



# **TEST REPORT**

**Report Number. :** 13268681-E2V2

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

**Model :** S27

**FCC ID :** SBVRM027

**ISED :** 5373A-RM027

**EUT Description :** 802.11 a/b/g/n/ac 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

**Date Of Issue:**

January 22, 2021

**Prepared by:**

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NVLAP Lab code: 200065-0

## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	12/18/2020	Initial Issue	
V2	1/22/2021	Updated Section 8 & 11 Added BT and BLE to EUT Description, Section 10 added statement, Updated Section 4.	Kiya Kedida

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SONOS INC.  
614 CHAPALA STREET  
SANTA BARBARA, CA 93101, U.S.A.

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

**MODEL:** S27

**SERIAL NUMBER:** A1002009W54-2A-1B-40-06-6E3 (Radiated Sample)  
A1002009W54-2A-1B-B0-02-94D (Radiated Sample)  
5CFFDD0001067 (Conducted Sample)

**DATE TESTED:** November 04, 2020 to November 13, 2020, November 18, 2020

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

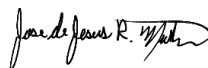
UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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

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

Approved & Released For  
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Kiya Kedida  
Senior Project Engineer  
Consumer Technology Division  
UL Verification Services Inc.

## 2. TEST RESULTS SUMMARY

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		None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power		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		None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions		None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions		None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions		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, and RSS-247 Issue 2.

### 4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input checked="" type="checkbox"/>	Building 1: 47173 Benicia Street, Fremont, California 94538, USA	US0104	2324A	208313
<input type="checkbox"/>	Building 2: 47266 Benicia Street, Fremont, California 94538, USA	US0104	22541	208313
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd, Fremont, California 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 <sub>Lab</sub>
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.4 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.84 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB

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

### 5.4. SAMPLE CALCULATION

#### RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

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

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

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

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

## 6. EQUIPMENT UNDER TEST

### 6.1. EUT DESCRIPTION

The EUT is a 802.11 a/b/g/n/ac 2x2 Client Device with BT and BLE .

### 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	2.35	1.72

### 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PCB antenna, with a maximum gain of 0.8dBi.

### 6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was V13.0.

The test utility software used during testing was QRCT v3.0.264.0.

### 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 fundamental of the EUT was investigated in 5 configurations, it was determined that Configurations 5 was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Configurations 5 orientation.

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

## 6.6. DESCRIPTION OF TEST SETUP

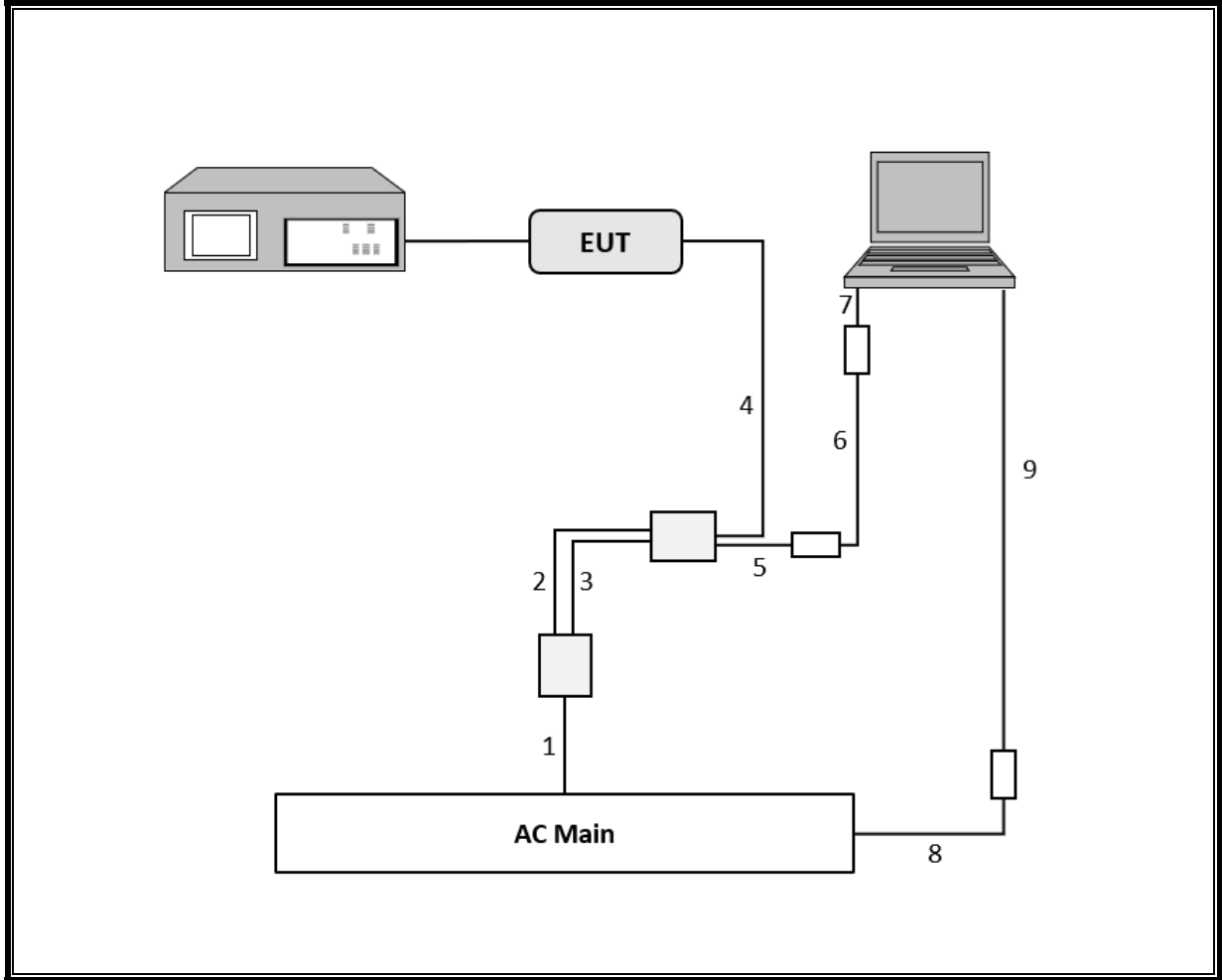
### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	X1 Carbon	R90HKAXY	N/A
AC Adaptor	Lenovo	ADLX45NCC2A	8SSA10E75794C1SG78H7210	N/A
Type-C Power Adapter	IIIP	PDS75-4UT01	N/A	N/A
Charger	ICT	LPS-05WB-1	20200908	N/A
Switching Power Supply	Phihong	PSAA10A-050QL6	P161401526A1	N/A

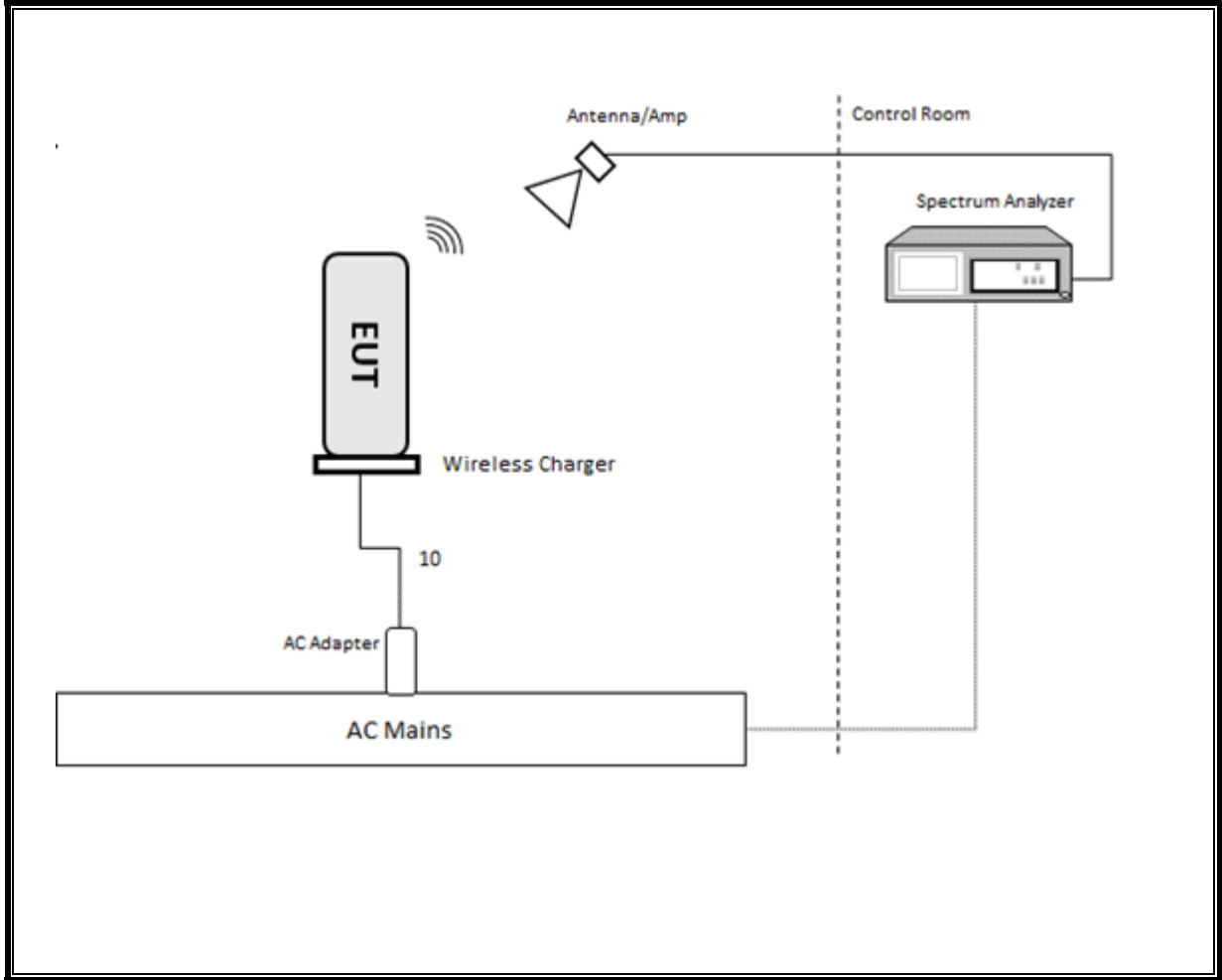
### I/O CABLES

Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length	Remarks
1	AC Adapter	1	AC	Unshielded	1m	AC Mains to Power Adapter
2	Type-C	2	USB Type-C	Unshielded	2m	Power Adapter to Power-In Splitter
3	Type-A	1	USB Type-A/Mini-USB	Unshielded	2m	Power Adapter to Power-In Splitter
4	Type-C	2	USB Type-C	Unshielded	1.5m	Splitter Output to EUT
5	Ethernet Adapt	1	Type-A to RJ45	Unshielded	0.2m	Splitter Output to Ethernet Adapter
6	Ethernet	2	RJ45	Unshielded	1m	Ethernet Adapter to Ethernet Adapter
7	Ethernet Adapt	1	RJ45 to Type A	Unshielded	0.3m	Ethernet Adapter to Laptop
8	AC Power	1	AC	Unshielded	1m	AC Mains to Power Adapter
9	DC Power	1	DC	Unshielded	1m	Power Adapter to Laptop
10	Type-A	1	USB Type-A	Unshielded	1m	Cabel to Switching Power Supply

