

TEST REPORT

Report Number.: 14441108-E4V1

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

Model : D35

Brand : DISH

FCC ID : DKNW76XM

EUT Description : TV SET TOP BOX CLIENT

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

Date of Issue:
2022-10-10

Prepared by:
UL VERIFICATION SERVICES INC.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888



REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2022-10-10	Initial Issue	---

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	4
2. TEST RESULTS SUMMARY	6
3. TEST METHODOLOGY	7
4. FACILITIES AND ACCREDITATION	7
5. DECISION RULES AND MEASUREMENT UNCERTAINTY	8
5.1. METROLOGICAL TRACEABILITY	8
5.2. DECISION RULES.....	8
5.3. MEASUREMENT UNCERTAINTY.....	8
5.4. SAMPLE CALCULATION	8
6. EQUIPMENT UNDER TEST	9
6.1. EUT DESCRIPTION	9
6.2. INTRODUCTION OF TEST DATA REUSE.....	9
6.3. SPOT CHECK VERIFICATION RESULTS SUMMARY	10
6.4. DESCRIPTION OF AVAILABLE ANTENNAS	11
6.5. SOFTWARE AND FIRMWARE.....	11
6.6. WORST-CASE CONFIGURATION AND MODE.....	11
6.7. DESCRIPTION OF TEST SETUP.....	12
7. TEST AND MEASUREMENT EQUIPMENT	14
8. MEASUREMENT METHOD.....	14
9. RADIATED TEST RESULTS.....	15
9.1. LIMITS AND PROCEDURE	15
9.2. TRANSMITTER ABOVE 1 GHz (BLE)	16
9.3. TRANSMITTER ABOVE 1 GHz (BT)	20
9.4. TRANSMITTER ABOVE 1 GHz (RF4CE Zigbee)	24
9.5. SPURIOUS EMISSIONS FOR CO-LOCATION	28
10. SETUP PHOTOS	33
Appendix A - Reference Test Report	34

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

SERIAL NUMBER: RADIATED: E4EXVJ03008G, CONDUCTED: E4EXVJ03011G

SAMPLE RECEIPT DATE: 2022-09-08 & 2022-09-29

DATE TESTED: 2022-09-13 & 2022-10-03, 2022-10-10

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:



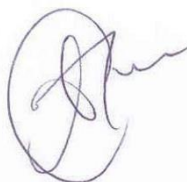
Francisco de Anda
Staff Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Gerardo Abrego
Senior Test Engineer
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:



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

2. TEST RESULTS SUMMARY

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

Below is a list of the data provided by the customer:

1. Antenna gain and type (see section 6.4)

BT

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Not performed	Per ANSI C63.10, Section 11.6.
See Comment	20dB BW	Not performed	ANSI C63.10 Sections 6.9.2 and 6.9.3
15.247 (a)(1)	Hopping Frequency Separation	Not performed	None.
15.247 (a)(1)(iii)	Number of Hopping Channels	Not performed	None.
15.247 (a)(1)(iii)	Average Time of Occupancy	Not performed	None.
15.247 (b)(1)	Output Power	Partial testing performed and complies	None.
See Comment	Average Power	Partial testing performed and complies	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (d)	Conducted Spurious Emissions	Not performed	None.
15.209, 15.205	Radiated Emissions	Partial testing performed and complies	None.
15.207	AC Mains Conducted Emissions	Not performed	None.

BLE/ RF4CE Zigbee

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Not performed	ANSI C63.10 Section 11.6.
-	99% OBW	Not performed	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	6dB BW	Not performed	None.
15.247 (b) (3)	Output Power	Partial testing performed and complies	None.
See Comment	Average power	Partial testing performed and complies	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	PSD	Not performed	None.
15.247 (d)	Conducted Spurious Emissions	Not performed	None.
15.209, 15.205	Radiated Emissions	Partial testing performed and complies	None.
15.207	AC Mains Conducted Emissions	Not performed	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, KDB 484596 D01.

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 checked="" 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 Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
 $36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a TV Set Top Box Client with RF4CE Zigbee, BLE (1Mbps), and BT radios.

6.2. INTRODUCTION OF TEST DATA REUSE

This application for certification is leveraging the data reuse procedures from KDB 484596 D01 based on reference BT/BLE of FCC ID: DKNPF99, and RF4CE Zigbee of FCC ID: DKNP27TJ to cover FCC ID: DKNW76XM.

The major difference among FCC IDs is FCC ID: DKNW76XM is using a new RF4CE Zigbee radio, all other circuitry and features are identical.

This report covers the BT/BLE and RF4CE Zigbee radios portion for FCC ID: DKNW76XM, where referenced FCC IDs for BT/BLE and RF4CE Zigbee data is reused. Verification testing was performed on worst-case modes for colocation and radiated emissions(BE/RSE) from BT/BLE's previous FCC ID: DKNPF99 and RF4CE Zigbee's previous FCC ID: DKNP27TJ to ensure the EUT remains compliant with new RF4CE Zigbee radio, FCC ID: DKNW76XM. See reference information as below.

Reference application that contains the reused reference data which is attached to this report in Appendix A.

Equipment Class	Reference FCC ID	Frequency Range (MHz)	Reference Report	Report Title/Section
DTS	DKNPF99	2402 to 2480	14160419-E1V1	BLE / All sections
DSS	DKNPF99	2402 to 2480	14160419-E2V1	BT / All sections
DTS	DKNP27TJ	2425 to 2475	14441108-E1	RF4CE Zigbee / All sections

6.3. SPOT CHECK VERIFICATION RESULTS SUMMARY

Test Engineer: 12485 GA			Test Date: 2022-10-10				
FCC ID: DKNW76XM SPOT CHECK RESULTS							
Technology	Mode	Test Item	Channel	Original model Output power (dBm)		Spot check model Output power (dBm)	
				D35		D35	
				DKNPF99		DKNW76XM	
				Peak	Avg	Peak	Avg
BLE	BLE	Output power	2402MHz, Low	8.62	6.02	9.1	6.61
			2480MHz, High	8.81	6.28	9.37	6.86
BT	GFSK		2402MHz, Low	7.78	7.5	8.29	8
			2441MHz, Mid	8.01	7.8	8.53	8.19
Technology	Mode	Channel		D35		D35	
				DKNP27TJ		DKNW76XM	
RF4CE Zigbee	O-QPSK	2425MH, Low	11.82	11.45	12.00	11.68	
		2450MHz, Mid	11.77	11.38	11.94	11.55	
		2475MHz, High	11.76	11.33	11.84	11.54	

FCC ID: DKNW76XM SPOT CHECK RESULTS									
Technology	Mode	Test Item	Channel	Original model (Worst margin dB)		Spot check model (Worst margin dB)		Delta (dB)	
				D35		D35			
				DKNPF99		DKNW76XM			
				H	V	H	V	H	V
BLE	BLE	RBE	2402MHz, Low	-9.3	-11.84	-11.95	-12.48	-2.65	-0.64
BT	GFSK		2402MHz, Low	-10.28	-14.16	-12.38	-12.19	-2.1	1.97
				Worst margin (dB)		Worst margin (dB)		Delta (dB)	
BLE	BLE	RSE	2480MHz, High	-8.56		-15.63		-7.07	
BT	GFSK		2441MHz, Mid	-6.31		-14.61		-8.3	
BT/Zigbee simultaneous RSE above 1G				-7.44		-5.2		2.24	

FCC ID: DKNW76XM SPOT CHECK RESULTS									
Technology	Mode	Test Item	Channel	Original model (Worst margin dB)		Spot check model (Worst margin dB)		Delta (dB)	
				D35		D35			
				DKNP27TJ		DKNW76XM			
				H	V	H	V	H	V
RF4CE Zigbee	O-QPSK	RBE	2475MHz, High	-3.1	-5.44	-4.49	-6.17	-1.39	-0.73
				Worst margin (dB)		Worst margin (dB)		Delta (dB)	
RF4CE Zigbee	O-QPSK	RSE	2425MH, Low	-5.02		-5.92		-0.9	

Comparison of the models, tests show EUT meets FCC Technical Limits.

