



TEST REPORT

Report Number. : 13710438-E2V2

Applicant : ENERGOUS CORPORATION
3590 NORTH FIRST STREET,
SUITE 210,
SAN JOSE, CA 95134, U.S.A.

Model : VN-1810

Brand : ENERGOUS

FCC ID : 2ADNG-VN1810

EUT Description : WIRELESS CHARGER

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

Date Of Issue:

September 17, 2021

Prepared by:

UL VERIFICATION SERVICES

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Fremont, CA 94538 U.S.A.

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
1	9/13/2021	Initial Issue	--
2	9/17/2021	Corrected firmware version on Section 6.4	Tina Chu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ENERGOUS CORPORATION
3590 NORTH FIRST STREET,
SUITE 210,
SAN JOSE, CA 95134, U.S.A

EUT DESCRIPTION: WIRELESS CHARGER

MODEL NUMBER: VN-1810

BRAND: ENERGOUS

SERIAL NUMBER: 7004(Radiated), 7000(Conducted)

SAMPLE RECEIPT DATE: AUGUST 24, 2021

DATE TESTED: AUGUST 24, 2021 TO SEPTEMBER 02, 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.

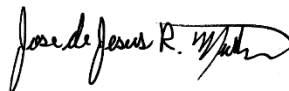
This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc. By:



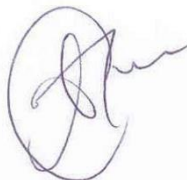
DAN CORONIA
OPERATIONS LEAD
UL Verification Services Inc.

Prepared By:



JOSE MARTINEZ
TEST ENGINEER
UL Verification Services Inc.

Reviewed By:



TINA CHU
SENIOR PROJECT ENGINEER
UL Verification Services Inc.

2. TEST RESULTS SUMMARY

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

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	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 LLC is accredited by A2LA, certification #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, USA	US0104	2324A	208313
<input type="checkbox"/>	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA	US0104	22541	208313
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA	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 an over-the-air, distance charging transmitter. Wireless power transfer is only transmitting a continuous carrier wave signal at 917.5 MHz frequency single channel when client device is positioned within the charging zone. The charging zone of the EUT is up to 1 meter for client device placed in front of the EUT. The EUT can only charge one client device at a time. The EUT uses BLE to pair with the client device.

This report documents test results of the Bluetooth Low Energy radio portion (EUT only supports BLE 1Mbps) of the wireless charger.

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	BLE	-1.66	0.68

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes an integrated antenna, with a maximum gain of 2dBi.

6.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Version: 5.0.2.255

The test utility software was WattUp app Version: : 4.0.31

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated band edge, harmonics, and spurious emissions from 1 GHz to 18GHz were performed with the EUT was set to transmit at the Low/Middle/High channels.

Radiated emission below 30MHz, below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT was set to transmit at the channel with highest output power as worst-case scenario.

The EUT is a tabletop device and it has two ports, one is the Conn power jack port for power only, second port is a micro USB port for command line interface control, end user will not have access to it. Therefore, all final radiated testing was performed with the EUT in tabletop orientation powered by AC/DC adapter via cable.

Worst-case data rate as provided by the client was:
BLE: 1 Mbps.

BLE and WPT bands operate simultaneously, simultaneous operation results are documented in UL document 13710438-E1 WPT report.

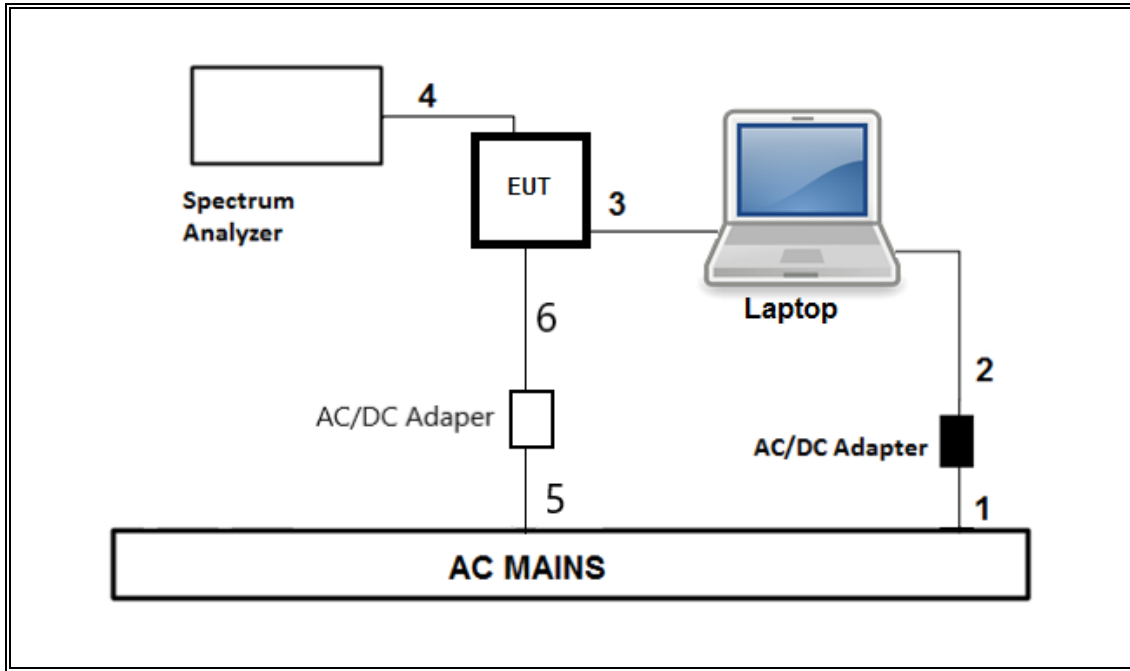
6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC		
EUT AC/DC Adapter (80 W)	TDK-Lambda	DT80PW280D	E20122202-4M-0011-2105	DoC		
Laptop	Dell	Latitude E7470	3F94RC2	DoC		
Laptop AC/DC adapter	Dell	LA65NM130	CN-03NKWD-72438-38D-0F54-A00	DoC		
I/O CABLES (RF CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	1	AC Mains to AC/DC Adapter
2	DC	1	DC	Un-shielded	1.5	AC/DC Adapter to Laptop
3	USB	1	UART	Un-shielded	1.5	EUT to Laptop
4	Antenna	1	SMA	Un-shielded	0.1	To spectrum analyzer
5	AC	1	AC	Un-shielded	1.8	AC Mains to AC/DC Adapter
6	DC	1	CONN PWR JACK	Un-shielded	1.5	AC/DC Adapter to EUT
I/O CABLES (RF RADIATED TEST/AC POWER LINE TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	1.8	AC Mains to AC/DC Adapter
2	DC	1	CONN PWR JACK	Un-shielded	1.5	AC/DC Adapter to EUT

TEST SETUP-CONDUCTED TEST

The EUT was connected to the test laptop via cable. Test software exercised the EUT.

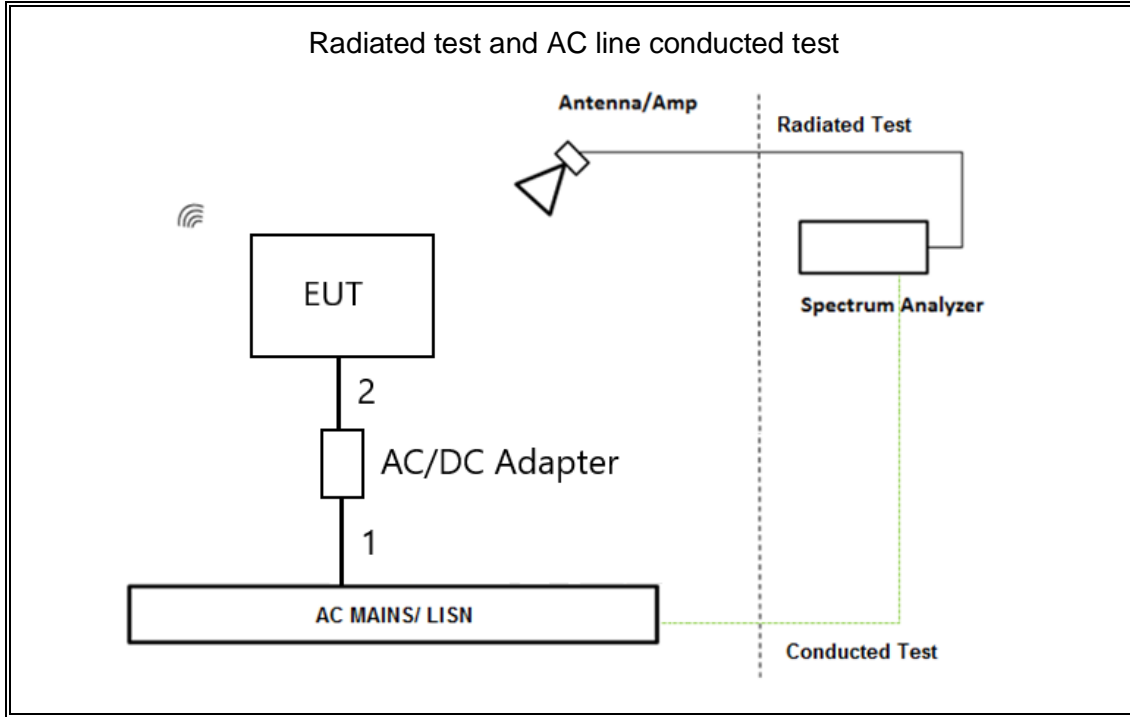
SETUP DIAGRAM



TEST SETUP- RADIATED TEST / AC LINE CONDUCTED TEST

The EUT was powered by an AC/DC adapter via cable. Test software exercised the EUT. Laptop was removed during the test.

SETUP DIAGRAM



7. MEASUREMENT METHOD

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW \geq DTS BW

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

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter
Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

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

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

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

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

Band-edge: ANSI C63.10 Subclause -11.13.3.4 Integration method -Trace averaging across ON and OFF times DC correction

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

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

8. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	SC-8015	05/24/2022	05/24/2021
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	SC-8014	05/24/2022	05/24/2021
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	*T863	08/31/2021	08/31/2020
Amplifier, 100MHz-18GHz	AMPLICAL	AMP0.1G18-47-20	PRE0197319	04/08/2022	04/08/2021
Antenna, Broadband Hybrid, 30MHz to 2GHz	Sunol Sciences Corp.	JB3	81560	09/24/2021	09/24/2020
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	01/21/2022	01/21/2021
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	02/21/2022	02/21/2021
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Keysight Technologies Inc	E4440A	T198	05/25/2022	01/25/2021
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1223	06/17/2022	06/17/2021
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1269	01/25/2022	01/25/2021
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	09/24/2021	09/24/2020
Rf Amplifier, 18-26.5GHz, 60dB gain	AMPLICAL	AMP18G26.5-60	171590	05/21/2022	05/21/2021
AC Line Conducted					
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250- 25-2-01-480V	PRE0186446	01/20/2022	01/20/2021
EMI TEST RECEIVER	Rohde & Schwarz	ESR	T1436	02/19/2022	02/19/2021
Transient Limiter	TE	TBFL1	207996	06/01/2022	06/01/2021
UL TEST SOFTWARE LIST					
Radiated Software	UL	UL EMC	Rev 9.5, 03 Jan, 2020		
Antenna Port Software	UL	UL RF	AP2021.5.12		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, 07 Jul 2020		

*Testing is completed before equipment expiration date.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

