Ossia, Inc.

REVISED TEST REPORT TO 102778-13

Cota Forever Tracker Client
Tracker Rx

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.249

Report No.: 102778-13A

Date of issue: August 30, 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 # 803.01

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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: 13076

REPORT PREPARED BY:

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

Project Number: 102778

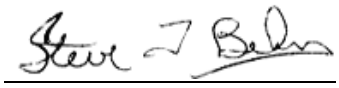
DATE OF EQUIPMENT RECEIPT: June 24, 2019
DATE(S) OF TESTING: June 24, 2019 and July 1-2, 2019

Revision History

Original: Testing of the Cota Forever Tracker Client, Model: Tracker Rx to FCC Part 15 Subpart C Section(s) 15.249.
Revision A: Changed NA1 definition for Summary of Results table. Added Conditions During Testing description with block diagram. Changed 15.249(a) Field Strength of Fundamental Test Data Summary - Voltage Variations description and added to the Note under Test Data Summary – Radiated Field Strength Measurement table. Added statement to test conditions on 15.249(a) Field Strength of Spurious Emissions.

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

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Japan
Canyon Park, Bothell, WA	US0081	US1022	A-0136
Brea, CA	US0060	US1025	A-0136
Fremont, CA	US0082	US1023	A-0136
Mariposa, CA	US0103	US1024	A-0136

*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 C - 15.249

Test Procedure	Description	Modifications	Results
15.215(c)	Occupied Bandwidth	NA	Pass
15.249(a)	Field Strength of Fundamental	NA	Pass
15.249(a)	Field Strength of Spurious Emissions	NA	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable

NA1 = Not applicable because the manufacturer declares the EUT cannot transmit with the beacon radio while charging via the USB interface (wired charging).

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
No modifications were made during testing.

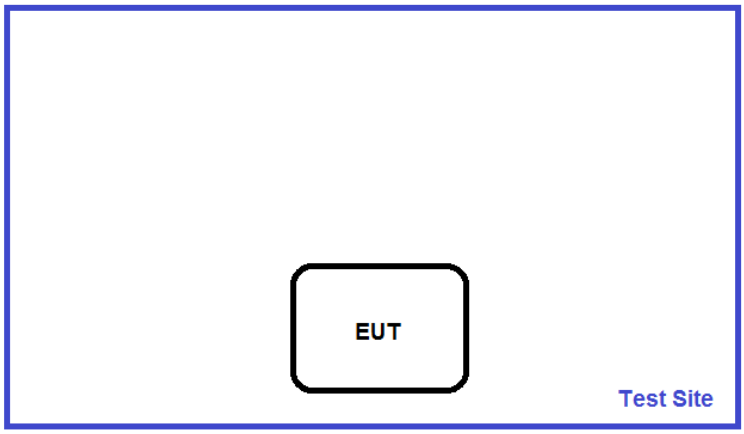
Modifications listed above must be incorporated into all production units.

Conditions During Testing

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

Summary of Conditions
The manufacturer declares the EUT is a wireless power client with integrated battery that is capable of being charged wirelessly with a Part 18 device, or via USB charging. The EUT also consists of an IEE802.15.4 radio and a beacon radio. The EUT cannot transmit while charging via USB interface (wired charging) so that configuration was not investigated for the radio emissions. The EUT was only tested as a standalone device (Configuration 1). The IEE802.15.4 radio emissions, unintentional emissions of the USB charging configuration, as well as the wireless charging functions are considered under the appropriate relevant standards separate reports. The manufacturer declares the radio under test was set to maximum output during testing.

Test Setup Block Diagram



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 Forever Tracker Client	Ossia, Inc.	Tracker Rx	728B

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Modulation Type(s):	OOK
Maximum Duty Cycle:	1.5%
Antenna Type(s) and Gain:	Patch, 6dBi
Antenna Connection Type:	Integral
Nominal Input Voltage:	Battery (3.7 VDC nominal)
Firmware / Software used for Test:	0.17_TC8

FCC Part 15 Subpart C

15.215(c) Occupied Bandwidth (20dB BW)

Test Setup/Conditions			
Test Location:	Canyon Park Lab C3	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	7/1/2019
Configuration:	1		
Test Setup:	Test mode: Continuously Transmitting The EUT is operating with a fresh battery installed. The EUT is set 1.5 meters high on Styrofoam table.		

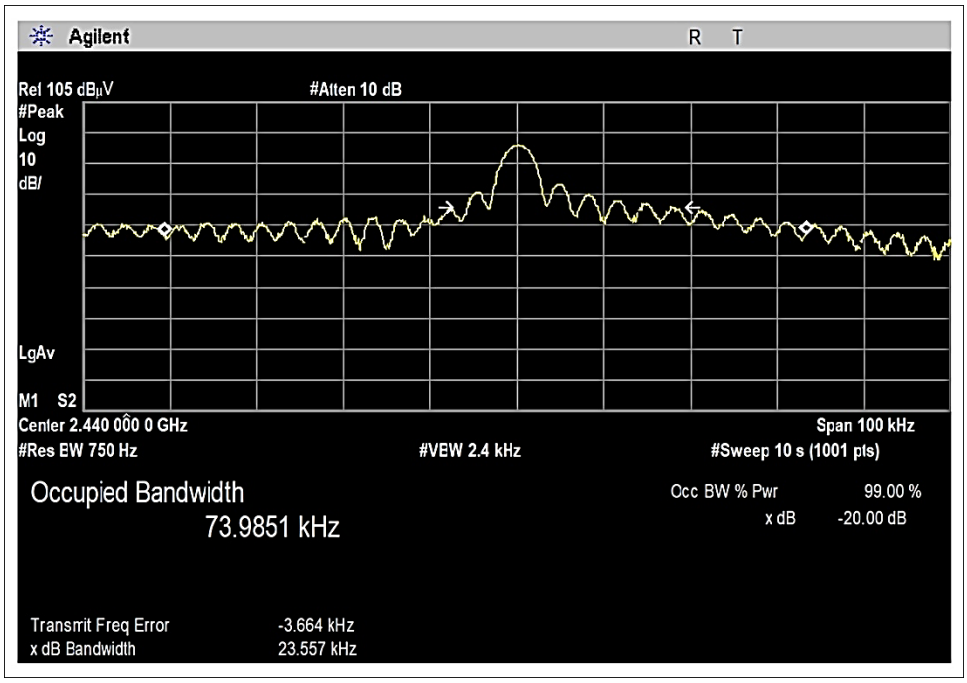
Environmental Conditions			
Temperature (ºC)	21-23	Relative Humidity (%):	35-40

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02871	Spectrum Analyzer	Agilent	E4440A	1/9/2019	1/9/2021
P06540	Cable	Andrews	Heliax	10/30/2017	10/30/2019
P06515	Cable	Andrews	Heliax	6/29/2018	6/29/2020
03540	Preamp	HP	83017A	5/13/2019	5/13/2021
P06503	Cable	Astrolab	32026-29801-29801-36	3/13/2018	3/13/2020
01467	Horn Antenna	EMCO	3115	7/21/2017	7/21/2019
P07226	Attenuator	Pasternack	PE7004-6	12/1/2017	12/1/2019

