



# **CERTIFICATION TEST REPORT**

**Report Number. :** 11886412-E1V6

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

**Model :** S14

**FCC ID :** SBVRM014

**ISED :** 5373A-RM014

**EUT Description :** HOME THEATER SPEAKER

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C  
ISED RSS - 247 ISSUE 2  
ISED RSS-GEN ISSUE 4

**Date Of Issue:**

April 30, 2018

**Prepared by:**

UL Verification Services Inc.  
47173 Benicia Street  
Fremont, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888

## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	12/5/2017	Initial Release	D. Corona
V2	12/13/2017	Updated Section 2 and 8.1	D. Corona
V3	02/22/2018	Updated section 5.5, 5.6, 9.2, 11. Added section 9.5	C. Susa
V4	03/12/2018	Updated EUT description from Wireless Smart Speaker to Home Theater Speaker	C. Susa
V5	03/14/2018	Updated Product description, Section 5.1	C. Susa
V6	04/30/2018	Updated Software and Firmware Description, Section 5.4	D. Corona

## TABLE OF CONTENTS

<b>TABLE OF CONTENTS</b> .....	<b>3</b>
<b>1. ATTESTATION OF TEST RESULTS</b> .....	<b>5</b>
<b>2. TEST METHODOLOGY</b> .....	<b>6</b>
<b>3. FACILITIES AND ACCREDITATION</b> .....	<b>6</b>
<b>4. CALIBRATION AND UNCERTAINTY</b> .....	<b>7</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i> .....	7
4.2. <i>SAMPLE CALCULATION</i> .....	7
4.3. <i>MEASUREMENT UNCERTAINTY</i> .....	7
<b>5. EQUIPMENT UNDER TEST</b> .....	<b>8</b>
5.1. <i>DESCRIPTION OF EUT</i> .....	8
5.2. <i>MAXIMUM OUTPUT POWER</i> .....	8
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i> .....	8
5.4. <i>SOFTWARE AND FIRMWARE</i> .....	8
5.5. <i>WORST-CASE CONFIGURATION AND MODE</i> .....	8
5.6. <i>DESCRIPTION OF TEST SETUP</i> .....	9
<b>6. TEST AND MEASUREMENT EQUIPMENT</b> .....	<b>14</b>
<b>7. MEASUREMENT METHODS</b> .....	<b>15</b>
<b>8. ANTENNA PORT TEST RESULTS</b> .....	<b>16</b>
8.1. <i>ON TIME, DUTY CYCLE</i> .....	16
8.2. <i>6 dB BANDWIDTH</i> .....	17
8.3. <i>99% BANDWIDTH</i> .....	18
8.4. <i>AVERAGE POWER</i> .....	20
8.5. <i>OUTPUT POWER</i> .....	21
8.6. <i>POWER SPECTRAL DENSITY</i> .....	22
8.7. <i>CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS</i> .....	24
<b>9. RADIATED TEST RESULTS</b> .....	<b>26</b>
9.1. <i>TRANSMITTER ABOVE 1 GHz</i> .....	27
9.1.1. <i>BANDEDGE (LOW CHANNEL)</i> .....	27
9.1.2. <i>BANDEDGE (HIGH CHANNEL)</i> .....	29

---

9.1.3. HARMONICS AND SPURIOUS EMISSIONS .....	31
9.2. WORST-CASE BELOW 1 GHz.....	37
9.3. WORST-CASE 18-26GHz .....	39
9.4. Worst Case 9 kHz - 30 MHz.....	41
9.5. WORST-CASE SIMULTANEOUS TRANSMISSION.....	43
<b>10. AC POWER LINE CONDUCTED EMISSIONS .....</b>	<b>45</b>
<b>11. SETUP PHOTOS .....</b>	<b>48</b>

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SONOS, INC.

**PRODUCT DESCRIPTION:** HOME THEATER SPEAKER

**MODEL:** S14

**SERIAL NUMBER:** 179-94-9F-3E-C0-07-0E-3 CA (Radiated Sample)  
1708 94 -9F-3E-D0-05-FE-2 (Radiated Sample)  
1709-94-9F-3E-D0-07-09-E (Conducted Sample)

**DATE TESTED:** NOVEMBER 13, 2017 - 14, 2017; February 14<sup>th</sup> - 16<sup>th</sup>, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 4	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. 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  
UL Verification Services Inc. By:

Prepared By:



DAN CORONIA  
OPERATIONS LEADER  
UL Verification Services Inc.

ERIC YU  
TEST ENGINEER  
UL Verification Services Inc.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 558074 D01 v04, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 2.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input checked="" type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input checked="" type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input type="checkbox"/> Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through C are covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under Industry Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0 except for ISED RSS-247 Issue 2. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

### 4.3. MEASUREMENT UNCERTAINTY

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

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is 802.11 a/b/g/n (HT20) master device. The model S14 is a high-performance all-in-one home theater smart speaker and part of Sonos' home sound system.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum output power as follows:

Frequency Range (MHz)	Mode	Average		Peak	
		Output Power (dBm)	Output Power (mW)	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE	-3.26	0.47	-2.63	0.55

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes antenna, with a maximum gain of 2.38 dBi

### 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was LabView WiFi controller application version 2.2.

### 5.5. WORST-CASE CONFIGURATION AND MODE

All measurements were performed with the AC plugged into a power source. The worst-case configuration for below 1GHz radiated emissions were performed with the EUT including the HDMI port exercised and the channel with the highest output power. The worst-case configuration for radiated emissions above 1GHz, and power line conducted emissions were performed with the EUT only and set to transmit at the channel with highest output power.

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.

For simultaneous transmission in the 2.4GHz and 5GHz bands, tests were conducted for various configurations having the highest power. No noticeable new emission was found.

Worst-case data rates as provided by the client were:

BLE: 1 Mbps.



## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop	Lenovo	X201	R9-BC7TG
AC/DC Adapter	Lenovo	ADLX90NCT2A	11S42T4418Z1ZF3B048J2Z
Television	Sony	XBR-43X830C	5082247

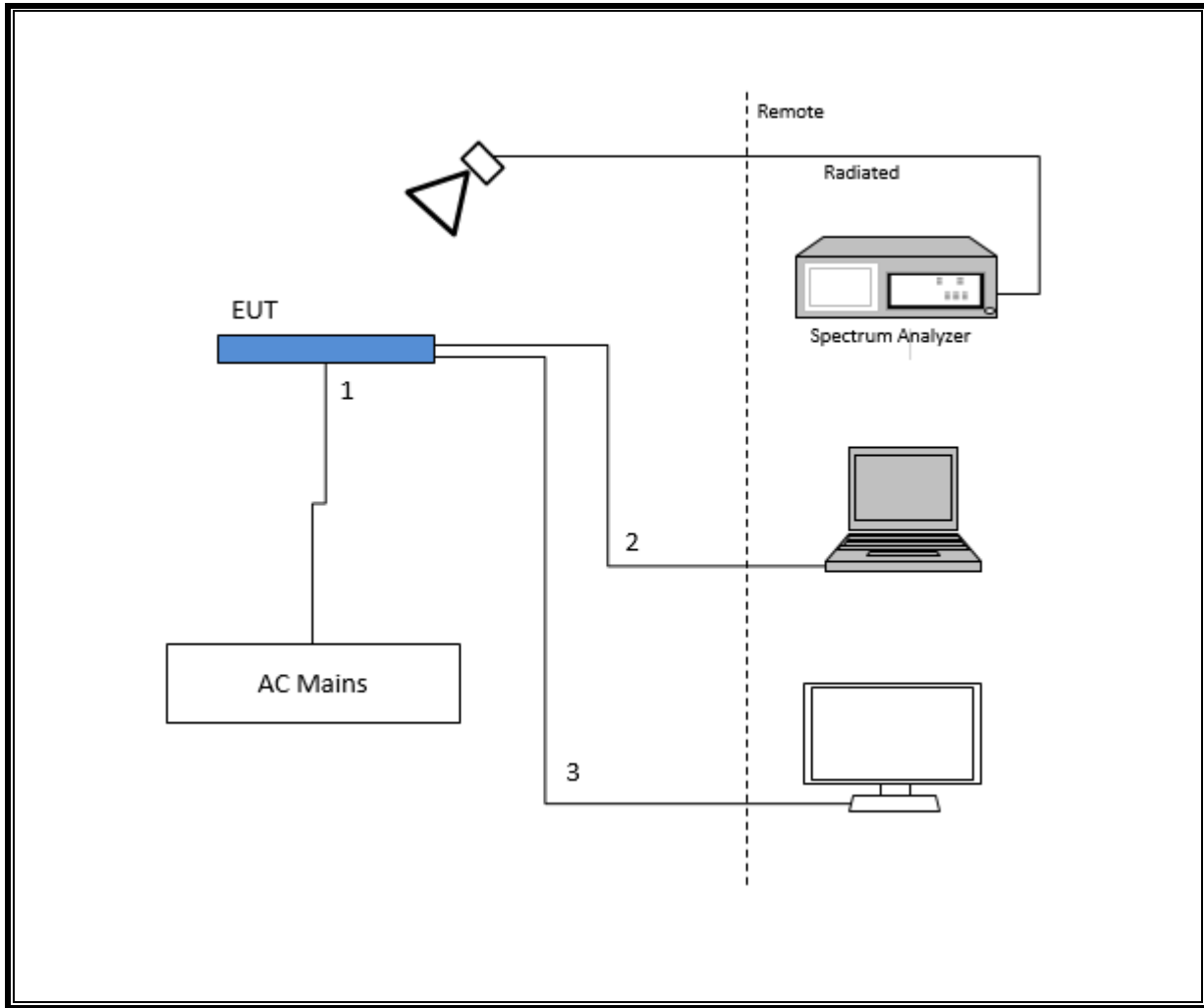
### I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC Power	1	AC	Unshielded	1.2	AC Mains to EUT
2	Ethernet	1	RJ45	Unshielded	1.5	Laptop to EUT
3	HDMI	1	HDMI	shielded	10.2	

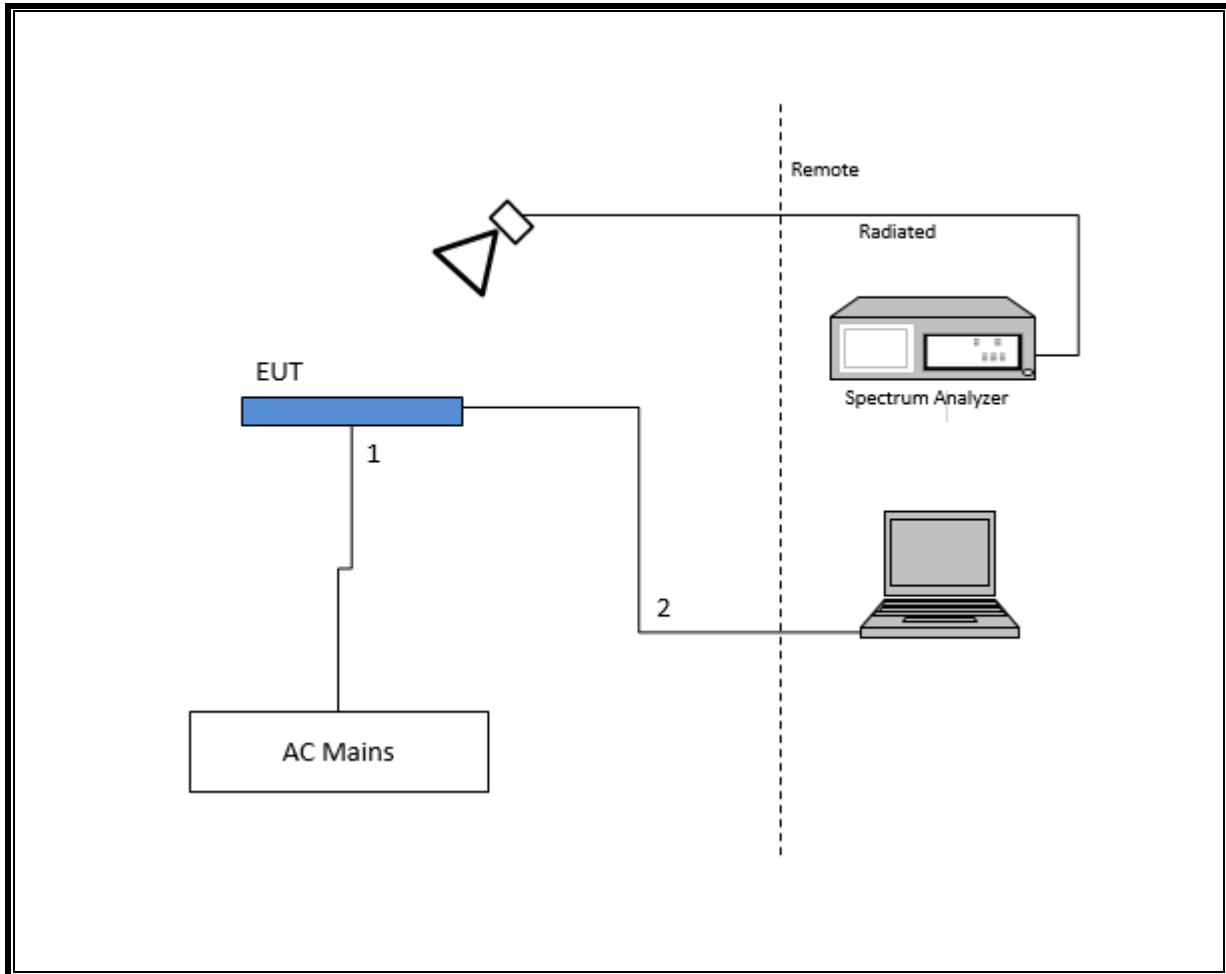
### TEST SETUP

The EUT is a stand-alone unit, and the radio is exercised by Atheros Radio Test 2 (ART2-GUI) software, via Ethernet cable.

