



TEST REPORT

Report Number. : 14160419-E2V1

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

Model : D35

Brand : DISH

FCC ID : DKNPF99

EUT Description : TV SET TOP BOX CLIENT

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

Date Of Issue:
March 21, 2022

Prepared by:
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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	3/21/2022	Initial Issue	---

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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 CLIENT

MODEL: D35

BRAND: DISH

SERIAL NUMBER: CONDUCTED: MJ4P6LB7
RADIATED: MJ486L88

SAMPLE RECEIPT DATE: MARCH 03, 2022

DATE TESTED: MARCH 04, 2022 TO MARCH 15, 2022

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 A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc. By:



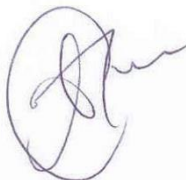
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2. TEST RESULTS SUMMARY

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	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 A2LA, Certificate Number 0751.05, 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	550739
<input type="checkbox"/>	Building 2: 47266 Benicia Street, Fremont, CA 94538	US0104	22541	550739
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd, Fremont, CA 94538	US0104	2324B	550739

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 TV Set Top Box Client with RF4CE Zigbee, BLE (1Mbps), 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	8.01	6.32
2402 - 2480	Enhanced DQPSK	7.82	6.05
2402 - 2480	Enhanced 8PSK	9.12	8.17

Note: GFSK, DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on these modes to showing compliance.

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 002.001.014.0647.0000

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.

This EUT supports BLE/BT + Zigbee simultaneous transmission, radiated emission test was performed, please refer to 14160419-E3 for result.

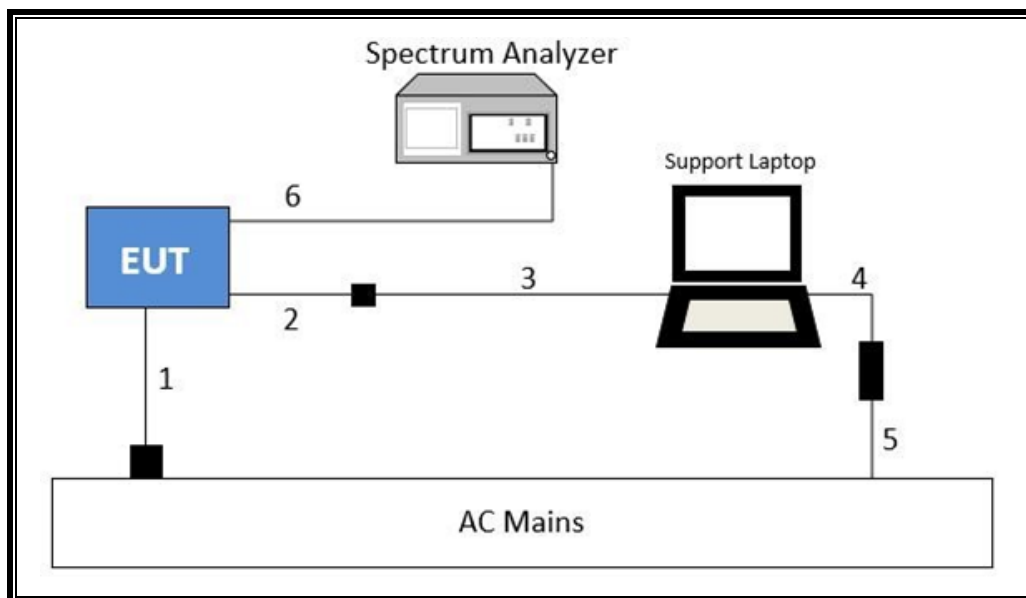
Worst-case data rates as provided by the client were:

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	222109	DoC		
Router	D-Link	EBR-2310	F311388010596	DoC		
Router Adapter	D-Link	AF0605	LF4R07082717180	DoC		
TV Emulator	DISH	TV Emulator	D52-12			
Laptop: Radiated test	HP	Elitebook 740	N/A	DoC		
AC/DC Adapter(Laptop): Radiated test	HP	N/A	N/A	DoC		
Laptop: conducted test	HP	Elitebook 740	N/A	DoC		
AC/DC Adapter(Laptop): conducted test	HP	N/A	N/A	DoC		
USB Flash Drive	Sandisk	Cruzer Glide 16GB	SDCZ60-016G	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	1.5	EUT to AC/DC adapter Mains
2	UART	1	UART	Un-shielded	0.1	EUT to USB adapter
3	UART	1	USB	Un-shielded	3	USB adapter to laptop
4	DC	1	AC	Un-shielded	3	
5	AC	1	AC	Un-shielded	1	
6	Antenna	1	RF	Un-shielded	0.2	To spectrum analyzer
I/O CABLES (RADIATED TEST/AC POWER LINE EMISSIONS)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	Barrel	Un-shielded	1.5	EUT to AC/DC adapter Mains
2	HDMI	1	HDMI	shielded	1	EUT to Emulator
3	RJ45	1	RJ45	Un-shielded	More than 3	EUT to Ethernet Router
4	Coaxial RF	1	Coaxial RF	shielded	0.2	75 ohm load terminated BNC port on coaxial cable
5	DC	1	Barrel	Un-shielded	1	Ethernet router to AC/DC adapter
6	UART	1	UART	Un-shielded	0.1	EUT to USB adapter
7	UART	1	USB	Un-shielded	2	USB adapter to laptop
8	DC	1	DC	Un-shielded	1	AC Adapter Laptop
9	AC	1	Two Prong	Un-shielded	2	AC adapter to AC Mains

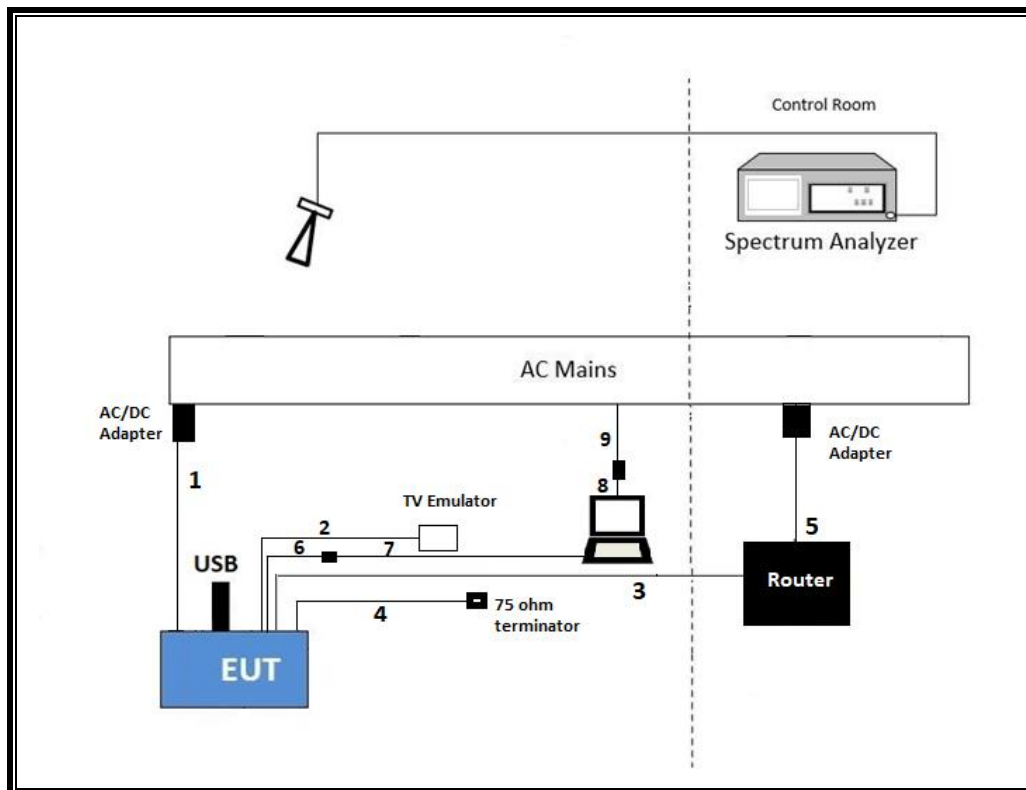
CONDUCTED TEST SETUP DIAGRAM



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/AC POWER LINE EMISSIONS SETUP DIAGRAM



TEST SETUP

The EUT is connected to a test laptop by USB to UART cable adapter, support equipment and powered by AC/DC adapter during the tests. 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
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T119	05/07/2022	05/07/2021
Amplifier 1-8GHz 30dB gain	L3 Narda	AMF-4D-01000800-30-29P	167495	03/09/2023	03/09/2022
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	T1568	03/09/2023	03/09/2022
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310N	T300	04/09/2022	04/09/2021
Amplifier, 1-7GHz, 24dB	AMPLICAL	AMP1G7-24-27	T1607	03/09/2023	03/09/2022
Antenna, BroadBand Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	171862	09/28/2022	09/28/2021
Loop Antenna	ELECTRO METRICS	EM-6871	PRE0179466	06/08/2022	06/08/2021
Loop Antenna	ELECTRO METRICS	EM-6872	PRE0179468	06/08/2022	06/08/2021
EMI TEST RECEIVER, with B8 option	Rohde & Schwarz	ESW44	PRE0179377	02/20/2023	02/20/2022
NSA, Test Site Validation	TDK RF SOLUTIONS INC.	ANSI C63.4 & CISPR 16-1-4	210613	09/18/2022	09/18/2021
Antenna, Horn 18 to 26.5GHz	A.R.A.	MWH-1826/B	81139	05/25/2022	05/25/2021
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Keysight Technologies Inc	8449B	80671	04/19/2022	04/19/2021
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Keysight Technologies Inc	E4440A	81311	02/03/2023	02/03/2022
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90715	01/26/2023	01/26/2022
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	81319	01/24/2023	01/24/2022
Thermometer - Digital	Control Company	14-650-118	175731	02/03/2023	02/03/2022
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	175765	1/26/2023	1/26/2022
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2	T24	1/20/2023	1/20/2022
EMI TEST RECEIVER	Rohde & Schwarz	ESR	T1436	2/19/2023	2/19/2022
Transient Limiter	COM-POWER	LIT-930A	T1457	1/20/2023	1/20/2022
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 2021.8.27		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, July 07, 2020		

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

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

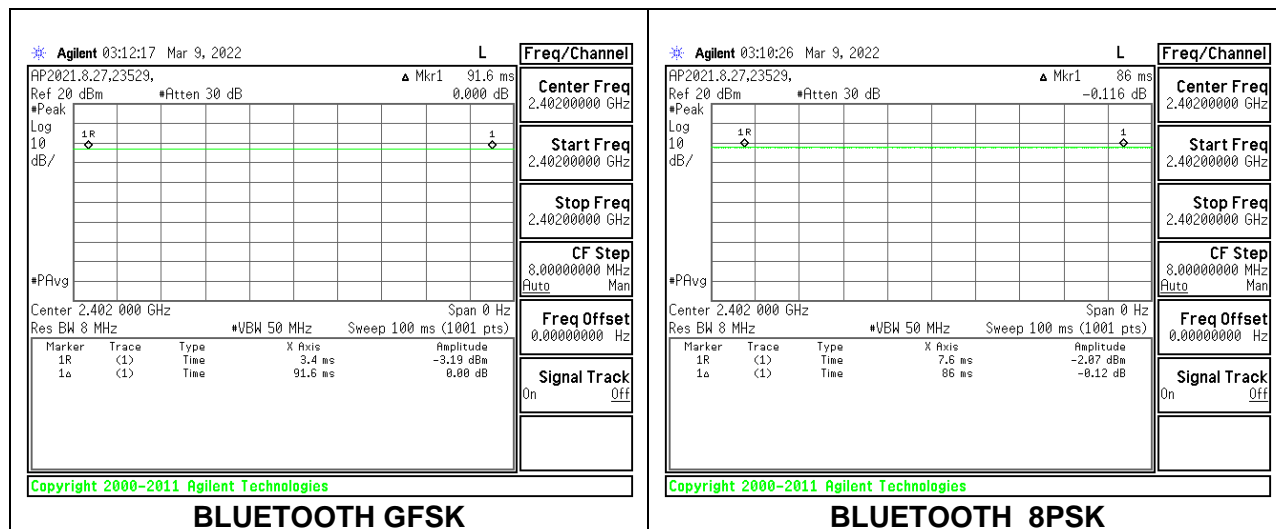
None; for reporting purposes only.

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	91.60	91.60	1.000	100.00	0.00	0.010
Bluetooth 8PSK	86.00	86.00	1.000	100.00	0.00	0.010



9.2. 20 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

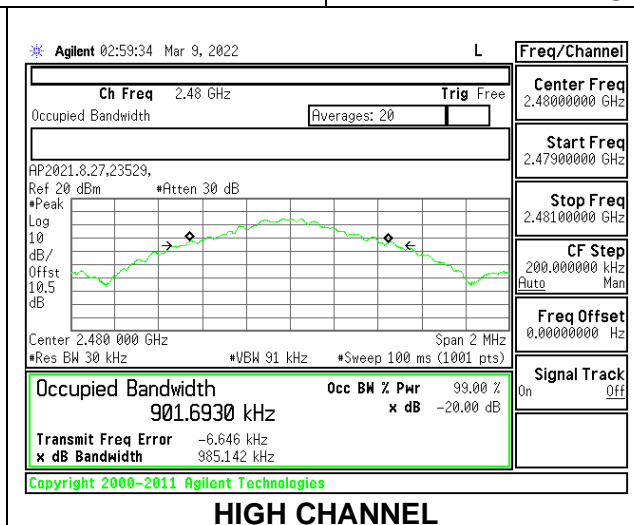
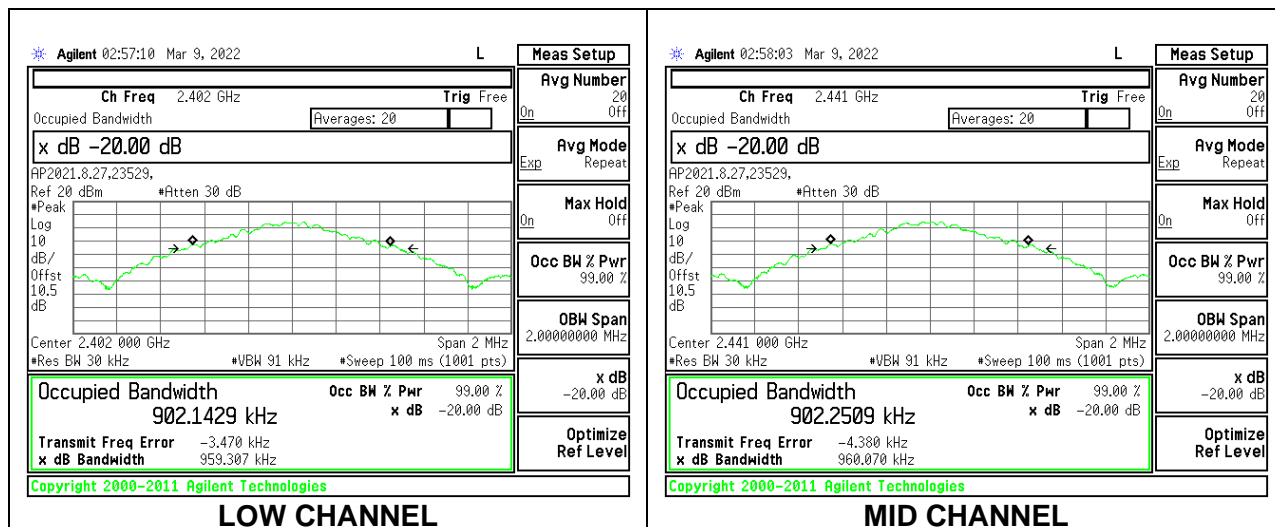
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set in the range of 1% to 5% of the OBW. The VBW is set to $\geq 3x$ RBW. The sweep time is coupled.

RESULTS

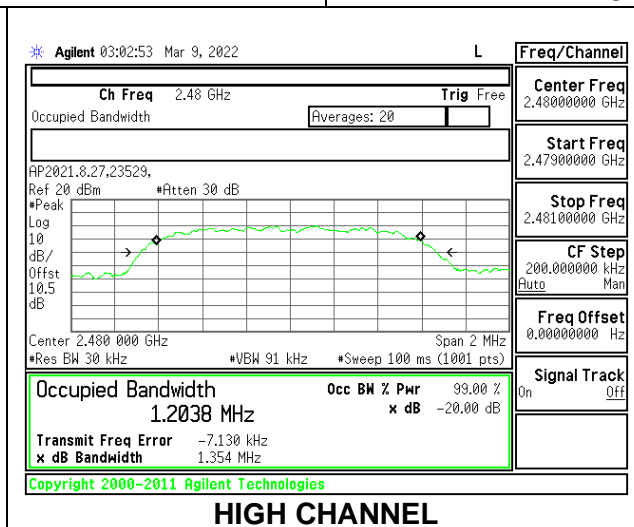
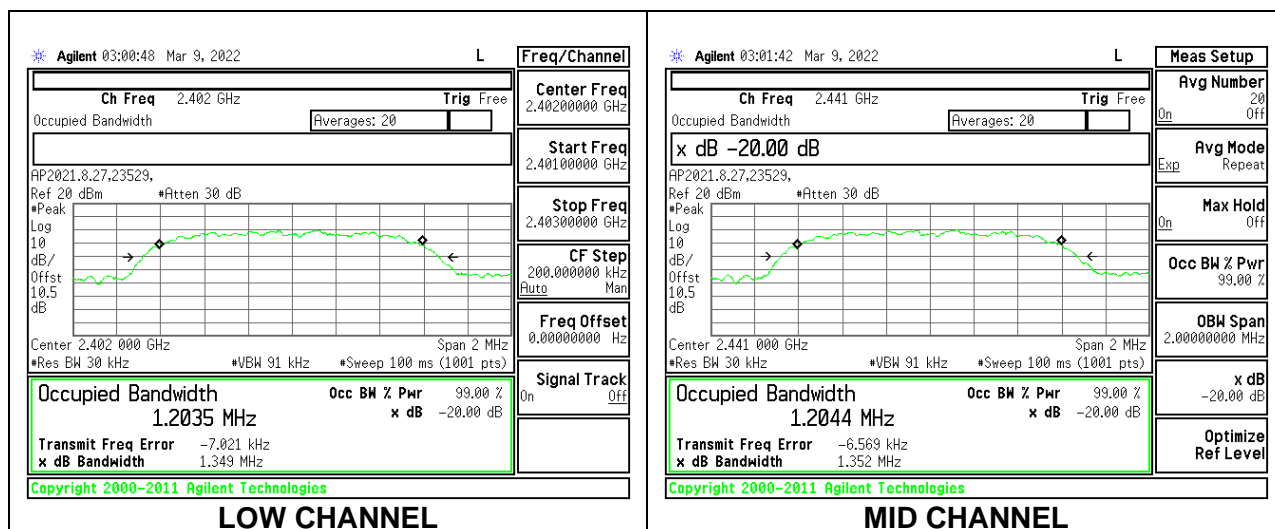
9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	0.959307
Mid	2441	0.96007
High	2480	0.985142



9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.349
Mid	2441	1.352
High	2480	1.354



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.

