



TEST REPORT

Report Number.: 13619076-E3V2

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

Model : D45

Brand : DISH

FCC ID : DKNRW33

EUT Description : TV SET TOP BOX

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

Date of Issue:

May 17, 2021

Prepared by:

UL VERIFICATION SERVICES

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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	3/29/2021	Initial Issue	--
V2	5/17/2021	Switched above 1G front and back photos to address TCB's questions	Tina Chu

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: TV SET TOP BOX

MODEL: D45

BRAND: DISH

SERIAL NUMBER: CONDUCTED: E4EXUH00011A
RADIATED: E4EUH00004A

SAMPLE RECEIPT DATE: FEBRUARY 12, 2021

DATE TESTED: FEBRUARY 16 – MARCH 11, 2021

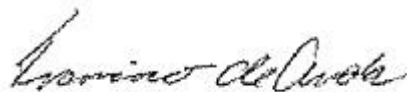
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies

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

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc. By:



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2. TEST RESULTS SUMMARY

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

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	6dB BW	Complies	None.
15.247 (b) (3)	Output Power	Complies	None.
See Comment	Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	PSD	Complies	None.
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 TV Set Top Box with RF4CE Zigbee, BLE (2Mbps), BT and 5GHz 802.11a/n/ac/ax 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)
2425-2475	ZIGBEE	5.48	3.53

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 4.1 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was Dish Agency Build 3.4.

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.

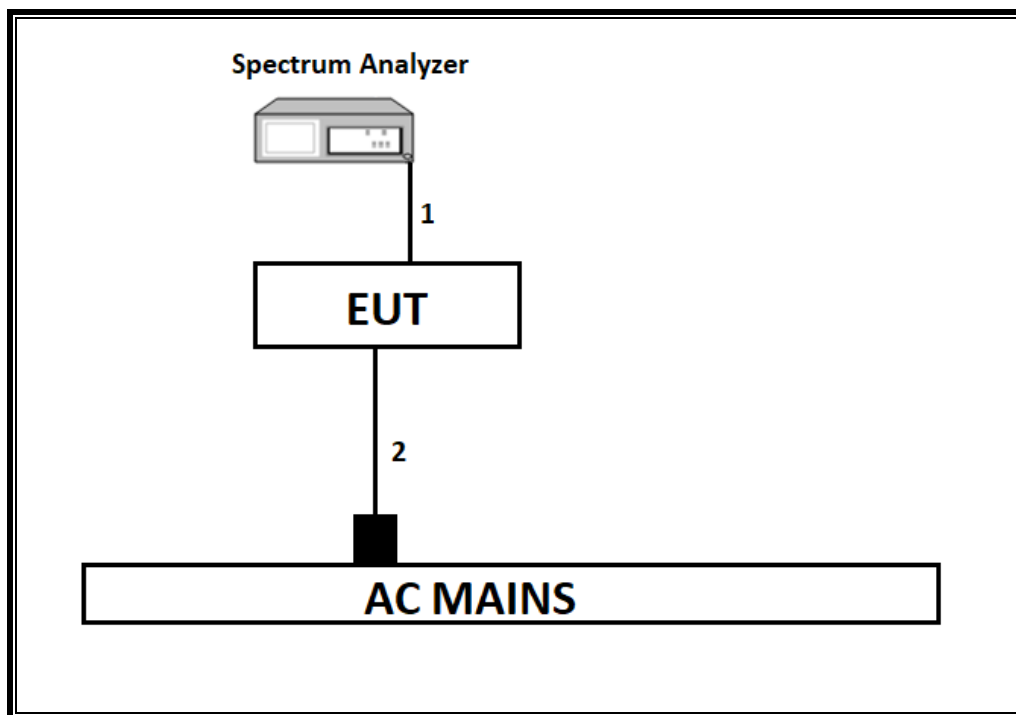
This EUT supports BLE/BT + Zigbee + WLAN 5GHz simultaneous transmission, radiated emission test was performed, please refer to 13619076-E4 for result.

Data rate provided by manufacturer: 250kbps, O-QPSK modulation.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC		
AC/DC Adapter (EUT)	NetBit	NBC25A120210VU	-	Doc		
Router	D-Link	EBR-2310	F311388010596	Doc		
AC/DC Adapter (Router)	D-Link	AF0605-B	-	Doc		
TV Emulator	Dish Technologies	-	D25-41	Doc		
Monitor	SCEPTRE	E248W-1920R	J07F248CCD8002	Doc		
AC/DC Adapter (Monitor)	BSY	BSYF120250U W	-	Doc		
USB Flash Drive	SanDisk	SDCZ60-016G	-	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	AC	1	Two Prong	Un-shielded	1	EUT to AC Mains
I/O CABLES (RADIATED TEST AND AC POWER LINE CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	Two Prong	Un-shielded	1	EUT to AC Mains
2	HDMI	1	HDMI	Un-shielded	2	EUT to Monitor
3	AC	1	Two Prong	Un-shielded	2.5	Monitor to AC Mains
4	RJ45	1	RJ45	Un-shielded	More than 3	EUT to Router
5	DC	1	AC-Two Prong	Un-shielded	2	Router adapter to AC Mains

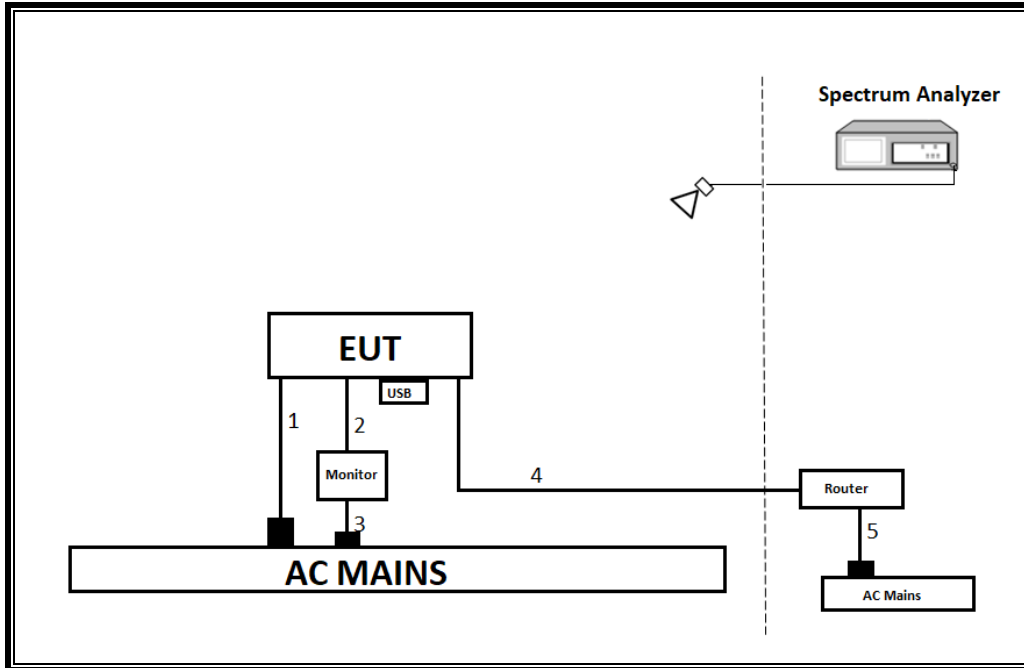
CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

Upon power up the EUT, the Zigbee radio will be exercised.

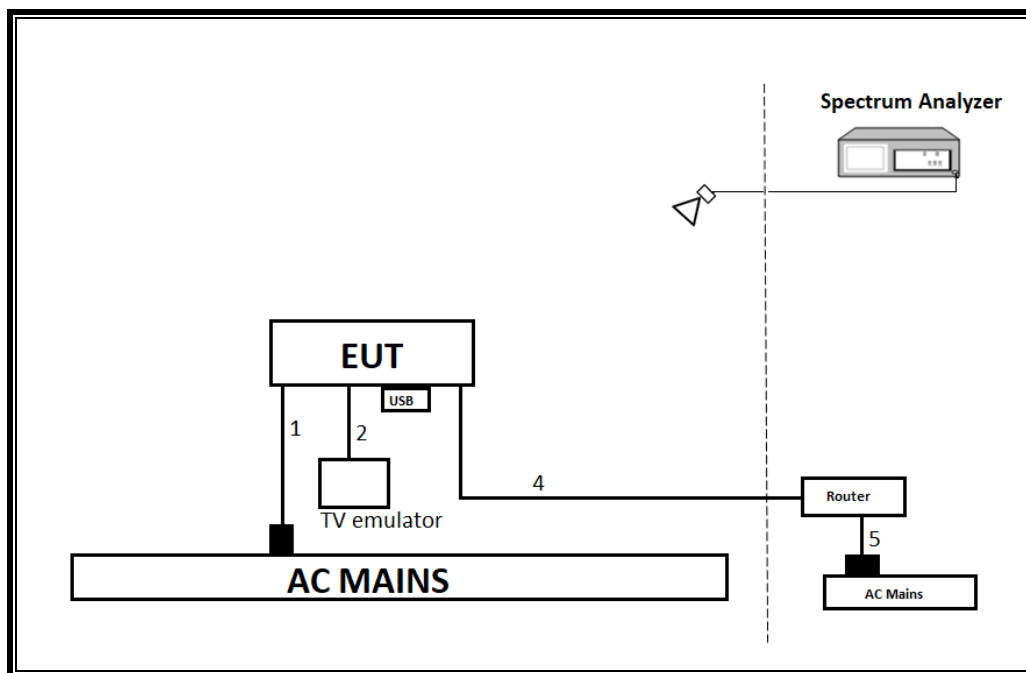
**RADIATED TEST SETUP DIAGRAM- ABOVE 1GHz, BELOW 30MHz, AND AC POWER LINE
CONDUCTED TEST SETUP DIAGRAM**



TEST SETUP

The EUT is connected to support equipment and AC powered. Upon power up the EUT, the Zigbee radio will be exercised. Power cycle to switch the test mode.

RADIATED TEST SETUP DIAGRAM- 30MHz to 1GHz



TEST SETUP

The EUT is connected to support equipment and AC powered. Upon power up the EUT, the Zigbee radio will be exercised. Power cycle to switch the test mode.

7. MEASUREMENT METHOD

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

6 dB BW: ANSI C63.10 Section 11.8.1

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

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

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

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

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

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

Band-edge: ANSI C63.10 Section 6.10

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

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

8. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	T477	9/24/2021	9/24/2020
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	1/21/2022	1/21/2021
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	8/31/2021	8/31/2020
Amplifier, 100MHz-18GHz	AMPLICAL	AMP0.1G18-47-20	PRE0197319	5/4/2021	5/4/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179376	2/21/2022	2/21/2021
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	PRE0179466	5/27/2021	5/27/2020
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	PRE0179468	5/27/2021	5/27/2020
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	9/24/2021	9/24/2020
Rf Amplifier, 18-26.5GHz, 60dB gain	AMPLICAL	AMP18G26.5-60	PRE0181238	6/7/2021	6/7/2020
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies Inc	E4446A	T123	1/22/2022	1/22/2021
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T143	*2/26/2021	2/26/2020
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1269	1/25/2022	1/25/2021
AC Line Conducted					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	PRE0186446	1/20/2022	1/20/2021
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2	T24	1/20/2022	1/20/2021
EMI TEST RECEIVER	Rohde & Schwarz	ESR	T1436	2/19/2022	2/19/2021
Transient Limiter	COM-POWER	LIT-930A	T1457	1/20/2022	1/20/2021
Test Software List					
Description	Manufacturer	Model	Version		
Radiated Software	UL	UL EMC	Rev 9.5, April 30, 2020, Oct 21, 2019		
Antenna Port Software	UL	UL RF	AP 2021.2.4		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, July 07, 2020		

*Test performed within calibration period.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