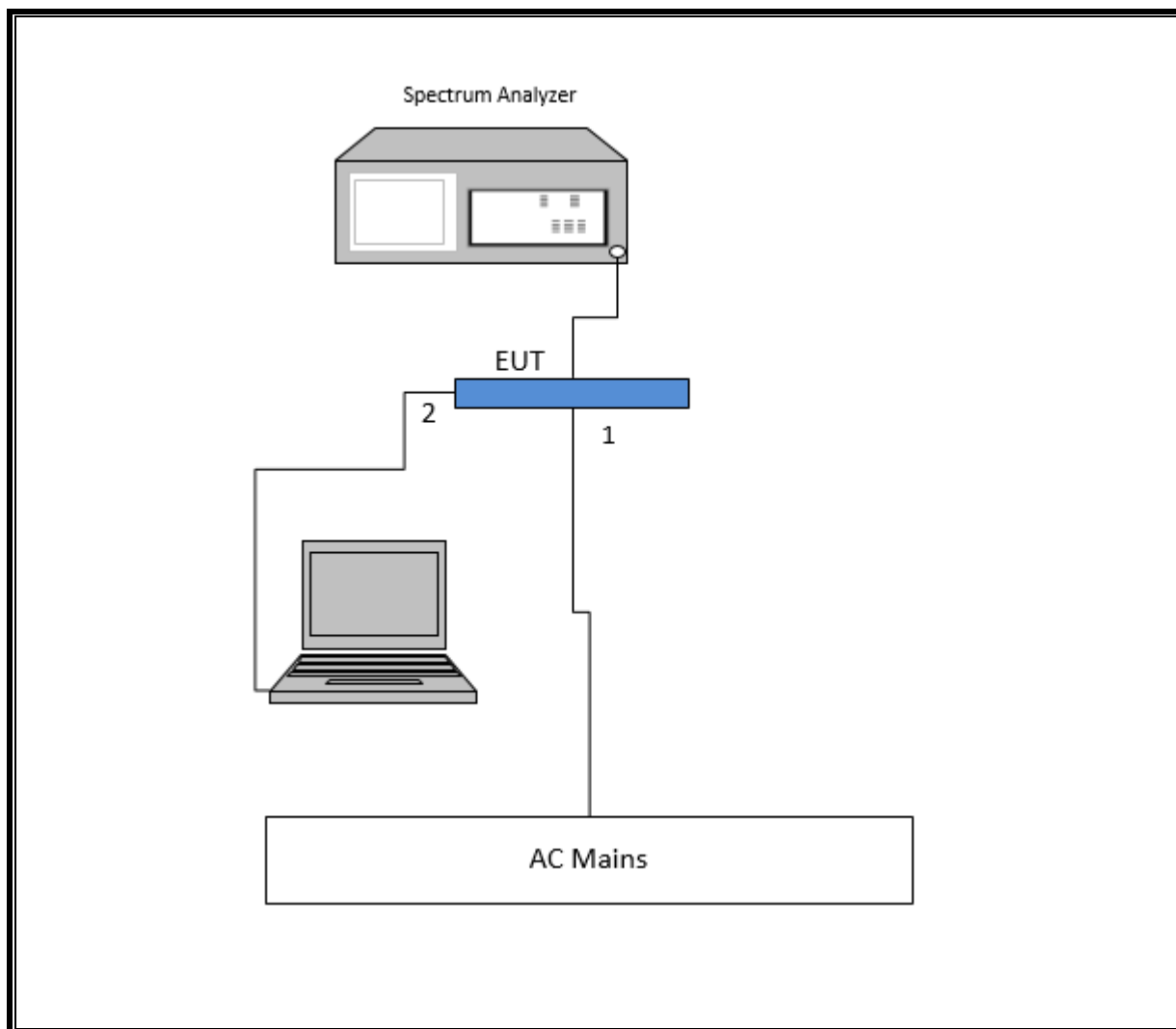
**SETUP DIAGRAM FOR RADIATED BELOW 1GHZ TESTS**



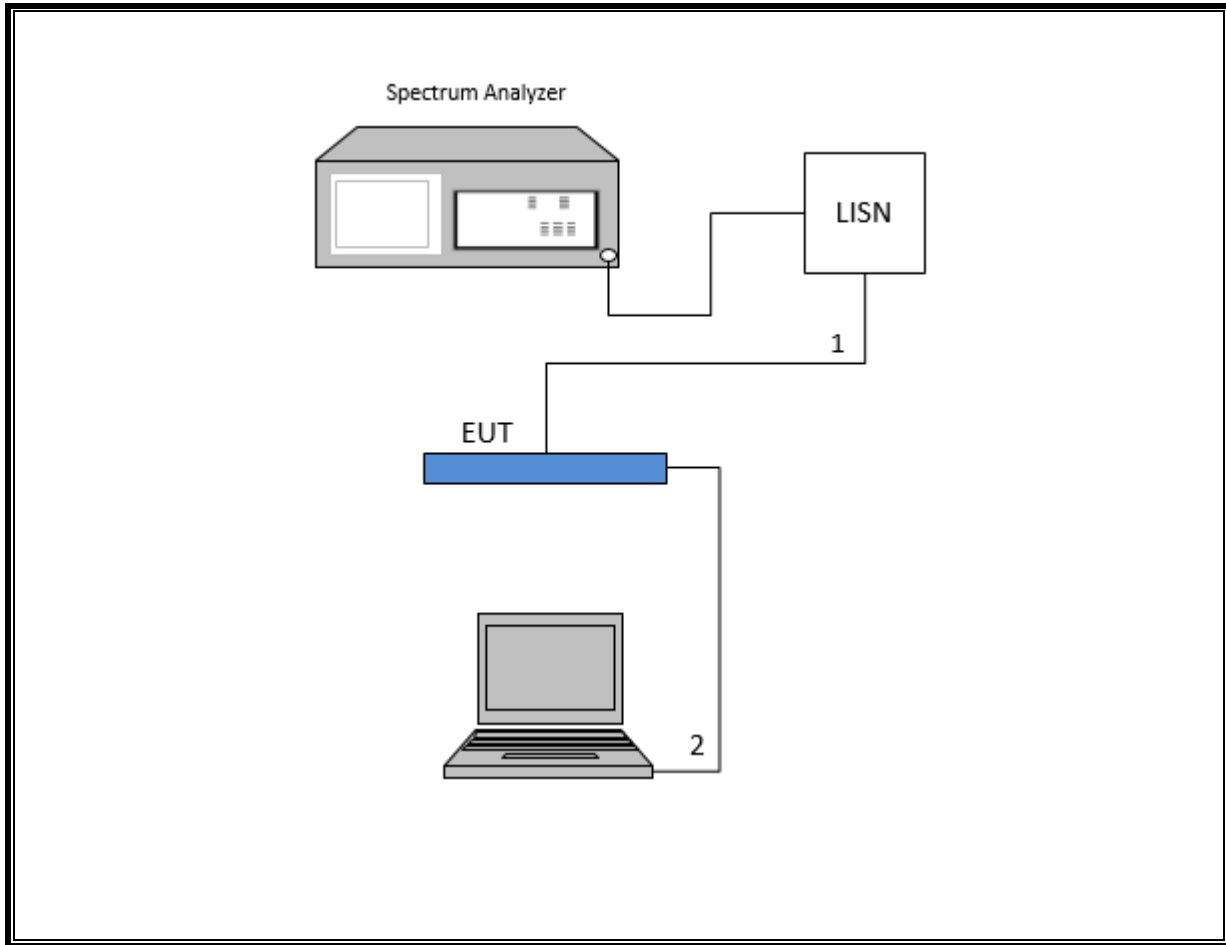
**SETUP DIAGRAM FOR RADIATED ABOVE 1GHZ TESTS**



**SETUP DIAGRAM FOR CONDUCTED TESTS**



**SETUP DIAGRAM FOR AC LINE CONDUCTED TEST**



## 6. 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	Asset	Cal Due
Antenna, Broadband Hybrid, 30MHz to 2000MHz w/4dB Pad	Sunol Sciences Corp.	JB1	T130	10/16/2018
Antenna, Active Loop 9kHz-30MHz	ETS-Lindgren	6502	T1683	02/17/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	03/07/2018
Antenna, Horn 18-26.5GHz	ARA	MWH-1826/B	T89	05/26/2018
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1264	07/08/2018
Power Sensor, P – series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T413	06/20/2018
Amplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	T493	12/16/2018
Amplifier, 10kHz-1GHz	Agilent (Keysight) Technologies	8447D	T15	08/26/2018
Amplifier, 1-26.5GHz	Keysight	8449B	T404	07/23/2018
Filter, BRF 5150 to 5350MHz	Micro-Tronics	BRC50703	T1850	07/16/18
Filter, BRF 2400 to 2500MHz	Micro-Tronics	BRM50702-02	T1784	05/16/18
High pass filter 3GHz	Micro-Tronics	HPM17543	T485	12/16/18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	T483	12/16/18
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Agilent (Keysight) Technologies	E4440A	T199	07/22/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T907	01/23/2018
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Agilent (Keysight) Technologies	E9030A	T905	01/11/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1466	04/11/2018
LISN	FISCHER	FCC-LISN-50/250-25-2-01	T1310	01/17/2018
Receiver, 10kHz-7GHz	ROHDE & SCHWARZ	ESR	T1436	01/06/2018

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, Dec 01, 2016
Conducted Emissions Software	UL	UL EMC	Ver 9.5, May 26, 2015
Antenna Port Software	UL	UL RF	Ver 6.0, Jan 19, 2017

## 7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 558074 D01 v04, Section 6.

6 dB BW: KDB 558074 D01 v04, Section 8.1.

Output Power: KDB 558074 D01 v04, Section 9.1.3.

Power Spectral Density: KDB 558074 D01 v04, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

Band-edge: KDB 558074 D01 v04, Section 12.1.

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

## 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME, DUTY CYCLE

#### LIMITS

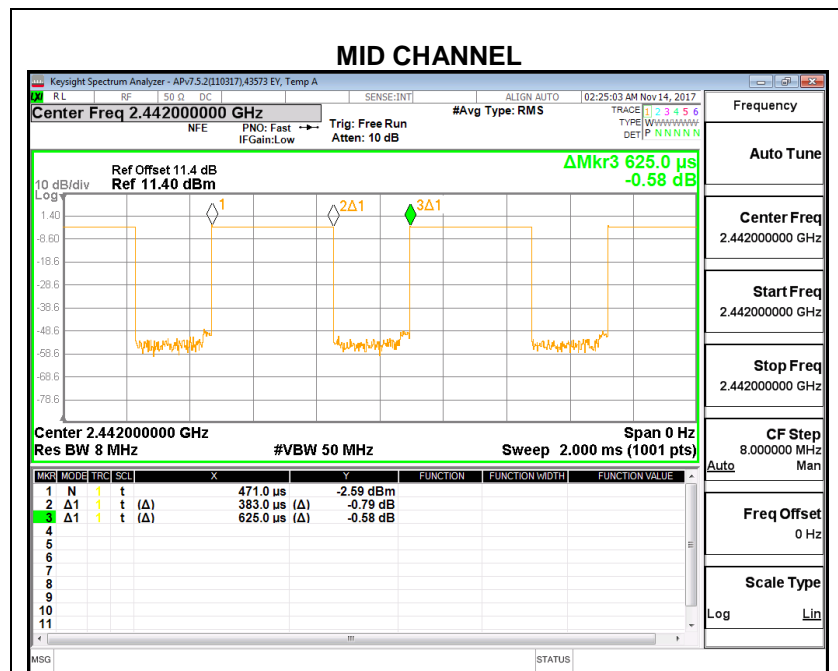
None; for reporting purposes only.

#### 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/T Minimum VBW (kHz)
BLE	0.383	0.625	0.613	61.28%	2.13	2.611





## 8.2. 6 dB BANDWIDTH

### LIMITS

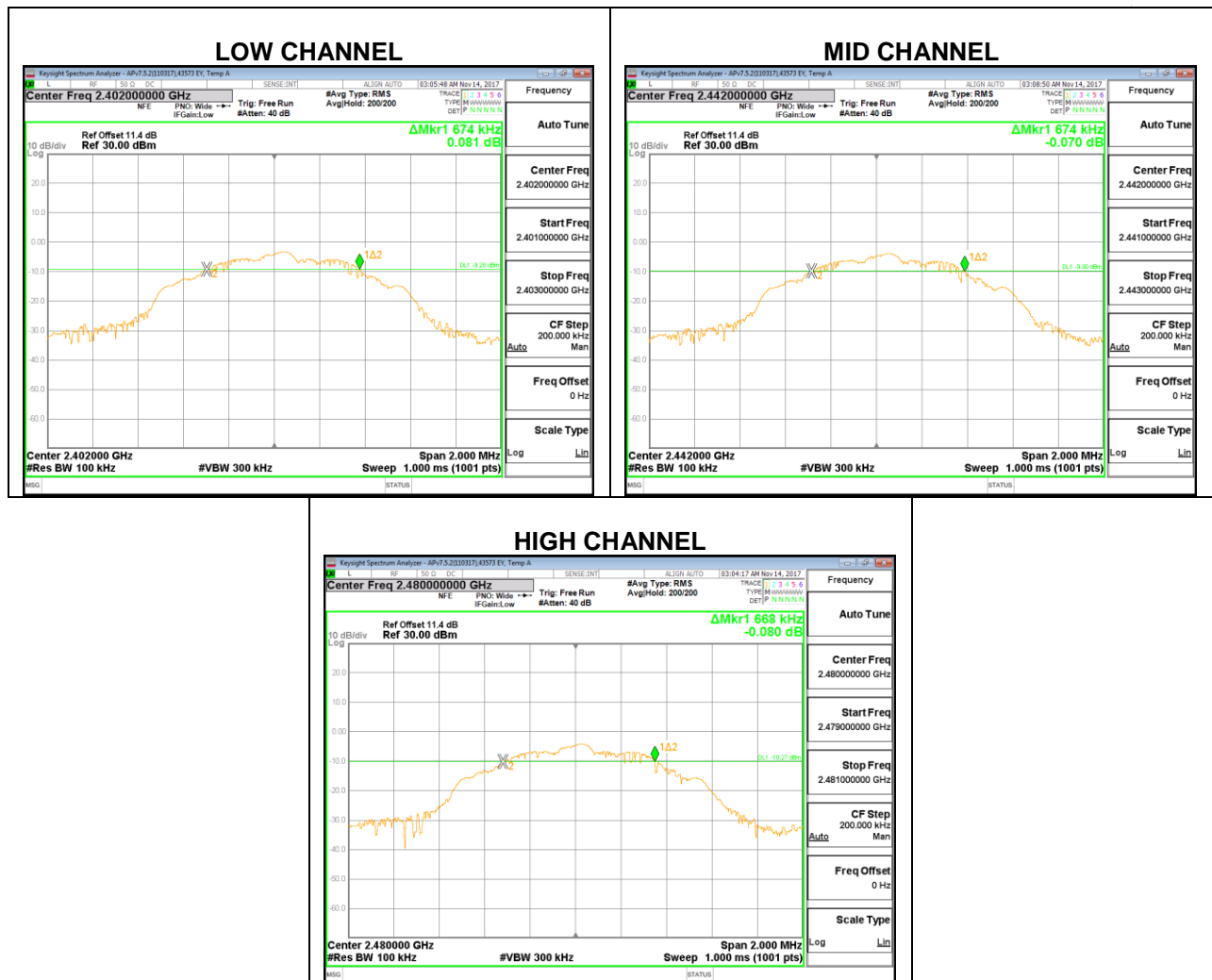
FCC §15.247 (a) (2)

