



CERTIFICATION TEST REPORT

Report Number. : 12049380-E1V3

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

Model : S16

FCC ID : SBVRM015

IC : 5373A-RM015

EUT Description : 4X4 802.11a/b/g/n HT20 CLIENT & MASTER DEVICE

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

Date Of Issue:

October 31, 2018

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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	10/5/2018	Initial Issue	-
V2	10/26/2018	Updated Section 5.5, 9.4 & 11	K.Kedida
V3	10/31/2018	Updated Section 5.6	K.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: 4X4 802.11a/b/g/n HT20 CLIENT & MASTER DEVICE

MODEL: S16

SERIAL NUMBER: 1807-34-7E-5C-00-10-20-4 (Radiated Sample)
1807-34-7E-5C-00-0F-D5-E (Conducted Sample)

DATE TESTED: August 16 – October 2, 2018

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. 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. All samples tested were in good operating condition throughout the entire test program. 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.

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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 v5, ANSI C63.10-2013, RSS-GEN Issue 5, 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, and 47658 Kato Road, 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	47658 Kato Rd.
☒ Chamber A (ISED:2324B-1)	☐ Chamber D (ISED:22541-1)	☒ Chamber K (ISED: 2324A-1)
☒ Chamber B (ISED:2324B-2)	☐ Chamber E (ISED:22541-2)	☐ Chamber L (ISED: 2324A-3)
☐ Chamber C (ISED:2324B-3)	☐ Chamber F (ISED:22541-3)	
	☐ Chamber G (ISED:22541-4)	
	☐ Chamber H (ISED:22541-5)	

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 ISED company address code 22541 with site numbers 22541 -1 through 22541-5, respectively. Chambers K and L are covered under ISED company address code 2324A with site numbers 2324A-1 and 2324A-3, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

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

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case 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. EUT DESCRIPTION

The EUT is a 4X4 802.11a/b/g/n HT20 CLIENT & MASTER DEVICE.

5.2. 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	-2.36	0.58

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes PCB antenna, with a maximum gain of 3.5dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT software ware installed during testing was 44.2-53220-RF-Complianc_20180523.

The test utility software used during testing was Sonos Compliance GUI V2.2.

5.5. WORST-CASE CONFIGURATION AND MODE

All configuration was investigated and the worst-case configuration for radiated emissions were performed with the EUT and exercised with all supported external accessories. Radiated bandage, harmonics, and spurious emissions from 1 GHz to 18GHz were performed with EUT set to transmit at the Low/Middle/High channels. 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 three orthogonal orientations X,Y,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	X1 Carbon	R9-01VD86	N/A
AC Adapter	Lenovo	ADLX65NLT2A	11S36200291ZZ200315AJU	N/A
Charging Base	Lenovo	X200	1S43R8781R934HPB	N/A
Speakers	Polk	T15	AM1565S9200	N/A
Monitor	Samsung	UN32J5003AF	0460CEG411339W	N/A

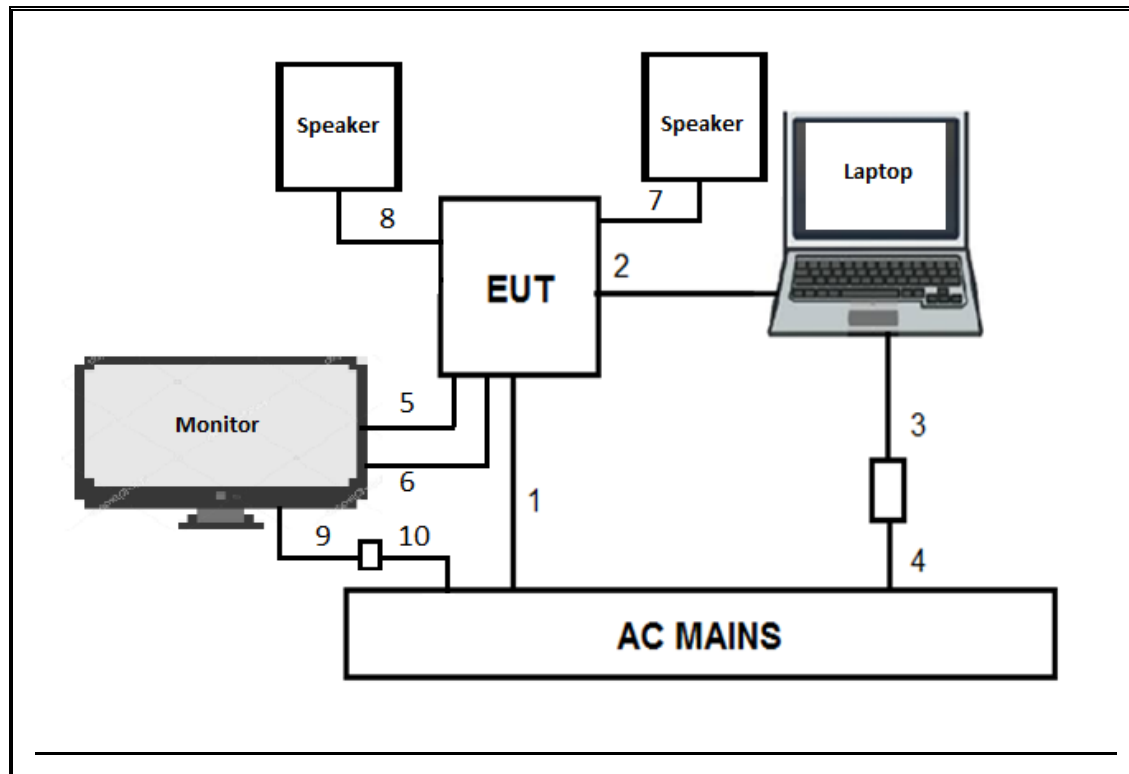
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC Power	1	AC	Unshielded	2	AC Mains to EUT
2	Ethernet	1	RJ45	Unshielded	10	EUT to Laptop
3	DC Power	1	DC	Shielded	1.2	AC/DC Adapter to Laptop
4	AC Power	1	AC	Unshielded	1	AC Mains to AC/DC Adapter
5	HDMI	1	HDMI port	Shielded	5	EUT to Monitor
6	Audio Cable	1	Audio Port	Unshielded	1	EUT to Monitor
7	Audio Cable	1	Audio Port	Unshielded	1	EUT to Speaker
8	Audio Cable	1	Audio Port	Unshielded	1	EUT to Speaker
9	DC Power	1	AC	Unshielded	5	AD/DC Adapter Monitor
10	AC Power	1	DC	Shielded	1.2	AC Mains to AC/DC Adapter

TEST SETUP

The EUT is a stand-alone unit, and the radio is exercised by Sonos Compliance GUI V2.2 test utility software via Ethernet.

SETUP DIAGRAM



6. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6.

6 dB BW: ANSI C63.10 Section 11.8.1. Option 1

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

Power Spectral Density: ANSI C63.10 Section 11.10.3 Method AVGPSD-1.

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

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 Subclause -11.13.3.4 Integration method -Trace averaging across ON and OFF times DC correction

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

7. 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
EMI Test Receiver	Rohde&Schwarz	ESR	1436	02/23/2019
Transient Limiter	COM-POWER	LIT-930	1457	03/01/2019
L.I.S.N	FCC INC.	FCC LISN 50/250	24	03/06/2019
EMI Test Receiver	Rohde&Schwarz	ESR	1436	02/23/2019
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T130	10/14/2018
Amplifier, 9KHz to 1GHz, 32dB	Agilent (keysight) Technologies	8447D	T15	08/15/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1466	04/16/2019
Antenna, Active Loop 9KHz to 30MHz	MICRO-TRONICS	AL-130R	PRE0165308	12/13/2018
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1450	02/05/2019
18 - 26.5 GHz Horn Antenna	Seavey Division	MWH-1826/B	T89	1/18/2019
Pre-Amp 1-26.5 GHz	Agilent	8449B	T404	3/9/2019
PXA Spectrum Analyzer, 3Hz to 44GHz	Keysight	N9030A	T1113	12/21/2018
Hybrid Antenna, 30MHz to 3GHz	SunAR rf motion	JB3	PRE0181575	8/1/2019
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180089	6/21/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	4/30/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	6/21/2019
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	T493	4/3/2019
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	T1569	6/3/2019
Filter, HPF 3.0GHz	MICRO-TRONICS	HPM17543	T1013	6/21/2019
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179522	5/11/2019

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, June 22, 2018
Antenna Port Software	UL	UL RF	Ver 8.4, June 12, 2018

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

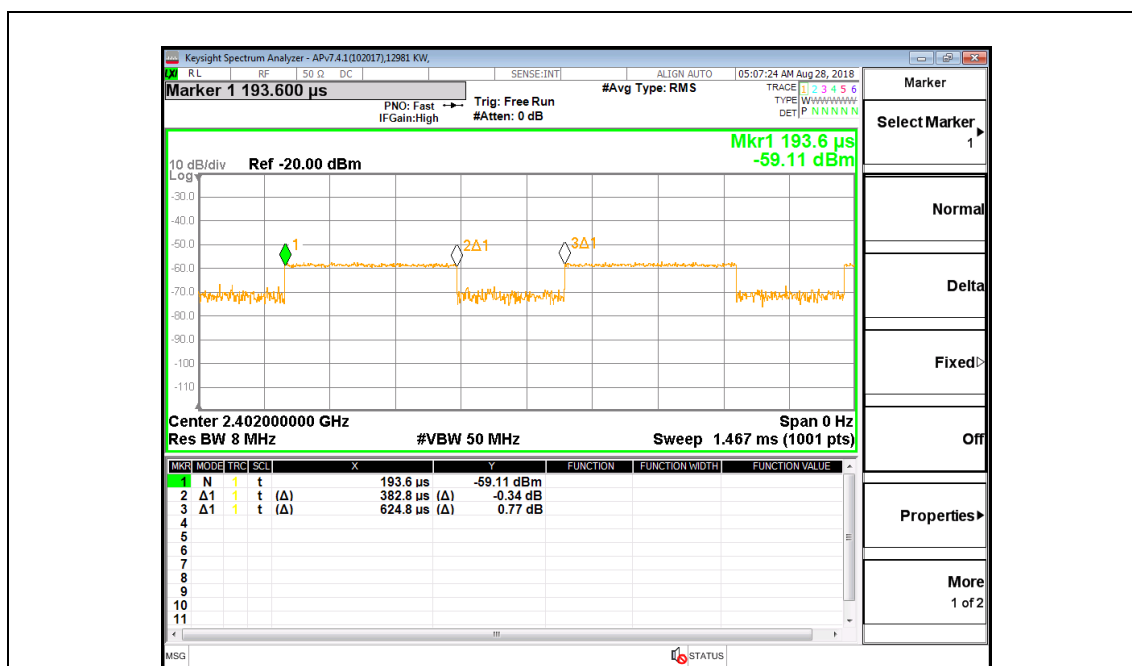
None; for reporting purposes only.

