



# **TEST REPORT**

**Report Number.:** 14093500-E2V2

**Applicant :** SONOS INC.  
614 CHAPALA ST.  
SANTA BARBARA, CA, 93101, U.S.A.

**Model :** S41

**Brand :** SONOS

**FCC ID :** SBVRM041

**IC :** 5373A-RM041

**EUT Description :** 802.11 a/b/g/n/ac/ax 2x2 Client Device with BT and BLE

**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:**

2022-10-24

**Prepared by:**

UL VERIFICATION SERVICES

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## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2022-10-13	Initial Issue	---
V2	2022-10-24	Updated Section 1 and 8	K.Kedida

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Sonos Inc.  
614 Chapala St.  
Santa Barbara, CA, 93101, U.S.A.

**EUT DESCRIPTION:** 802.11 a/b/g/n/ac/ax 2x2 Client Device with BT and BLE

**MODEL:** S41

**BRAND:** SONOS

**SERIAL NUMBER:** Radiated Sample: 528B4 and 6B90A  
Conducted Sample: 4304F

**SAMPLE RECEIPT DATE:** April 11, 2022

**DATE TESTED:** April 13 to May 06, 2022

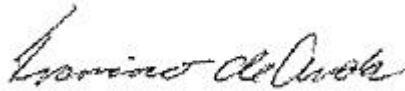
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + A1 + A2	Complies

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  
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Kiya Kedida  
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.

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	Compliant	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Compliant	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	Compliant	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Compliant	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Compliant	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Compliant	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
<input checked="" type="checkbox"/>	Building 1: 47173 Benicia Street Fremont, CA 94538, U.S.A	US0104	2324A	208313
<input type="checkbox"/>	Building 2: 47266 Benicia Street Fremont, CA 94538, U.S.A	US0104	22541	208313
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd Fremont, CA 94538, U.S.A	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 <sub>Lab</sub>
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	2.87 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 an 802.11 a/b/g/n/ac/ax 2x2 Client Device with BT and BLE.

This report covers BLE radio

### 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 (1Mbps)	11.14	13.00

### 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes a PCB antenna, with a maximum gain of 4 dBi.

### 6.4. SOFTWARE AND FIRMWARE

The EUT software used during testing was 69.1-26251-diag.

The test utility software used during testing was Command Line (CLI) method.

### 6.5. WORST-CASE CONFIGURATION AND MODE

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

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle, and high channels.

The EUT can only be setup in desktop orientation; therefore, all radiated testing was performed with the EUT in desktop orientation.

The worst-case data rate was determined to be as follow, based on input from the manufacturer of the radio.

BLE: 1 Mbps.

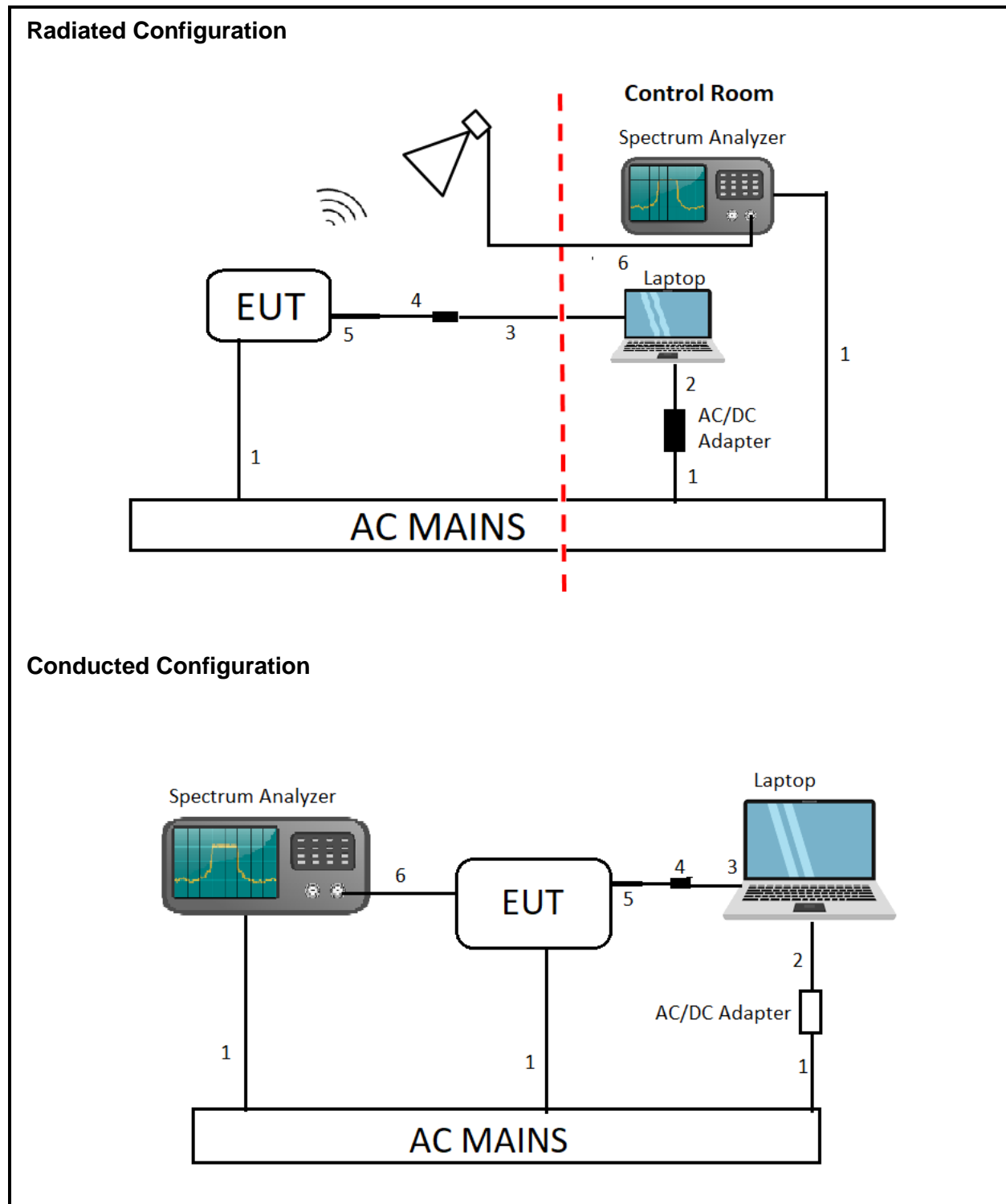
## 6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Laptop		Lenovo	T460s	PC0JMBF8		Doc
Laptop AC/DC Adapter		Lenovo	ADLX90NLC2A	11S45N0247Z1ZSHH448JEY		Doc
USB-A to Ethernet Adapter		Plugable	USB2-E100	8CAE4CE46AFA		Doc
USB-C to USB-A Female Adapter		Amazon Basics	L6LUC160-CS-R	N/A		Doc
I/O CABLES (CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	3	AC	Un-shielded	1.25	AC Mains to EUT/Spectrum Analyzer/AC/DC Adapter
2	DC	1	DC	Un-shielded	1	AC/DC Adapter to Laptop
3	Ethernet	1	RJ45	Un-shielded	1.5	Laptop to USB Ethernet Adapter
4	USB-A	1	USB-A	Shielded	0.05	USB EthernetAdapter to USB
5	USB-C	1	USB-C	Shielded	0.05	EUT to USB-C/USB-A Female Adapter
6	SMA Cable	1	SMA	Un-Shielded	0.1	EUT to Spectrum Analyzer
I/O CABLES (RADIATED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	3	AC	Un-shielded	1.25	AC Mains to EUT/Spectrum Analyzer/AC/DC Adapter
2	DC	1	DC	Un-shielded	1	AC/DC Adapter to Laptop
3	Ethernet	1	RJ45	Un-shielded	10	Laptop to USB Ethernet Adapter
4	USB-A	1	USB-A	Shielded	0.05	USB EthernetAdapter to USB
5	USB-C	1	USB-C	Shielded	0.05	EUT to USB-C/USB-A Female Adapter
6	SMA Cable	1	SMA	Un-Shielded	10	EUT to Horn Antenna

### TEST SETUP

The EUT is a stand-alone unit, and the radio is exercised remotely by Command Line test utility software via ethernet.

## SETUP DIAGRAM



## 7. MEASUREMENT METHOD

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

6 dB BW: ANSI C63.10 Subclause -11.8.1     $RBW \geq DTS \text{ BW}$

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 Section 6.10

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, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	171862	2022-09-28	2021-09-28
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310N	29654	2023-04-24	2022-04-24
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	T119	2022-05-07*	2021-05-07
RF Filter Box, 1-18GHz	FREMONT	SAC-L1	171013	2023-03-09	2022-03-09
EMI TEST RECEIVER, with B8 option	Rohde & Schwarz	ESW44	PRE0179377	2023-02-20	2022-02-20
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201499	2023-02-17	2022-02-17
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	172363	2022-12-07	2021-12-07
Amplifier 18-26.5GHz, +5Vdc, -54dBm P1dB	AMPLICAL	AMP18G26.5-60	171583	2023-01-27	2022-01-27
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	SC-8015	2022-05-24*	2021-05-24
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	SC-8014	2022-05-24*	2021-05-24
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent Technologies	N9030A	80396	2023-01-02	2022-01-02
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1268	2023-02-03	2022-02-03
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	90419	2023-03-02	2022-03-02
AC Line Conducted					
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	175765	2023-01-25	2022-01-25
EMI TEST RECEIVER	Rohde & Schwarz	ESR	93091	2023-02-21	2022-02-21
Transient Limiter	TE	TBFL1	207996	2022-06-01	2021-06-01
UL TEST SOFTWARE LIST					
Radiated Software	UL	UL EMC	Ver 2022-07-06		
Antenna Port Software	UL	UL RF	Ver 2022.5.31		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, 2022-02-17		

\*Test performed before calibration expired.

