



# **TEST REPORT**

**Report Number.:** 13618993-E2V2

**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

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NVLAP Lab code: 200065-0

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## 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

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# 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 22, 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.

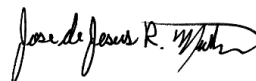
Approved & Released For  
UL Verification Services Inc. By:



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

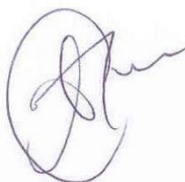
Prepared By:



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

Reviewed By:



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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	Per ANSI C63.10, Section 11.6.
See Comment	20dB BW/99% OBW	Reporting purposes only	ANSI C63.10 Sections 6.9.2 and 6.9.3
15.247 (a)(1)	Hopping Frequency Separation		None.
15.247 (a)(1)(iii)	Number of Hopping Channels		None.
15.247 (a)(1)(iii)	Average Time of Occupancy		None.
15.247 (b)(1)	Output Power		None.
See Comment	Average Power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
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:

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

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

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

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

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



## 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	Basic GFSK	8.68	7.38
	Enhanced DQPSK	7.57	5.71
	Enhanced 8PSK	7.62	5.78

Note: GFSK, DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on these modes to show compliance. For average power data refer to section 9.7.

### 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.

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## 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.

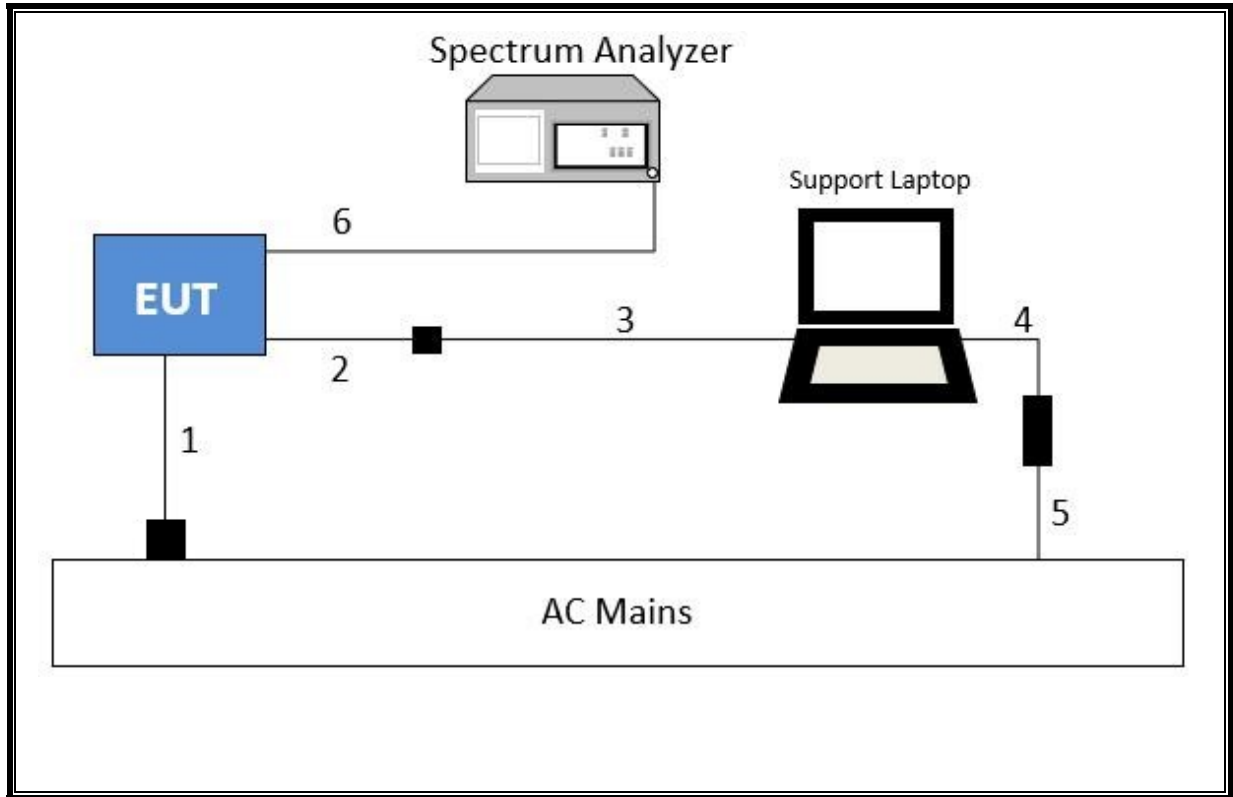
Worst-case data rates as provided by the client were:

GFSK mode: DH5  
8PSK mode: 3-DH5

## 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 (Monitor)	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 pin Serial	1	Header	Un-shielded	.2	EUT to micro USB
3	Micro USB	1	USB	Shielded	1	Micro USB to Laptop
4	DC	1	DC	Un-shielded	1	AC Adapter to Laptop
5	AC	1	Two Prong	Un-shielded	1	AC Adapter to AC 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	Two Prong	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	Ethernet	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

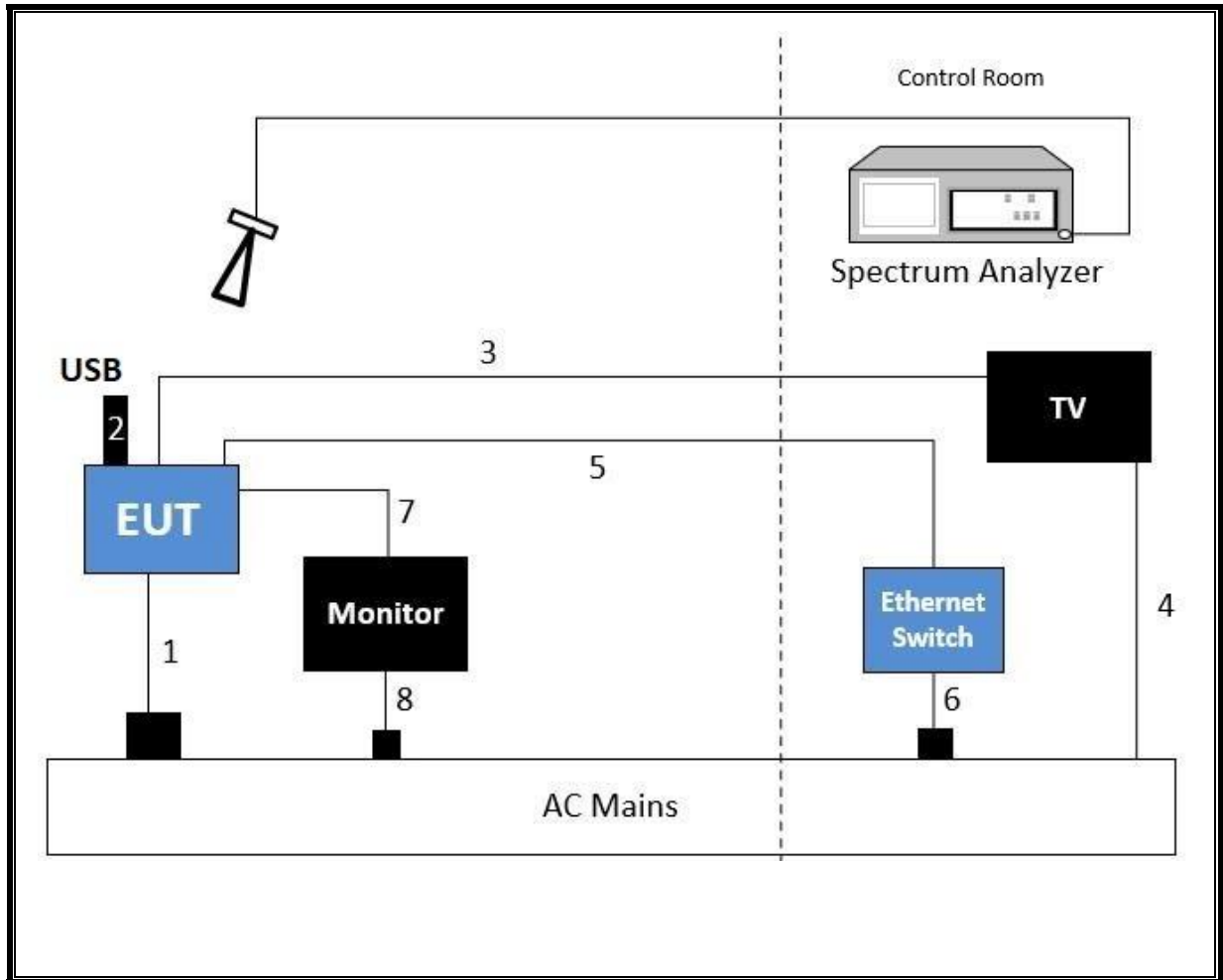
**CONDCUTED TEST SETUP DIAGRAM**



**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.

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## 7. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

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

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Conducted Spurious Emissions: ANSI C63.10-2013 Section 7.8.8

Conducted Band-Edge: ANSI C63.10-2013 Section 6.10.4

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

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

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		
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/T Minimum VBW (kHz)
Bluetooth GFSK	0.017	0.017	1.000	100.00	0.00	0.010
Bluetooth 8PSK	0.235	0.235	1.000	100.00	0.00	0.010





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## **9.2. 20 dB AND 99% BANDWIDTH**

### **LIMITS**

None; for reporting purposes only.

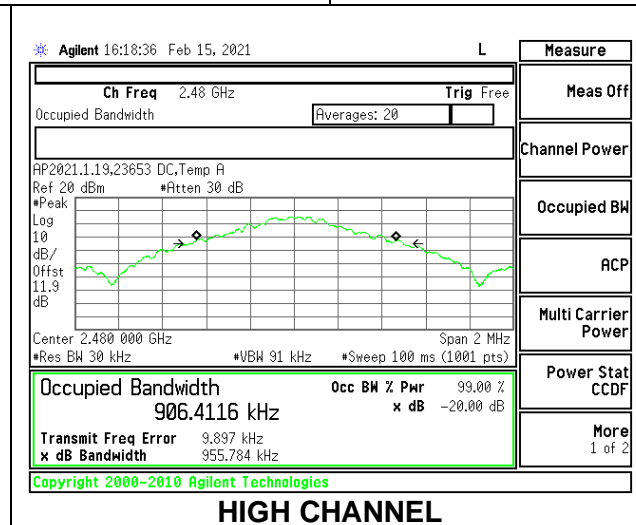
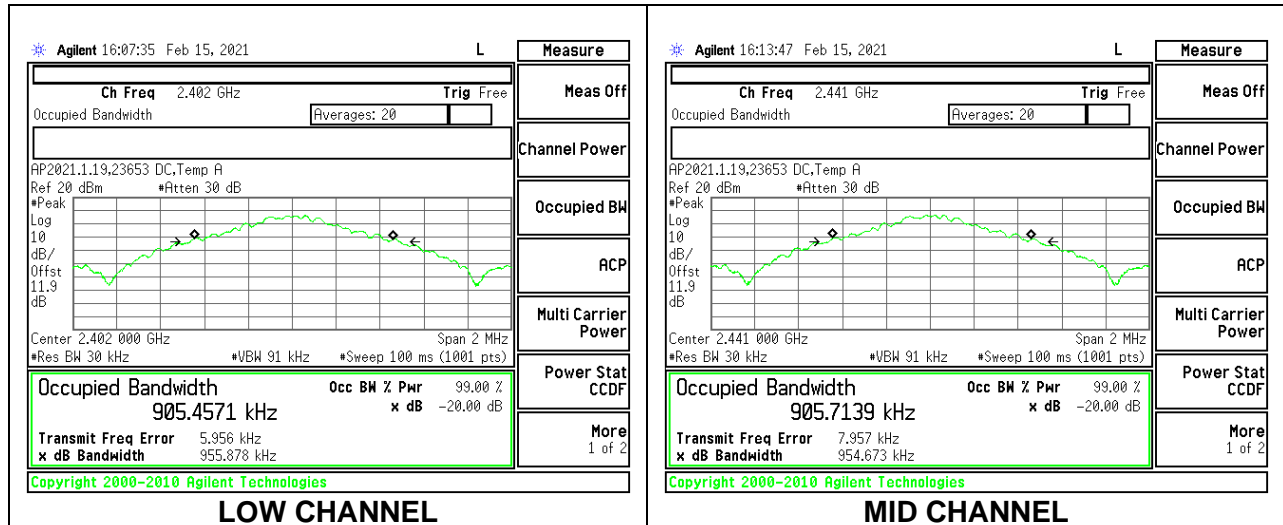
### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

### **RESULTS**

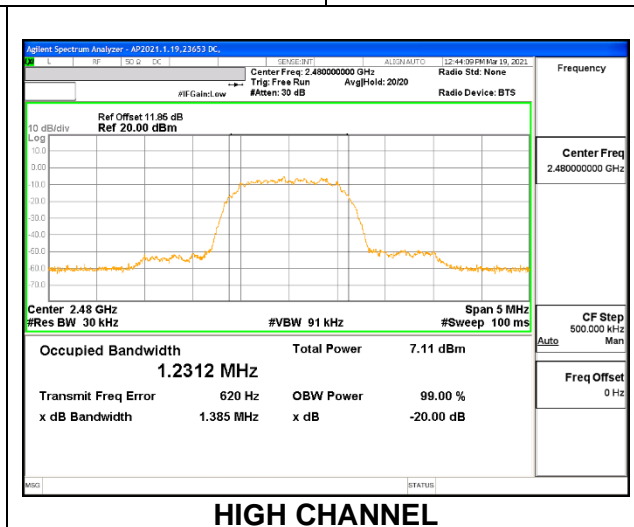
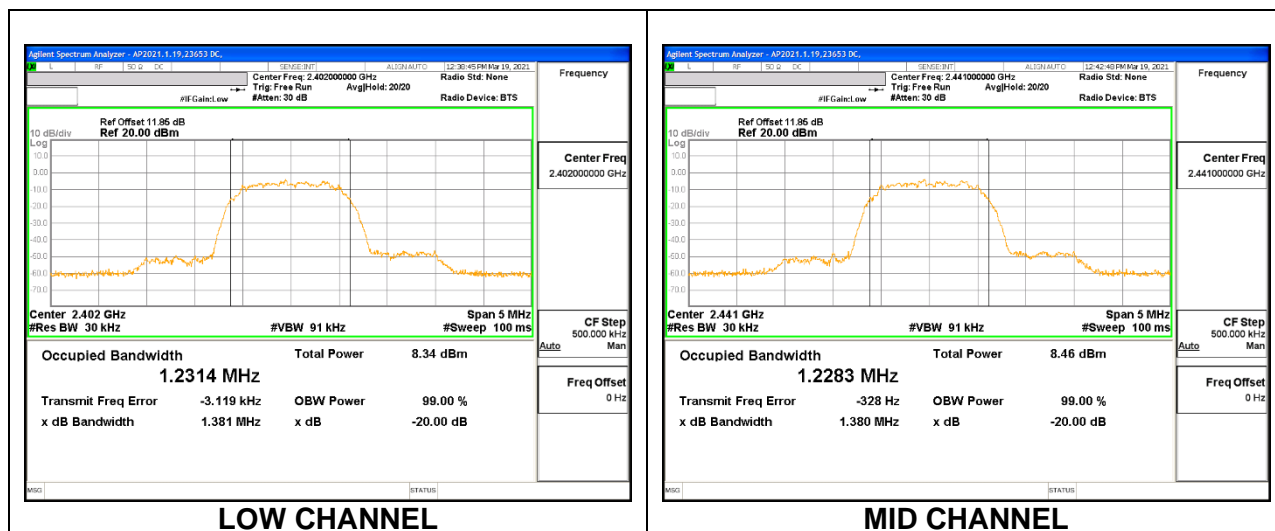
### 9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.955878	0.9054571
Mid	2441	0.954673	0.9057139
High	2480	0.955784	0.9064116



## 9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.381	1.2314
Mid	2441	1.38	1.2283
High	2480	1.385	1.2312



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### **9.3. HOPPING FREQUENCY SEPARATION**

#### **LIMITS**

FCC §15.247 (a) (1)

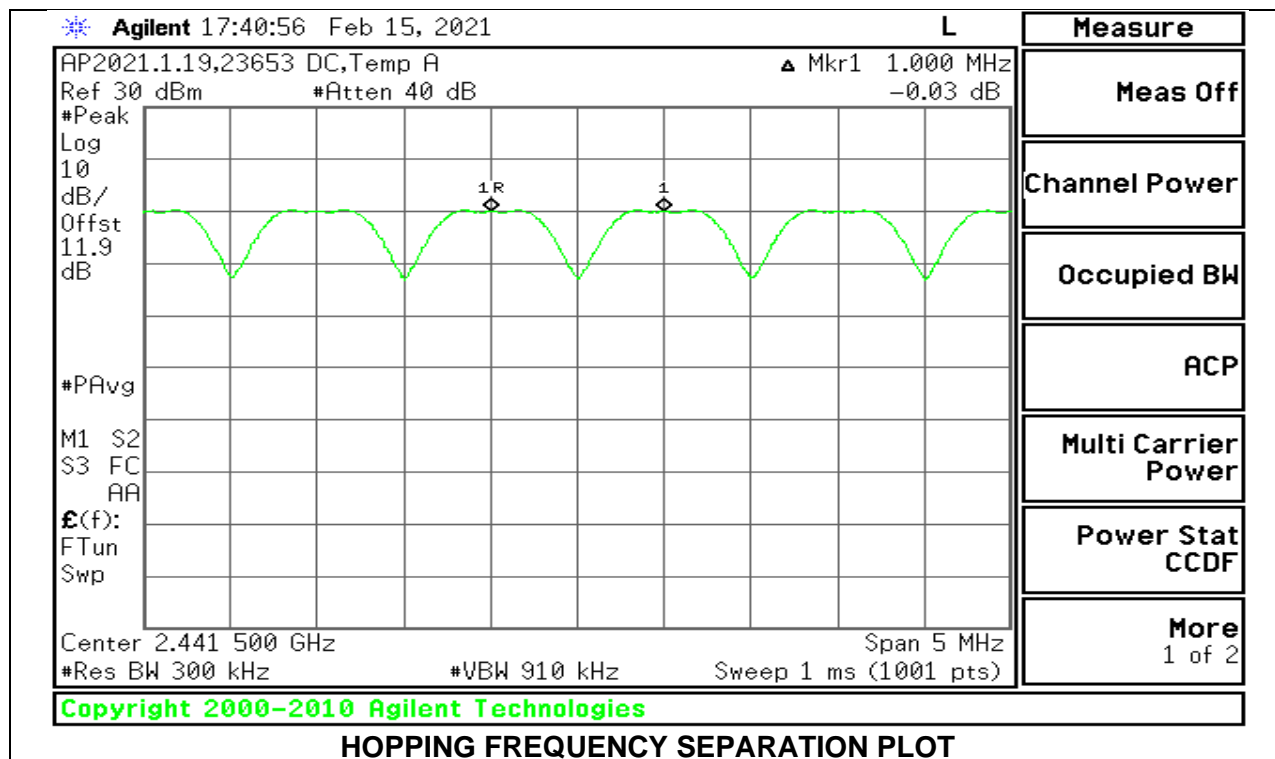
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

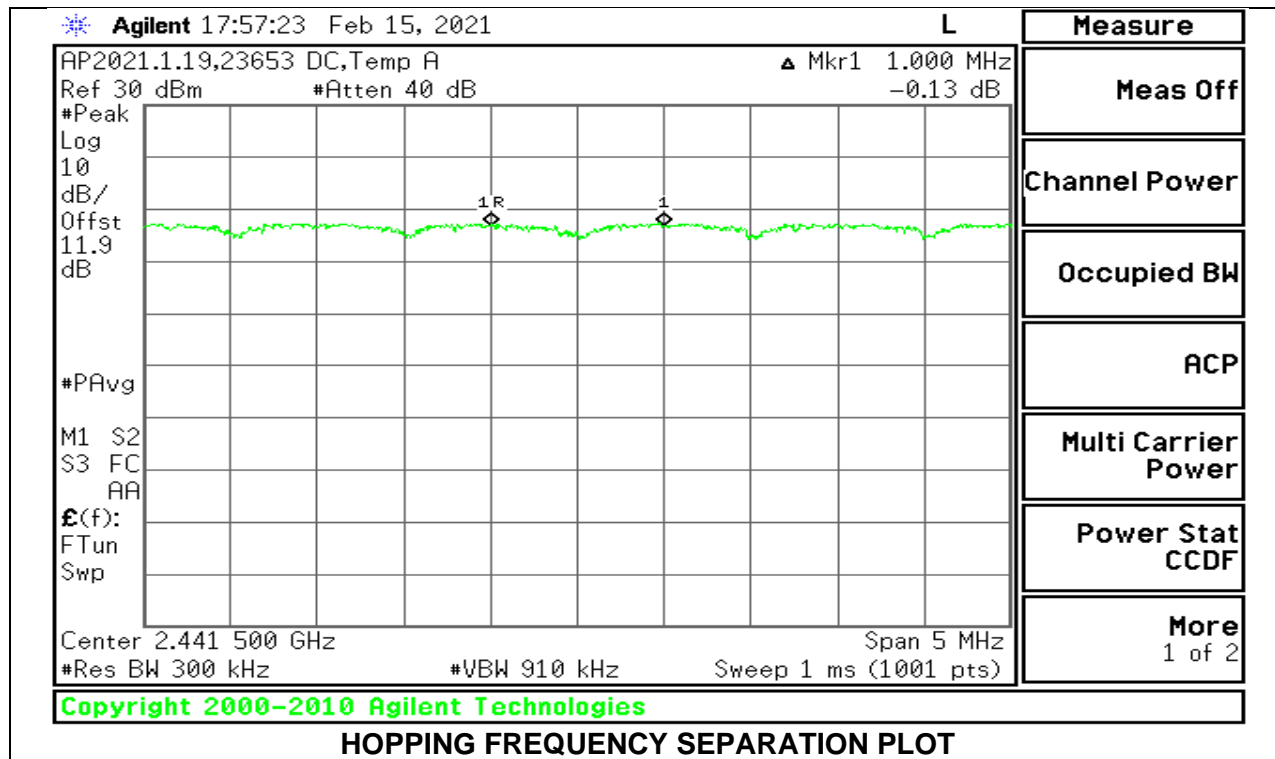
#### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to  $VBW \geq RBW$ . The sweep time is coupled.

