# Ossia, Inc.

**REVISED TEST REPORT TO 102778-12** 

Cota Forever Tracker Client Model: Tracker Rx

**Tested to The Following Standards:** 

FCC Part 15 Subpart C Section(s)

15.247 (DTS 2400-2483.5 MHz)

Report No.: 102778-12A

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.

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**REPORT PREPARED FOR:** 

# **ADMINISTRATIVE INFORMATION**

## **Test Report Information**

**REPORT PREPARED BY:** 

Ossia, Inc.	Darcy Thompson
1100 112th Ave NE Suite 301	CKC Laboratories, Inc.
Bellevue WA 98004	5046 Sierra Pines Drive
	Mariposa, CA 95338
Representative: Bob McDonald	Project Number: 102778
Customer Reference Number: 13076	
DATE OF EQUIPMENT RECEIPT:	July 1, 2019
DATE(S) OF TESTING:	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) 15.247 (DTS 2400-2483.5 MHz)

**Revision A:** Changed NA2 definition for Summary of Results table. Added Conditions During Testing description with block diagram. Changed 15.247(b)(3) Output Power Test Data Summary - Voltage Variations description. Replaced the 15.247(e) Power Spectral Density data table. Added statement to test conditions for 15.247(d) Radiated Emissions & Band Edge. Replaced the 15.247 Radiated Band Edge plots and data.

## **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 -7 Bel

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**

<b>CKC Laboratories Proprietary Software</b>	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 - 15.247 (DTS)

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	Pass
15.247(b)(3)	Output Power	NA	Pass
15.247(e)	Power Spectral Density	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	NA1
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA2

NA = Not Applicable

NA1 = Not applicable because the EUT has an integral antenna.

NA2 = Not applicable because the manufacturer declares the EUT cannot transmit with the IEE802.15.4 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 beacon 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.

<b>Configuration 1</b>				
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
Type of Wideband System:	Zigbee 802.15.4
Operating Frequency Range:	2405-2480MHz
Modulation Type(s):	OQPSK
Maximum Duty Cycle:	100% tested as worst case
Number of TX Chains:	1
Antenna Type(s) and Gain:	Patch, 6dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral
Nominal Input Voltage:	Battery (3.7 VDC)
Firmware / Software used for Test:	0.17_TC8



# FCC Part 15 Subpart C

# 15.247(a)(2) 6dB Bandwidth

Test Setup/Conditions					
Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson		
Test Method:	ANSI C63.10 (2013), KDB 558074	Test Date(s):	7/1/2019		
	v05r02 (April 2, 2019)				
Configuration:	Configuration: 1				
Test Setup:	Test mode: Continuously Modulated				
The EUT is operating with a fresh battery installed. The EUT is set 1.5 meters high on Styrofoam table.					

Environmental Conditions				
Temperature ( <sup>o</sup> C)	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	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	06503 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						
FrequencyAntennaModulationMeasuredLi(MHz)Port(kHz)(kHz)(kHz)					Results		
2405	1	OQPSK	1611	≥500	Pass		
2440	1	OQPSK	1619	≥500	Pass		
2480	1	OQPSK	1600	≥500	Pass		



## Plot(s)



Low Channel



Middle Channel





High Channel



Test Setup Photo(s)



# 15.247(b)(3) Output Power

#### **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 Measurement						
Measuremen	nt Option: RBW >	DTS Bandwidth					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Field Strength (dBuV/m @3m)	Calculated EIRP (dBm)	Calculated Conducted Power (dBm)	Conducted Power Limit (dBm)	Results
2405	OQPSK	Integral / 6dBi	94.9	-0.33	-6.33	≤30	Pass
2440	OQPSK	Integral / 6dBi	95.1	-0.13	-6.13	≤30	Pass
2480	OQPSK	Integral / 6dBi	94.5	-0.73	-6.73	≤30	Pass

For fixed point-to-point antennas, the limit is calculated in accordance with 15.247(c)(1):  $Limit = 30 - Roundup\left(\frac{G-6}{3}\right)$ 

For directional beamforming antennas, the limit is calculated in accordance with 15.247(c)(2) and KDB 662911.