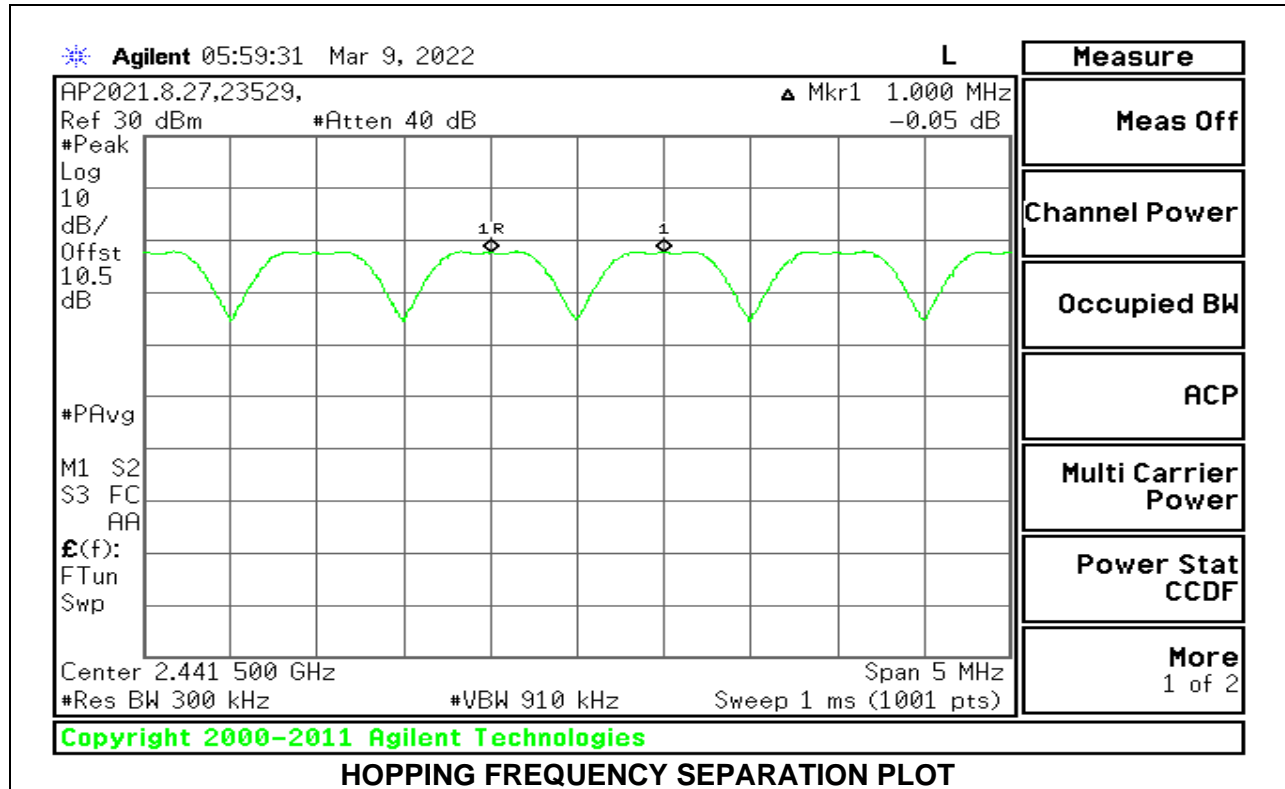
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

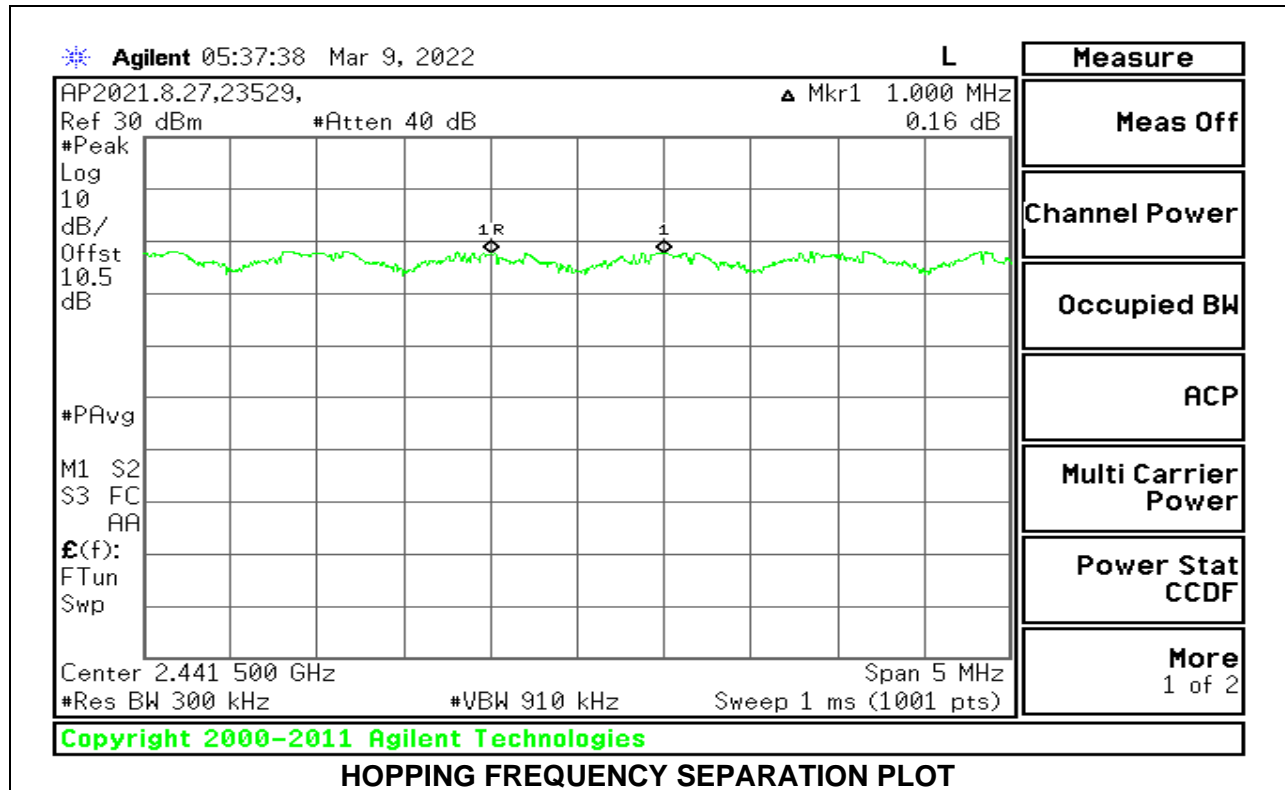
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to $VBW \geq RBW$. The sweep time is coupled.

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.

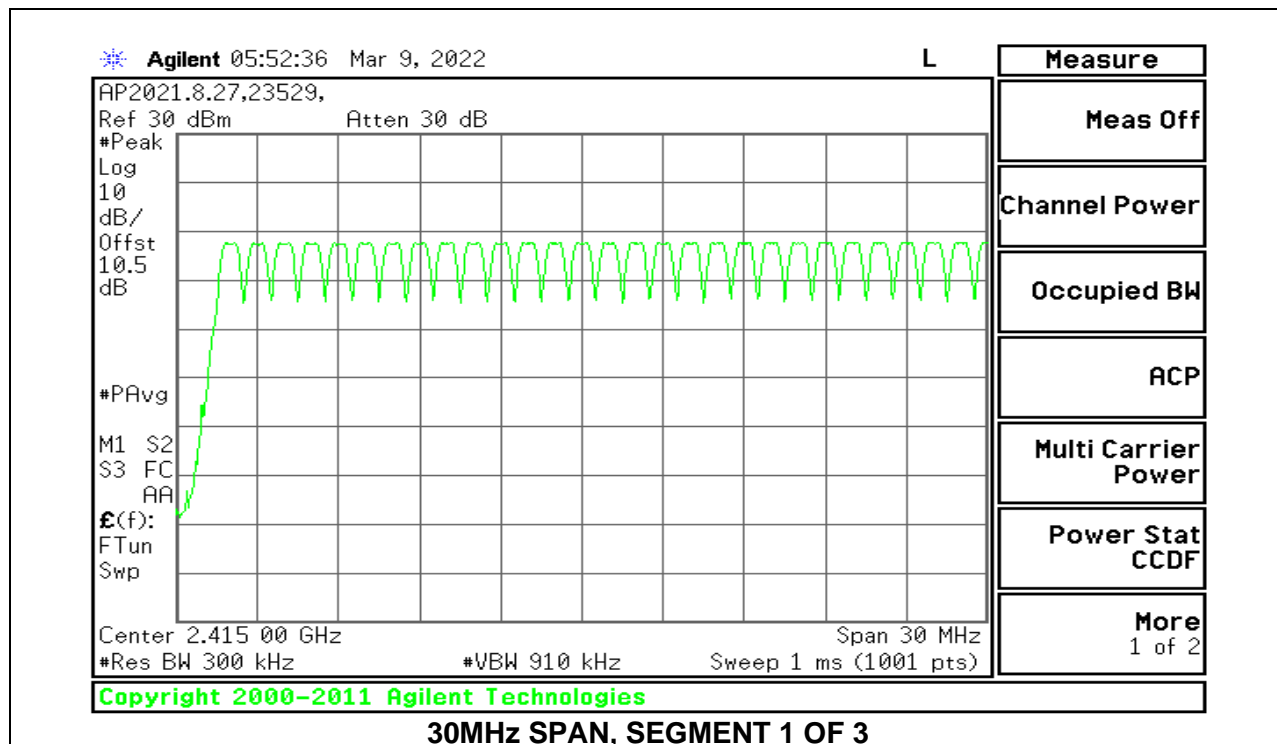
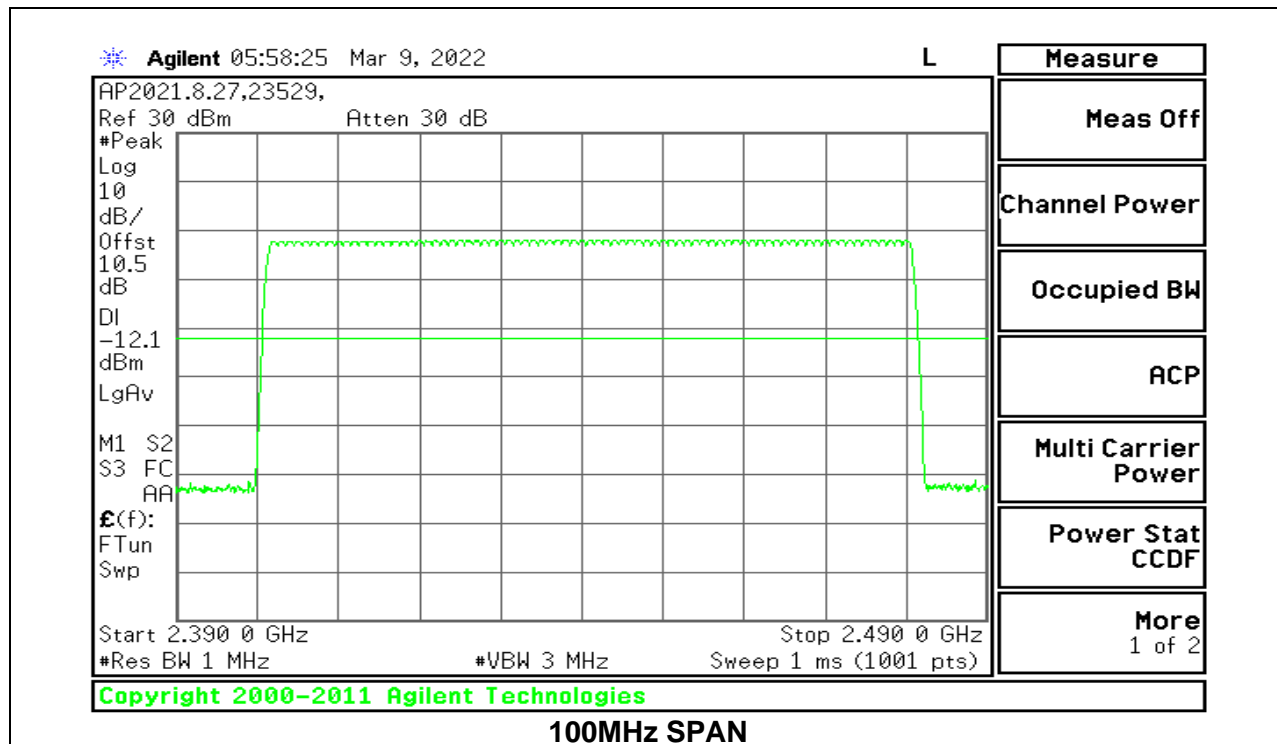
TEST PROCEDURE

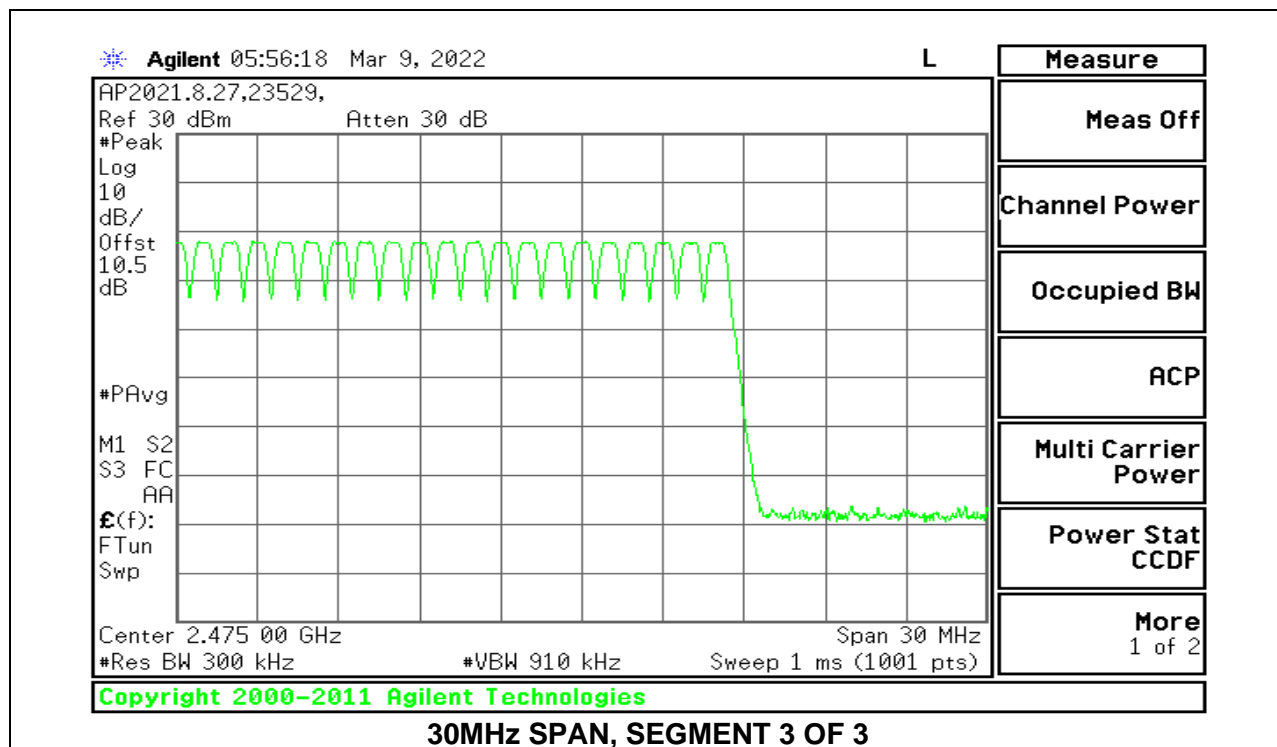
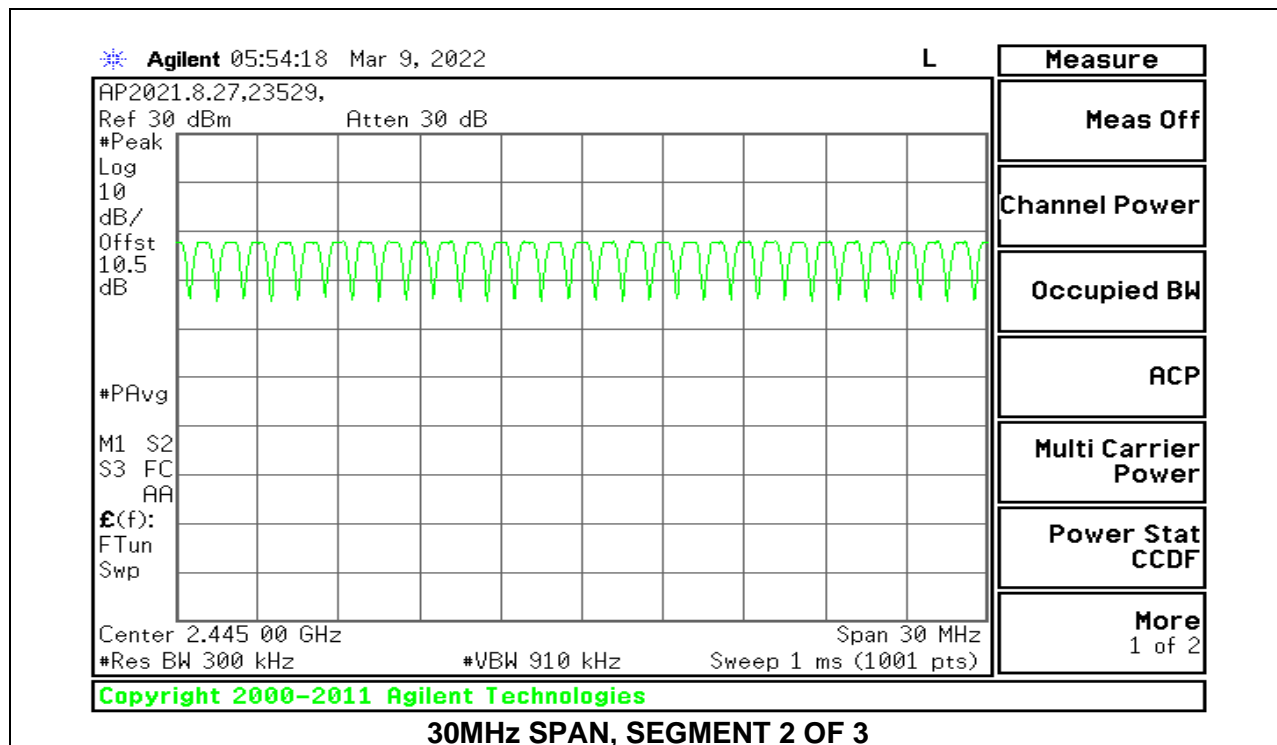
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

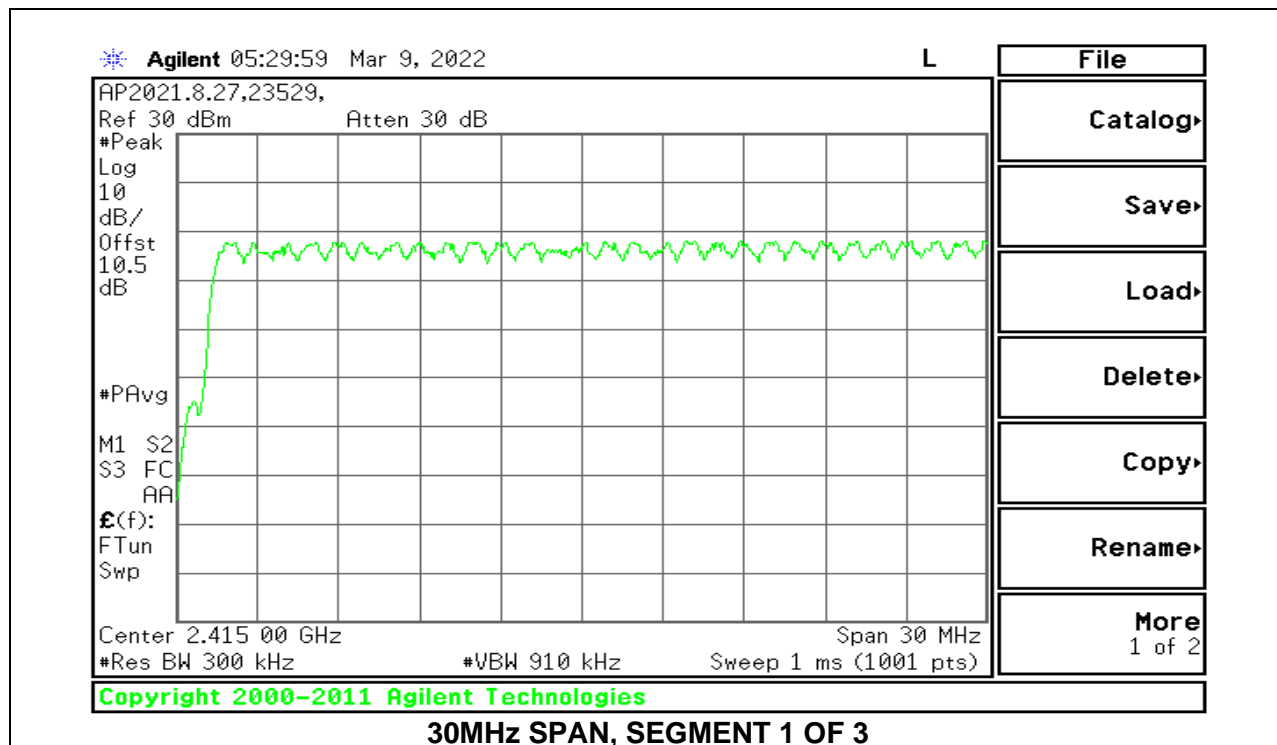
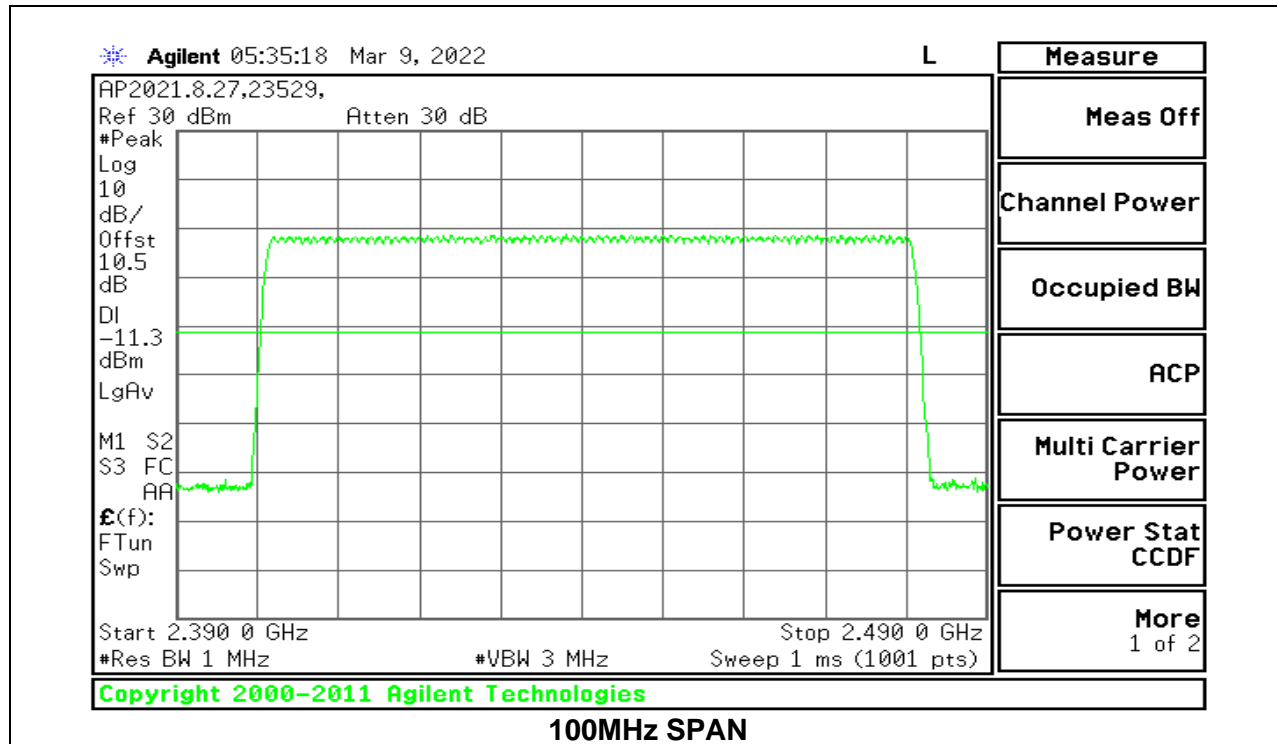
Normal Mode: 79 Channels Observed