6.4. DESCRIPTION OF AVAILABLE ANTENNAS

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

The BT/BLE radio utilizes a PCB Inverted F antenna, with a maximum gain of 4.2 dBi.
The RF4CE Zigbee radio utilizes a PCB Inverted F antenna, with a maximum gain of 4.1 dBi

6.5. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was:

Zigbee FW: TL8656_V0008

BT/BLE FW: BCM 02.011.0330.0000

The EUT utility installed during testing was cybluetool 0.1.55.1

6.6. WORST-CASE CONFIGURATION AND MODE

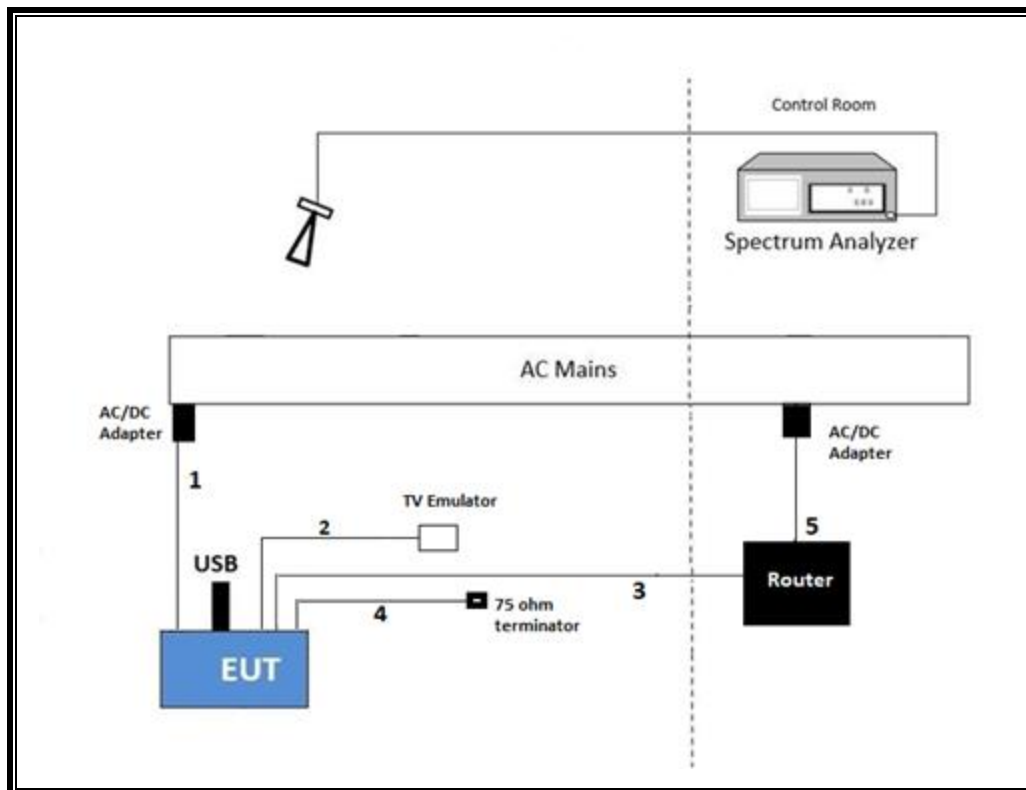
The EUT is a desktop device, therefore, all final radiated testing was performed with the EUT in X orientation.

This EUT supports BLE/BT + Zigbee simultaneous transmission, radiated emission test 30MHz to 18GHz and Zigbee's previous FCC ID: DKNPF99 worst-case modes were performed on this FCC ID: DKNW76XM to ensure the testing remains compliant with new RF4CE Zigbee radio.

6.7. 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 colocation test	HP	Elitebook 740	N/A	DoC		
AC/DC Adapter(Laptop): Radiated colocation test	HP	HSTNN-DA40	N/A	DoC		
USB Flash Drive	Sandisk	Cruzer Glide 16GB	SDCZ60-016G	DoC		
I/O CABLES (RADIATED 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	HDMI	1	HDMI	shielded	2.5	EUT to Emulator
3	RJ45	1	RJ45	Un-shielded	More than 3	EUT to Ethernet Router
4	Coaxial RF	1	Coaxial RF	shielded	1	75 ohm load terminated BNC port on coaxial cable
5	DC	1	Barrel	Un-shielded	1.8	Ethernet router to AC/DC Adapter

RADIATED TEST 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 BLE/BT radio card. Laptop was removed during the testing.

Power cycling the EUT selects Zigbee radio mode/channel.

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	80403	2023-06-08	2022-06-08
RF Filter Box, 1-18GHz	UL-FR1	NA	171389	2023-05-31	2022-05-31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201497	2023-02-18	2022-02-18
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	80813	2023-06-08	2022-06-08
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	2023-02-08	2022-02-08
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	169927	2023-02-16	2022-02-16
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	90388	2023-01-24	2022-01-24
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90733	2023-01-24	2022-01-24
Test Software List					
Description	Manufacturer	Model	Version		
Radiated Software	UL	UL EMC	Sept 15 2022, Dec 28 2015, Dec 29 2015, Jul 6 2022, Jul 15, 2014		

8. MEASUREMENT METHOD

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

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

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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

TEST PROCEDURE

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

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

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

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

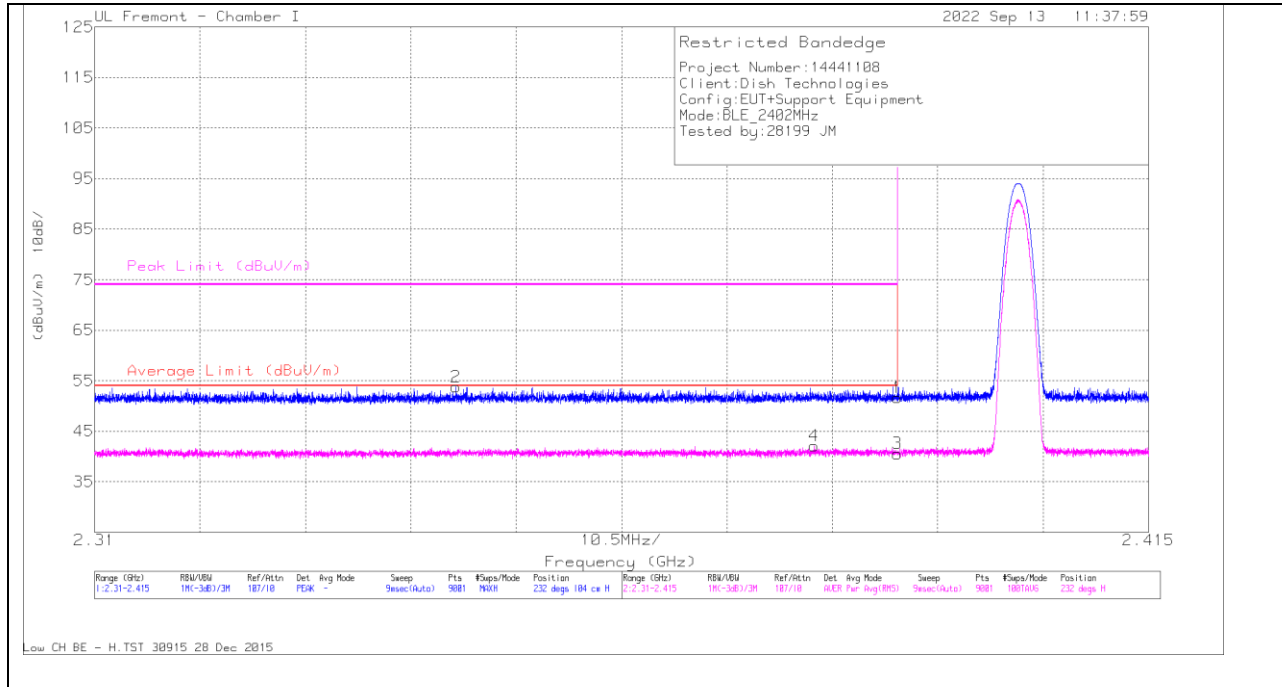
The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

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

9.2. TRANSMITTER ABOVE 1 GHz (BLE)

BANDEDGE (LOW CHANNEL)

