



TEST REPORT

Report Number. : 13575695-E2V1

Applicant : DISH TECHNOLOGIES L.L.C.
90 INVERNESS CIRCLE EAST
ENGLEWOOD, CO 80112, UNITED STATES

Model : D25

FCC ID : DKNEA66

EUT Description : WHOLE HOME DVR ACCESSORY

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

Date Of Issue:

February 09, 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	2/9/2021	Initial Issue	--

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	5
2. TEST RESULTS SUMMARY	7
3. TEST METHODOLOGY	7
4. FACILITIES AND ACCREDITATION	7
5. DECISION RULES AND MEASUREMENT UNCERTAINTY	8
5.1. METROLOGICAL TRACEABILITY	8
5.2. DECISION RULES.....	8
5.3. MEASUREMENT UNCERTAINTY.....	8
5.4. SAMPLE CALCULATION	8
6. EQUIPMENT UNDER TEST	9
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
7. TEST AND MEASUREMENT EQUIPMENT	13
8. MEASUREMENT METHODS	14
9. ANTENNA PORT TEST RESULTS	15
9.1. ON TIME AND DUTY CYCLE.....	15
9.2. 20 dB AND 99% BANDWIDTH	16
9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION	17
9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	18
9.3. HOPPING FREQUENCY SEPARATION	19
9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION	20
9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	21
9.4. NUMBER OF HOPPING CHANNELS.....	22
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION	23
9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	25
9.5. AVERAGE TIME OF OCCUPANCY.....	27

9.5.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	28
9.5.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	30
9.6.	<i>OUTPUT POWER</i>	32
9.6.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	32
9.6.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	33
9.6.3.	BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION	33
9.7.	<i>AVERAGE POWER</i>	34
9.7.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	34
9.7.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	35
9.7.3.	BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION	35
9.8.	<i>CONDUCTED SPURIOUS EMISSIONS</i>	36
9.8.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	37
9.8.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	39
10.	RADIATED TEST RESULTS	41
10.1.	<i>TRANSMITTER ABOVE 1 GHz</i>	43
10.1.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION.....	43
10.1.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION	53
10.2.	<i>WORST CASE BELOW 30MHz</i>	63
10.3.	<i>WORST CASE BELOW 1 GHz</i>	64
10.4.	<i>WORST CASE 18-26 GHz</i>	66
11.	AC POWER LINE CONDUCTED EMISSIONS	68
12.	SETUP PHOTOS	71

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: DISH TECHNOLOGIES L.L.C.
90 INVERNESS CIRCLE EAST
ENGLEWOOD, CO 80112, UNITED STATES

EUT DESCRIPTION: WHOLE HOME DVR ACCESSORY

MODEL: D25

SERIAL NUMBER: CONDUCTED: R5EWSG00124L
RADIATED: R5EWSG00152L

DATE TESTED: JANUARY 12, 2021 – FEBRUARY 3, 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:



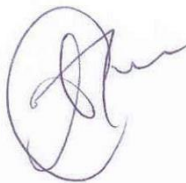
Francisco de Anda
Staff Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Brian Shen
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	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	Complies	None.
15.247 (a)(1)(iii)	Number of Hopping Channels	Complies	None.
15.247 (a)(1)(iii)	Average Time of Occupancy	Complies	None.
15.247 (b)(1)	Output Power	Complies	None.
See Comment	Average Power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (d)	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	Radiated Emissions	Complies	None.
15.207	AC Mains Conducted Emissions	Complies	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 _{Lab}
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	4.73 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 Whole Home DVR Accessory with 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	8.74	7.48
	Enhanced DQPSK	7.54	5.68
	Enhanced 8PSK	7.75	5.96

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.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB Inverted F antenna, with a maximum gain of 4.92 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 is a desktop device, therefore, all final radiated testing was performed with the EUT in X orientation.

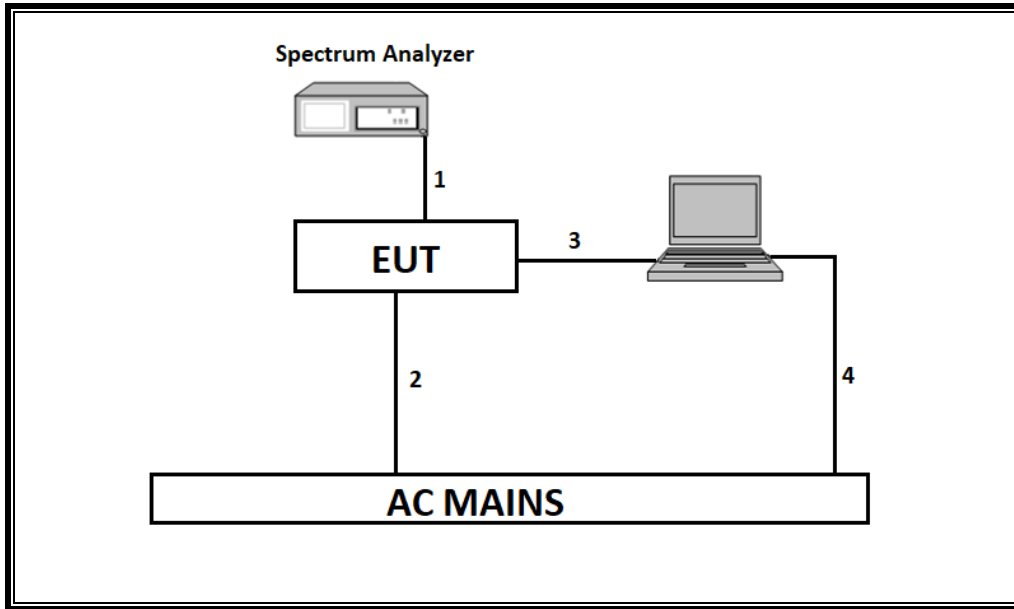
Worst-case data rates as provided by the client were:

GFSK mode: DH5
8PSK mode: 3-DH5

6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC		
Laptop	HP	EliteBook 740	N/A	DoC		
AC/DC Adapter	HP	N/A	N/A	DoC		
USB to UART cable	N/A	N/A	N/A	DoC		
AC/DC Adapter	LITEON	PB-1180-6ES1	ETC2003033761	DoC		
Monitor	HP	HP 2311x	N/A	Doc		
AC/DC Adapter	Asian Poower Devices Inc.	NB-65B19	YE45315128015622300	Doc		
USB-C Dock Gen2	Lenovo	LDC-G2	N/A	Doc		
AC/DC Adapter	Lenovo	ADLX90NCC2A	N/A	Doc		
I/O CABLES (CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	RF	Un-shielded	0.2	To spectrum analyzer
2	two-pin	1	AC	Un-shielded	1	EUT to AC Mains
3	UART	1	USB	Un-shielded	1.5	
4	DC	1	AC	Un-shielded	3	
I/O CABLES (RADIATED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	two-pin	1	AC	Un-shielded	1	EUT to AC Mains
2	UART	1	USB	Shielded	1.5	EUT to Laptop
3	DC	1	AC	Un-shielded	2.5	
4	HDMI	1	HDMI	Shielded	2	EUT to Monitor
5	DC	1	AC	Un-shielded	2.5	
6	USB-C	1	USB-C	Shielded	2	EUT to USB Type C dock
7	DC	1	AC	Un-shielded	2.5	

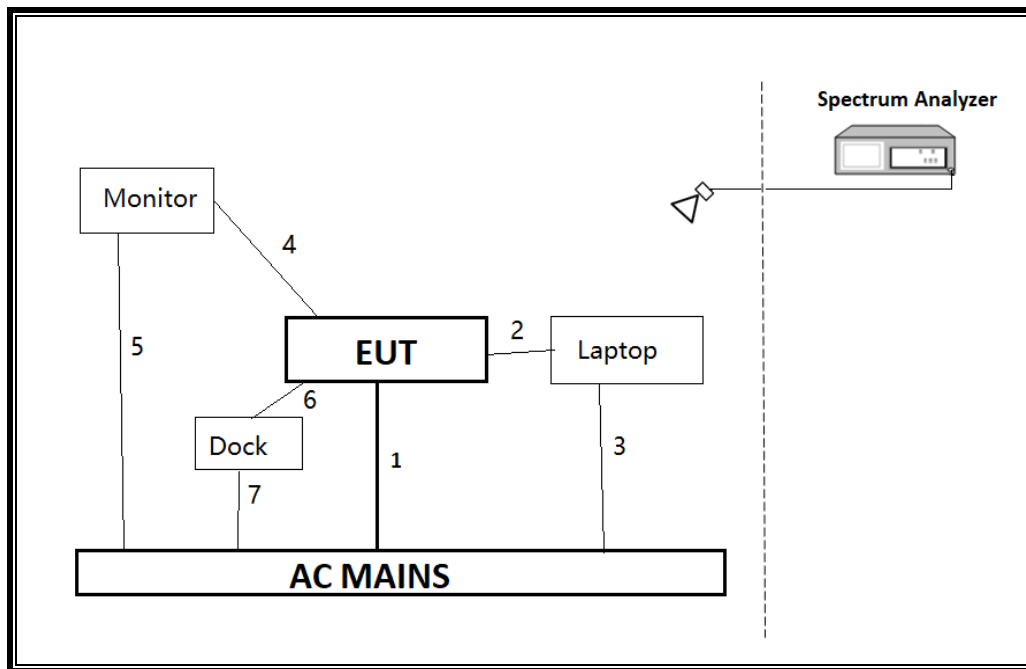
CONDUCTED TEST SETUP DIAGRAM



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 SETUP DIAGRAM



TEST SETUP

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

7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	2/26/2021	2/26/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	5/26/2021	5/26/2020
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	T1568	4/14/2021	4/14/2020
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*	1/23/2021	1/23/2020
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
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T341	7/29/2021	7/29/2020
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1223	4/10/2021	4/10/2020
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1264*	1/21/2021	1/21/2020
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
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
L.I.S.N	FCC INC.	FCC LISN 50/250	T24	1/20/2022	1/20/2021
EMI TEST RECEIVER 9kHz - 3.6GHz	Rohde & Schwarz	ESR3	PRE0181317	2/26/2021	2/26/2020
Transient Limiter	COM-POWER	LIT-930A	PRE0129246	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 2020.12.3		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, July 07, 2020		

*Test performed within calibration period.

8. 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.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

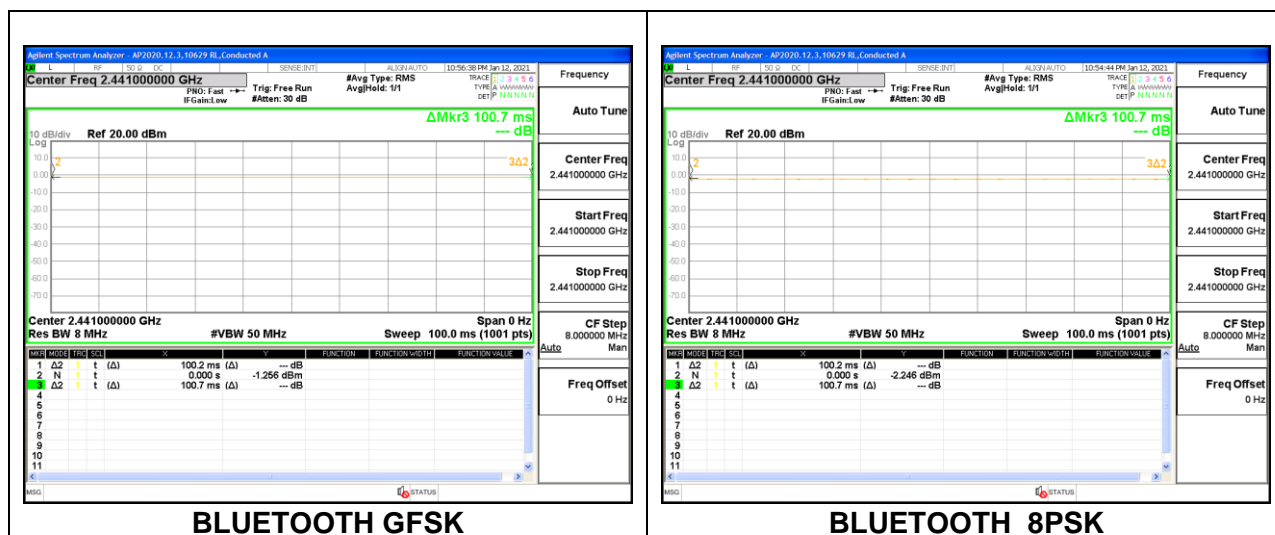
None; for reporting purposes only.

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	100.20	100.70	0.995	100	0.00	0.010
Bluetooth 8PSK	100.20	100.70	0.995	100	0.00	0.010



9.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

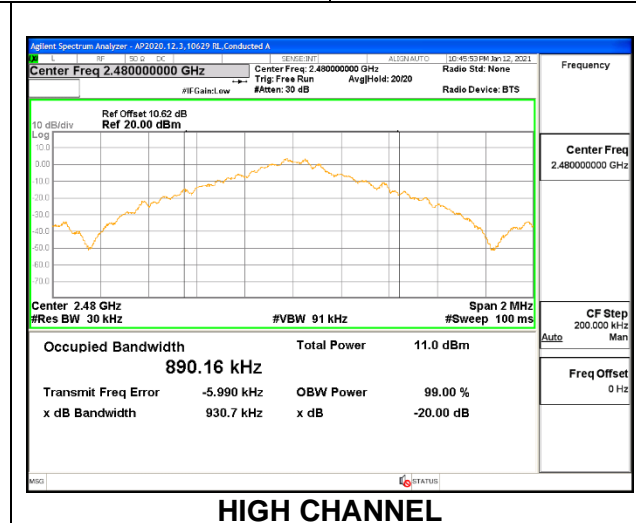
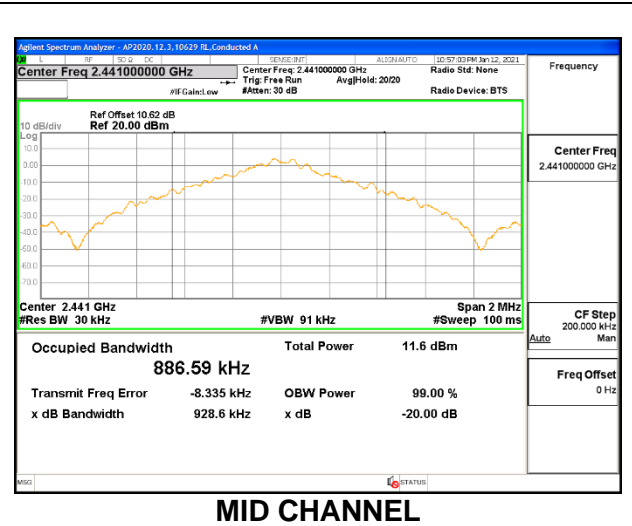
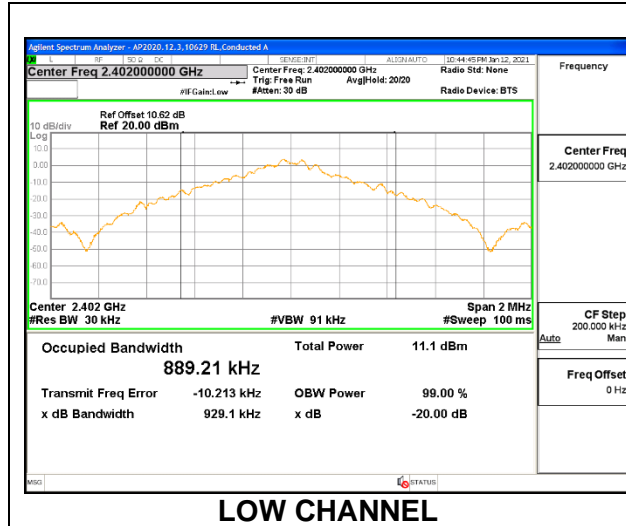
TEST PROCEDURE

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 three times RBW. The sweep time is coupled.

RESULTS

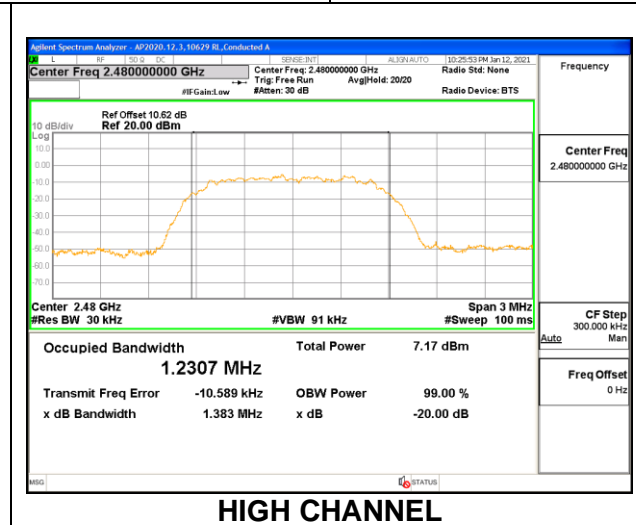
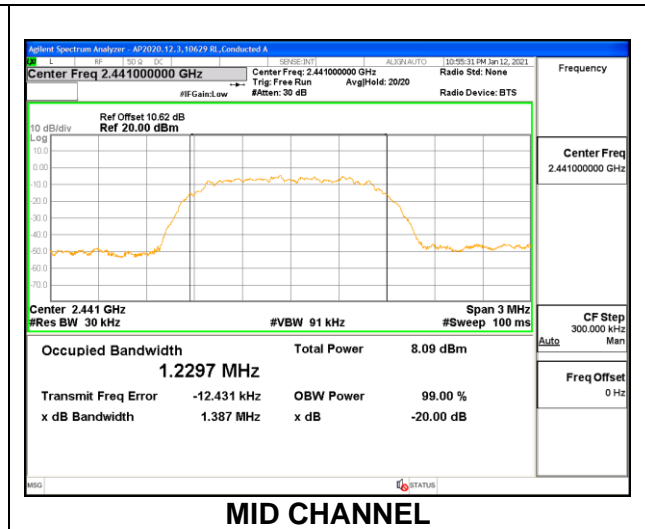
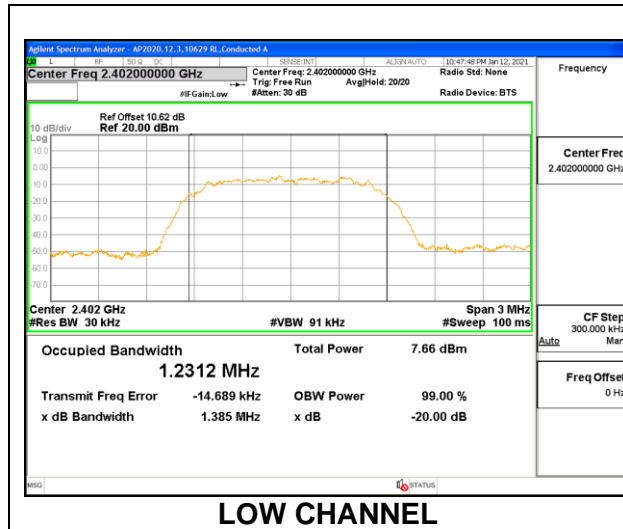
9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.9291	0.88921
Mid	2441	0.9286	0.88659
High	2480	0.9307	0.89016



9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.385	1.2312
Mid	2441	1.387	1.2297
High	2480	1.383	1.2307



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.

