



# TEST REPORT

**Report Number. :** 13618993-E1V2

**Applicant :** DISH TECHNOLOGIES LLC  
90 INVERNESS CIRCLE EAST  
ENGLEWOOD, CO 80112, UNITED STATES

**Model :** D35

**Brand :** DISH

**FCC ID :** DKNBC88

**EUT Description :** TV SET TOP BOX CLIENT

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

**Date Of Issue:**

April 06, 2021

**Prepared by:**

UL VERIFICATION SERVICES

47173 Benicia Street

Fremont, CA 94538 U.S.A.

TEL: (510) 319-4000

FAX: (510) 661-0888



NVLAP Lab code: 200065-0

## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	3/30/2021	Initial Issue	---
V2	4/6/2021	Added AC power line I/O cables/block diagram on Section 6.6	Tina Chu

## 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 RESULTS SUMMARY .....</b>	<b>7</b>
<b>3. TEST METHODOLOGY .....</b>	<b>7</b>
<b>4. FACILITIES AND ACCREDITATION .....</b>	<b>7</b>
<b>5. DECISION RULES AND MEASUREMENT UNCERTAINTY .....</b>	<b>8</b>
5.1. METROLOGICAL TRACEABILITY .....	8
5.2. DECISION RULES.....	8
5.3. MEASUREMENT UNCERTAINTY.....	8
5.4. SAMPLE CALCULATION .....	8
<b>6. EQUIPMENT UNDER TEST .....</b>	<b>9</b>
6.1. EUT DESCRIPTION .....	9
6.2. MAXIMUM OUTPUT POWER.....	9
6.3. DESCRIPTION OF AVAILABLE ANTENNAS .....	9
6.4. SOFTWARE AND FIRMWARE.....	9
6.5. WORST-CASE CONFIGURATION AND MODE.....	9
6.6. DESCRIPTION OF TEST SETUP.....	10
<b>7. MEASUREMENT METHOD.....</b>	<b>13</b>
<b>8. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>14</b>
<b>9. ANTENNA PORT TEST RESULTS .....</b>	<b>15</b>
9.1. ON TIME AND DUTY CYCLE.....	15
9.2. 99% BANDWIDTH.....	16
9.3. 6 dB BANDWIDTH.....	17
9.4. OUTPUT POWER.....	18
9.5. AVERAGE POWER.....	19
9.6. POWER SPECTRAL DENSITY.....	20
9.7. CONDUCTED SPURIOUS EMISSIONS.....	21
<b>10. RADIATED TEST RESULTS .....</b>	<b>23</b>

---

10.1.	LIMITS AND PROCEDURE.....	23
10.2.	TRANSMITTER ABOVE 1 GHz.....	25
10.3.	WORST CASE BELOW 30MHz .....	35
10.4.	WORST CASE BELOW 1 GHz .....	37
10.5.	WORST CASE 18-26 GHz.....	39
<b>11.</b>	<b>AC POWER LINE CONDUCTED EMISSIONS .....</b>	<b>41</b>
<b>12.</b>	<b>SETUP PHOTOS .....</b>	<b>44</b>

## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** DISH TECHNOLOGIES LLC  
90 INVERNESS CIRCLE EAST  
ENGLEWOOD, CO 80112, UNITED STATES

**EUT DESCRIPTION:** TV SET TOP BOX

**MODEL:** D35

**BRAND:** DISH

**SERIAL NUMBER:** CONDUCTED: E4EXVH00009A  
RADIATED: E4EXVH00006A

**SAMPLE RECEIPT DATE:** FEBRUARY 12, 2021

**DATE TESTED:** FEBRUARY 15, 2021- MARCH 19, 2021

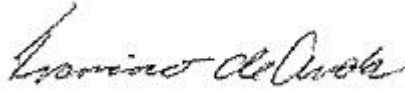
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies

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.

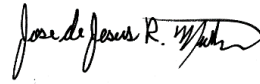
Approved & Released For  
UL Verification Services Inc. By:



---

Francisco deAnda  
Staff Engineer  
Consumer Technology Division  
UL Verification Services Inc.

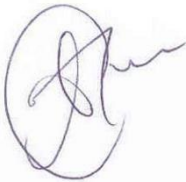
Prepared By:



---

Jose Martinez  
Laboratory Engineer  
Consumer Technology Division  
UL Verification Services Inc.

Reviewed By:



---

Tina Chu  
Senior Project Engineer  
Consumer Technology Division  
UL Verification Services Inc.

## 2. TEST RESULTS SUMMARY

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	6dB BW		None.
15.247 (b) (3)	Output Power		None.
See Comment	Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	PSD		None.
15.247 (d)	Conducted Spurious Emissions		None.
15.209, 15.205	Radiated Emissions		None.
15.207	AC Mains Conducted Emissions		None.

## 3. 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, KDB 414788 D01 Radiated Test Site v01r01.

## 4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input type="checkbox"/>	Building 1: 47173 Benicia Street, Fremont, CA 94538	US0104	2324A	208313
<input type="checkbox"/>	Building 2: 47266 Benicia Street, Fremont, CA 94538	US0104	22541	208313
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd, Fremont, CA 94538	US0104	2324B	208313

## 5. DECISION RULES AND MEASUREMENT UNCERTAINTY

### 5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

### 5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U <sub>Lab</sub>
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.74 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB

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

### 5.4. 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)

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

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

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

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



## 6. EQUIPMENT UNDER TEST

### 6.1. EUT DESCRIPTION

The EUT is a TV Set Top Box Client with RF4CE Zigbee, BLE (2Mbps), and BT radios.

### 6.2. 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	8.10	6.46

### 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna gain(s) and type, as provided by the manufacturer, are as follows:

The radio utilizes a PCB Inverted F antenna, with a maximum gain of 4.2 dBi.

### 6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was BCM 02.011.0330.0000.

The test utility software used during testing was cybluetool 0.1.55.1.

### 6.5. 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 EUT can only be setup in desktop orientation; therefore, all radiated testing was performed with the EUT in desktop orientation.

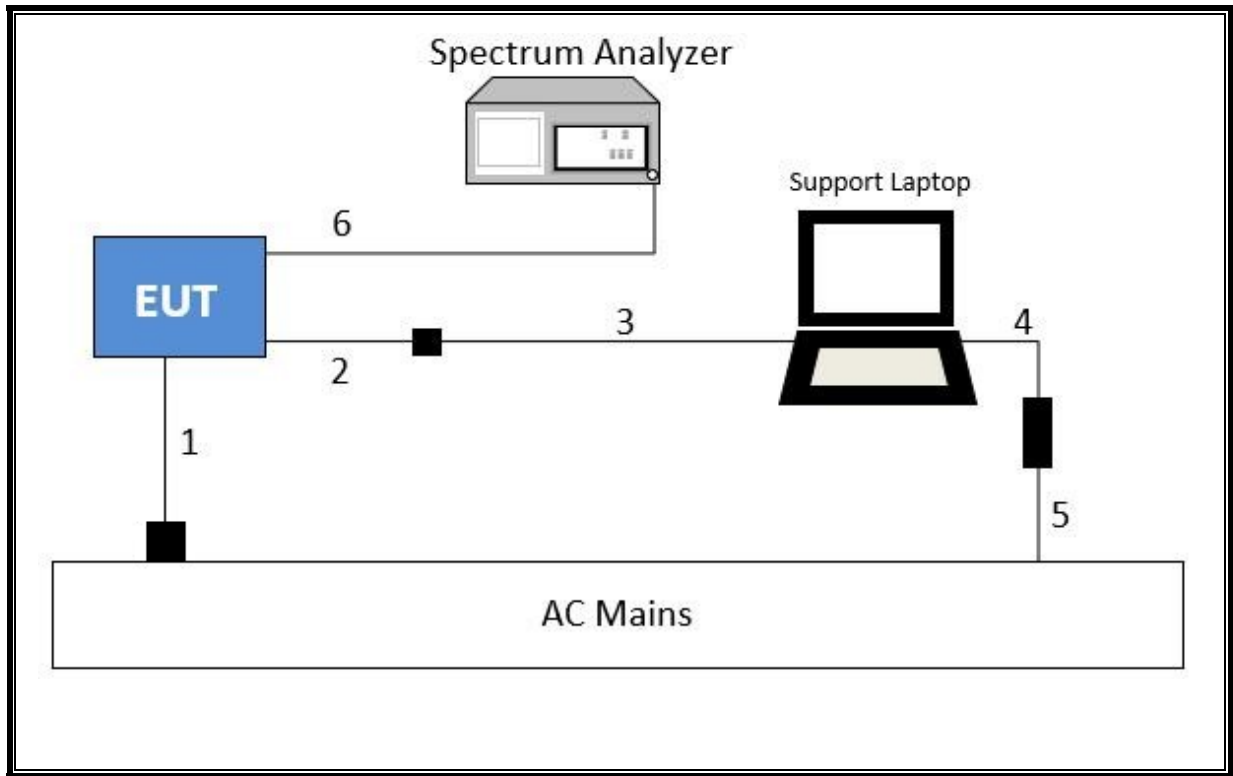
This EUT supports BLE/BT + Zigbee simultaneous transmission, radiated emission test was performed, please refer to 13618993-E3 for result.

EUT supports only 2Mbps data rate. Only this mode was investigated.

## 6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC		
AC/DC Adapter (EUT)	NetBit	NBC25A120210VU	-	Doc		
Switch	Netgear	FS108	1D417A3N0386A	Doc		
Switching Adapter	Netgear	DSA-9R-05 AUS	-	Doc		
Laptop	HP	EliteBook 740	-	DoC		
AC/DC Adapter (Laptop)	HP	HSTNN-DA40	-	DoC		
Monitor	SCEPTRE	E248W-1920R	J07F248CCD8002	Doc		
AC/DC Adapter	BSY	BSYF120250U W	-	Doc		
USB Flash Drive	SanDisk	SDCZ60-016G	-	Doc		
TV	Sharp	LC-43LB601U	MZVI4YA008695	Doc		
I/O CABLES (CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	Barrel	Un-shielded	1	EUT to AC/DC adapter Mains
2	6-pinSerial	1	Header	Un-shielded	0.2	EUT to micro USB
3	Micro USB	1	USB	Shielded	1	Micro USB to Laptop
4	DC	1	DC	Un-shielded	1	AC/DC Adapter to Laptop
5	AC	1	Two Prong	Un-shielded	1	AC/DC Adapter to Mains
6	Antenna	1	RF	Un-shielded	0.2	To spectrum analyzer
I/O CABLES (RADIATED TEST AND AC POWER LINE CONDUCTED TEST )						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	Barrel	Un-shielded	1	EUT to AC/DC adapter Mains
2	USB	1	Type A	Un-shielded	0	USB to EUT
3	Coaxial	1	Coaxial	Shielded	More than 3	EUT to TV
4	AC	1	Two Prong	Un-shielded	1.5	TV to AC mains
5	RJ45	1	RJ45	Un-shielded	More than 3	EUT to Ethernet Switch
6	AC	1	Two Prong	Un-shielded	1	Ethernet switch to AC Mains
7	HDMI	1	HDMI	Un-shielded	1	EUT to Monitor
8	DC	1	Two Prong	Un-shielded	2.5	Monitor to AC Mains