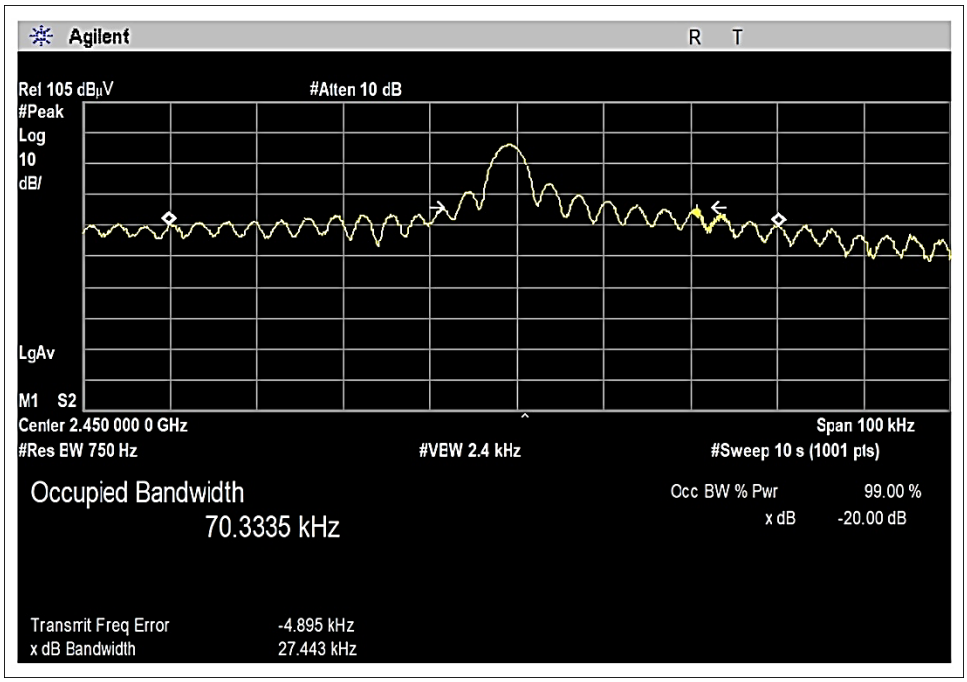
Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2440	1	OOK	23.557	None	NA
2450	1	OOK	27.443	None	NA
2460	1	OOK	20.600	None	NA

NA = Not applicable, because FCC 15.215 does not give any limits so there is no criteria for pass or fail.

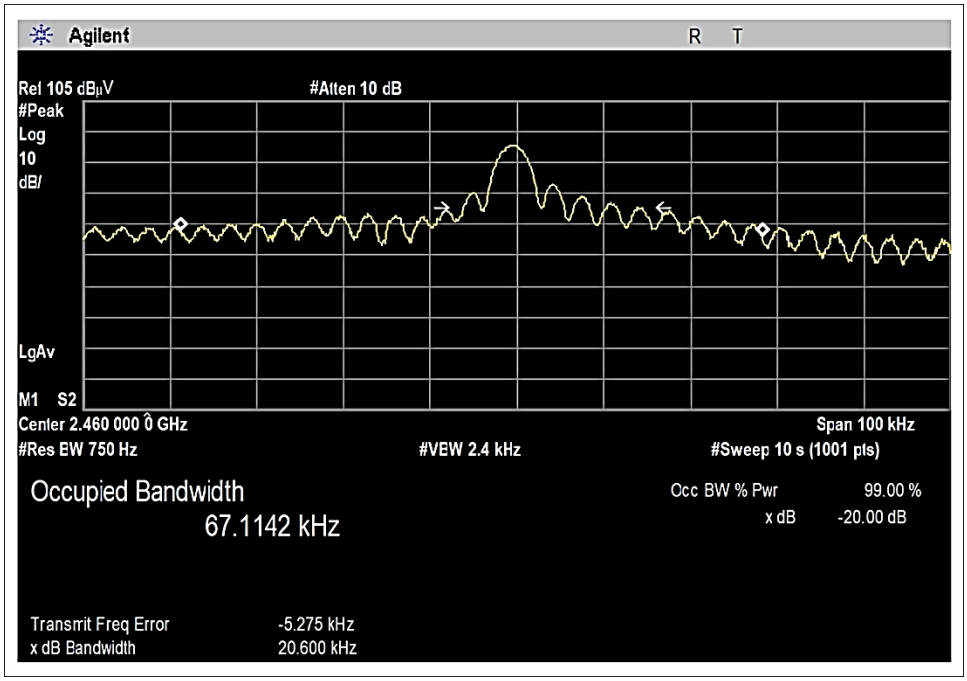
Plot(s)



Low Channel



Middle Channel



High Channel

Test Setup Photo(s)

15.249(a) Field Strength of Fundamental

Test Data Summary - Voltage Variations

This equipment is battery powered and manufacturer declares the radio under test cannot operate while charging via USB. The manufacturer declares the voltage supplied to the radio circuitry from the battery is regulated. Power output tests were performed using a fresh battery.

Test Data Summary – Radiated Field Strength Measurement

Data plots show uncorrected peak data.
Corrected readings for peak and average field strengths are in tabular data

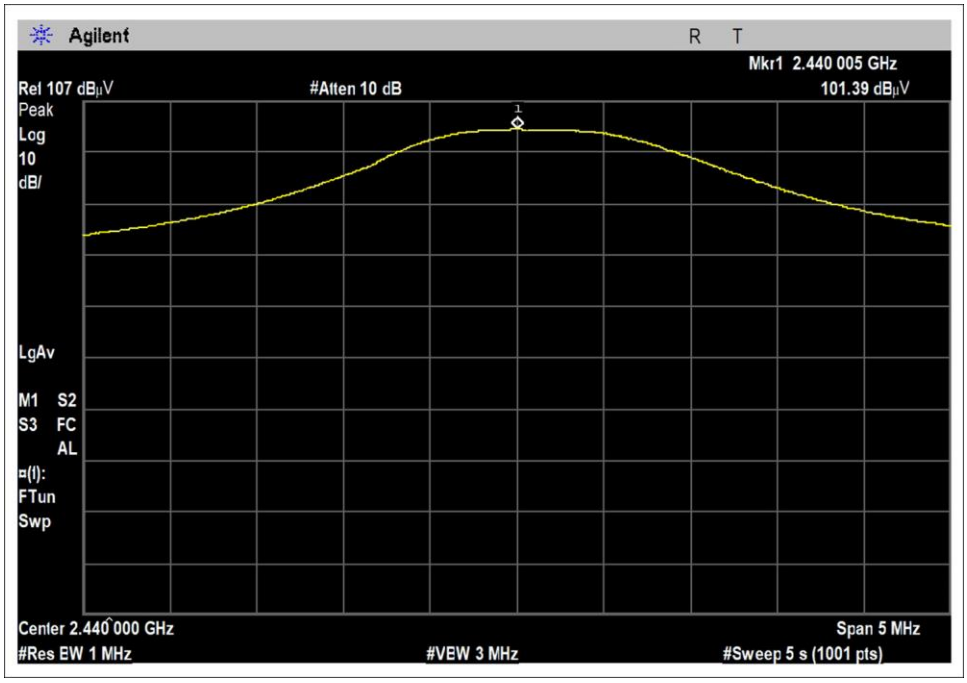
Frequency (MHz)	Modulation	Ant. Type	Measured (dBuV/m @ 3m)	Limit (dBuV/m @ 3m)	Results
2440 (peak)	OOK	Integral	105.0	≤114	Pass
2440 (average)	OOK	Integral	70.0	≤94	Pass
2450 (peak)	OOK	Integral	105.0	≤114	Pass
2450 (average)	OOK	Integral	70.1	≤94	Pass
2460 (peak)	OOK	Integral	104.6	≤114	Pass
2460 (average)	OOK	Integral	69.4	≤94	Pass

Note: The peak limit is 20dB above the 94dBuV/m average limit.