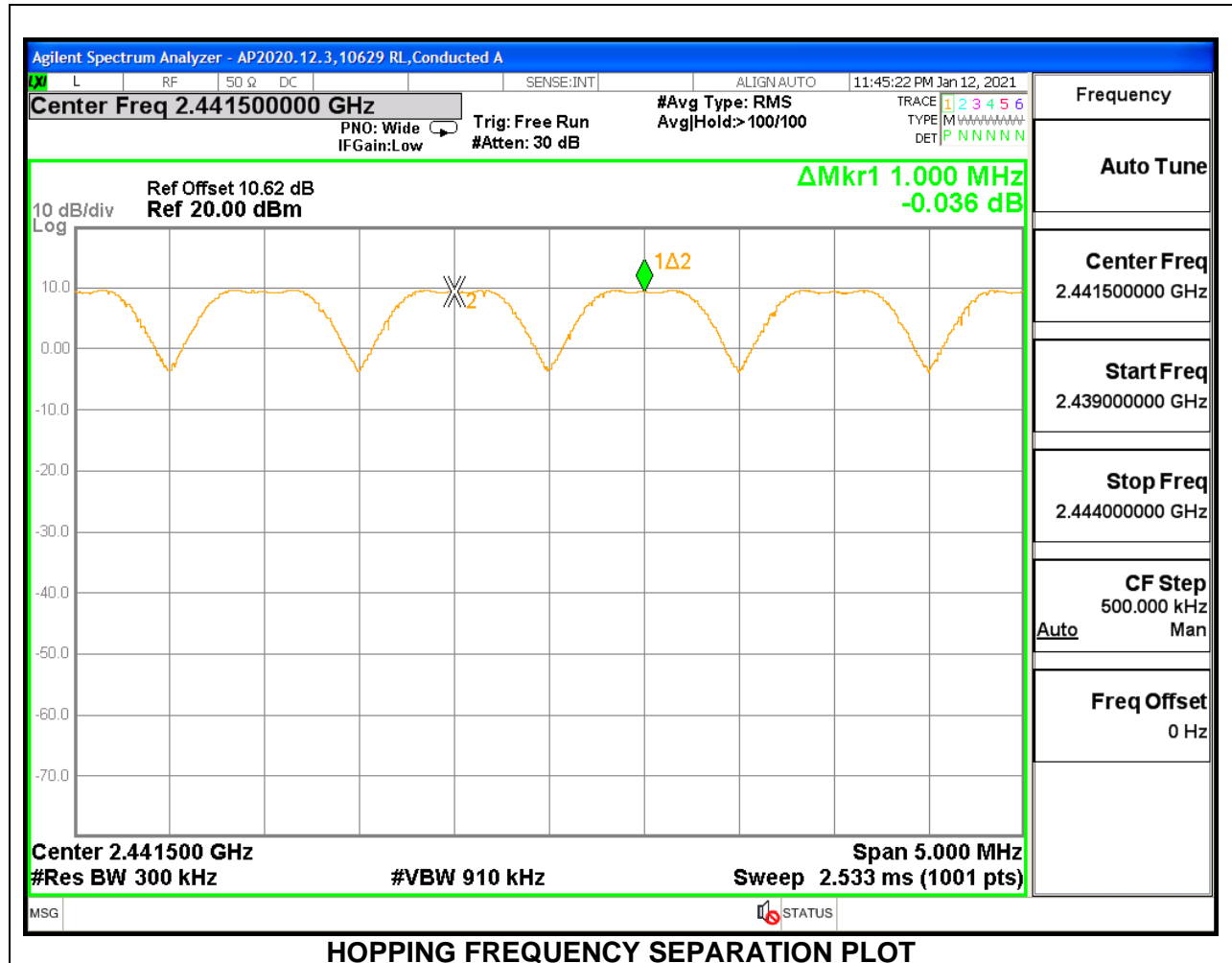
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

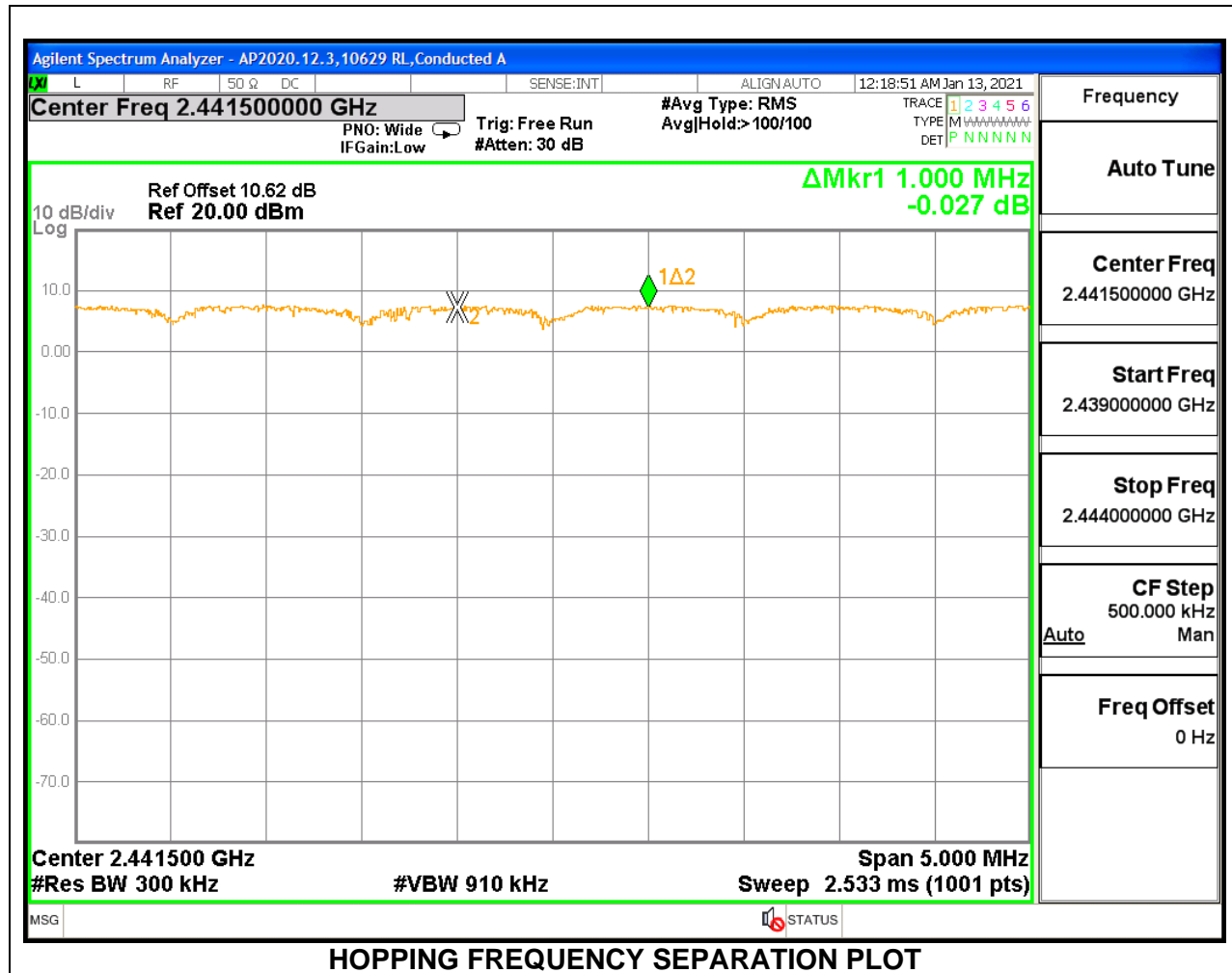
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to $VBW \geq RBW$. The sweep time is coupled.

RESULTS

9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



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.

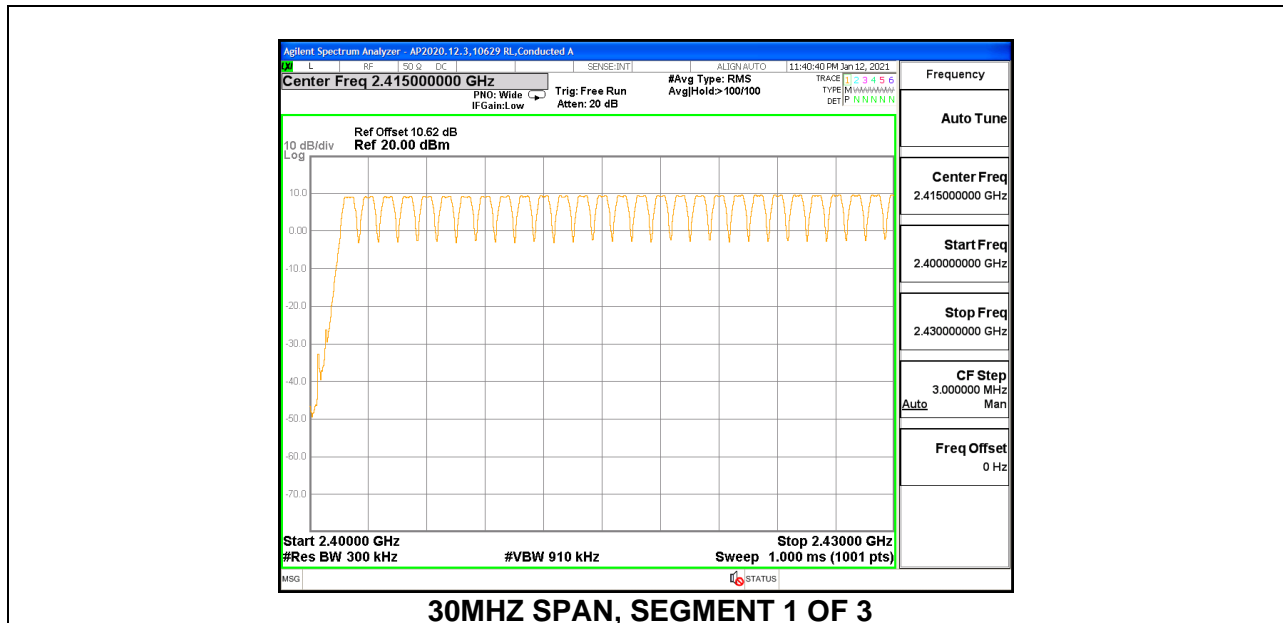
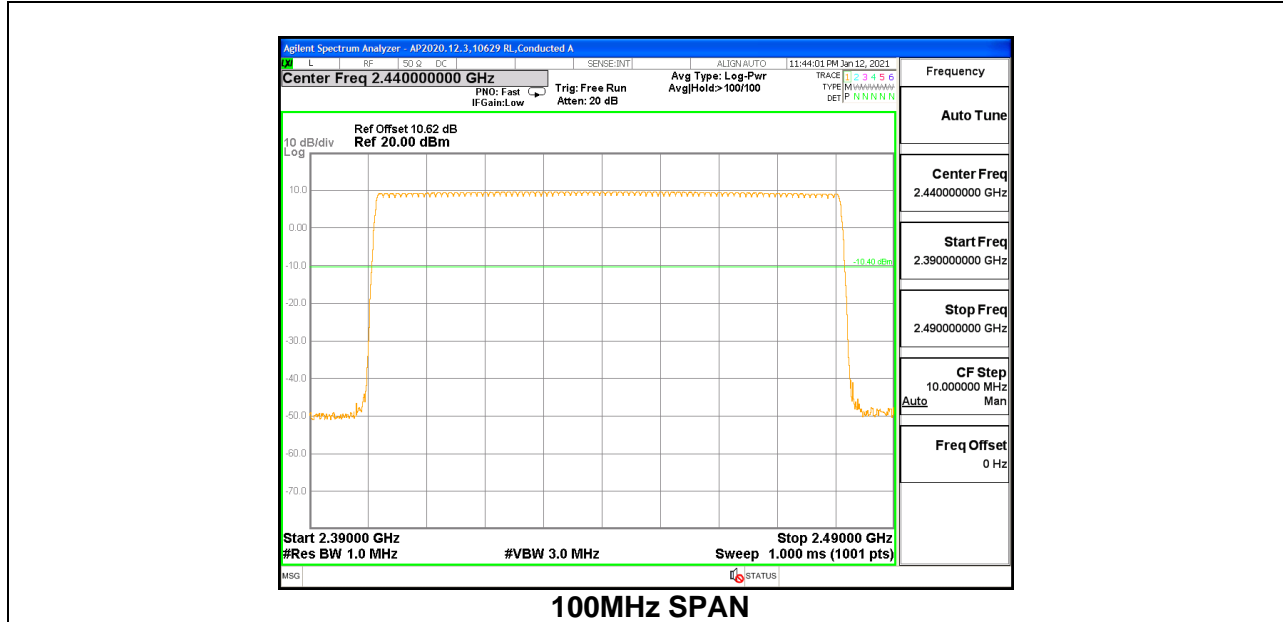
TEST PROCEDURE

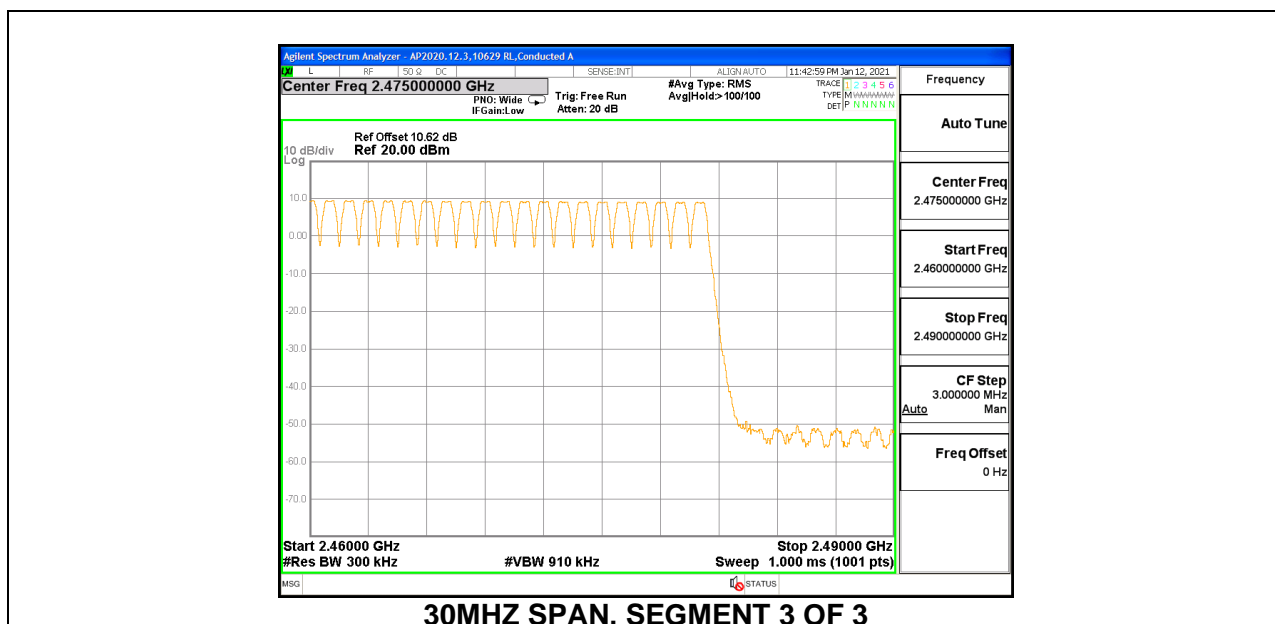
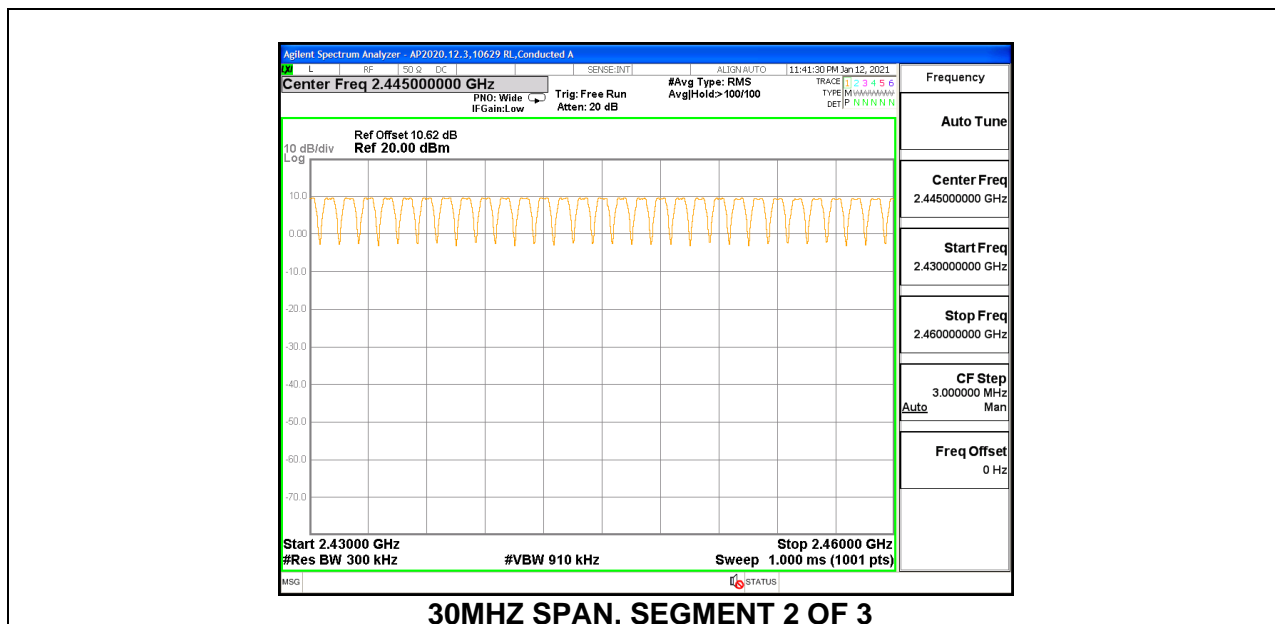
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

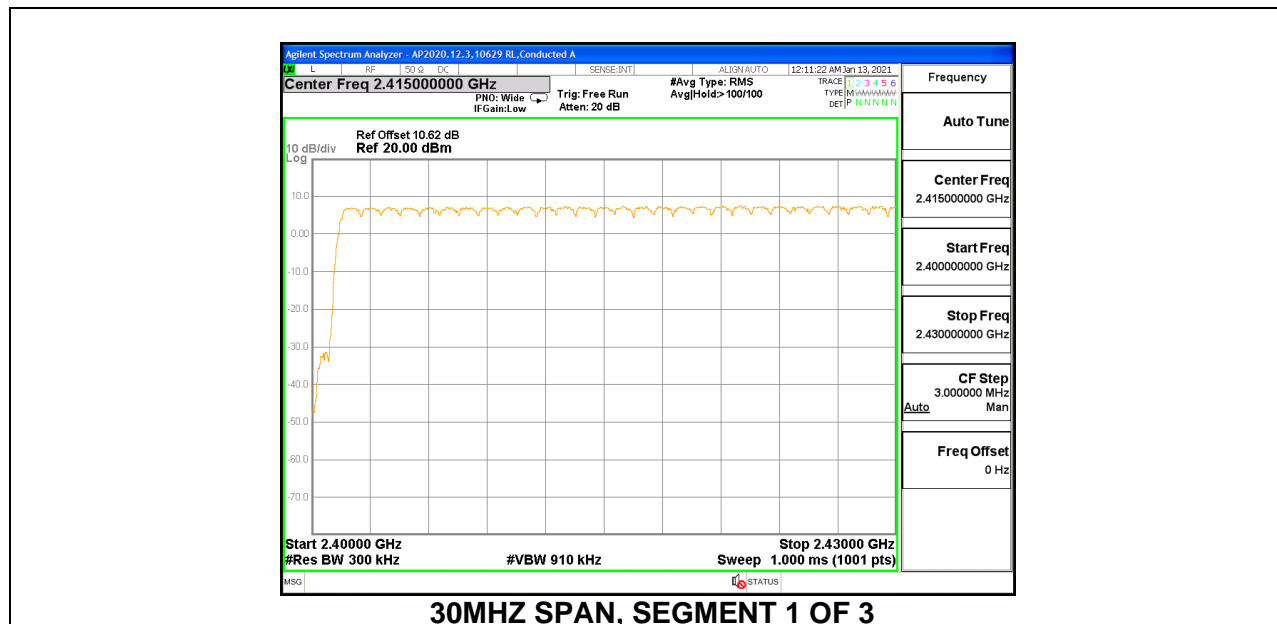
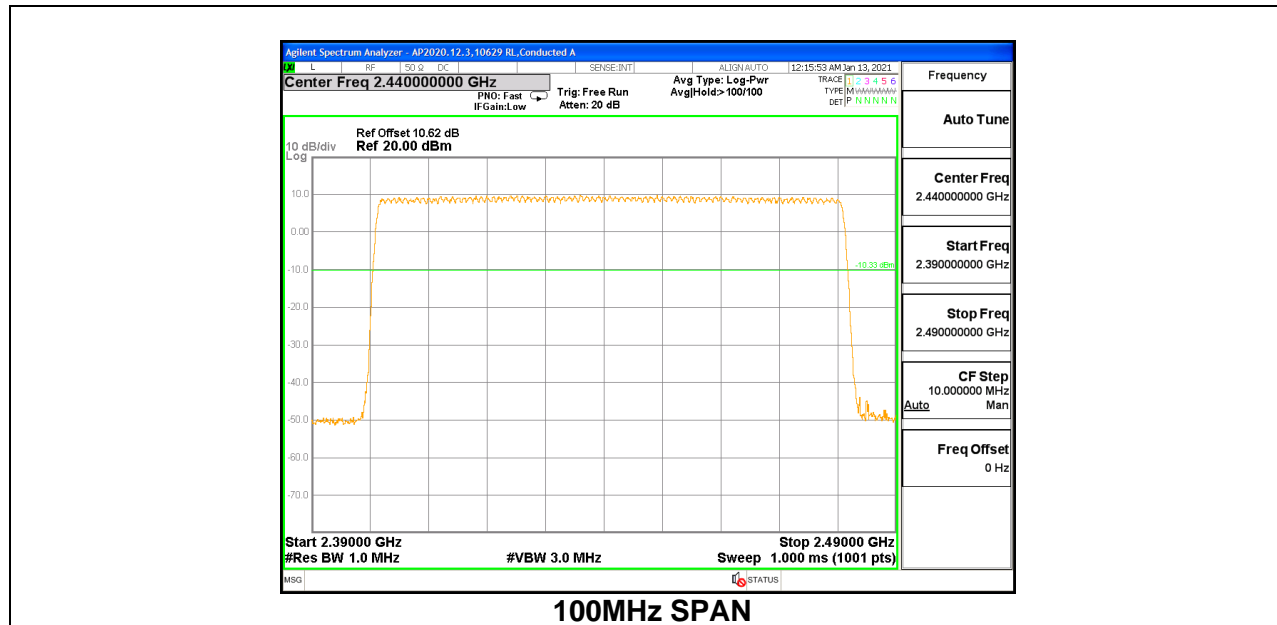
Normal Mode: 79 Channels Observed

