



TEST REPORT

Report Number. : 14262501-E2V2

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

Model : VN55

Brand : ENERGOUS

FCC ID : 2ADNG-VN55

IC : 23686-VN55

EUT Description : WIRELESS CHARGER

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5 + A1 + A2

Date Of Issue:

May 04, 2022

Prepared by:

UL VERIFICATION SERVICES
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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	4/25/2022	Initial Issue	-
V2	5/4/2022	Updated report to address TCB's questions	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: VN55

BRAND: ENERGOUS

SERIAL NUMBER: 5072 (CONDUCTED); AEFEC0B3 (RADIATED)

SAMPLE RECEIPT DATE: MARCH 31, 2022

DATE TESTED: MARCH 31, 2022 TO APRIL 09, 2022

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + A1 + A2	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.

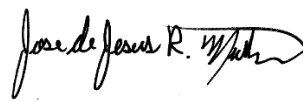
This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This 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:



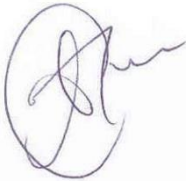
DAN CORONIA
OPERATIONS LEADER
UL Verification Services Inc.

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	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Complies	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Complies	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	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, RSS-GEN Issue 5 + A1 + A2, and RSS-247 Issue 2.

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
☒	Building 1: 47173 Benicia Street, Fremont, CA 94538, USA	US0104	2324A	550739
☐	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA	US0104	22541	550739
☒	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA	US0104	2324B	550739

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U _{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

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 stand-alone wireless charger with BLE and Zigbee 802.15.4 that is mounted on a ceiling or a wall. The wireless charger transmits power via a frequency hopping signal between 917.2MHz to 918.8MHz and a DTS Zigbee 802.15.4 signal between 2402MHz and 2480MHz, and charges multiple receivers at a time.

This report documents test results of the Bluetooth Low Energy radio portion (BLE only supports 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	21.49	140.93

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes two embedded internal antennas, with a maximum gain of 2.5 dBi as total.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was dtm_ble_ant0_3dBm

The test utility software used during testing was dtm_ble_ant0_3dBm

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 wall or ceiling mounted device and it has one USB type C port for power only. The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z1, and Z2, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation. Due to applicant is only able to exercise the commands via a USB cable that connected to a laptop, therefore all final radiated testing were performed with the EUT in X orientation powered by laptop via USB cable.

AC powerline was performed in two configurations:

Configuration 1: powered by laptop via USB cable where the BLE Tx continuously

Configuration 2: powered by AC/DC adapter via USB cable where BLE (beaconing mode), MSK tag mode and WPT bands transmit simultaneously as worst case.

Worst-case data rate as provided by the client was:

BLE: 1 Mbps.

The EUT only supports BLE 2 Tx (MIMO) at the same time, it does not support 1 Tx (SISO). All radiated tests are performed on 2 Tx (MIMO) only.

WPT band and BLE (beaconing mode) transmit simultaneously, simultaneous operation result of the radiated emissions is documented in UL document 14262501-E1 WPT report.

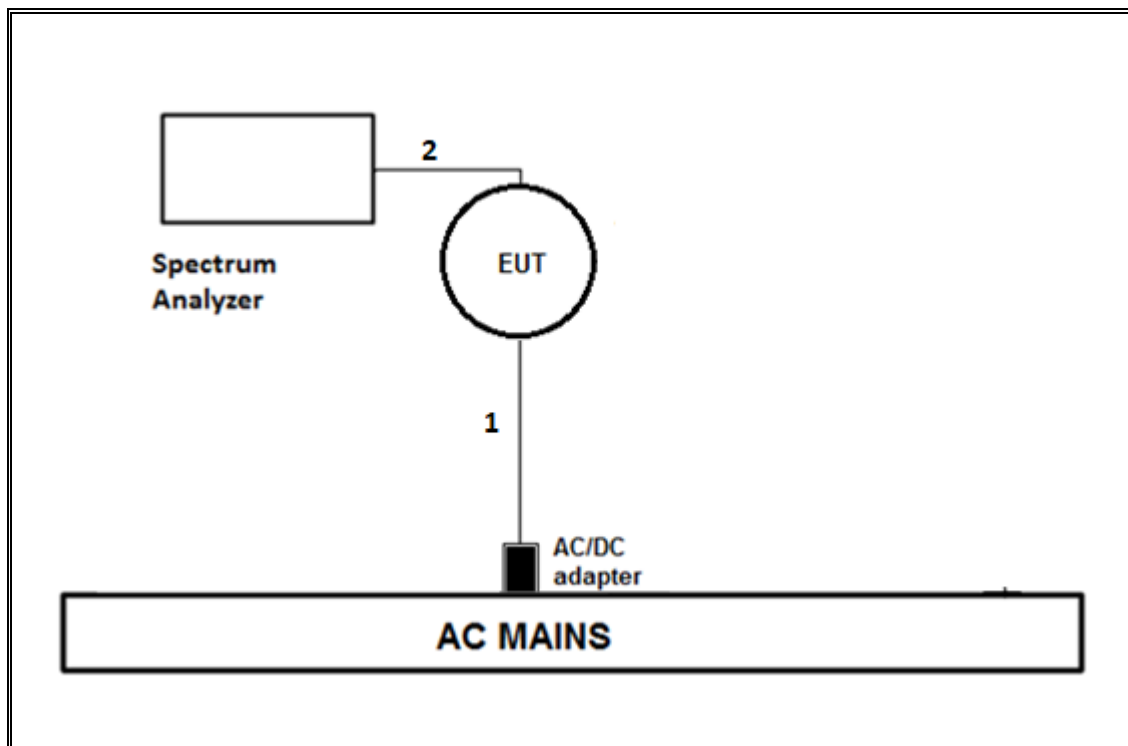
6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Laptop		Dell	Precision M3800	1N80562		DoC
Laptop AC/DC adapter		Dell	HA130PM130	CN-0V363H-CH200-732-03L8-A00		DoC
AC/DC Switching Adapter		CUI Inc.	HDP-QB05010U	-		DoC
I/O CABLES (RF CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB Type C	Shielded	1	
2	Antenna	1	SMA	Un-shielded	0.15	To spectrum analyzer
I/O CABLES (RF RADIATED TEST/AC LINE CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB Type C	Shielded	1	

TEST SETUP-RF CONDUCTED TEST

The EUT was powered by AC/DC adapter via USB cable. Test software exercised the EUT. Laptop was removed after test setup.

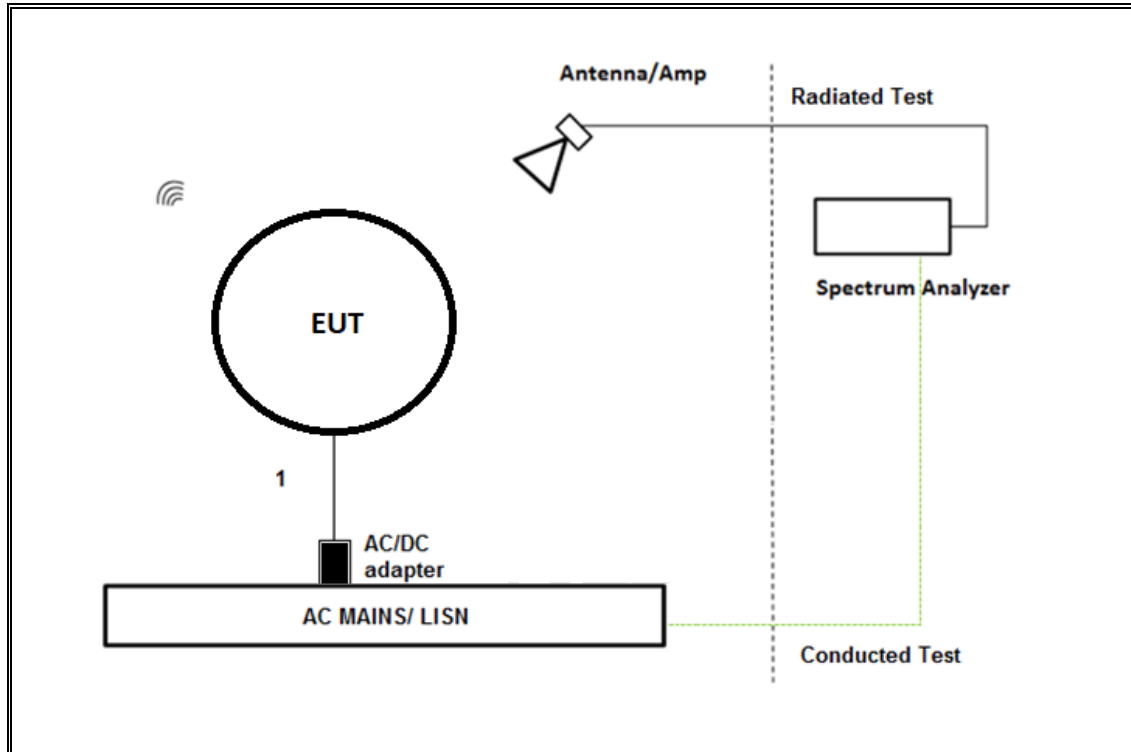
SETUP DIAGRAMS



TEST SETUP- RADIATED TEST / AC LINE CONDUCTED TEST

The EUT was powered by AC/DC adapter via USB cable. Test software exercised the EUT. Laptop was removed after test setup.

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	PRE0179466 (170014)	06/08/2022	06/08/2021
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	PRE0179468 (170016)	06/08/2022	06/08/2021
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	82258	10/01/2022	10/01/2021
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	02/08/2023	02/08/2022
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	80404	08/04/2022	08/04/2021
Amplifier, 100MHz-18GHz	AMPLICAL	AMP0.1G18-47-20	PRE0197319	04/08/2022	04/08/2021
Thermometer	Control Company	14-650-118	160656	03/30/2023	03/30/2022
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	02/16/2023	02/16/2022
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	79834	05/07/2022	05/07/2021
Amplifier, 100MHz-18GHz	MITEQ	AFS42-00101800-25-S-42	150755	03/09/2023	03/09/2022
Thermometer - Digital	Control Company	14-650-118	175731	02/03/2023	02/03/2022
EMI TEST RECEIVER, with B8 option	Rohde & Schwarz	ESW44	169937	02/20/2023	02/20/2022
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	81139	05/25/2022	05/25/2021
Rf Amplifier, 18-26.5GHz, 60dB gain	AMPLICAL	AMP18G26.5-60	171590	05/21/2022	05/21/2021
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Keysight Technologies Inc	E4440A	81311	02/02/2023	02/02/2022
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90719	01/24/2023	01/24/2022
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	90391	02/03/2023	02/03/2022
AC Line Conducted					
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	175765	01/26/2023	01/26/2022
EMI TEST RECEIVER	Rohde & Schwarz	ESR	93091	02/21/2023	02/21/2022
Transient Limiter	TE	TBFL1	207996	06/01/2022	06/01/2021
UL TEST SOFTWARE LIST					
Radiated Software	UL	UL EMC	Rev 9.5, Jan 03, 2020		
Antenna Port Software	UL	UL RF	Ver 2021.08.27		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, 07 Jul 2020		

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

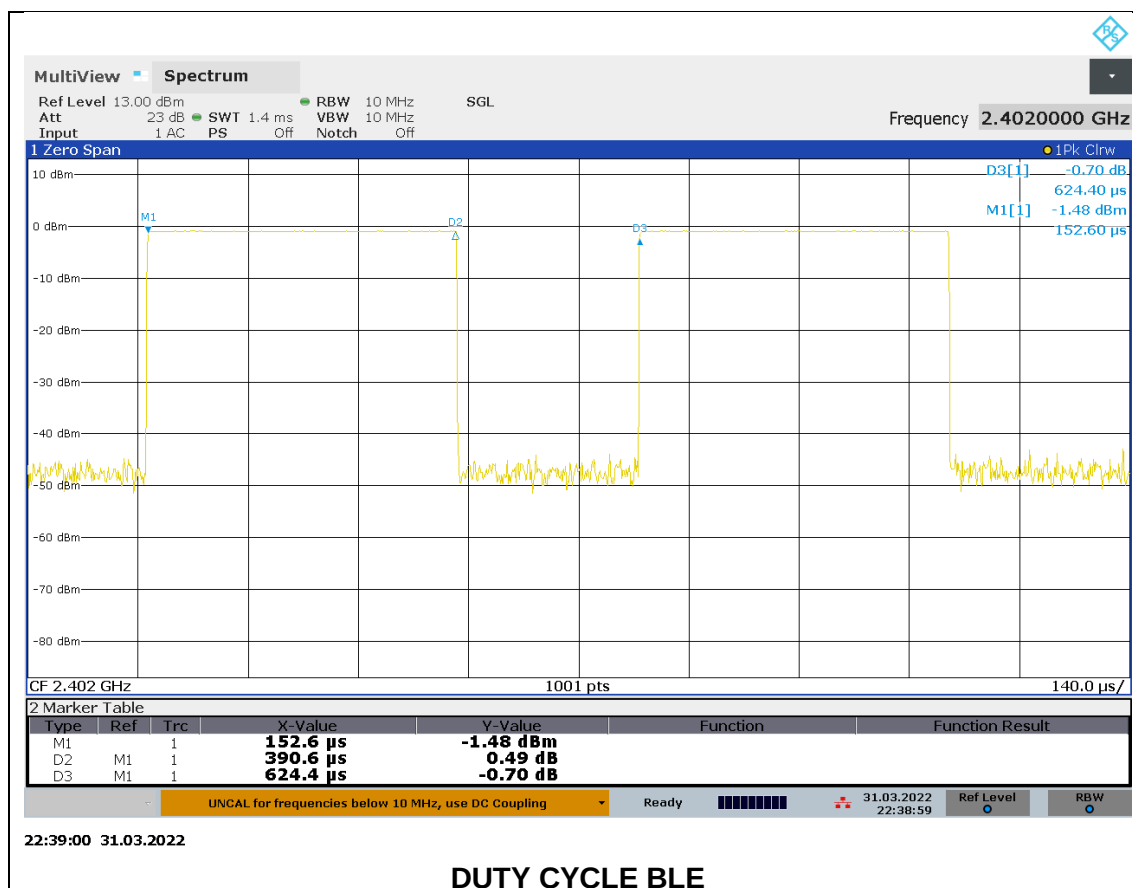
PROCEDURE

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	0.391	0.624	0.626	62.56	2.04	2.560