**CONDUCTED TEST SETUP DIAGRAM**



**RADIATED TEST SETUP DIAGRAM**



## **7. MEASUREMENT METHOD**

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

6 dB BW: ANSI C63.10 Section 11.8.1

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

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

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

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

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

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

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

Band-edge: ANSI C63.10 Section 6.10

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

## 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
PXA Signal Analyzer 3Hz-44GHz	Agilent Technologies	N9030A	T341	07/29/2021	07/29/2020
Power meter	Keysight	N1911A	T1268	01/22/2021	01/22/2020
Power sensor	Keysight	N1921A	T1223	04/10/2021	04/10/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0203383	02/18/2021	02/18/2020
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T477	09/24/2021	09/24/2020
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	01/23/2021	01/23/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	08/31/2021	08/31/2020
Amplifier, 100MHz-18GHz	AMPLICAL	AMP0.1G18-47-20	PRE0197319	05/04/2021	05/04/2020
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO-METRICS	EM-6871	PRE0179465	07/27/2021	07/27/2020
Antenna, Passive Loop 100kHz to 30MHz	ELECTRO-METRICS	EM-6872	PRE0179467	07/27/2021	07/27/2020
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	06/07/2021	06/07/2020
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1264	01/21/2021	01/21/2020
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1223	04/10/2021	04/10/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T341	07/29/2021	07/29/2020
AC Line Conducted					
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/20/2021	02/20/2020
LISN for Conducted Emissions CISPR-16	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	PRE0186446	01/21/2021	01/21/2020
Test Software List					
Radiated Software	UL	UL EMC		Ver 9.5, April 30, 2020	
Antenna Port Software	UL	UL RF		Ver 2020.11.8	
AC Line Conducted Software	UL	UL EMC		Ver 9.5, July 7, 2020	

## 9. ANTENNA PORT TEST RESULTS

### 9.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

#### PROCEDURE

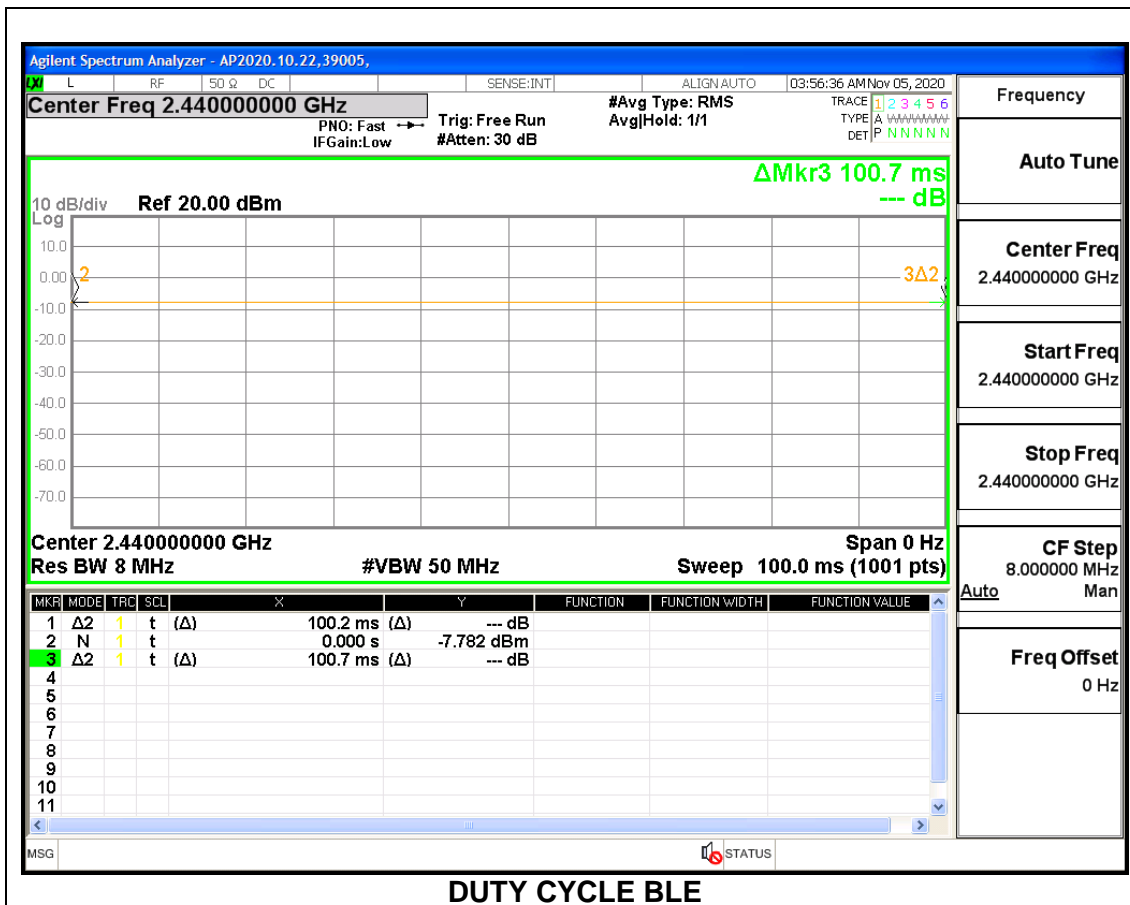
KDB 558074 Zero-Span Spectrum Analyzer Method.

#### 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	100.2	100.7	0.995	99.50%	0.00	0.010



DUTY CYCLE PLOT



DUTY CYCLE BLE

**9.2. 99% BANDWIDTH**

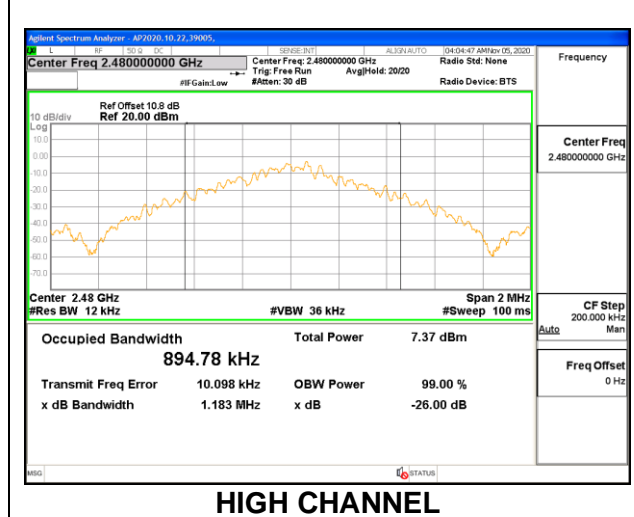
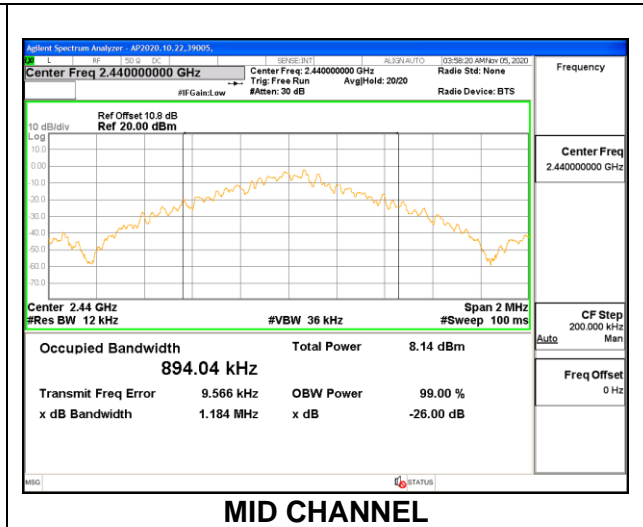
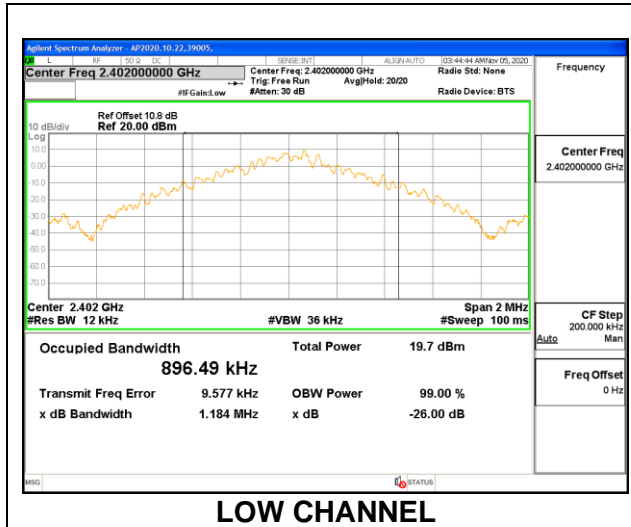
**LIMITS**

None; for reporting purposes only.

**RESULTS**

### 9.2.1. BLE (1Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	0.8965
Middle	2440	0.8940
High	2480	0.8948



### **9.3. 6 dB BANDWIDTH**

#### **LIMITS**

FCC §15.247 (a) (2)

RSS-247 5.2 (a)

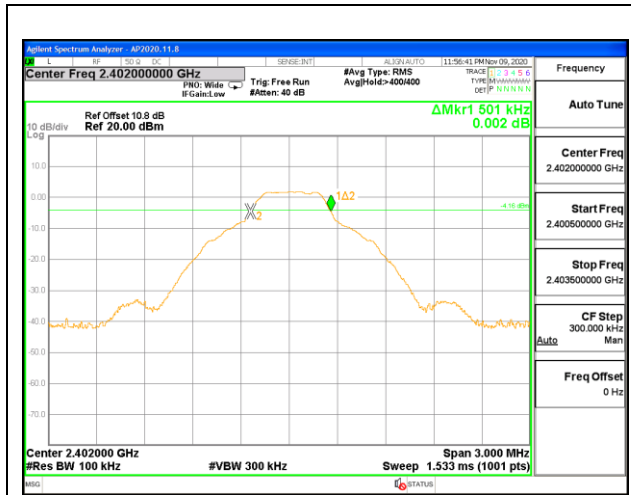
The minimum 6 dB bandwidth shall be at least 500 kHz.

#### **RESULTS**

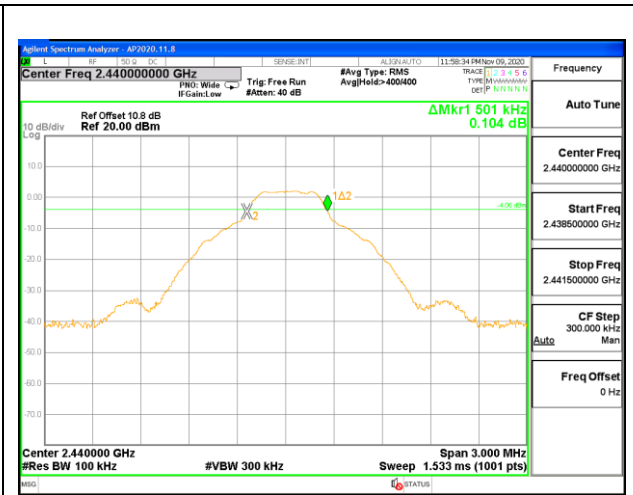
### 9.3.1. BLE (1Mbps)

Tested By:	12485
Date:	11/9/2020

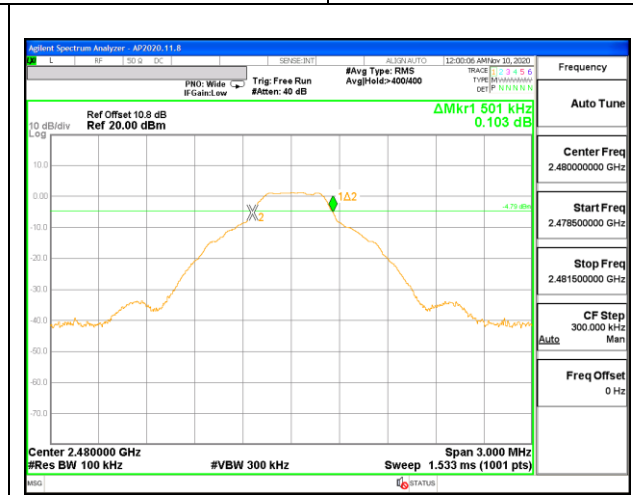
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.501	0.5
Middle	2440	0.501	0.5
High	2480	0.501	0.5



**LOW CHANNEL**



**MID CHANNEL**



**HIGH CHANNEL**

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## **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 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**