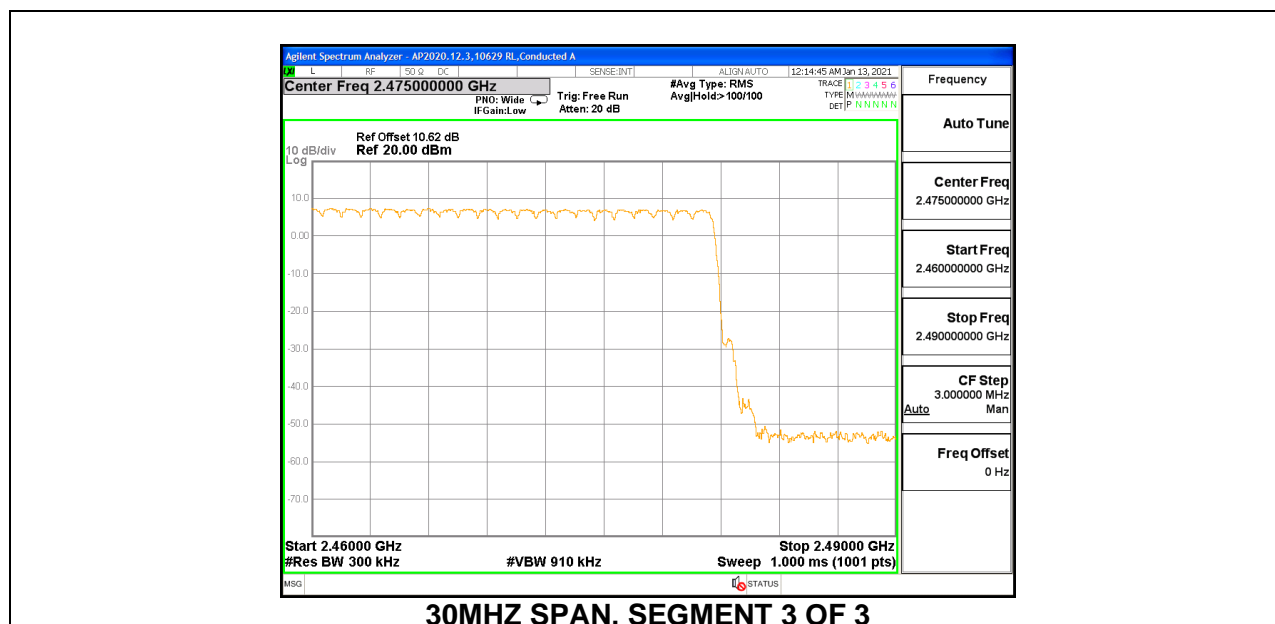
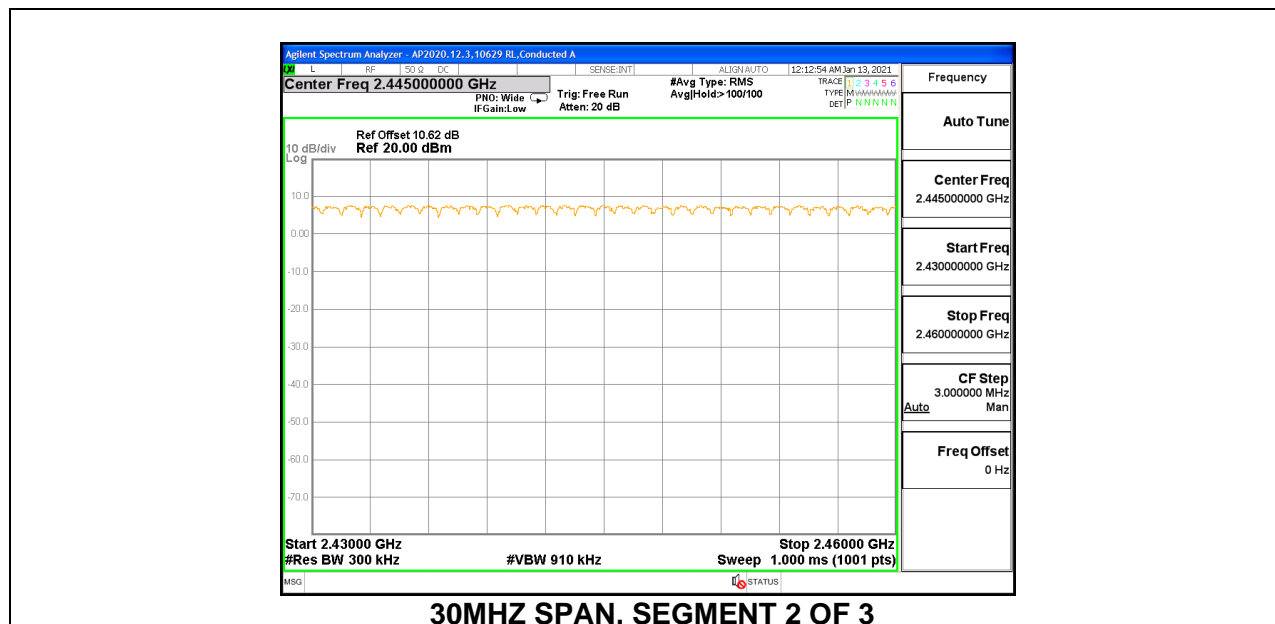
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION





9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION





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.

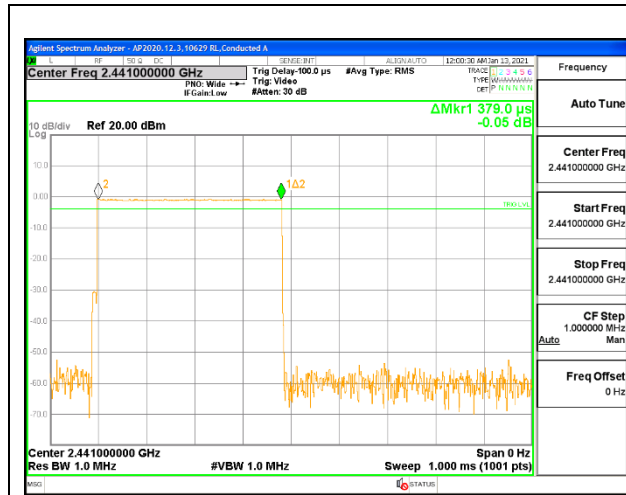
The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$.

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

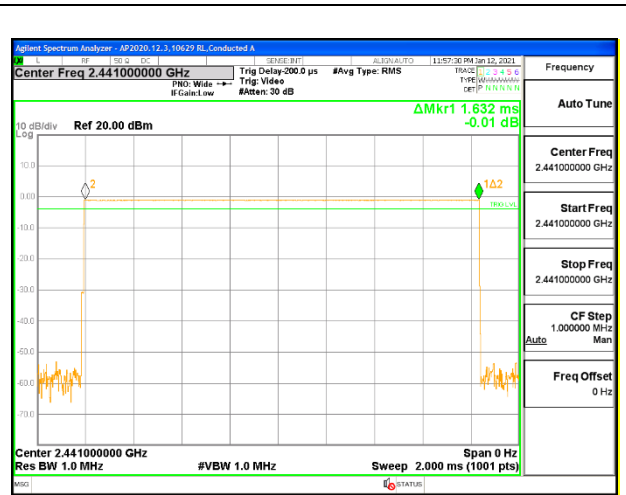
RESULTS

9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

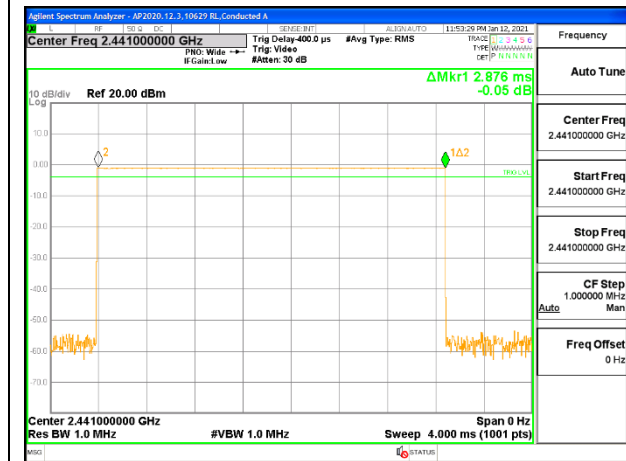
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.379	32	0.1213	0.4	-0.2787
DH3	1.632	19	0.3101	0.4	-0.0899
DH5	2.876	11	0.3164	0.4	-0.0836
GFSK AFH Mode					
DH Packet	Pulse Width (sec)	Number of Pulses 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	4.75	0.07752	0.4	-0.3225
DH5	2.876	2.75	0.07909	0.4	-0.3209



PULSE WIDTH - DH1



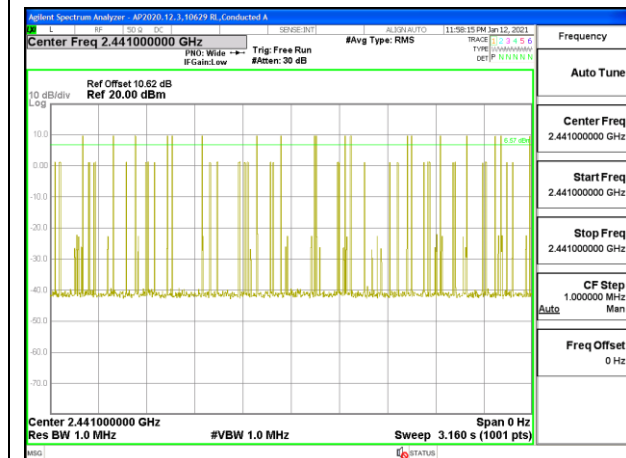
PULSE WIDTH - DH3



PULSE WIDTH - DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH3

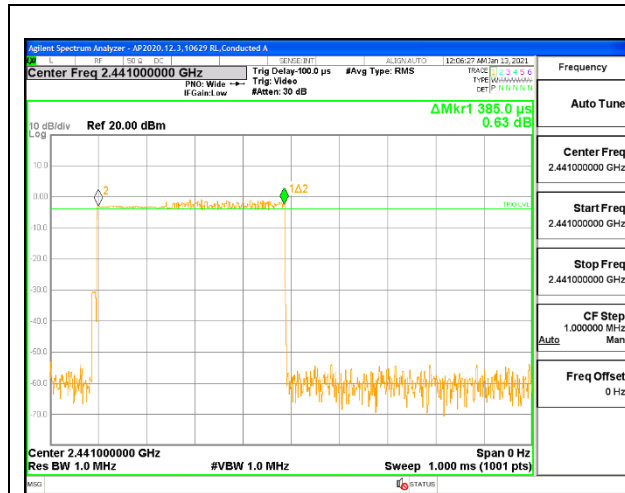


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH5

9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
3DH1	0.385	31	0.11935	0.4	-0.2807
3DH3	1.632	17	0.27744	0.4	-0.1226
3DH5	2.876	10	0.2876	0.4	-0.1124

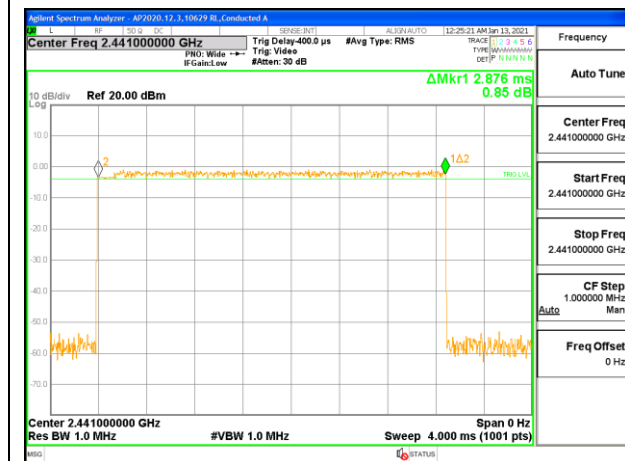
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.



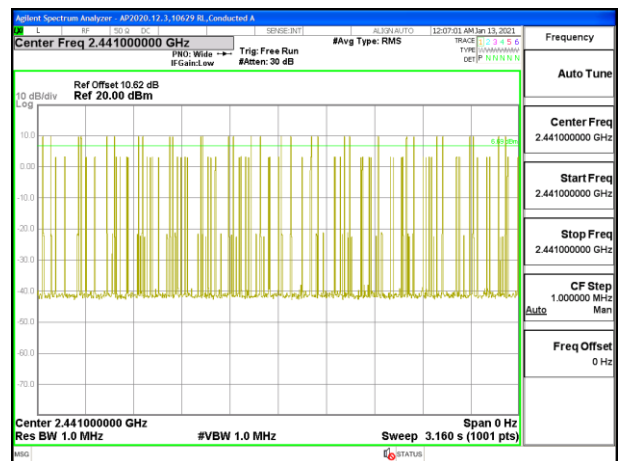
PULSE WIDTH – 3DH1



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 gated RF power meter.

The cable assembly insertion loss was entered as an offset in the power meter to allow for a peak reading of power.

RESULTS

9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	10629 RL
Date:	1/12/2021

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.35	21	-12.65
Middle	2441	8.74	21	-12.26
High	2480	8.12	21	-12.88

9.6.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	10629 RL
Date:	1/12/2021

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.75	21	-13.25
Middle	2441	7.73	21	-13.27
High	2480	7.03	21	-13.97

9.6.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	10629 RL
Date:	1/12/2021

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.25	21	-13.75
Middle	2441	7.54	21	-13.46
High	2480	6.82	21	-14.18

9.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	10629 RL
Date	1/12/2021

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	8.18
Middle	2441	8.56
High	2480	7.92

9.7.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	10629 RL
Date	1/12/2021

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	4.59
Middle	2441	4.88
High	2480	4.12

9.7.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	10629 RL
Date	1/12/2021

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	4.57
Middle	2441	4.86
High	2480	4.1

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.

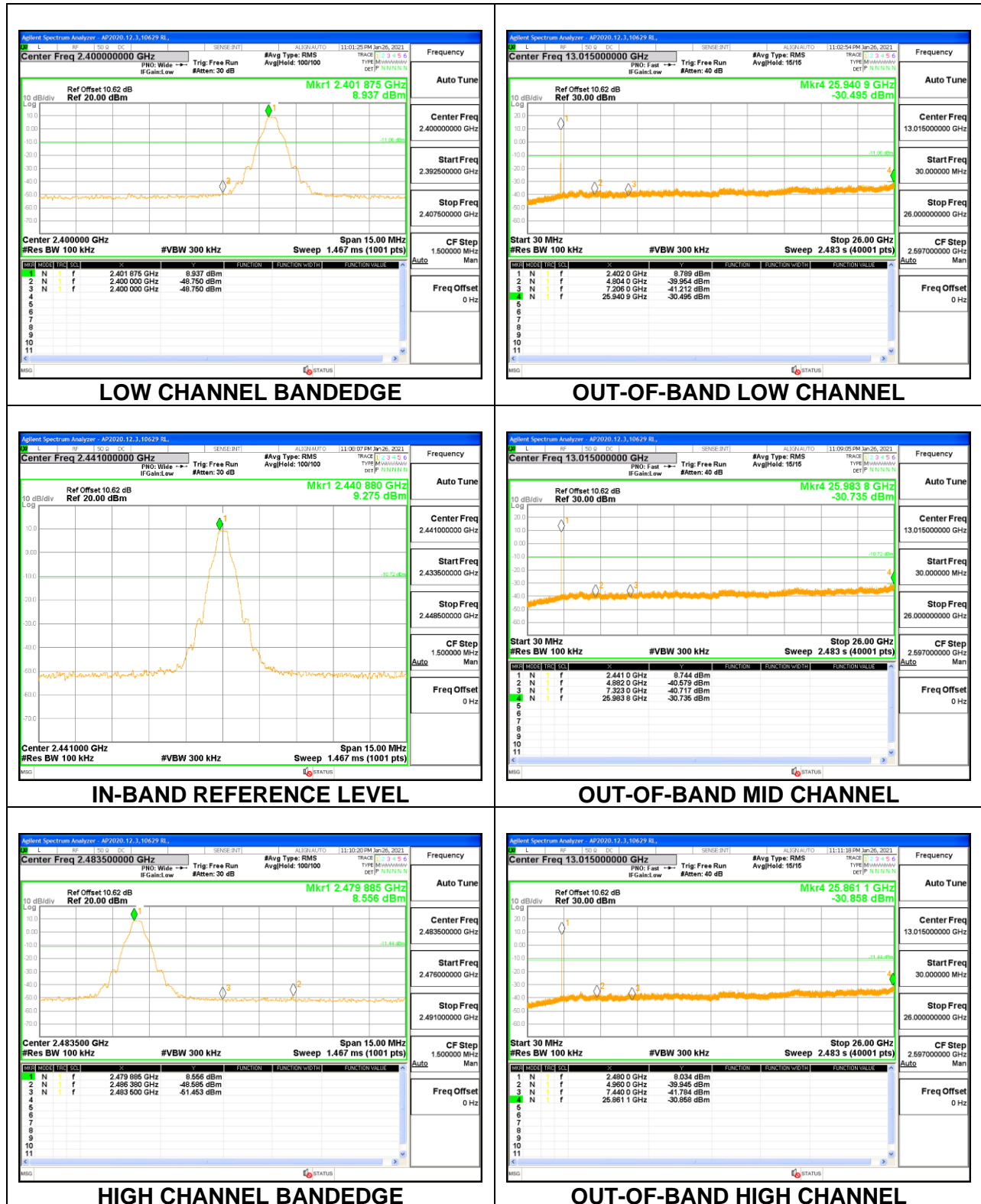
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