Test Engineer	20756 DC
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9.2. 99% BANDWIDTH

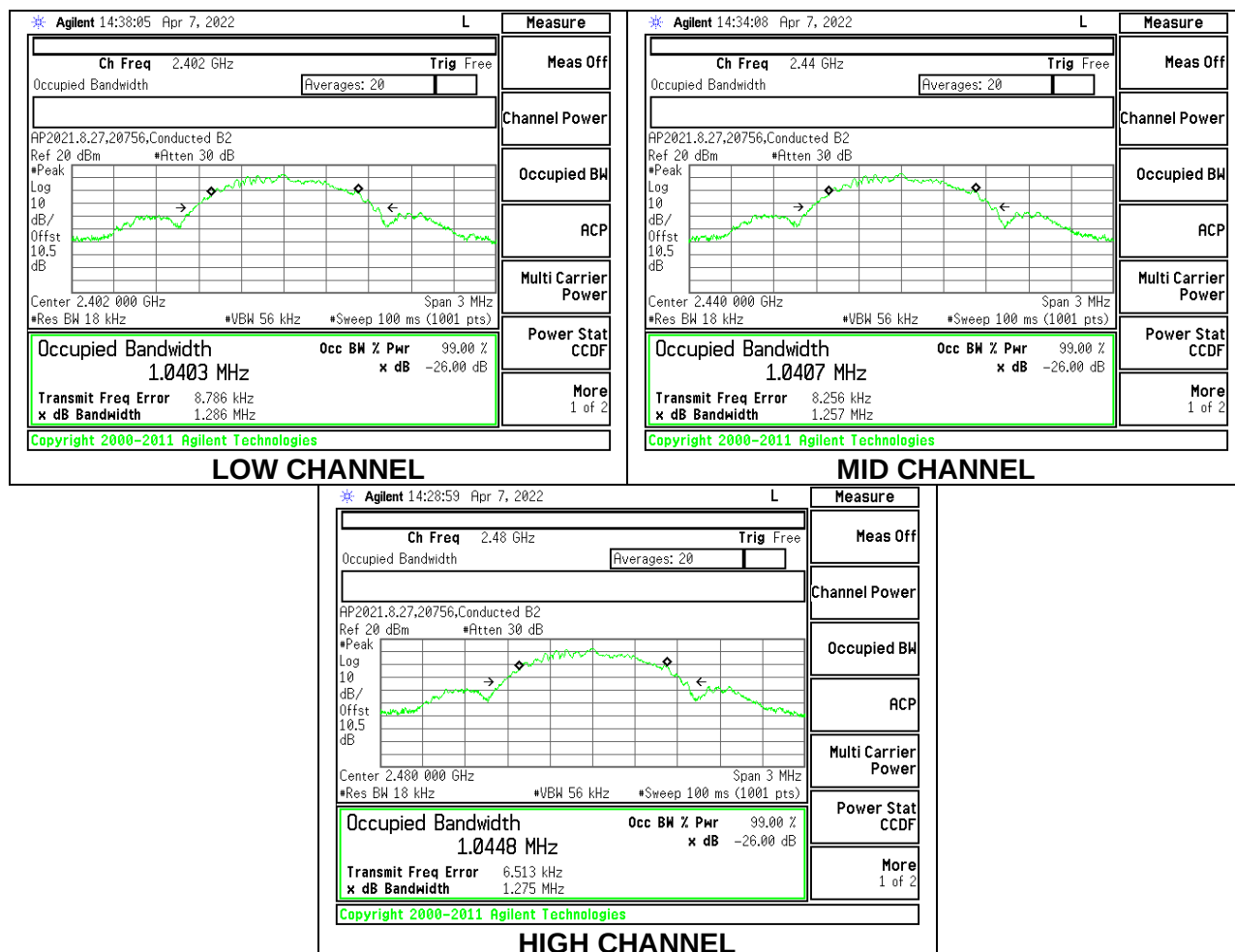
LIMITS

None; for reporting purposes only.

RESULTS

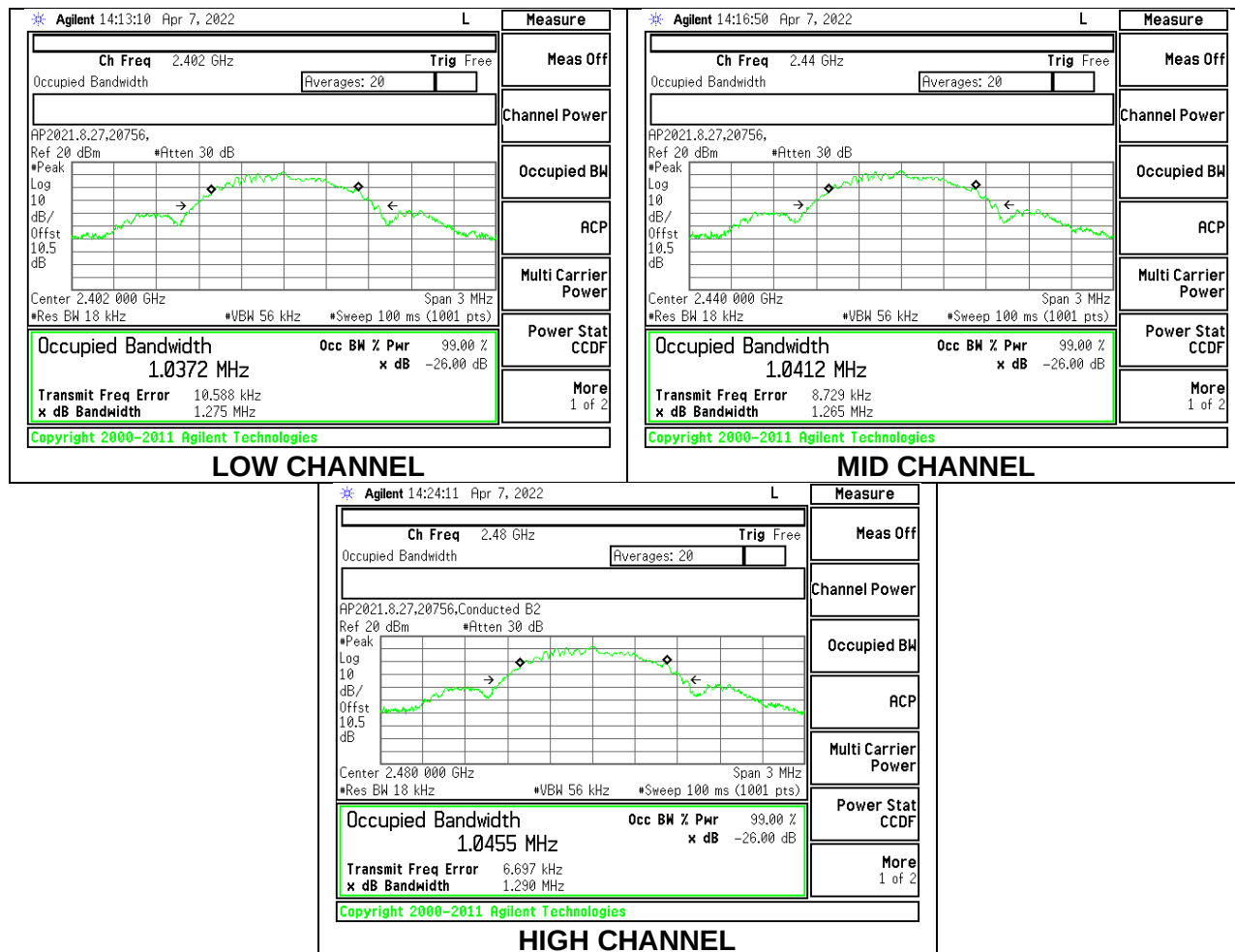
Antenna 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0403
Middle	2440	1.0407
High	2480	1.0448



Antenna 2

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0372
Middle	2440	1.0412
High	2480	1.0455



9.3. 6 dB BANDWIDTH

LIMITS

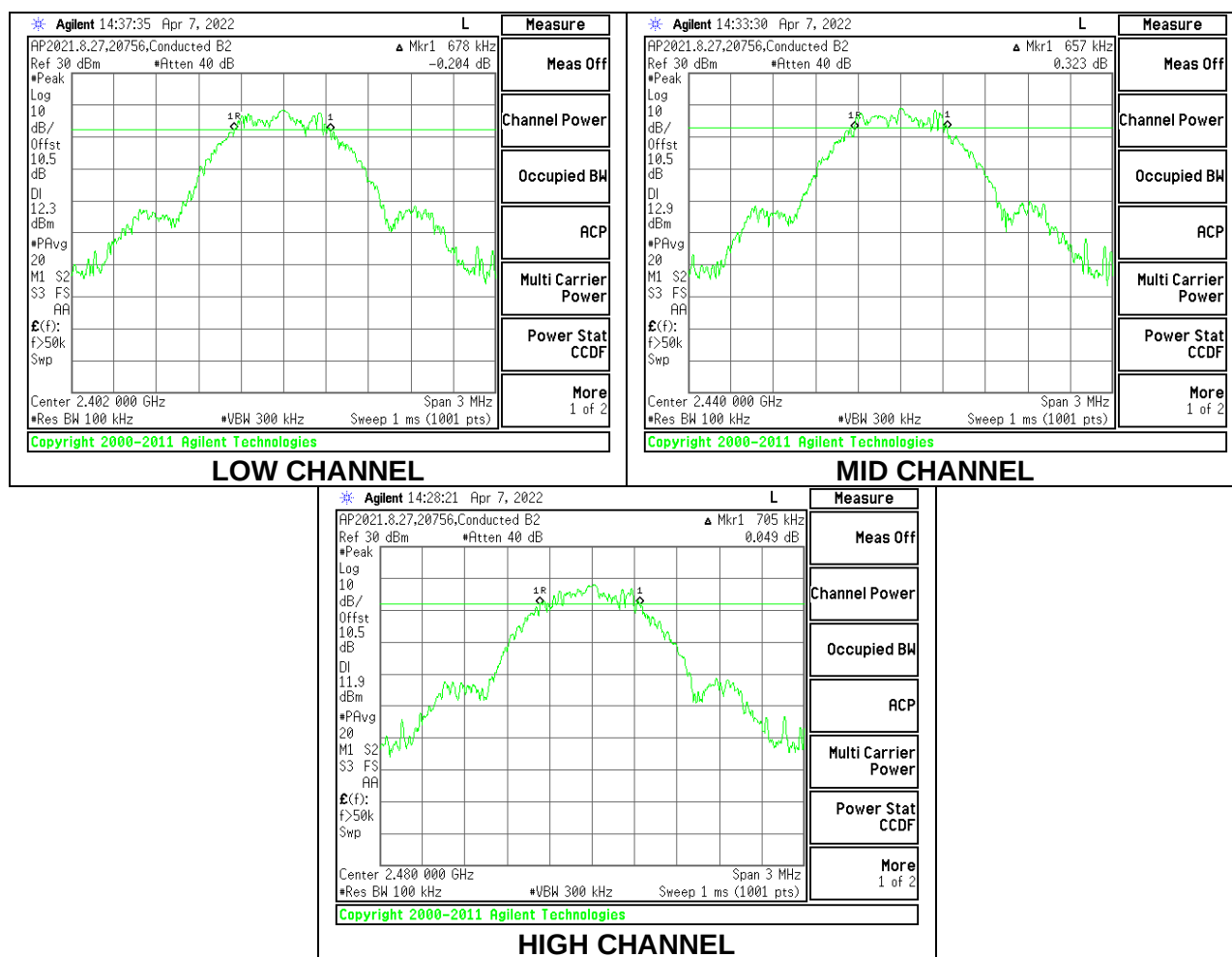
FCC §15.247 (a) (2)
RSS-247 5.2 (a)