PROCEDURE

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
BLE	0.383	0.625	0.613	61.27%	2.13	2.612

DUTY CYCLE PLOTS



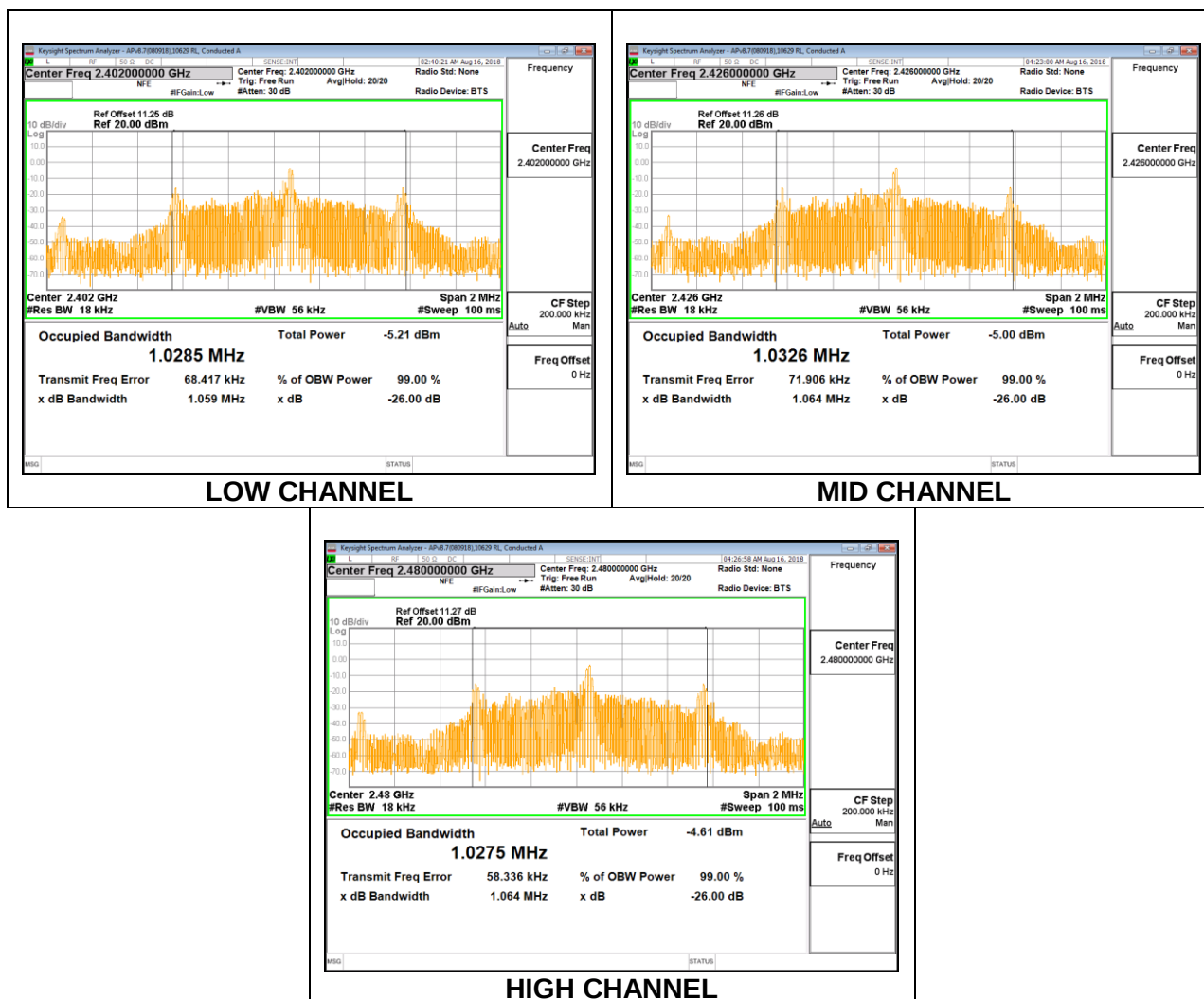
8.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.029
Middle	2426	1.033
High	2480	1.028



8.3. 6 dB BANDWIDTH

LIMITS

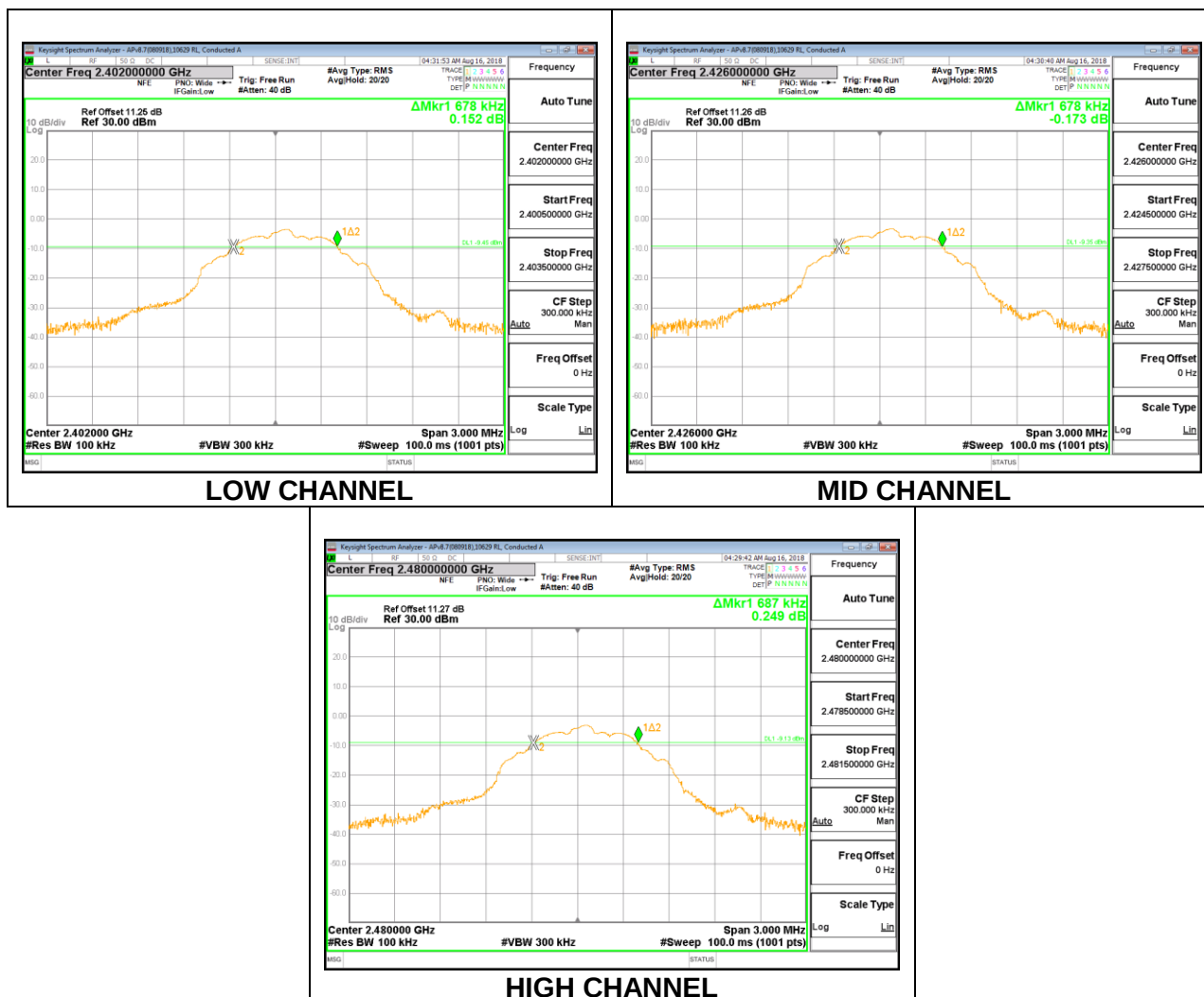
FCC §15.407 (e)

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	0.678	0.5
Middle	2426	0.678	0.5
High	2480	0.687	0.5



8.4. 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 cable assembly insertion loss was entered as an offset in the power meter to allow for a gated Average reading of power.

RESULTS

Tested By:	12506 JM
Date:	9/26/2018

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-2.520	30	-32.520
Middle	2426	-2.360	30	-32.360
High	2480	-2.410	30	-32.410

8.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter. The cable assembly insertion loss was entered as an offset in the power meter to allow for a Peak reading of power.

RESULTS

Tested By:	12506 JM
Date:	9/26/2018

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-2.710
Middle	2426	-2.560
High	2480	-2.420

8.6. POWER SPECTRAL DENSITY

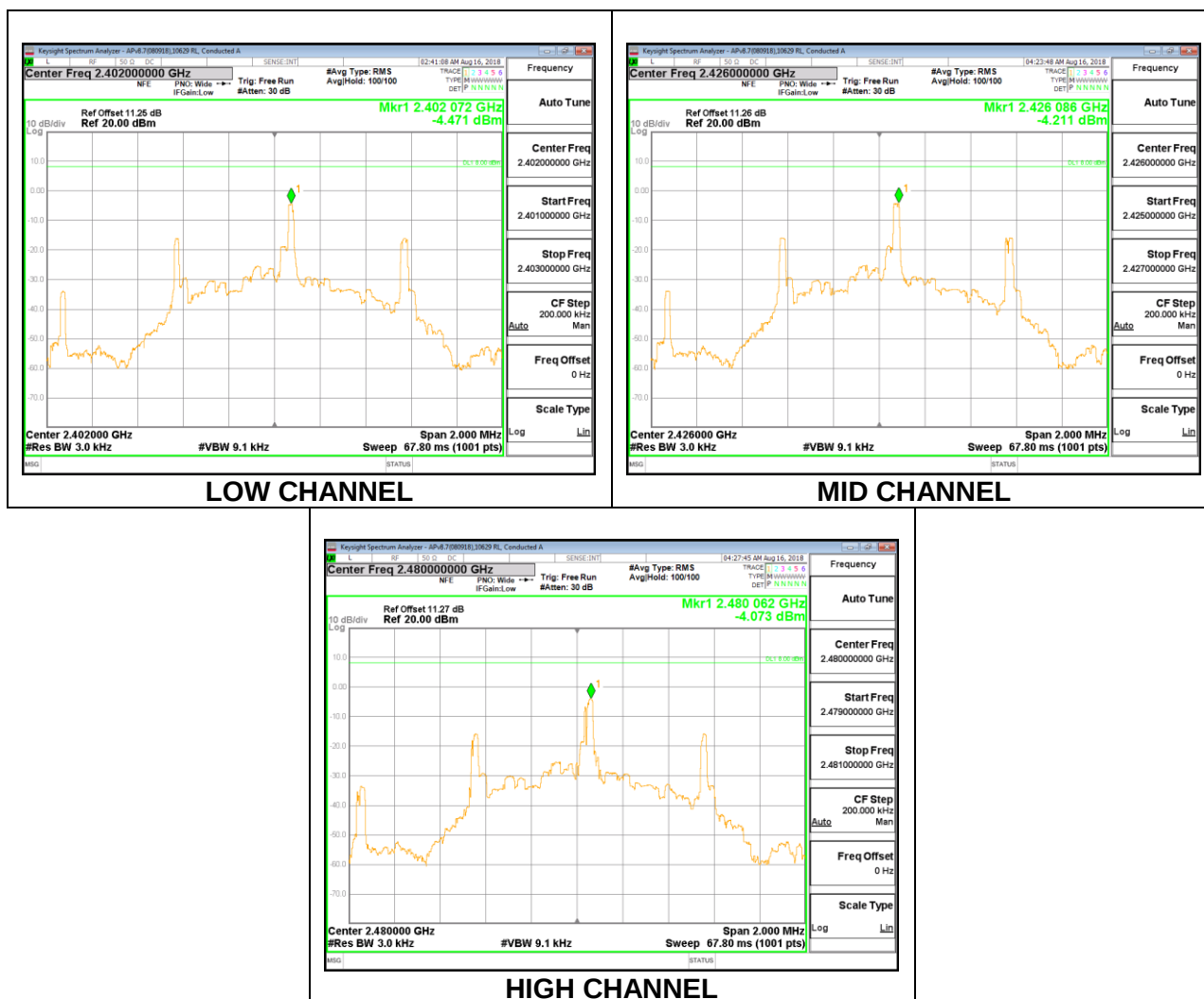
LIMITS

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	-4.47	8	-12.47
Middle	2426	-4.21	8	-12.21
High	2480	-4.07	8	-12.07