### 9.4.1. BLE (1Mbps)

<b>Tested By:</b>	12485
<b>Date:</b>	11/4/2020

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Power Reading (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
Low	2402	2.33	30	-27.670
Middle	2440	2.35	30	-27.650
High	2480	1.91	30	-28.090

---

## **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**



### 9.5.1. BLE (1Mbps)

<b>Tested By:</b>	12485
<b>Date:</b>	11/4/2020

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>AV power (dBm)</b>
Low	2402	2.17
Middle	2440	2.2
High	2480	1.83

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## **9.6. POWER SPECTRAL DENSITY**

### **LIMITS**

FCC §15.247 (e)

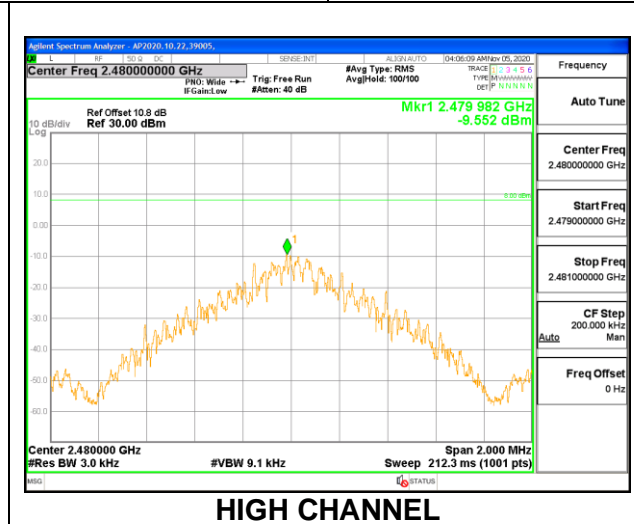
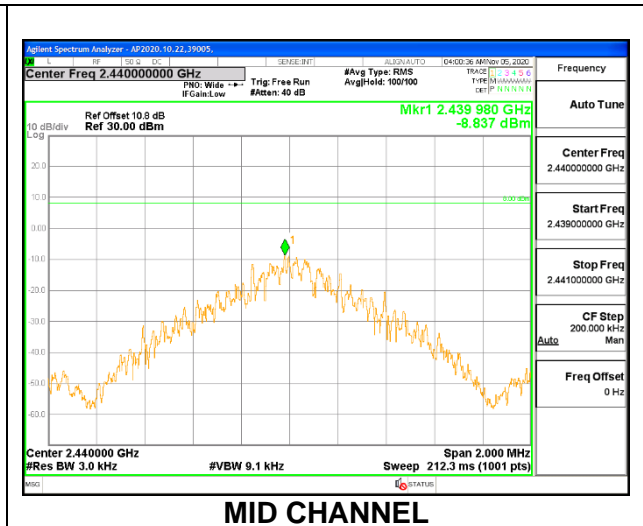
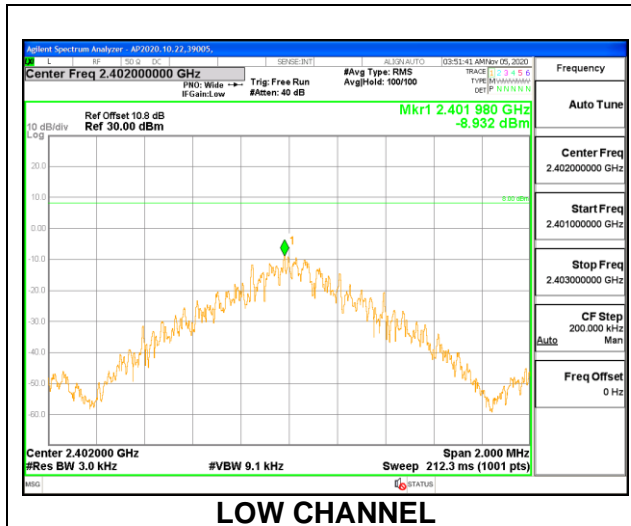
RSS-247 (5.2) (b)

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**

### 9.6.1. BLE (1Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-8.93	8	-16.93
Middle	2440	-8.84	8	-16.84
High	2480	-9.55	8	-17.55



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## **9.7. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

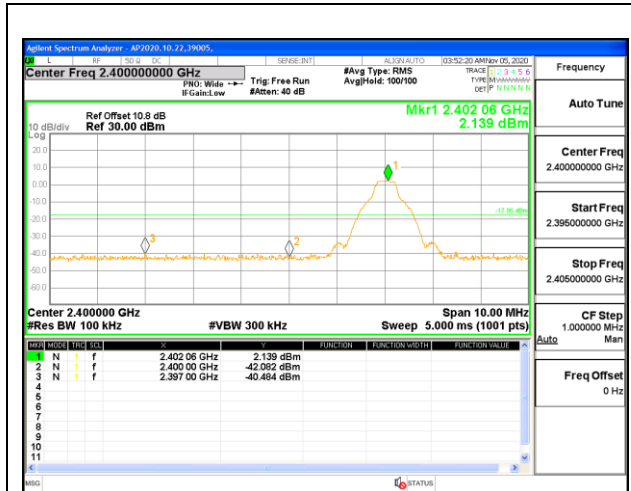
FCC §15.247 (d)

RSS-247 5.5

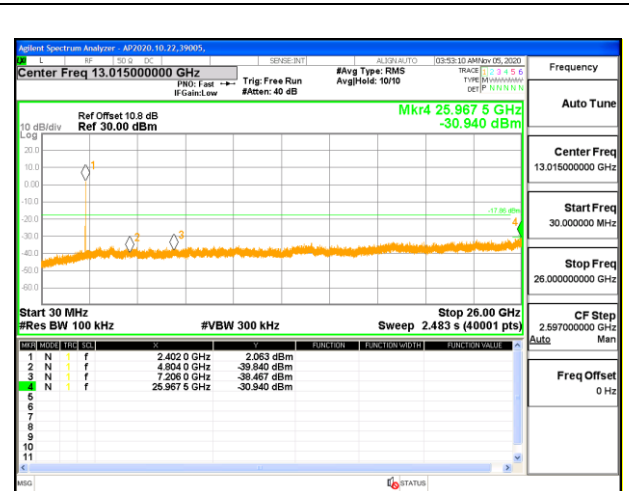
Output power was measured based on the use of a peak measurement, spurious emissions are required to be 20dBc.

### **RESULTS**

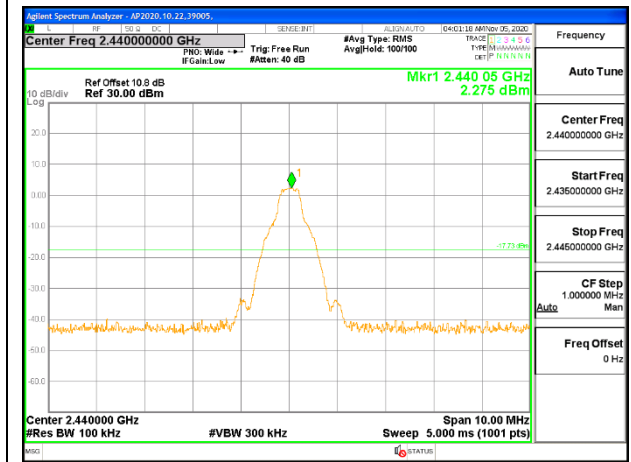
### 9.7.1. BLE (1Mbps)



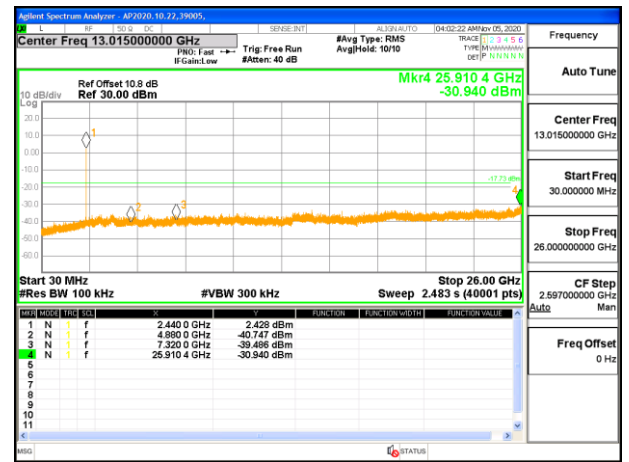
**LOW CHANNEL BANDEDGE**



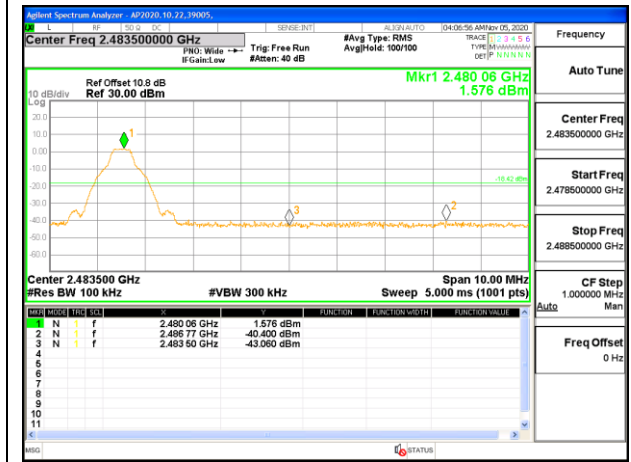
**OUT-OF-BAND LOW CHANNEL**



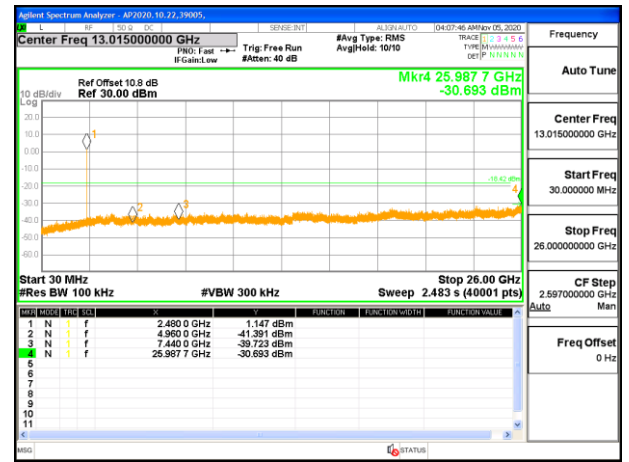
**IN-BAND REFERENCE LEVEL**



**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.

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.

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

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.