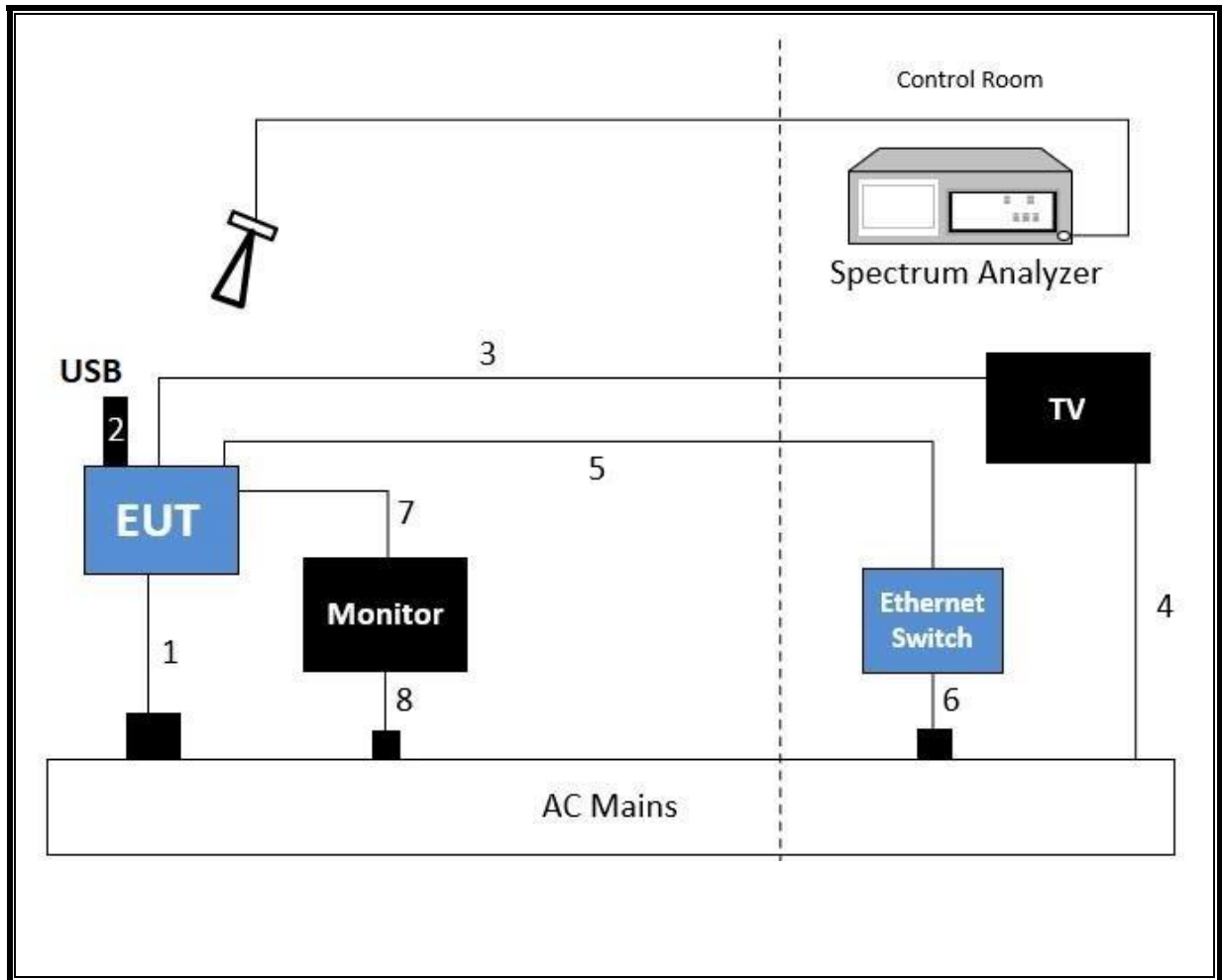
**CONDCUTED TEST SETUP DIAGRAM**



**TEST SETUP**

The EUT is connected to a test laptop by USB to UART cable adapter during the tests. Test software exercised the radio card.

**RADIATED TEST AND AC POWER LINE CONDUCTED TEST SETUP DIAGRAM**



**TEST SETUP**

The EUT is connected to support equipment and AC powered. Test software exercised the radio card.

---

## 7. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10 Section 11.6.

6 dB BW: ANSI C63.10 Section 11.8.1

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

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

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

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

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

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

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

Band-edge: ANSI C63.10 Section 6.10

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

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

## 8. 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
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	PRE0184970 (174373)	12/2/2021	12/2/2020
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310N	T300	3/2/2022	3/2/2021
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	170647	12/29/2021	12/29/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	5/26/2021	5/26/2020
Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	PRE0180571	4/14/2021	4/14/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179376	2/21/2022	2/21/2021
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	PRE0179466	5/27/2021	5/27/2020
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	PRE0179468	5/27/2021	5/27/2020
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	9/24/2021	9/24/2020
Rf Amplifier, 18-26.5GHz, 60dB gain	AMPLICAL	AMP18G26.5-60	PRE0181238	6/7/2021	6/7/2020
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies Inc	E4446A	T123	1/22/2022	1/22/2021
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T143	*2/26/2021	2/26/2020
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1269	1/25/2022	1/25/2021
AC Line Conducted					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	PRE0186446	1/20/2022	1/20/2021
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2	T24	1/20/2022	1/20/2021
EMI TEST RECEIVER	Rohde & Schwarz	ESR	T1436	2/19/2022	2/19/2021
Transient Limiter	COM-POWER	LIT-930A	T1457	1/20/2022	1/20/2021
Test Software List					
Description	Manufacturer	Model	Version		
Radiated Software	UL	UL EMC	Rev 9.5, April 30, 2020, , Oct 21, 2019		
Antenna Port Software	UL	UL RF	AP 2021.1.19, AP 2021.3.16		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, July 07, 2020		

\*Test performed within calibration period.

## 9. ANTENNA PORT TEST RESULTS

### 9.1. ON TIME AND DUTY CYCLE

#### LIMITS

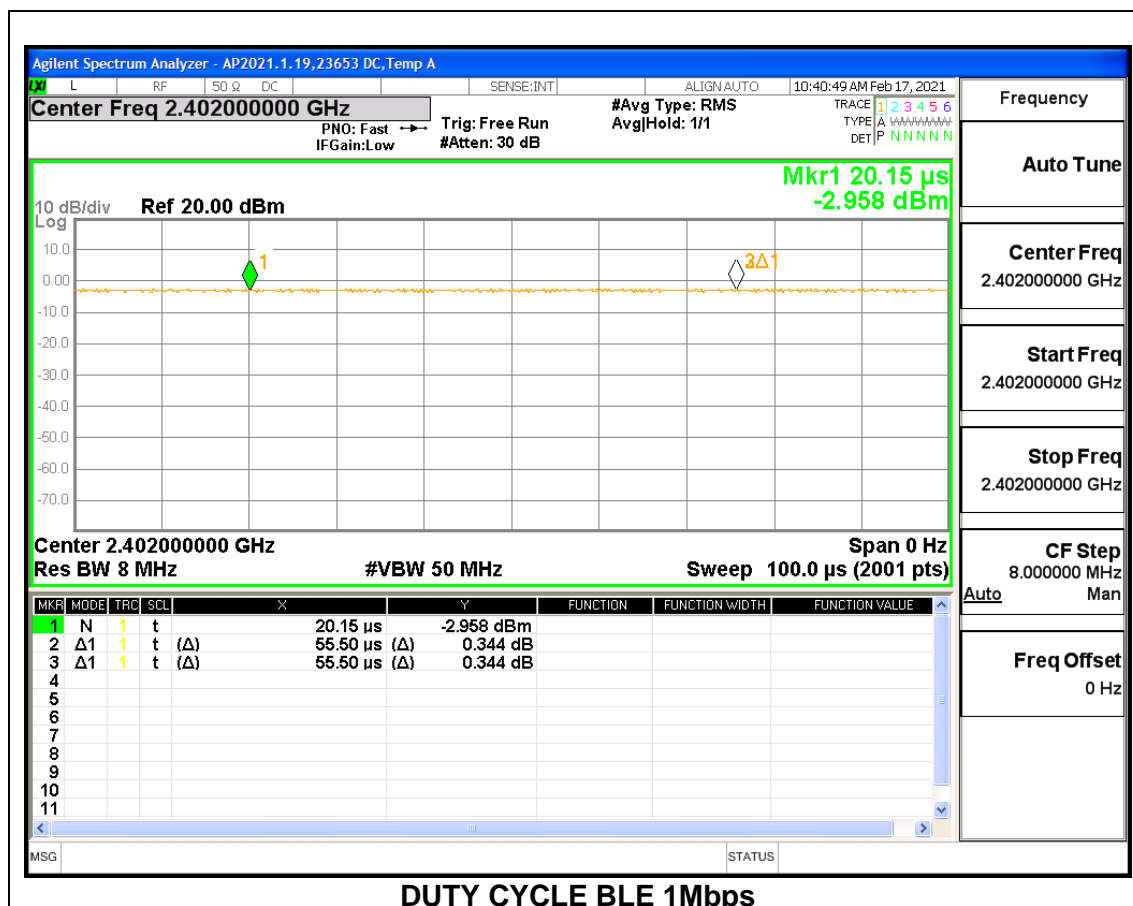
None; for reporting purposes only.

#### PROCEDURE

ANSI C63.10, Section 11.6.Zero-Span Spectrum Analyzer Method.

#### ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
BLE 2Mbps	0.020	0.020	1.000	100.00	0.00	0.010



## 9.2. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	2.2225
Middle	2440	2.2247
High	2480	2.2229





### 9.3. 6 dB BANDWIDTH

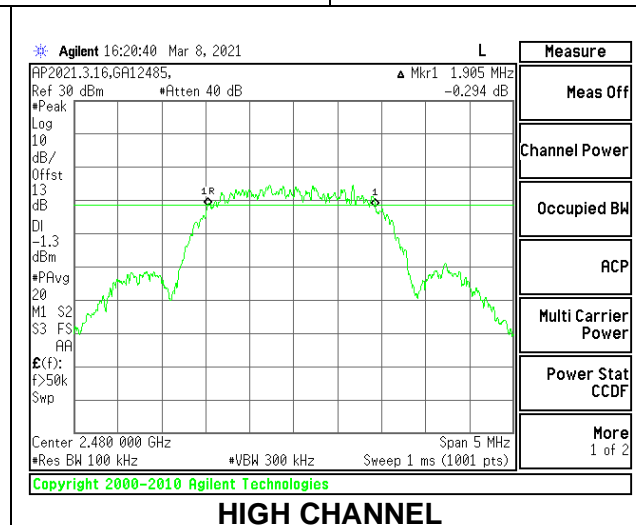
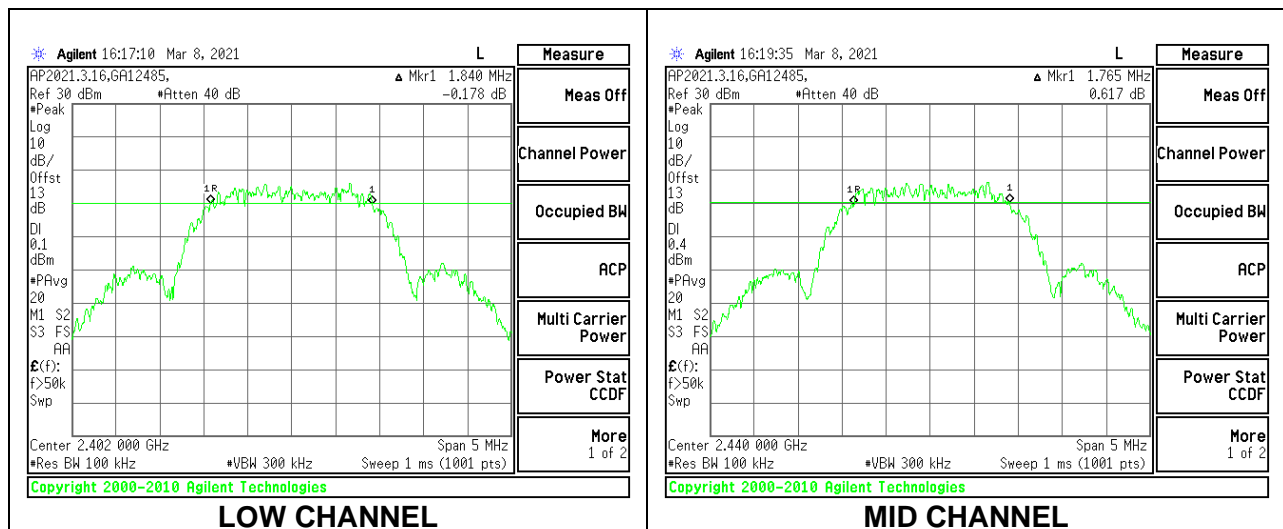
#### LIMITS

FCC §15.247 (a) (2)

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

#### RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.840	0.5
Middle	2440	1.765	0.5
High	2480	1.905	0.5



## 9.4. 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

Measurements perform using a wideband RF power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband peak power sensor. Peak output power was read directly from the power meter.

### RESULTS

<b>Tested By:</b>	20756 CW
<b>Date:</b>	2/17/2021

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Power Reading (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
Low	2402	8.10	30	-21.900
Middle	2440	8.07	30	-21.930
High	2480	6.62	30	-23.380

## 9.5. AVERAGE POWER

### LIMITS

None; for reporting purposes only.

### TEST PROCEDURE

Measurements perform using a wideband RF power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband average power sensor. Gated average output power was read directly from power meter.