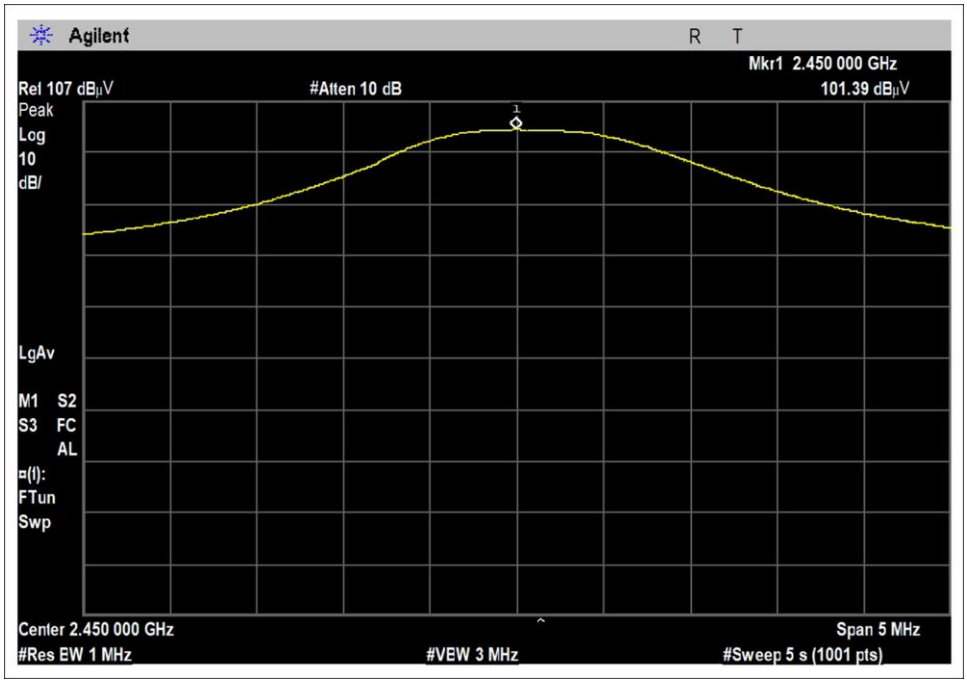
The manufacturer declares a 1.5% duty cycle over a 100ms period based on the following information: Beacon duration: 300us. Number of beacons per 100ms period: 5 (Beacon every 20ms).
The maximum duty cycle over a single pulse train to be considered under FCC 15.35c would still be 1.5%=0.3/20 per the manufacturer.

Average data was collected using the average detector with the EUT operating at its maximum duty cycle per manufacturer as worst case. The following settings were used: RBW=1MHz, VBW=3MHz, Span=0 (centered on fundamental frequency). Sweep time was set to 5 seconds, 1001 points used.

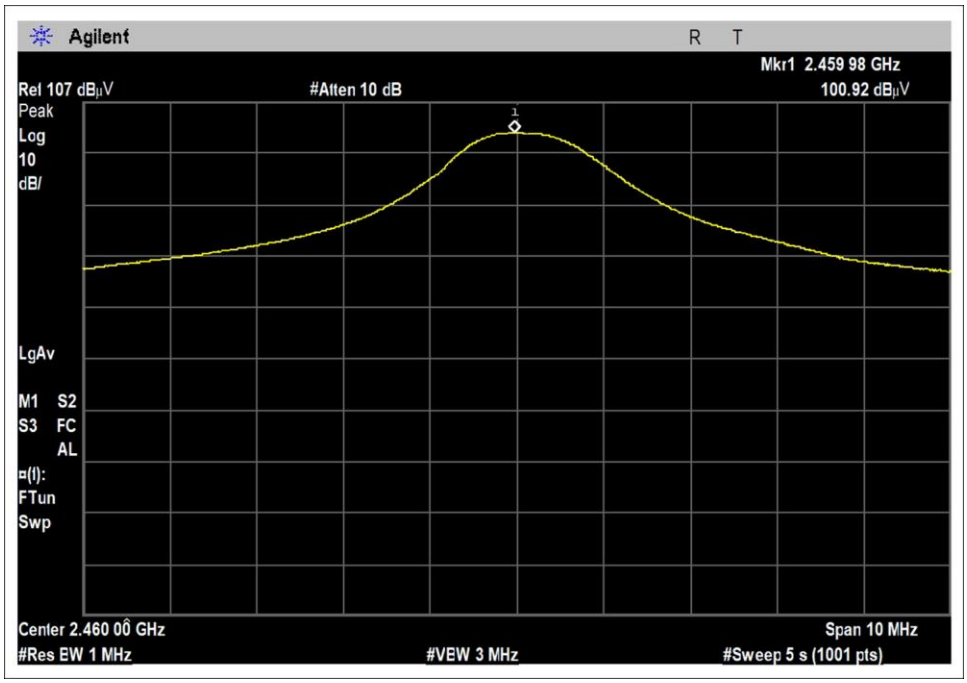
Plot(s)



Low Channel



Middle Channel



High Channel

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:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) PEAK**		
Work Order #:	**102778**	Date:	7/1/2019
Test Type:	**Maximized Emissions**	Time:	13:17:36
Tested By:	Michael Atkinson	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			

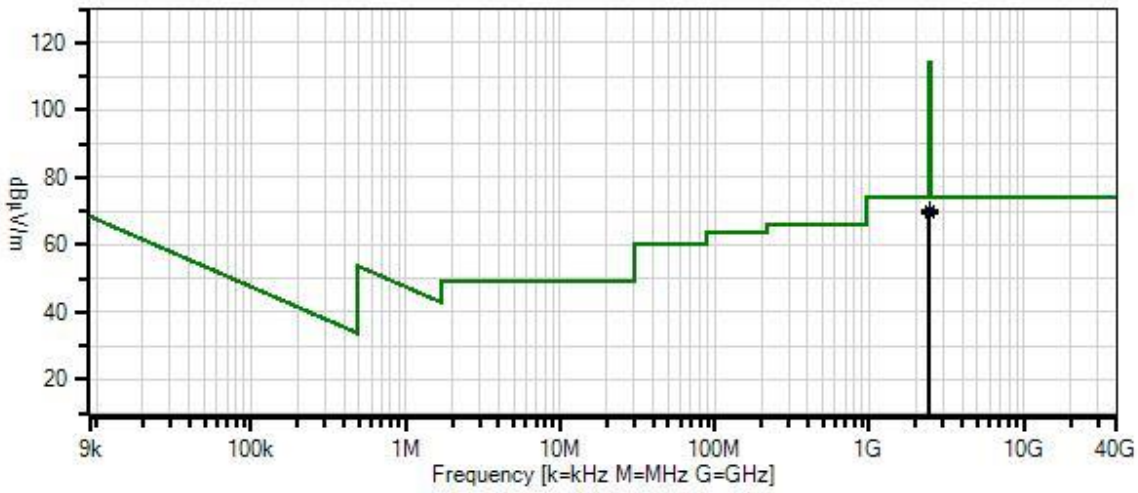
Test Conditions / Notes:

Temperature: 21-23°C
Humidity: 35-40%
Pressure: 101.5-103kPa

Test Method: ANSI 63.10 (2013)

EUT is continuously transmitting with a fresh battery installed.
Investigated L, M, and H channels.
X, Y, & Z axes investigated, horizontal and vertical polarities investigated with worst case reported.

