CERTIFICATION TEST REPORT

Report Number. : 12148309-E2V3

Applicant	:	SONOS INC. 614 CHAPALA STREET SANTA BARBARA, CA 93101, U.S.A
Model	:	S17
FCC ID	:	SBVRM017
IC	:	5373A-RM017
EUT Description	:	802.11 a/b/g/n 4x4 (HT20) Client Device
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
July 30, 2019

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	6/13/2019	Initial Issue	
V2	6/20/2019	Updated Section 5.3, 5.5 & 7	K.Kedida
V3	7/30/2019	Updated Section 5.5	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: 802.11 a/b/g/n 4x4 (HT20) Client Device

MODEL: S17

SERIAL NUMBER: 5C-AA-FD-D0-08-14(Radiated)
5C-FF-DD-00-03-69 (Conducted)

DATE TESTED: March 6 – 29, 2019

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
UL Verification Services Inc. By:

Dan Coronia
Project Engineer/Operations Leader
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:

Kiya Kedida
Senior Project Engineer
Consumer Technology Division
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, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05, 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	☐ Chamber D	☐ Chamber I
☐ Chamber B	☐ Chamber E	☒ Chamber J
☐ Chamber C	☐ Chamber F	☒ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

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

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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 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 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 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 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	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is an 802.11 a/b/g/n 4x4 (HT20) Client Device. Product model S17 is a high-performance wireless speaker and part of the Sonos sound system. The device's primary function will be for streaming via WiFi, but also features Bluetooth audio streaming and Bluetooth Low Energy, used for simplified set-up.

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	-2.28	0.59

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PCB antenna, with a maximum gain of 3.4 dBi.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Sonos Compliance GUI 4.0.

5.5. WORST-CASE CONFIGURATION AND MODE

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

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

The EUT can only be setup in desktop orientation; therefore, all radiated testing was performed with the EUT in desktop orientation. The test set-up includes the power supply and USB-C Cord. Note that the USB-C Cord is not supplied with the product, it is used as support equipment for testing purposes only.

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

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	X230	SON-00002240	N/A
AC Adapter	Lenovo	42T4418	11S42T4418Z1ZGWG0B5776	N/A

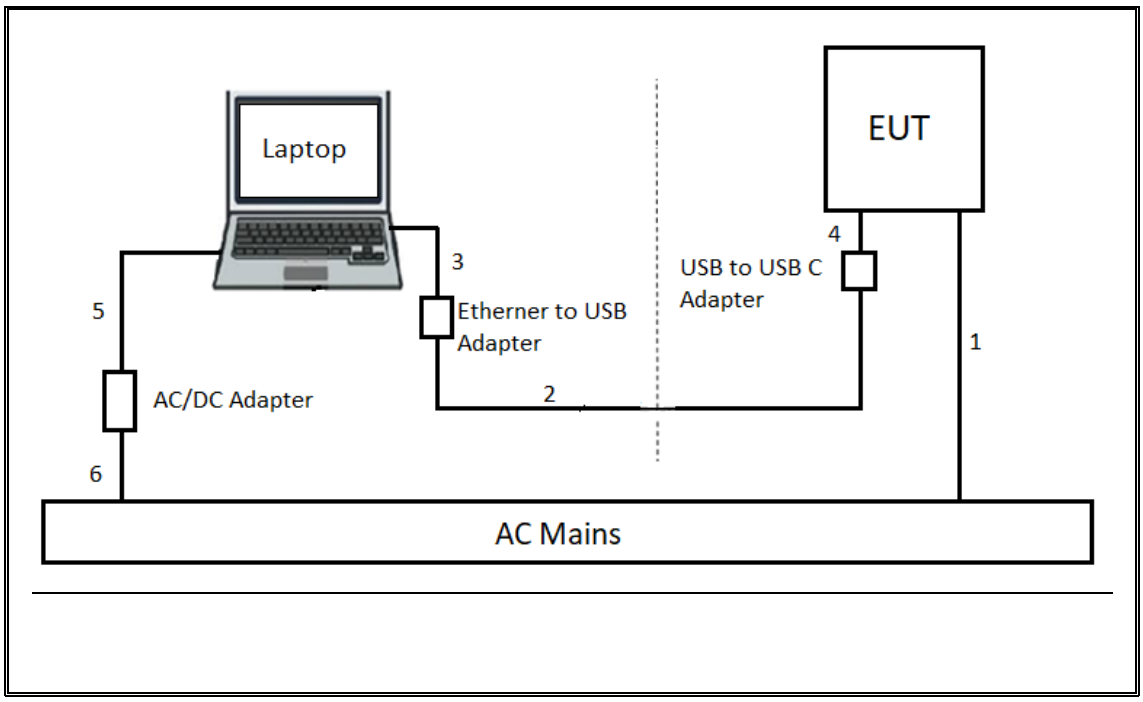
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identica**	**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	Ethernet to Ethernet converter
3	Ethernet to USB	1	RJ45 to USB	Unshielded	0.2	USB to USB adapter
4	USB adapter to USB C	1	USB to USB C	Unshielded	0.12	USB C to EUT
5	DC Power	1	DC	Shielded	1.2	AC/DC Adapter to Laptop
6	AC Power	1	AC	Unshielded	1	AC Mains to AC/DC Adapter

TEST SETUP

The EUT connected to support laptop via the ethernet cable during testing.
The test utility software on support laptop exercised the radio card.
For radiated testing, the support laptop was set up outside the chamber.

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

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

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 11.10.2 Method PKPSD (peak PSD)

Band-edge: ANSI C63.10 Section 11.13.3.4 Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction factor

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

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

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

Conducted emissions in restricted frequency bands: ANSI C63.10 Section 11.12.

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

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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**	**Last Cal**
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180174	05/31/2019	05/31/2018
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	12/13/2019	12/13/2018
Antenna, Horn 1-18GHz	AR	AMPL-ATH1G18	PRE0189055	4/20/2019	4/20/2018
Amplifier, 1-7GHz, 24dB	AMPLICAL	AMP1G7-24-27	T1608	07/30/2019	07/30/2018
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	05/04/2019	05/04/2018
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179375	05/08/2019	05/08/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1450	01/23/2020	01/23/2019
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1264	01/31/2020	01/31/2019
Hybrid Antenna, 30MHz to 3GHz	SunAR rf motion	JB3	PRE0181575	08/01/2019	08/01/2018
18 - 26.5 GHz Horn Antenna	ARA	MWH-1826/B	T448	03/13/2019	03/13/2018
Pre-Amp 1-26.5 GHz	Agilent	8449B	T404	03/09/2020	03/09/2019
Antenna, Passive Loop 30Hz to 1MHz	ELETRO METRICS	EM-6871	PRE0179465	05/22/2019	05/22/2018
Antenna, Passive Loop 100kHz to 30MHz	ELETRO METRICS	EM-6872	PRE0179467	05/22/2019	05/22/2018
AC Line Conducted					
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/14/2020	02/14/2019
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	06/15/2019	06/15/2018

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 9.5, Jan 07, 2019
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
BLE	0.382	0.624	0.612	61.22%	2.13	2.618

DUTY CYCLE PLOTS

DUTY CYCLE BLE

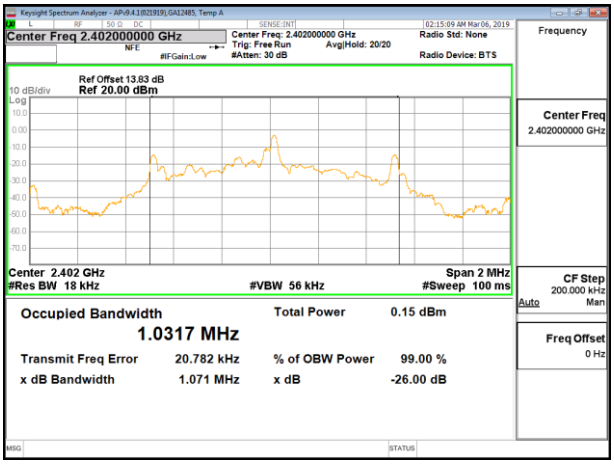
8.2. 99% BANDWIDTH

LIMITS

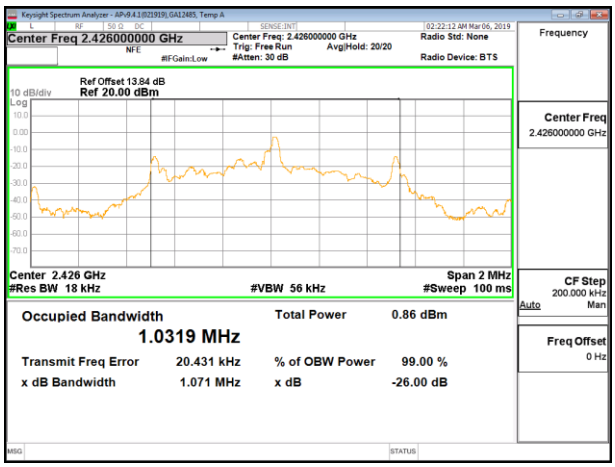
None; for reporting purposes only.

RESULTS

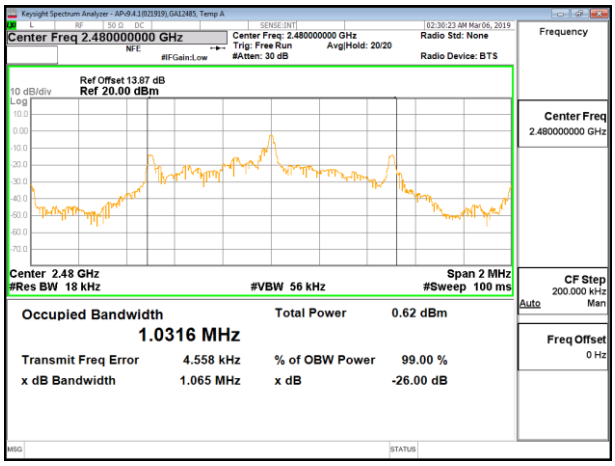
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0317
Middle	2426	1.0319
High	2480	1.0316



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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	0.6750	0.5
Middle	2426	0.6210	0.5
High	2480	0.6510	0.5

LOW CHANNEL

MID CHANNEL

HIGH CHANNEL

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 peak reading of power.