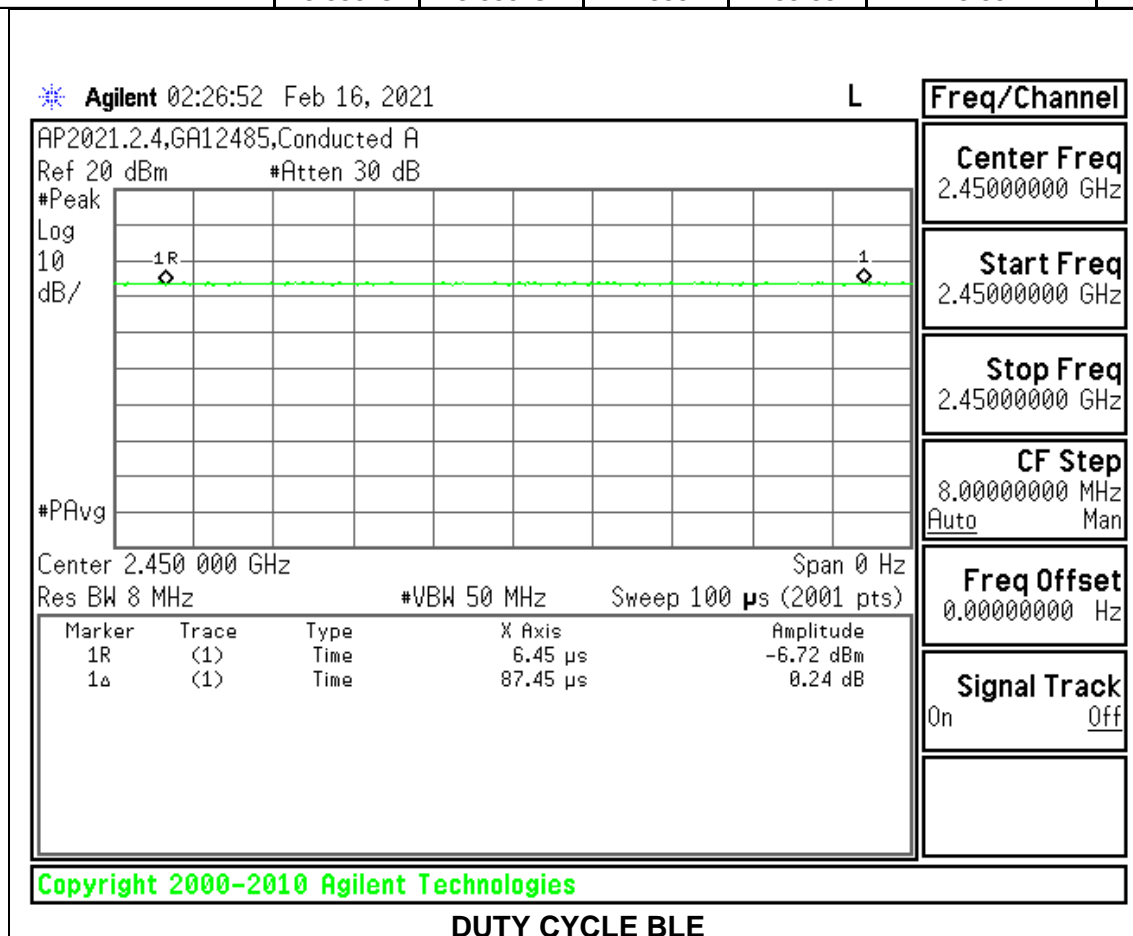
None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
ZIGBEE	0.00645	0.00645	1.000	100.00	0.00	0.010



9.2. 6 dB BANDWIDTH

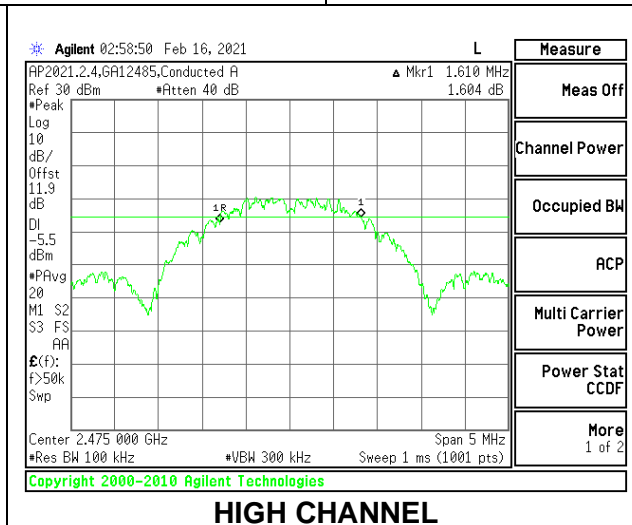
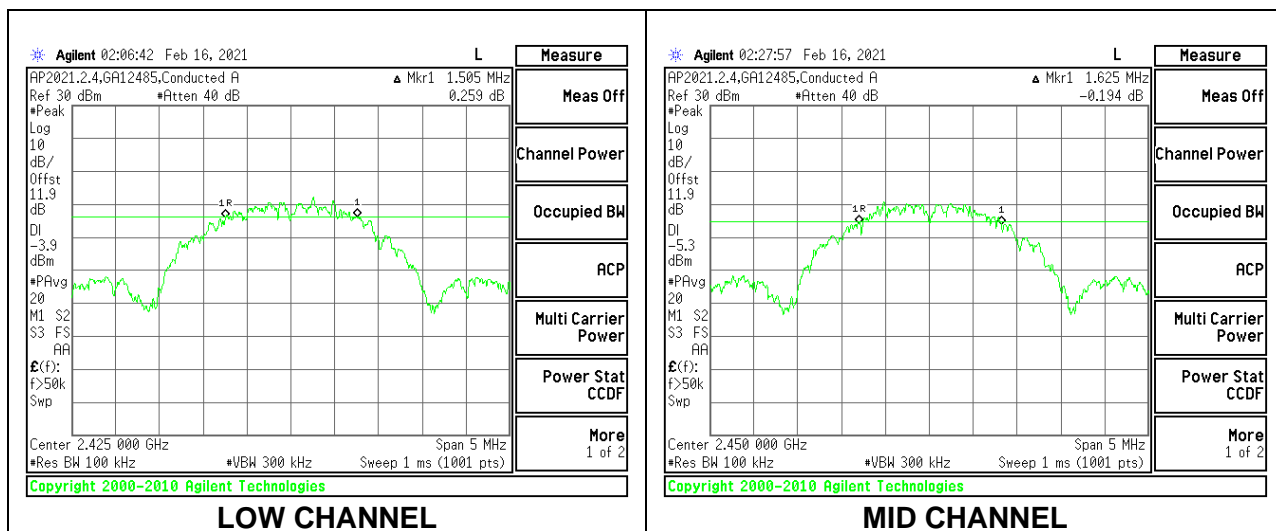
LIMITS

FCC §15.247 (a) (2)

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

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2425	1.505	0.5
Middle	2450	1.625	0.5
High	2475	1.610	0.5



9.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

Measurements perform using a wideband RF power meter.

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

RESULTS

Tested By:	12485 GA
Date:	2/17/2021

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2425	5.48	30	-24.520
Middle	2450	5.30	30	-24.700
High	2475	5.11	30	-24.890

9.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband RF power meter.

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

RESULTS

Tested By:	12485 GA
Date:	2/17/2021

Channel	Frequency (MHz)	AV power (dBm)
Low	2425	5.21
Middle	2450	5.01
High	2475	4.88

9.5. POWER SPECTRAL DENSITY

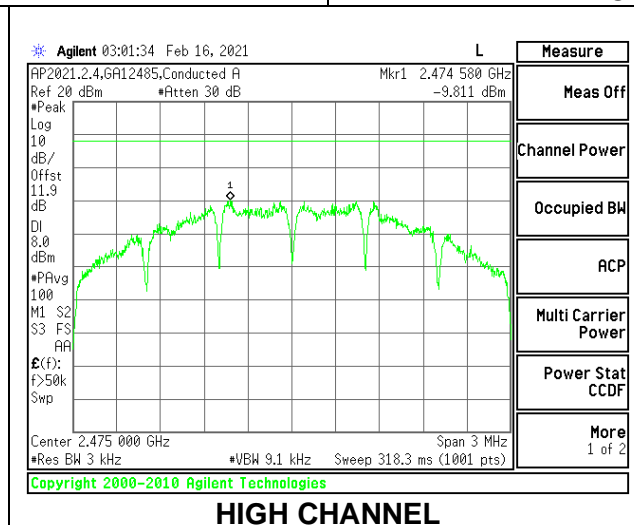
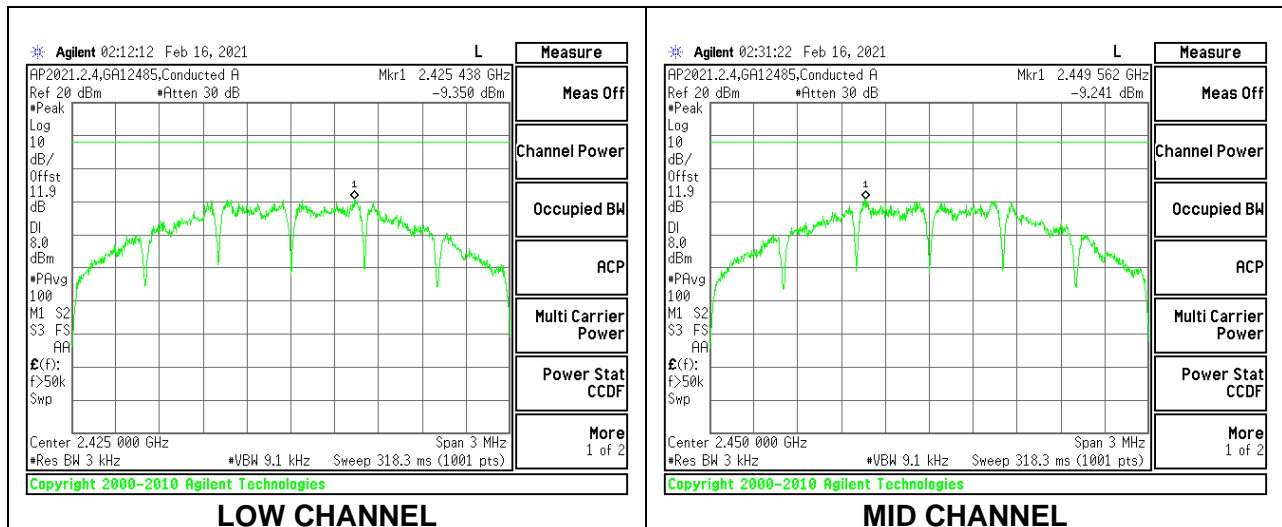
LIMITS

FCC §15.247 (e)

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

RESULTS

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2425	-9.35	8	-17.35
Middle	2450	-9.24	8	-17.24
High	2475	-9.81	8	-17.81



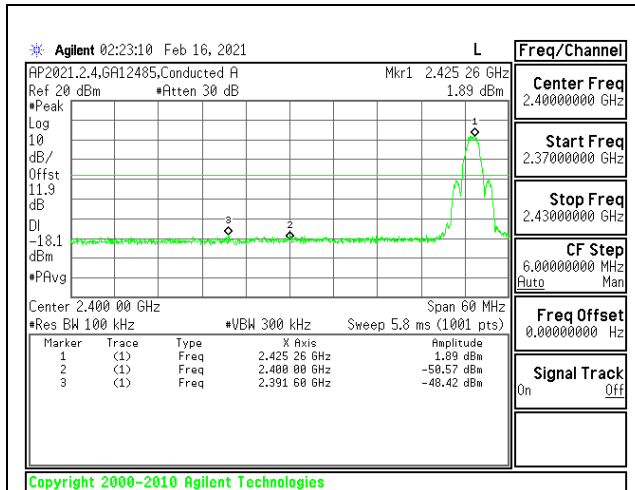
9.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

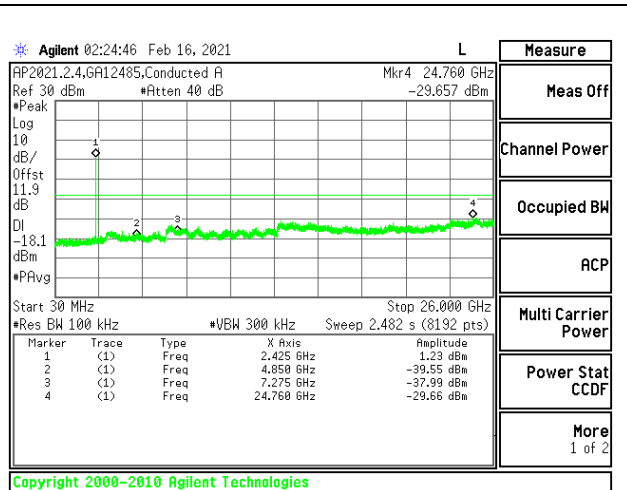
FCC §15.247 (d)

