Ossia, Inc.

REVISED EMC TEST REPORT TO 102450-2

Cota WPT Source
Model: Venus v2

Tested to The Following Standards:

FCC Part 15 Subpart B Section 15.107 & 15.109

Report No.: 102450-2A

Date of issue: May 7, 2019

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Test Certificate # 803.05

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Ossia, Inc.
1100 112th Ave NE Suite 301
Bellevue, WA 98004

Representative: Bob McDonald
Customer Reference Number: 13042

REPORT PREPARED BY:

Darcy Thompson
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 102450

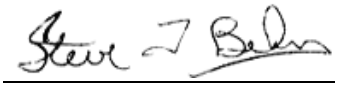
DATE OF EQUIPMENT RECEIPT: April 4, 2019
DATE(S) OF TESTING: April 4 – 5, 2019

Revision History

Original: Testing of the Cota WPT Source, Model: Venus v2 to FCC Part 15 Subpart B Section 15.107 & 15.109.
Revision A: To update the customer address.

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
22116 23rd Drive S.E., Suite A
Canyon Park, Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.12
EMITest Immunity	5.03.10

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	JAPAN
Canyon Park, Bothell, WA	US0081	US1022	A-0148

*CKC's list of NIST designated countries can be found at: https://standards.gov/cabs/designations.html

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart B

Test Procedure	Description	Modifications	Results
15.107 Class A	Conducted Emissions	Mod #1, 2, and 3	Pass
15.109 Class A	Radiated Emissions Below 1GHz Above 1GHz	 Mod #1 and 3 NA	 Pass Pass

NA = Not Applicable

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
Modification #1: Ferrite added On DC power lines internal to EUT.
Modification #2: Ferrite added to AC power line at EUT.
Modification #3: Internal WiFi router removed.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
Cota WPT Source	Ossia, Inc.	Venus v2	33

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop (Programming)	Apple	MacBook Pro A1398	NA
USB Charger	Belkin	F8M670	NA

FCC PART 15 SUBPART B

15.107 AC Conducted Emissions

Test Notes: Conducted Disturbances at Mains Terminals, LISN method.

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Ossia, Inc.**		
Specification:	**15.107 AC Mains Class A - Average**		
Work Order #:	**102450**	Date:	4/5/2019
Test Type:	**Conducted Emissions**	Time:	10:11:50
Tested By:	Matthew Harrison	Sequence#:	19
Software:	EMITest 5.03.12		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

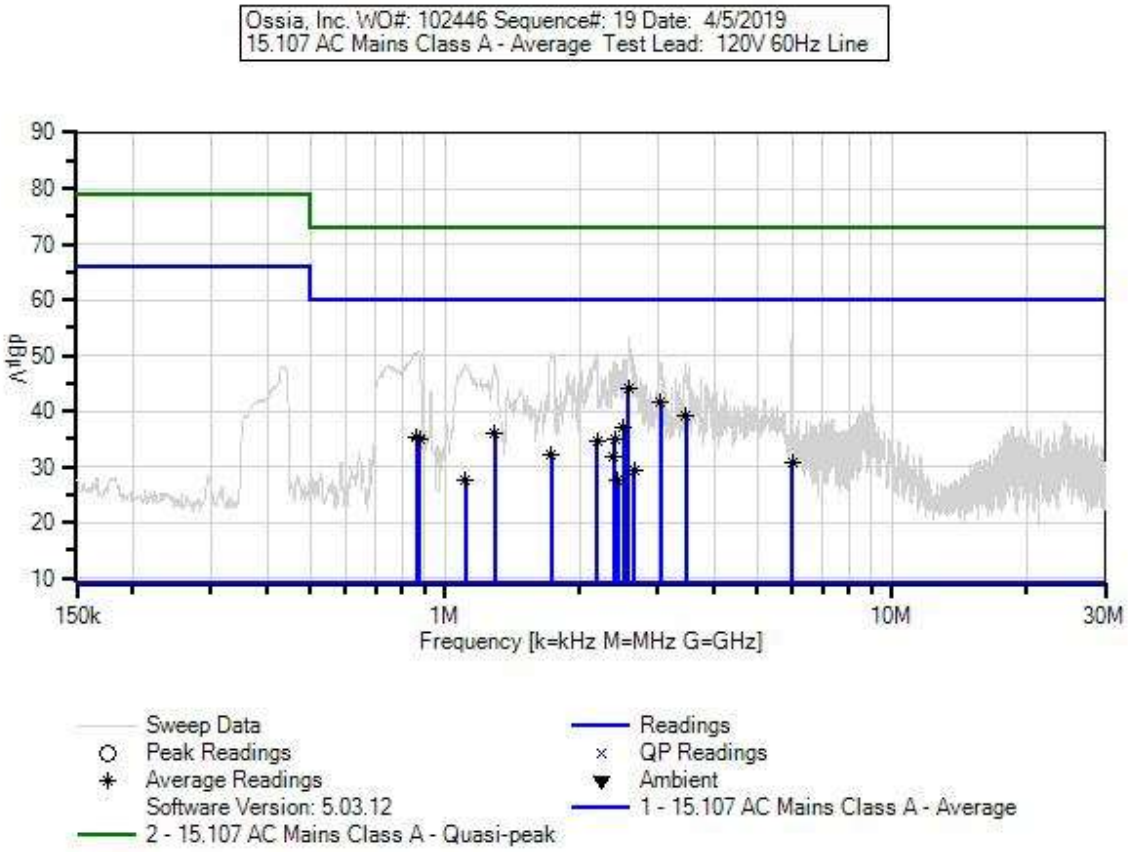
Temperature: 20-21°C
Pressure: 101.8kPa
Humidity: 28%
Frequency: 150kHz-30MHz

Test Method: ANSI 63.4 (2014)

All radios are in standby or RX mode.