RESULTS

Tested By:	GA 12485
Date:	3/14/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-2.52	30	-32.52
Middle	2426	-2.33	30	-32.33
High	2480	-2.28	30	-32.28

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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 gated average reading of power.

RESULTS

Tested By:	GA 12485
Date:	3/14/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-3.00
Middle	2426	-2.77
High	2480	-2.76

8.6. POWER SPECTRAL DENSITY

LIMITS

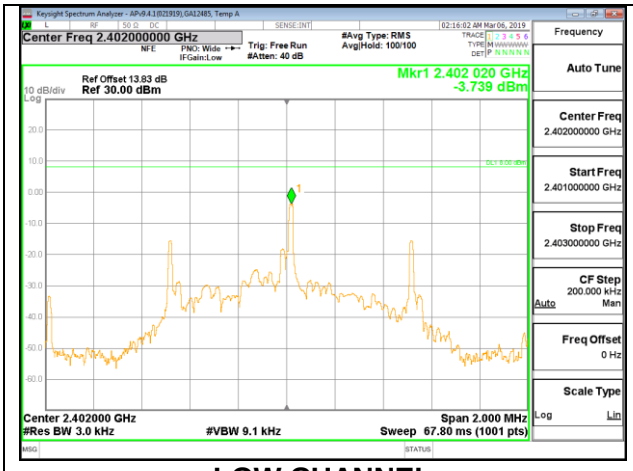
FCC §15.247 (e)

RSS-247 (5.2) (b)

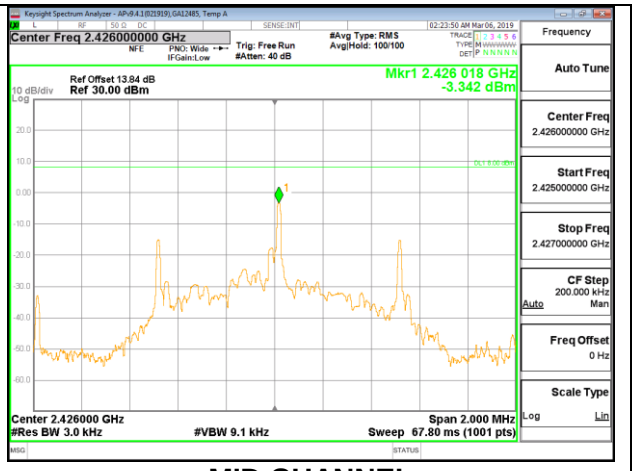
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

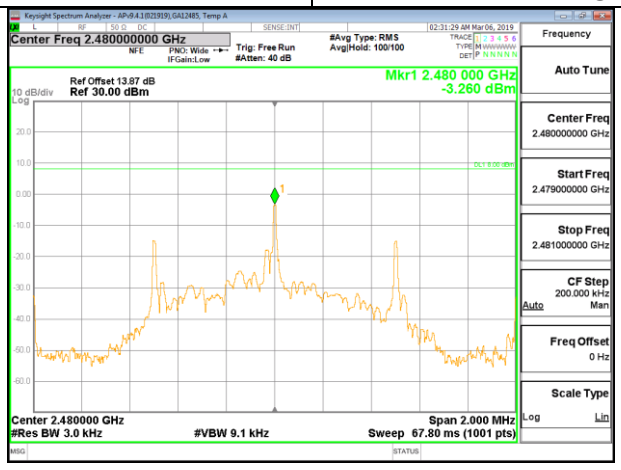
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-3.74	8	-11.74
Middle	2426	-3.34	8	-11.34
High	2480	-3.26	8	-11.26



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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

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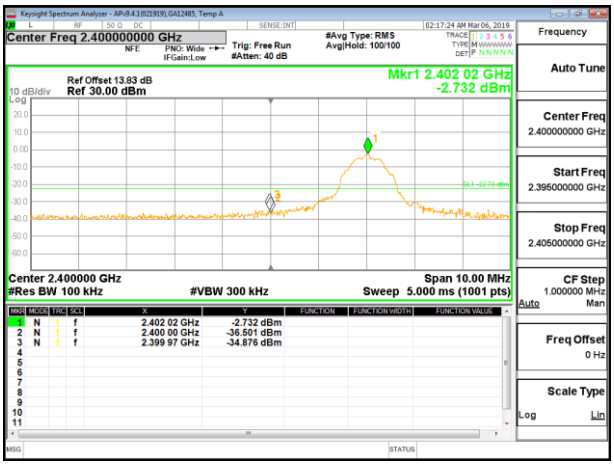
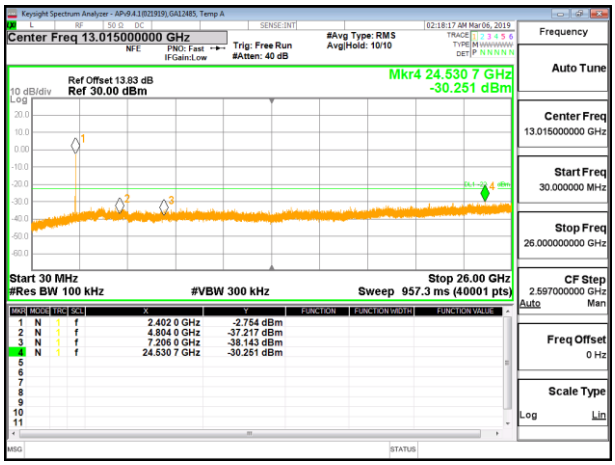
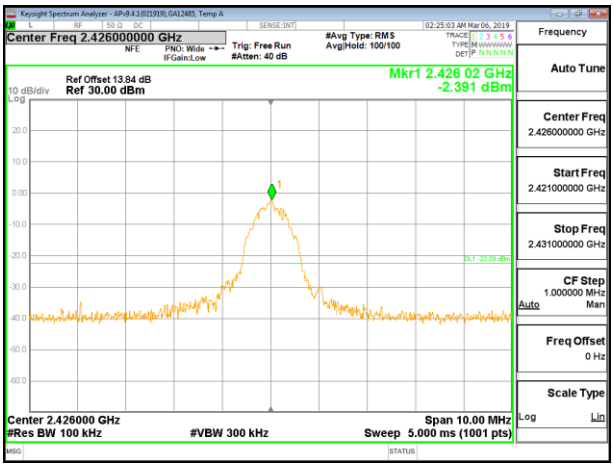


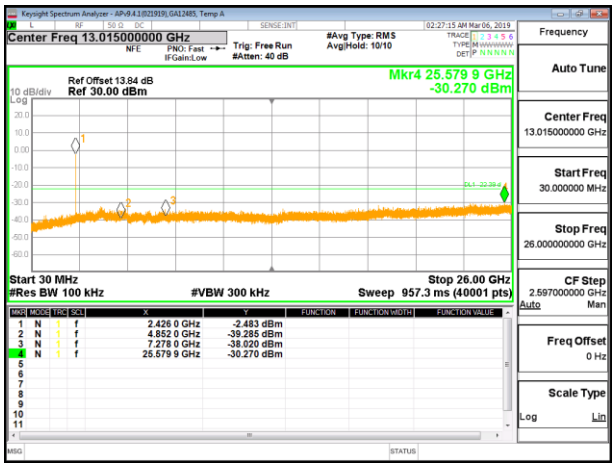
LOW CHANNEL BANDEDGE



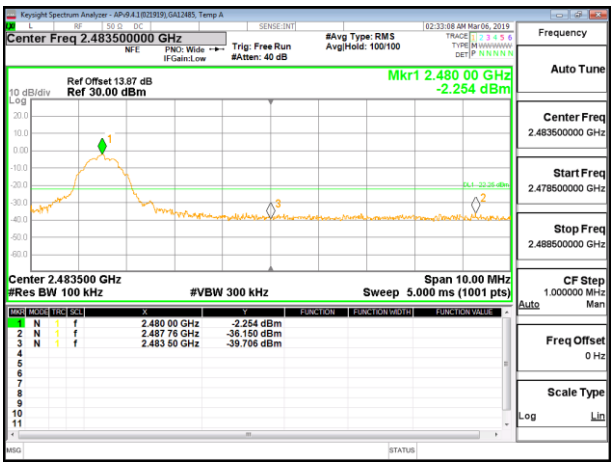
OUT-OF-BAND LOW CHANNEL



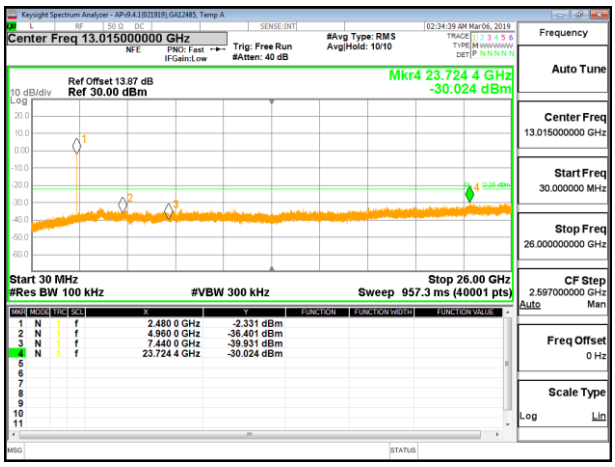
IN-BAND REFERENCE LEVEL



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.

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.

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.