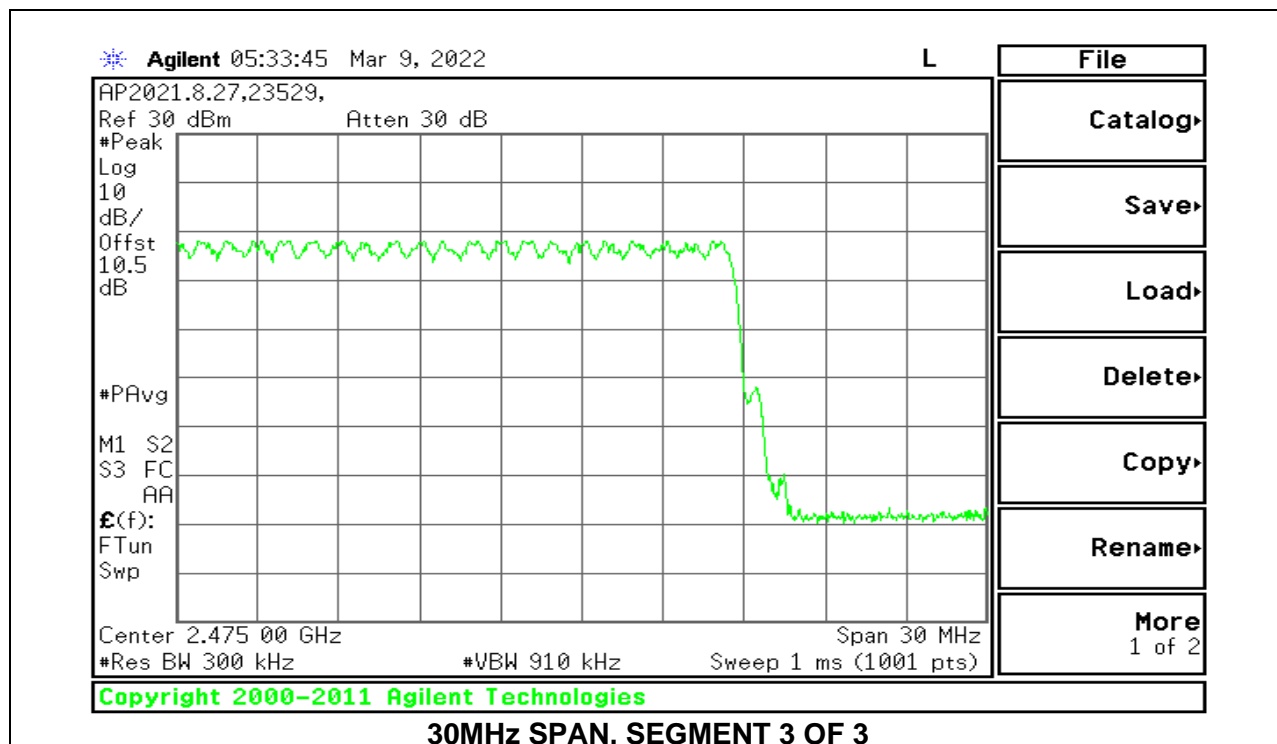
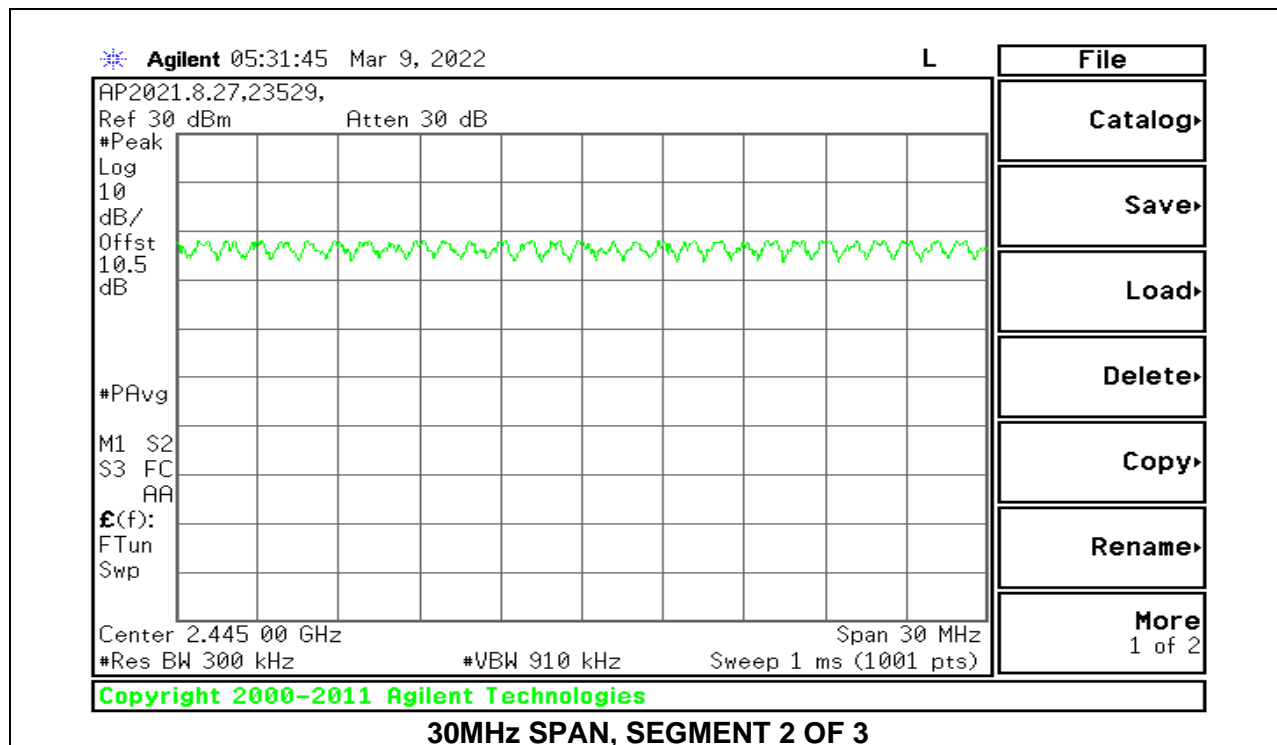
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION





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.

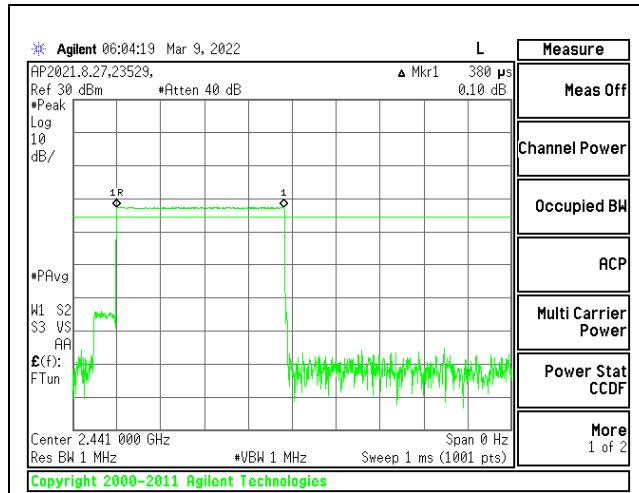
The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$.

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

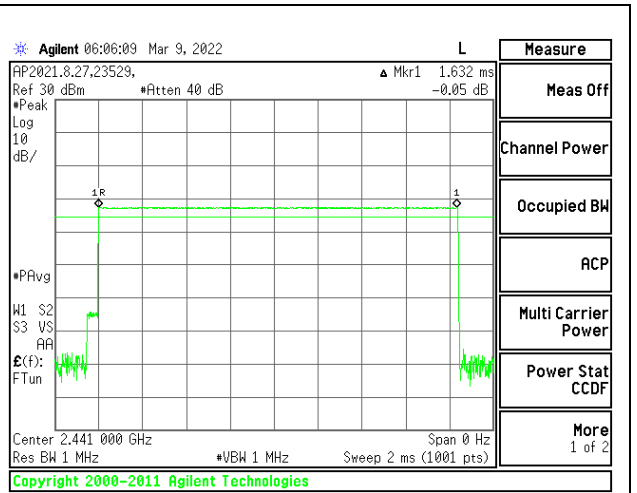
RESULTS

9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

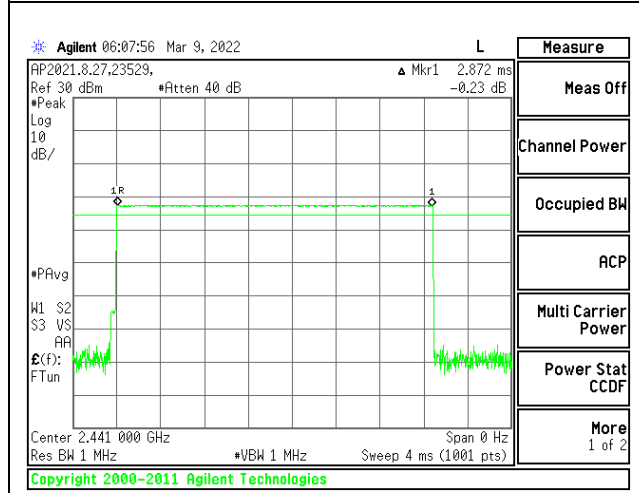
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.38	32	0.1216	0.4	-0.2784
DH3	1.632	19	0.3101	0.4	-0.0899
DH5	2.872	14	0.4021	0.4	0.0021
GFSK AFH Mode					
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.38	8	0.03040	0.4	-0.3696
DH3	1.632	4.75	0.07752	0.4	-0.3225
DH5	2.872	3.5	0.10052	0.4	-0.2995



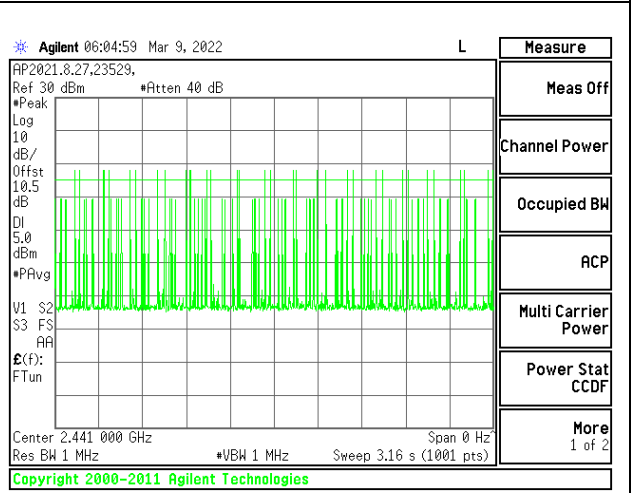
PULSE WIDTH – DH1



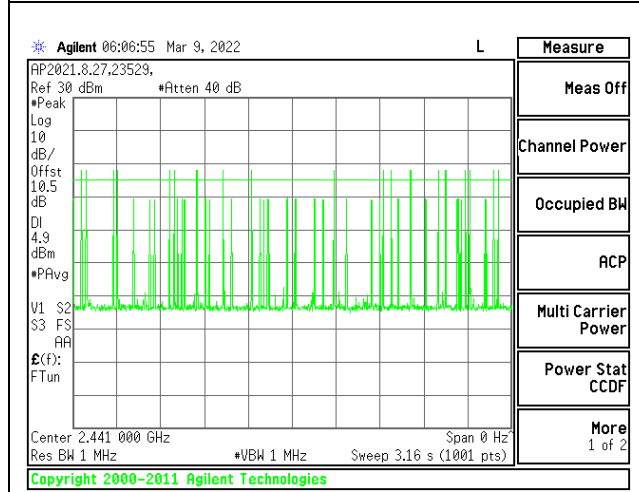
PULSE WIDTH – DH3



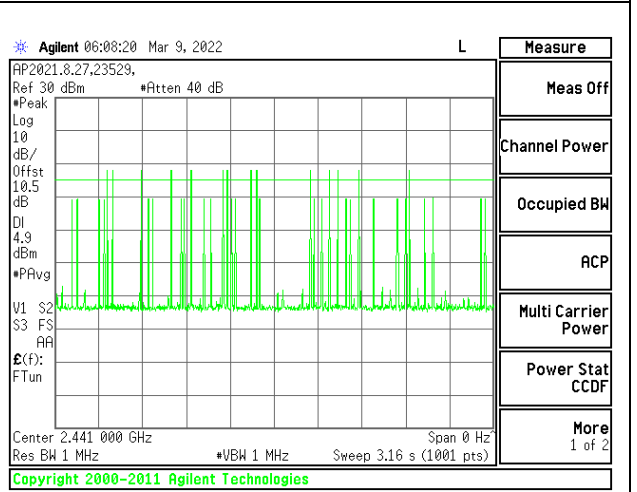
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

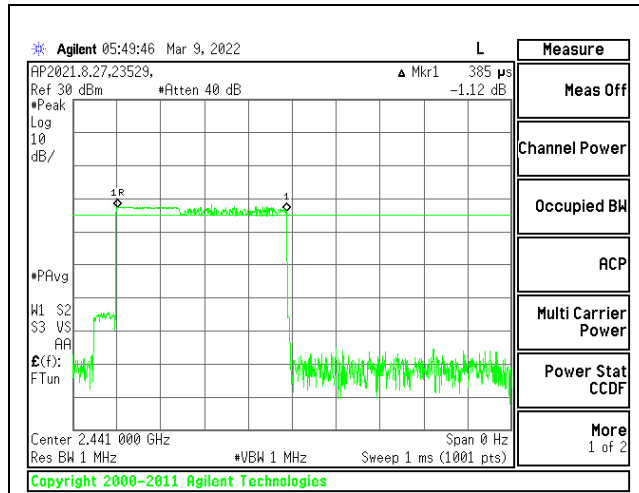


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

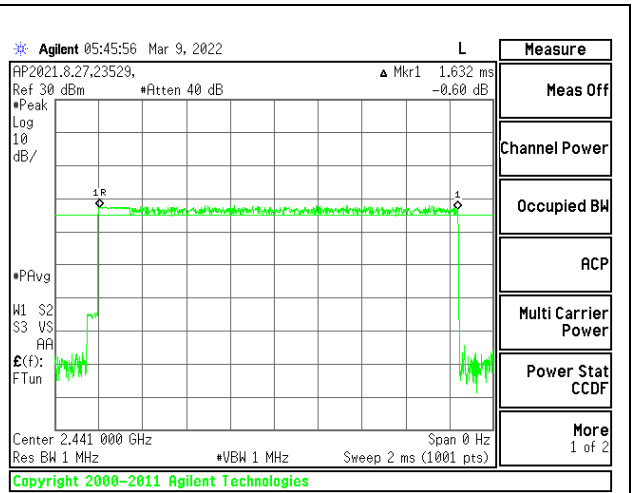
9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

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	32	0.1232	0.4	-0.2768
3DH3	1.632	15	0.2448	0.4	-0.1552
3DH5	2.88	12	0.3456	0.4	-0.0544

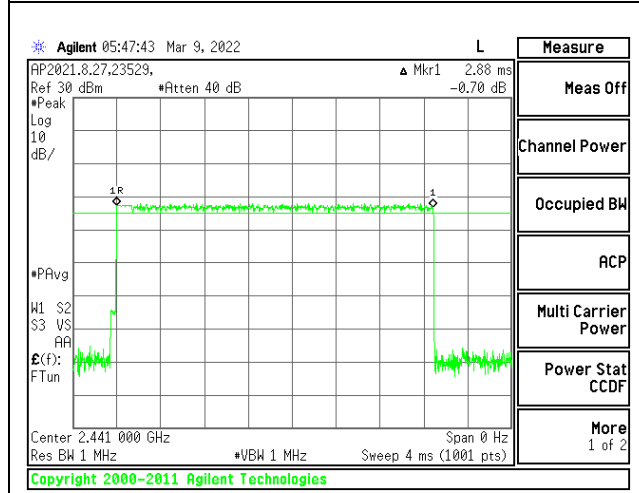
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.



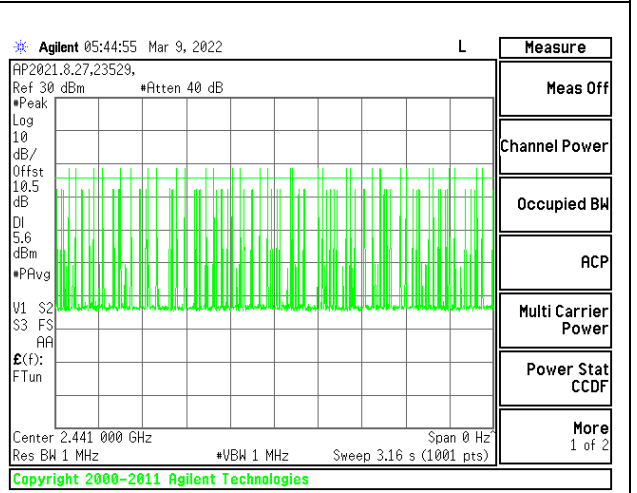
PULSE WIDTH - 3DH1



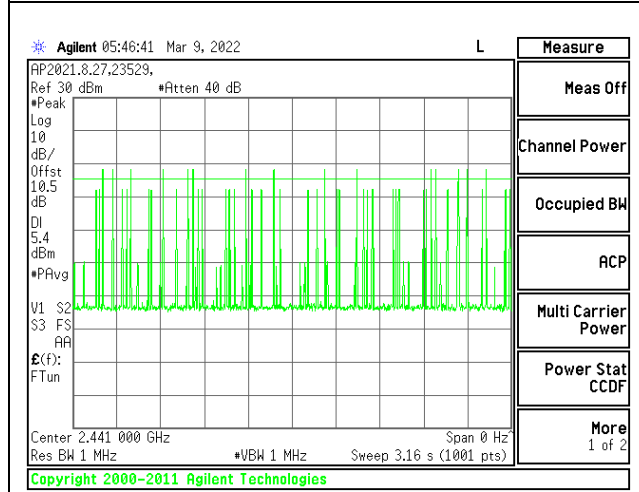
PULSE WIDTH - 3DH3



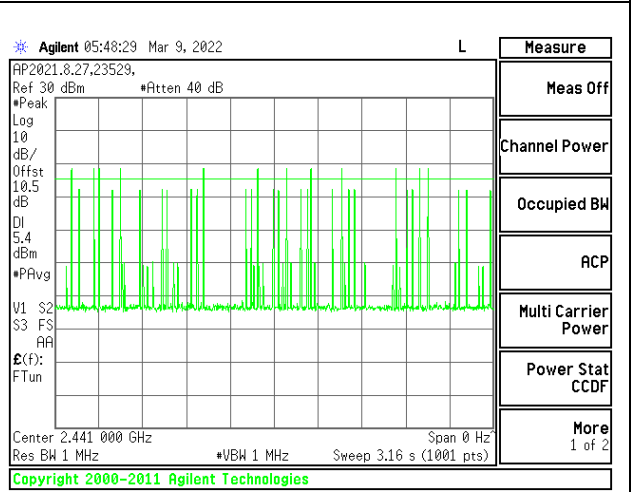
PULSE WIDTH - 3DH5



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

§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

The transmitter output is connected to a 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 power meter.

RESULTS

9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	23529 QL/19497 AF
Date:	3/4/2022

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.78	21	-13.22
Middle	2441	8.01	21	-12.99
High	2480	7.92	21	-13.08

9.6.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	23529 QL/19497 AF
Date:	3/4/2022

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.55	21	-13.45
Middle	2441	7.82	21	-13.18
High	2480	7.75	21	-13.25

9.6.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	23529 QL/19497 AF
Date:	3/4/2022

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.87	21	-12.13
Middle	2441	9.12	21	-11.88
High	2480	8.97	21	-12.03

9.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

The transmitter output is connected to a 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:	23529 QL/19497 AF
Date	3/4/2022

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.50
Middle	2441	7.80
High	2480	7.69

9.7.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	23529 QL/19497 AF
Date	3/4/2022

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.03
Middle	2441	6.36
High	2480	6.29

9.7.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	23529 QL/19497 AF
Date	3/4/2022

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.04
Middle	2441	6.36
High	2480	6.29

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.