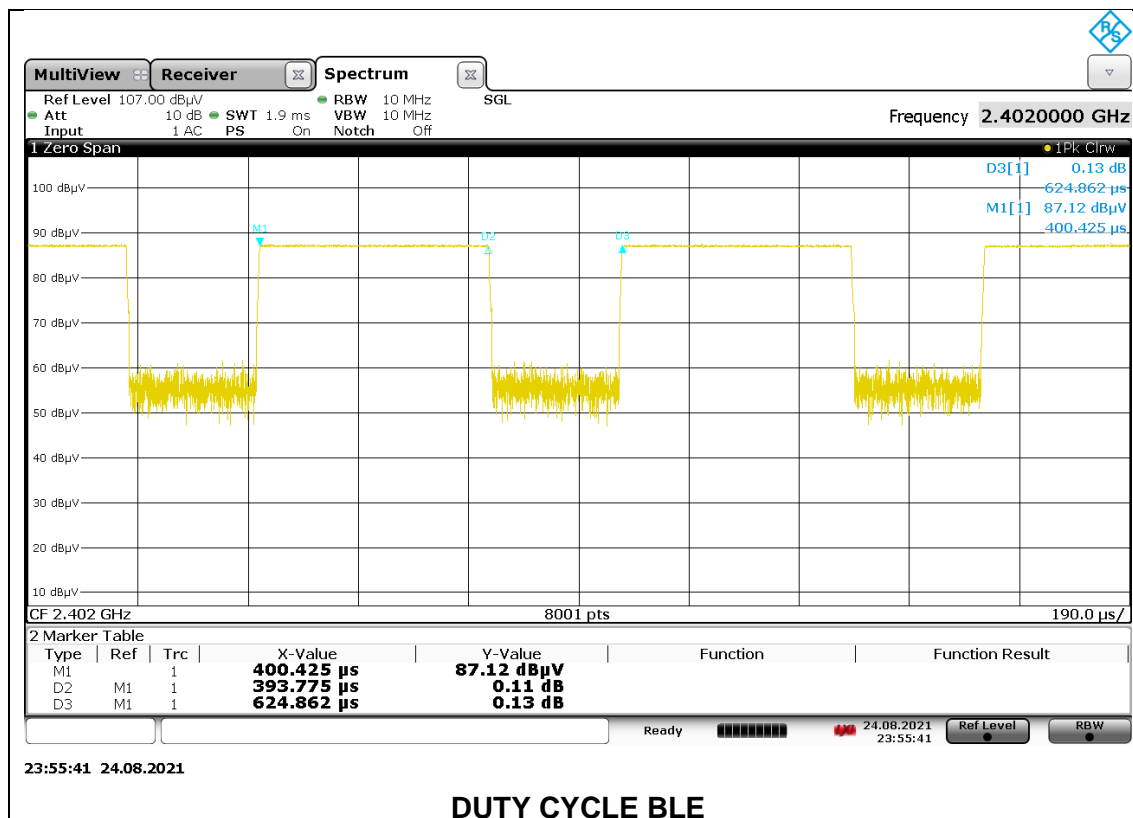
PROCEDURE

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						
BLE	0.3938	0.6249	0.630	63.02	2.01	2.540

Test engineer: 19498 ER



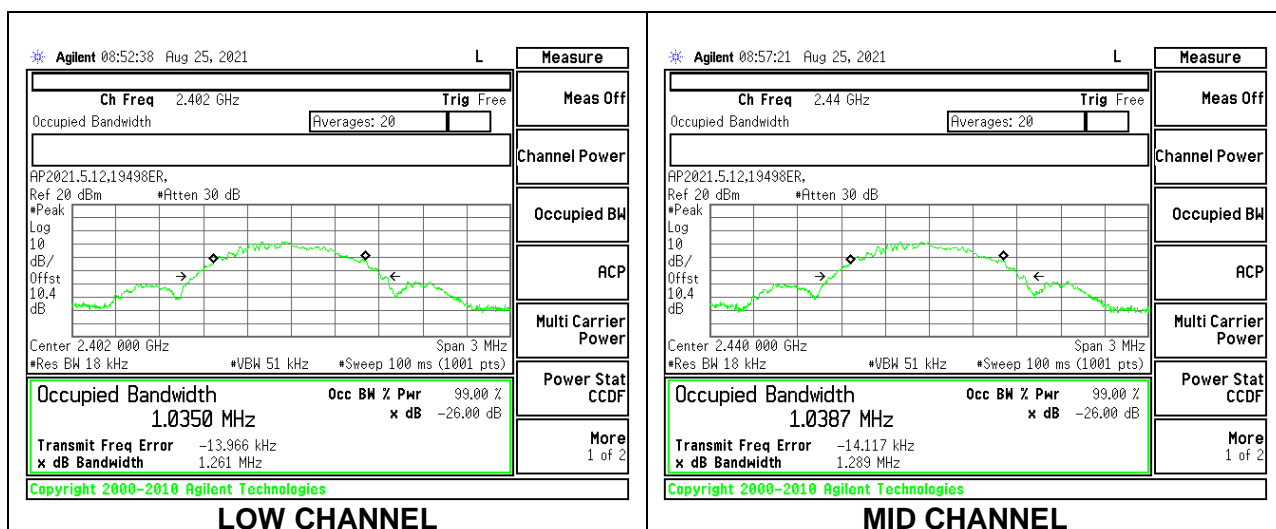
9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

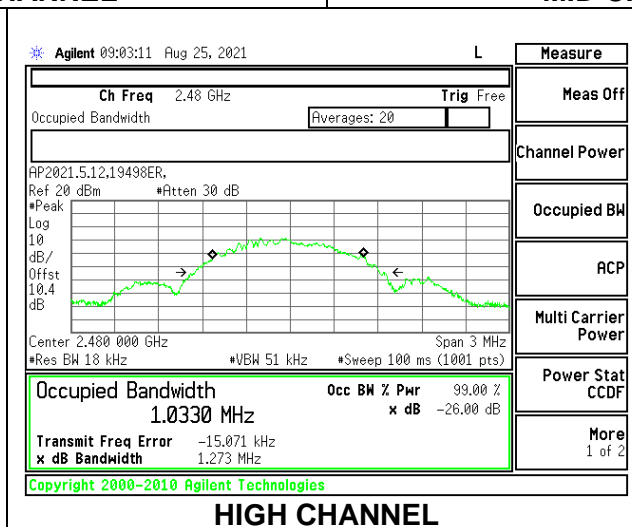
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0350
Middle	2440	1.0387
High	2480	1.0330



LOW CHANNEL

MID CHANNEL



HIGH CHANNEL

9.3. 6 dB BANDWIDTH

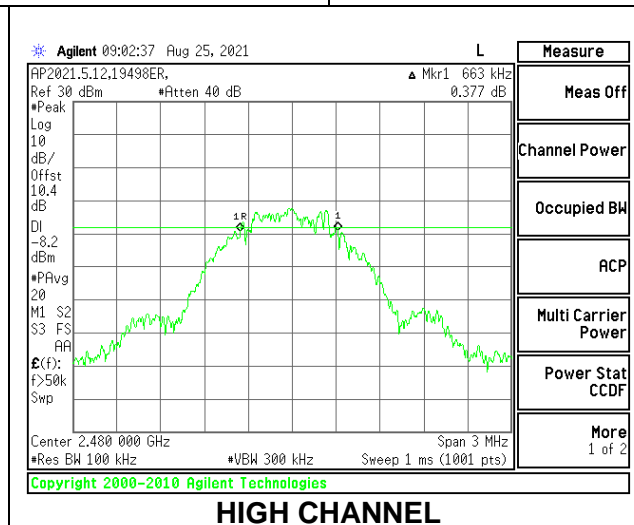
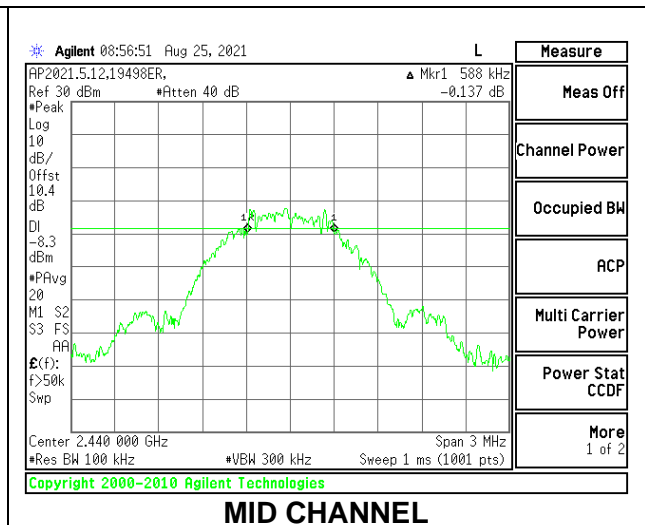
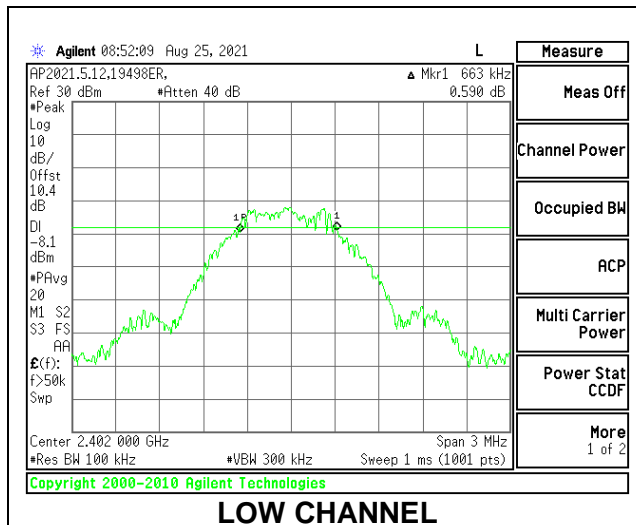
LIMITS

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	2402	0.663	0.5
Middle	2440	0.588	0.5
High	2480	0.663	0.5



9.4. 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

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

Tested By:	19498 ER
Date:	8/25/2021

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-1.660	30	-31.660
Middle	2440	-1.760	30	-31.760
High	2480	-1.910	30	-31.910

9.5. 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

Tested By:	19498 ER
Date:	8/25/2021

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-1.92
Middle	2440	-2.04
High	2480	-2.18

9.6. POWER SPECTRAL DENSITY

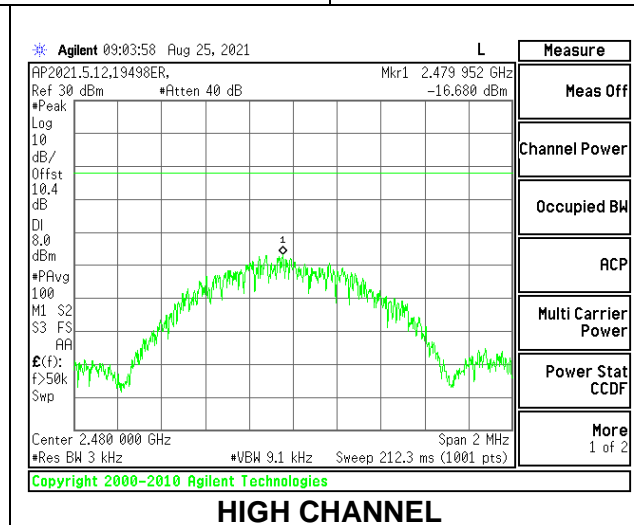
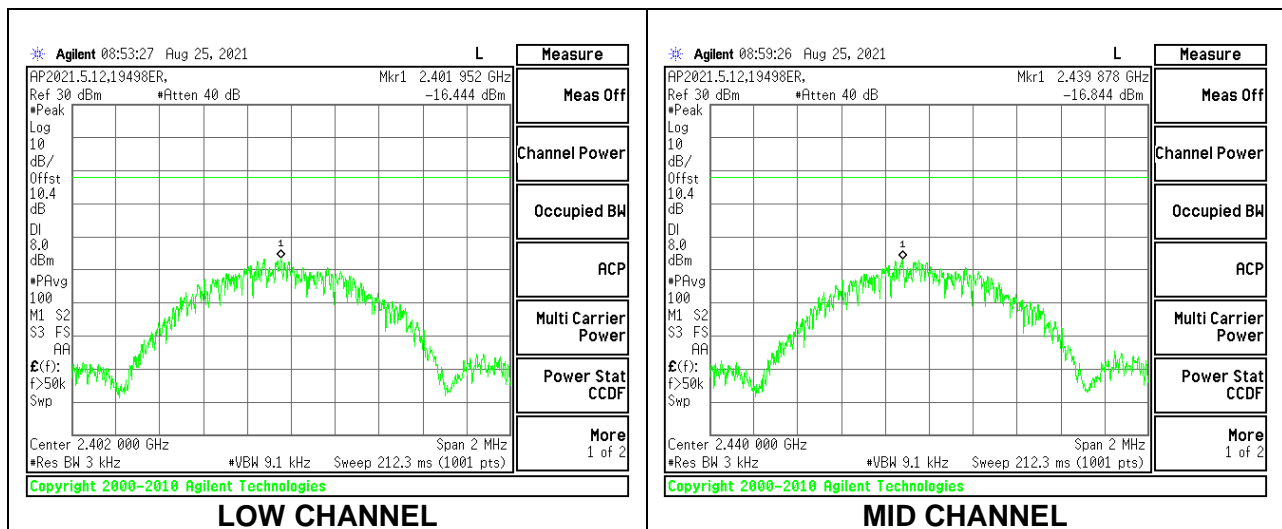
LIMITS