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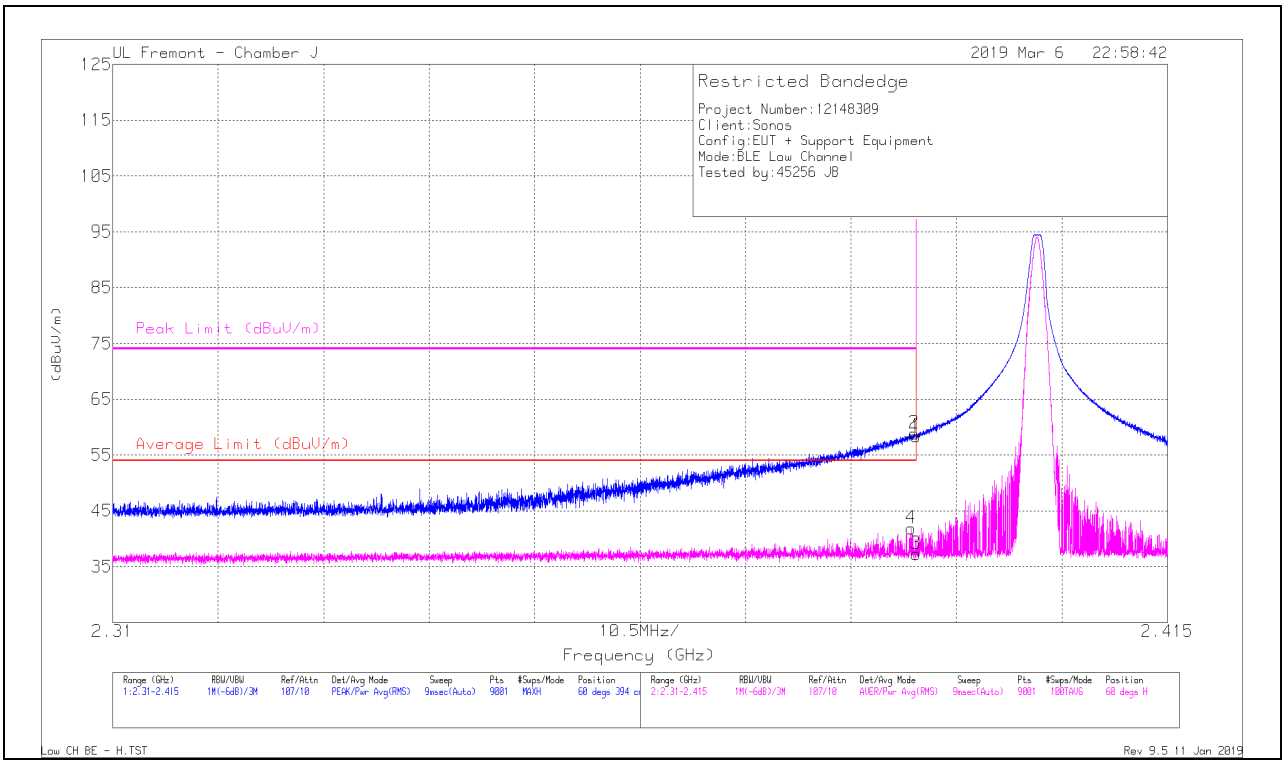
9.2. TRANSMITTER ABOVE 1 GHz

BANDEDGE (LOW CHANNEL)

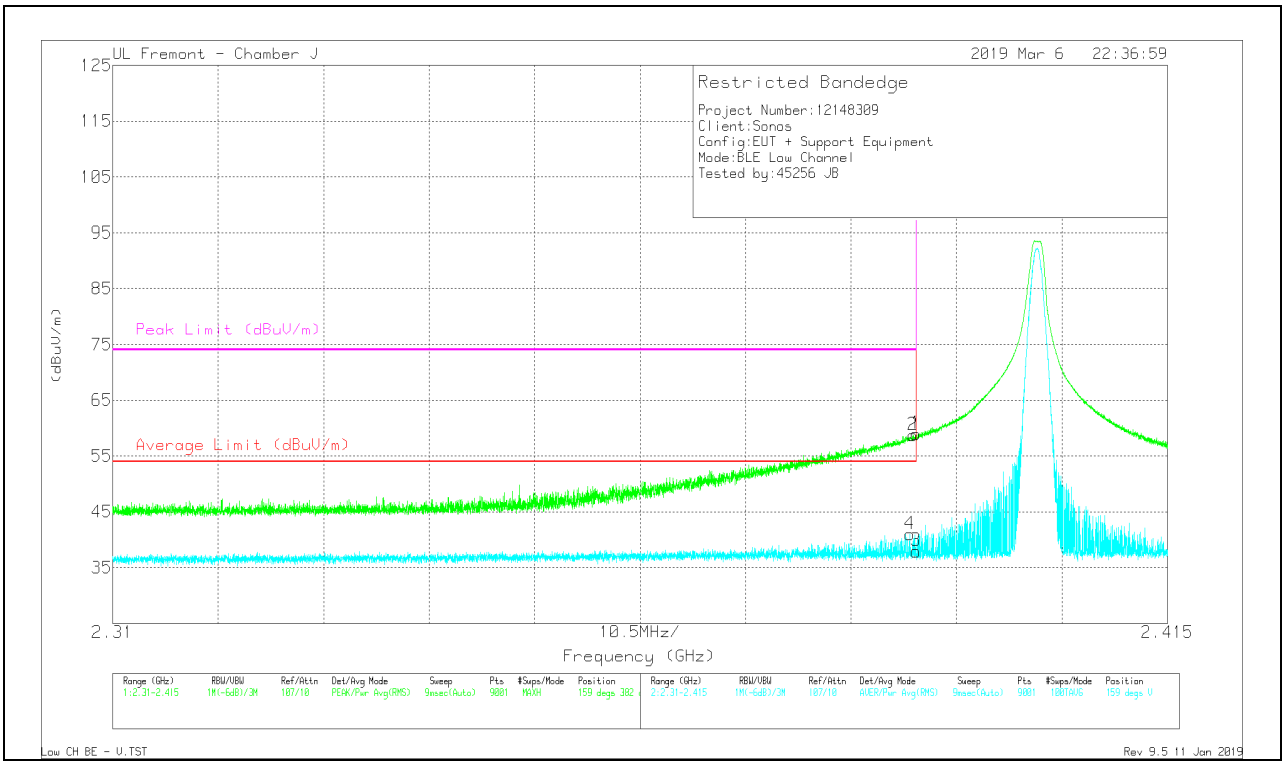
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/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	54.71	Pk	29.5	-25.8	0	58.41	-	-	74	-15.59	60	394	H
2	* 2.39	55.12	Pk	29.5	-25.8	0	58.82	-	-	74	-15.18	60	394	H
3	* 2.39	31.43	RMS	29.5	-25.8	2.13	37.28	54	-16.72	-	-	60	394	H
4	* 2.389	36	RMS	29.5	-25.8	2.13	41.85	54	-12.15	-	-	60	394	H

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

VERTICAL RESULT

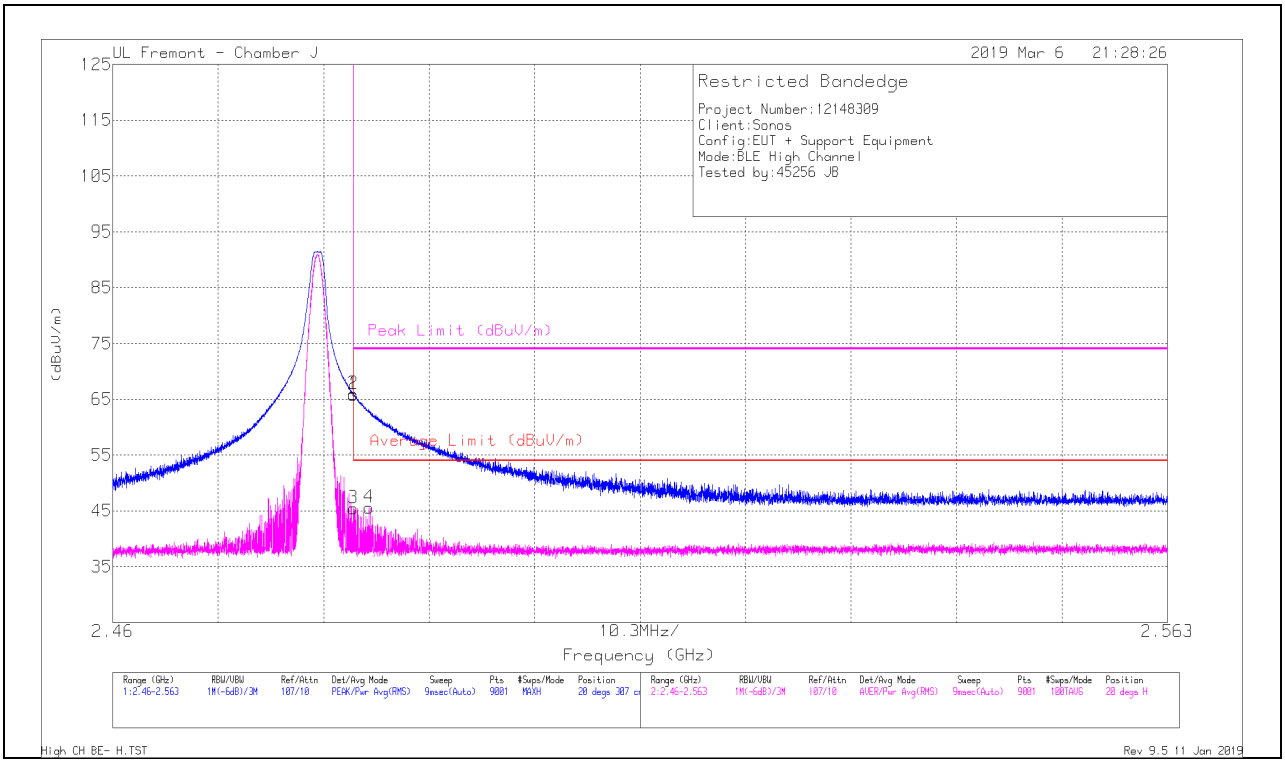


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*2.39	55.29	Pk	29.5	-25.8	0	58.99	-	-	74	-15.01	159	382	V
2	*2.39	55.01	Pk	29.5	-25.8	0	58.71	-	-	74	-15.29	159	382	V
3	*2.39	32.09	RMS	29.5	-25.8	2.13	37.94	54	-16.06	-	-	159	382	V
4	*2.389	35.17	RMS	29.5	-25.8	2.13	41.02	54	-12.98	-	-	159	382	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 PRE0189055 (dB/m)	Amp/Cbl/Fltr/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	61.67	Pk	29.9	-25.8	0	65.77	-	-	74	-8.23	20	307	H
2	*2.484	61.78	Pk	29.9	-25.8	0	65.88	-	-	74	-8.12	20	307	H
3	*2.484	39.24	RMS	29.9	-25.8	2.13	45.49	54	-8.51	-	-	20	307	H
4	*2.485	39.34	RMS	29.9	-25.8	2.13	45.59	54	-8.41	-	-	20	307	H