## 9. ANTENNA PORT TEST RESULTS

### 9.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

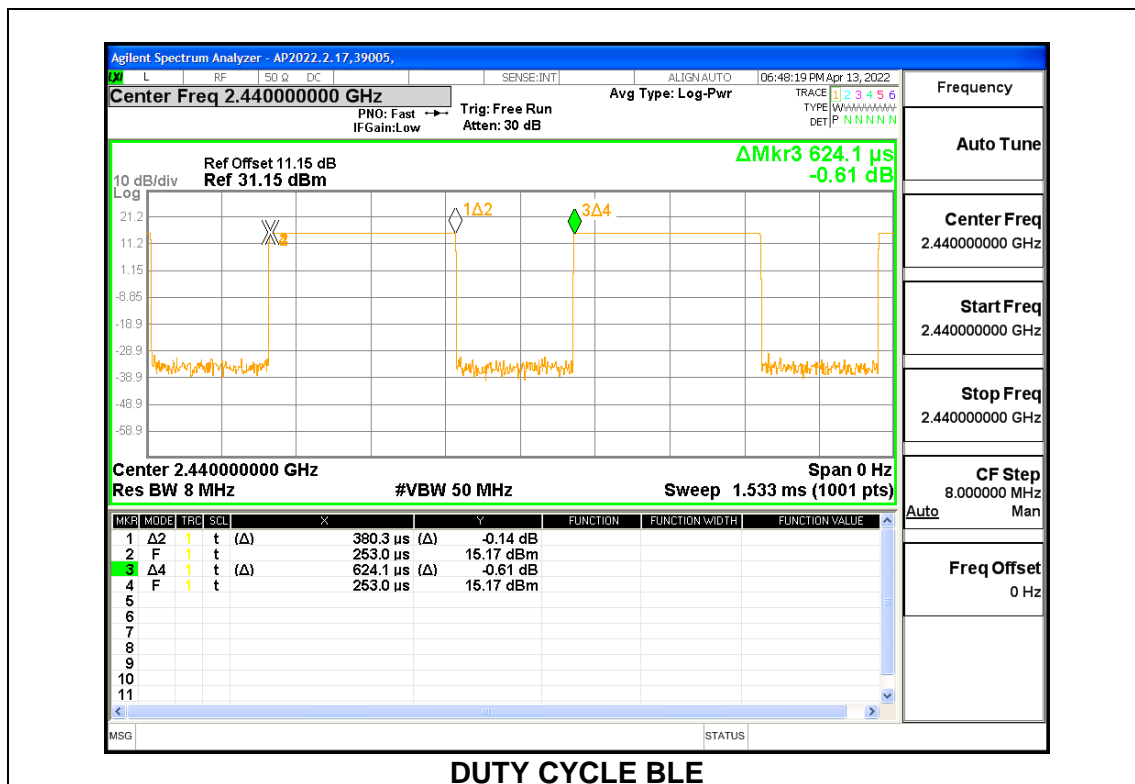
#### PROCEDURE

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 (1Mbps)	0.380	0.624	0.609	60.94	2.15	2.630

#### DUTY CYCLE PLOTS



## 9.2. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0341
Middle	2440	1.0352
High	2480	1.0336





### 9.3. 6 dB BANDWIDTH

#### LIMITS

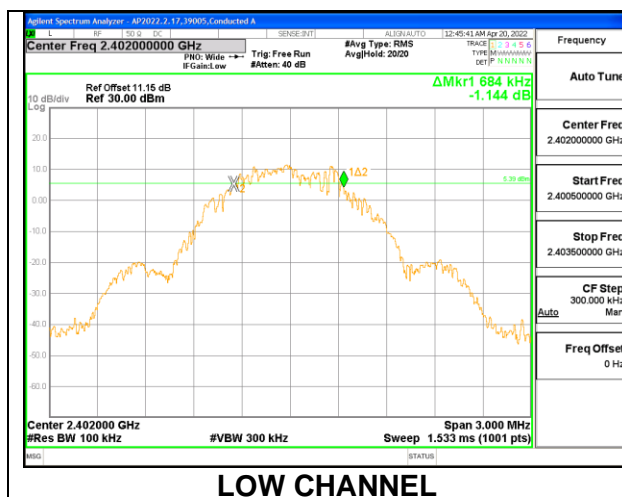
FCC §15.247 (a) (2)

RSS-247 5.2 (a)

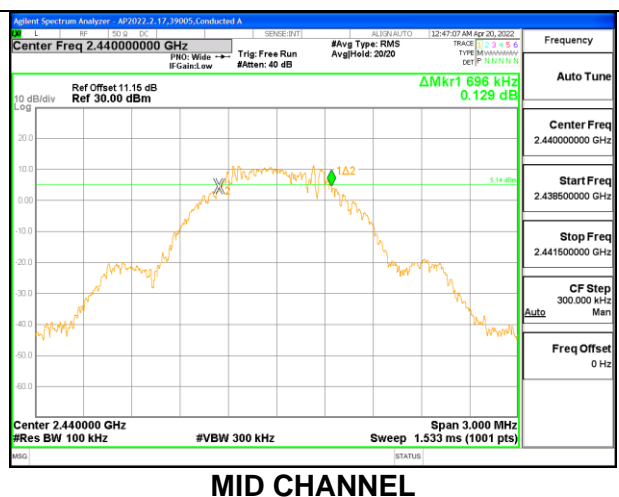
The minimum 6 dB bandwidth shall be at least 500 kHz.

#### RESULTS

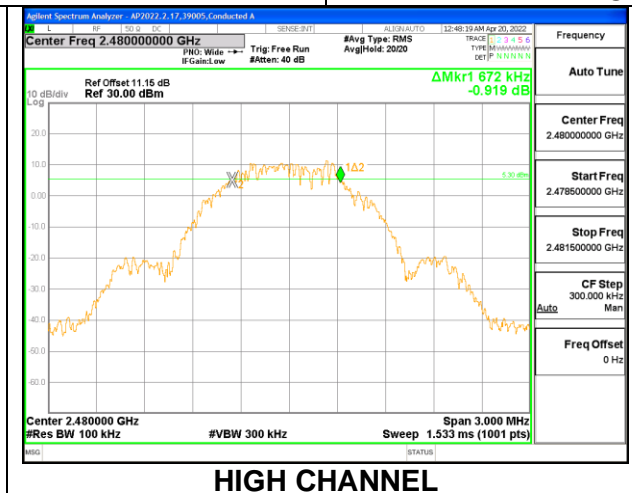
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.684	0.5
Middle	2440	0.696	0.5
High	2480	0.672	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

## 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

<b>Tested By:</b>	RA39005
<b>Date:</b>	4/21/2022

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Power Reading (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
Low	2402	11.13	30	-18.870
Middle	2440	11.14	30	-18.860
High	2480	10.86	30	-19.140

## 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

<b>Tested By:</b>	RA39005
<b>Date:</b>	4/21/2022

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>AV power (dBm)</b>
Low	2402	10.89
Middle	2440	10.91
High	2480	10.81

## 9.6. POWER SPECTRAL DENSITY

### LIMITS

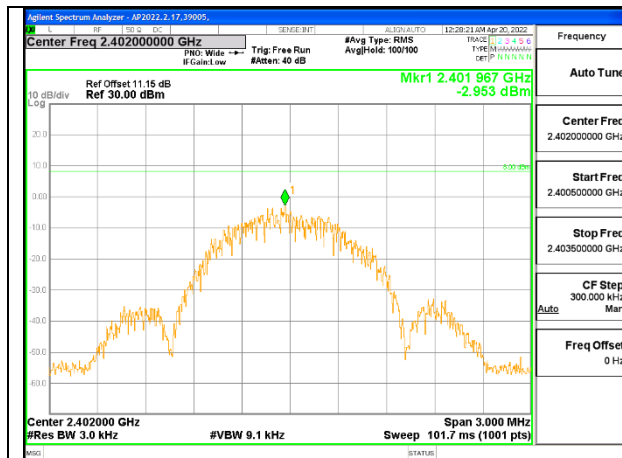
FCC §15.247 (e)

RSS-247 (5.2) (b)

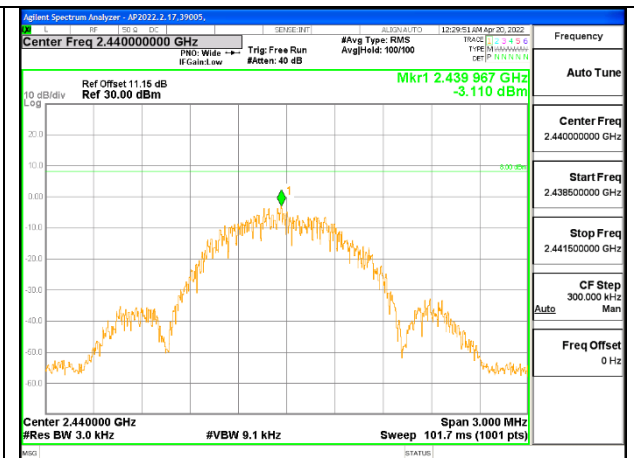
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### RESULTS

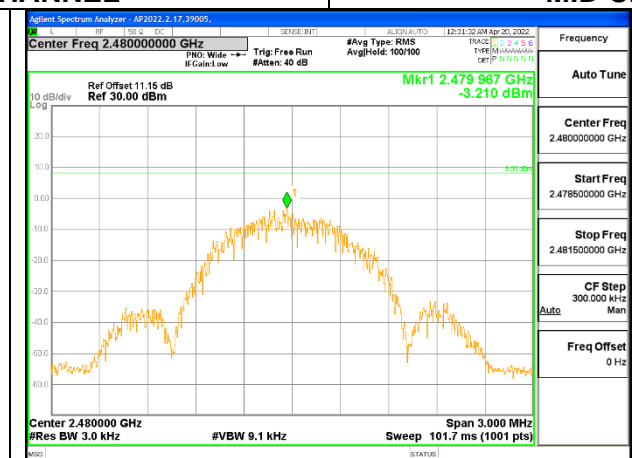
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-2.953	8	-10.95
Middle	2440	-3.110	8	-11.11
High	2480	-3.210	8	-11.21



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

## **9.7. CONDUCTED SPURIOUS EMISSIONS**

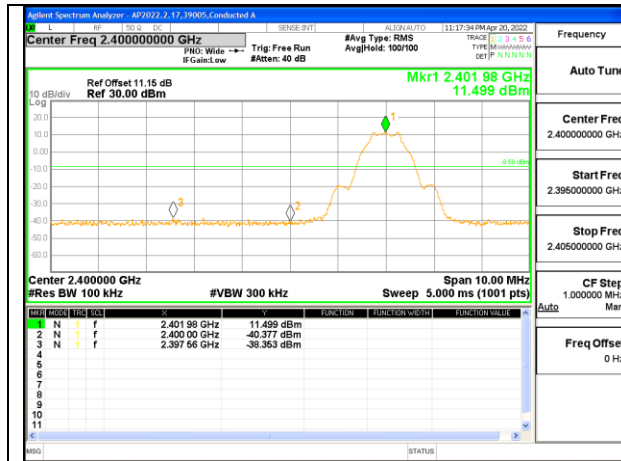
### **LIMITS**

FCC §15.247 (d)