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

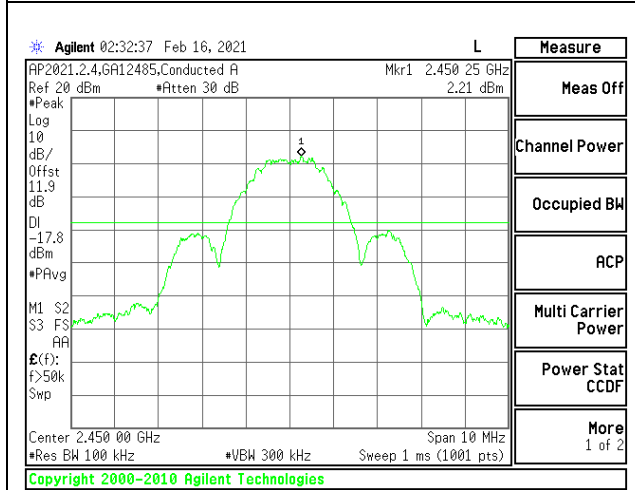
RESULTS



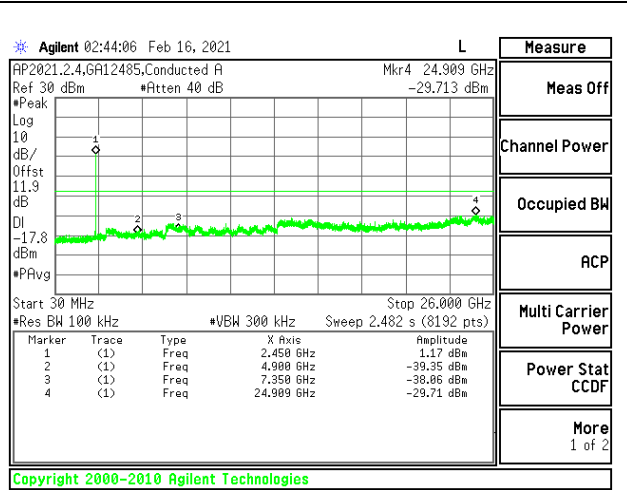
LOW CHANNEL BANDEDGE



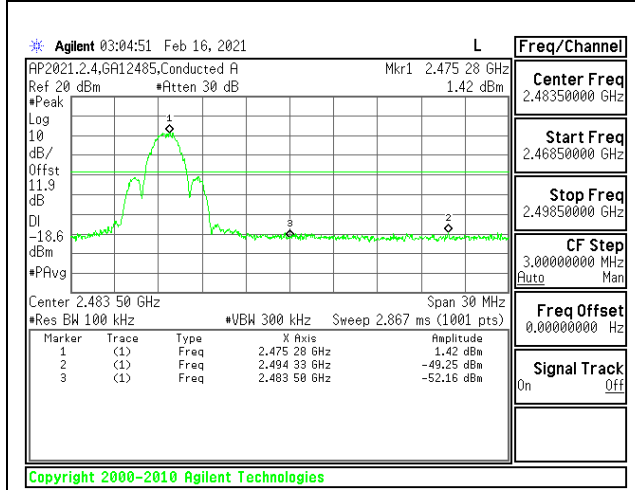
OUT-OF-BAND LOW CHANNEL



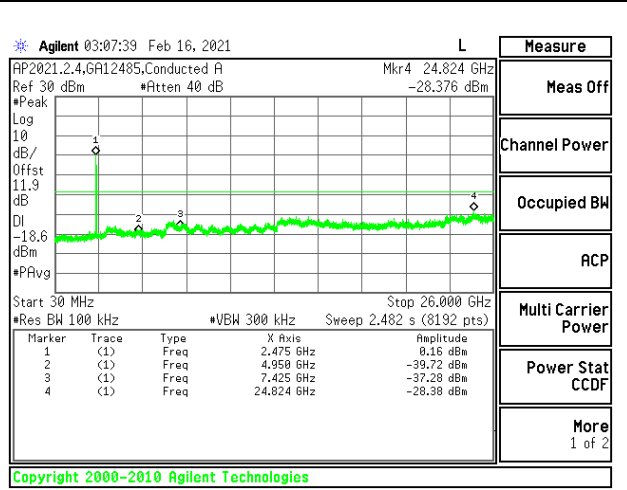
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

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

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

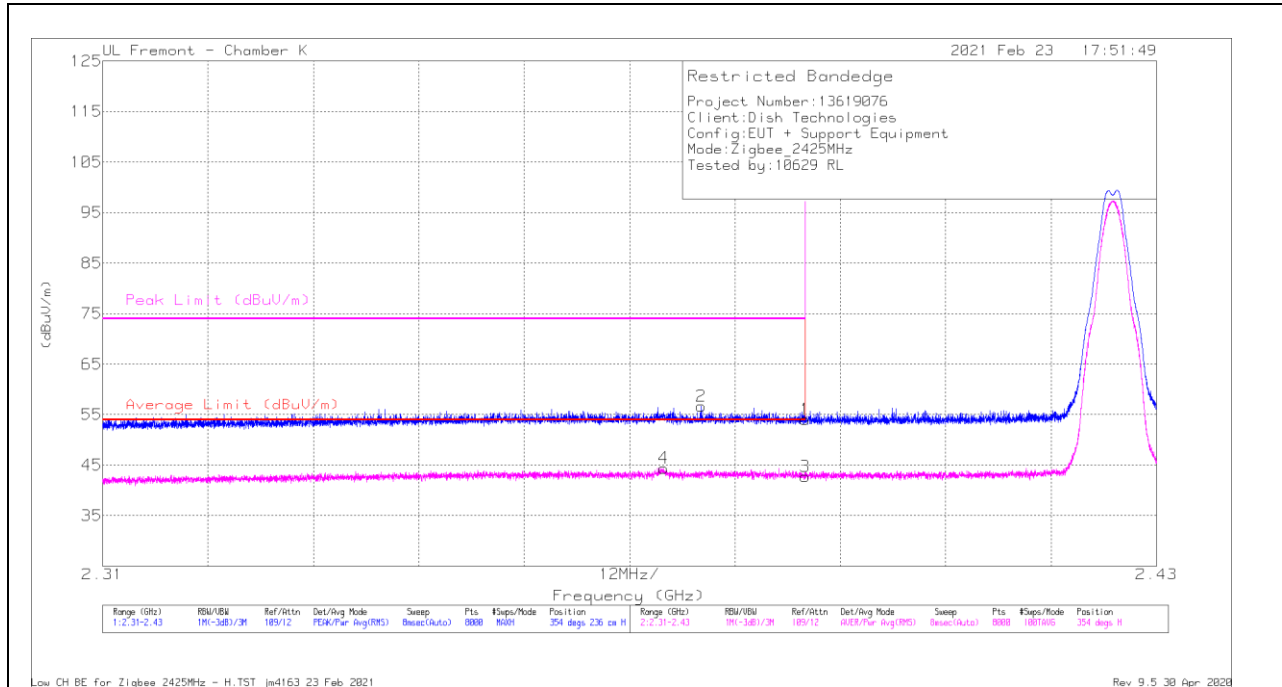
KDB 558074 D01 15.247 Meas Guidance v05r02

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

10.2. TRANSMITTER ABOVE 1 GHz

BANDEDGE (LOW CHANNEL)

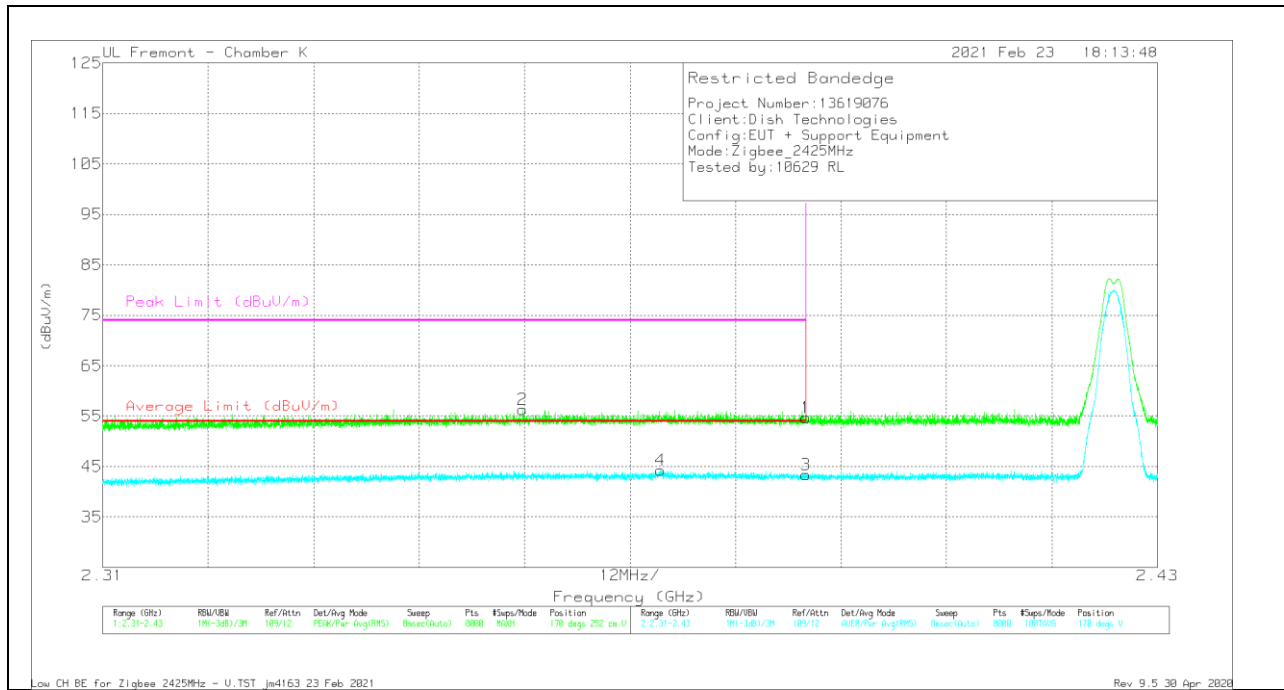
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (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	* 2.38999	33.29	Pk	32.4	-11.6	54.09	-	-	74	-19.91	354	236	H
2	* 2.37814	35.85	Pk	32.4	-11.6	56.65	-	-	74	-17.35	354	236	H
3	* 2.38999	21.9	RMS	32.4	-11.6	42.7	54	-11.3	-	-	354	236	H
4	* 2.37386	23.63	RMS	32.4	-11.6	44.43	54	-9.57	-	-	354	236	H