Conducted RF output power calculated in accordance with ANSI C63.10.

$$P(W) = \frac{(E \cdot d)^2}{30 \, G}$$

Or equivalently, in logarithmic form:

P(dBm) = E(dBuV/m) + 20LOG(d) - G - 104.77



#### Plots



#### Low Channel



Middle Channel





High Channel



## Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23	rd Drive SE, Suite A • Bothell,	WA 98021 • 1-800-500-4EMC (4362)
Customer:	Ossia, Inc.		
Specification:	15.247(b) Power Output (24	00-2483.5 MHz DTS)	
Work Order #:	102778	Date:	7/1/2019
Test Type:	Maximized Emissions	Time:	15:44:09
Tested By:	Michael Atkinson	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: 21-23°C				
Humidity: 35-40%				
Pressure: 101.5-103kPa				
Test Method: ANSI 63.10 (2 KDB 558074 v05r02 (April	2013) 2, 2019)			

Test mode: Continuously Modulated

The EUT is operating with a fresh battery installed.

The EUT is set 1.5 meters high on Styrofoam table.

X, Y, and Z axes investigated as well as horizontal and vertical antenna polarities investigated, worst case reported. Low, Mid, and High channels investigated.



Ossia, Inc. WO#: 102778 Sequence#: 13 Date: 7/1/2019 15.247(b) Power Output (2400-2483.5 MHz DTS) Test Distance: 3 Meters Vert





#### Test Equipment:

ID	Asset #	Description	Model	<b>Calibration Date</b>	Cal Due Date
	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T1	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
T2	ANP07226	Attenuator	PE7004-6	12/1/2017	12/1/2019
T3	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T4	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T5	ANP06503	Cable	32026-29801-	3/13/2018	3/13/2020
			29801-36		
T6	AN01467	Horn Antenna-ANSI	3115	7/21/2017	7/21/2019
		C63.5 Calibration			

Me	asu	rement Data:	Re	eading lis	ted by ma	argin.		Τe	est Distance	e: 3 Meters	•	
#	ŧ	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
				T5	T6							
		MHz	dBµV	dB	dB	dB	dB	Table	$dB\mu V/m$	$dB\mu V/m$	dB	Ant
	1	2440.390M	91.5	+0.4	+5.8	+2.6	-34.3	+0.0	95.1	131.2	-36.1	Vert
				+1.0	+28.1					Battery Po	wered	
	2	2405.390M	91.3	+0.4	+5.8	+2.6	-34.3	+0.0	94.9	131.2	-36.3	Vert
				+1.0	+28.1					Battery Po	wered	
	3	2479.478M	90.7	+0.4	+5.8	+2.7	-34.2	+0.0	94.5	131.2	-36.7	Vert
				+1.0	+28.1					Battery Po	wered	



## Test Setup Photo(s)





X Axis





Y Axis



Z Axis



# 15.247(e) Power Spectral Density

	Test Data Summary - Radiated Measurement								
Measuren	nent Method:	: PKPSD							
Frequency (MHz) Modulation Ant. Type / Gain (dBi) Non- corrected Value from Analyzer (dBuV) Correction Factors of measurement system (dB) Corrected Field Strength (dBuV/m @3m) Calculated (dBm/3kHz) Limit (dBm/3kHz) Resu Its									
2405	OQPSK	Integral / 6dBi	78.7	3.6	82.3	-18.9	≤8	Pass	
2440	OQPSK	Integral / 6dBi	78.6	3.6	82.2	-19.0	≤8	Pass	
2480	OQPSK	Integral / 6dBi	78.0	3.8	81.8	-19.4	≤8	Pass	

Conducted RF output power calculated in accordance with ANSI C63.10.