### RESULTS

<b>Tested By:</b>	20756 CW
<b>Date:</b>	2/17/2021

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>AV power (dBm)</b>
Low	2402	7.75
Middle	2440	7.65
High	2480	6.30

## 9.6. POWER SPECTRAL DENSITY

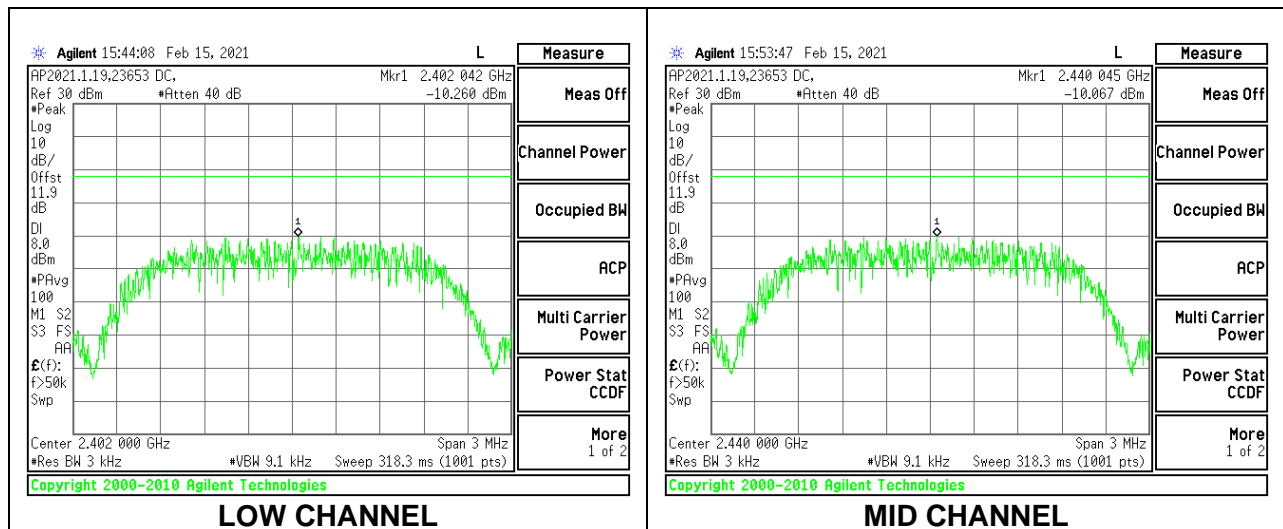
### LIMITS

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.

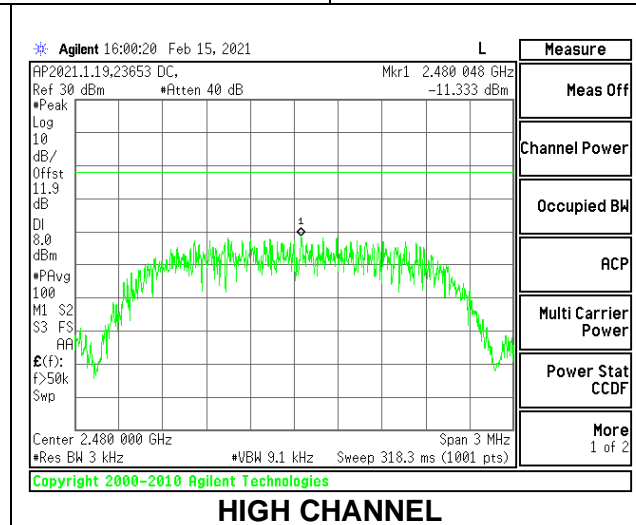
### RESULTS

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-10.26	8	-18.26
Middle	2440	-10.07	8	-18.07
High	2480	-11.33	8	-19.33



**LOW CHANNEL**

**MID CHANNEL**



**HIGH CHANNEL**

---

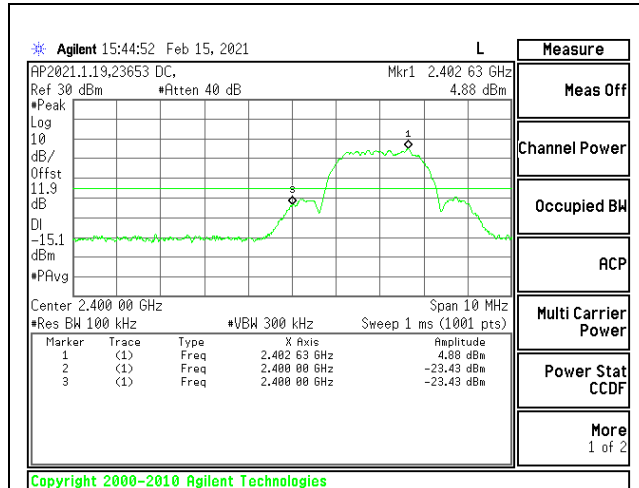
## 9.7. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

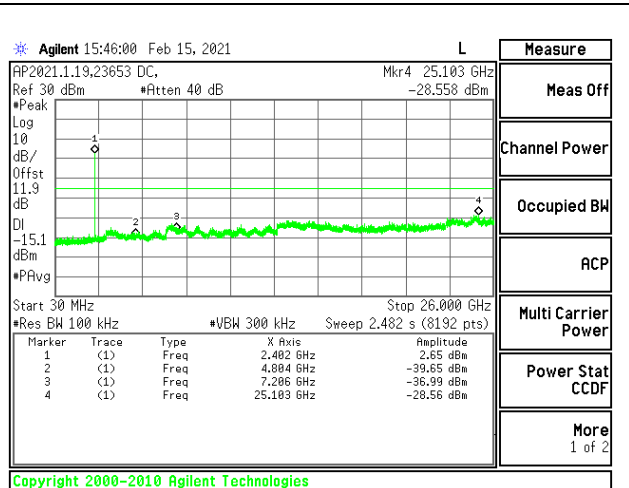
FCC §15.247 (d)

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

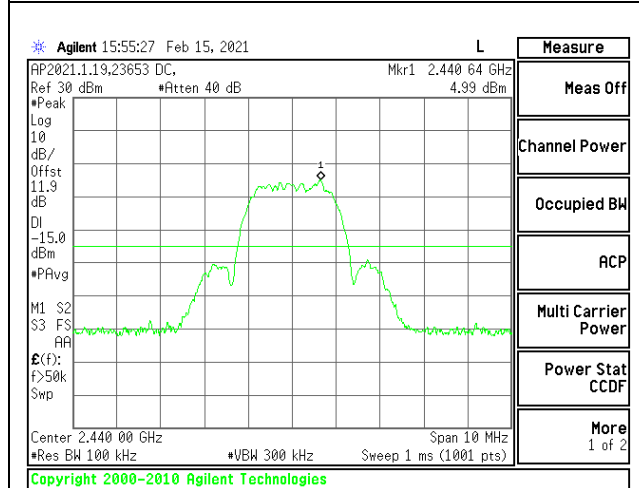
### RESULT



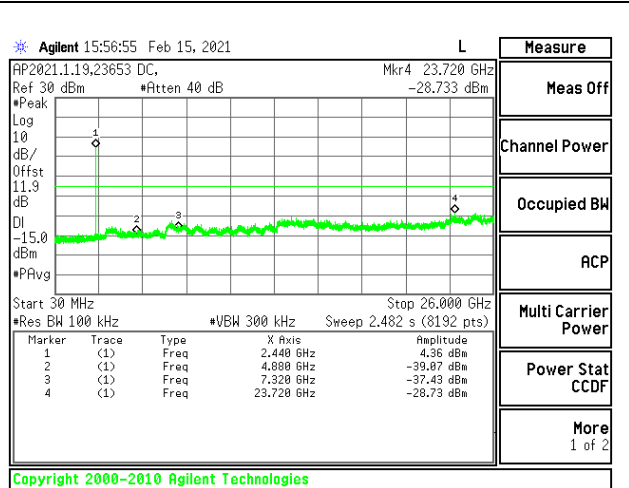
**LOW CHANNEL BANDEGE**



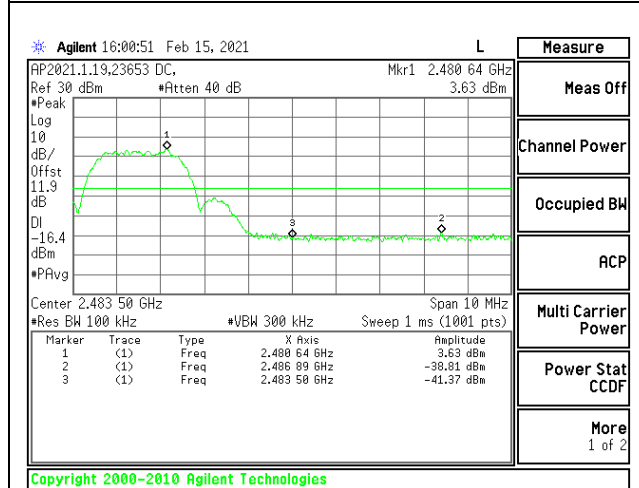
**OUT-OF-BAND LOW CHANNEL**



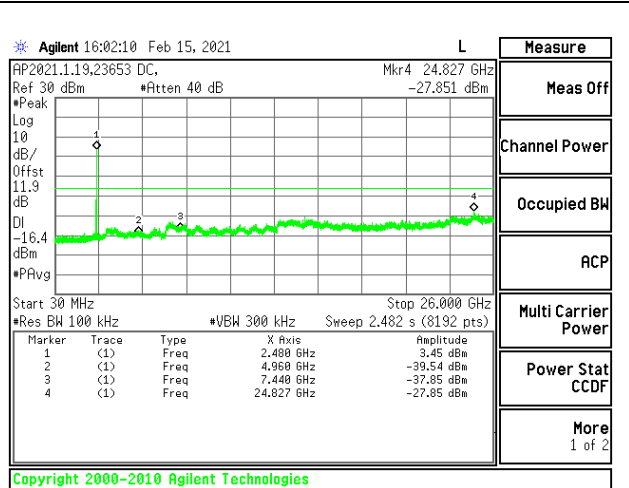
**IN-BAND REFERENCE LEVEL**



**OUT-OF-BAND MID CHANNEL**



**HIGH CHANNEL BANDEGE**



**OUT-OF-BAND HIGH CHANNEL**

## 10. RADIATED TEST RESULTS

### 10.1. 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 in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

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.

2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only. Blue color trace on plots: Parallel orientation. Green color trace on plots: Perpendicular orientation.

Base 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.

#### **KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification**

OFS and chamber correlation testing had been performed and chamber measured test result is the worst-case test result.

#### **KDB 558074 D01 15.247 Meas Guidance v05r02**

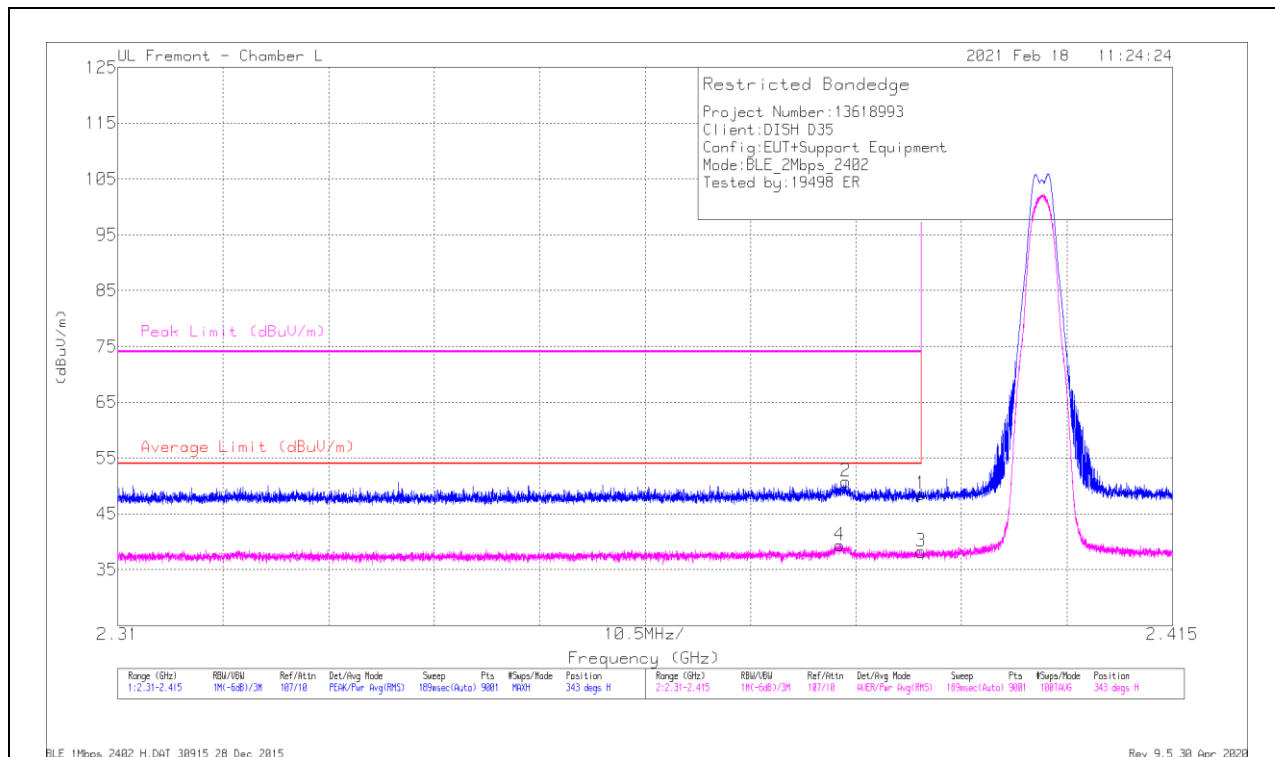
Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.