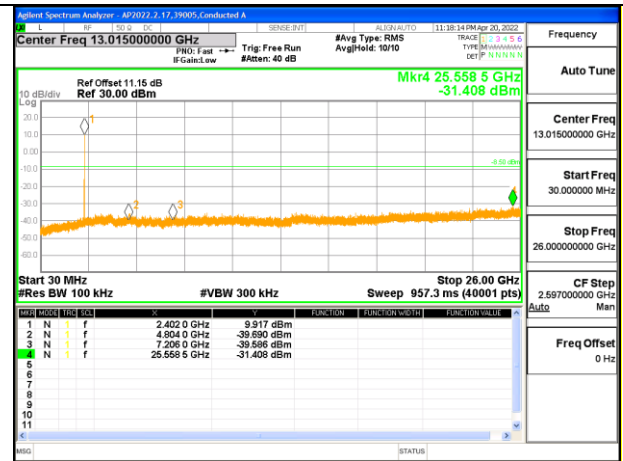
RSS-247 5.5

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

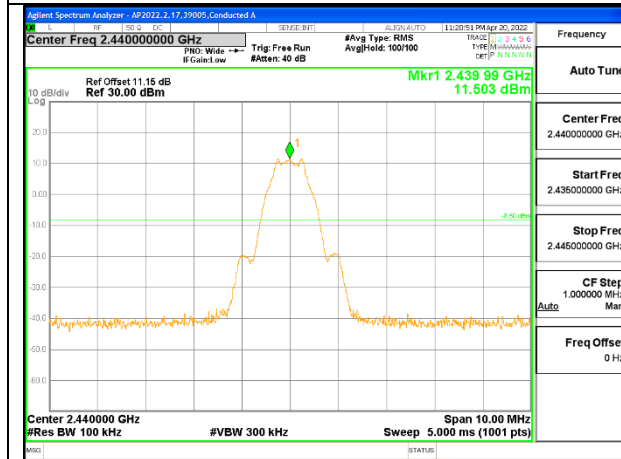
### **RESULTS**



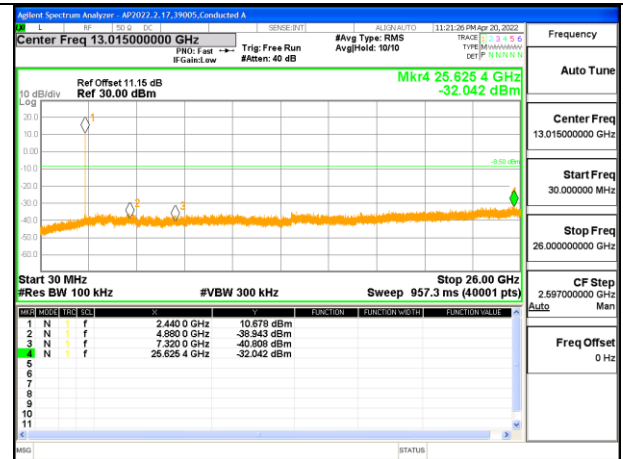
**LOW CHANNEL BANDEDGE**



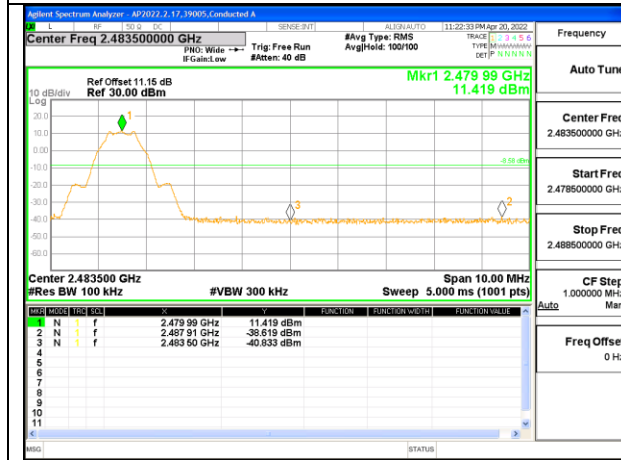
**OUT-OF-BAND LOW CHANNEL**



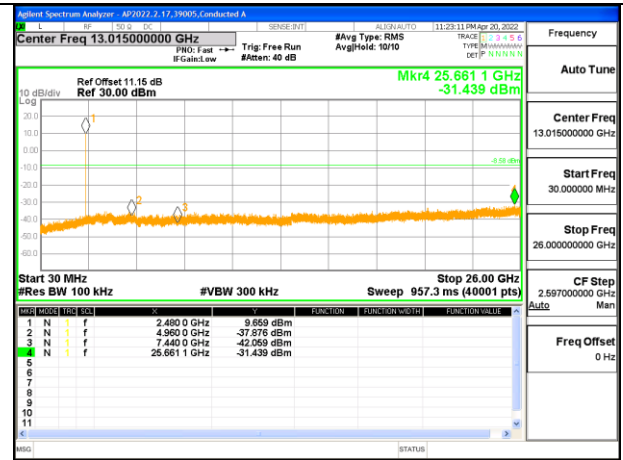
**IN-BAND REFERENCE LEVEL**



**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

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. Peak detection is used unless otherwise noted as quasi-peak.

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.

2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

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.

**KB 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.

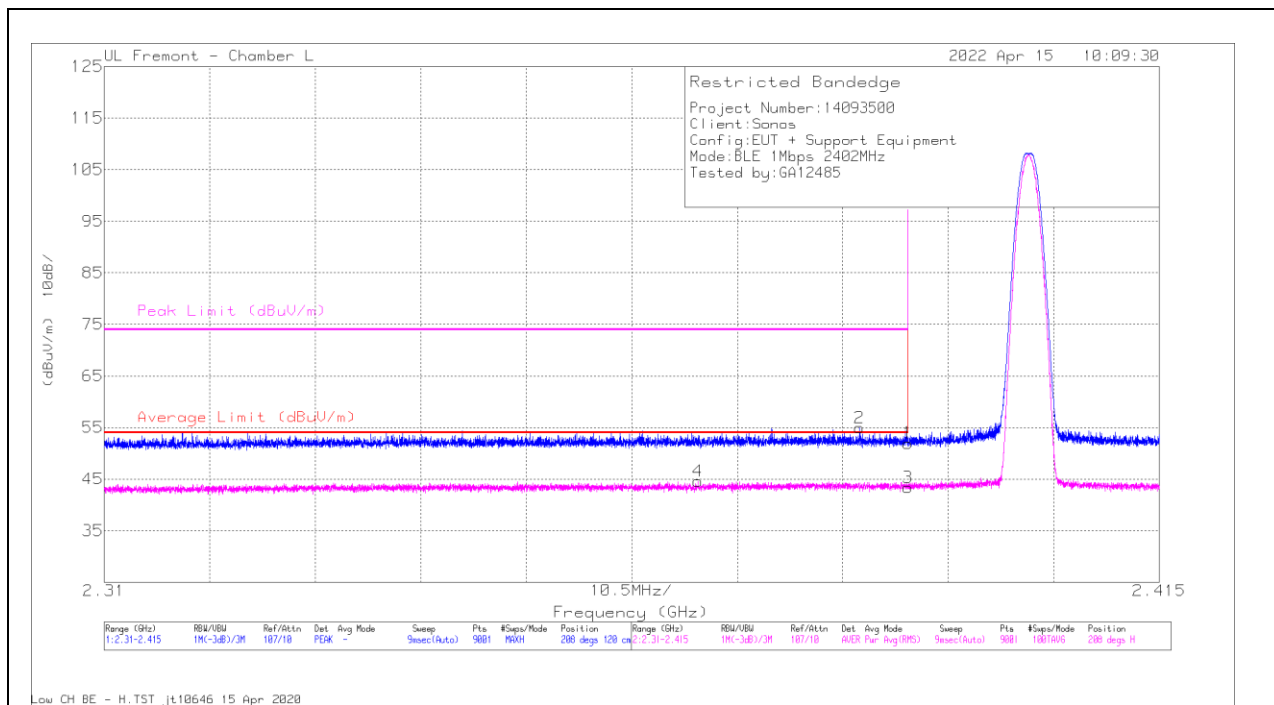


## 10.2. TRANSMITTER ABOVE 1 GHz

### Antenna 1

### BANDEDGE (LOW CHANNEL)

### HORIZONTAL RESULT



### Trace Markers

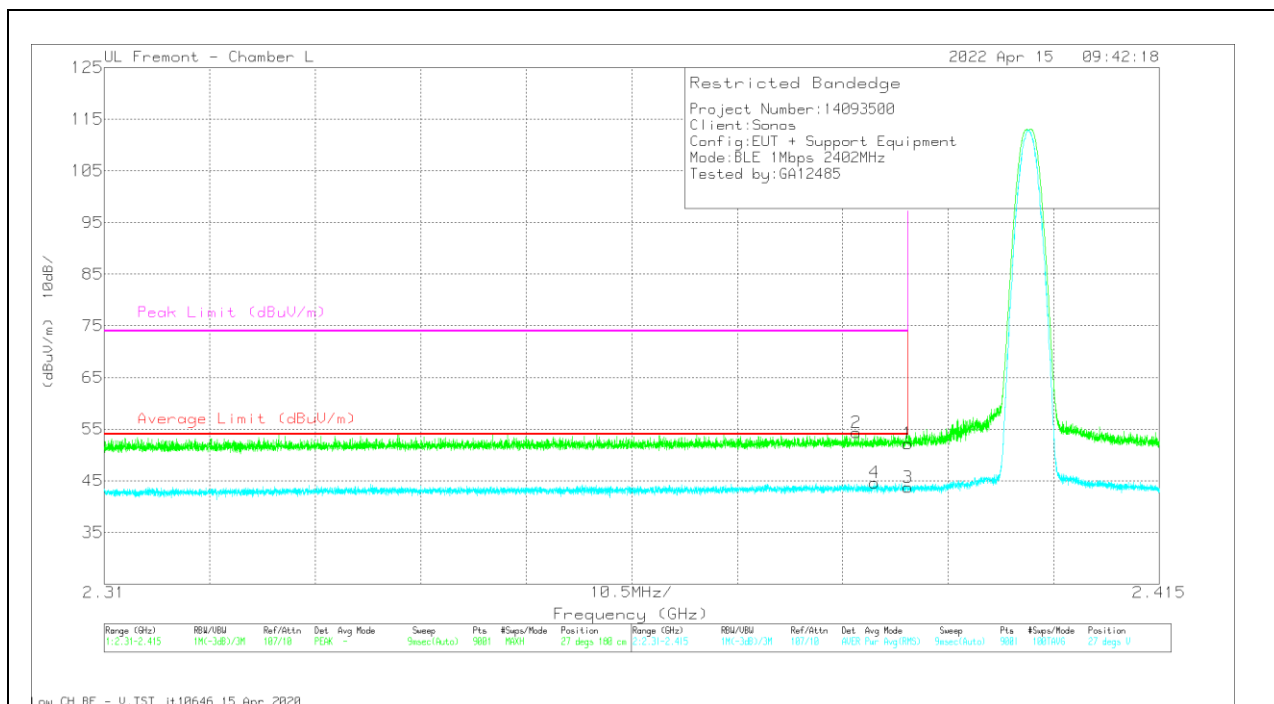
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.23	Pk	32	-19.3	0	51.93	-	-	74	-22.07	208	120	H
2	* 2.385147	42.23	Pk	32.1	-19.4	0	54.93	-	-	74	-19.07	208	120	H
3	* 2.39	28.5	RMS	32	-19.3	2.15	43.35	54	-10.65	-	-	208	120	H
4	* 2.36907	29.84	RMS	32	-19.4	2.15	44.59	54	-9.41	-	-	208	120	H

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

Pk - Peak detector

RMS - RMS detection

## VERTICAL RESULT



## Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/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	* 2.39	39.5	Pk	32	-19.3	0	52.2	-	-	74	-21.8	27	180	V
2	* 2.384832	41.53	Pk	32.1	-19.3	0	54.33	-	-	74	-19.67	27	180	V
3	* 2.39	28.87	RMS	32	-19.3	2.15	43.72	54	-10.28	-	-	27	180	V
4	* 2.386652	29.79	RMS	32.1	-19.4	2.15	44.64	54	-9.36	-	-	27	180	V