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	2402	-16.444	8	-24.44
Middle	2440	-16.844	8	-24.84
High	2480	-16.680	8	-24.68



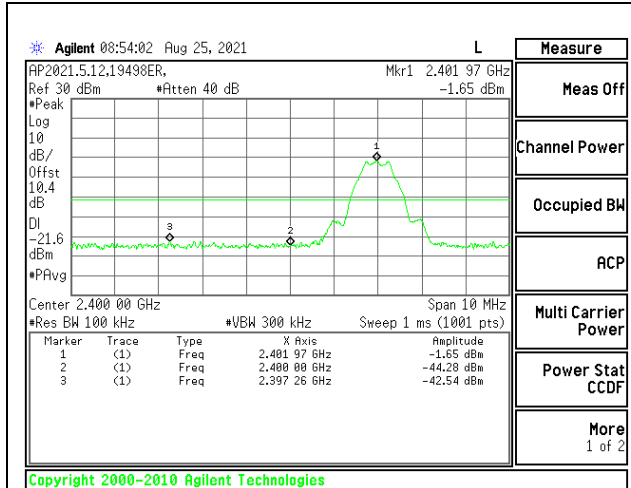
9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

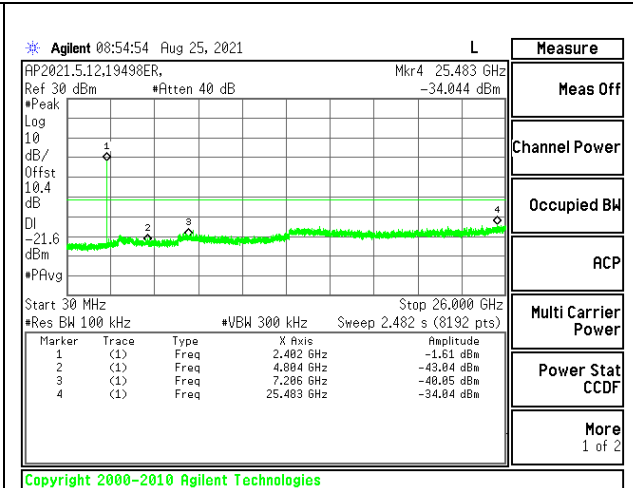
FCC §15.247 (d)

Output power was measured based on the use of a peak measurement, therefore, spurious emissions are required to be 20 dBc.

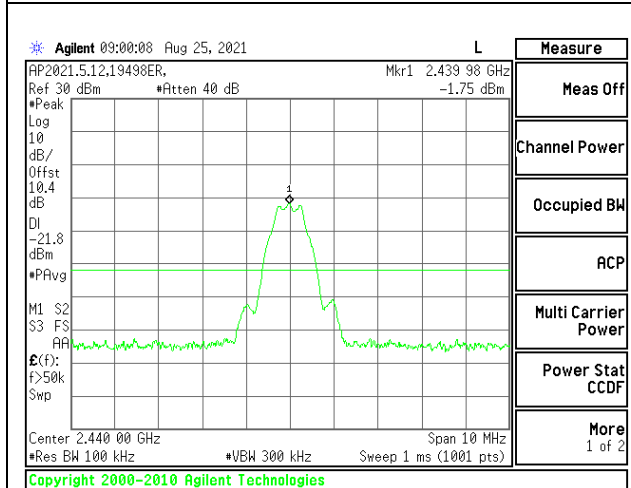
RESULTS



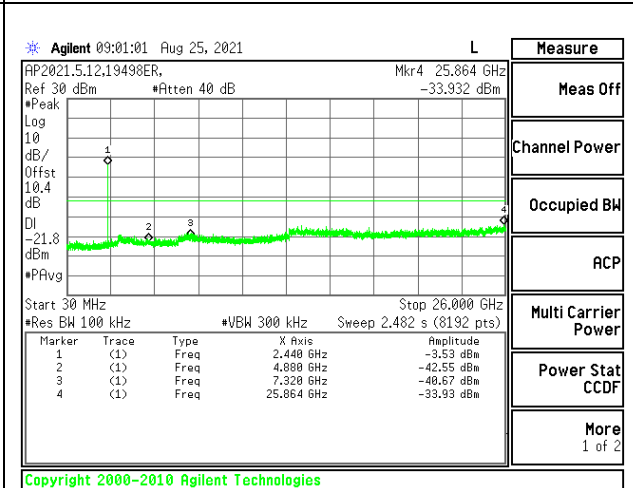
LOW CHANNEL BANDEDGE



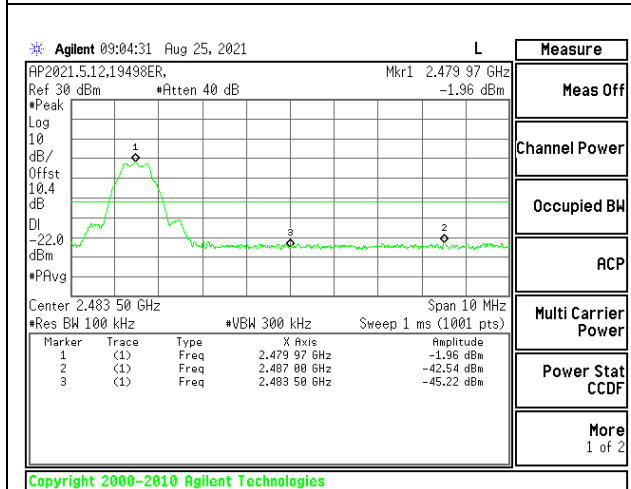
OUT-OF-BAND LOW CHANNEL



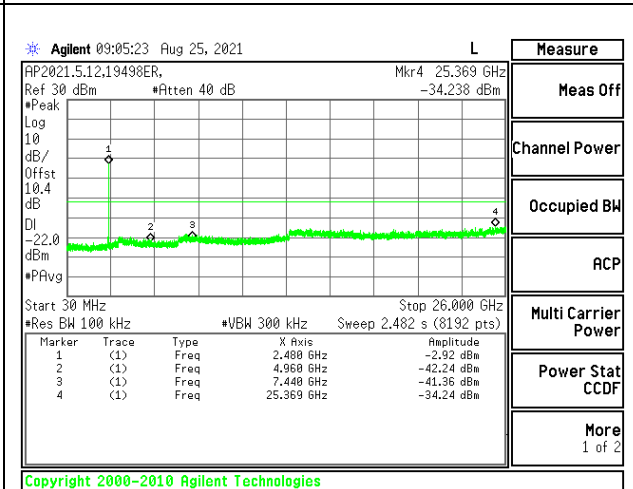
IN-BAND REFERENCE LEVEL



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 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.

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.

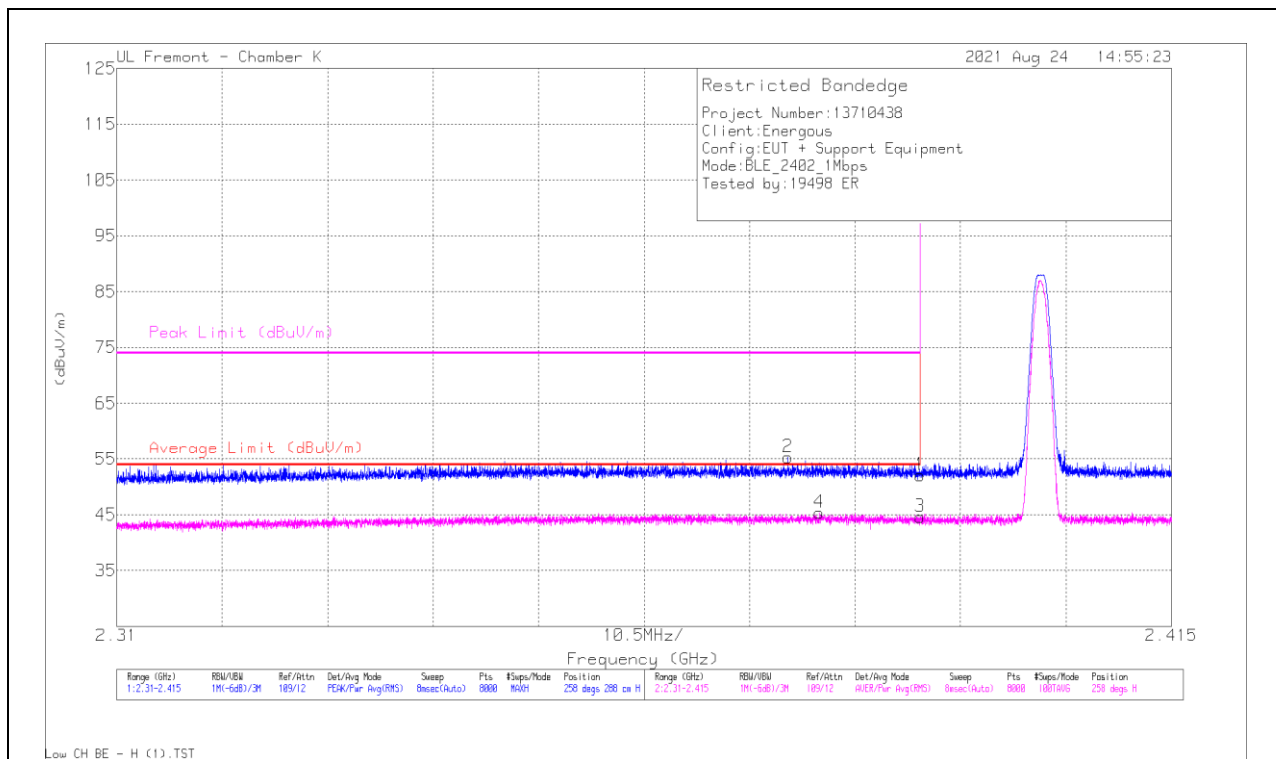
KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