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	0.674	0.5
Middle	2440	<b>0.674</b>	0.5
High	2480	0.668	0.5



### 8.3. 99% BANDWIDTH

#### LIMITS

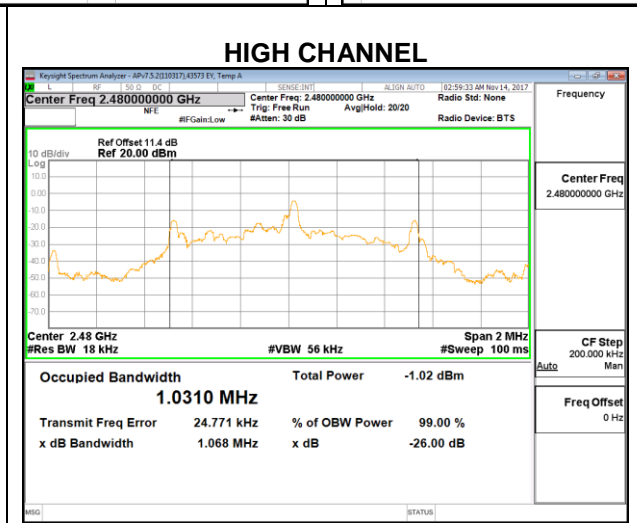
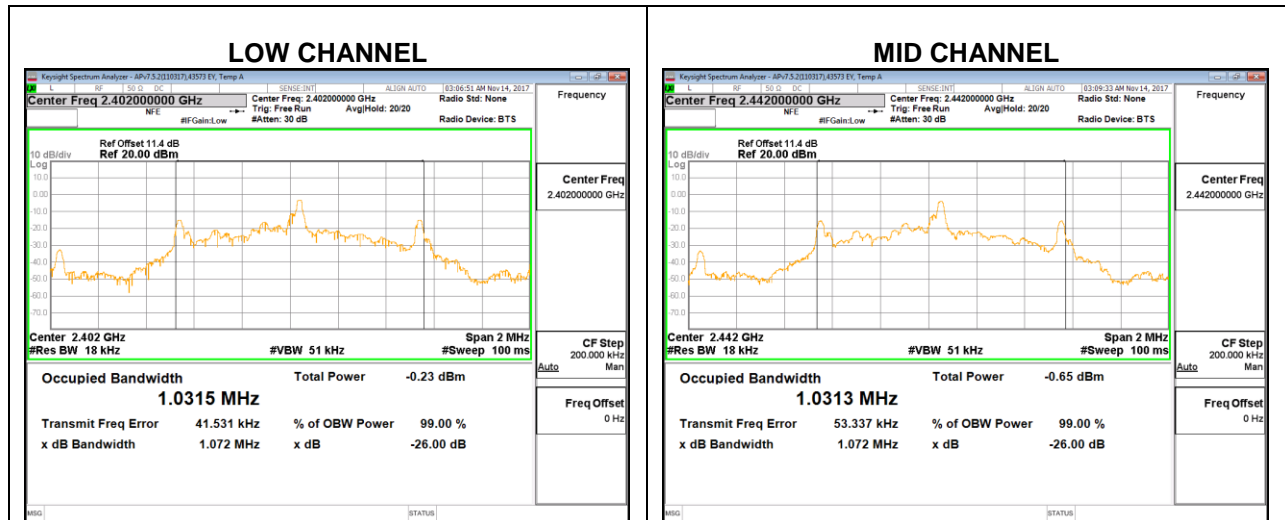
None; for reporting purposes only.

#### Test Procedure

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

#### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	<b>1.0315</b>
Middle	2440	1.0313
High	2480	1.0310



## 8.4. AVERAGE POWER

### LIMITS

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

### RESULTS

<b>TEST ENGINEER:</b>	43573	<b>Date:</b>	11/14/17
-----------------------	-------	--------------	----------

Channel	Frequency (MHz)	AV Power (dBm)
Low	2402	-3.26
Middle	2440	-3.44
High	2480	-3.77

## 8.5. OUTPUT POWER

### LIMITS

FCC §15.247 (b)

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 cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

### RESULTS

<b>TEST ENGINEER:</b>	43573	<b>Date:</b>	11/14/17
-----------------------	-------	--------------	----------

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Power Reading (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
Low	2402	-2.63	30	-32.630
Middle	2440	-2.91	30	-32.910
High	2480	-3.31	30	-33.310

## 8.6. POWER SPECTRAL DENSITY

### LIMITS

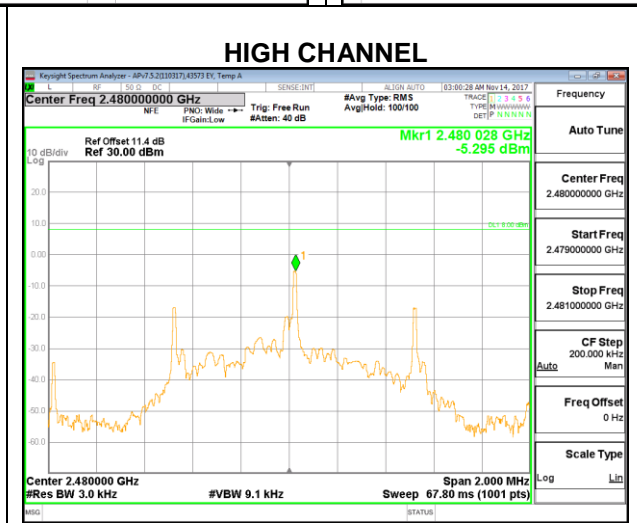
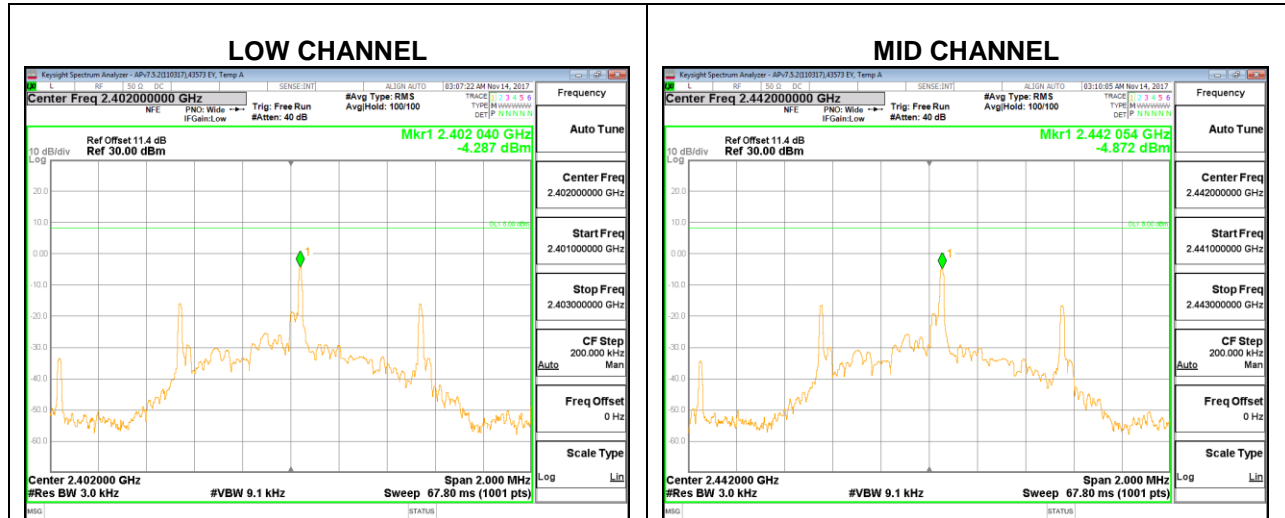
FCC §15.247 (e)

IC 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	-4.29	8	-12.29
Middle	2440	-4.87	8	-12.87
High	2480	-5.30	8	-13.30



## **8.7. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS**

### **LIMITS**

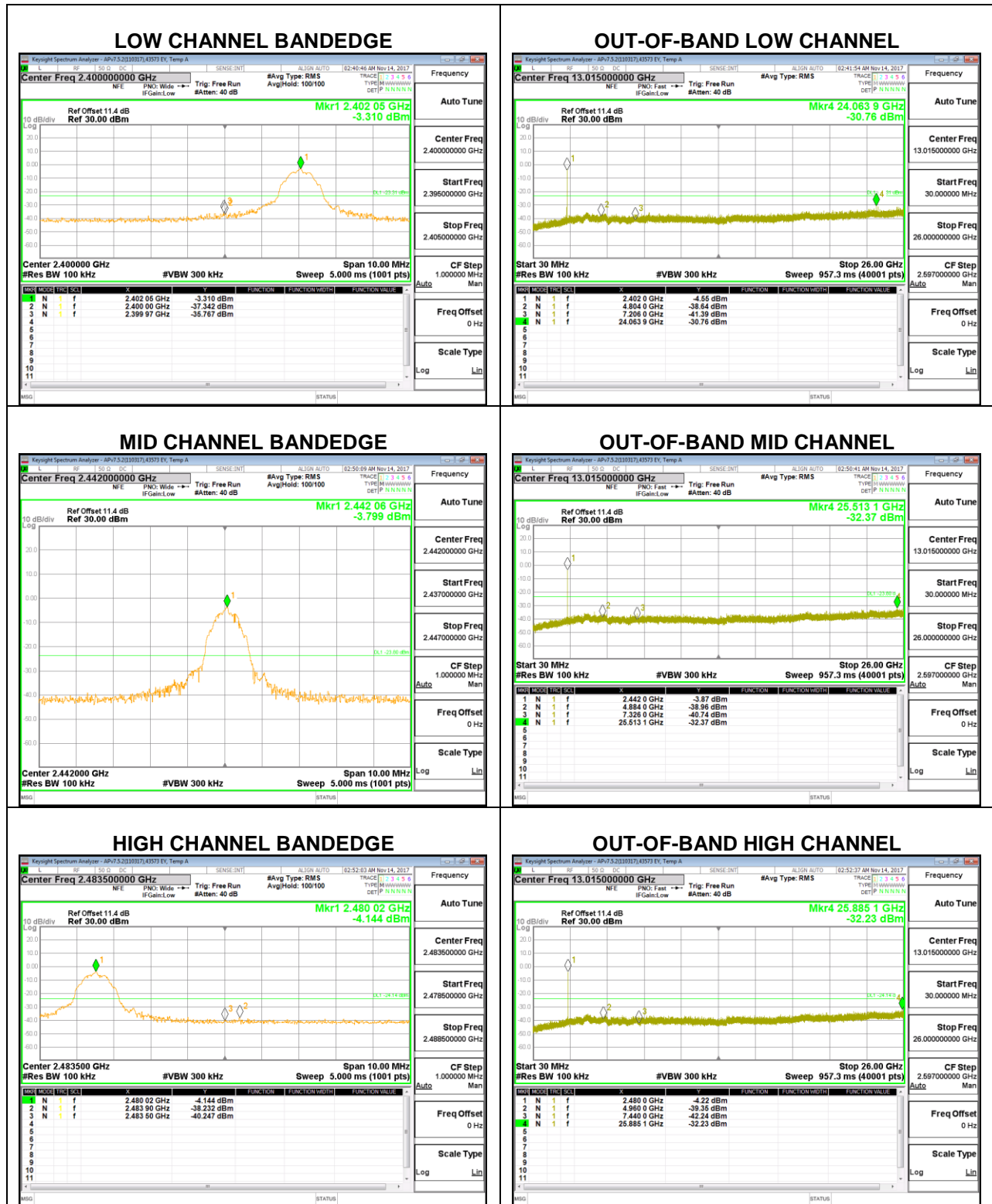
FCC §15.247 (d)

IC RSS-247 (5.5)

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

### **RESULTS**





## 9. RADIATED TEST RESULTS

### 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.

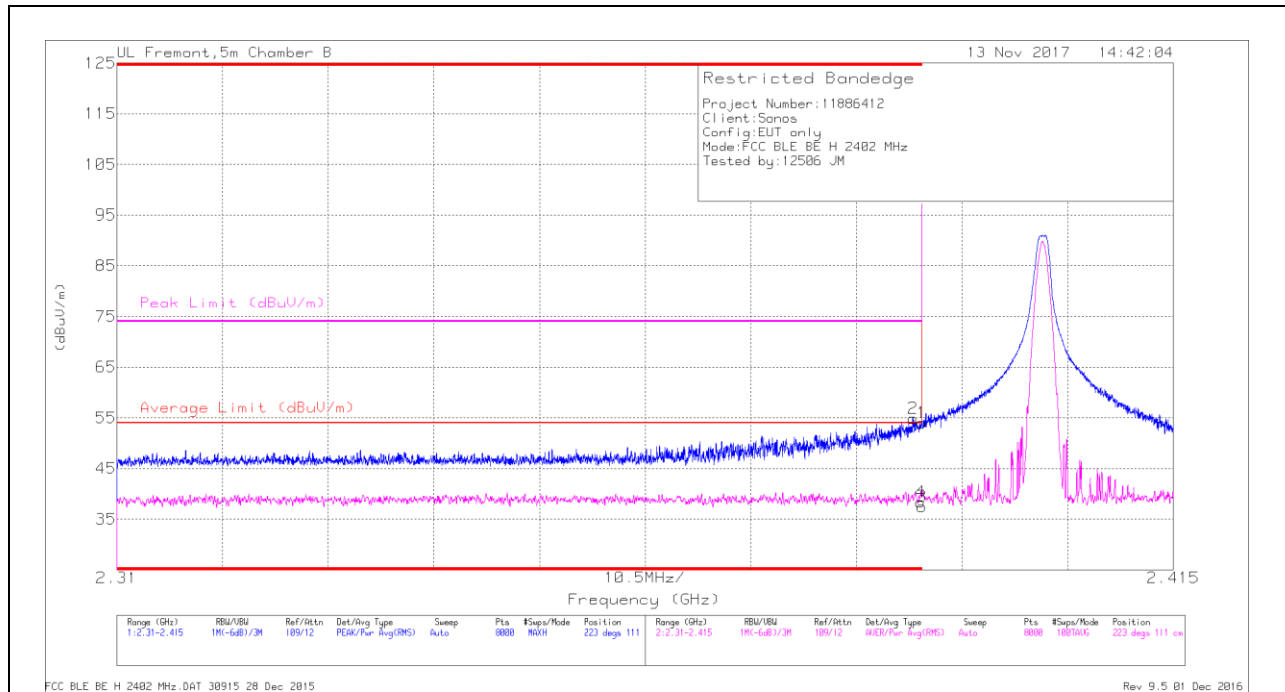
The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

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.

