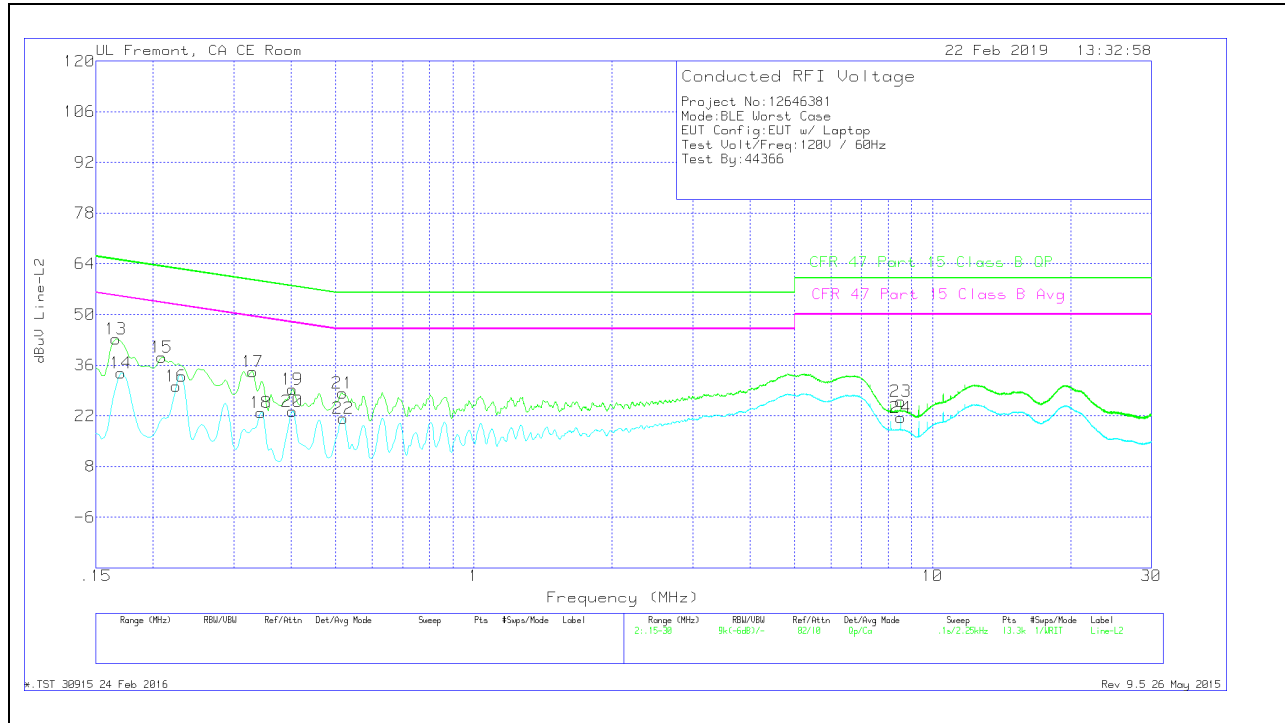
Range 1: Line-L1 .15 - 30MHz

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	.16575	32.41	Qp	.1	0	10.1	42.61	65.17	-22.56	-	-
2	.17025	20.79	Ca	0	0	10.1	30.89	-	-	54.95	-24.06
3	.21075	32.48	Qp	0	0	10.1	42.58	63.18	-20.6	-	-
4	.222	14.83	Ca	0	0	10.1	24.93	-	-	52.74	-27.81
5	.33	26.67	Qp	0	0	10.1	36.77	59.45	-22.68	-	-
6	.33	11.37	Ca	0	0	10.1	21.47	-	-	49.45	-27.98
7	.40425	24.55	Qp	0	0	10.1	34.65	57.77	-23.12	-	-
8	.40425	19.45	Ca	0	0	10.1	29.55	-	-	47.77	-18.22
9	.519	23.77	Qp	0	0	10.1	33.87	56	-22.13	-	-
10	.51675	18.45	Ca	0	0	10.1	28.55	-	-	46	-17.45
11	8.52675	13.46	Qp	0	.2	10.2	23.86	60	-36.14	-	-
12	8.52675	9.3	Ca	0	.2	10.2	19.7	-	-	50	-30.3