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

10.2. TRANSMITTER ABOVE 1 GHz

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



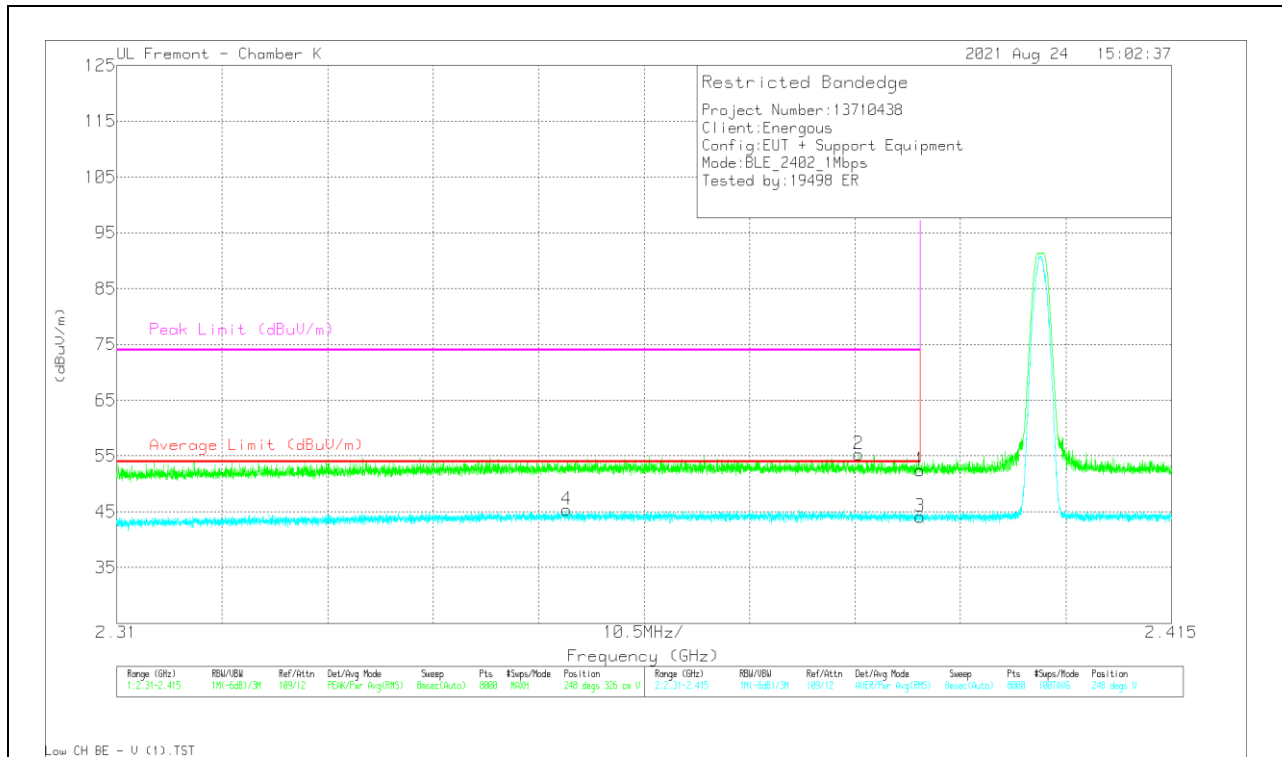
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT863 (dB/m)	Amp/Cb/Filt/Pa d (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.39	30.82	Pk	32.4	-11.2	0	52.02	-	-	74	-21.98	258	288	H
2	2.37682	34.07	Pk	32.4	-11.2	0	55.27	-	-	74	-18.73	258	288	H
3	2.39	21.38	RMS	32.4	-11.2	2.01	44.59	54	-9.41	-	-	258	288	H
4	2.37993	22.15	RMS	32.4	-11.2	2.01	45.36	54	-8.64	-	-	258	288	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



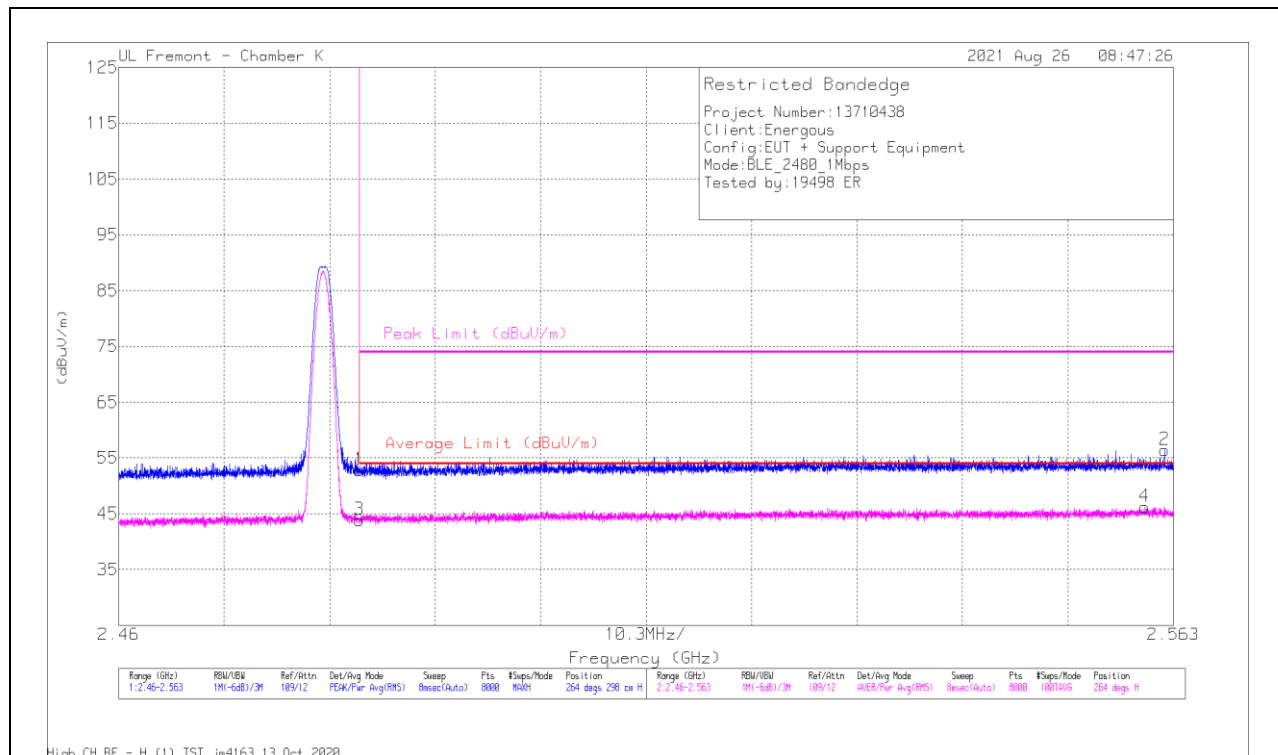
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT863 (dB/m)	Amp/Cal/Filt/Pa d (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.39	31.22	Pk	32.4	-11.2	0	52.42	-	-	74	-21.58	248	326	V
2	2.38385	34.14	Pk	32.4	-11.2	0	55.34	-	-	74	-18.66	248	326	V
3	2.39	20.9	RMS	32.4	-11.2	2.01	44.11	54	-9.89	-	-	248	326	V
4	2.35478	22.18	RMS	32.4	-11.2	2.01	45.39	54	-8.61	-	-	248	326	V

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

Pk - Peak detector
 RMS - RMS detection

BANEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



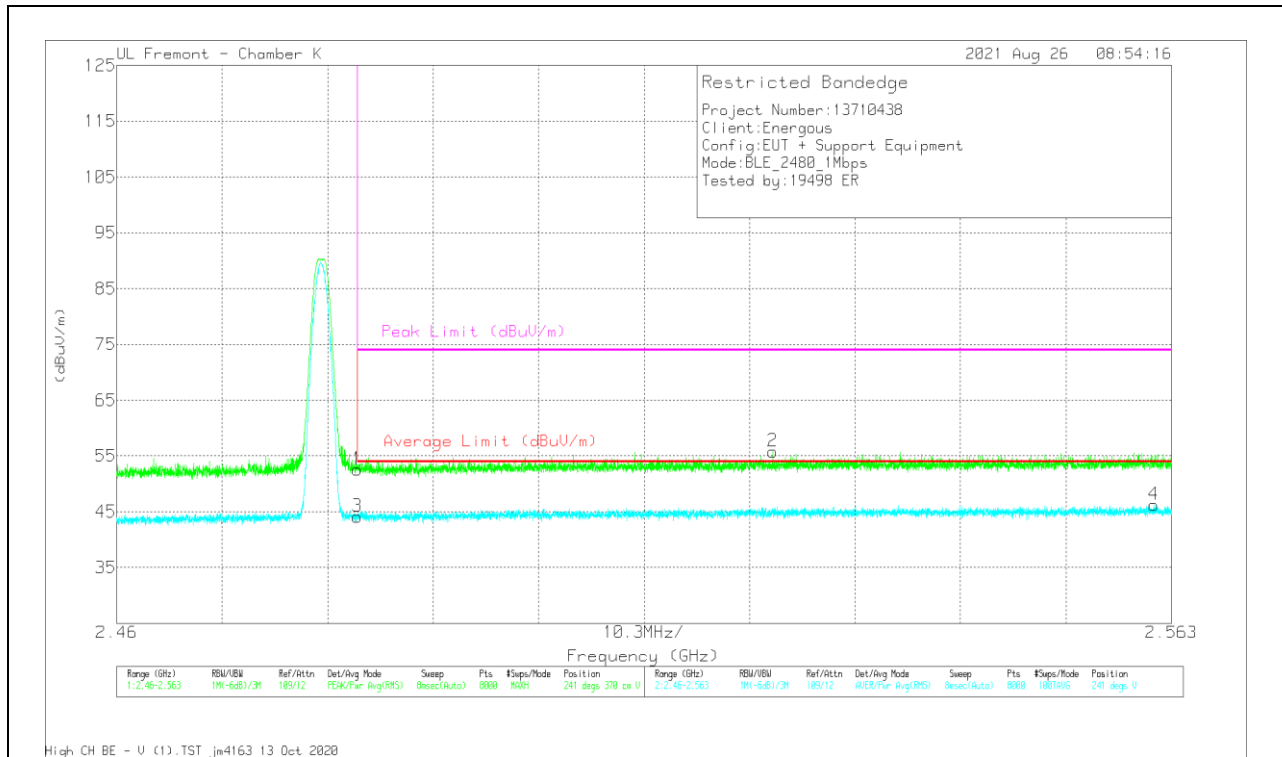
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dBm)	Amp/Cb/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	31.24	Pk	32.5	-10.9	0	52.84	-	-	74	-21.16	264	298	H
2	2.56214	34.21	Pk	32.7	-10.5	0	56.41	-	-	74	-17.59	264	298	H
3	* 2.4835	20.22	RMS	32.5	-10.9	2.01	43.83	54	-10.17	-	-	264	298	H
4	2.56017	21.89	RMS	32.8	-10.5	2.01	46.2	54	-7.8	-	-	264	298	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 (dBm)	Amp/Cal/Filt/Pad (dB)	DC Corr (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	30.98	Pk	32.5	-10.9	0	52.58	-	-	74	-21.42	241	370	V
2	2.52408	33.75	Pk	32.8	-10.8	0	55.75	-	-	74	-18.25	241	370	V
3	* 2.4835	20.47	RMS	32.5	-10.9	2.01	44.08	54	-9.92	-	-	241	370	V
4	2.5613	21.88	RMS	32.8	-10.5	2.01	46.19	54	-7.81	-	-	241	370	V