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

VERTICAL RESULT

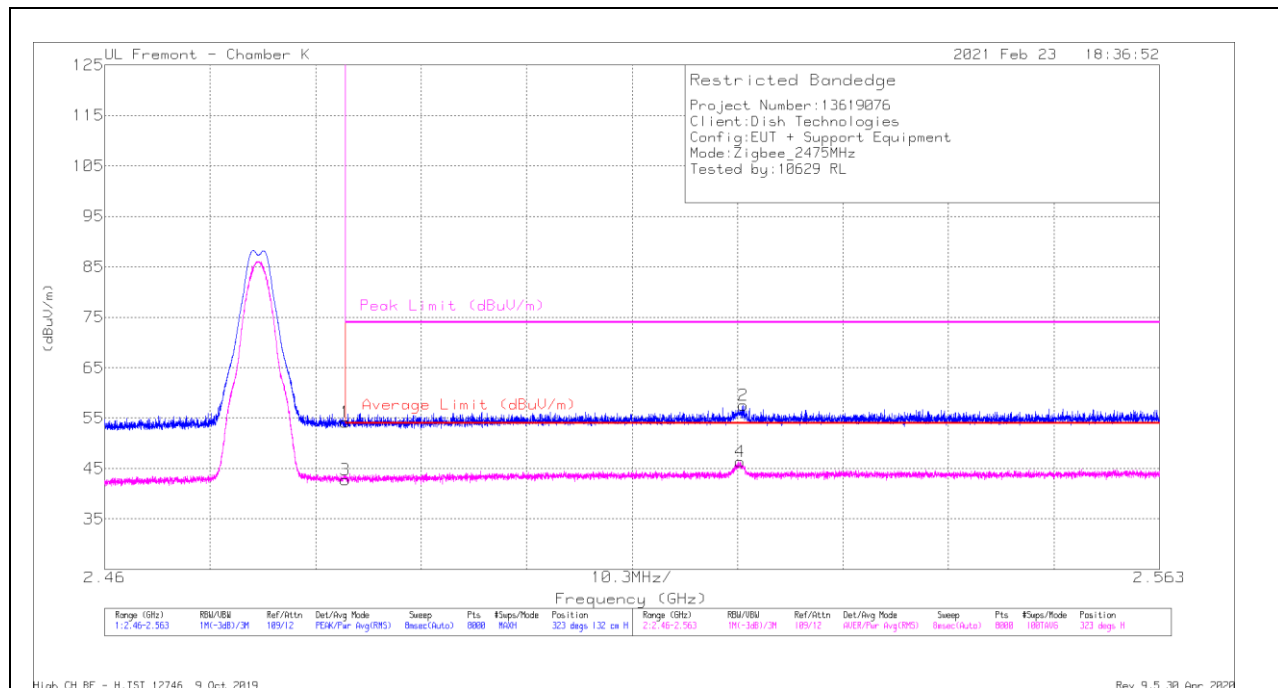


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	33.91	Pk	32.4	-11.6	54.71	-	-	74	-19.29	170	252	V
2	* 2.35778	35.55	Pk	32.4	-11.6	56.35	-	-	74	-17.65	170	252	V
3	* 2.38999	22.57	RMS	32.4	-11.6	43.37	54	-10.63	-	-	170	252	V
4	* 2.37344	23.43	RMS	32.4	-11.6	44.23	54	-9.77	-	-	170	252	V

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

BANDEDGE (HIGH CHANNEL)

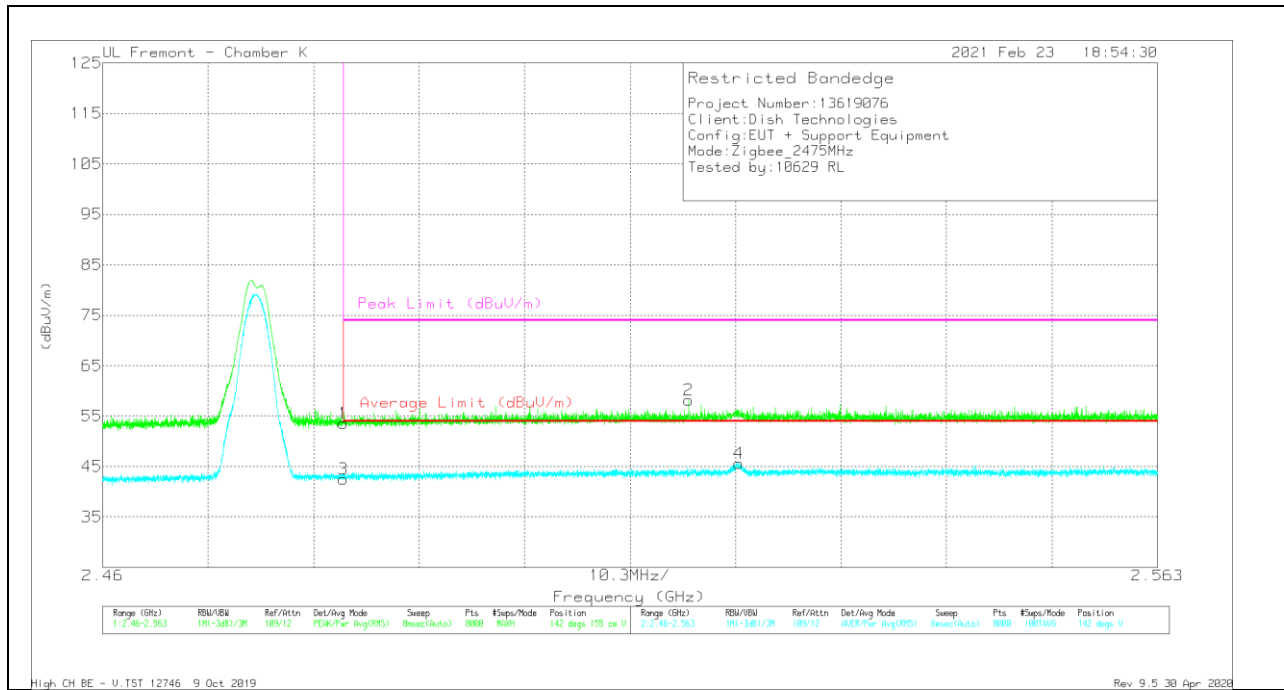
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	32.88	PK	32.5	-11.2	54.18	-	-	74	-19.82	323	132	H
2	2.52236	35.96	PK	32.8	-11.2	57.56	-	-	74	-16.44	323	132	H
3	* 2.4835	21.43	RMS	32.5	-11.2	42.73	54	-11.27	-	-	323	132	H
4	2.52203	24.8	RMS	32.8	-11.2	46.4	54	-7.6	-	-	323	132	H

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

VERTICAL RESULT

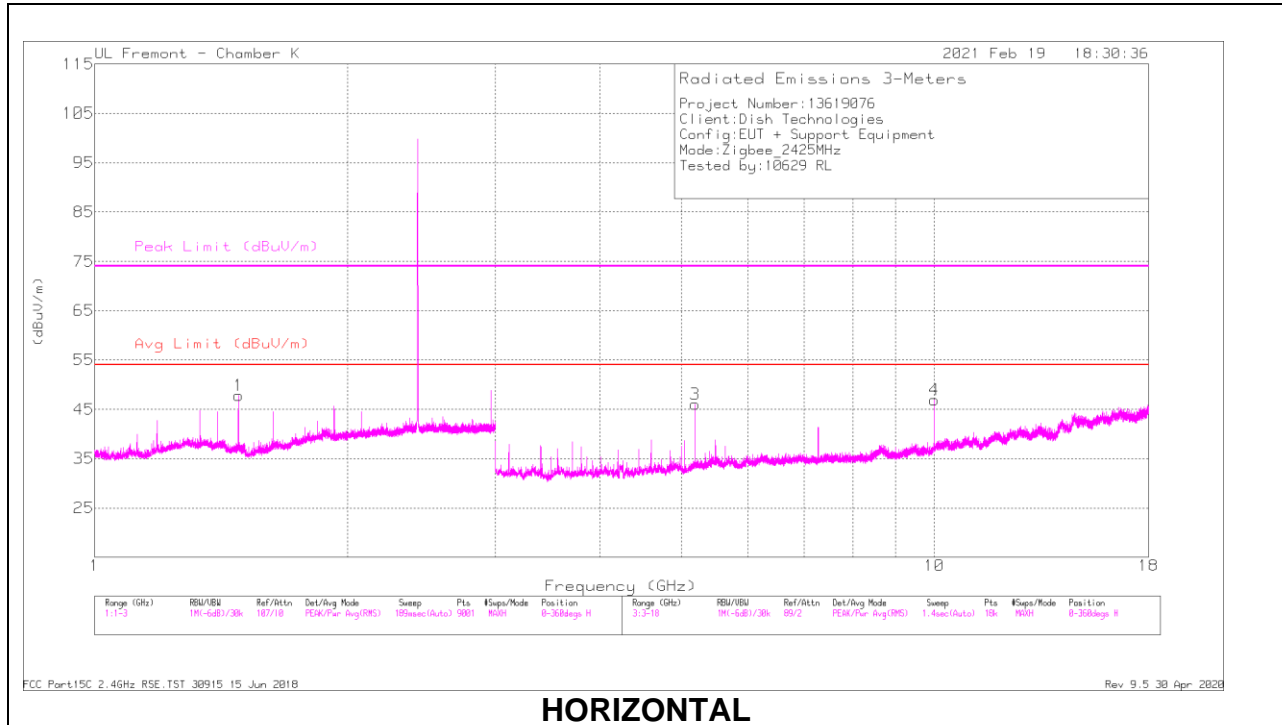


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	32.25	Pk	32.5	-11.2	53.55	-	-	74	-20.45	142	155	V
2	2.51723	36.58	Pk	32.8	-11.2	58.18	-	-	74	-15.82	142	155	V
3	* 2.4835	21.25	RMS	32.5	-11.2	42.55	54	-11.45	-	-	142	155	V
4	2.52209	24.03	RMS	32.8	-11.2	45.63	54	-8.37	-	-	142	155	V

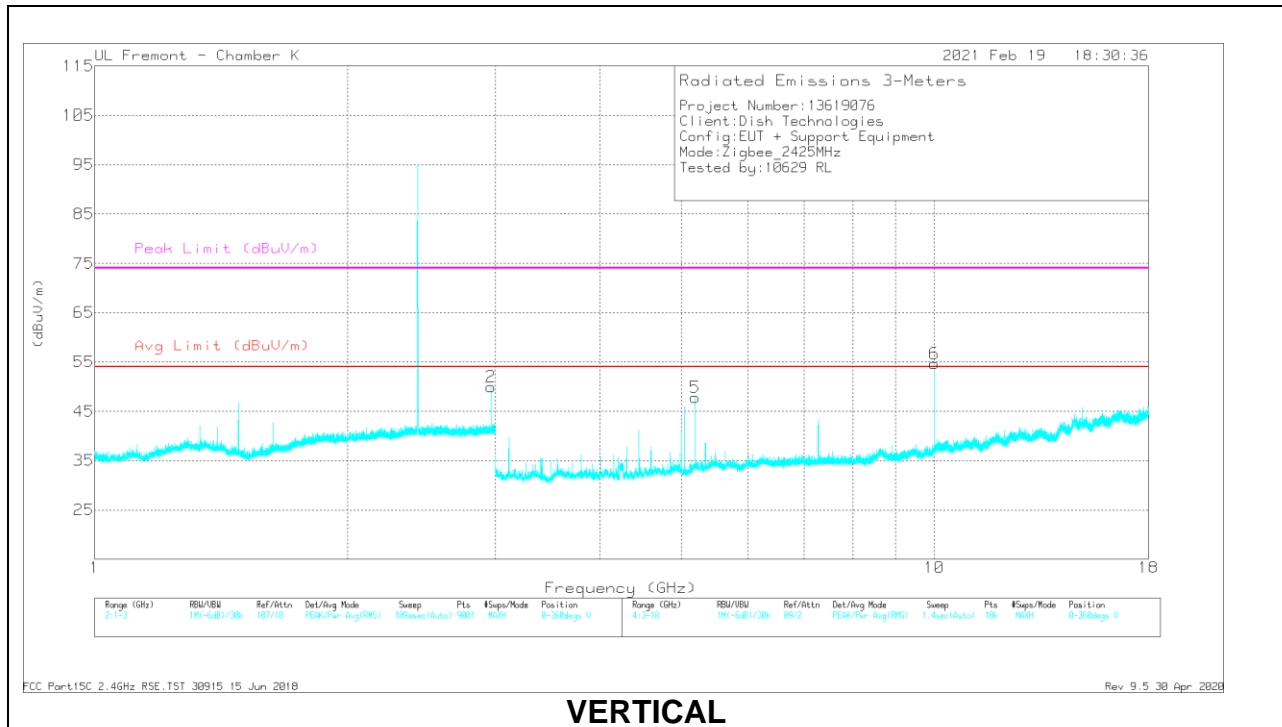
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