## 9.1. TRANSMITTER ABOVE 1 GHz

### 9.1.1. BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT



#### Trace Markers

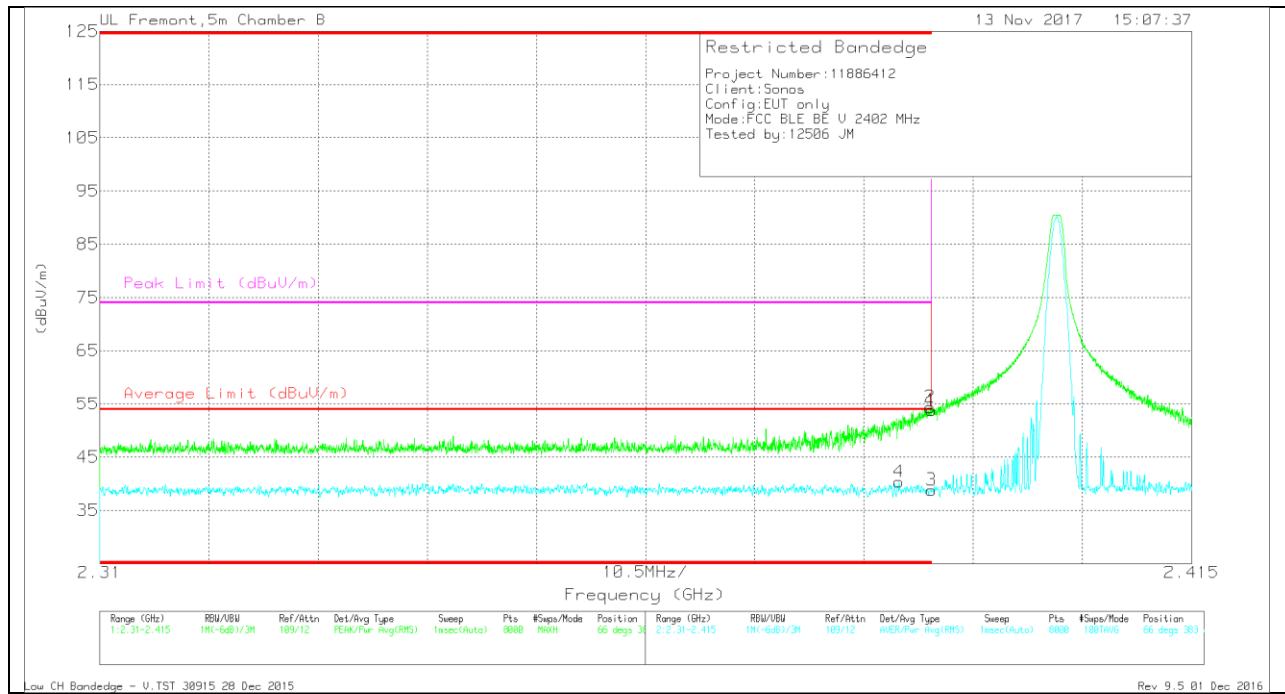
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT863 (dB/m)	Amp/Chl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	43.25	Pk	32	-21.2	0	54.05	-	-	74	-19.95	223	111	H
2	* 2.389	44.07	Pk	32	-21.2	0	54.87	-	-	74	-19.13	223	111	H
3	* 2.39	26.67	RMS	32	-21.2	2.13	39.6	54	-14.4	-	-	223	111	H
4	* 2.39	27.52	RMS	32	-21.2	2.13	40.45	54	-13.55	-	-	223	111	H

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

Pk - Peak detector

RMS - RMS detection

**VERTICAL RESULT**



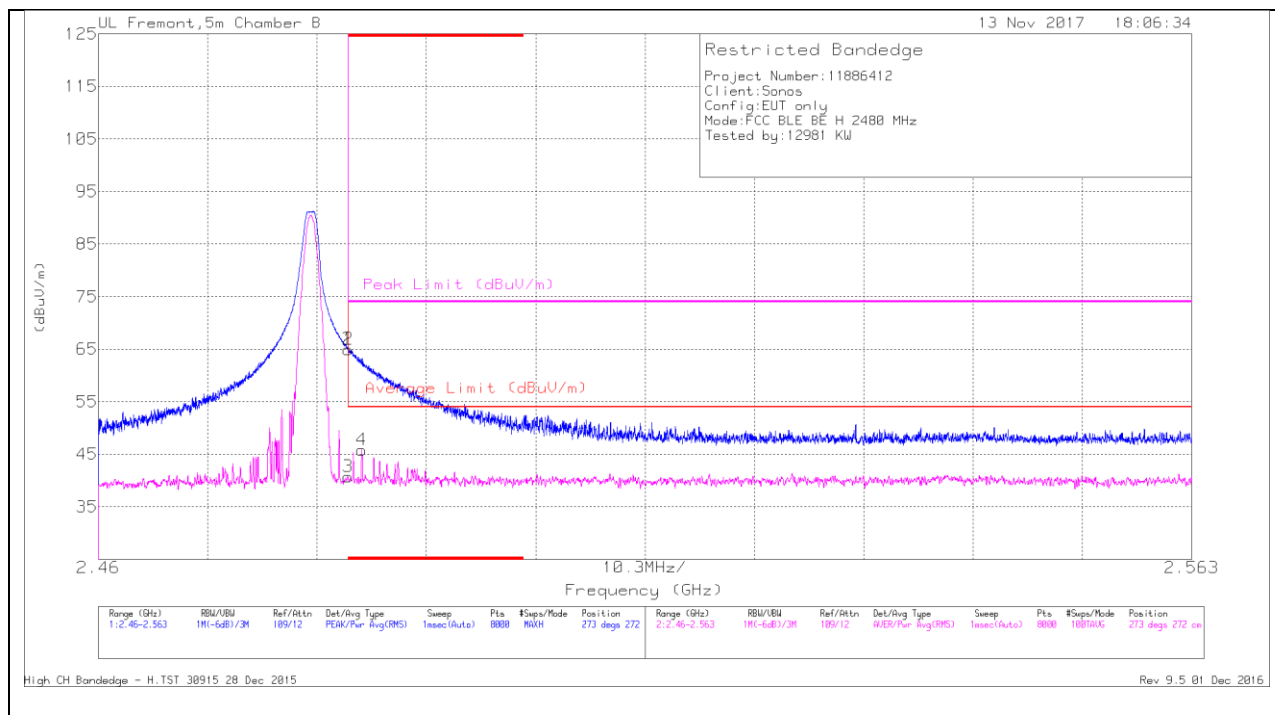
**Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Ch/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
4	* 2.387	27.41	RMS	32	-21.2	2.13	40.34	54	-13.66	-	-	66	383	V
1	* 2.39	42.99	Pk	32	-21.2	0	53.79	-	-	74	-20.21	66	383	V
2	* 2.39	43.58	Pk	32	-21.2	0	54.38	-	-	74	-19.62	66	383	V
3	* 2.39	25.86	RMS	32	-21.2	2.13	38.79	54	-15.21	-	-	66	383	V

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

### 9.1.2. BANDEDGE (HIGH CHANNEL)

#### HORIZONTAL RESULT



#### Trace Markers

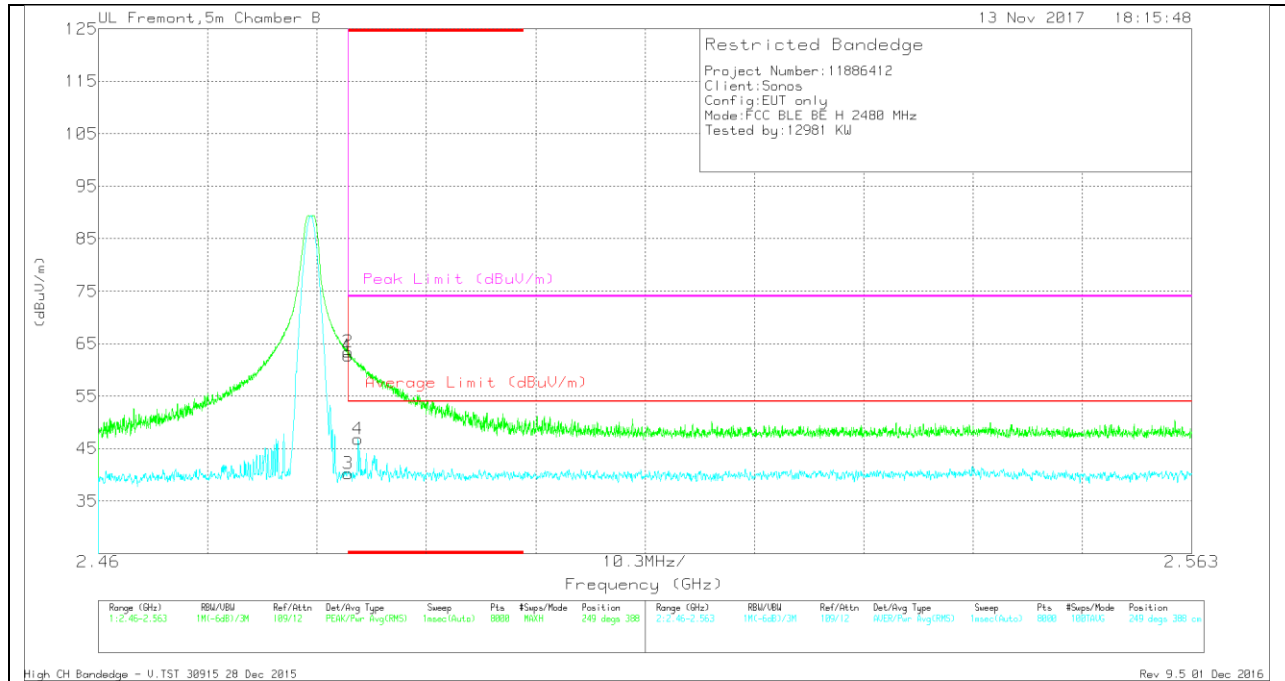
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT863 (dB/m)	Amp/GB/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	53.32	Pk	32.5	-20.9	0	64.92	-	-	74	-9.08	273	272	H
2	* 2.484	53.4	Pk	32.5	-20.9	0	65	-	-	74	-9	273	272	H
3	* 2.484	27.02	RMS	32.5	-20.9	2.13	40.75	54	-13.25	-	-	273	272	H
4	* 2.485	31.96	RMS	32.5	-20.8	2.13	45.79	54	-8.21	-	-	273	272	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/Ftr/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	* 2.484	51.09	PK	32.5	-20.9	0	62.69	-	-	74	-11.31	249	388	V
2	* 2.484	51.88	PK	32.5	-20.9	0	63.48	-	-	74	-10.52	249	388	V
3	* 2.484	26.52	RMS	32.5	-20.9	2.13	40.25	54	-13.75	-	-	249	388	V
4	* 2.484	33.1	RMS	32.5	-20.9	2.13	46.83	54	-7.17	-	-	249	388	V