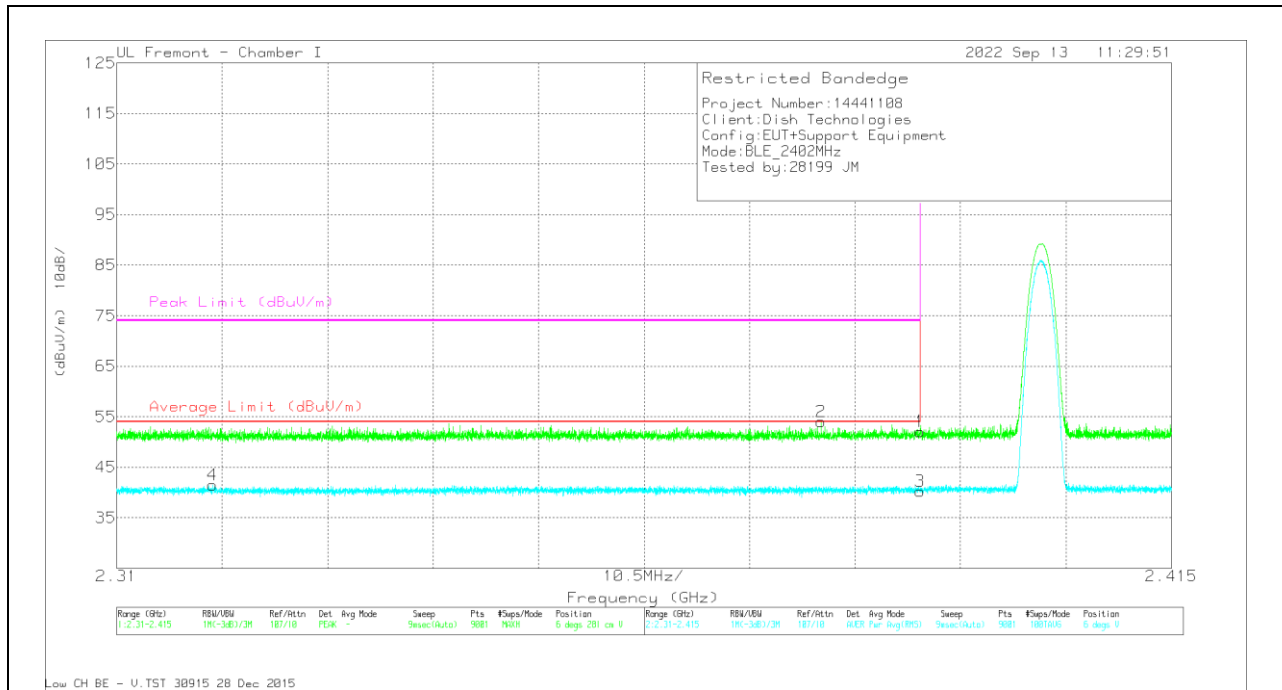
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/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	39.92	Pk	32.3	-20.6	51.62	-	-	74	-22.38	232	104	H
2	* 2.346016	42.08	Pk	32.1	-20.4	53.78	-	-	74	-20.22	232	104	H
3	* 2.39	28.85	RMS	32.3	-20.6	40.55	54	-13.45	-	-	232	104	H
4	* 2.381682	30.35	RMS	32.2	-20.5	42.05	54	-11.95	-	-	232	104	H

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

VERTICAL RESULT

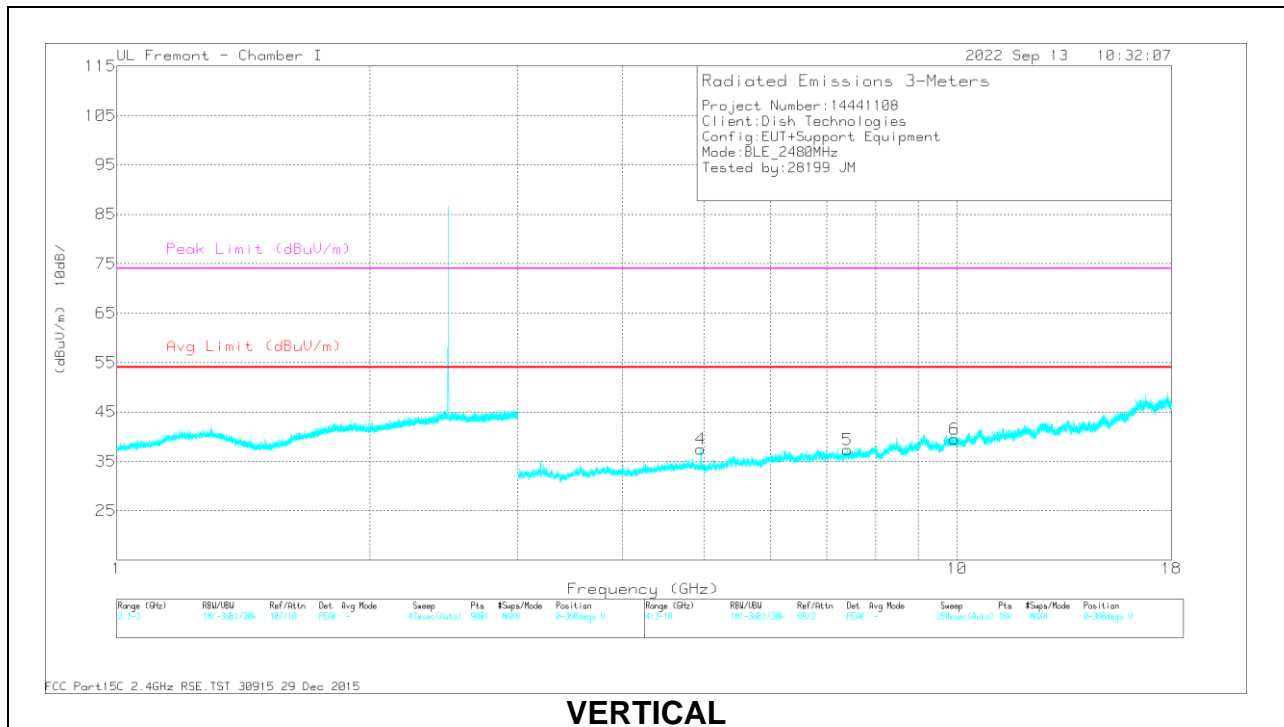
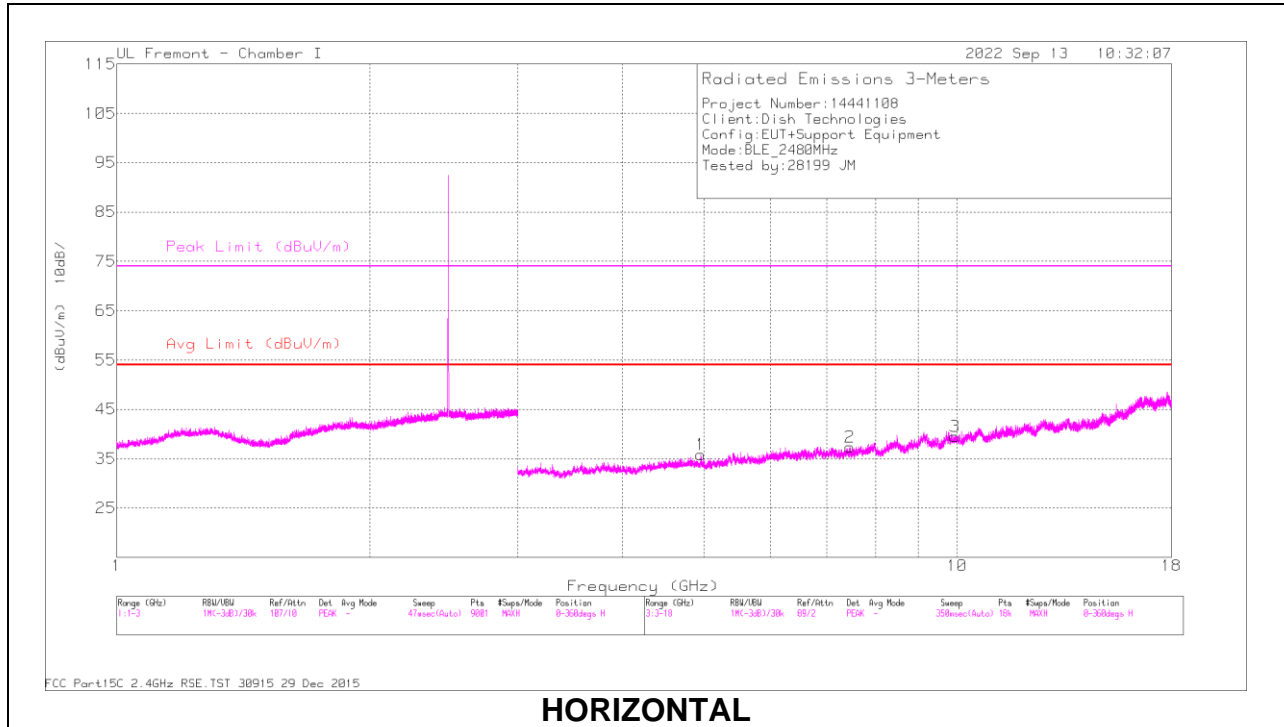


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.39	Pk	32.3	-20.6	52.09	-	-	74	-21.91	6	281	V
2	* 2.380107	42.31	Pk	32.2	-20.5	54.01	-	-	74	-19.99	6	281	V
3	* 2.39	28.51	RMS	32.3	-20.6	40.21	54	-13.79	-	-	6	281	V
4	* 2.319555	29.92	RMS	32	-20.4	41.52	54	-12.48	-	-	6	281	V