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

RESULTS

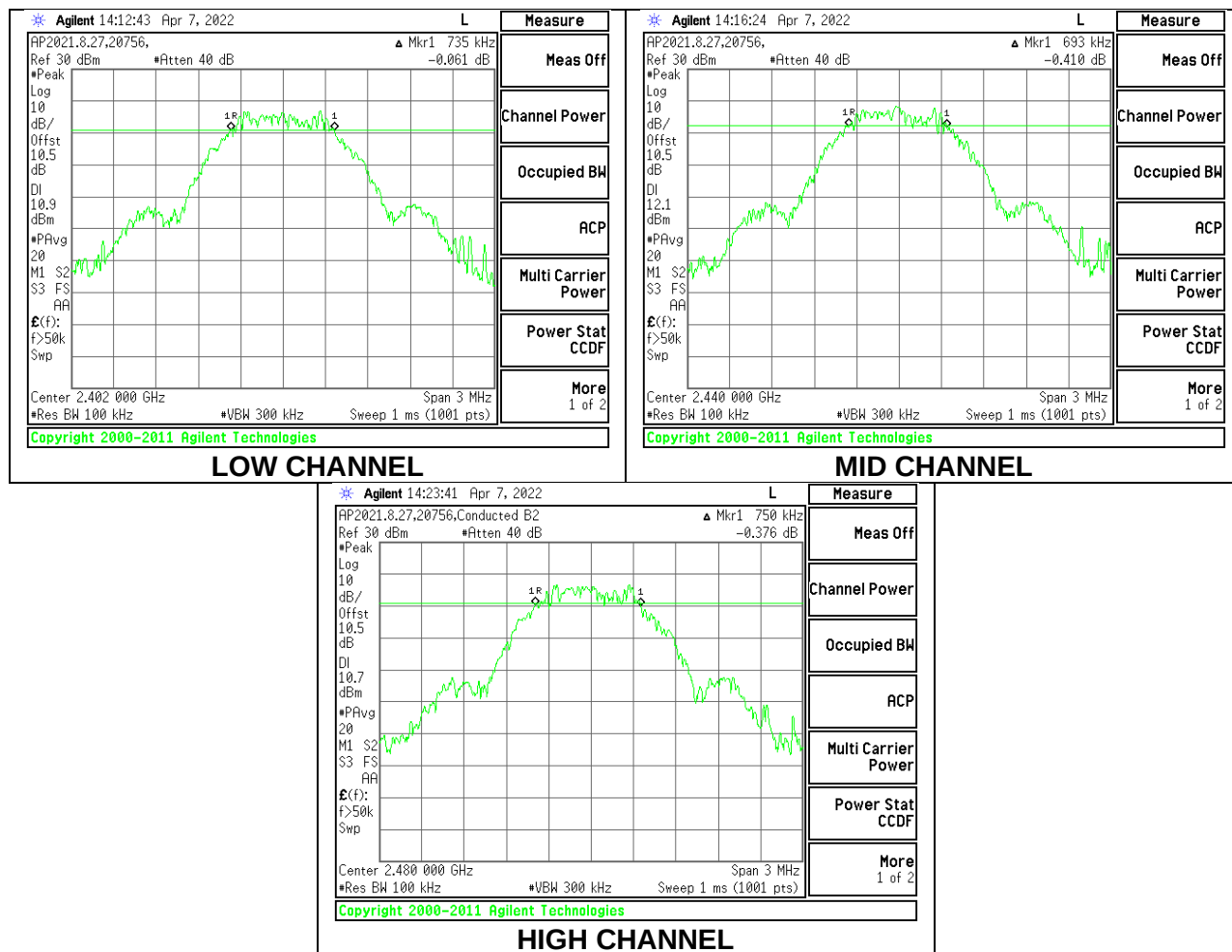
Antenna 1

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.678	0.5
Middle	2440	0.657	0.5
High	2480	0.705	0.5



Antenna 2

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.735	0.5
Middle	2440	0.693	0.5
High	2480	0.750	0.5



9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

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 power sensor. Peak output power was read directly from power meter.

RESULTS

Antenna 1 + Antenna 2

Tested By:	20756 CW
Date:	4/9/2022

Channel	Frequency (MHz)	Output Power Antenna 1 (dBm)	Output Power Antenna 2 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	18.03	17.39	20.73	30	-9.27
Middle	2440	18.64	18.32	21.49	30	-8.51
High	2480	18.13	17.44	20.81	30	-9.19

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 power sensor. Gated average output power was read directly from power meter.

RESULTS

Antenna 1 + Antenna 2

Tested By:	20756 CW
Date:	4/7/2022

Channel	Frequency (MHz)	Average Power Antenna 1 (dBm)	Average Power Antenna 2 (dBm)	Total Power (dBm)
Low	2402	17.88	17.27	20.60
Middle	2440	18.5	18.28	21.40
High	2480	17.93	17.29	20.63

9.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

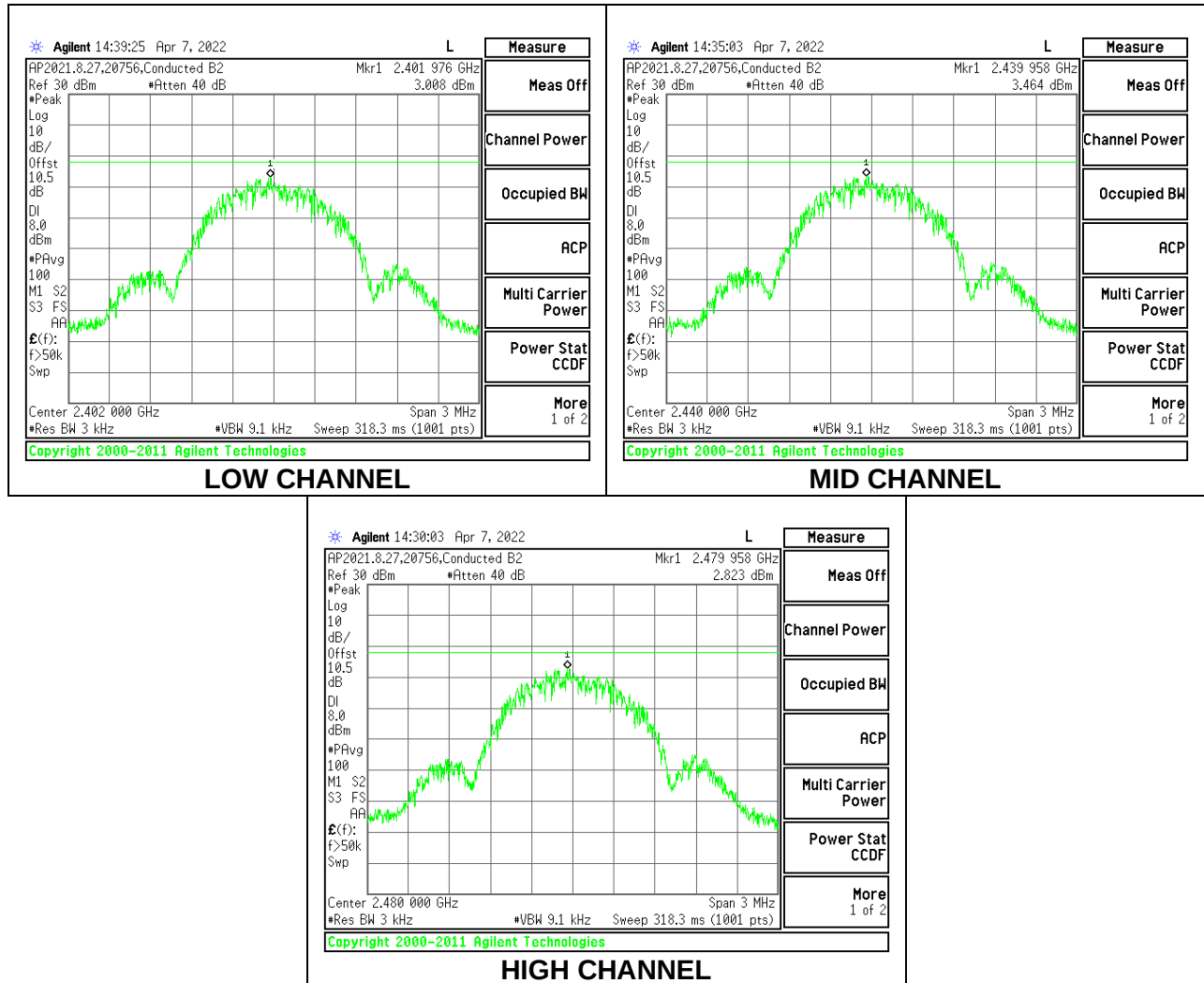
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

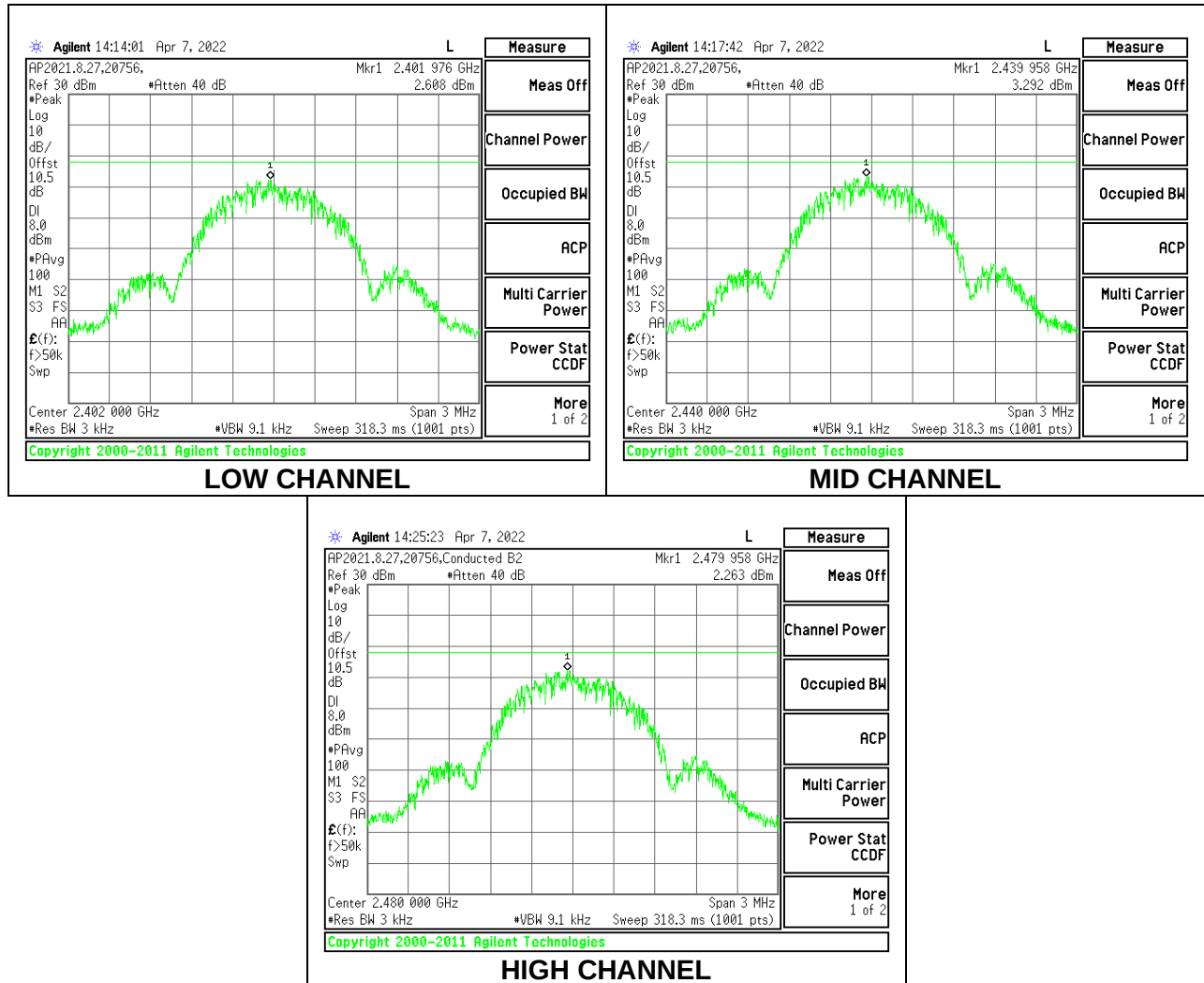
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas (dBm/ 3kHz)	Antenna 2 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2402	3.008	2.608	5.82	8.0	-2.2
Mid	2440	3.464	3.292	6.39	8.0	-1.6
High	2480	2.823	2.263	5.56	8.0	-2.4

Antenna 1



Antenna 2



9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

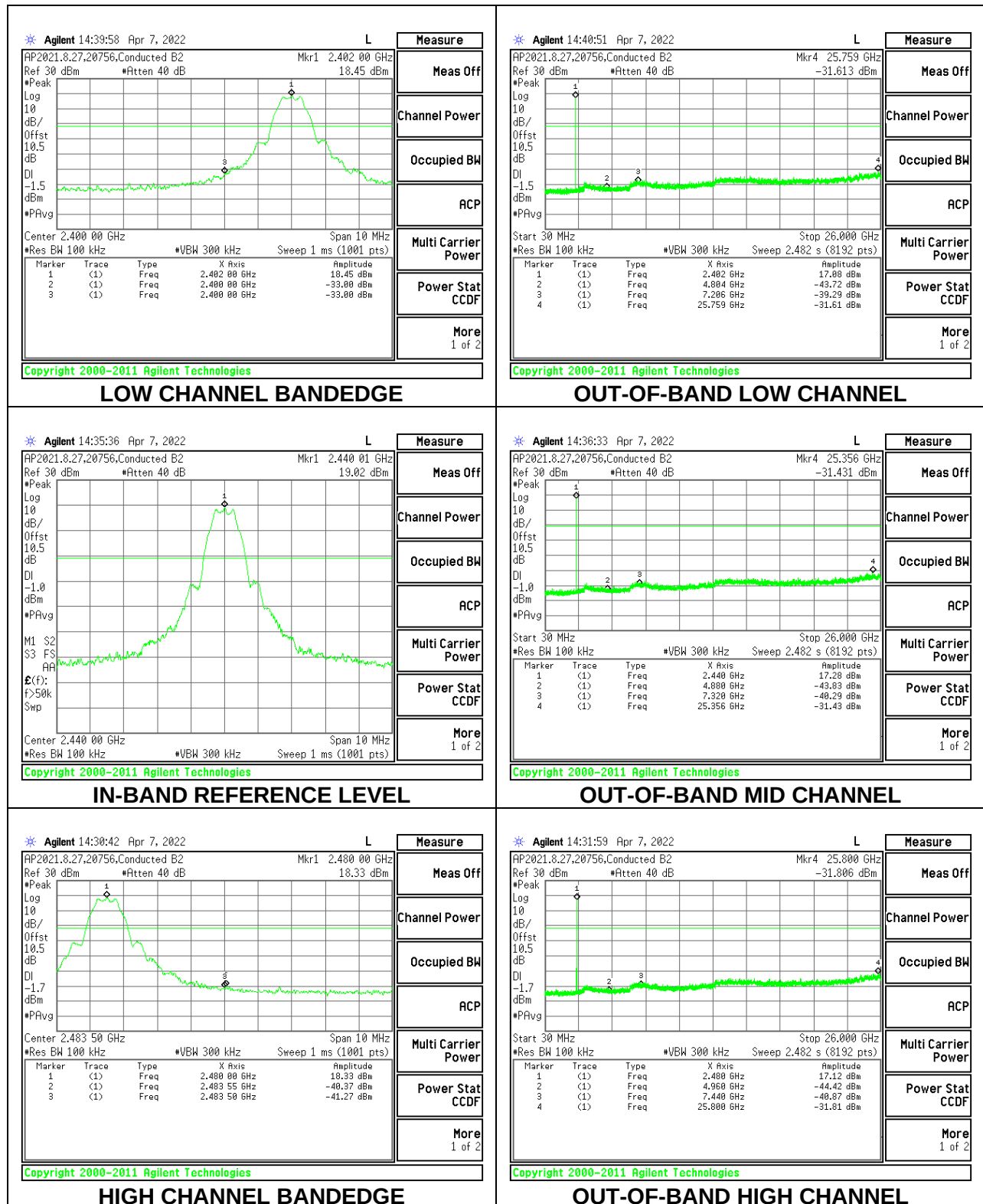
FCC §15.247 (d)