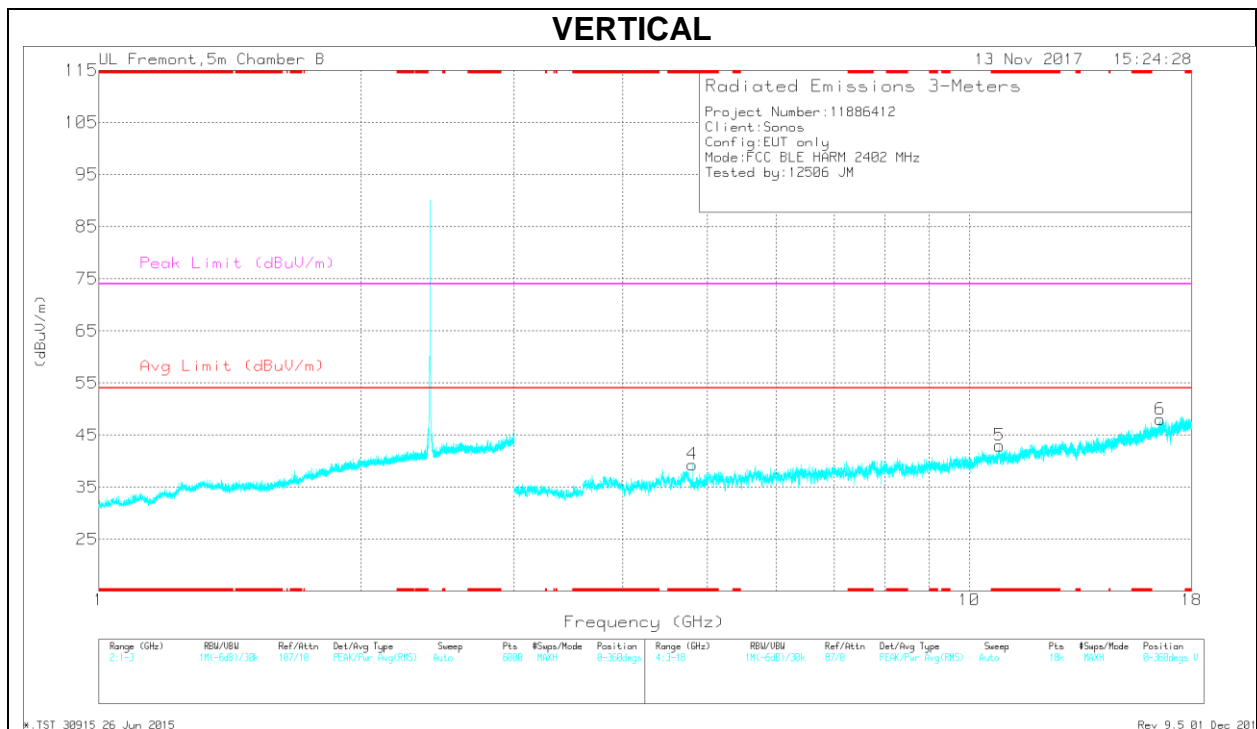
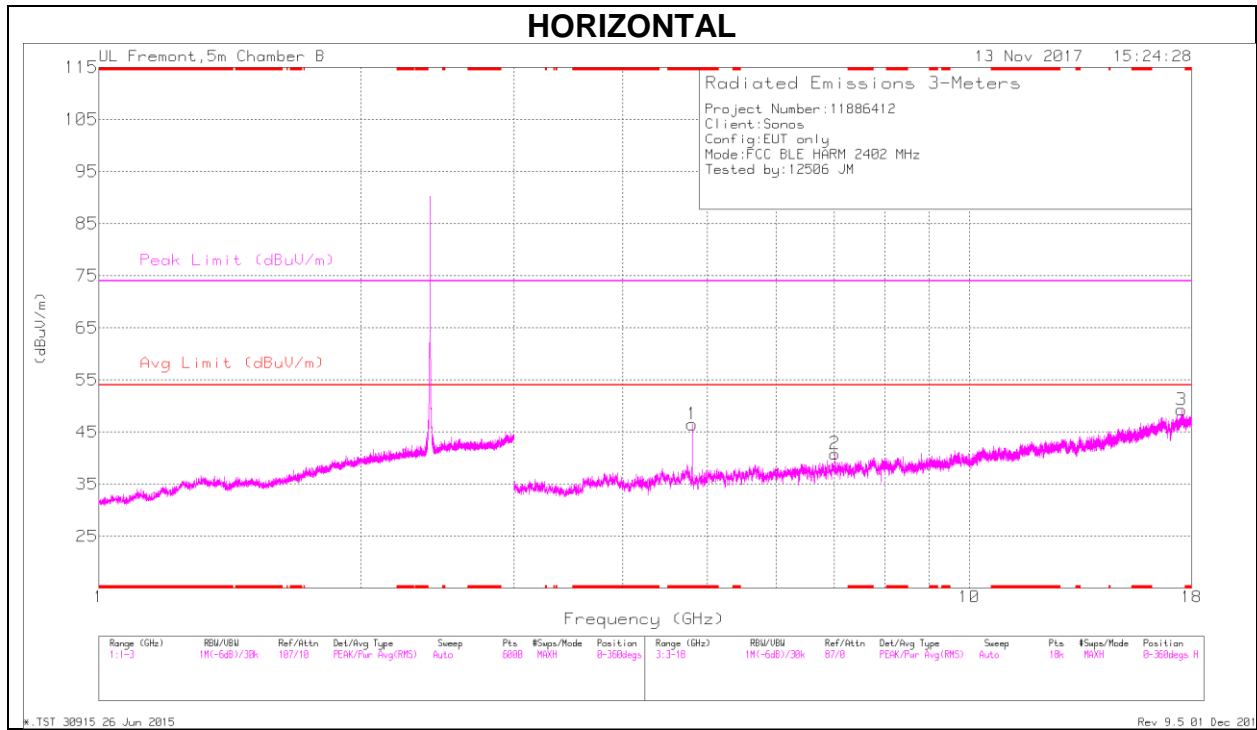
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

RMS - RMS detection

### 9.1.3. HARMONICS AND SPURIOUS EMISSIONS

#### LOW CHANNEL RESULTS



### RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtz/Paid (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
* 4.804	45.28	PK2	34.4	-28.9	0	50.78	-	-	74	-23.22	335	231	H
* 4.804	39.05	MAV1	34.4	-28.9	2.13	46.68	54	-7.32	-	-	335	231	H
* 4.803	42.21	PK2	34.4	-28.9	0	47.71	-	-	74	-26.29	6	365	V
* 4.804	34.57	MAV1	34.4	-28.9	2.13	42.2	54	-11.8	-	-	6	365	V
* 10.827	33.5	PK2	37.7	-22.4	0	48.8	-	-	74	-25.2	221	348	V
* 10.824	21.11	MAV1	37.7	-22.5	2.13	38.44	54	-15.56	-	-	221	348	V
7.012	37.66	PK2	35.8	-27.7	0	45.76	-	-	-	-	359	355	H
16.567	30.99	PK2	41.9	-19.5	0	53.39	-	-	-	-	0	269	V
17.526	30.99	PK2	41.7	-17.7	0	54.99	-	-	-	-	263	120	H

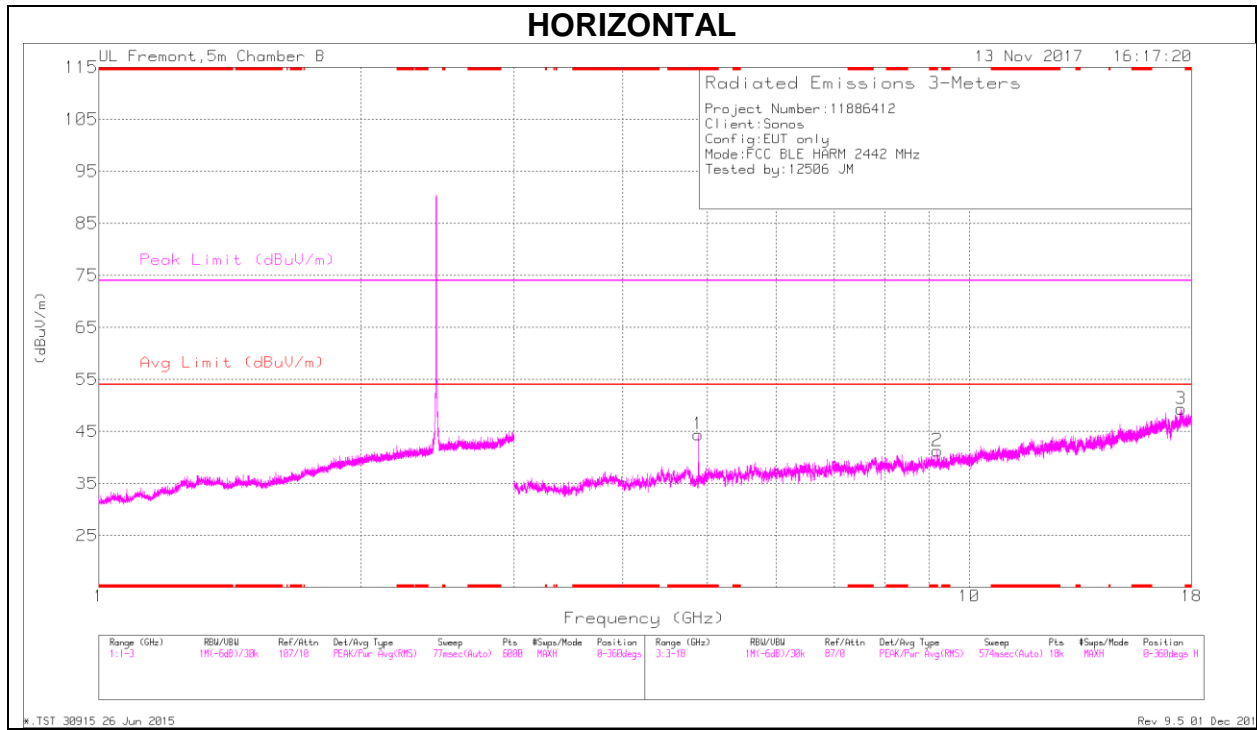
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