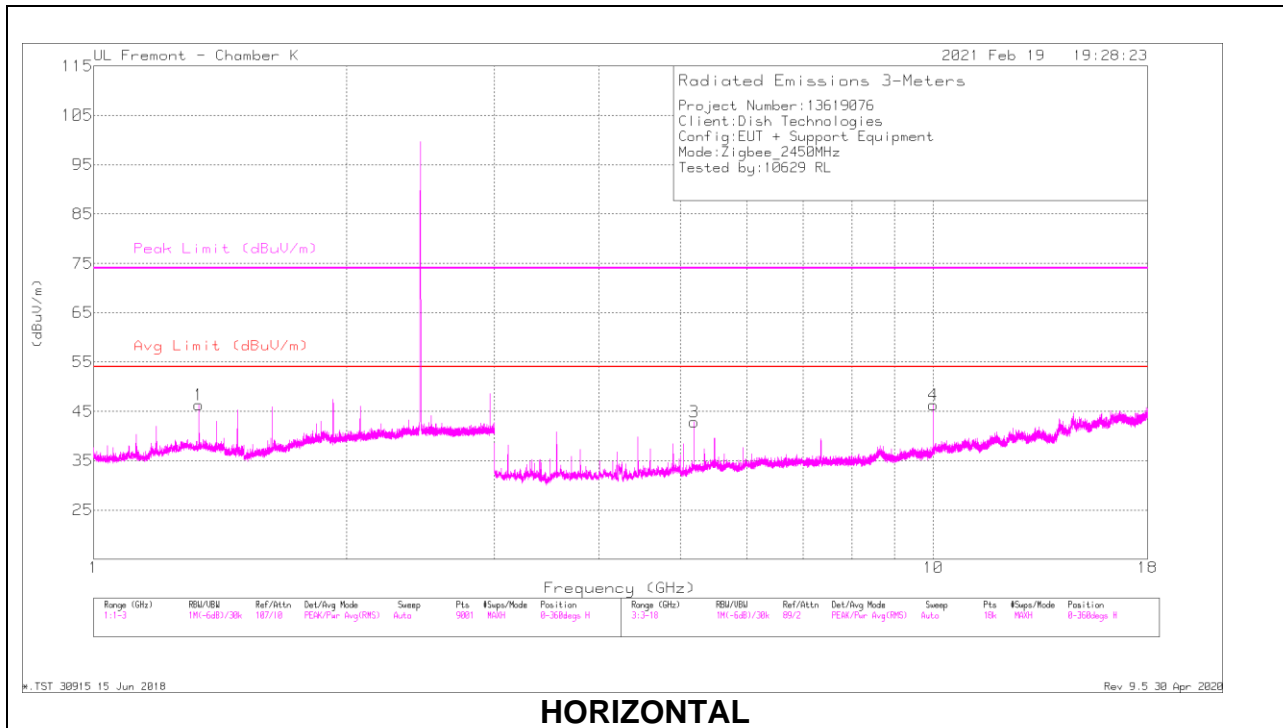
VERTICAL

Radiated Emissions

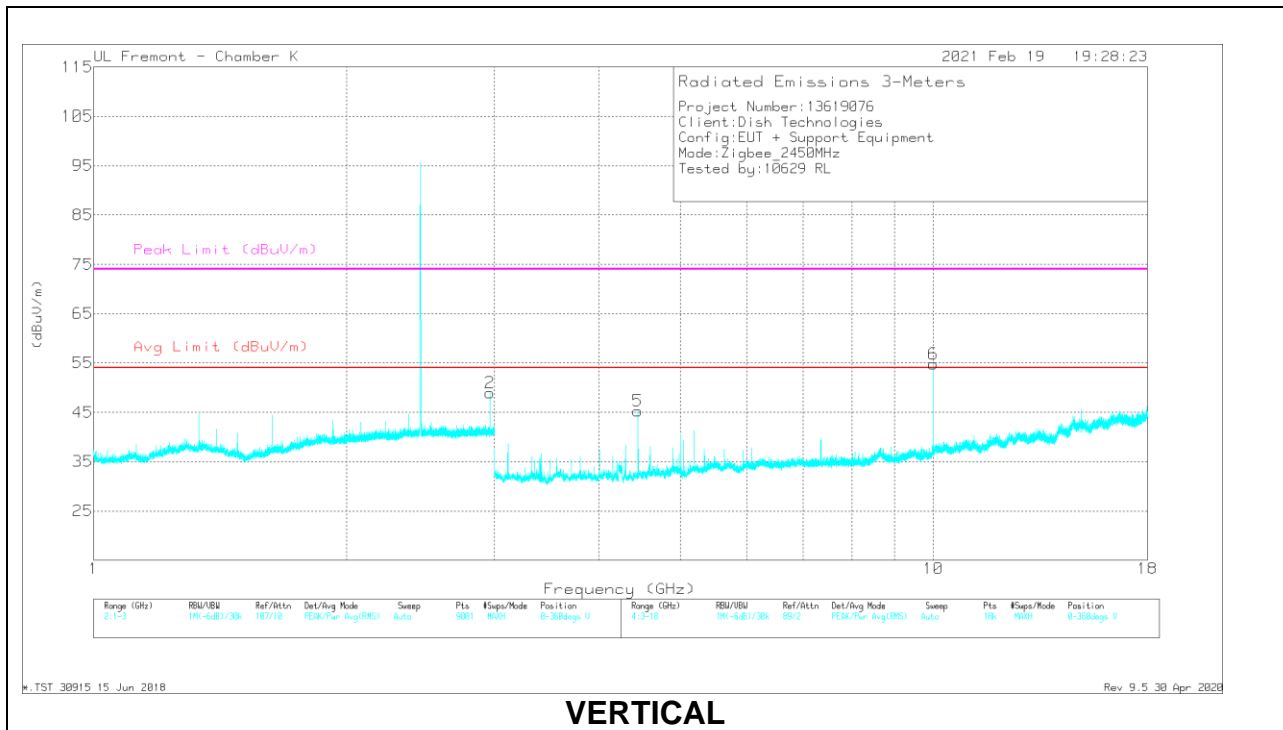
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.48359	61.6	PK2	27.9	-36.5	53	-	-	74	-21	65	375	H
	* 1.48351	53.06	MAv1	27.9	-36.5	44.46	54	-9.54	-	-	65	375	H
2	2.96697	57.83	PK2	32.8	-33.3	57.33	-	-	-	-	324	98	V
3	5.19226	58.36	PK2	34.6	-40.3	52.66	-	-	-	-	268	99	H
4	10.00008	51.47	PK2	37.1	-36.7	51.87	-	-	-	-	265	212	H
5	5.19227	58.14	PK2	34.6	-40.3	52.44	-	-	-	-	348	101	V
6	9.99999	56.42	PK2	37.1	-36.7	56.82	-	-	-	-	288	99	V

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

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

Radiated Emissions

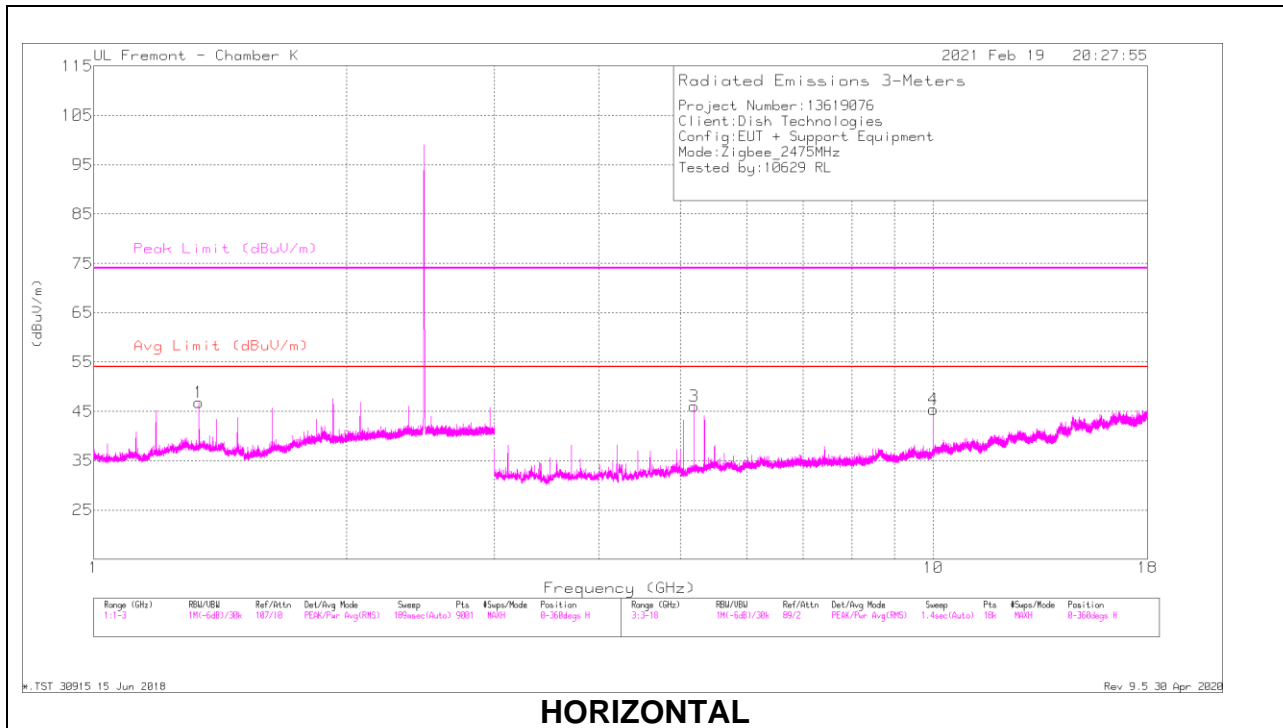
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.33519	60.87	PK2	29.2	-36.6	53.47	-	-	74	-20.53	12	241	H
	* 1.3351	55.12	MAv1	29.2	-36.6	47.72	54	-6.28	-	-	12	241	H
2	2.96702	58.28	PK2	32.8	-33.3	57.78	-	-	-	-	80	300	V
3	5.19233	58.1	PK2	34.6	-40.3	52.4	-	-	-	-	280	103	H
4	10.00003	52.46	PK2	37.1	-36.7	52.86	-	-	-	-	276	403	H
5	4.45058	57.9	PK2	34	-41.7	50.2	-	-	-	-	98	261	V
6	9.99994	56.5	PK2	37.1	-36.7	56.9	-	-	-	-	288	99	V

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

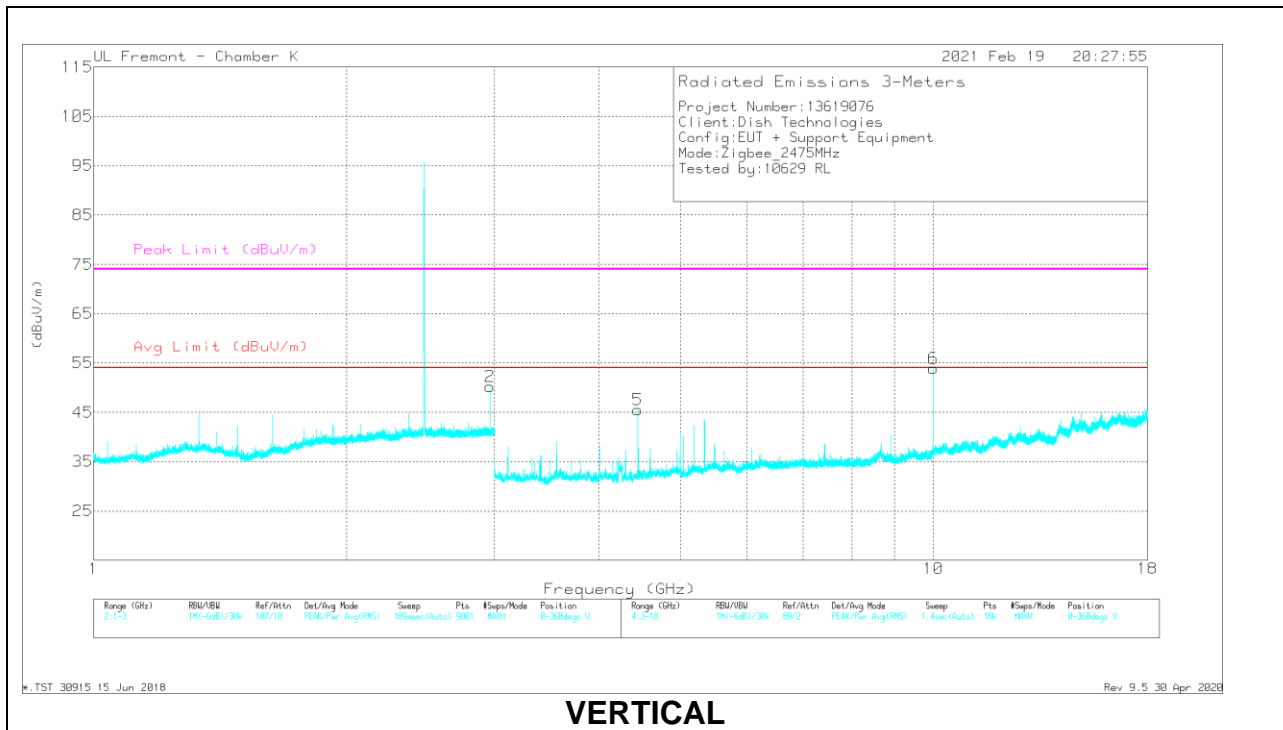
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