## 10.2. TRANSMITTER ABOVE 1 GHz

### BANDEDGE (LOW CHANNEL)

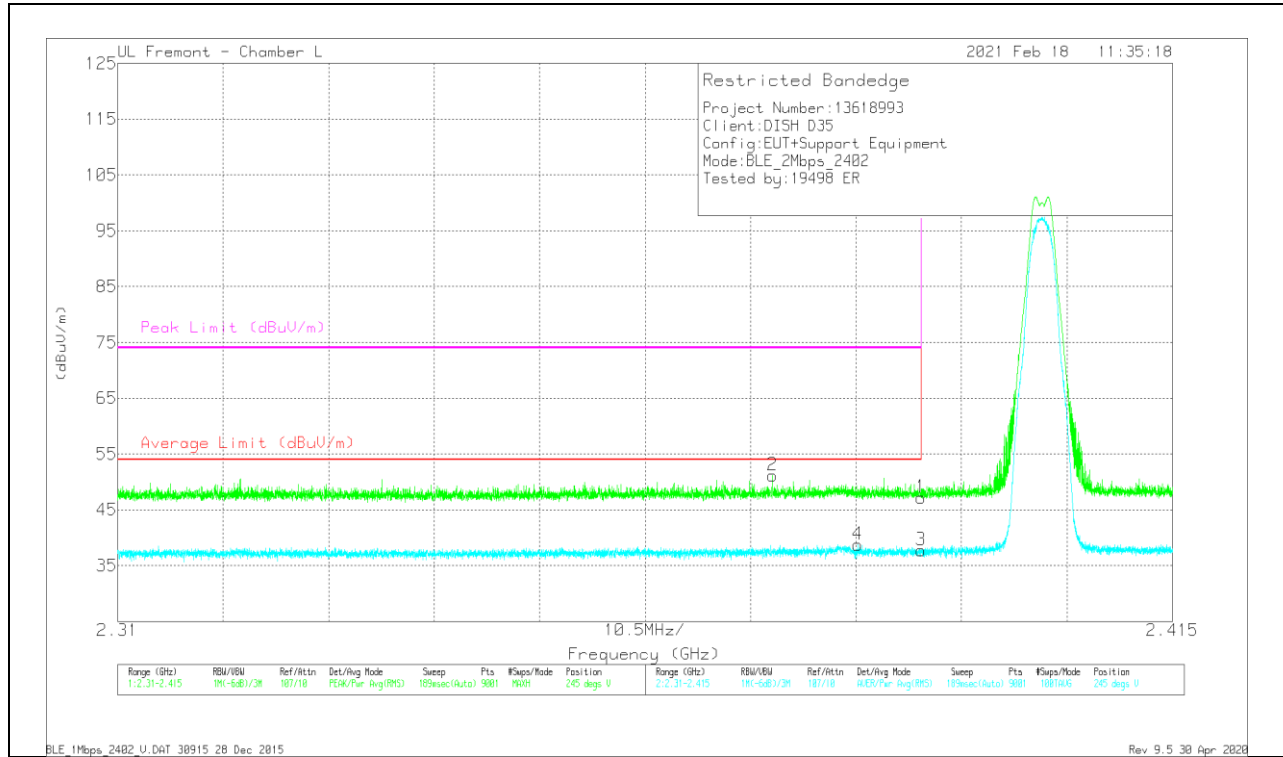
#### HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cb/Ftr/Paid (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	37.8	Pk	31.9	-21.1	48.6	-	-	74	-25.4	343	125	H
2	* 2.38251	40.05	Pk	31.8	-21.1	50.75	-	-	74	-23.25	343	125	H
3	* 2.38999	27.39	RMS	31.9	-21.1	38.19	54	-15.81	-	-	343	125	H
4	* 2.38189	28.7	RMS	31.8	-21.1	39.4	54	-14.6	-	-	343	125	H

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

### VERTICAL RESULT

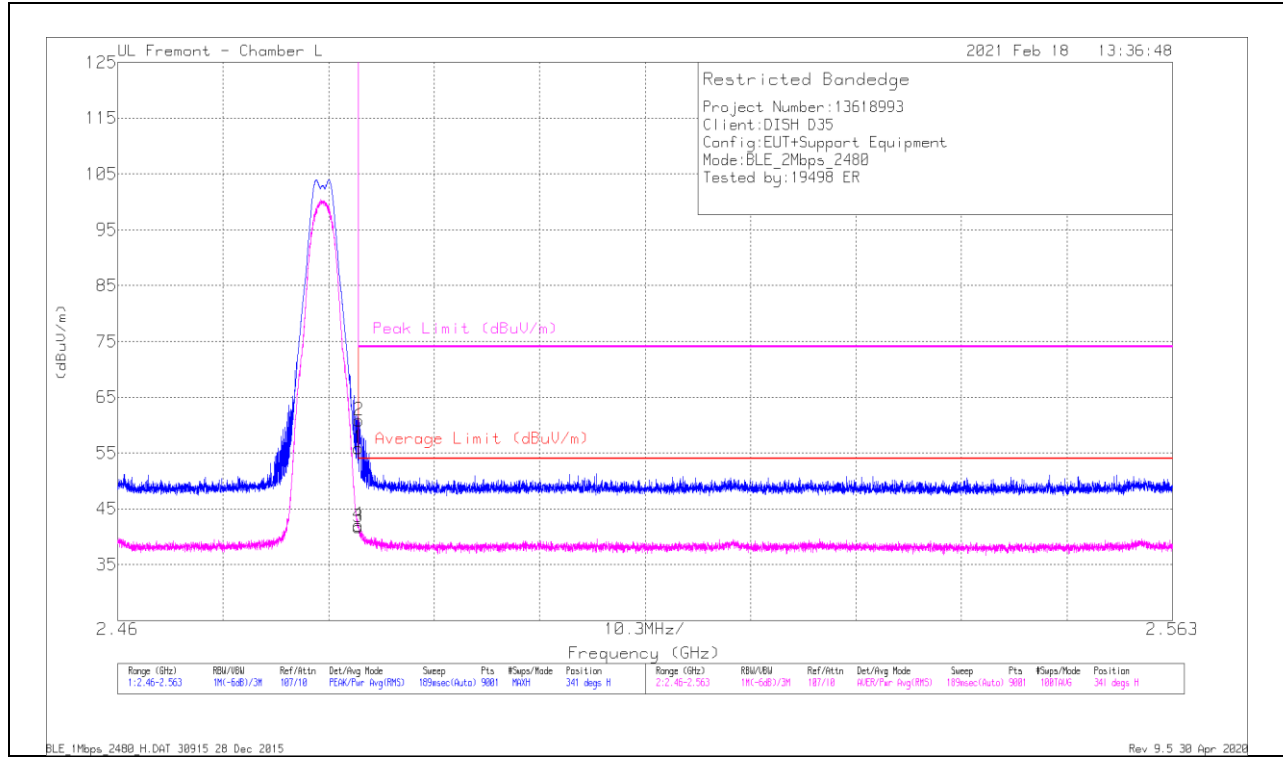


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	36.39	Pk	31.9	-21.1	47.19	-	-	74	-26.81	245	101	V
2	* 2.37521	40.54	Pk	31.8	-21.2	51.14	-	-	74	-22.86	245	101	V
3	* 2.38999	27	RMS	31.9	-21.1	37.8	54	-16.2	-	-	245	101	V
4	* 2.38368	28.1	RMS	31.8	-21.1	38.8	54	-15.2	-	-	245	101	V

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

**BANDEDGE (HIGH CHANNEL)**

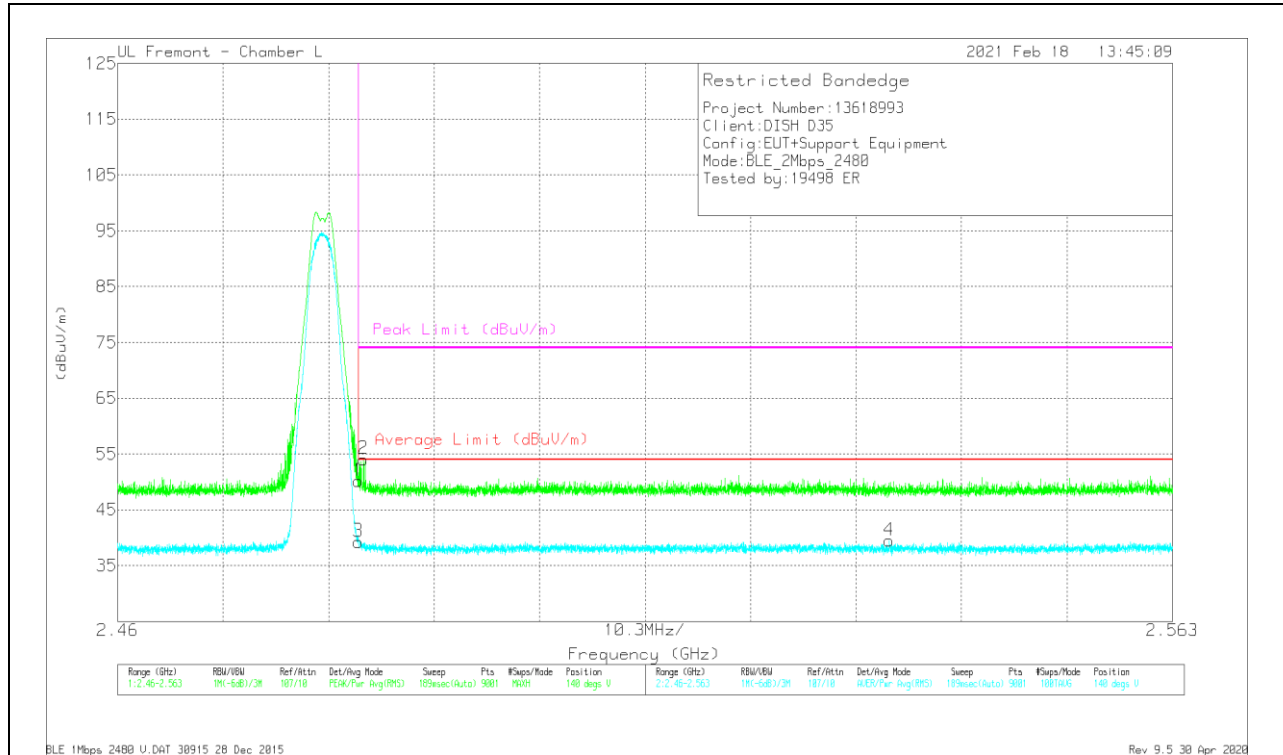
**HORIZONTAL RESULT**



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cb/Filt/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	* 2.48351	44.47	Pk	32.3	-20.9	55.87	-	-	74	-18.13	341	117	H
2	* 2.48353	49.5	Pk	32.3	-20.9	60.9	-	-	74	-13.1	341	117	H
3	* 2.48351	30.31	RMS	32.3	-20.9	41.71	54	-12.29	-	-	341	117	H
4	* 2.48352	30.64	RMS	32.3	-20.9	42.04	54	-11.96	-	-	341	117	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 344 (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	* 2.48351	38.76	Pk	32.3	-20.9	50.16	-	-	74	-23.84	140	119	V
2	* 2.48398	42.68	Pk	32.3	-20.9	54.08	-	-	74	-19.92	140	119	V
3	* 2.48351	27.9	RMS	32.3	-20.9	39.3	54	-14.7	-	-	140	119	V
4	2.53534	28.08	RMS	32.3	-20.9	39.48	54	-14.52	-	-	140	119	V