$$P(W) = \frac{(E \cdot d)^2}{30 \, G}$$

Or equivalently, in logarithmic form:

$$P(dBm) = E(dBuV/m) + 20LOG(d) - G - 104.77$$

Plots



Low Channel





#### Middle Channel



High Channel



## Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 221162	23rd Drive SE, Suite A • Bothell,	WA 98021 • 1-800-500-4EMC (4362)
Customer:	Ossia, Inc.		
Specification:	15.247(e) Peak Power Spec	ctral Density (2400-2483.5 MH	Hz DTS)
Work Order #:	102778	Date:	7/1/2019
Test Type:	Maximized Emissions	Time:	15:55:31
Tested By:	Michael Atkinson	Sequence#:	14
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) KDB 558074 v05r02 (April 2, 2019) Test mode: Continuously Modulated The EUT is operating with a fresh battery installed. The EUT is set 1.5 meters high on Styrofoam table. X, Y, and Z axes investigated as well as horizontal and vertical antenna polarities investigated, worst case reported. Low, Mid, and High channels investigated.



Ossia, Inc. WO#: 102778 Sequence#: 14 Date: 7/1/2019 15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS) Test Distance: 3 Meters Vert



- Readings

O Peak Readings

× QP Readings

\* Average Readings

Ambient

Software Version: 5.03.12

- 1 - 15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)



### Test Equipment:

ID	Asset #	Description	Model	<b>Calibration Date</b>	Cal Due Date
	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T1	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
T2	ANP07226	Attenuator	PE7004-6	12/1/2017	12/1/2019
Т3	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T4	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T5	ANP06503	Cable	32026-29801-	3/13/2018	3/13/2020
			29801-36		
T6	AN01467	Horn Antenna-ANSI	3115	7/21/2017	7/21/2019
		C63.5 Calibration			

Mea	surement Data:	Re	eading lis	ted by ma	argin.		Τe	est Distance	e: 3 Meters		
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6							
	MHz	dBµV	dB	dB	dB	dB	Table	$dB\mu V/m$	$dB\mu V/m$	dB	Ant
	1 2404.938M	78.7	+0.4	+5.8	+2.6	-34.3	+0.0	82.3	109.2	-26.9	Vert
			+1.0	+28.1							
	2 2439.935M	78.6	+0.4	+5.8	+2.6	-34.3	+0.0	82.2	109.2	-27.0	Vert
			+1.0	+28.1							
	3 2479.938M	78.0	+0.4	+5.8	+2.7	-34.2	+0.0	81.8	109.2	-27.4	Vert
			+1.0	+28.1							



## Test Setup Photo(s)





X Axis





Y Axis



Z Axis



# 15.247(d) Radiated Emissions & Band Edge

#### Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 221162	23rd Drive SE, Suite A • Bothell,	WA 98021 •	1-800-500-4EMC (4362)
Customer:	Ossia, Inc.			
Specification:	15.209 Radiated Emissions	5		
Work Order #:	102778	Date:	7/2/2019	
Test Type:	Maximized Emissions	Time:	11:08:01	
Tested By:	Michael Atkinson	Sequence#:	8	
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) KDB 558074 v05r02 (April 2, 2019)

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#: 8 Date: 7/2/2019 15.209 Radiated Emissions Test Distance: 3 Meters Various





#### Test Equipment:

ID	Asset #	Description	Model	<b>Calibration Date</b>	Cal Due Date
T1	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T2	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
Т3	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T4	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T5	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T6	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T7	AN00851	Biconilog Antenna	CBL6111C	5/1/2018	5/1/2020
T8	ANP07226	Attenuator	PE7004-6	12/1/2017	12/1/2019
Т9	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T10	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T11	ANP06503	Cable	32026-29801-	3/13/2018	3/13/2020
			29801-36		
T12	AN01467	Horn Antenna-ANSI	3115	7/21/2017	7/21/2019
		C63.5 Calibration			
T13	AN02741	Active Horn Antenna	AMFW-5F-	4/26/2019	4/26/2021
			12001800-20-		
			10P		
T14	AN03122	Cable	32026-2-29801-	3/13/2018	3/13/2020
			36		
T15	AN02742	Active Horn Antenna	AMFW-5F-	10/16/2018	10/16/2020
			18002650-20-		
			10P		
T16	ANP06678	Cable	32026-29801-	3/13/2018	3/13/2020
			29801-144		
T17	AN02763-69	Waveguide	Multiple	4/23/2018	4/23/2020
T18	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020