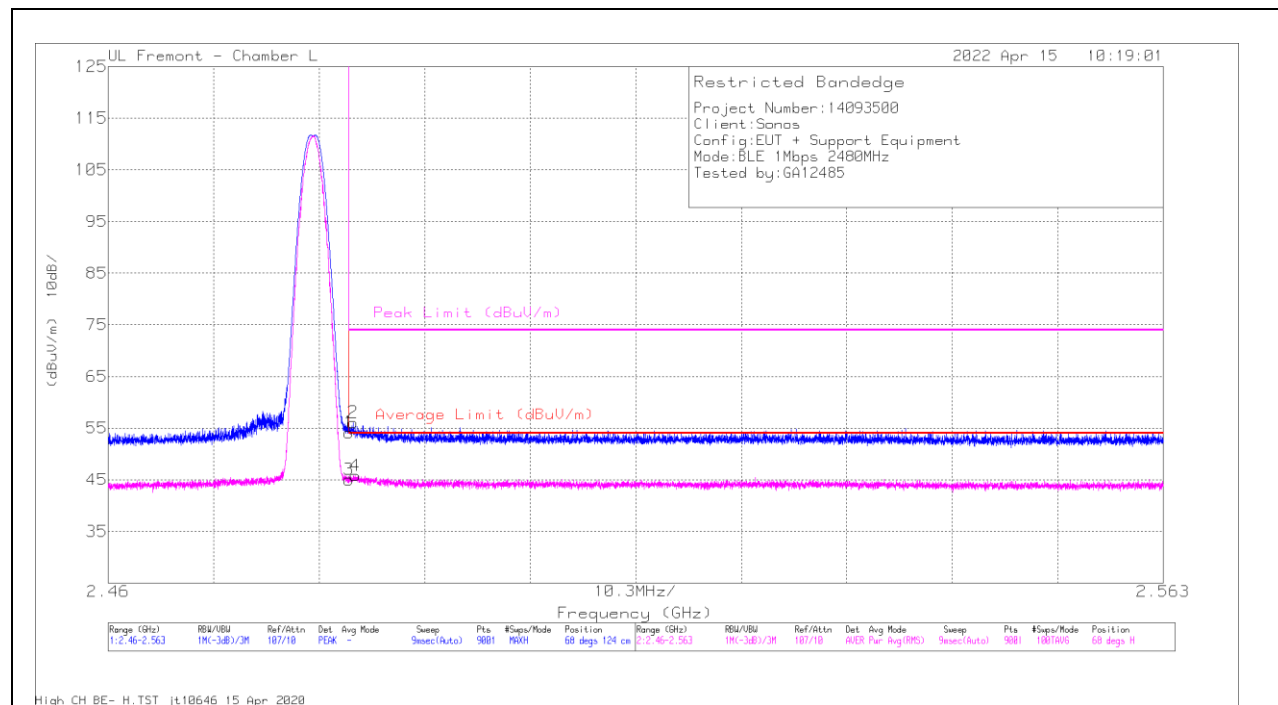
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

## BANDEDGE (HIGH CHANNEL)

### HORIZONTAL RESULT



### Trace Markers

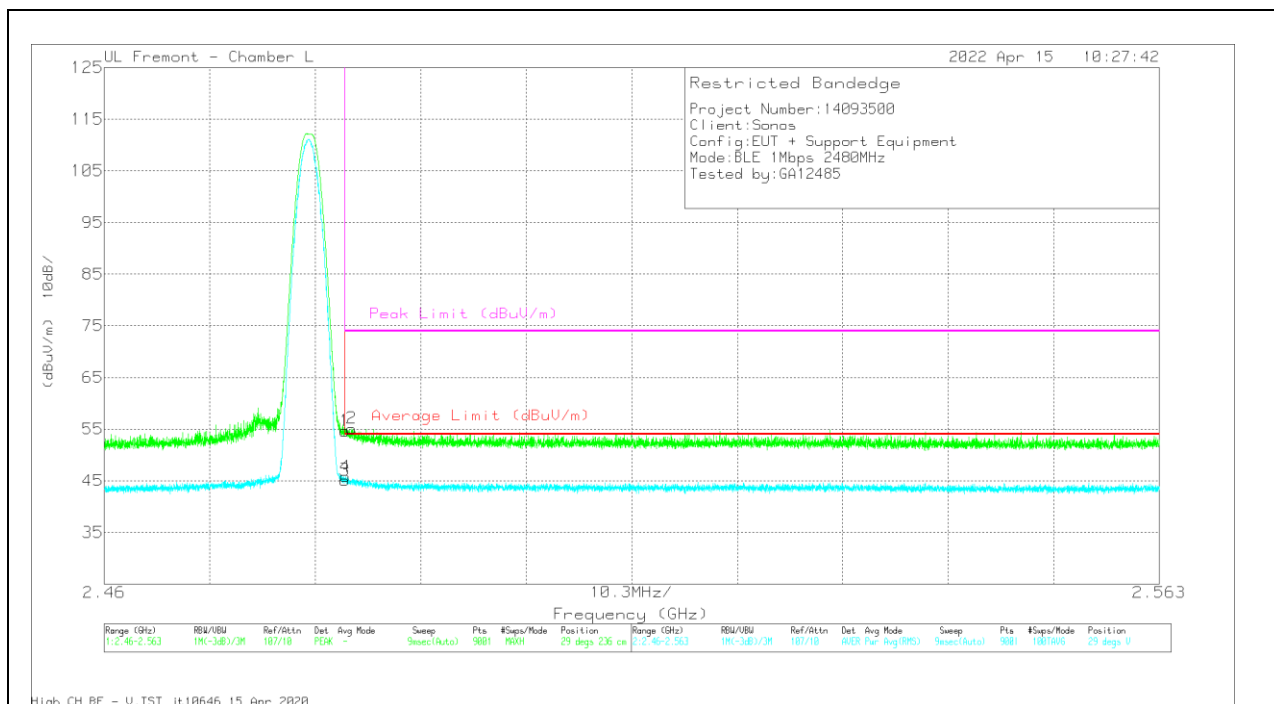
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	40.83	Pk	32.3	-19	0	54.13	-	-	74	-19.87	68	124	H
2	* 2.483907	42.77	Pk	32.3	-19	0	56.07	-	-	74	-17.93	68	124	H
3	* 2.4835	29.57	RMS	32.3	-19	2.15	45.02	54	-8.98	-	-	68	124	H
4	* 2.484124	30.36	RMS	32.3	-19	2.15	45.81	54	-8.19	-	-	68	124	H

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

Pk - Peak detector

RMS - RMS detection

## VERTICAL RESULT



## Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/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	41.37	Pk	32.3	-19	0	54.67	-	-	74	-19.33	29	236	V
2	* 2.484181	41.83	Pk	32.3	-19	0	55.13	-	-	74	-18.87	29	236	V
3	* 2.4835	29.65	RMS	32.3	-19	2.15	45.1	54	-8.9	-	-	29	236	V
4	* 2.483529	30.36	RMS	32.3	-19	2.15	45.81	54	-8.19	-	-	29	236	V

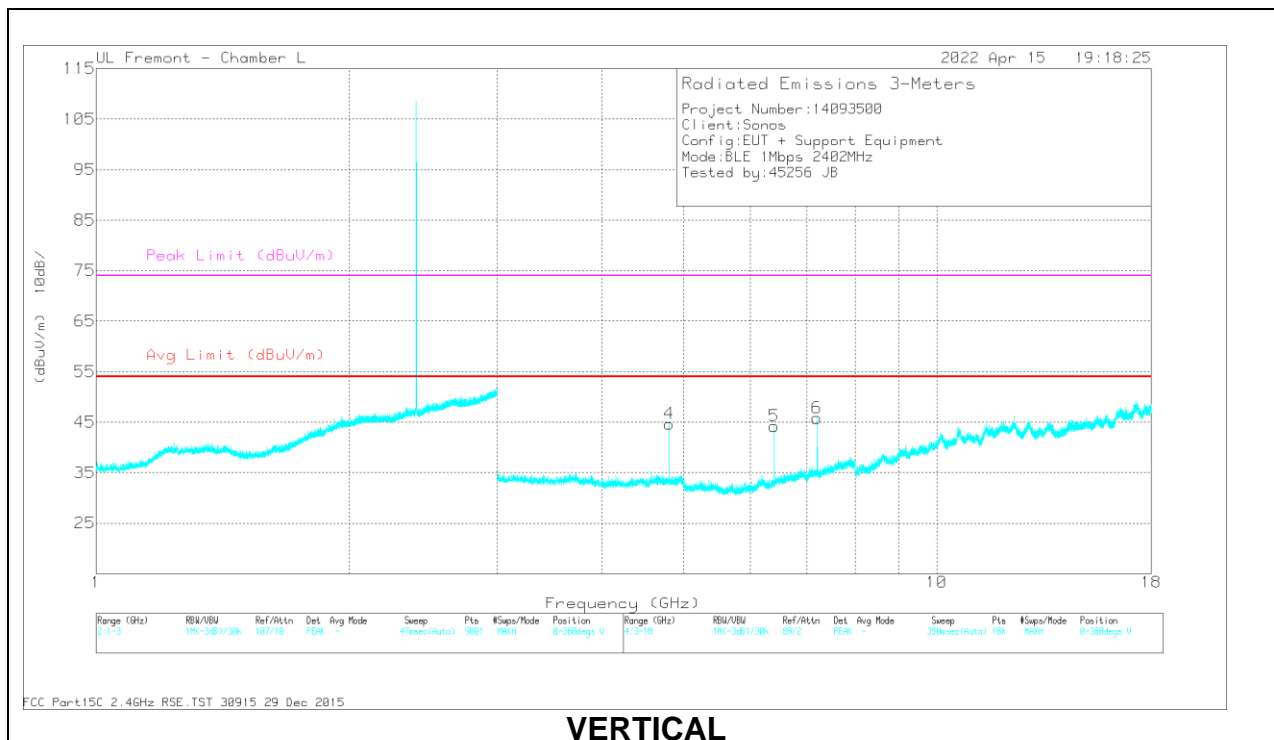
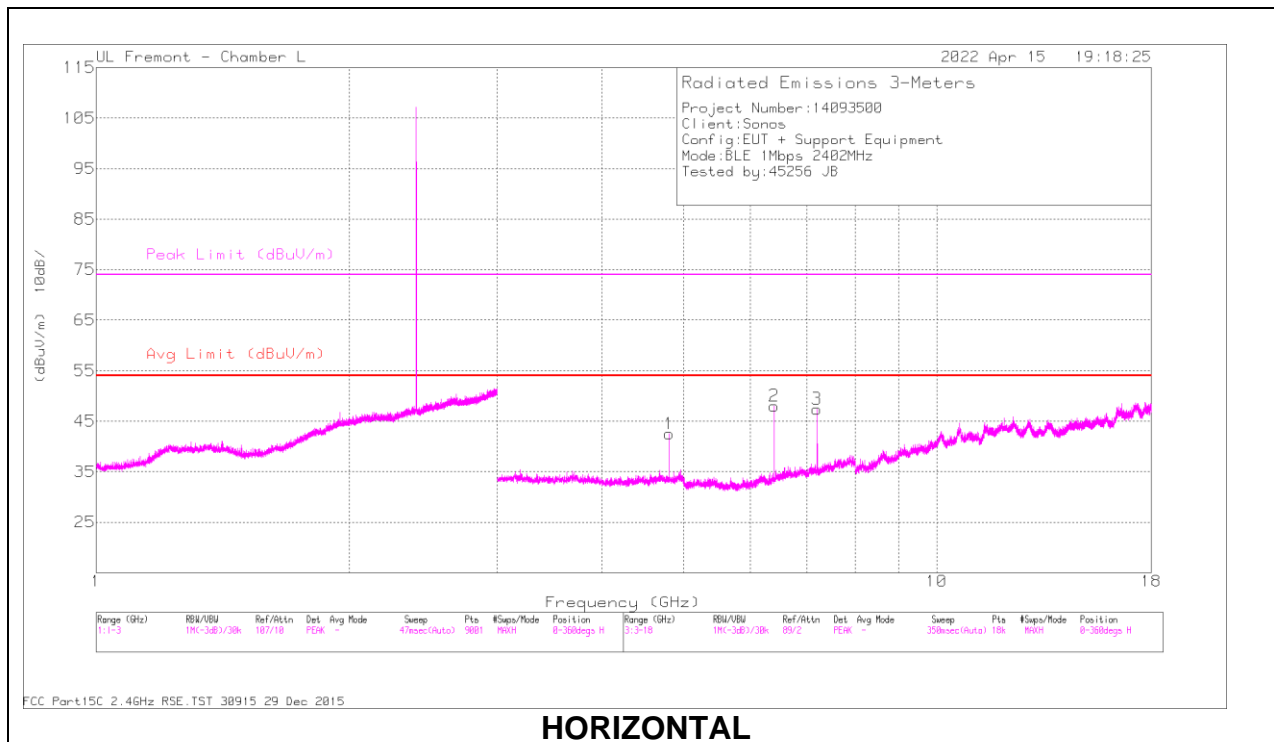
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