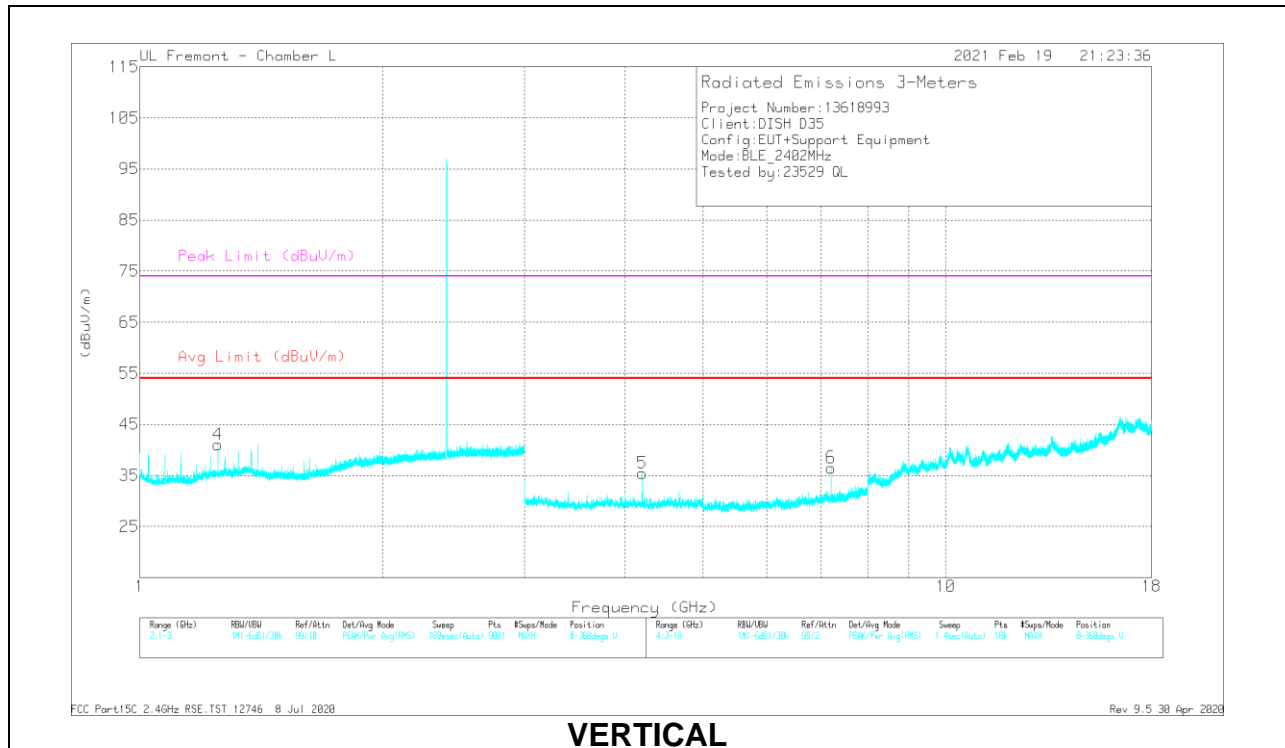
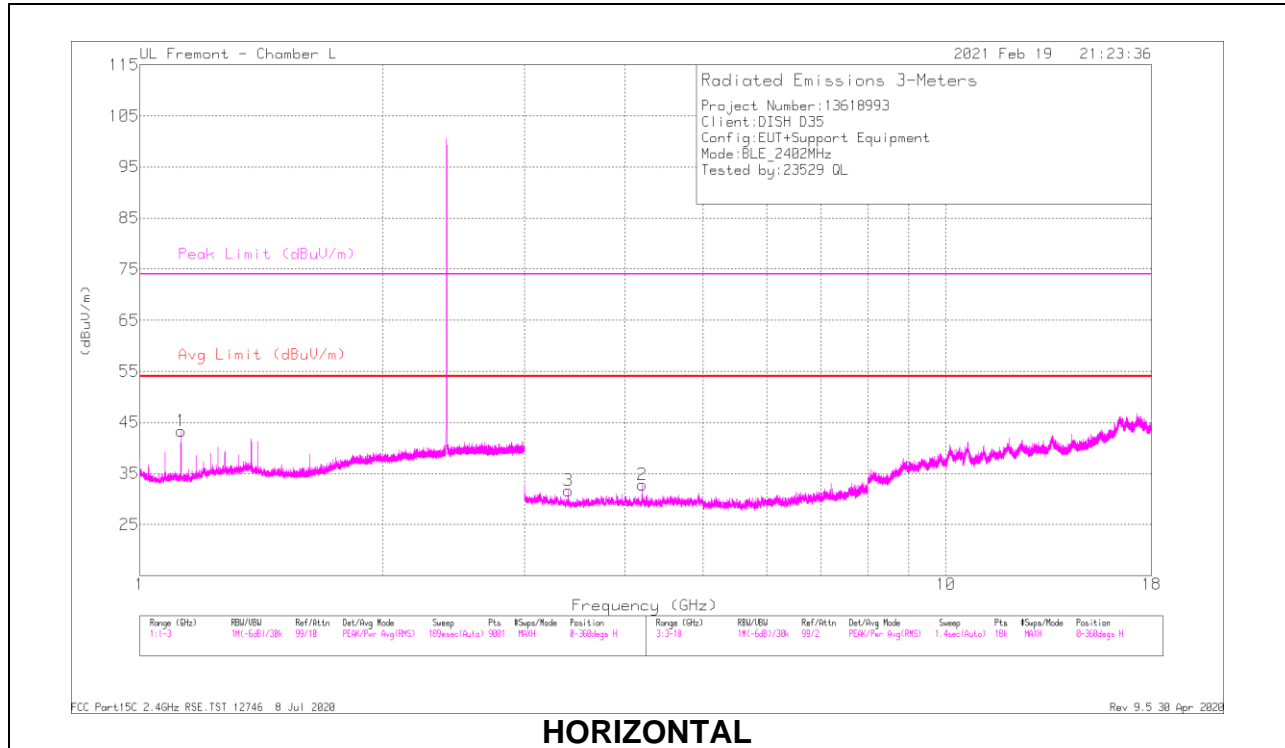
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

**HARMONICS AND SPURIOUS EMISSIONS**

**LOW CHANNEL RESULTS**

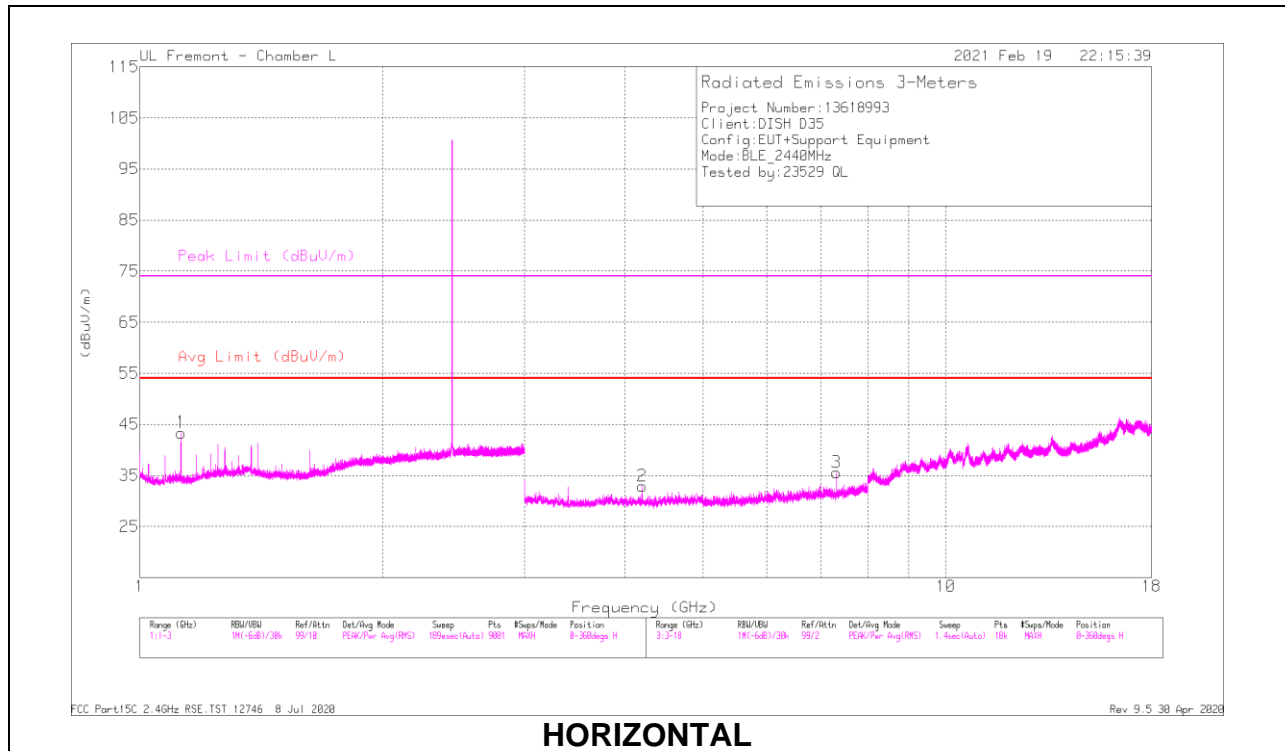


**RADIATED EMISSIONS**

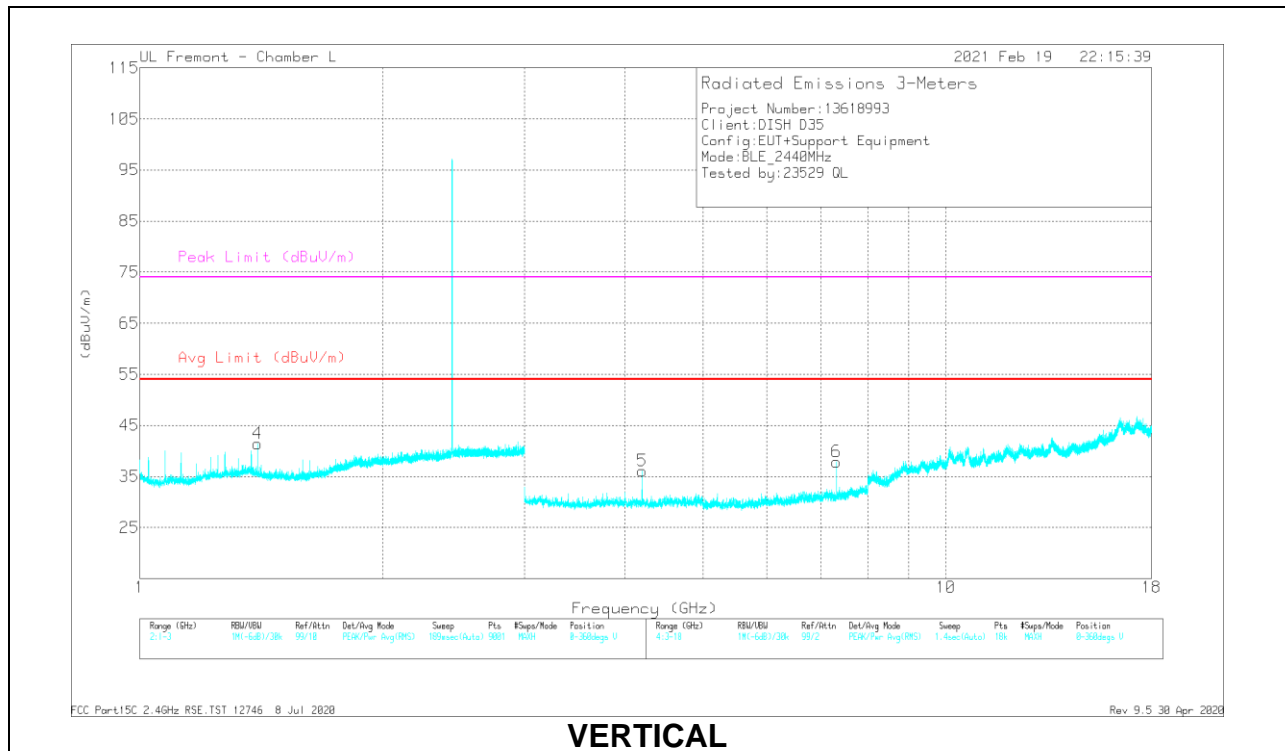
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.12496	44.05	PK2	27.3	-24.1	47.25	-	-	74	-26.75	183	141	H
	* 1.12499	35.79	MAv1	27.3	-24.1	38.99	54	-15.01	-	-	183	141	H
4	* 1.24945	39.82	PK2	28.6	-23.8	44.62	-	-	74	-29.38	178	156	V
	* 1.24999	30.19	MAv1	28.6	-23.8	34.99	54	-19.01	-	-	178	156	V
2	* 4.20123	34.59	PK2	33.5	-27.6	40.49	-	-	74	-33.51	210	398	H
	* 4.19999	23.77	MAv1	33.4	-27.5	29.67	54	-24.33	-	-	210	398	H
3	3.39977	35.92	PK2	32.6	-28.6	39.92	-	-	-	-	215	381	H
5	* 4.19993	31.75	PK2	33.4	-27.5	37.65	-	-	74	-36.35	56	386	V
	* 4.2	31.88	MAv1	33.4	-27.5	37.78	54	-16.22	-	-	56	386	V
6	7.20792	34.54	PK2	35.5	-23.9	46.14	-	-	-	-	120	391	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