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

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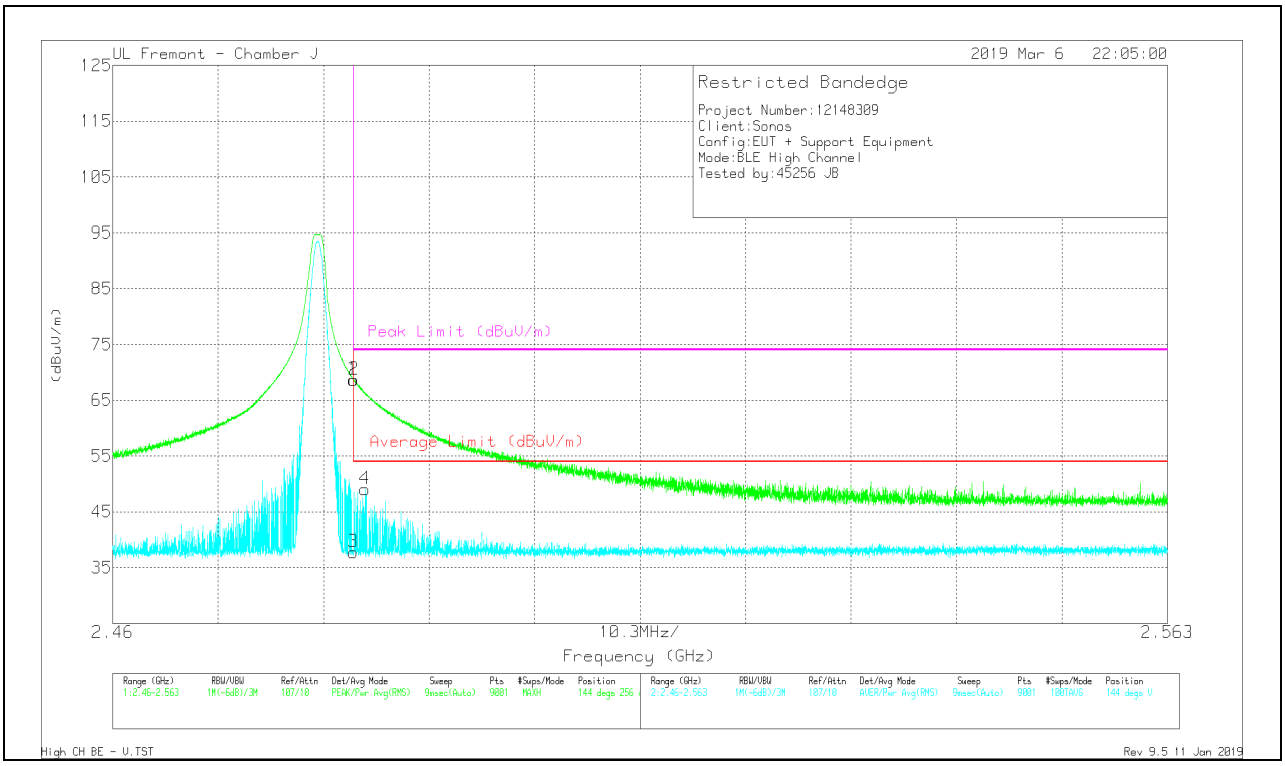
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/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	64.62	Pk	29.9	-25.8	0	68.72	-	-	74	-5.28	144	256	V
2	*2.484	64.52	Pk	29.9	-25.8	0	68.62	-	-	74	-5.38	144	256	V
3	*2.484	31.47	RMS	29.9	-25.8	2.13	37.72	54	-16.28	-	-	144	256	V
4	*2.485	42.84	RMS	29.9	-25.8	2.13	49.09	54	-4.91	-	-	144	256	V

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

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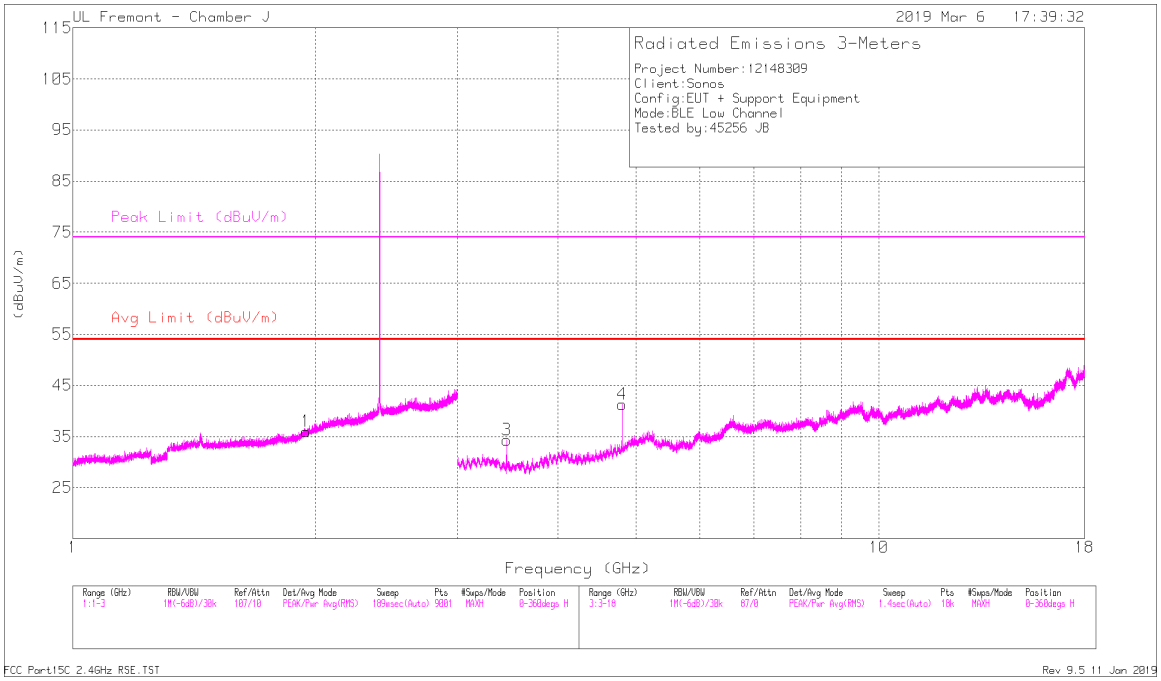
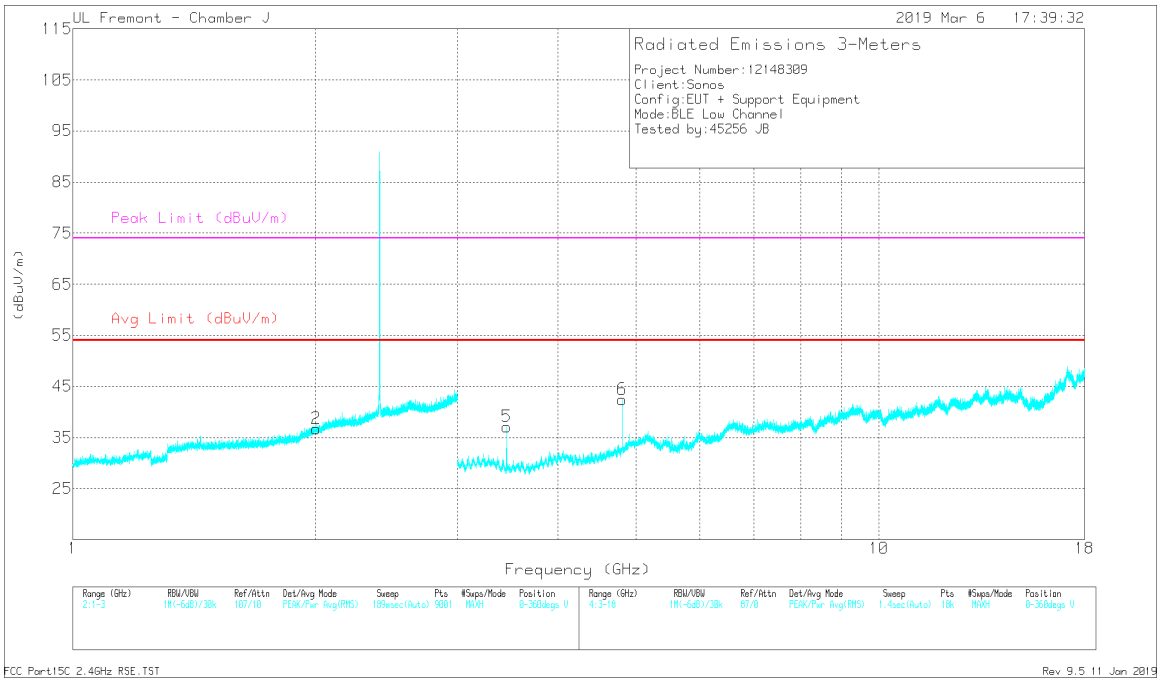
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/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	1.946	24.8	Pk	27.1	-16	0	35.9	-	-	-	-	0-360	102	H
2	2.005	24.67	Pk	28	-15.9	0	36.77	-	-	-	-	0-360	102	V
3	3.453	37.46	Pk	30.6	-33.8	0	34.26	-	-	-	-	0-360	198	H
4	* 4.803	38.72	Pk	33.9	-31.3	0	41.32	-	-	74	-32.68	0-360	198	H
5	3.453	40.29	Pk	30.6	-33.8	0	37.09	-	-	-	-	0-360	102	V
6	* 4.803	39.85	Pk	33.9	-31.3	0	42.45	-	-	74	-31.55	0-360	198	V