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

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

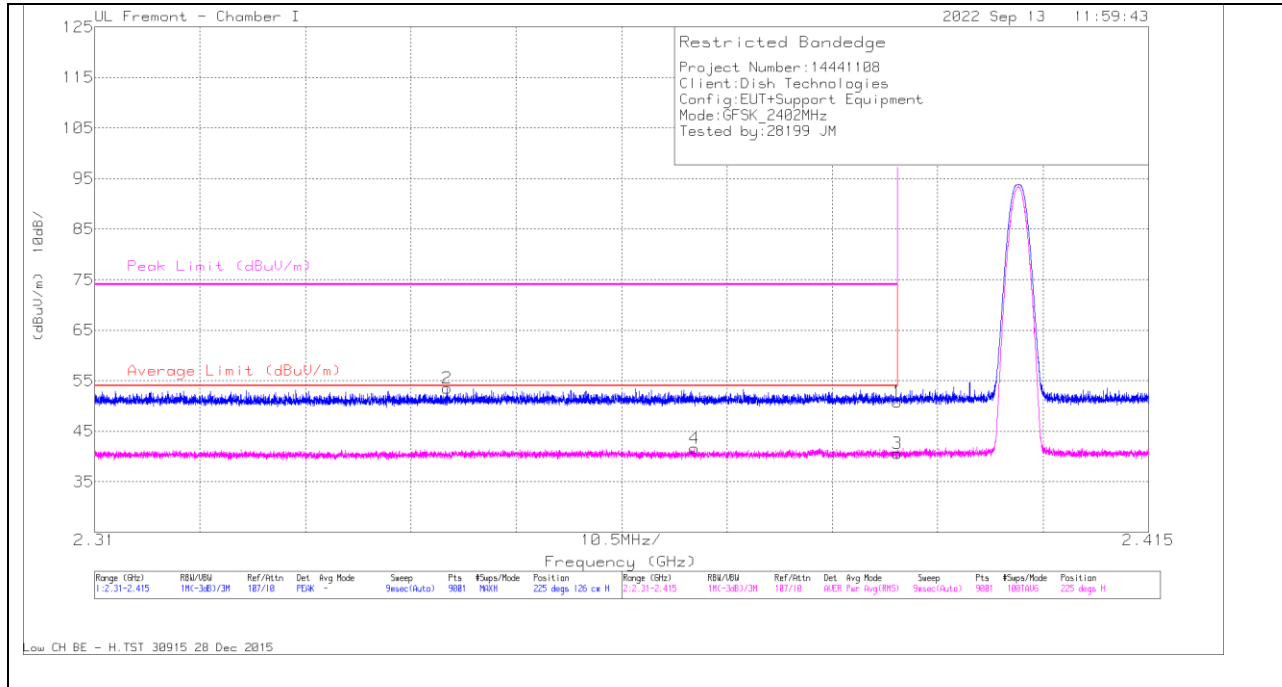
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/Filtr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.959811	41.18	PK2	34.5	-28.6	47.08	-	-	74	-26.92	60	139	H
	* 4.960015	30.01	MAv1	34.5	-28.6	35.91	54	-18.09	-	-	60	139	H
2	* 7.453742	36.27	PK2	36	-24.9	47.37	-	-	74	-26.63	117	210	H
	* 7.454434	24.34	MAv1	36	-24.9	35.44	54	-18.56	-	-	117	210	H
3	9.944627	34.9	PK2	37.5	-22.4	50	-	-	-	-	23	256	H
	9.942875	23.24	MAv1	37.5	-22.4	38.34	-	-	-	-	23	256	H
4	* 4.960605	41.99	PK2	34.5	-28.6	47.89	-	-	74	-26.11	284	102	V
	* 4.959938	32.47	MAv1	34.5	-28.6	38.37	54	-15.63	-	-	284	102	V
5	* 7.402906	36.19	PK2	36	-25	47.19	-	-	74	-26.81	114	145	V
	* 7.402374	24.79	MAv1	36	-24.9	35.89	54	-18.11	-	-	114	145	V
6	9.942477	35.56	PK2	37.5	-22.4	50.66	-	-	-	-	60	219	V
	9.940411	23.07	MAv1	37.5	-22.4	38.17	-	-	-	-	60	219	V

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

9.3. TRANSMITTER ABOVE 1 GHz (BT)

BANDEDGE (LOW CHANNEL)

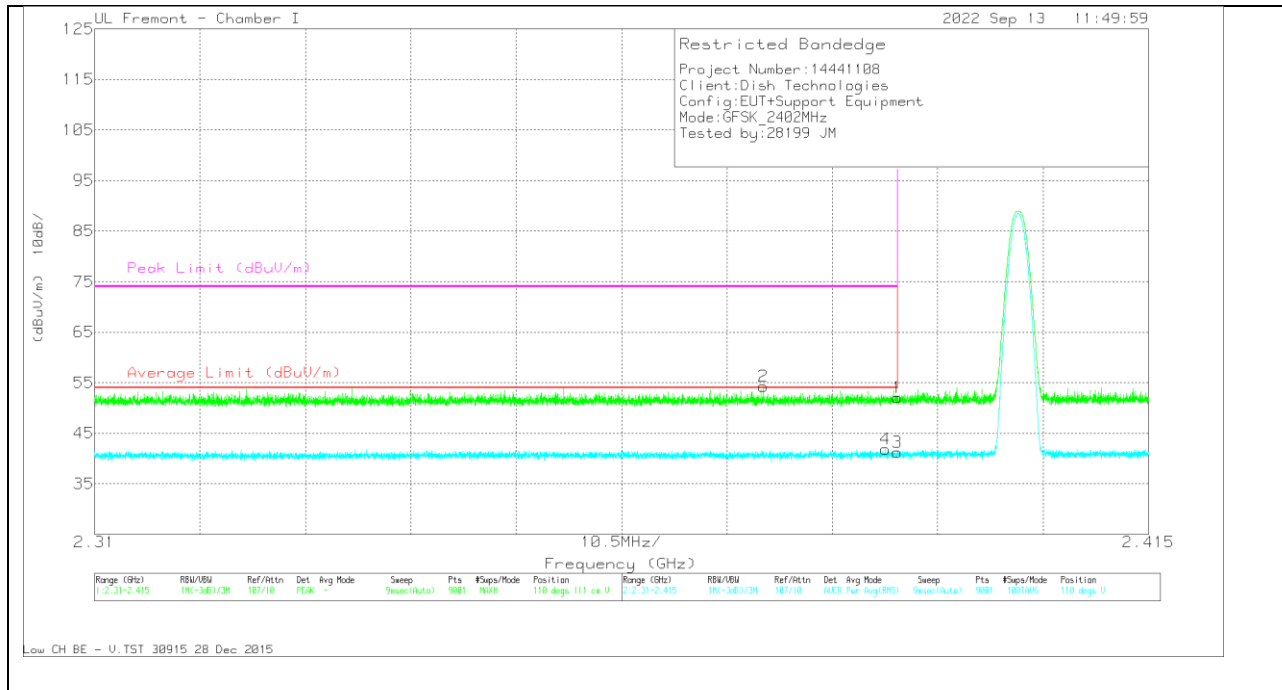
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/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	39.05	Pk	32.3	-20.6	50.75	-	-	74	-23.25	225	126	H
2	* 2.345129	41.83	Pk	32.1	-20.4	53.53	-	-	74	-20.47	225	126	H
3	* 2.39	28.91	RMS	32.3	-20.6	40.61	54	-13.39	-	-	225	126	H
4	* 2.369735	30.02	RMS	32.1	-20.5	41.62	54	-12.38	-	-	225	126	H