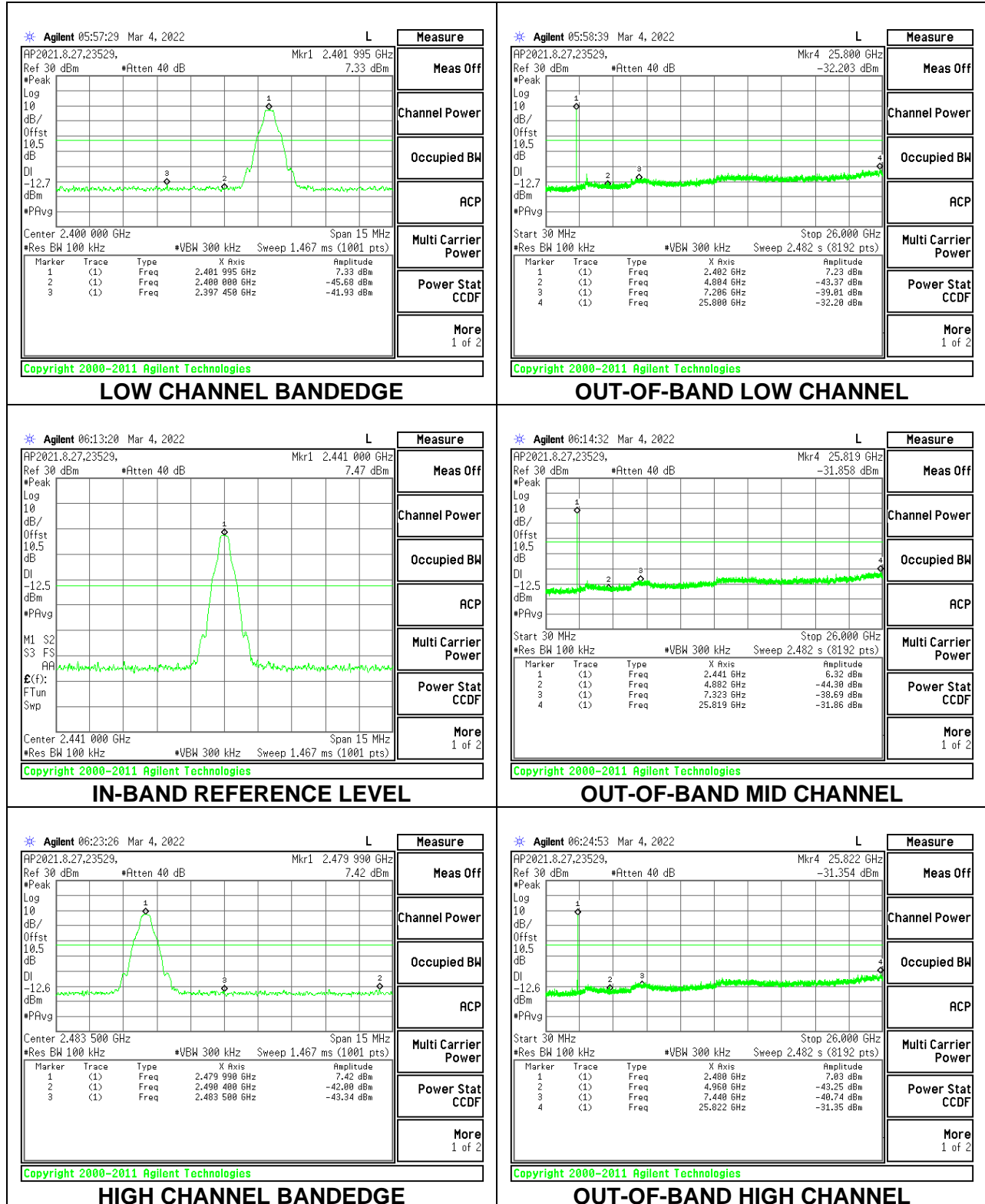
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

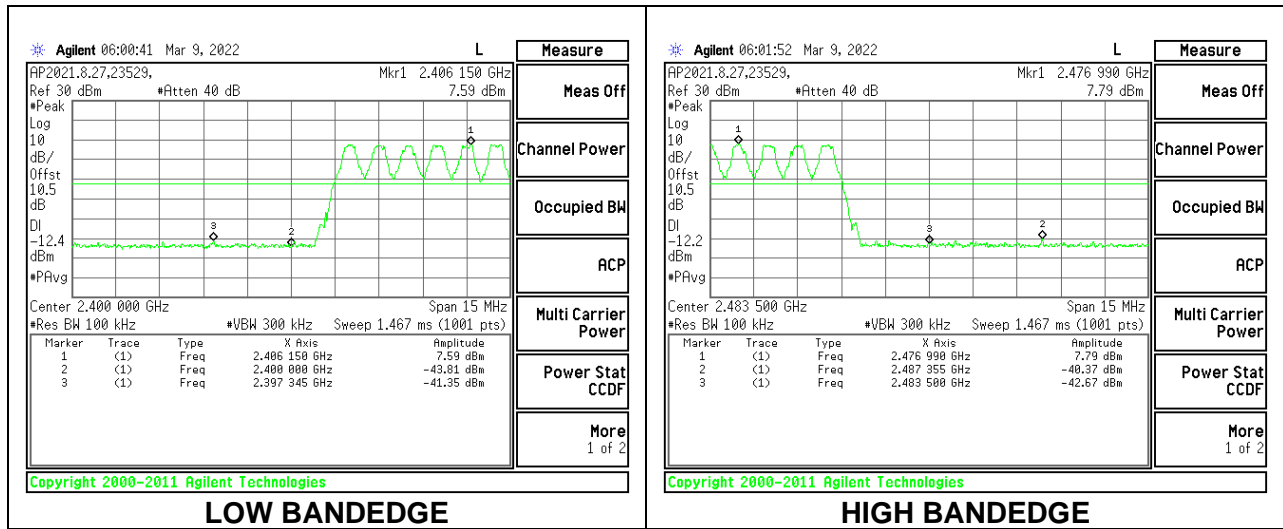
RESULTS

9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

SPURIOUS EMISSIONS, NON-HOPPING

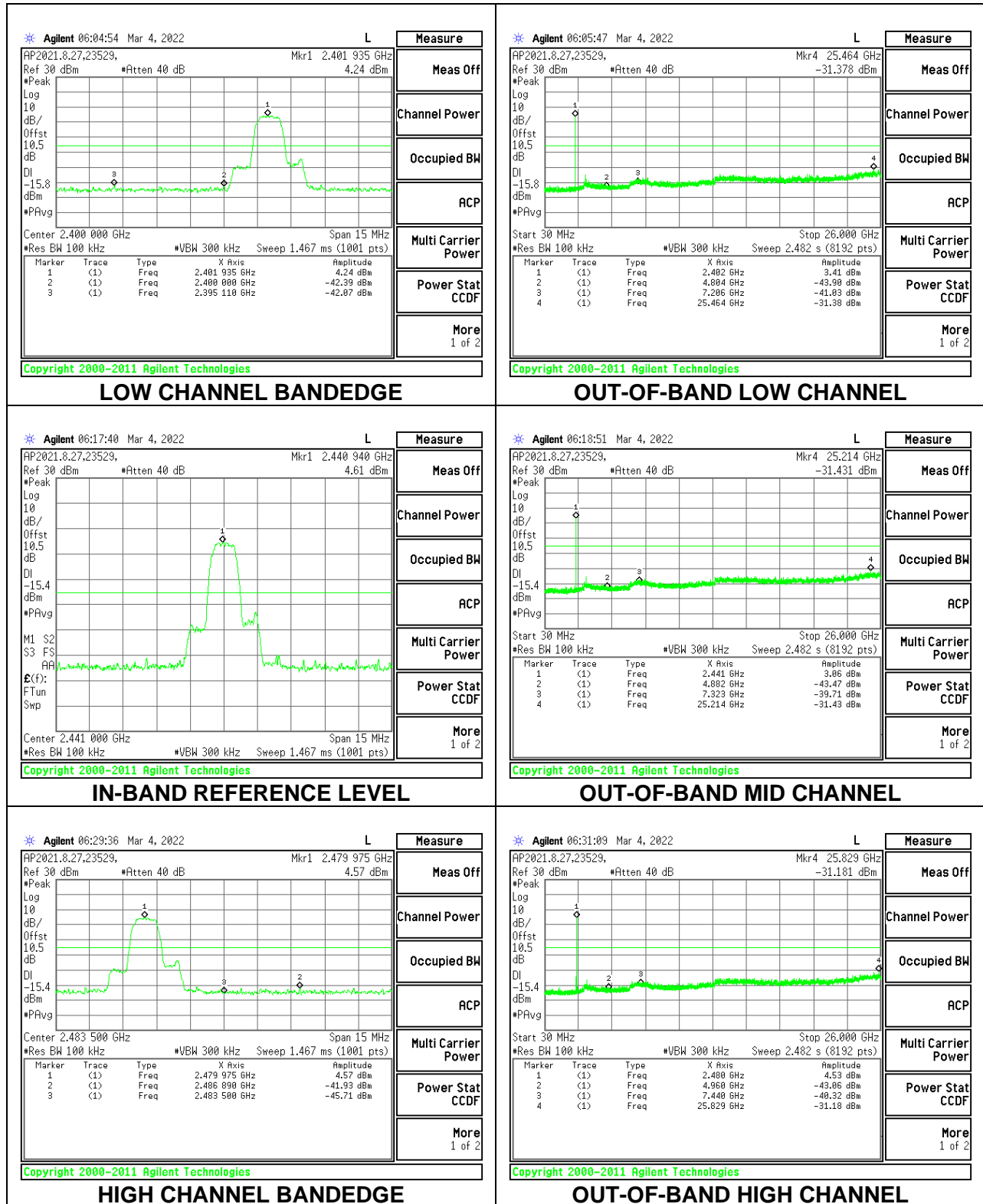


SPURIOUS BANDEGE EMISSIONS WITH HOPPING ON

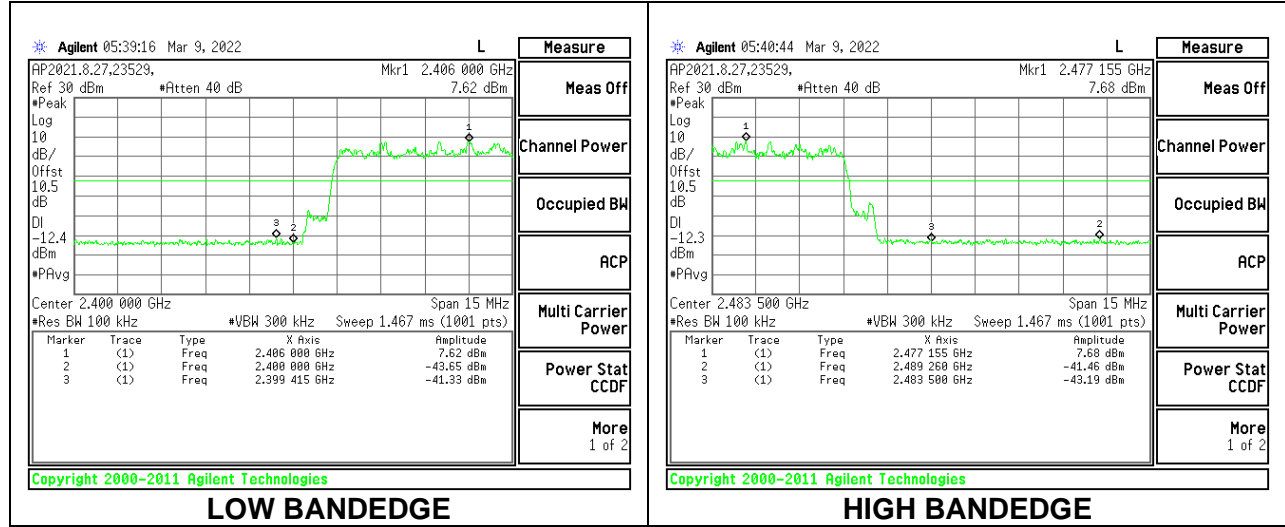


9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

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.

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

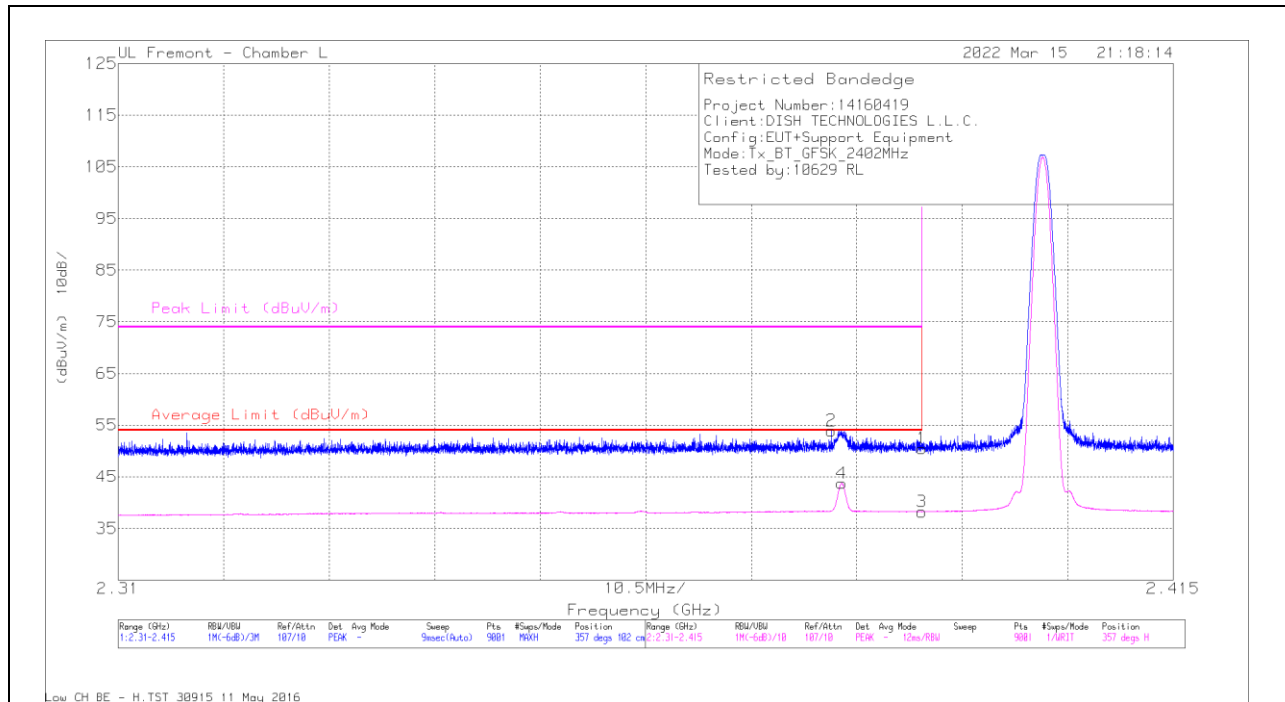
Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can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

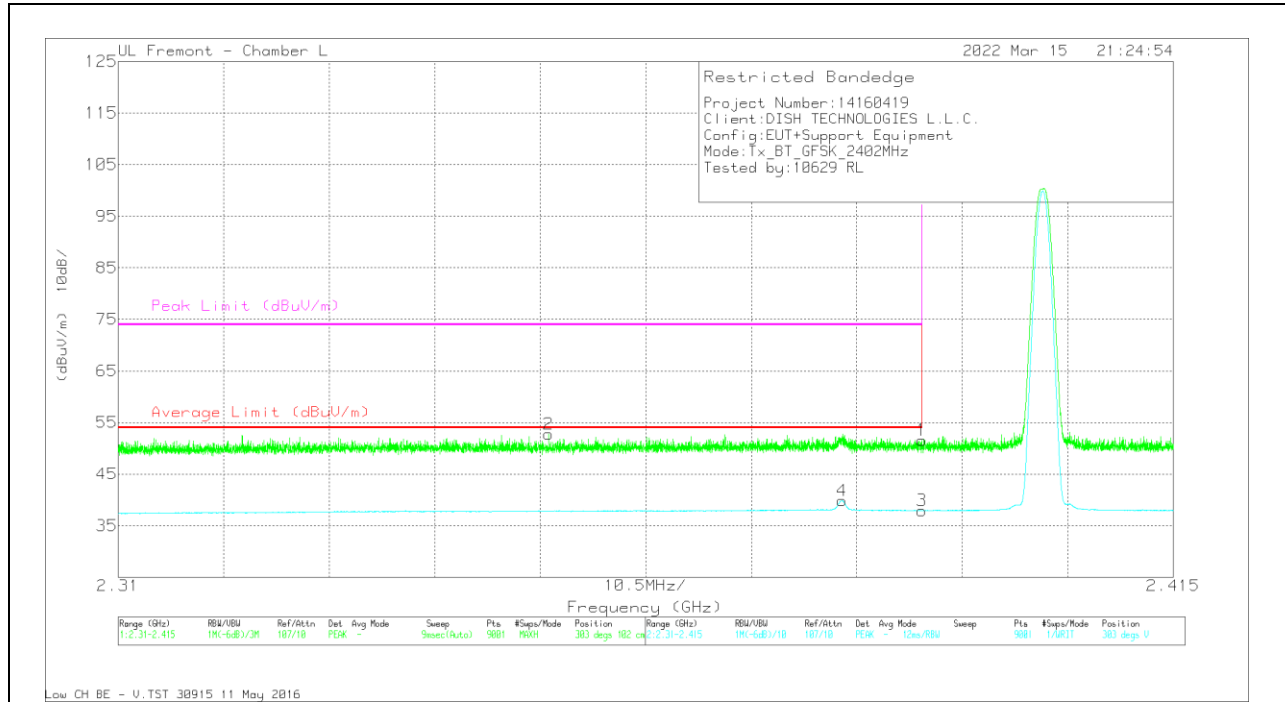
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filt/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	* 2.39	37.81	Pk	32	-19.3	50.51	-	-	74	-23.49	357	102	H
2	* 2.38097	41.19	Pk	32.1	-19.4	53.89	-	-	74	-20.11	357	102	H
3	* 2.39	25.51	VA1T	32	-19.3	38.21	54	-15.79	-	-	357	102	H
4	* 2.382009	31.02	VA1T	32.1	-19.4	43.72	54	-10.28	-	-	357	102	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

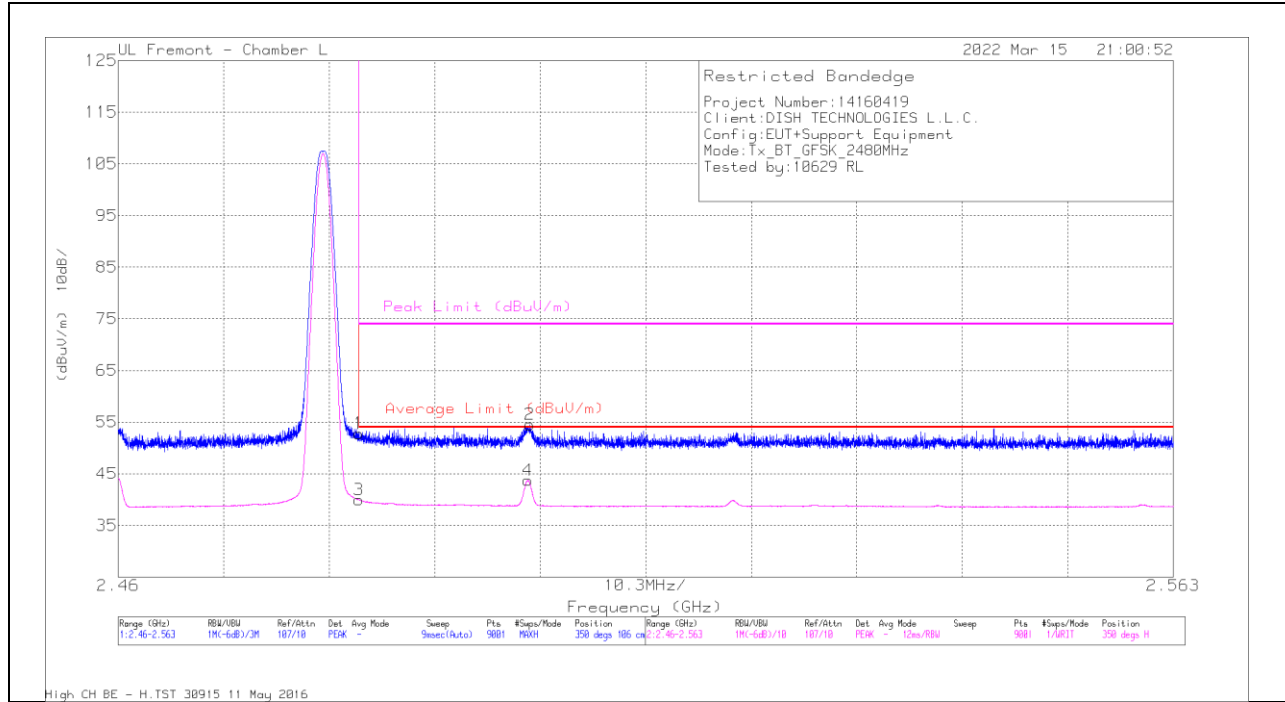


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.86	Pk	32	-19.3	51.56	-	-	74	-22.44	303	102	V
2	* 2.352841	40.24	Pk	32	-19.5	52.74	-	-	74	-21.26	303	102	V
3	* 2.39	25.22	VA1T	32	-19.3	37.92	54	-16.08	-	-	303	102	V
4	* 2.38202	27.14	VA1T	32.1	-19.4	39.84	54	-14.16	-	-	303	102	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)