### 9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



### 9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



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## **9.4. NUMBER OF HOPPING CHANNELS**

### **LIMITS**

FCC §15.247 (a) (1) (iii)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

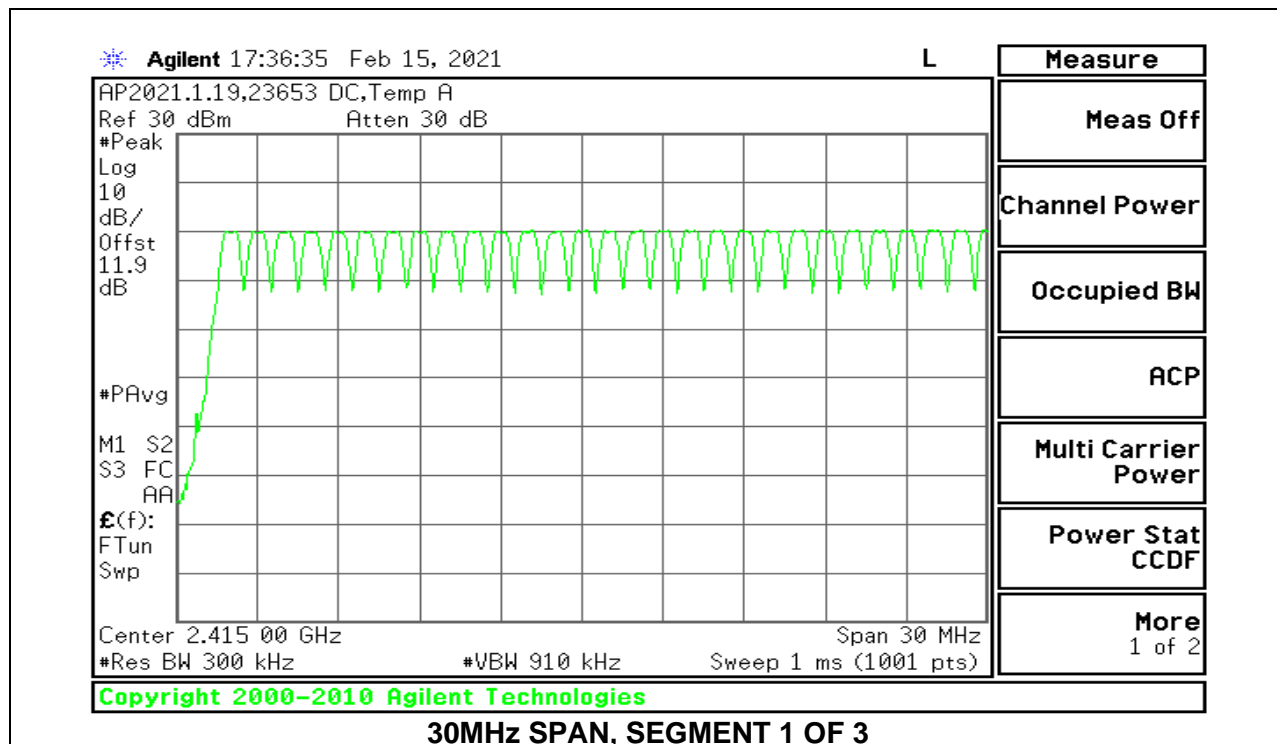
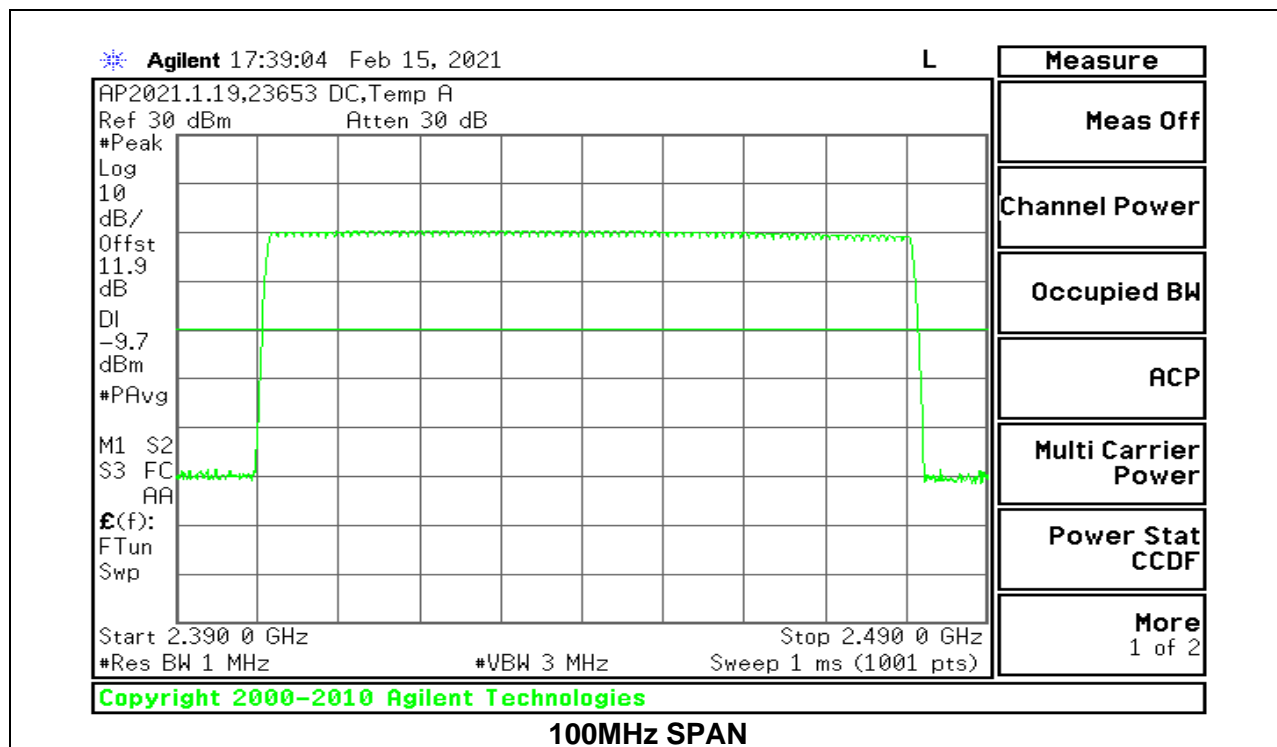
### **TEST PROCEDURE**

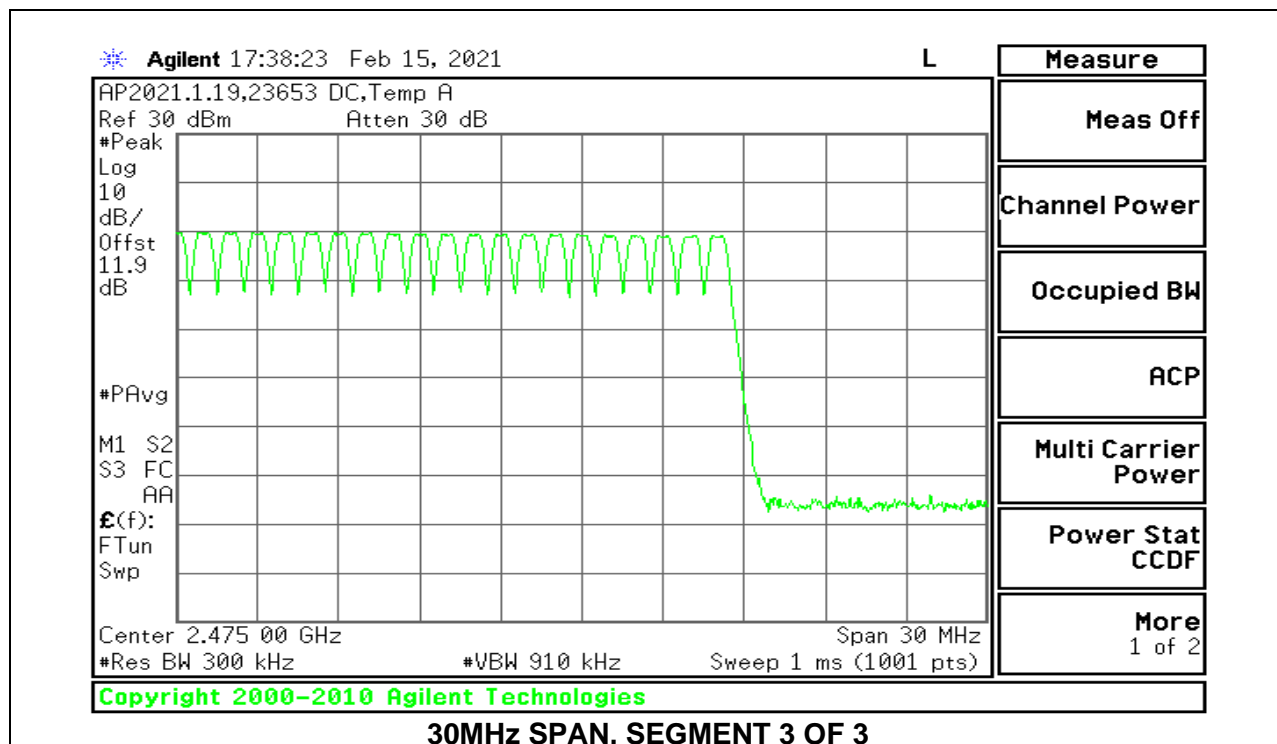
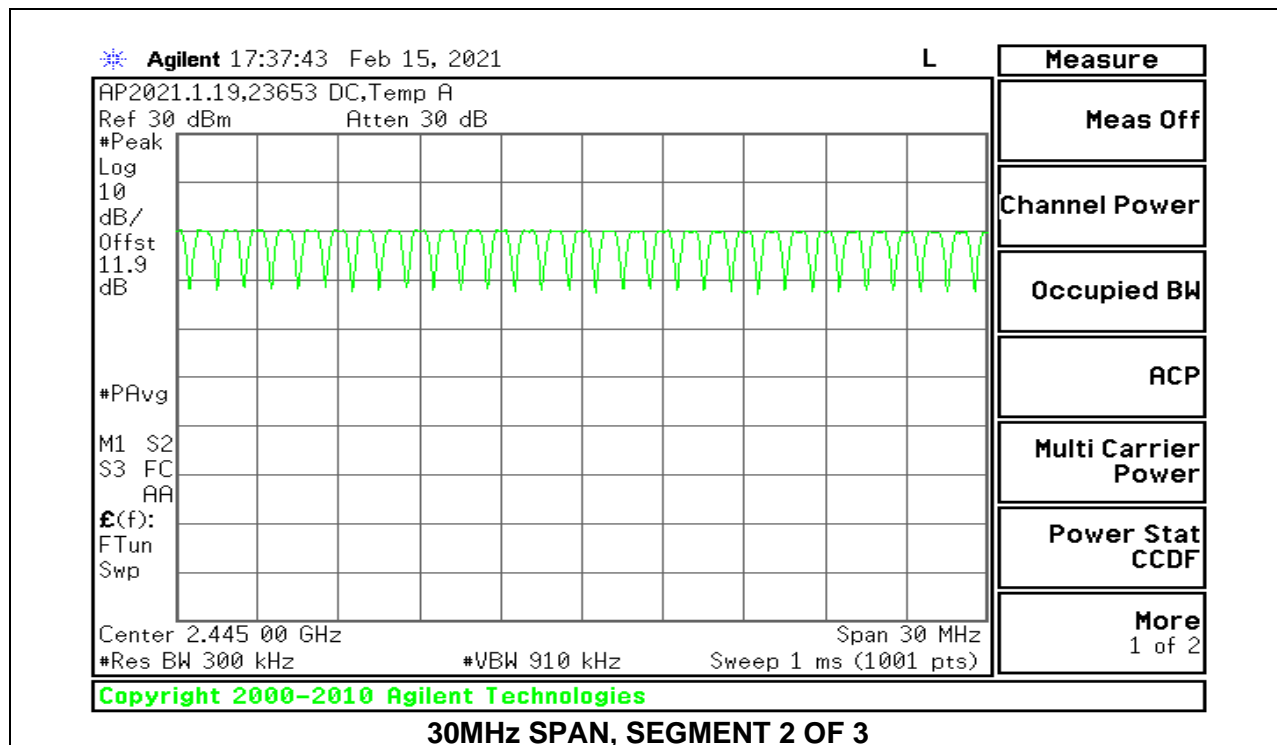
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

### **RESULTS**

Normal Mode: 79 Channels Observed

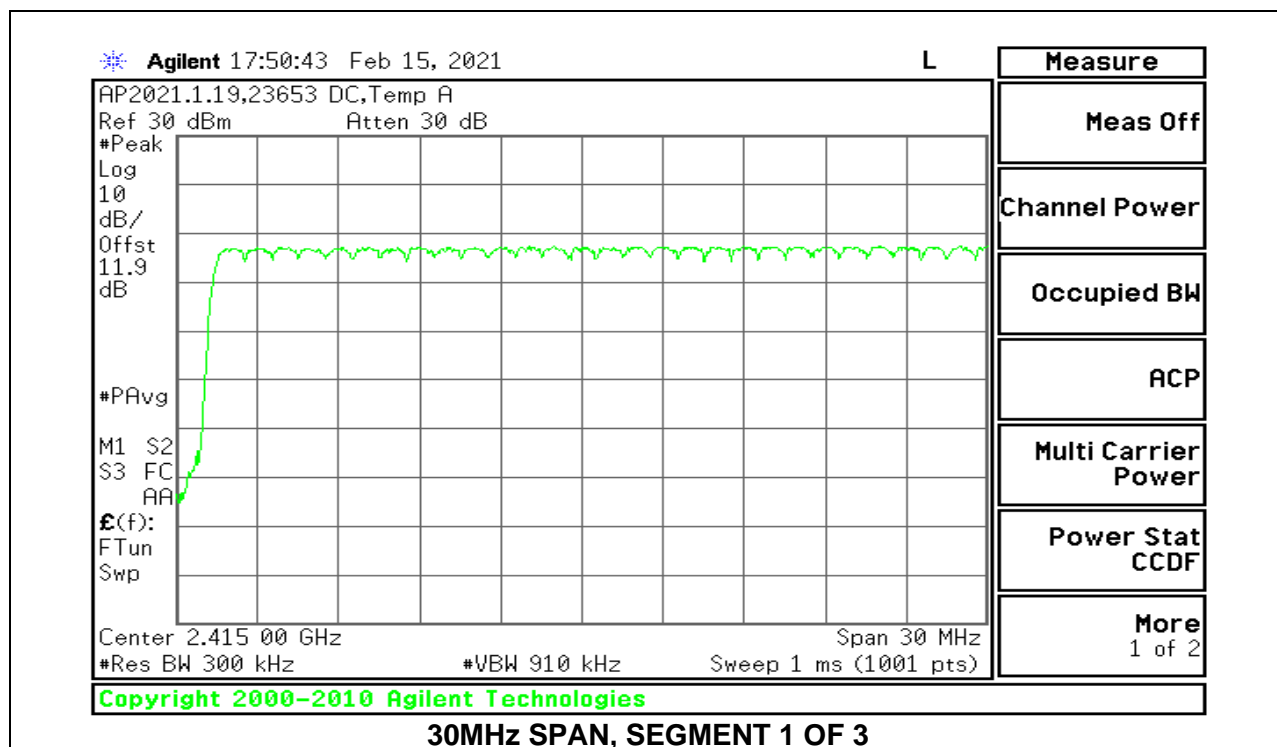
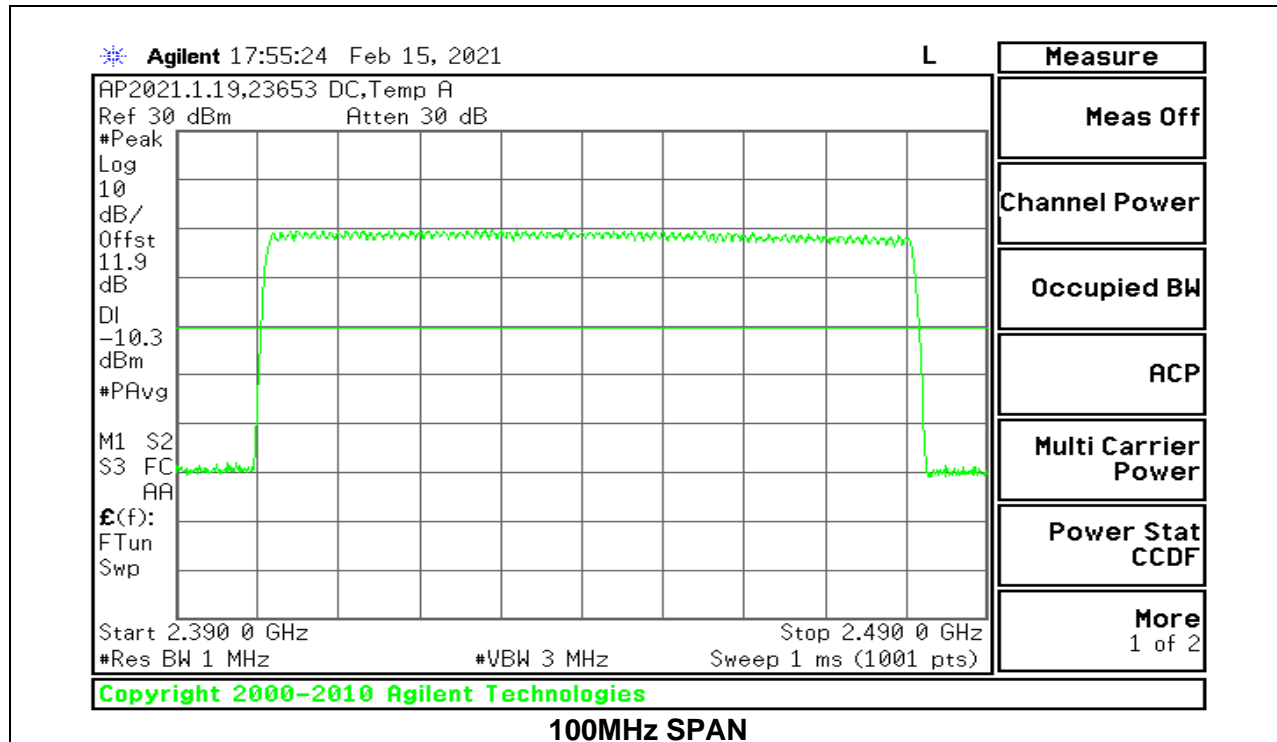
### 9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

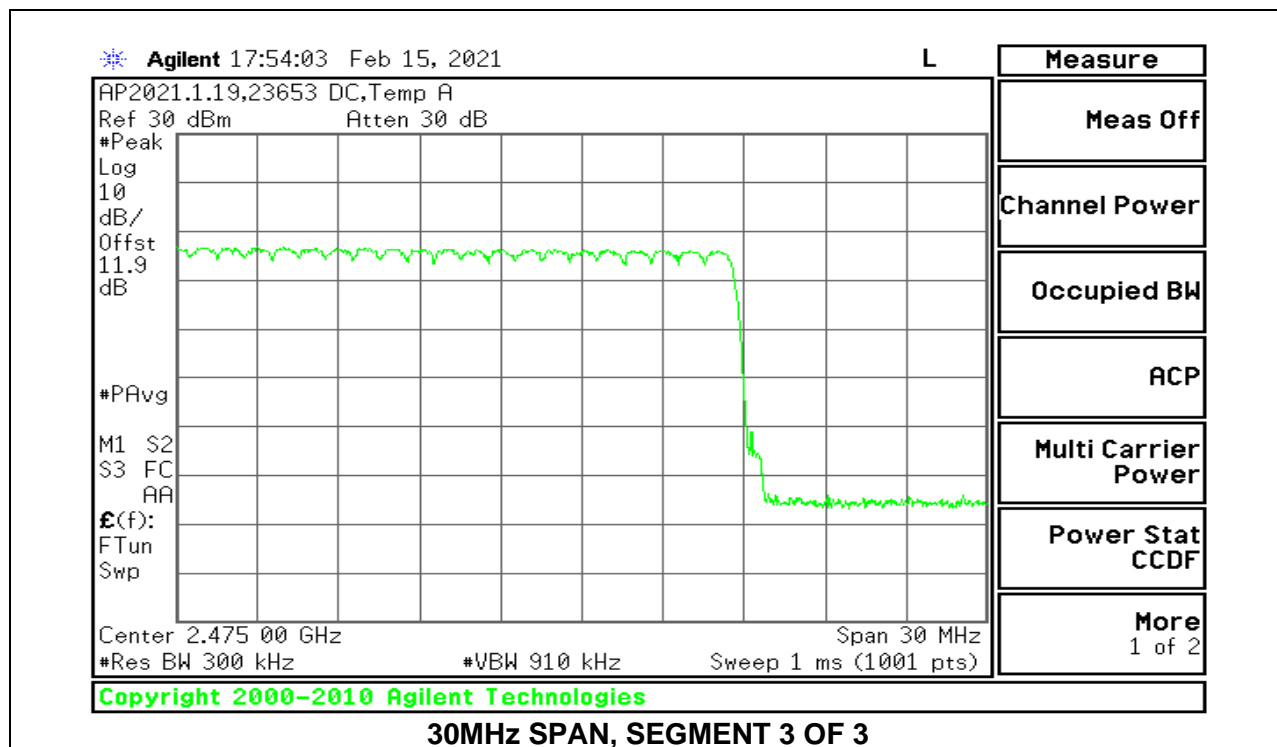
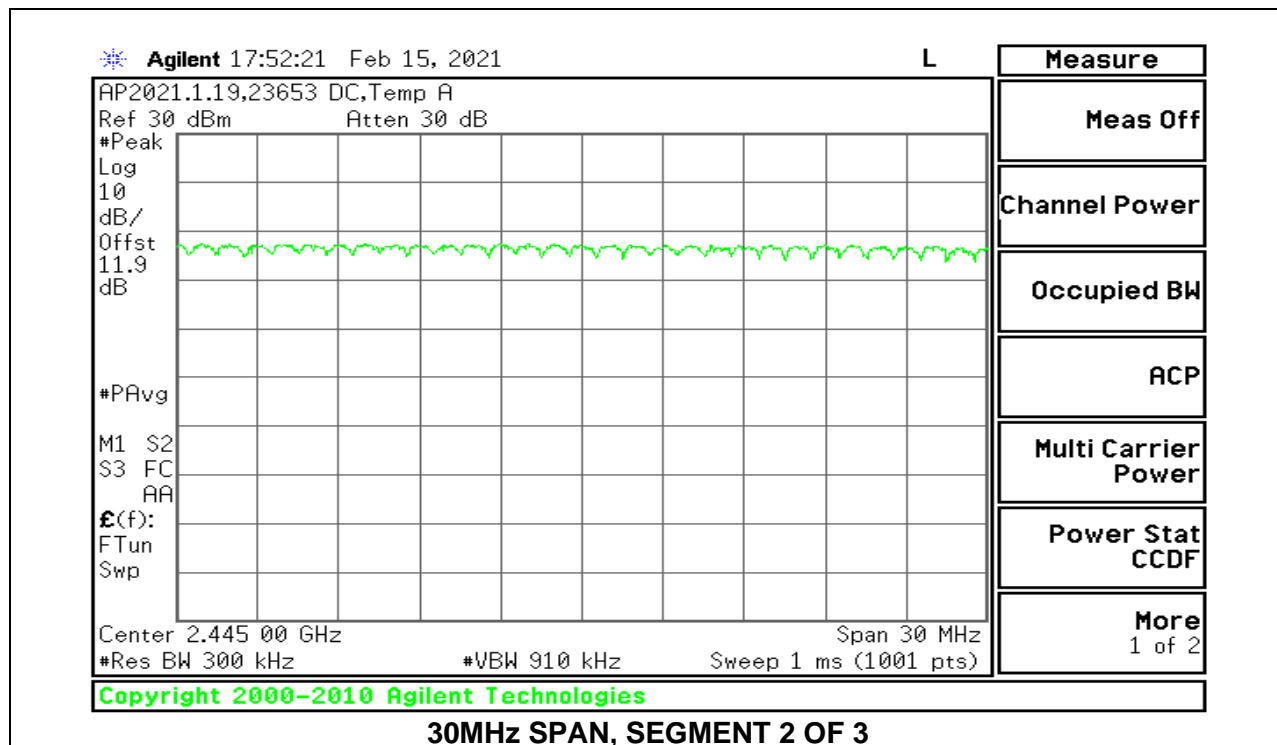