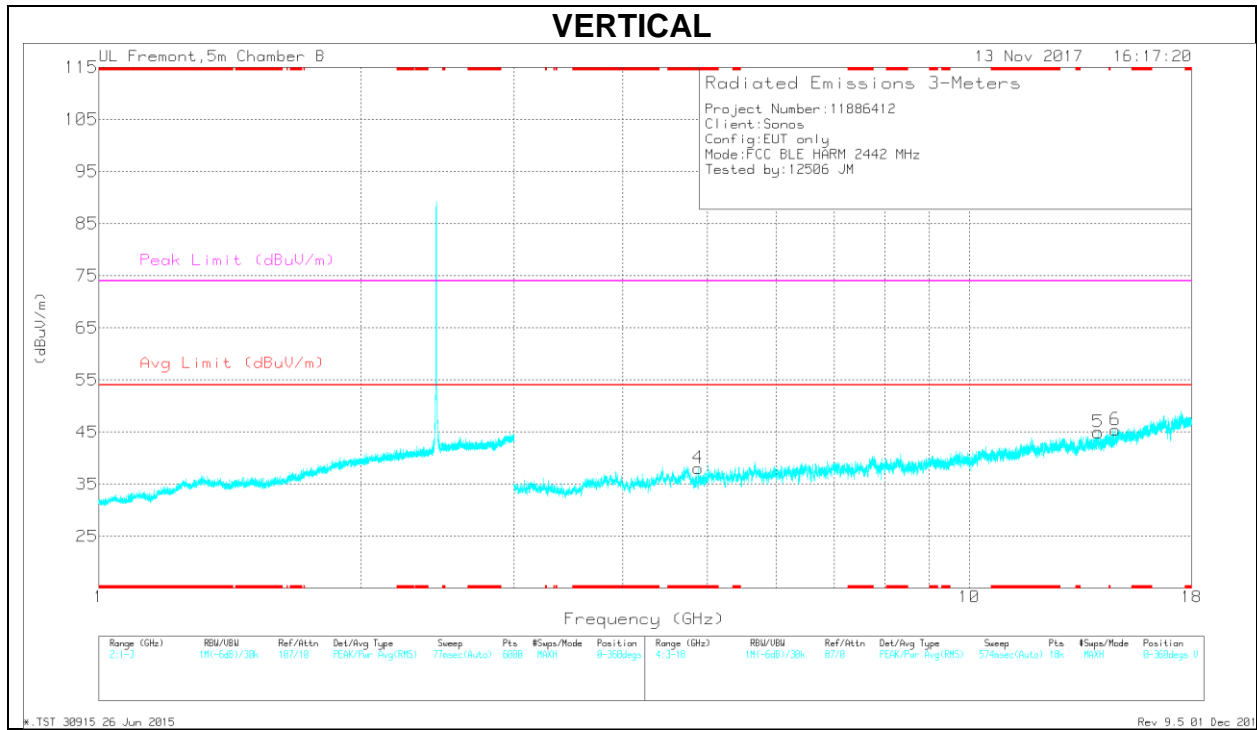
PK2 - KDB558074 Method: Maximum Peak

MAV1 - KDB558074 Option 1 Maximum RMS Average



**MID CHANNEL, RESULTS**





## RADIATED EMISSIONS

### Radiated Emissions

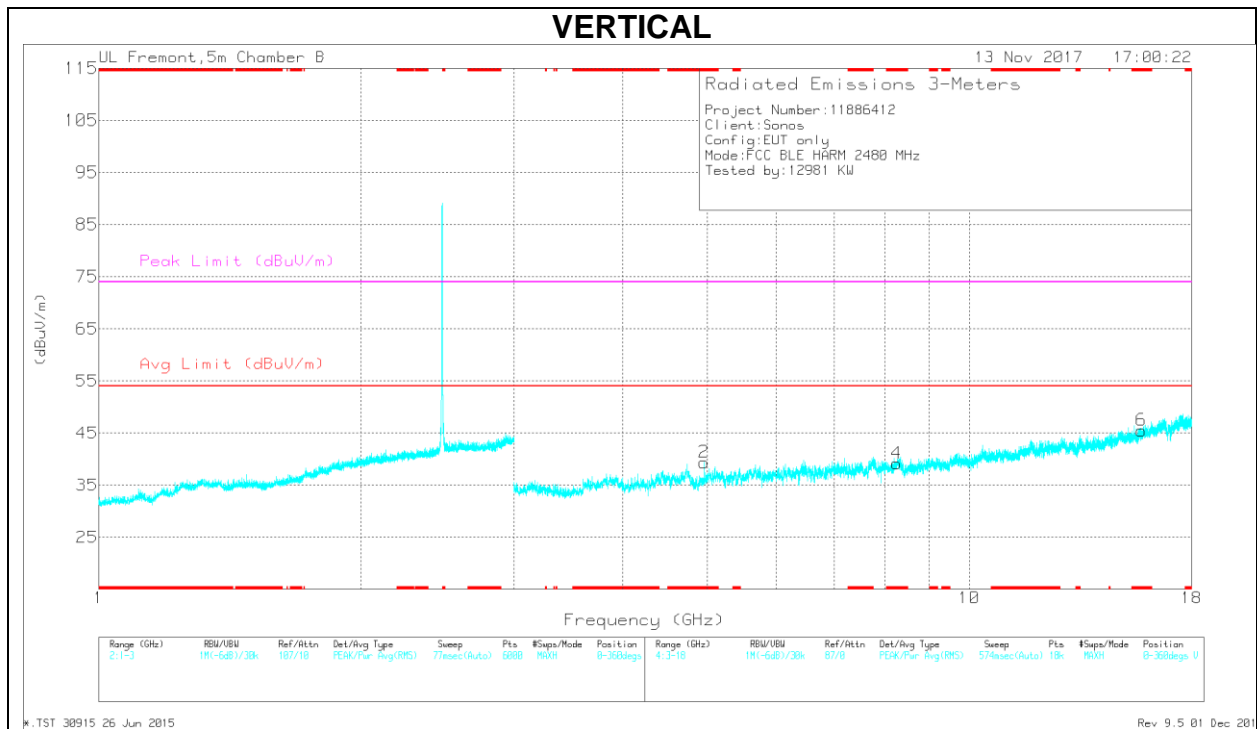
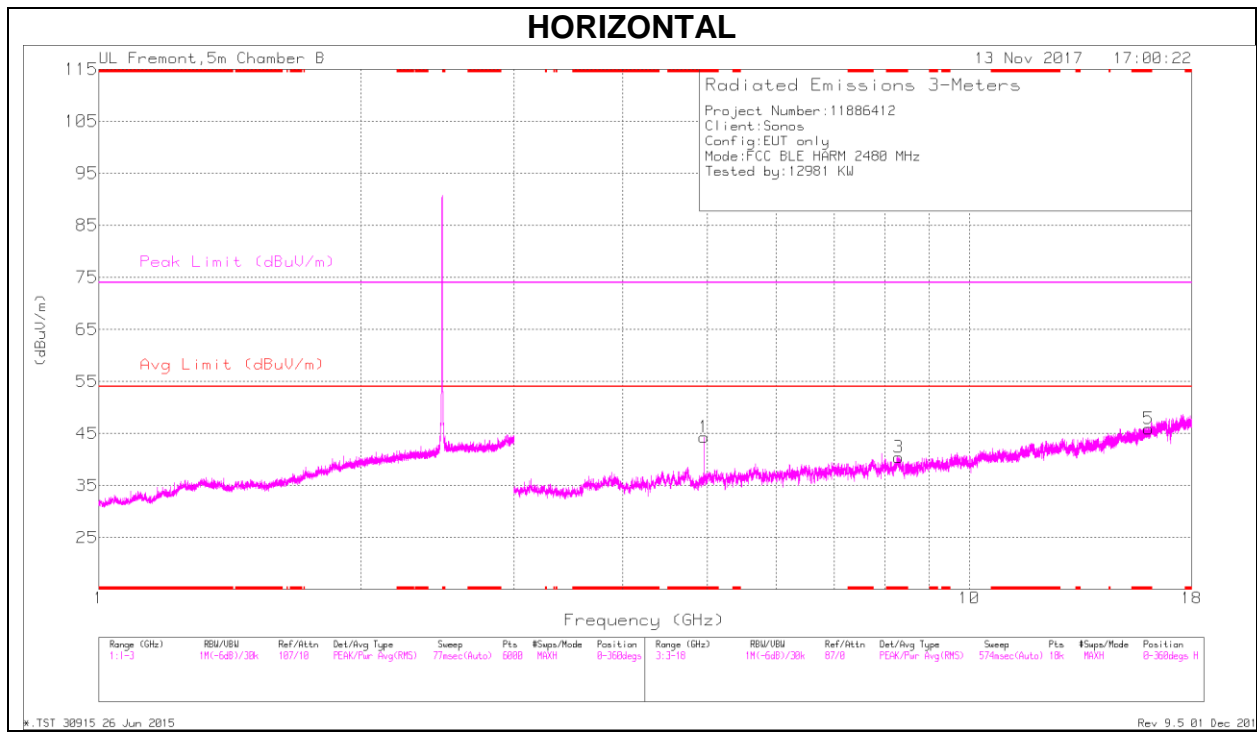
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.884	43.5	PK2	34.4	-30.1	0	47.8	-	-	74	-26.2	339	234	H
* 4.884	36.83	MAV1	34.4	-30.1	2.13	43.26	54	-10.74	-	-	339	234	H
* 9.19	33.34	PK2	36.4	-23.7	0	46.04	-	-	74	-27.96	337	218	H
* 9.187	22.04	MAV1	36.4	-23.7	2.13	36.87	54	-17.13	-	-	337	218	H
* 4.885	38.88	PK2	34.4	-30.1	0	43.18	-	-	74	-30.82	332	261	V
* 4.884	29.58	MAV1	34.4	-30.1	2.13	36.01	54	-17.99	-	-	332	261	V
14.06	31.99	PK2	39.2	-20.8	0	50.39	-	-	-	-	129	295	V
14.718	31.17	PK2	40.4	-21.4	0	50.17	-	-	-	-	219	350	V
17.52	30.72	PK2	41.7	-17.5	0	54.92	-	-	-	-	358	359	H

\* - 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

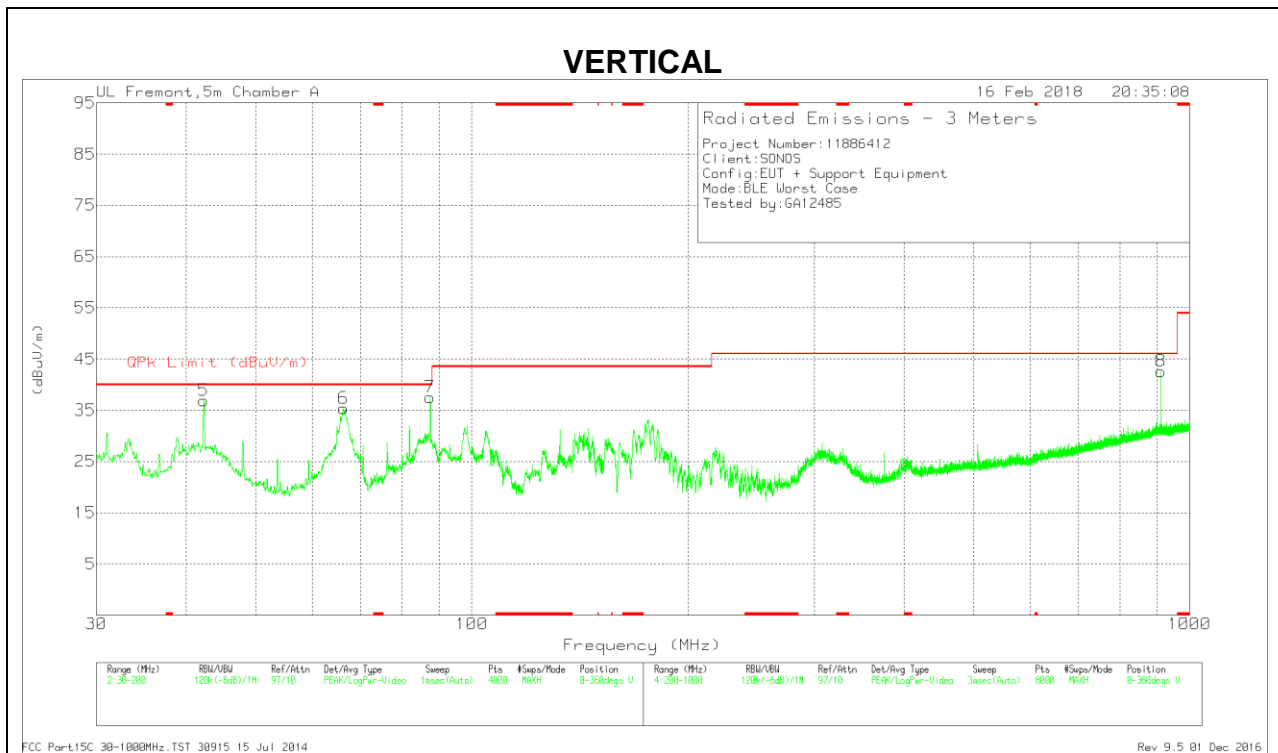
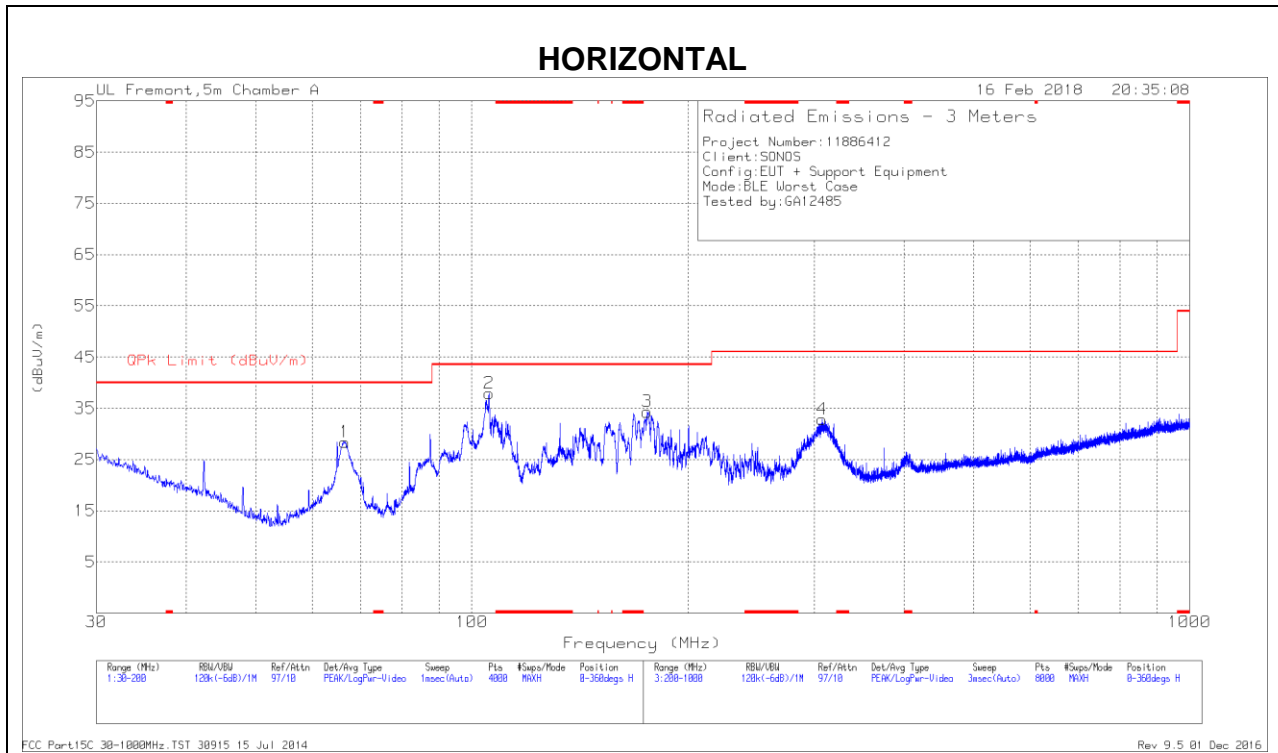
Frequency (GHz)	Meter Reading (dBuV)	Det	AFT863 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.959	43.77	PK2	34.4	-29.7	0	48.47	-	-	74	-25.53	340	254	H
* 4.96	36.12	MAV1	34.4	-29.6	2.13	43.05	54	-10.95	-	-	340	254	H
* 8.296	35.26	PK2	36.1	-25.2	0	46.16	-	-	74	-27.84	277	400	H
* 8.295	23.69	MAV1	36.1	-25.1	2.13	36.82	54	-17.18	-	-	277	400	H
* 16.068	29.84	PK2	41.2	-19.9	0	51.14	-	-	74	-22.86	284	283	H
* 16.066	18.74	MAV1	41.2	-19.9	2.13	42.17	54	-11.83	-	-	284	283	H
* 4.96	39.38	PK2	34.4	-29.6	0	44.18	-	-	74	-29.82	114	140	V
* 4.96	29.82	MAV1	34.4	-29.6	2.13	36.75	54	-17.25	-	-	114	140	V
* 8.255	35.86	PK2	36.1	-26.2	0	45.76	-	-	74	-28.24	356	325	V
* 8.256	24.39	MAV1	36.1	-26.1	2.13	36.52	54	-17.48	-	-	356	325	V
* 15.758	31.06	PK2	40.8	-20.1	0	51.76	-	-	74	-22.24	313	301	V
* 15.756	19.54	MAV1	40.8	-20.2	2.13	42.27	54	-11.73	-	-	313	301	V