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

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE01890 55 (dB/m)	Amp/Cbl/Fltr/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
* 4.804	42.93	PK2	33.9	-31.3	0	45.53	-	-	74	-28.47	71	204	H
* 4.804	35.74	MAv1	33.9	-31.3	2.13	40.47	54	-13.53	-	-	71	204	H
* 4.804	44.33	PK2	33.9	-31.3	0	46.93	-	-	74	-27.07	148	318	V
* 4.804	37.35	MAv1	33.9	-31.3	2.13	42.08	54	-11.92	-	-	148	318	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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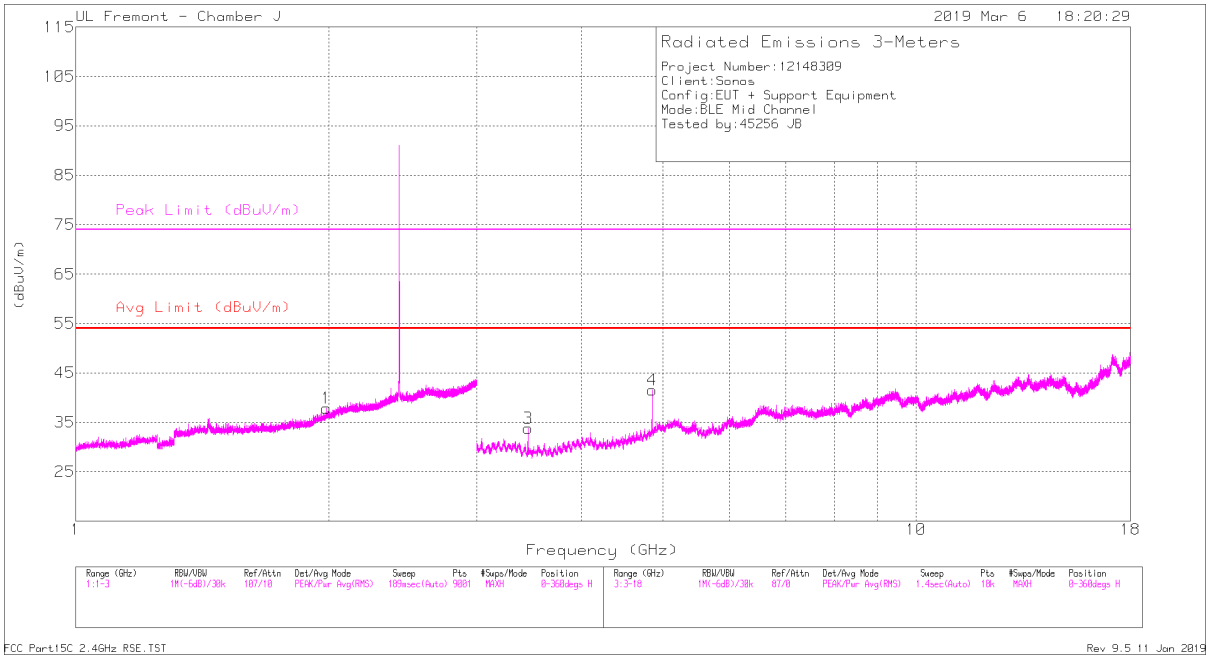
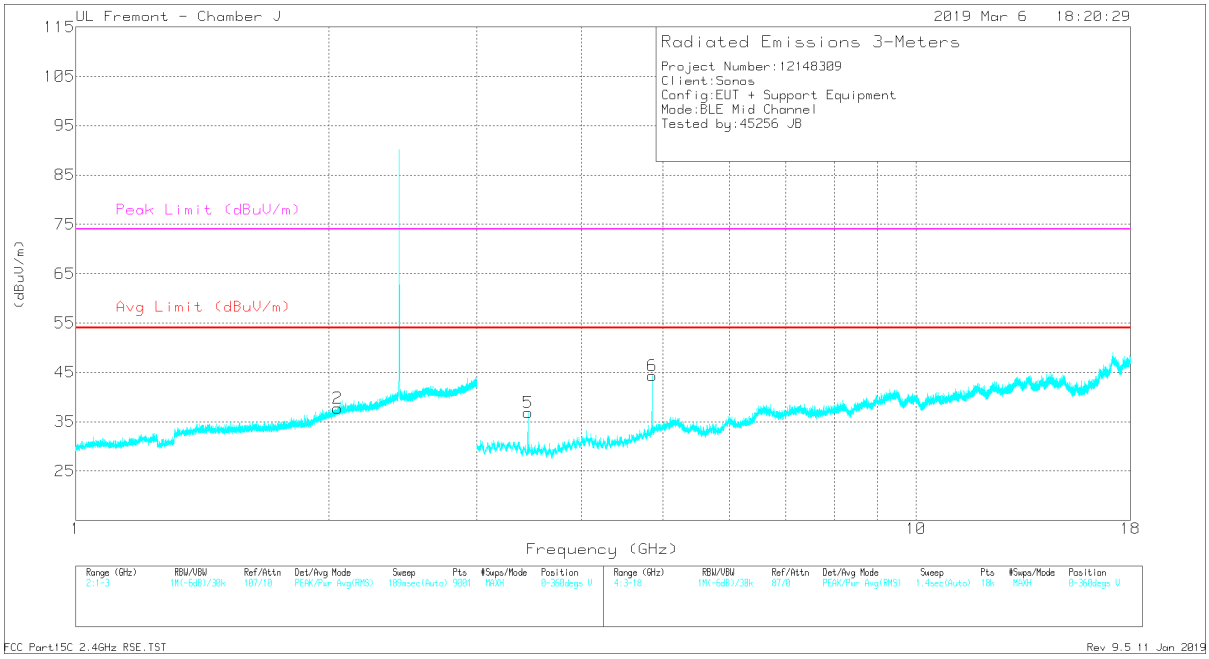
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/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	1.988	26.09	Pk	27.7	-15.9	0	37.89	-	-	-	-	0-360	101	H
2	2.049	25.33	Pk	28.2	-15.8	0	37.73	-	-	-	-	0-360	102	V
3	3.453	36.97	Pk	30.6	-33.8	0	33.77	-	-	-	-	0-360	198	H
4	* 4.852	38.84	Pk	34.2	-31.5	0	41.54	-	-	74	-32.46	0-360	198	H
5	3.453	40.05	Pk	30.6	-33.8	0	36.85	-	-	-	-	0-360	102	V
6	* 4.852	41.61	Pk	34.2	-31.5	0	44.31	-	-	74	-29.69	0-360	198	V