### 9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION





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## 9.5. AVERAGE TIME OF OCCUPANCY

### LIMITS

FCC §15.247 (a) (1) (iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### TEST PROCEDURE

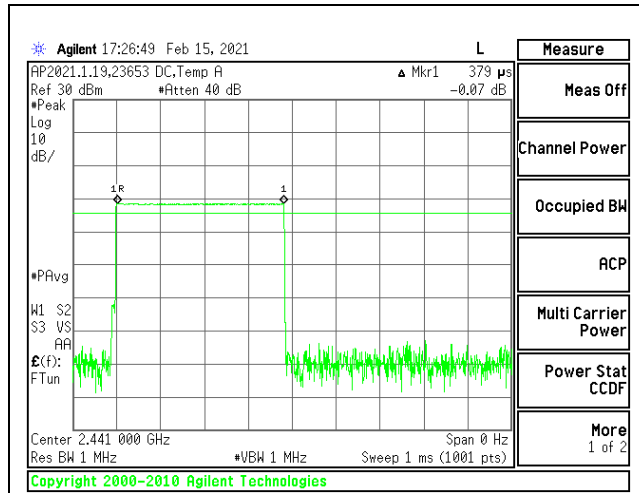
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 3.16 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$ .

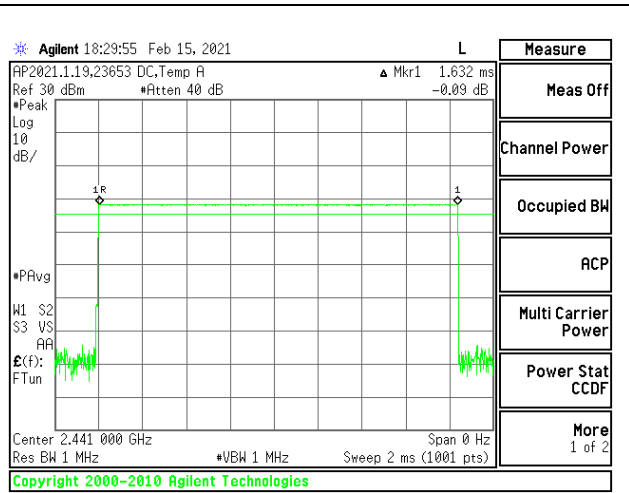
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels \* 0.4 seconds) is equal to  $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{ pulse width}$ .

### 9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

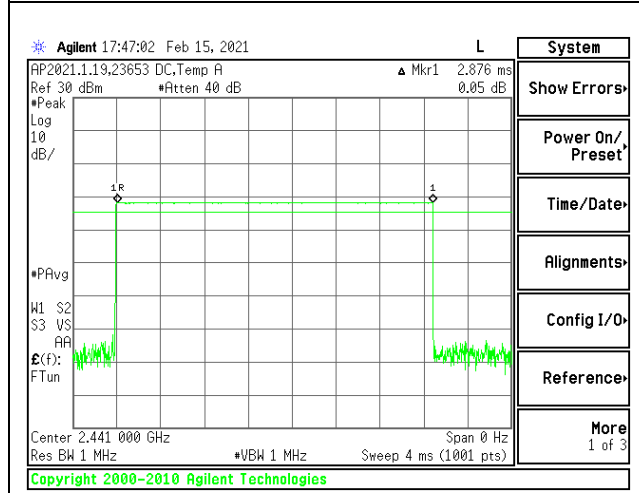
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
<b>GFSK Normal Mode</b>					
DH1	0.379	32	0.1213	0.4	-0.2787
DH3	1.632	16	0.2611	0.4	-0.1389
DH5	2.876	11	0.3164	0.4	-0.0836
<b>GFSK AFH Mode</b>					
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.379	8	0.03032	0.4	-0.3697
DH3	1.632	4	0.06528	0.4	-0.3347
DH5	2.876	2.75	0.07909	0.4	-0.3209



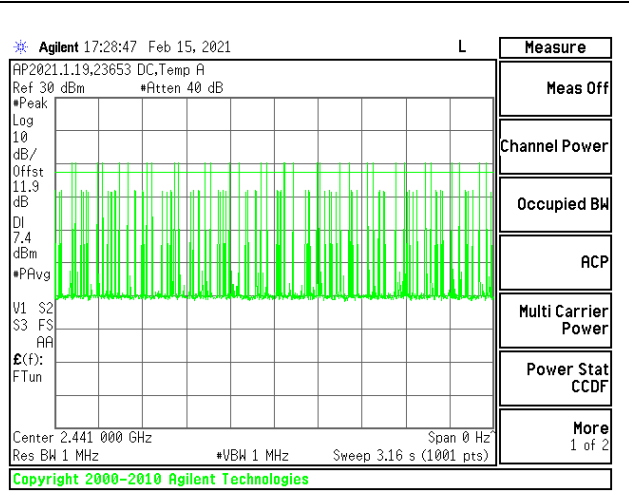
**PULSE WIDTH – DH1**



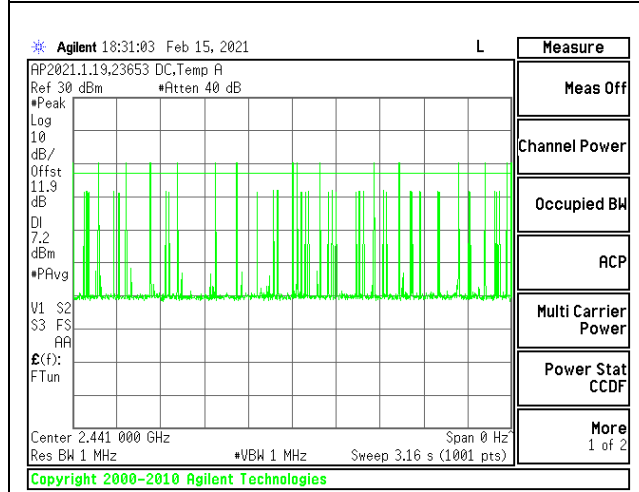
**PULSE WIDTH – DH3**



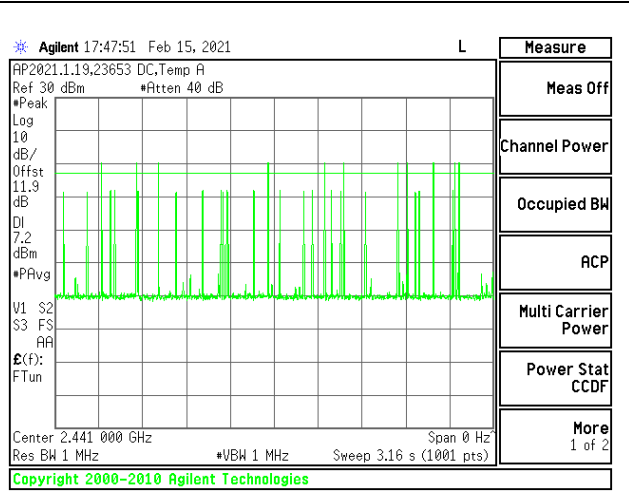
**PULSE WIDTH – DH5**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**

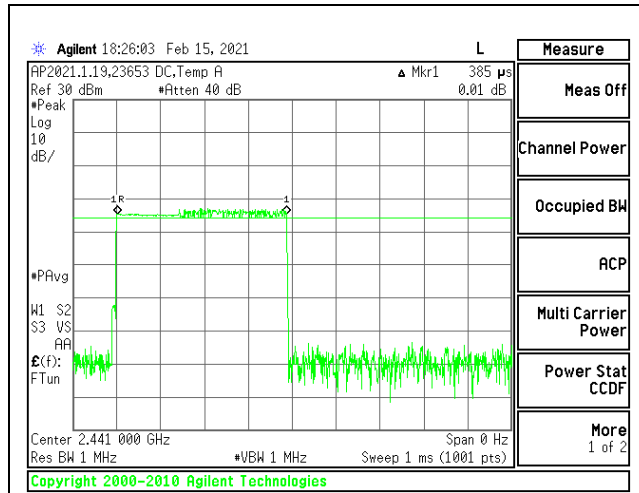


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**

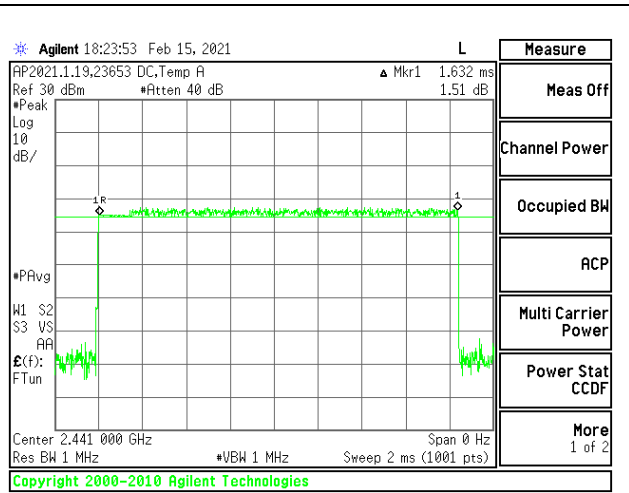
### 9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

	Width (msec)	Pulses in 3.16 seconds	of Occupancy (sec)	(sec)	(sec)
8PSK Normal Mode					
3DH1	0.385	31	0.11935	0.4	-0.2807
3DH3	1.632	16	0.26112	0.4	-0.1389
3DH5	2.88	11	0.3168	0.4	-0.0832

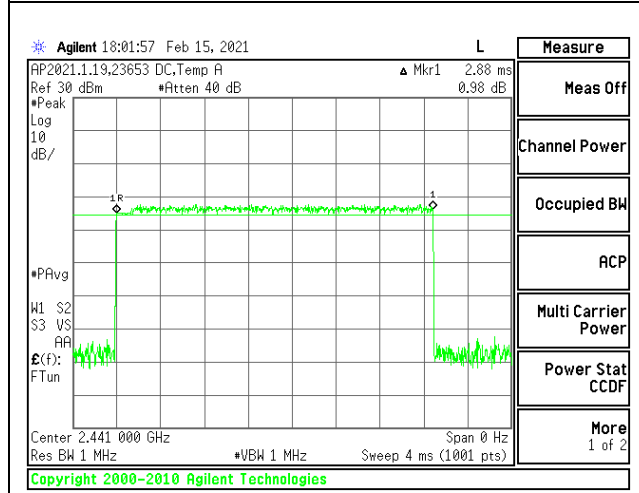
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.



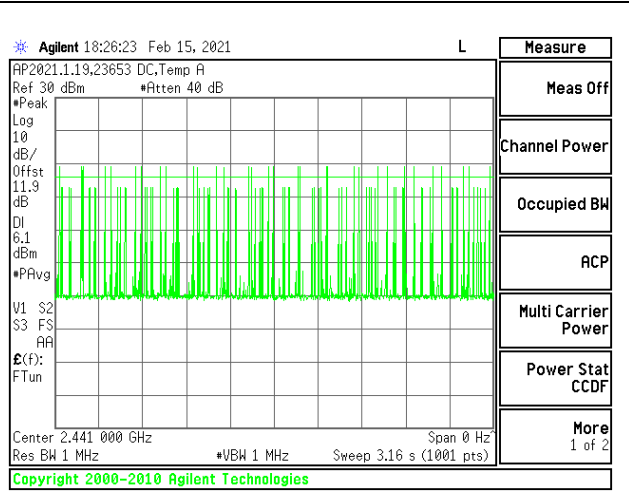
**PULSE WIDTH – 3DH1**



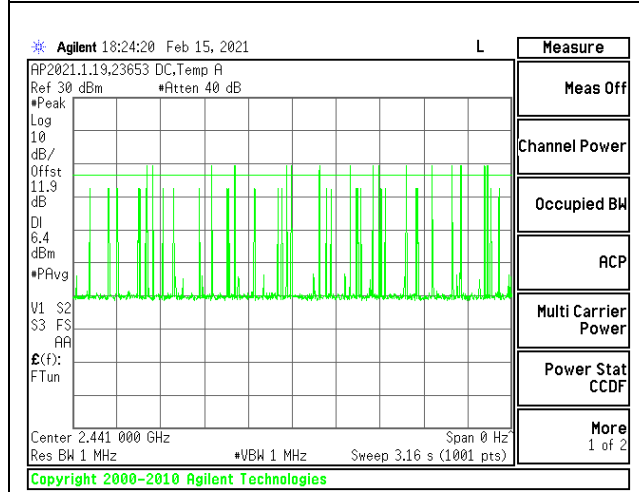
**PULSE WIDTH – 3DH3**



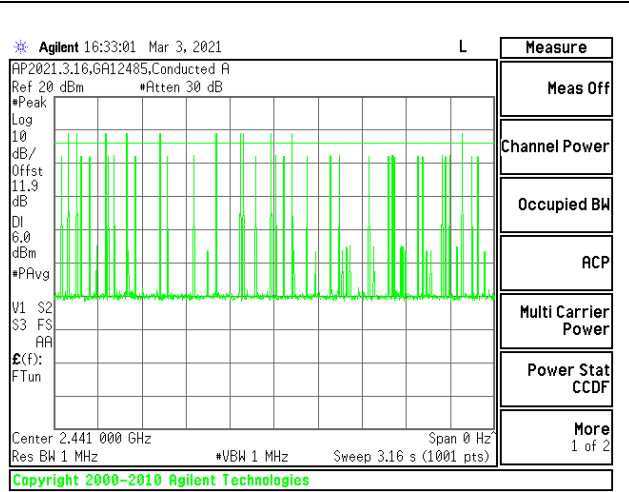
**PULSE WIDTH – 3DH5**



**NUMBER OF PULSES IN 3.16 SECOND  
 OBSERVATION PERIOD – 3DH1**



**NUMBER OF PULSES IN 3.16 SECOND  
 OBSERVATION PERIOD – 3DH3**



**NUMBER OF PULSES IN 3.16 SECOND  
 OBSERVATION PERIOD – 3DH5**

## **9.6. OUTPUT POWER**

### **LIMITS**

§15.247 (b) (1)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

### **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**



### 9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	20756 CW
Date:	2/17/2021

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.68	21	-12.32
Middle	2441	8.56	21	-12.44
High	2480	7.44	21	-13.56

### 9.6.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	20756 CW
Date:	2/17/2021

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.57	21	-13.43
Middle	2441	7.03	21	-13.97
High	2480	6.01	21	-14.99

### 9.6.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	20756 CW
Date:	2/17/2021

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.62	21	-13.38
Middle	2441	7.47	21	-13.53
High	2480	6.18	21	-14.82

## **9.7. 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**

### 9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	20756 CW
Date	2/17/2021

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	8.47
Middle	2441	8.43
High	2480	7.29

### 9.7.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	20756 CW
Date	2/17/2021

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	4.92
Middle	2441	4.81
High	2480	3.45

### 9.7.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	20756 CW
Date	2/17/2021

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	4.93
Middle	2441	4.81
High	2480	3.45

---

## 9.8. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.247 (d)

Limit = -20 dBc

### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

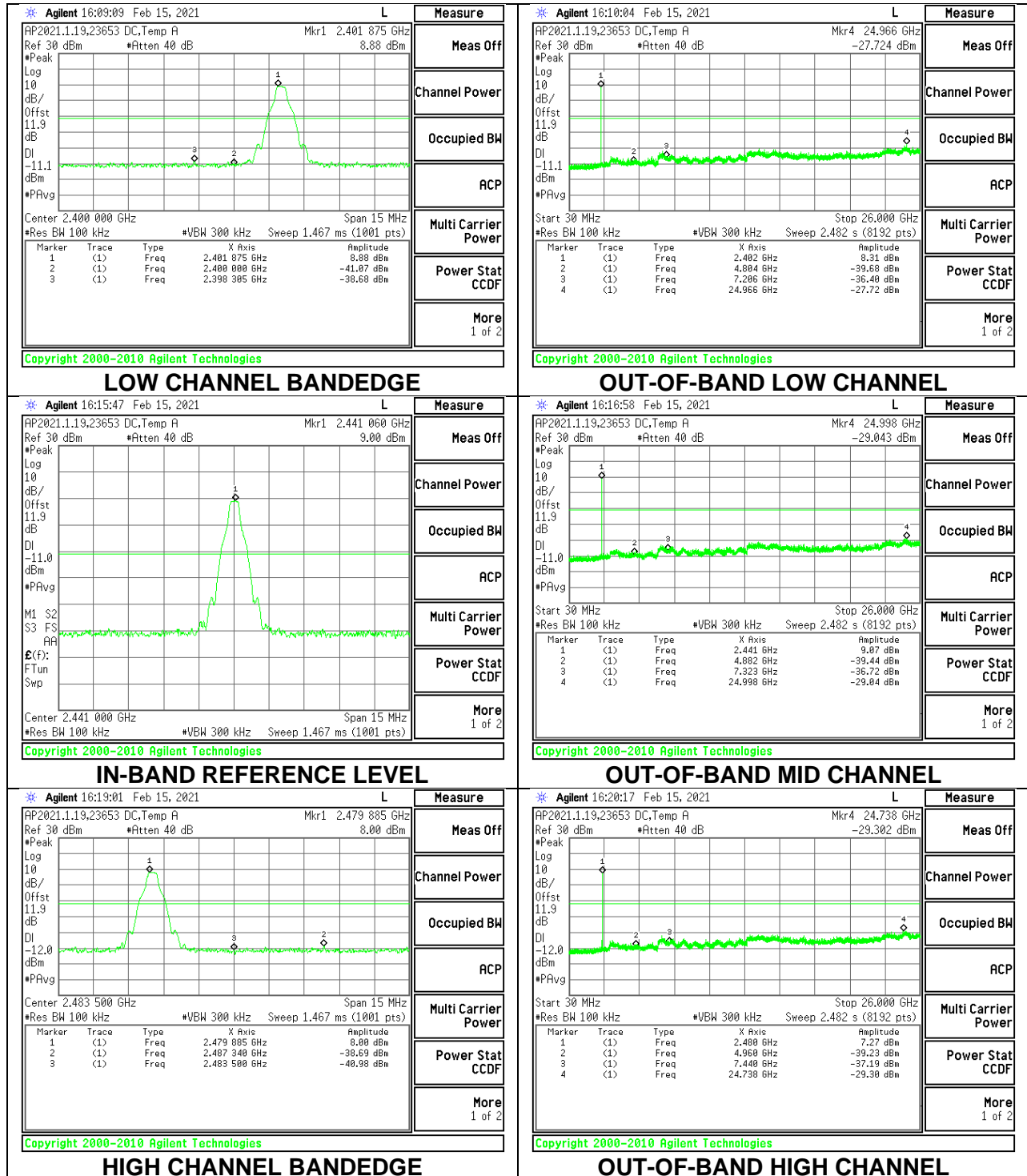
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