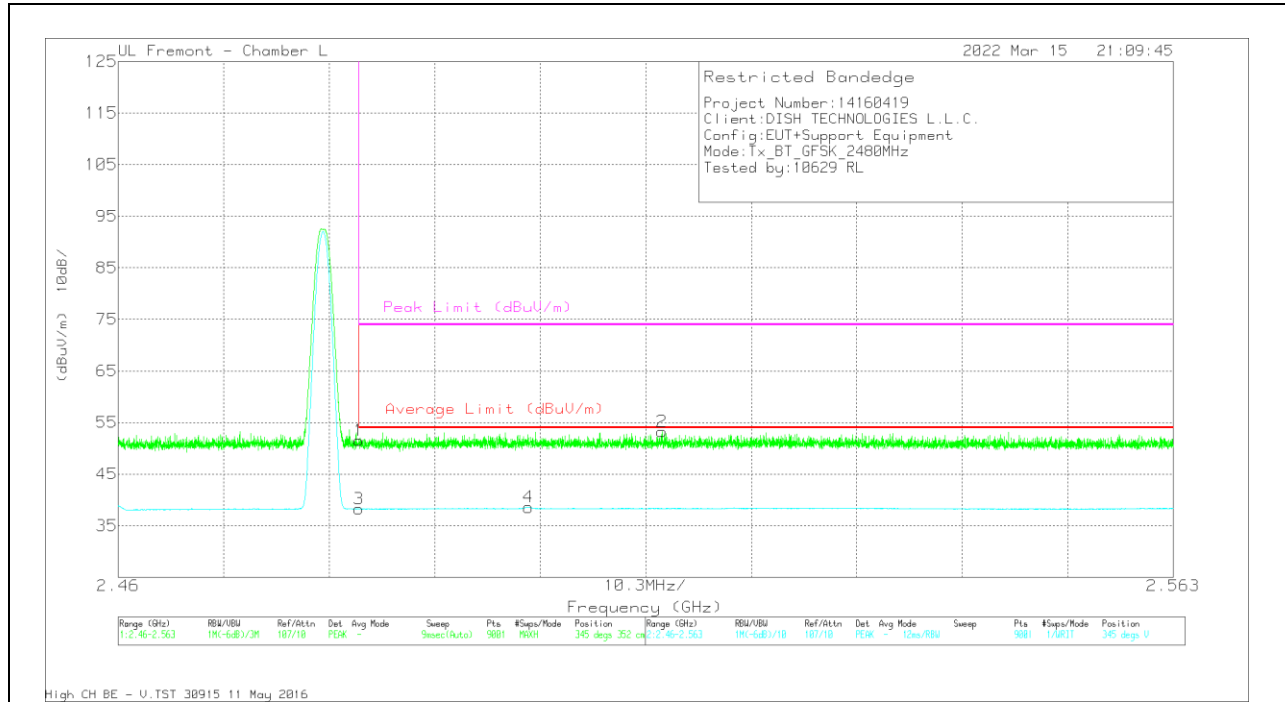
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/Filtr/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	* 2.4835	39.5	Pk	32.3	-19	52.8	-	-	74	-21.2	350	106	H
2	2.500157	41.23	Pk	32.4	-19.1	54.53	-	-	74	-19.47	350	106	H
3	* 2.4835	26.64	VA1T	32.3	-19	39.94	54	-14.06	-	-	350	106	H
4	* 2.499985	30.42	VA1T	32.4	-19.1	43.72	54	-10.28	-	-	350	106	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

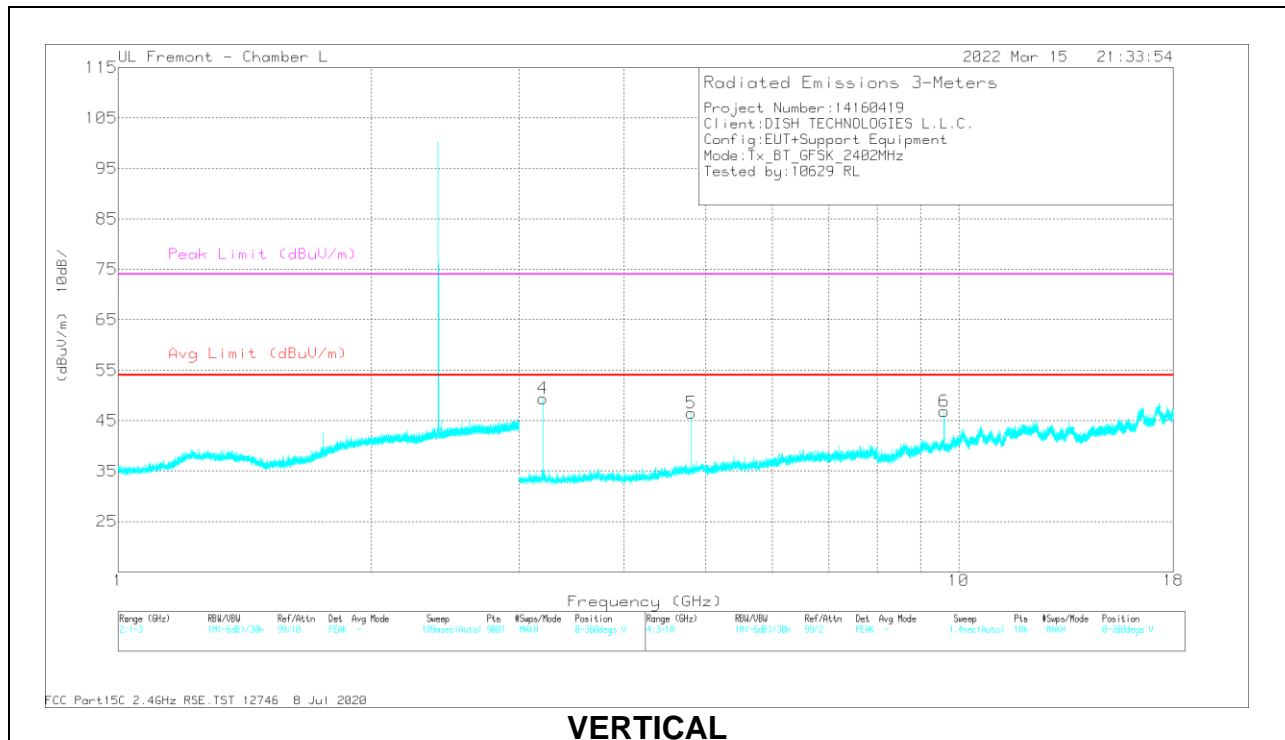
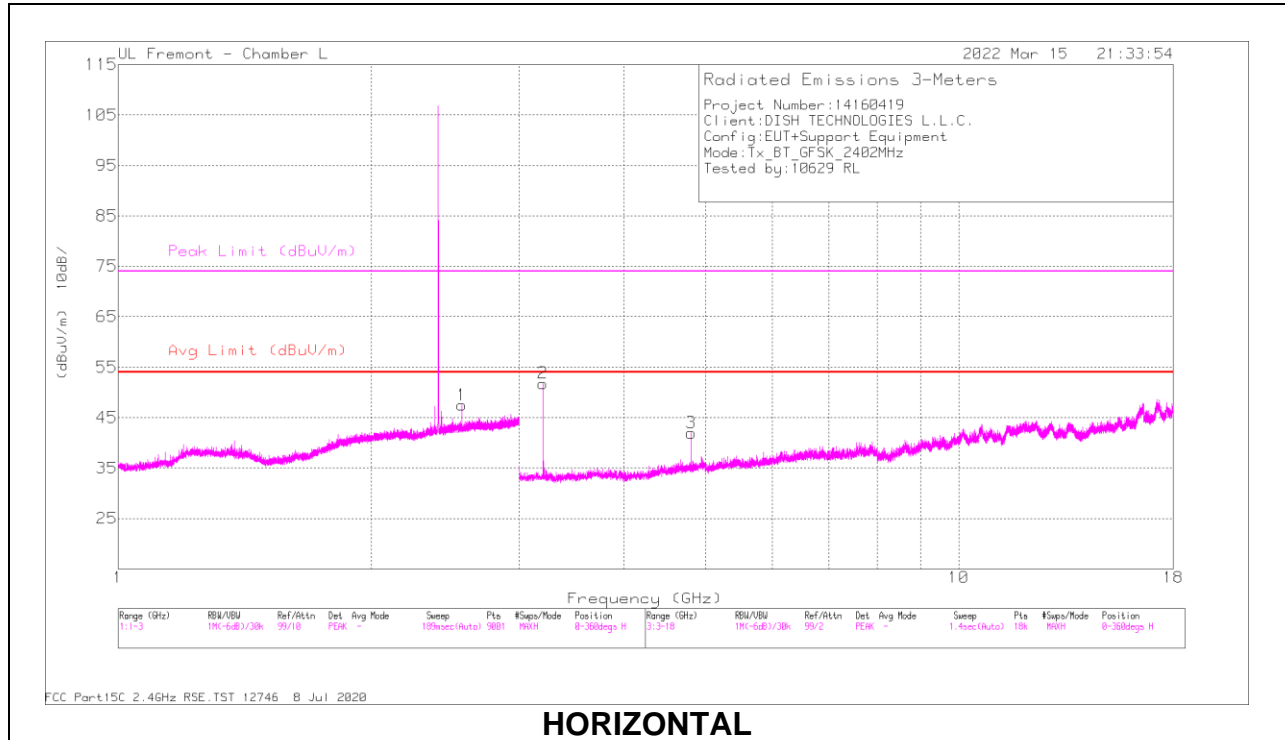


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	38.21	Pk	32.3	-19	51.51	-	-	74	-22.49	345	352	V
2	2.513089	39.82	Pk	32.4	-19	53.22	-	-	74	-20.78	345	352	V
3	* 2.4835	24.93	VA1T	32.3	-19	38.23	54	-15.77	-	-	345	352	V
4	2.500031	25.27	VA1T	32.4	-19.1	38.57	54	-15.43	-	-	345	352	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

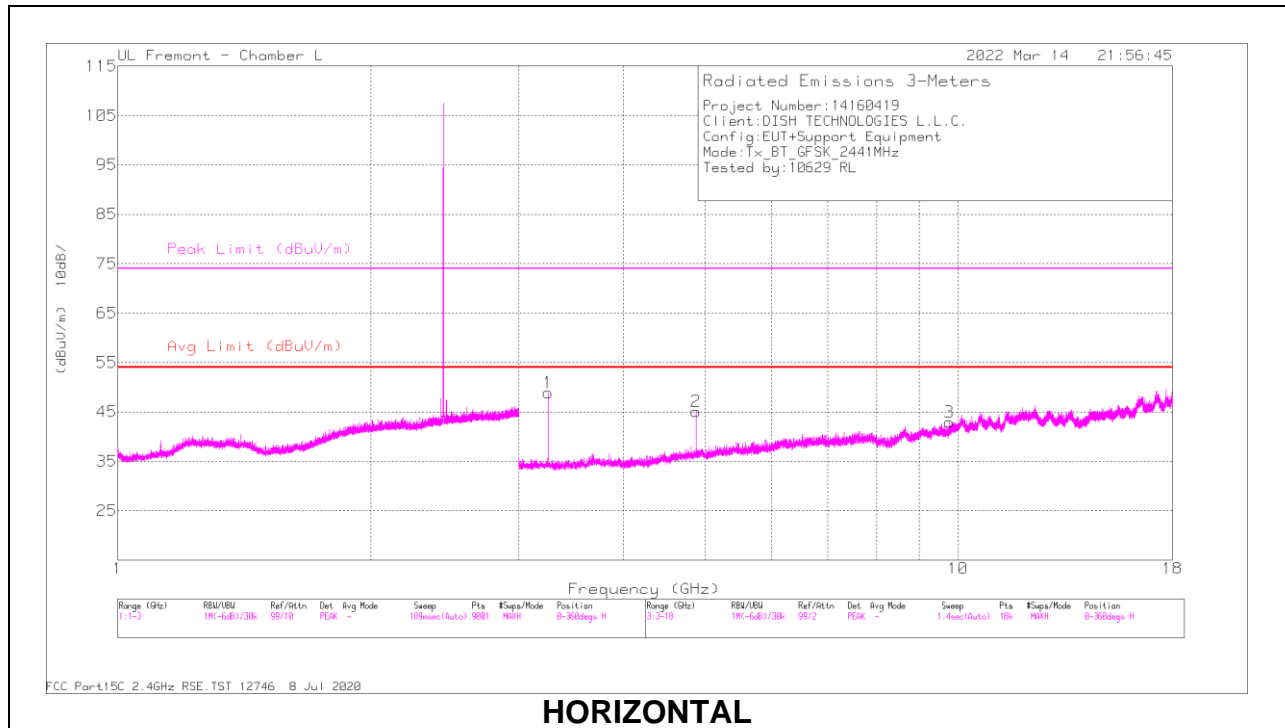


RADIATED EMISSIONS

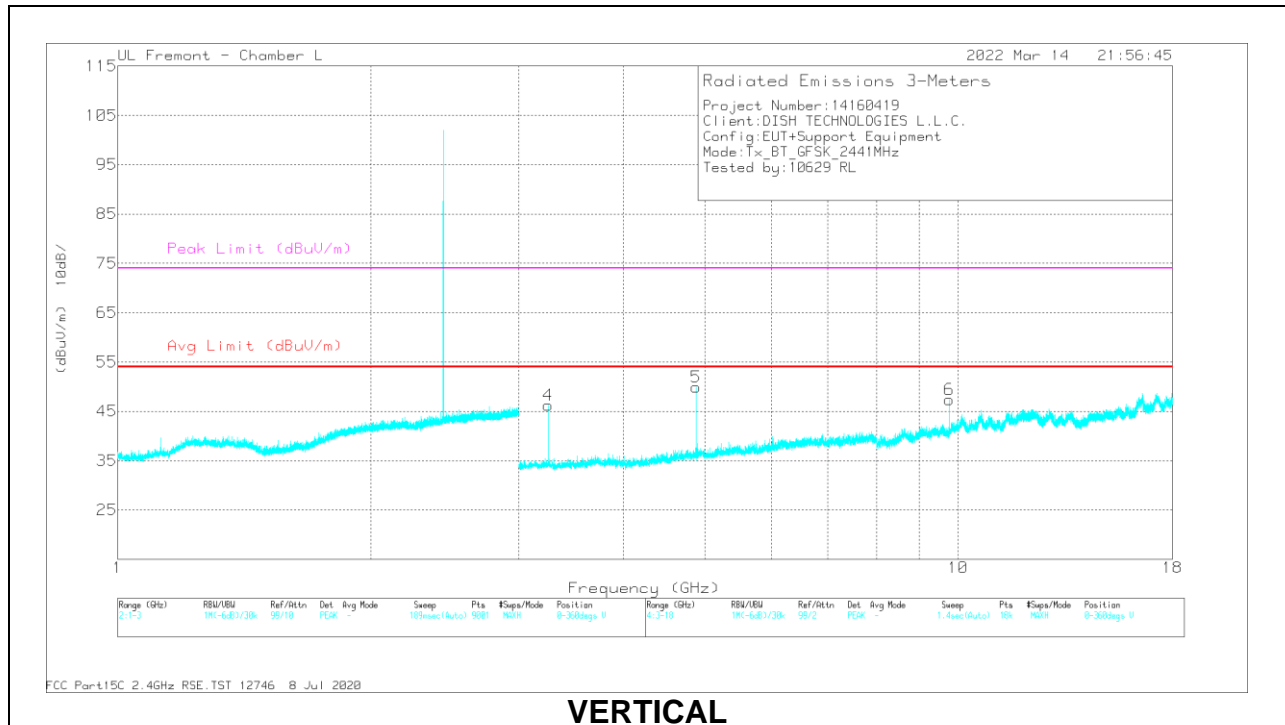
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.561918	40.91	PKFH	32.2	-18.9	54.21	-	-	-	-	343	110	H
	2.562018	31.83	VA1T	32.2	-18.9	45.13	-	-	-	-	343	110	H
2	3.202631	47.75	PKFH	32.9	-26.6	54.05	-	-	-	-	167	101	H
	3.202661	45.92	VA1T	32.9	-26.6	52.22	-	-	-	-	167	101	H
3	* 4.804288	38.51	PKFH	34.1	-24.5	48.11	-	-	74	-25.89	348	397	H
	* 4.803998	31.38	VA1T	34.1	-24.5	40.98	54	-13.02	-	-	348	397	H
4	3.202631	44.4	PKFH	32.9	-26.6	50.7	-	-	-	-	243	101	V
	3.202651	42.03	VA1T	32.9	-26.6	48.33	-	-	-	-	243	101	V
5	* 4.803524	41.94	PKFH	34.1	-24.5	51.54	-	-	74	-22.46	255	108	V
	* 4.803973	36.78	VA1T	34.1	-24.5	46.38	54	-7.62	-	-	255	108	V
6	9.6076	33.92	PKFH	36.8	-16.3	54.42	-	-	-	-	96	101	V
	9.60796	26.67	VA1T	36.8	-16.3	47.17	-	-	-	-	96	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

MID CHANNEL RESULTS



HORIZONTAL



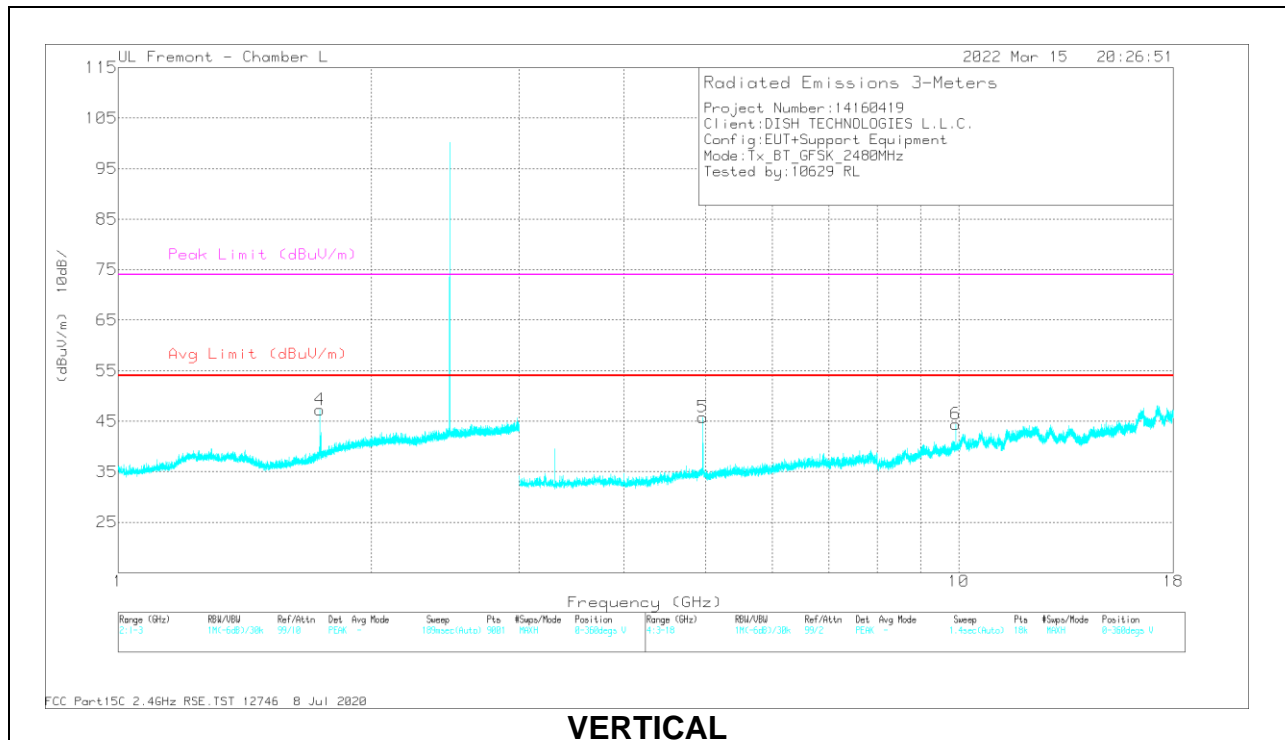
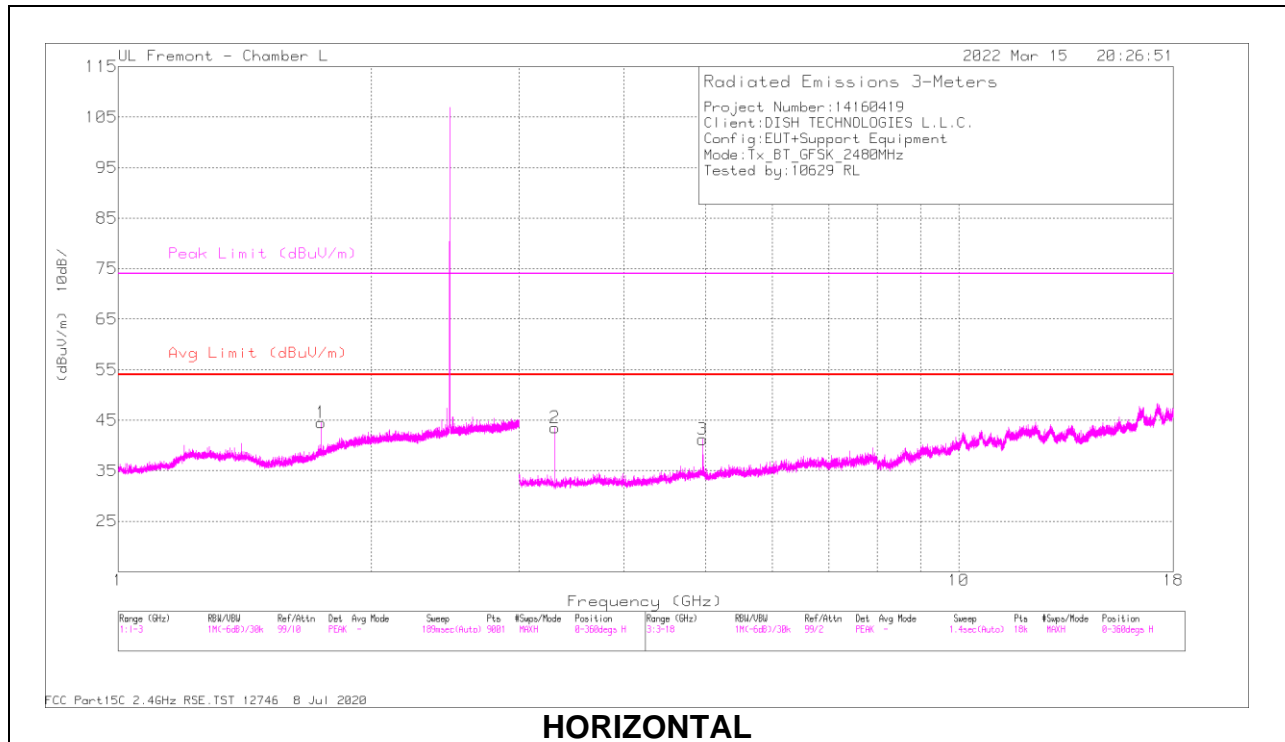
VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	3.25475	45.93	PKFH	33.1	-26.9	52.13	-	-	-	-	155	101	H
	3.254661	42.58	VA1T	33.1	-26.9	48.78	-	-	-	-	155	101	H
2	* 4.882152	42.29	PKFH	34.2	-24.3	52.19	-	-	74	-21.81	210	118	H
	* 4.881982	34.84	VA1T	34.2	-24.3	44.74	54	-9.26	-	-	210	118	H
3	9.764172	31.71	PKFH	37	-17.1	51.61	-	-	-	-	326	234	H
	9.763942	21.27	VA1T	37	-17.1	41.17	-	-	-	-	326	234	H
4	3.254621	44.13	PKFH	33.1	-26.9	50.33	-	-	-	-	255	102	V
	3.254651	39.74	VA1T	33.1	-26.9	45.94	-	-	-	-	255	102	V
5	* 4.882002	43.83	PKFH	34.2	-24.3	53.73	-	-	74	-20.27	218	101	V
	* 4.881982	37.79	VA1T	34.2	-24.3	47.69	54	-6.31	-	-	218	101	V
6	9.763742	35.59	PKFH	37	-17.1	55.49	-	-	-	-	93	102	V
	9.763982	27.51	VA1T	37	-17.1	47.41	-	-	-	-	93	102	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