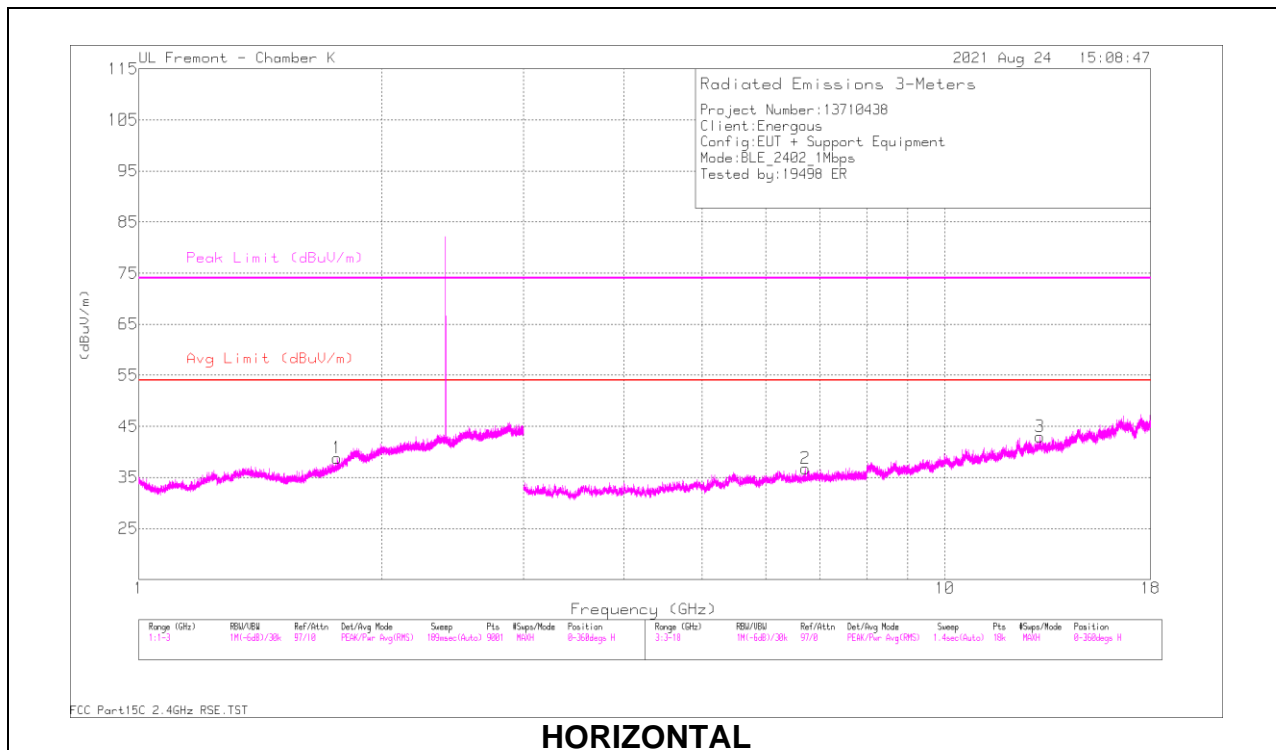
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

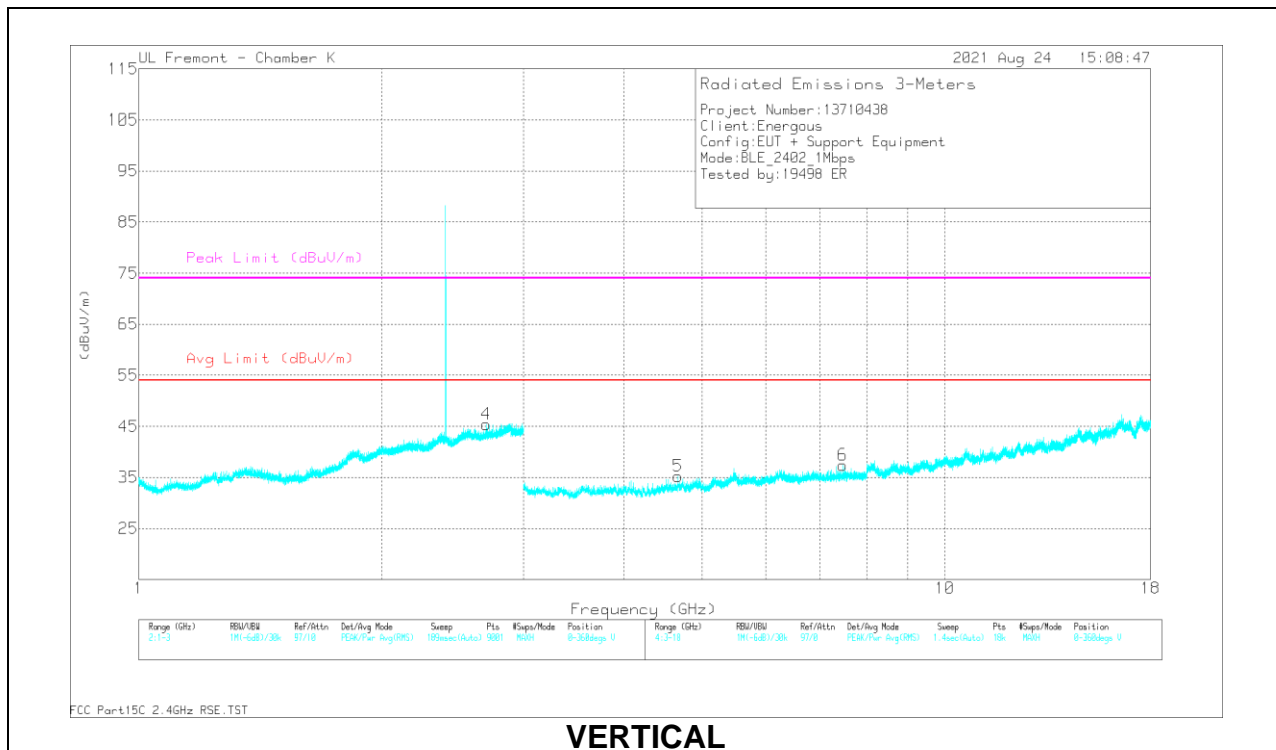
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



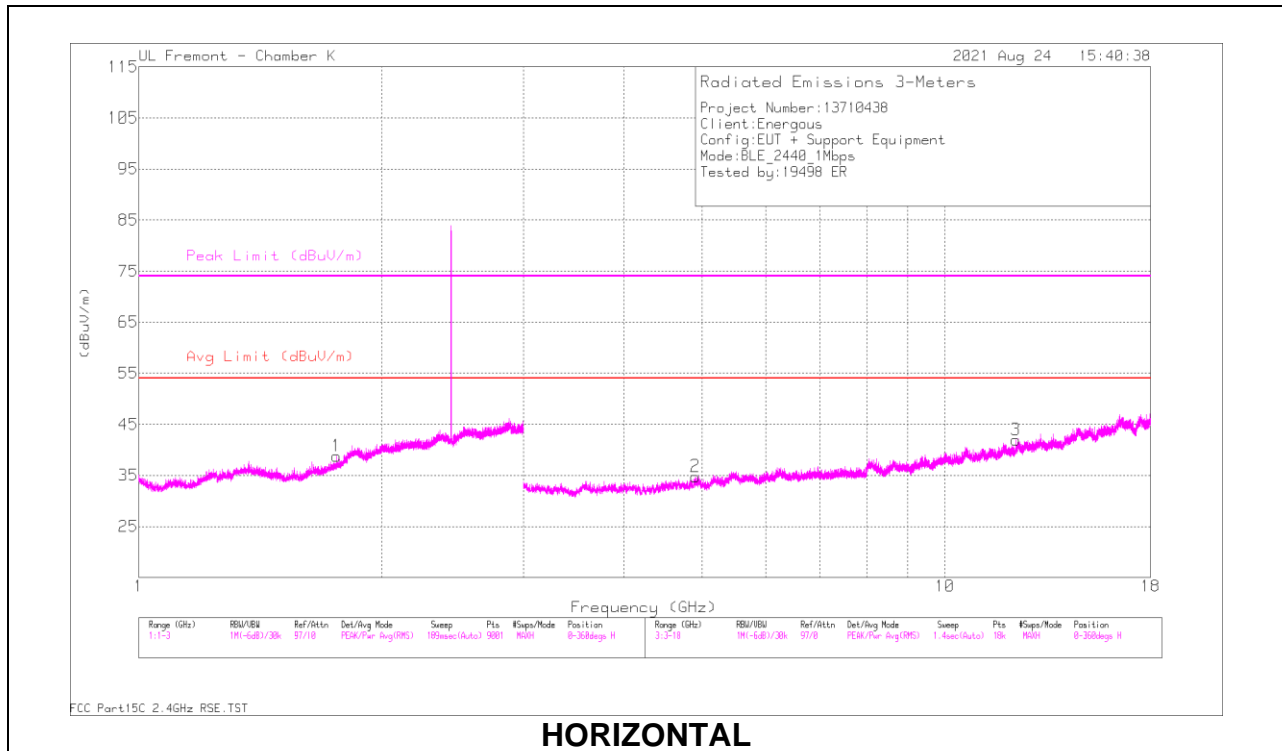
VERTICAL

RADIATED EMISSIONS

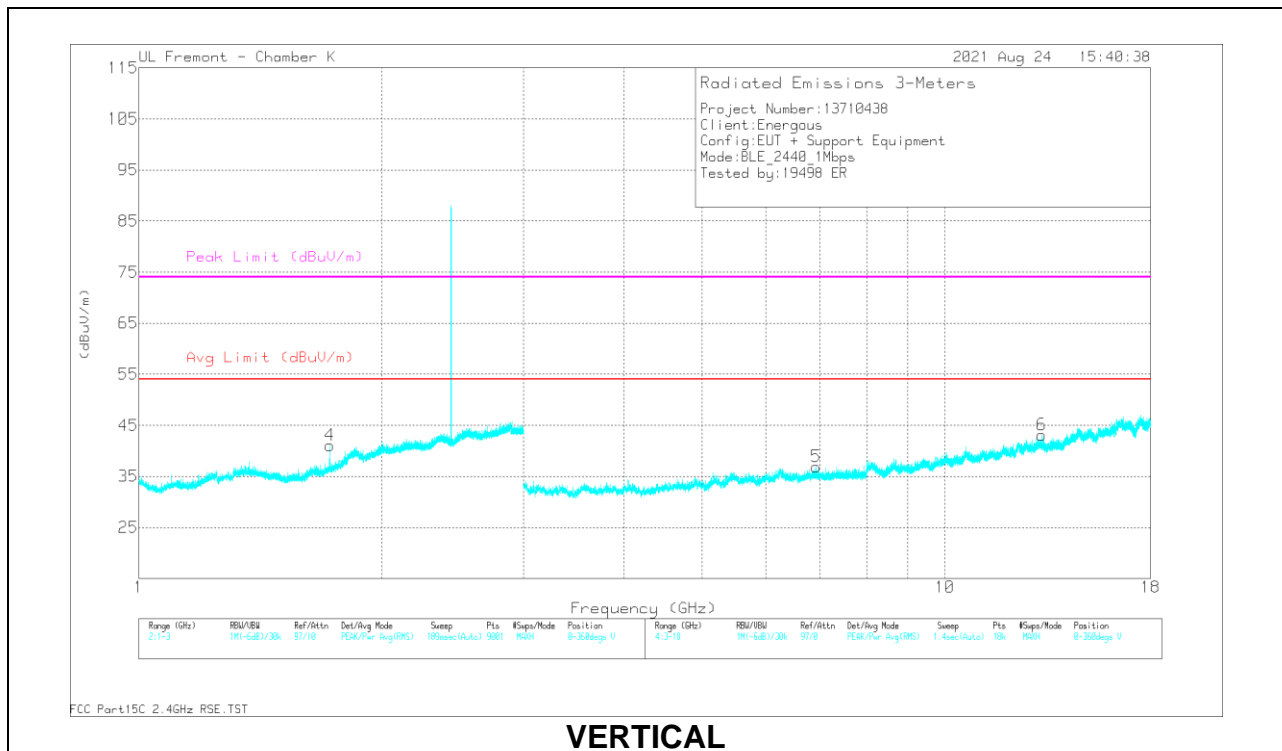
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ftr/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.76053	29.84	PK2	29.8	-12.4	0	47.24	-	-	-	-	264	151	H
4	* 2.70108	31.77	PK2	32.5	-10.4	0	53.87	-	-	74	-20.13	318	286	V
	* 2.70173	20.21	MAv1	32.5	-10.4	2.01	44.32	54	-9.68	-	-	318	286	V
2	6.71095	47.36	PK2	35.9	-37.7	0	45.56	-	-	-	-	136	110	H
3	13.13453	46.06	PK2	39.6	-33.3	0	52.36	-	-	-	-	278	238	H
5	* 4.66865	50.22	PK2	34.4	-40.7	0	43.92	-	-	74	-30.08	219	120	V
	* 4.66867	38.64	MAv1	34.4	-40.7	2.01	34.35	54	-19.65	-	-	219	120	V
6	* 7.46918	46.9	PK2	36.1	-37.1	0	45.9	-	-	74	-28.1	182	246	V
	* 7.47086	35.09	MAv1	36.1	-37	2.01	36.2	54	-17.8	-	-	182	246	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