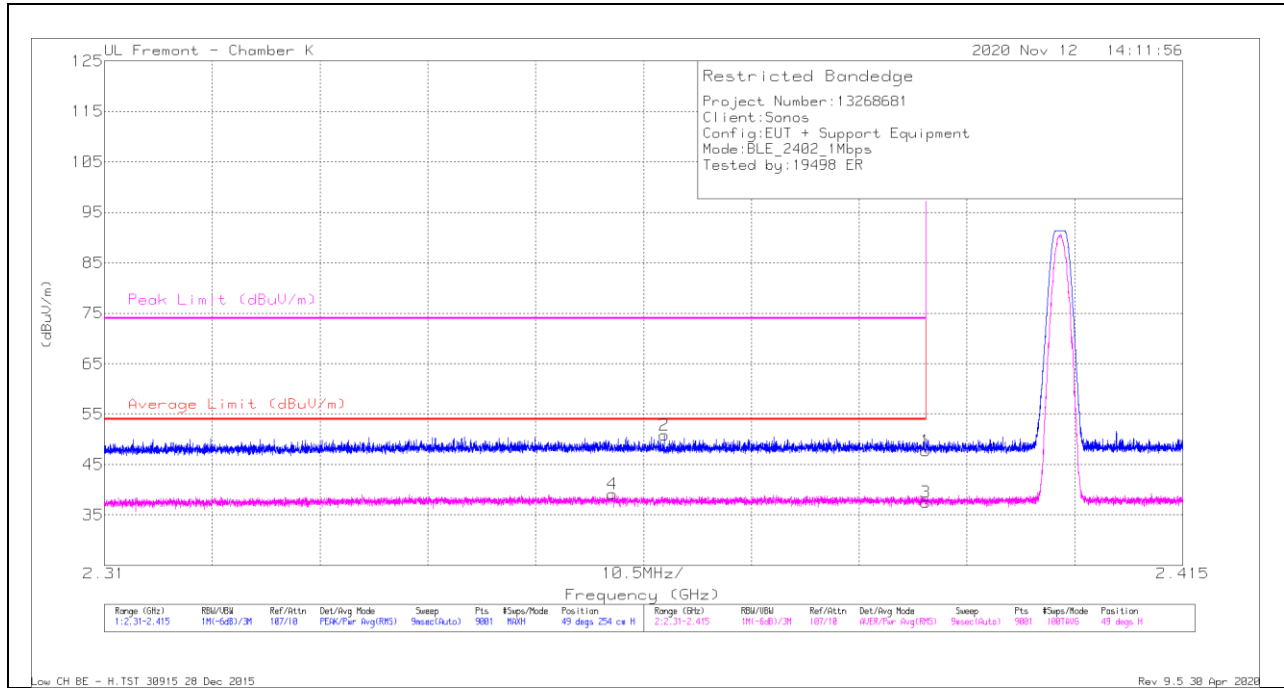
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

## 10.2. TRANSMITTER ABOVE 1 GHz

### 10.2.1. BLE (1Mbps)

### BANDEDGE (LOW CHANNEL)

### HORIZONTAL RESULT



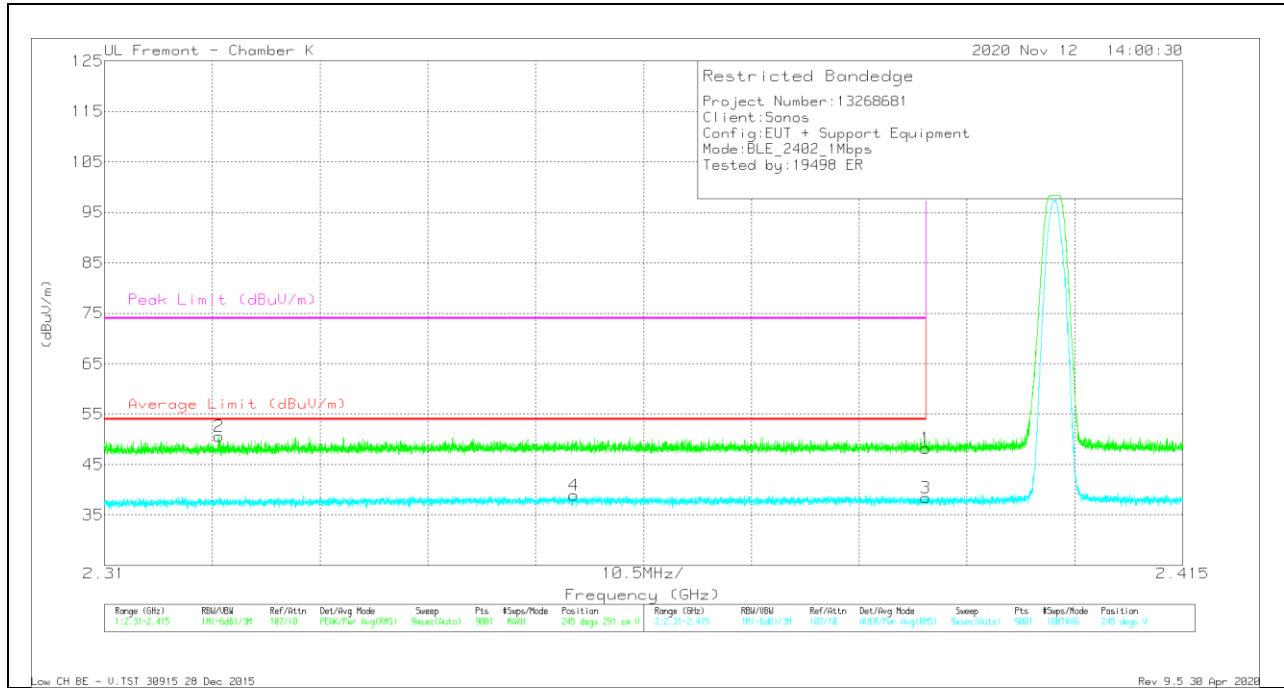
### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/CbW/Fltr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	50.37	Pk	32.4	-35	47.77	-	-	74	-26.23	49	254	H
2	* 2.36453	53.49	Pk	32.4	-35.1	50.79	-	-	74	-23.21	49	254	H
3	* 2.38999	40.17	RMS	32.4	-35	37.57	54	-16.43	-	-	49	254	H
4	* 2.35944	41.99	RMS	32.4	-35.2	39.19	54	-14.81	-	-	49	254	H

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



### VERTICAL RESULT



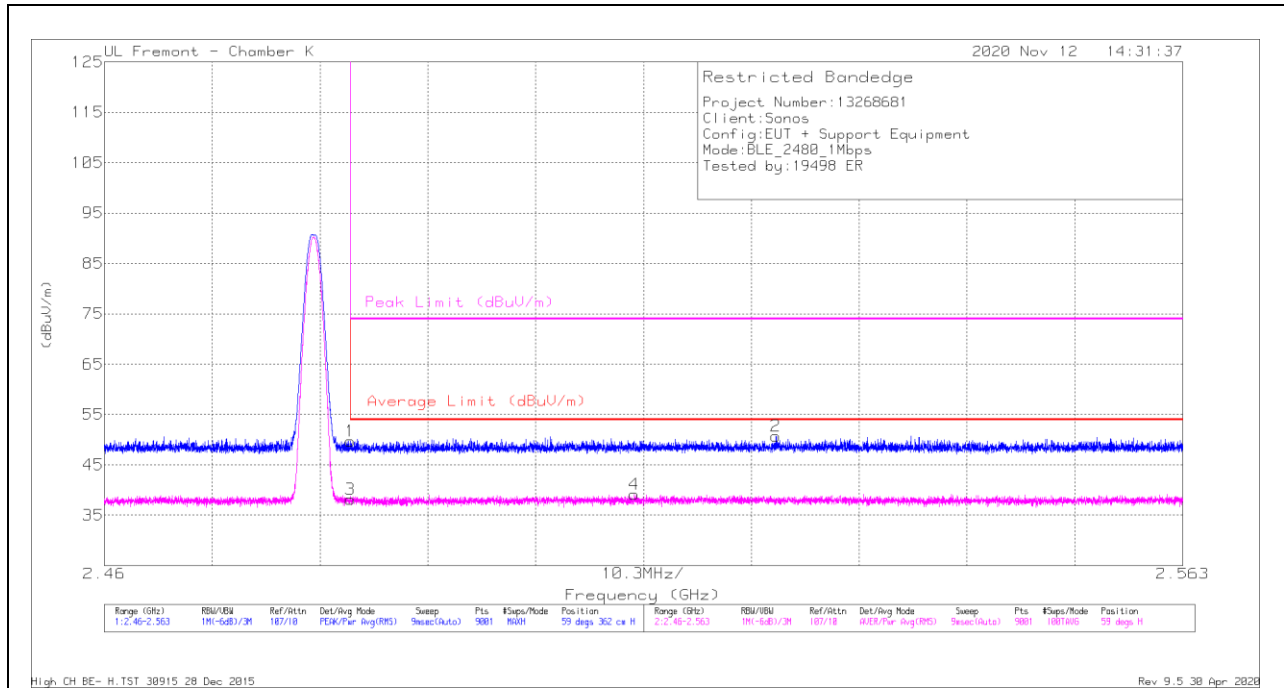
### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cb/Filtr/Par d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	50.86	Pk	32.4	-35	48.26	-	-	74	-25.74	245	291	V
2	* 2.32114	53.91	Pk	32	-35.3	50.61	-	-	74	-23.39	245	291	V
3	* 2.38999	40.96	RMS	32.4	-35	38.36	54	-15.64	-	-	245	291	V
4	* 2.35575	41.75	RMS	32.4	-35.2	38.95	54	-15.05	-	-	245	291	V

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

## BANDEDGE (HIGH CHANNEL)

### HORIZONTAL RESULT

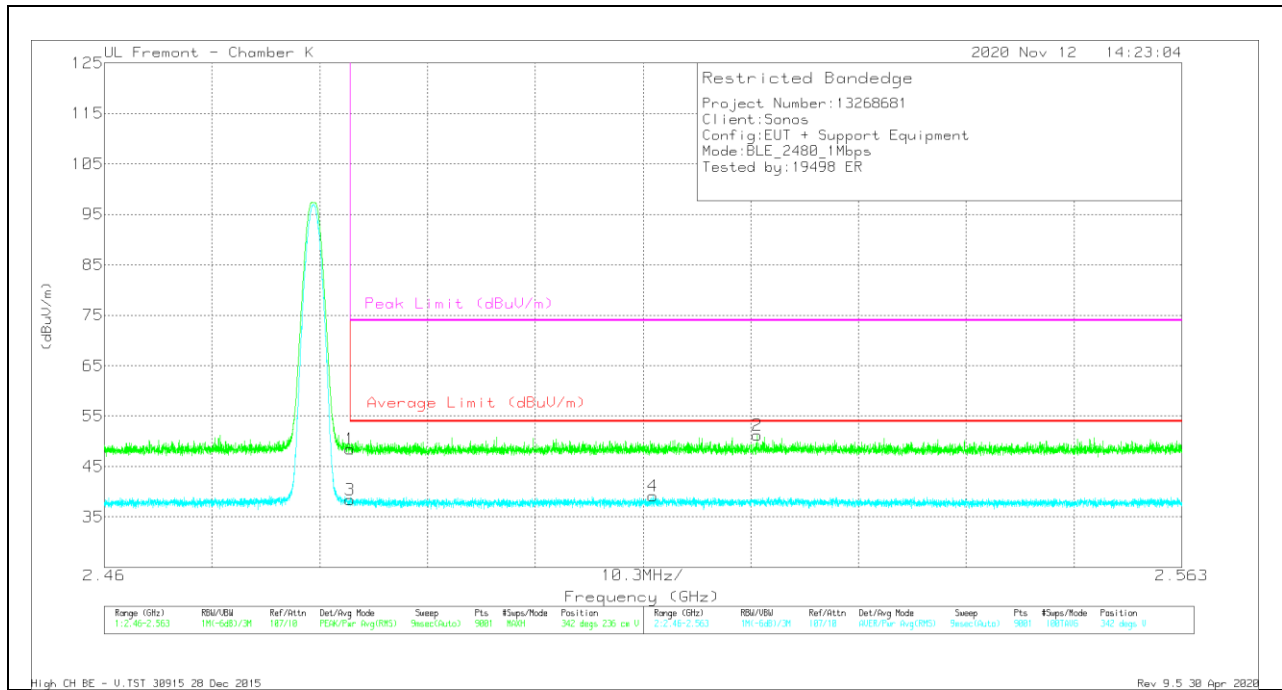


### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/CbW/Ftr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	51.83	Pk	32.5	-34.6	49.73	-	-	74	-24.27	59	362	H
2	2.52416	52.44	Pk	32.8	-34.5	50.74	-	-	74	-23.26	59	362	H
3	* 2.48351	40.21	RMS	32.5	-34.6	38.11	54	-15.89	-	-	59	362	H
4	2.51061	41.08	RMS	32.7	-34.6	39.18	54	-14.82	-	-	59	362	H