RADIATED EMISSIONS

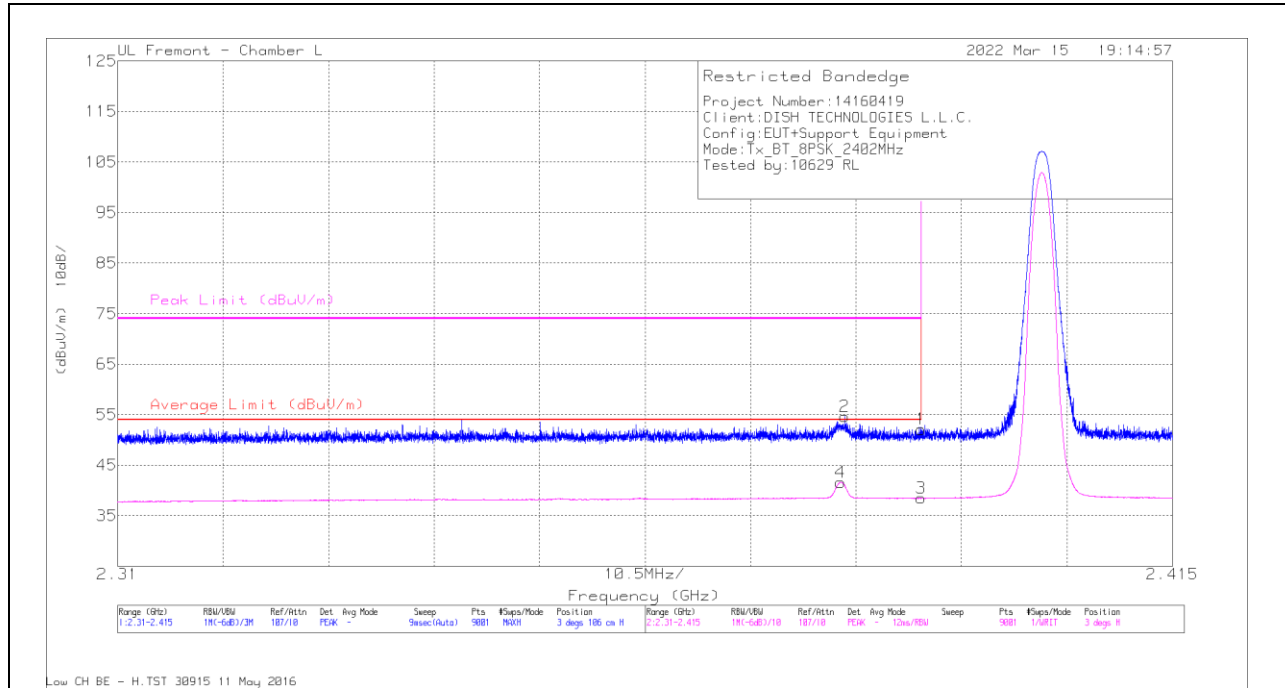
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.740772	39.47	PKFH	29.5	-21.3	47.67	-	-	-	-	152	152	H
	1.741661	25.56	VA1T	29.5	-21.3	33.76	-	-	-	-	152	152	H
4	1.737479	39.94	PKFH	29.5	-21.3	48.14	-	-	-	-	137	109	V
	1.735469	25.81	VA1T	29.5	-21.3	34.01	-	-	-	-	137	109	V
2	3.306659	42.39	PKFH	32.5	-26.5	48.39	-	-	-	-	167	101	H
	3.306659	38.69	VA1T	32.5	-26.5	44.69	-	-	-	-	167	101	H
3	* 4.959855	38.06	PKFH	34.2	-23.2	49.06	-	-	74	-24.94	212	132	H
	* 4.959855	31.32	VA1T	34.2	-23.2	42.32	54	-11.68	-	-	212	132	H
5	* 4.95968	41.52	PKFH	34.2	-23.2	52.52	-	-	74	-21.48	27	107	V
	* 4.95988	35.26	VA1T	34.2	-23.2	46.26	54	-7.74	-	-	27	107	V
6	9.919984	33.04	PKFH	37.1	-16.5	53.64	-	-	-	-	88	102	V
	9.919934	24.63	VA1T	37.1	-16.5	45.23	-	-	-	-	88	102	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)

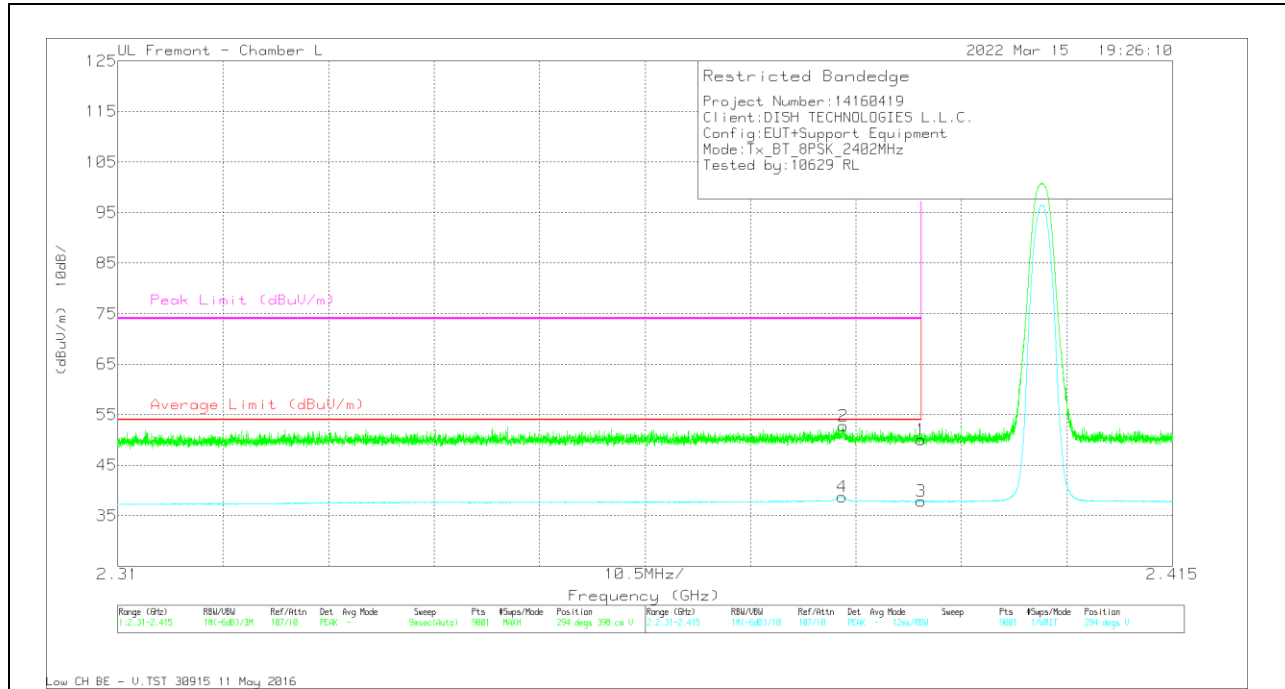
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/Filt/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	* 2.39	39.39	Pk	32	-19.3	52.09	-	-	74	-21.91	3	106	H
2	* 2.382359	41.98	Pk	32.1	-19.4	54.68	-	-	74	-19.32	3	106	H
3	* 2.39	25.76	VA1T	32	-19.3	38.46	54	-15.54	-	-	3	106	H
4	* 2.381962	28.95	VA1T	32.1	-19.4	41.65	54	-12.35	-	-	3	106	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

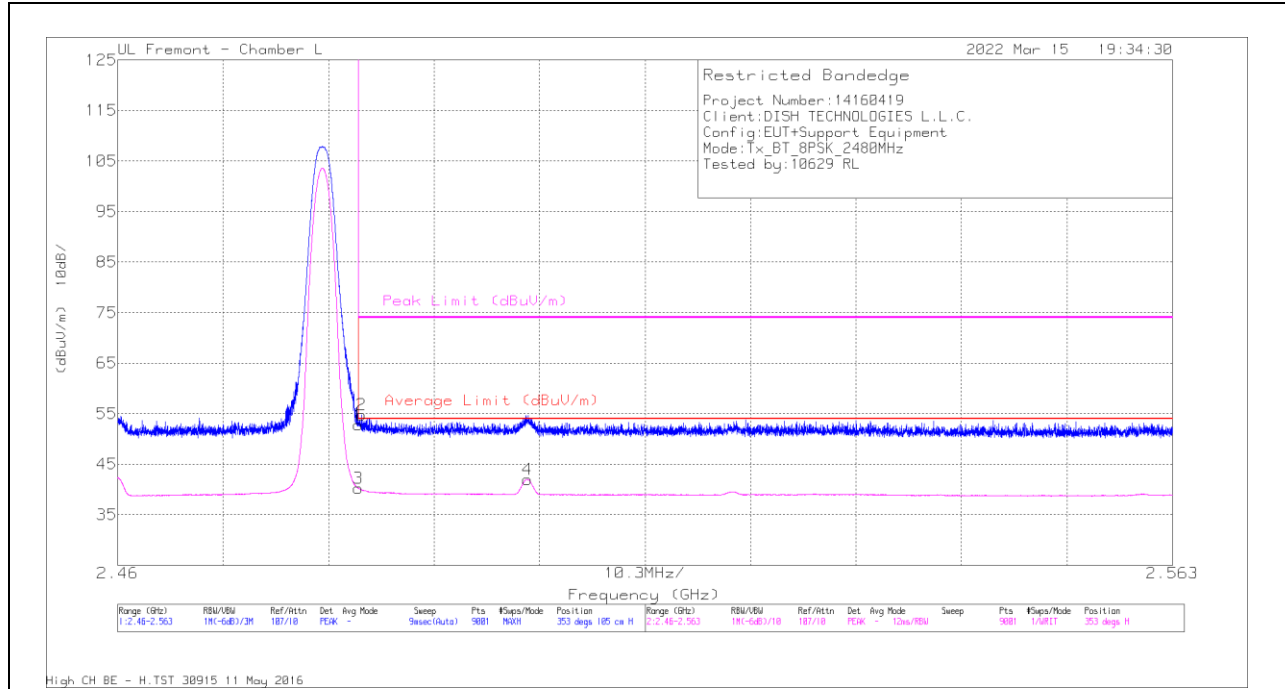


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	37.3	Pk	32	-19.3	50	-	-	74	-24	294	398	V
2	* 2.38223	40.09	Pk	32.1	-19.4	52.79	-	-	74	-21.21	294	398	V
3	* 2.39	25.17	VA1T	32	-19.3	37.87	54	-16.13	-	-	294	398	V
4	* 2.38209	25.99	VA1T	32.1	-19.4	38.69	54	-15.31	-	-	294	398	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)

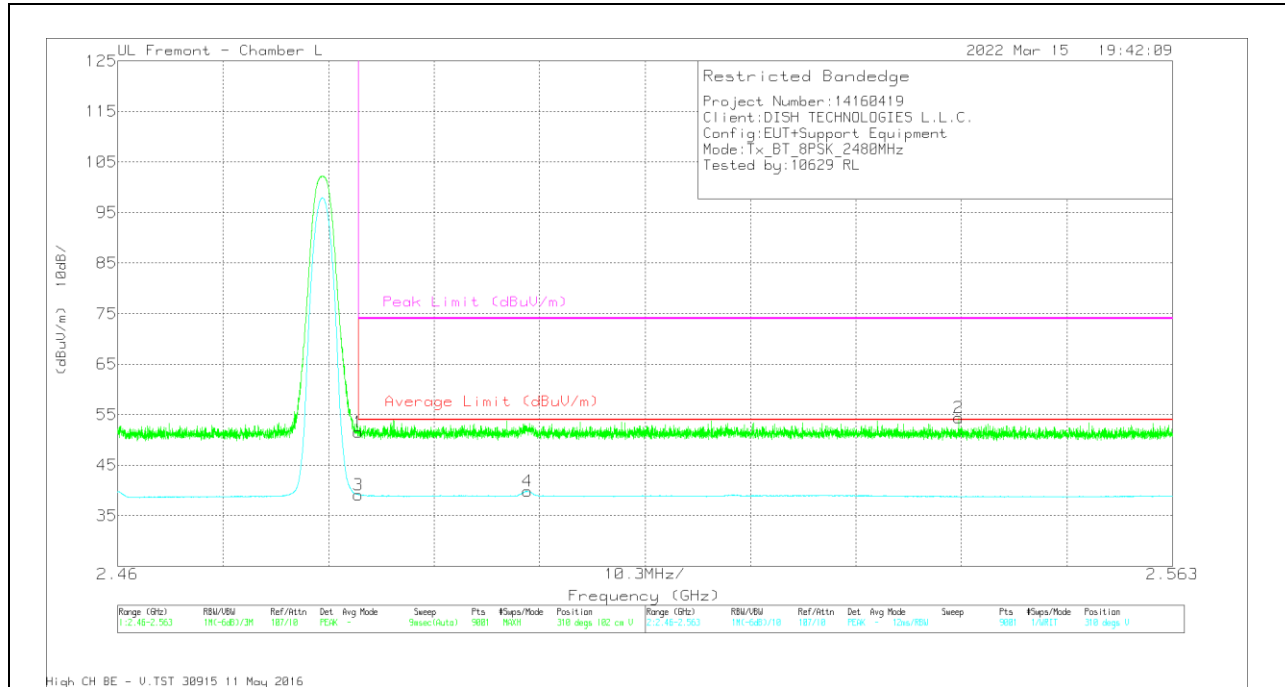
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/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	* 2.4835	39.46	Pk	32.3	-19	52.76	-	-	74	-21.24	353	105	H
2	* 2.483826	41.5	Pk	32.3	-19	54.8	-	-	74	-19.2	353	105	H
3	* 2.4835	26.91	VA1T	32.3	-19	40.21	54	-13.79	-	-	353	105	H
4	2.500031	28.69	VA1T	32.4	-19.1	41.99	54	-12.01	-	-	353	105	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

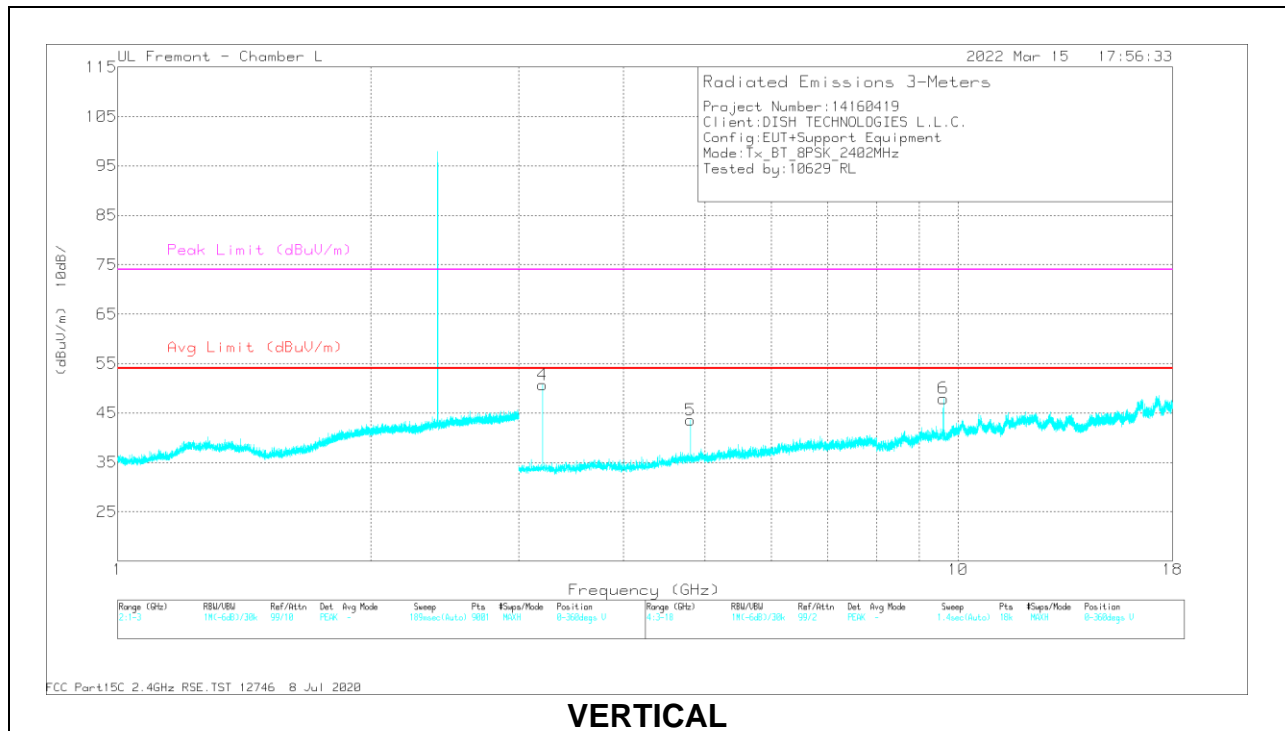
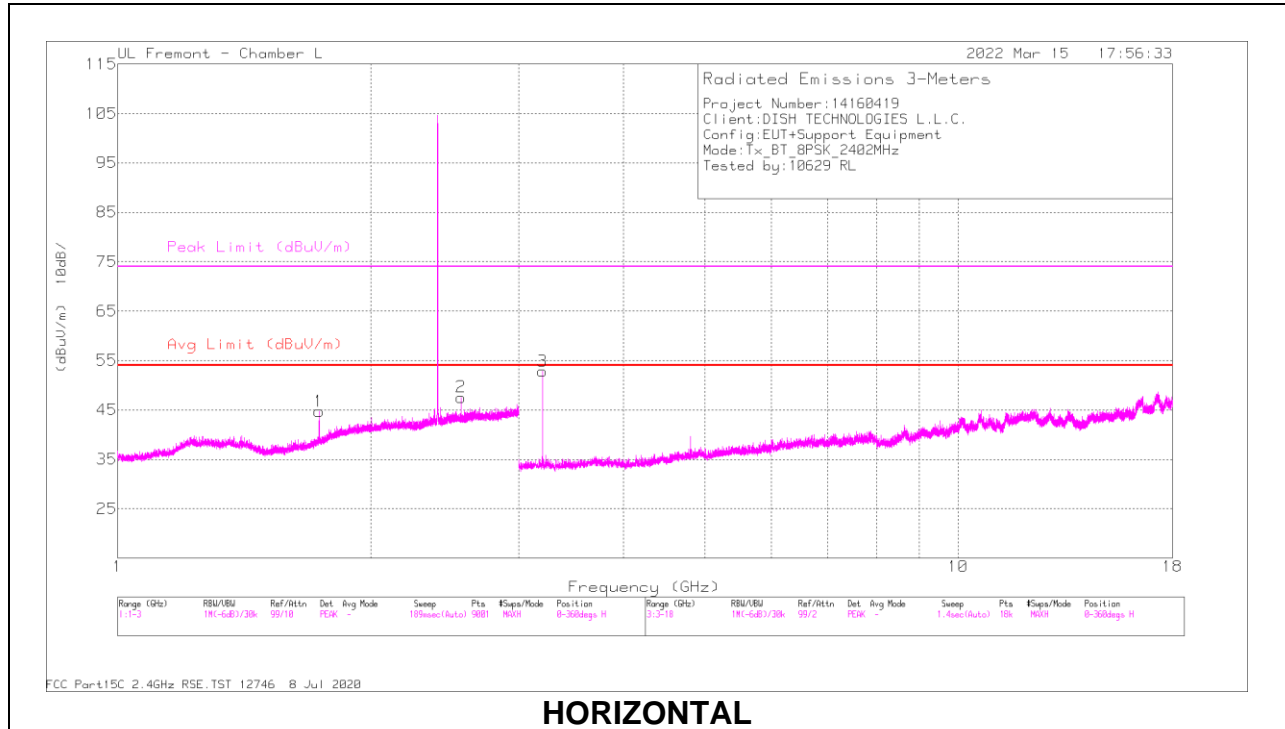