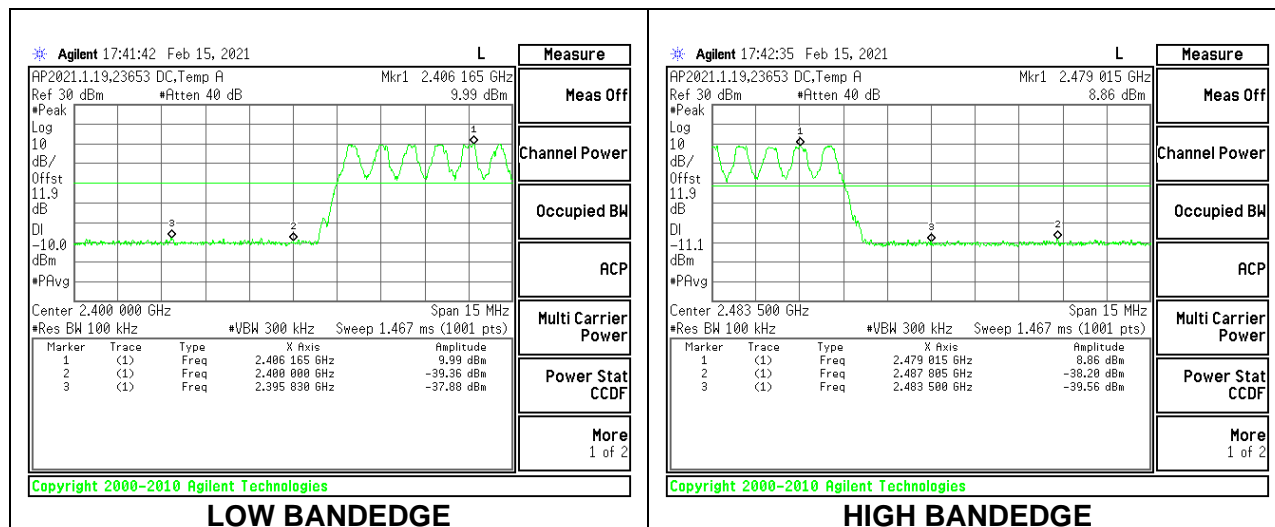
### RESULTS

### 9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

#### SPURIOUS EMISSIONS, NON-HOPPING

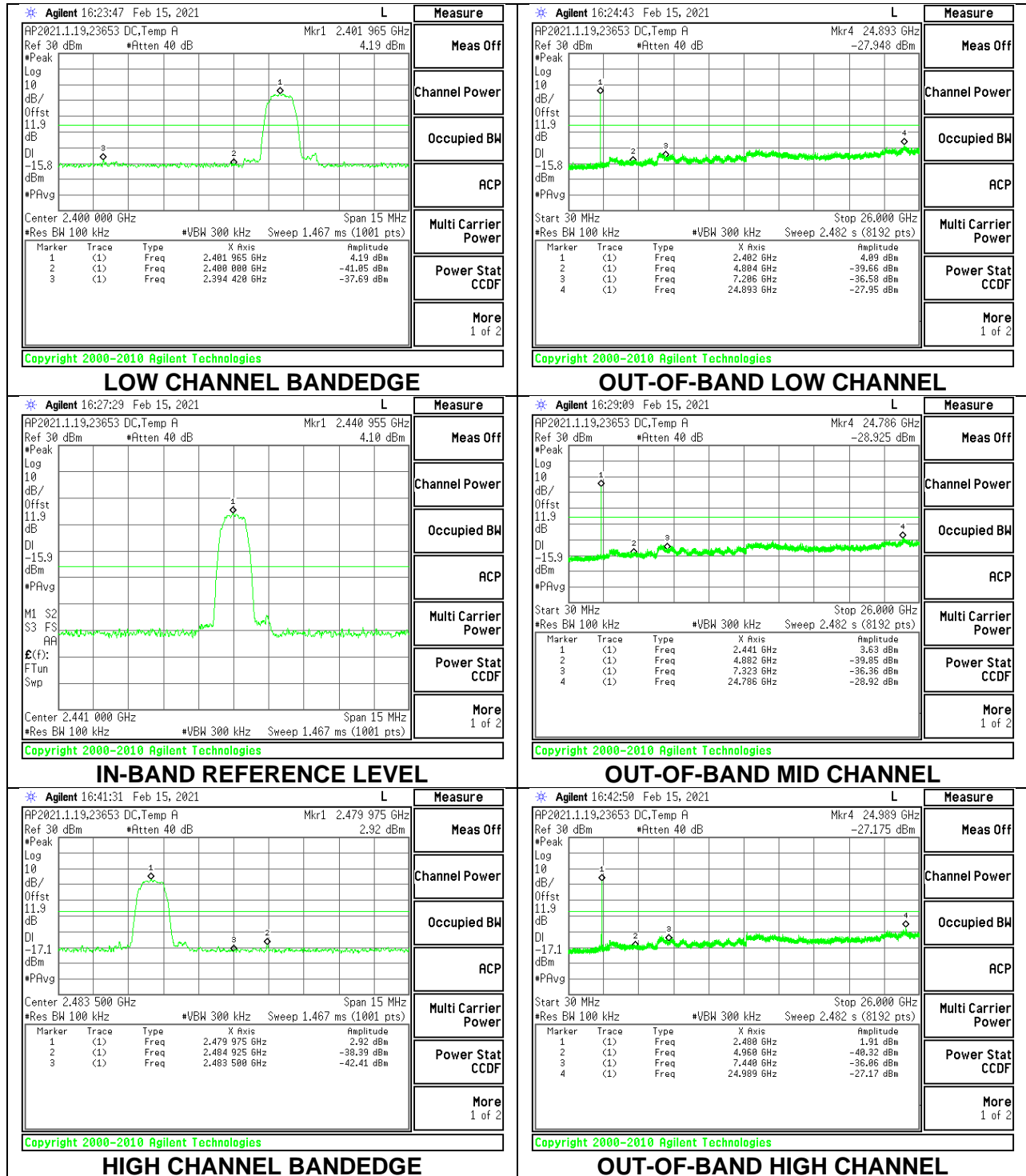


**SPURIOUS BANDEGE EMISSIONS WITH HOPPING ON**

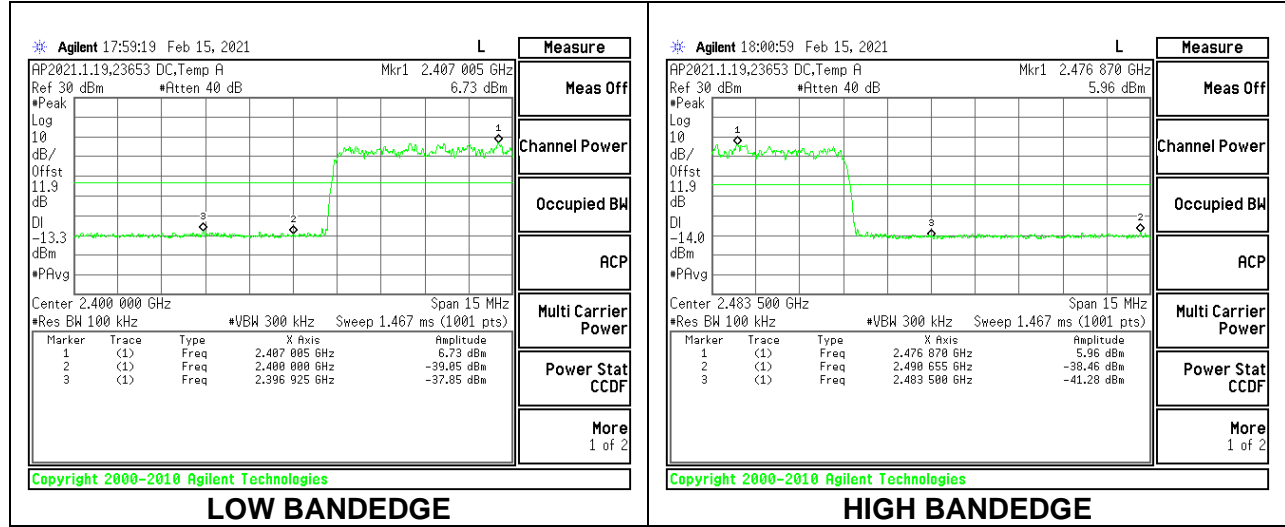


## 9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

### SPURIOUS EMISSIONS, NON-HOPPING



**SPURIOUS BANDEGE EMISSIONS WITH HOPPING ON**





## 10. RADIATED TEST RESULTS

### 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 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector 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**

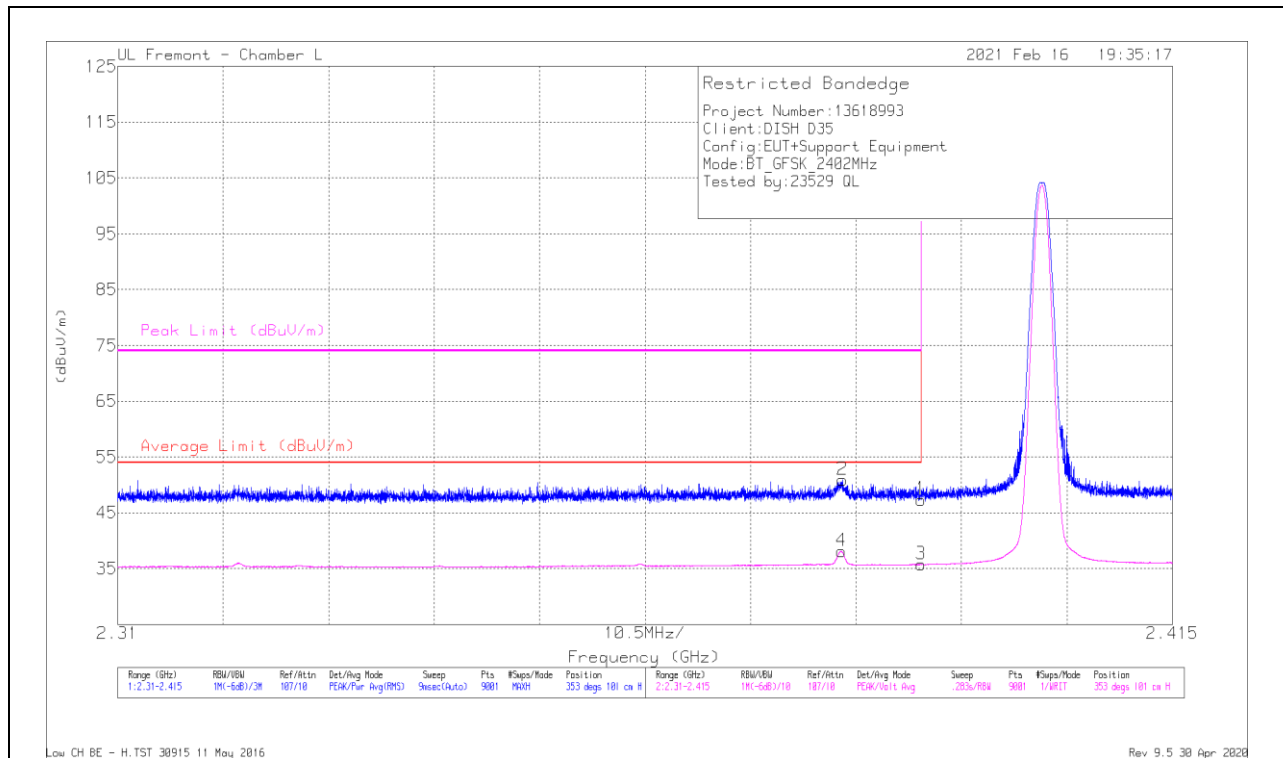
Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can 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.

## 10.1. TRANSMITTER ABOVE 1 GHz

### 10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

#### BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT



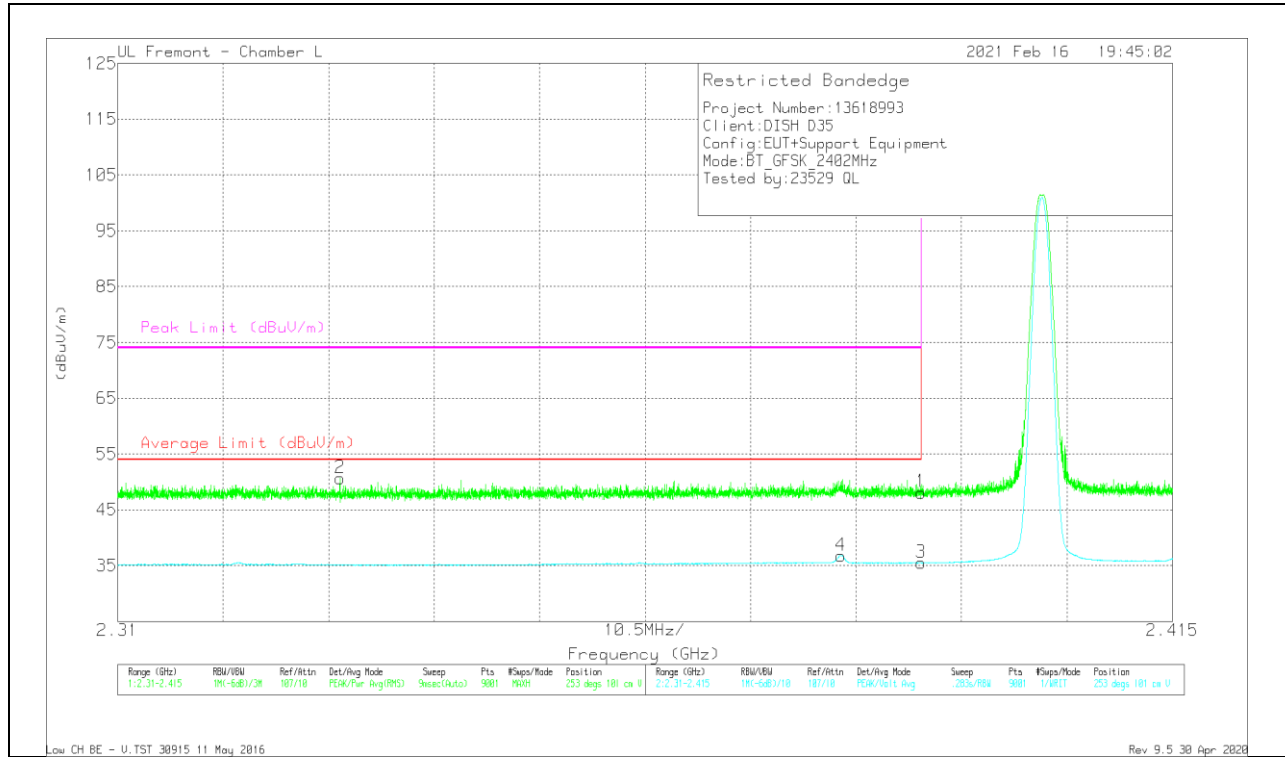
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Paid (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	36.57	Pk	31.9	-21.1	47.37	-	-	74	-26.63	353	101	H
2	* 2.38215	40.22	Pk	31.8	-21.1	50.92	-	-	74	-23.08	353	101	H
3	* 2.38999	24.93	VA1T	31.9	-21.1	35.73	54	-18.27	-	-	353	101	H
4	* 2.38203	27.42	VA1T	31.8	-21.1	38.12	54	-15.88	-	-	353	101	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average  $V_B=1/T_{on}$  where:  $T_{on}$  is transmit duration

### VERTICAL RESULT

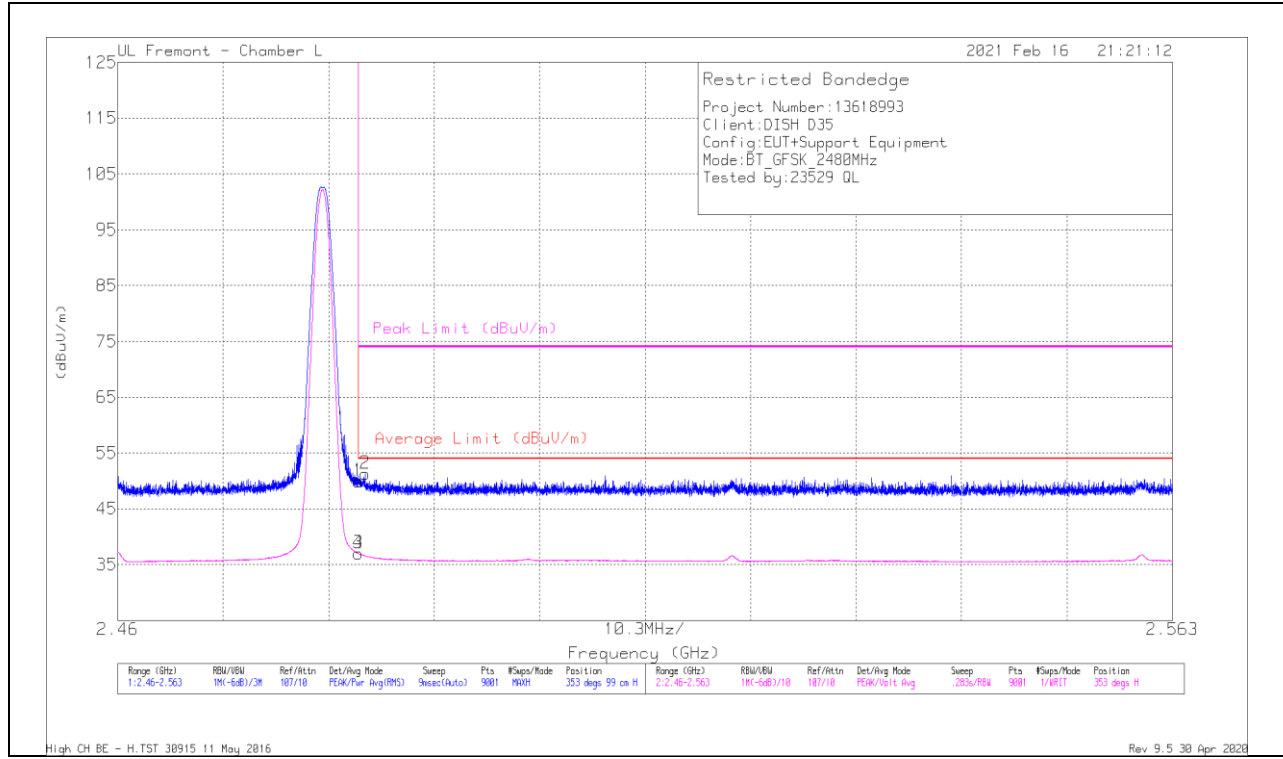


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Paid (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	37.32	Pk	31.9	-21.1	48.12	-	-	74	-25.88	253	101	V
2	* 2.33212	40.36	Pk	31.6	-21.3	50.66	-	-	74	-23.34	253	101	V
3	* 2.38999	24.69	VA1T	31.9	-21.1	35.49	54	-18.51	-	-	253	101	V
4	* 2.38202	26.08	VA1T	31.8	-21.1	36.78	54	-17.22	-	-	253	101	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

**BANDEDGE (HIGH CHANNEL)**

**HORIZONTAL RESULT**



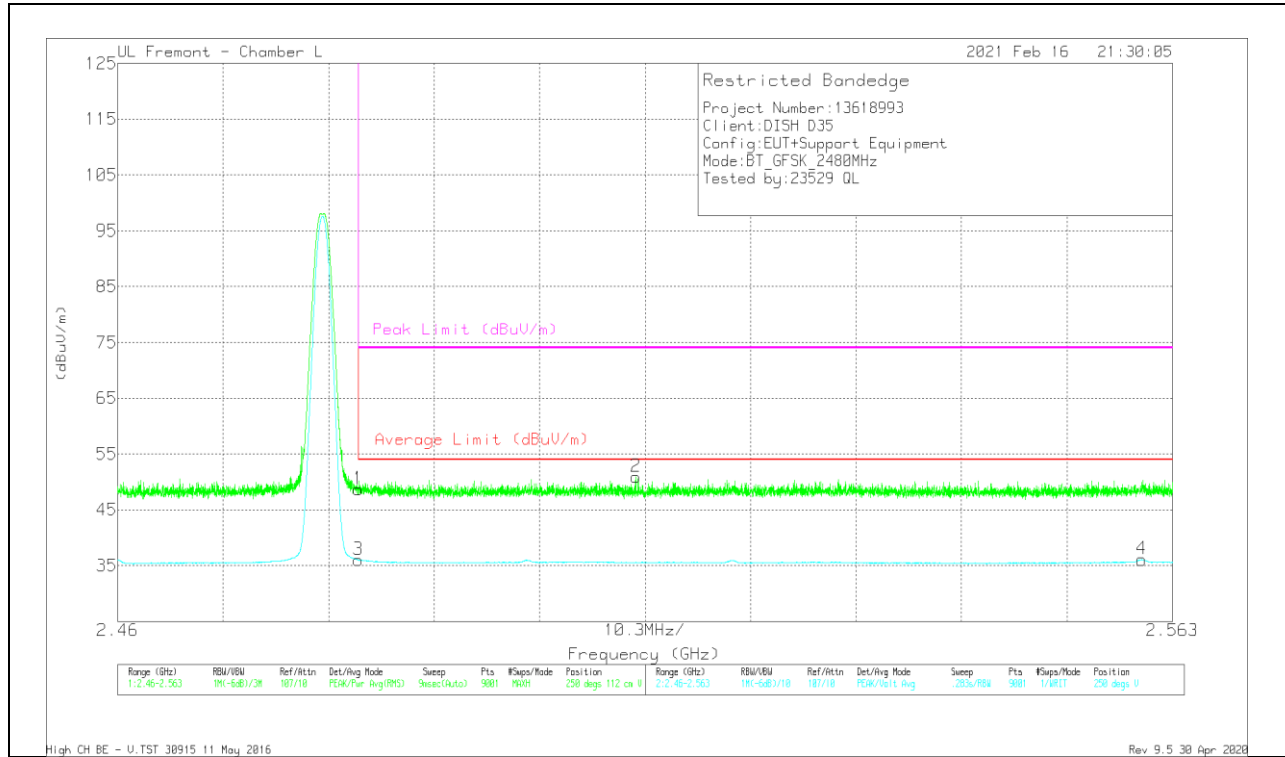
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	38.49	Pk	32.3	-20.9	49.89	-	-	74	-24.11	353	99	H
2	* 2.48416	39.94	Pk	32.3	-20.9	51.34	-	-	74	-22.66	353	99	H
3	* 2.48351	25.56	VA1T	32.3	-20.9	36.96	54	-17.04	-	-	353	99	H
4	* 2.48352	25.56	VA1T	32.3	-20.9	36.96	54	-17.04	-	-	353	99	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