Meas	surement Data:	R	Reading listed by margin.				Te	est Distance	e: 3 Meters		
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7	T8					
			T9	T10	T11	T12					
			T13	T14	T15	T16					
			T17	T18							
	MHz	dBµV	dB	dB	dB	dB	Table	$dB\mu V/m$	$dB\mu V/m$	dB	Ant
	1 2630.000M	39.6	+0.0	+0.5	+0.0	+0.0	+0.0	43.9	54.0	-10.1	Horiz
			+0.0	+0.0	+0.0	+5.8					
			+2.6	-34.2	+1.1	+28.5					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0							
	2 368.500M	38.2	+0.0	+0.2	+1.0	-27.4	+0.0	34.3	46.0	-11.7	Horiz
			+1.1	+5.8	+15.4	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0							



2 71 700M	29.4		+0.1	+0.4	27.0		22.6	40.0	16.4	Horiz
5 /1./00M	30.4	+0.0	+0.1	+0.4	-27.9	+0.0	25.0	40.0	-10.4	HOUL
		+0.3	+0.0	+0.3	$\pm 0.0$					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0	10.0	10.0					
1 457 800M	20.4	+0.0	+0.2	±1.1	27.0	+0.0	27.2	46.0	18.8	Vort
4 457.00000	29.4	+0.0 $\pm1.3$	+0.2 +5.8	$^{+1.1}$	-27.9 ±0.0	+0.0	21.2	40.0	-10.0	VCIT
		+1.5	+0.0	+17.5	+0.0					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0	10.0	10.0					
5 4959.040M	24.1	+0.0	+0.5	+0.0	+0.0	+0.0	35.1	54.0	-18.9	Horiz
Ave		+0.0	+0.0	+0.0	+5.8		0011	High	1019	110112
		+4.2	-33.6	+1.6	+32.5			8		
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
^ 4959.040M	34.9	+0.0	+0.5	+0.0	+0.0	+0.0	45.9	54.0	-8.1	Horiz
		+0.0	+0.0	+0.0	+5.8			High		
		+4.2	-33.6	+1.6	+32.5			•		
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
7 12397.420	39.8	+0.0	+1.1	+0.0	+0.0	+0.0	34.9	54.0	-19.1	Horiz
М		+0.0	+0.0	+0.0	+0.0					
		+7.0	+0.0	+0.0	+0.0			High		
		-13.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
8 4881.108M	23.9	+0.0	+0.5	+0.0	+0.0	+0.0	34.8	54.0	-19.2	Vert
Ave		+0.0	+0.0	+0.0	+5.8			Mid		
		+4.2	-33.6	+1.6	+32.4					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
9 4808.960M	24.0	+0.0	+0.5	+0.0	+0.0	+0.0	34.7	54.0	-19.3	Vert
Ave		+0.0	+0.0	+0.0	+5.9			Low		
		+4.1	-33.6	+1.5	+32.3					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
^ 4808.960M	34.9	+0.0	+0.5	+0.0	+0.0	+0.0	45.6	54.0	-8.4	Vert
		+0.0	+0.0	+0.0	+5.9			Low		
		+4.1	-33.6	+1.5	+32.3					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							