8.7. CONDUCTED SPURIOUS EMISSIONS

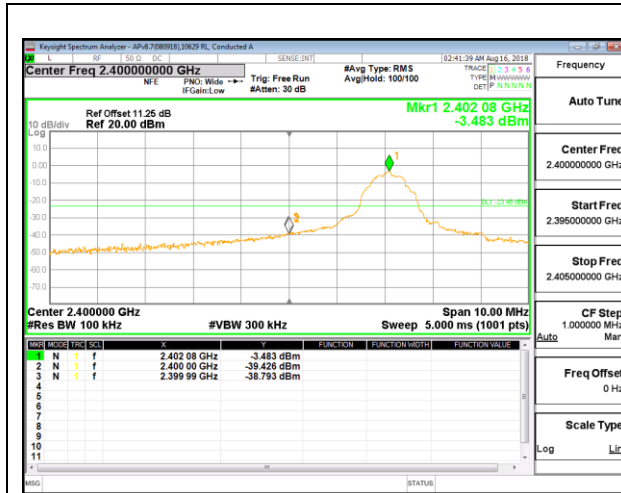
LIMITS

FCC §15.247 (d)

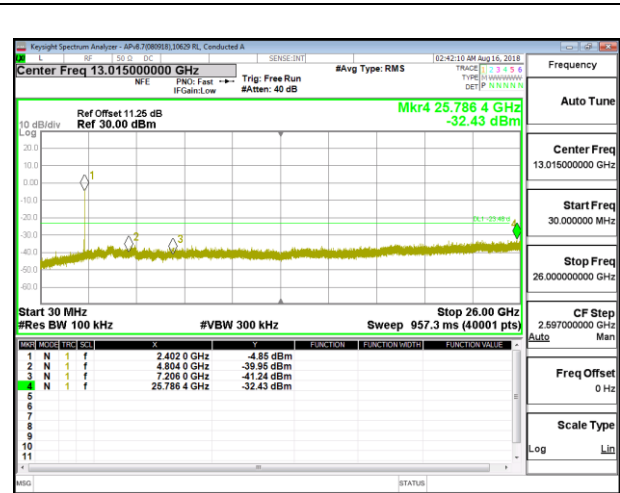
RSS-247 5.5

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

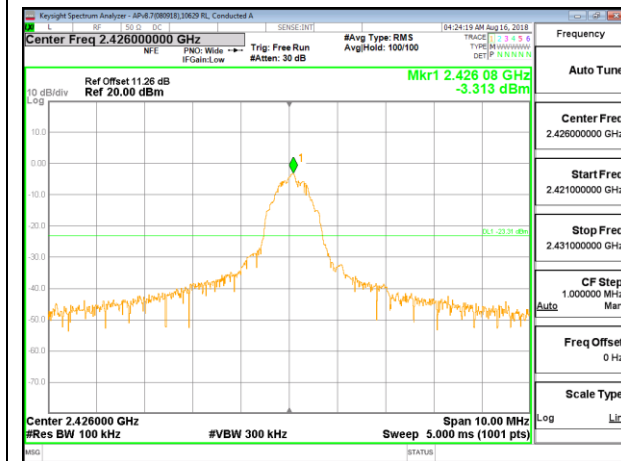
RESULTS



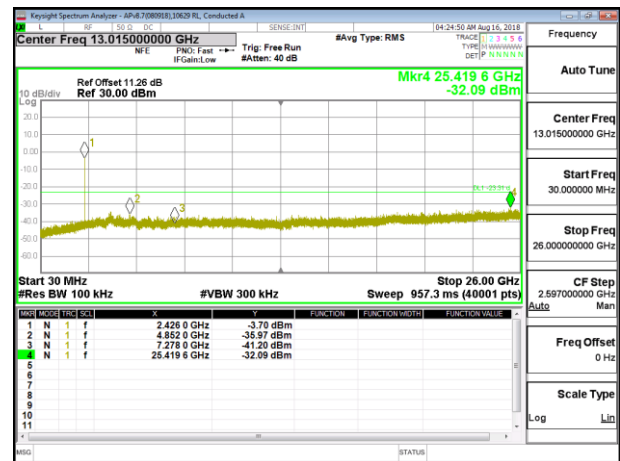
LOW CHANNEL BANDEDGE



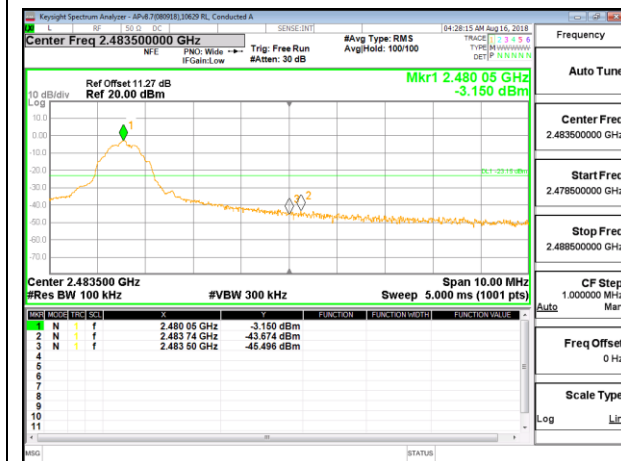
OUT-OF-BAND LOW CHANNEL



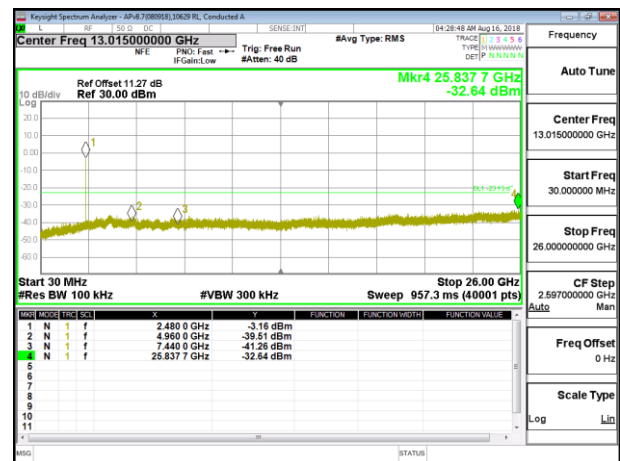
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

9. RADIATED TEST RESULTS

9.1. 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.

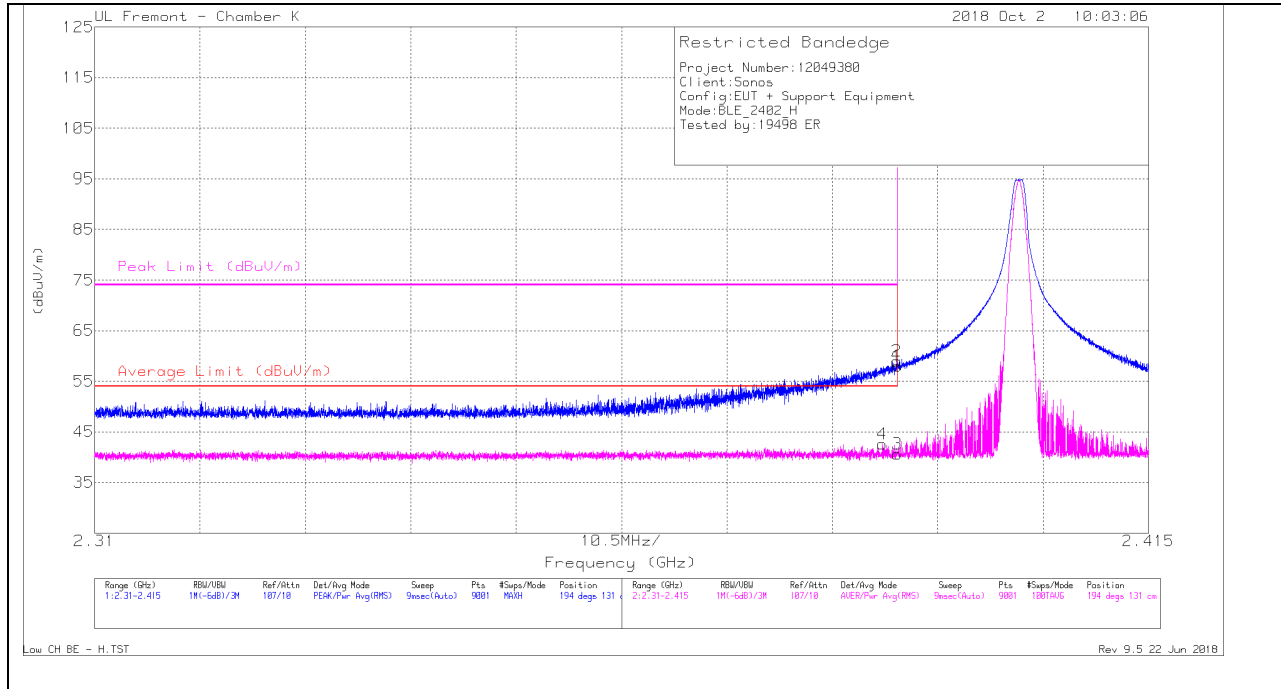
The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

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.

9.2. TRANSMITTER ABOVE 1 GHz

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



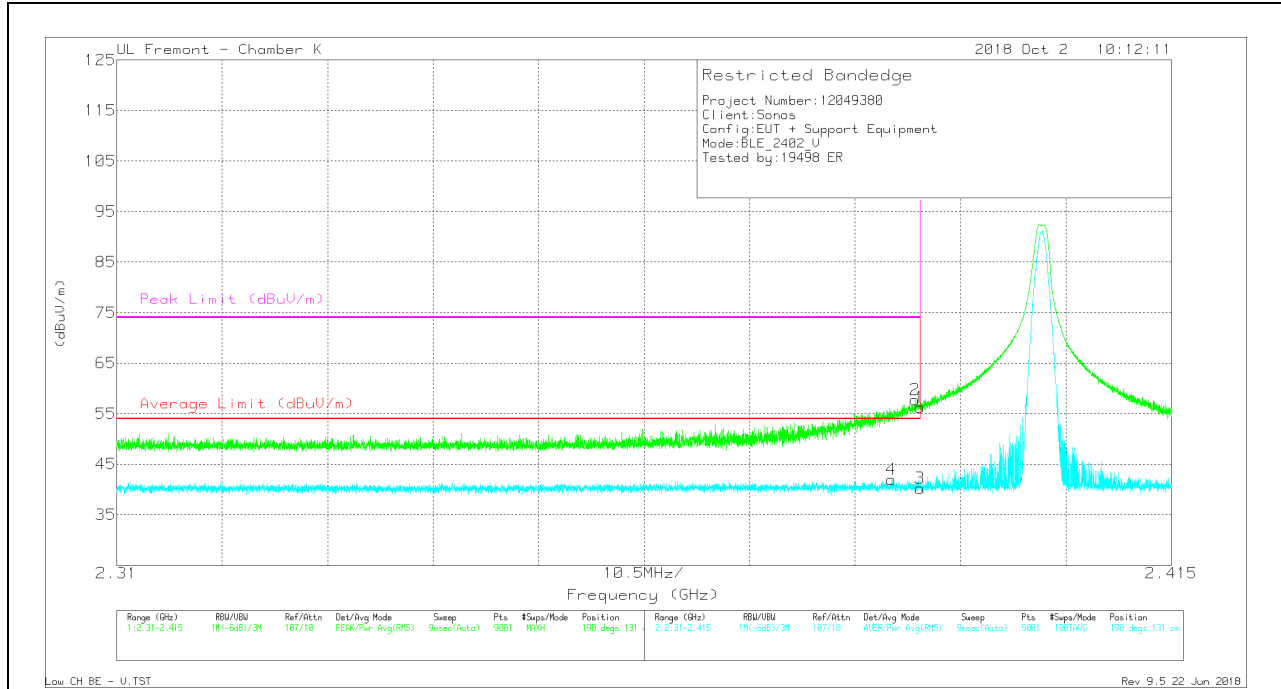
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Ch/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	50.76	Pk	31.9	-24.7	0	57.96	-	-	74	-16.04	194	131	H
2	* 2.39	51.74	Pk	31.9	-24.7	0	58.94	-	-	74	-15.06	194	131	H
3	* 2.39	31.27	RMS	31.9	-24.7	2.13	40.6	54	-13.4	-	-	194	131	H
4	* 2.388	33.11	RMS	31.9	-24.6	2.13	42.54	54	-11.46	-	-	194	131	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Chl/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Asimuth (Degs)	Height (cm)	Polarity
1	* 2.39	49.04	Pk	31.9	-24.7	0	56.24	-	-	74	-17.76	190	131	V
2	* 2.389	50.55	Pk	31.9	-24.7	0	57.75	-	-	74	-16.25	190	131	V
3	* 2.39	30.87	RMS	31.9	-24.7	2.13	40.2	54	-13.8	-	-	190	131	V
4	* 2.387	32.57	RMS	31.9	-24.6	2.13	42	54	-12	-	-	190	131	V