Ossia, Inc. WO#: 102778 Sequence#: 12 Date: 7/1/2019
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) PEAK Test Distance: 3 Meters Vert



Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.12
1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) PEAK

Test Equipment:

ID	Asset #/Serial #	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	ANP07226	Attenuator	PE7004-6	12/1/2017	12/1/2019
T4	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T5	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T6	ANP06503	Cable	32026-29801-29801-36	3/13/2018	3/13/2020
T7	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019

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	2450.000M	66.5	+0.0	+0.4	+5.8	+2.6	+0.0	70.1	94.0	-23.9	Vert
	Ave		-34.3	+1.0	+28.1						
^	2450.000M	101.4	+0.0	+0.4	+5.8	+2.6	+0.0	105.0	114.0	-9.0	Vert
			-34.3	+1.0	+28.1						
3	2440.005M	66.4	+0.0	+0.4	+5.8	+2.6	+0.0	70.0	94.0	-24.0	Vert
	Ave		-34.3	+1.0	+28.1						
^	2440.005M	101.4	+0.0	+0.4	+5.8	+2.6	+0.0	105.0	114.0	-9.0	Vert
			-34.3	+1.0	+28.1						
5	2460.000M	65.7	+0.0	+0.4	+5.8	+2.7	+0.0	69.4	94.0	-24.6	Vert
	Ave		-34.3	+1.0	+28.1						
^	2459.980M	100.9	+0.0	+0.4	+5.8	+2.7	+0.0	104.6	114.0	-9.4	Vert
			-34.3	+1.0	+28.1						

Test Setup Photo(s)

Above 1 GHz

X Axis

Y Axis

Z Axis

15.249(a) Field Strength of Spurious Emissions

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:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**102778**	Date:	7/2/2019
Test Type:	**Maximized Emissions**	Time:	10:28:40
Tested By:	Michael Atkinson	Sequence#:	10
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

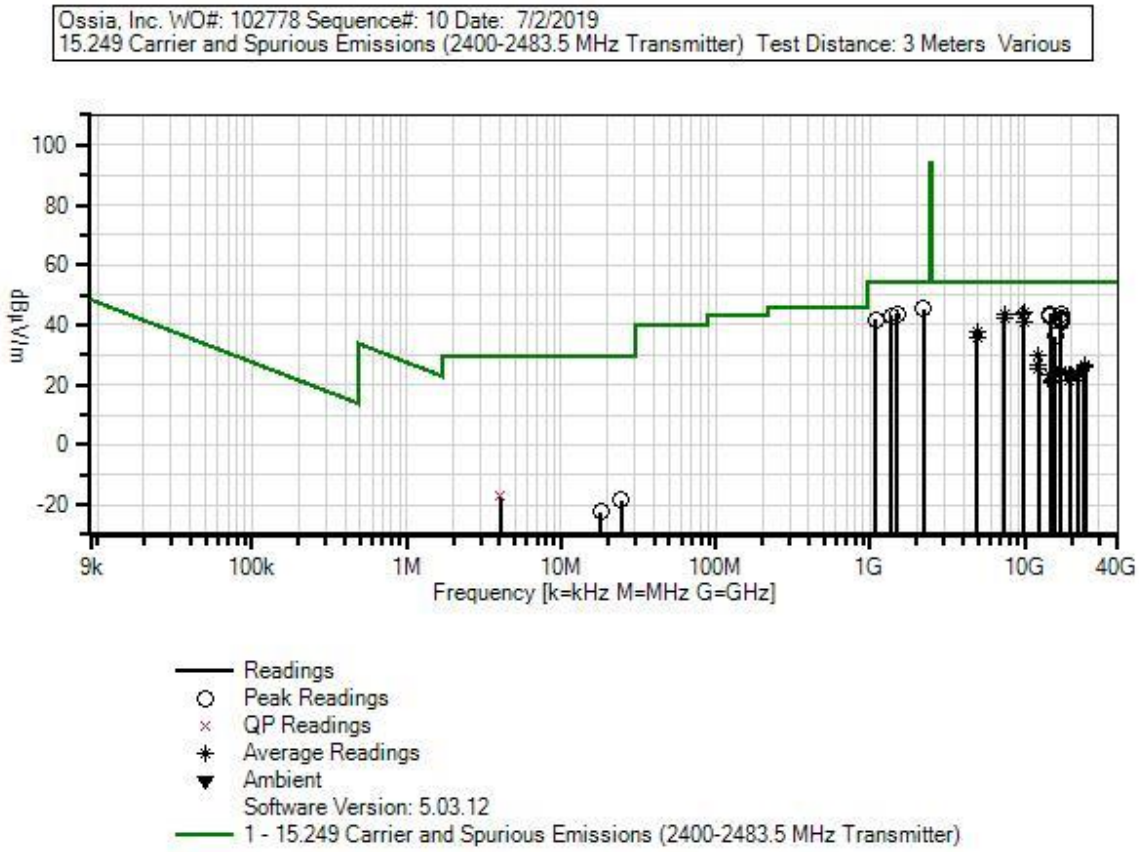
Test Conditions / Notes:

Temperature: 21-23°C
Humidity: 35-40%
Pressure: 101.5-103kPa

Test Method: ANSI 63.10 (2013)

EUT is continuously transmitting.
Investigated L, M, H channels, worst case reported.
EUT is investigated in X, Y, & Z Axis with worst case reported.
Investigated 3 x orthogonal axes below 30MHz, investigated horizontal and vertical polarities above 30MHz, worst case reported.

For data collected below 30MHz an alternative test site (semi-anechoic chamber) was used instead of an open-field test site. The alternative test-site has been correlated to produce representative data compared to an open-field test site.


Ossia, Inc. WO#: 102778 Sequence#: 10 Date: 7/2/2019
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters Various
100
80
60
40
20
0
-20
dBµV/m
9k
100k
1M
10M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.12
1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

Test Equipment:

ID	Asset #/Serial #	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
	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
	AN02307	Preamp	8447D	1/15/2018	1/15/2020
	ANP05360	Cable	RG214	1/31/2018	1/31/2020
	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
	AN00851	Biconilog Antenna	CBL6111C	5/1/2018	5/1/2020
T3	ANP07226	Attenuator	PE7004-6	12/1/2017	12/1/2019
T4	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T5	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T6	ANP06503	Cable	32026-29801-29801-36	3/13/2018	3/13/2020
T7	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T8	AN02741	Active Horn Antenna	AMFW-5F-12001800-20-10P	4/26/2019	4/26/2021
T9	AN03122	Cable	32026-2-29801-36	3/13/2018	3/13/2020
T10	AN02763-69	Waveguide	Multiple	4/23/2018	4/23/2020
T11	ANP06678	Cable	32026-29801-29801-144	3/13/2018	3/13/2020
T12	AN02742	Active Horn Antenna	AMFW-5F-18002650-20-10P	10/16/2018	10/16/2020
T13	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020

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

#	Freq	Rdng	T1 T5 T9 T13	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2195.000M	42.2	+0.0 -34.4 +0.0 +0.0	+0.4 +0.9 +0.0	+5.8 +28.2 +0.0	+2.4 +0.0 +0.0	+0.0	45.5	54.0	-8.5	Horiz
2	9840.040M Ave	24.9	+0.0 -33.9 +0.0 +0.0	+0.4 +2.6 +0.0	+6.0 +37.7 +0.0	+6.3 +0.0 +0.0	+0.0	44.0	54.0 High	-10.0	Vert
^	9840.040M	40.6	+0.0 -33.9 +0.0 +0.0	+0.4 +2.6 +0.0	+6.0 +37.7 +0.0	+6.3 +0.0 +0.0	+0.0	59.7	54.0 High	+5.7	Vert