RSS-247 5.5

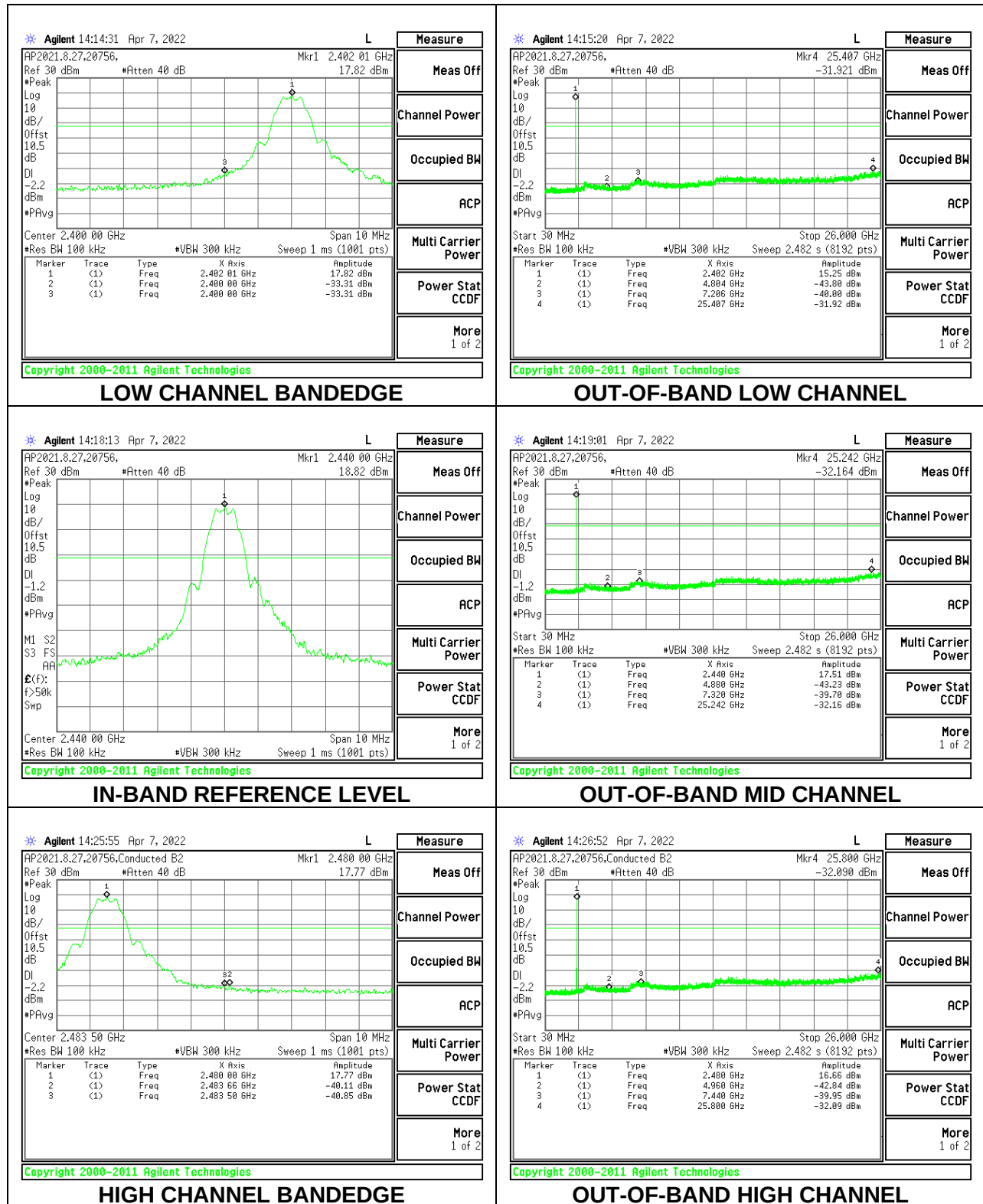
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dBc.

RESULTS

Antenna 1



Antenna 2



10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

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.

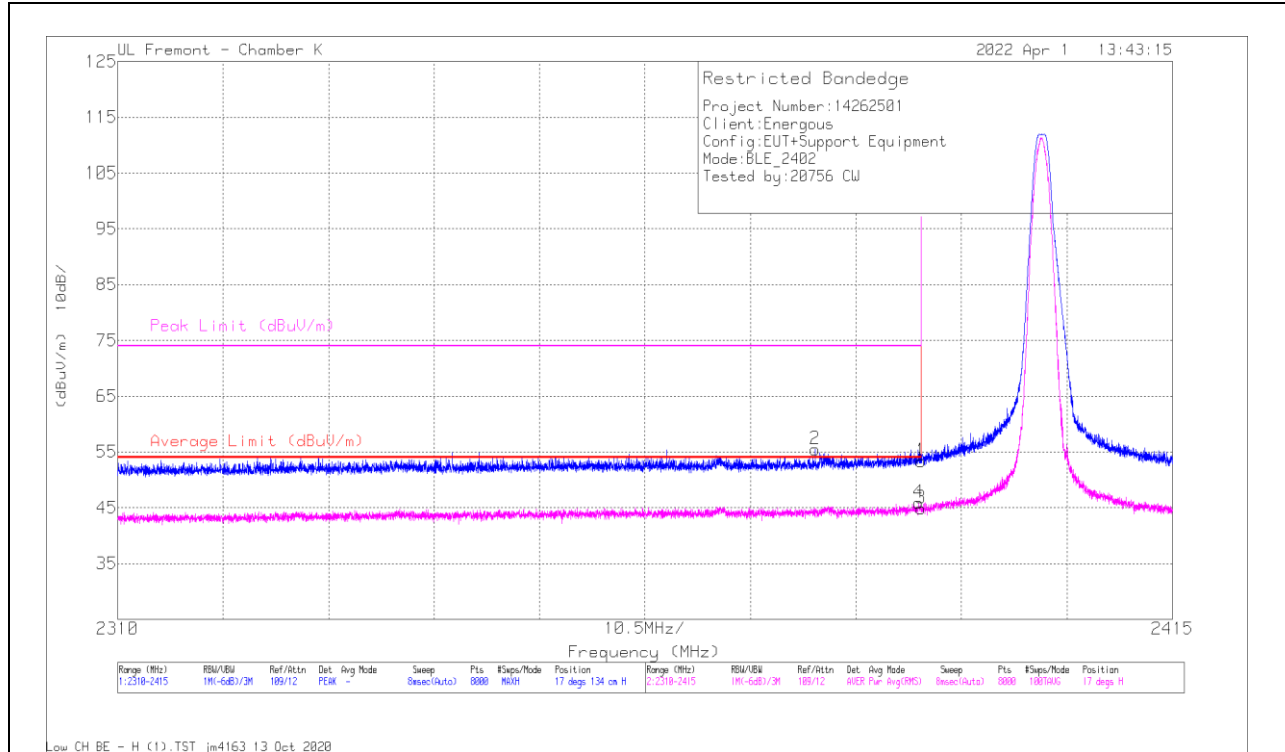
NOTE: The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table), using the free space impedance of 377 Ohms. For example the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to $Y - 51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

10.2. TRANSMITTER ABOVE 1 GHz

Antenna 1 + Antenna 2

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



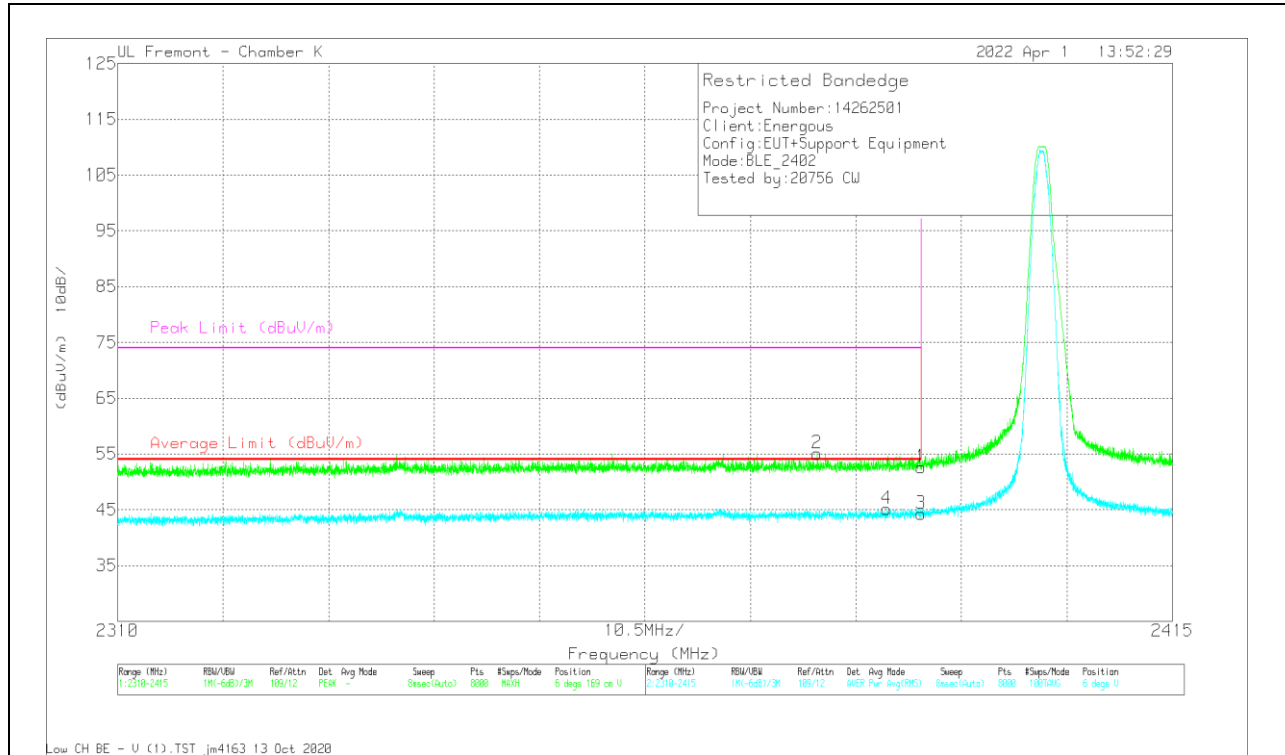
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 90404 (dBm)	Amp/Chn/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2390	32.5	Pk	32.1	-11.2	0	53.4	-	-	74	-20.6	17	134	H
2	* 2379.429	34.46	Pk	32.2	-11.2	0	55.46	-	-	74	-19.54	17	134	H
3	* 2390	21.96	RMS	32.1	-11.2	2.04	44.9	54	-9.1	-	-	17	134	H
4	* 2389.747	22.96	RMS	32.1	-11.2	2.04	45.9	54	-8.1	-	-	17	134	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 80454 (dBm)	Ampl/ChFtr/Pd (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2390	31.69	Pk	32.1	-11.2	0	52.59	-	-	74	-21.41	6	169	V
2	* 2379.652	34.05	Pk	32.2	-11.2	0	55.05	-	-	74	-18.95	6	169	V
3	* 2390	21.4	RMS	32.1	-11.2	2.04	44.34	54	-9.66	-	-	6	169	V
4	* 2386.57	22.27	RMS	32.1	-11.2	2.04	45.21	54	-8.79	-	-	6	169	V

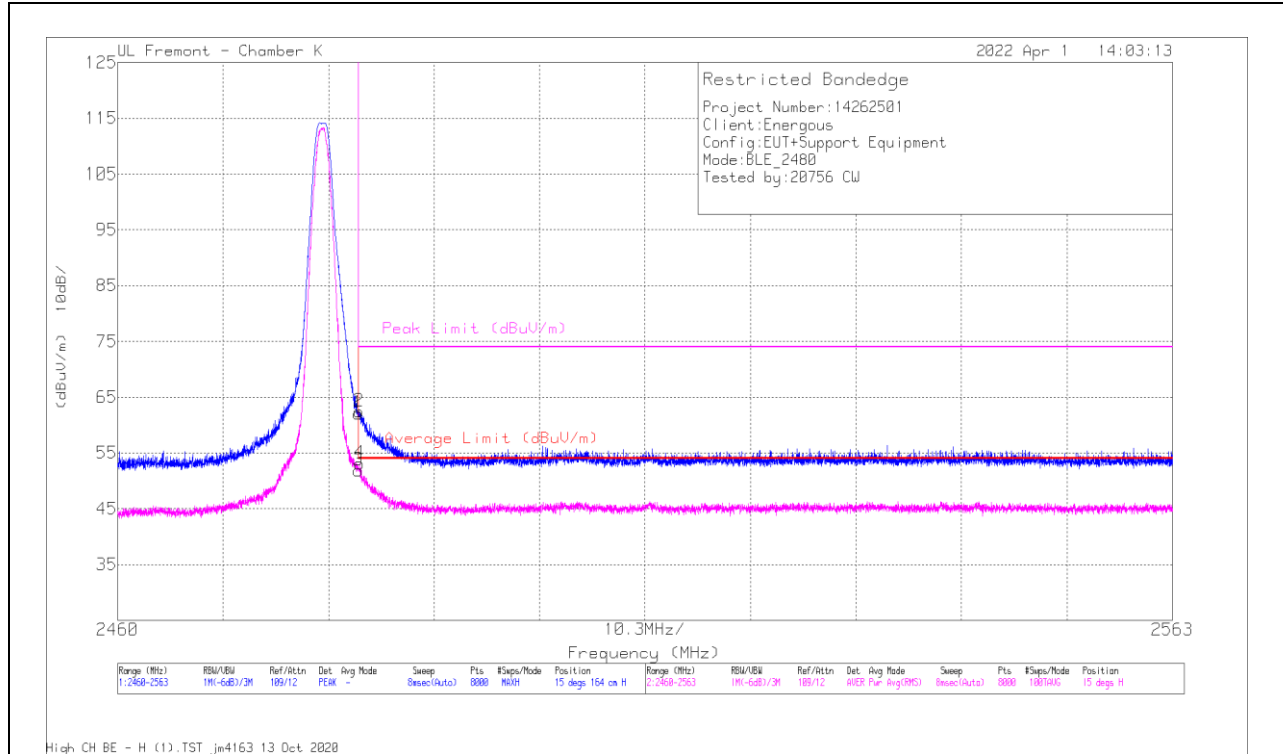
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