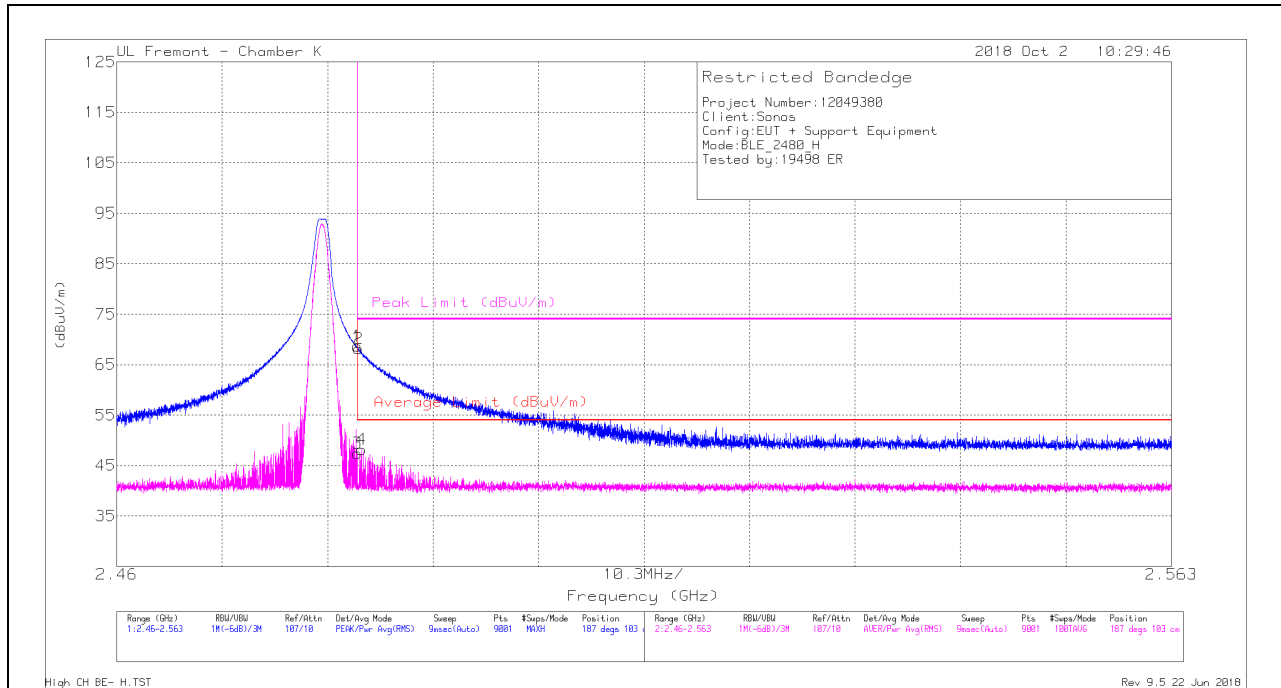
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



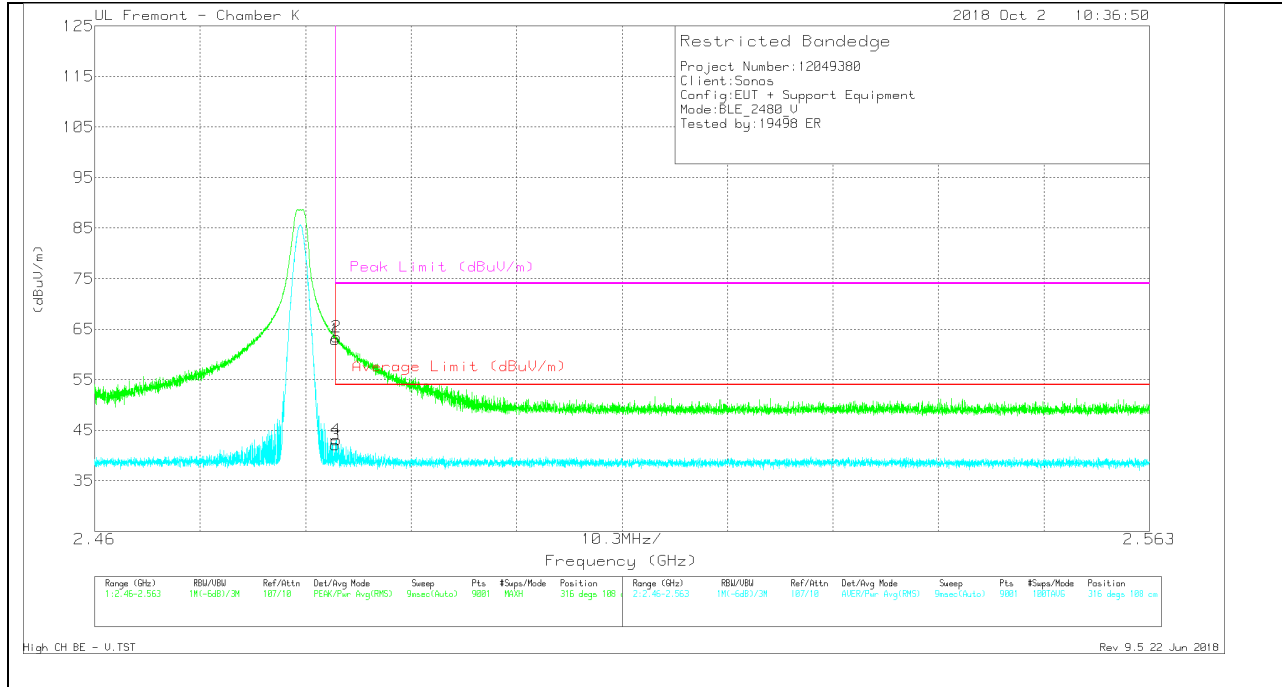
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2.484	61.18	Pk	32.3	-24.8	0	68.68	-	-	74	-5.32	187	103	H
2	* 2.484	60.67	Pk	32.3	-24.8	0	68.17	-	-	74	-5.83	187	103	H
3	* 2.484	37.86	RMS	32.3	-24.8	2.13	47.49	54	-6.51	-	-	187	103	H
4	* 2.484	38.53	RMS	32.3	-24.8	2.13	48.16	54	-5.84	-	-	187	103	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT 344 (dB/m)	Amp/Cb/Filt/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	* 2.484	55.46	Pk	32.3	-24.8	62.96	-	-	74	-11.04	316	108	V
2	* 2.484	55.96	Pk	32.3	-24.8	63.46	-	-	74	-10.54	316	108	V
3	* 2.484	34.55	RMS	32.3	-24.8	42.05	54	-11.95	-	-	316	108	V
4	* 2.484	35.59	RMS	32.3	-24.8	43.09	54	-10.91	-	-	316	108	V

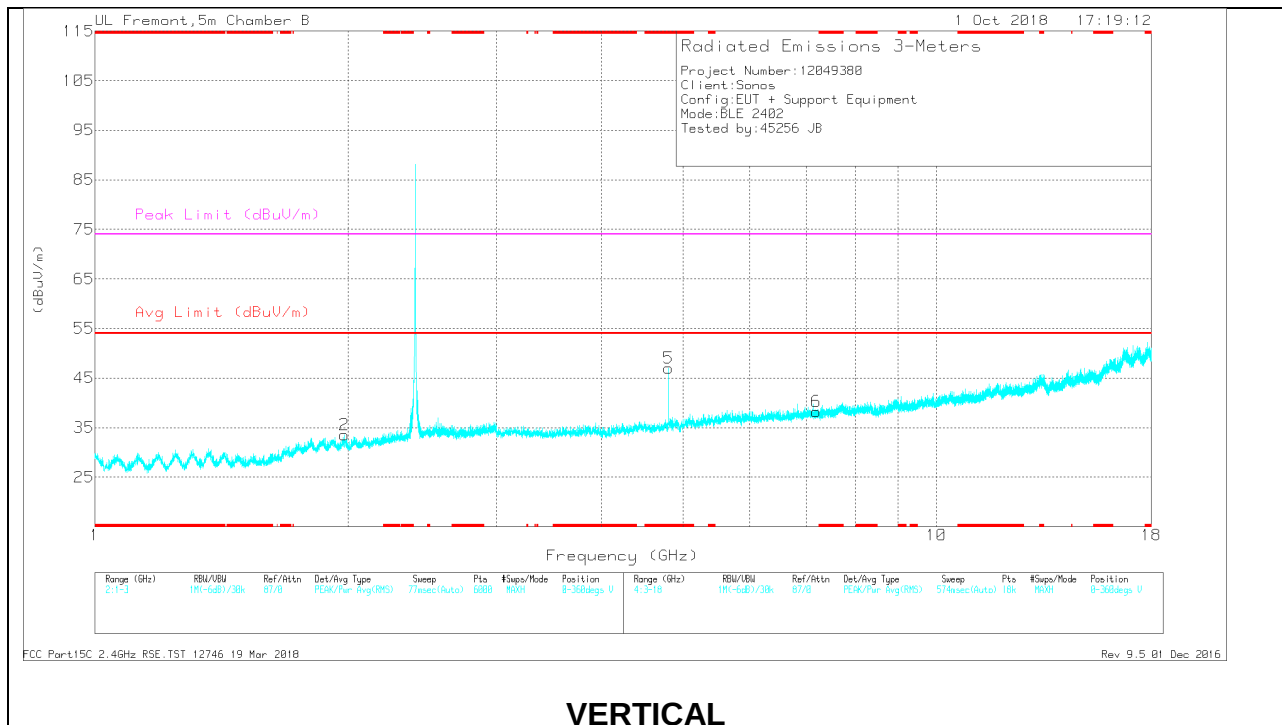
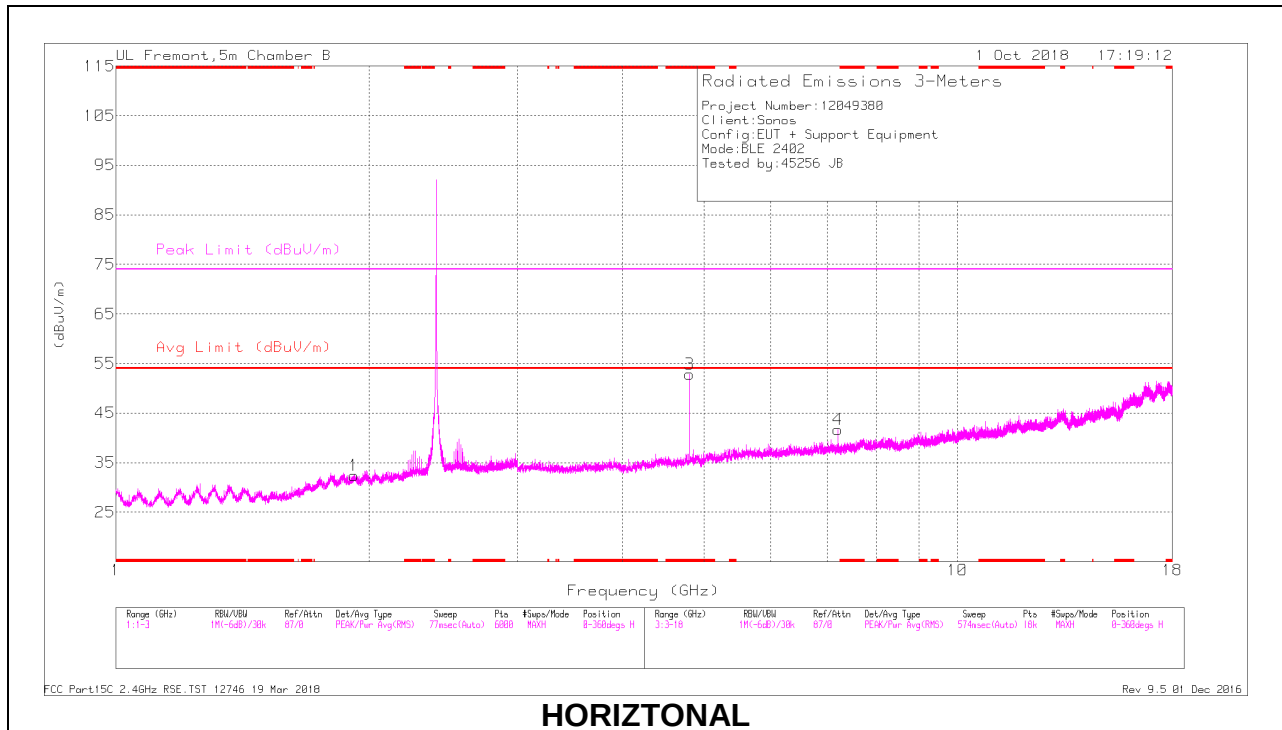
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 4.804	48.03	Pk	34	-29.2	0	52.83	-	-	74	-21.17	0-360	199	H
5	* 4.804	42.25	Pk	34	-29.2	0	47.05	-	-	74	-26.95	0-360	199	V
1	1.919	22.29	Pk	31	-20.9	0	32.39	-	-	-	-	0-360	102	H
2	1.978	23.6	Pk	30.9	-20.9	0	33.6	-	-	-	-	0-360	200	V
6	7.198	29.51	Pk	35.9	-27.2	0	38.21	-	-	-	-	0-360	102	V
4	7.207	33.11	Pk	35.9	-27.3	0	41.71	-	-	-	-	0-360	199	H