4	17080.017 M	45.2	+0.0 +0.0 +0.0 +0.0	+1.3 +0.0 +0.0	+0.0 +0.0 +0.0	+9.0 -11.6 +0.0	+0.0	43.9	54.0 Low	-10.1	Horiz
5	14639.800 M	49.8	+0.0 +0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+0.0 +0.0 +0.0	+8.2 -14.7 +0.0	+0.0	43.8	54.0 Low	-10.2	Horiz
6	7320.130M Ave	27.4	+0.0 -34.6 +0.0 +0.0	+0.9 +2.1 +0.0	+6.0 +36.5 +0.0	+5.4 +0.0 +0.0	+0.0	43.7	54.0 Low	-10.3	Horiz
^	7320.130M	50.0	+0.0 -34.6 +0.0 +0.0	+0.9 +2.1 +0.0	+6.0 +36.5 +0.0	+5.4 +0.0 +0.0	+0.0	66.3	54.0 Low	+12.3	Horiz
8	7349.996M Ave	27.1	+0.0 -34.6 +0.0 +0.0	+1.0 +2.1 +0.0	+6.0 +36.6 +0.0	+5.4 +0.0 +0.0	+0.0	43.6	54.0 Mid	-10.4	Horiz
^	7349.957M	49.2	+0.0 -34.6 +0.0 +0.0	+1.0 +2.1 +0.0	+6.0 +36.6 +0.0	+5.4 +0.0 +0.0	+0.0	65.7	54.0 Mid	+11.7	Horiz
10	1487.000M	44.3	+0.0 -35.4 +0.0 +0.0	+0.4 +0.6 +0.0	+5.9 +25.6 +0.0	+2.2 +0.0 +0.0	+0.0	43.6	54.0	-10.4	Horiz
11	9760.563M Ave	24.4	+0.0 -33.9 +0.0 +0.0	+0.5 +2.6 +0.0	+6.0 +37.6 +0.0	+6.3 +0.0 +0.0	+0.0	43.5	54.0 Low	-10.5	Vert
^	9760.563M	40.2	+0.0 -33.9 +0.0 +0.0	+0.5 +2.6 +0.0	+6.0 +37.6 +0.0	+6.3 +0.0 +0.0	+0.0	59.3	54.0 Low	+5.3	Vert
13	1370.000M	44.7	+0.0 -35.7 +0.0 +0.0	+0.4 +0.6 +0.0	+5.9 +25.2 +0.0	+2.0 +0.0 +0.0	+0.0	43.1	54.0	-10.9	Horiz
14	14639.900 M	48.7	+0.0 +0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+0.0 +0.0 +0.0	+8.2 -14.7 +0.0	+0.0	42.7	54.0 Low	-11.3	Vert
15	7380.080M Ave	25.9	+0.0 -34.6 +0.0 +0.0	+1.0 +2.2 +0.0	+6.0 +36.7 +0.0	+5.4 +0.0 +0.0	+0.0	42.6	54.0 High	-11.4	Vert
^	7380.080M	49.2	+0.0 -34.6 +0.0 +0.0	+1.0 +2.2 +0.0	+6.0 +36.7 +0.0	+5.4 +0.0 +0.0	+0.0	65.9	54.0 High	+11.9	Vert

17	17080.117 M	43.7	+0.0 +0.0 +0.0 +0.0	+1.3 +0.0 +0.0	+0.0 +0.0 +0.0	+9.0 -11.6 +0.0	+0.0	42.4	54.0 Low	-11.6	Vert
18	1079.200M	46.1	+0.0 -36.8 +0.0 +0.0	+0.4 +0.5 +0.0	+5.8 +24.1 +0.0	+1.8 +0.0 +0.0	+0.0	41.9	54.0	-12.1	Vert
19	17080.100 M	43.1	+0.0 +0.0 +0.0 +0.0	+1.3 +0.0 +0.0	+0.0 +0.0 +0.0	+9.0 -11.6 +0.0	+0.0	41.8	54.0 Low	-12.2	Vert
20	17080.450 M	42.7	+0.0 +0.0 +0.0 +0.0	+1.3 +0.0 +0.0	+0.0 +0.0 +0.0	+9.0 -11.6 +0.0	+0.0	41.4	54.0 Low	-12.6	Vert
21	17219.980 M	42.9	+0.0 +0.0 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0 +0.0 +0.0	+8.8 -11.6 +0.0	+0.0	41.3	54.0 High	-12.7	Horiz
22	9799.996M Ave	22.1	+0.0 -33.9 +0.0 +0.0	+0.5 +2.6 +0.0	+6.0 +37.6 +0.0	+6.3 +0.0 +0.0	+0.0	41.2	54.0 Mid	-12.8	Vert
^	9799.996M	40.4	+0.0 -33.9 +0.0 +0.0	+0.5 +2.6 +0.0	+6.0 +37.6 +0.0	+6.3 +0.0 +0.0	+0.0	59.5	54.0 Mid	+5.5	Vert
24	17150.200 M	42.7	+0.0 +0.0 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0 +0.0 +0.0	+8.9 -11.7 +0.0	+0.0	41.1	54.0 Mid	-12.9	Horiz
25	4879.970M Ave	26.7	+0.0 -33.6 +0.0 +0.0	+0.5 +1.6 +0.0	+5.8 +32.4 +0.0	+4.2 +0.0 +0.0	+0.0	37.6	54.0 Low	-16.4	Vert
^	4879.970M	49.5	+0.0 -33.6 +0.0 +0.0	+0.5 +1.6 +0.0	+5.8 +32.4 +0.0	+4.2 +0.0 +0.0	+0.0	60.4	54.0 Low	+6.4	Vert
27	15612.000 M	39.3	+0.0 +0.0 +0.0 +0.0	+1.3 +0.0 +0.0	+0.0 +0.0 +0.0	+8.2 -12.7 +0.0	+0.0	36.1	54.0 High	-17.9	Horiz
28	4920.050M Ave	25.0	+0.0 -33.6 +0.0 +0.0	+0.5 +1.6 +0.0	+5.8 +32.5 +0.0	+4.2 +0.0 +0.0	+0.0	36.0	54.0 High	-18.0	Vert
^	4920.050M	48.2	+0.0 -33.6 +0.0 +0.0	+0.5 +1.6 +0.0	+5.8 +32.5 +0.0	+4.2 +0.0 +0.0	+0.0	59.2	54.0 High	+5.2	Vert

30	4899.996M Ave	24.7	+0.0 -33.6 +0.0 +0.0	+0.5 +1.6 +0.0	+5.8 +32.5 +0.0	+4.2 +0.0 +0.0	+0.0	35.7	54.0 Mid	-18.3	Vert
^	4899.996M	47.4	+0.0 -33.6 +0.0 +0.0	+0.5 +1.6 +0.0	+5.8 +32.5 +0.0	+4.2 +0.0 +0.0	+0.0	58.4	54.0 Mid	+4.4	Vert
32	12200.133 M Ave	34.8	+0.0 +0.0 +0.0 +0.0	+1.0 +0.0 +0.0	+0.0 +0.0 +0.0	+6.9 -12.8 +0.0	+0.0	29.9	54.0 Low	-24.1	Horiz
^	12200.133 M	65.4	+0.0 +0.0 +0.0 +0.0	+1.0 +0.0 +0.0	+0.0 +0.0 +0.0	+6.9 -12.8 +0.0	+0.0	60.5	54.0	+6.5	Horiz
34	24600.124 M Ave	24.8	+0.0 +0.0 +2.6 +0.0	+0.0 +0.0 +1.8	+0.0 +0.0 +9.7	+0.0 +0.0 -12.4	+0.0	26.5	54.0 High	-27.5	Vert
^	24600.124 M	45.8	+0.0 +0.0 +2.6 +0.0	+0.0 +0.0 +1.8	+0.0 +0.0 +9.7	+0.0 +0.0 -12.4	+0.0	47.5	54.0 High	-6.5	Vert
36	12250.167 M Ave	31.5	+0.0 +0.0 +0.0 +0.0	+1.0 +0.0 +0.0	+0.0 +0.0 +0.0	+6.9 -12.9 +0.0	+0.0	26.5	54.0 Mid	-27.5	Horiz
^	12250.167 M	62.9	+0.0 +0.0 +0.0 +0.0	+1.0 +0.0 +0.0	+0.0 +0.0 +0.0	+6.9 -12.9 +0.0	+0.0	57.9	54.0 Mid	+3.9	Horiz
38	24499.938 M Ave	24.4	+0.0 +0.0 +2.6 +0.0	+0.0 +0.0 +1.8	+0.0 +0.0 +9.7	+0.0 +0.0 -12.5	+0.0	26.0	54.0 Mid	-28.0	Vert
^	24499.938 M	43.7	+0.0 +0.0 +2.6 +0.0	+0.0 +0.0 +1.8	+0.0 +0.0 +9.7	+0.0 +0.0 -12.5	+0.0	45.3	54.0 Mid	-8.7	Vert
40	24399.948 M Ave	24.3	+0.0 +0.0 +2.6 +0.0	+0.0 +0.0 +1.8	+0.0 +0.0 +9.7	+0.0 +0.0 -12.7	+0.0	25.7	54.0 Low	-28.3	Vert
^	24399.948 M	43.2	+0.0 +0.0 +2.6 +0.0	+0.0 +0.0 +1.8	+0.0 +0.0 +9.7	+0.0 +0.0 -12.7	+0.0	44.6	54.0 Low	-9.4	Vert