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

### VERTICAL RESULT



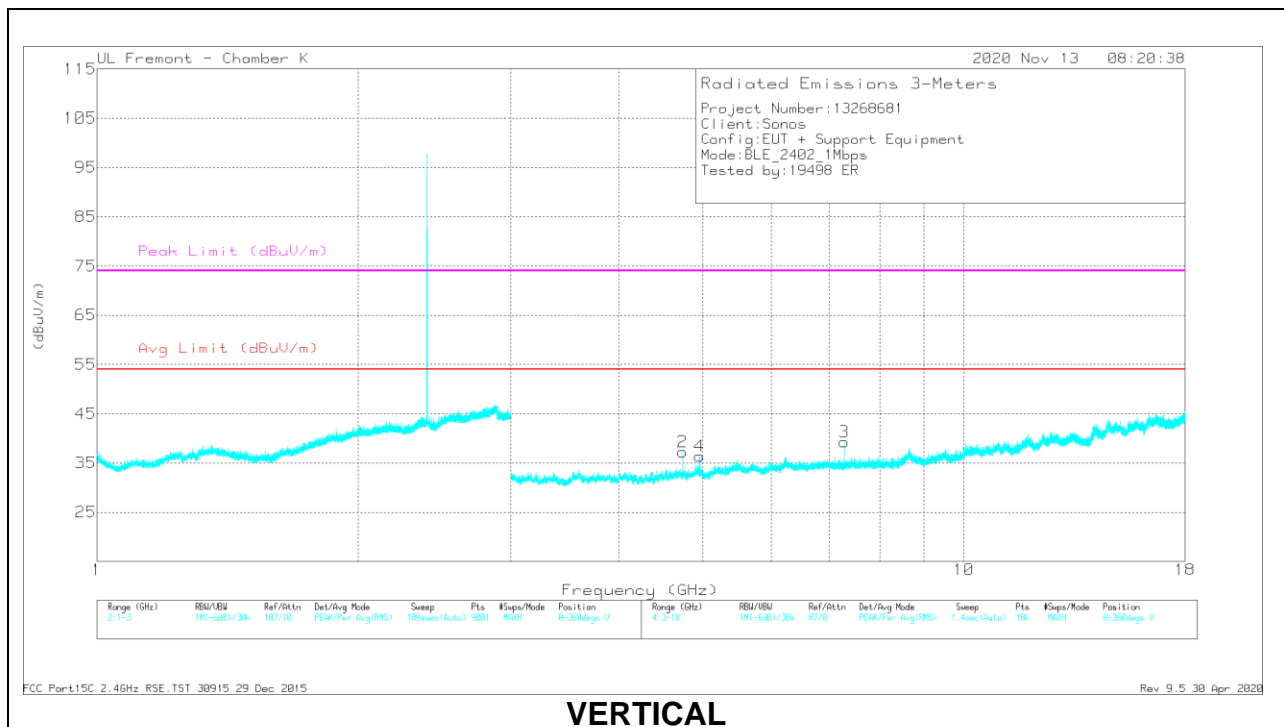
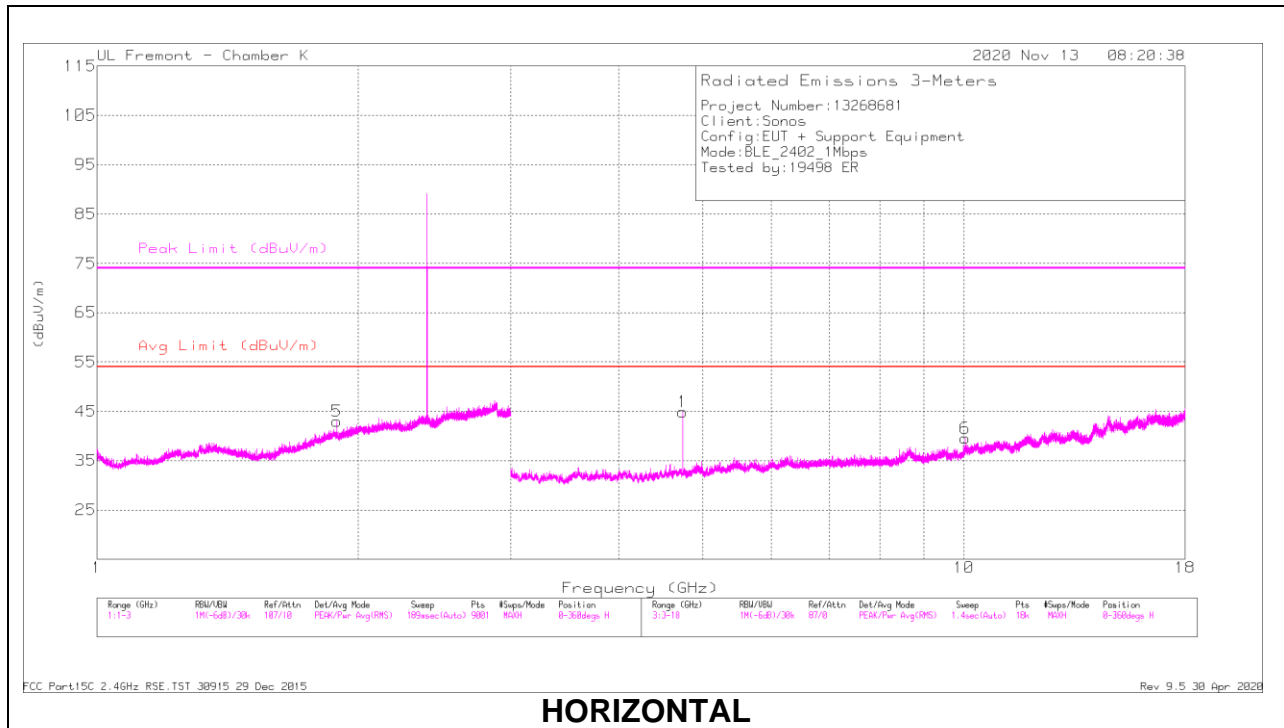
### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cb/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	50.59	Pk	32.5	-34.6	48.49	-	-	74	-25.51	342	236	V
2	2.52239	52.98	Pk	32.8	-34.6	51.18	-	-	74	-22.82	342	236	V
3	* 2.48351	40.56	RMS	32.5	-34.6	38.46	54	-15.54	-	-	342	236	V
4	2.51247	40.94	RMS	32.7	-34.5	39.14	54	-14.86	-	-	342	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

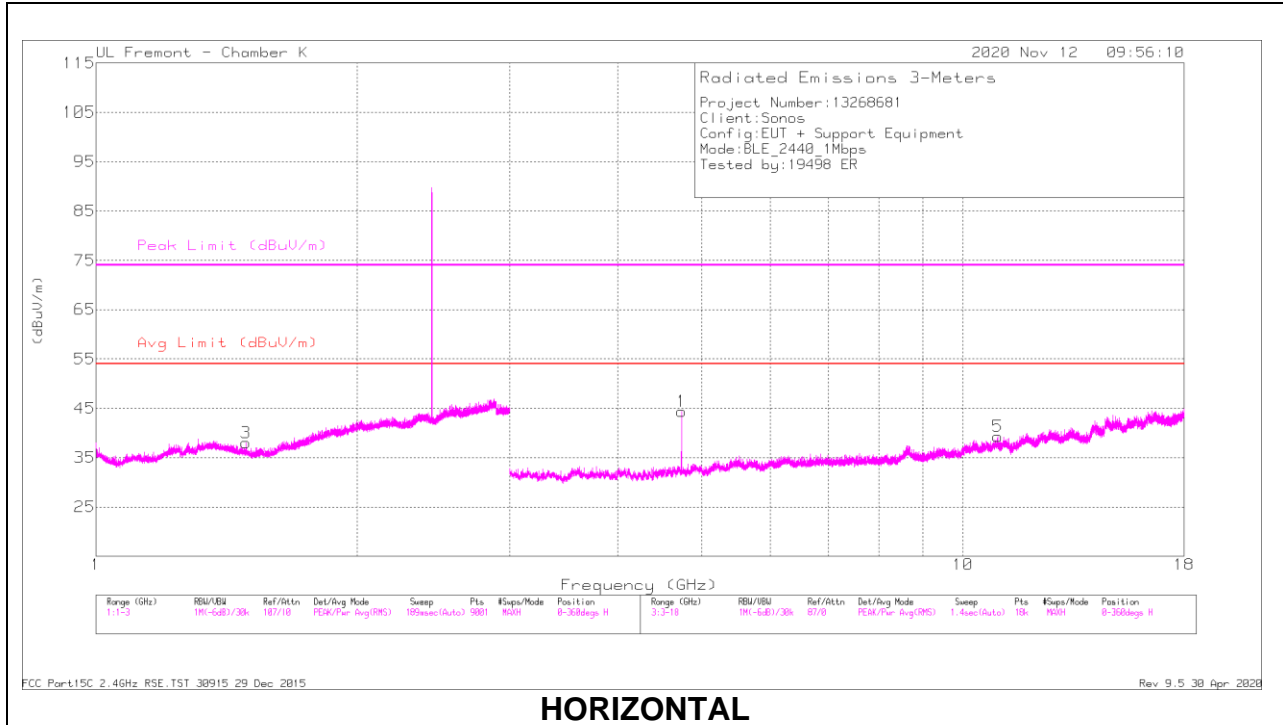
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	1.89695	32.14	PK2	30.8	-12.4	50.54	-	-	-	-	311	356	H
6	10.04869	46.34	PK2	37.3	-36.6	47.04	-	-	-	-	182	104	H
1	* 4.7356	55.31	PK2	34.2	-41.2	48.31	-	-	74	-25.69	163	99	H
	* 4.73569	51.26	MAv1	34.2	-41.2	44.26	54	-9.74	-	-	163	99	H
2	* 4.73548	52.59	PK2	34.2	-41.2	45.59	-	-	74	-28.41	316	400	V
	* 4.73536	46.23	MAv1	34.2	-41.2	39.23	54	-14.77	-	-	316	400	V
3	* 7.28848	46.78	PK2	36.1	-38.4	44.48	-	-	74	-29.52	17	340	V
	* 7.28499	35.66	MAv1	36.1	-38.4	33.36	54	-20.64	-	-	17	340	V
4	* 4.96499	49.53	PK2	34.3	-40.6	43.23	-	-	74	-30.77	190	332	V
	* 4.95286	38	MAv1	34.3	-40.7	31.6	54	-22.4	-	-	190	332	V

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

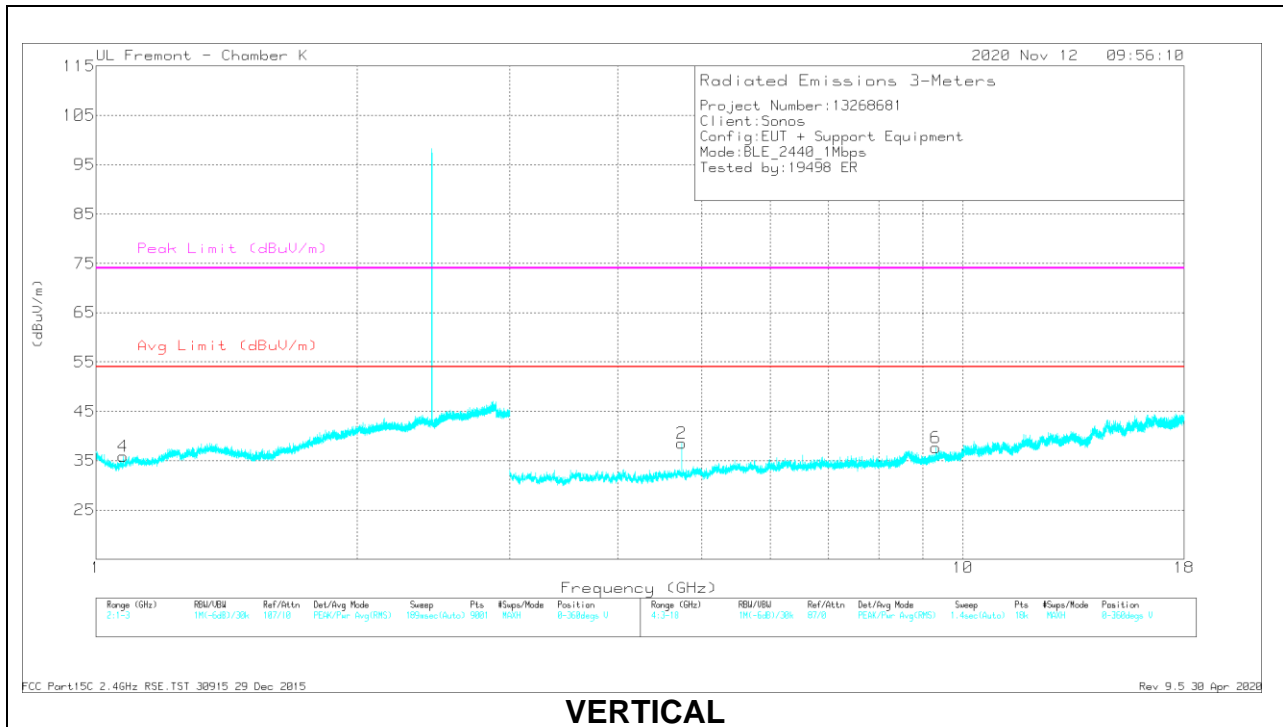
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