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

Pk - Peak detector

Radiated Emissions

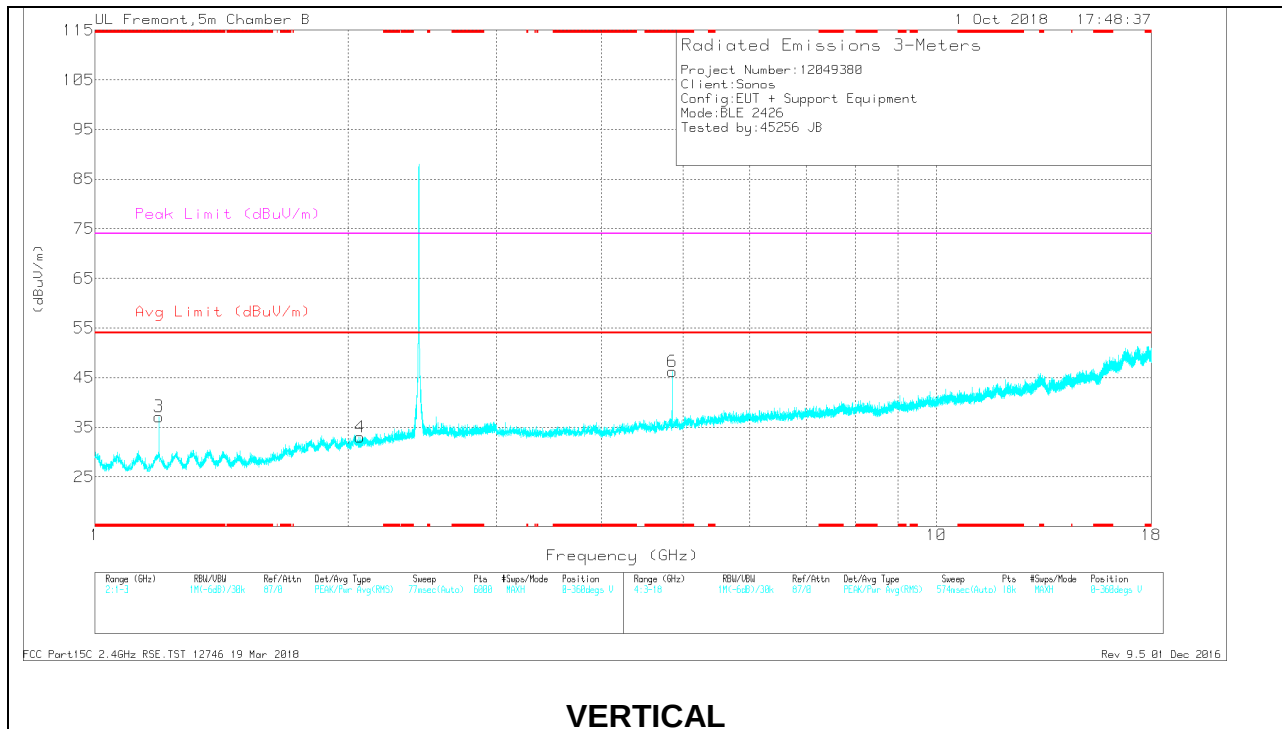
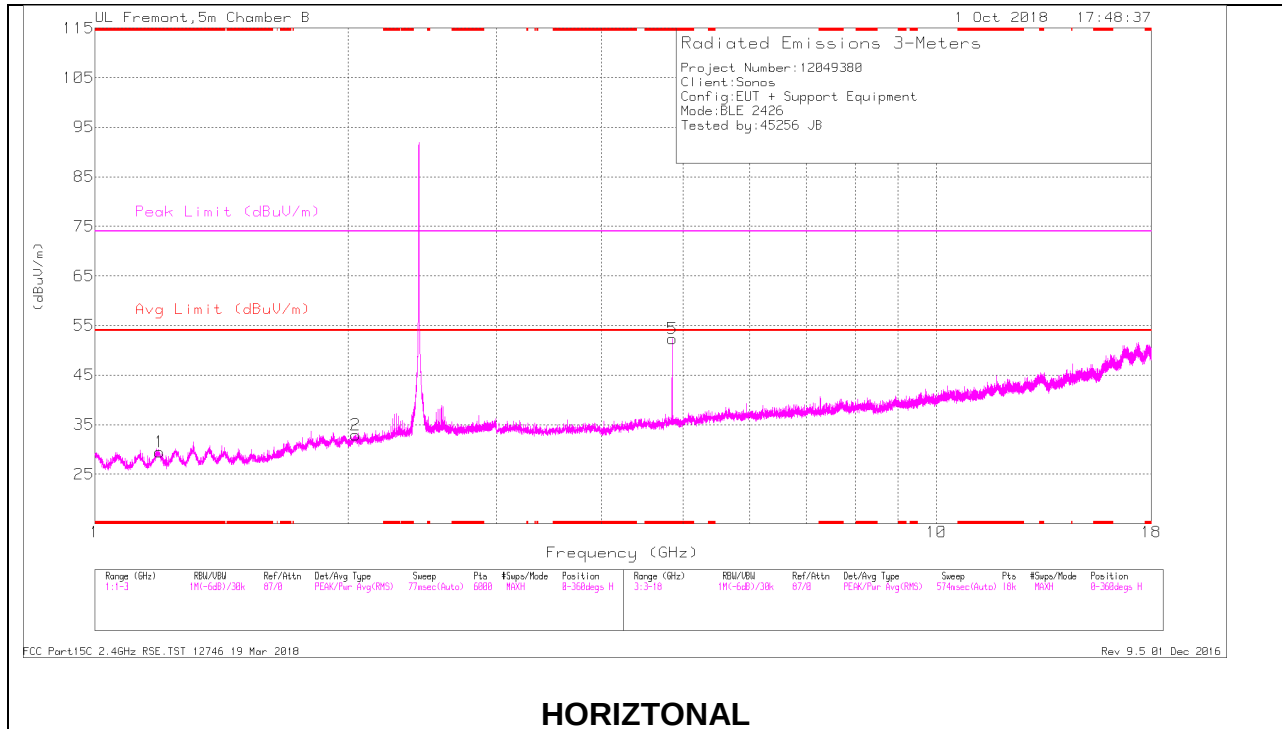
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.805	51.23	PK2	34	-29.3	0	55.93	-	-	74	-18.07	89	160	H
* 4.804	47.02	MAv1	34	-29.2	2.13	53.95	54	-0.05	-	-	89	160	H
* 4.805	46.7	PK2	34	-29.3	0	51.4	-	-	74	-22.6	170	279	V
* 4.804	40.93	MAv1	34	-29.2	2.13	47.86	54	-6.14	-	-	170	279	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL RESULTS



RADIATED EMISSIONS

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (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
1	* 1.193	23.84	Pk	28.1	-22.5	0	29.44	-	-	74	-44.56	0-360	102	H
3	* 1.192	31.36	Pk	28.1	-22.3	0	37.16	-	-	74	-36.84	0-360	102	V
5	* 4.853	48.01	Pk	34.2	-29.9	0	52.31	-	-	74	-21.69	0-360	102	H
6	* 4.852	41.91	Pk	34.2	-29.9	0	46.21	-	-	74	-27.79	0-360	199	V
2	2.04	22.76	Pk	31	-20.9	0	32.86	-	-	-	-	0-360	199	H
4	2.065	23.09	Pk	31	-21	0	33.09	-	-	-	-	0-360	102	V