Qp - Quasi-Peak detector

Ca - CISPR average detection

### LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz

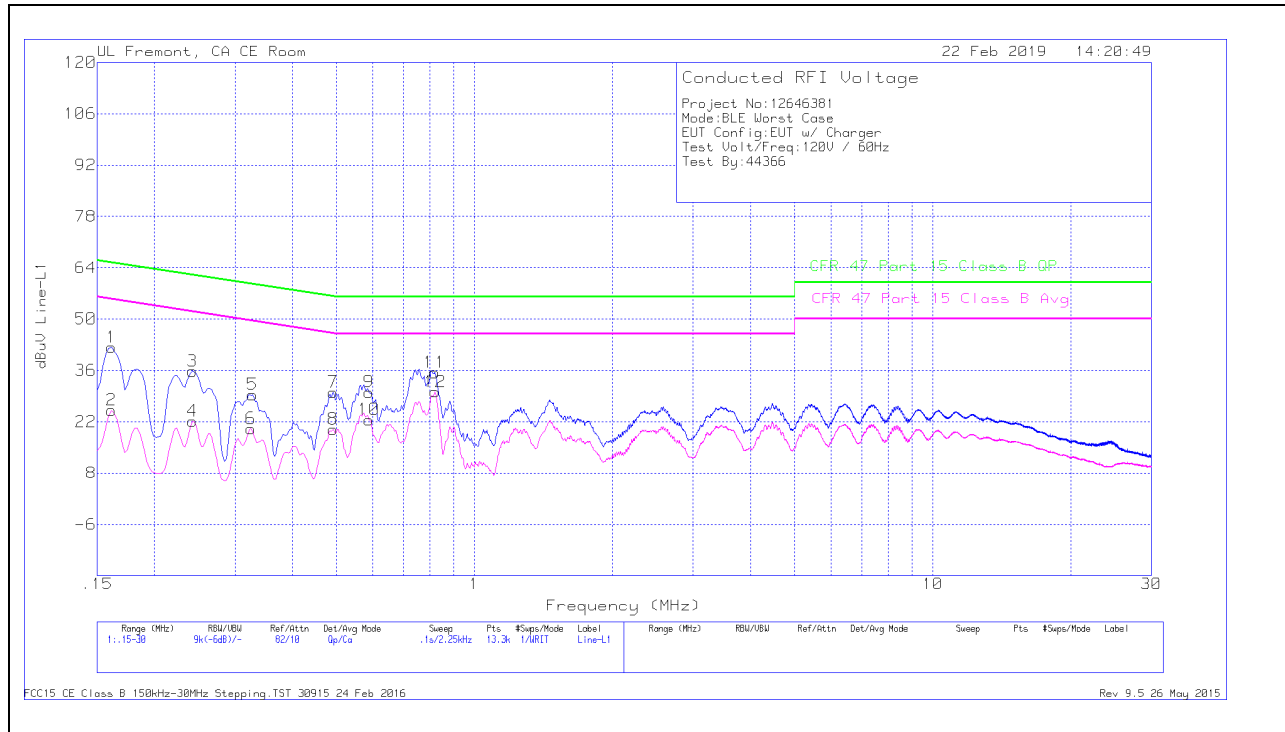
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.16575	32.98	Qp	.1	0	10.1	43.18	65.17	-21.99	-	-
14	.17025	23.8	Ca	0	0	10.1	33.9	-	-	54.95	-21.05
15	.2085	28.09	Qp	0	0	10.1	38.19	63.26	-25.07	-	-
16	.22425	20.1	Ca	0	0	10.1	30.2	-	-	52.66	-22.46
17	.33	24.16	Qp	0	0	10.1	34.26	59.45	-25.19	-	-
18	.3435	12.83	Ca	0	0	10.1	22.93	-	-	49.12	-26.19
19	.402	19.27	Qp	0	0	10.1	29.37	57.81	-28.44	-	-
20	.402	13.12	Ca	0	0	10.1	23.22	-	-	47.81	-24.59
21	.51675	18.12	Qp	0	0	10.1	28.22	56	-27.78	-	-
22	.519	11.24	Ca	0	0	10.1	21.34	-	-	46	-24.66
23	8.52	15.66	Qp	0	.2	10.2	26.06	60	-33.94	-	-
24	8.52	11.13	Ca	0	.2	10.2	21.53	-	-	50	-28.47