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	38.2	Pk	32.3	-19	51.5	-	-	74	-22.5	310	102	V
2	2.542111	41.05	Pk	32.3	-19	54.35	-	-	74	-19.65	310	102	V
3	* 2.4835	25.87	VA1T	32.3	-19	39.17	54	-14.83	-	-	310	102	V
4	2.50002	26.57	VA1T	32.4	-19.1	39.87	54	-14.13	-	-	310	102	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

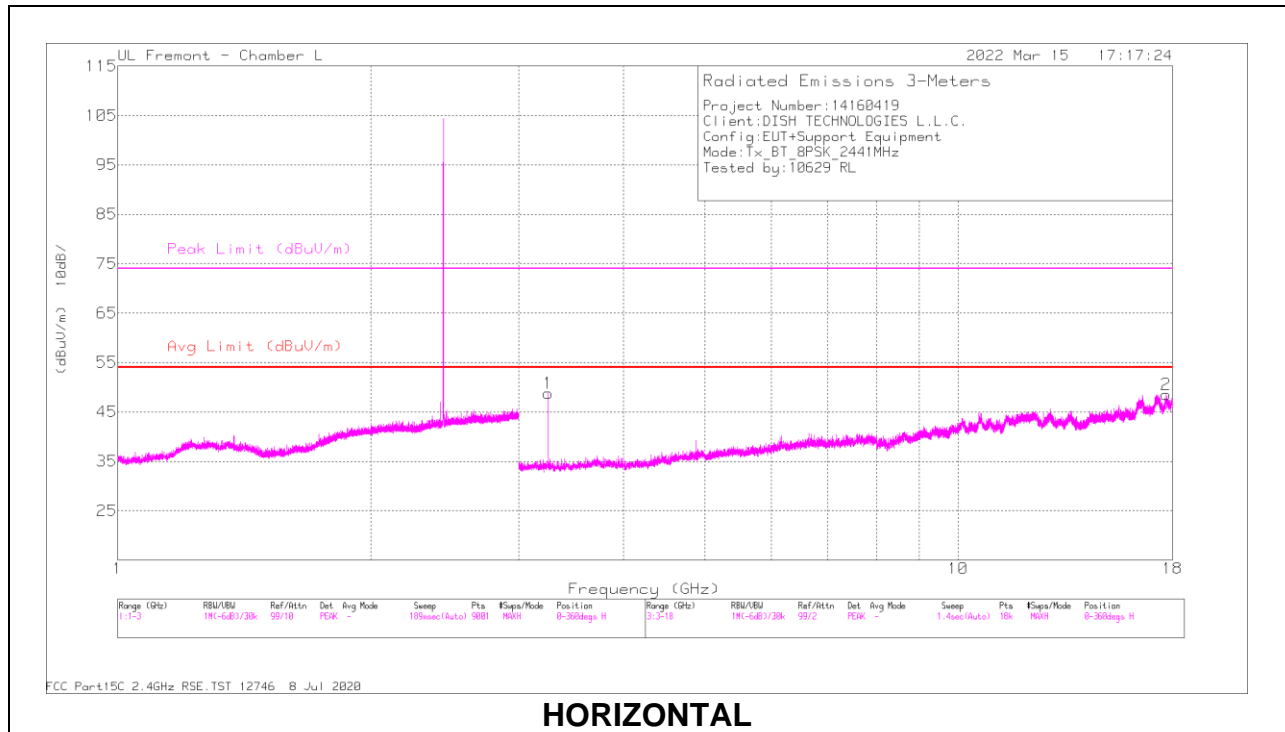


RADIATED EMISSIONS

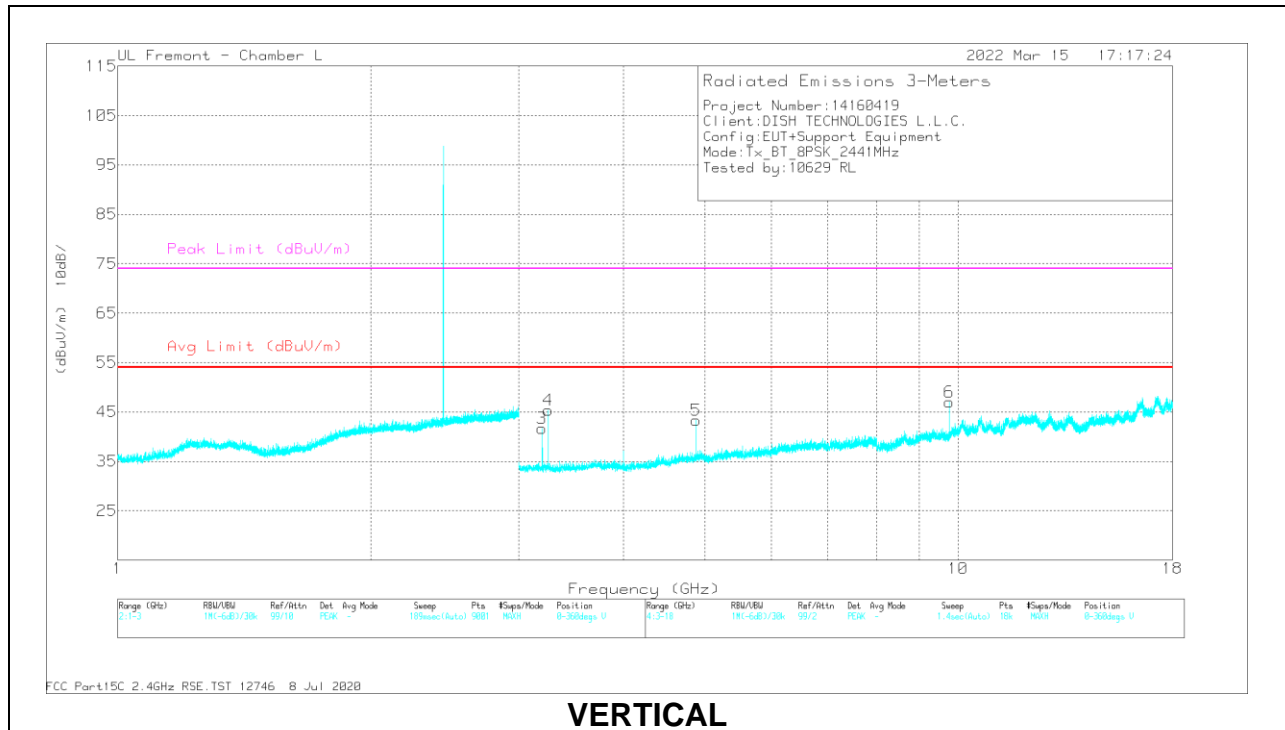
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.736826	40.17	PKFH	29.5	-21.3	48.37	-	-	-	-	232	106	H
	1.735691	26.23	VA1T	29.5	-21.3	34.43	-	-	-	-	232	106	H
2	2.561978	41.24	PKFH	32.2	-18.9	54.54	-	-	-	-	346	102	H
	2.561978	30.11	VA1T	32.2	-18.9	43.41	-	-	-	-	346	102	H
3	3.202621	48.78	PKFH	32.9	-26.6	55.08	-	-	-	-	167	103	H
	3.202661	46.53	VA1T	32.9	-26.6	52.83	-	-	-	-	167	103	H
4	3.202791	46.81	PKFH	32.9	-26.6	53.11	-	-	-	-	240	101	V
	3.202651	44	VA1T	32.9	-26.6	50.3	-	-	-	-	240	101	V
5	* 4.803953	42.26	PKFH	34.1	-24.5	51.86	-	-	74	-22.14	257	101	V
	* 4.804023	32.14	VA1T	34.1	-24.5	41.74	54	-12.26	-	-	257	101	V
6	9.60788	35.48	PKFH	36.8	-16.3	55.98	-	-	-	-	96	110	V
	9.60795	27.75	VA1T	36.8	-16.3	48.25	-	-	-	-	96	110	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



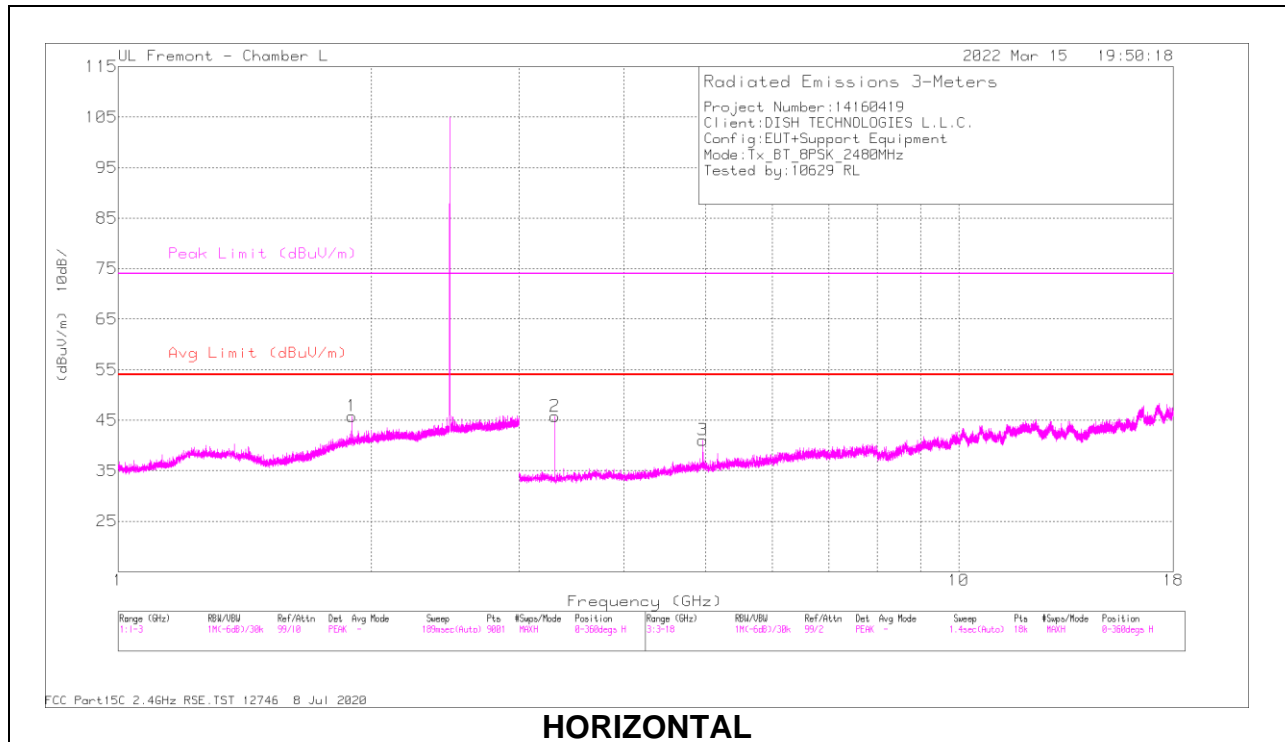
VERTICAL

RADIATED EMISSIONS

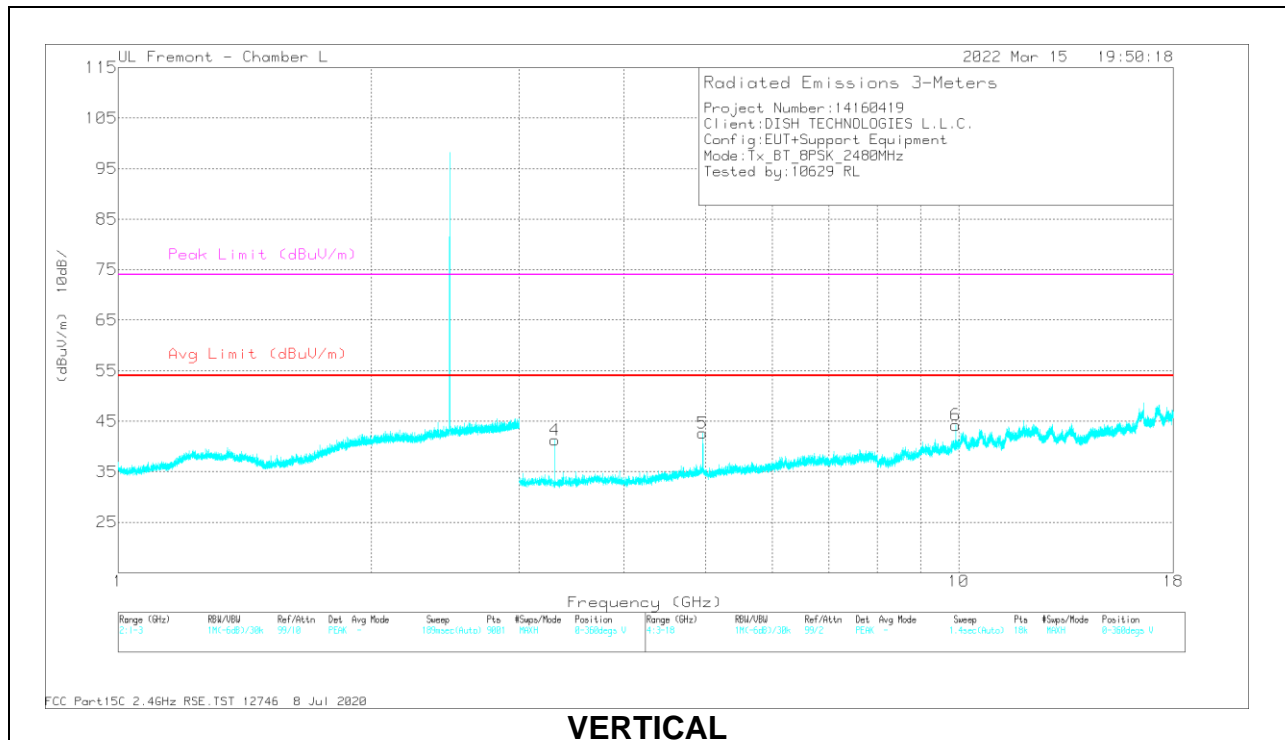
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.25469	45.81	PKFH	33.1	-26.9	52.01	-	-	-	-	170	102	H
	3.254651	42.66	VA1T	33.1	-26.9	48.86	-	-	-	-	170	102	H
2	17.691635	29.66	PKFH	41.3	-14.3	56.66	-	-	-	-	145	101	H
	17.689807	16.1	VA1T	41.4	-14.3	43.2	-	-	-	-	145	101	H
3	3.200037	41.19	PKFH	32.9	-26.6	47.49	-	-	-	-	355	309	V
	3.200047	22.8	VA1T	32.9	-26.6	29.1	-	-	-	-	355	309	V
4	3.254611	43.79	PKFH	33.1	-26.9	49.99	-	-	-	-	269	101	V
	3.254641	39.51	VA1T	33.1	-26.9	45.71	-	-	-	-	269	101	V
5	* 4.881732	43.29	PKFH	34.2	-24.3	53.19	-	-	74	-20.81	212	101	V
	* 4.881992	32.85	VA1T	34.2	-24.3	42.75	54	-11.25	-	-	212	101	V
6	9.763882	34.65	PKFH	37	-17.1	54.55	-	-	-	-	95	101	V
	9.763972	27.8	VA1T	37	-17.1	47.7	-	-	-	-	95	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

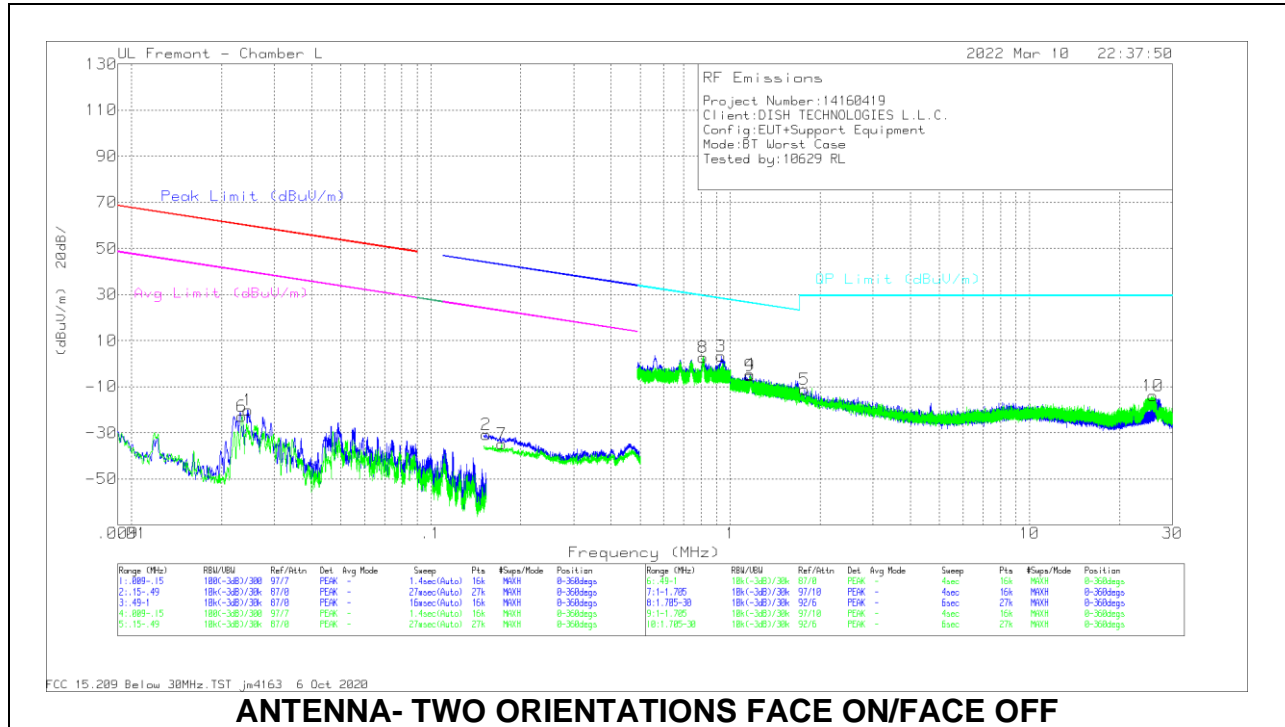
RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	1.898309	39.66	PKFH	31.3	-20.8	50.16	-	-	-	-	49	213	H
	1.900557	25.29	VA1T	31.2	-20.8	35.69	-	-	-	-	49	213	H
2	3.306709	42.86	PKFH	32.5	-26.5	48.86	-	-	-	-	167	101	H
	3.306669	39.3	VA1T	32.5	-26.5	45.3	-	-	-	-	167	101	H
3	* 4.959591	38.2	PKFH	34.2	-23.2	49.2	-	-	74	-24.8	90	102	H
	* 4.96003	28.48	VA1T	34.2	-23.2	39.48	54	-14.52	-	-	90	102	H
4	3.306579	40.84	PKFH	32.5	-26.5	46.84	-	-	-	-	239	108	V
	3.306649	35.67	VA1T	32.5	-26.5	41.67	-	-	-	-	239	108	V
5	* 4.960025	39.05	PKFH	34.2	-23.2	50.05	-	-	74	-23.95	64	106	V
	* 4.960015	30.03	VA1T	34.2	-23.2	41.03	54	-12.97	-	-	64	106	V
6	9.919799	33.13	PKFH	37.1	-16.5	53.73	-	-	-	-	93	101	V
	9.919958	25.56	VA1T	37.1	-16.5	46.16	-	-	-	-	93	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	.0245	32.62	Pk	58.6	-31.4	-80	-20.18	59.82	-80	39.82	-60	0-360
2	.1531	25.21	Pk	56	-32	-80	-30.79	43.93	-74.72	23.93	-54.72	0-360
6	.0234	29.64	Pk	58.7	-31.3	-80	-22.96	60.2	-83.16	40.2	-63.16	0-360
7	.1725	21.04	Pk	56.1	-32	-80	-34.86	42.89	-77.75	22.89	-57.75	0-360

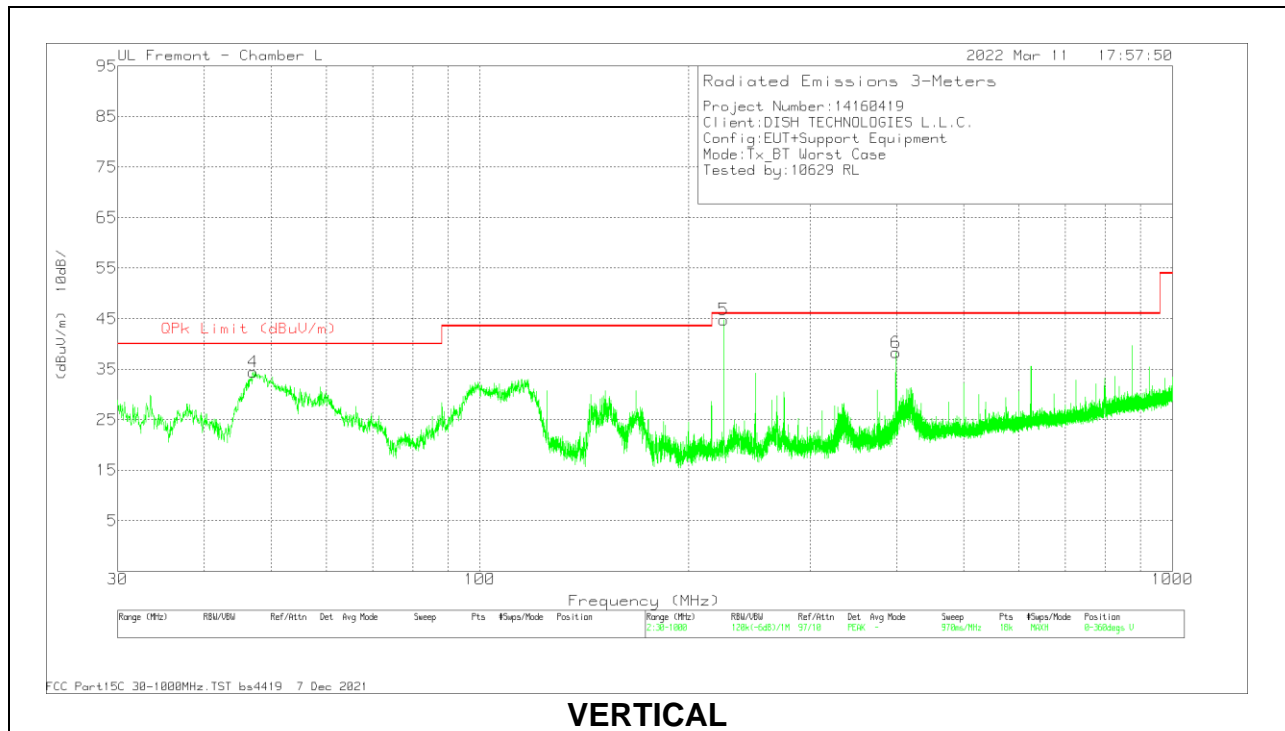
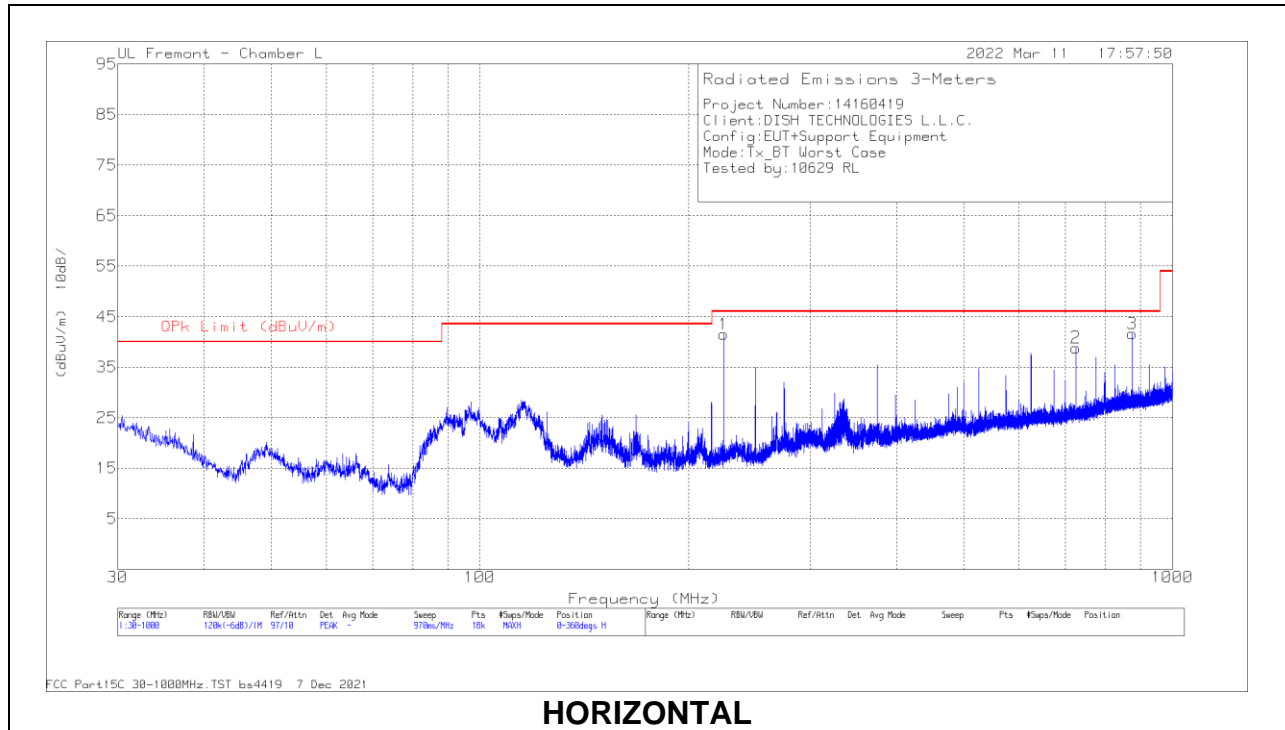
Pk - Peak detector

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	.9324	18.77	Pk	56.3	-31.9	-40	3.17	28.23	-25.06	0-360
8	.8116	18.38	Pk	56.3	-31.9	-40	2.78	29.43	-26.65	0-360
4	1.1661	21.25	Pk	46	-31.9	-40	-4.65	26.29	-30.94	0-360
5	1.771	17.86	Pk	42.8	-31.8	-40	-11.14	29.5	-40.64	0-360
9	1.1669	20.77	Pk	46	-31.9	-40	-5.13	26.28	-31.41	0-360
10	25.8803	24.04	Pk	33.4	-31.4	-40	-13.96	29.5	-43.46	0-360

Pk - Peak detector

10.3. WORST CASE BELOW 1 GHZ

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



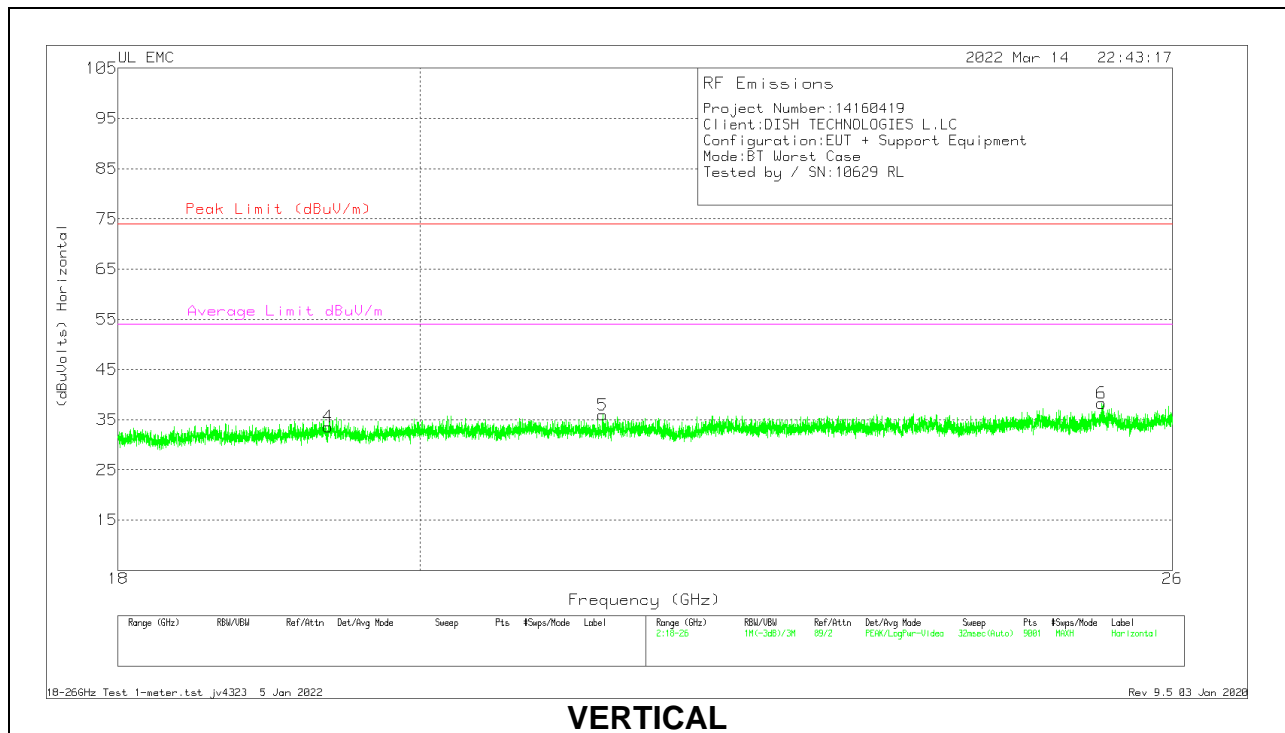
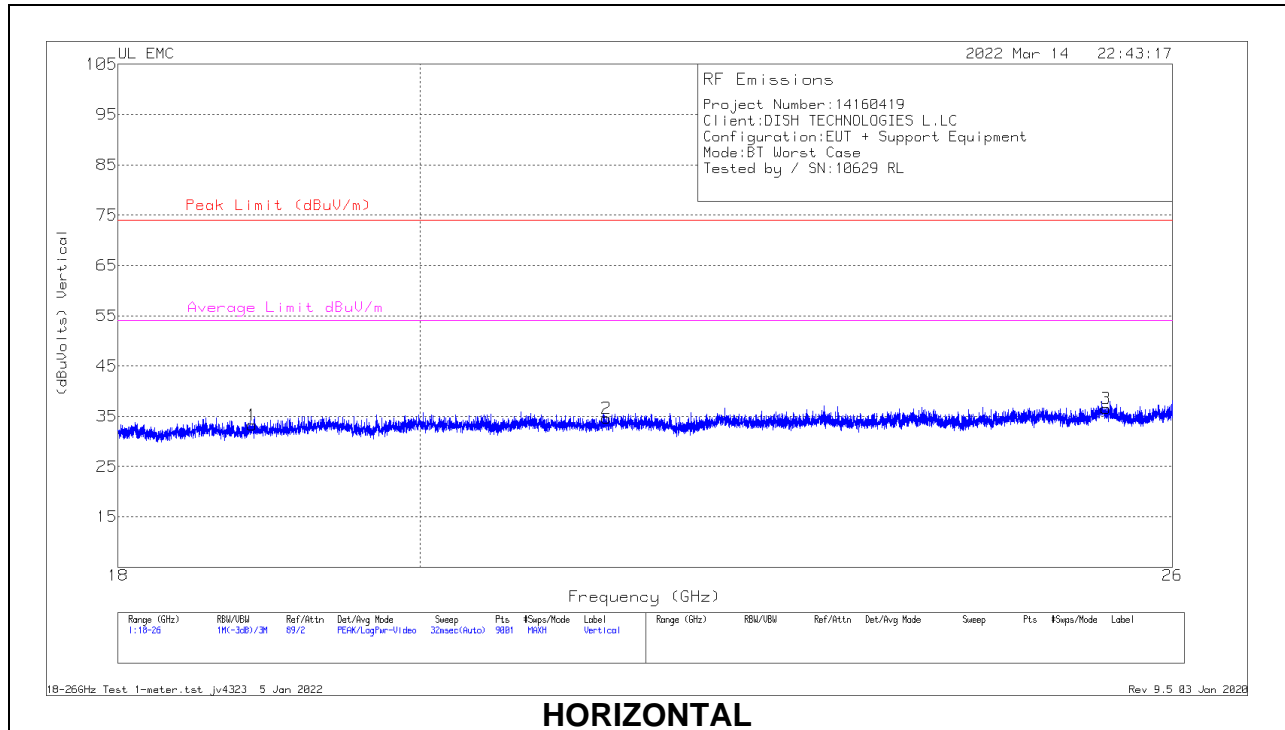
Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	171862 ACF (dB)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	224.97	54.78	Pk	16.6	-29.9	41.48	46.02	-4.54	0-360	101	H
	224.999	55.13	Qp	16.6	-29.9	41.83	46.02	-4.19	71	133	H
2	725.006	40.75	Pk	26.4	-28.3	38.85	46.02	-7.17	0-360	101	H
	875.033	41.25	Pk	27.8	-27.4	41.65	46.02	-4.37	0-360	101	H
3	875.002	41.38	Qp	27.8	-27.4	41.78	46.02	-4.24	34	101	H
	47.0289	50.66	Pk	15	-31.2	34.46	40	-5.54	0-360	101	V
4	47.8351	46.82	Qp	14.6	-31.2	30.22	40	-9.78	34	102	V
	224.97	58.11	Pk	16.6	-29.9	44.81	46.02	-1.21	0-360	101	V
5	225.002	58.79	Qp	16.6	-30	45.39	46.02	-.63	162	101	V
	399.194	45.93	Pk	21.4	-29	38.33	46.02	-7.69	0-360	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	AF 81139 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	PK Margin (dB)	Average Limit dBuV/m	Margin (dB)
1	18.86222	67.85	Pk	33	-58.1	-9.5	33.25	74	-40.75	54	-20.75
2	21.34311	67.62	Pk	33.8	-57.3	-9.5	34.62	74	-39.38	54	-19.38
3	25.40445	66.25	Pk	35	-55.2	-9.5	36.55	74	-37.45	54	-17.45
4	19.368	66.79	Pk	33.4	-57.1	-9.5	33.59	74	-40.41	54	-20.41
5	21.31378	69.15	Pk	33.7	-57.4	-9.5	35.95	74	-38.05	54	-18.05
6	25.36533	67.95	Pk	35	-55.2	-9.5	38.25	74	-35.75	54	-15.75

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

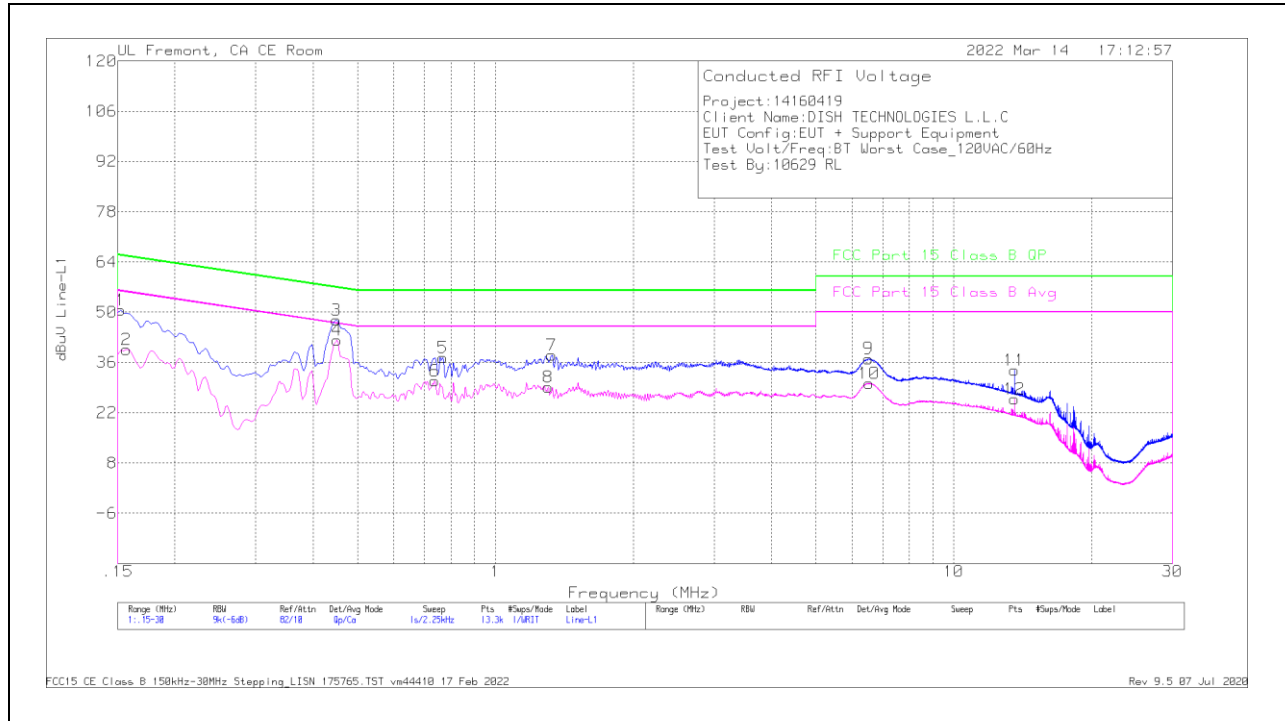
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

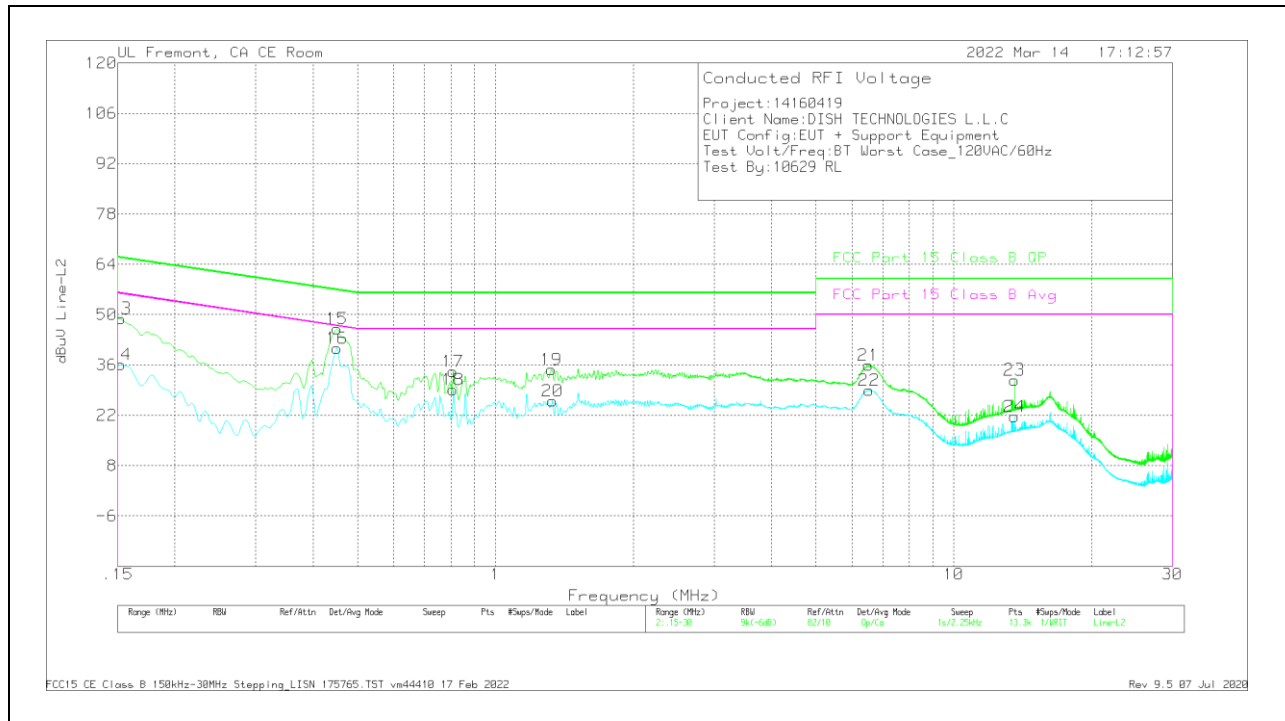
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 LISN L1	C1&C3 cable	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)Margin (dB)
2	.15675	30.12	Ca	.1	0	9.4	39.62	-	-	55.63	-16.01
4	.4515	33.01	Ca	0	0	9.3	42.31	-	-	46.85	-4.54
6	.73725	21.5	Ca	0	.1	9.3	30.9	-	-	46	-15.1
8	1.30425	19.79	Ca	0	.1	9.3	29.19	-	-	46	-16.81
10	6.53775	20.8	Ca	0	.1	9.3	30.2	-	-	50	-19.8
12	13.56	16.27	Ca	.1	.2	9.3	25.87	-	-	50	-24.13
1	.15225	41.05	Qp	.1	0	9.4	50.55	65.88	-15.33	-	-
3	.44925	38.46	Qp	0	0	9.3	47.76	56.89	-9.13	-	-
5	.76875	28	Qp	0	.1	9.3	37.4	56	-18.6	-	-
7	1.32675	28.62	Qp	0	.1	9.3	38.02	56	-17.98	-	-
9	6.522	27.68	Qp	0	.1	9.3	37.08	60	-22.92	-	-
11	13.56	24.28	Qp	.1	.2	9.3	33.88	60	-26.12	-	-

Qp - Quasi-Peak detector
 Ca - CISPR average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 LISN L2	C2&C3 cable	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Aw(CISPR)Margin (dB)
14	.15225	26.6	Ca	.1	0	9.4	36.1	-	-	55.88	-19.78
16	.4515	31.38	Ca	0	0	9.3	40.68	-	-	46.85	-6.17
18	.80925	19.7	Ca	0	.1	9.3	29.1	-	-	46	-16.9
20	1.33125	16.58	Ca	0	.1	9.3	25.98	-	-	46	-20.02
22	6.54225	19.59	Ca	0	.1	9.3	28.99	-	-	50	-21.01
24	13.56	12.1	Ca	.1	.2	9.3	21.7	-	-	50	-28.3
13	.15225	39.44	Qp	.1	0	9.4	48.94	65.88	-16.94	-	-
15	.4515	36.73	Qp	0	0	9.3	46.03	56.85	-10.82	-	-
17	.80925	24.8	Qp	0	.1	9.3	34.2	56	-21.8	-	-
19	1.3245	25.38	Qp	0	.1	9.3	34.78	56	-21.22	-	-
21	6.51525	26.49	Qp	0	.1	9.3	35.89	60	-24.11	-	-
23	13.56	22.24	Qp	.1	.2	9.3	31.84	60	-28.16	-	-

Qp - Quasi-Peak detector
 Ca - CISPR average detection