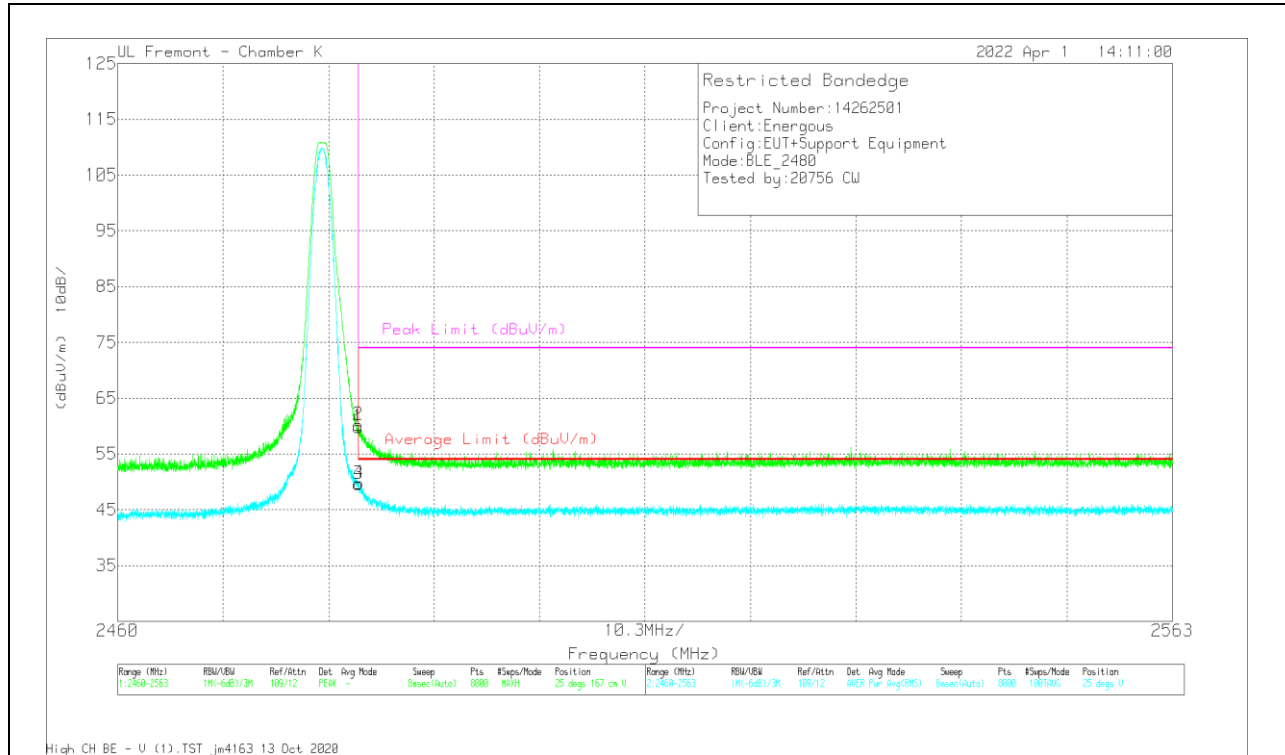
Marker	Frequency (MHz)	Meas Reading (dBuV)	Det	AF 80404 (dBm)	AmplChlFiltz (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (m)	Polarity
1	*2483.5	40.24	Pk	32.7	-10.9	0	62.04	-	-	74	-11.96	15	164	H
2	*2483.539	40.71	Pk	32.7	-10.9	0	62.51	-	-	74	-11.49	15	164	H
3	*2483.5	29.05	RMS	32.7	-10.9	2.04	51.89	54	-2.11	-	-	15	164	H
4	*2483.642	29.23	RMS	32.7	-10.9	2.04	53.07	54	-93	-	-	15	164	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 80454 (dBm)	Ampl/Cat/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2483.5	32.04	Pk	32.7	-10.9	0	59.94	-	-	74	-14.16	25	167	V
2	* 2483.513	38.46	Pk	32.7	-10.9	0	60.26	-	-	74	-13.74	25	167	V
3	* 2483.5	25.83	RMS	32.7	-10.9	2.04	49.67	54	-4.33	-	-	25	167	V
4	* 2483.591	25.88	RMS	32.7	-10.9	2.04	49.72	54	-4.28	-	-	25	167	V

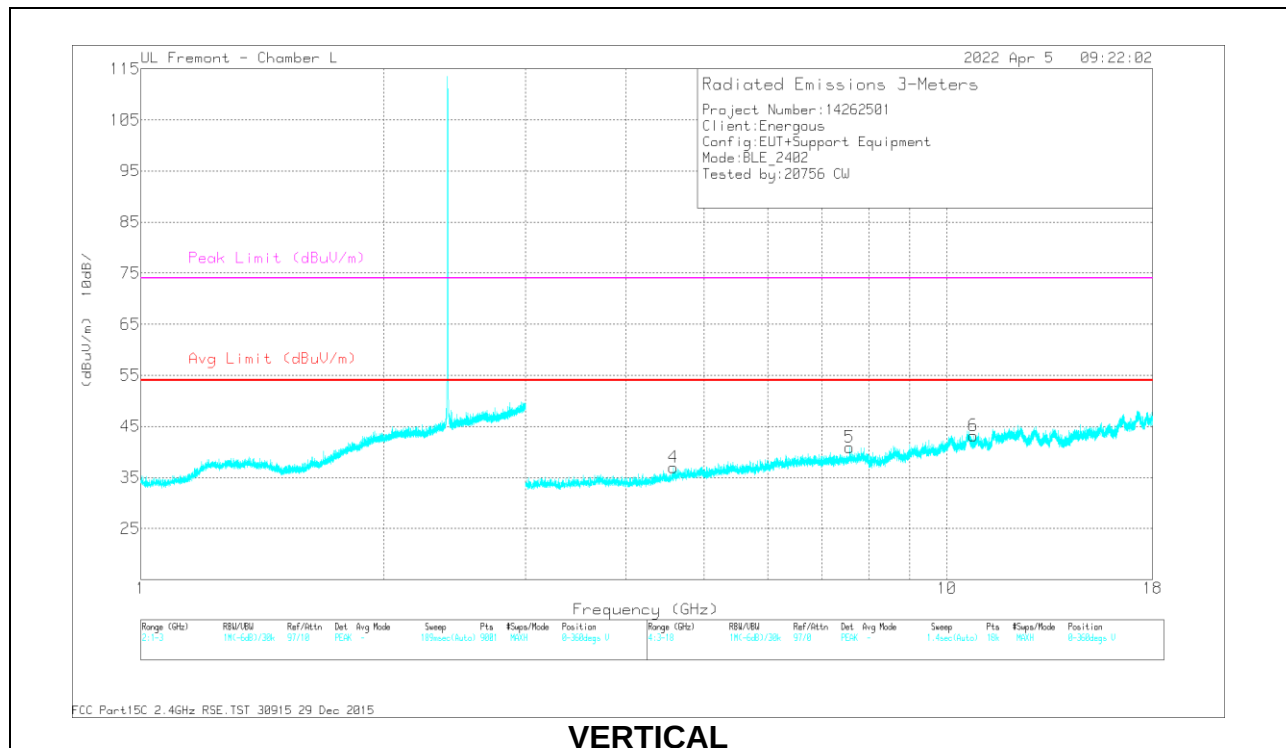
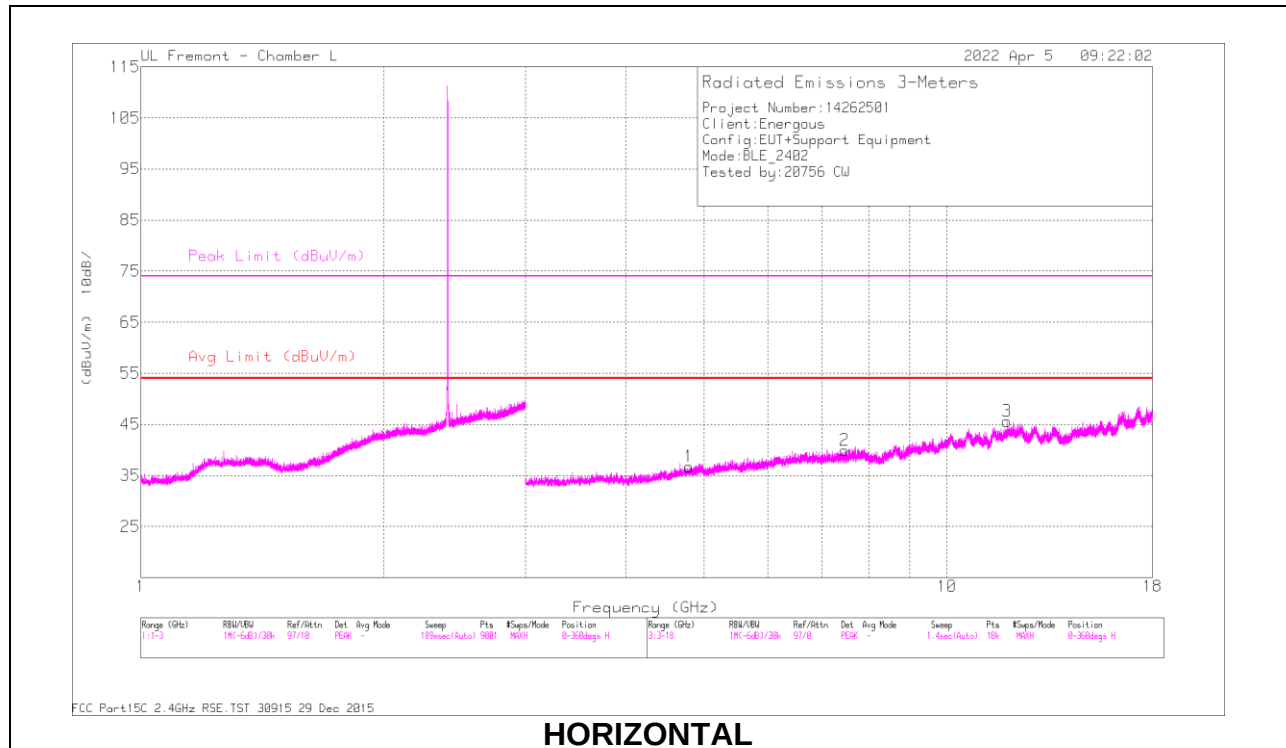
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