Router unplugged, light ring cable plugged in & ferrites on DC power cables and ferrite on AC line at EUT side.

Modifications #1, 2, and 3 were in place during testing.


Ossia, Inc. WO#: 102446 Sequence#: 19 Date: 4/5/2019
15.107 AC Mains Class A - Average Test Lead: 120V 60Hz Line
90
80
70
60
50
40
30
20
10
dBµV
150k
1M
10M
30M
Frequency [k=kHz M=MHz G=GHz]
Sweep Data
Peak Readings
Average Readings
Software Version: 5.03.12
2 - 15.107 AC Mains Class A - Quasi-peak
Readings
QP Readings
Ambient
1 - 15.107 AC Mains Class A - Average

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06219	Attenuator	768-10	4/13/2018	4/13/2020
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
T4	AN01311	50uH LISN-Line1 (L)	3816/2	3/16/2018	3/16/2020
	AN01311	50uH LISN-Line2 (N)	3816/2	3/16/2018	3/16/2020
	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/15/2018	1/15/2020

Measurement Data: Reading listed by margin. Test Lead: Line

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1 Ave	2.578M	34.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	43.9	60.0	-16.1	Line
^	2.578M	43.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	53.1	60.0	-6.9	Line
3 Ave	3.046M	31.9	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	41.5	60.0	-18.5	Line
^	3.046M	39.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.9	60.0	-11.1	Line
5 Ave	3.459M	29.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	39.0	60.0	-21.0	Line
^	3.459M	39.2	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.8	60.0	-11.2	Line
7 Ave	2.515M	27.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	36.9	60.0	-23.1	Line
^	2.515M	39.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.4	60.0	-10.6	Line
9 Ave	1.290M	26.3	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	35.9	60.0	-24.1	Line
^	1.290M	39.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	48.8	60.0	-11.2	Line
11 Ave	865.571k	25.7	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	35.3	60.0	-24.7	Line
^	865.570k	41.1	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	50.7	60.0	-9.3	Line
13 Ave	2.400M	25.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	34.9	60.0	-25.1	Line
^	2.400M	39.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.1	60.0	-10.9	Line
15 Ave	877.205k	25.3	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	34.9	60.0	-25.1	Line
^	877.205k	40.0	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	49.6	60.0	-10.4	Line

17 Ave	2.191M	25.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	34.7	60.0	-25.3	Line
^	2.191M	40.7	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.3	60.0	-9.7	Line
19 Ave	1.732M	22.7	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	32.3	60.0	-27.7	Line
^	1.732M	40.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.4	60.0	-9.6	Line
21 Ave	2.387M	22.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	31.9	60.0	-28.1	Line
^	2.387M	39.2	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.8	60.0	-11.2	Line
23 Ave	5.977M	21.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.9	60.0	-29.1	Line
^	5.977M	43.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	53.0	60.0	-7.0	Line
25 Ave	2.659M	19.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	29.4	60.0	-30.6	Line
^	2.659M	38.7	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.3	60.0	-11.7	Line
27 Ave	1.111M	18.0	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	27.6	60.0	-32.4	Line
^	1.111M	39.0	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	48.6	60.0	-11.4	Line
29 Ave	2.434M	17.9	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	27.5	60.0	-32.5	Line
^	2.434M	38.7	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.3	60.0	-11.7	Line

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Ossia, Inc.**		
Specification:	**15.107 AC Mains Class A - Average**		
Work Order #:	**102450**	Date:	4/5/2019
Test Type:	**Conducted Emissions**	Time:	10:24:06
Tested By:	Matthew Harrison	Sequence#:	20
Software:	EMITest 5.03.12		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 20-21°C
Pressure: 101.8kPa
Humidity: 28%
Frequency: 150kHz-30MHz

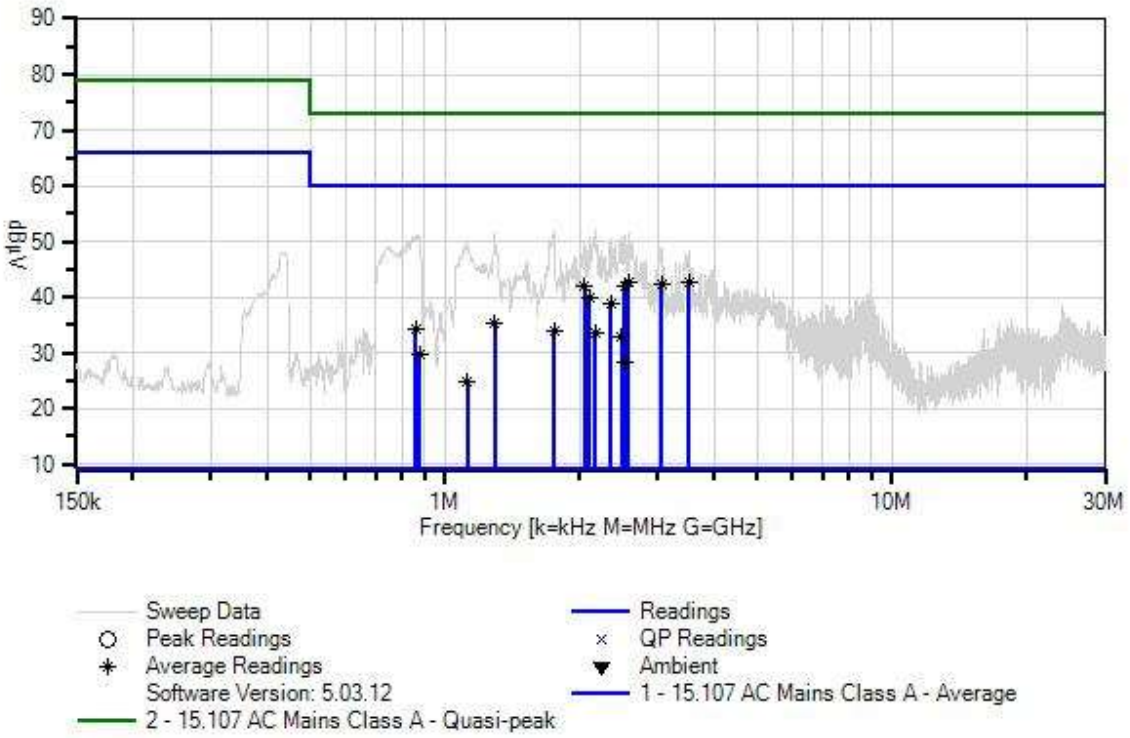
Test Method: ANSI 63.4 (2014)