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

Pk - Peak detector

Radiated Emissions

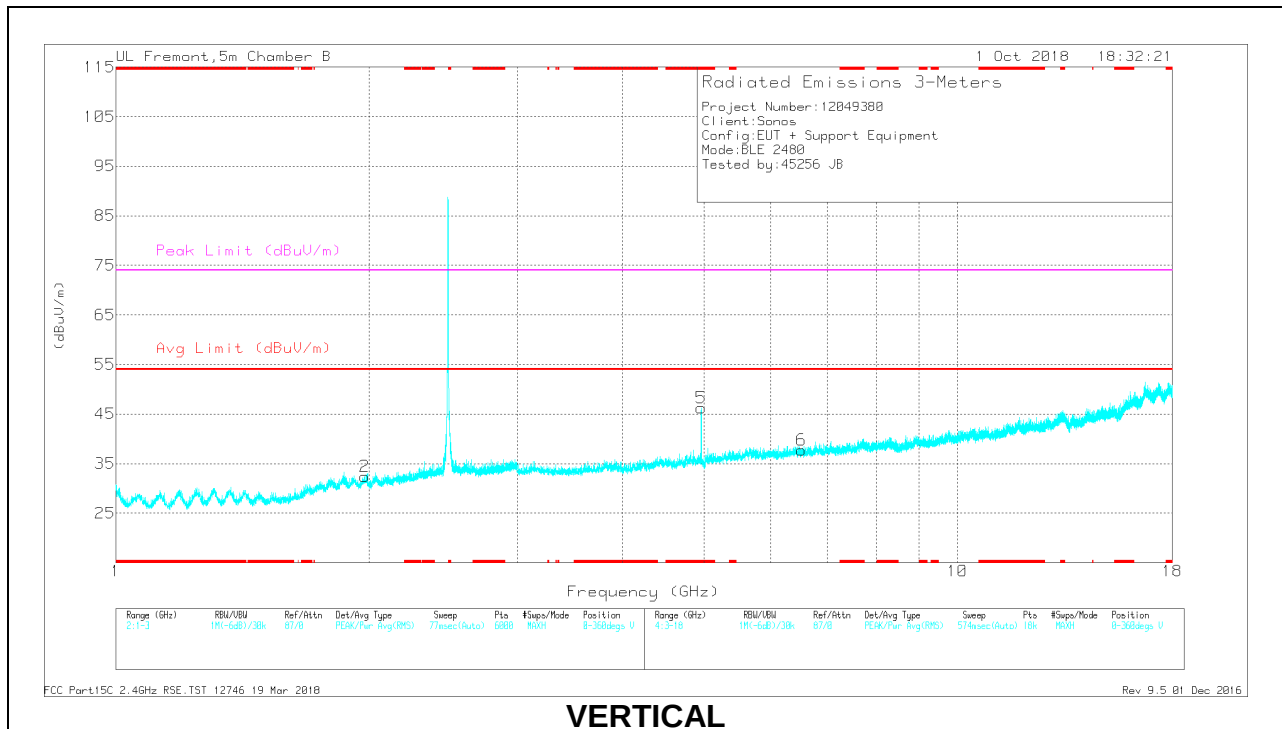
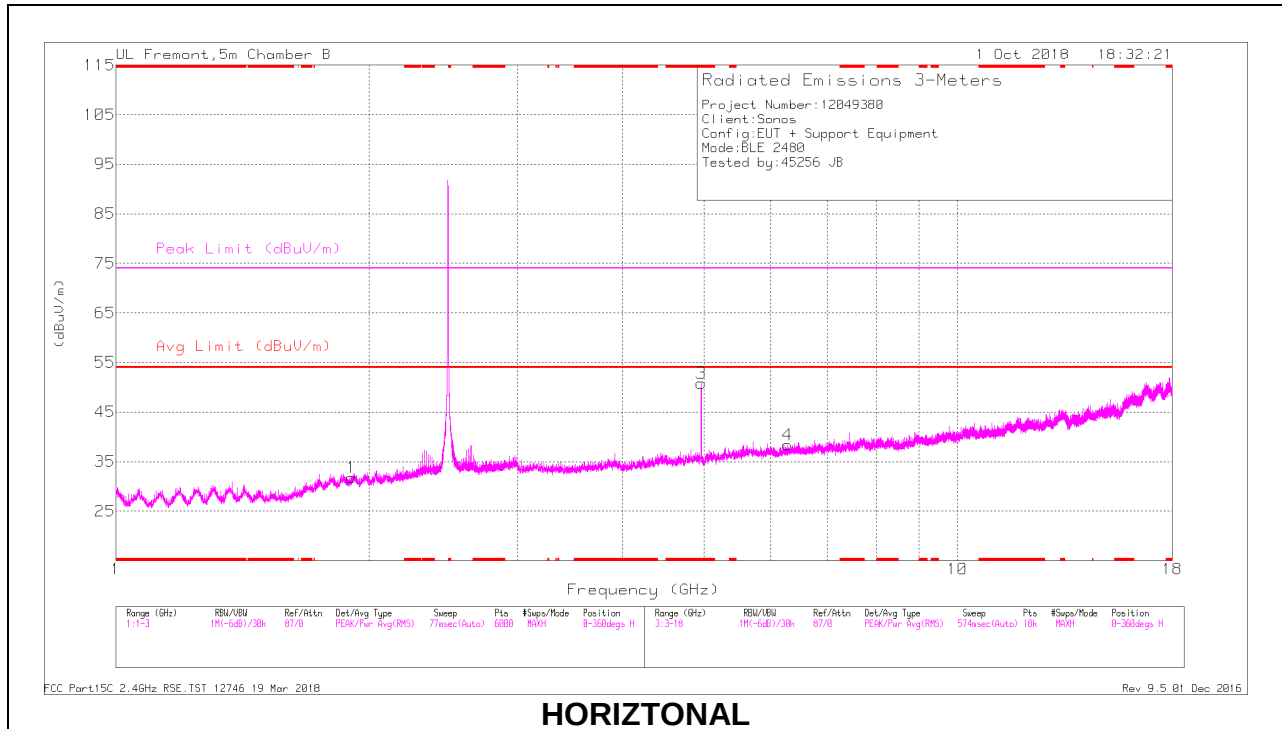
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.194	30.4	PK2	28.1	-22.5	0	36	-	-	74	-38	200	169	H
* 1.192	18.05	MAv1	28.1	-22.3	2.13	25.98	54	-28.02	-	-	200	169	H
* 1.193	31.54	PK2	28.1	-22.4	0	37.24	-	-	74	-36.76	283	185	V
* 1.191	18.18	MAv1	28.1	-22.4	2.13	26.01	54	-27.99	-	-	283	185	V
* 4.852	51.44	PK2	34.2	-29.9	0	55.74	-	-	74	-18.26	92	149	H
* 4.852	46.31	MAv1	34.2	-29.9	2.13	52.74	54	-1.26	-	-	92	149	H
* 4.852	46.68	PK2	34.2	-29.9	0	50.98	-	-	74	-23.02	171	278	V
* 4.852	40.76	MAv1	34.2	-29.9	2.13	47.19	54	-6.81	-	-	171	278	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 4.96	46.25	Pk	34.5	-29.9	0	50.85	-	-	74	-23.15	0-360	102	H
5	* 4.96	41.68	Pk	34.5	-29.9	0	46.28	-	-	74	-27.72	0-360	199	V
1	1.906	21.77	Pk	31	-21	0	31.77	-	-	-	-	0-360	199	H
2	1.975	22.44	Pk	30.9	-20.9	0	32.44	-	-	-	-	0-360	200	V
4	6.285	31.44	Pk	35.6	-28.7	0	38.34	-	-	-	-	0-360	102	H
6	6.521	30.19	Pk	35.6	-28.1	0	37.69	-	-	-	-	0-360	102	V

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

Pk - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.961	49.92	PK2	34.5	-29.8	0	54.62	-	-	74	-19.38	91	109	H
* 4.96	45.08	MAv1	34.5	-29.9	2.13	51.81	54	-2.19	-	-	91	109	H
* 4.961	47.12	PK2	34.5	-29.8	0	51.82	-	-	74	-22.18	166	277	V
* 4.96	40.58	MAv1	34.5	-29.9	2.13	47.31	54	-6.69	-	-	166	277	V

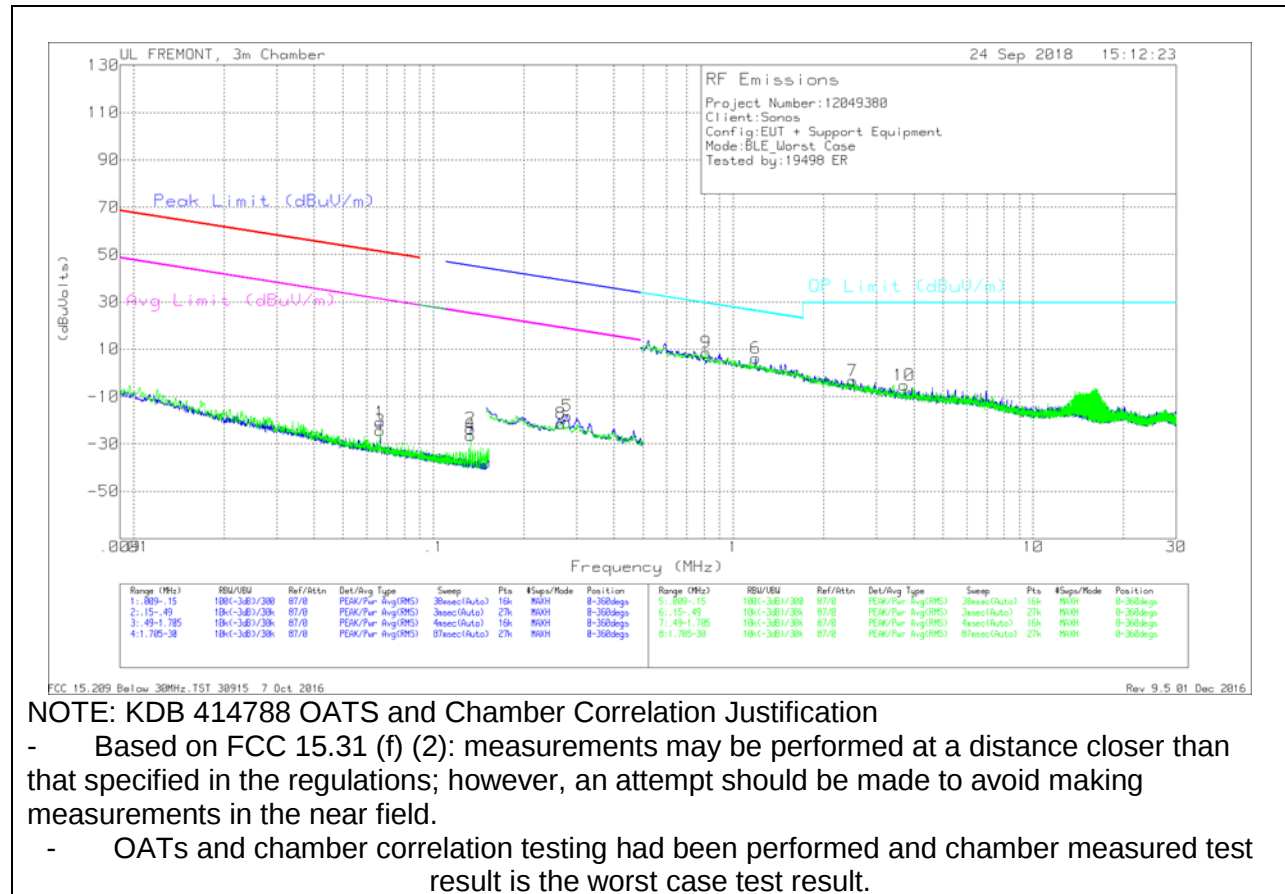
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

9.3. Worst Case Below 30 MHz

SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION)



Below 30 MHz Data

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.06625	42.36	Pk	12	1.4	-80	-24.24	51.16	-75.4	31.16	-55.4	0-360
1	.06634	45.83	Pk	12	1.4	-80	-20.77	51.15	-71.92	31.15	-51.92	0-360
4	.13276	40.46	Pk	11.8	1.4	-80	-26.34	45.16	-71.5	25.16	-51.5	0-360
2	.13288	43.34	Pk	11.8	1.4	-80	-23.46	45.16	-68.62	25.16	-48.62	0-360
8	.26614	45.27	Pk	11.7	1.5	-80	-21.53	39.11	-60.64	19.11	-40.64	0-360
5	.27928	48.58	Pk	11.7	1.5	-80	-18.22	38.69	-56.91	18.69	-36.91	0-360