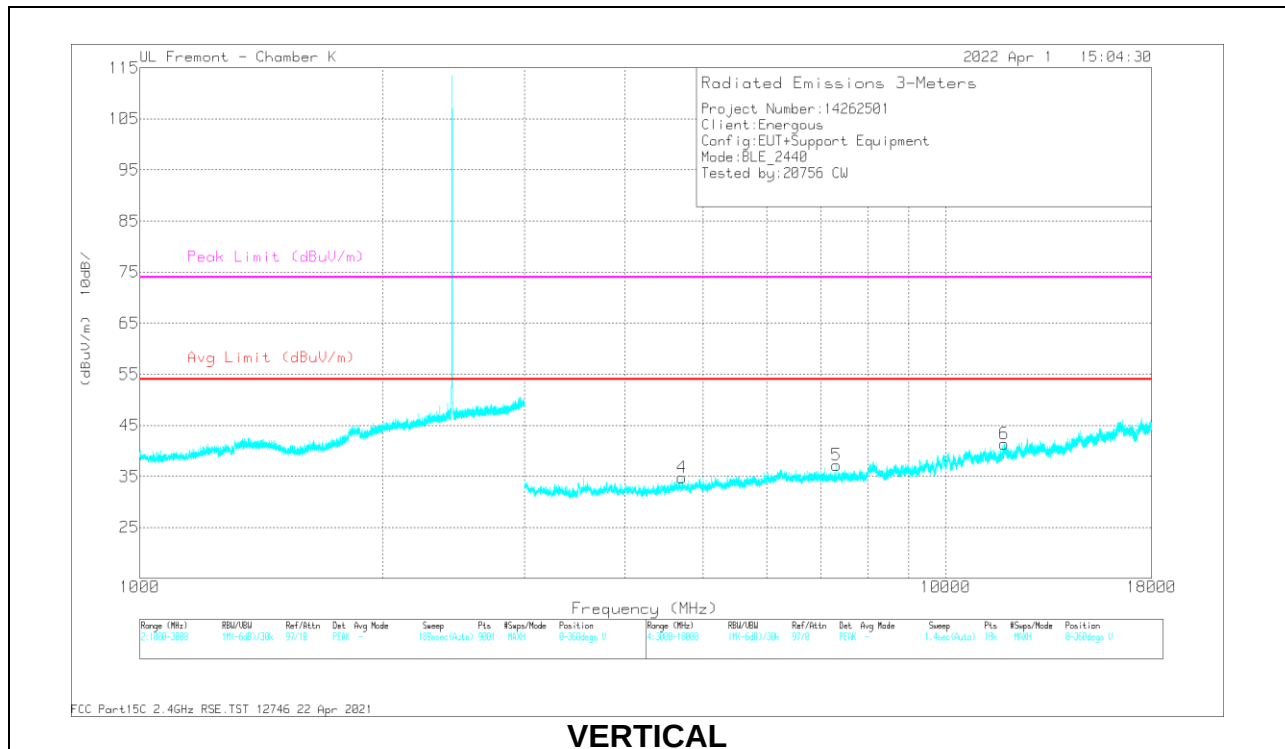
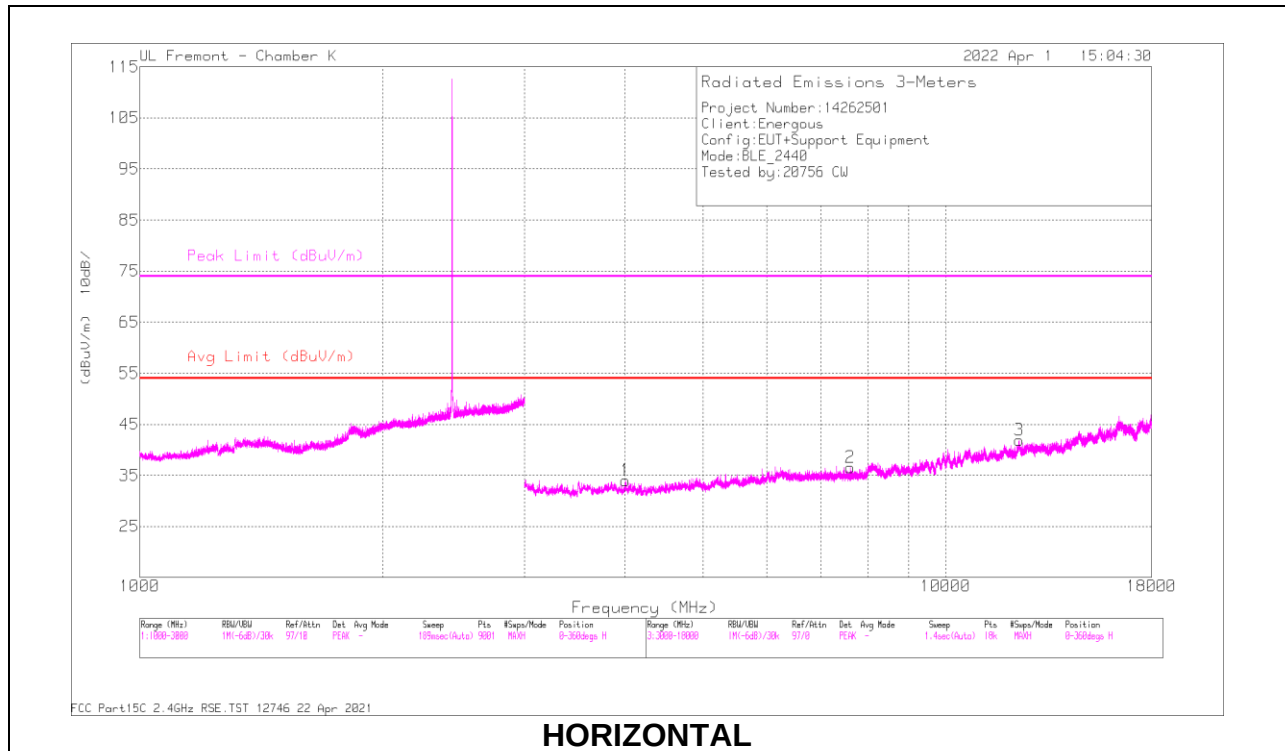
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 79834 (dB/m)	Ampl/Cbl/Filt/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.787148	36.75	PK2	34.1	-24.4	0	46.45	-	-	74	-27.55	27	367	H
	* 4.785789	24.71	MAv1	34.1	-24.4	2.04	36.45	54	-17.55	-	-	27	367	H
2	* 7.466009	33.42	PK2	35.7	-19.9	0	49.22	-	-	74	-24.78	182	111	H
	* 7.465869	22.06	MAv1	35.7	-19.9	2.04	39.9	54	-14.1	-	-	182	111	H
3	* 11.882822	29.53	PK2	39.1	-16.2	0	52.43	-	-	74	-21.57	340	127	H
	* 11.882961	18.39	MAv1	39.1	-16.2	2.04	43.33	54	-10.67	-	-	340	127	H
4	* 4.580128	36.5	PK2	33.9	-25.1	0	45.3	-	-	74	-28.7	244	380	V
	* 4.581655	24.9	MAv1	33.9	-25.1	2.04	35.74	54	-18.26	-	-	244	380	V
5	* 7.571777	32.42	PK2	35.7	-19.1	0	49.02	-	-	74	-24.98	37	101	V
	* 7.571397	20.83	MAv1	35.7	-19.1	2.04	39.47	54	-14.53	-	-	37	101	V
6	* 10.781225	29.89	PK2	37.8	-16.3	0	51.39	-	-	74	-22.61	311	117	V
	* 10.78198	18.88	MAv1	37.9	-16.3	2.04	42.52	54	-11.48	-	-	311	117	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



RADIATED EMISSIONS

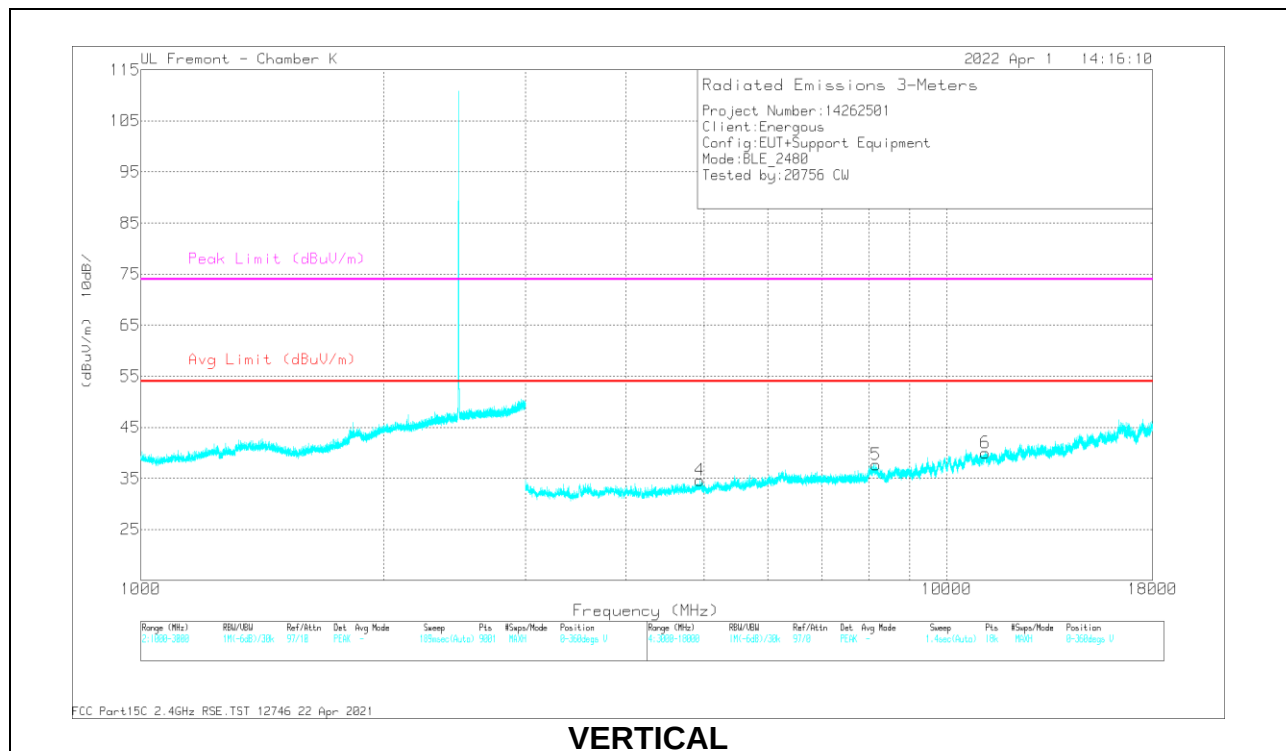
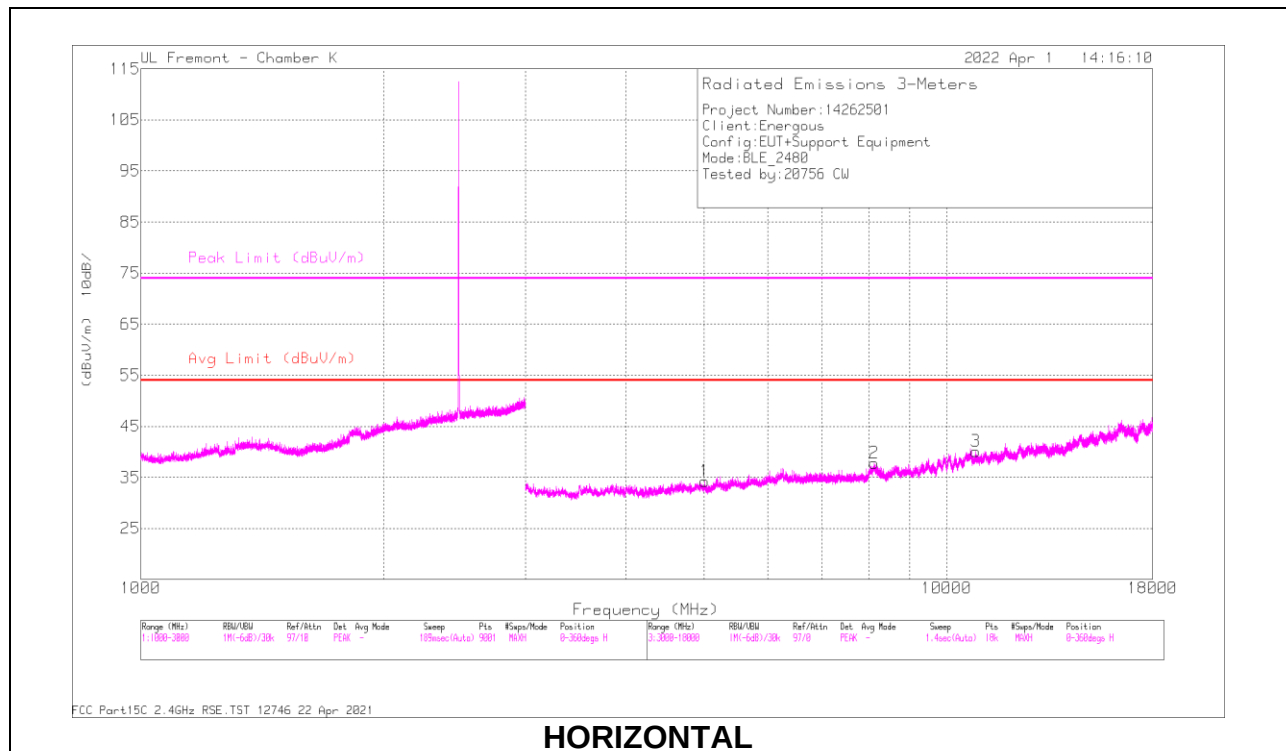
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Ampl/Cbl/Filt/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4004.491	50.64	PK2	33.5	-41.1	0	43.04	-	-	74	-30.96	263	219	H
	* 4005.522	39.14	MAv1	33.5	-41.1	2.04	33.58	54	-20.42	-	-	263	219	H
2	* 7612.547	46.68	PK2	35.9	-37.3	0	45.28	-	-	74	-28.72	222	367	H
	* 7614.253	34.89	MAv1	35.9	-37.3	2.04	35.53	54	-18.47	-	-	222	367	H
3	* 12343.445	43.96	PK2	39.1	-32.8	0	50.26	-	-	74	-23.74	180	187	H
	* 12343.652	32.89	MAv1	39.1	-32.8	2.04	41.23	54	-12.77	-	-	180	187	H
4	* 4711.061	50.11	PK2	34.1	-40.6	0	43.61	-	-	74	-30.39	184	231	V
	* 4709.974	38.01	MAv1	34.1	-40.6	2.04	33.55	54	-20.45	-	-	184	231	V
5	* 7319.115	48.27	PK2	35.8	-37.4	0	46.67	-	-	74	-27.33	337	207	V
	* 7319.319	37.35	MAv1	35.8	-37.4	2.04	37.79	54	-16.21	-	-	337	207	V
6	* 11816.417	45.03	PK2	38.6	-33.4	0	50.23	-	-	74	-23.77	14	110	V
	* 11817.476	33.31	MAv1	38.6	-33.5	2.04	40.45	54	-13.55	-	-	14	110	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



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Ampl/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	* 5008.37	49.68	PK2	34.2	-39.8	0	44.08	-	-	74	-29.92	216	371	H
	* 5008.278	37.54	MAv1	34.2	-39.8	2.04	33.98	54	-20.02	-	-	216	371	H
2	* 8119.987	47.61	PK2	35.9	-36.5	0	47.01	-	-	74	-26.99	130	163	H
	* 8122.017	36.25	MAv1	35.9	-36.6	2.04	37.59	54	-16.41	-	-	130	163	H
3	* 10855.81	46.18	PK2	38.2	-35.7	0	48.68	-	-	74	-25.32	331	276	H
	* 10857.428	35	MAv1	38.2	-35.7	2.04	39.54	54	-14.46	-	-	331	276	H
4	* 4942.263	49.73	PK2	34.2	-40	0	43.93	-	-	74	-30.07	134	189	V
	* 4943.646	38.08	MAv1	34.2	-40	2.04	34.32	54	-19.68	-	-	134	189	V
5	* 8175.05	47.85	PK2	35.9	-36.8	0	46.95	-	-	74	-27.05	16	138	V
	* 8174.546	35.88	MAv1	35.9	-36.8	2.04	37.02	54	-16.98	-	-	16	138	V
6	* 11161.374	46.47	PK2	38	-34.7	0	49.77	-	-	74	-24.23	350	360	V
	* 11159.919	35	MAv1	38	-34.7	2.04	40.34	54	-13.66	-	-	350	360	V