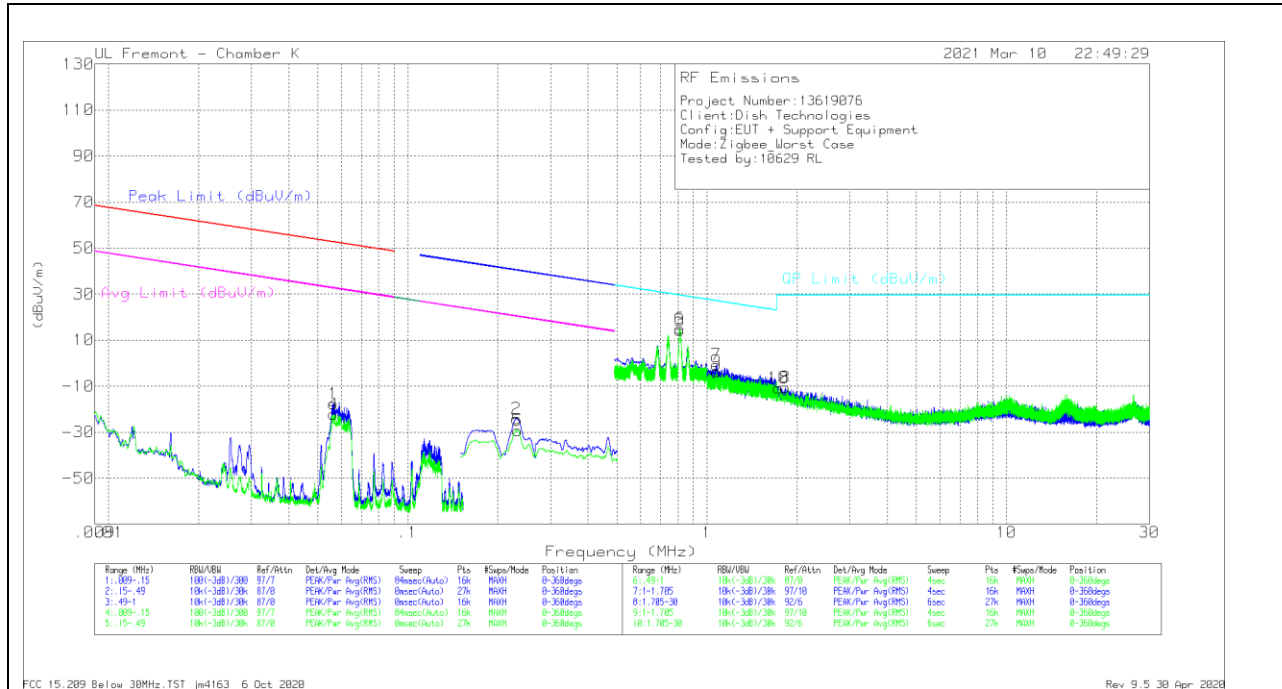
Radiated Emissions

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (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	* 1.33511	60.34	PK2	29.2	-36.6	52.94	-	-	74	-21.06	19	143	H
	* 1.33511	54.68	MAv1	29.2	-36.6	47.28	54	-6.72	-	-	19	143	H
2	2.96698	58.22	PK2	32.8	-33.3	57.72	-	-	-	-	321	99	V
3	5.19222	57.13	PK2	34.6	-40.3	51.43	-	-	-	-	289	104	H
4	9.99975	52.68	PK2	37.1	-36.7	53.08	-	-	-	-	276	405	H
5	4.45046	58.49	PK2	34	-41.7	50.79	-	-	-	-	8	140	V
6	10.00005	56.12	PK2	37.1	-36.7	56.52	-	-	-	-	287	115	V

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

10.3. WORST CASE BELOW 30MHz

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



Below 30MHz Data

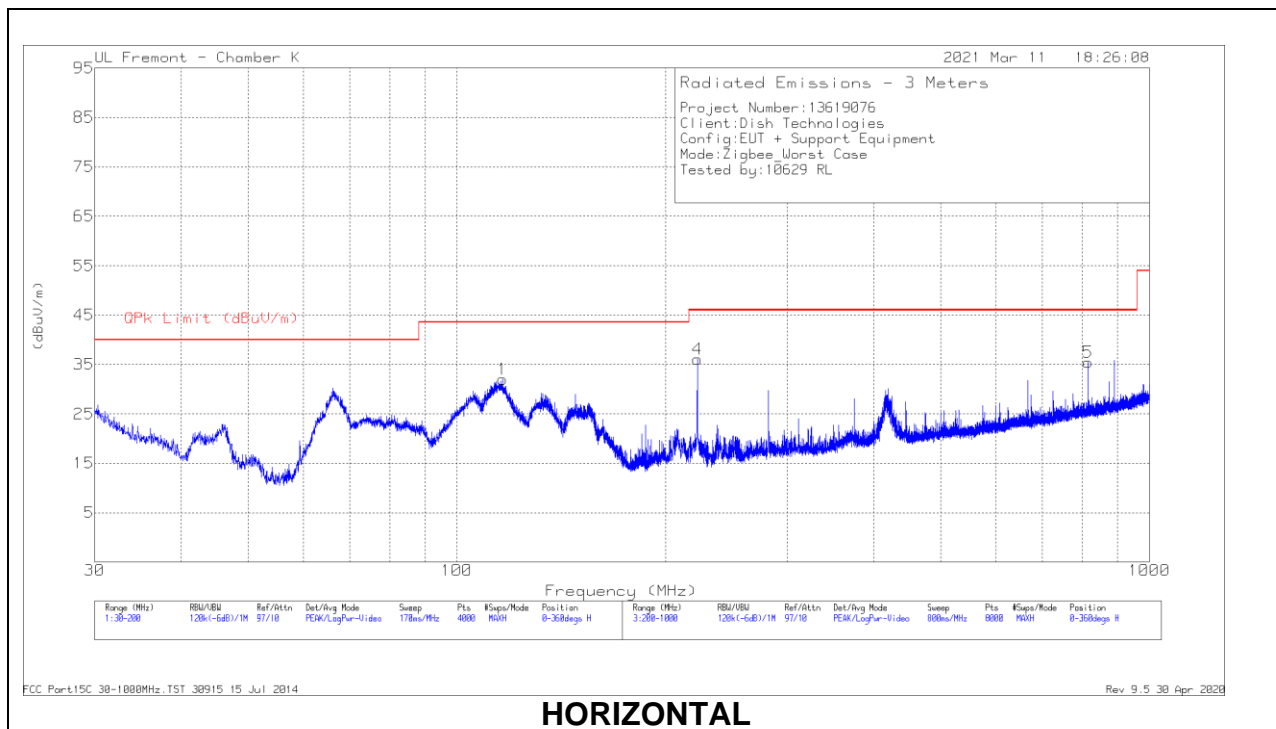
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.05633	38.33	Pk	56.5	-32.3	-80	-17.47	52.57	-70.04	32.57	-50.04	-	-	0-360
2	.23109	31.75	Pk	56.3	-32.2	-80	-24.15	40.34	-64.49	20.34	-44.49	-	-	0-360
4	.05651	33.65	Pk	56.5	-32.3	-80	-22.15	52.54	-74.69	32.54	-54.69	-	-	0-360
5	.23315	26.61	Pk	56.3	-32.2	-80	-29.29	40.26	-69.55	20.26	-49.55	-	-	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.81184	30.14	Pk	56.3	-32.2	-40	14.24	-	-	-	-	29.43	-15.19	0-360
6	.81138	30.98	Pk	56.3	-32.2	-40	15.08	-	-	-	-	29.43	-14.35	0-360
7	1.07405	24.78	Pk	46.5	-32.1	-40	-8.2	-	-	-	-	27	-27.82	0-360
8	1.82552	19.19	Pk	42.5	-32.1	-40	-10.41	-	-	-	-	29.5	-39.91	0-360
9	1.07352	22.04	Pk	46.5	-32.1	-40	-3.56	-	-	-	-	27.01	-30.57	0-360
10	1.72806	18.26	Pk	43	-32.1	-40	-10.84	-	-	-	-	29.5	-40.34	0-360

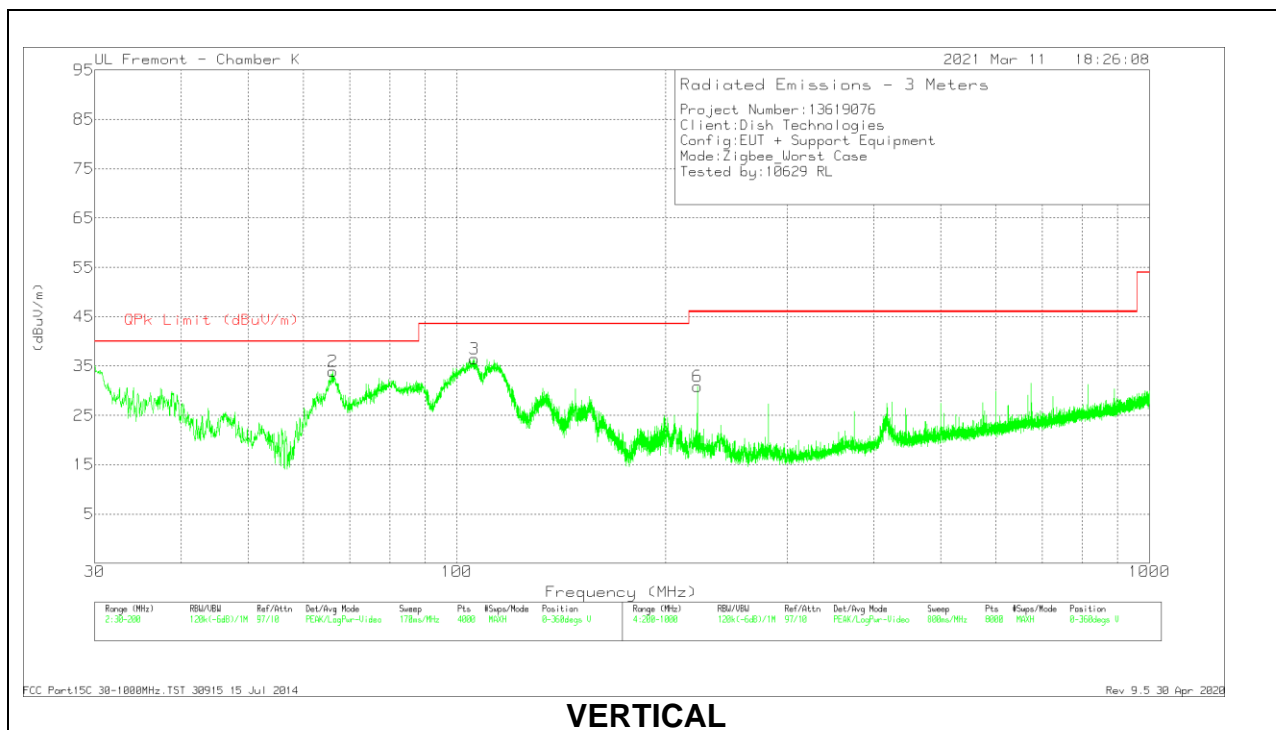
Pk - Peak detector

10.4. WORST CASE BELOW 1 GHz

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



HORIZONTAL



VERTICAL

Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 114.4819	43.84	Pk	19.2	-30.8	32.24	-	-	325	201	H
	* 114.4819	40.14	Qp	19.2	-30.8	28.54	43.52	-14.98	325	201	H
2	66.3394	51.6	Pk	14.1	-31.2	34.5	-	-	100	99	V
	66.2194	46.81	Qp	14.1	-31.2	29.71	40	-10.29	100	99	V
3	105.5332	50.32	Pk	17.7	-30.9	37.12	-	-	325	96	V
	105.5332	46.02	Qp	17.7	-30.9	32.82	43.52	-10.7	325	96	V
4	222.5274	50.59	Pk	17.4	-30.2	37.79	-	-	350	146	H
	222.5274	49.36	Qp	17.4	-30.2	36.56	46.02	-9.46	350	146	H
5	815.9446	35.66	Pk	28	-28	35.66	-	-	311	193	H
	815.9446	33.04	Qp	28	-28	33.04	46.02	-12.98	311	193	H
6	222.5269	45.78	Pk	17.4	-30.2	32.98	-	-	149	95	V
	222.5269	44.04	Qp	17.4	-30.2	31.24	46.02	-14.78	149	95	V