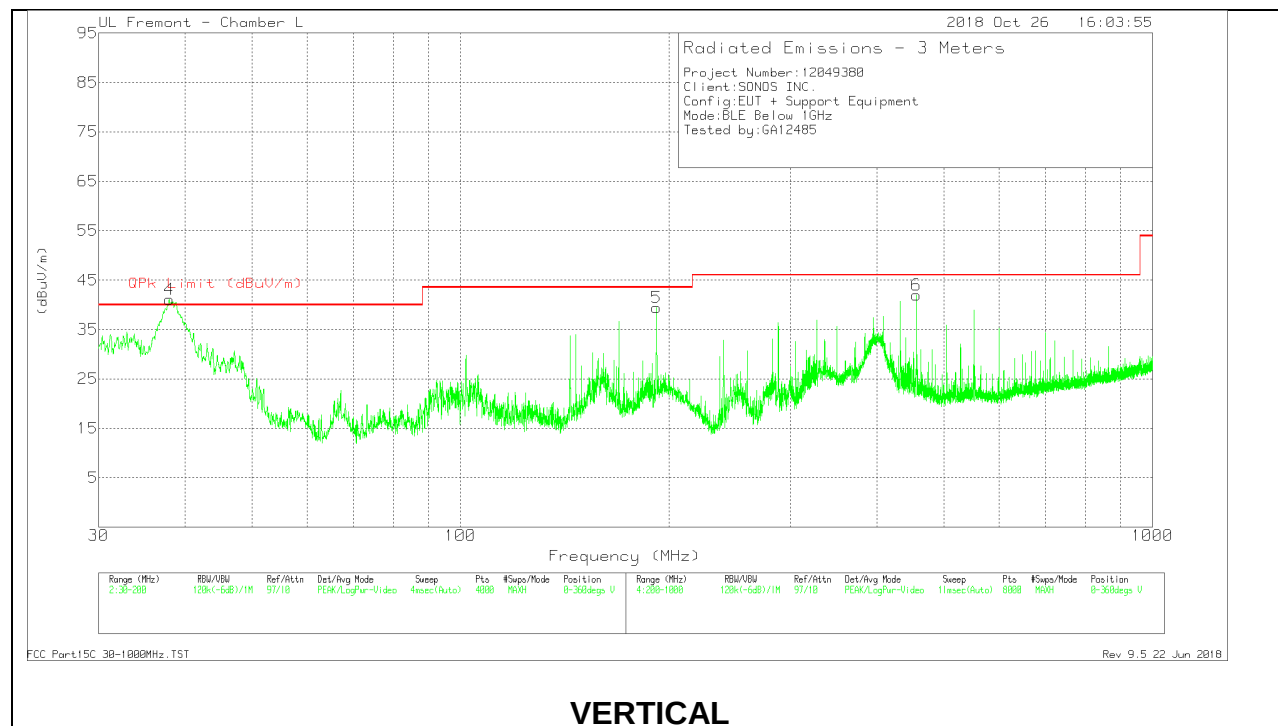
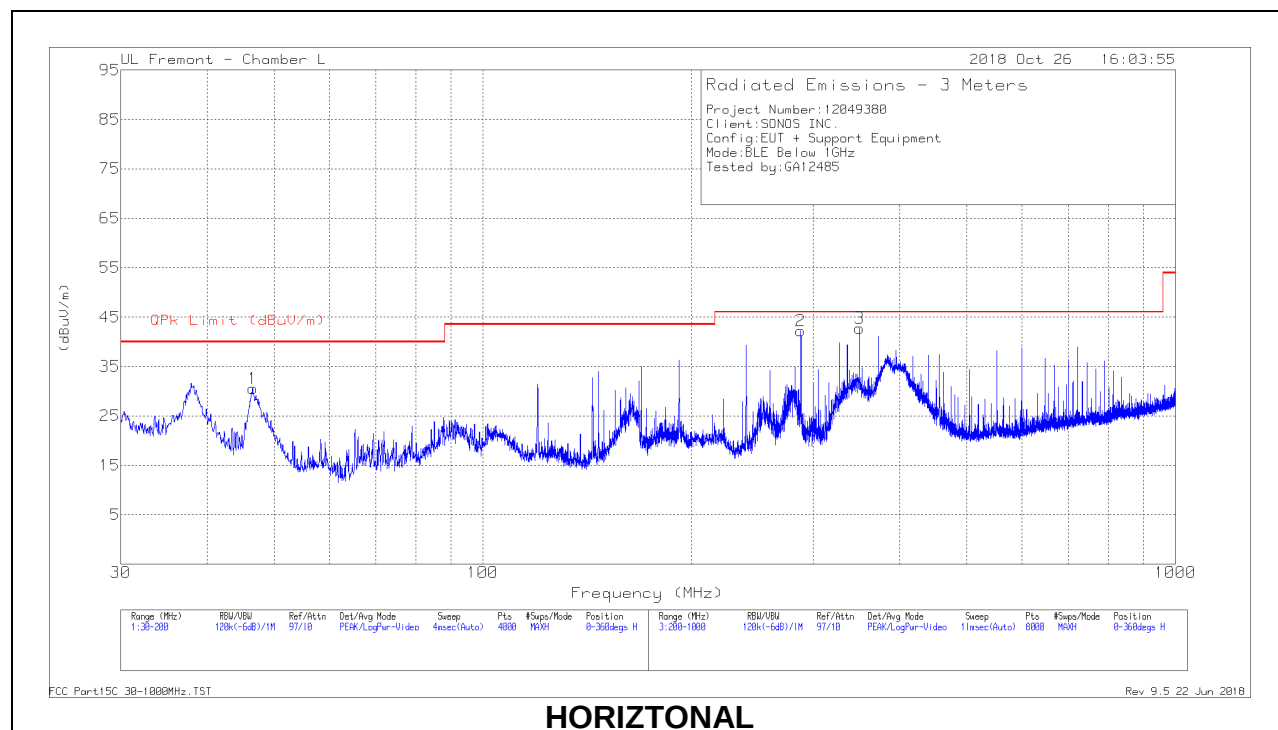
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
9	.81182	35.19	Pk	11.8	1.5	-40	8.49	29.43	-20.94	0-360
6	1.18795	32.99	Pk	11.8	1.5	-40	6.29	26.13	-19.84	0-360
7	2.50253	23.41	Pk	11.8	1.5	-40	-3.29	29.5	-32.79	0-360
10	3.70458	21.72	Pk	11.7	1.5	-40	-5.08	29.5	-34.58	0-360

Pk - Peak detector

9.4. Worst Case Below 1 GHz

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



Below 1GHz Data

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181574 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	46.5368	46.78	Pk	15.2	-31.4	30.58	40	-9.42	0-360	399	H
4	* 37.9496	51.58	Pk	21	-31.5	41.08	40	1.08	0-360	100	V
5	191.9244	52.44	Pk	17.5	-30.5	39.44	43.52	-4.08	0-360	100	V
2	287.9114	52.84	Pk	19.2	-29.8	42.24	46.02	-3.78	0-360	100	H
3	349.9195	52.47	Pk	20.1	-29.8	42.77	46.02	-3.25	0-360	100	H
6	455.9333	48.62	Pk	22.8	-29.5	41.92	46.02	-4.1	0-360	100	V

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

Pk - Peak detector

Radiated Emissions

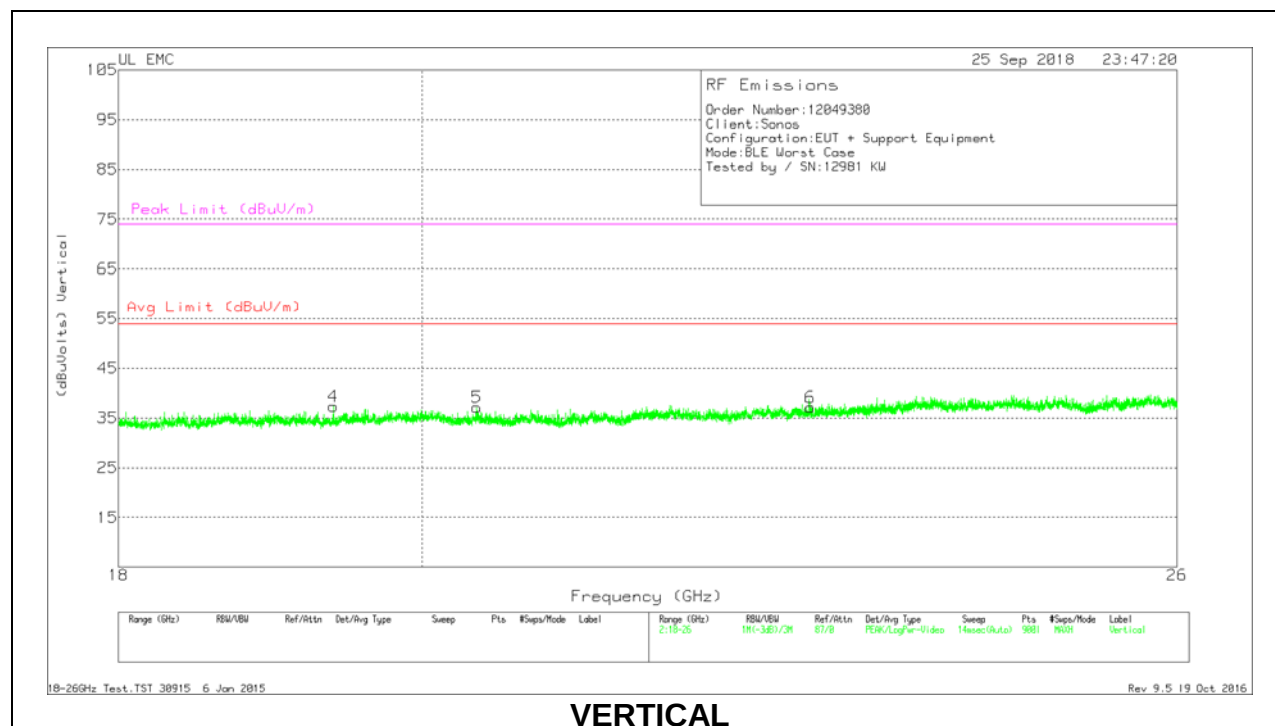
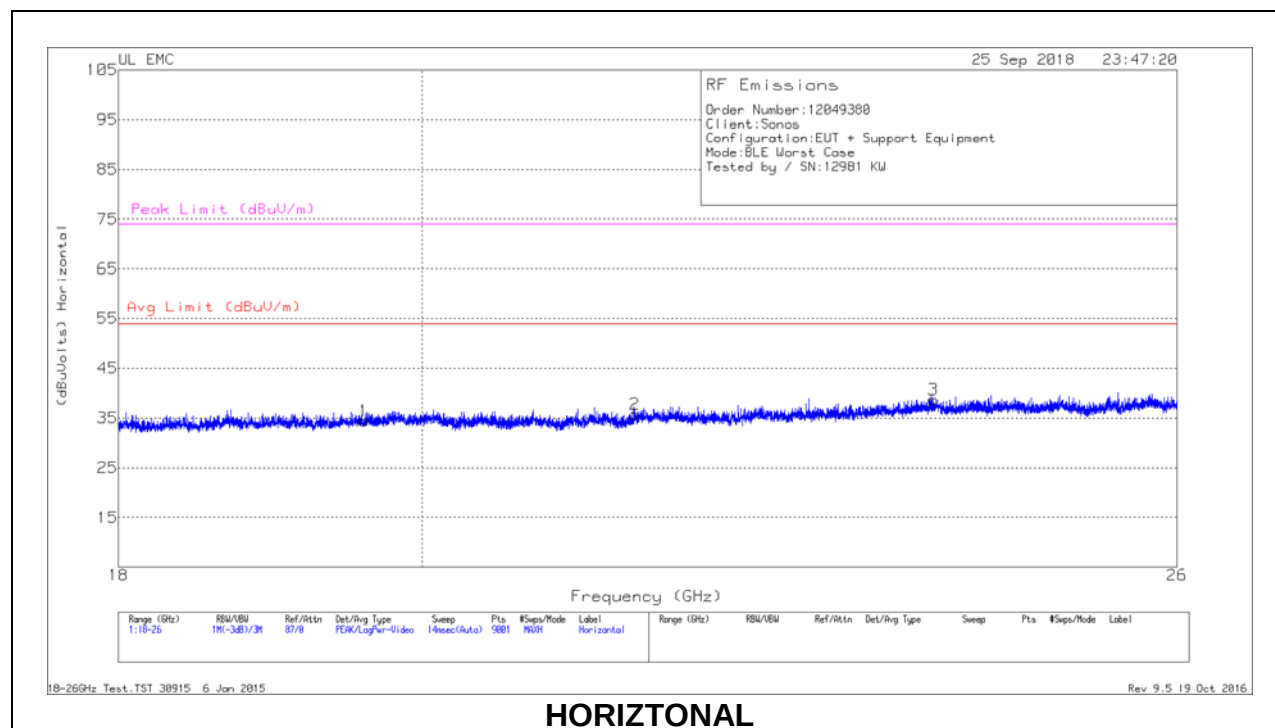
Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181574 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
46.5876	45.06	Qp	15.2	-31.4	28.86	40	-11.14	316	386	H
* 38.0119	48.46	Qp	21	-31.5	37.96	40	-2.04	26	116	V
191.9234	51.74	Qp	17.5	-30.5	38.74	43.52	-4.78	148	100	V
288.0073	52.53	Qp	19.2	-29.8	41.93	46.02	-4.09	226	102	H
349.978	51.9	Qp	20.1	-29.8	42.2	46.02	-3.82	141	100	H
456.0033	46.91	Qp	22.8	-29.5	40.21	46.02	-5.81	166	112	V