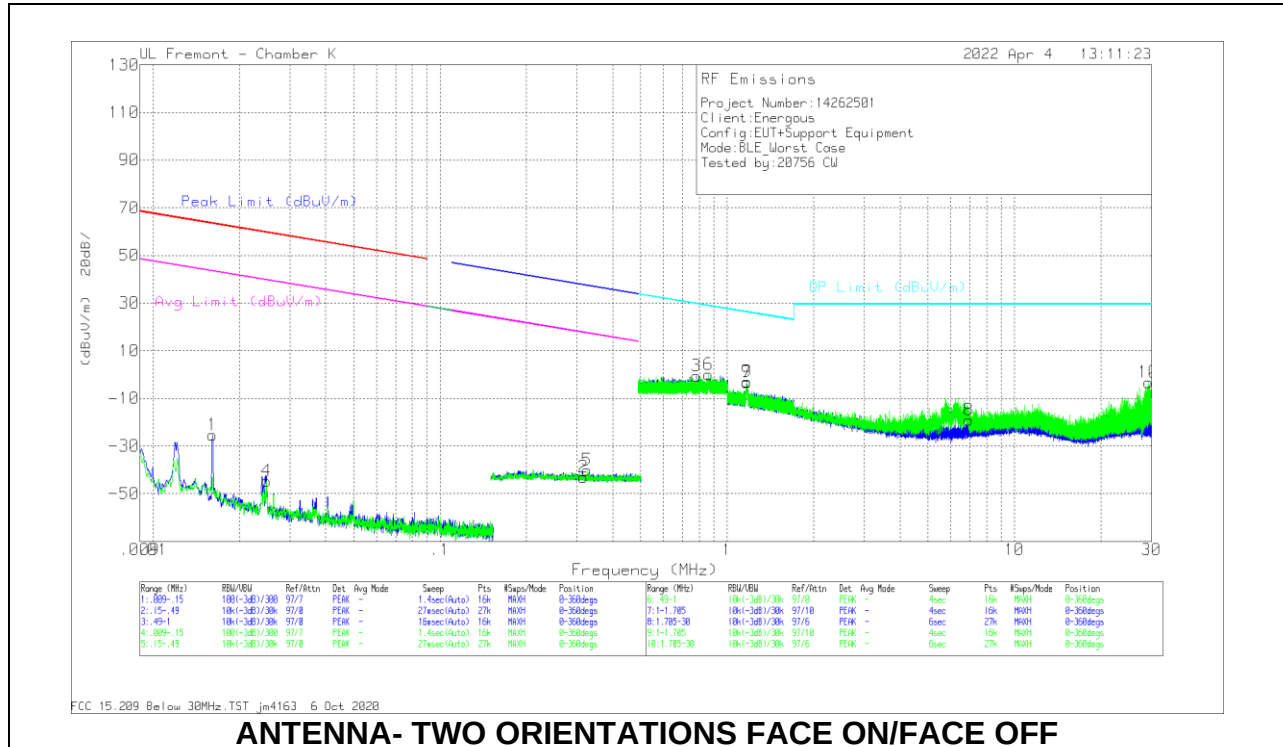
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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

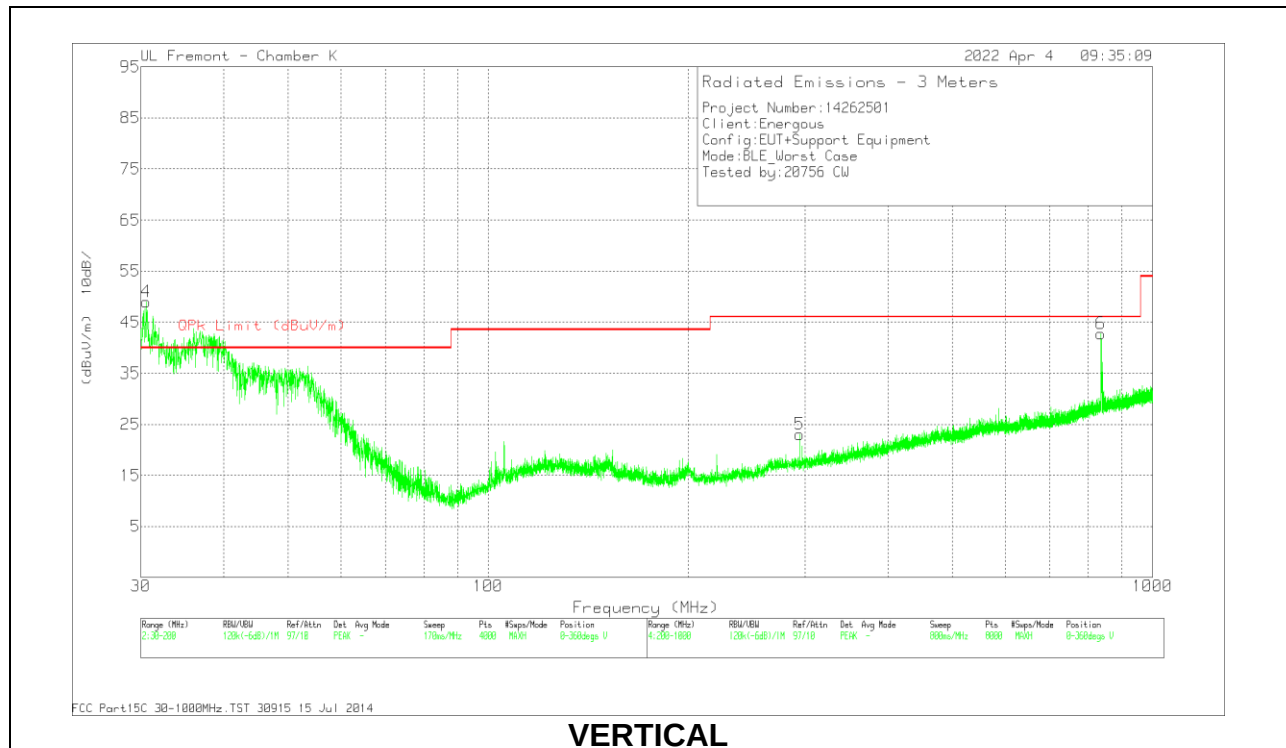
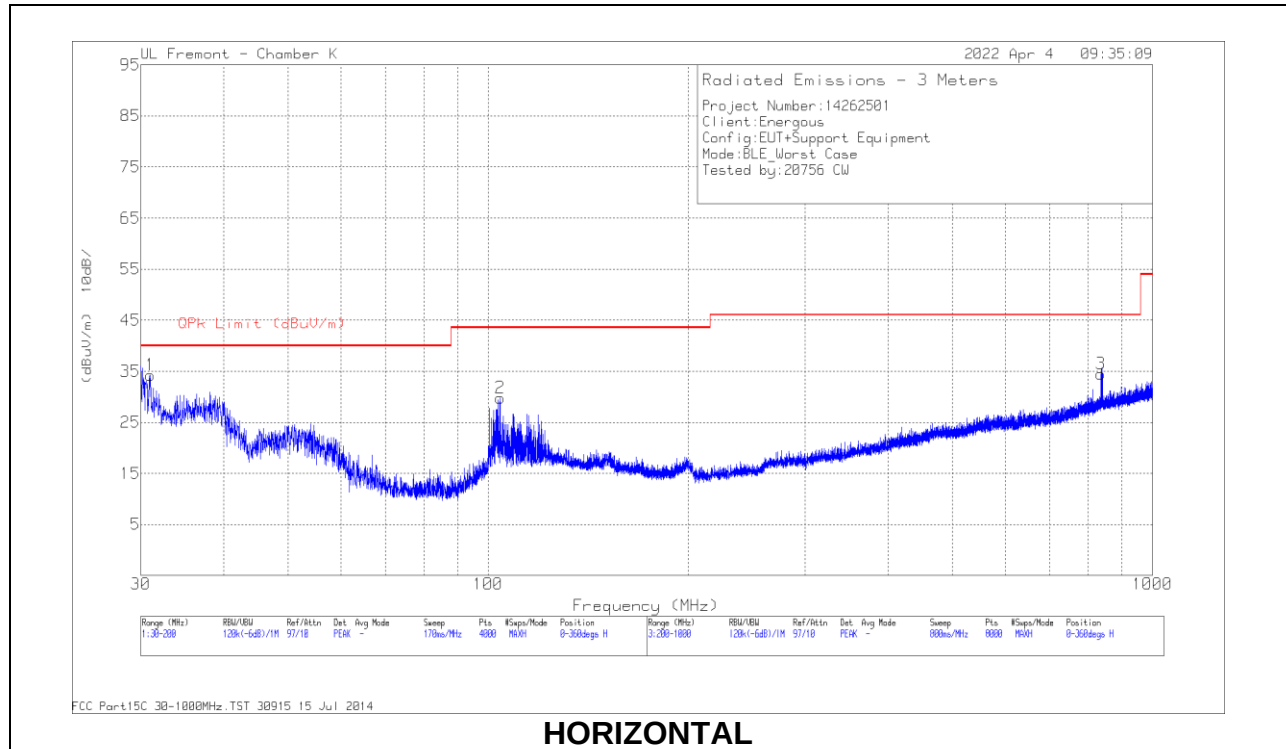
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.0161	26.52	PK	59.5	-31.4	-80	-25.38	63.43	-88.81	43.43	-68.81	-	-	-	-	0-360
2	.3154	13.03	PK	56.2	-32.2	-80	-42.97	-	-	-	-	37.63	-80.6	17.63	-60.6	0-360
4	.0249	8.62	PK	58.5	-31.9	-80	-44.78	59.67	-104.45	39.67	-84.45	-	-	-	-	0-360
5	.3244	15.91	PK	56.2	-32.2	-80	-40.09	-	-	-	-	37.39	-77.48	17.39	-57.48	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.7799	15.28	PK	56.2	-32.1	-40	-62	29.77	-30.39	0-360
6	.8608	15.8	PK	56.2	-32.1	-40	-1	28.92	-29.02	0-360
7	1.1724	22.9	PK	45.8	-32.1	-40	-3.4	26.24	-29.64	0-360
8	6.9188	17.81	PK	34.8	-31.8	-40	-19.19	29.5	-48.69	0-360
9	1.1694	23.29	PK	45.8	-32.1	-40	-3.01	26.27	-29.28	0-360
10	29.2789	34.82	PK	33.5	-31.5	-40	-3.18	29.5	-32.68	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	82258 ACF (dB)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	31.0212	39.6	Pk	27.1	-31.5	35.2	40	-4.8	25	287	H
	31.0212	28.34	Qp	27.1	-31.5	23.94	40	-16.06	25	287	H
2	104.267	42.94	Pk	17.8	-30.9	29.84	43.52	-13.68	0-360	295	H
4	39.176	53.32	Pk	20.8	-31.4	42.72	-	-	90	110	V
	39.176	45.65	Qp	20.8	-31.4	35.05	40	-4.95	90	110	V
3	835.783	33.88	Pk	28.2	-27.6	34.48	46.02	-11.54	0-360	199	H
5	294.512	33.05	Pk	19.7	-29.7	23.05	46.02	-22.97	0-360	99	V
6	835.845	43.39	Pk	28.2	-27.6	43.99	46.02	-2.03	8	222	V