Qp - Quasi-Peak detector

Ca - CISPR average detection

**10.1.2. AC Power Line Norm**

**LINE 1 RESULTS**



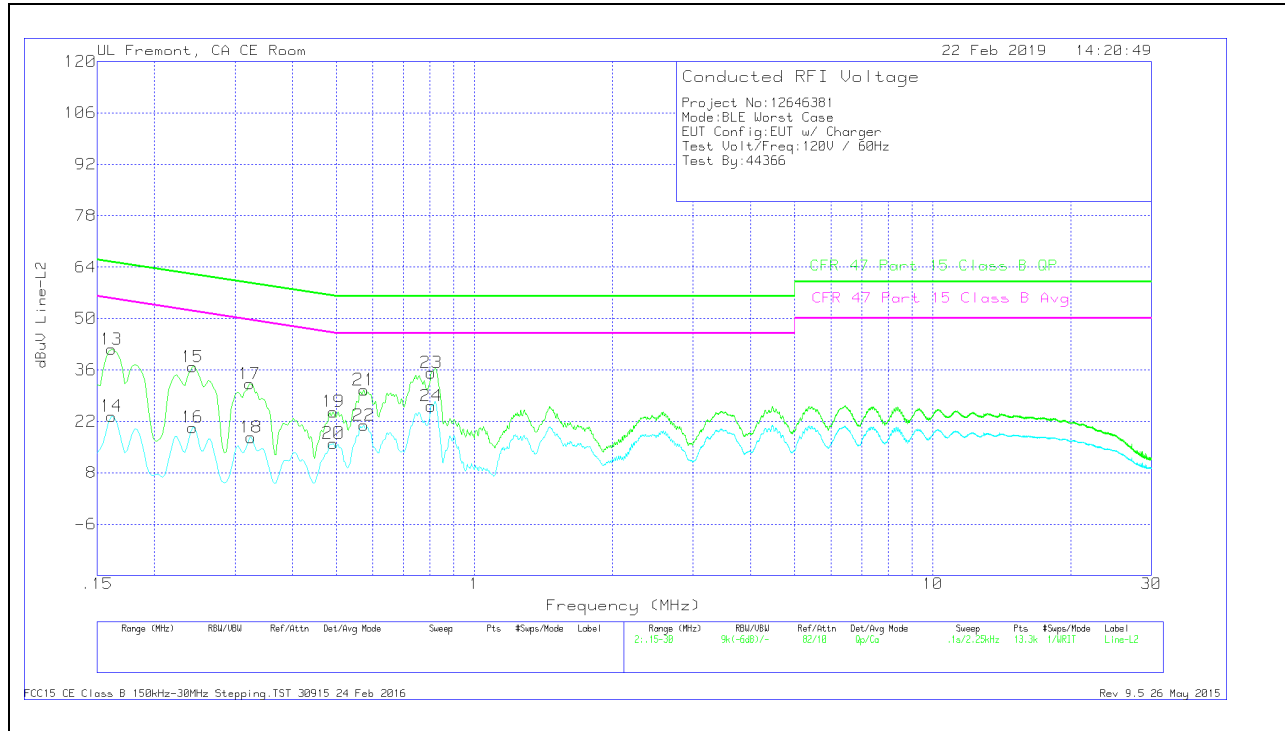
Range 1: Line-L1 .15 - 30MHz

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	32.1	Qp	.1	0	10.1	42.3	65.4	-23.1	-	-
2	.16125	14.93	Ca	.1	0	10.1	25.13	-	-	55.4	-30.27
3	.24225	25.66	Qp	0	0	10.1	35.76	62.02	-26.26	-	-
4	.24225	12.05	Ca	0	0	10.1	22.15	-	-	52.02	-29.87
5	.32775	19.3	Qp	0	0	10.1	29.4	59.51	-30.11	-	-
6	.3255	10.01	Ca	0	0	10.1	20.11	-	-	49.57	-29.46
7	.492	19.93	Qp	0	0	10.1	30.03	56.13	-26.1	-	-
8	.492	9.87	Ca	0	0	10.1	19.97	-	-	46.13	-26.16
9	.58875	19.97	Qp	0	0	10.1	30.07	56	-25.93	-	-
10	.58875	12.46	Ca	0	0	10.1	22.56	-	-	46	-23.44
11	.81825	25.3	Qp	0	0	10.1	35.4	56	-20.6	-	-
12	.8205	20.06	Ca	0	0	10.1	30.16	-	-	46	-15.84

Qp - Quasi-Peak detector

Ca - CISPR average detection

### LINE 2 RESULTS



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	.16125	31.44	Qp	.1	0	10.1	41.64	65.4	-23.76	-	-
14	.16125	13.19	Ca	.1	0	10.1	23.39	-	-	55.4	-32.01
15	.24225	26.7	Qp	0	0	10.1	36.8	62.02	-25.22	-	-
16	.24225	10.22	Ca	0	0	10.1	20.32	-	-	52.02	-31.7
17	.32325	22.08	Qp	0	0	10.1	32.18	59.62	-27.44	-	-
18	.3255	7.53	Ca	0	0	10.1	17.63	-	-	49.57	-31.94
19	.492	14.51	Qp	0	0	10.1	24.61	56.13	-31.52	-	-
20	.492	5.93	Ca	0	0	10.1	16.03	-	-	46.13	-30.1
21	.573	20.43	Qp	0	0	10.1	30.53	56	-25.47	-	-
22	.573	10.81	Ca	0	0	10.1	20.91	-	-	46	-25.09
23	.80475	25.14	Qp	0	0	10.1	35.24	56	-20.76	-	-
24	.80475	16.07	Ca	0	0	10.1	26.17	-	-	46	-19.83

Qp - Quasi-Peak detector

Ca - CISPR average detection



## **11. SETUP PHOTOS**

Please refer to 12646381-EP1V1 for setup photos

**END OF TEST REPORT**