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

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/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
* 4.852	44.11	PK2	34.2	-31.5	0	46.81	-	-	74	-27.19	278	254	H
* 4.852	36.47	MAv1	34.2	-31.5	2.13	41.3	54	-12.7	-	-	278	254	H
* 4.852	45.67	PK2	34.2	-31.5	0	48.37	-	-	74	-25.63	143	315	V
* 4.852	37.47	MAv1	34.2	-31.5	2.13	42.3	54	-11.7	-	-	143	315	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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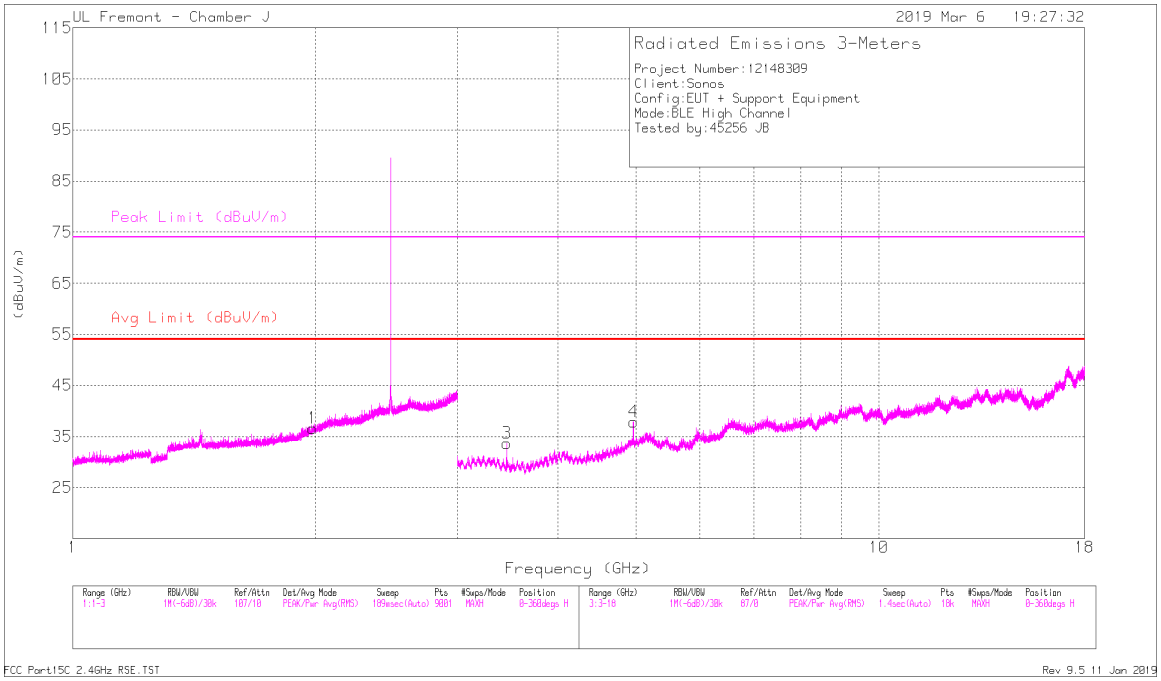
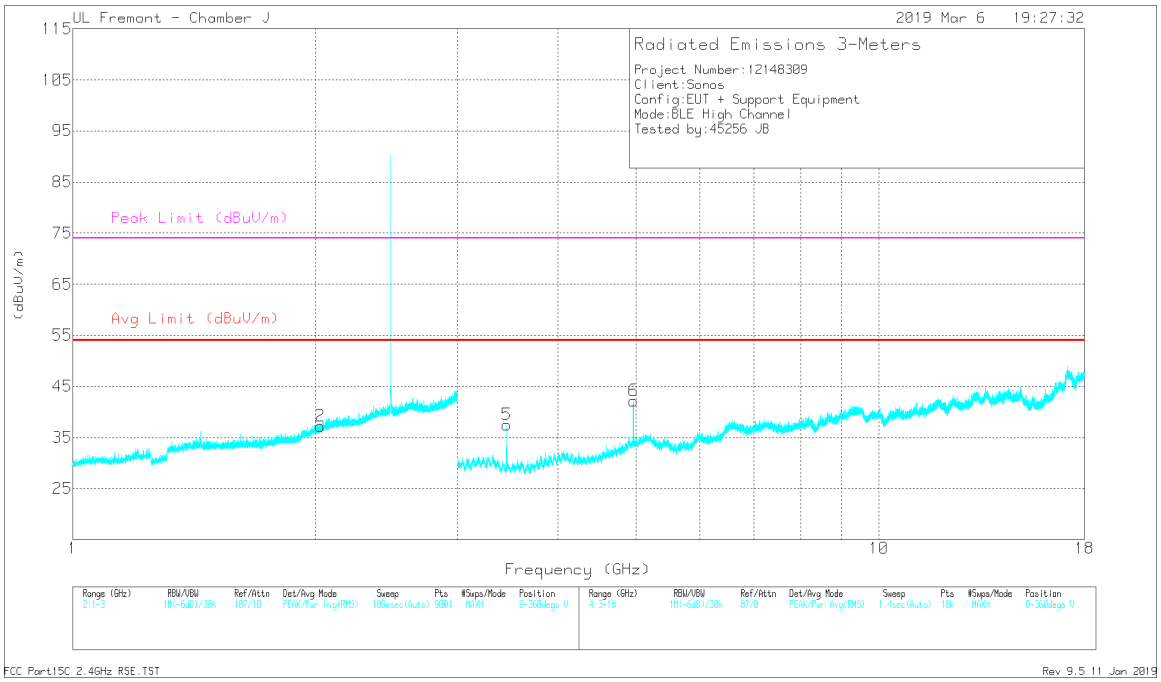
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/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	1.985	24.74	Pk	27.7	-15.9	0	36.54	-	-	-	-	0-360	102	H
2	2.028	24.98	Pk	28.1	-15.9	0	37.18	-	-	-	-	0-360	198	V
3	3.453	36.88	Pk	30.6	-33.8	0	33.68	-	-	-	-	0-360	198	H
4	* 4.96	33.47	Pk	34.8	-30.4	0	37.87	-	-	74	-36.13	0-360	198	H
5	3.453	40.7	Pk	30.6	-33.8	0	37.5	-	-	-	-	0-360	102	V
6	* 4.96	37.78	Pk	34.8	-30.4	0	42.18	-	-	74	-31.82	0-360	198	V

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

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/ 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
* 4.96	40.78	PK2	34.8	-30.4	0	45.18	-	-	74	-28.82	109	214	H
* 4.96	33.07	MAv1	34.8	-30.4	2.13	39.6	54	-14.4	-	-	109	214	H
* 4.96	42.46	PK2	34.8	-30.4	0	46.86	-	-	74	-27.14	151	304	V
* 4.96	33.9	MAv1	34.8	-30.4	2.13	40.43	54	-13.57	-	-	151	304	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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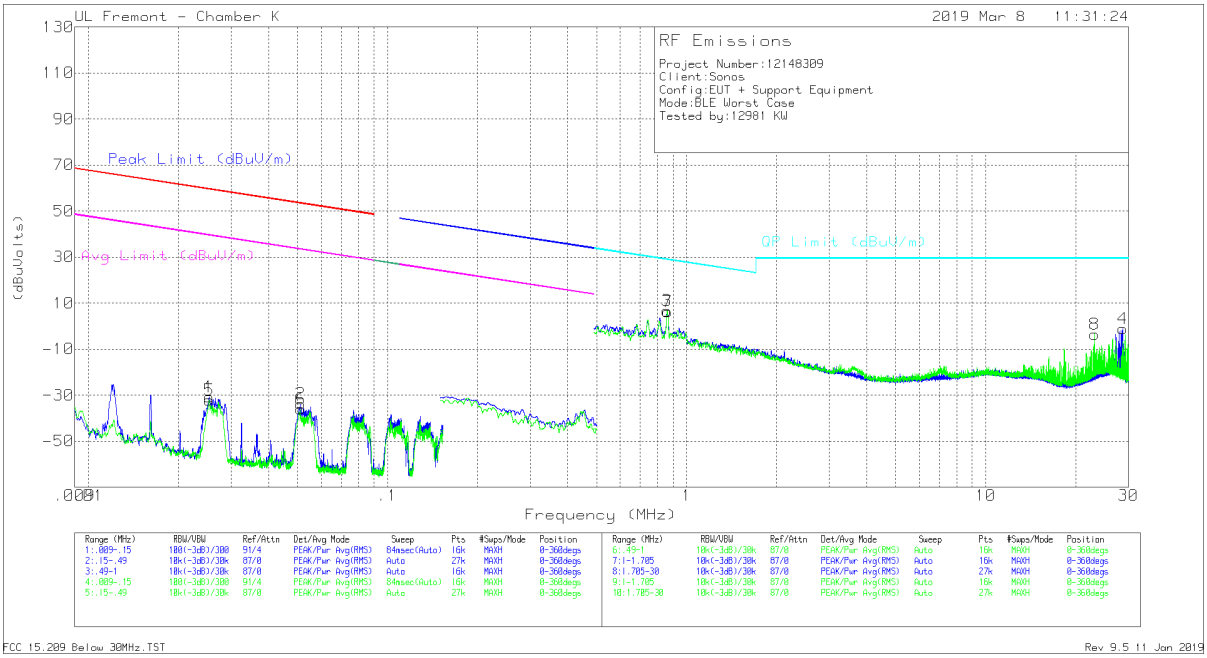
9.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- TWO ORIENTATIONS

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Cables w/ PRE0186650	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.02535	23.11	Pk	58.4	-32.2	-80	-30.69	59.5	-90.19	39.5	-70.19	0-360
2	.05126	21.33	Pk	57	-32.2	-80	-33.87	53.39	-87.26	33.39	-67.26	0-360
5	.02534	21.7	Pk	58.4	-32.2	-80	-32.1	59.51	-91.61	39.51	-71.61	0-360
6	.05124	19.32	Pk	57	-32.2	-80	-35.88	53.39	-89.27	33.39	-69.27	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Cables w/ PRE0186650	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.85979	22.47	Pk	56.3	-32.1	-40	6.67	28.93	-22.26	0-360
7	.8636	21.97	Pk	56.3	-32.1	-40	6.17	28.89	-22.72	0-360
4	28.68471	37.99	Pk	32.6	-31.6	-40	-1.01	29.5	-30.51	0-360
8	23.12612	33.94	Pk	34	-31.6	-40	-3.66	29.5	-33.16	0-360