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

PK2 - KDB558074 Method: Maximum Peak

MAV1 - KDB558074 Option 1 Maximum RMS Average

## 9.2. WORST-CASE BELOW 1 GHz

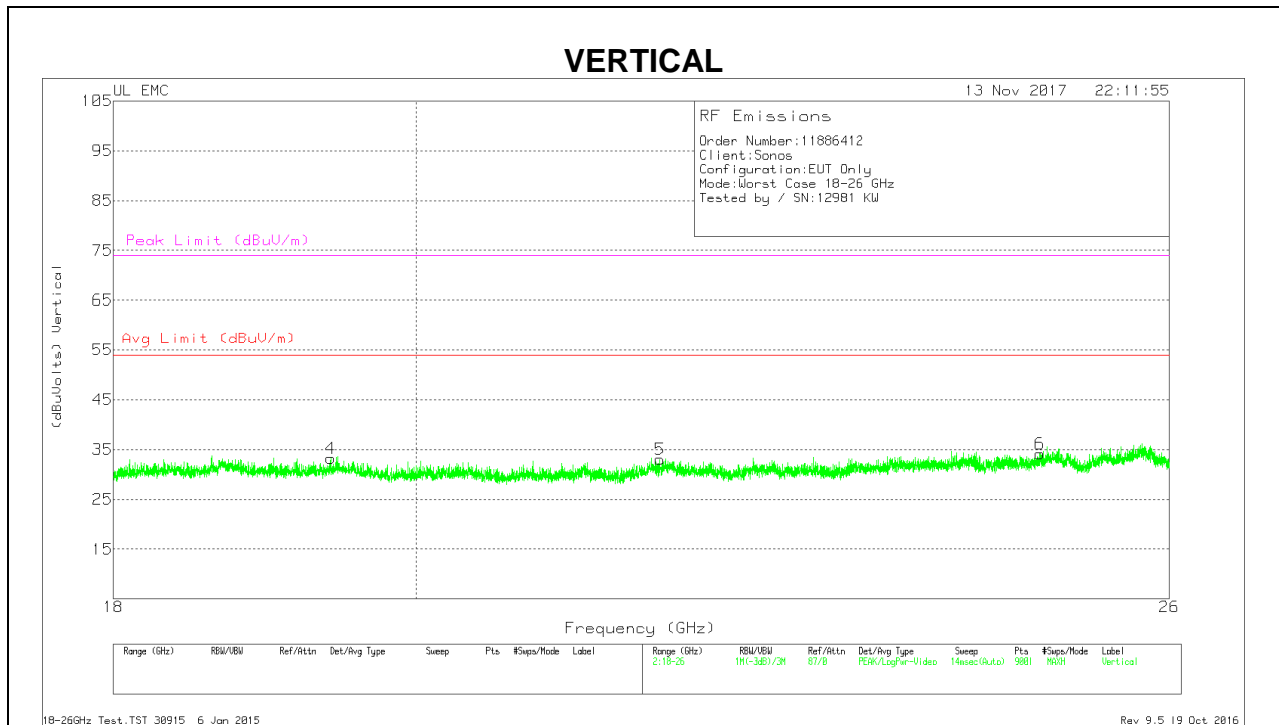
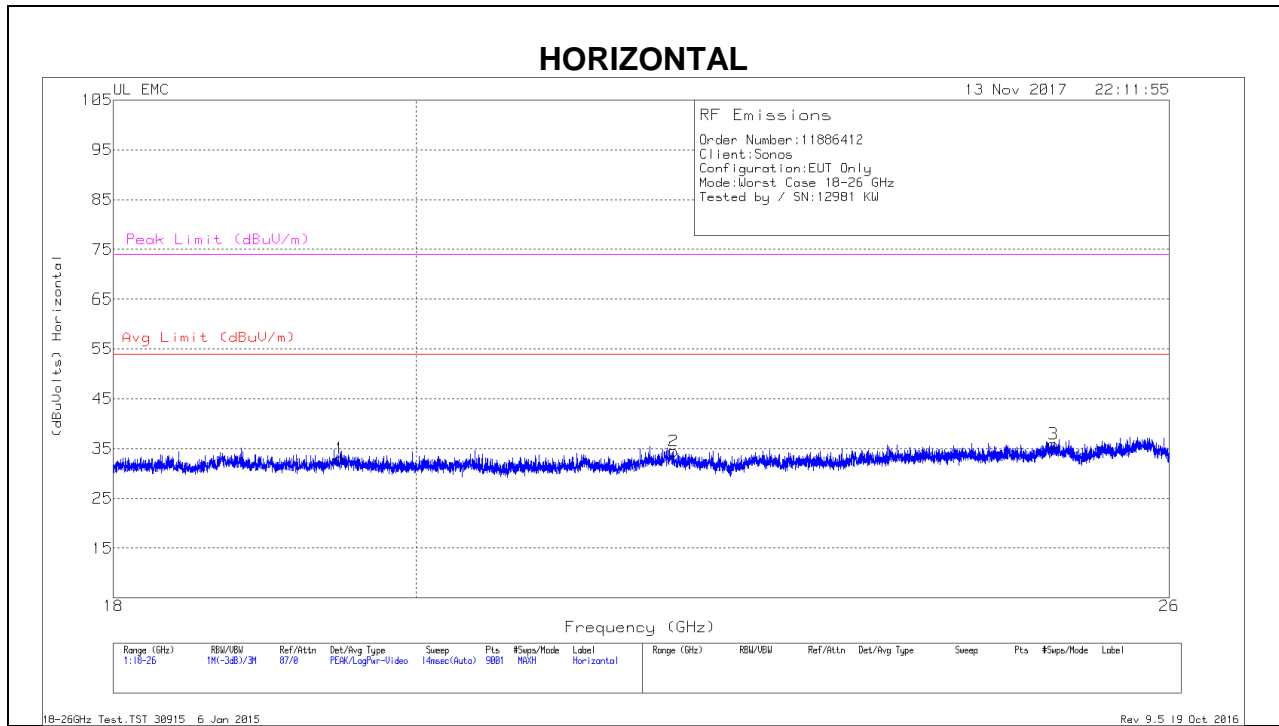


**Below 1GHz DATA**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	42.3349	45.75	Qp	16.2	-27.1	34.85	40	-5.15	354	103	V
6	66.2838	46.85	Qp	12.1	-26.8	32.15	40	-7.85	284	104	V
7	87.4951	51.65	Qp	11.4	-26.5	36.55	40	-3.45	311	129	V
2	105.7322	45	Qp	15.7	-26.3	34.4	43.52	-9.12	296	260	H
8	911.1811	22.36	Qp	26.6	-23	25.96	46.02	-20.06	322	340	V
4	307.714	39.85	Pk	17.6	-24.6	32.85	46.02	-13.17	0-360	101	H
3	175.6002	44.5	Pk	15.4	-25.6	34.3	43.52	-9.22	0-360	200	H
1	66.5169	43.14	Pk	12.1	-26.8	28.44	40	-11.56	0-360	300	H

Qp - Quasi-Peak detector  
 Pk - Peak detector

### 9.3. WORST-CASE 18-26GHz



**18-26GHz DATA**

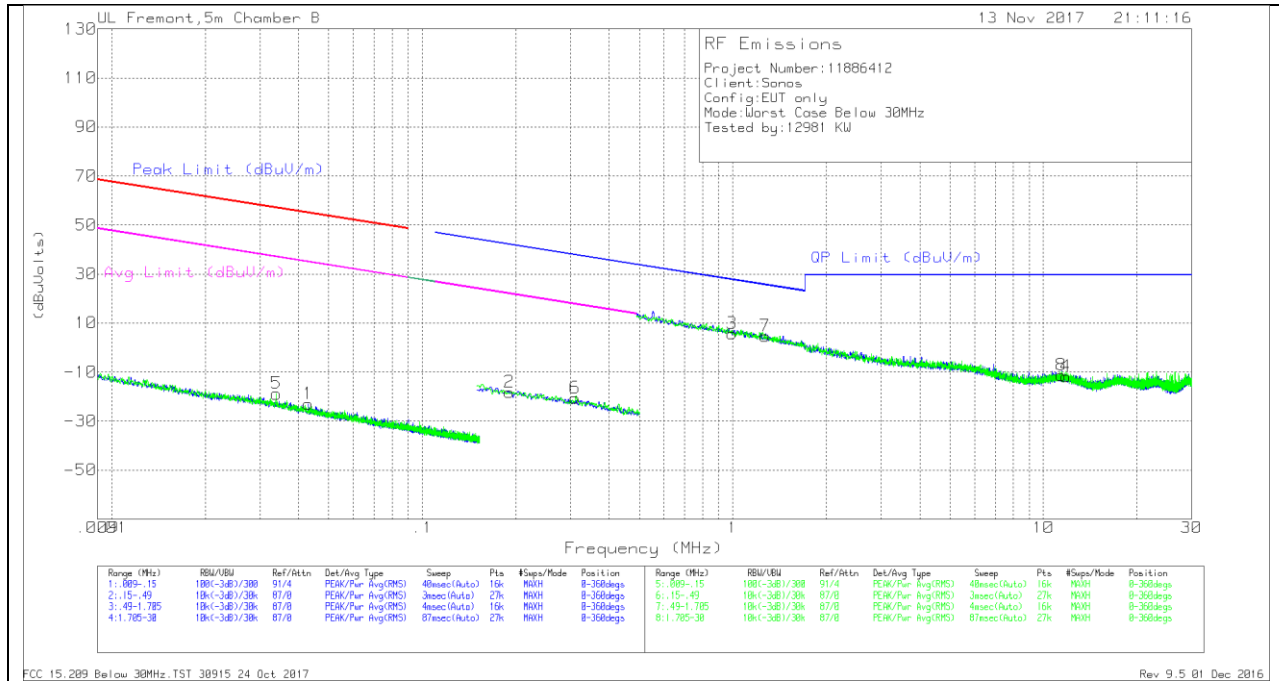
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.477	34.9	Pk	32.5	-24.9	-9.5	33	54	-21	74	-41
2	21.876	35.69	Pk	33.3	-25	-9.5	34.49	54	-19.51	74	-39.51
3	24.971	35.5	Pk	34.1	-24.2	-9.5	35.9	54	-18.1	74	-38.1
4	19.415	35.24	Pk	32.5	-25	-9.5	33.24	54	-20.76	74	-40.76
5	21.772	34.31	Pk	33.3	-25.1	-9.5	33.01	54	-20.99	74	-40.99
6	24.852	33.94	Pk	34	-24.3	-9.5	34.14	54	-19.86	74	-39.86

Pk - Peak detector



### 9.4. Worst Case 9 kHz - 30 MHz



**NOTE: KDB 414788 OATS and Chamber Correlation Justification**

- Based 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.
- OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

**9 KHz – 30 MHz DATA**

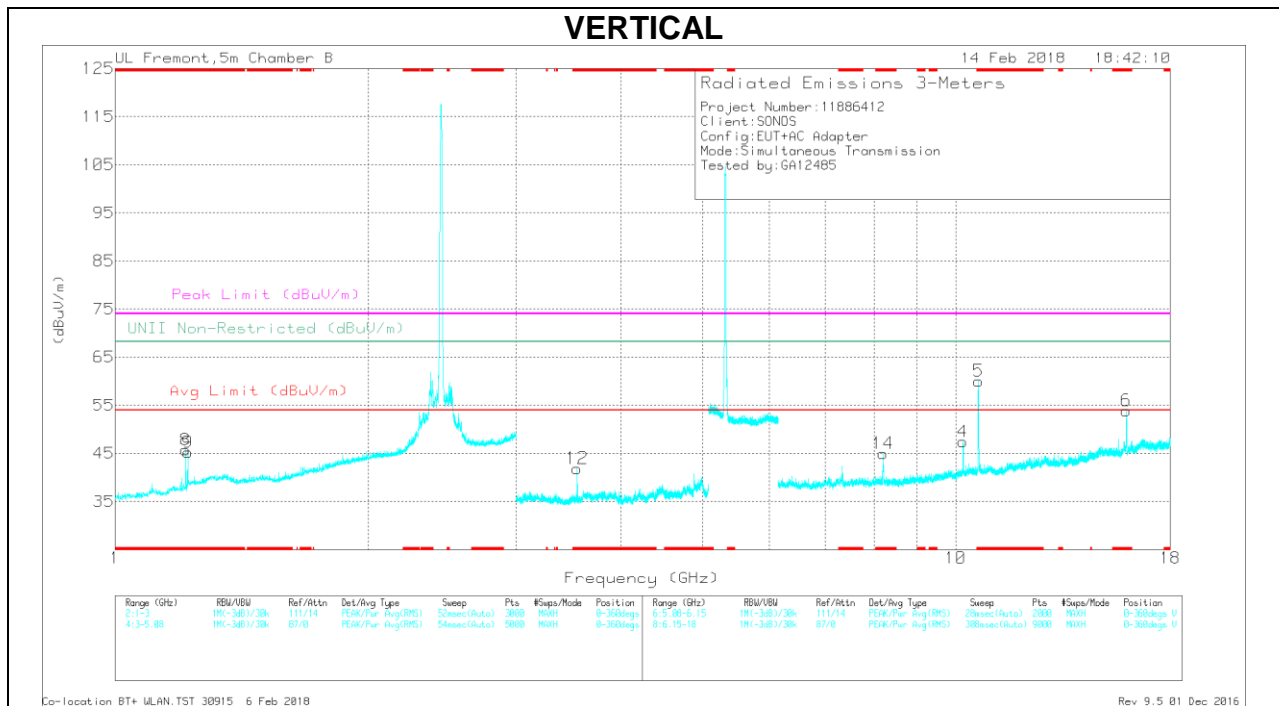
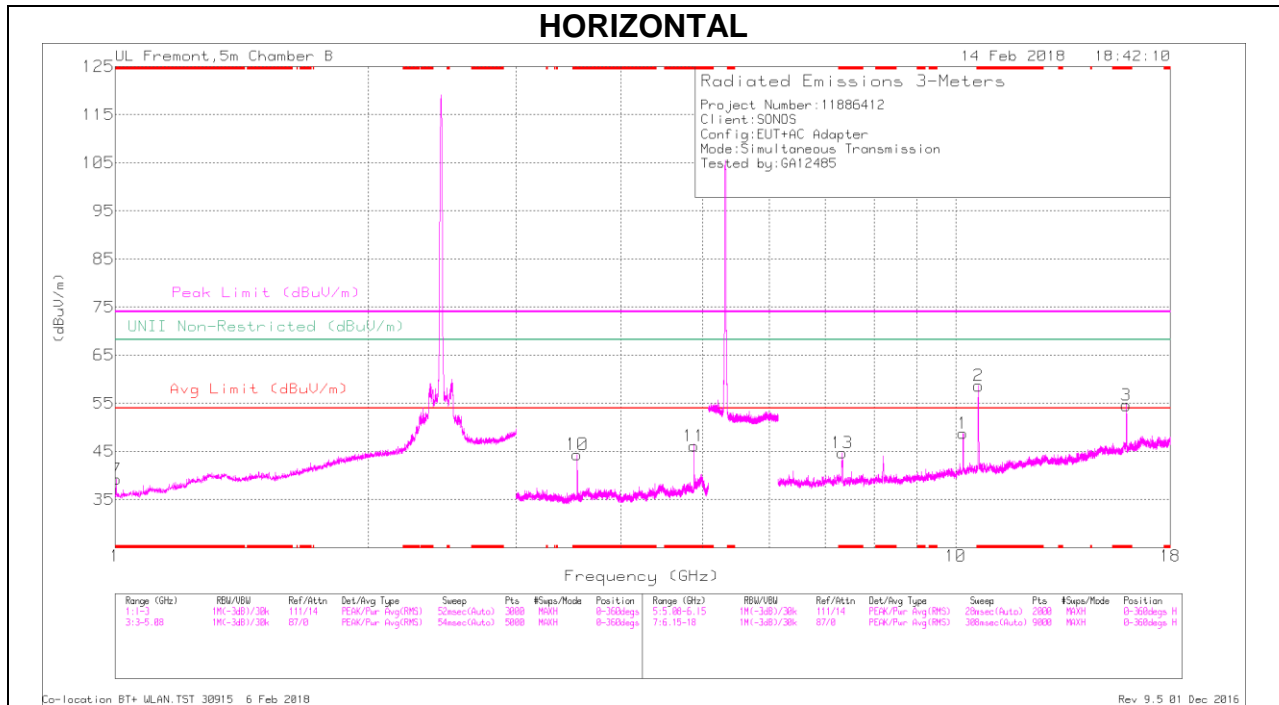
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
5	.03393	44.42	Pk	15.3	1.4	-80	-18.88	56.97	-75.85	36.97	-55.85	-	-	-	-	0-360
1	.04299	40.87	Pk	14.7	1.4	-80	-23.03	54.92	-77.95	34.92	-57.95	-	-	-	-	0-360
2	.19076	46.26	Pk	13.9	1.5	-80	-18.34	-	-	-	-	42.01	-60.35	22.01	-40.35	0-360
6	.31104	44.09	Pk	13.8	1.5	-80	-20.61	-	-	-	-	37.75	-58.36	17.75	-38.36	0-360