All radios are in standby or RX mode.

Router unplugged, light ring cable plugged in & ferrites on DC power cables and ferrite on AC line at EUT side.

Modifications #1, 2, and 3 were in place during testing.

Ossia, Inc. WO#: 102446 Sequence#: 20 Date: 4/5/2019
15.107 AC Mains Class A - Average Test Lead: 120V 60Hz Neutral



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06219	Attenuator	768-10	4/13/2018	4/13/2020
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
	AN01311	50uH LISN-Line1 (L)	3816/2	3/16/2018	3/16/2020
T4	AN01311	50uH LISN-Line2 (N)	3816/2	3/16/2018	3/16/2020
	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/15/2018	1/15/2020

Measurement Data: Reading listed by margin. Test Lead: Neutral

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1 Ave	2.578M	33.2	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	42.8	60.0	-17.2	Neutr
^	2.578M	41.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	51.4	60.0	-8.6	Neutr
3 Ave	3.518M	33.2	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	42.8	60.0	-17.2	Neutr
^	3.518M	38.9	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.5	60.0	-11.5	Neutr
5 Ave	3.050M	32.7	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	42.3	60.0	-17.7	Neutr
^	3.050M	39.6	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.2	60.0	-10.8	Neutr
7 Ave	2.523M	32.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	42.0	60.0	-18.0	Neutr
^	2.523M	41.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	51.1	60.0	-8.9	Neutr
9 Ave	2.051M	32.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	41.9	60.0	-18.1	Neutr
^	2.051M	40.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.7	60.0	-10.3	Neutr
11 Ave	2.110M	30.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	39.9	60.0	-20.1	Neutr
^	2.110M	41.0	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.6	60.0	-9.4	Neutr
13 Ave	2.349M	29.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	38.9	60.0	-21.1	Neutr
^	2.349M	40.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.4	60.0	-9.6	Neutr
15 Ave	1.290M	25.7	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	35.3	60.0	-24.7	Neutr
^	1.290M	42.0	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	51.6	60.0	-8.4	Neutr

17 Ave	861.207k	24.8	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	34.4	60.0	-25.6	Neutr
^	861.207k	41.5	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	51.1	60.0	-8.9	Neutr
19 Ave	1.758M	24.3	+9.1 +0.2	+0.1	+0.0	+0.3	+0.0	34.0	60.0	-26.0	Neutr
^	1.758M	42.1	+9.1 +0.2	+0.1	+0.0	+0.3	+0.0	51.8	60.0	-8.2	Neutr
21 Ave	2.174M	23.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	33.4	60.0	-26.6	Neutr
^	2.174M	42.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	52.0	60.0	-8.0	Neutr
23 Ave	2.485M	23.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	32.9	60.0	-27.1	Neutr
^	2.485M	41.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.7	60.0	-9.3	Neutr
25 Ave	877.205k	20.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	29.8	60.0	-30.2	Neutr
^	877.205k	41.3	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	50.9	60.0	-9.1	Neutr
27 Ave	2.540M	18.6	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	28.2	60.0	-31.8	Neutr
^	2.540M	39.9	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.5	60.0	-10.5	Neutr
29 Ave	1.124M	15.1	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	24.7	60.0	-35.3	Neutr
^	1.124M	40.4	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	50.0	60.0	-10.0	Neutr

Test Setup Photo(s)

15.109 Radiated Emissions

Test Notes: Radiated disturbances emanating from enclosure.

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Ossia, Inc.**		
Specification:	**15.109 Radiated Emissions Class A**		
Work Order #:	**102450**	Date:	4/4/2019
Test Type:	**Maximized Emissions**	Time:	14:57:07
Tested By:	Matthew Harrison	Sequence#:	12
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