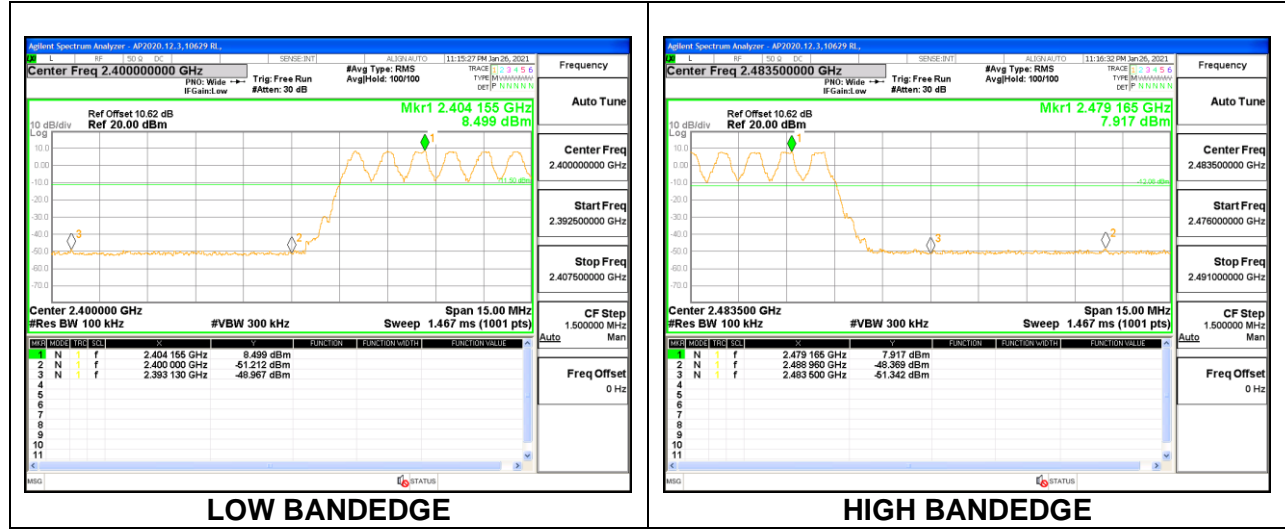
RESULTS

9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

SPURIOUS EMISSIONS, NON-HOPPING

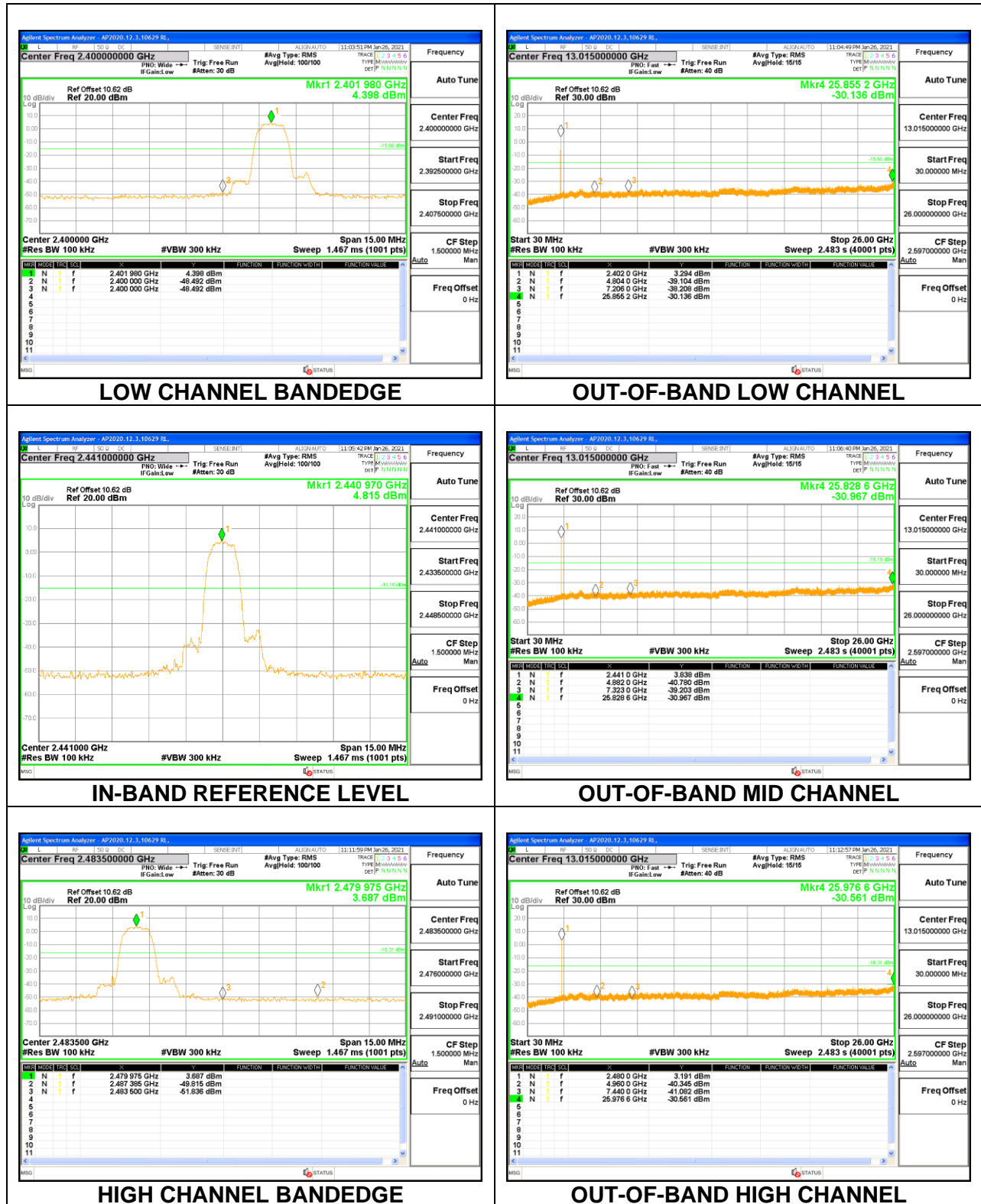


SPURIOUS BANDEGE EMISSIONS WITH HOPPING ON

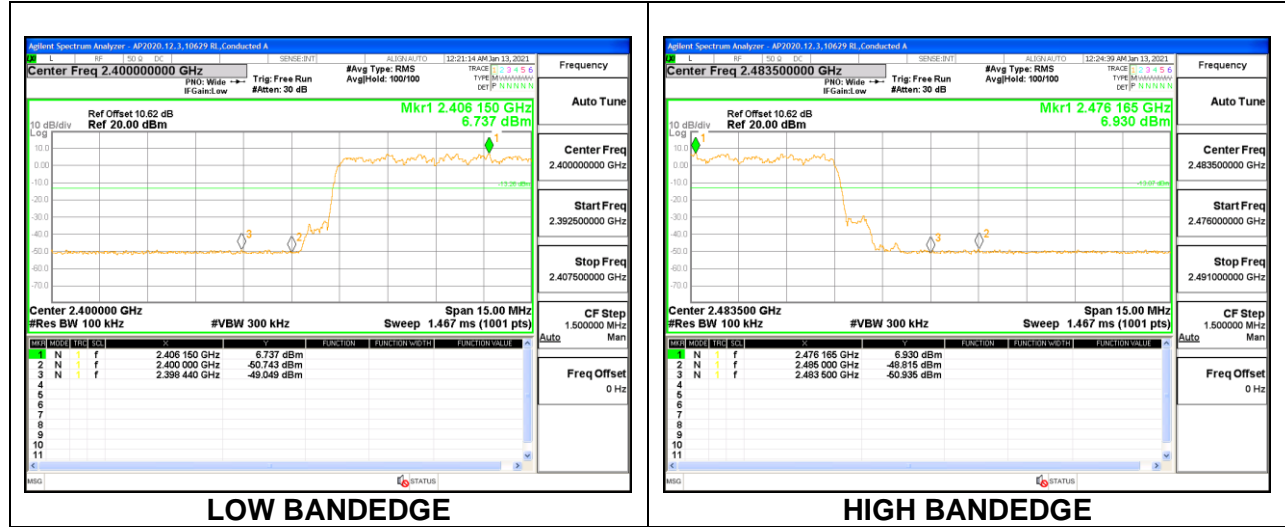


9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

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 v05r01

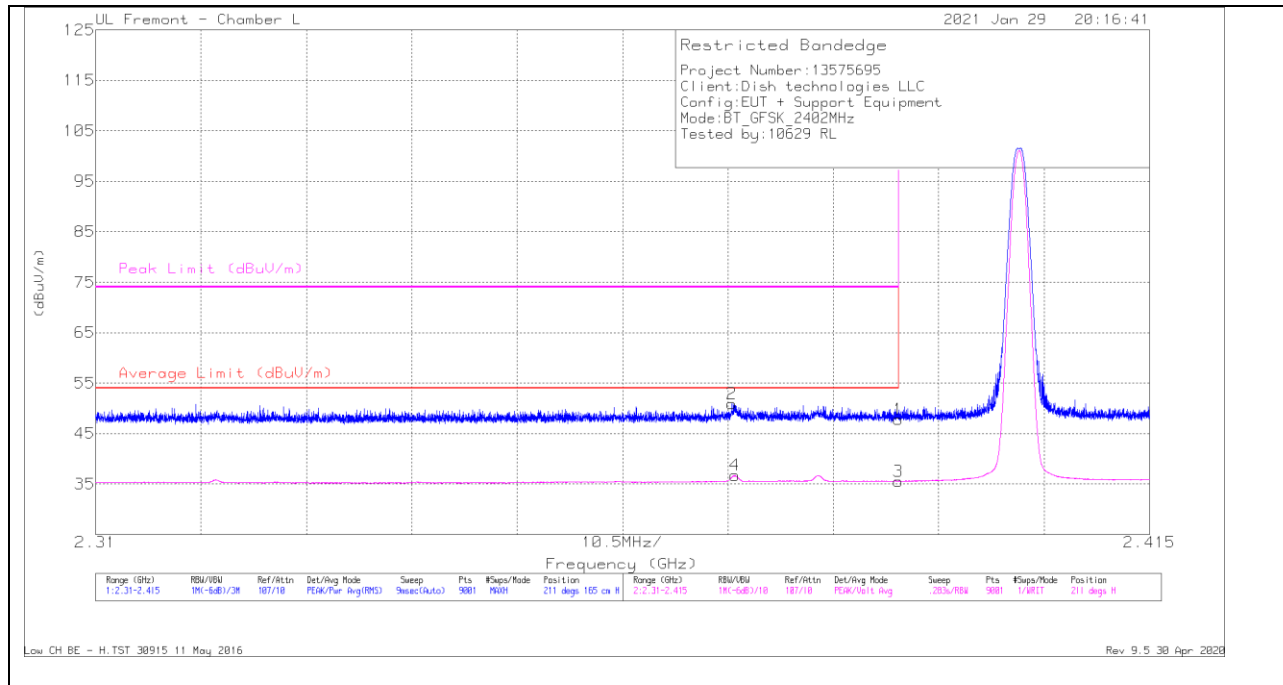
Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can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

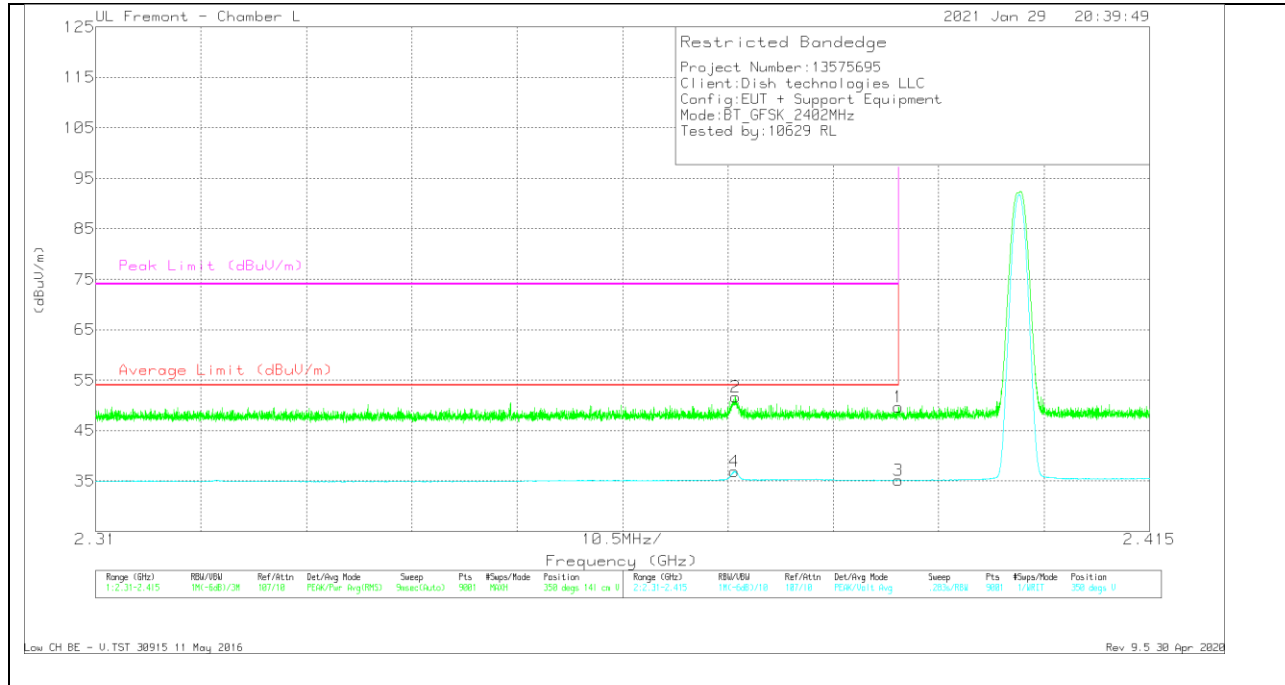
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/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	* 2.38999	37.05	Pk	31.9	-21.1	47.85	-	-	74	-26.15	211	165	H
2	* 2.3734	40.34	Pk	31.8	-21.2	50.94	-	-	74	-23.06	211	165	H
3	* 2.38999	24.77	VA1T	31.9	-21.1	35.57	54	-18.43	-	-	211	165	H
4	* 2.3737	26.1	VA1T	31.8	-21.2	36.7	54	-17.3	-	-	211	165	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

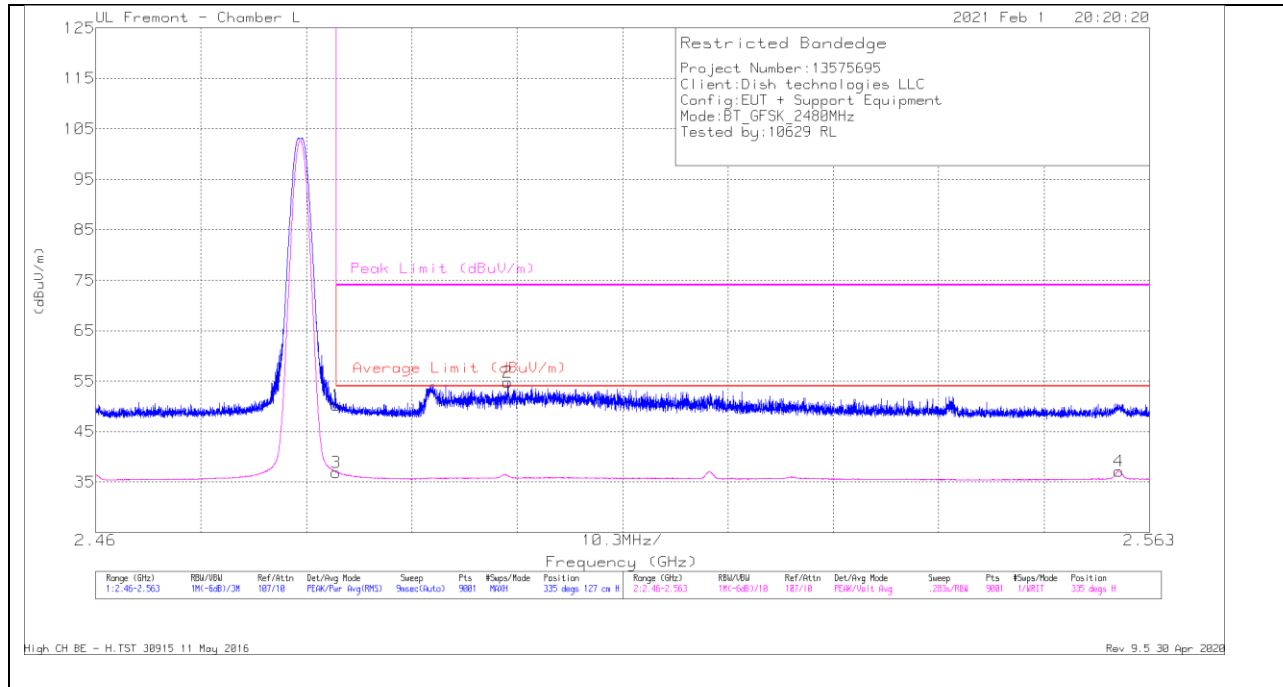


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	38.83	Pk	31.9	-21.1	49.63	-	-	74	-24.37	350	141	V
2	* 2.37377	41.09	Pk	31.8	-21.2	51.69	-	-	74	-22.31	350	141	V
3	* 2.38999	24.39	VA1T	31.9	-21.1	35.19	54	-18.81	-	-	350	141	V
4	* 2.37361	26.33	VA1T	31.8	-21.2	36.93	54	-17.07	-	-	350	141	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)

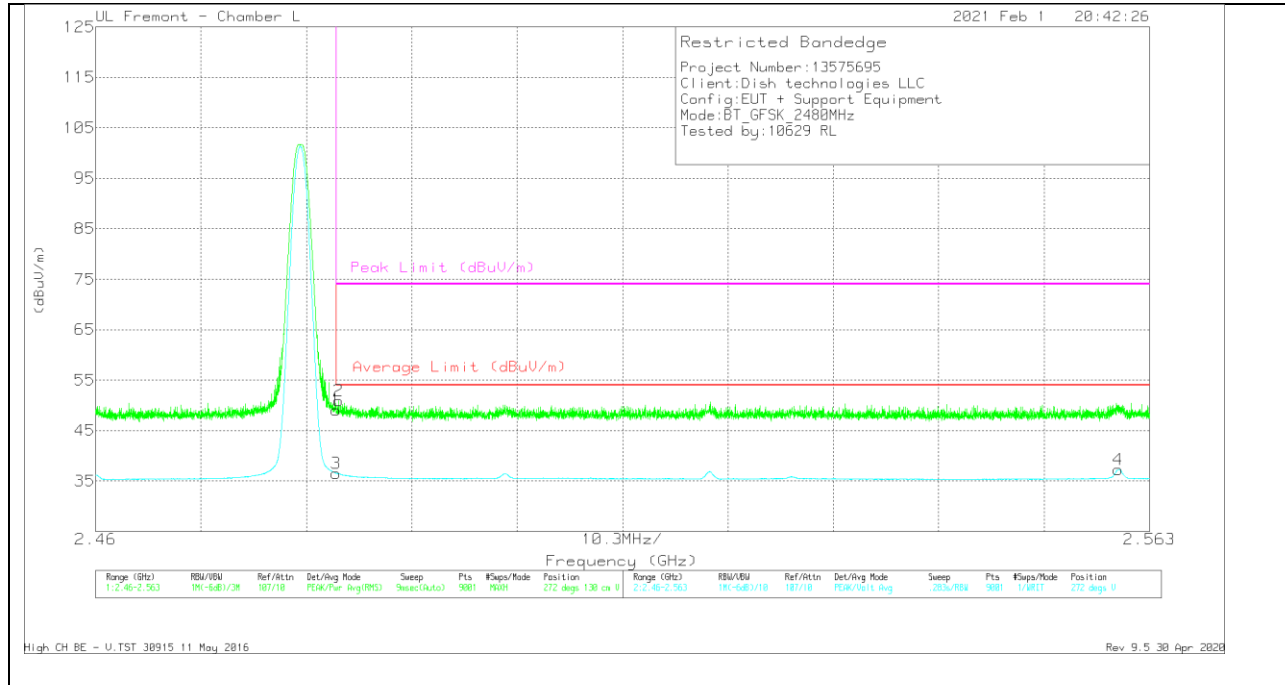
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/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	* 2.48351	38.75	Pk	32.3	-20.9	50.15	-	-	74	-23.85	335	127	H
2	2.50026	43.23	Pk	32.4	-20.9	54.73	-	-	74	-19.27	335	127	H
3	* 2.48351	25.53	VA1T	32.3	-20.9	36.93	54	-17.07	-	-	335	127	H
4	2.56002	25.53	VA1T	32.4	-20.8	37.13	54	-16.87	-	-	335	127	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