### MID CHANNEL RESULTS



### HORIZONTAL



### VERTICAL

**RADIATED EMISSIONS**

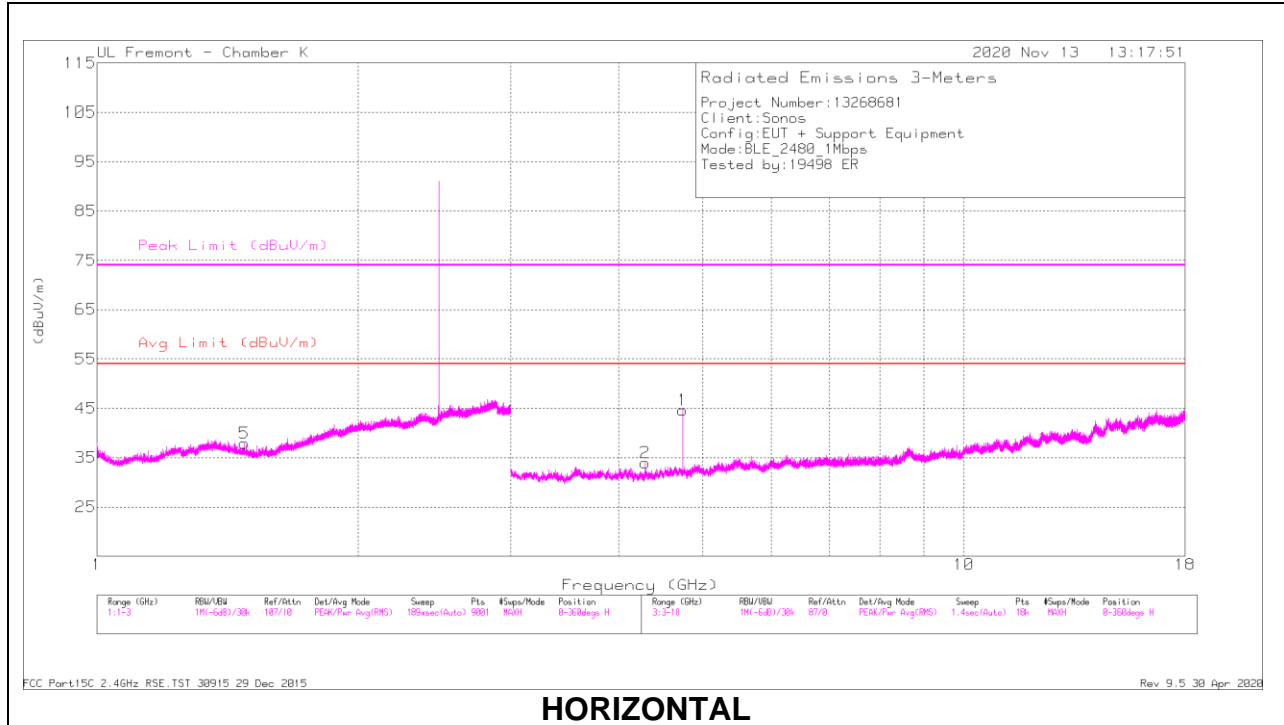
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 1.49004	28.17	PK2	27.8	-13.2	42.77	-	-	74	-31.23	315	191	H
	* 1.48786	16.98	MAv1	27.9	-13.2	31.68	54	-22.32	-	-	315	191	H
4	* 1.07561	27.56	PK2	27	-14.1	40.46	-	-	74	-33.54	284	288	V
	* 1.07755	17.05	MAv1	27.1	-14.1	30.05	54	-23.95	-	-	284	288	V
1	* 4.73654	53.45	PK2	34.2	-41.2	46.45	-	-	74	-27.55	169	97	H
	* 4.7366	50.22	MAv1	34.2	-41.2	43.22	54	-10.78	-	-	169	97	H
5	* 10.96946	44.64	PK2	37.8	-36.2	46.24	-	-	74	-27.76	192	122	H
	* 10.96874	33.3	MAv1	37.8	-36.2	34.9	54	-19.1	-	-	192	122	H
2	* 4.73626	50.32	PK2	34.2	-41.2	43.32	-	-	74	-30.68	208	97	V
	* 4.73636	44.08	MAv1	34.2	-41.2	37.08	54	-16.92	-	-	208	97	V
6	* 9.31044	44.8	PK2	36.5	-37	44.3	-	-	74	-29.7	161	282	V
	* 9.30875	33.26	MAv1	36.5	-37	32.76	54	-21.24	-	-	161	282	V

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

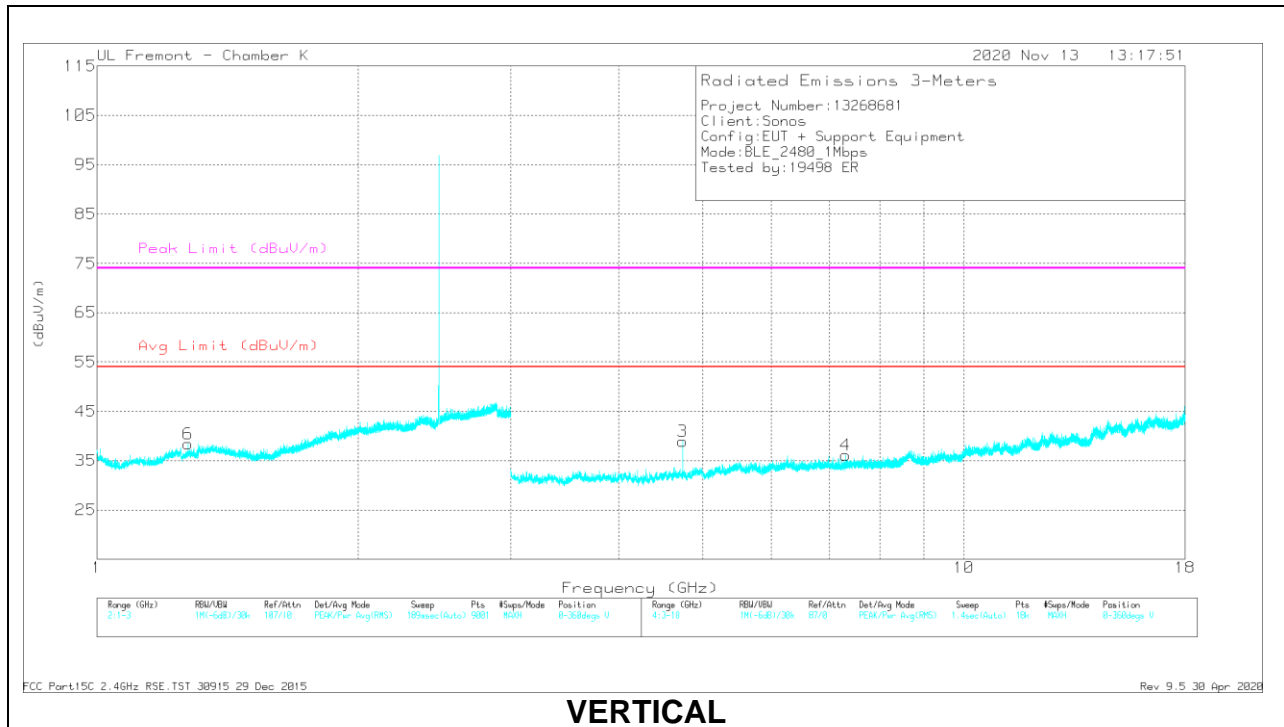
PK2 - KDB558074 Method: Maximum Peak

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/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	* 1.47855	28.15	PK2	27.9	-13.2	42.85	-	-	74	-31.15	6	341	H
	* 1.47708	17.04	MAv1	28	-13.2	31.84	54	-22.16	-	-	6	341	H
6	* 1.27667	26.99	PK2	29.5	-13.7	42.79	-	-	74	-31.21	33	128	V
	* 1.27455	16.33	MAv1	29.4	-13.7	32.03	54	-21.97	-	-	33	128	V
1	* 4.73664	55.37	PK2	34.2	-41.2	48.37	-	-	74	-25.63	160	115	H
	* 4.7366	51.18	MAv1	34.2	-41.2	44.18	54	-9.82	-	-	160	115	H
2	* 4.29974	50.07	PK2	33.6	-41.8	41.87	-	-	74	-32.13	97	242	H
	* 4.29788	38.5	MAv1	33.6	-41.8	30.3	54	-23.7	-	-	97	242	H
3	* 4.73617	52.79	PK2	34.2	-41.2	45.79	-	-	74	-28.21	221	99	V
	* 4.73601	46.98	MAv1	34.2	-41.2	39.98	54	-14.02	-	-	221	99	V
4	* 7.32009	46.56	PK2	36	-38.2	44.36	-	-	74	-29.64	136	354	V
	* 7.31232	35.49	MAv1	36.1	-38.3	33.29	54	-20.71	-	-	136	354	V

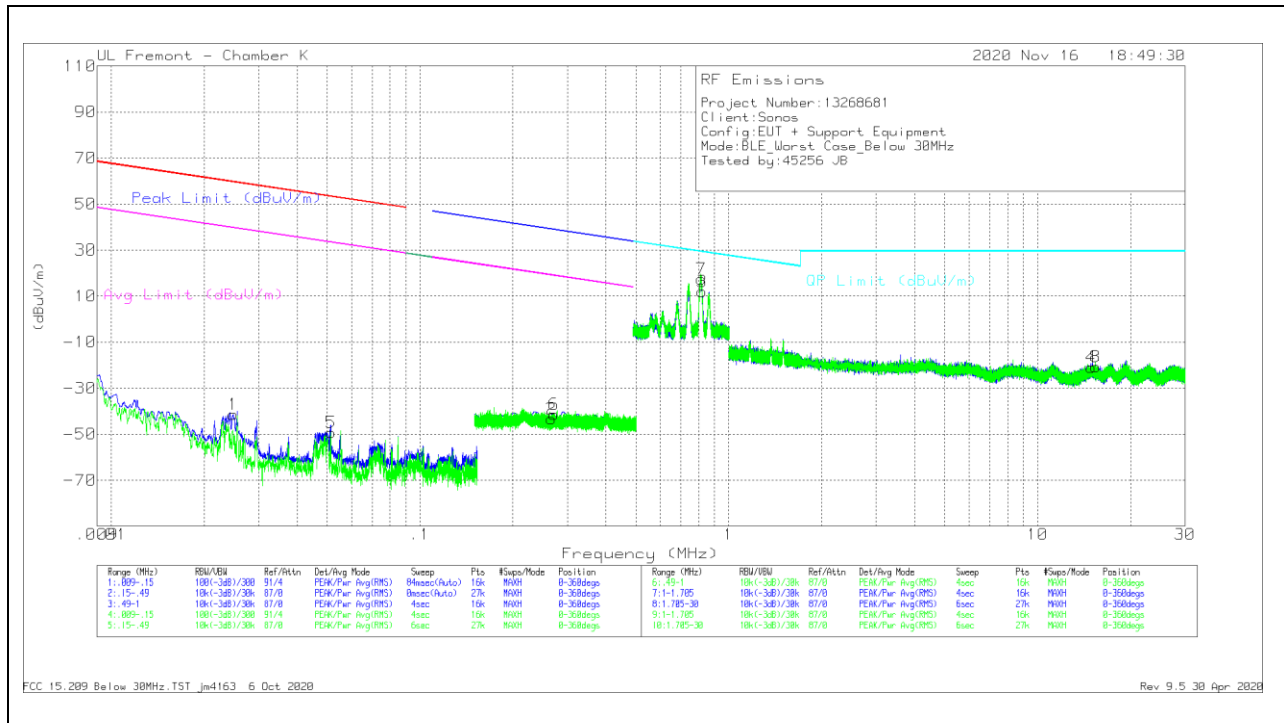
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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	Meter	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected	Peak Limit (dBuV/m)	Margin	Avg Limit (dBuV/m)	Margin	Peak Limit (dBuV/m)	Margin	Avg Limit (dBuV/m)	Margin	Azimuth
1	0.02486	12.3	Pk	58.3	-32.1	-80	-41.5	59.67	-101.17	39.67	-81.17	-	-	-	-	0-360
2	0.26686	13.09	Pk	55.9	-32.2	-80	-43.21	-	-	-	-	39.09	-82.3	19.09	-62.3	0-360
5	0.05144	6.25	Pk	56.8	-32.3	-80	-49.25	53.36	-102.61	33.36	-82.61	-	-	-	-	0-360
6	0.27203	15.01	Pk	55.9	-32.2	-80	-41.29	-	-	-	-	38.92	-80.21	18.92	-60.21	0-360