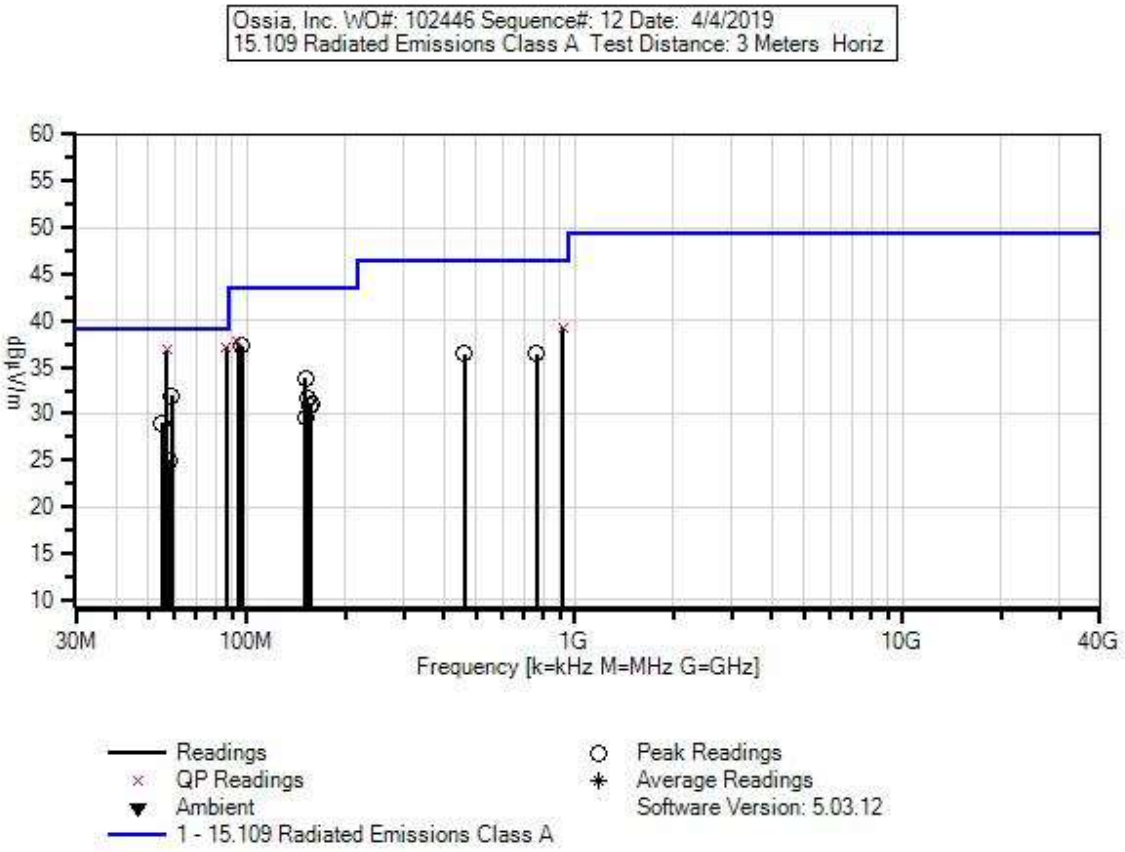
Temperature: 20-21°C
Pressure: 101.8kPa
Humidity: 28%
Frequency: 30-1000MHz

Test Method: ANSI 63.4 (2014)

All radios are in standby or RX mode.
The EUT is investigated in X, Y & Z Axis with only the worst case reported.

Router unplugged, light ring cable plugged in & ferrites on DC power cables.

Modifications #1 and 3 were in place during testing.


Ossia, Inc. WO#: 102446 Sequence#: 12 Date: 4/4/2019
15.109 Radiated Emissions Class A Test Distance: 3 Meters Horiz
60
55
50
45
40
35
30
25
20
15
10
dBµV/m
30M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
QP Readings
Ambient
1 - 15.109 Radiated Emissions Class A
Peak Readings
Average Readings
Software Version: 5.03.12

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T2	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
T3	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T4	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019
T5	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T6	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T7	ANP05360	Cable	RG214	1/31/2018	1/31/2020

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	86.759M	61.8	+0.0	+0.1	-27.8	+6.7	-10.5	37.2	39.1	-1.9	Horiz
	QP		+5.9	+0.5	+0.5						
^	86.759M	64.6	+0.0	+0.1	-27.8	+6.7	-10.5	40.0	39.1	+0.9	Horiz
			+5.9	+0.5	+0.5						
3	57.019M	61.9	+0.0	+0.1	-27.9	+6.6	-10.5	36.9	39.1	-2.2	Horiz
	QP		+5.9	+0.4	+0.4						
^	57.019M	66.6	+0.0	+0.1	-27.9	+6.6	-10.5	41.6	39.1	+2.5	Horiz
			+5.9	+0.4	+0.4						
5	94.075M	61.5	+0.0	+0.1	-27.7	+7.4	-10.5	37.7	43.5	-5.8	Horiz
	QP		+5.9	+0.5	+0.5						
^	94.075M	64.7	+0.0	+0.1	-27.7	+7.4	-10.5	40.9	43.5	-2.6	Horiz
			+5.9	+0.5	+0.5						
7	96.549M	60.8	+0.0	+0.1	-27.7	+7.7	-10.5	37.3	43.5	-6.2	Horiz
			+5.9	+0.5	+0.5						
8	918.748M	42.7	+0.0	+0.4	-27.3	+24.5	-10.5	39.3	46.4	-7.1	Horiz
	QP		+5.9	+1.6	+2.0						
^	918.748M	43.3	+0.0	+0.4	-27.3	+24.5	-10.5	39.9	46.4	-6.5	Horiz
			+5.9	+1.6	+2.0						
10	59.015M	56.8	+0.0	+0.1	-27.9	+6.7	-10.5	31.9	39.1	-7.2	Horiz
			+5.9	+0.4	+0.4						
11	150.963M	55.0	+0.0	+0.2	-27.5	+9.4	-10.5	33.8	43.5	-9.7	Horiz
			+5.9	+0.6	+0.7						
12	459.431M	48.5	+0.0	+0.2	-27.9	+17.8	-10.5	36.4	46.4	-10.0	Horiz
			+5.9	+1.1	+1.3						
13	765.617M	42.8	+0.0	+0.3	-27.9	+22.7	-10.5	36.4	46.4	-10.0	Horiz
			+5.9	+1.4	+1.7						