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

VERTICAL RESULT

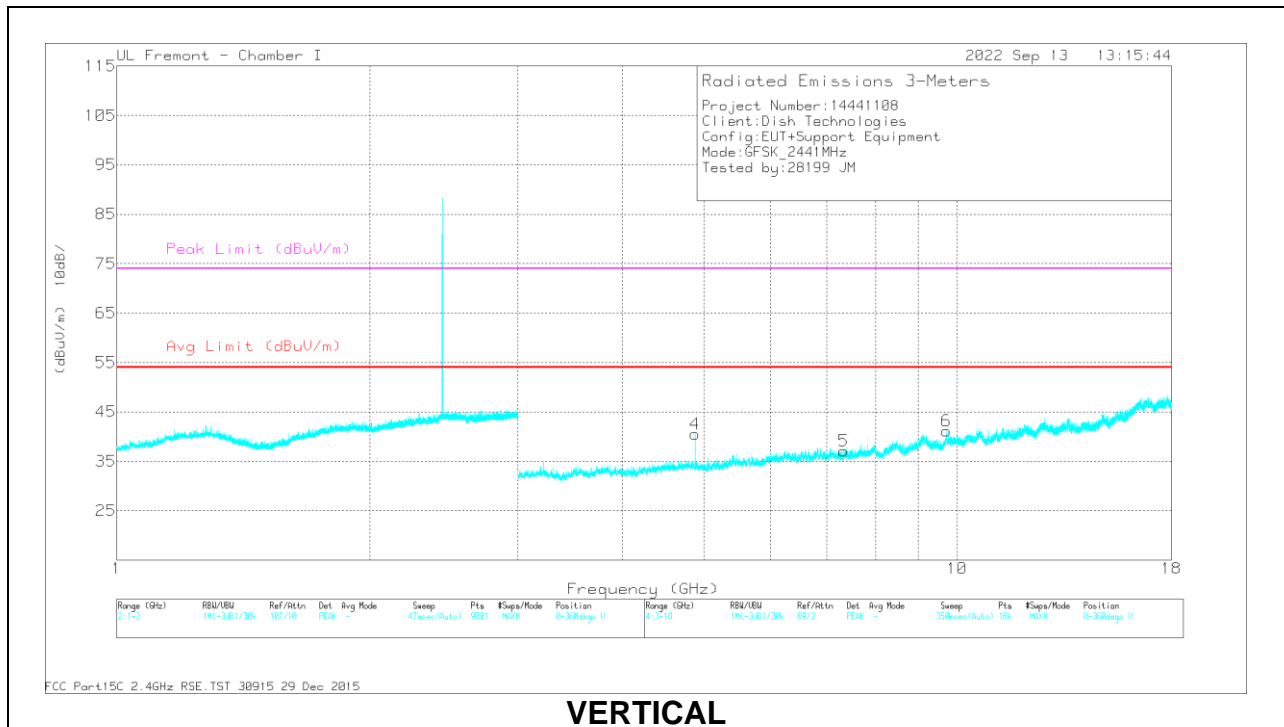
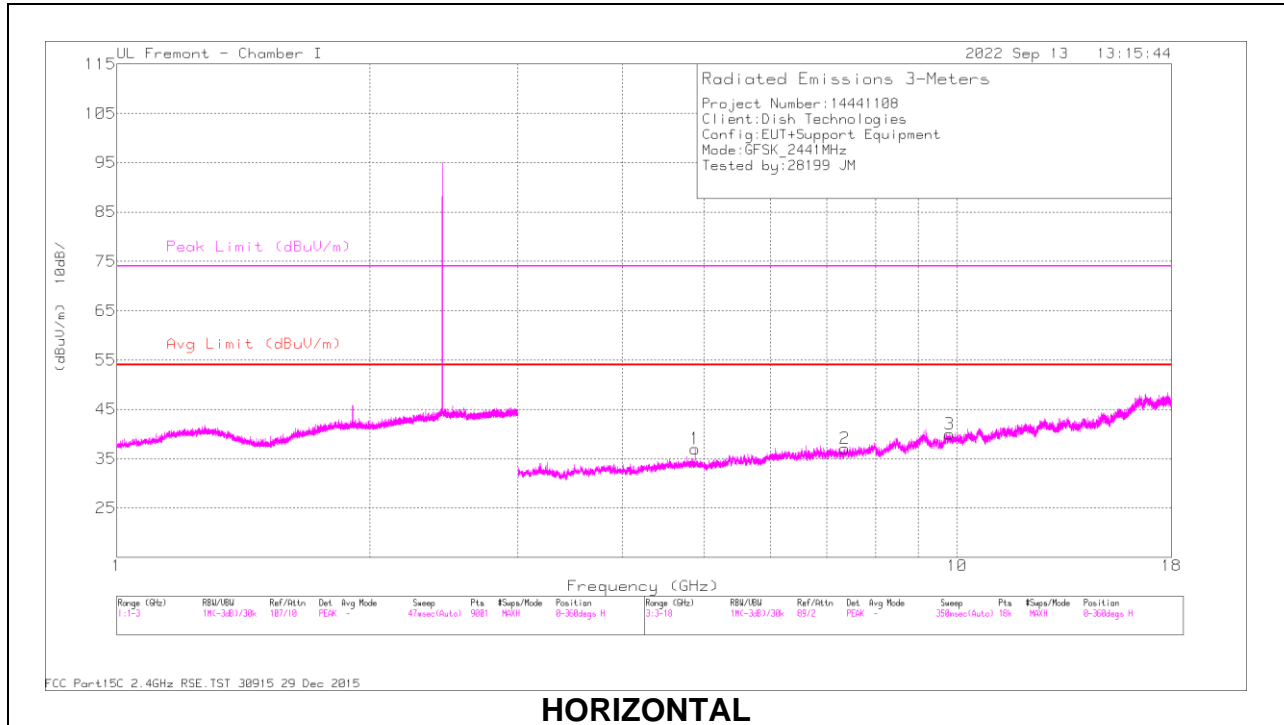


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.28	Pk	32.3	-20.6	51.98	-	-	74	-22.02	110	111	V
2	* 2.37663	42.56	Pk	32.2	-20.5	54.26	-	-	74	-19.74	110	111	V
3	* 2.39	29.55	RMS	32.3	-20.6	41.25	54	-12.75	-	-	110	111	V
4	* 2.388764	30.21	RMS	32.2	-20.6	41.81	54	-12.19	-	-	110	111	V

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

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL RESULTS



RADIATED EMISSIONS

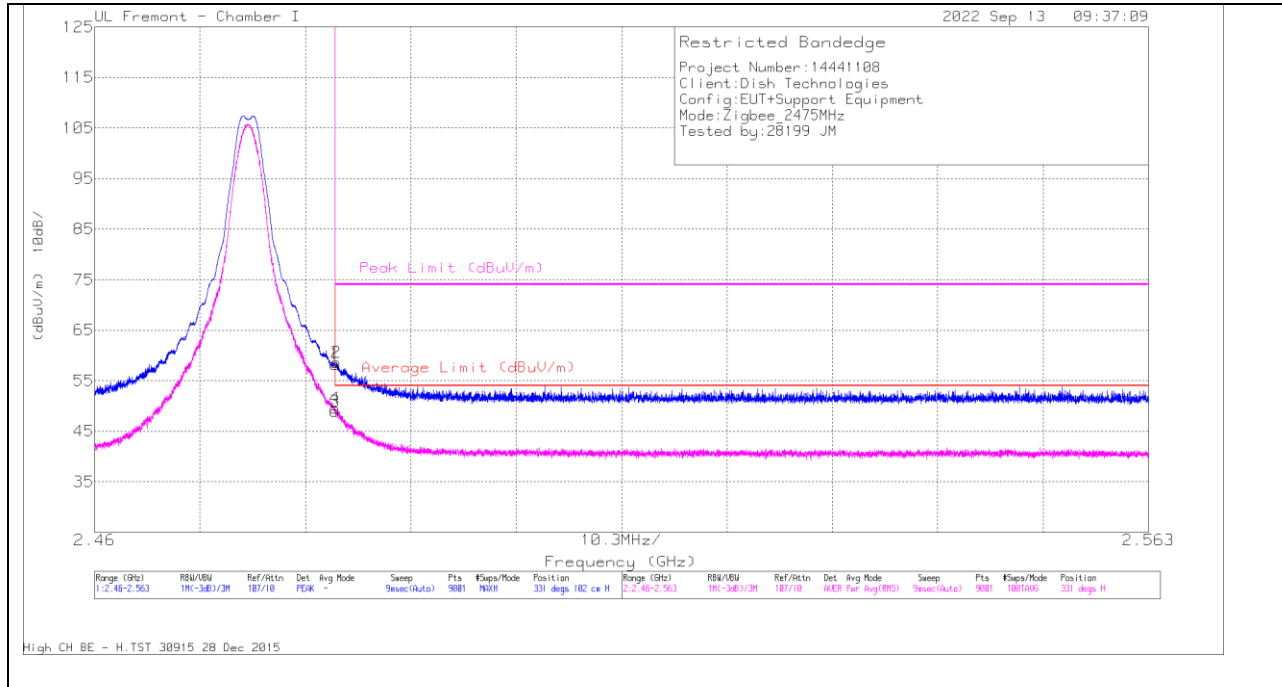
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/Filtr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.881516	39.26	PKFH	34.6	-28	45.86	-	-	74	-28.14	86	101	H
	* 4.881996	29.23	VA1T	34.6	-28	35.83	54	-18.17	-	-	86	101	H
2	* 7.350226	34.56	PKFH	36	-25.6	44.96	-	-	74	-29.04	286	138	H
	* 7.349515	21.44	VA1T	36	-25.6	31.84	54	-22.16	-	-	286	138	H
3	9.792153	33.07	PKFH	37.3	-22.2	48.17	-	-	-	-	104	195	H
	9.792617	19.44	VA1T	37.3	-22.2	34.54	-	-	-	-	104	195	H
4	* 4.881768	40.23	PKFH	34.6	-28	46.83	-	-	74	-27.17	244	105	V
	* 4.88204	32.79	VA1T	34.6	-28	39.39	54	-14.61	-	-	244	105	V
5	* 7.334226	35.21	PKFH	36	-25.8	45.41	-	-	74	-28.59	218	150	V
	* 7.3366	21.52	VA1T	36	-25.8	31.72	54	-22.28	-	-	218	150	V
6	9.718581	32.54	PKFH	37.2	-21.3	48.44	-	-	-	-	153	156	V
	9.716847	19.06	VA1T	37.2	-21.3	34.96	-	-	-	-	153	156	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