## HARMONICS AND SPURIOUS EMISSIONS

### LOW CHANNEL RESULTS



## RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 4.803534	41.65	PK2	34.1	-24.5	0	51.25	-	-	74	-22.75	102	113	H
	* 4.803738	32.59	MAv1	34.1	-24.5	2.15	44.34	54	-9.66	-	-	102	113	H
2	6.405191	33.7	Pk	35.7	-21.4	0	48	-	-	-	-	0-360	101	H
3	7.205326	40.34	PK2	35.6	-20.1	0	55.84	-	-	-	-	350	106	H
	7.205174	32.34	MAv1	35.5	-20.1	2.15	49.89	-	-	-	-	350	106	H
4	* 4.803794	40.93	PK2	34.1	-24.5	0	50.53	-	-	74	-23.47	360	103	V
	* 4.803754	32.42	MAv1	34.1	-24.5	2.15	44.17	54	-9.83	-	-	360	103	V
5	6.405191	29.92	Pk	35.7	-21.4	0	44.22	-	-	-	-	0-360	101	V
6	7.206716	38.71	PK2	35.5	-20.2	0	54.01	-	-	-	-	147	104	V
	7.205298	30.59	MAv1	35.6	-20.1	2.15	48.24	-	-	-	-	147	104	V

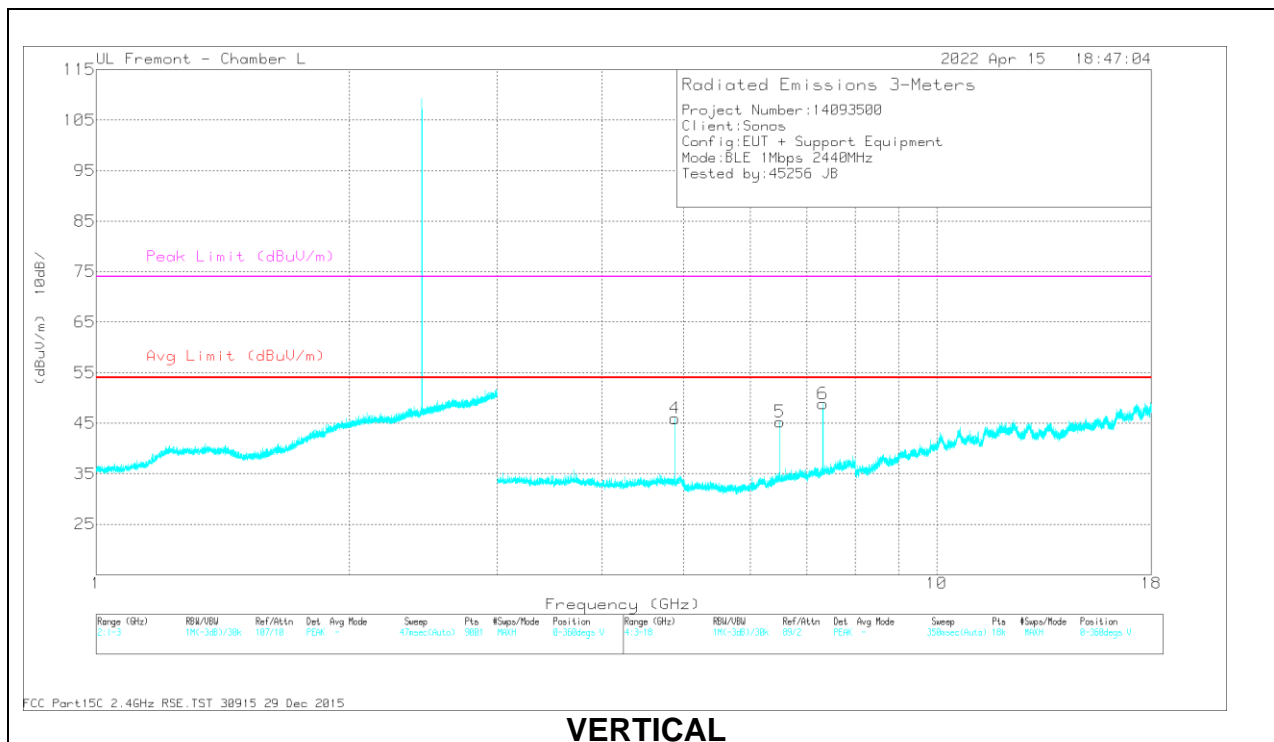
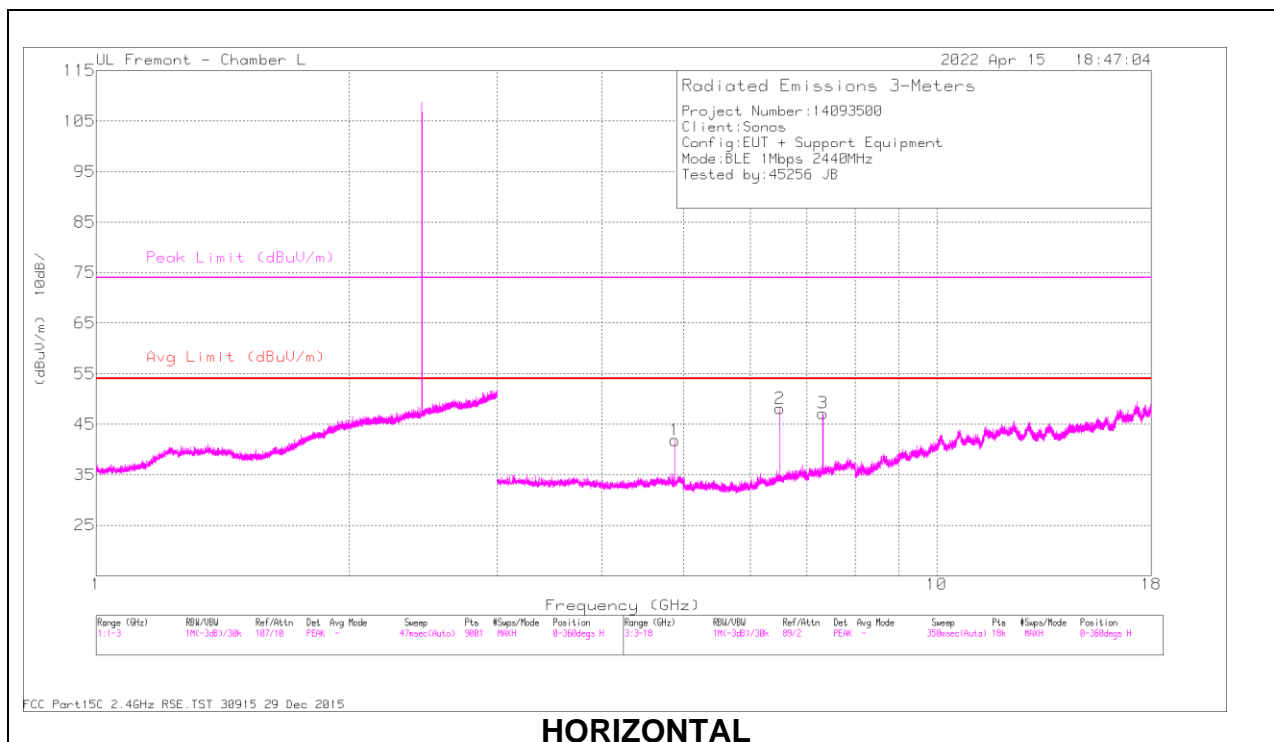
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

## MID CHANNEL RESULTS



## RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 4.879568	40.09	PK2	34.2	-24.4	0	49.89	-	-	74	-24.11	104	104	H
	* 4.879572	31.06	MAv1	34.2	-24.4	2.15	43.01	54	-10.99	-	-	104	104	H
2	6.50603	33.91	Pk	35.8	-21.6	0	48.11	-	-	-	-	0-360	101	H
3	* 7.319101	40.98	PK2	35.6	-20.1	0	56.48	-	-	74	-17.52	40	108	H
	* 7.319353	33.63	MAv1	35.6	-20.1	2.15	51.28	54	-2.72	-	-	40	108	H
4	* 4.880415	44.23	PK2	34.2	-24.4	0	54.03	-	-	74	-19.97	121	111	V
	* 4.879975	36.63	MAv1	34.2	-24.4	2.15	48.58	54	-5.42	-	-	121	111	V
5	6.50603	31.06	Pk	35.8	-21.6	0	45.26	-	-	-	-	0-360	101	V
6	* 7.319163	41.1	PK2	35.6	-20.1	0	56.6	-	-	74	-17.4	185	109	V
	* 7.319227	34.31	MAv1	35.6	-20.1	2.15	51.96	54	-2.04	-	-	185	109	V