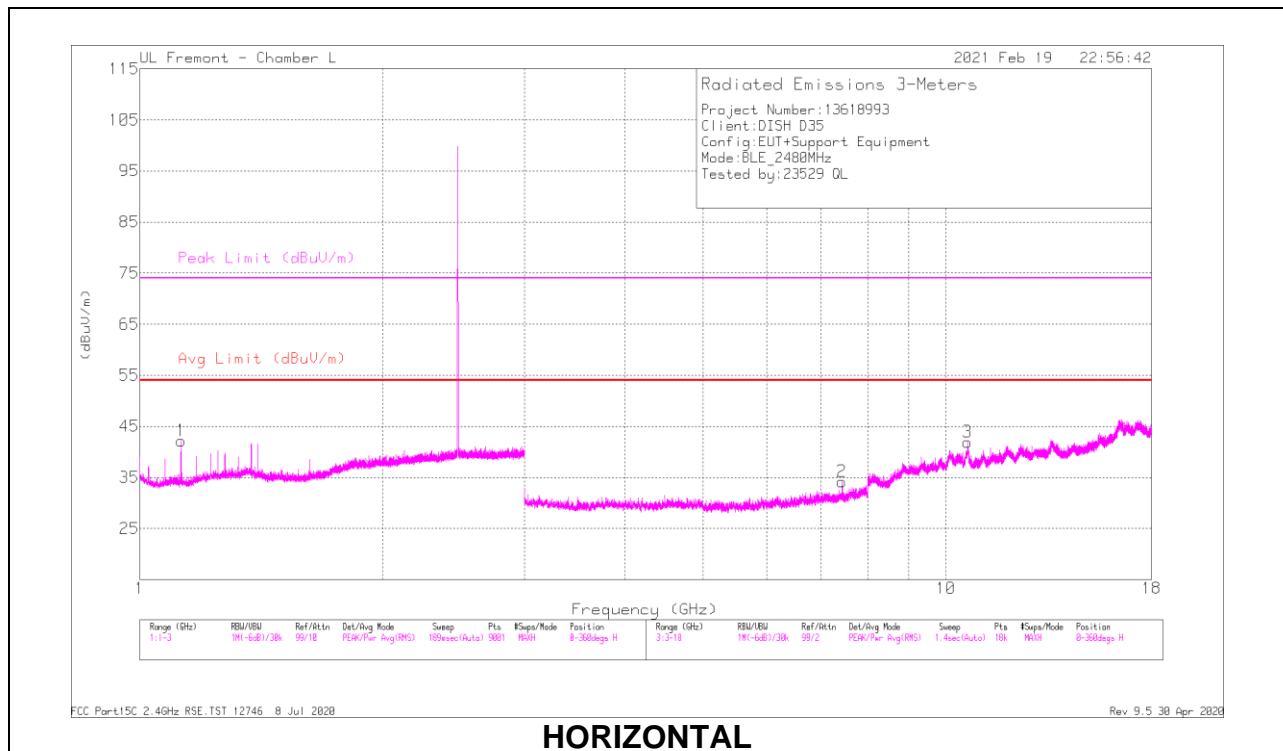
**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/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	* 1.12491	43.69	PK2	27.3	-24.1	46.89	-	-	74	-27.11	199	169	H
	* 1.125	33.99	MAv1	27.3	-24.1	37.19	54	-16.81	-	-	199	168	H
4	* 1.40011	41.41	PK2	28.7	-23.4	46.71	-	-	74	-27.29	250	106	V
	* 1.4	33.58	MAv1	28.7	-23.4	38.88	54	-15.12	-	-	250	106	V
2	* 4.20077	34.92	PK2	33.5	-27.6	40.82	-	-	74	-33.18	207	392	H
	* 4.20122	23.83	MAv1	33.5	-27.6	29.73	54	-24.27	-	-	207	392	H
3	* 7.32195	32.44	PK2	35.5	-23.5	44.44	-	-	74	-29.56	191	110	H
	* 7.32183	23.04	MAv1	35.5	-23.5	35.04	54	-18.96	-	-	191	110	H
5	* 4.19992	37.76	PK2	33.4	-27.5	43.66	-	-	74	-30.34	220	398	V
	* 4.19998	27.49	MAv1	33.4	-27.5	33.39	54	-20.61	-	-	220	398	V
6	* 7.32188	34.44	PK2	35.5	-23.5	46.44	-	-	74	-27.56	18	392	V
	* 7.32189	23.93	MAv1	35.5	-23.5	35.93	54	-18.07	-	-	18	392	V

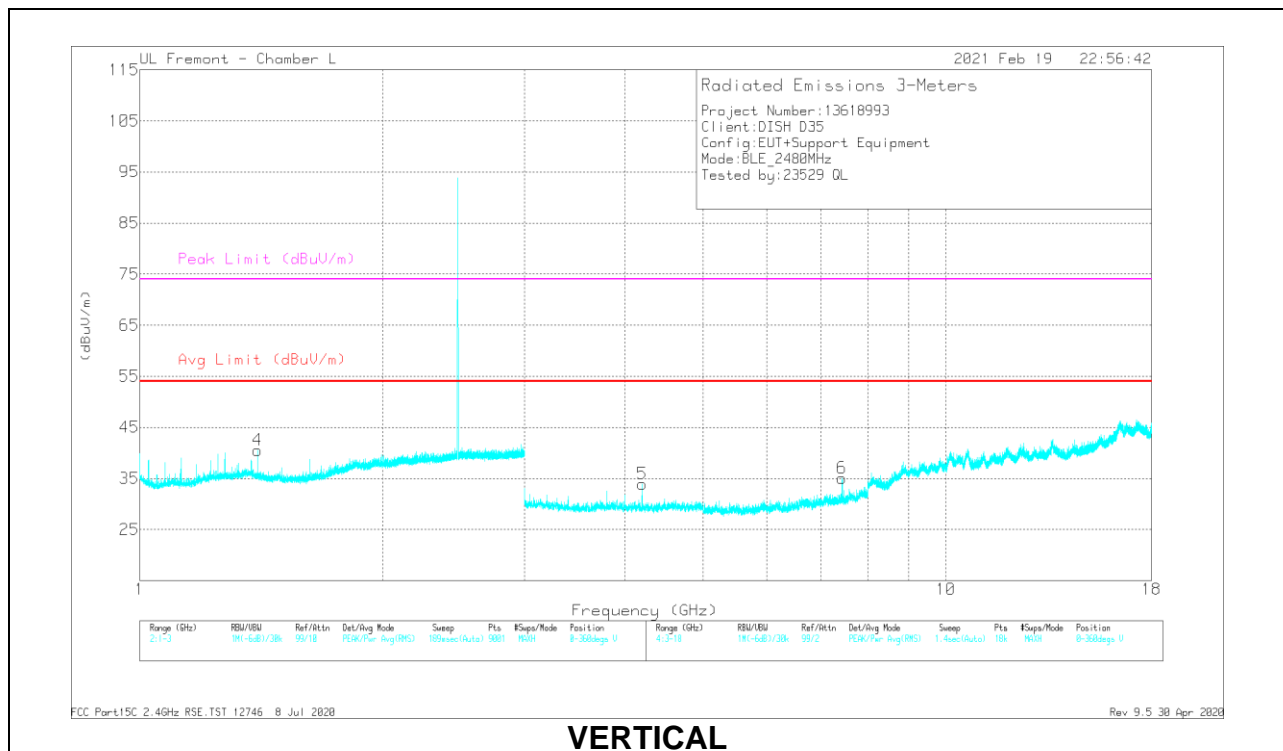
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PK2 - KDB558074 Method: Maximum Peak  
 MAv1 - KDB558074 Option 1 Maximum RMS Average



### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

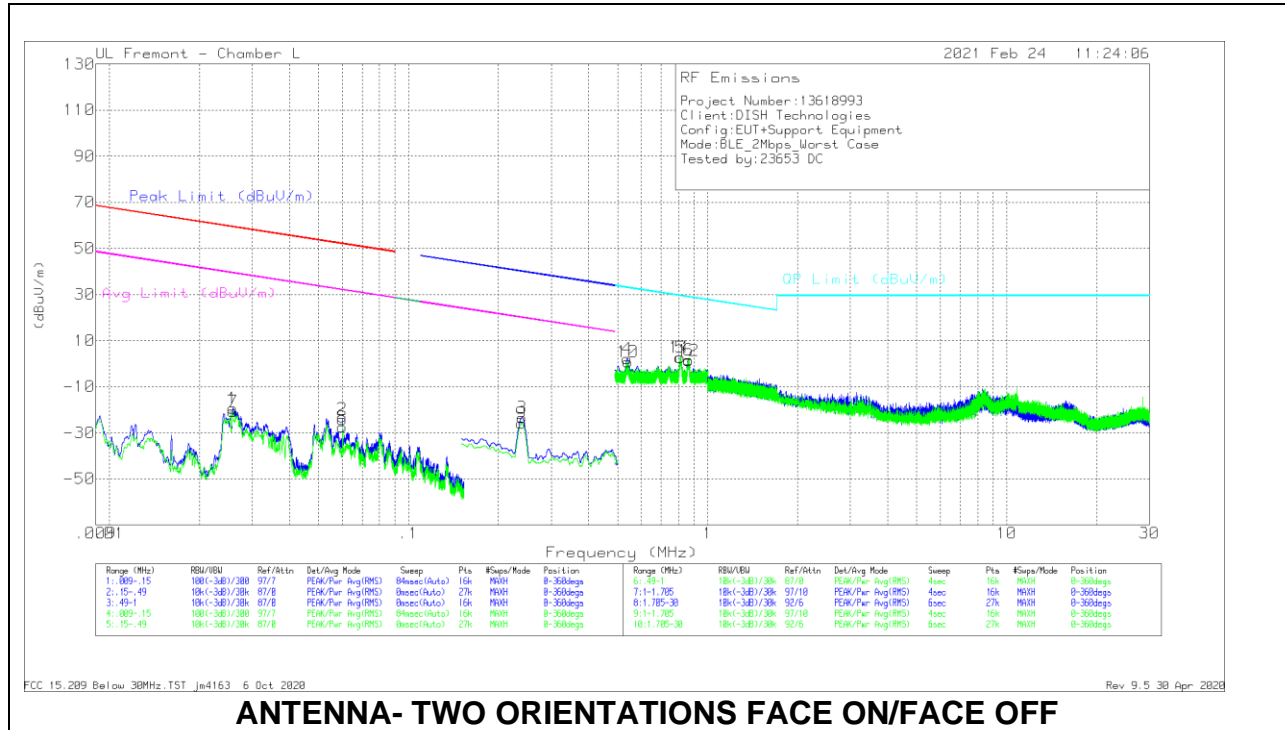
**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.12493	44.61	PK2	27.3	-24.1	47.81	-	-	74	-26.19	185	144	H
	* 1.125	35.31	MAv1	27.3	-24.1	38.51	54	-15.49	-	-	185	144	H
4	* 1.39997	41.69	PK2	28.7	-23.4	46.99	-	-	74	-27.01	54	106	V
	* 1.4	33.4	MAv1	28.7	-23.4	38.7	54	-15.3	-	-	54	106	V
2	* 7.43866	32.62	PK2	35.6	-23.2	45.02	-	-	74	-28.98	118	116	H
	* 7.43859	21.01	MAv1	35.6	-23.2	33.41	54	-20.59	-	-	118	116	H
3	* 10.64655	26.9	PK2	37.9	-17.2	47.6	-	-	74	-26.4	141	210	H
	* 10.64705	16	MAv1	37.9	-17.2	36.7	54	-17.3	-	-	141	210	H
5	* 4.20004	37.71	PK2	33.4	-27.5	43.61	-	-	74	-30.39	58	396	V
	* 4.20002	30.14	MAv1	33.4	-27.5	36.04	54	-17.96	-	-	58	396	V
6	* 7.43856	31.57	PK2	35.6	-23.2	43.97	-	-	74	-30.03	345	398	V
	* 7.43808	20.92	MAv1	35.6	-23.2	33.32	54	-20.68	-	-	345	398	V