14	55.022M	54.1	+0.0 +5.9	+0.1 +0.4	-27.9 +0.4	+6.5	-10.5	29.0	39.1	-10.1	Horiz
15	153.125M	52.3	+0.0 +5.9	+0.2 +0.6	-27.5 +0.7	+9.9	-10.5	31.6	43.5	-11.9	Horiz
16	156.969M	51.3	+0.0 +5.9	+0.2 +0.6	-27.5 +0.7	+10.4	-10.5	31.1	43.5	-12.4	Horiz
17	155.047M	51.2	+0.0 +5.9	+0.2 +0.6	-27.5 +0.7	+10.2	-10.5	30.8	43.5	-12.7	Horiz
18	151.924M	50.5	+0.0 +5.9	+0.2 +0.6	-27.5 +0.7	+9.7	-10.5	29.6	43.5	-13.9	Horiz
19	57.618M	50.0	+0.0 +5.9	+0.1 +0.4	-27.9 +0.4	+6.6	-10.5	25.0	39.1	-14.1	Horiz

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Ossia, Inc.**		
Specification:	**15.109 Radiated Emissions Class A**		
Work Order #:	**102450**	Date:	4/4/2019
Test Type:	**Maximized Emissions**	Time:	15:16:47
Tested By:	Matthew Harrison	Sequence#:	13
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 20-21°C
Pressure: 101.8kPa
Humidity: 28%
Frequency: 30-1000MHz

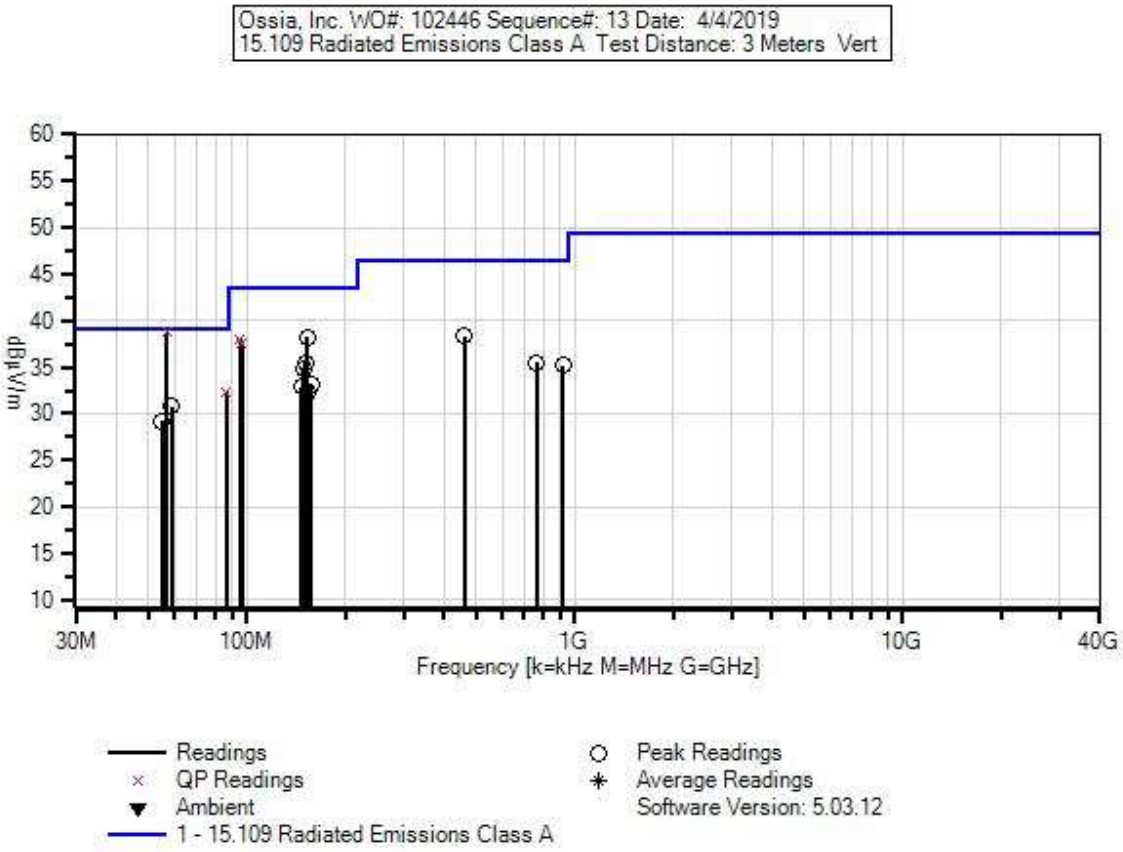
Test Method: ANSI 63.4 (2014)

All radios are in standby or RX mode.

The EUT is investigated in X, Y & Z Axis with only the worst case reported.

Router unplugged, light ring cable plugged in & ferrites on DC power cables.

Modifications #1 and 3 were in place during testing.