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

Qp - Quasi-Peak detector

9.5. Worst Case 18-26 GHz

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



18 – 26GHz DATA

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	19.601	36.67	Pk	32.5	-25.2	-9.5	34.47	54	-19.53	74	-39.53
2	21.537	37.43	Pk	33	-25.2	-9.5	35.73	54	-18.27	74	-38.27
3	23.887	38.73	Pk	33.5	-24	-9.5	38.73	54	-15.27	74	-35.27
4	19.396	39.55	Pk	32.4	-25.1	-9.5	37.35	54	-16.65	74	-36.65
5	20.384	39.04	Pk	32.6	-25	-9.5	37.14	54	-16.86	74	-36.86
6	22.89	38.21	Pk	33.4	-25	-9.5	37.11	54	-16.89	74	-36.89

Pk - Peak detector

10. 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.

TEST PROCEDURE

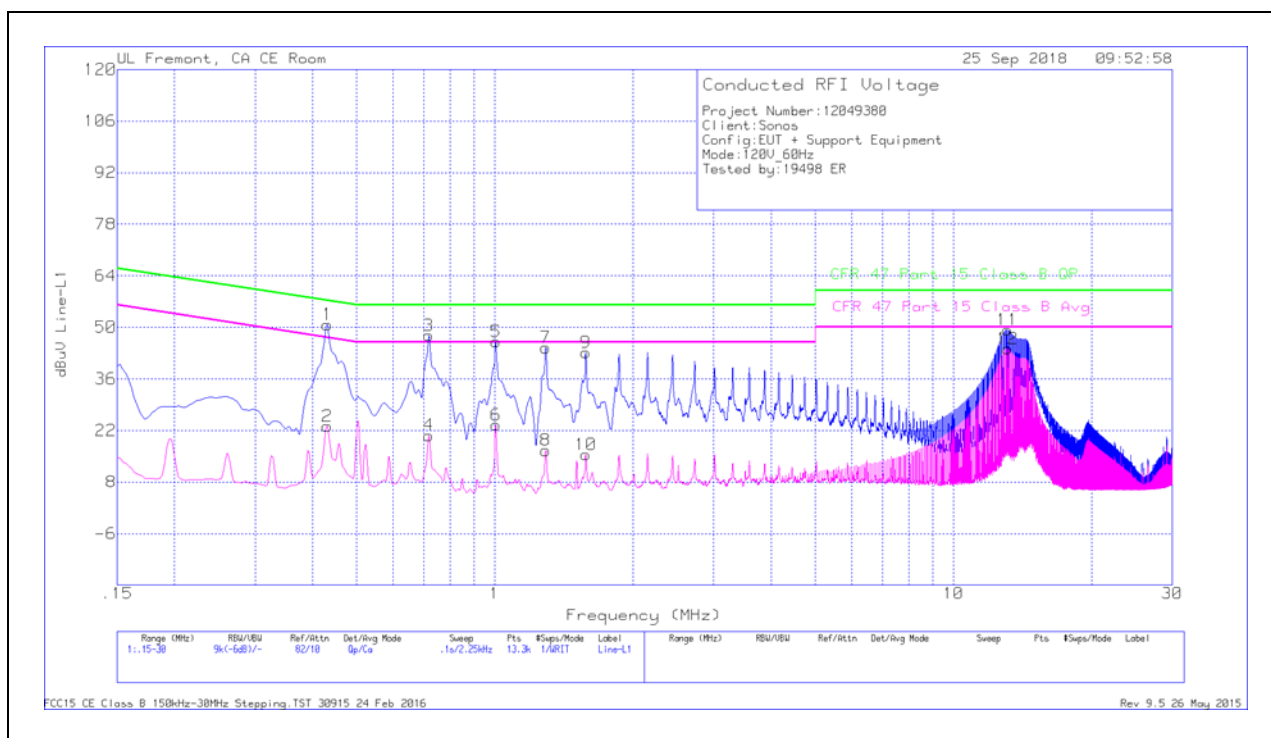
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

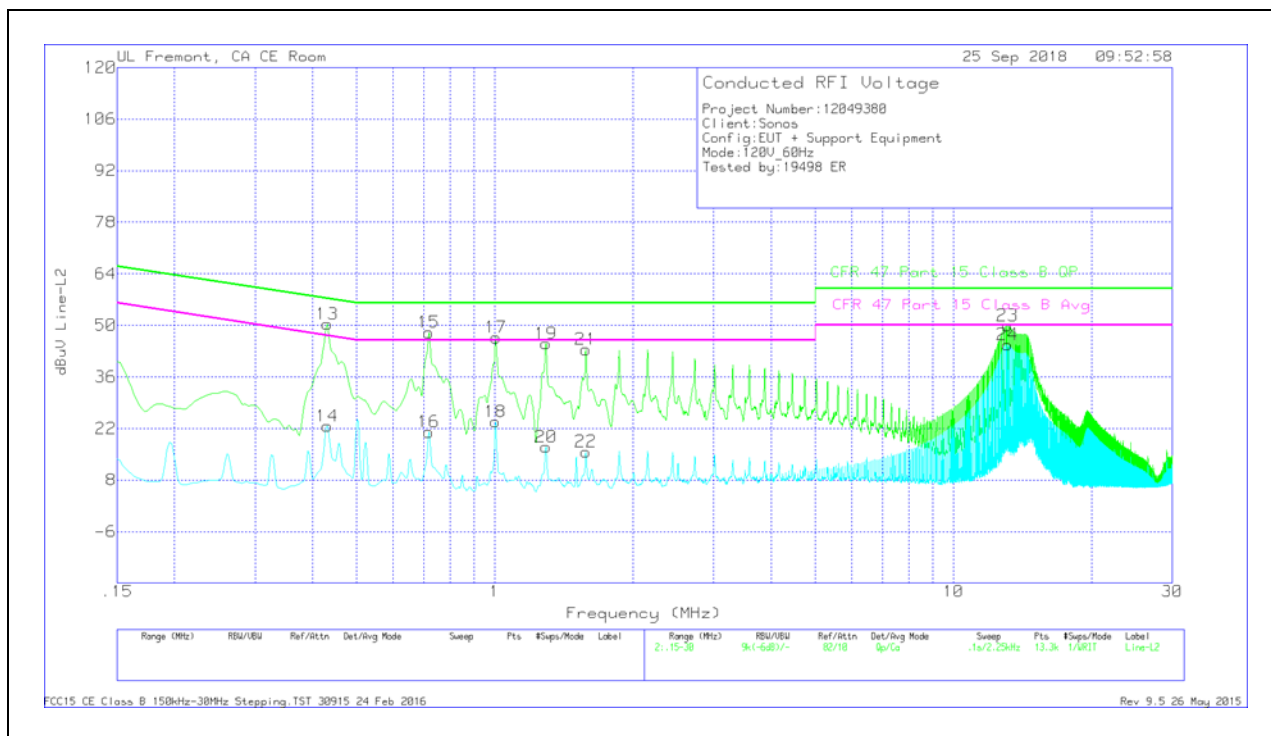


Trace Markers

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	.43125	40.63	Qp	0	0	10.1	50.73	57.23	-6.5	-	-
2	.43125	13.01	Ca	0	0	10.1	23.11	-	-	47.23	-24.12
3	.717	37.67	Qp	0	0	10.1	47.77	56	-8.23	-	-
4	.717	10.57	Ca	0	0	10.1	20.67	-	-	46	-25.33
5	1.005	35.86	Qp	0	.1	10.1	46.06	56	-9.94	-	-
6	1.005	13.26	Ca	0	.1	10.1	23.46	-	-	46	-22.54
7	1.29075	34.28	Qp	0	.1	10.1	44.48	56	-11.52	-	-
8	1.29075	6.38	Ca	0	.1	10.1	16.58	-	-	46	-29.42
9	1.57875	32.94	Qp	0	.1	10.1	43.14	56	-12.86	-	-
10	1.57875	5.22	Ca	0	.1	10.1	15.42	-	-	46	-30.58
11	13.119	38.84	Qp	.1	.2	10.2	49.34	60	-10.66	-	-
12	13.119	33.69	Ca	.1	.2	10.2	44.19	-	-	50	-5.81

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



Trace Markers

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)
1	.43125	40.63	Qp	0	0	10.1	50.73	57.23	-6.5	-	-
2	.43125	13.01	Ca	0	0	10.1	23.11	-	-	47.23	-24.12
3	.717	37.67	Qp	0	0	10.1	47.77	56	-8.23	-	-
4	.717	10.57	Ca	0	0	10.1	20.67	-	-	46	-25.33
5	1.005	35.86	Qp	0	.1	10.1	46.06	56	-9.94	-	-
6	1.005	13.26	Ca	0	.1	10.1	23.46	-	-	46	-22.54
7	1.29075	34.28	Qp	0	.1	10.1	44.48	56	-11.52	-	-
8	1.29075	6.38	Ca	0	.1	10.1	16.58	-	-	46	-29.42
9	1.57875	32.94	Qp	0	.1	10.1	43.14	56	-12.86	-	-
10	1.57875	5.22	Ca	0	.1	10.1	15.42	-	-	46	-30.58
11	13.119	38.84	Qp	.1	.2	10.2	49.34	60	-10.66	-	-
12	13.119	33.69	Ca	.1	.2	10.2	44.19	-	-	50	-5.81

Qp - Quasi-Peak detector

Ca - CISPR average detection