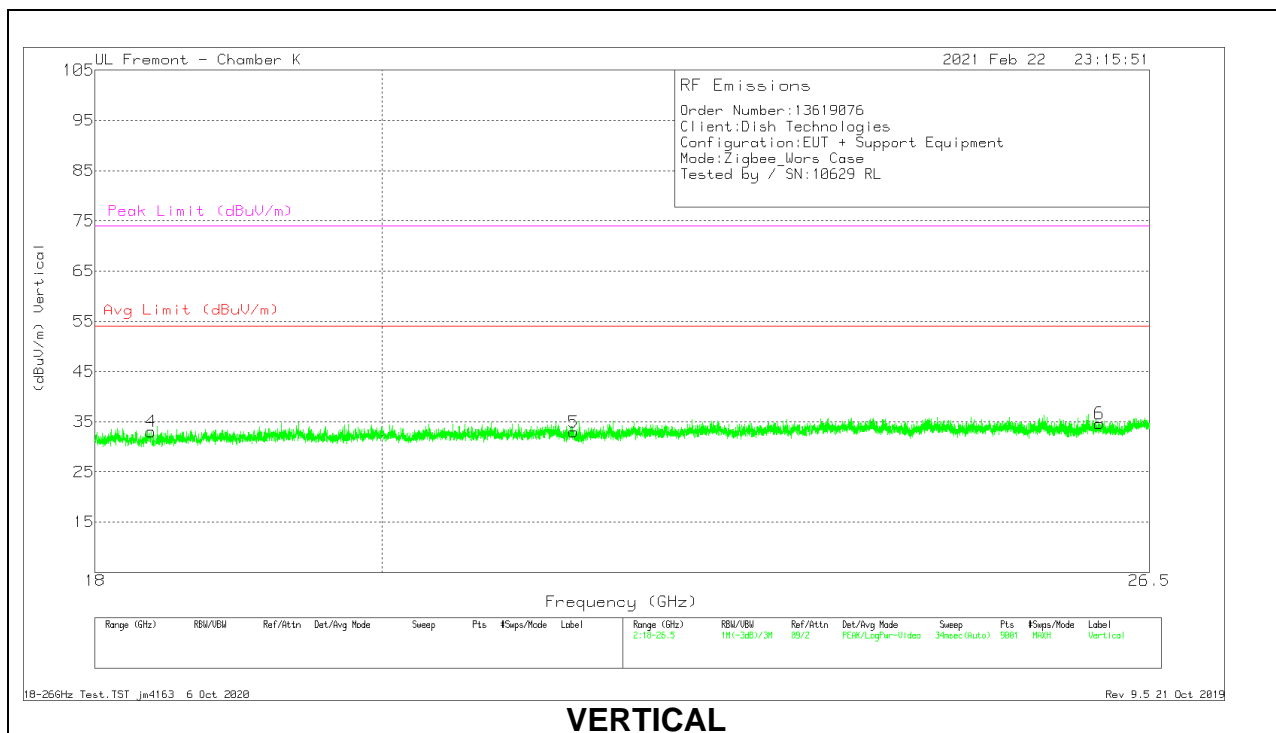
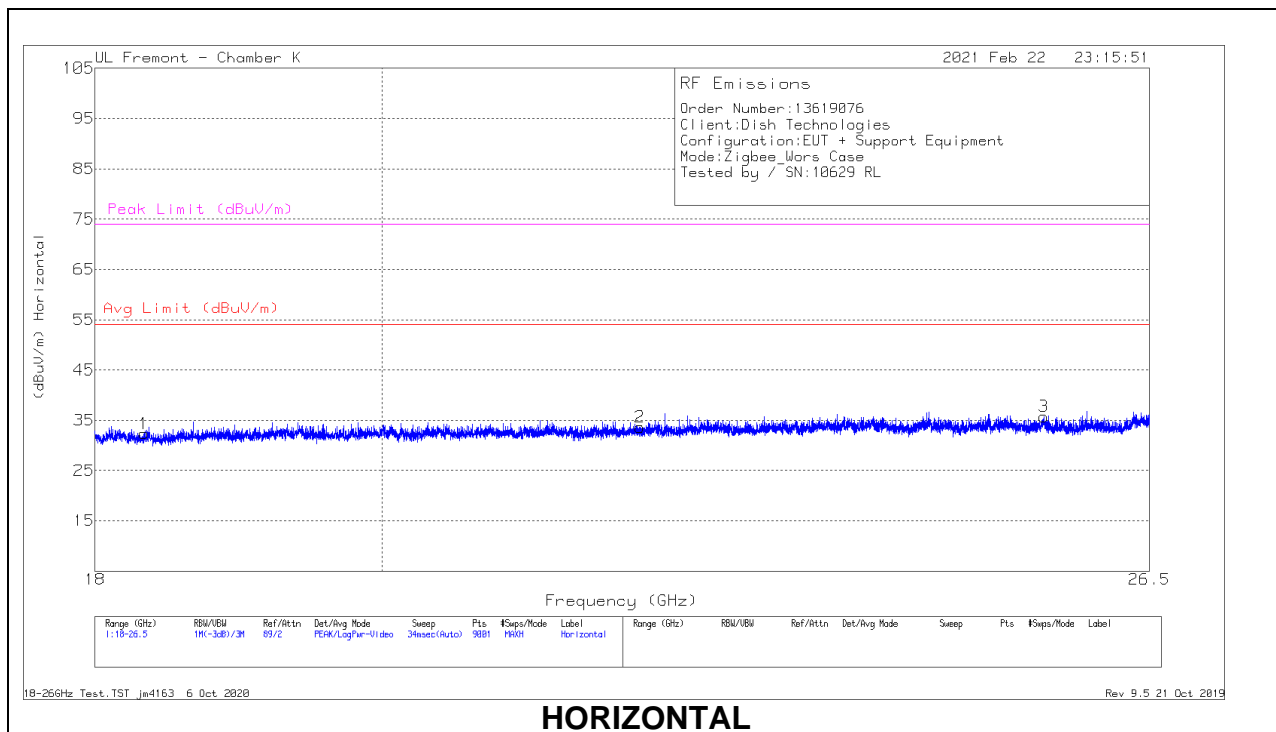
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

10.5. WORST CASE 18-26 GHz

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



18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T447 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	18.32772	69.27	Pk	32.3	-59.7	-9.5	32.37	54	-21.63	74	-41.63
2	21.98366	67.54	Pk	33.4	-57.8	-9.5	33.64	54	-20.36	74	-40.36
3	25.49133	65.75	Pk	34.5	-55	-9.5	35.75	54	-18.25	74	-38.25
4	18.37494	69.62	Pk	32.3	-59.4	-9.5	33.02	54	-20.98	74	-40.98
5	21.45383	66.56	Pk	33.2	-57.3	-9.5	32.96	54	-21.04	74	-41.04
6	26.0155	64.73	Pk	34.5	-55.1	-9.5	34.63	54	-19.37	74	-39.37

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

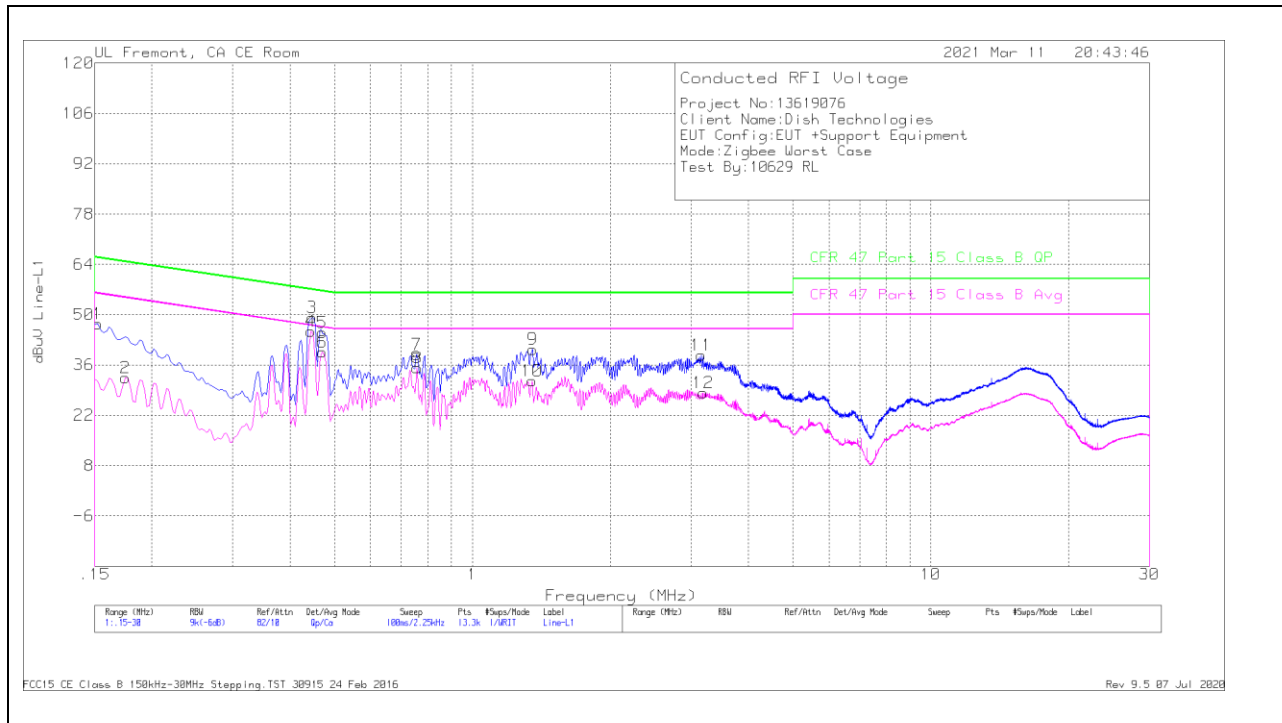
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

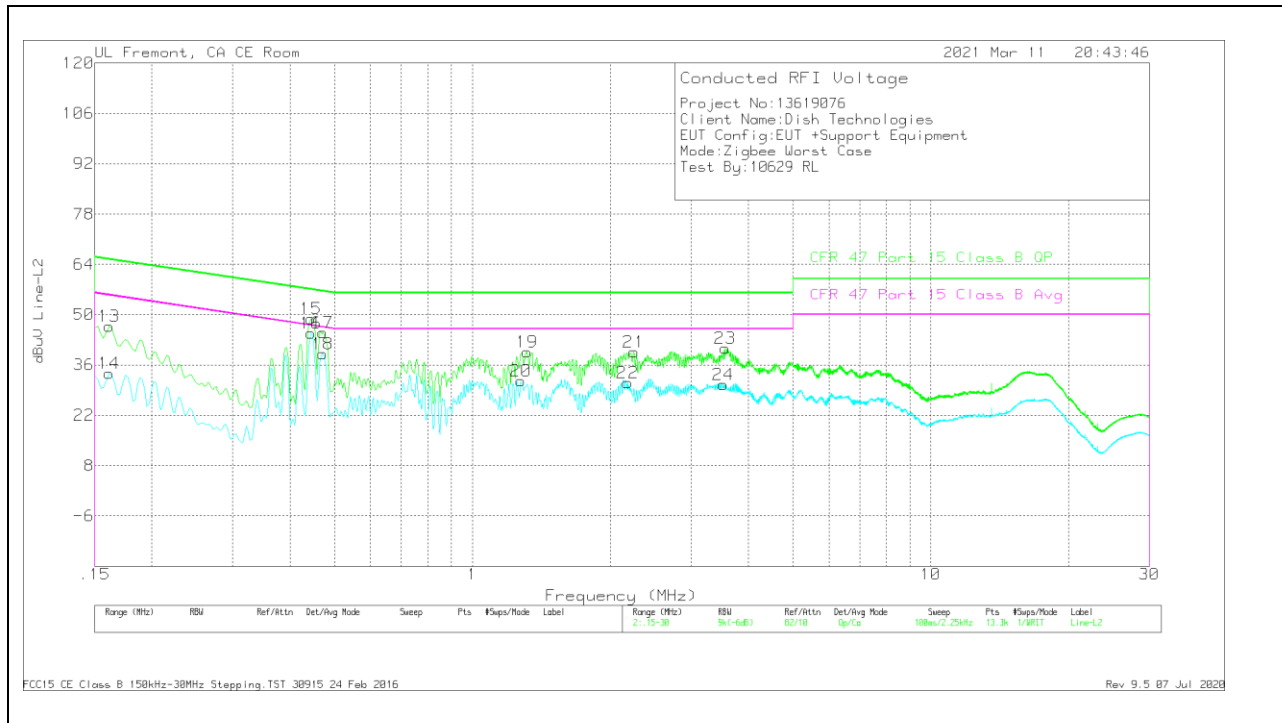
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 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	37.28	Qp	.1	0	10.1	47.48	65.88	-18.4	-	-
2	.17475	22.29	Ca	0	0	10.1	32.39	-	-	54.73	-22.34
3	.447	39.07	Qp	0	0	10.1	49.17	56.93	-7.76	-	-
4	.44475	35.19	Ca	0	0	10.1	45.29	-	-	46.97	-1.68
5	.4695	34.96	Qp	0	0	10.1	45.06	56.52	-11.46	-	-
6	.4695	29.44	Ca	0	0	10.1	39.54	-	-	46.52	-6.98
7	.75525	28.72	Qp	0	.1	10.1	38.92	56	-17.08	-	-
8	.7575	25.08	Ca	0	.1	10.1	35.28	-	-	46	-10.72
9	1.35375	30.19	Qp	0	.1	10.1	40.39	56	-15.61	-	-
10	1.3515	21.42	Ca	0	.1	10.1	31.62	-	-	46	-14.38
11	3.156	28.37	Qp	0	.1	10.2	38.67	56	-17.33	-	-
12	3.18525	17.91	Ca	0	.1	10.2	28.21	-	-	46	-17.79