9.4. TRANSMITTER ABOVE 1 GHz (RF4CE Zigbee)

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



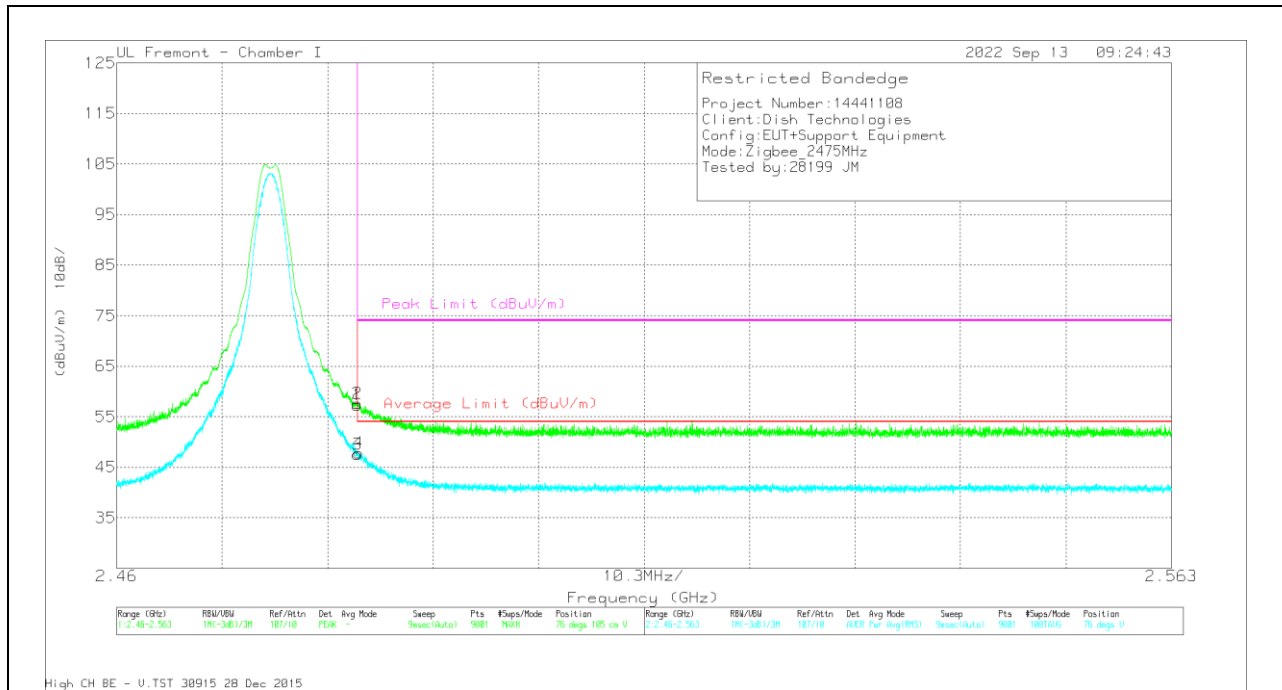
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	46.8	Pk	32.6	-21.1	58.3	-	-	74	-15.7	331	102	H
2	* 2.483643	47.07	Pk	32.6	-21.1	58.57	-	-	74	-15.43	331	102	H
3	* 2.4835	37.42	RMS	32.6	-21.1	48.92	54	-5.08	-	-	331	102	H
4	* 2.483517	38.01	RMS	32.6	-21.1	49.51	54	-4.49	-	-	331	102	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT

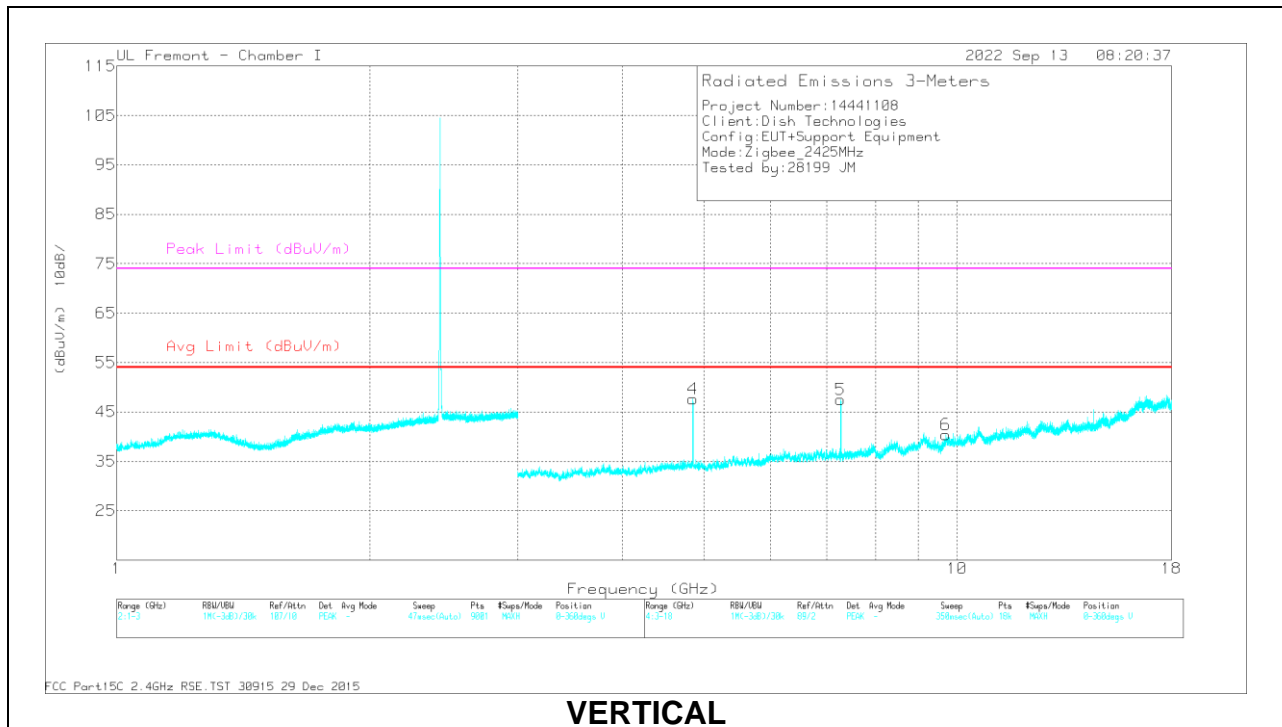
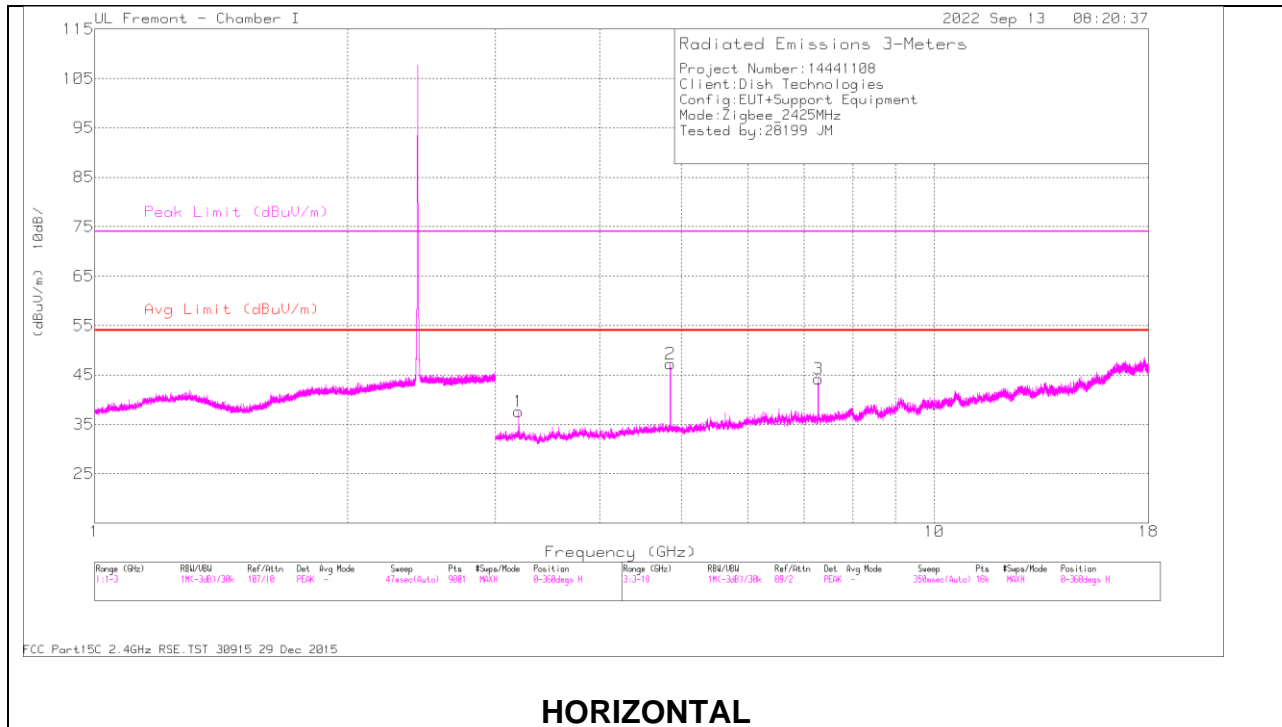