Ossia, Inc. WO#: 102446 Sequence#: 13 Date: 4/4/2019
15.109 Radiated Emissions Class A Test Distance: 3 Meters Vert
60
55
50
45
40
35
30
25
20
15
10
dBµV/m
30M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
QP Readings
Ambient
1 - 15.109 Radiated Emissions Class A
Peak Readings
Average Readings
Software Version: 5.03.12

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T1	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
T2	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T3	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019
T4	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T5	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T6	ANP05360	Cable	RG214	1/31/2018	1/31/2020

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	57.000M	63.8	+0.1 +0.4	-27.9 +0.4	+6.6	+5.9	-10.5	38.8	39.1	-0.3	Vert
	QP										
^	57.000M	66.6	+0.1 +0.4	-27.9 +0.4	+6.6	+5.9	-10.5	41.6	39.1	+2.5	Vert
3	153.005M	58.9	+0.2 +0.6	-27.5 +0.7	+9.9	+5.9	-10.5	38.2	43.5	-5.3	Vert
4	95.151M	61.7	+0.1 +0.5	-27.7 +0.5	+7.5	+5.9	-10.5	38.0	43.5	-5.5	Vert
	QP										
^	95.151M	65.0	+0.1 +0.5	-27.7 +0.5	+7.5	+5.9	-10.5	41.3	43.5	-2.2	Vert
6	96.549M	61.1	+0.1 +0.5	-27.7 +0.5	+7.7	+5.9	-10.5	37.6	43.5	-5.9	Vert
	QP										
^	96.549M	64.5	+0.1 +0.5	-27.7 +0.5	+7.7	+5.9	-10.5	41.0	43.5	-2.5	Vert
8	86.300M	57.1	+0.1 +0.5	-27.8 +0.5	+6.6	+5.9	-10.5	32.4	39.1	-6.7	Vert
	QP										
^	86.300M	60.4	+0.1 +0.5	-27.8 +0.5	+6.6	+5.9	-10.5	35.7	39.1	-3.4	Vert
10	150.963M	56.7	+0.2 +0.6	-27.5 +0.7	+9.4	+5.9	-10.5	35.5	43.5	-8.0	Vert
11	459.311M	50.4	+0.2 +1.1	-27.9 +1.3	+17.8	+5.9	-10.5	38.3	46.4	-8.1	Vert
12	59.015M	55.7	+0.1 +0.4	-27.9 +0.4	+6.7	+5.9	-10.5	30.8	39.1	-8.3	Vert
13	149.041M	56.4	+0.2 +0.6	-27.5 +0.7	+9.0	+5.9	-10.5	34.8	43.5	-8.7	Vert

14	55.022M	54.3	+0.1 +0.4	-27.9 +0.4	+6.5	+5.9	-10.5	29.2	39.1	-9.9	Vert
15	156.969M	53.4	+0.2 +0.6	-27.5 +0.7	+10.4	+5.9	-10.5	33.2	43.5	-10.3	Vert
16	146.999M	54.9	+0.2 +0.6	-27.5 +0.7	+8.6	+5.9	-10.5	32.9	43.5	-10.6	Vert
17	765.617M	41.9	+0.3 +1.4	-27.9 +1.7	+22.7	+5.9	-10.5	35.5	46.4	-10.9	Vert
18	153.966M	52.8	+0.2 +0.6	-27.5 +0.7	+10.1	+5.9	-10.5	32.3	43.5	-11.2	Vert
19	918.770M	38.6	+0.4 +1.6	-27.3 +2.0	+24.5	+5.9	-10.5	35.2	46.4	-11.2	Vert

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Ossia, Inc.**		
Specification:	**15.109 Radiated Emissions Class A**		
Work Order #:	**102450**	Date:	4/2/2019
Test Type:	**Maximized Emissions**	Time:	11:21:48
Tested By:	Steven Pittsford	Sequence#:	2
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

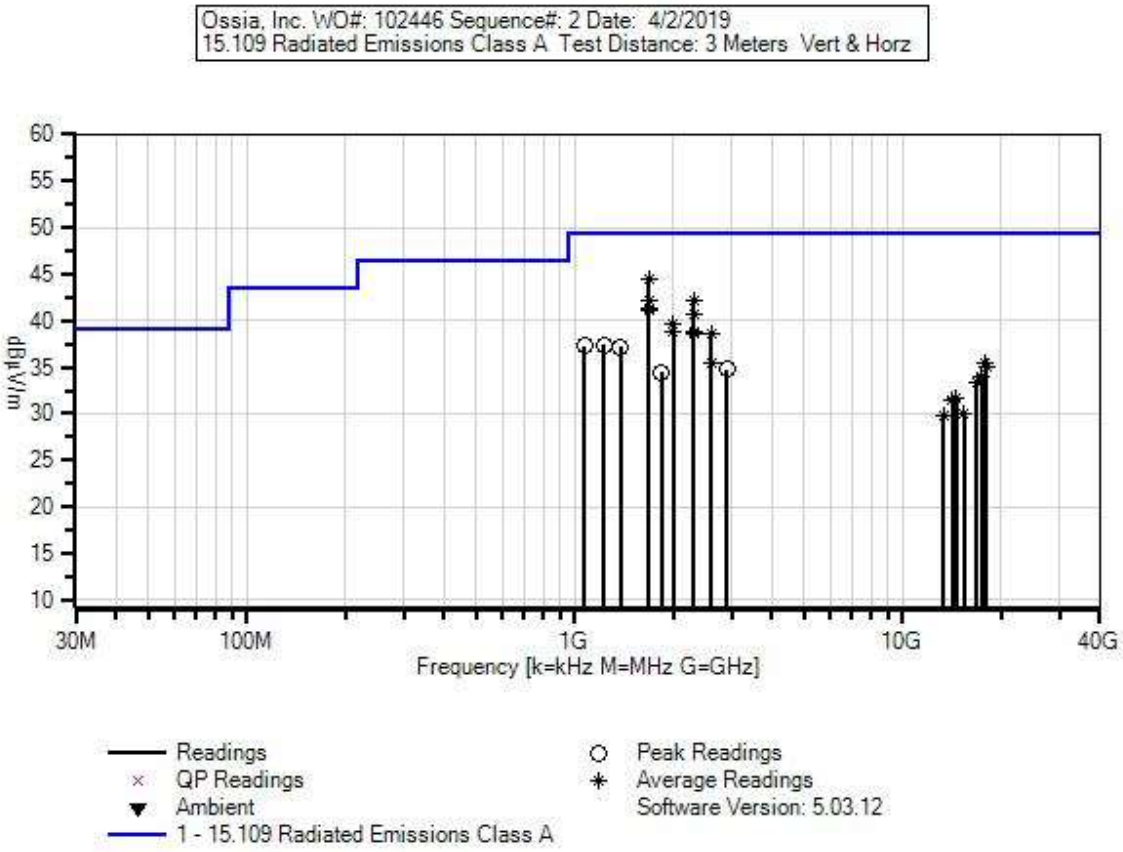
Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 20-21°C
Pressure: 101.8kPa
Humidity: 28%
Frequency: 1-18GHz (Max operating frequency = 2.48GHz)

Test Method: ANSI 63.4 (2014)

All radios are in standby or RX mode.
The EUT is investigated in X, Y & Z Axis with only the worst case reported.
Vertical and Horizontal polarities investigated


Ossia, Inc. WO#: 102446 Sequence#: 2 Date: 4/2/2019
15.109 Radiated Emissions Class A Test Distance: 3 Meters Vert & Horz
60
55
50
45
40
35
30
25
20
15
10
dBµV/m
30M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
QP Readings
Ambient
1 - 15.109 Radiated Emissions Class A
Peak Readings
Average Readings
Software Version: 5.03.12

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T2	ANP06503	Cable	32026-29801-29801-36	3/13/2018	3/13/2020
T3	AN03540	Preamp	83017A	3/25/2019	3/25/2021
T4	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T5	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T6	ANP06540	Cable	Heliax	10/30/2017	10/30/2019

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	1684.380M	60.5	+0.0	+0.7	-34.7	+25.8	-10.5	44.5	49.5	-5.0	Vert
	Ave		+2.2	+0.5			250		Y		106
2	1684.423M	58.2	+0.0	+0.7	-34.7	+25.8	-10.5	42.2	49.5	-7.3	Horiz
	Ave		+2.2	+0.5			73		Z		162
3	2296.894M	54.9	+0.0	+0.9	-34.2	+28.1	-10.5	42.1	49.5	-7.4	None
	Ave		+2.5	+0.4			135		Z		121
^	2296.894M	56.1	+0.0	+0.9	-34.2	+28.1	-10.5	43.3	49.5	-6.2	None
			+2.5	+0.4			135		Z		121
5	1684.407M	57.3	+0.0	+0.7	-34.7	+25.8	-10.5	41.3	49.5	-8.2	Vert
	Ave		+2.2	+0.5			189		X		99
^	1684.380M	61.3	+0.0	+0.7	-34.7	+25.8	-10.5	45.3	49.5	-4.2	Vert
			+2.2	+0.5			250		Y		106
^	1684.407M	57.6	+0.0	+0.7	-34.7	+25.8	-10.5	41.6	49.5	-7.9	Vert
			+2.2	+0.5			189		X		99
8	1684.407M	57.1	+0.0	+0.7	-34.7	+25.8	-10.5	41.1	49.5	-8.4	Horiz
	Ave		+2.2	+0.5			267		X		123
^	1684.423M	59.2	+0.0	+0.7	-34.7	+25.8	-10.5	43.2	49.5	-6.3	Horiz
			+2.2	+0.5			73		Z		162
^	1684.407M	58.3	+0.0	+0.7	-34.7	+25.8	-10.5	42.3	49.5	-7.2	Horiz
			+2.2	+0.5			267		X		123
11	2296.865M	53.5	+0.0	+0.9	-34.2	+28.1	-10.5	40.7	49.5	-8.8	Horiz
	Ave		+2.5	+0.4			271		X		115
^	2296.865M	55.3	+0.0	+0.9	-34.2	+28.1	-10.5	42.5	49.5	-7.0	Horiz
			+2.5	+0.4			360		X		105
13	1990.621M	53.0	+0.0	+0.8	-34.4	+28.1	-10.5	39.7	49.5	-9.8	None
	Ave		+2.4	+0.3			261		X		109
^	1990.621M	54.8	+0.0	+0.8	-34.4	+28.1	-10.5	41.5	49.5	-8.0	None
			+2.4	+0.3			281		X		109
15	1990.621M	52.2	+0.0	+0.8	-34.4	+28.1	-10.5	38.9	49.5	-10.6	Vert
	Ave		+2.4	+0.3			337		X		99
^	1990.621M	53.8	+0.0	+0.8	-34.4	+28.1	-10.5	40.5	49.5	-9.0	Vert
			+2.4	+0.3			337		X		99