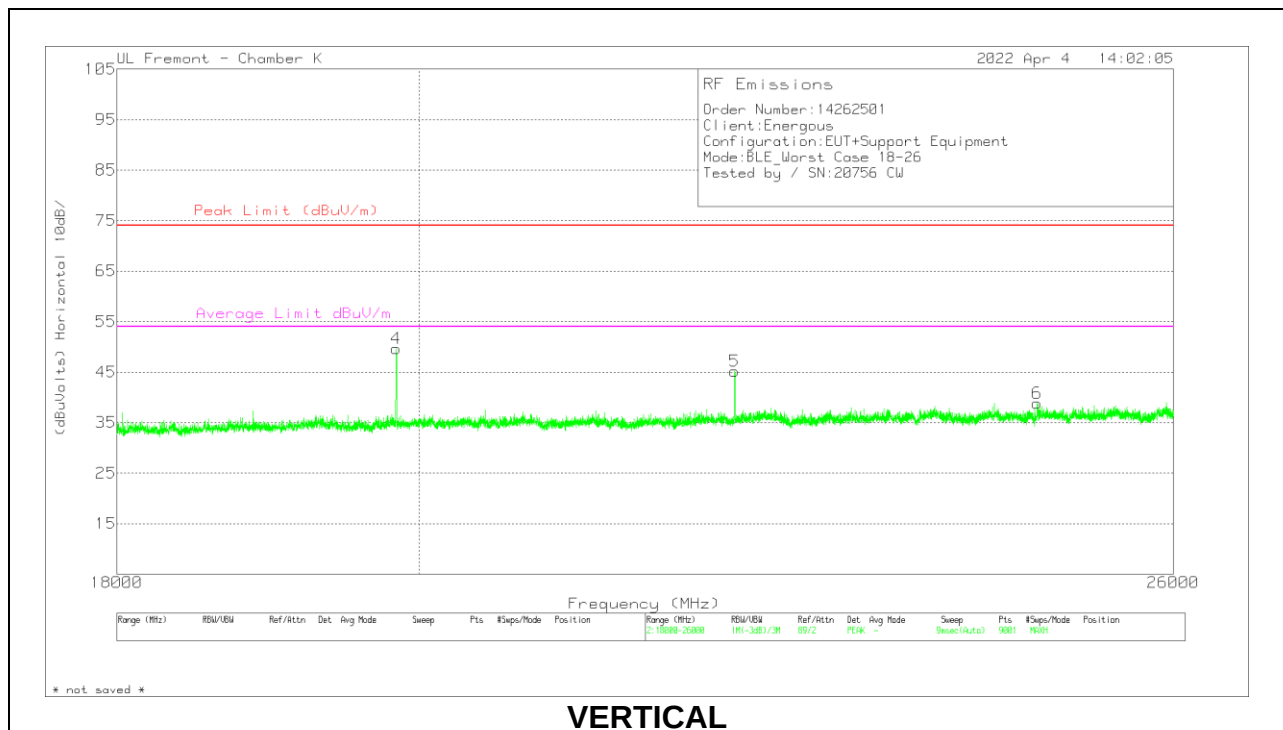
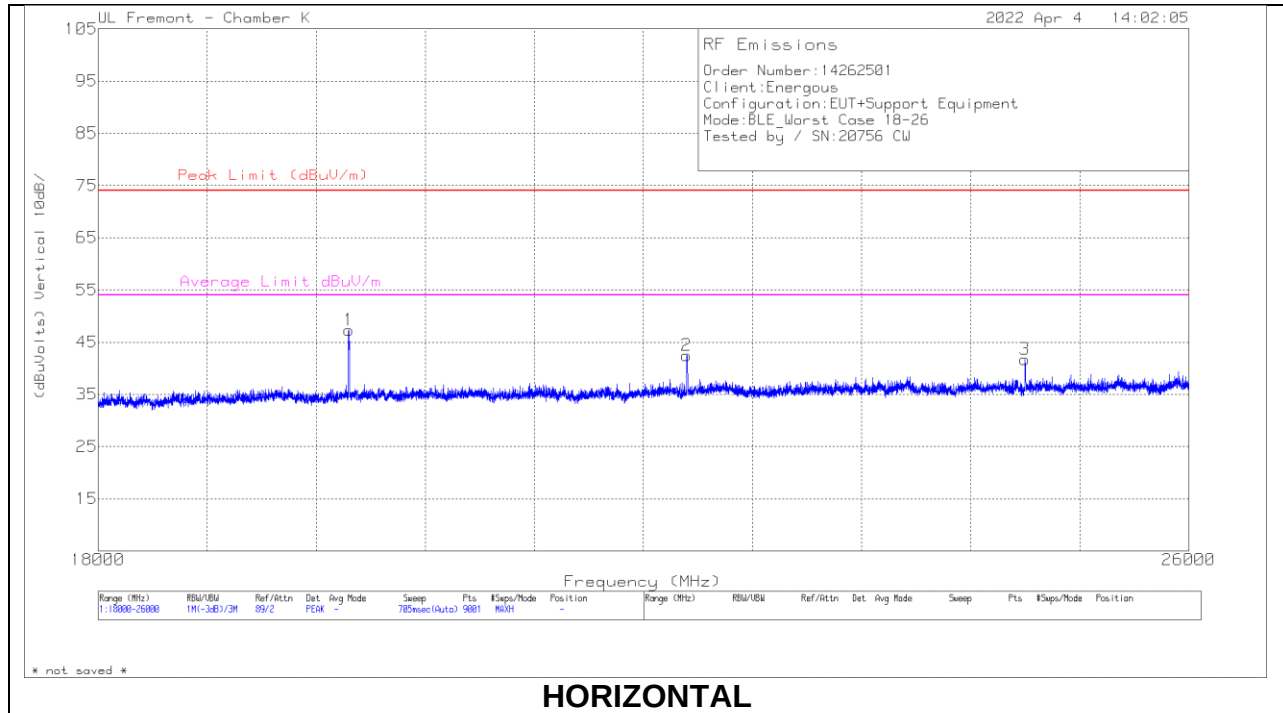
Pk - Peak detector

Qp - Quasi-Peak detector

Note: Marker 6 was maximized at peak as worst case.

10.5. WORST CASE 18-26 GHZ

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



18 – 26GHz DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 81139 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	PK Margin (dB)	Average Limit dBuV/m	Margin (dB)
1	19838.222	80.4	Pk	33.6	-57.2	-9.5	47.3	74	-26.7	54	-6.7
2	22317.334	75.43	Pk	34.3	-57.8	-9.5	42.43	74	-31.57	54	-11.57
3	24797.334	71.83	Pk	35	-55.6	-9.5	41.73	74	-32.27	54	-12.27
4	19837.334	82.66	Pk	33.6	-57.1	-9.5	49.66	74	-24.34	54	-4.34
5	22318.223	78.16	Pk	34.3	-57.8	-9.5	45.16	74	-28.84	54	-8.84
6	24797.334	68.95	Pk	35	-55.6	-9.5	38.85	74	-35.15	54	-15.15

Pk - Peak detector

Frequency (MHz)	Meter Reading (dBuV)	Det	AF 81139 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	PK Margin (dB)	Average Limit dBuV/m	Margin (dB)
19837.915	82.35	Pk	33.6	-57.2	-9.5	49.25	74	-24.75	54	-4.75
19837.915	74.95	RMS	33.6	-57.2	-9.5	41.85	-	-	54	-12.15

Pk - Peak detector

RMS - RMS detection

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

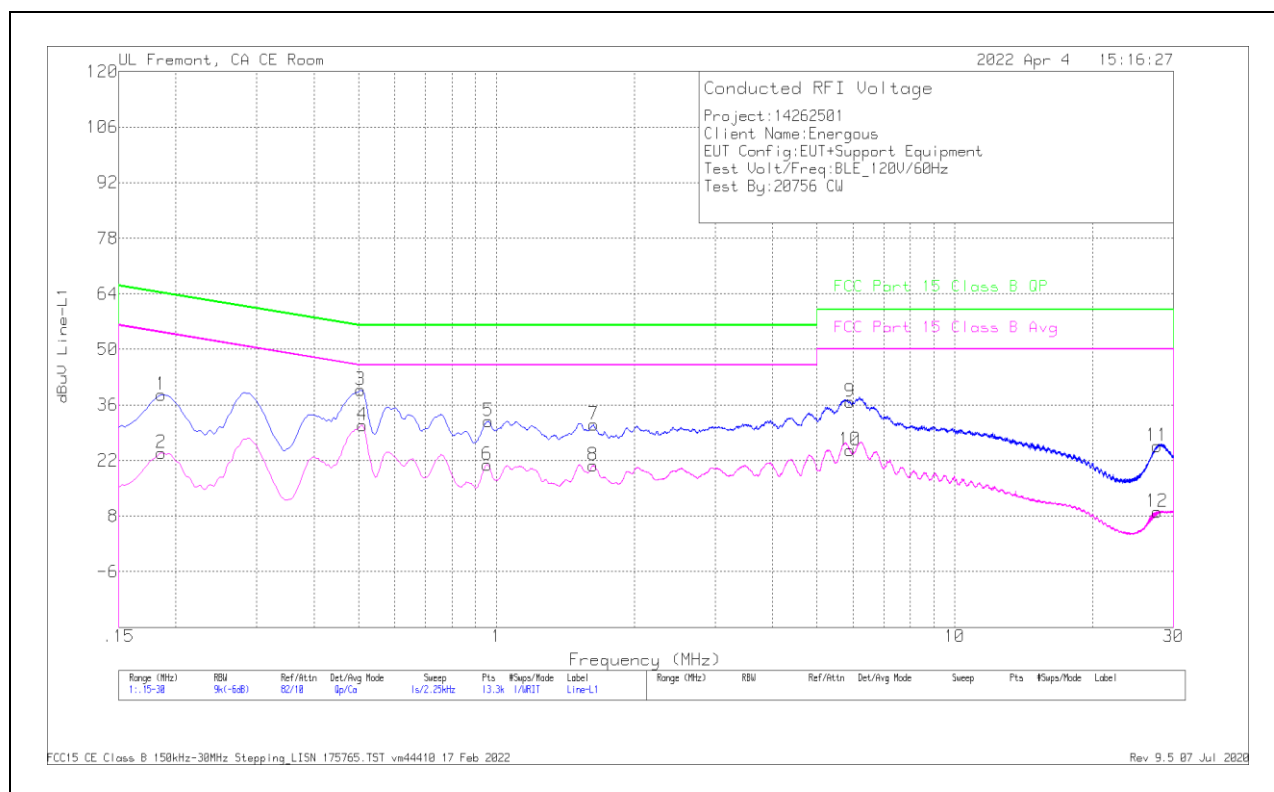
RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	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



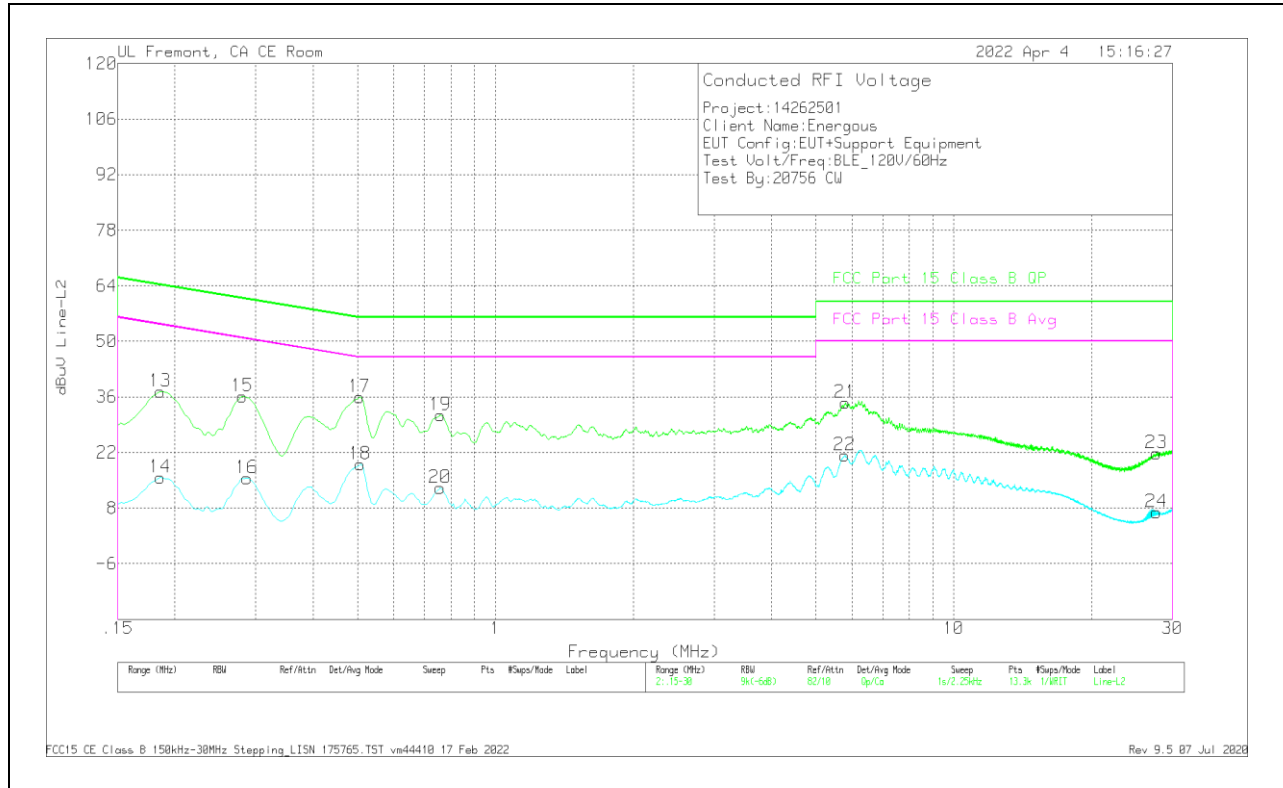
Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 LISN L1	C1&C3 cable	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)M argin (dB)
2	.186	14.41	Ca	.1	0	9.4	23.91	-	-	54.21	-30.3
4	.51	21.57	Ca	0	0	9.3	30.87	-	-	46	-15.13
6	.9555	11.59	Ca	0	.1	9.3	20.99	-	-	46	-25.01
8	1.62713	11.32	Ca	0	.1	9.3	20.72	-	-	46	-25.28
10	5.901	15.27	Ca	0	.1	9.3	24.67	-	-	50	-25.33
12	27.6495	-8	Ca	.2	.3	9.4	9.1	-	-	50	-40.9
1	.186	29.08	Qp	.1	0	9.4	38.58	64.21	-25.63	-	-
3	.5055	30.43	Qp	0	0	9.3	39.73	56	-16.27	-	-
5	.96225	22.46	Qp	0	.1	9.3	31.86	56	-24.14	-	-
7	1.62825	21.64	Qp	0	.1	9.3	31.04	56	-24.96	-	-
9	5.901	27.34	Qp	0	.1	9.3	36.74	60	-23.26	-	-
11	27.61575	15.69	Qp	.2	.3	9.4	25.59	60	-34.41	-	-

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 LISN L2	C2&C3 cable	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)M argin (dB)
14	.186	6.24	Ca	.1	0	9.4	15.74	-	-	54.21	-38.47
16	.28725	6.26	Ca	0	0	9.3	15.56	-	-	50.6	-35.04
18	.50775	9.74	Ca	0	0	9.3	19.04	-	-	46	-26.96
20	.7575	3.64	Ca	0	.1	9.3	13.04	-	-	46	-32.96
22	5.784	11.84	Ca	0	.1	9.3	21.24	-	-	50	-28.76
24	27.68325	-2.87	Ca	.2	.3	9.4	7.03	-	-	50	-42.97
13	.186	27.92	Qp	.1	0	9.4	37.42	64.21	-26.79	-	-
15	.2805	26.85	Qp	0	0	9.3	36.15	60.8	-24.65	-	-
17	.5055	26.63	Qp	0	0	9.3	35.93	56	-20.07	-	-
19	.75975	22.02	Qp	0	.1	9.3	31.42	56	-24.58	-	-
21	5.8065	25.15	Qp	0	.1	9.3	34.55	60	-25.45	-	-
23	27.68325	11.85	Qp	0	.3	9.4	21.75	60	-38.25	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection