



# **CERTIFICATION TEST REPORT**

**Report Number. :** 12554903-E1V2

**Applicant :** Dish Technologies LLC  
9601 Meridian Blvd  
Englewood, CO, 80112  
USA

**Model :** NHGBC

**FCC ID :** DKNBC

**EUT Description :** Battery Charger with BLE

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

**Date Of Issue:**  
December 27, 2018

**Prepared by:**  
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## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	12/19/2018	Initial Issue	---
V2	12/27/2018	Updated Sections 6, 8.4,8.5 & 9.3	E.Yu

## 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>12</b>
<b>7. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>13</b>
<b>8. ANTENNA PORT TEST RESULTS .....</b>	<b>14</b>
8.1. <i>ON TIME AND DUTY CYCLE.....</i>	<i>14</i>
8.2. <i>99% BANDWIDTH.....</i>	<i>15</i>
8.2.1. <i>BLE.....</i>	<i>15</i>
8.3. <i>6 dB BANDWIDTH.....</i>	<i>16</i>
8.3.1. <i>BLE.....</i>	<i>17</i>
8.4. <i>OUTPUT POWER.....</i>	<i>18</i>
8.4.1. <i>BLE.....</i>	<i>18</i>
8.5. <i>AVERAGE POWER.....</i>	<i>19</i>
8.5.1. <i>BLE.....</i>	<i>19</i>
8.6. <i>POWER SPECTRAL DENSITY .....</i>	<i>20</i>
8.6.1. <i>BLE.....</i>	<i>21</i>
8.7. <i>CONDUCTED SPURIOUS EMISSIONS.....</i>	<i>22</i>
8.7.1. <i>BLE.....</i>	<i>23</i>

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<b>9. RADIATED TEST RESULTS.....</b>	<b>24</b>
9.1. <i>LIMITS AND PROCEDURE.....</i>	<i>24</i>
9.2. <i>TRANSMITTER ABOVE 1 GHz.....</i>	<i>25</i>
9.2.1. <i>BLE.....</i>	<i>25</i>
9.3. <i>WORST-CASE BELOW 30 MHz.....</i>	<i>35</i>
9.4. <i>Worst Case Below 1 GHz.....</i>	<i>36</i>
9.5. <i>Worst Case 18-26 GHz.....</i>	<i>38</i>
<b>10. AC POWER LINE CONDUCTED EMISSIONS .....</b>	<b>40</b>
10.1.1. <i>AC Power Line Norm.....</i>	<i>41</i>
<b>11. SETUP PHOTOS .....</b>	<b>43</b>

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Dish Technologies LLC  
9601 Meridian Blvd  
Englewood, CO, 80112  
USA

**EUT DESCRIPTION:** Battery Charger with BLE

**MODEL:** NHGBC

**SERIAL NUMBER:** NOVA P2-1 Prototype

**DATE TESTED:** DECEMBER 11 –DECEMBER 18, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies

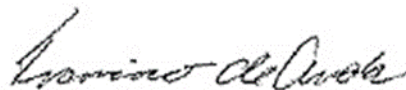
UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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.

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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 v05.

## 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 type="checkbox"/> Chamber A (ISED:2324B-1)	<input type="checkbox"/> Chamber D (ISED:22541-1)	<input checked="" type="checkbox"/> Chamber I (ISED:2324A-5)
<input type="checkbox"/> Chamber B (ISED:2324B-2)	<input type="checkbox"/> Chamber E (ISED:22541-2)	<input checked="" type="checkbox"/> Chamber J (ISED:2324A-6)
<input checked="" 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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

36.5 dBuV + 0 dB + 10.1 dB + 0 dB = 46.6 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	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. EUT DESCRIPTION

The EUT is a Battery Charger with BLE 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	2.91	1.95

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an inverted F printed antenna, with a maximum gain of 3.35dBi.

### 5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was FCC BLE Test v1.1

The test utility software used during testing was Labview serial vi.

### 5.5. WORST-CASE CONFIGURATION AND MODE

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

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

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.

Worst-case data rate as provided by the client was:

BLE: 1 Mbps



## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC
Laptop AC/DC Adapter	HP	HSTNN-DA40	744893-001	NA
Laptop	HP	EliteBook740	NA	NA
DC Battery	Duracell	DURA6-12F2-LE	NA	NA

### I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Unshielded	1	AC Mains to AC/DC Adapter
2	DC	1	DC	Unshielded	1.5	AC/DC Adapter to Laptop
3	USB	1	USB	Shielded	1	Laptop to EUT
4	Antenna	1	SMA	Unshielded	0.08	To spectrum analyzer
6	DC	1	DC	Unshielded	0.3	Battery to EUT

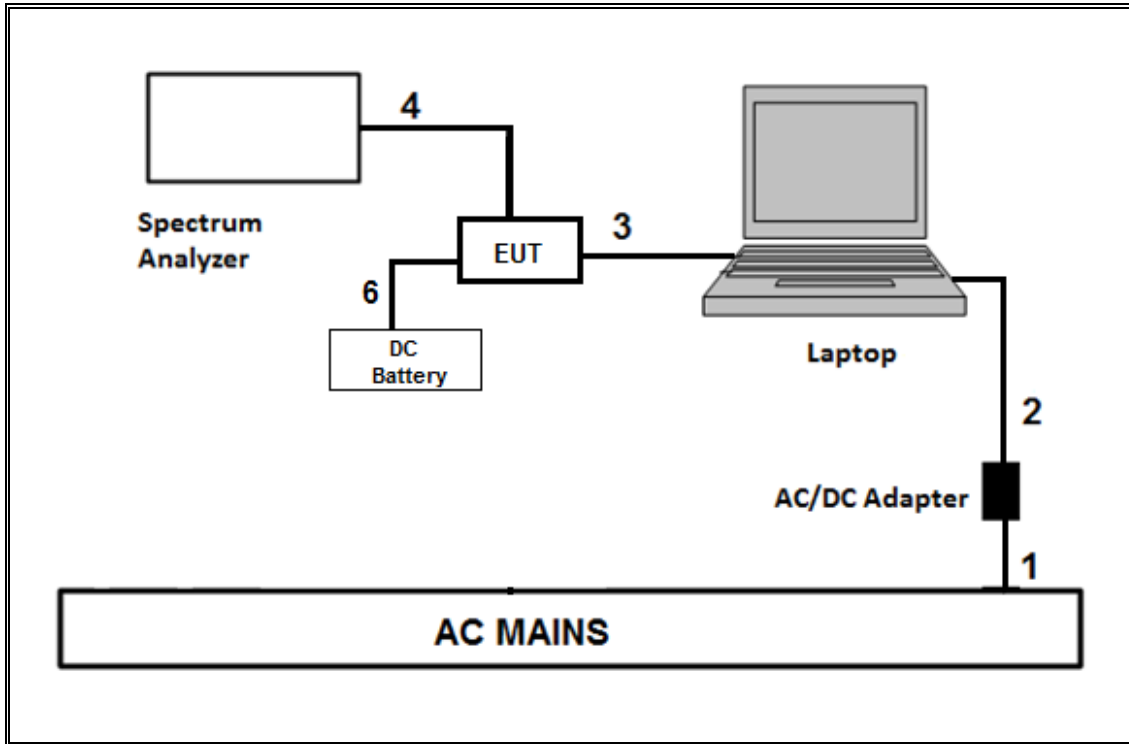
### I/O CABLES (AC POWER CONDUCTED TEST AND RADIATED TEST)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
5	AC	1	AC	Shielded	1.5	AC Power Cord to EUT

**TEST SETUP- ANTENNA PORT CONDUCTED TESTS**

The EUT was connected to and powered by battery. Test software exercised the EUT.

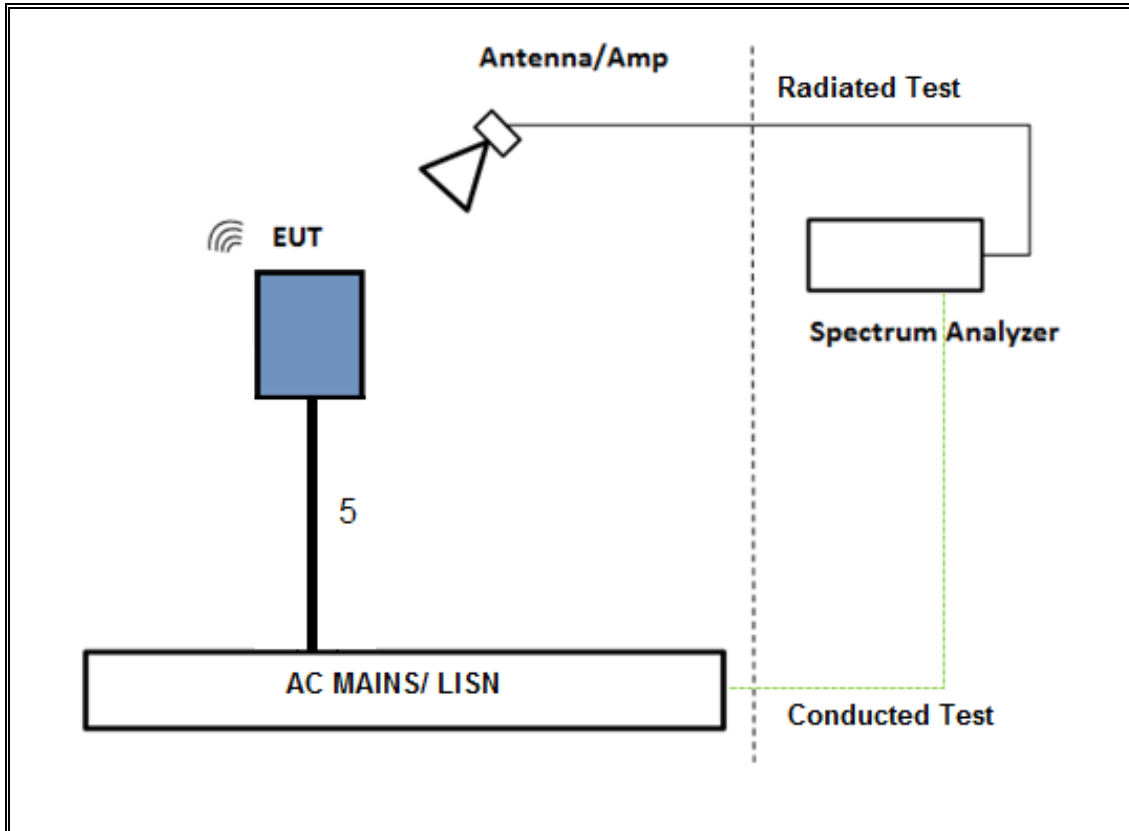
**SETUP DIAGRAM**



**TEST SETUP- AC LINE CONDUCTED TEST AND RADIATED EMISSIONS TEST**

The EUT was connected to AC power cord. Test software exercised the EUT.