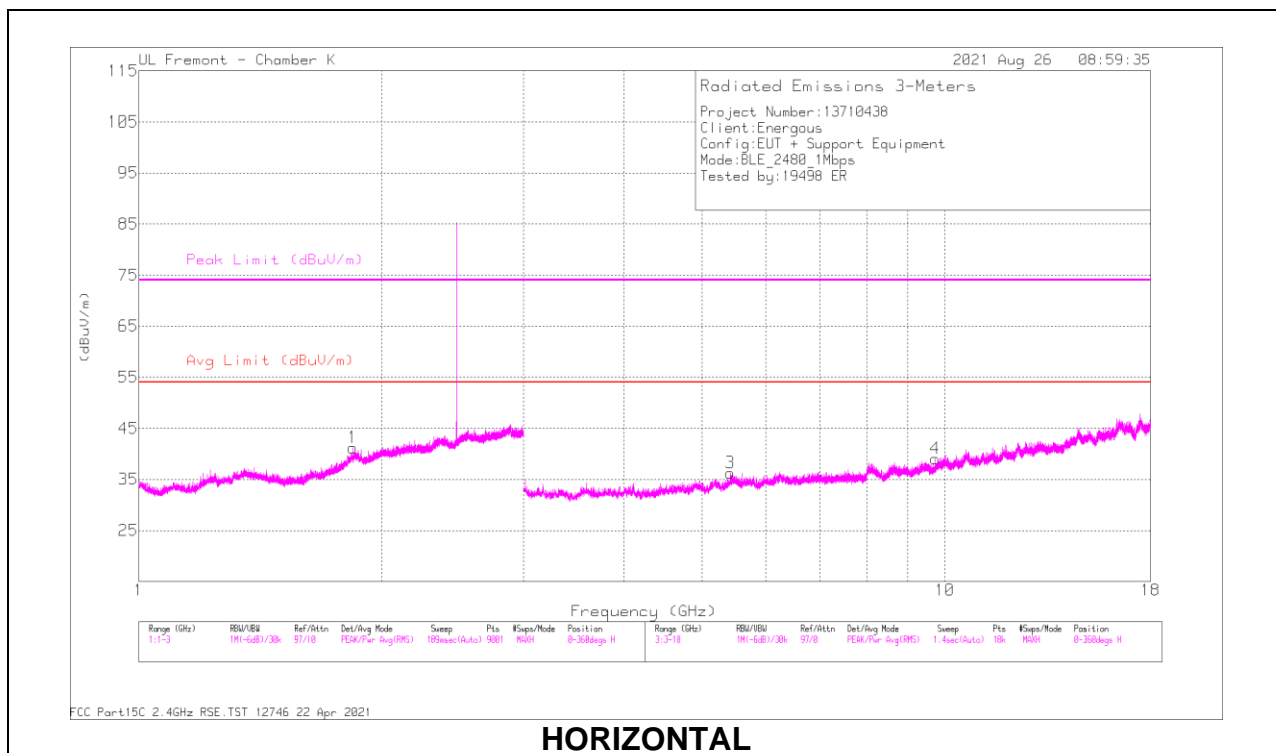
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ftr/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.75952	30.53	PK2	29.8	-12.4	0	47.93	-	-	-	-	360	118	H
4	1.72723	29.85	PK2	29.6	-12.4	0	47.05	-	-	-	-	170	346	V
2	* 4.90545	49.7	PK2	34.4	-40	0	44.1	-	-	74	-29.9	107	377	H
	* 4.90762	38	MAV1	34.4	-40	2.01	34.41	54	-19.59	-	-	107	377	H
3	* 12.25941	44.73	PK2	39.3	-33.5	0	50.53	-	-	74	-23.47	107	279	H
	* 12.26111	33.12	MAV1	39.3	-33.5	2.01	40.93	54	-13.07	-	-	107	279	H
5	6.92835	47.59	PK2	36	-37.6	0	45.99	-	-	-	-	161	122	V
6	13.19997	44.53	PK2	39.6	-33.8	0	50.33	-	-	-	-	95	267	V

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

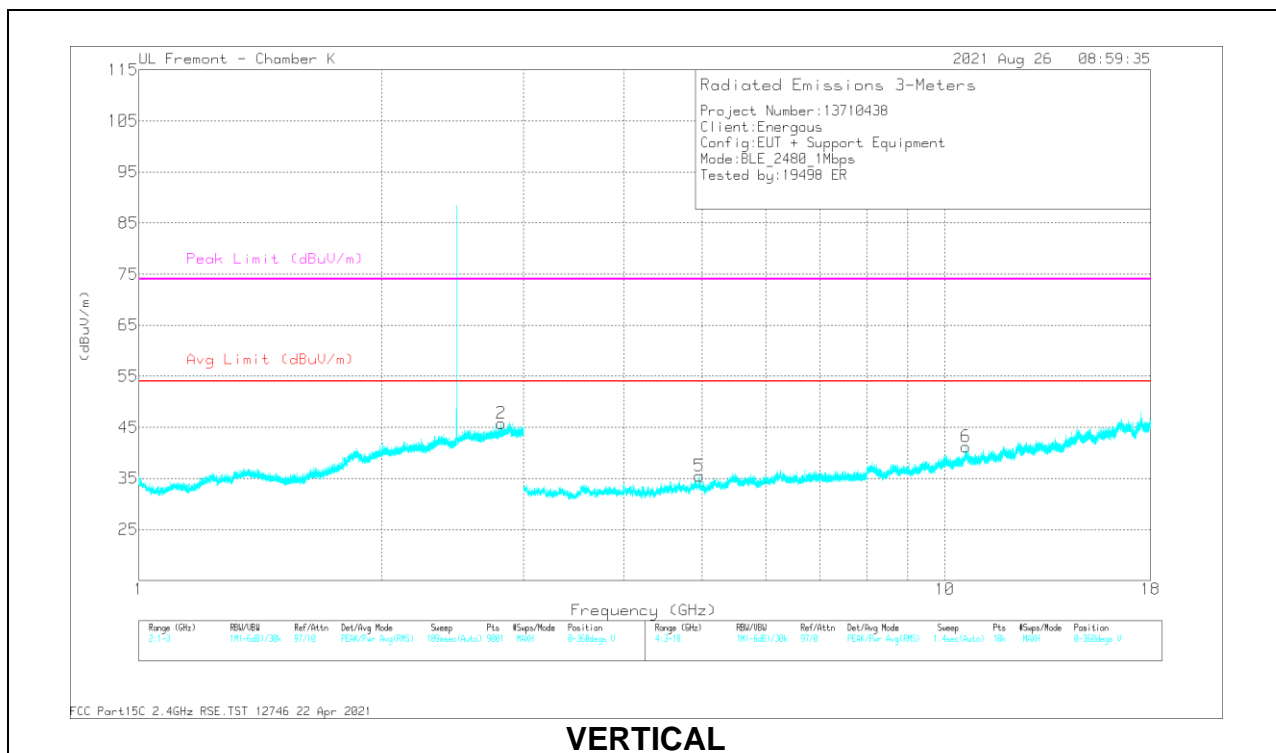
PK2 - KDB558074 Method: Maximum Peak

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)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.84453	30.55	PK2	30.7	-12.2	0	49.05	-	-	-	-	49	191	H
2	* 2.81748	31.65	PK2	32.5	-10.1	0	54.05	-	-	74	-19.95	286	287	V
	* 2.81958	20.39	MAv1	32.5	-10.1	2.01	44.8	54	-9.2	-	-	286	287	V
4	9.73814	45.83	PK2	37	-35.7	0	47.13	-	-	-	-	140	113	H
3	* 5.42105	48.69	PK2	35.4	-39.3	0	44.79	-	-	74	-29.21	189	207	H
	* 5.42258	37.48	MAv1	35.5	-39.4	2.01	35.59	54	-18.41	-	-	189	207	H
5	* 4.96171	49.46	PK2	34.3	-39.9	0	43.86	-	-	74	-30.14	62	321	V
	* 4.9598	38.15	MAv1	34.3	-39.9	2.01	34.56	54	-19.44	-	-	62	321	V
6	* 10.62791	47.12	PK2	37.9	-35.4	0	49.62	-	-	74	-24.38	197	346	V
	* 10.62685	35.88	MAv1	37.9	-35.4	2.01	40.39	54	-13.61	-	-	197	346	V

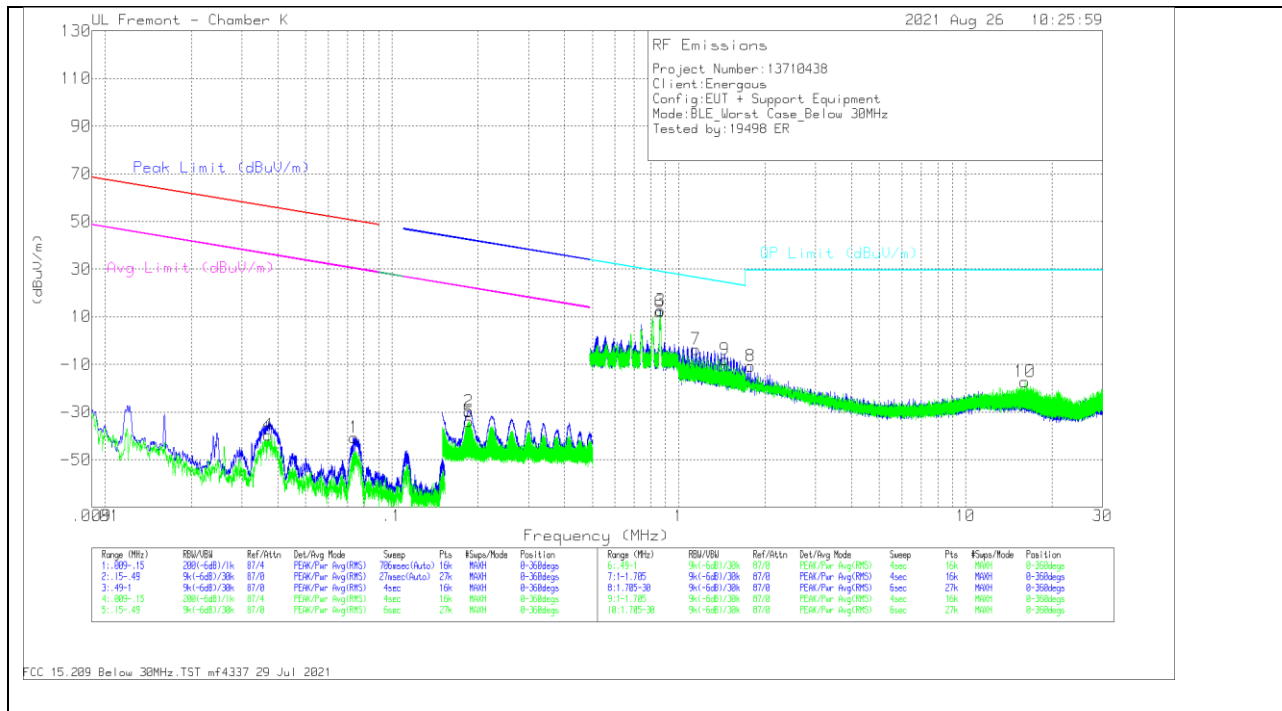
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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)	PK Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.07382	15.67	Pk	55.9	-32.2	-80	-40.63	50.22	-90.85	30.22	-70.85	-	-	-	-	0-360
2	.18596	26.36	Pk	56.1	-32.2	-80	-29.74	-	-	-	-	42.23	-71.97	22.23	-51.97	0-360
4	.03713	15.23	Pk	57.4	-32.2	-80	-39.57	56.19	-95.76	36.19	-75.76	-	-	-	-	0-360
5	.18536	22.19	Pk	56.1	-32.2	-80	-33.91	-	-	-	-	42.26	-76.17	22.26	-56.17	0-360