Pk - Peak detector

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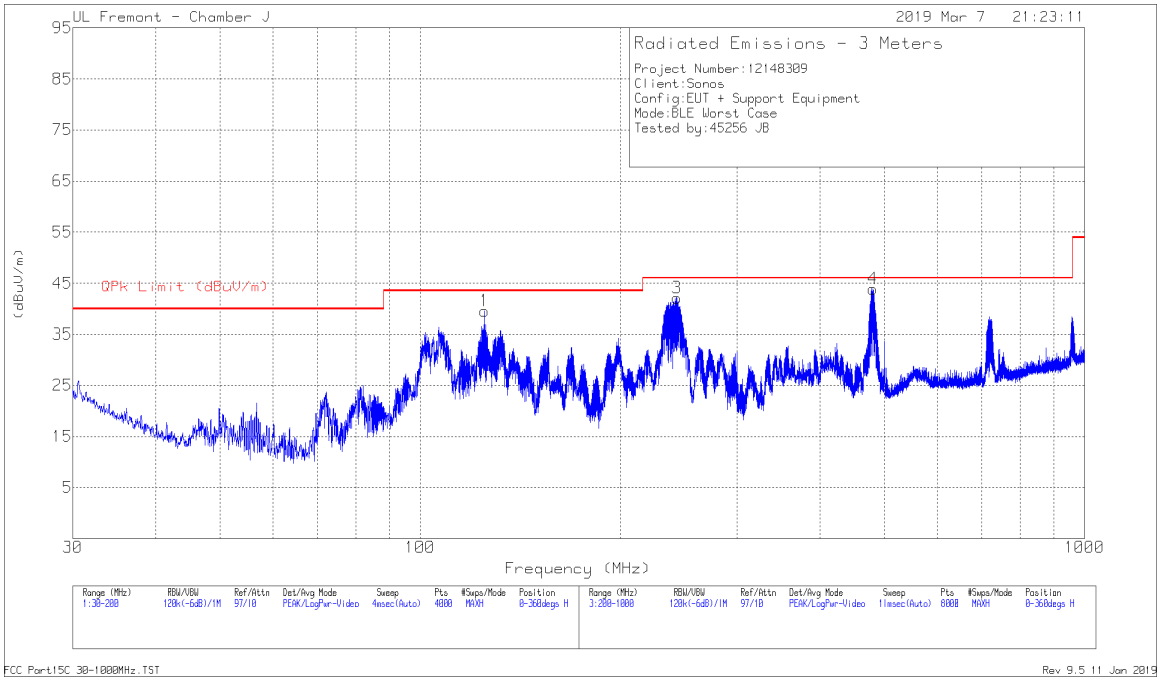
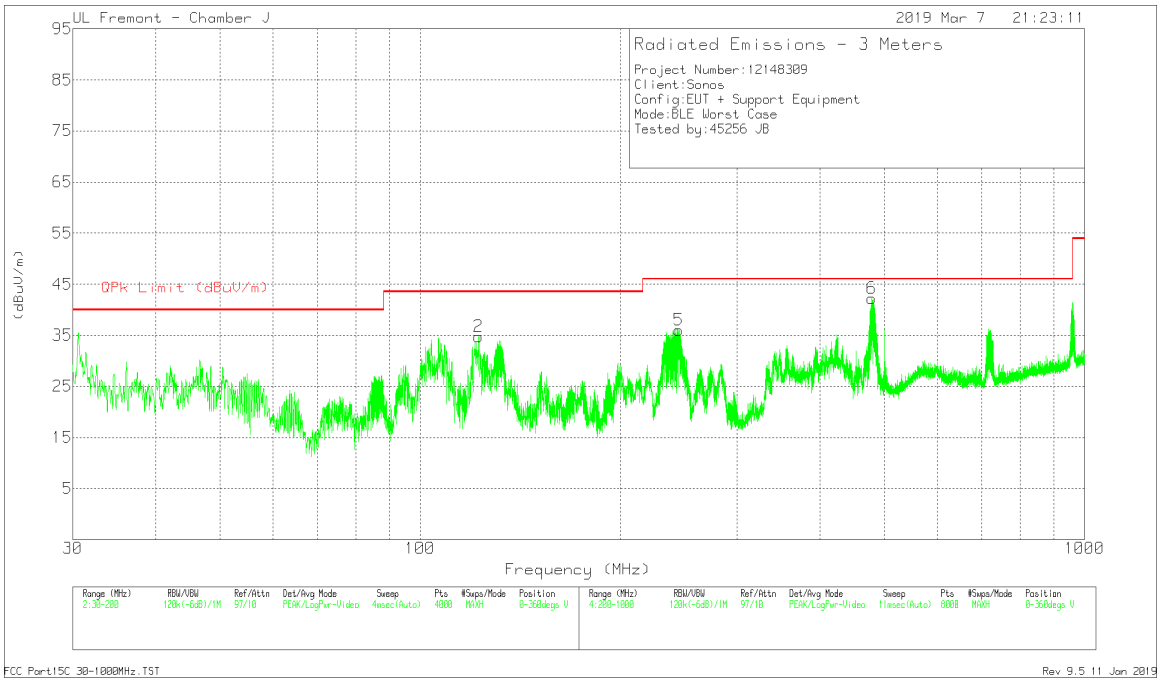
9.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

Below 1GHz Data

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 125.0121	50.53	Pk	19.8	-30.8	39.53	43.52	-3.99	0-360	198	H
2	* 122.5039	45.78	Pk	19.8	-30.8	34.78	43.52	-8.74	0-360	101	V
3	* 243.5057	54.85	Pk	17.5	-30.2	42.15	46.02	-3.87	0-360	101	H
4	480.6365	49.65	Pk	23.6	-29.4	43.85	46.02	-2.17	0-360	101	H
5	* 245.0059	48.73	Pk	17.5	-30.2	36.03	46.02	-9.99	0-360	101	V
6	478.5362	48.06	Pk	23.6	-29.4	42.26	46.02	-3.76	0-360	198	V

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 125.0351	46.24	Qp	19.8	-30.8	35.24	43.52	-8.28	101	212	H
* 243.2875	52.84	Qp	17.5	-30.2	40.14	46.02	-5.88	98	116	H
480.7233	48.54	Qp	23.6	-29.4	42.74	46.02	-3.28	103	187	H
478.5415	47.24	Qp	23.6	-29.4	41.44	46.02	-4.58	186	186	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Qp - Quasi-Peak detector

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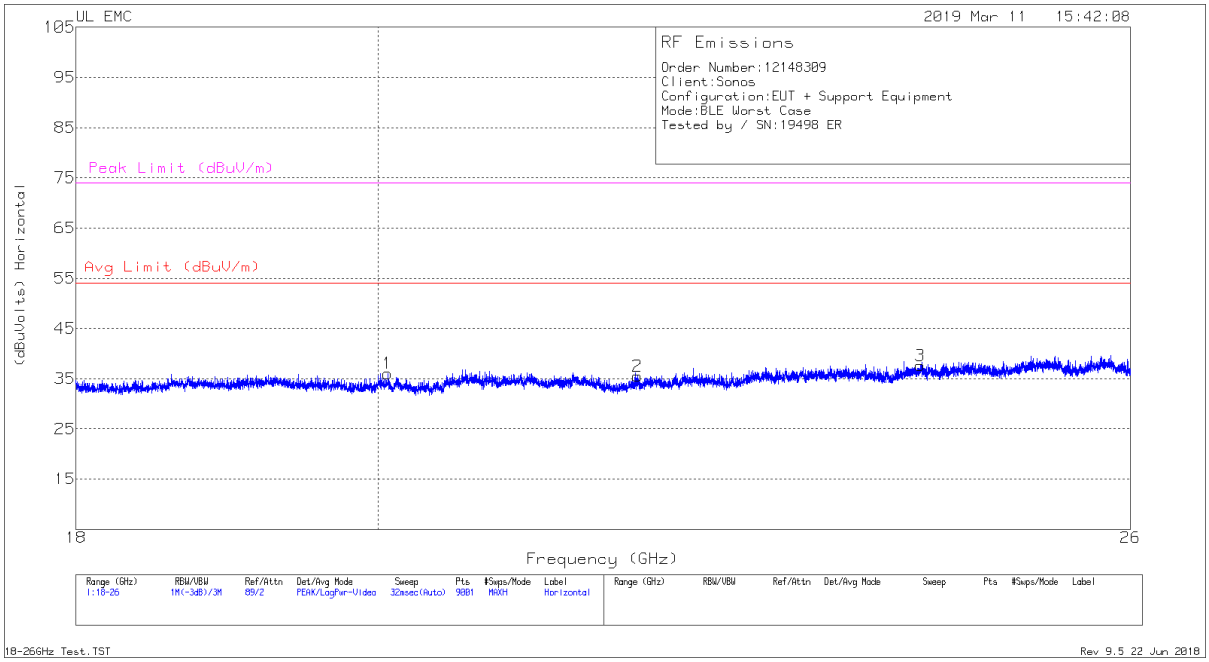
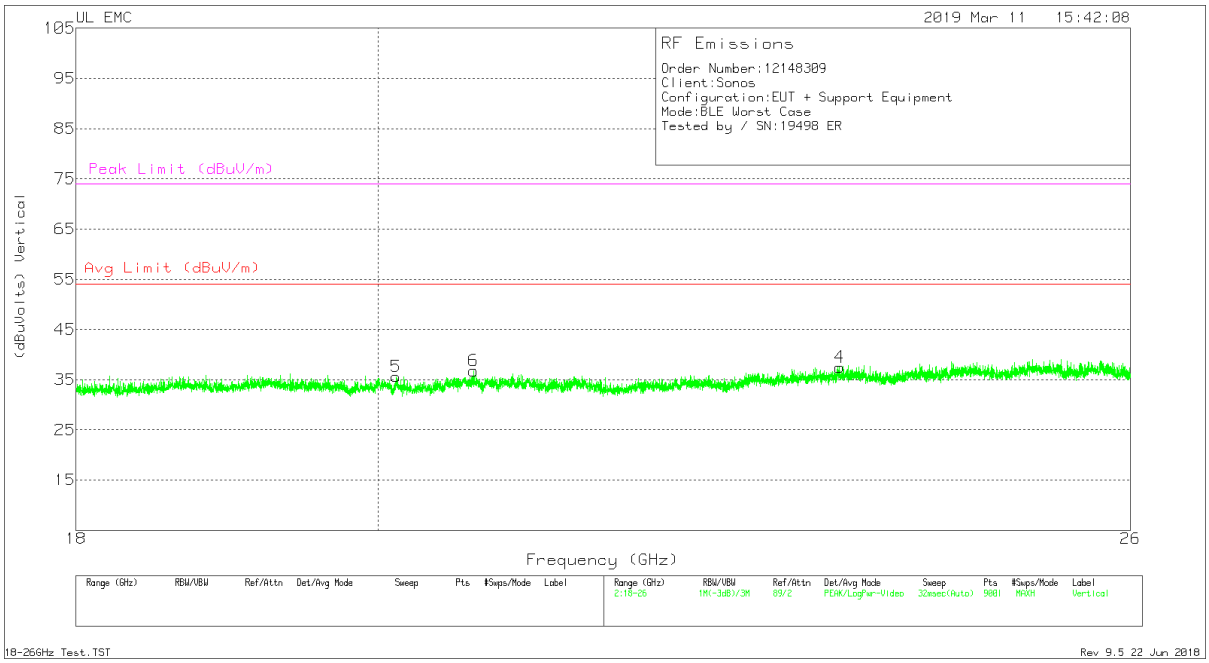
9.5. WORST CASE 18-26 GHz

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



HORIZTONAL



VERTICAL

18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T448 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	20.067	69.41	Pk	32.7	-56.6	-9.5	36.01	54	-17.99	74	-37.99
2	21.892	68.9	Pk	33.3	-57.2	-9.5	35.5	54	-18.5	74	-38.5
3	24.161	69.91	Pk	34	-56.8	-9.5	37.61	54	-16.39	74	-36.39
4	23.491	70.19	Pk	33.9	-57.1	-9.5	37.49	54	-16.51	74	-36.51
5	20.124	69.32	Pk	32.7	-56.9	-9.5	35.62	54	-18.38	74	-38.38
6	20.677	70.1	Pk	33	-56.8	-9.5	36.8	54	-17.2	74	-37.2

Pk - Peak detector

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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.