17	2296.800M Ave	51.6	+0.0 +2.5	+0.9 +0.4	-34.2	+28.1	-10.5	38.8	X	49.5	-10.7	Vert 135
18	2603.068M Ave	50.7	+0.0 +2.7	+1.0 +0.4	-34.1	+28.4	-10.5 354	38.6	X	49.5	-10.9	Horiz 126
^	2603.068M	52.7	+0.0 +2.7	+1.0 +0.4	-34.1	+28.4	-10.5 354	40.6	X	49.5	-8.9	Horiz 99
20	2296.885M Ave	51.3	+0.0 +2.5	+0.9 +0.4	-34.2	+28.1	-10.5	38.5	Y	49.5	-11.0	Vert 99
^	2296.800M	53.7	+0.0 +2.5	+0.9 +0.4	-34.2	+28.1	-10.5	40.9	X	49.5	-8.6	Vert 135
^	2296.885M	53.0	+0.0 +2.5	+0.9 +0.4	-34.2	+28.1	-10.5 65	40.2	Y	49.5	-9.3	Vert 99
23	1224.000M	56.2	+0.0 +1.8	+0.6 +0.4	-35.8	+24.7	-10.5 262	37.4		49.5	-12.1	Vert 105
24	1072.000M	57.4	+0.0 +1.8	+0.5 +0.4	-36.5	+24.1	-10.5 141	37.2		49.5	-12.3	Vert 105
25	1378.000M	54.8	+0.0 +2.0	+0.6 +0.4	-35.3	+25.2	-10.5 335	37.2		49.5	-12.3	Vert 105
26	2603.068M Ave	47.6	+0.0 +2.7	+1.0 +0.4	-34.1	+28.4	-10.5 -15	35.5	X	49.5	-14.0	Vert 99
^	2603.068M	50.8	+0.0 +2.7	+1.0 +0.4	-34.1	+28.4	-10.5 -15	38.7	X	49.5	-10.8	Vert 99
28	17862.240 M Ave	23.3	+0.0 +8.8	+3.8 +1.4	-34.7	+43.3	-10.5	35.4		49.5	-14.1	Vert 135
^	17862.240 M	36.4	+0.0 +8.8	+3.8 +1.4	-34.7	+43.3	-10.5 360	48.5		49.5	-1.0	Vert 105
30	17985.240 M Ave	23.0	+0.0 +9.0	+3.8 +1.4	-34.8	+43.2	-10.5	35.1		49.5	-14.4	Vert 135
^	17985.240 M	35.8	+0.0 +9.0	+3.8 +1.4	-34.8	+43.2	-10.5 360	47.9		49.5	-1.6	Vert 105
32	2910.000M	45.4	+0.0 +2.8	+1.1 +0.6	-33.9	+29.3	-10.5 360	34.8		49.5	-14.7	Vert 105
33	1838.000M	49.3	+0.0 +2.3	+0.7 +0.4	-34.5	+26.7	-10.5 360	34.4		49.5	-15.1	Vert 105
34	17403.696 M Ave	22.6	+0.0 +8.5	+3.7 +1.2	-34.8	+43.2	-10.5 137	33.9		49.5	-15.6	Vert 135
^	17403.696 M	35.7	+0.0 +8.5	+3.7 +1.2	-34.8	+43.2	-10.5 360	47.0		49.5	-2.5	Vert 105
36	16791.997 M Ave	23.8	+0.0 +9.0	+3.9 +1.4	-34.9	+40.6	-10.5 360	33.3		49.5	-16.2	Vert 135
^	16792.000 M	36.0	+0.0 +9.0	+3.9 +1.4	-34.9	+40.6	-10.5 360	45.5		49.5	-4.0	Vert 105

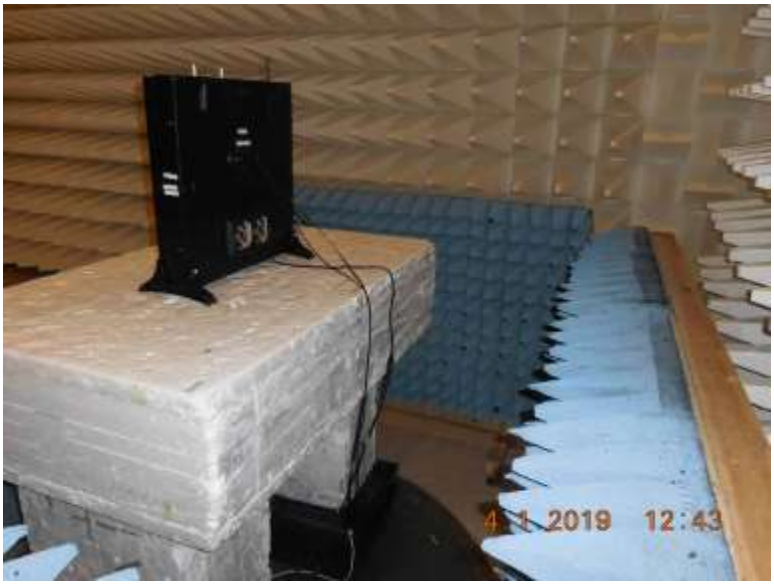
38	14572.000	22.9	+0.0	+3.6	-34.4	+41.3	-10.5	31.7	49.5	-17.8	Vert
	M		+8.2	+0.6							
	Ave						360				135
^	14572.000	34.7	+0.0	+3.6	-34.4	+41.3	-10.5	43.5	49.5	-6.0	Vert
	M		+8.2	+0.6							
							360				105
40	14136.000	23.3	+0.0	+3.3	-34.3	+41.1	-10.5	31.5	49.5	-18.0	Vert
	M		+7.8	+0.8							
	Ave						360				135
^	14136.000	35.7	+0.0	+3.3	-34.3	+41.1	-10.5	43.9	49.5	-5.6	Vert
	M		+7.8	+0.8							
							360				105
42	15352.000	22.8	+0.0	+3.7	-34.6	+39.2	-10.5	30.0	49.5	-19.5	Vert
	M		+8.3	+1.1							
	Ave						360				135
^	15352.000	35.8	+0.0	+3.7	-34.6	+39.2	-10.5	43.0	49.5	-6.5	Vert
	M		+8.3	+1.1							
							360				105
44	13283.761	23.2	+0.0	+3.4	-34.5	+39.5	-10.5	29.7	49.5	-19.8	Vert
	M		+7.4	+1.2							
	Ave						360				135
^	13283.761	36.5	+0.0	+3.4	-34.5	+39.5	-10.5	43.0	49.5	-6.5	Vert
	M		+7.4	+1.2							
							360				105

Test Setup Photo(s)

Below 1GHz

Above 1GHz

X-Axis



Y-Axis

Z-Axis

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.