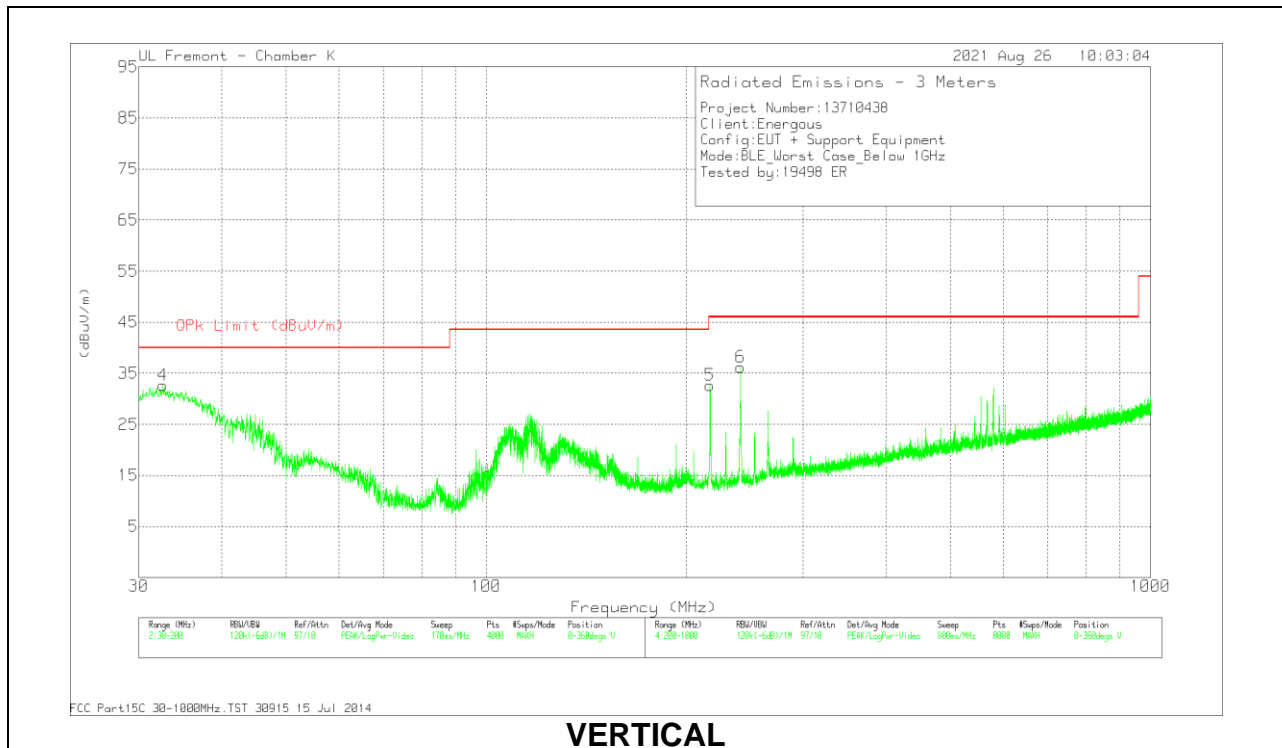
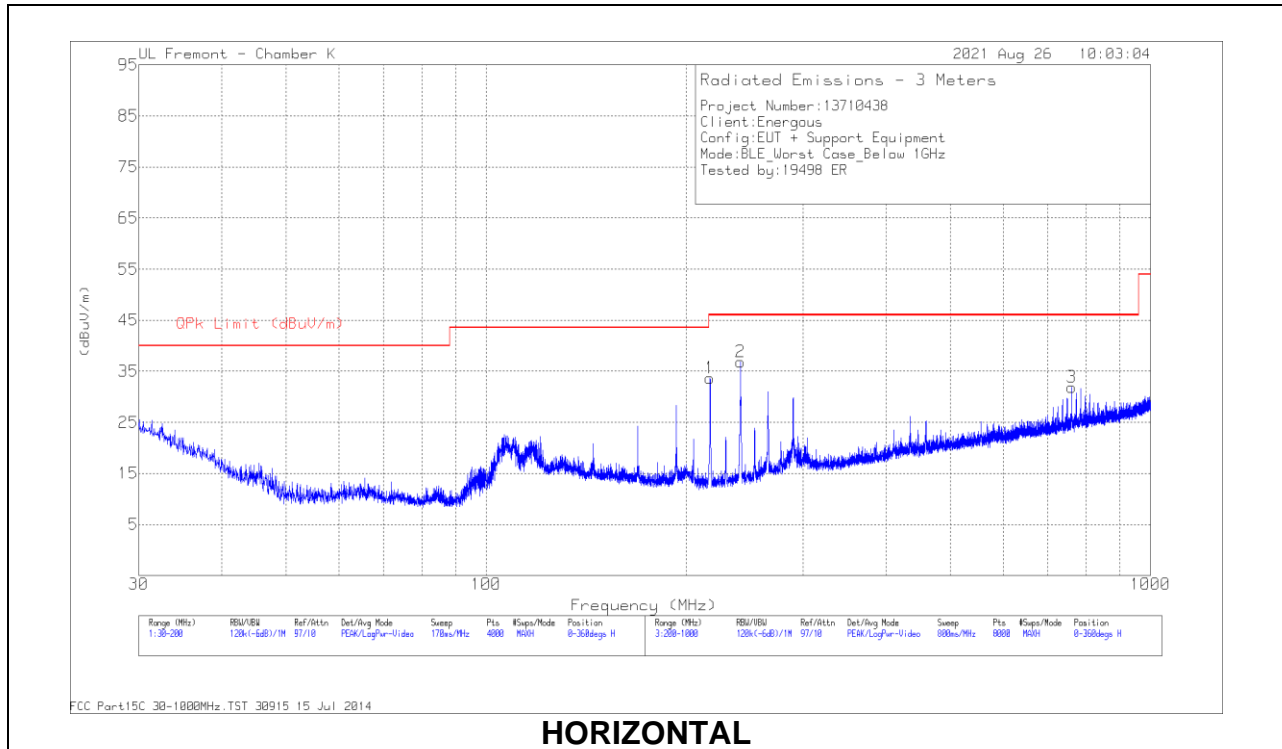
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 300m (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.86222	28.63	Pk	56.2	-32.2	-40	12.63	28.91	-16.28	0-360
6	.86168	28.12	Pk	56.2	-32.2	-40	12.12	28.91	-16.79	0-360
7	1.14925	22.43	Pk	45.9	-32.1	-40	-3.77	26.42	-30.19	0-360
8	1.77941	18.66	Pk	42.6	-32.1	-40	-10.84	29.5	-40.34	0-360
9	1.44871	19.77	Pk	44.4	-32.1	-40	-7.93	24.41	-32.34	0-360
10	16.06889	20.7	Pk	33.6	-31.7	-40	-17.4	29.5	-46.9	0-360

Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

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



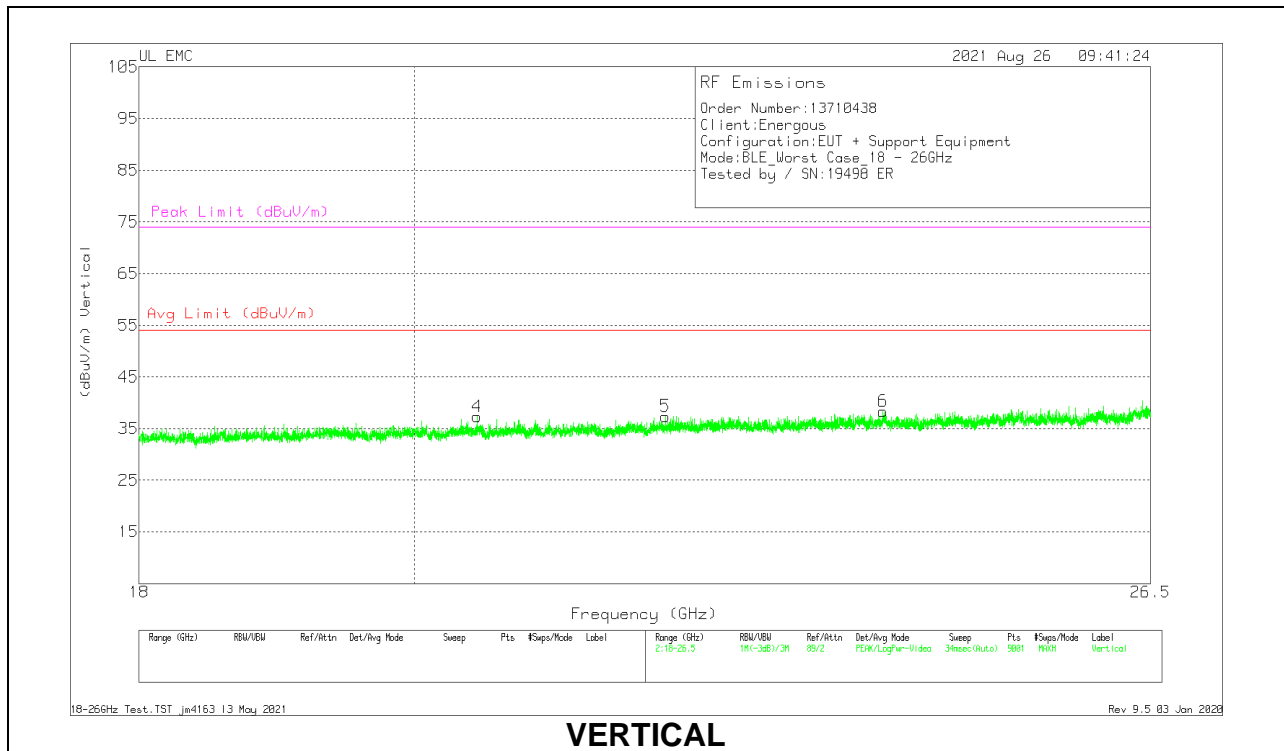
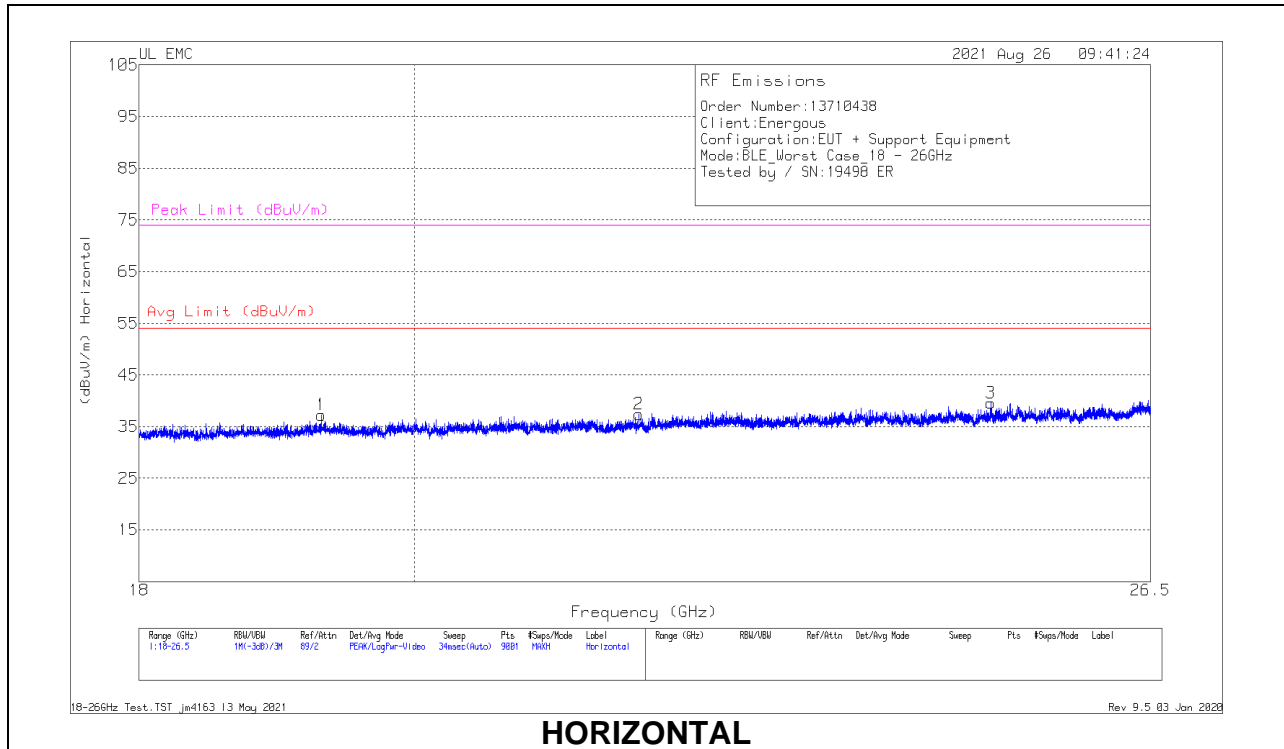
Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 81560 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	45.026	34.96	Qp	16.9	-31.4	20.46	40	-19.54	121	97	V
1	217.3022	46.8	Pk	17.1	-30.2	33.7	46.02	-12.32	0-360	99	H
2	* 241.5054	48.92	Pk	18	-30.1	36.82	46.02	-9.2	0-360	99	H
3	761.273	32.82	Pk	27.3	-28.2	31.92	46.02	-14.1	0-360	199	H
5	217.3022	45.77	Pk	17.1	-30.2	32.67	46.02	-13.35	0-360	199	V
6	* 241.4054	48.35	Pk	18	-30.1	36.25	46.02	-9.77	0-360	199	V