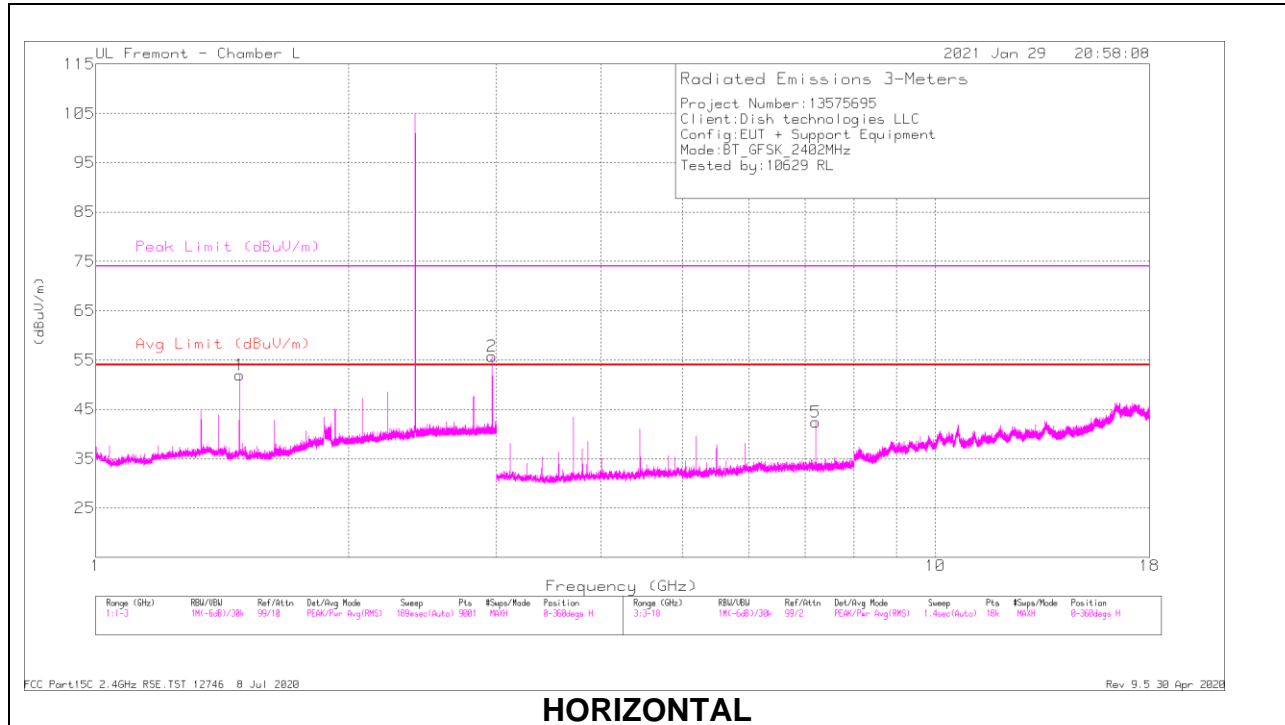


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	37.65	Pk	32.3	-20.9	49.05	-	-	74	-24.95	272	130	V
2	* 2.48376	39.56	Pk	32.3	-20.9	50.96	-	-	74	-23.04	272	130	V
3	* 2.48351	25.09	VA1T	32.3	-20.9	36.49	54	-17.51	-	-	272	130	V
4	2.55996	25.69	VA1T	32.4	-20.8	37.29	54	-16.71	-	-	272	130	V

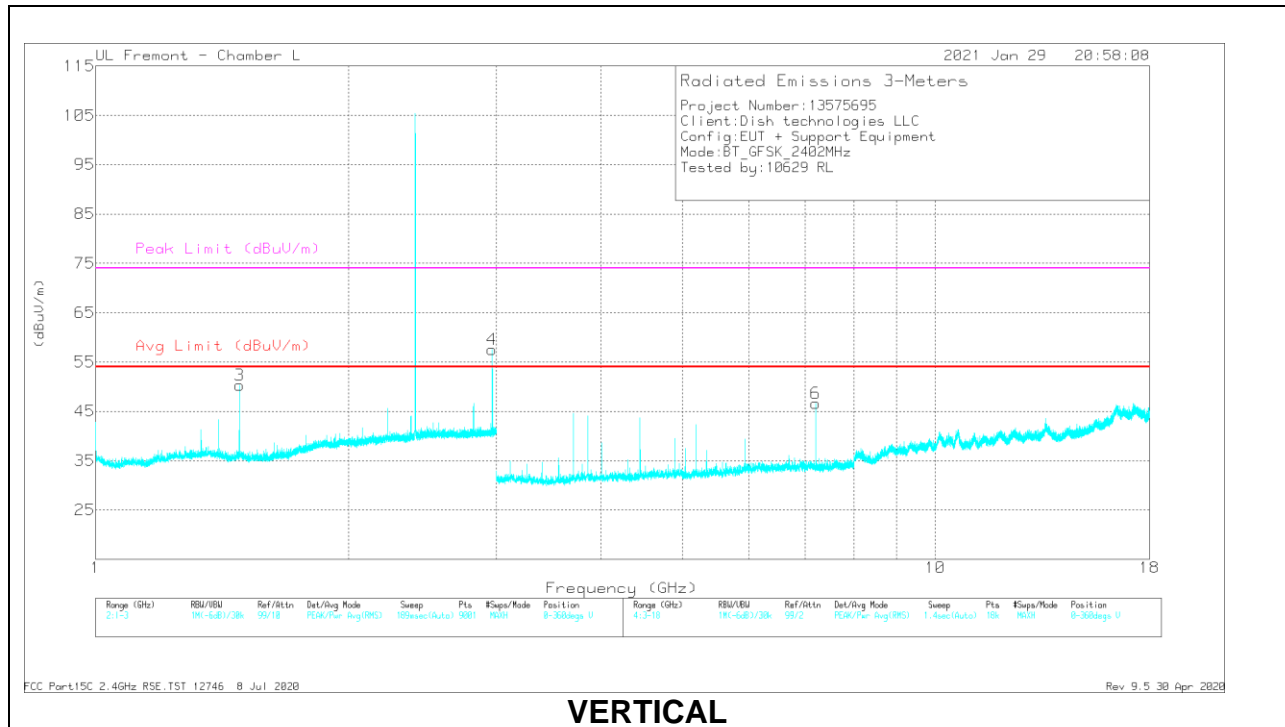
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



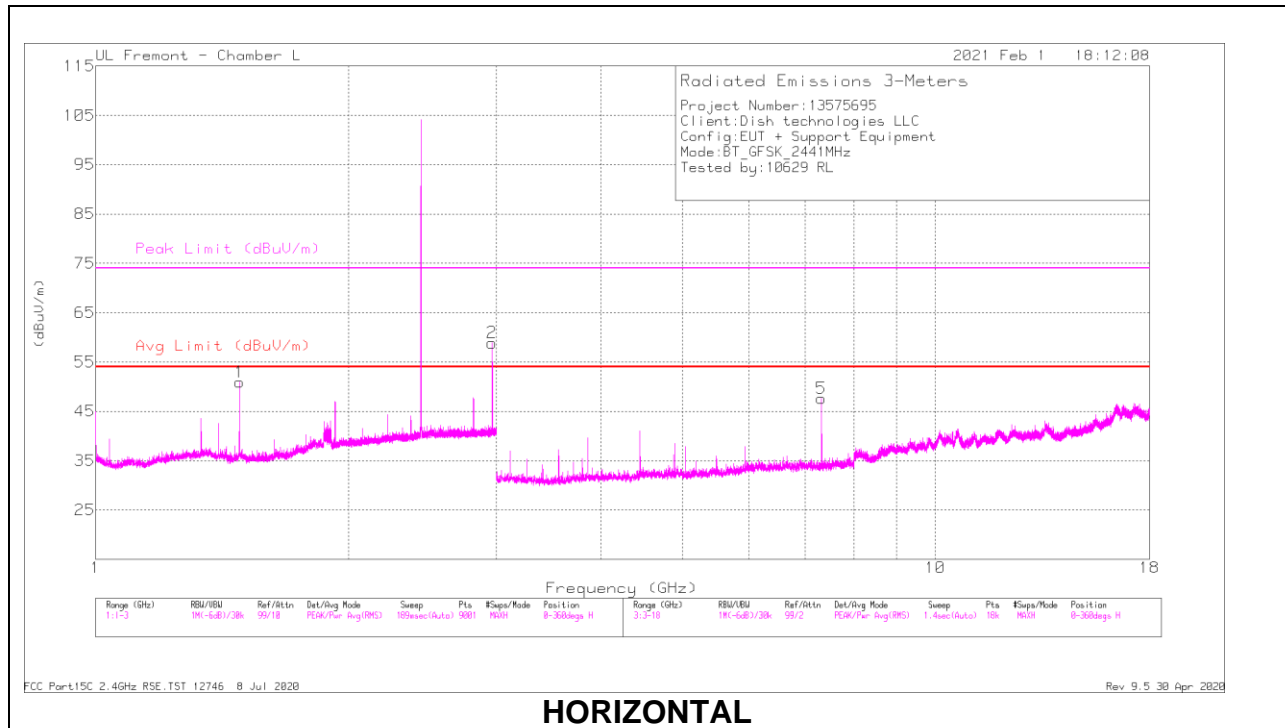
VERTICAL

RADIATED EMISSIONS

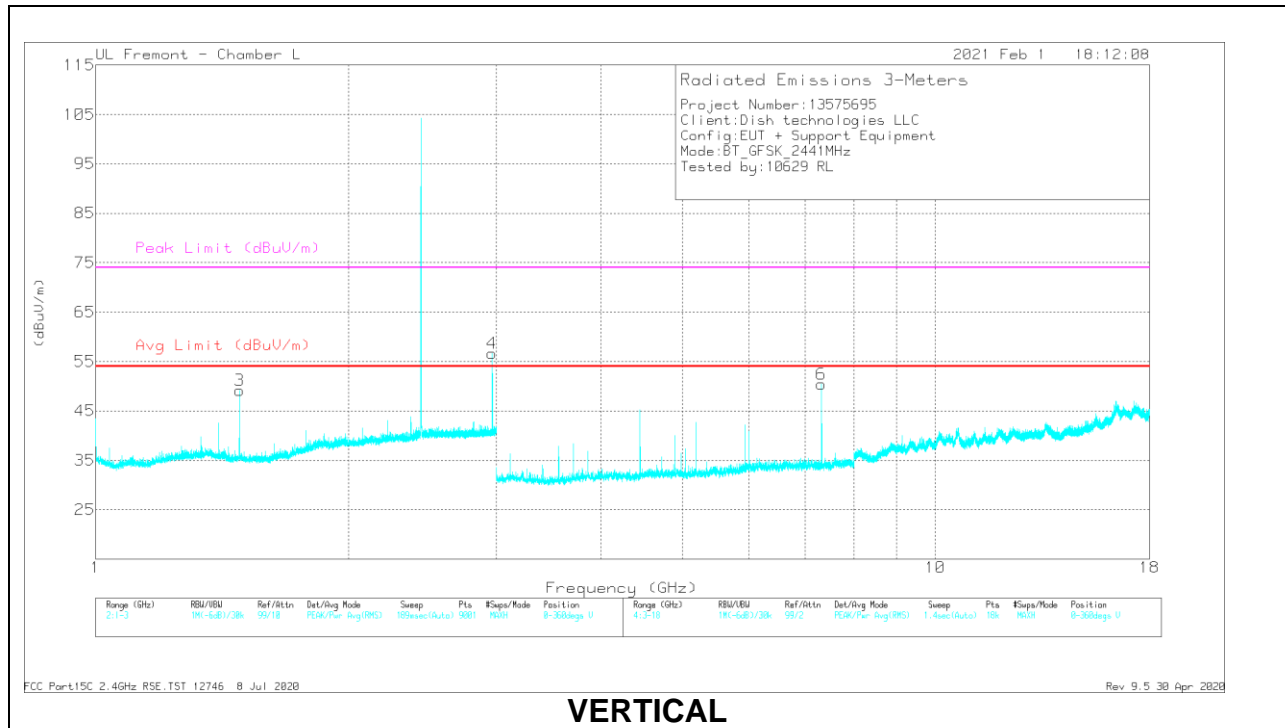
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.48358	49.35	PKFH	28.2	-23.1	54.45	-	-	74	-19.55	266	146	H
	* 1.48357	42.76	VA1T	28.2	-23.1	47.86	54	-6.14	-	-	266	146	H
2	2.96703	47.14	PKFH	32.6	-20.1	59.64	-	-	-	-	169	256	H
3	* 1.48349	50.45	PKFH	28.2	-23.1	55.55	-	-	74	-18.45	54	126	V
	* 1.48354	43.09	VA1T	28.2	-23.1	48.19	54	-5.81	-	-	54	126	V
4	2.96697	46.14	PKFH	32.6	-20.1	58.64	-	-	-	-	171	195	V
5	7.20554	35.6	PKFH	35.5	-23.9	47.2	-	-	-	-	60	108	H
6	7.20562	37.19	PKFH	35.5	-23.9	48.79	-	-	-	-	90	107	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

MID CHANNEL RESULTS



HORIZONTAL



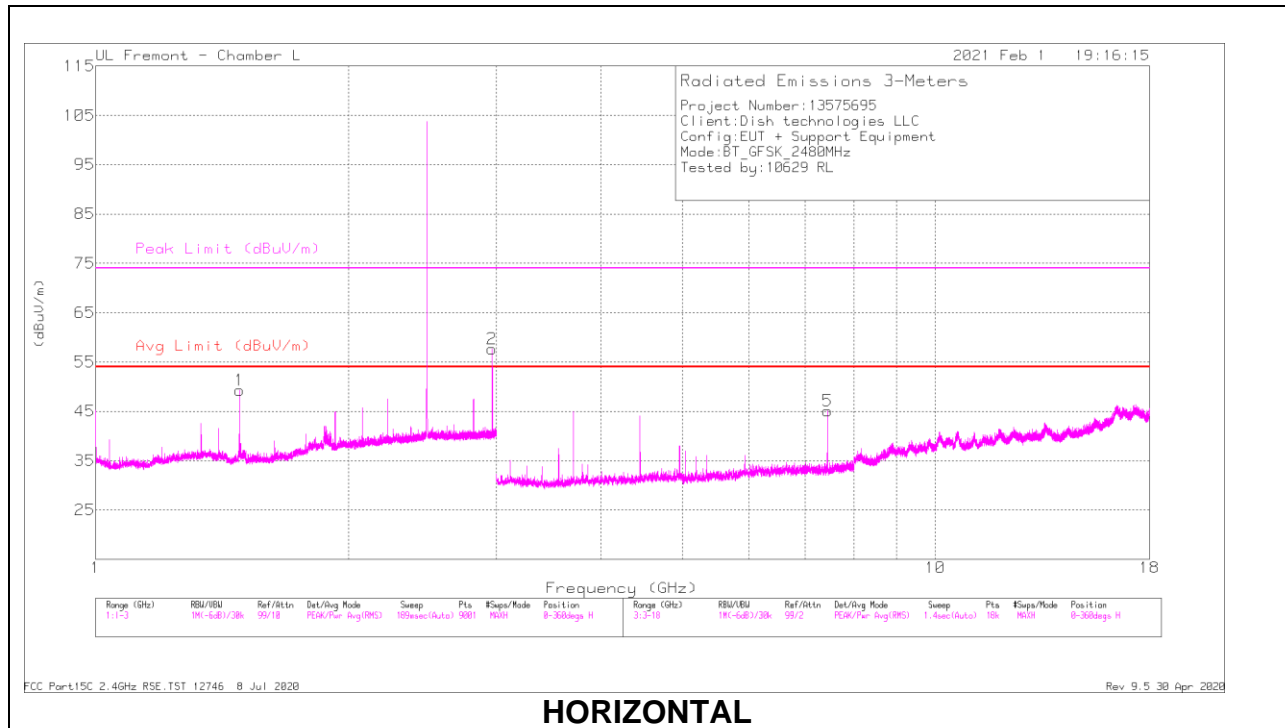
VERTICAL

RADIATED EMISSIONS

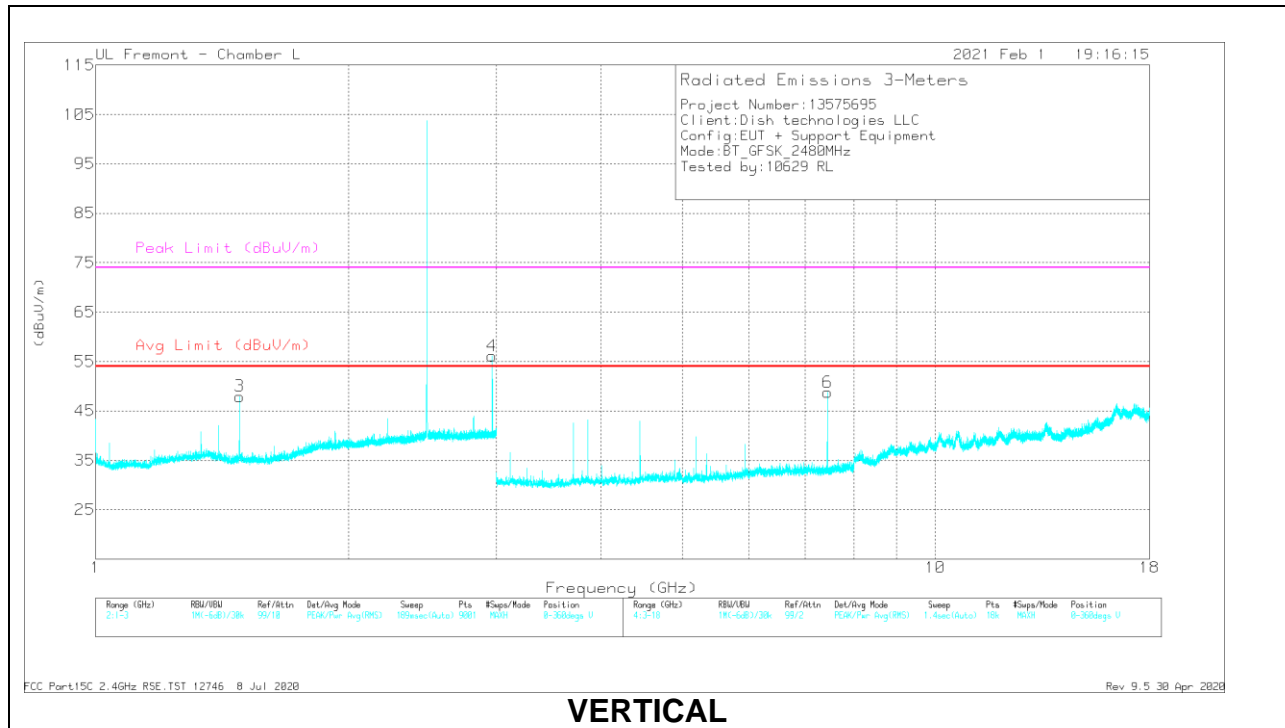
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.48366	49.08	PKFH	28.2	-23.1	54.18	-	-	74	-19.82	188	137	H
	* 1.48356	43.07	VA1T	28.2	-23.1	48.17	54	-5.83	-	-	188	137	H
2	2.96716	50.18	PKFH	32.6	-20.1	62.68	-	-	-	-	185	174	H
	* 1.48363	49.3	PKFH	28.2	-23.1	54.4	-	-	74	-19.6	208	233	V
3	* 1.48357	42.93	VA1T	28.2	-23.1	48.03	54	-5.97	-	-	208	233	V
	2.96716	47.92	PKFH	32.6	-20.1	60.42	-	-	-	-	3	390	V
4	* 7.32335	38.81	PKFH	35.5	-23.5	50.81	-	-	74	-23.19	24	102	H
	* 7.32298	33.09	VA1T	35.5	-23.5	45.09	54	-8.91	-	-	24	102	H
5	* 7.32346	40.07	PKFH	35.5	-23.5	52.07	-	-	74	-21.93	85	101	V
	* 7.32297	34.86	VA1T	35.5	-23.5	46.86	54	-7.14	-	-	85	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