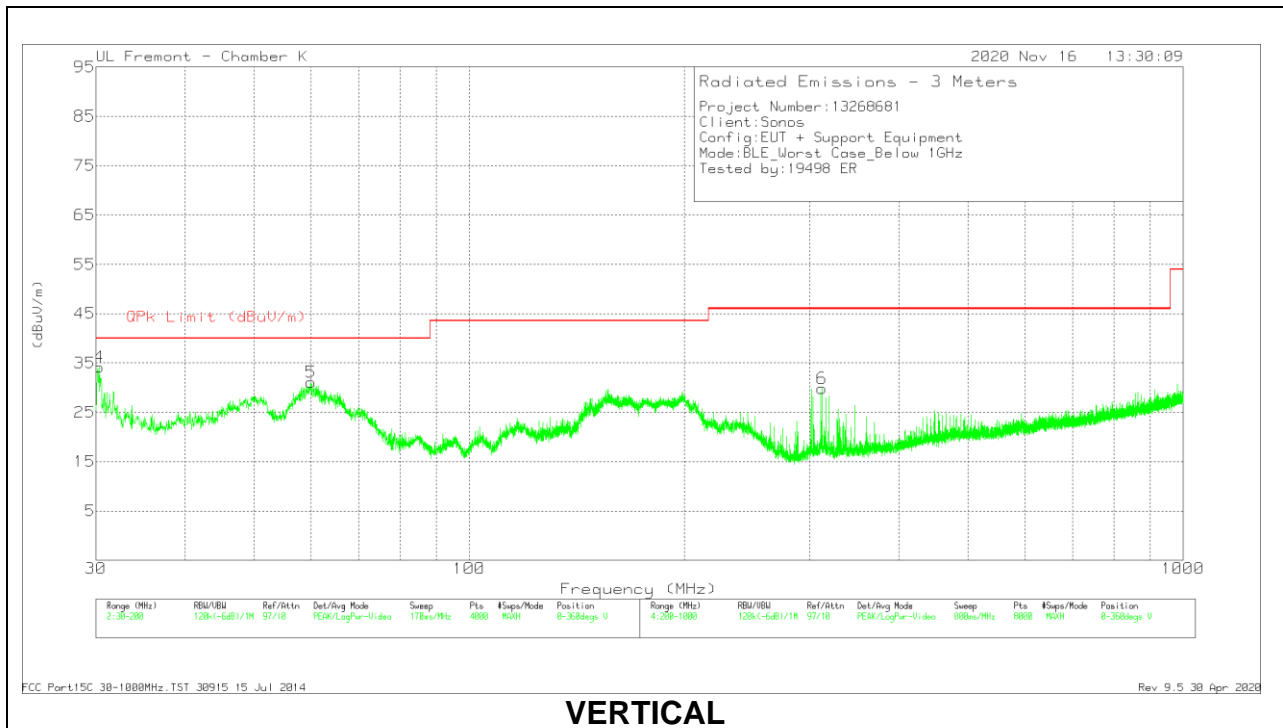
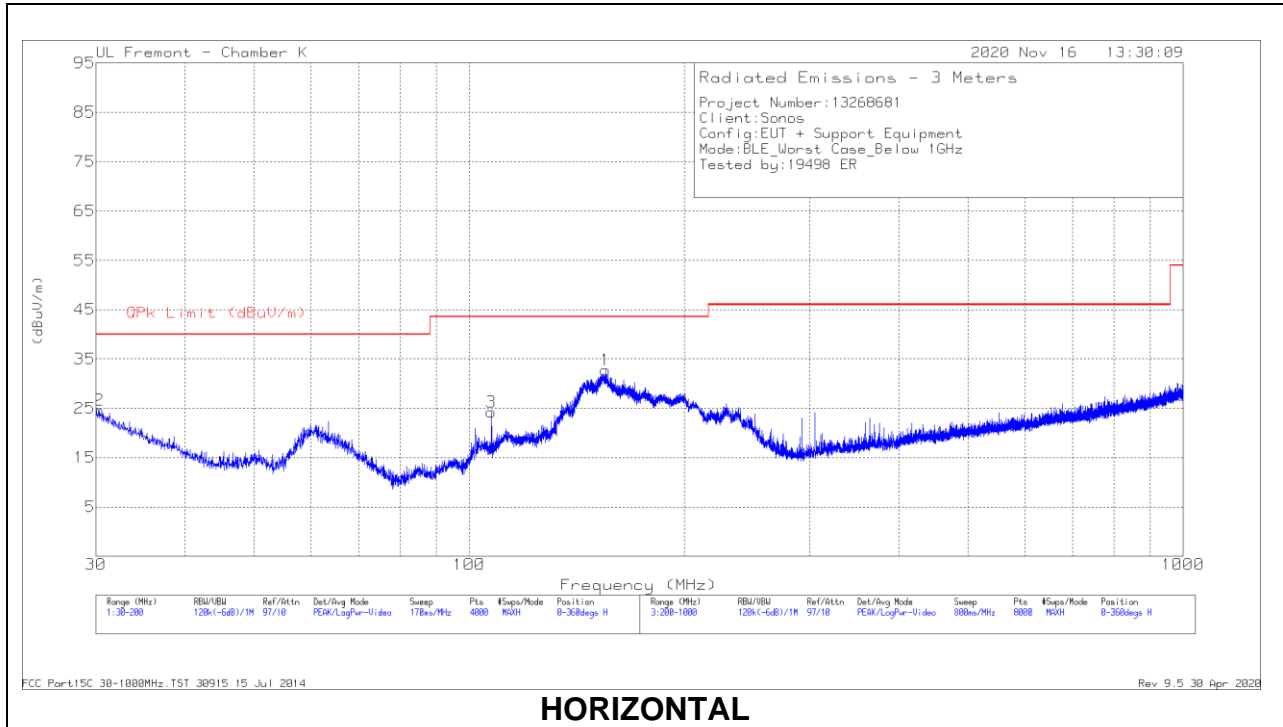
Pk - Peak detector

Marker	Frequency	Meter	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected	QP Limit (dBuV/m)	Margin	Azimuth
3	0.8189	28.09	Pk	56	-32.1	-40	11.99	29.35	-17.36	0-360
7	0.81541	33.62	Pk	56	-32.1	-40	17.52	29.39	-11.87	0-360
4	14.90875	16.44	Pk	34.4	-31.7	-40	-20.86	29.5	-50.36	0-360
8	15.44533	16.52	Pk	34.4	-31.7	-40	-20.78	29.5	-50.28	0-360

Pk - Peak detector

### 10.4. WORST CASE BELOW 1 GHZ

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



**Below 1GHz Data**

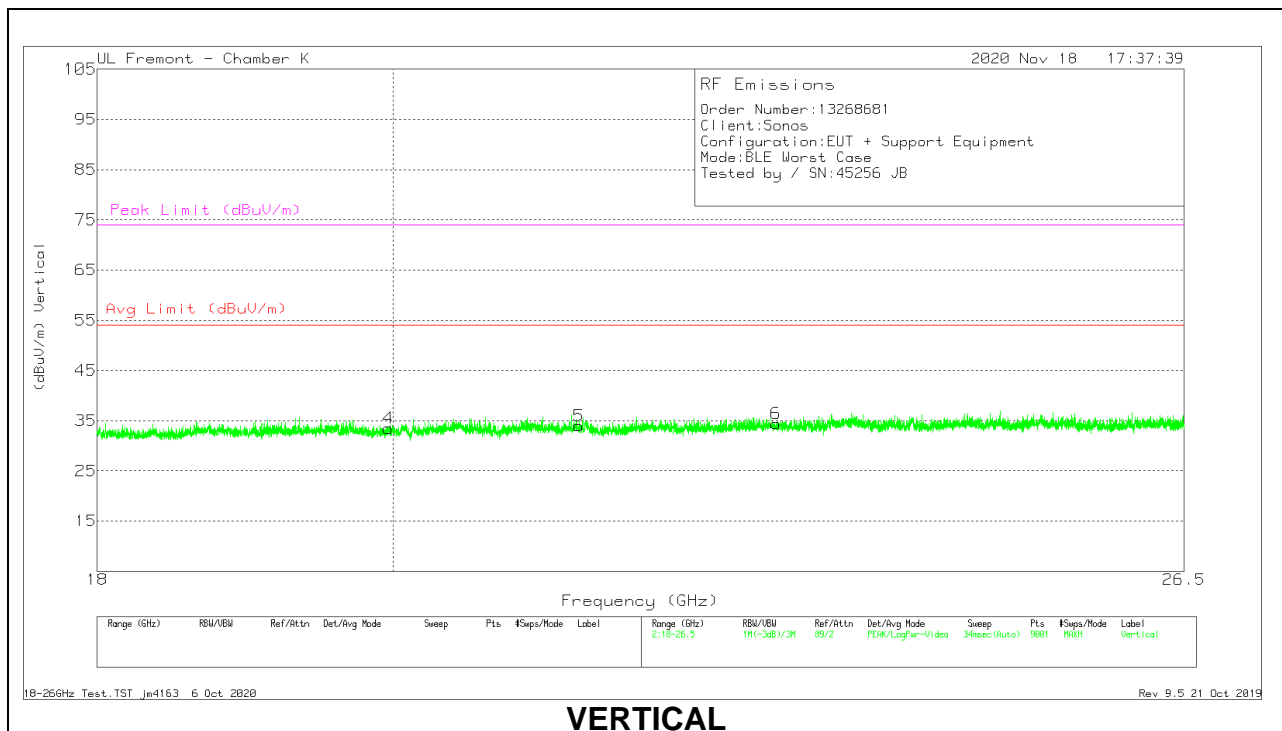
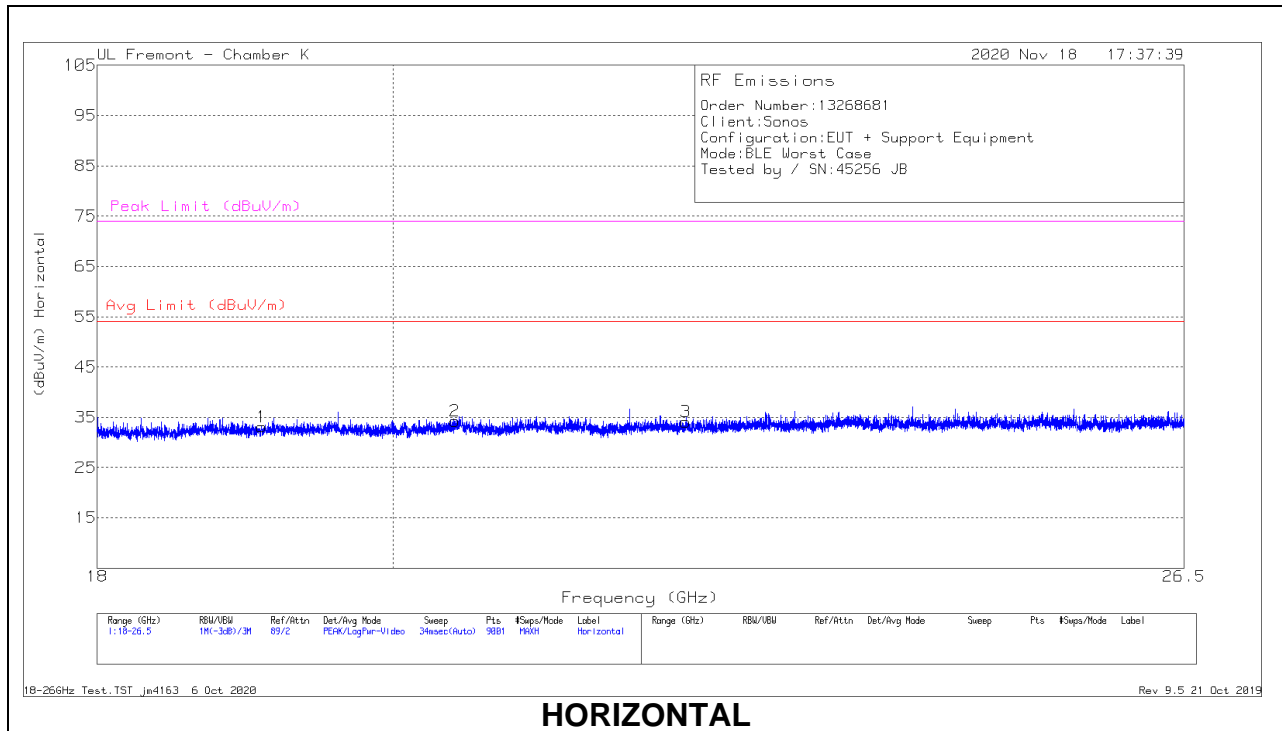
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	155.2374	44.83	Pk	18.6	-30.6	32.83	43.52	-10.69	0-360	201	H
2	30.3401	28.56	Pk	27.7	-31.6	24.66	40	-15.34	0-360	301	H
3	107.3275	37.02	Pk	18.1	-30.9	24.22	43.52	-19.3	0-360	301	H
4	30.3401	38.11	Pk	27.7	-31.6	34.21	40	-5.79	0-360	100	V
	30.1479	32.44	Qp	27.9	-31.6	28.74	40	-11.26	32	98	V
5	60.0553	48.68	Pk	13.6	-31.2	31.08	40	-8.92	0-360	100	V
6	312.0146	39.48	Pk	20.2	-29.8	29.88	46.02	-16.14	0-360	99	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	T447 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.08328	67.72	Pk	32.6	-57.7	-9.5	33.12	54	-20.88	74	-40.88
2	20.44328	67.33	Pk	33.1	-56.7	-9.5	34.23	54	-19.77	74	-39.77
3	22.19239	67.49	Pk	33.5	-57.4	-9.5	34.09	54	-19.91	74	-39.91
4	19.96539	67.05	Pk	32.8	-56.9	-9.5	33.45	54	-20.55	74	-40.55
5	21.36317	67.76	Pk	33.1	-57.4	-9.5	33.96	54	-20.04	74	-40.04
6	22.91772	67.71	Pk	33.7	-57.5	-9.5	34.41	54	-19.59	74	-39.59