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	18-26GHz Horn	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.29861	70.61	Pk	33.2	-57.1	-9.5	37.21	-	-	74	-36.79
2	21.791	70.55	Pk	33.7	-57.4	-9.5	37.35	-	-	74	-36.65
3	24.92844	69.45	Pk	35.1	-55.5	-9.5	39.55	-	-	74	-34.45
4	20.48389	69.92	Pk	33.5	-56.6	-9.5	37.32	-	-	74	-36.68
5	22.01294	70.74	Pk	33.8	-57.7	-9.5	37.34	-	-	74	-36.66
6	23.92355	70.14	Pk	34.6	-56.9	-9.5	38.34	-	-	74	-35.66

Pk - Peak detector

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

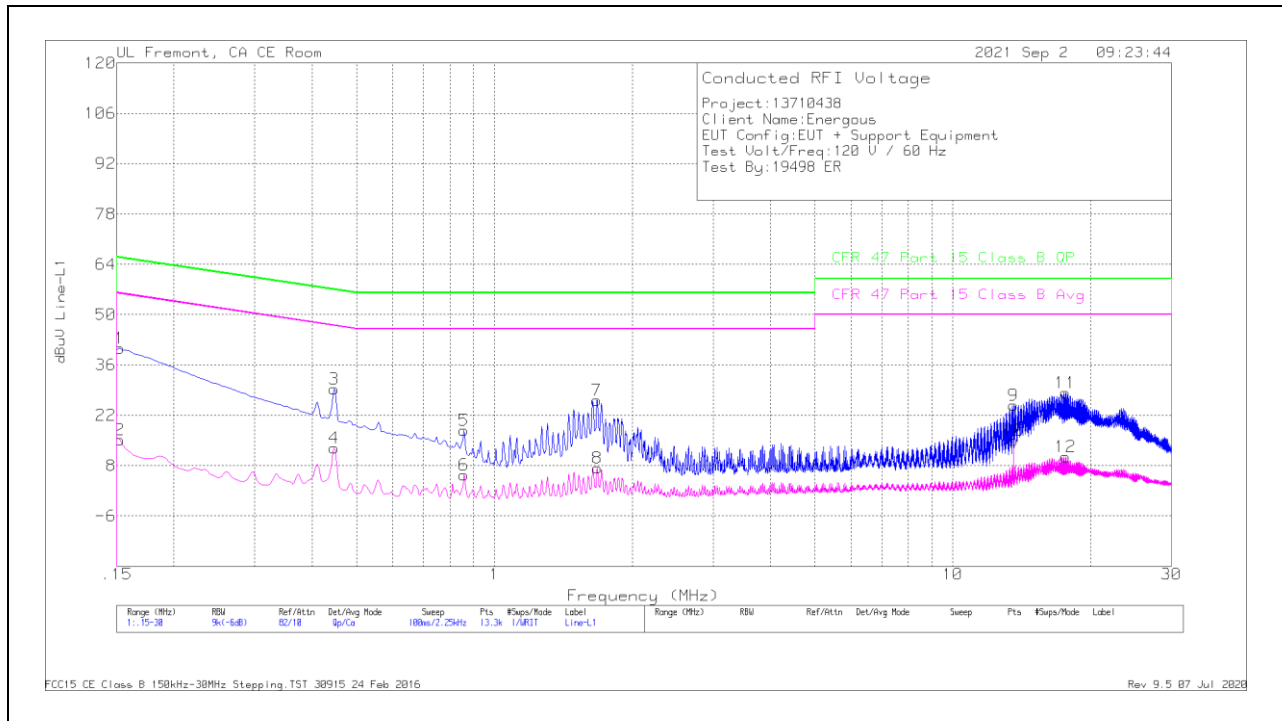
FCC §15.207 (a)

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.

RESULTS

LINE 1 RESULTS



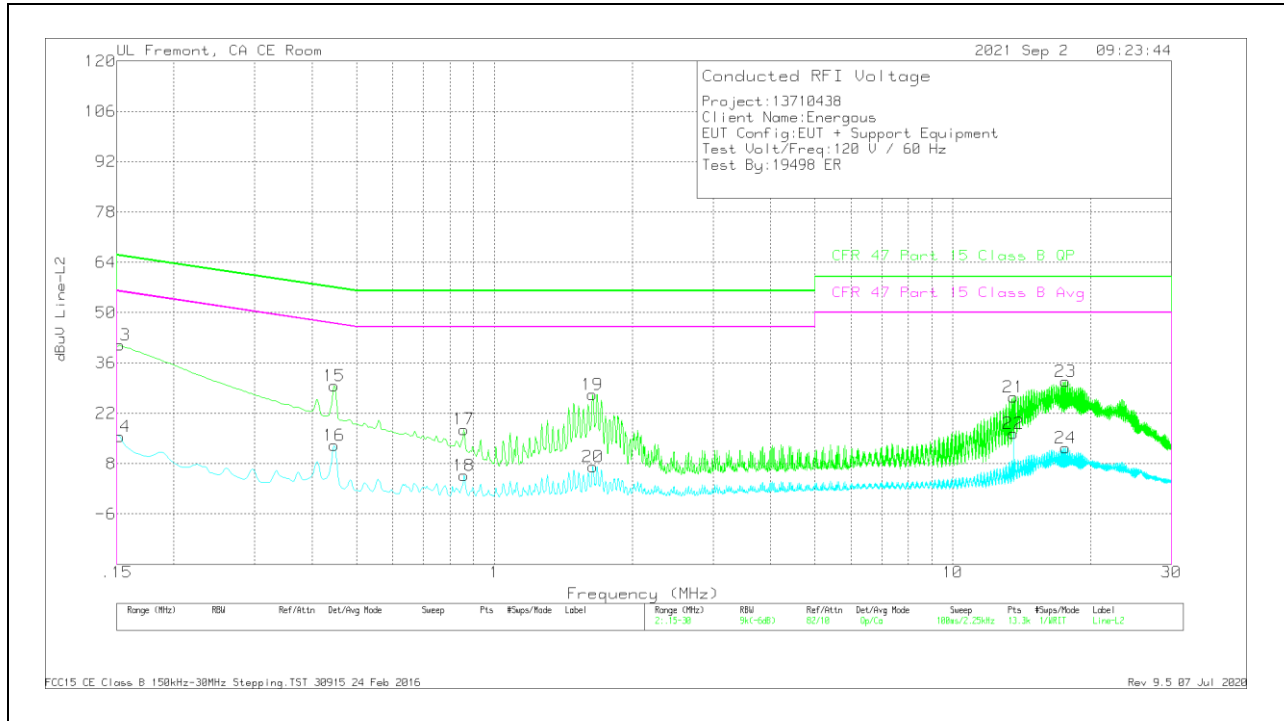
Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE018644 6 L1	LC Cables C1&C3 dB	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
2	.15225	5.76	Ca	.1	0	9.4	15.26	-	-	55.88	-40.62
4	.447	3.6	Ca	0	0	9.3	12.9	-	-	46.93	-34.03
6	.85875	-3.95	Ca	0	.1	9.3	5.45	-	-	46	-40.55
8	1.6755	-2.09	Ca	0	.1	9.3	7.31	-	-	46	-38.69
10	13.56	5.37	Ca	.1	.2	9.3	14.97	-	-	50	-35.03
12	17.6325	.9	Ca	0	.2	9.3	10.4	-	-	50	-39.6
1	.15225	31.19	Qp	.1	0	9.4	40.69	65.88	-25.19	-	-
3	.447	20.01	Qp	0	0	9.3	29.31	56.93	-27.62	-	-
5	.85875	8.37	Qp	0	.1	9.3	17.77	56	-38.23	-	-
7	1.67325	16.83	Qp	0	.1	9.3	26.23	56	-29.77	-	-
9	13.56	15.19	Qp	.1	.2	9.3	24.79	60	-35.21	-	-
11	17.63025	18.82	Qp	0	.2	9.3	28.32	60	-31.68	-	-

Qp - Quasi-Peak detector

Ca - CISPR average detection

NOTE: Markers 9 and 10, 13.56MHz is an external NFC signal unrelated to the EUT.

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE018644 6 L2	LC Cables C2&C3 dB	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
14	.15225	6.09	Ca	0	0	9.4	15.49	-	-	55.88	-40.39
16	.447	3.86	Ca	0	0	9.3	13.16	-	-	46.93	-33.77
18	.85875	-4.64	Ca	0	.1	9.3	4.76	-	-	46	-41.24
20	1.6395	-2.19	Ca	0	.1	9.3	7.21	-	-	46	-38.79
22	13.56	6.88	Ca	.1	.2	9.3	16.48	-	-	50	-33.52
24	17.628	2.96	Ca	0	.2	9.3	12.46	-	-	50	-37.54
13	.15225	31.56	Qp	0	0	9.4	40.96	65.88	-24.92	-	-
15	.447	20.32	Qp	0	0	9.3	29.62	56.93	-27.31	-	-
17	.85875	8.14	Qp	0	.1	9.3	17.54	56	-38.46	-	-
19	1.63725	17.89	Qp	0	.1	9.3	27.29	56	-28.71	-	-
21	13.56	16.94	Qp	.1	.2	9.3	26.54	60	-33.46	-	-
23	17.628	21.43	Qp	0	.2	9.3	30.93	60	-29.07	-	-

Qp - Quasi-Peak detector

Ca - CISPR average detection

NOTE: Markers 21 and 22, 13.56MHz is an external NFC signal unrelated to the EUT.