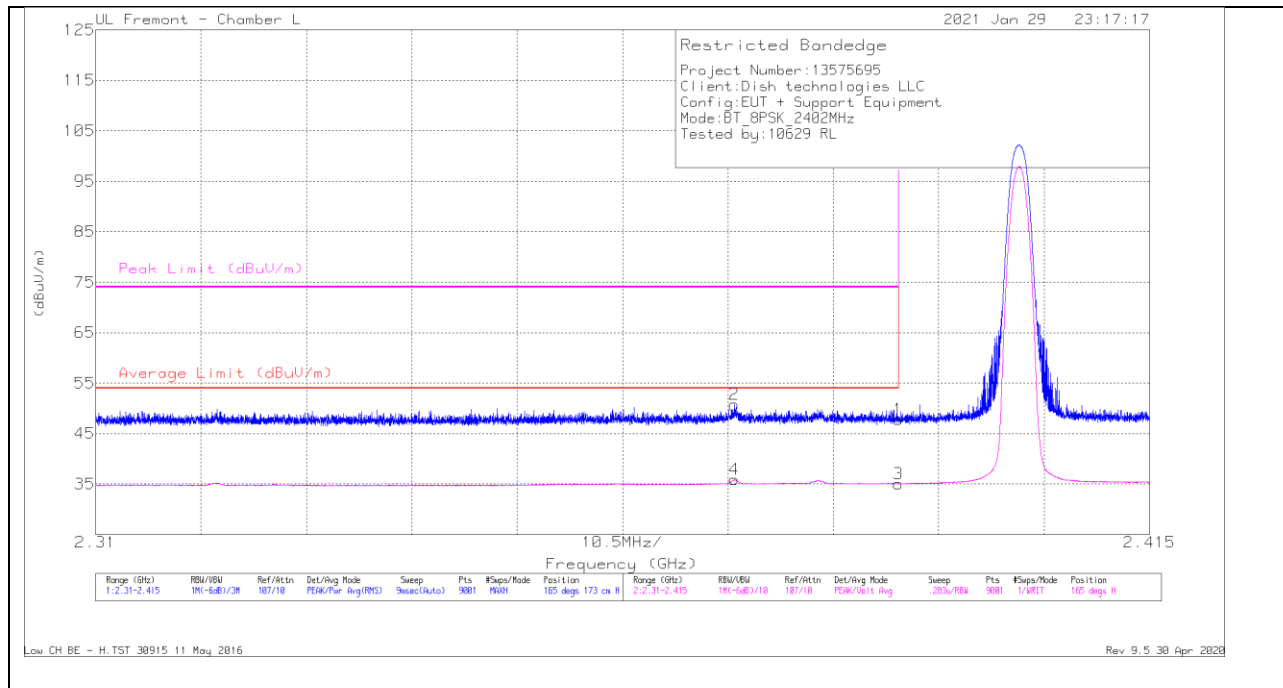
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.48341	49.35	PKFH	28.2	-23.1	54.45	-	-	74	-19.55	189	138	H
	* 1.48357	43.14	VA1T	28.2	-23.1	48.24	54	-5.76	-	-	189	138	H
2	2.96709	49.84	PKFH	32.6	-20.1	62.34	-	-	-	-	193	188	H
3	* 1.48348	47.21	PKFH	28.2	-23.1	52.31	-	-	74	-21.69	166	102	V
	* 1.48352	40.6	VA1T	28.2	-23.1	45.7	54	-8.3	-	-	166	102	V
4	2.96715	48.65	PKFH	32.6	-20.1	61.15	-	-	-	-	171	106	V
5	* 7.44019	36.21	PKFH	35.6	-23.2	48.61	-	-	74	-25.39	20	106	H
	* 7.43998	30.21	VA1T	35.6	-23.2	42.61	54	-11.39	-	-	20	106	H
6	* 7.43958	40.7	PKFH	35.6	-23.2	53.1	-	-	74	-20.9	82	101	V
	* 7.44	35.32	VA1T	35.6	-23.2	47.72	54	-6.28	-	-	82	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
 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)

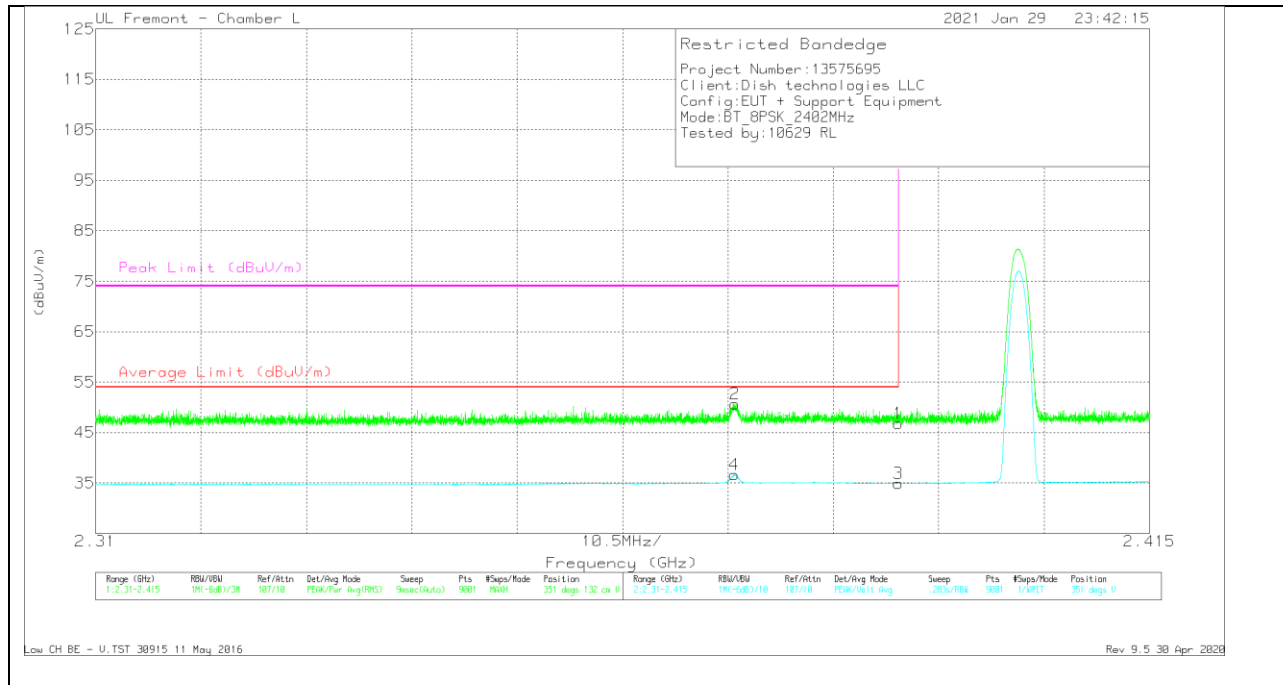
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cb/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	* 2.38999	37.02	Pk	31.9	-21.1	47.82	-	-	74	-26.18	165	173	H
2	* 2.37366	40.13	Pk	31.8	-21.2	50.73	-	-	74	-23.27	165	173	H
3	* 2.38999	24.25	VA1T	31.9	-21.1	35.05	54	-18.95	-	-	165	173	H
4	* 2.37366	25.25	VA1T	31.8	-21.2	35.85	54	-18.15	-	-	165	173	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

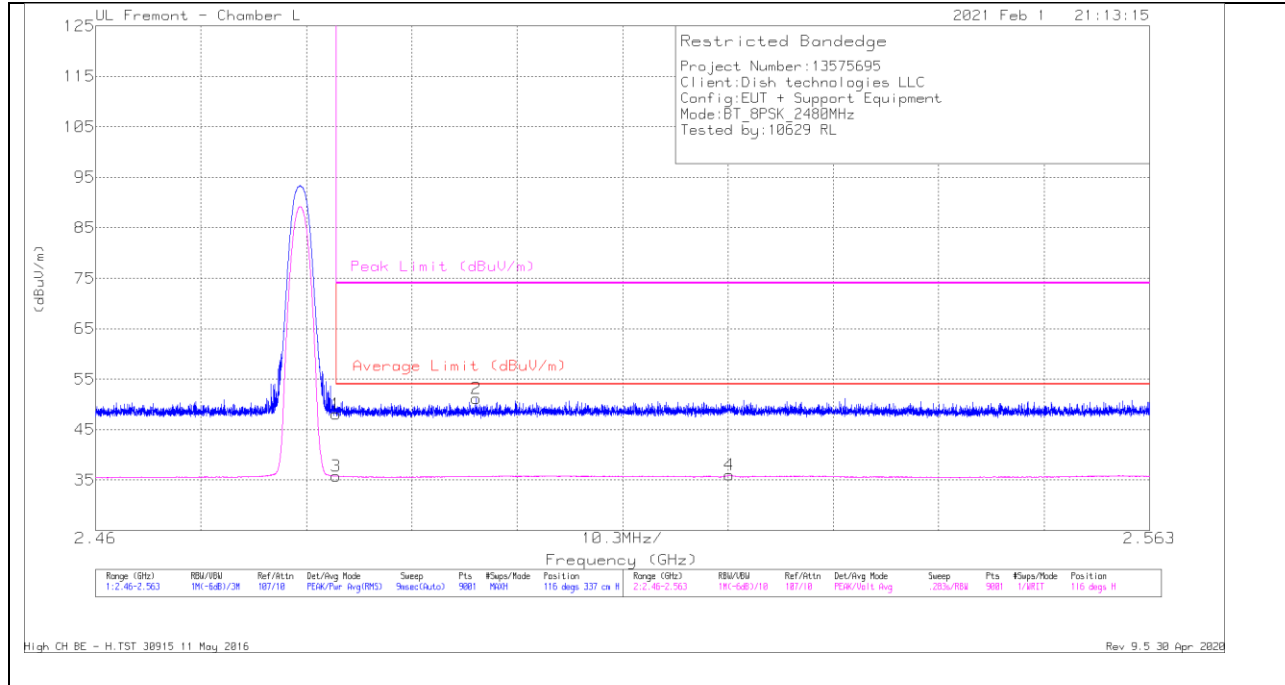


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	36.04	Pk	31.9	-21.1	46.84	-	-	74	-27.16	351	132	V
2	* 2.37367	40.12	Pk	31.8	-21.2	50.72	-	-	74	-23.28	351	132	V
3	* 2.38999	24.1	VA1T	31.9	-21.1	34.9	54	-19.1	-	-	351	132	V
4	* 2.37363	26.09	VA1T	31.8	-21.2	36.69	54	-17.31	-	-	351	132	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)

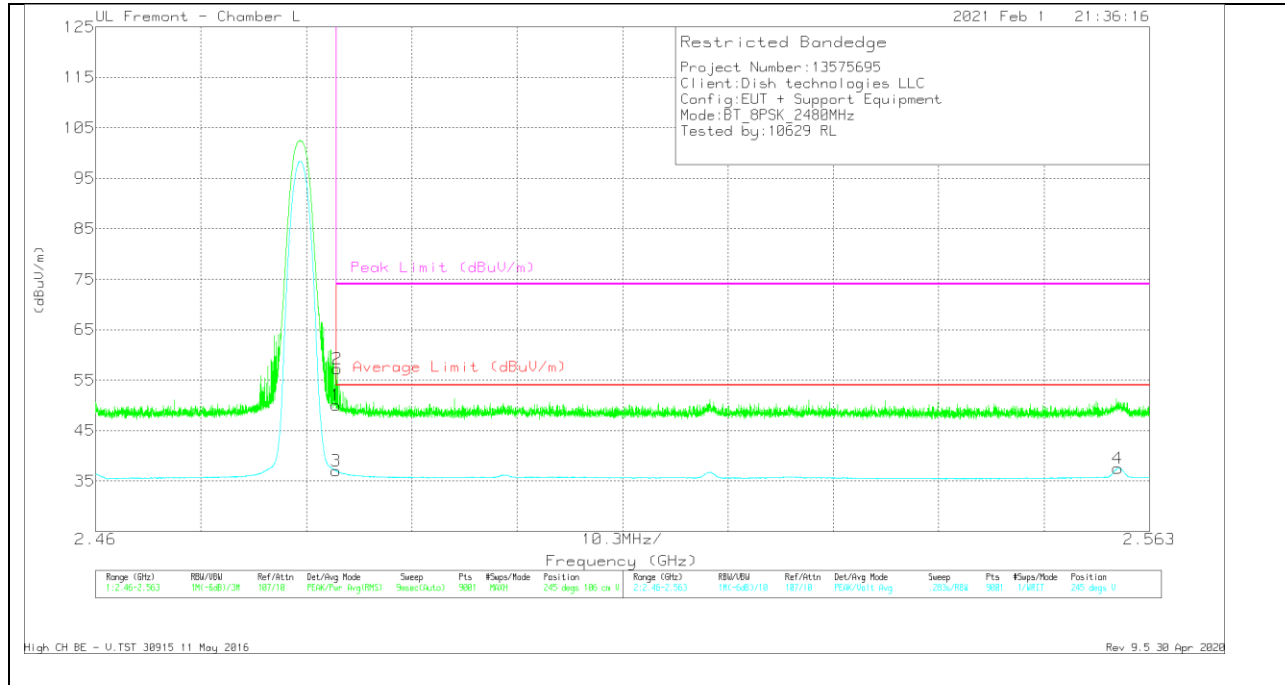
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/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	* 2.48351	36.68	Pk	32.3	-20.9	48.08	-	-	74	-25.92	116	337	H
2	* 2.49719	39.74	Pk	32.3	-20.9	51.14	-	-	74	-22.86	116	337	H
3	* 2.48351	24.38	VA1T	32.3	-20.9	35.78	54	-18.22	-	-	116	337	H
4	2.52192	24.57	VA1T	32.3	-20.9	35.97	54	-18.03	-	-	116	337	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

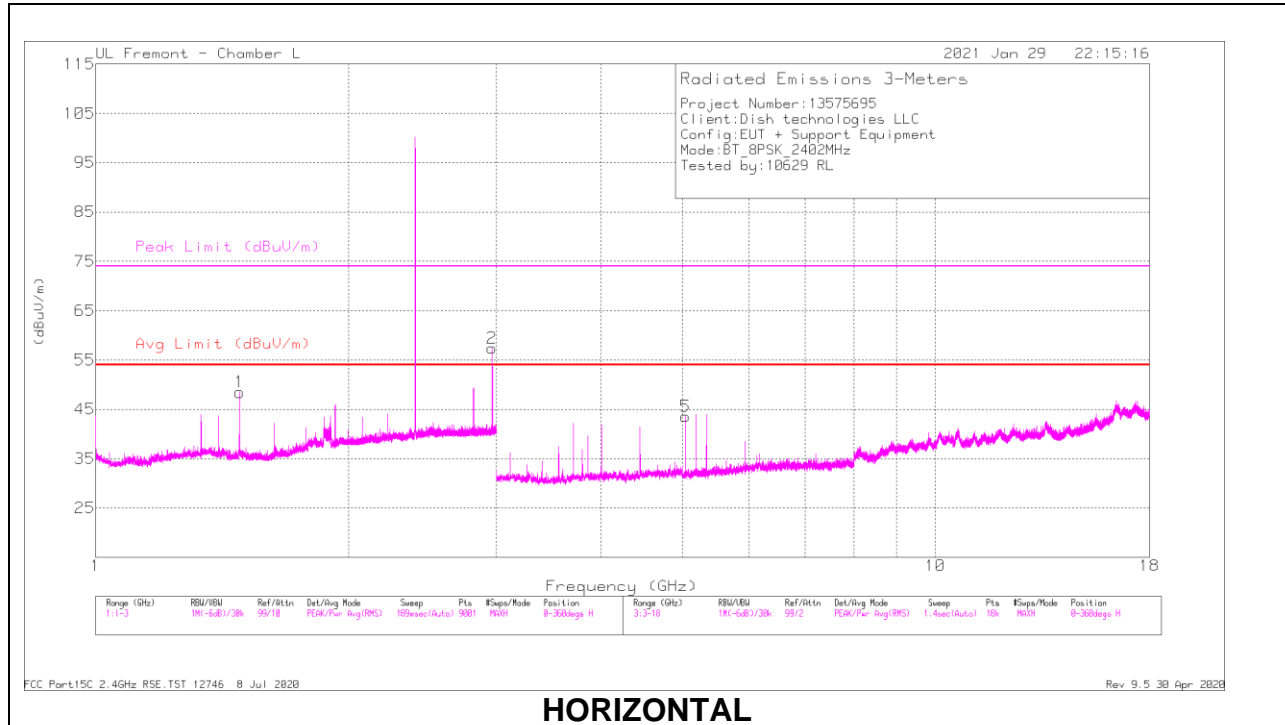


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	38.67	Pk	32.3	-20.9	50.07	-	-	74	-23.93	245	106	V
2	* 2.48364	45.89	Pk	32.3	-20.9	57.29	-	-	74	-16.71	245	106	V
3	* 2.48351	25.64	VA1T	32.3	-20.9	37.04	54	-16.96	-	-	245	106	V
4	2.55991	25.91	VA1T	32.4	-20.8	37.51	54	-16.49	-	-	245	106	V

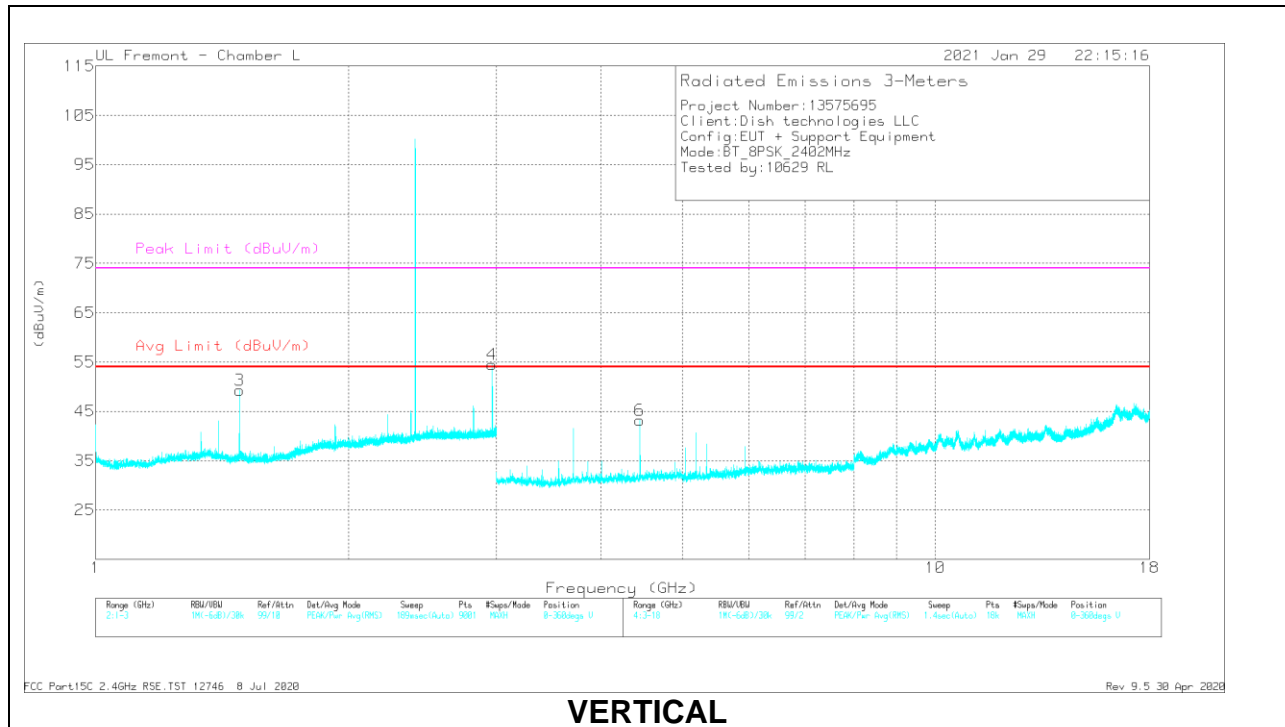
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