**Pk - Peak detector**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.99418	29.92	Pk	14.3	1.5	-40	5.72	27.67	-21.95	0-360
7	1.27143	28.92	Pk	14.3	1.5	-40	4.72	25.54	-20.82	0-360
8	11.42992	12.4	Pk	14.7	1.6	-40	-11.3	29.5	-40.8	0-360
4	11.80667	11.93	Pk	14.7	1.6	-40	-11.77	29.5	-41.27	0-360

**Pk - Peak detector**

### 9.5. WORST-CASE SIMULTANEOUS TRANSMISSION



**SIMULTANEOUS TRANSMISSION DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cb/Ftr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 1.002	39.72	PK2	27.5	-23.7	0	43.52	-	-	74	-30.48	-	-	24	340	H
	* 1.004	27.67	MAv1	27.5	-23.6	.56	32.13	54	-21.87	-	-	-	-	24	340	H
8	* 1.211	39.51	PK2	28.2	-22.8	0	44.91	-	-	74	-29.09	-	-	179	342	H
	* 1.214	27.59	MAv1	28.2	-22.9	.56	33.45	54	-20.55	-	-	-	-	179	342	H
9	* 1.222	39.69	PK2	28.3	-22.2	0	45.79	-	-	74	-28.21	-	-	22	378	H
	* 1.223	27.75	MAv1	28.3	-22.2	.56	34.41	54	-19.59	-	-	-	-	22	378	H
10	* 3.547	47.91	PK2	33	-31.7	0	49.21	-	-	74	-24.79	-	-	135	320	H
	* 3.547	41.5	MAv1	33	-31.7	.56	43.36	54	-10.64	-	-	-	-	135	320	H
11	* 4.884	47.31	PK2	34.4	-31.3	0	50.41	-	-	74	-23.59	-	-	162	254	H
	* 4.884	40.18	MAv1	34.4	-31.3	.56	43.84	54	-10.16	-	-	-	-	162	254	H
12	* 3.546	47.27	PK2	33	-31.7	0	48.57	-	-	74	-25.43	-	-	283	191	H
	* 3.547	40.12	MAv1	33	-31.7	.56	41.98	54	-12.02	-	-	-	-	283	191	H
2	* 10.64	51.07	PK-U	37.6	-24.1	0	64.57	-	-	74	-9.43	-	-	118	400	H
	* 10.64	39.93	ADR	37.6	-24.1	.56	53.99	54	-0.01	-	-	-	-	118	400	H
3	* 15.96	46.55	PK-U	41.1	-22	0	65.65	-	-	74	-8.35	-	-	135	168	H
	* 15.96	32.78	ADR	41.1	-22	.56	52.44	54	-1.56	-	-	-	-	135	168	H
13	* 7.326	44.1	PK2	35.9	-28.1	0	51.9	-	-	74	-22.1	-	-	281	385	H
	* 7.327	30.06	MAv1	35.9	-28.1	.56	38.42	54	-15.58	-	-	-	-	281	385	H
5	* 10.64	51.36	PK-U	37.6	-24.1	0	64.86	-	-	74	-9.14	-	-	118	399	H
	* 10.64	40.35	ADR	37.6	-24.1	.56	53.41	54	-0.59	-	-	-	-	118	399	H
6	* 15.96	45.74	PK-U	41.1	-22	0	64.84	-	-	74	-9.16	-	-	131	102	H
	* 15.959	31.29	ADR	41.1	-22	.56	50.95	54	-3.05	-	-	-	-	131	102	H
14	* 8.196	42.68	PK2	36	-27.9	0	50.78	-	-	74	-23.22	-	-	330	233	H
	* 8.196	28.77	MAv1	36	-27.9	.56	37.43	54	-16.57	-	-	-	-	330	233	H
1	10.203	47.4	PK-U	37.4	-25.5	0	59.3	-	-	74	-14.7	68.2	-8.9	128	198	H
4	10.203	48.66	PK-U	37.4	-25.5	0	60.56	-	-	74	-13.44	68.2	-7.64	124	201	H

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PK2 - KDB558074 Method: Maximum Peak  
 MAv1 - KDB558074 Option 1 Maximum RMS Average  
 PK-U - U-NII: Maximum Peak  
 ADR - U-NII AD primary method, RMS average

## 10. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

### TEST PROCEDURE

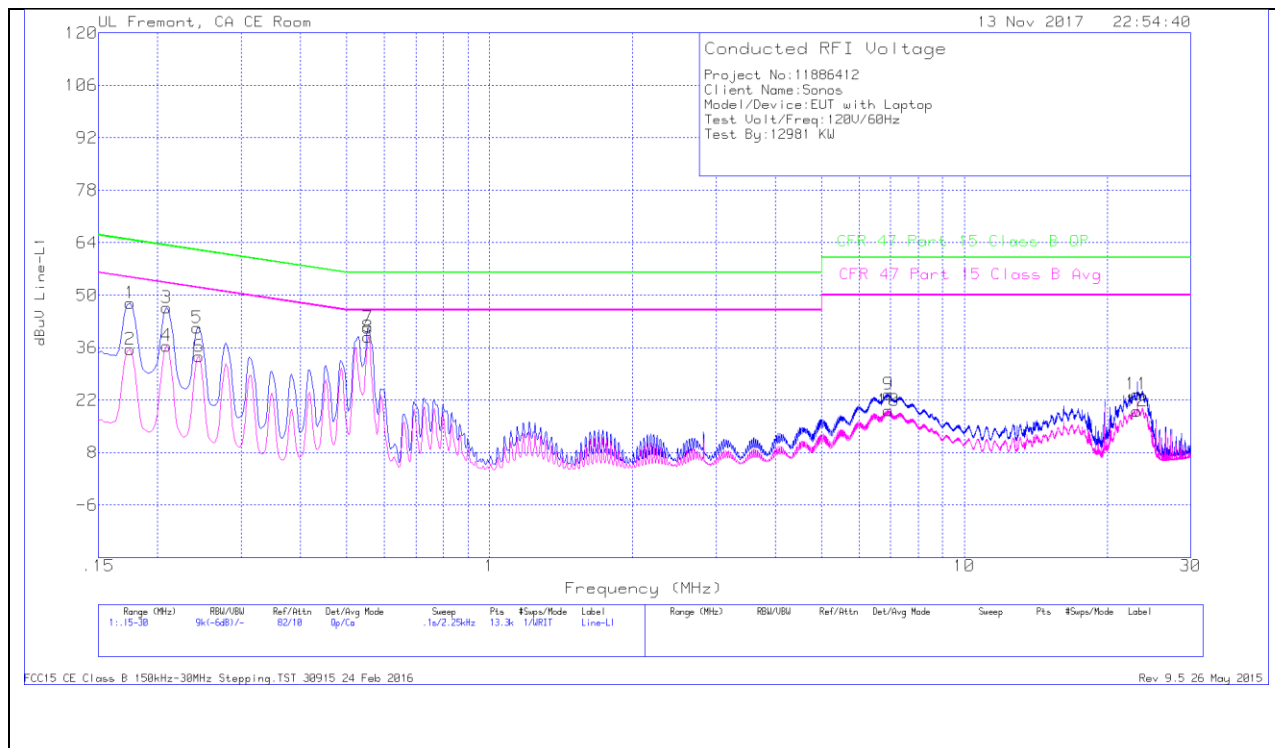
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

### RESULTS

### LINE 1 RESULTS



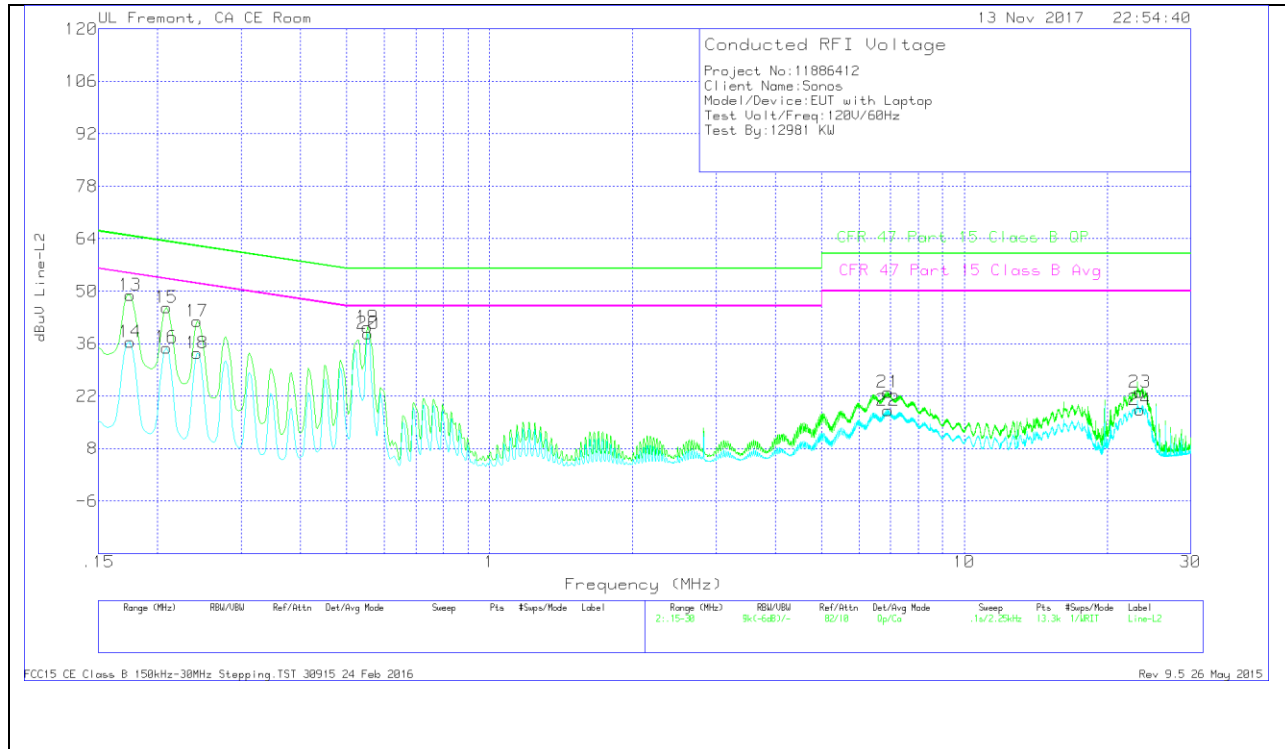
Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	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	.17475	37.84	Qp	0	0	10.1	47.94	64.73	-16.79	-	-
2	.17475	25.54	Ca	0	0	10.1	35.64	-	-	54.73	-19.09
3	.2085	36.58	Qp	0	0	10.1	46.68	63.26	-16.58	-	-
4	.2085	26.42	Ca	0	0	10.1	36.52	-	-	53.26	-16.74
5	.24225	31.26	Qp	0	0	10.1	41.36	62.02	-20.66	-	-
6	.2445	23.55	Ca	0	0	10.1	33.65	-	-	51.94	-18.29
7	.555	31.26	Qp	0	0	10.1	41.36	56	-14.64	-	-
8	.555	28.75	Ca	0	0	10.1	38.85	-	-	46	-7.15
9	6.9225	13.22	Qp	0	.2	10.2	23.62	60	-36.38	-	-
10	6.92475	8.79	Ca	0	.2	10.2	19.19	-	-	50	-30.81
11	23.07075	12.85	Qp	.1	.3	10.4	23.65	60	-36.35	-	-
12	23.07075	8.22	Ca	.1	.3	10.4	19.02	-	-	50	-30.98

Qp - Quasi-Peak detector

Ca - CISPR average detection

### LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	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	.17475	38.93	Qp	0	0	10.1	49.03	64.73	-15.7	-	-
14	.17475	26.28	Ca	0	0	10.1	36.38	-	-	54.73	-18.35
15	.2085	35.56	Qp	0	0	10.1	45.66	63.26	-17.6	-	-
16	.2085	24.86	Ca	0	0	10.1	34.96	-	-	53.26	-18.3
17	.24225	31.87	Qp	0	0	10.1	41.97	62.02	-20.05	-	-
18	.24225	23.34	Ca	0	0	10.1	33.44	-	-	52.02	-18.58
19	.55275	30.3	Qp	0	0	10.1	40.4	56	-15.6	-	-
20	.555	28.68	Ca	0	0	10.1	38.78	-	-	46	-7.22
21	6.9135	12.61	Qp	0	.2	10.2	23.01	60	-36.99	-	-
22	6.9135	7.81	Ca	0	.2	10.2	18.21	-	-	50	-31.79
23	23.4375	12.29	Qp	0	.3	10.4	22.99	60	-37.01	-	-
24	23.4375	7.7	Ca	0	.3	10.4	18.4	-	-	50	-31.6

Qp - Quasi-Peak detector

Ca - CISPR average detection