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

### 10.3. WORST CASE BELOW 30MHz

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



**ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF**

**Below 30MHz Data**

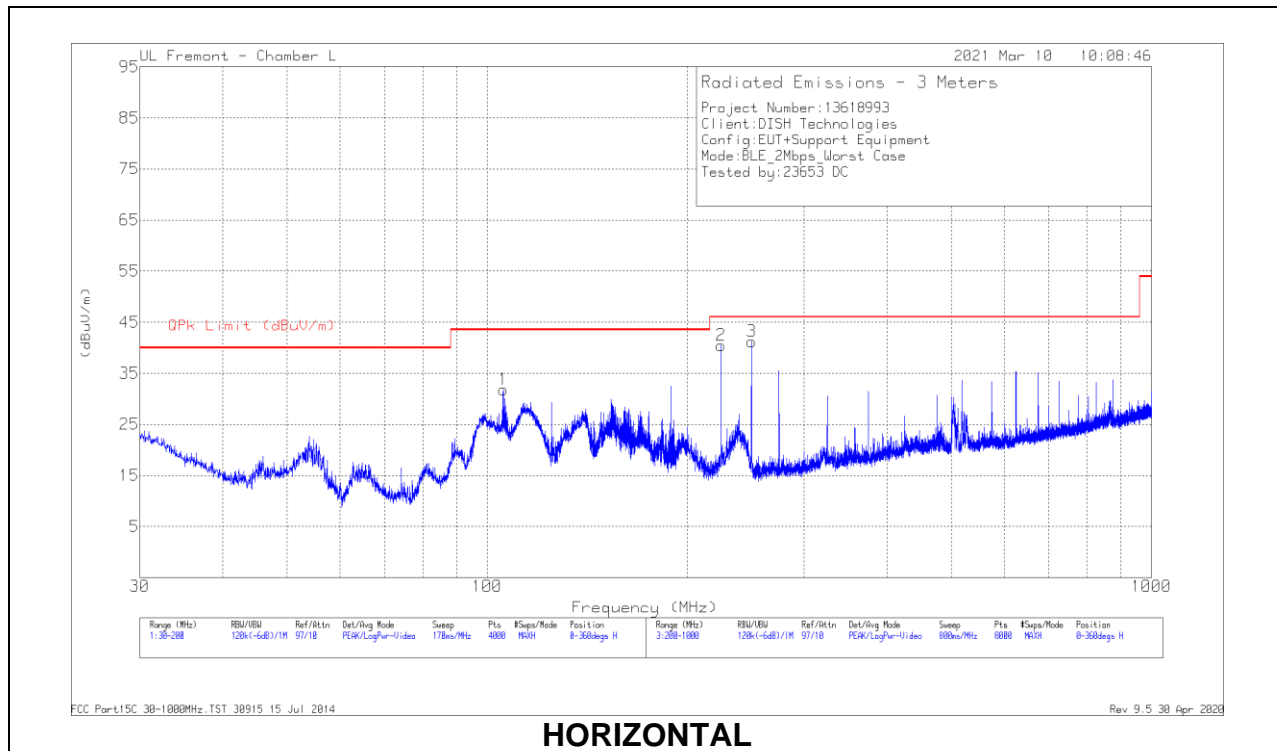
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.02588	34.72	Pk	58.4	-32.4	-80	-19.28	59.32	-78.6	39.32	-58.6	-	-	-	-	0-360
2	.06017	32.1	Pk	56.2	-32.4	-80	-24.1	52	-76.1	32	-56.1	-	-	-	-	0-360
3	.23999	32.56	Pk	56.3	-32.3	-80	-23.44	-	-	-	40.01	-63.45	-	20.01	-43.45	0-360
7	.02591	33.26	Pk	58.4	-32.4	-80	-20.74	59.32	-80.06	39.32	-60.06	-	-	-	-	0-360
8	.06015	28.71	Pk	56.2	-32.4	-80	-27.49	52	-79.49	32	-59.49	-	-	-	-	0-360
9	.23861	30.05	Pk	56.3	-32.3	-80	-25.95	-	-	-	-	40.06	-66.01	20.06	-46.01	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.5393	18.29	Pk	56.2	-32.2	-40	2.28	32.97	-30.69	0-360
5	.80986	18.57	Pk	56.3	-32.2	-40	2.67	29.45	-26.78	0-360
6	.86333	17.57	Pk	56.3	-32.2	-40	1.67	28.89	-27.22	0-360
10	.54046	16.8	Pk	56.2	-32.2	-40	.8	32.95	-32.15	0-360
11	.80923	18.74	Pk	56.3	-32.2	-40	2.84	29.45	-26.61	0-360
12	.86224	17.31	Pk	56.3	-32.2	-40	1.41	28.91	-27.5	0-360

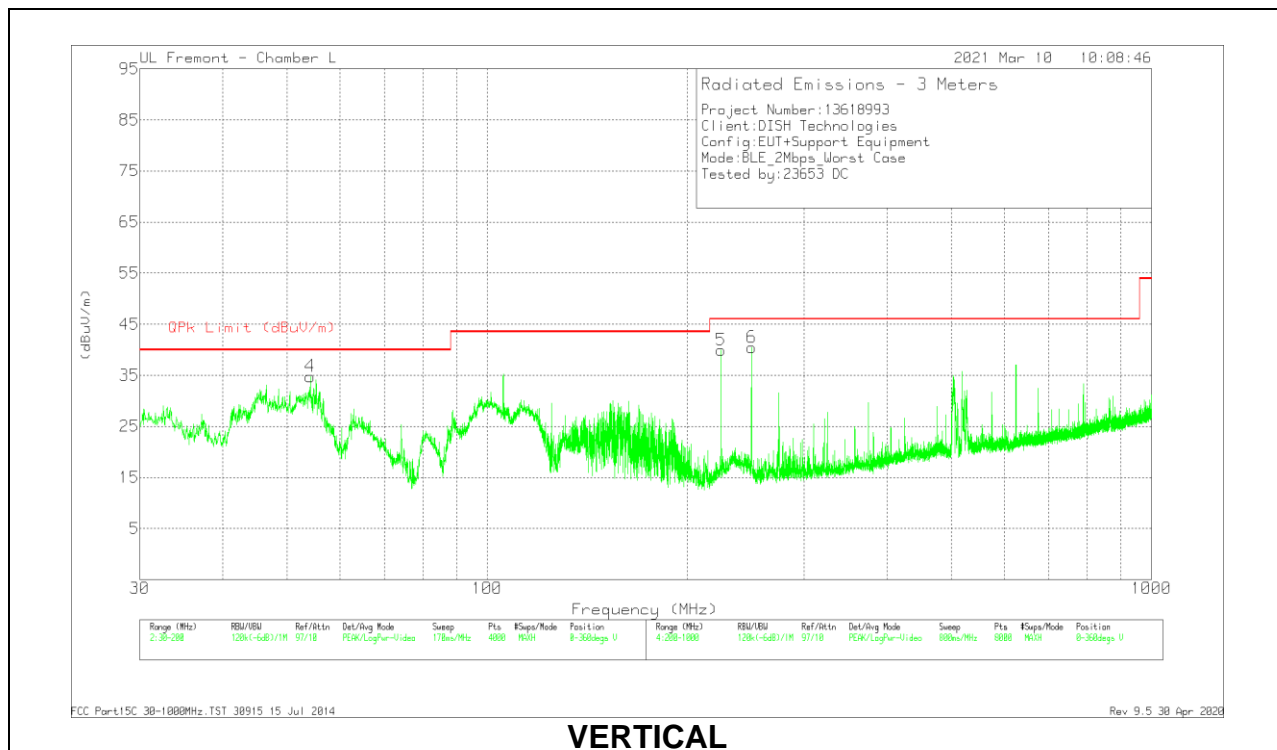
Pk - Peak detector

### 10.4. 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 174373 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	105.7601	47.65	Pk	17.6	-30.7	34.55	43.52	-8.97	57	313	H
	105.767	45.44	Qp	17.6	-30.7	32.34	43.52	-11.18	57	313	H
4	53.9214	51.16	Pk	13.2	-31.2	33.16	40	-6.84	21	109	V
	53.8175	45.1	Qp	13.2	-31.2	27.1	40	-12.9	21	109	V
2	224.9951	54.33	Pk	16.7	-30	41.03	46.02	-4.99	209	143	H
	225.0001	53.5	Qp	16.7	-30	40.2	46.02	-5.82	209	143	H
3	* 249.9945	55.25	Pk	17.3	-29.9	42.65	46.02	-3.37	213	116	H
	* 249.9955	54.57	Qp	17.3	-29.9	41.97	46.02	-4.05	213	116	H
5	224.9963	48.24	Pk	16.7	-30	34.94	46.02	-11.08	210	101	V
	224.9943	46.96	Qp	16.7	-30	33.66	46.02	-12.36	210	101	V
6	* 250.0004	54.05	Pk	17.3	-29.9	41.45	46.02	-4.57	311	103	V
	* 249.9954	53.12	Qp	17.3	-29.9	40.52	46.02	-5.5	311	103	V

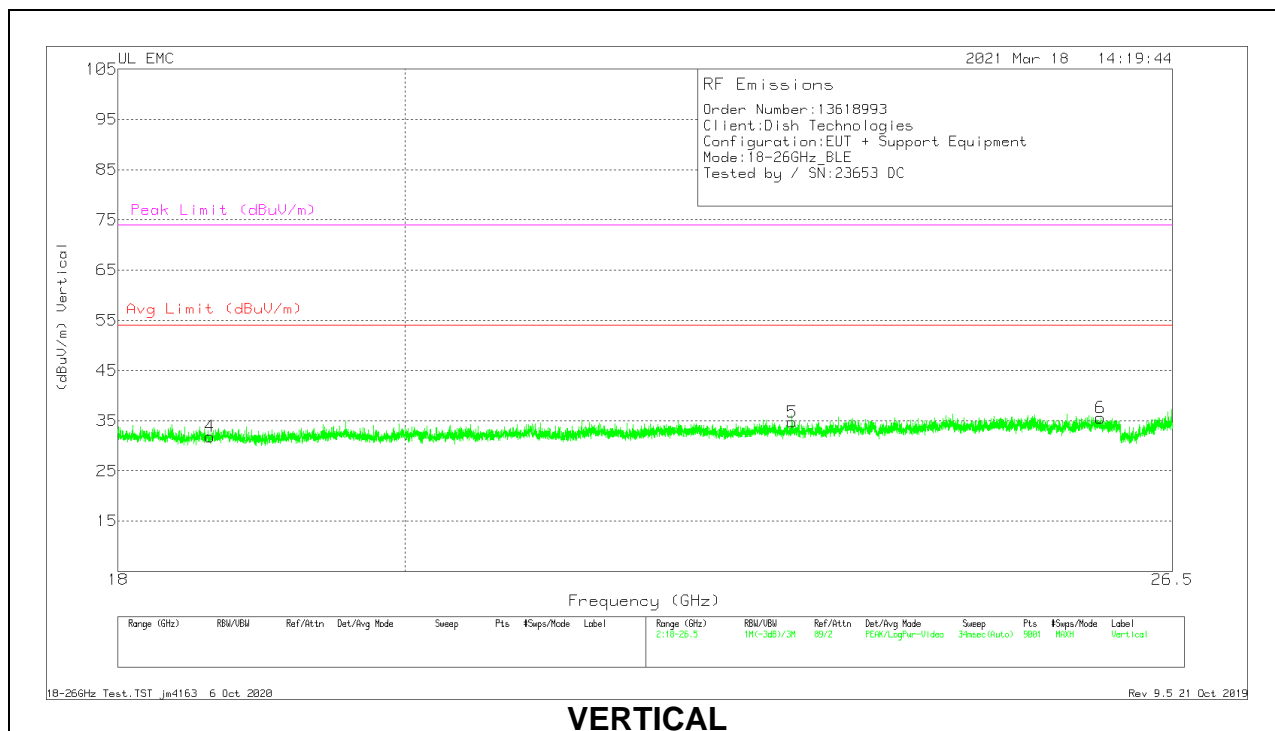
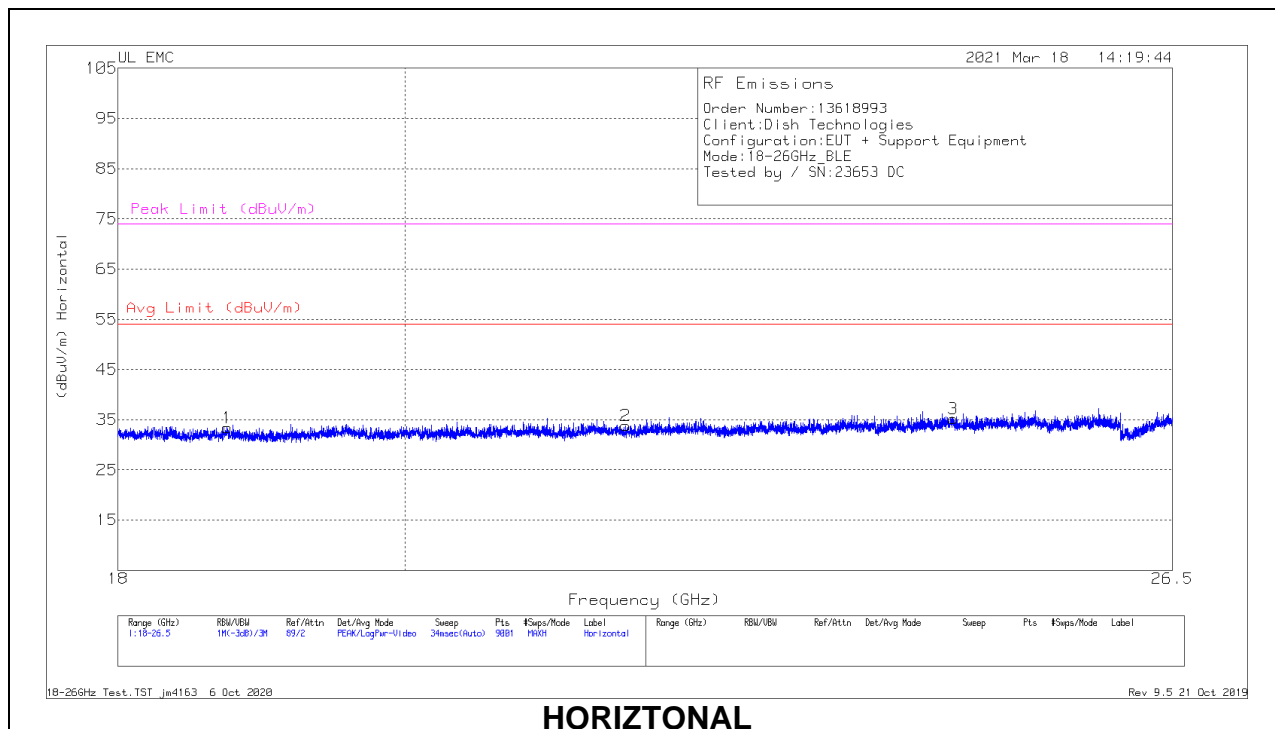
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