**SETUP DIAGRAM**



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## 6. MEASUREMENT METHOD

6 dB BW: ANSI C63.10 Subclause -11.8.1

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

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

Average Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

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

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

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 -11.13.3.4 Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction

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

## 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	Asset	Cal Due
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	09/25/2019
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180174	05/31/2019
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T862	05/24/2019
Amplifier, 1 to 18GHz	MITEQ	AFS42-00101800-25-S-42	PRE1782151	08/01/2019
Antenna, Horn 1-18GHz	ETS Lindgren	3117	AT0067	03/06/2019
Amplifier, 1 to 18GHz	Amplical	AMP1G18-35	T1571	07/30/2019
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	PRE0181575	08/01/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	E4446A	T146	08/13/2019
Antenna Horn, 18 to 26GHz	ARA	MWH-1826/B	T447	06/19/2019
Pre-Amp 1-26.5 GHz	Agilent	8449B	T404	03/09/2019
EMI Test Receiver	Rohde&Schwarz	ESW44	PRE0179372	05/04/2019
EMI Test Receiver	Rohde&Schwarz	ESW44	PRE0179367	04/28/2019
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1271	07/17/2019
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1225	04/10/2019
AC Line Conducted				
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/21/2019
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	06/15/2019
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, June 22, 2018	
Antenna Port Software	UL	UL RF	Ver 8.8.1, Sep 26, 2018	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

### NOTES:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

## 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME AND DUTY CYCLE

#### LIMITS

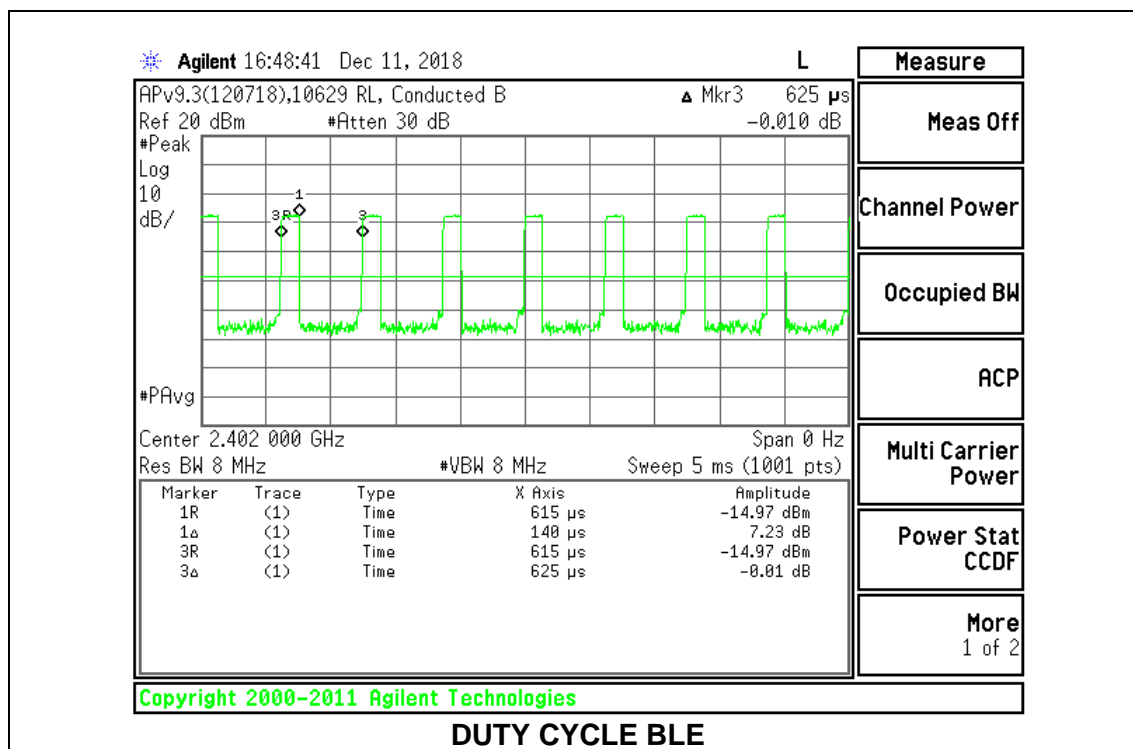
None; for reporting purposes only.

#### 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)
2.4GHz Band						
BLE	0.140	0.625	0.224	22.40%	6.50	7.143

#### DUTY CYCLE PLOTS



## 8.2. 99% BANDWIDTH

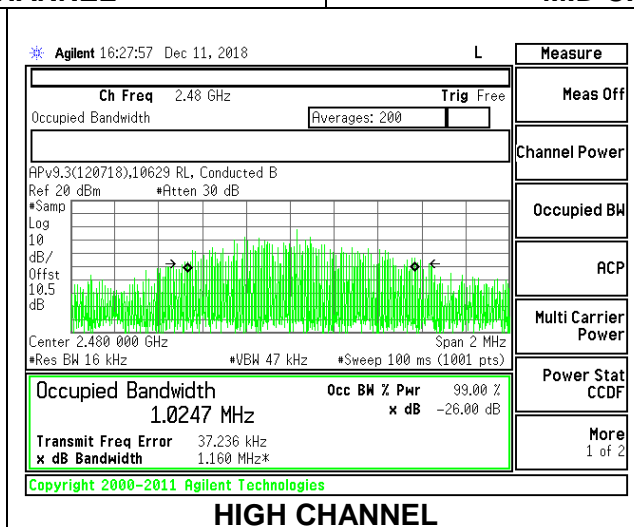
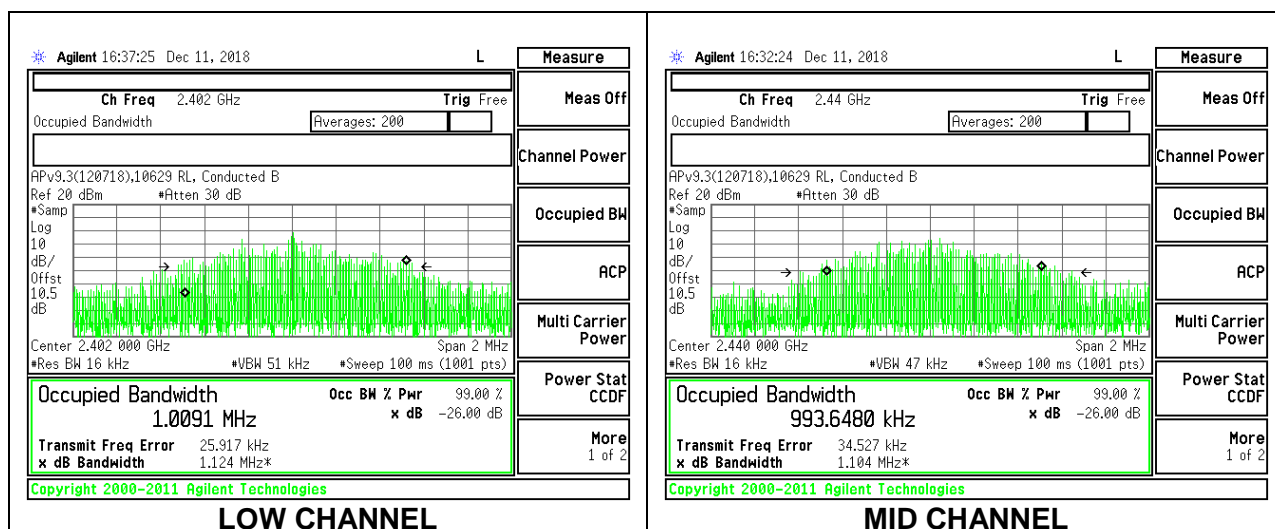
### LIMITS

None; for reporting purposes only.

### RESULTS

#### 8.2.1. BLE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.009
Middle	2440	0.994
High	2480	1.025



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

#### **LIMITS**

FCC §15.407 (e)

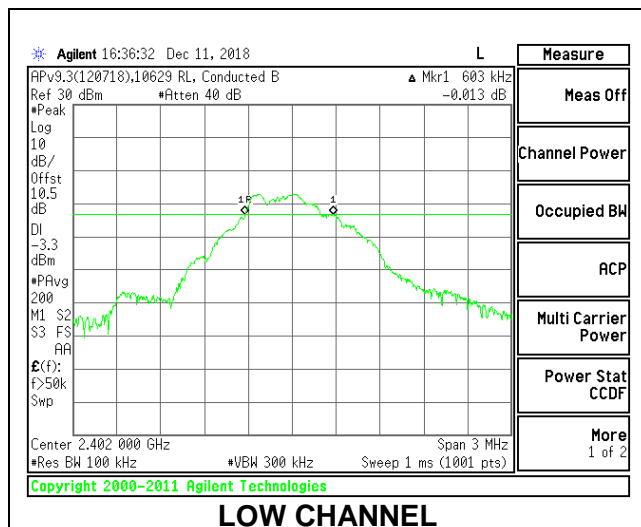
The minimum 6 dB bandwidth shall be at least 500 kHz.

#### **RESULTS**

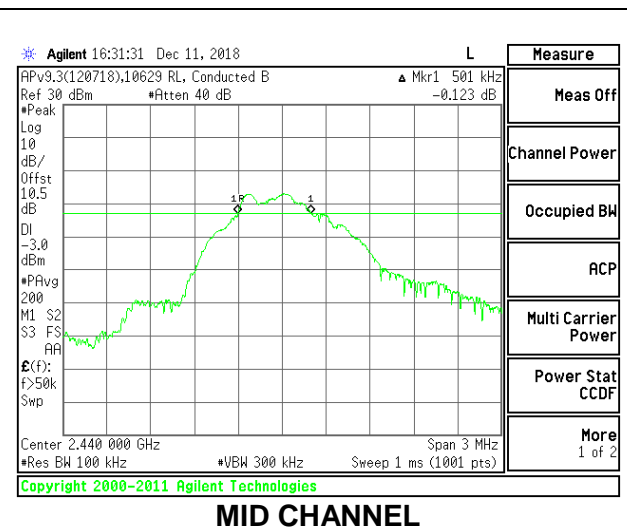


**8.3.1. BLE**

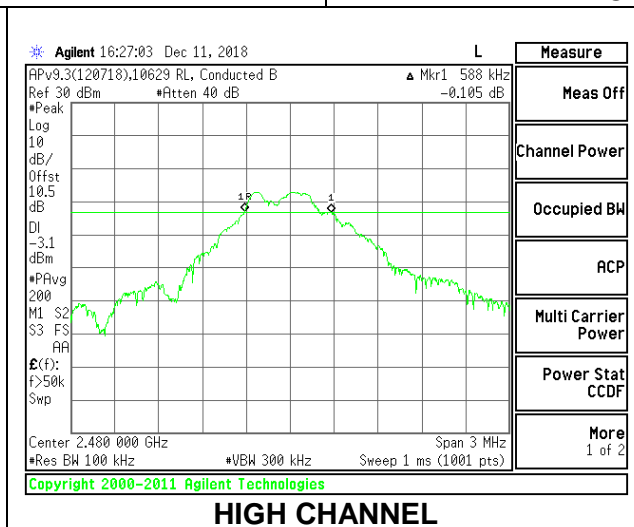
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.603	0.5
Middle	2440	0.501	0.5
High	2480	0.588	0.5



**LOW CHANNEL**



**MID CHANNEL**



**HIGH CHANNEL**

## 8.4. OUTPUT POWER

### LIMITS

FCC §15.247 (b) (3)

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 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

### RESULTS

#### 8.4.1. BLE

<b>Tested By:</b>	10629 RL
<b>Date:</b>	12/11/2018

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Power Reading (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
Low	2402	2.65	30	-27.35
Middle	2440	2.91	30	-27.09
High	2480	2.86	30	-27.14

## 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 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

### RESULTS

#### 8.5.1. BLE

<b>Tested By:</b>	10629 RL
<b>Date:</b>	12/11/2018

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>AV power (dBm)</b>
Low	2402	2.47
Middle	2440	2.73
High	2480	2.69

## **8.6. POWER SPECTRAL DENSITY**

### **LIMITS**

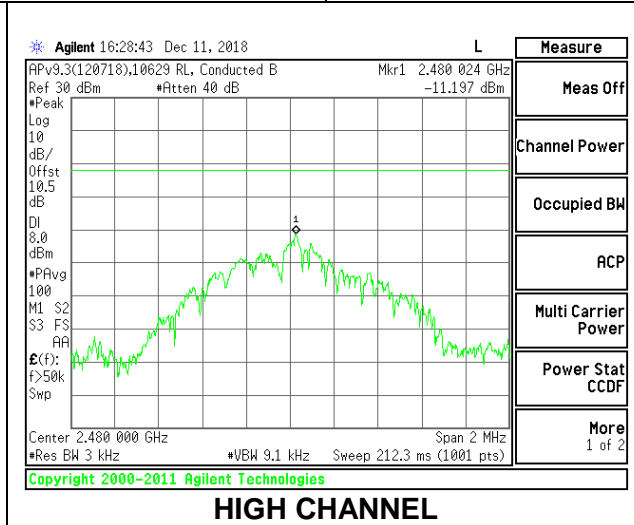
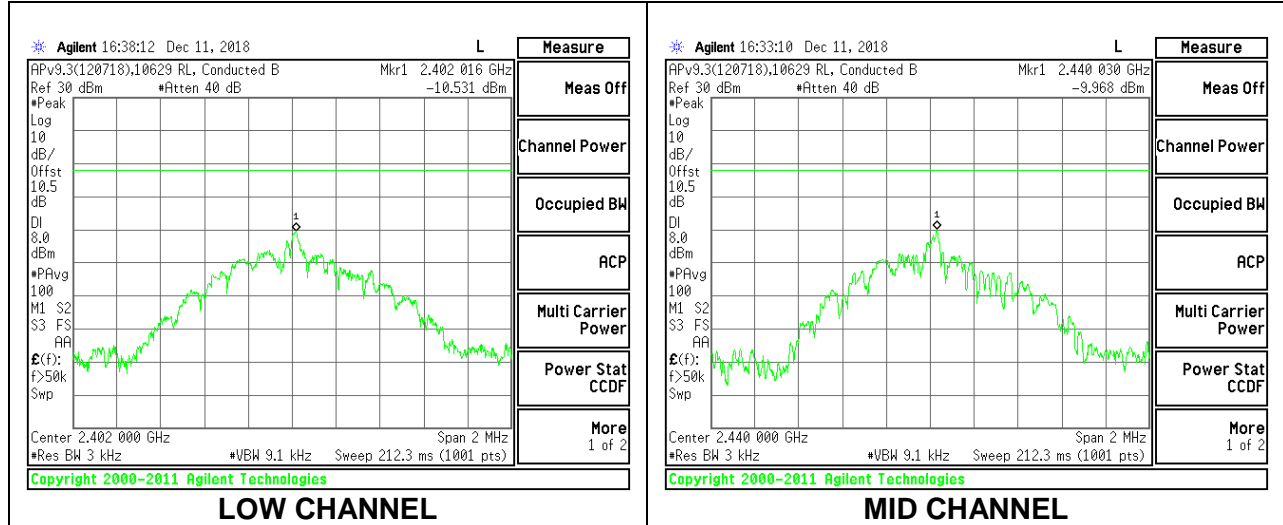
FCC §15.247 (e)

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

### **RESULTS**

**8.6.1. BLE**

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-10.53	8	-18.53
Middle	2440	-9.97	8	-17.97
High	2480	-11.20	8	-19.20



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## **8.7. CONDUCTED SPURIOUS EMISSIONS**

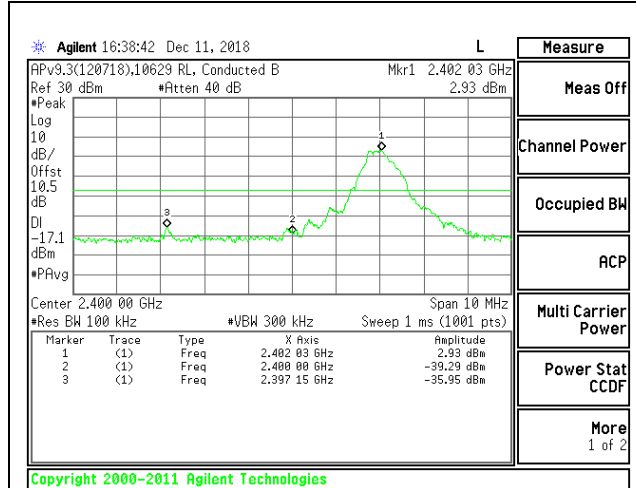
### **LIMITS**

FCC §15.247 (d)

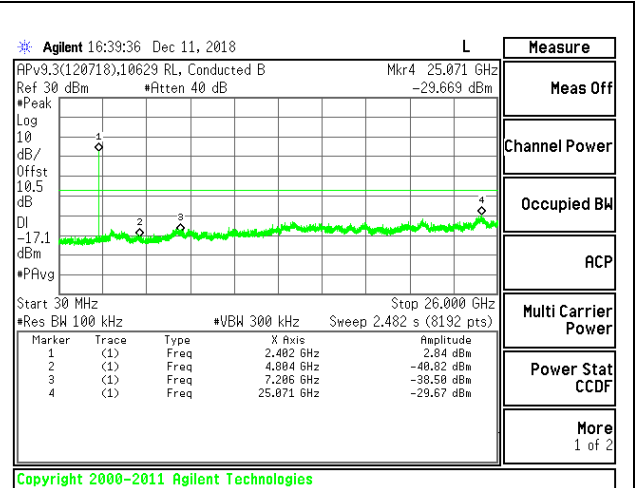
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

### **RESULTS**

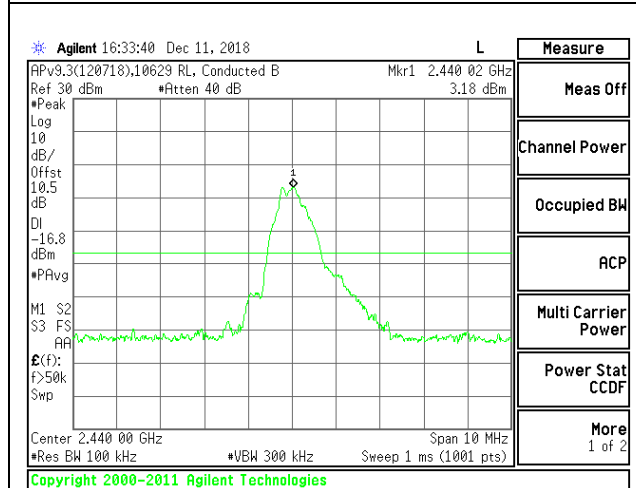
8.7.1. BLE



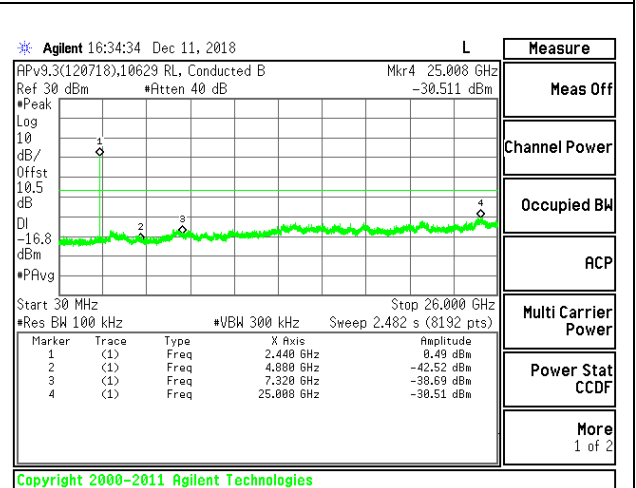
LOW CHANNEL BANDEDGE



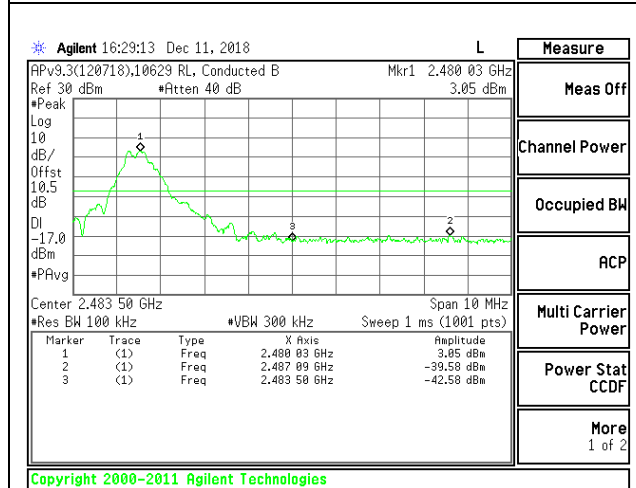
OUT-OF-BAND LOW CHANNEL



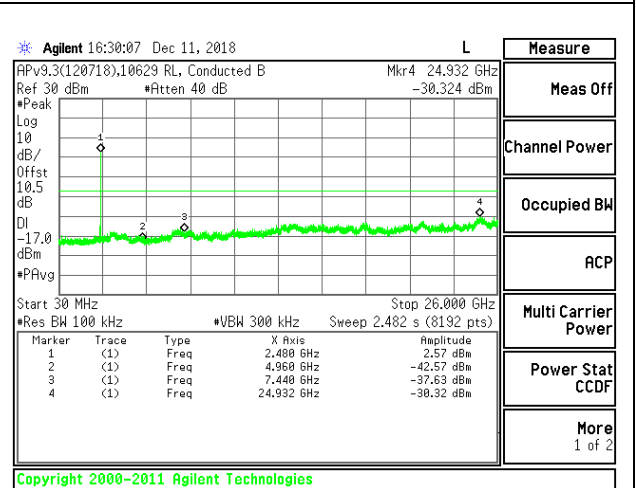
IN-BAND REFERENCE LEVEL



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

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.