42	12299.760	30.6	+0.0	+1.0	+0.0	+6.9	+0.0	25.6	54.0	-28.4	Horiz
	M		+0.0	+0.0	+0.0	-12.9					
	Ave		+0.0	+0.0	+0.0	+0.0			High		
			+0.0								
^	12299.760	61.8	+0.0	+1.0	+0.0	+6.9	+0.0	56.8	54.0	+2.8	Horiz
	M		+0.0	+0.0	+0.0	-12.9					
			+0.0	+0.0	+0.0	+0.0			High		
			+0.0								
44	17079.867	25.8	+0.0	+1.3	+0.0	+9.0	+0.0	24.5	54.0	-29.5	Horiz
	M		+0.0	+0.0	+0.0	-11.6					
	Ave		+0.0	+0.0	+0.0	+0.0			Low		
			+0.0								
^	17079.900	40.0	+0.0	+1.3	+0.0	+9.0	+0.0	38.7	54.0	-15.3	Horiz
	M		+0.0	+0.0	+0.0	-11.6					
			+0.0	+0.0	+0.0	+0.0			Low		
			+0.0								
46	22050.138	26.9	+0.0	+0.0	+0.0	+0.0	+0.0	24.0	54.0	-30.0	Vert
	M		+0.0	+0.0	+0.0	+0.0					
	Ave		+2.5	+1.8	+8.9	-16.1			Mid		
			+0.0								
^	22050.138	43.7	+0.0	+0.0	+0.0	+0.0	+0.0	40.8	54.0	-13.2	Vert
	M		+0.0	+0.0	+0.0	+0.0					
			+2.5	+1.8	+8.9	-16.1			Mid		
			+0.0								
48	17149.933	25.5	+0.0	+1.2	+0.0	+8.9	+0.0	23.9	54.0	-30.1	Horiz
	M		+0.0	+0.0	+0.0	-11.7					
	Ave		+0.0	+0.0	+0.0	+0.0			Mid		
			+0.0								
49	17220.090	25.4	+0.0	+1.2	+0.0	+8.8	+0.0	23.8	54.0	-30.2	Horiz
	M		+0.0	+0.0	+0.0	-11.6					
	Ave		+0.0	+0.0	+0.0	+0.0			High		
			+0.0								
50	22139.928	26.6	+0.0	+0.0	+0.0	+0.0	+0.0	23.6	54.0	-30.4	Vert
	M		+0.0	+0.0	+0.0	+0.0					
	Ave		+2.5	+1.8	+8.9	-16.2			High		
			+0.0								
^	22139.928	45.2	+0.0	+0.0	+0.0	+0.0	+0.0	42.2	54.0	-11.8	Vert
	M		+0.0	+0.0	+0.0	+0.0					
			+2.5	+1.8	+8.9	-16.2			High		
			+0.0								
52	19600.064	23.9	+0.0	+0.0	+0.0	+0.0	+0.0	23.6	54.0	-30.4	Vert
	M		+0.0	+0.0	+0.0	+0.0					
	Ave		+2.3	+1.9	+8.5	-13.0			Mid		
			+0.0								
^	19600.064	39.4	+0.0	+0.0	+0.0	+0.0	+0.0	39.1	54.0	-14.9	Vert
	M		+0.0	+0.0	+0.0	+0.0					
			+2.3	+1.9	+8.5	-13.0			Mid		
			+0.0								

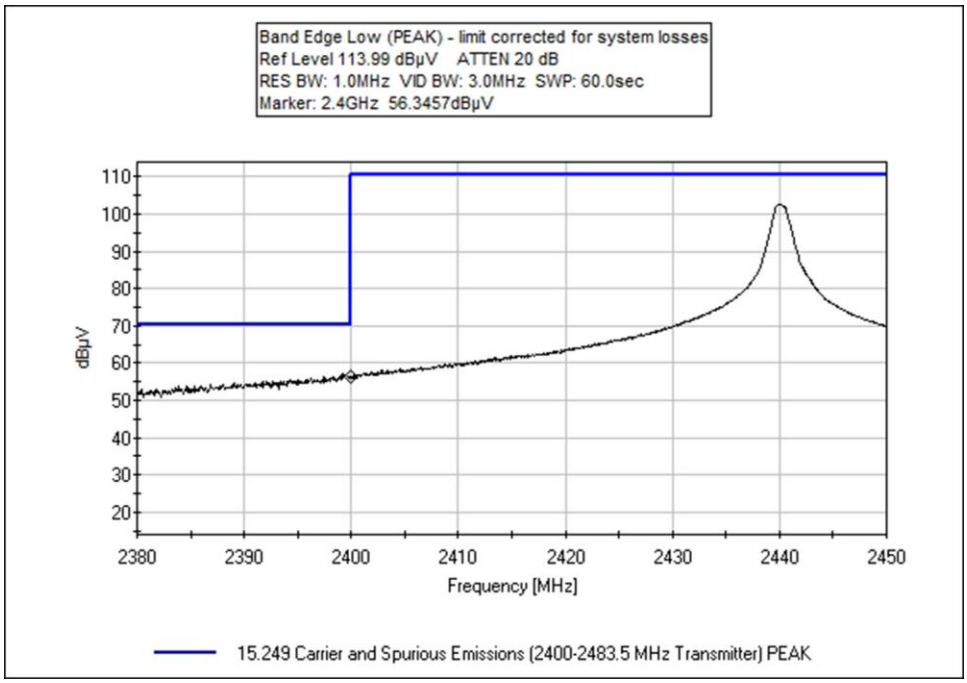
54	19680.010	23.5	+0.0	+0.0	+0.0	+0.0	+0.0	23.3	54.0	-30.7	Vert
	M		+0.0	+0.0	+0.0	+0.0					
	Ave		+2.3	+1.9	+8.5	-12.9			High		
			+0.0								
^	19680.010	39.1	+0.0	+0.0	+0.0	+0.0	+0.0	38.9	54.0	-15.1	Vert
	M		+0.0	+0.0	+0.0	+0.0					
			+2.3	+1.9	+8.5	-12.9			High		
			+0.0								
56	14639.950	29.1	+0.0	+0.5	+0.0	+8.2	+0.0	23.1	54.0	-30.9	Horiz
	M		+0.0	+0.0	+0.0	-14.7					
	Ave		+0.0	+0.0	+0.0	+0.0			Low		
			+0.0								
^	14639.950	54.9	+0.0	+0.5	+0.0	+8.2	+0.0	48.9	54.0	-5.1	Horiz
	M		+0.0	+0.0	+0.0	-14.7					
			+0.0	+0.0	+0.0	+0.0			Low		
			+0.0								
58	21960.006	25.7	+0.0	+0.0	+0.0	+0.0	+0.0	22.9	54.0	-31.1	Vert
	M		+0.0	+0.0	+0.0	+0.0					
	Ave		+2.5	+1.8	+8.9	-16.0			Low		
			+0.0								
^	21960.006	44.1	+0.0	+0.0	+0.0	+0.0	+0.0	41.3	54.0	-12.7	Vert
	M		+0.0	+0.0	+0.0	+0.0					
			+2.5	+1.8	+8.9	-16.0			Low		
			+0.0								
60	19519.864	22.0	+0.0	+0.0	+0.0	+0.0	+0.0	21.7	54.0	-32.3	Vert
	M		+0.0	+0.0	+0.0	+0.0					
	Ave		+2.3	+1.8	+8.5	-12.9			Low		
			+0.0								
^	19519.864	40.2	+0.0	+0.0	+0.0	+0.0	+0.0	39.9	54.0	-14.1	Vert
	M		+0.0	+0.0	+0.0	+0.0					
			+2.3	+1.8	+8.5	-12.9			Low		
			+0.0								
62	14700.200	27.4	+0.0	+0.5	+0.0	+8.3	+0.0	21.6	54.0	-32.4	Horiz
	M		+0.0	+0.0	+0.0	-14.6					
	Ave		+0.0	+0.0	+0.0	+0.0			Mid		
			+0.0								
^	14700.200	50.2	+0.0	+0.5	+0.0	+8.3	+0.0	44.4	54.0	-9.6	Horiz
	M		+0.0	+0.0	+0.0	-14.6					
			+0.0	+0.0	+0.0	+0.0			Mid		
			+0.0								
64	14760.120	26.8	+0.0	+0.4	+0.0	+8.4	+0.0	21.1	54.0	-32.9	Horiz
	M		+0.0	+0.0	+0.0	-14.5					
	Ave		+0.0	+0.0	+0.0	+0.0			High		
			+0.0								
^	14760.170	50.5	+0.0	+0.4	+0.0	+8.4	+0.0	44.8	54.0	-9.2	Horiz
	M		+0.0	+0.0	+0.0	-14.5					
			+0.0	+0.0	+0.0	+0.0			High		
			+0.0								
66	476.400k	40.0	+0.0	+0.0	+0.0	+0.0	-80.0	-30.3	14.0	-44.3	Para
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+9.7								