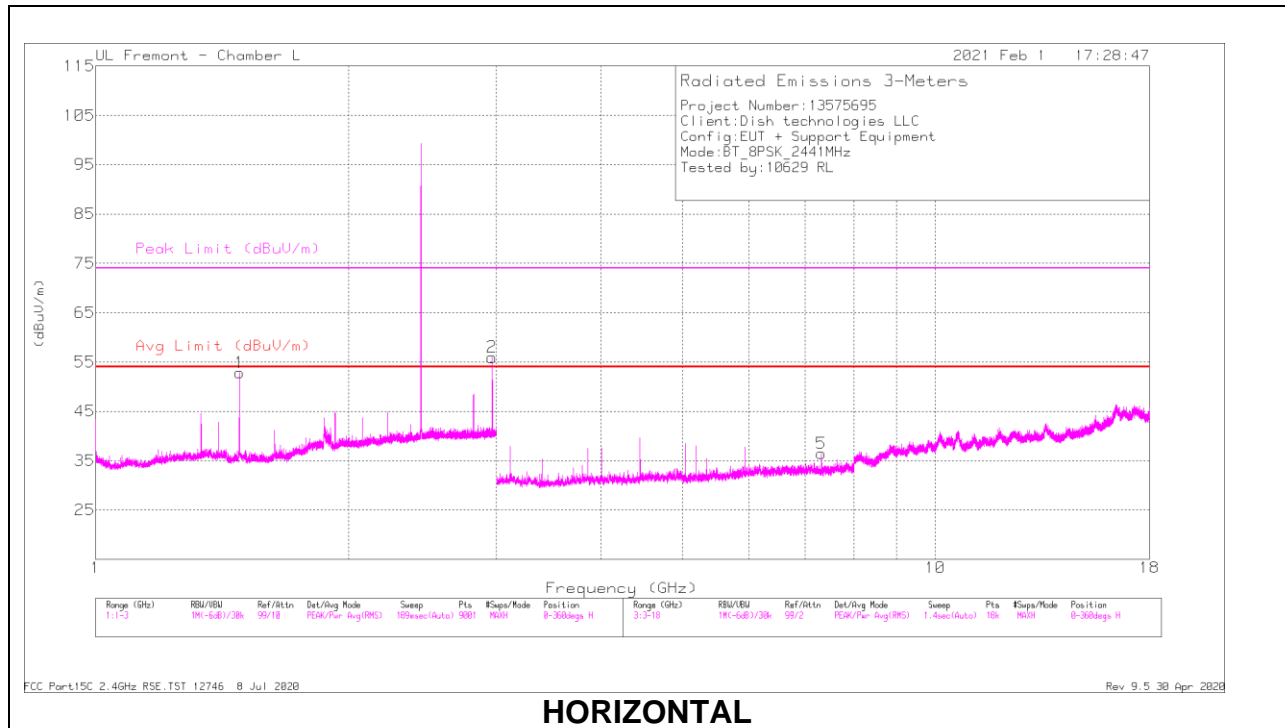
VERTICAL

RADIATED EMISSIONS

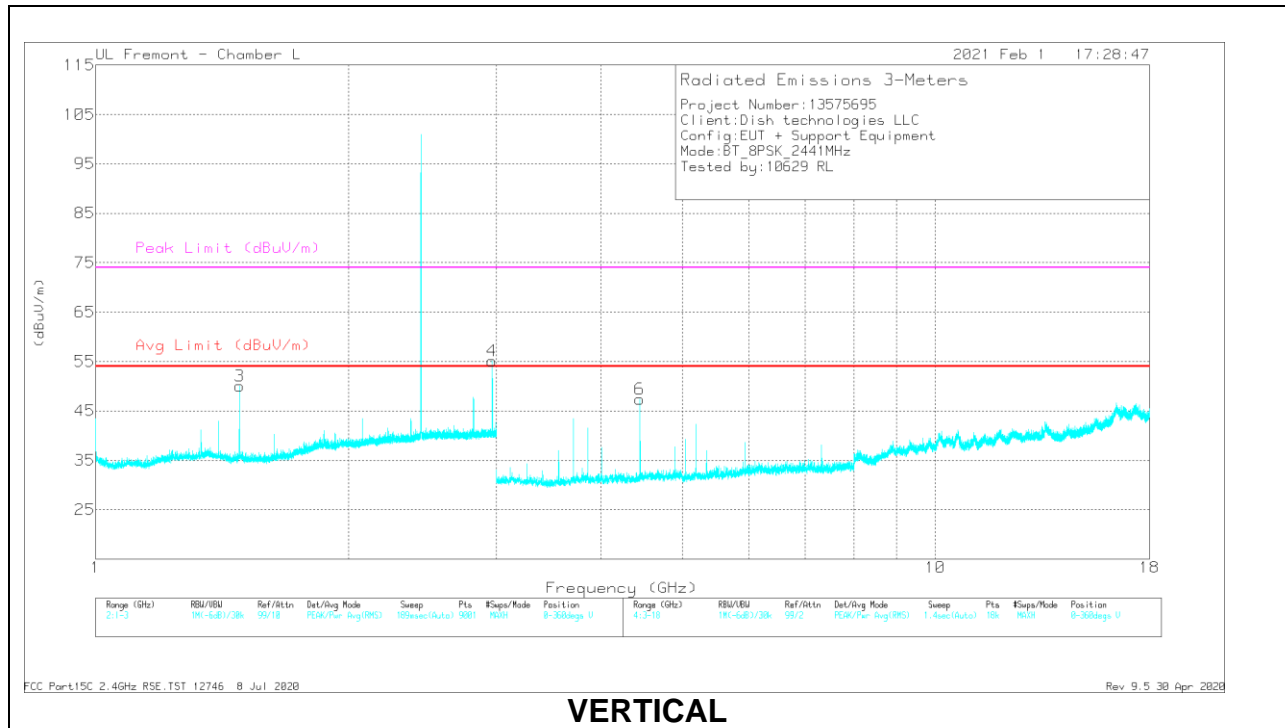
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.48355	49.28	PKFH	28.2	-23.1	54.38	-	-	74	-19.62	355	191	H
	* 1.48352	42.54	VA1T	28.2	-23.1	47.64	54	-6.36	-	-	355	191	H
2	2.96688	46.06	PKFH	32.6	-20.1	58.56	-	-	-	-	99	155	H
3	* 1.48356	49.09	PKFH	28.2	-23.1	54.19	-	-	74	-19.81	54	124	V
	* 1.48356	42.23	VA1T	28.2	-23.1	47.33	54	-6.67	-	-	54	124	V
4	2.96702	46.07	PKFH	32.6	-20.1	58.57	-	-	-	-	164	194	V
5	* 5.044	39.5	PKFH	34.2	-27.1	46.6	-	-	74	-27.4	151	109	H
	* 5.044	23.52	VA1T	34.2	-27.1	30.62	54	-23.38	-	-	151	109	H
6	4.45058	41.03	PKFH	33.7	-27.2	47.53	-	-	-	-	22	112	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

MID CHANNEL RESULTS



HORIZONTAL



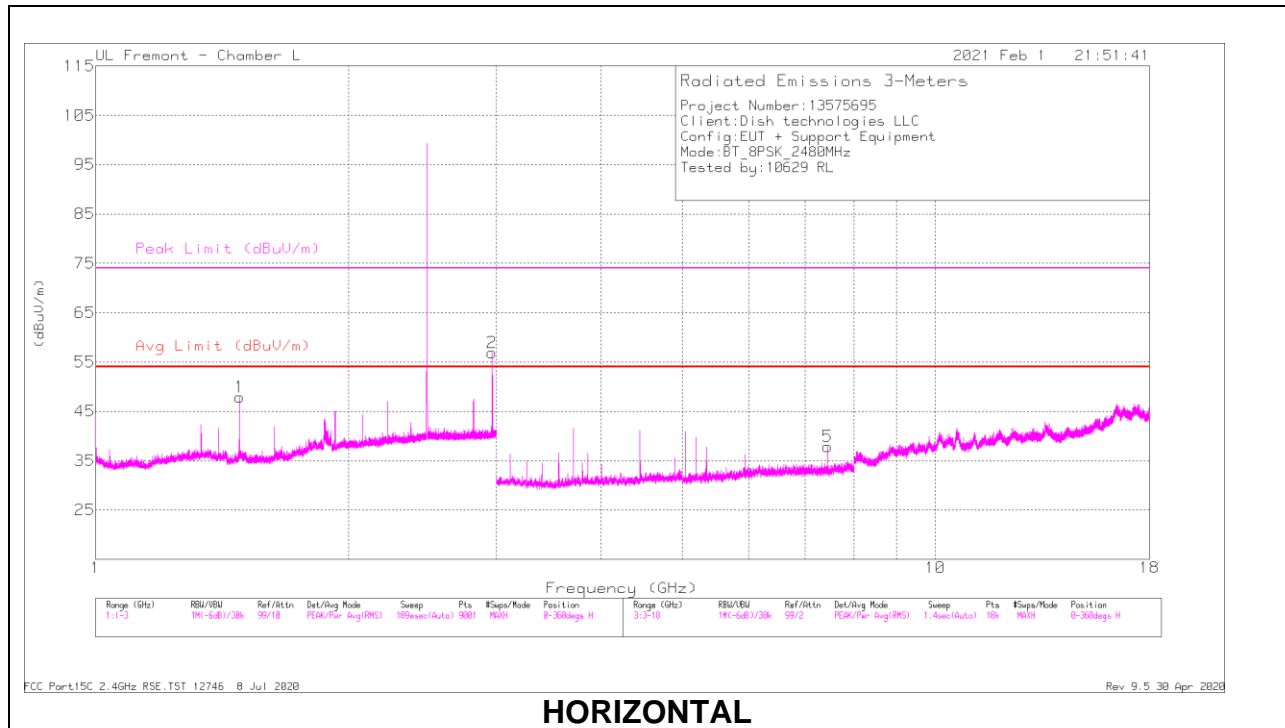
VERTICAL

RADIATED EMISSIONS

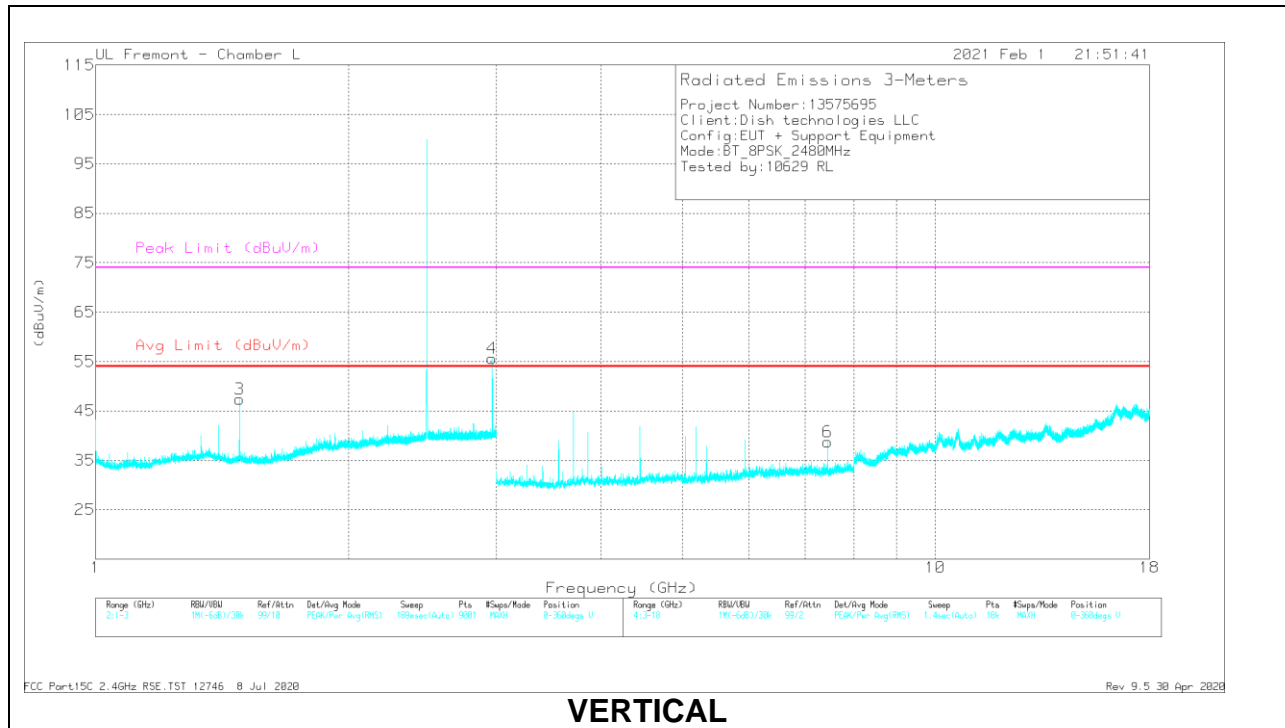
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.4836	49.72	PKFH	28.2	-23.1	54.82	-	-	74	-19.18	355	193	H
	* 1.48352	42.77	VA1T	28.2	-23.1	47.87	54	-6.13	-	-	355	193	H
2	2.9672	46.7	PKFH	32.6	-20.1	59.2	-	-	-	-	187	135	H
3	* 1.48359	49.31	PKFH	28.2	-23.1	54.41	-	-	74	-19.59	32	396	V
	* 1.48358	42.09	VA1T	28.2	-23.1	47.19	54	-6.81	-	-	32	396	V
4	2.96726	45.74	PKFH	32.6	-20.1	58.24	-	-	-	-	203	105	V
5	* 7.32304	31.38	PKFH	35.5	-23.5	43.38	-	-	74	-30.62	25	101	H
	* 7.32296	19.54	VA1T	35.5	-23.5	31.54	54	-22.46	-	-	25	101	H
6	4.45052	41.34	PKFH	33.7	-27.2	47.84	-	-	-	-	243	194	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

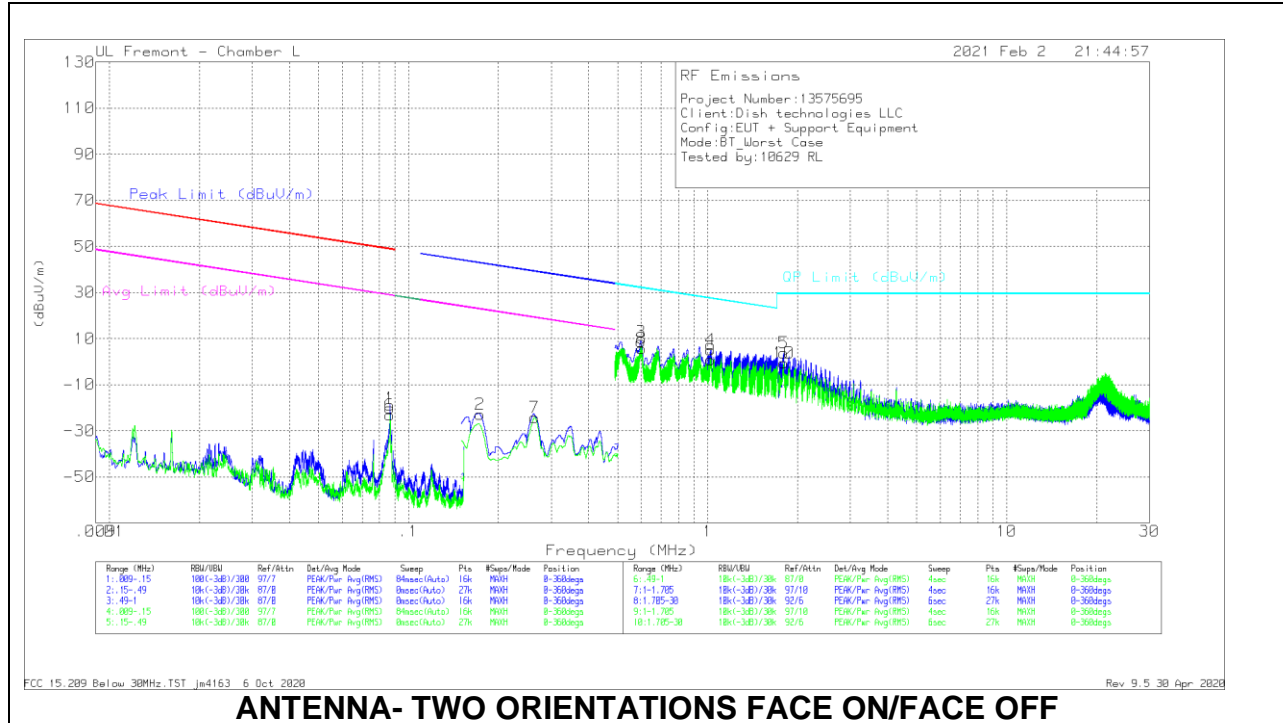
RADIATED EMISSIONS

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	* 1.48354	48.63	PKFH	28.2	-23.1	53.73	-	-	74	-20.27	195	147	H
	* 1.48352	42.09	VA1T	28.2	-23.1	47.19	54	-6.81	-	-	195	147	H
2	2.967	46.27	PKFH	32.6	-20.1	58.77	-	-	-	-	130	105	H
3	* 1.4836	47.56	PKFH	28.2	-23.1	52.66	-	-	74	-21.34	172	108	V
	* 1.48355	40.94	VA1T	28.2	-23.1	46.04	54	-7.96	-	-	172	108	V
4	2.96703	48.16	PKFH	32.6	-20.1	60.66	-	-	-	-	195	103	V
5	* 7.43969	32.95	PKFH	35.6	-23.2	45.35	-	-	74	-28.65	23	101	H
	* 7.43997	21.74	VA1T	35.6	-23.2	34.14	54	-19.86	-	-	23	101	H
6	* 7.43954	33.52	PKFH	35.6	-23.2	45.92	-	-	74	-28.08	80	101	V
	* 7.43996	23.05	VA1T	35.6	-23.2	35.45	54	-18.55	-	-	80	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton 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)	Azimuth (Degs)
1	.08685	36.23	Pk	55.8	-32.3	-80	-20.27	48.81	-69.08	28.81	-49.08	0-360
2	.17354	33.33	Pk	56.1	-32.3	-80	-22.87	42.83	-65.7	22.83	-45.7	0-360
6	.08679	33.42	Pk	55.8	-32.3	-80	-23.08	48.82	-71.9	28.82	-51.9	0-360
7	.26424	31.94	Pk	56.2	-32.3	-80	-24.16	39.17	-63.33	19.17	-43.33	0-360

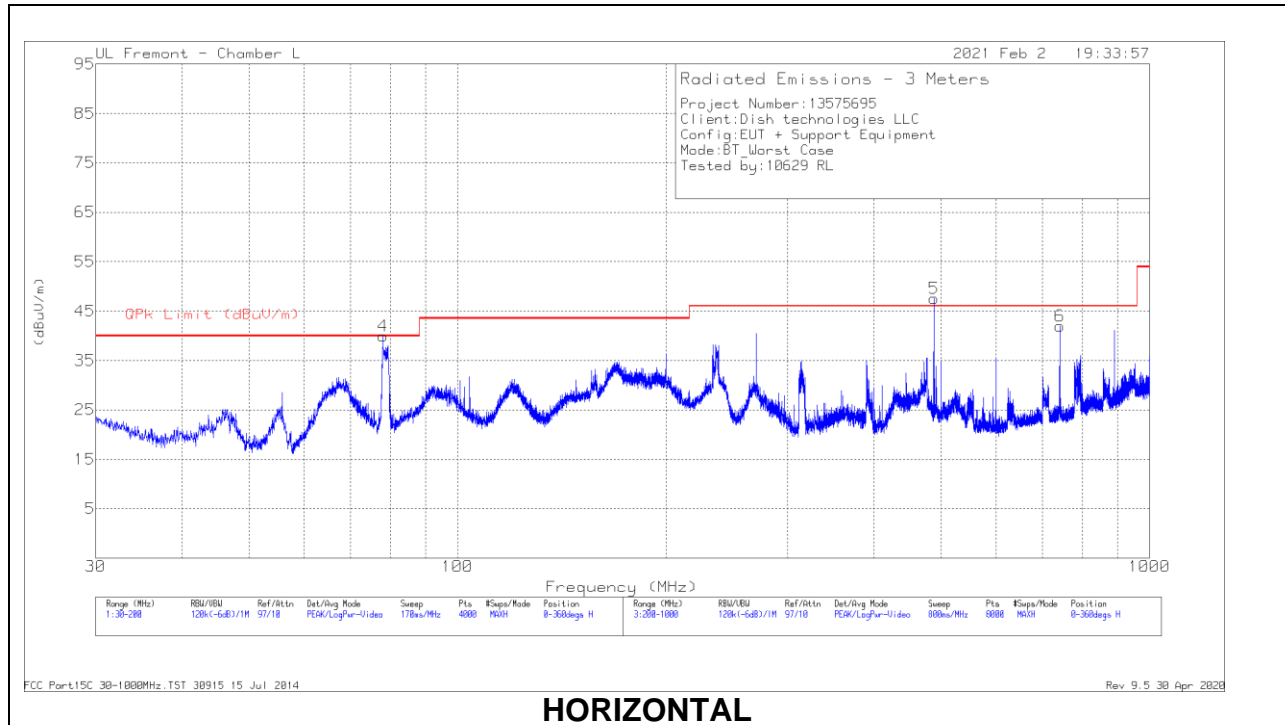
Pk - Peak detector

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)
3	.5996	24.81	Pk	56.2	-32.2	-40	8.81	32.05	-23.24	0-360
8	.602	21.81	Pk	56.2	-32.2	-40	5.81	32.02	-26.21	0-360
4	1.02288	30.65	Pk	46.8	-32.2	-40	5.25	27.43	-22.18	0-360
5	1.79408	33.29	Pk	42.7	-32.1	-40	3.89	29.5	-25.61	0-360
9	1.02253	26.26	Pk	46.8	-32.2	-40	.86	27.43	-26.57	0-360
10	1.79303	28.83	Pk	42.7	-32.1	-40	-.57	29.5	-30.07	0-360