Pk - Peak detector

## 11. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

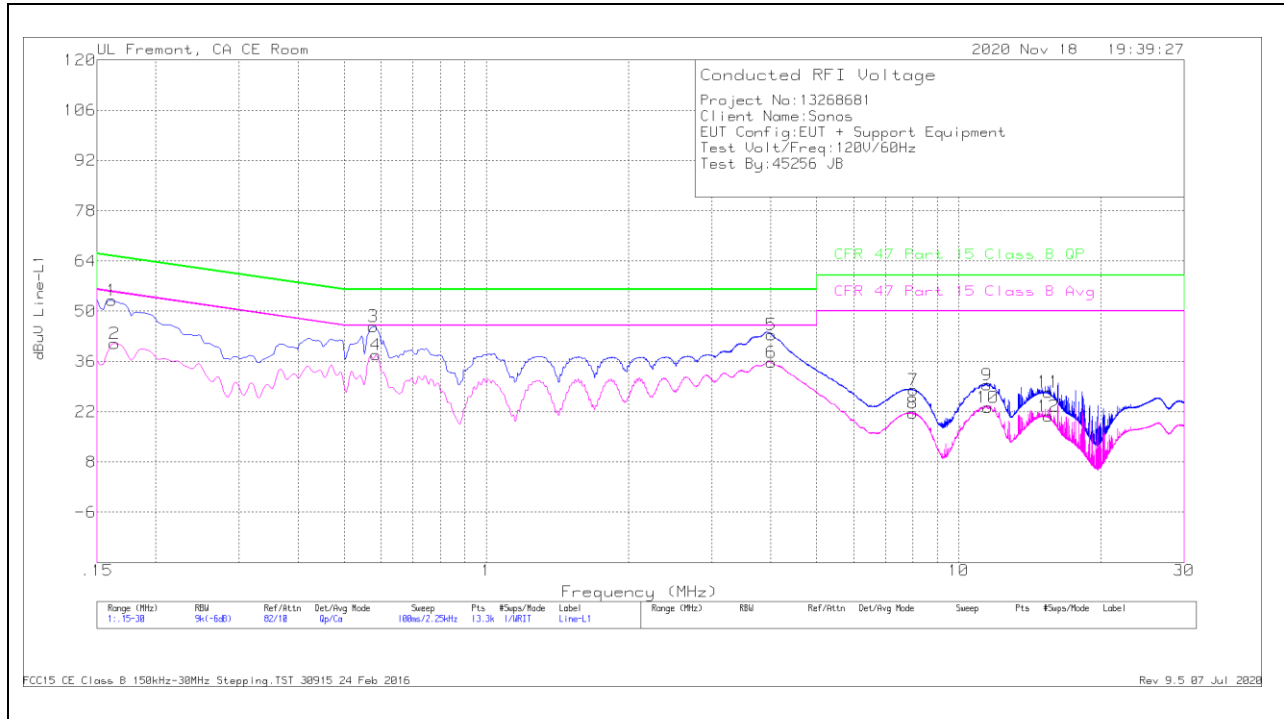
Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

### RESULTS

11.1.1. AC Power Line

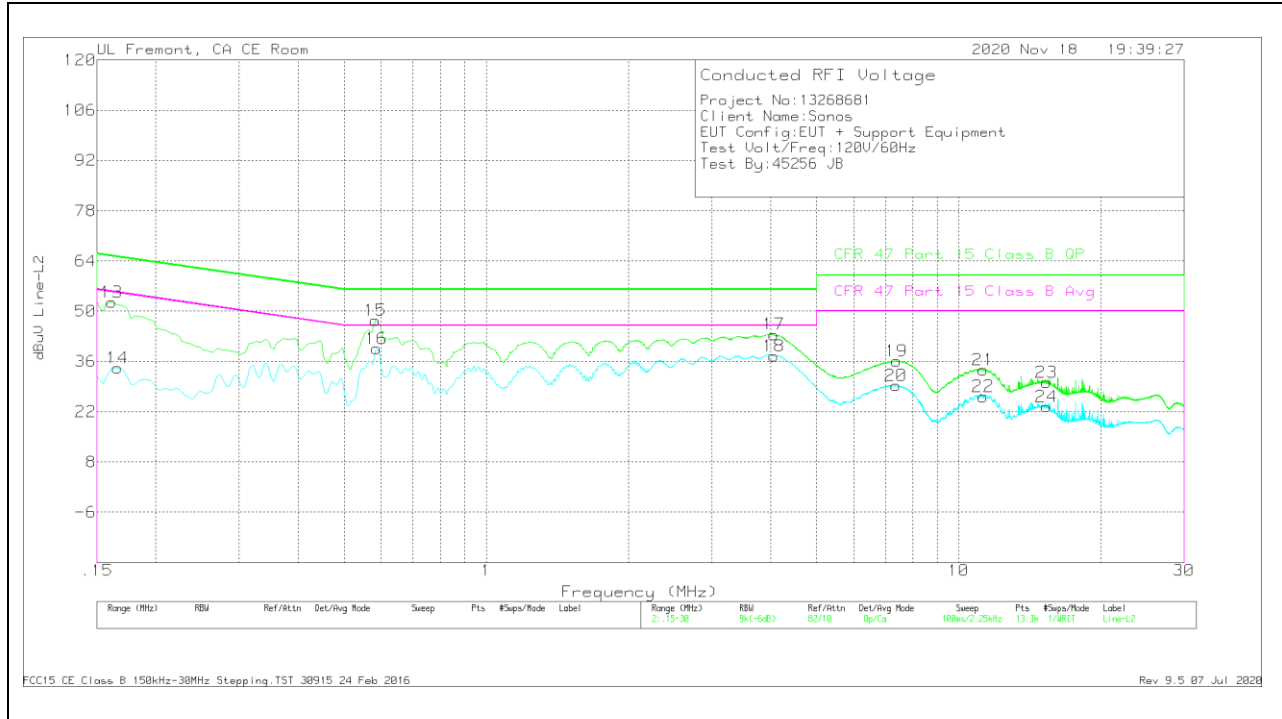
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE018644 6 LISN L1	LC Cables C1&C3 dB	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.16125	42.99	Qp	0	0	10.1	53.09	65.4	-12.31	-	-
2	.1635	30.83	Ca	0	0	10.1	40.93	-	-	55.28	-14.35
3	.5775	35.7	Qp	0	0	10.1	45.8	56	-10.2	-	-
4	.58425	27.83	Ca	0	0	10.1	37.93	-	-	46	-8.07
5	4.0155	33.15	Qp	0	.1	10.2	43.45	56	-12.55	-	-
6	4.0155	25.43	Ca	0	.1	10.2	35.73	-	-	46	-10.27
7	8.0295	17.86	Qp	0	.1	10.2	28.16	60	-31.84	-	-
8	8.00475	11.33	Ca	0	.1	10.2	21.63	-	-	50	-28.37
9	11.49675	18.96	Qp	.1	.2	10.2	29.46	60	-30.54	-	-
10	11.526	12.63	Ca	.1	.2	10.2	23.13	-	-	50	-26.87
11	15.46575	16.98	Qp	0	.2	10.3	27.48	60	-32.52	-	-
12	15.495	10.23	Ca	0	.2	10.3	20.73	-	-	50	-29.27



### LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE018644 6 LISN L2	LC Cables C2&C3 dB	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16125	42.5	Qp	0	0	10.1	52.6	65.4	-12.8	-	-
14	.16575	24.16	Ca	0	0	10.1	34.26	-	-	55.17	-20.91
15	.582	37.3	Qp	0	0	10.1	47.4	56	-8.6	-	-
16	.5865	29.53	Ca	0	0	10.1	39.63	-	-	46	-6.37
17	4.06275	33.24	Qp	0	.1	10.2	43.54	56	-12.46	-	-
18	4.06388	27.27	Ca	0	.1	10.2	37.57	-	-	46	-8.43
19	7.39725	25.82	Qp	0	.1	10.2	36.12	60	-23.88	-	-
20	7.3725	19.02	Ca	0	.1	10.2	29.32	-	-	50	-20.68
21	11.25825	23.24	Qp	0	.2	10.2	33.64	60	-26.36	-	-
22	11.25938	15.86	Ca	0	.2	10.2	26.26	-	-	50	-23.74
23	15.34425	19.62	Qp	0	.2	10.3	30.12	60	-29.88	-	-
24	15.342	12.81	Ca	0	.2	10.3	23.31	-	-	50	-26.69