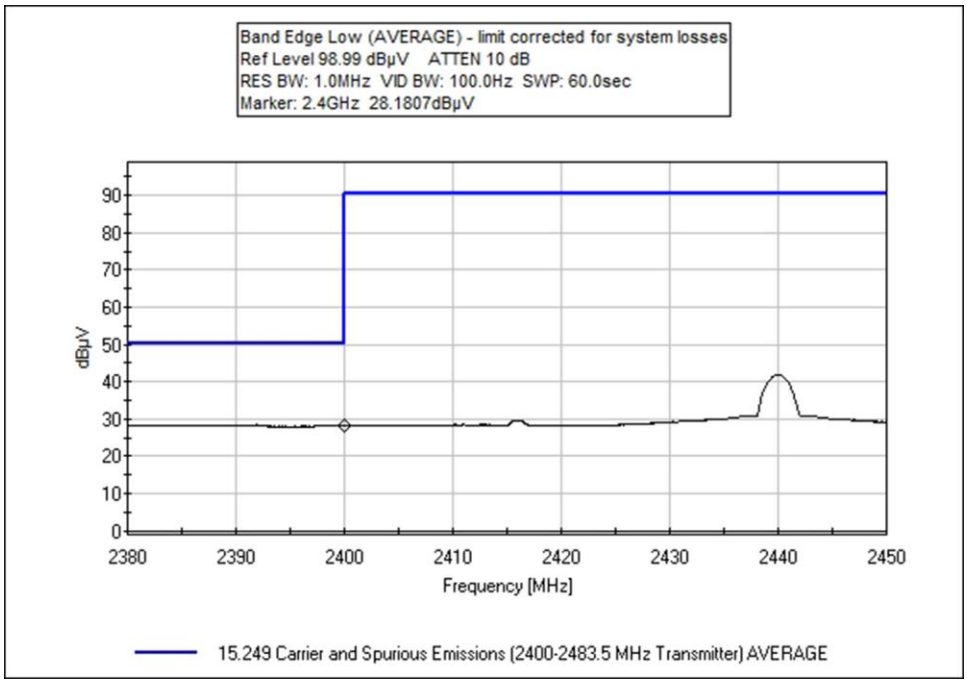
67	4.064M QP	13.2	+0.0 +0.0 +0.0 +9.7	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.1 +0.0 +0.0	-40.0	-17.0	29.5	-46.5	Perp
^	4.064M	20.6	+0.0 +0.0 +0.0 +9.7	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.1 +0.0 +0.0	-40.0	-9.6	29.5	-39.1	Perp
69	24.575M	14.2	+0.0 +0.0 +0.0 +7.1	+0.1 +0.0 +0.0	+0.0 +0.0 +0.0	+0.3 +0.0 +0.0	-40.0	-18.3	29.5	-47.8	Para
70	448.012k QP	35.5	+0.0 +0.0 +0.0 +9.7	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.1 +0.0 +0.0	-80.0	-34.7	14.6	-49.3	Para
71	18.075M	8.9	+0.0 +0.0 +0.0 +8.4	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.2 +0.0 +0.0	-40.0	-22.5	29.5	-52.0	Groun