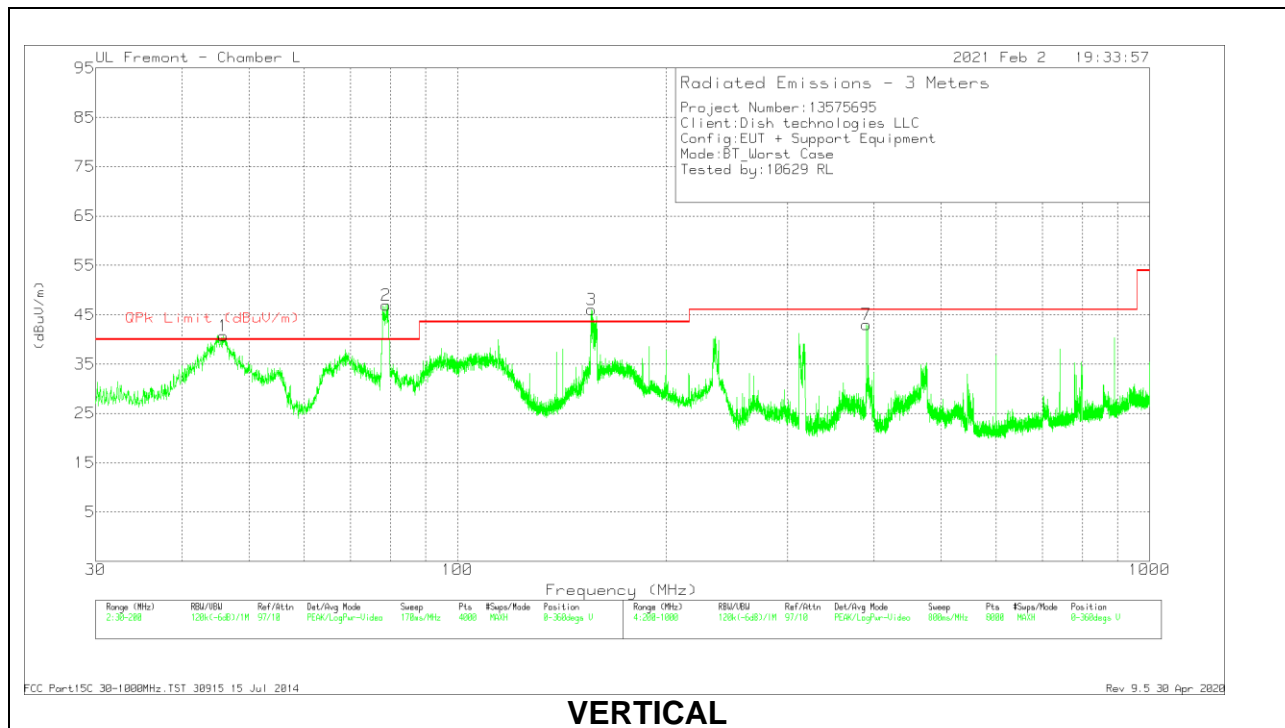
Pk - Peak detector

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	78.0799	57.1	Pk	13.7	-30.9	39.9	40	-.1	0-360	299	H
	79.3692	43.63	Qp	13.5	-30.9	26.23	40	-13.77	60	396	H
1	45.8991	56.25	Pk	15.6	-31.2	40.65	40	.65	0-360	101	V
	45.8991	49.69	Qp	15.6	-31.2	34.09	40	-5.91	207	106	V
2	78.8451	64.35	Pk	13.5	-30.9	46.95	40	6.95	0-360	101	V
	79.2945	49.66	Qp	13.5	-30.9	32.26	40	-7.74	45	104	V
3	156.1301	58.14	Pk	18.3	-30.4	46.04	43.52	2.52	0-360	101	V
	156.1073	52.3	Qp	18.3	-30.4	40.2	43.52	-3.32	116	102	V
5	487.9374	53.31	Pk	23.4	-29.1	47.61	46.02	1.59	0-360	199	H
	491.7234	28.01	Qp	23.4	-29	22.41	46.02	-23.61	276	251	H
6	741.7704	44.2	Pk	26.4	-28.6	42	46.02	-4.02	0-360	101	H
	**741.7694	51.93	Qp	26.4	-28.6	49.73	46.02	3.71	129	105	H
7	389.6246	51.15	Pk	20.9	-29.1	42.95	46.02	-3.07	0-360	101	V
	389.7471	41.39	Qp	20.9	-29.1	33.19	46.02	-12.83	145	108	V

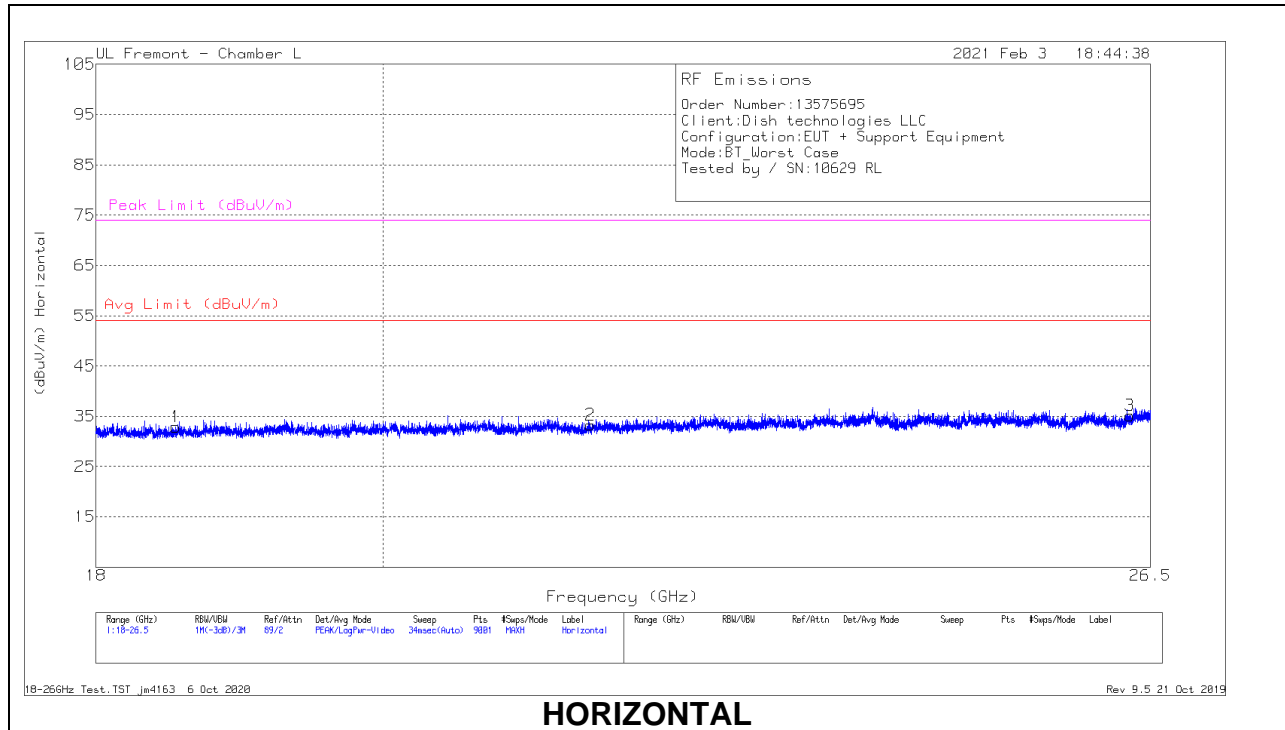
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** Verification has been performed where support equipment monitor was turn on, the emission occurred. When the monitor was turned off or only EUT standalone powered by AC power only, this emission was not present. It was determined that this emission came from support equipment and not EUT related.

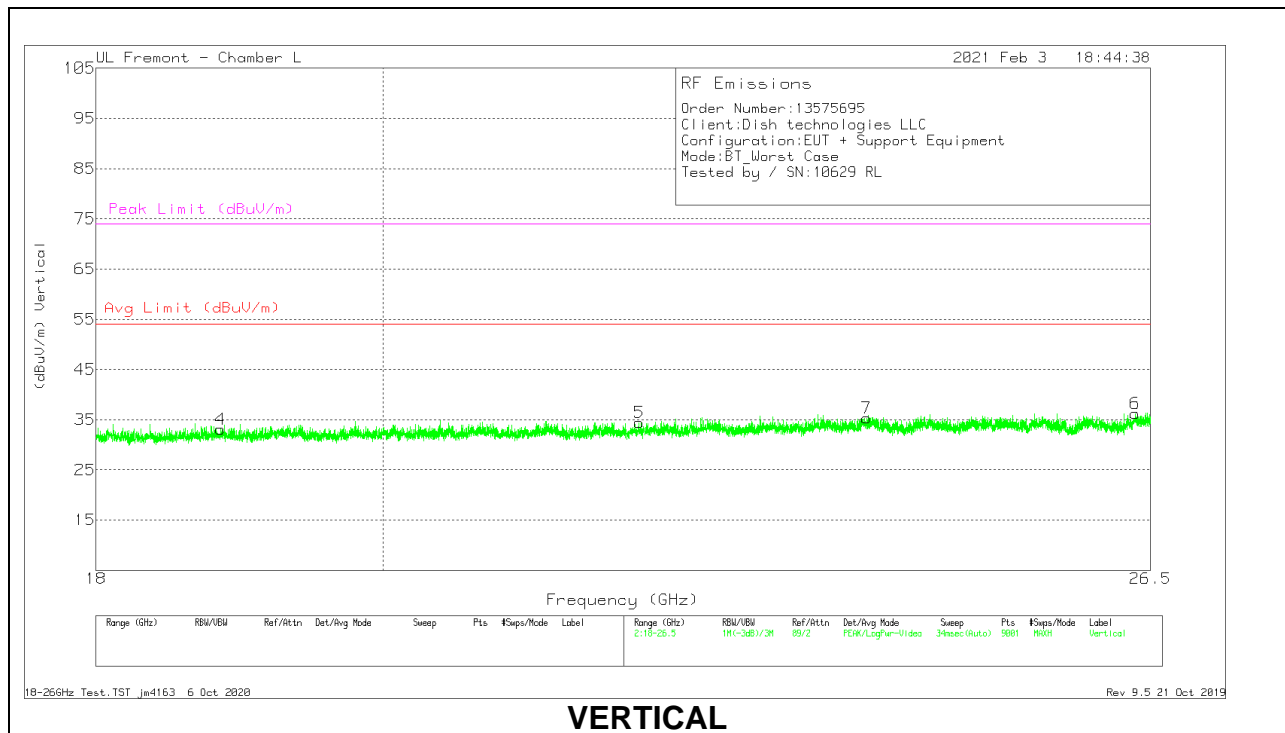
Qp - Quasi-Peak detector

10.4. WORST CASE 18-26 GHz

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



HORIZONTAL



VERTICAL

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	18.53361	69.08	Pk	32.4	-59.1	-9.5	32.88	54	-21.12	74	-41.12
2	21.57755	66.98	Pk	33.2	-57.4	-9.5	33.28	54	-20.72	74	-40.72
3	26.30166	64.84	Pk	34.6	-54.8	-9.5	35.14	54	-18.86	74	-38.86
4	18.8415	68.41	Pk	32.4	-58.2	-9.5	33.11	54	-20.89	74	-40.89
5	21.96666	68.14	Pk	33.4	-57.6	-9.5	34.44	54	-19.56	74	-39.56
6	26.35172	65.44	Pk	34.6	-54.3	-9.5	36.24	54	-17.76	74	-37.76

Pk - Peak detector

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dB μ 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

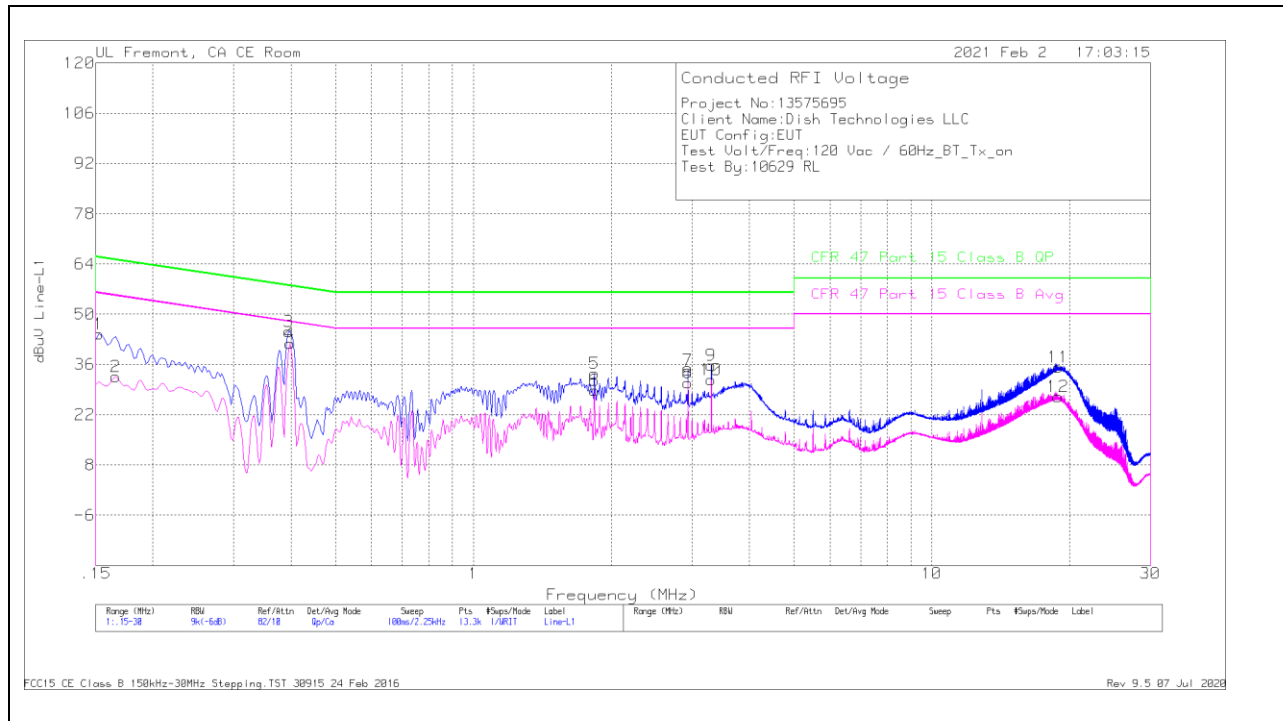
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

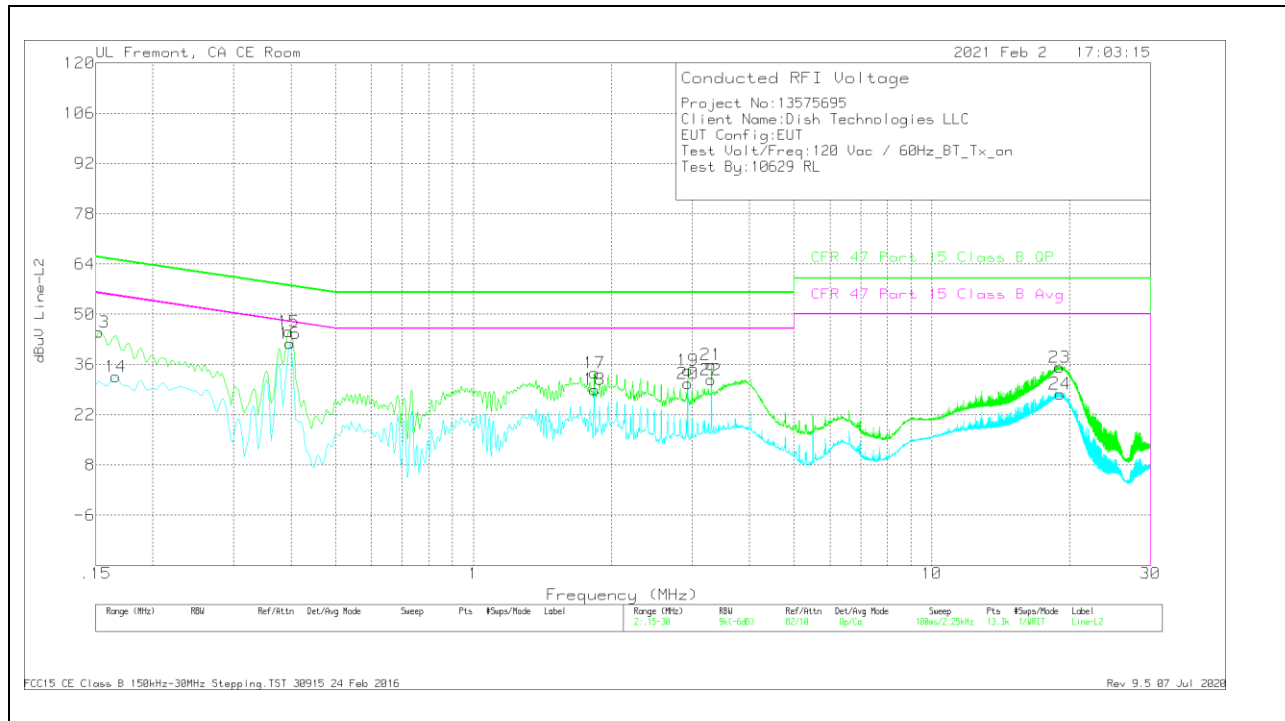
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN 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) Margin (dB)
1	.15225	34.35	Qp	.1	0	10.1	44.55	65.88	-21.33	-	-
2	.16575	22.46	Ca	0	0	10.1	32.56	-	-	55.17	-22.61
3	.39525	35.09	Qp	0	0	10.1	45.19	57.95	-12.76	-	-
4	.3975	31.73	Ca	0	0	10.1	41.83	-	-	47.91	-6.08
5	1.83525	23.27	Qp	0	.1	10.1	33.47	56	-22.53	-	-
6	1.83525	18.66	Ca	0	.1	10.1	28.86	-	-	46	-17.14
7	2.93775	24.18	Qp	0	.1	10.1	34.38	56	-21.62	-	-
8	2.93775	20.71	Ca	0	.1	10.1	30.91	-	-	46	-15.09
9	3.3045	25.5	Qp	0	.1	10.2	35.8	56	-20.2	-	-
10	3.3045	21.49	Ca	0	.1	10.2	31.79	-	-	46	-14.21
11	18.8835	24.73	Qp	0	.2	10.3	35.23	60	-24.77	-	-
12	18.85425	16.58	Ca	0	.2	10.3	27.08	-	-	50	-22.92

Qp - Quasi-Peak detector
 Ca - CISPR average detection

LINE 2 RESULTS



Range 1: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN 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) Margin (dB)
13	.15225	34.86	Qp	0	0	10.1	44.96	65.88	-20.92	-	-
14	.16575	22.51	Ca	0	0	10.1	32.61	-	-	55.17	-22.56
15	.39525	35.04	Qp	0	0	10.1	45.14	57.95	-12.81	-	-
16	.3975	31.7	Ca	0	0	10.1	41.8	-	-	47.91	-6.11
17	1.83525	23.49	Qp	0	.1	10.1	33.69	56	-22.31	-	-
18	1.83525	18.85	Ca	0	.1	10.1	29.05	-	-	46	-16.95
19	2.9355	24.24	Qp	0	.1	10.1	34.44	56	-21.56	-	-
20	2.9355	20.57	Ca	0	.1	10.1	30.77	-	-	46	-15.23
21	3.30225	25.63	Qp	0	.1	10.2	35.93	56	-20.07	-	-
22	3.30225	21.38	Ca	0	.1	10.2	31.68	-	-	46	-14.32
23	19.00275	24.74	Qp	0	.2	10.3	35.24	60	-24.76	-	-
24	19.03425	17.33	Ca	0	.2	10.3	27.83	-	-	50	-22.17

Qp - Quasi-Peak detector
 Ca - CISPR average detection