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	45.81	Pk	32.6	-21.1	57.31	-	-	74	-16.69	76	105	V
2	* 2.483506	46.17	Pk	32.6	-21.1	57.67	-	-	74	-16.33	76	105	V
3	* 2.4835	36.1	RMS	32.6	-21.1	47.6	54	-6.4	-	-	76	105	V
4	* 2.483643	36.33	RMS	32.6	-21.1	47.83	54	-6.17	-	-	76	105	V

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

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/Filtr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.200221	41.6	PK2	33.4	-29.4	45.6	-	-	-	-	108	104	H
	3.197288	27.66	MAv1	33.3	-29.4	31.56	-	-	-	-	108	104	H
2	* 4.849096	47.19	PK2	34.5	-27.8	53.89	-	-	74	-20.11	228	125	H
	* 4.849191	41.15	MAv1	34.6	-27.8	47.95	54	-6.05	-	-	228	125	H
3	* 7.276185	42.4	PK2	36	-25.9	52.5	-	-	74	-21.5	266	109	H
	* 7.276461	34.94	MAv1	36	-25.9	45.04	54	-8.96	-	-	266	109	H
4	* 4.848932	47.27	PK2	34.5	-27.8	53.97	-	-	74	-20.03	261	287	V
	* 4.849	41.38	MAv1	34.5	-27.8	48.08	54	-5.92	-	-	261	287	V
5	* 7.273529	44.32	PK2	36	-25.9	54.42	-	-	74	-19.58	342	104	V
	* 7.273605	37.63	MAv1	36	-25.9	47.73	54	-6.27	-	-	342	104	V
6	9.701638	34.59	PK2	37.2	-21.4	50.39	-	-	-	-	236	202	V
	9.702054	23.94	MAv1	37.2	-21.4	39.74	-	-	-	-	236	202	V

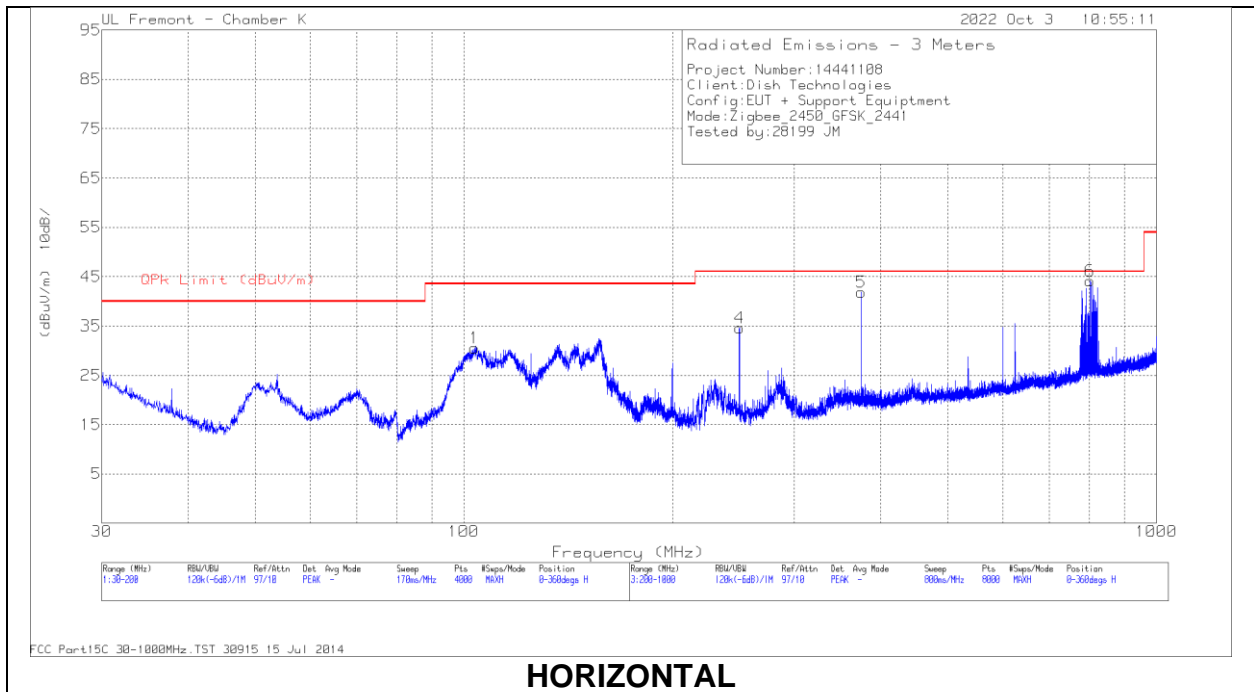
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK2 - KDB558074 Method: Maximum Peak
 MAv1 - KDB558074 Option 1 Maximum RMS Average