### VERTICAL RESULT

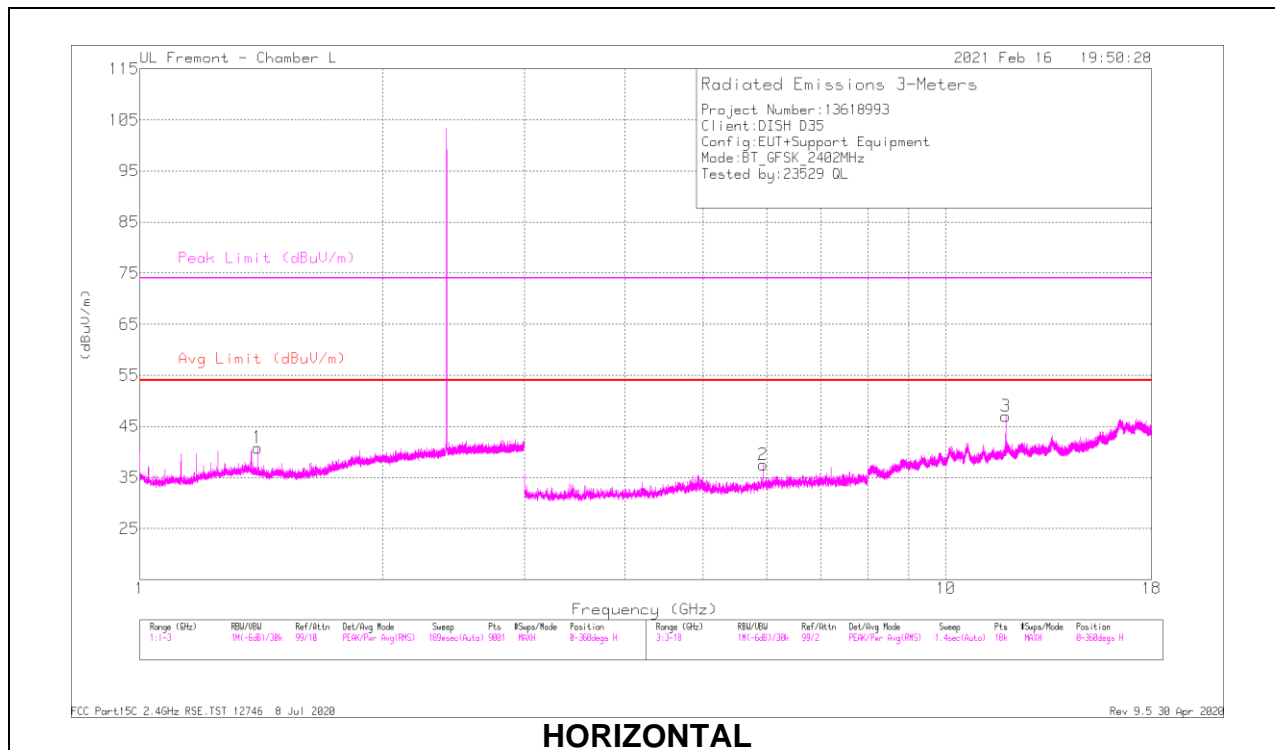


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/CbI/Ftr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	37.23	Pk	32.3	-20.9	48.63	-	-	74	-25.37	250	112	V
2	2.51058	39.41	Pk	32.4	-20.9	50.91	-	-	74	-23.09	250	112	V
3	* 2.48351	24.64	VA1T	32.3	-20.9	36.04	54	-17.96	-	-	250	112	V
4	2.56002	24.48	VA1T	32.4	-20.8	36.08	54	-17.92	-	-	250	112	V

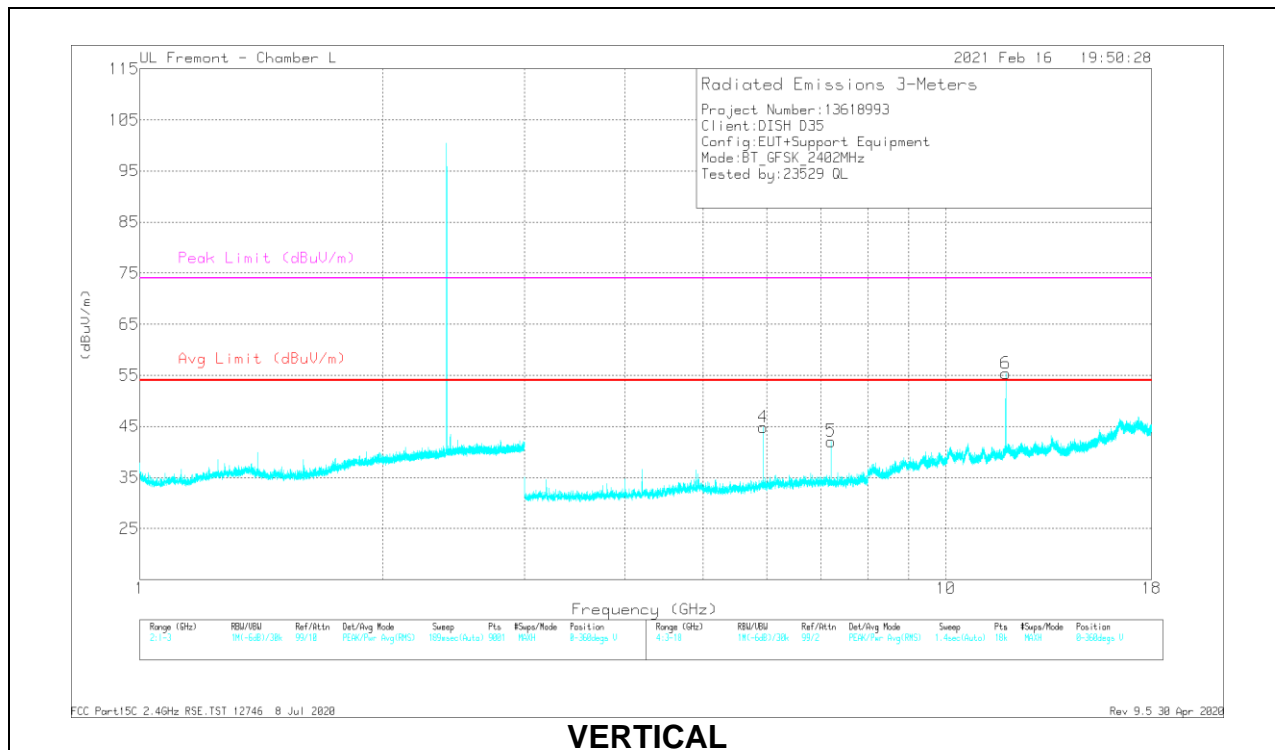
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average  $V_B=1/T_{on}$  where:  $T_{on}$  is transmit duration

# HARMONICS AND SPURIOUS EMISSIONS

## LOW CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

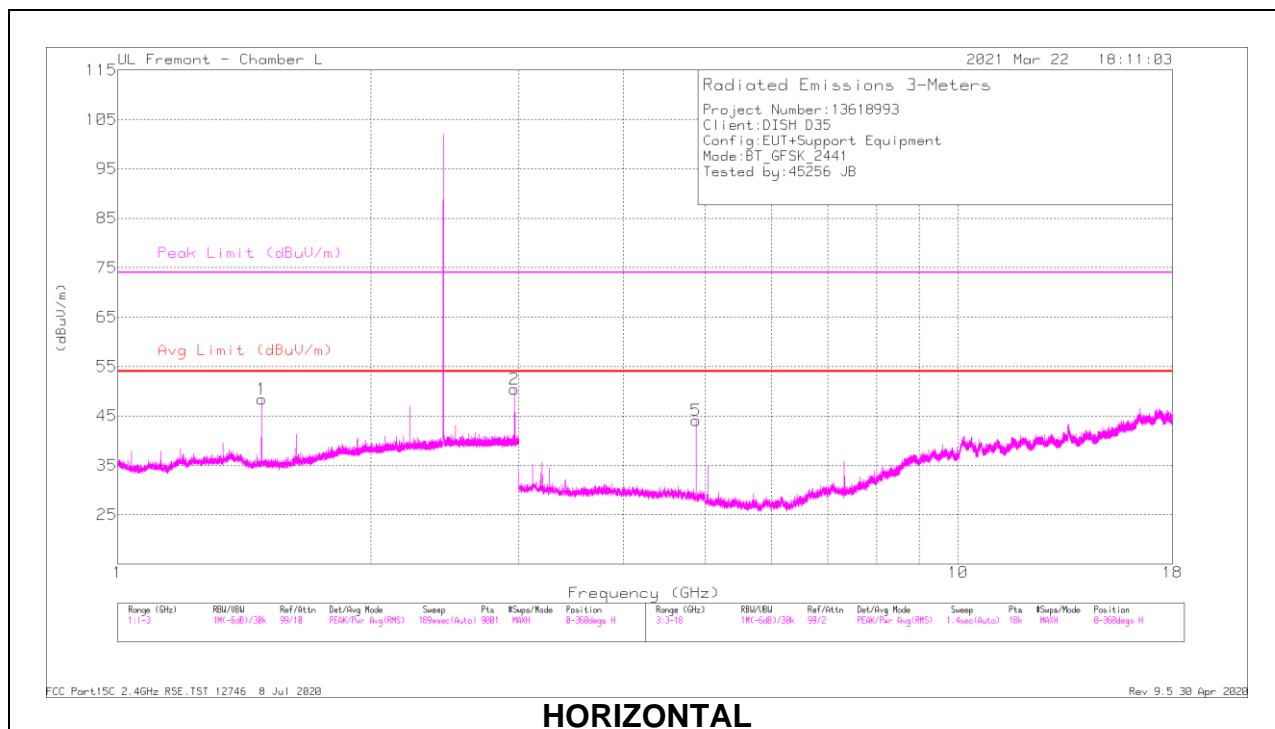
**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/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	* 1.4001	40.7	PKFH	28.7	-23.4	46	-	-	74	-28	313	280	H
	* 1.39999	30.83	VA1T	28.7	-23.4	36.13	54	-17.87	-	-	313	280	H
2	5.93105	32.96	PKFH	35.2	-25.3	42.86	-	-	-	-	254	397	H
3	* 11.8681	34.13	PKFH	38.5	-19.2	53.43	-	-	74	-20.57	172	101	H
	* 11.86815	28.73	VA1T	38.5	-19.2	48.03	54	-5.97	-	-	172	101	H
6	* 11.86811	37.57	PKFH	38.5	-19.2	56.87	-	-	74	-17.13	46	386	V
	* 11.86816	34.19	VA1T	38.5	-19.2	53.49	54	-5.1	-	-	46	386	V
4	5.93392	36.4	PKFH	35.2	-25.4	46.2	-	-	-	-	226	390	V
5	7.20579	35.51	PKFH	35.5	-23.9	47.11	-	-	-	-	51	392	V

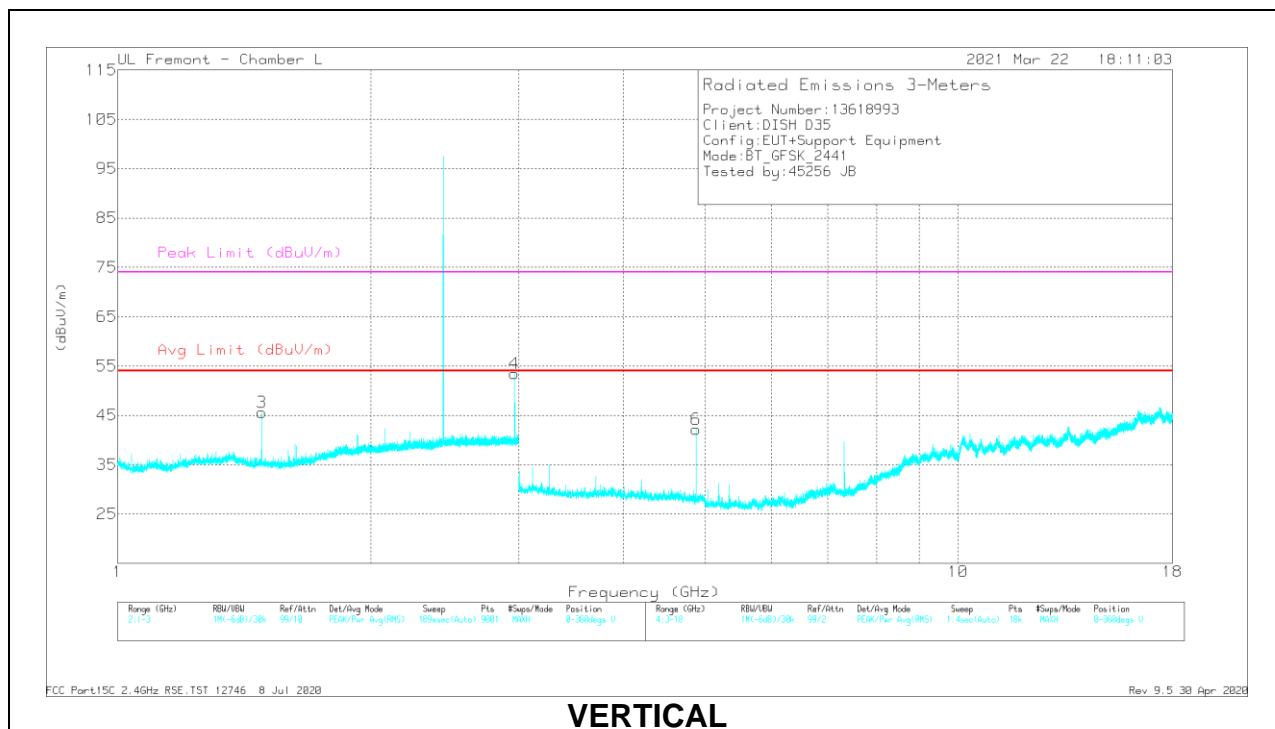
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 VA1T - FHSS: Linear Voltage Average  $VB=1/Ton$  where: Ton is transmit duration



### MID CHANNEL RESULTS



**HORIZONTAL**



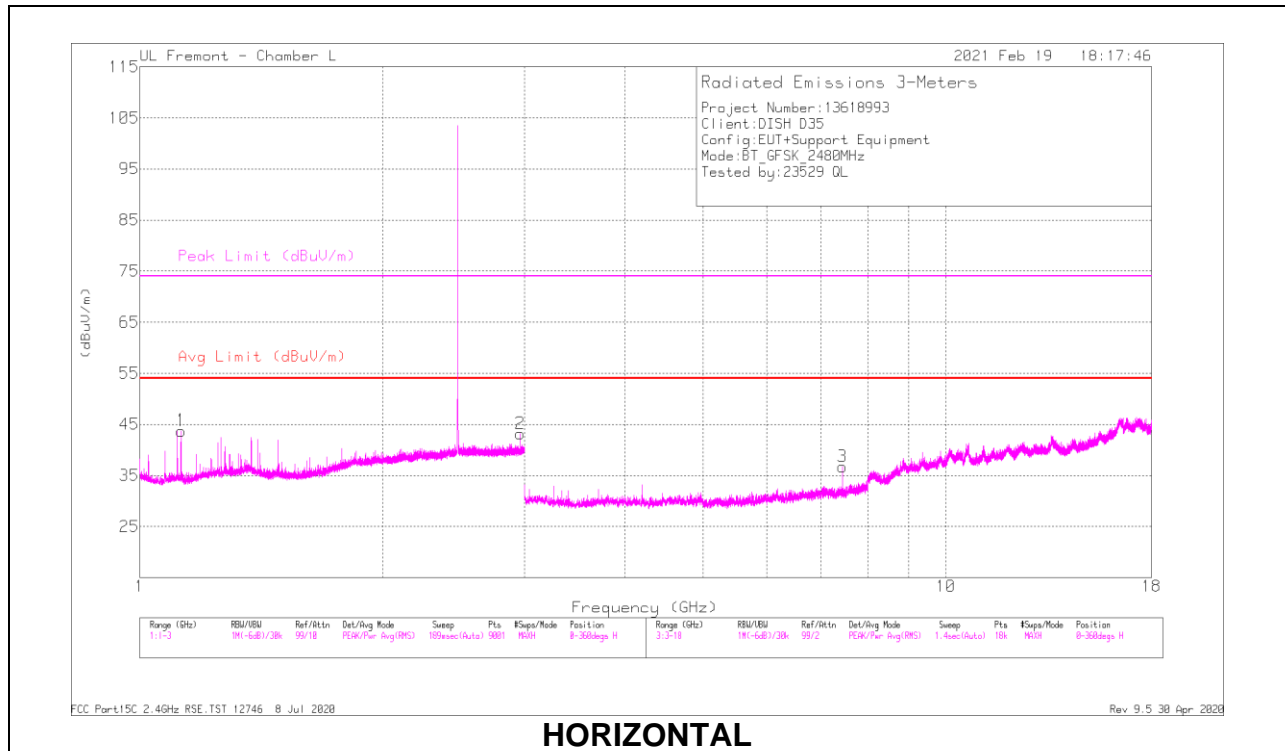
**VERTICAL**

**RADIATED EMISSIONS**

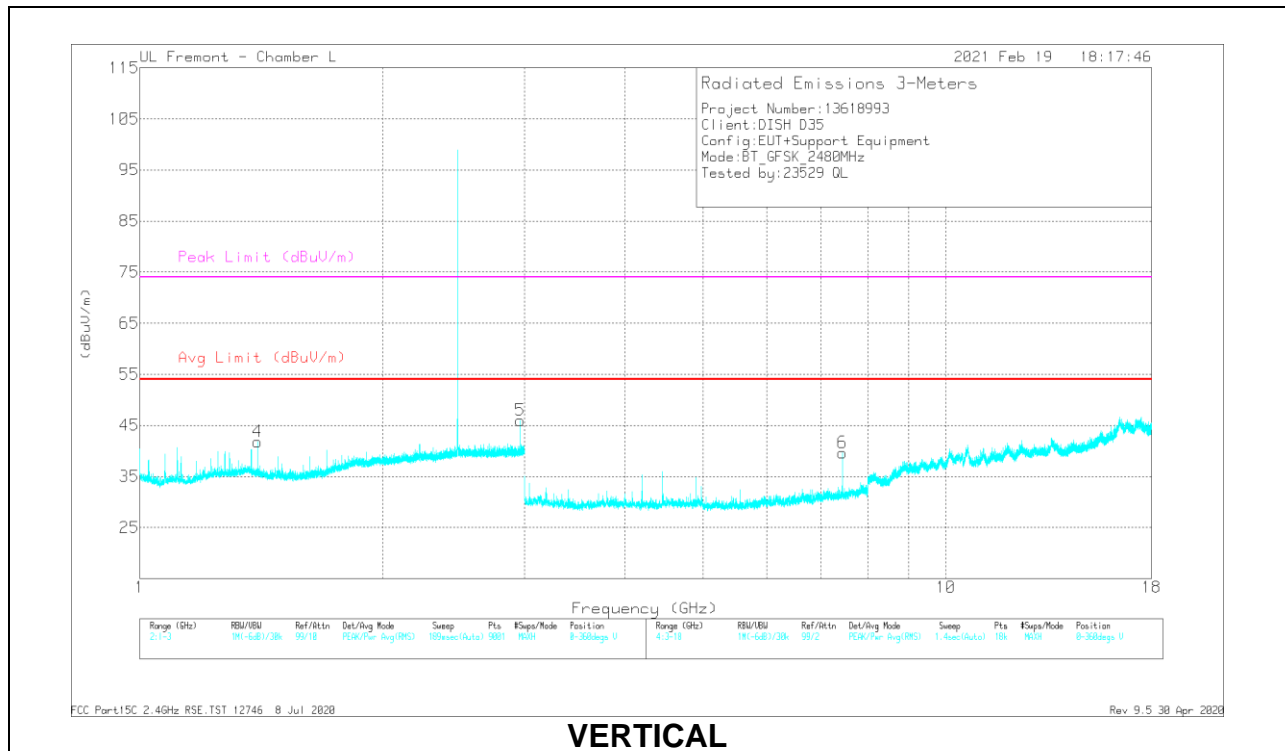
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.48343	49.64	PKFH	28.2	-23.1	54.74	-	-	74	-19.26	254	188	H
	* 1.48348	43.63	VA1T	28.2	-23.1	48.73	54	-5.27	-	-	254	188	H
2	2.96699	42.24	PKFH	32.6	-20.1	54.74	-	-	-	-	227	114	H
	2.96699	34.59	VA1T	32.6	-20.1	47.09	-	-	-	-	227	114	H
3	* 1.4834	44.65	PKFH	28.2	-23.1	49.75	-	-	74	-24.25	59	391	V
	* 1.48353	37.37	VA1T	28.2	-23.1	42.47	54	-11.53	-	-	59	391	V
4	2.96699	45.52	PKFH	32.6	-20.1	58.02	-	-	-	-	199	101	V
	2.967	38.5	VA1T	32.6	-20.1	51	-	-	-	-	199	101	V
5	* 4.88189	38.41	PKFH	34.1	-27.1	45.41	-	-	74	-28.59	63	394	H
	* 4.882	32.43	VA1T	34.1	-27.1	39.43	54	-14.57	-	-	63	394	H
6	* 4.88214	37.87	PKFH	34.1	-27.1	44.87	-	-	74	-29.13	204	397	V
	* 4.882	32.11	VA1T	34.1	-27.1	39.11	54	-14.89	-	-	204	397	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