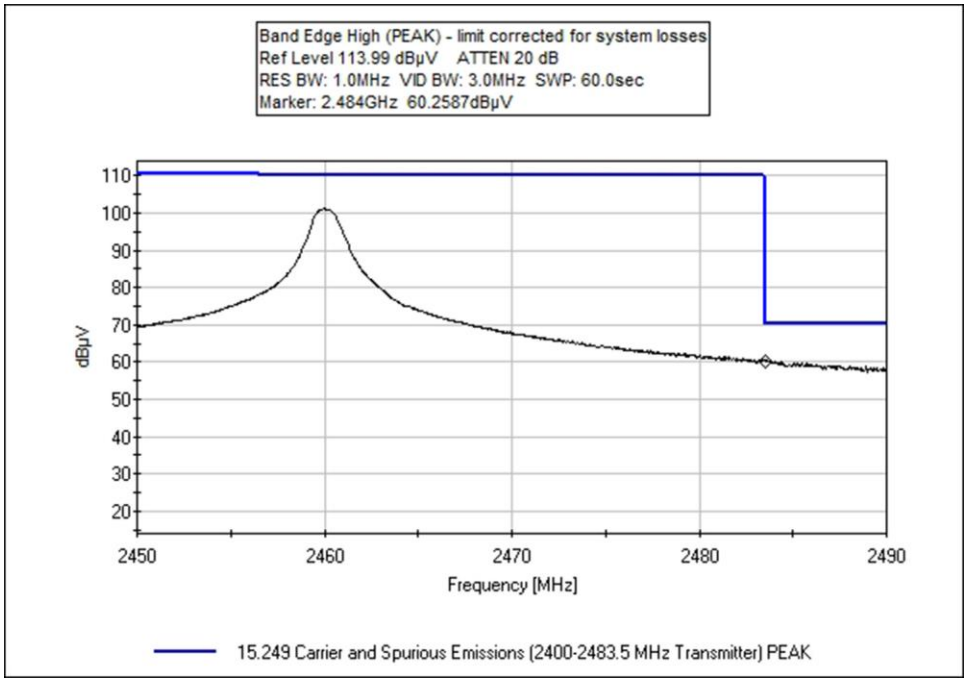
Band Edge

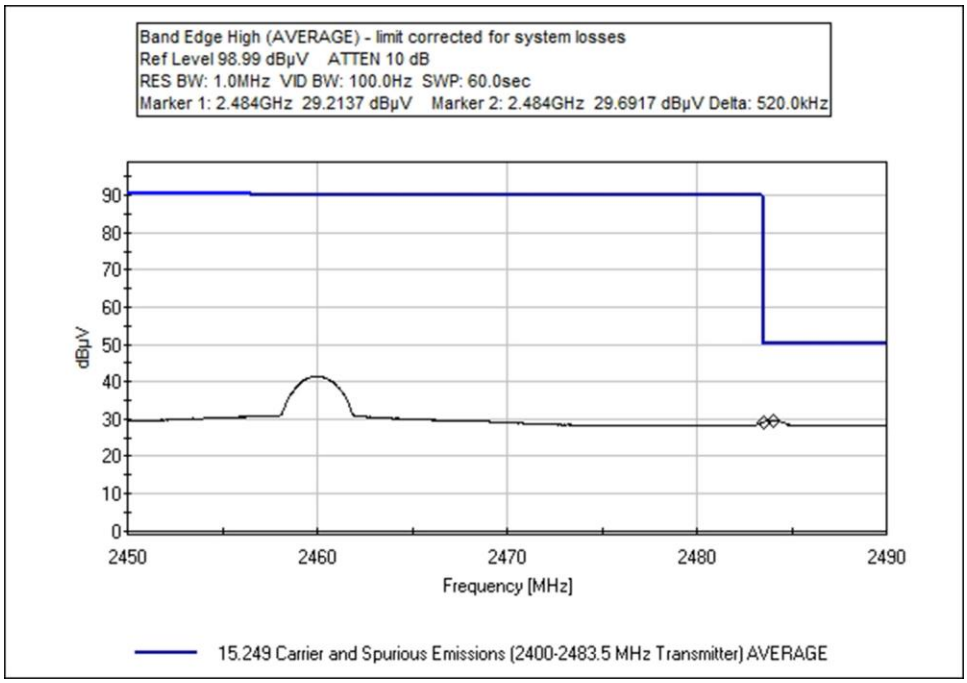
Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
2400.0 (Peak)	OOK	Integral Patch	59.9	<74	Pass
2400.0 (Average)	OOK	Integral Patch	31.8	<54	Pass
2483.5 (Peak)	OOK	Integral Patch	64.1	<74	Pass
2483.5 (Average)	OOK	Integral Patch	33.0	<54	Pass
2484.02 (Average)	OOK	Integral Patch	33.5	<54	Pass

Band Edge Plots




Band Edge Low (AVERAGE) - limit corrected for system losses
Ref Level 98.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 100.0Hz SWP: 60.0sec
Marker: 2.4GHz 28.1807dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
2380
2390
2400
2410
2420
2430
2440
2450
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) AVERAGE


Band Edge High (PEAK) - limit corrected for system losses
Ref Level 113.99 dBµV ATTEN 20 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 60.0sec
Marker: 2.484GHz 60.2587dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
2450
2460
2470
2480
2490
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) PEAK


Band Edge High (AVERAGE) - limit corrected for system losses
Ref Level 98.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 100.0Hz SWP: 60.0sec
Marker 1: 2.484GHz 29.2137 dBµV Marker 2: 2.484GHz 29.6917 dBµV Delta: 520.0kHz
dBµV
90
80
70
60
50
40
30
20
10
0
2450
2460
2470
2480
2490
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) AVERAGE

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:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) AVERAGE**		
Work Order #:	**102778**	Date:	6/24/2019
Test Type:	**Maximized Emissions**	Time:	11:51:18
Tested By:	Michael Atkinson	Sequence#:	11
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

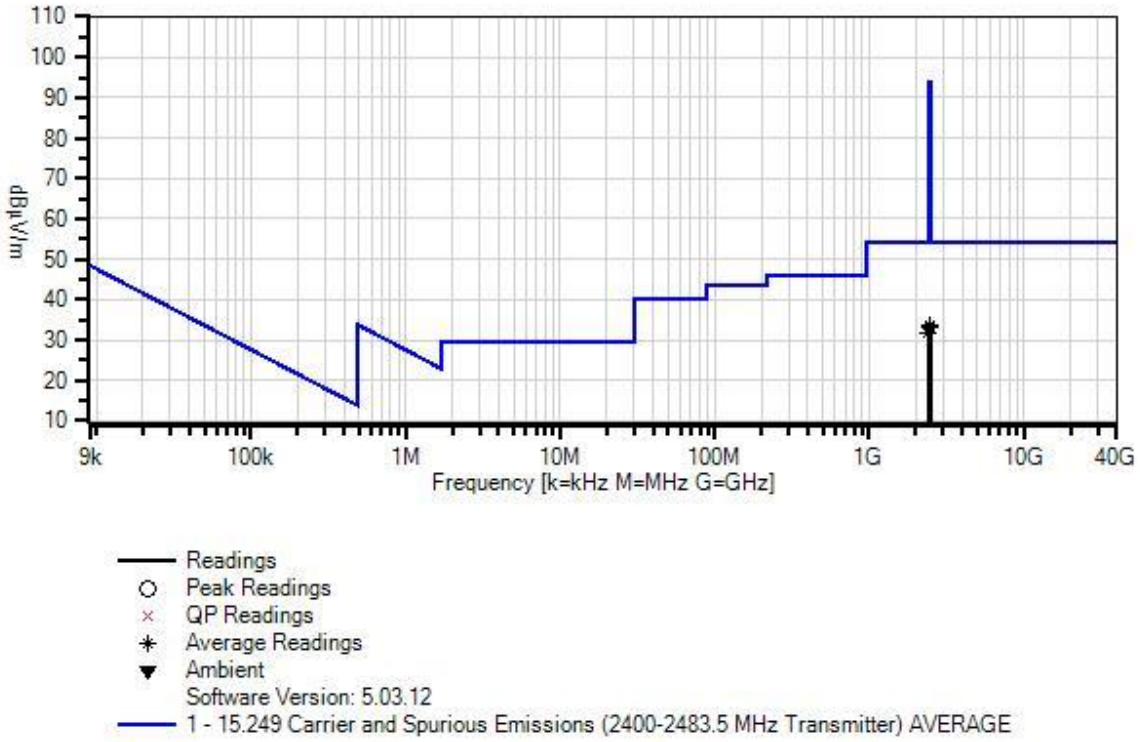
Test Conditions / Notes:

Temperature: 21-23°C
Humidity: 35-40%
Pressure: 101.5-103kPa

Test Method: ANSI 63.10 (2013)

EUT is continuously transmitting with a fresh battery installed.
Investigated L and H channels.
X, Y, & Z axes investigated, horizontal and vertical polarities investigated with worst case reported.

Ossia, Inc. WO#: 102778 Sequence#: 11 Date: 6/24/2019
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) AVERAGE Test Distance: 3 Meters Vert



Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.12
1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) AVERAGE

Test Equipment:

ID	Asset #/Serial #	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
	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
	AN02307	Preamp	8447D	1/15/2018	1/15/2020
	ANP05360	Cable	RG214	1/31/2018	1/31/2020
	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
	AN00851	Biconilog Antenna	CBL6111C	5/1/2018	5/1/2020
T3	ANP07226	Attenuator	PE7004-6	12/1/2017	12/1/2019
T4	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T5	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T6	ANP06503	Cable	32026-29801-29801-36	3/13/2018	3/13/2020
T7	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019

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	2484.020M	29.7	+0.0	+0.4	+5.8	+2.7	+0.0	33.5	54.0	-20.5	Vert
	Ave		-34.2	+1.0	+28.1						
2	2483.500M	29.2	+0.0	+0.4	+5.8	+2.7	+0.0	33.0	54.0	-21.0	Vert
	Ave		-34.2	+1.0	+28.1						
^	2483.500M	60.3	+0.0	+0.4	+5.8	+2.7	+0.0	64.1	74.0	-9.9	Vert
			-34.2	+1.0	+28.1						
4	2400.000M	28.2	+0.0	+0.4	+5.8	+2.6	+0.0	31.8	54.0	-22.2	Vert
	Ave		-34.3	+1.0	+28.1						
^	2400.000M	56.3	+0.0	+0.4	+5.8	+2.6	+0.0	59.9	74.0	-14.1	Vert
			-34.3	+1.0	+28.1						

Test Setup Photo(s)

Below 1 GHz

Above 1 GHz

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. Compliance is deemed to occur provided measurements are below the specified limits.

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.