9.5. SPURIOUS EMISSIONS FOR CO-LOCATION

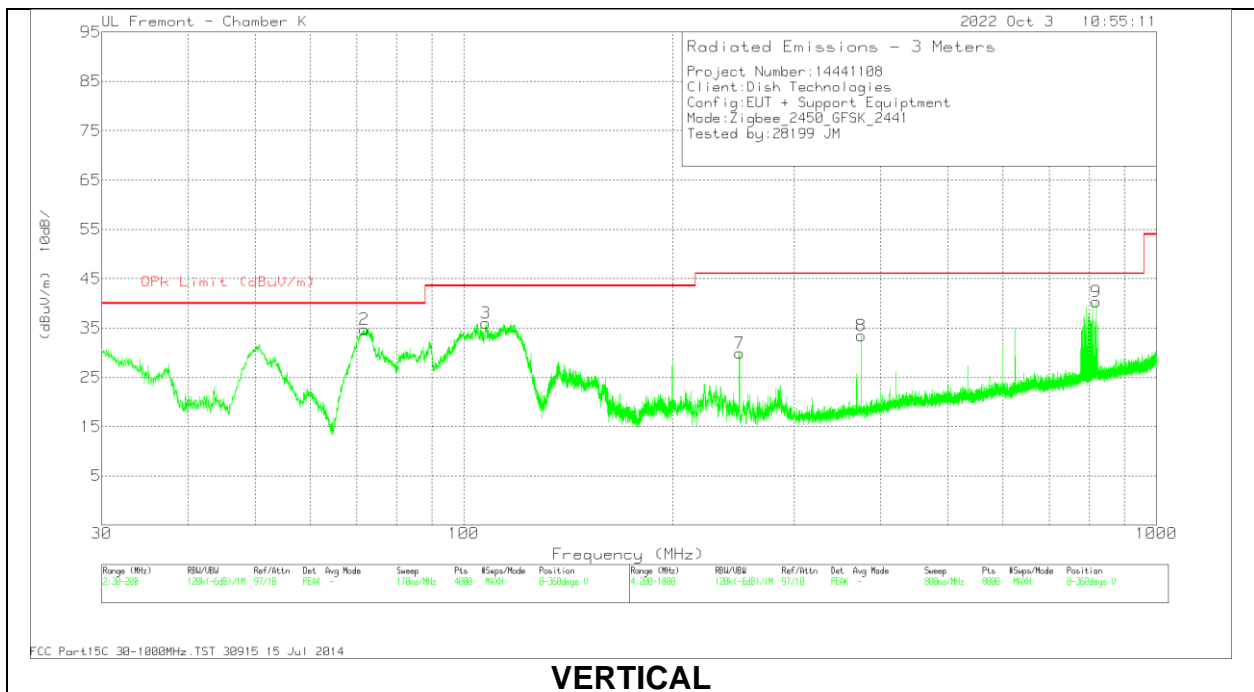
TEST-CASE CONDITIONS

Mode	Frequency (MHz)
BT GFSK	2441
Zigbee	2450

HARMONICS AND SPURIOUS EMISSIONS 30MHz TO 1GHz



HORIZONTAL



VERTICAL

Radiated Emissions

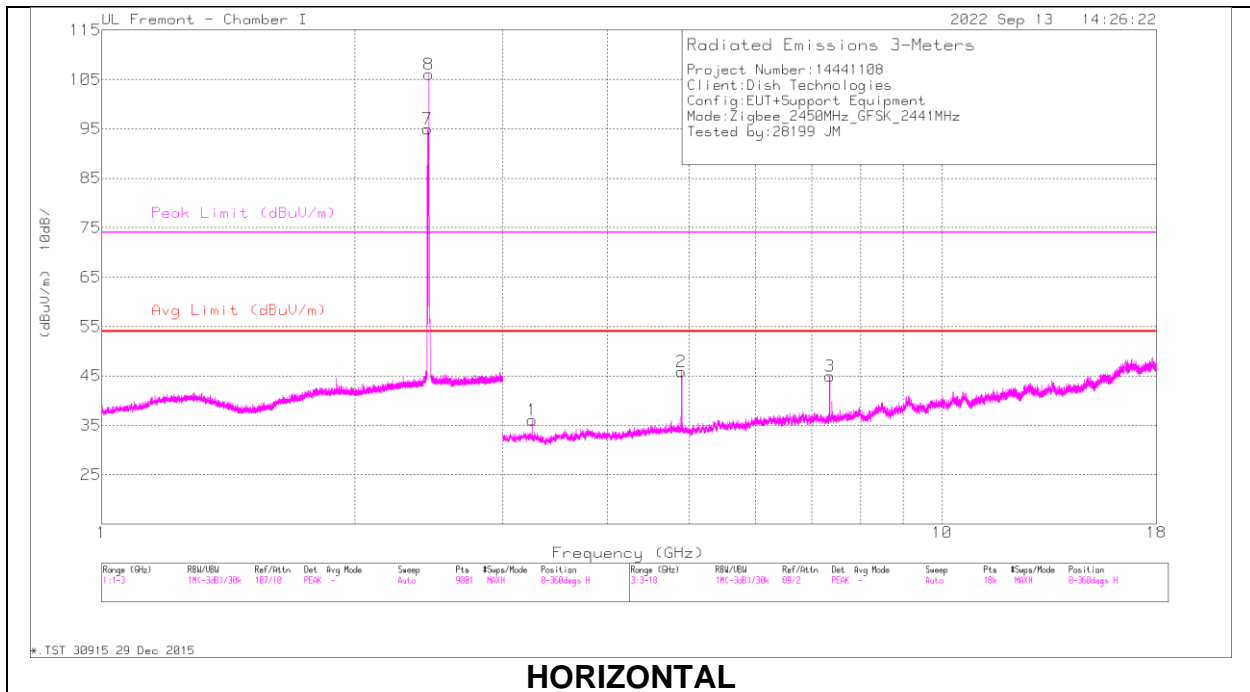
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid Antenna ACF(dB)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	103.714	43.92	Pk	17.5	-30.9	30.52	43.52	-13	0-360	295	H
2	71.0943	45.35	Qp	14.2	-31.1	28.45	40	-11.55	48	99	V
3	107.54	48.52	Pk	18.4	-30.9	36.02	43.52	-7.5	0-360	97	V
4	* 250.007	46.35	Pk	18.3	-30	34.65	46.02	-11.37	0-360	99	H
5	374.999	49.97	Qp	21.6	-29.4	42.17	46.02	-3.85	135	98	H
6	803.347	42.31	Qp	27.8	-27.8	42.31	46.02	-3.71	77	98	H
7	* 250.007	41.59	Pk	18.3	-30	29.89	46.02	-16.13	0-360	99	V
8	374.997	40.7	Qp	21.6	-29.4	32.9	46.02	-13.12	108	111	V
9	819.959	33.25	Qp	28.2	-27.8	33.65	46.02	-12.37	270	98	V

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

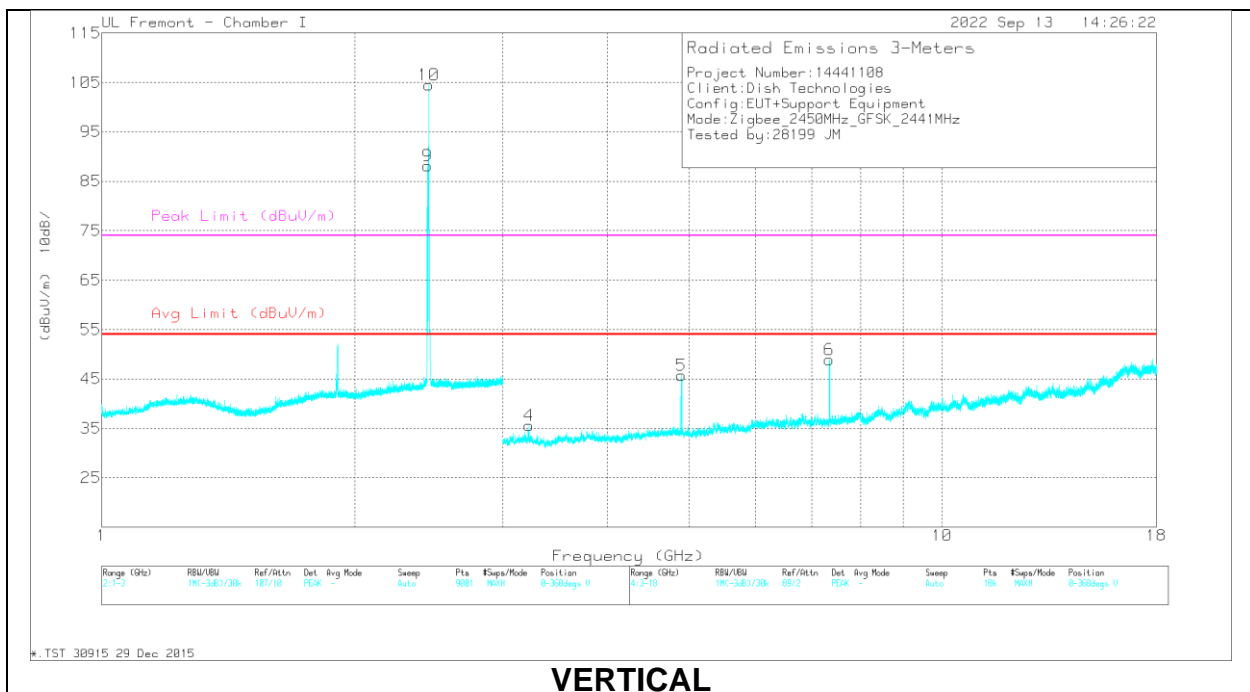
Pk - Peak detector

Qp - Quasi-Peak detector

HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz



HORIZONTAL



VERTICAL

Radiated Emissions

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn Antenna ACF(dB)	Amp/Cbl/Filtr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.254825	39.99	PK2	33.2	-29.6	43.59	-	-	-	-	0	134	H
	3.254693	29.94	MAv1	33.2	-29.6	33.54	-	-	-	-	0	134	H
2	* 4.899	46.05	PK2	34.6	-28.1	52.55	-	-	74	-21.45	226	161	H
	* 4.8991	39.17	MAv1	34.6	-28.1	45.67	54	-8.33	-	-	226	161	H
3	* 7.351485	42.8	PK2	36	-25.6	53.2	-	-	74	-20.8	264	102	H
	* 7.351235	34.59	MAv1	36	-25.6	44.99	54	-9.01	-	-	264	102	H
4	3.22321	41.91	PK2	33.2	-29.6	45.51	-	-	-	-	67	192	V
	3.221632	28.88	MAv1	33.3	-29.4	32.78	-	-	-	-	67	192	V
5	* 4.898919	45.97	PK2	34.6	-28.1	52.47	-	-	74	-21.53	271	266	V
	* 4.900849	39.22	MAv1	34.5	-28.1	45.62	54	-8.38	-	-	271	266	V
6	* 7.348657	44.97	PK2	36	-25.6	55.37	-	-	74	-18.63	343	118	V
	* 7.348521	38.4	MAv1	36	-25.6	48.8	54	-5.2	-	-	343	118	V

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