## 10.5. 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 (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	18.73478	69.02	Pk	32.4	-58.5	-9.5	33.42	54	-20.58	74	-40.58
2	21.68333	67.61	Pk	33.2	-57.5	-9.5	33.81	54	-20.19	74	-40.19
3	24.4515	66.57	Pk	34.3	-56.2	-9.5	35.17	54	-18.83	74	-38.83
4	18.61767	67.7	Pk	32.4	-58.8	-9.5	31.8	54	-22.2	74	-42.2
5	23.049	67.81	Pk	33.8	-57.4	-9.5	34.71	54	-19.29	74	-39.29
6	25.80961	65.95	Pk	34.4	-55.3	-9.5	35.55	54	-18.45	74	-38.45

Pk - Peak detector



## 11. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

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.

### TEST PROCEDURE

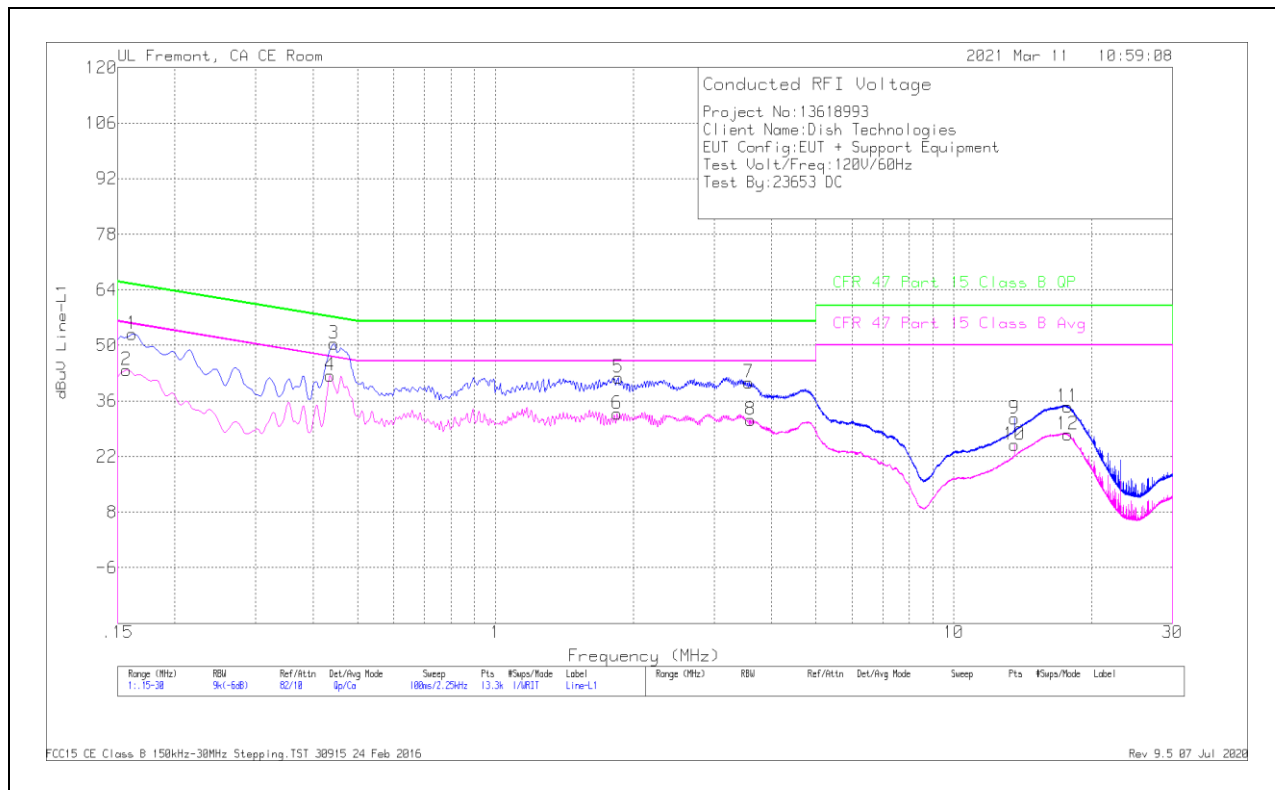
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

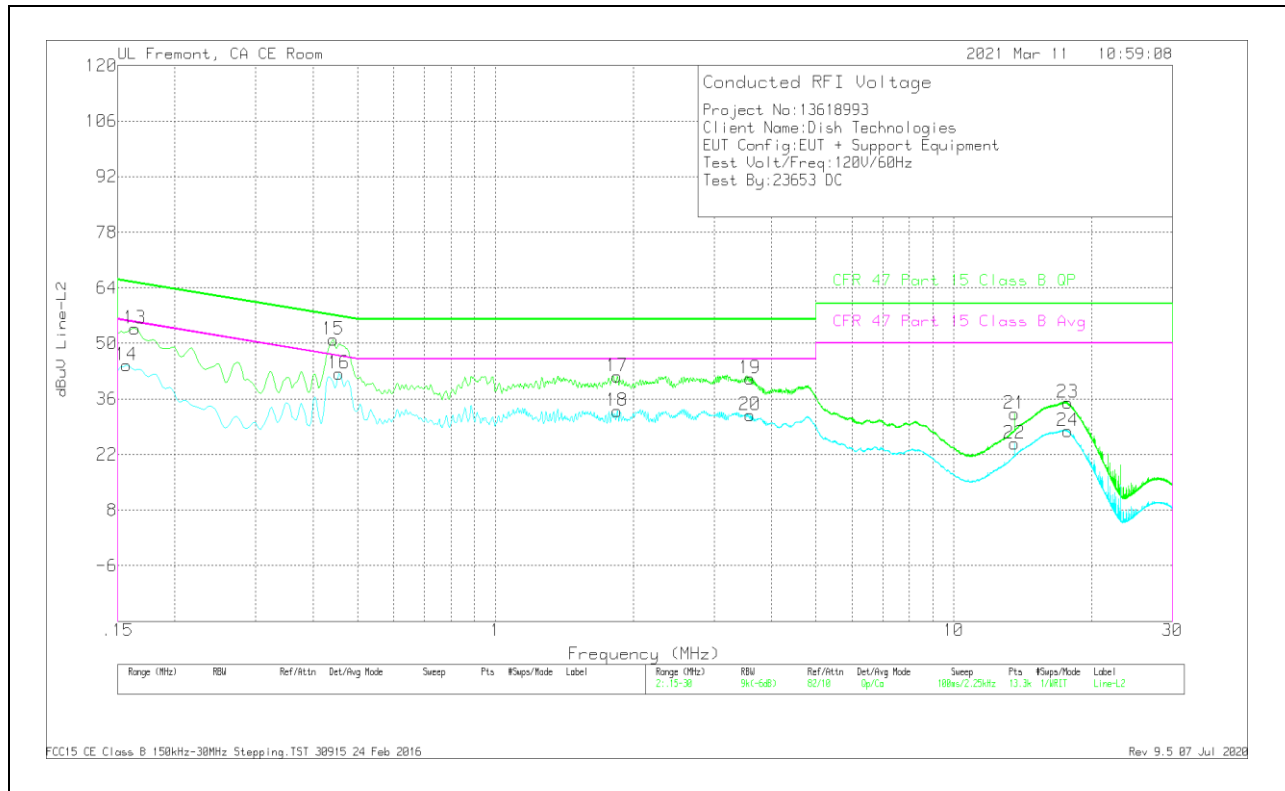
### LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz												
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE018644 6 L1	LC Cables C1&C3 dB	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)M argin (dB)	
1	.16125	42.84	Qp	0	0	10.1	52.94	65.4	-12.46	-	-	
2	.15675	33.67	Ca	.1	0	10.1	43.87	-	-	55.63	-11.76	
3	.44475	40.28	Qp	0	0	10.1	50.38	56.97	-6.59	-	-	
4	.43575	32.29	Ca	0	0	10.1	42.39	-	-	47.14	-4.75	
5	1.85325	31.67	Qp	0	.1	10.1	41.87	56	-14.13	-	-	
6	1.842	22.54	Ca	0	.1	10.1	32.74	-	-	46	-13.26	
7	3.5745	30.32	Qp	0	.1	10.2	40.62	56	-15.38	-	-	
8	3.6015	20.98	Ca	0	.1	10.2	31.28	-	-	46	-14.72	
9	13.56	21.14	Qp	.1	.2	10.2	31.64	60	-28.36	-	-	
10	13.56	14.53	Ca	.1	.2	10.2	25.03	-	-	50	-24.97	
11	17.74725	24.13	Qp	0	.2	10.3	34.63	60	-25.37	-	-	
12	17.75625	17.11	Ca	0	.2	10.3	27.61	-	-	50	-22.39	

Qp - Quasi-Peak detector  
 Ca - CISPR average detection

### LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE018644 6 L2	LC Cables C2&C3 dB	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)M argin (dB)
13	.1635	43.69	Qp	0	0	10.1	53.79	65.28	-11.49	-	-
14	.15675	34.36	Ca	0	0	10.1	44.46	-	-	55.63	-11.17
15	.4425	40.83	Qp	0	0	10.1	50.93	57.01	-6.08	-	-
16	.456	32.33	Ca	0	0	10.1	42.43	-	-	46.77	-4.34
17	1.84425	31.51	Qp	0	.1	10.1	41.71	56	-14.29	-	-
18	1.84425	22.74	Ca	0	.1	10.1	32.94	-	-	46	-13.06
19	3.5925	30.83	Qp	0	.1	10.2	41.13	56	-14.87	-	-
20	3.597	21.56	Ca	0	.1	10.2	31.86	-	-	46	-14.14
21	13.56	21.81	Qp	.1	.2	10.2	32.31	60	-27.69	-	-
22	13.56	14.31	Ca	.1	.2	10.2	24.81	-	-	50	-25.19
23	17.71125	24.56	Qp	0	.2	10.3	35.06	60	-24.94	-	-
24	17.754	17.45	Ca	0	.2	10.3	27.95	-	-	50	-22.05

Qp - Quasi-Peak detector  
 Ca - CISPR average detection