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

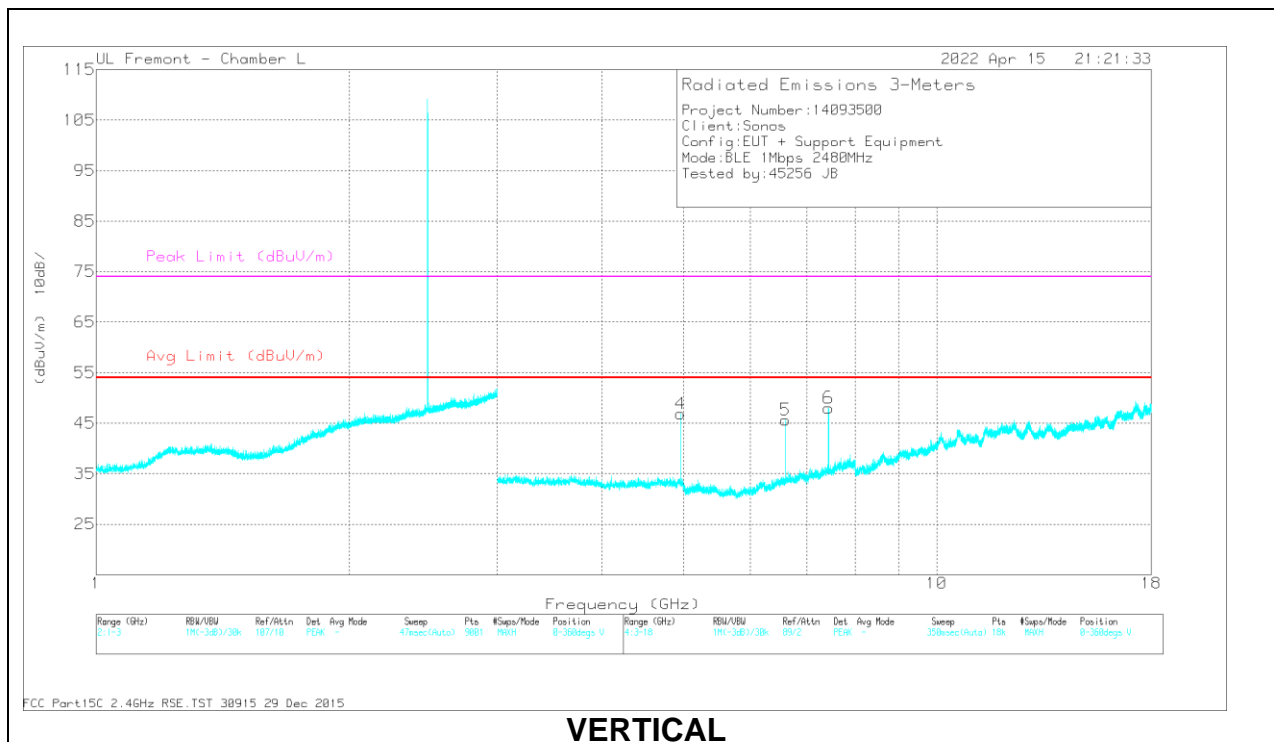
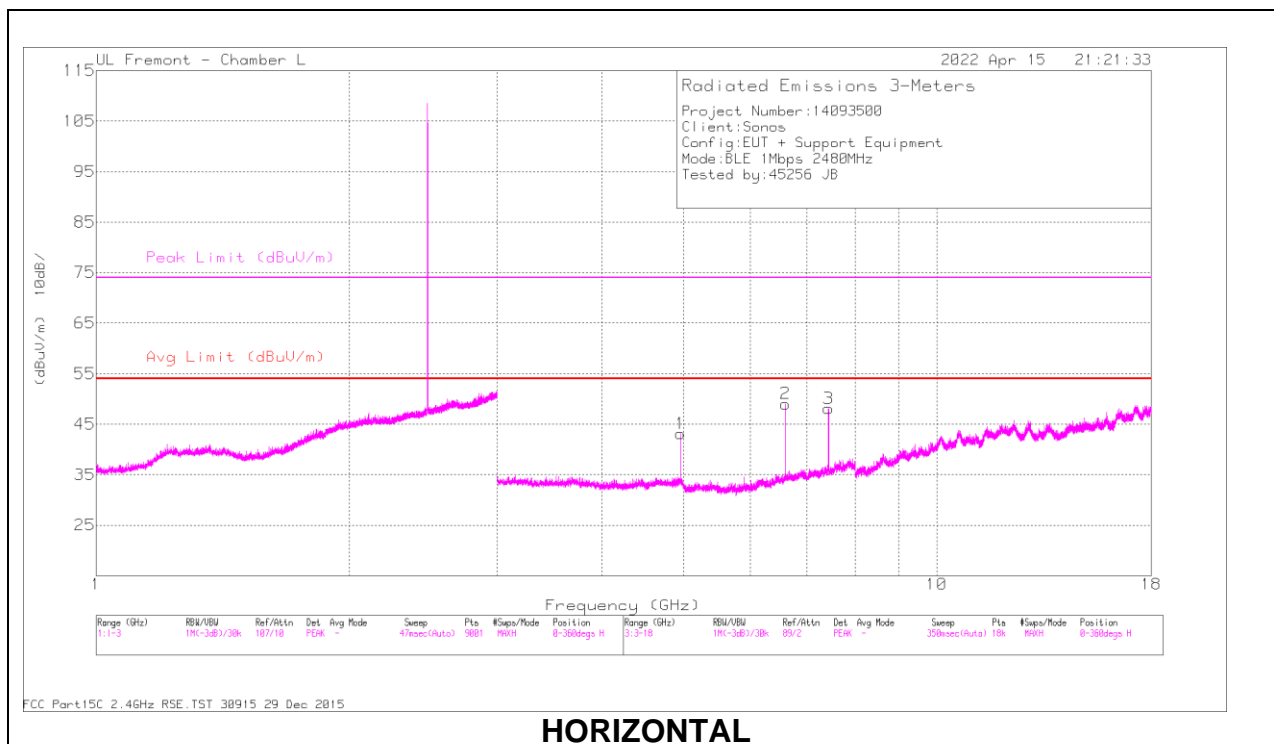
Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



## HIGH CHANNEL RESULTS



## RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 4.956256	40.88	PK2	34.2	-23.2	0	51.88	-	-	74	-22.12	110	112	H
	* 4.955877	32.62	MAv1	34.2	-23.2	2.15	45.77	54	-8.23	-	-	110	112	H
2	6.607702	34.55	Pk	35.7	-21.2	0	49.05	-	-	-	-	0-360	101	H
3	* 7.43371	41.81	PK2	35.7	-19.9	0	57.61	-	-	74	-16.39	40	110	H
	* 7.433486	34.22	MAv1	35.7	-19.9	2.15	52.17	54	-1.83	-	-	40	110	H
4	* 4.956418	43.42	PK2	34.2	-23.2	0	54.42	-	-	74	-19.58	123	112	V
	* 4.955983	36.55	MAv1	34.2	-23.2	2.15	49.7	54	-4.3	-	-	123	112	V
5	6.607702	31.13	Pk	35.7	-21.2	0	45.63	-	-	-	-	0-360	101	V
6	* 7.433614	39.75	PK2	35.7	-19.9	0	55.55	-	-	74	-18.45	185	101	V
	* 7.433334	32.27	MAv1	35.7	-19.9	2.15	50.22	54	-3.78	-	-	185	101	V

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

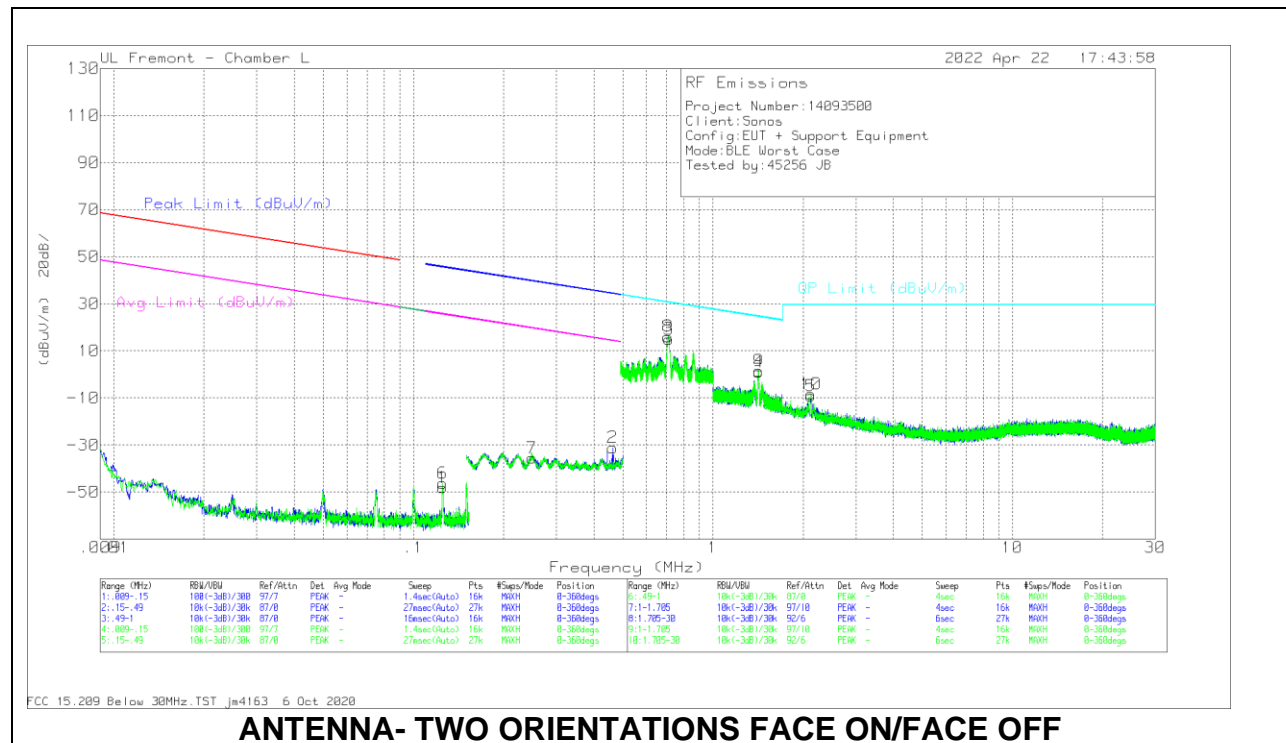
Pk - Peak detector

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)



### ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

### Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Polarity
1	.125	8.04	Pk	55.8	-32	-80	-48.16	45.69	-93.85	25.69	-73.85	0-360	Face-On
2	.4626	24.67	Pk	56.2	-32	-80	-31.13	34.3	-65.43	14.3	-45.43	0-360	Face-On
6	.1252	9.92	Pk	55.8	-32	-80	-46.28	45.68	-91.96	25.68	-71.96	0-360	Face-Off
7	.2485	20.16	Pk	56.3	-32	-80	-35.54	39.71	-75.25	19.71	-55.25	0-360	Face-Off