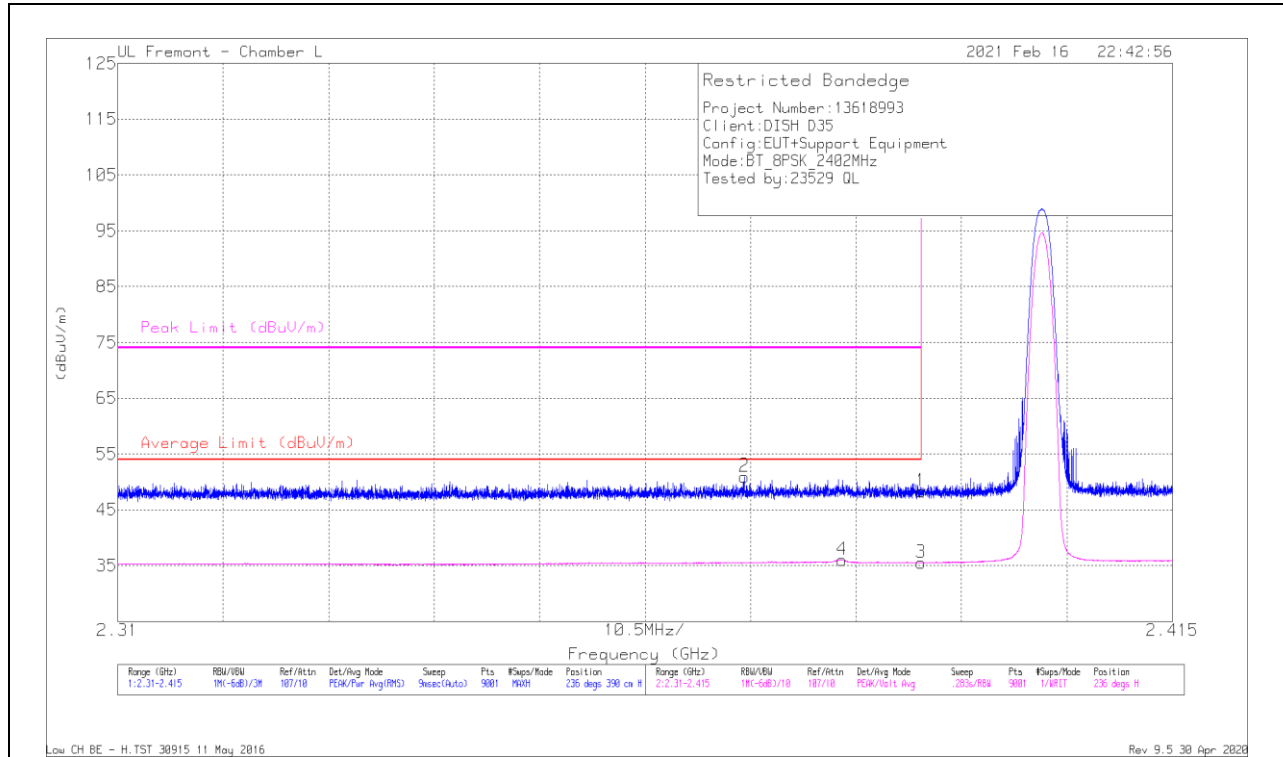
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.12509	43.68	PKFH	27.3	-24.1	46.88	-	-	74	-27.12	175	118	H
	* 1.12497	32.01	VA1T	27.3	-24.1	35.21	54	-18.79	-	-	175	118	H
2	2.96703	40.2	PKFH	32.6	-20.1	52.7	-	-	-	-	211	117	H
	* 1.39952	44.38	PKFH	28.7	-23.4	49.68	-	-	74	-24.32	217	393	V
4	* 1.39998	28.49	VA1T	28.7	-23.4	33.79	54	-20.21	-	-	217	393	V
	2.96707	40.64	PKFH	32.6	-20.1	53.14	-	-	-	-	192	105	V
3	* 7.43998	33.41	PKFH	35.6	-23.2	45.81	-	-	74	-28.19	125	101	H
	* 7.43998	24.2	VA1T	35.6	-23.2	36.6	54	-17.4	-	-	125	101	H
6	* 7.43949	36.02	PKFH	35.6	-23.2	48.42	-	-	74	-25.58	14	398	V
	* 7.43998	27.35	VA1T	35.6	-23.2	39.75	54	-14.25	-	-	14	398	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 VA1T - FHSS: Linear Voltage Average  $VB=1/Ton$  where: Ton is transmit duration

## 10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

### BANDEDGE (LOW CHANNEL)

### HORIZONTAL RESULT



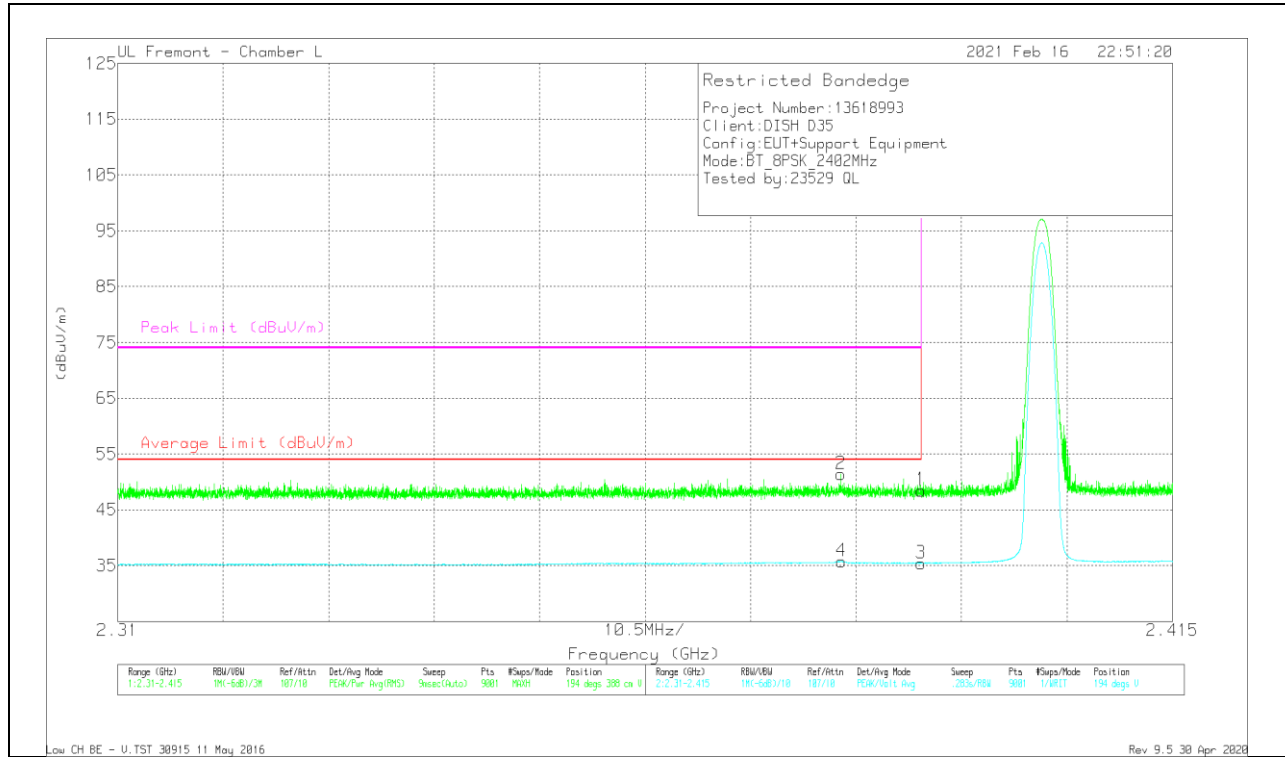
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	37.45	Pk	31.9	-21.1	48.25	-	-	74	-25.75	236	390	H
2	* 2.3724	40.37	Pk	31.8	-21.2	50.97	-	-	74	-23.03	236	390	H
3	* 2.38999	24.74	VA1T	31.9	-21.1	35.54	54	-18.46	-	-	236	390	H
4	* 2.38209	25.32	VA1T	31.8	-21.1	36.02	54	-17.98	-	-	236	390	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average  $VB=1/Ton$  where:  $Ton$  is transmit duration

### VERTICAL RESULT

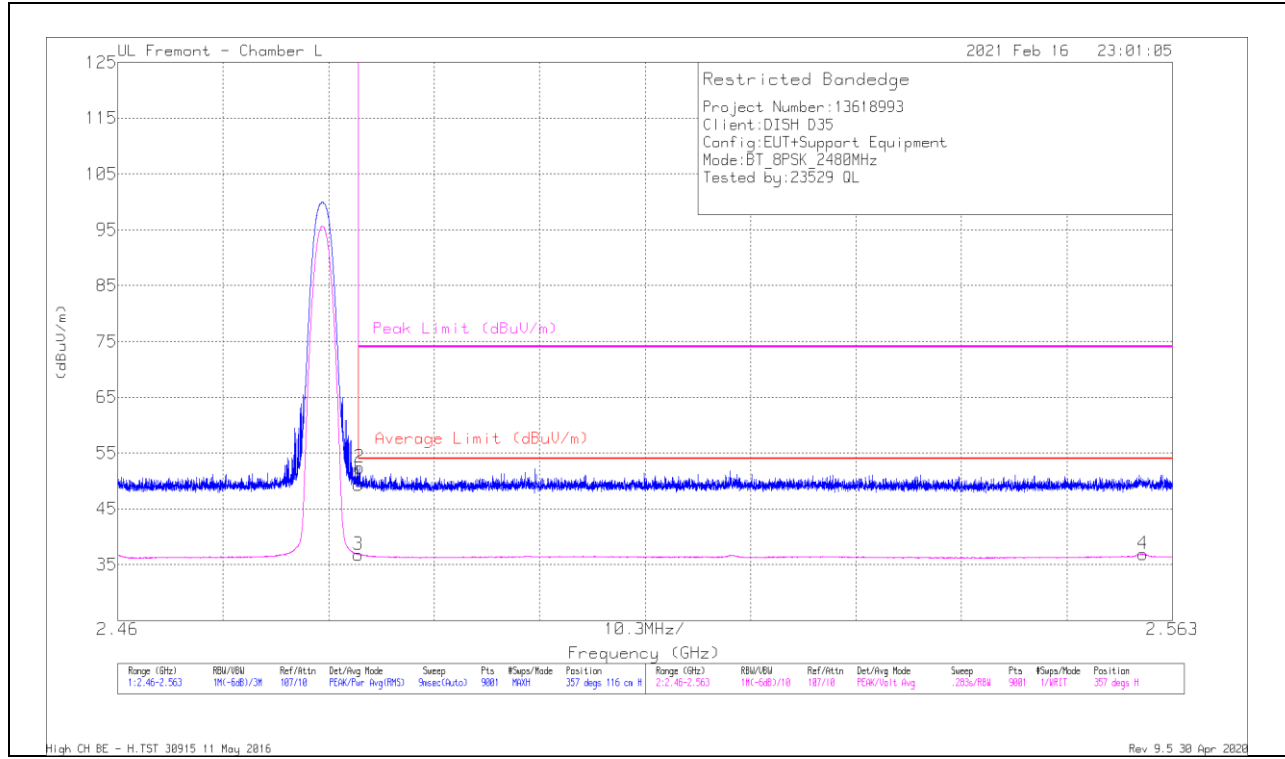


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Par d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	37.69	Pk	31.9	-21.1	48.49	-	-	74	-25.51	194	388	V
2	* 2.38197	40.69	Pk	31.8	-21.1	51.39	-	-	74	-22.61	194	388	V
3	* 2.38999	24.64	VA1T	31.9	-21.1	35.44	54	-18.56	-	-	194	388	V
4	* 2.38206	25.08	VA1T	31.8	-21.1	35.78	54	-18.22	-	-	194	388	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average  $V_B=1/T_{on}$  where:  $T_{on}$  is transmit duration

**BANDEDGE (HIGH CHANNEL)**

**HORIZONTAL RESULT**



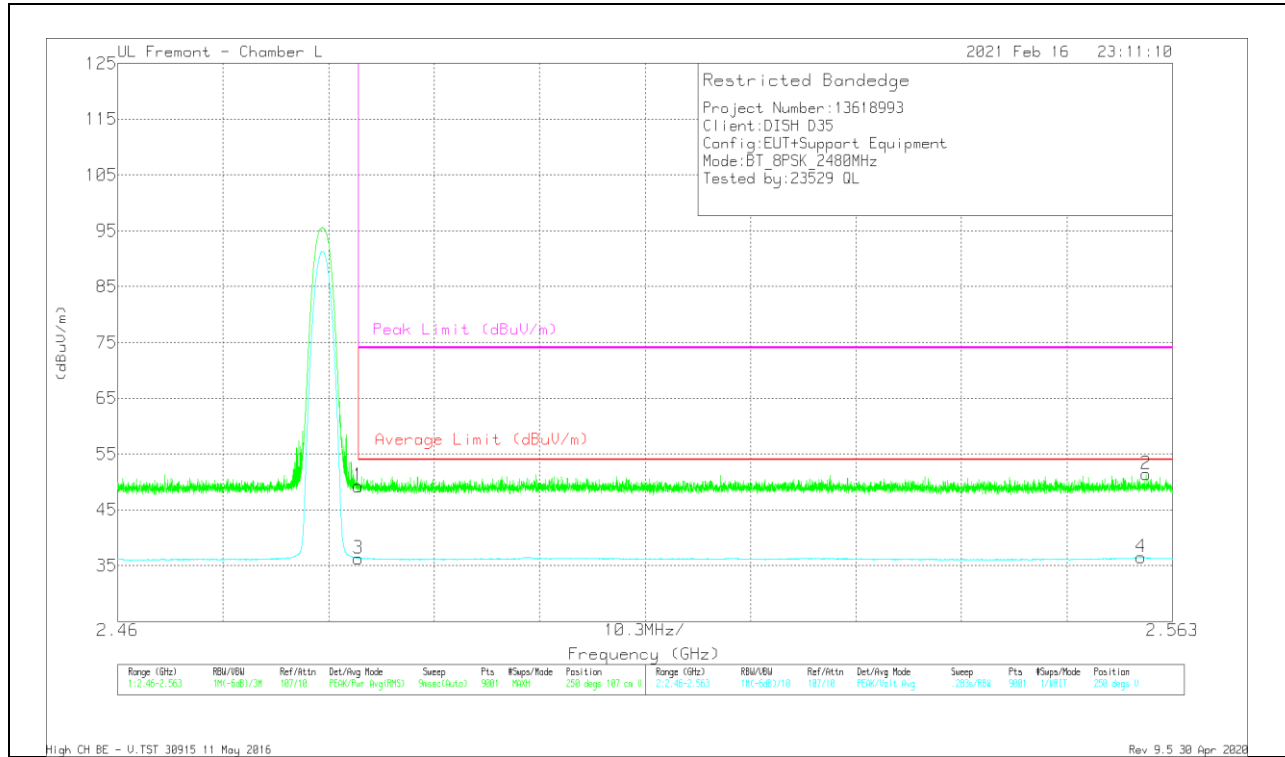
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	37.9	Pk	32.3	-20.9	49.3	-	-	74	-24.7	357	116	H
2	* 2.48364	41.03	Pk	32.3	-20.9	52.43	-	-	74	-21.57	357	116	H
3	* 2.48351	25.4	VA1T	32.3	-20.9	36.8	54	-17.2	-	-	357	116	H
4	2.56015	25.27	VA1T	32.4	-20.8	36.87	54	-17.13	-	-	357	116	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average  $V_B=1/T_{on}$  where:  $T_{on}$  is transmit duration

### VERTICAL RESULT



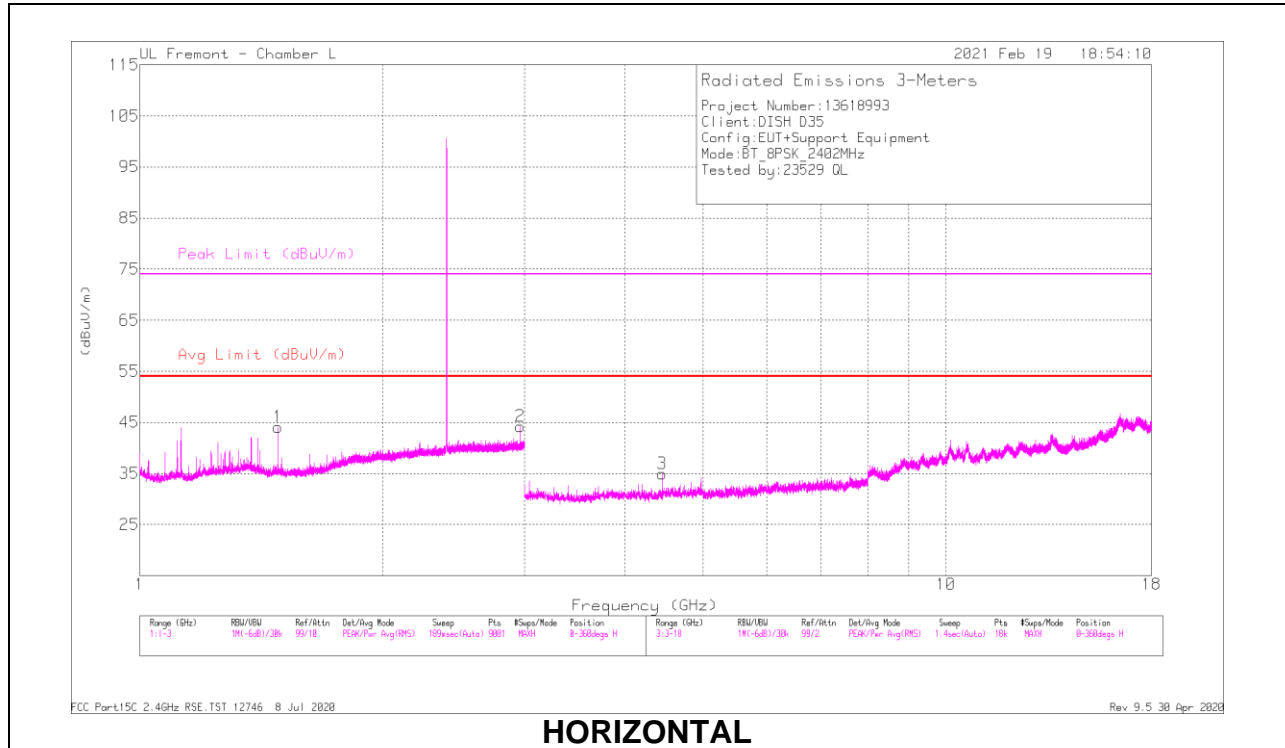
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Ftr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	37.84	Pk	32.3	-20.9	49.24	-	-	74	-24.76	250	107	V
2	2.56043	39.83	Pk	32.4	-20.8	51.43	-	-	74	-22.57	250	107	V
3	* 2.48351	24.9	VA1T	32.3	-20.9	36.3	54	-17.7	-	-	250	107	V
4	2.55992	24.91	VA1T	32.4	-20.8	36.51	54	-17.49	-	-	250	107	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

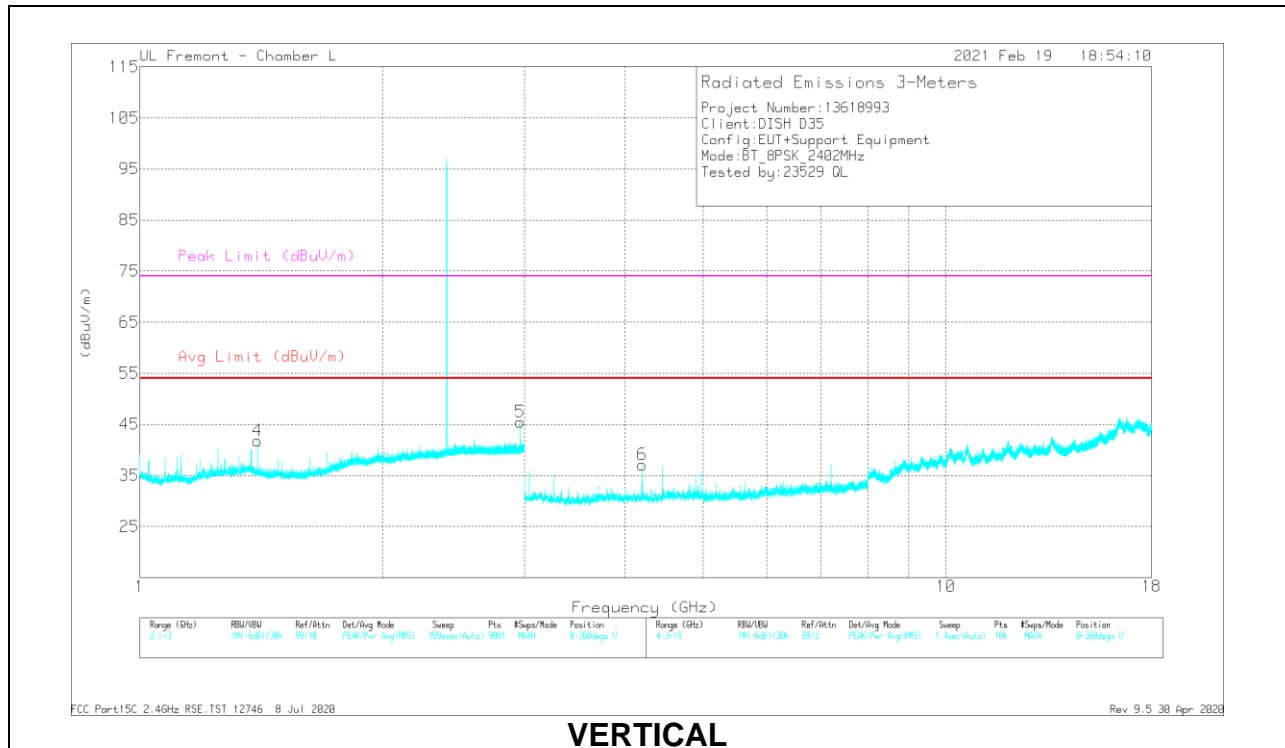


**HARMONICS AND SPURIOUS EMISSIONS**

**LOW CHANNEL RESULTS**



**HORIZONTAL**



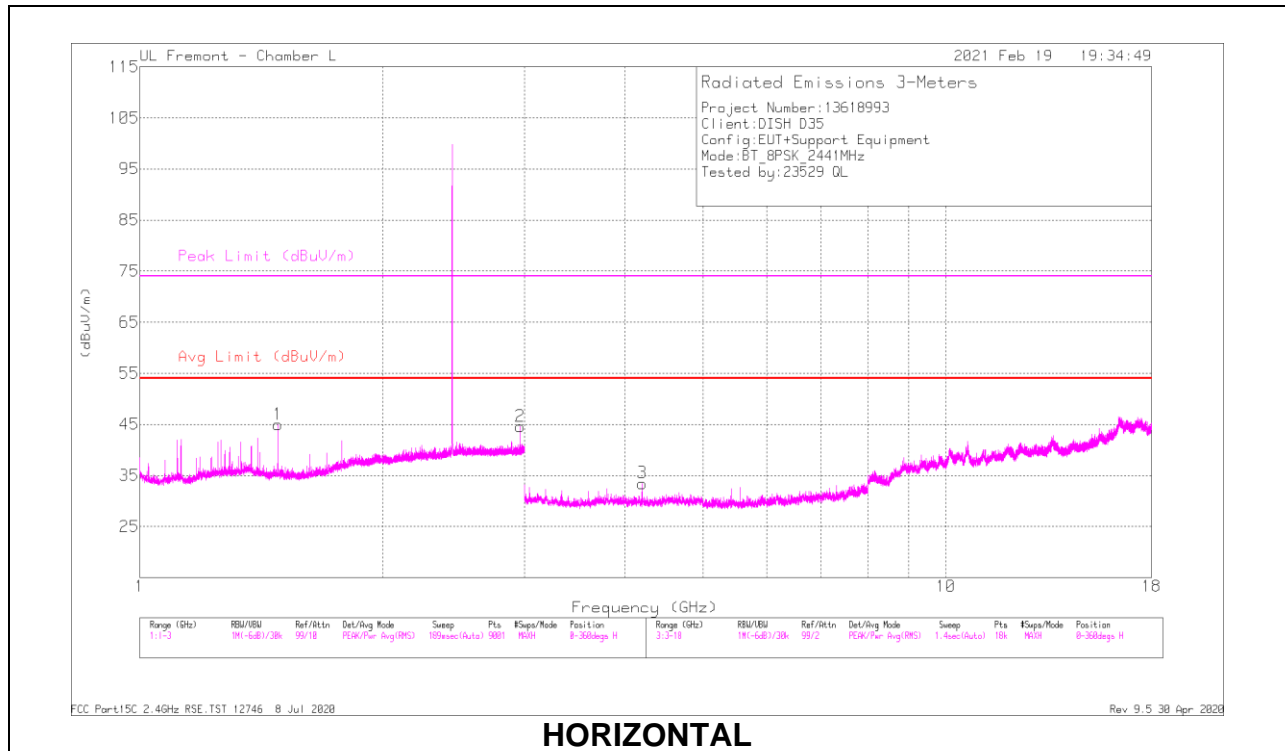
**VERTICAL**

**RADIATED EMISSIONS**

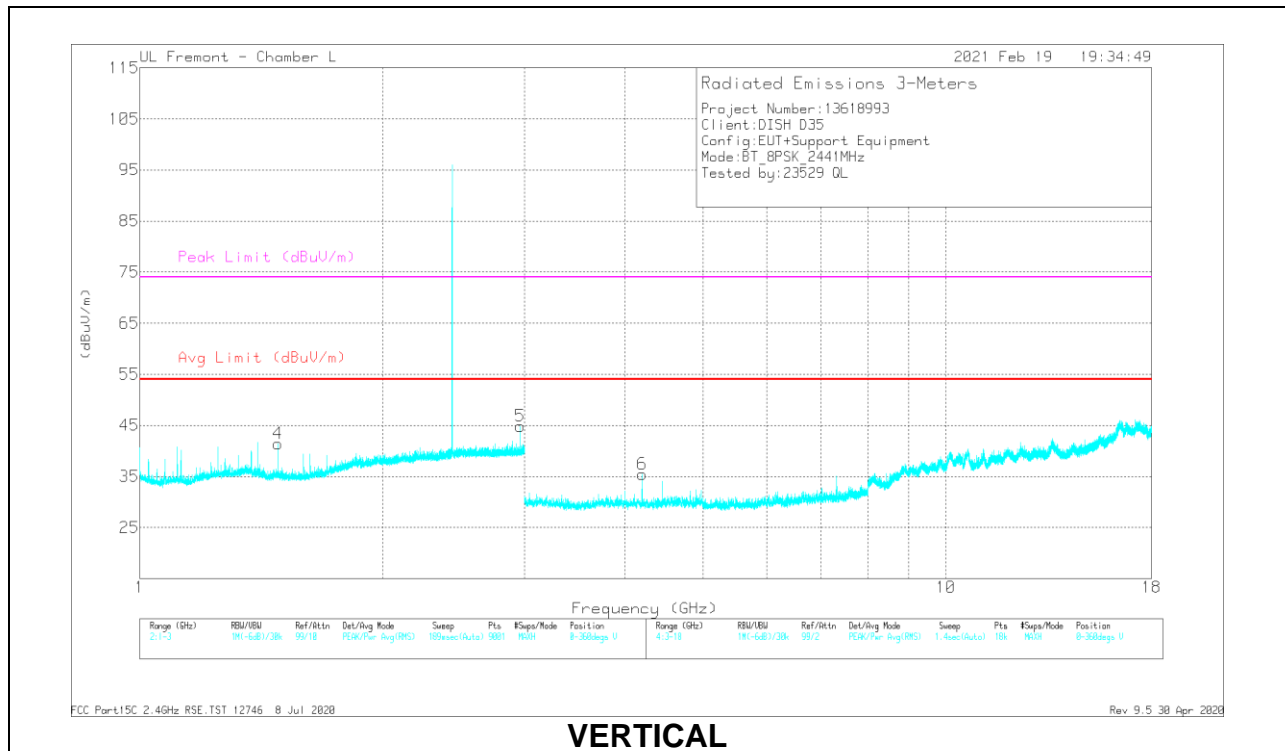
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.48342	43.11	PKFH	28.2	-23.1	48.21	-	-	74	-25.79	265	110	H
	* 1.48347	32.3	VA1T	28.2	-23.1	37.4	54	-16.6	-	-	265	110	H
2	2.96715	39.94	PKFH	32.6	-20.1	52.44	-	-	-	-	213	115	H
4	* 1.39978	41.83	PKFH	28.7	-23.4	47.13	-	-	74	-26.87	47	334	V
	* 1.4	34.92	VA1T	28.7	-23.4	40.22	54	-13.78	-	-	47	334	V
5	2.96685	40	PKFH	32.6	-20.1	52.5	-	-	-	-	196	112	V
3	4.45072	34.57	PKFH	33.7	-27.2	41.07	-	-	-	-	128	398	H
6	* 4.19994	35.67	PKFH	33.4	-27.5	41.57	-	-	74	-32.43	343	387	V
	* 4.2	23.51	VA1T	33.4	-27.5	29.41	54	-24.59	-	-	343	387	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 VA1T - FHSS: Linear Voltage Average  $VB=1/Ton$  where: Ton is transmit duration

### MID CHANNEL RESULTS



### HORIZONTAL



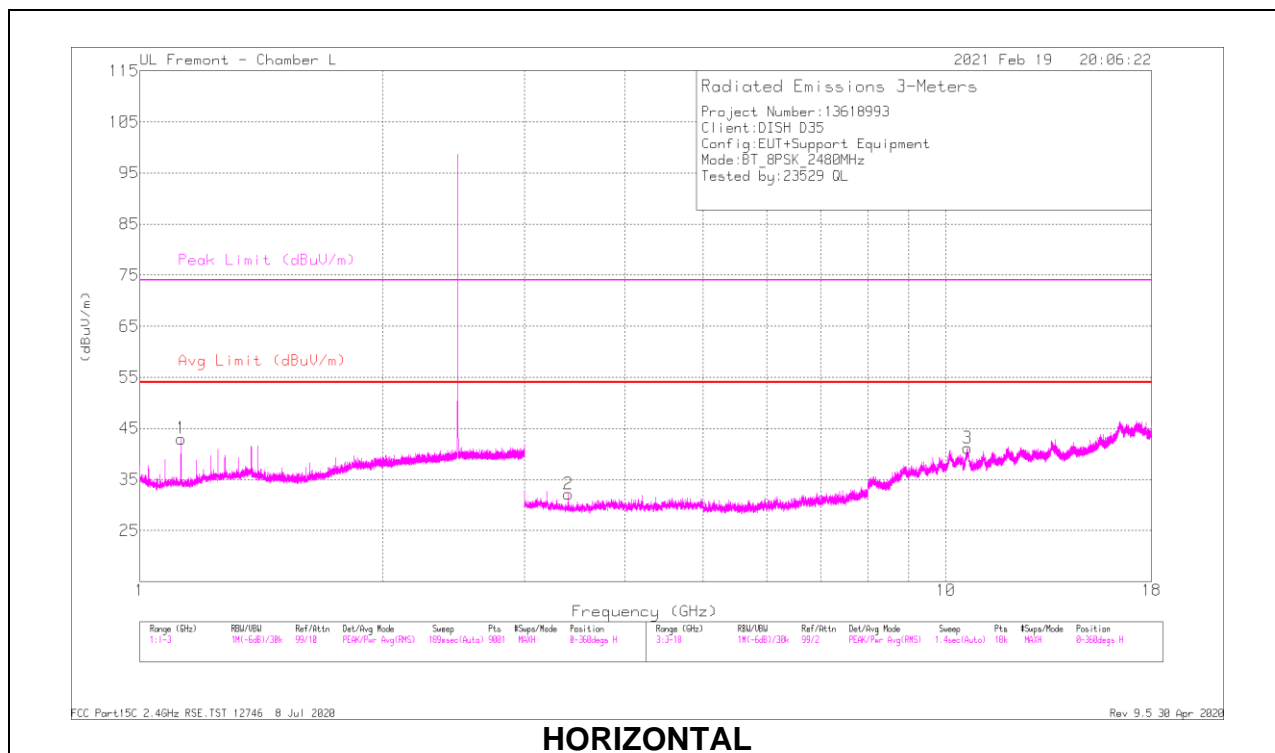
### VERTICAL

**RADIATED EMISSIONS**

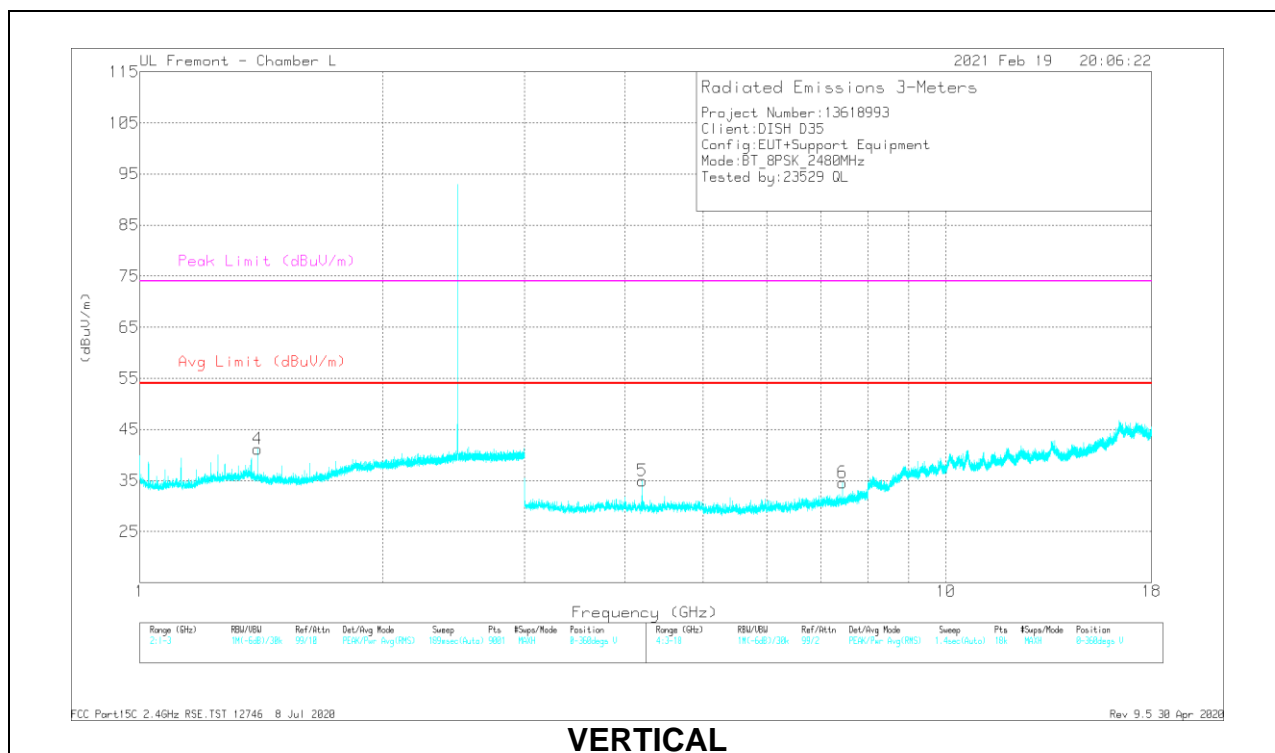
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.48342	43.24	PKFH	28.2	-23.1	48.34	-	-	74	-25.66	255	155	H
	* 1.4835	33.2	VA1T	28.2	-23.1	38.3	54	-15.7	-	-	255	155	H
2	2.96705	40.06	PKFH	32.6	-20.1	52.56	-	-	-	-	213	117	H
4	* 1.48336	41.53	PKFH	28.2	-23.1	46.63	-	-	74	-27.37	184	105	V
	* 1.48354	29.89	VA1T	28.2	-23.1	34.99	54	-19.01	-	-	184	105	V
5	2.96696	40.79	PKFH	32.6	-20.1	53.29	-	-	-	-	195	110	V
3	* 4.19901	32.62	PKFH	33.4	-27.5	38.52	-	-	74	-35.48	21	164	H
	* 4.2	20.61	VA1T	33.4	-27.5	26.51	54	-27.49	-	-	21	164	H
6	* 4.20002	38.08	PKFH	33.4	-27.5	43.98	-	-	74	-30.02	68	386	V
	* 4.20001	31.6	VA1T	33.4	-27.5	37.5	54	-16.5	-	-	68	386	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 VA1T - FHSS: Linear Voltage Average  $VB=1/Ton$  where: Ton is transmit duration

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

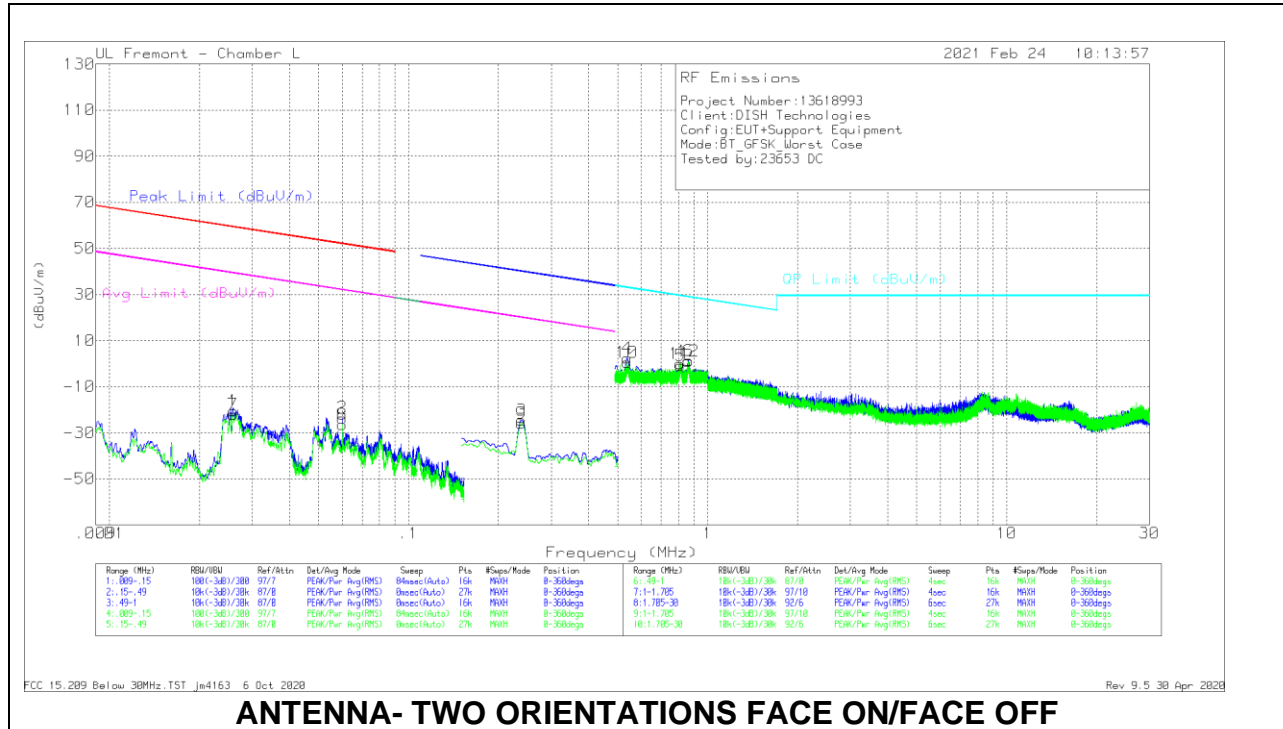
**RADIATED EMISSIONS**

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	* 1.12507	45.09	PKFH	27.3	-24.1	48.29	-	-	74	-25.71	184	138	H
	* 1.125	36.07	VA1T	27.3	-24.1	39.27	54	-14.73	-	-	184	138	H
4	* 1.39849	42.02	PKFH	28.7	-23.4	47.32	-	-	74	-26.68	187	390	V
	* 1.39991	27.25	VA1T	28.7	-23.4	32.55	54	-21.45	-	-	187	390	V
2	3.39791	36.33	PKFH	32.6	-28.6	40.33	-	-	-	-	105	391	H
	* 10.64724	28.41	PKFH	37.9	-17.2	49.11	-	-	74	-24.89	157	309	H
3	* 10.6499	14.39	VA1T	37.9	-17.2	35.09	54	-18.91	-	-	157	309	H
	* 4.20009	36.18	PKFH	33.4	-27.5	42.08	-	-	74	-31.92	227	393	V
5	* 4.19995	23.83	VA1T	33.4	-27.5	29.73	54	-24.27	-	-	227	393	V
	* 7.44069	31.84	PKFH	35.6	-23.2	44.24	-	-	74	-29.76	112	388	V
6	* 7.44	19.77	VA1T	35.6	-23.2	32.17	54	-21.83	-	-	112	388	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 VA1T - FHSS: Linear Voltage Average  $V_B=1/T_{on}$  where:  $T_{on}$  is transmit duration

## 10.2. WORST CASE BELOW 30MHz

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



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

#### Below 30MHz Data

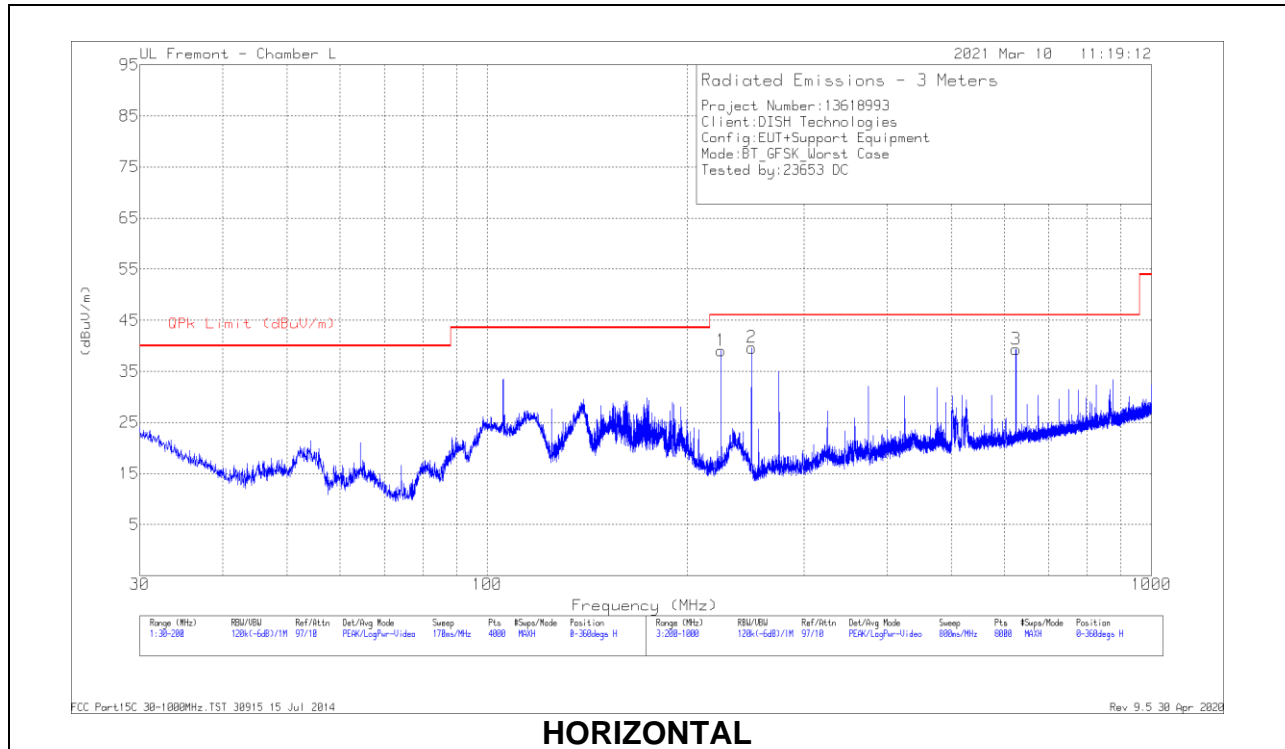
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.02597	33.54	Pk	58.4	-32.4	-80	-20.46	59.3	-79.76	39.3	-59.76	-	-	-	-	0-360
2	.06015	32.65	Pk	56.2	-32.4	-80	-23.55	52	-76.55	32	-55.55	-	-	-	-	0-360
3	.23902	31.62	Pk	56.3	-32.3	-80	-24.38	-	-	-	-	40.05	-64.43	20.05	-44.43	0-360
7	.02591	32	Pk	58.4	-32.4	-80	-22	59.32	-81.32	39.32	-61.32	-	-	-	-	0-360
8	.06013	29.84	Pk	56.2	-32.4	-80	-26.36	52	-78.36	32	-58.36	-	-	-	-	0-360
9	.23894	30.11	Pk	56.3	-32.3	-80	-25.89	-	-	-	-	40.05	-65.94	20.05	-45.94	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB)	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.53853	18.41	Pk	56.2	-32.2	-40	2.41	32.98	-30.57	0-360
5	.81184	15.18	Pk	56.3	-32.2	-40	-7.2	29.43	-30.15	0-360
6	.8617	17.15	Pk	56.3	-32.2	-40	1.25	28.91	-27.66	0-360
10	.5373	16.55	Pk	56.2	-32.2	-40	.55	33	-32.45	0-360
11	.80805	15.79	Pk	56.3	-32.2	-40	-1.1	29.47	-29.58	0-360
12	.86165	16.89	Pk	56.3	-32.2	-40	.99	28.91	-27.92	0-360

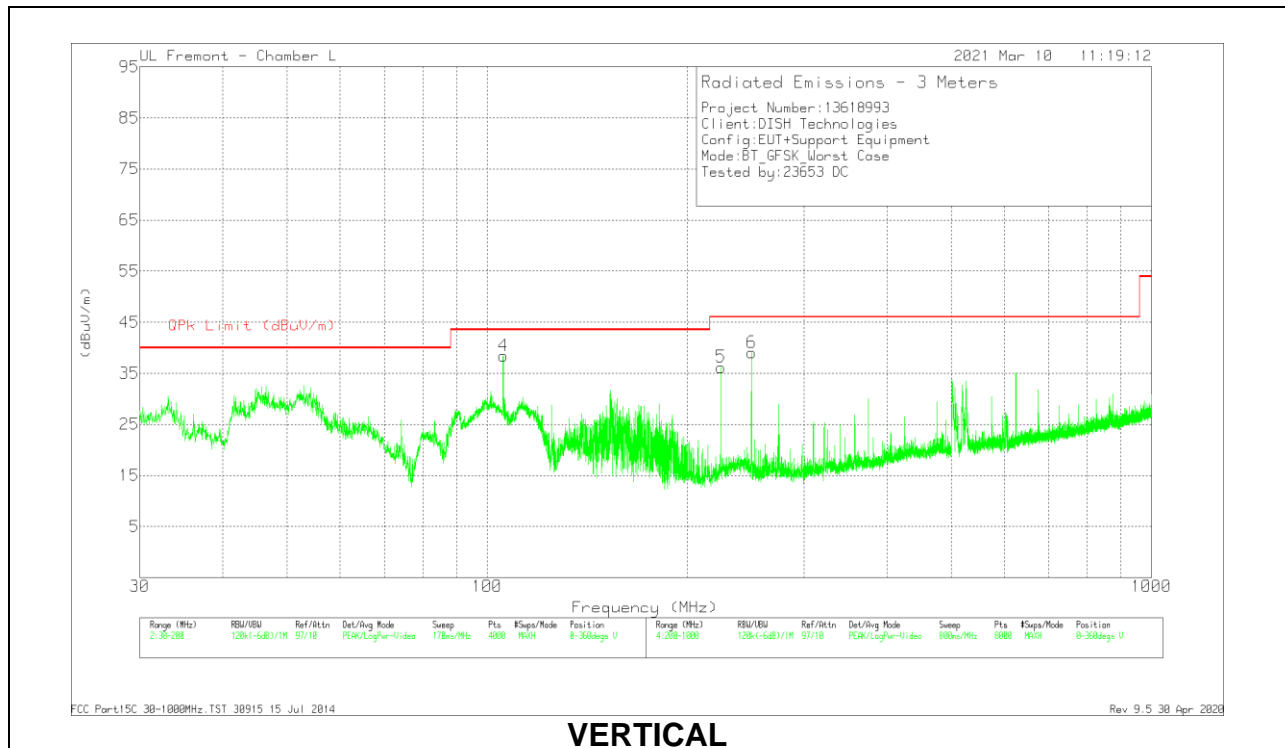
Pk - Peak detector

### 10.3. WORST CASE BELOW 1 GHz

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



**HORIZONTAL**



**VERTICAL**



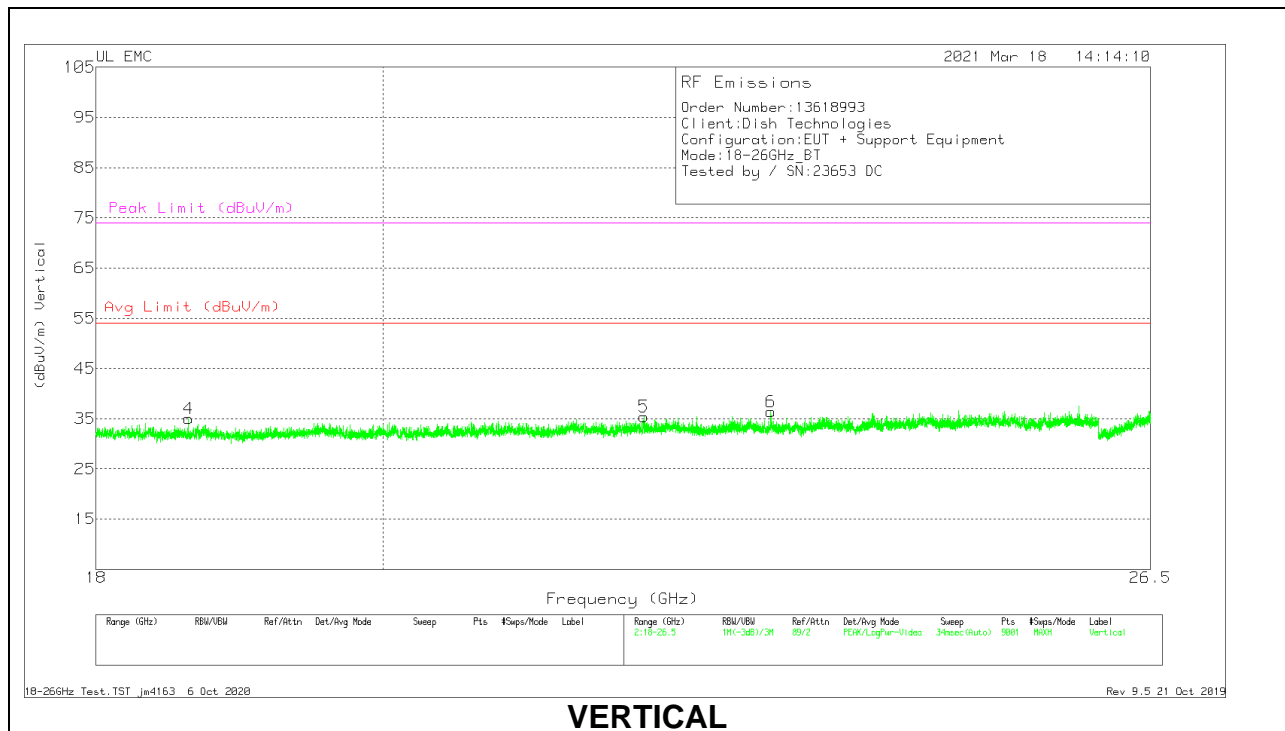
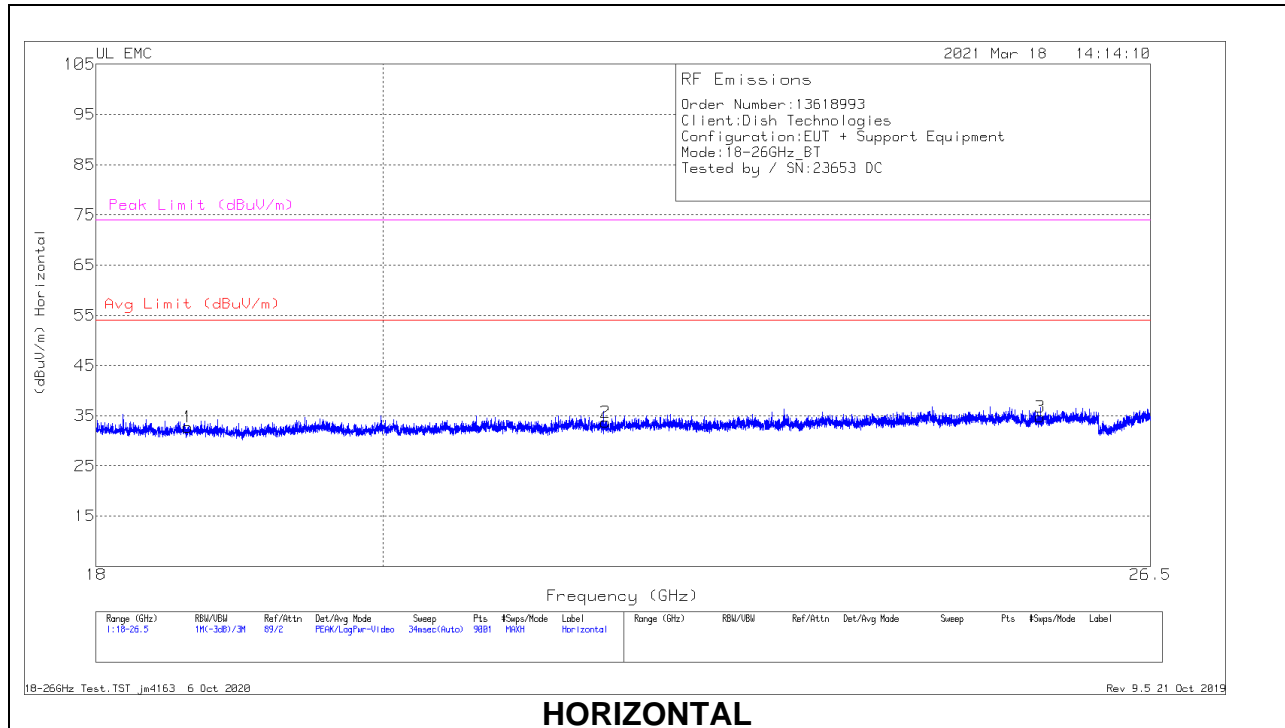
**Below 1GHz Data**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 174373 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	105.7514	52.08	Pk	17.6	-30.7	38.98	43.52	-4.54	161	112	V
	105.7672	49.39	Qp	17.6	-30.7	36.29	43.52	-7.23	161	112	V
1	225.0012	53.26	Pk	16.7	-30	39.96	46.02	-6.06	199	140	H
	225.0016	52.45	Qp	16.7	-30	39.15	46.02	-6.87	199	140	H
2	* 249.9967	53.54	Pk	17.3	-29.9	40.94	46.02	-5.08	208	110	H
	* 249.9967	52.85	Qp	17.3	-29.9	40.25	46.02	-5.77	208	110	H
3	625.0002	44.17	Pk	25.1	-28.5	40.77	46.02	-5.25	304	101	H
	625.0002	43.04	Qp	25.1	-28.5	39.64	46.02	-6.38	304	101	H
5	224.9991	51.46	Pk	16.7	-30	38.16	46.02	-7.86	218	103	V
	224.9991	50.75	Qp	16.7	-30	37.45	46.02	-8.57	218	103	V
6	* 249.9993	52.37	Pk	17.3	-29.9	39.77	46.02	-6.25	311	101	V
	* 249.9993	51.7	Qp	17.3	-29.9	39.1	46.02	-6.92	311	101	V

Pk - Peak detector  
 Qp - Quasi-Peak detector

### 10.4. 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 (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	18.61672	68.61	Pk	32.4	-58.8	-9.5	32.71	54	-21.29	74	-41.29
2	21.69844	67.6	Pk	33.2	-57.6	-9.5	33.7	54	-20.3	74	-40.3
3	25.44694	65.16	Pk	34.5	-55.4	-9.5	34.76	54	-19.24	74	-39.24
4	18.6205	70.91	Pk	32.4	-58.8	-9.5	35.01	54	-18.99	74	-38.99
5	22.00539	69.19	Pk	33.4	-57.7	-9.5	35.39	54	-18.61	74	-38.61
6	23.05466	69.5	Pk	33.8	-57.4	-9.5	36.4	54	-17.6	74	-37.6

Pk - Peak detector

## 11. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

\*Decreases with the logarithm of the frequency.

### TEST PROCEDURE

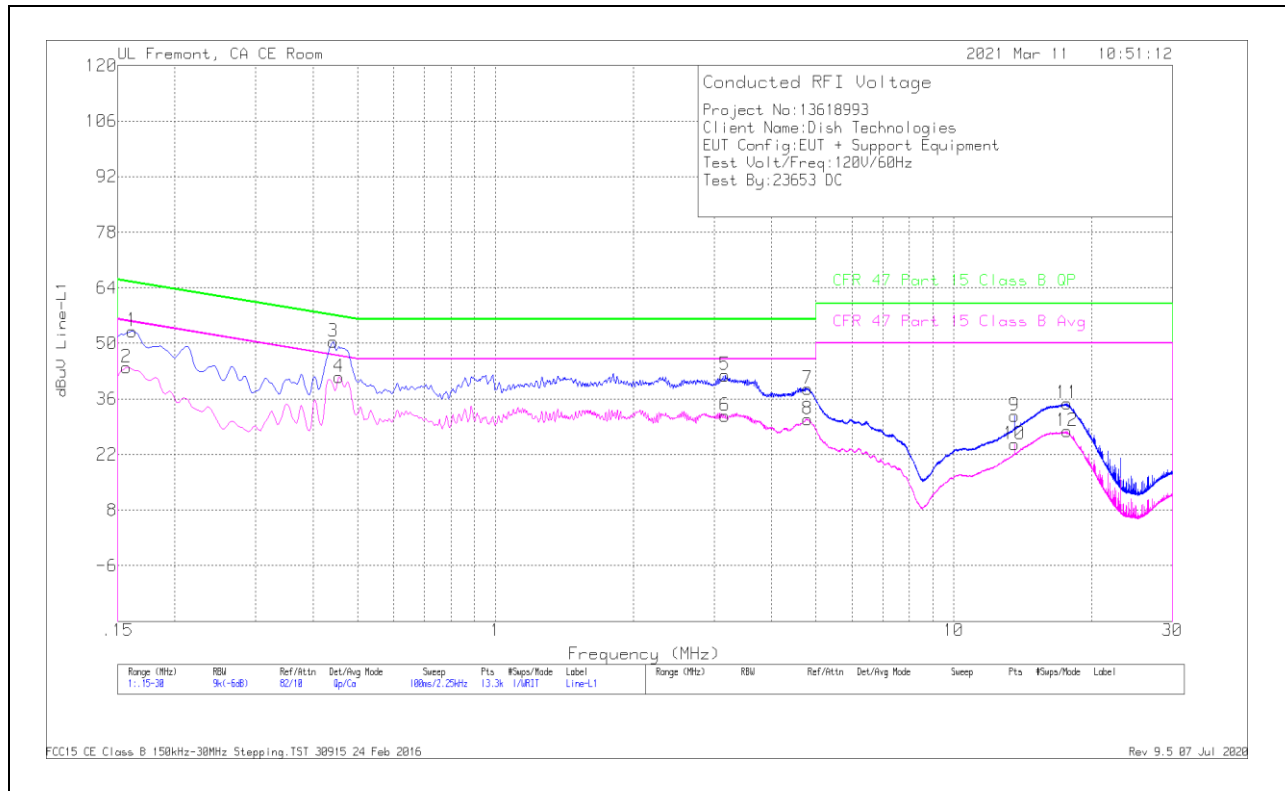
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

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

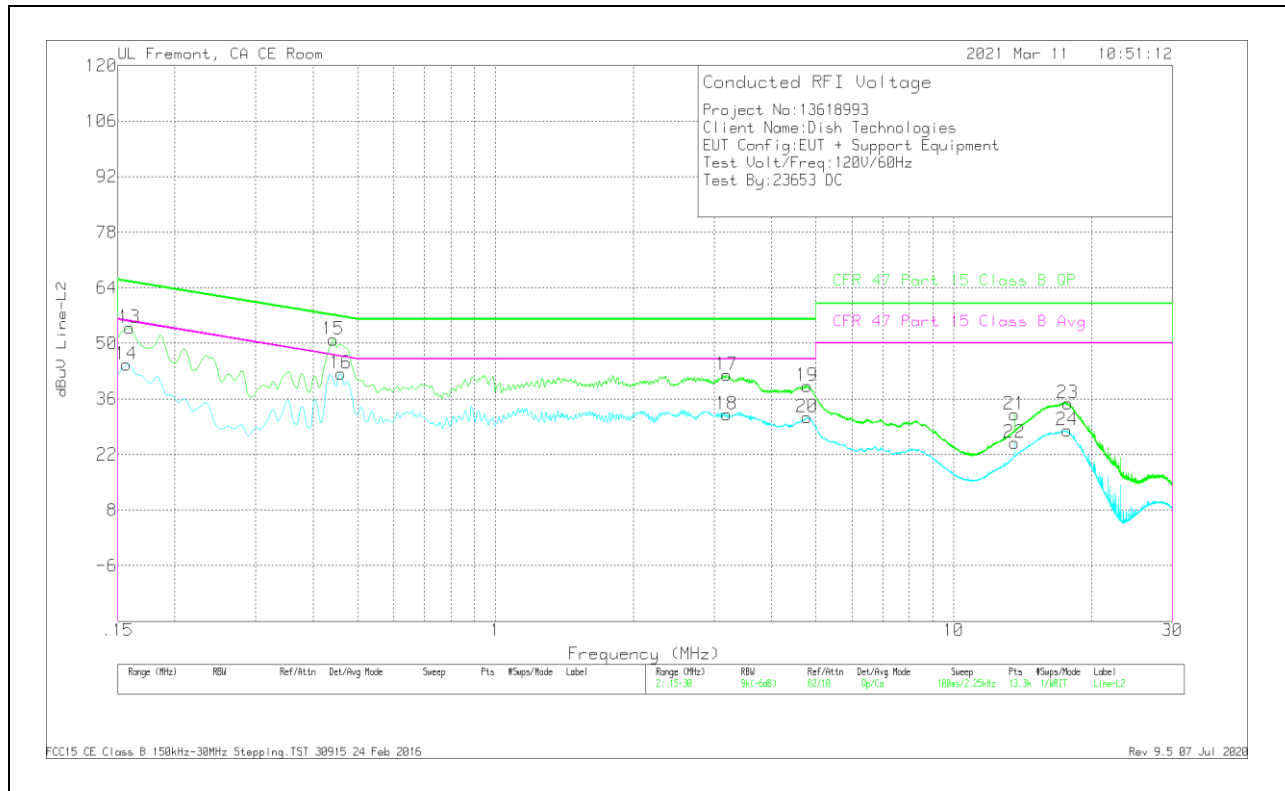
### LINE 1 RESULTS



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	43.03	Qp	0	0	10.1	53.13	65.4	-12.27	-	-
2	.15675	33.73	Ca	.1	0	10.1	43.93	-	-	55.63	-11.7
3	.4425	40.27	Qp	0	0	10.1	50.37	57.01	-6.64	-	-
4	.456	31.49	Ca	0	0	10.1	41.59	-	-	46.77	-5.18
5	3.17288	31.67	Qp	0	.1	10.2	41.97	56	-14.03	-	-
6	3.17175	21.46	Ca	0	.1	10.2	31.76	-	-	46	-14.24
7	4.8075	28.34	Qp	0	.1	10.2	38.64	56	-17.36	-	-
8	4.80075	20.58	Ca	0	.1	10.2	30.88	-	-	46	-15.12
9	13.56	21.24	Qp	.1	.2	10.2	31.74	60	-28.26	-	-
10	13.56	14.14	Ca	.1	.2	10.2	24.64	-	-	50	-25.36
11	17.69325	24.34	Qp	0	.2	10.3	34.84	60	-25.16	-	-
12	17.69325	17.42	Ca	0	.2	10.3	27.92	-	-	50	-22.08

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	.159	43.78	Qp	0	0	10.1	53.88	65.52	-11.64	-	-
14	.15675	34.62	Ca	0	0	10.1	44.72	-	-	55.63	-10.91
15	.4425	40.84	Qp	0	0	10.1	50.94	57.01	-6.07	-	-
16	.4605	32.31	Ca	0	0	10.1	42.41	-	-	46.68	-4.27
17	3.201	31.79	Qp	0	.1	10.2	42.09	56	-13.91	-	-
18	3.19538	21.79	Ca	0	.1	10.2	32.09	-	-	46	-13.91
19	4.7895	29.02	Qp	0	.1	10.2	39.32	56	-16.68	-	-
20	4.7895	21.07	Ca	0	.1	10.2	31.37	-	-	46	-14.63
21	13.56	21.66	Qp	.1	.2	10.2	32.16	60	-27.84	-	-
22	13.56	14.41	Ca	.1	.2	10.2	24.91	-	-	50	-25.09
23	17.72475	24.37	Qp	0	.2	10.3	34.87	60	-25.13	-	-
24	17.69325	17.66	Ca	0	.2	10.3	28.16	-	-	50	-21.84

Qp - Quasi-Peak detector  
 Ca - CISPR average detection