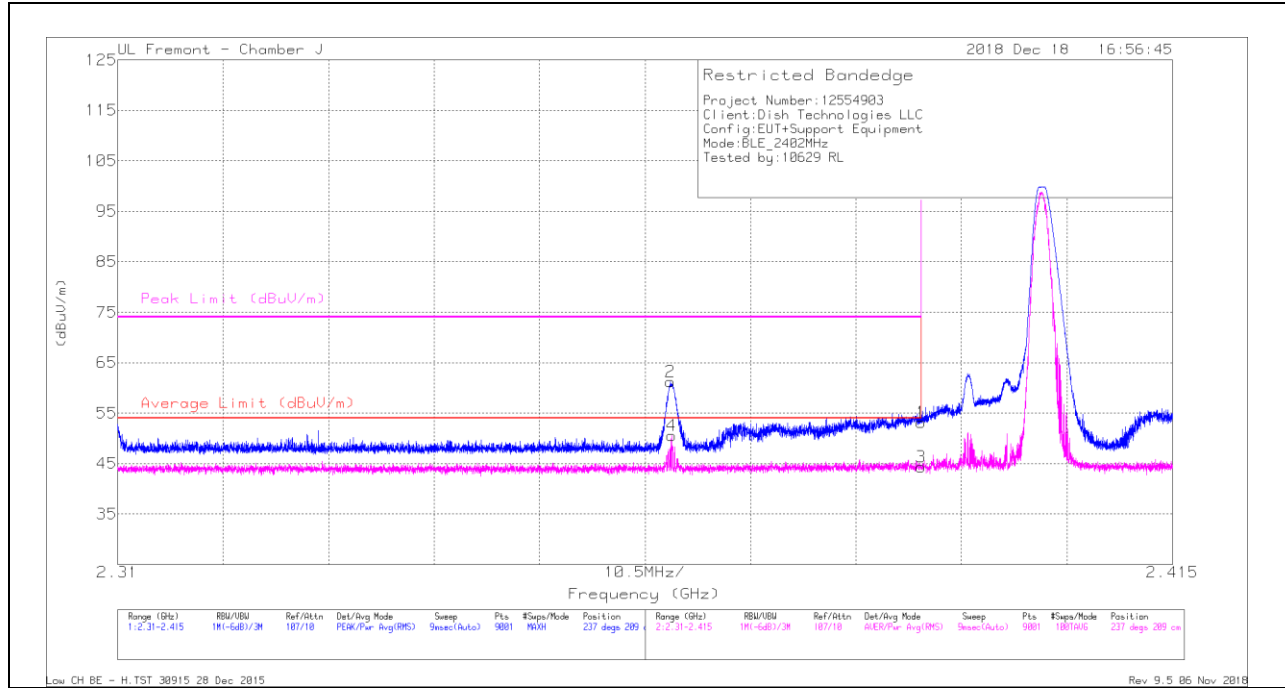


## 9.2. TRANSMITTER ABOVE 1 GHz

### 9.2.1. BLE

#### BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT



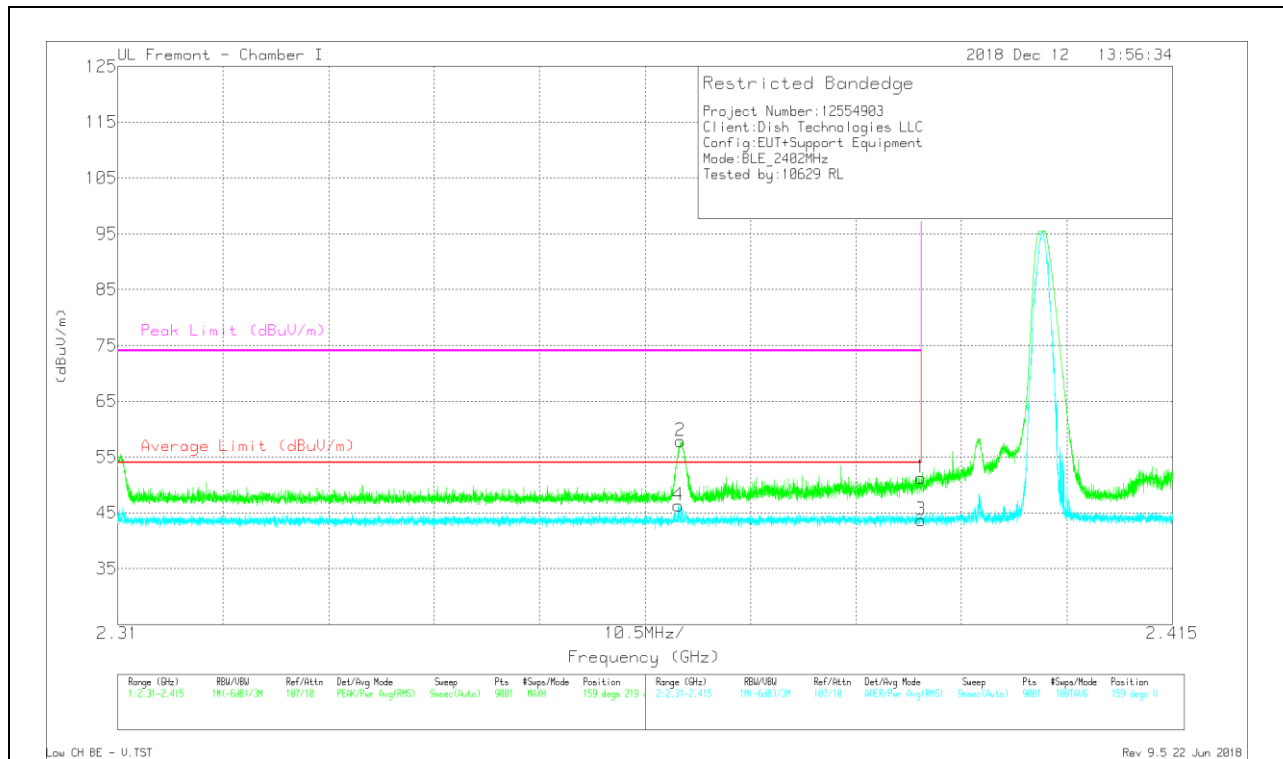
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0067 (dB/m)	Amp/Cb/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	46.96	Pk	32	-25.8	0	53.16	-	-	74	-20.84	237	209	H
2	* 2.365	55.07	Pk	31.9	-25.8	0	61.17	-	-	74	-12.83	237	209	H
3	* 2.39	31.61	RMS	32	-25.8	6.5	44.31	54	-9.69	-	-	237	209	H
4	* 2.365	37.98	RMS	31.9	-25.8	6.5	50.58	54	-3.42	-	-	237	209	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 T862 (dB/m)	Amp/Cb/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	41.04	Pk	31.8	-21.6	0	51.24	-	-	74	-22.76	159	219	V
2	* 2.366	47.75	Pk	31.6	-21.5	0	57.85	-	-	74	-16.15	159	219	V
3	* 2.39	27.05	RMS	31.8	-21.6	6.5	43.75	54	-10.25	-	-	159	219	V
4	* 2.366	29.77	RMS	31.6	-21.5	6.5	46.37	54	-7.63	-	-	159	219	V

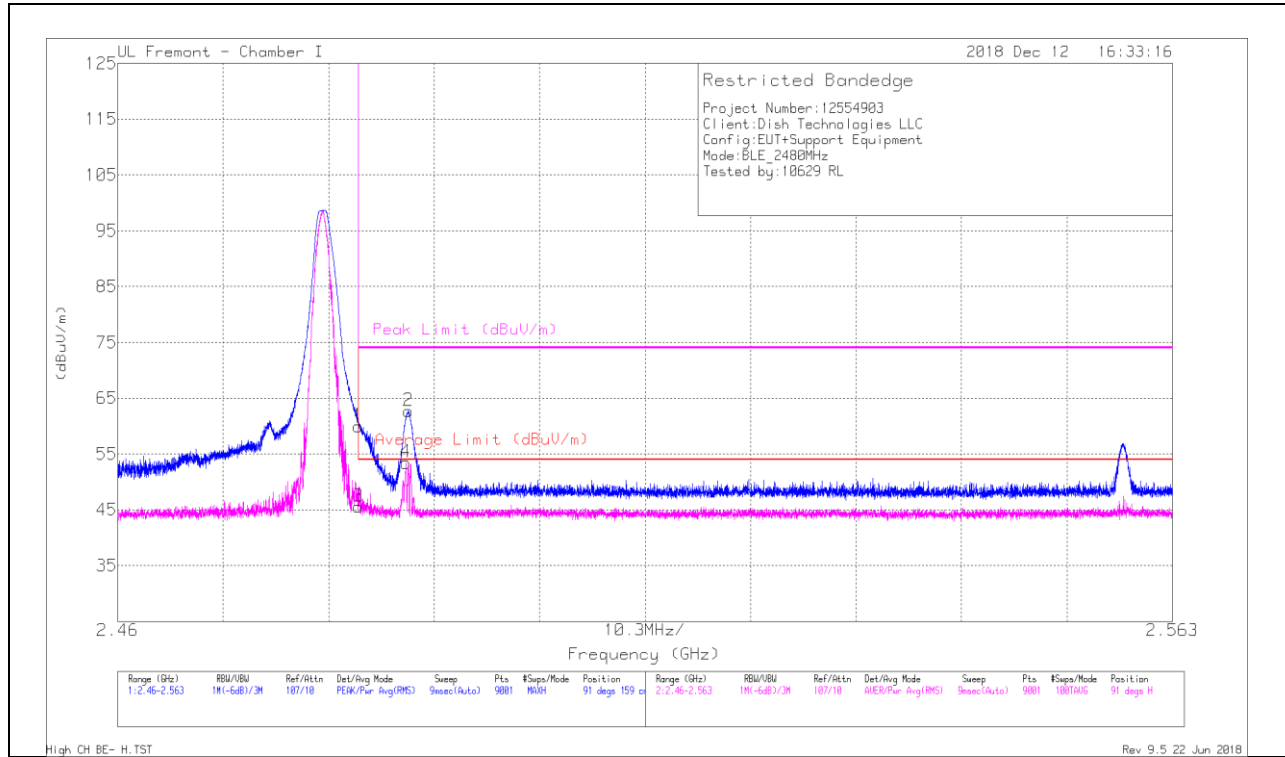
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

**BANDEDGE (HIGH CHANNEL)**

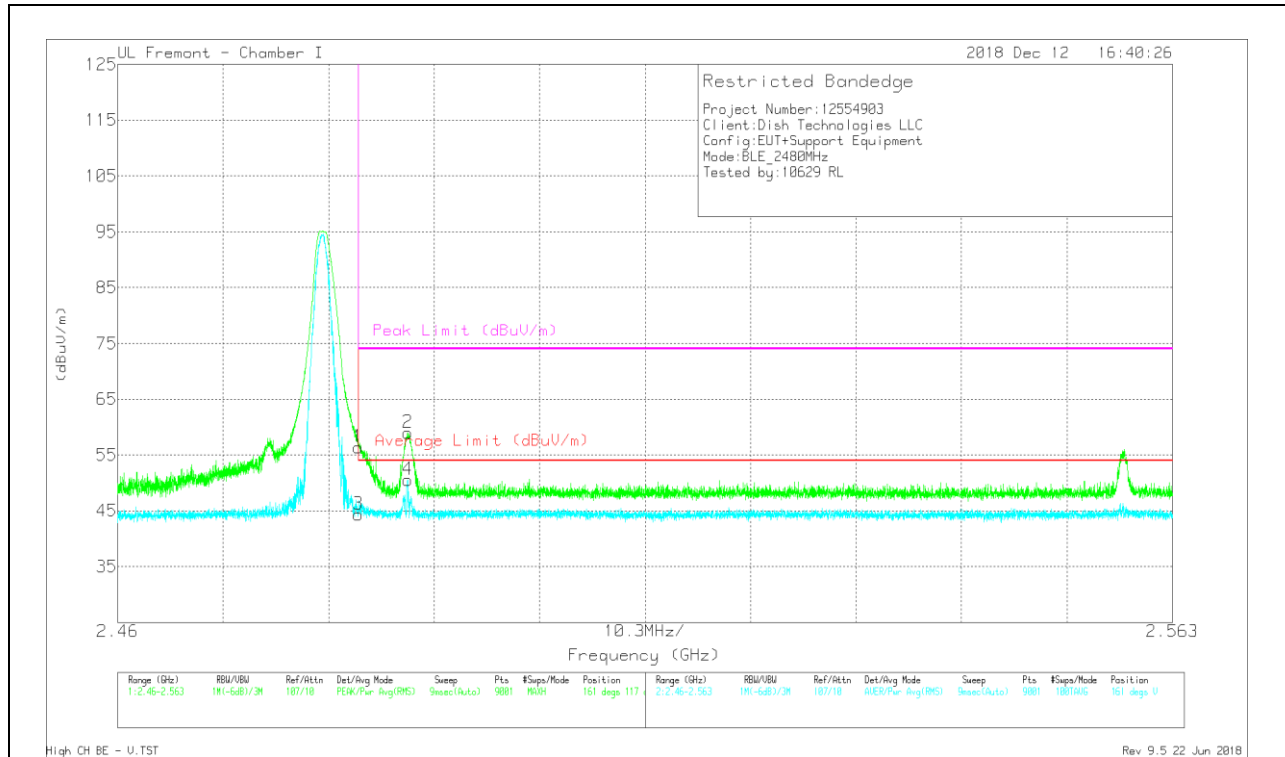
**HORIZONTAL RESULT**



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cb/Fitr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBu/m)	Average Limit (dBu/m)	Margin (dB)	Peak Limit (dBu/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	49.22	Pk	32.4	-21.7	0	59.92	-	-	74	-14.08	91	159	H
2	* 2.488	52.06	Pk	32.4	-21.7	0	62.76	-	-	74	-11.24	91	159	H
3	* 2.484	28.37	RMS	32.4	-21.7	6.5	45.57	54	-8.43	-	-	91	159	H
4	* 2.488	36.26	RMS	32.4	-21.7	6.5	53.46	54	-5.4	-	-	91	159	H

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

### VERTICAL RESULT

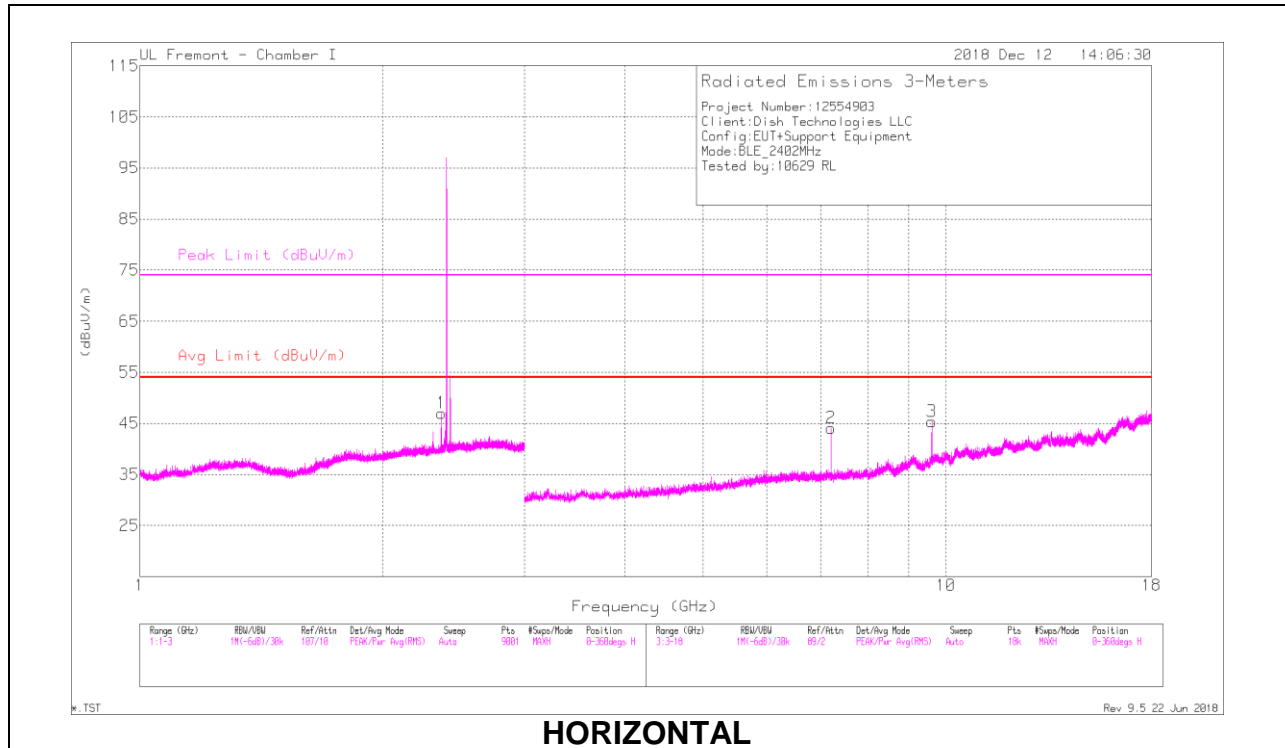


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cal/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	45.63	Pk	32.4	-21.7	0	56.33	-	-	74	-17.67	161	117	V
2	* 2.488	48.26	Pk	32.4	-21.7	0	58.96	-	-	74	-15.04	161	117	V
3	* 2.484	27.18	RMS	32.4	-21.7	6.5	44.38	54	-9.62	-	-	161	117	V
4	* 2.488	33.36	RMS	32.4	-21.7	6.5	50.56	54	-3.44	-	-	161	117	V

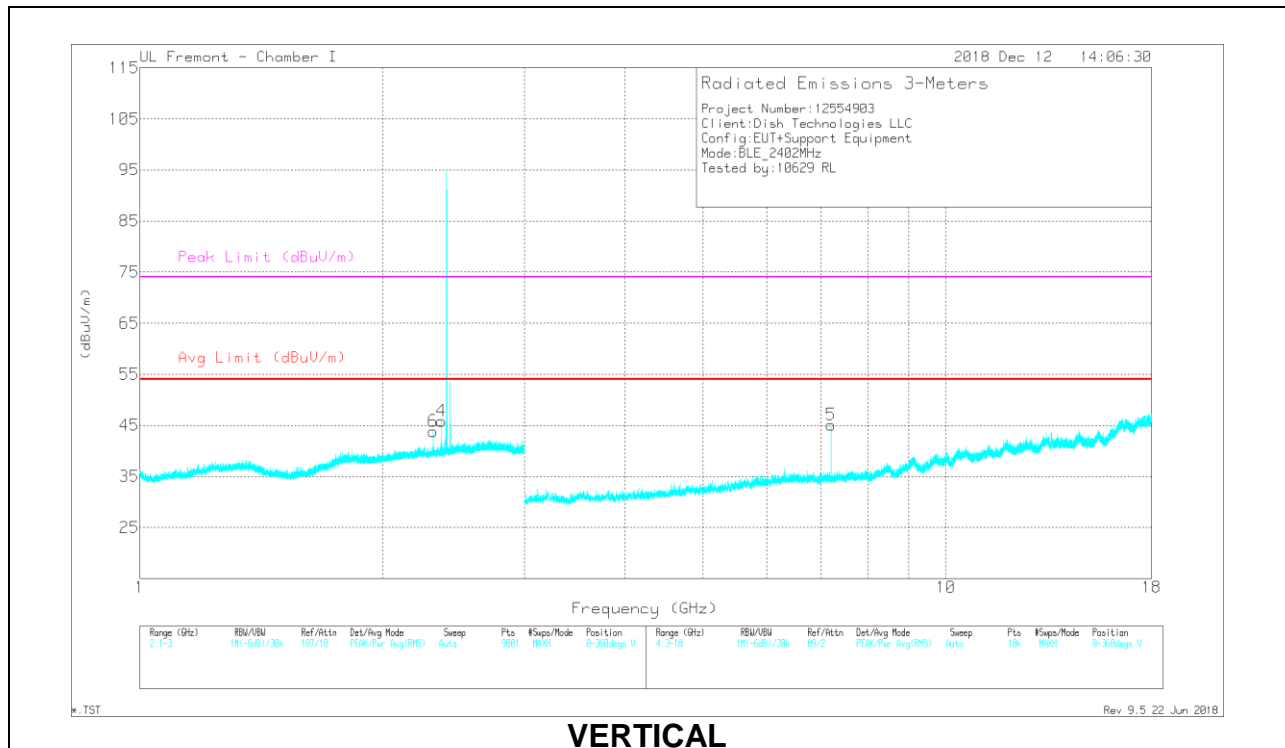
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 RMS - RMS detection

**HARMONICS AND SPURIOUS EMISSIONS**

**LOW CHANNEL RESULTS**



**HORIZONTAL**



**VERTICAL**

### RADIATED EMISSIONS

#### Trace Markers

Marker	Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.366	36.84	Pk	31.6	-21.5	0	46.94	-	-	74	-27.06	0-360	198	H
4	* 2.366	35.71	Pk	31.6	-21.5	0	45.81	-	-	74	-28.19	0-360	198	V
6	* 2.31	33.79	Pk	31.5	-21.5	0	43.79	-	-	74	-30.21	0-360	102	V
2	7.205	34.47	Pk	35.6	-26	0	44.07	-	-	-	-	0-360	198	H
3	9.608	30.83	Pk	36.7	-22.2	0	45.33	-	-	-	-	0-360	198	H
5	7.206	35.46	Pk	35.6	-26	0	45.06	-	-	-	-	0-360	198	V

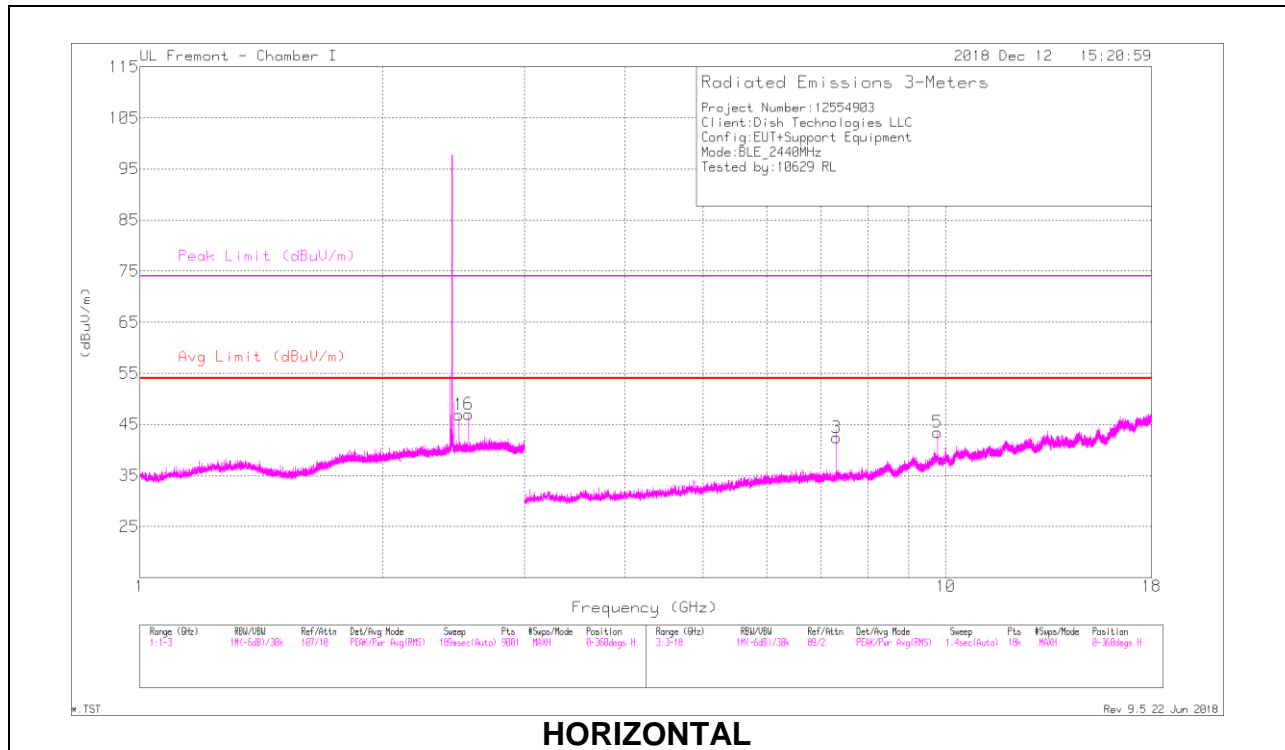
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector

#### Radiated Emissions

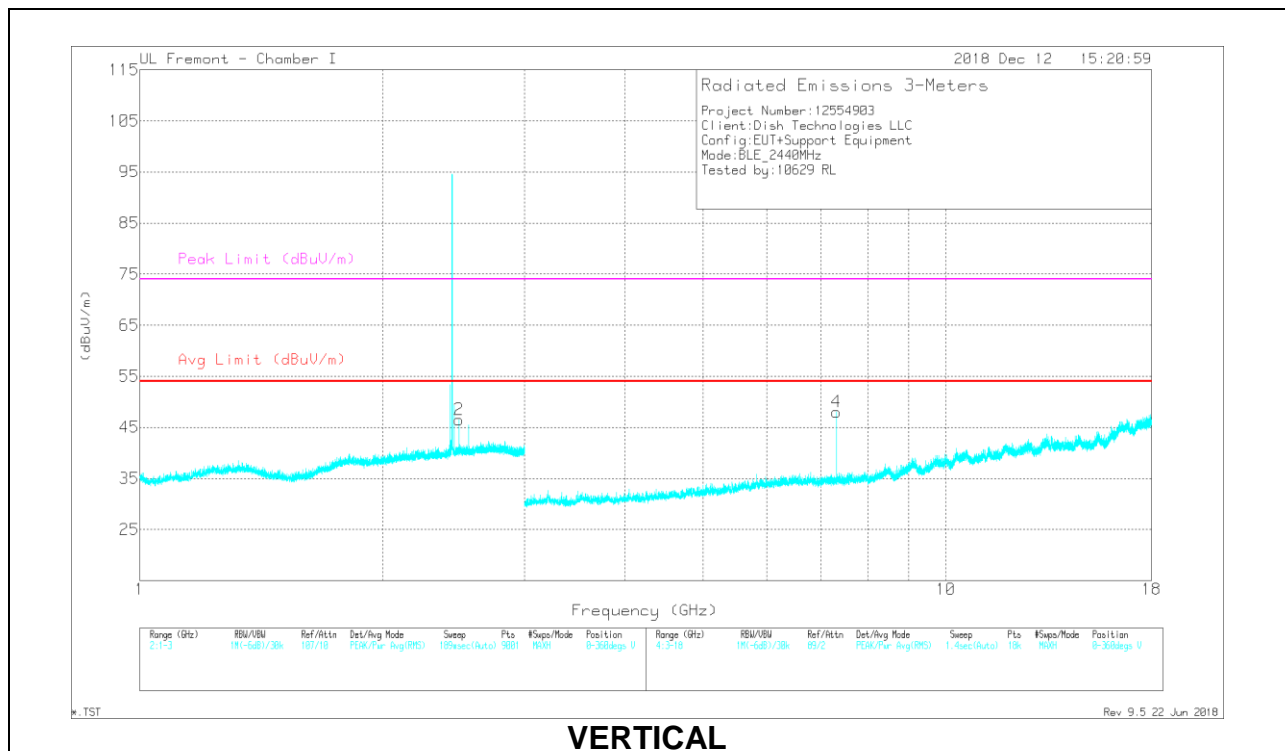
Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Filtr /Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.366	43.43	PK2	31.6	-21.5	0	53.53	-	-	74	-20.47	84	228	H
* 2.362	27.55	MAv1	31.6	-21.5	6.5	44.15	54	-9.85	-	-	84	228	H
* 2.366	41.04	PK2	31.6	-21.5	0	51.14	-	-	74	-22.86	150	358	V
* 2.366	27.87	MAv1	31.6	-21.5	6.5	44.47	54	-9.53	-	-	150	358	V
* 2.366	46.69	PK2	31.6	-21.5	0	56.79	-	-	74	-17.21	157	352	V
* 2.327	28.49	MAv1	31.5	-21.5	6.5	44.99	54	-9.01	-	-	157	352	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**

**Trace Markers**

Marker	Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.488	36.14	Pk	32.4	-21.7	0	46.84	-	-	74	-27.16	0-360	198	H
6	2.558	36.24	Pk	32.4	-21.6	0	47.04	-	-	-	-	0-360	198	H
2	* 2.488	35.83	Pk	32.4	-21.7	0	46.53	-	-	74	-27.47	0-360	199	V
3	* 7.32	32.88	Pk	35.6	-26	0	42.48	-	-	74	-31.52	0-360	188	H
5	9.76	27.03	Pk	36.9	-20.5	0	43.43	-	-	-	-	0-360	198	H
4	* 7.32	38.44	Pk	35.6	-26	0	48.04	-	-	74	-25.96	0-360	199	V

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

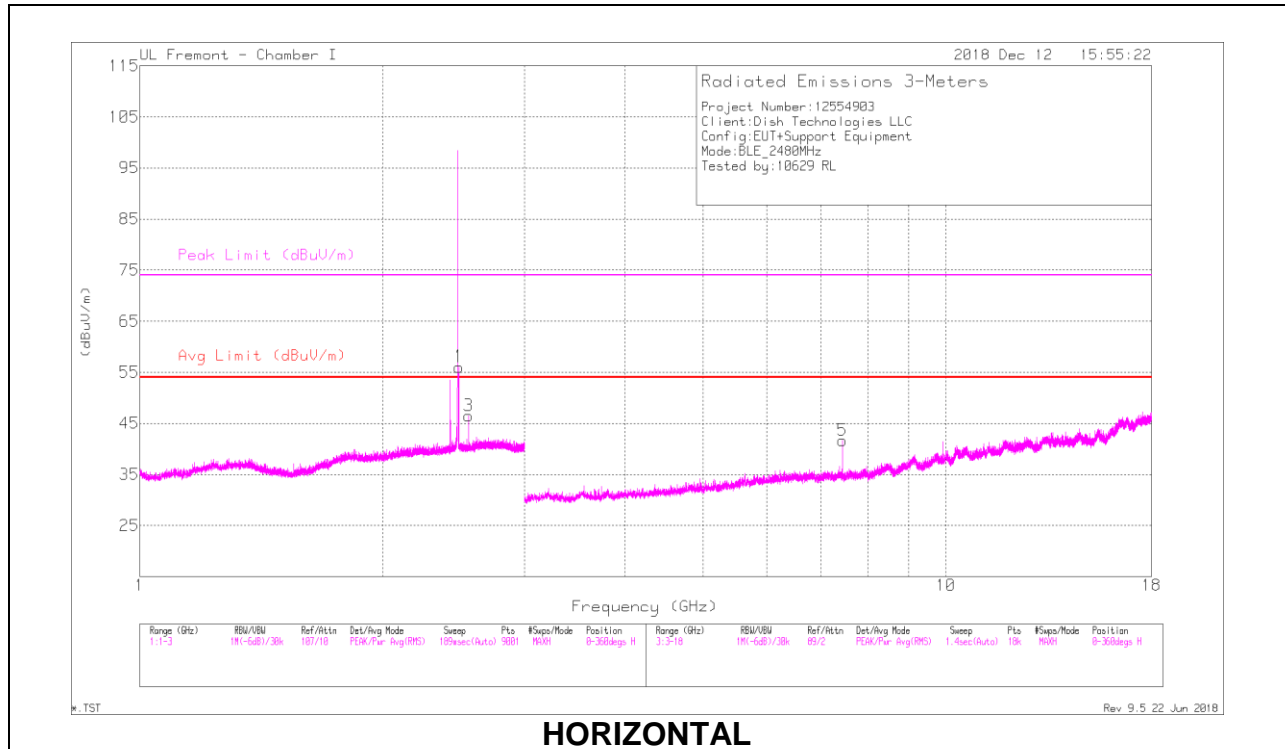
**Radiated Emissions**

Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Filtr /Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.488	43.7	PK2	32.4	-21.7	0	54.4	-	-	74	-19.6	93	159	H
* 2.49	28.02	MAv1	32.5	-21.7	6.5	45.32	54	-8.68	-	-	93	159	H
* 2.488	43.27	PK2	32.4	-21.7	0	53.97	-	-	74	-20.03	141	239	V
* 2.488	27.85	MAv1	32.4	-21.7	6.5	45.05	54	-8.95	-	-	141	239	V
* 7.321	38.21	PK2	35.6	-26	0	47.81	-	-	74	-26.19	17	110	H
* 7.32	24.67	MAv1	35.6	-26	6.5	40.77	54	-13.23	-	-	17	110	H
* 7.32	39.91	PK2	35.6	-26	0	49.51	-	-	74	-24.49	174	197	V
* 7.32	24.02	MAv1	35.6	-26	6.5	40.12	54	-13.88	-	-	174	197	V

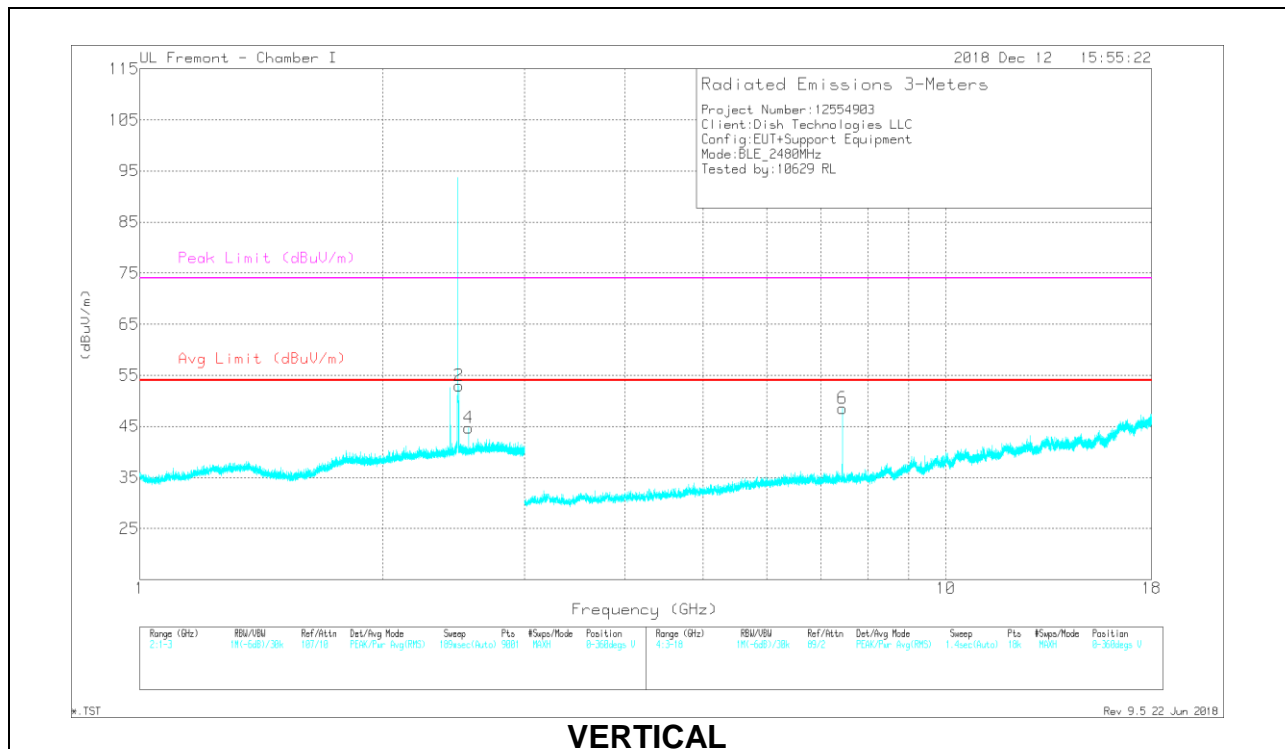
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PK2 - KDB558074 Method: Maximum Peak  
 MAv1 - KDB558074 Option 1 Maximum RMS Average



### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

## RADIATED EMISSIONS

### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fitr/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
1	* 2.488	45.37	Pk	32.4	-21.7	0	56.07	-	-	74	-17.93	0-360	100	H
3	2.558	35.71	Pk	32.4	-21.6	0	46.51	-	-	-	-	0-360	100	H
2	* 2.488	42.25	Pk	32.4	-21.7	0	52.95	-	-	74	-21.05	0-360	102	V
4	2.558	33.9	Pk	32.4	-21.6	0	44.7	-	-	-	-	0-360	102	V
5	* 7.44	31.16	Pk	35.6	-25.1	0	41.66	-	-	74	-32.34	0-360	199	H
6	* 7.439	38.01	Pk	35.6	-25.1	0	48.51	-	-	74	-25.49	0-360	199	V

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

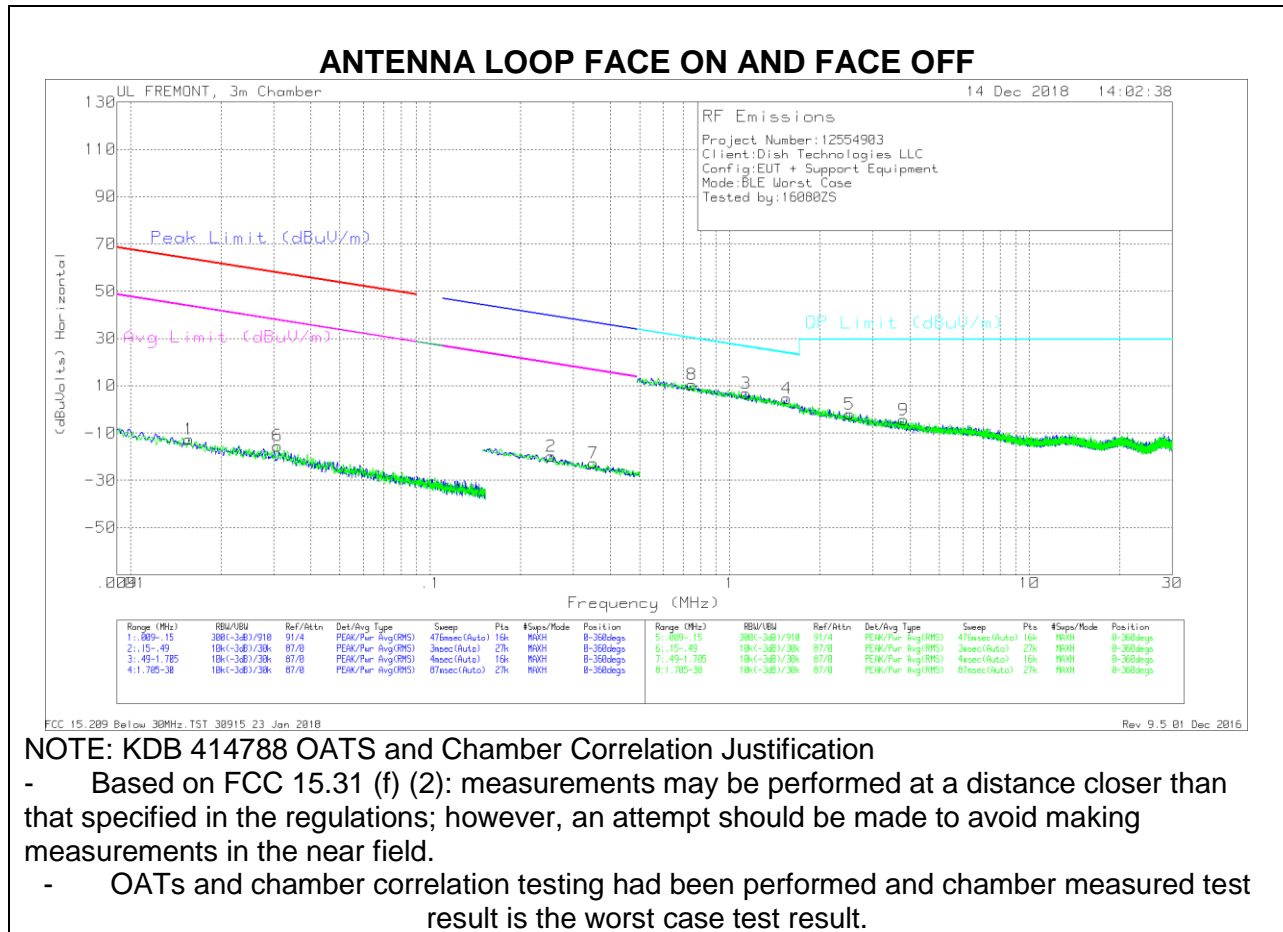
### Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fitr/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
* 2.49	38.19	PK2	32.5	-21.7	0	48.99	-	-	74	-25.01	81	117	H
* 2.488	27.7	MAv1	32.4	-21.7	6.5	44.9	54	-9.1	-	-	81	117	H
* 2.487	37.94	PK2	32.4	-21.7	0	48.64	-	-	74	-25.36	160	375	V
* 2.489	27.94	MAv1	32.4	-21.7	6.5	45.14	54	-8.86	-	-	160	375	V
* 7.439	37.2	PK2	35.6	-25.1	0	47.7	-	-	74	-26.3	20	116	H
* 7.44	25.44	MAv1	35.6	-25.1	6.5	42.44	54	-11.56	-	-	20	116	H
* 7.44	40.77	PK2	35.6	-25.1	0	51.27	-	-	74	-22.73	158	272	V
* 7.44	26.47	MAv1	35.6	-25.1	6.5	43.47	54	-10.53	-	-	158	272	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 30 MHz

#### SPURIOUS EMISSIONS 9kHz TO 30 MHz (WORST-CASE CONFIGURATION)



#### DATA

##### Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01566	51.05	Pk	14.8	1.4	-80	-12.75	63.69	-76.44	43.69	-56.44	-	-	-	-	0-360
6	.03087	47.87	Pk	15.3	1.4	-80	-15.43	57.79	-73.22	37.79	-53.22	-	-	-	-	0-360
2	.2539	45.1	Pk	13.7	1.5	-80	-19.7	-	-	-	-	39.52	-59.22	19.52	-39.22	0-360
7	.35077	42.07	Pk	13.7	1.5	-80	-22.73	-	-	-	-	36.71	-59.44	16.71	-39.44	0-360

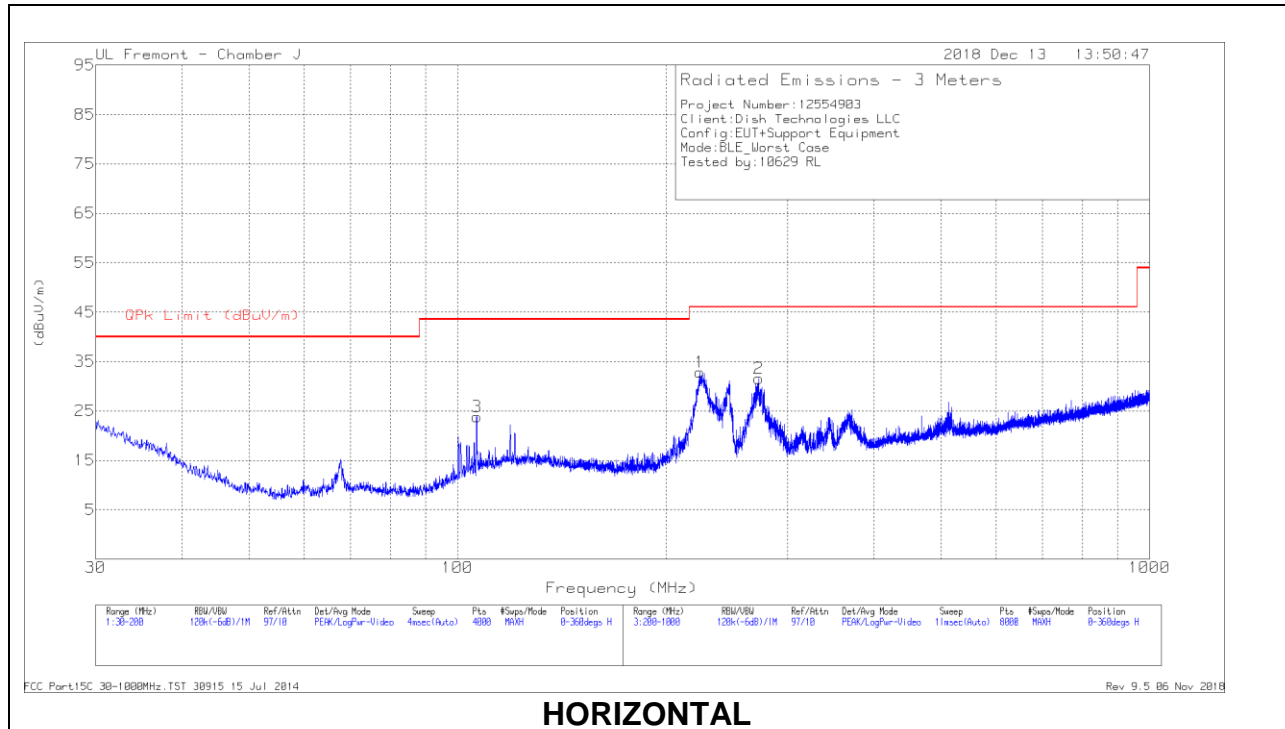
##### Pk - Peak detector

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)
8	.74844	35.07	Pk	13.9	1.5	-40	10.47	30.13	-19.66	0-360
3	1.13072	31.11	Pk	14.2	1.5	-40	6.81	26.56	-19.75	0-360
4	1.54781	28.82	Pk	14.2	1.5	-40	4.52	23.84	-19.32	0-360
5	2.50567	22.07	Pk	14.3	1.5	-40	-2.13	29.5	-31.63	0-360
9	3.801	19.76	Pk	14.4	1.5	-40	-4.34	29.5	-33.84	0-360

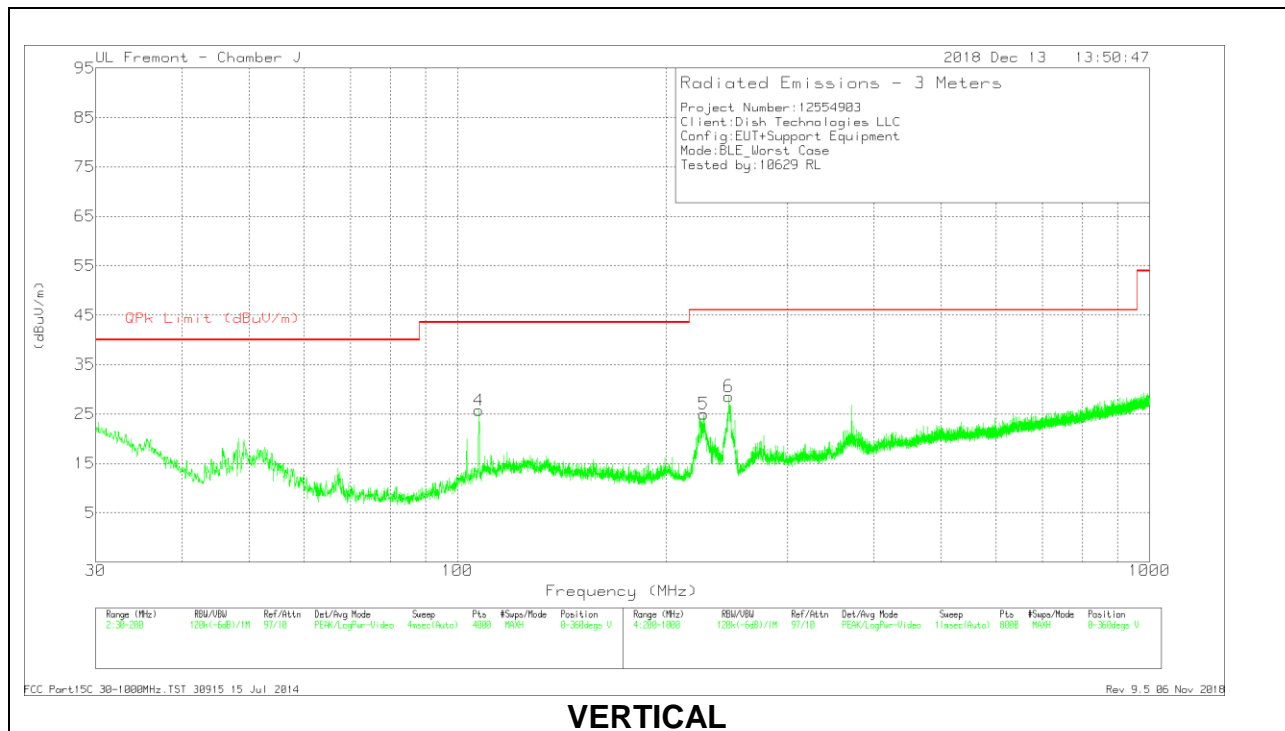
##### Pk - Peak detector

### 9.4. 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 PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	106.5836	36.78	Pk	18	-30.9	23.88	43.52	-19.64	0-360	298	H
4	107.37	38.4	Pk	18.2	-30.9	25.7	43.52	-17.82	0-360	101	V
1	224.2031	46.49	Pk	16.7	-30.3	32.89	46.02	-13.13	0-360	101	H
2	* 272.5094	42.41	Pk	19.2	-30.1	31.51	46.02	-14.51	0-360	101	H
5	226.8535	38.53	Pk	16.8	-30.3	25.03	46.02	-20.99	0-360	198	V
6	* 246.6061	41.18	Pk	17.5	-30.1	28.58	46.02	-17.44	0-360	198	V

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

Pk - Peak detector

**Radiated Emissions**

Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 270.9314	44.65	Pk	19.1	-30.1	33.65	46.02	-12.37	9	111	H
* 270.9314	37.8	Qp	19.1	-30.1	26.8	46.02	-19.22	9	111	H
* 247.5051	40.82	Pk	17.4	-30.1	28.12	46.02	-17.9	212	254	V
* 247.5051	34.4	Qp	17.4	-30.1	21.7	46.02	-24.32	212	254	V

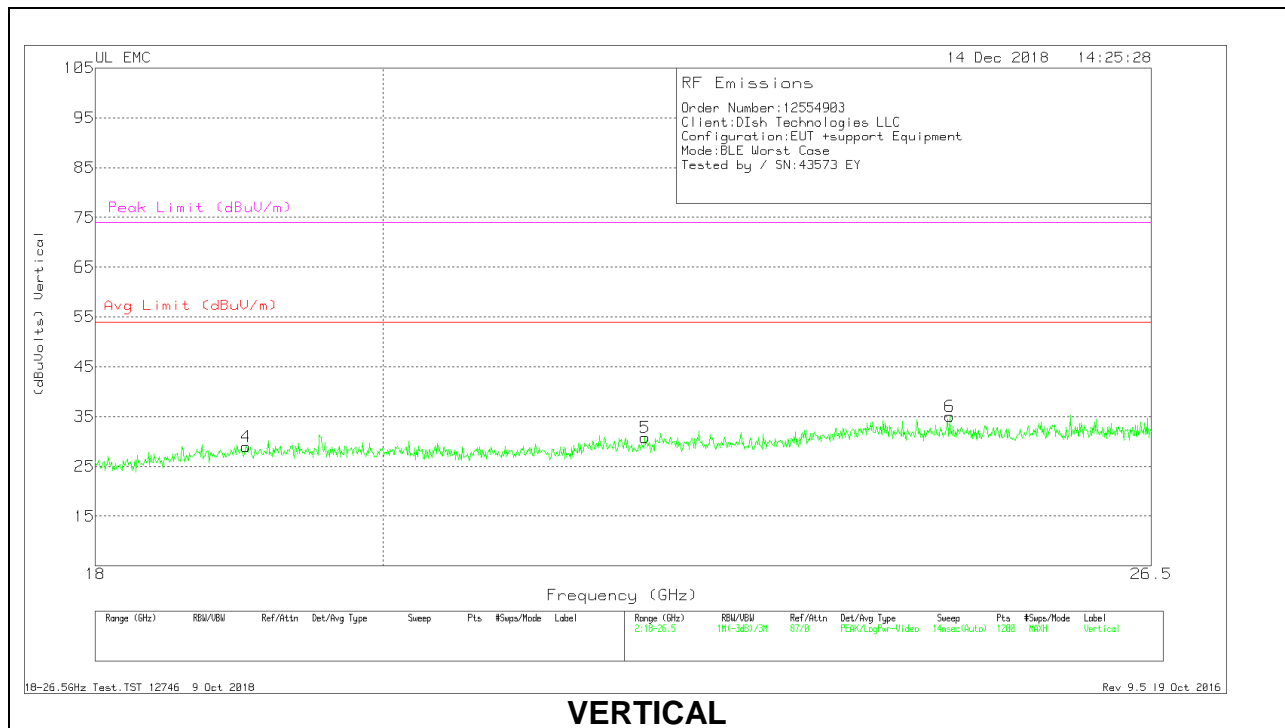
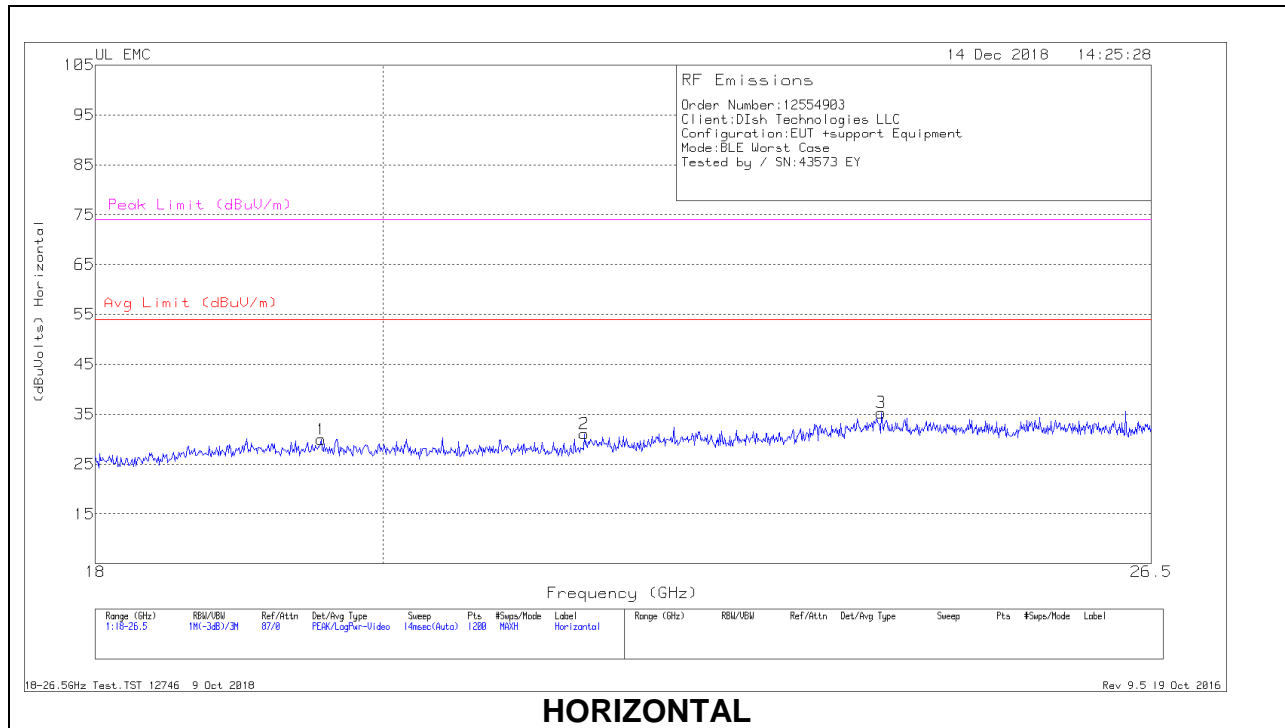
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

### 9.5. 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	19.553	31.73	Pk	32.8	-25.1	-9.5	29.93	54	-24.07	74	-44.07
2	21.53	32.55	Pk	33.1	-25.1	-9.5	31.05	54	-22.95	74	-42.95
3	24.005	34.87	Pk	34.3	-24.4	-9.5	35.27	54	-18.73	74	-38.73
4	19.021	30.57	Pk	32.6	-24.7	-9.5	28.97	54	-25.03	74	-45.03
5	22.013	32.19	Pk	33.3	-25.2	-9.5	30.79	54	-23.21	74	-43.21
6	24.614	34.44	Pk	34.4	-24.3	-9.5	35.04	54	-18.96	74	-38.96

Pk - Peak detector

## 10. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

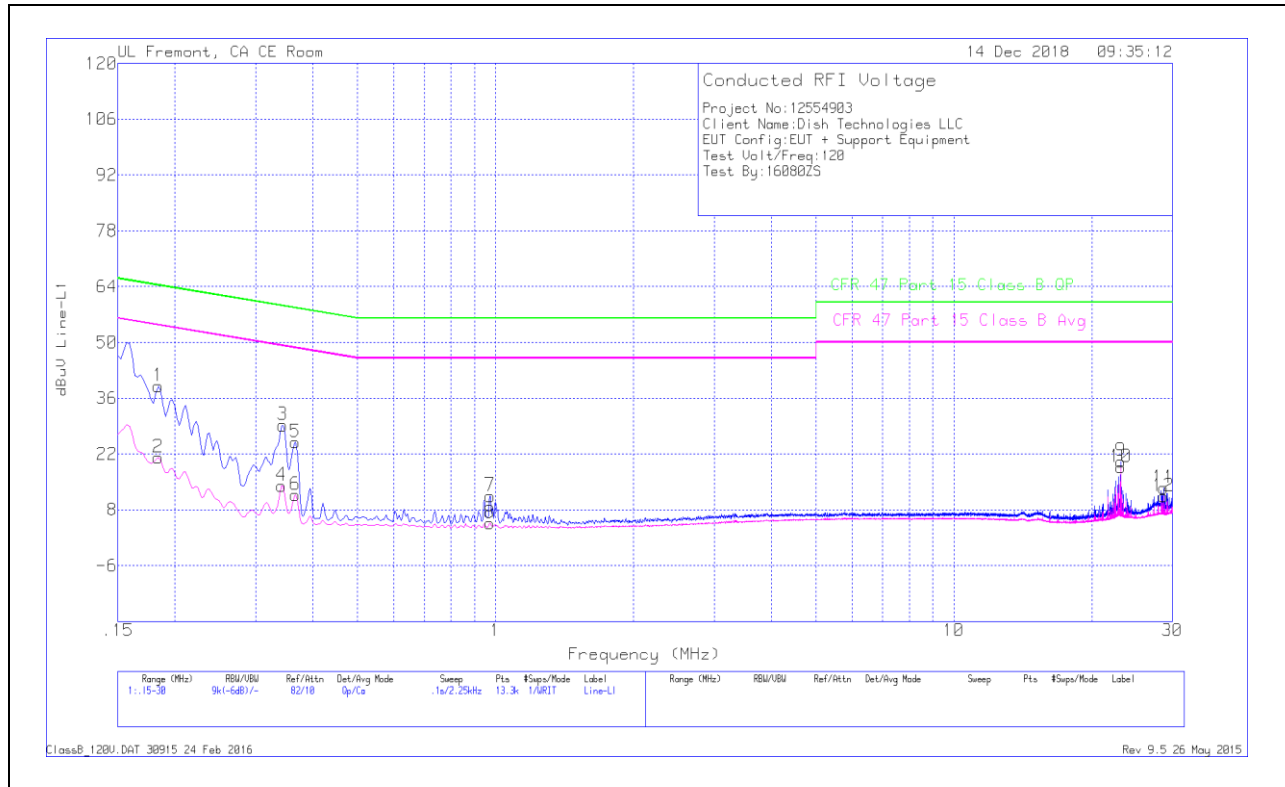
\*Decreases with the logarithm of the frequency.

### RESULTS



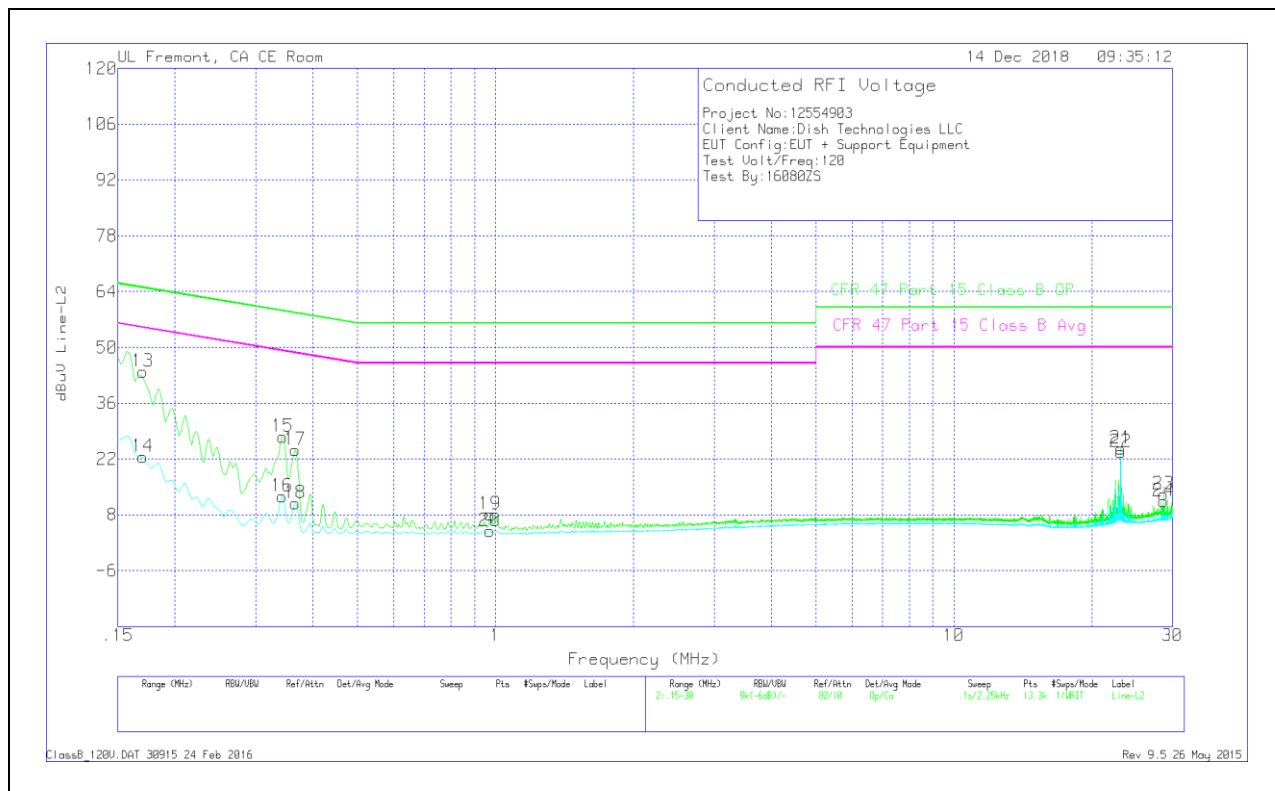
10.1.1. AC Power Line Norm

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	.18375	28.94	Qp	0	0	10.1	39.04	64.31	-25.27	-	-
2	.18375	11.02	Ca	0	0	10.1	21.12	-	-	54.31	-33.19
3	.3435	19.13	Qp	0	0	10.1	29.23	59.12	-29.89	-	-
4	.34125	4	Ca	0	0	10.1	14.1	-	-	49.17	-35.07
5	.366	14.82	Qp	0	0	10.1	24.92	58.59	-33.67	-	-
6	.366	1.58	Ca	0	0	10.1	11.68	-	-	48.59	-36.91
7	.9735	1.29	Qp	0	.1	10.1	11.49	56	-44.51	-	-
8	.97237	-5.59	Ca	0	.1	10.1	4.61	-	-	46	-41.39
9	23.1315	9.39	Qp	.1	.3	10.4	20.19	60	-39.81	-	-
10	23.1315	7.86	Ca	.1	.3	10.4	18.66	-	-	50	-31.34
11	28.689	2.45	Qp	.1	.4	10.5	13.45	60	-46.55	-	-
12	28.689	.41	Ca	.1	.4	10.5	11.41	-	-	50	-38.59

### 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	.17025	42.45	Qp	0	0	10.1	52.55	64.95	-12.4	-	-
14	.17025	12.41	Ca	0	0	10.1	22.51	-	-	54.95	-32.44
15	.3435	17.55	Qp	0	0	10.1	27.65	59.12	-31.47	-	-
16	.34237	2.52	Ca	0	0	10.1	12.62	-	-	49.15	-36.53
17	.366	14.18	Qp	0	0	10.1	24.28	58.59	-34.31	-	-
18	.366	.75	Ca	0	0	10.1	10.85	-	-	48.59	-37.74
19	.9735	-2.13	Qp	0	.1	10.1	8.07	56	-47.93	-	-
20	.97237	-6.2	Ca	0	.1	10.1	4	-	-	46	-42
21	23.1315	13.87	Qp	.1	.3	10.4	24.67	60	-35.33	-	-
22	23.1315	12.91	Ca	.1	.3	10.4	23.71	-	-	50	-26.29
23	28.689	2.19	Qp	.1	.4	10.5	13.19	60	-46.81	-	-
24	28.689	.47	Ca	.1	.4	10.5	11.47	-	-	50	-38.53