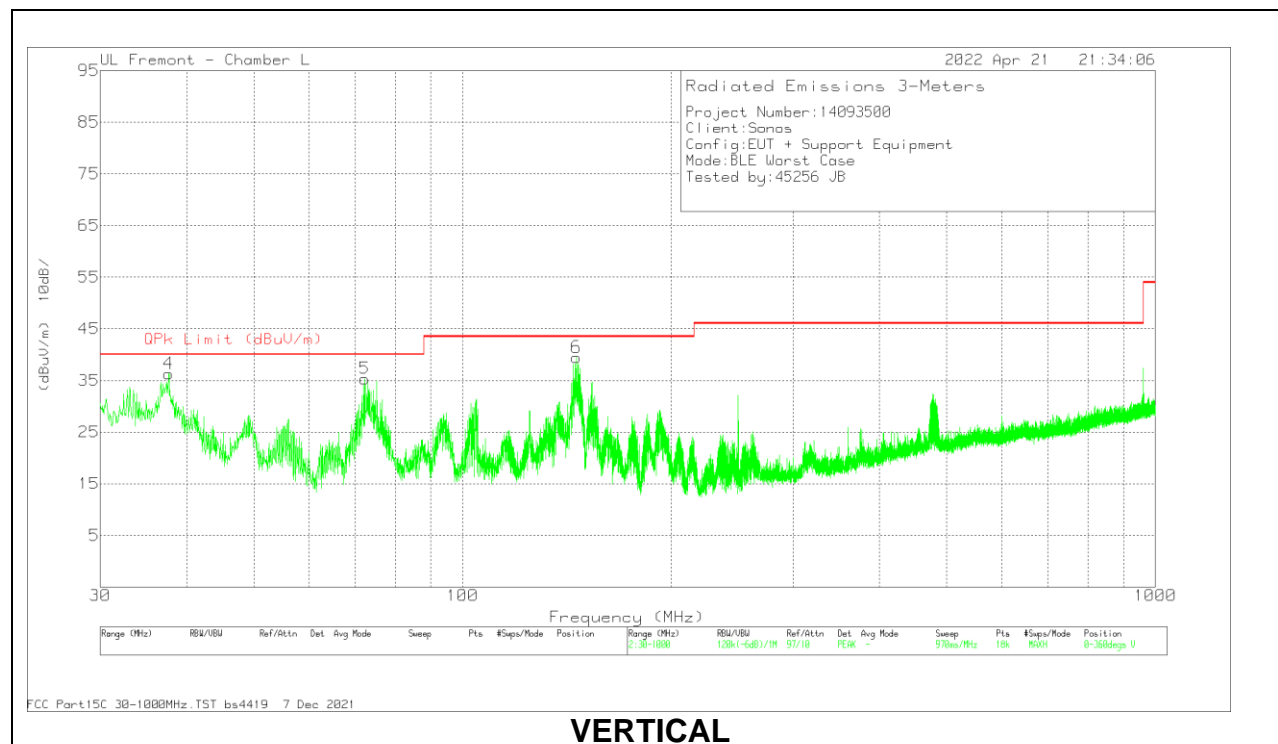
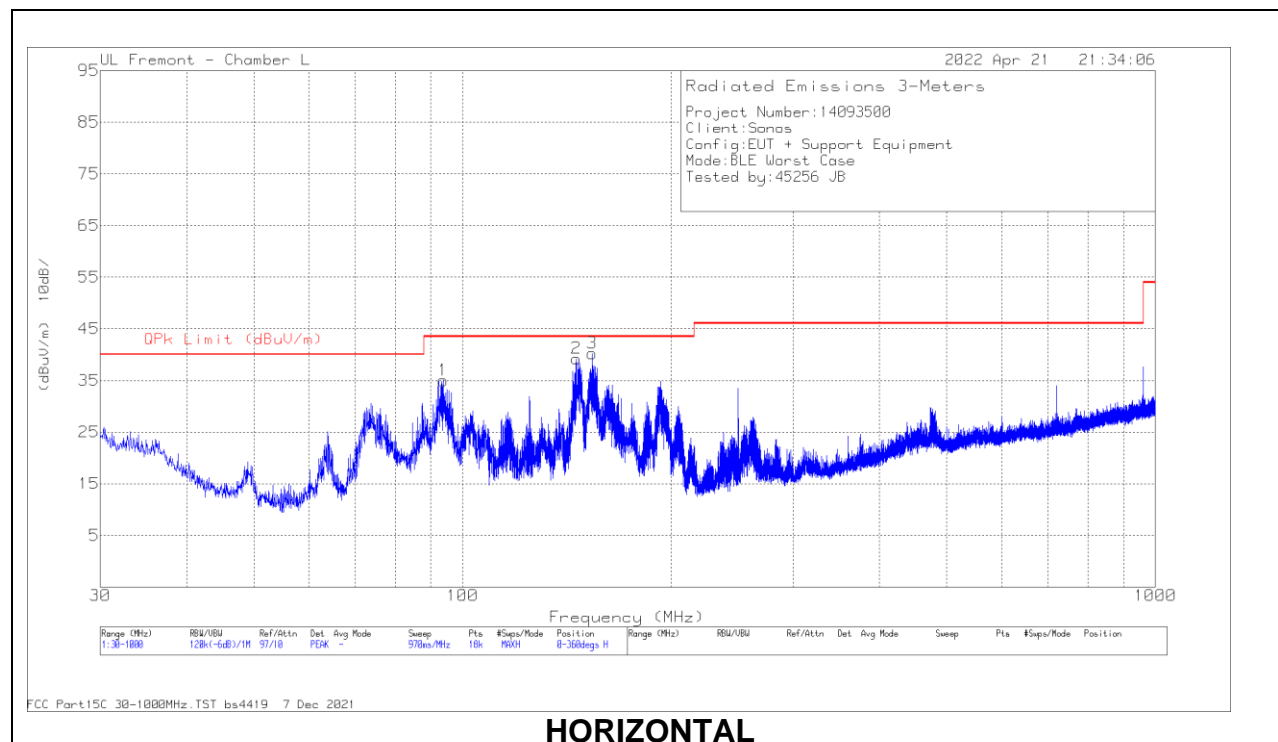
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Polarity
3	.7129	30.69	Pk	56.2	-31.9	-40	14.99	30.55	-15.56	0-360	Face-On
8	.7078	31.79	Pk	56.2	-31.9	-40	16.09	30.62	-14.53	0-360	Face-Off
4	1.42	28.18	Pk	44.7	-31.9	-40	.98	24.58	-23.6	0-360	Face-On
5	2.1253	21.44	Pk	41.2	-31.8	-40	-9.16	29.5	-38.66	0-360	Face-On
9	1.4196	28.67	Pk	44.7	-31.9	-40	1.47	24.59	-23.12	0-360	Face-Off
10	2.1253	22.24	Pk	41.2	-31.8	-40	-8.36	29.5	-37.86	0-360	Face-Off

Pk - Peak detector

## 10.4. WORST CASE BELOW 1 GHz

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



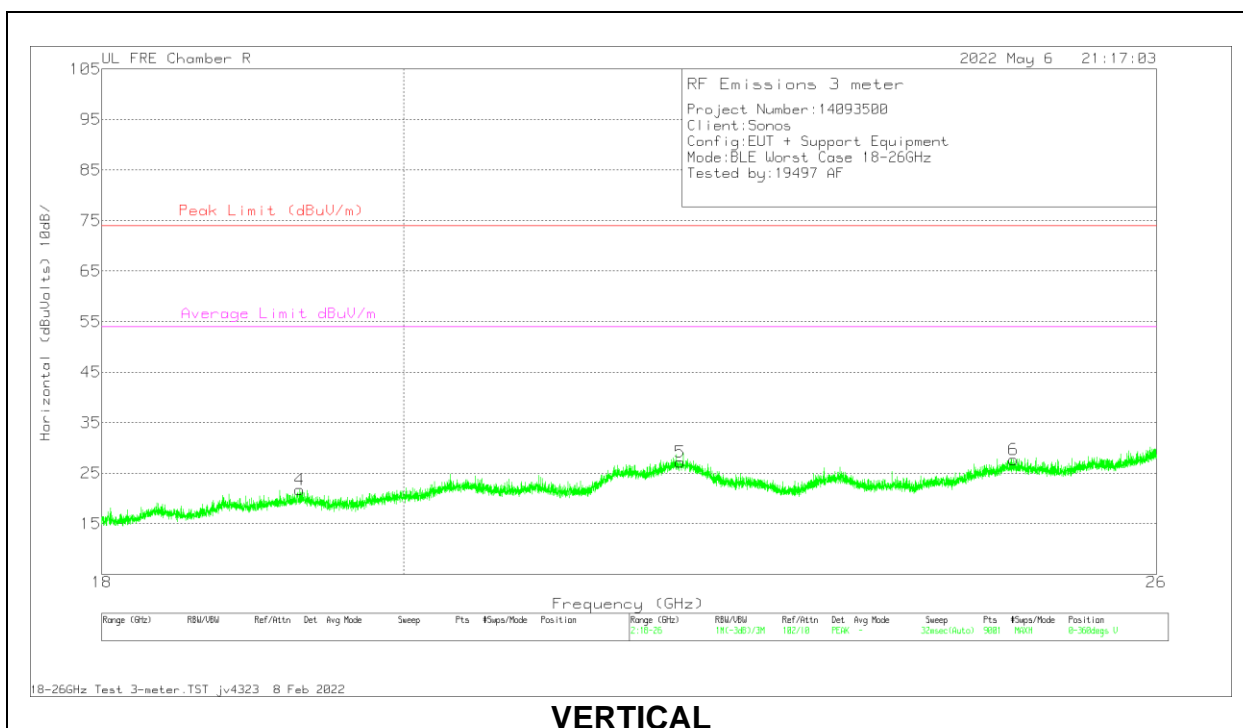
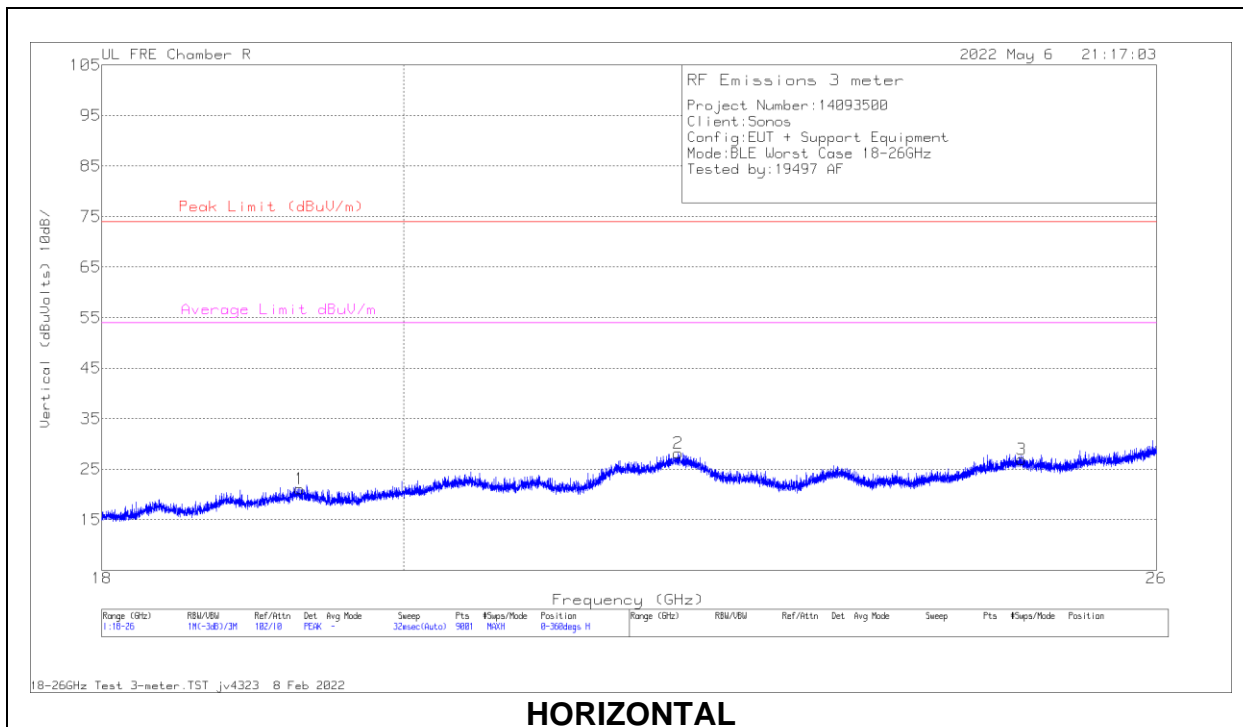
## Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	171862 ACF (dB)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	93.8585	51.31	Pk	14.4	-30.7	35.01	43.52	-8.51	0-360	199	H
2	146.172	46.88	Qp	18.4	-30.3	34.98	43.52	-8.54	92	139	H
3	154.239	50.63	Qp	18.2	-30.3	38.53	43.52	-4.99	93	117	H
4	37.2626	40.85	Qp	21.5	-31.3	31.05	40	-8.95	151	121	V
5	72.4971	50.02	Qp	13.9	-31	32.92	40	-7.08	184	107	V
6	146.119	49.02	Qp	18.4	-30.3	37.12	43.52	-6.4	180	253	V