RESULTS

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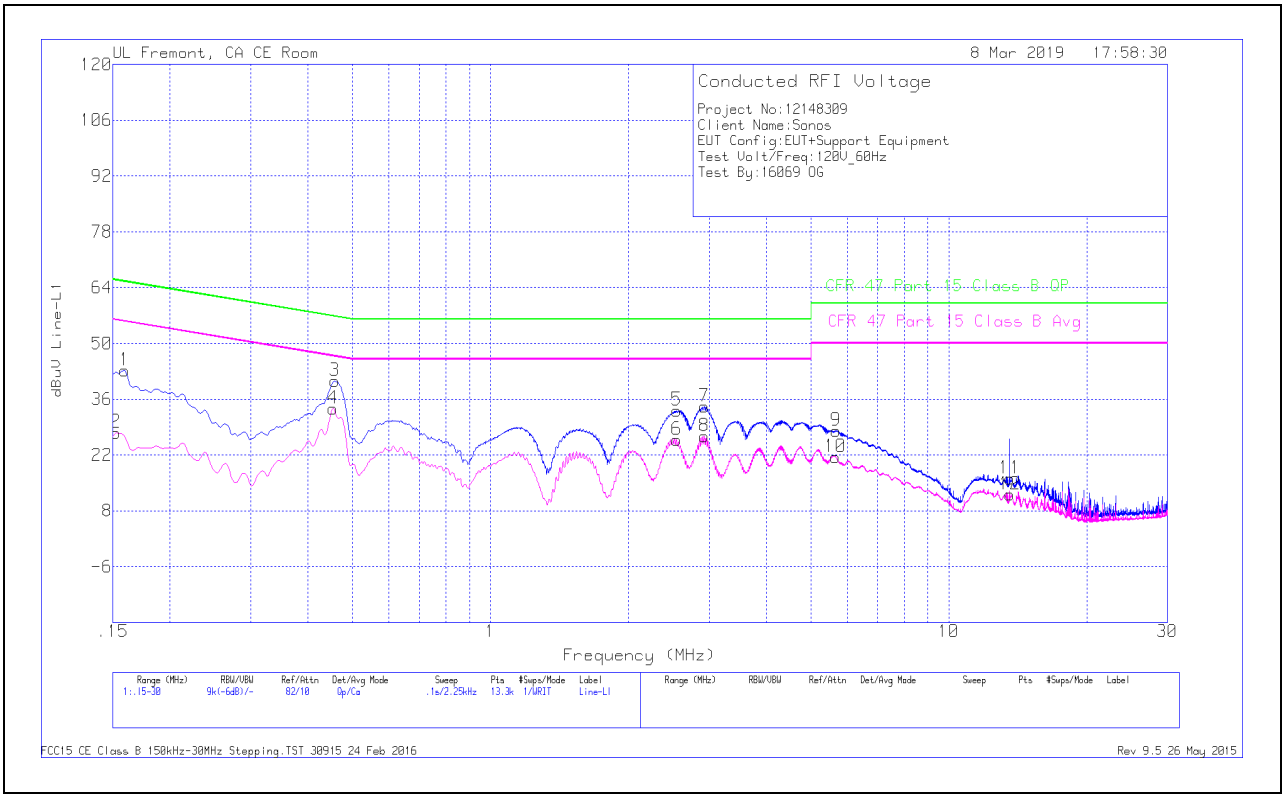
AC Power Line Norm

LINE 1 RESULTS

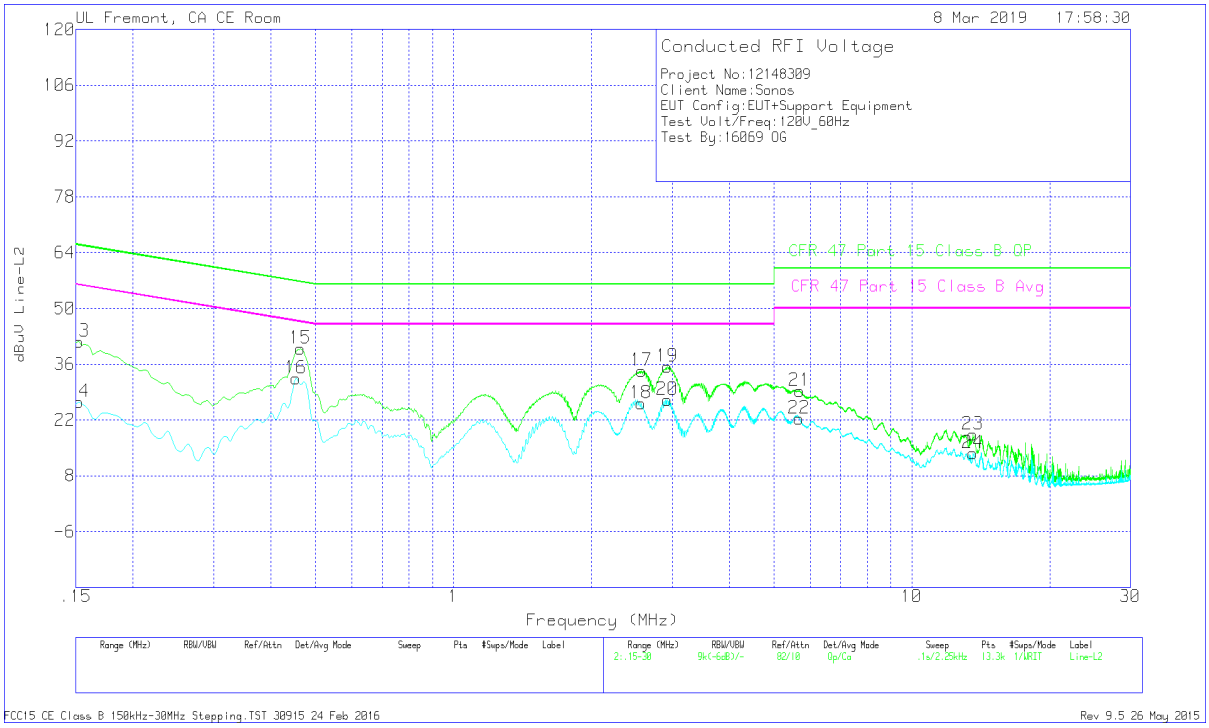


Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.159	33.07	Qp	.1	0	10.1	43.27	65.52	-22.25	-	-
2	.15225	17.46	Ca	.1	0	10.1	27.66	-	-	55.88	-28.22
3	.45825	30.52	Qp	0	0	10.1	40.62	56.72	-16.1	-	-
4	.45375	23.61	Ca	0	0	10.1	33.71	-	-	46.81	-13.1
5	2.5485	23.02	Qp	0	.1	10.1	33.22	56	-22.78	-	-
6	2.54625	15.71	Ca	0	.1	10.1	25.91	-	-	46	-20.09
7	2.92875	23.97	Qp	0	.1	10.1	34.17	56	-21.83	-	-
8	2.931	16.43	Ca	0	.1	10.1	26.63	-	-	46	-19.37
9	5.66925	17.7	Qp	0	.2	10.2	28.1	60	-31.9	-	-
10	5.66588	11.02	Ca	0	.2	10.2	21.42	-	-	50	-28.58
11	13.6027	5.6	Qp	.1	.2	10.2	16.1	60	-43.9	-	-
12	13.6027	1.68	Ca	.1	.2	10.2	12.18	-	-	50	-37.82

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	.15225	31.43	Qp	.1	0	10.1	41.63	65.88	-24.25	-	-
14	.15225	16.34	Ca	.1	0	10.1	26.54	-	-	55.88	-29.34
15	.46275	29.76	Qp	0	0	10.1	39.86	56.64	-16.78	-	-
16	.45375	22.37	Ca	0	0	10.1	32.47	-	-	46.81	-14.34
17	2.57325	24.14	Qp	0	.1	10.1	34.34	56	-21.66	-	-
18	2.5665	16.02	Ca	0	.1	10.1	26.22	-	-	46	-19.78
19	2.92875	25.15	Qp	0	.1	10.1	35.35	56	-20.65	-	-
20	2.92875	16.91	Ca	0	.1	10.1	27.11	-	-	46	-18.89
21	5.6985	18.99	Qp	0	.2	10.2	29.39	60	-30.61	-	-
22	5.685	12	Ca	0	.2	10.2	22.4	-	-	50	-27.6
23	13.6027	7.85	Qp	.1	.2	10.2	18.35	60	-41.65	-	-
24	13.6027	3.14	Ca	.1	.2	10.2	13.64	-	-	50	-36.36

Qp - Quasi-Peak detector

Ca - CISPR average detection

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