Qp - Quasi-Peak detector
 Ca - CISPR average detection

LINE 2 RESULTS

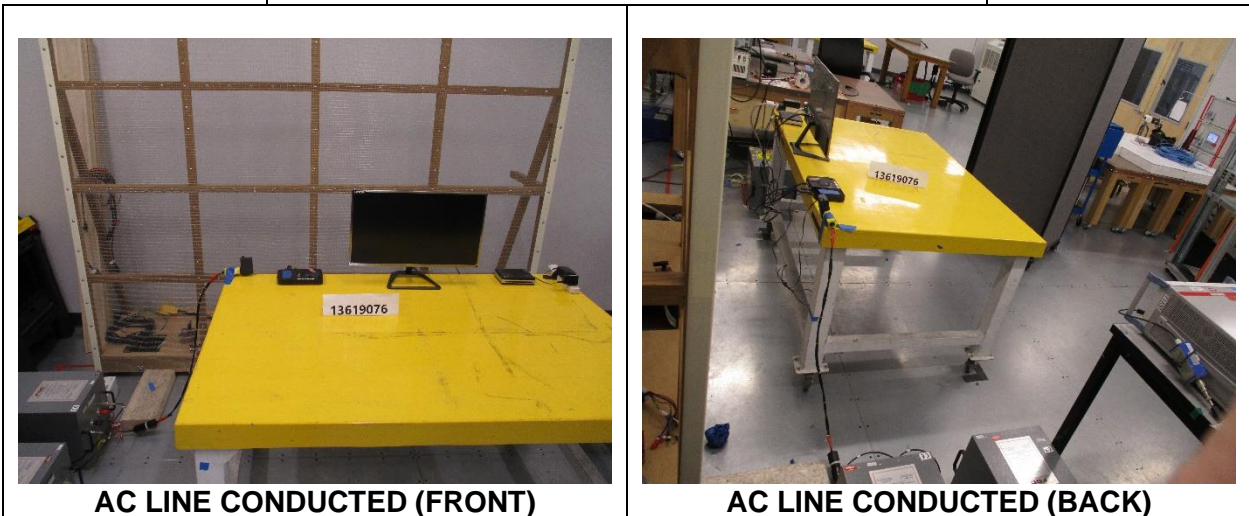
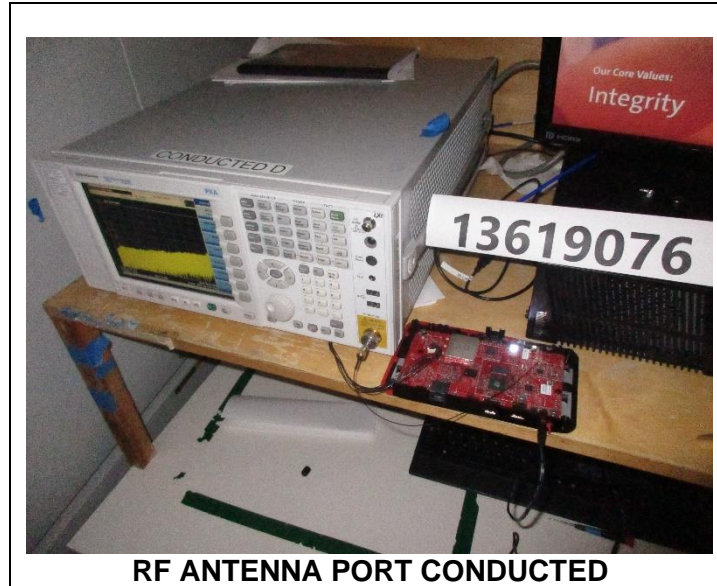


Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 L2	LC Cables C2&C3 dB	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16125	36.73	Qp	0	0	10.1	46.83	65.4	-18.57	-	-
14	.16125	23.63	Ca	0	0	10.1	33.73	-	-	55.4	-21.67
15	.44475	38.76	Qp	0	0	10.1	48.86	56.97	-8.11	-	-
16	.44475	34.73	Ca	0	0	10.1	44.83	-	-	46.97	-2.14
17	.47175	34.87	Qp	0	0	10.1	44.97	56.48	-11.51	-	-
18	.47175	29.02	Ca	0	0	10.1	39.12	-	-	46.48	-7.36
19	1.3155	29.35	Qp	0	.1	10.1	39.55	56	-16.45	-	-
20	1.275	21.41	Ca	0	.1	10.1	31.61	-	-	46	-14.39
21	2.2515	29.48	Qp	0	.1	10.1	39.68	56	-16.32	-	-
22	2.18175	20.79	Ca	0	.1	10.1	30.99	-	-	46	-15.01
23	3.5565	30.31	Qp	0	.1	10.2	40.61	56	-15.39	-	-
24	3.53063	20.29	Ca	0	.1	10.2	30.59	-	-	46	-15.41

Qp - Quasi-Peak detector
 Ca - CISPR average detection

12. SETUP PHOTOS

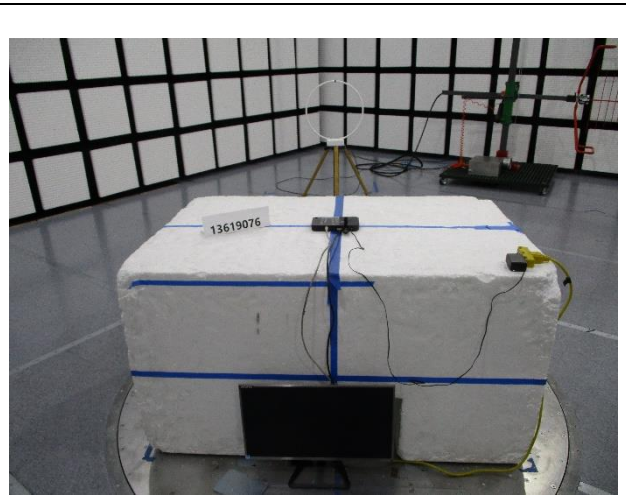
ANTENNA PORT AND AC LINE CONDUCTED SETUP



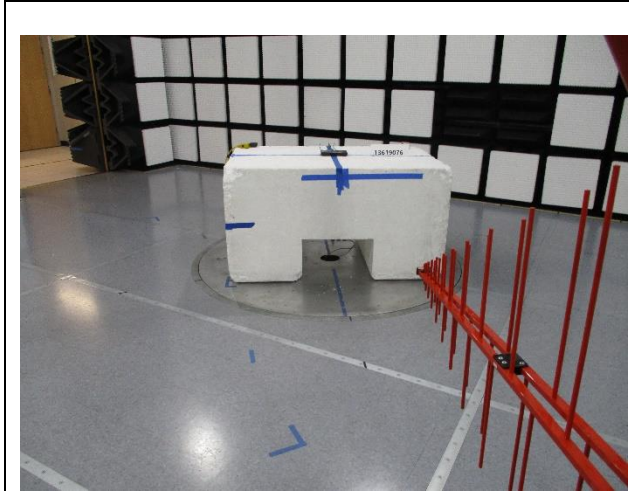
RADIATED RF MEASUREMENT SETUP



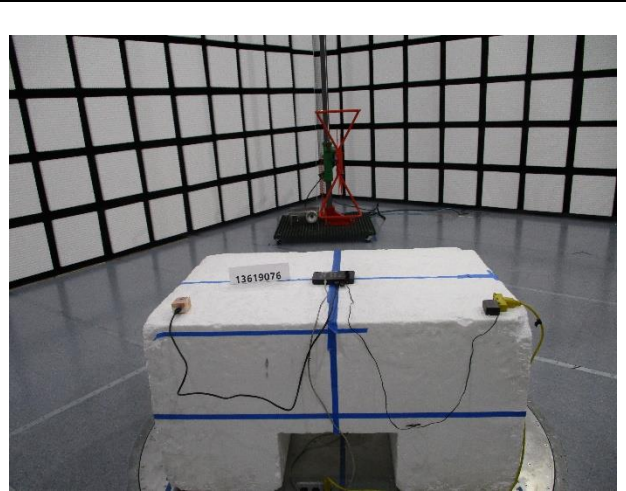
BELOW 30MHz (FRONT)



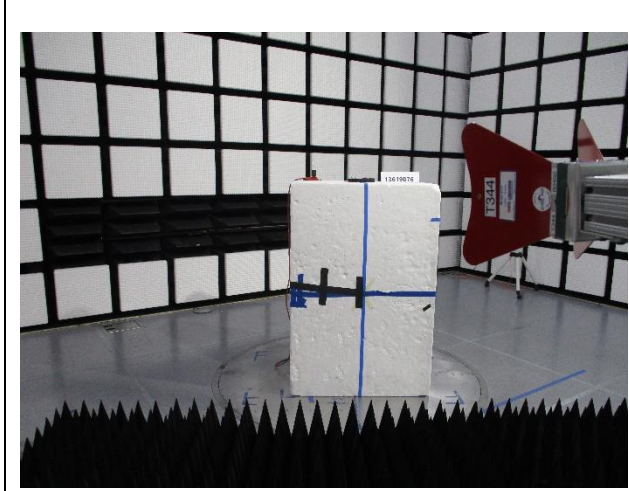
BELOW 30Hz (BACK)



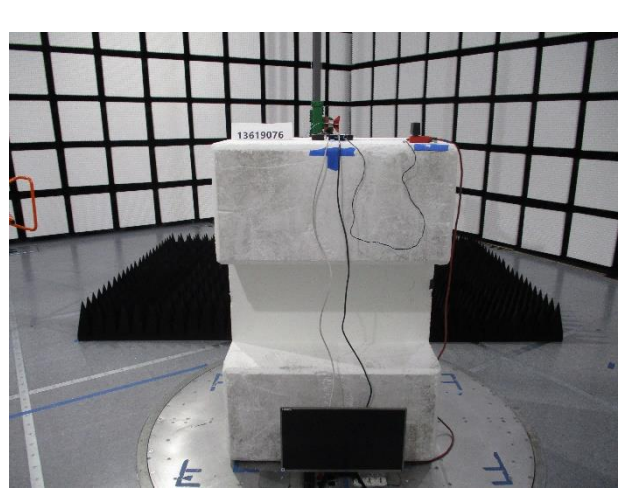
BELOW 1GHz (FRONT)



BELOW 1GHz (BACK)



ABOVE 1GHz (FRONT)



ABOVE 1GHz (BACK)

END OF TEST REPORT