Pk - Peak detector

Qp - Quasi-Peak detector

## 10.5. WORST CASE 18-26 GHz



## 18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	172363 AF (dB/m)	171583 Amp (dB)	Cables (dB)	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	PK Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 19.286222	39.26	Pk	32.9	-65.5	14.4	21.06	74	-52.94	54	-32.94	0-360	99	H
4	* 19.286222	39.88	Pk	32.9	-65.5	14.4	21.68	74	-52.32	54	-32.32	0-360	99	V
5	* 22.022223	43.37	Pk	33.5	-65.1	15.4	27.17	74	-46.83	54	-26.83	0-360	99	V
2	22.008889	44.37	Pk	33.5	-65.1	15.4	28.17	74	-45.83	54	-25.83	0-360	99	H
6	24.736001	40.96	Pk	34.6	-64.2	16.3	27.66	74	-46.34	54	-26.34	0-360	99	V
3	24.808001	40.26	Pk	34.6	-64.2	16.3	26.96	74	-47.04	54	-27.04	0-360	99	H

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

Pk - Peak detector

## 11. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 <sup>*</sup>	56 to 46 <sup>*</sup>
0.5-5	56	46
5-30	60	50

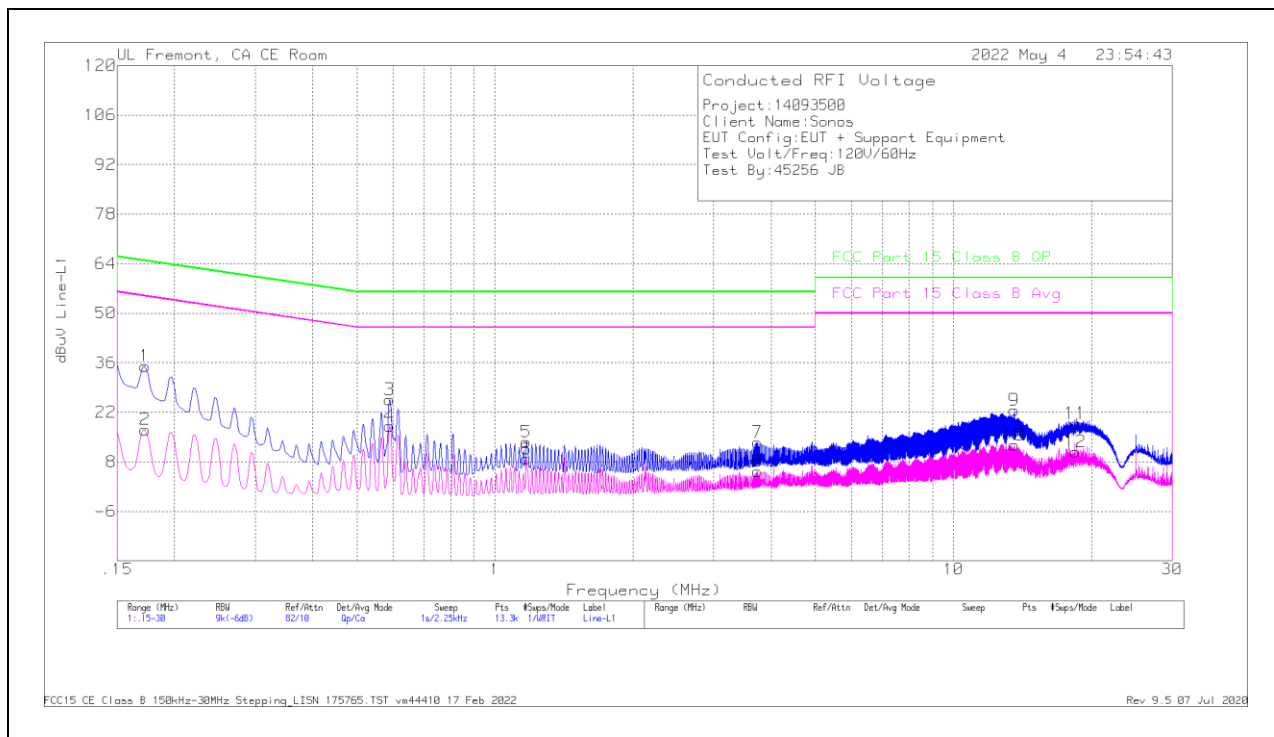
<sup>\*</sup> Decreases with the logarithm of the frequency.

### RESULTS



## 11.1. AC POWER LINE

### LINE 1 RESULTS

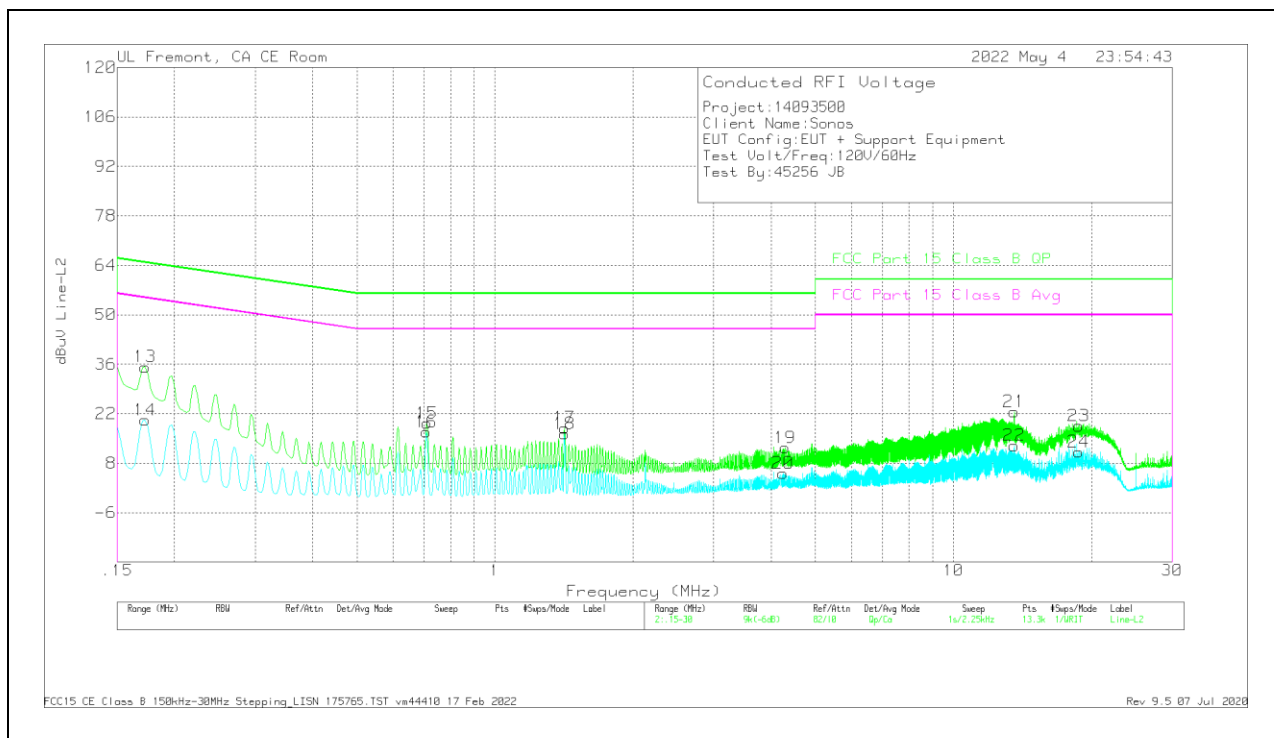


Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 LISN L1	C1&C3 cable	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)M argin (dB)
2	.1725	7.6	Ca	.1	0	9.4	17.1	-	-	54.84	-37.74
4	.58875	8.71	Ca	0	.1	9.3	18.11	-	-	46	-27.89
6	1.16925	-5.58	Ca	0	.1	9.3	8.82	-	-	46	-37.18
8	3.732	-4.13	Ca	0	.1	9.3	5.27	-	-	46	-40.73
10	13.56	3.16	Ca	.1	.2	9.3	12.76	-	-	50	-37.24
12	18.4335	1.23	Ca	.1	.2	9.3	10.83	-	-	50	-39.17
1	.1725	25.57	Qp	.1	0	9.4	35.07	64.84	-29.77	-	-
3	.58875	16.18	Qp	0	.1	9.3	25.58	56	-30.42	-	-
5	1.16925	4.21	Qp	0	.1	9.3	13.61	56	-42.39	-	-
7	3.732	4.12	Qp	0	.1	9.3	13.52	56	-42.48	-	-
9	13.56	12.95	Qp	.1	.2	9.3	22.55	60	-37.45	-	-
11	18.43125	9.27	Qp	.1	.2	9.3	18.87	60	-41.13	-	-

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	.1725	10.72	Ca	.1	0	9.4	20.22	-	-	54.84	-34.62
16	.708	7.46	Ca	0	.1	9.3	16.86	-	-	46	-29.14
18	1.41675	6.92	Ca	0	.1	9.3	16.32	-	-	46	-29.68
20	4.24725	-4.22	Ca	0	.1	9.3	5.18	-	-	46	-40.82
22	13.56	3.41	Ca	.1	.2	9.3	13.01	-	-	50	-36.99
24	18.753	1.57	Ca	.1	.2	9.3	11.17	-	-	50	-38.83
13	.1725	35.38	Qp	.1	0	9.4	44.88	64.84	-19.96	-	-
15	.71025	9.93	Qp	0	.1	9.3	19.33	56	-36.67	-	-
17	1.41675	8.59	Qp	0	.1	9.3	17.99	56	-38.01	-	-
19	4.2945	3	Qp	0	.1	9.3	12.4	56	-43.6	-	-
21	13.56	12.96	Qp	.1	.2	9.3	22.56	60	-37.44	-	-
23	18.753	8.95	Qp	.1	.2	9.3	18.55	60	-41.45	-	-

Qp - Quasi-Peak detector

Ca - CISPR average detection