11 12397.380	39.5	+0.0	+1.1	+0.0	+0.0	+0.0	34.6	54.0	-19.4	Vert
М		+0.0	+0.0	+0.0	+0.0					
		+7.0	+0.0	+0.0	+0.0			High		
		-13.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
12 780.800M	22.9	+0.0	+0.3	+1.5	-27.8	+0.0	26.6	46.0	-19.4	Vert
QP		+1.8	+5.8	+22.1	+0.0					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
^ 780.800M	28.9	+0.0	+0.3	+1.5	-27.8	+0.0	32.6	46.0	-13.4	Vert
		+1.8	+5.8	+22.1	+0.0					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0	+0.0	+0.0					
14 4001.04014	22.5	+0.0	+0.0	.0.0	.0.0	.0.0	24.4	54.0	10.6	
14 4881.040M	23.5	+0.0	+0.5	+0.0	+0.0	+0.0	34.4	54.0 M:4	-19.6	Horiz
Ave		+0.0	+0.0	+0.0	+5.8			MIA		
		+4.2	-55.0	+1.0	+32.4					
		+0.0	+0.0	+0.0	+0.0					
A 4881 040M	34.6	+0.0	+0.0				45.5	54.0	8 5	Uoriz
4001.040101	54.0	+0.0	+0.3	+0.0	+0.0	$\pm 0.0$	45.5	Mid	-0.5	TIOTIZ
		$^{+0.0}_{+4.2}$	-33 6	+0.0	+32.0			WIIG		
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0	10.0	10.0					
16 4959.220M	22.5	+0.0	+0.5	+0.0	+0.0	+0.0	33.5	54.0	-20.5	Vert
Ave		+0.0	+0.0	+0.0	+5.8			High		
		+4.2	-33.6	+1.6	+32.5			0		
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
^ 4959.220M	34.7	+0.0	+0.5	+0.0	+0.0	+0.0	45.7	54.0	-8.3	Vert
		+0.0	+0.0	+0.0	+5.8			High		
		+4.2	-33.6	+1.6	+32.5					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
18 4810.877M	22.5	+0.0	+0.5	+0.0	+0.0	+0.0	33.2	54.0	-20.8	Horiz
Ave		+0.0	+0.0	+0.0	+5.9			Low		
		+4.1	-33.6	+1.5	+32.3					
		+0.0	+0.0	+0.0	+0.0					
	<b>a</b> · -	+0.0	+0.0			0.7				
^ 4810.900M	34.8	+0.0	+0.5	+0.0	+0.0	+0.0	45.5	54.0	-8.5	Horiz
		+0.0	+0.0	+0.0	+5.9			Low		
		+4.1	-33.6	+1.5	+32.3					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							



20 516.000M	23.3	+0.0	+0.3	+1.2	-28.2	+0.0	22.2	46.0	-23.8	Horiz
QP		+1.4	+5.8	+18.4	+0.0					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
^ 516.000M	38.3	+0.0	+0.3	+1.2	-28.2	+0.0	37.2	46.0	-8.8	Horiz
		+1.4	+5.8	+18.4	+0.0					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
22 12022.533	33.7	+0.0	+1.0	+0.0	+0.0	+0.0	28.5	54.0	-25.5	Horiz
М		+0.0	+0.0	+0.0	+0.0			-		
Ave		+6.8	+0.0	+0.0	+0.0			Low		
		-13.0	+0.0	+0.0	+0.0					
10000 500		+0.0	+0.0	0.0	0.0	0.0	20.2		14.0	** •
^ 12022.533	44.4	+0.0	+1.0	+0.0	+0.0	+0.0	39.2	54.0	-14.8	Horiz
М		+0.0	+0.0	+0.0	+0.0			×		
		+6.8	+0.0	+0.0	+0.0			Low		
		-13.0	+0.0	+0.0	+0.0					
24 12107 450	21.5	+0.0	+0.0	.0.0	.0.0	. 0. 0	26.6	54.0	27.4	
24 12197.450	31.5	+0.0	+1.0	+0.0	+0.0	+0.0	26.6	54.0	-27.4	Horiz
M		+0.0	+0.0	+0.0	+0.0			M: J		
Ave		+0.9	+0.0	+0.0	+0.0			Mid		
		-12.8	+0.0	+0.0	+0.0					
25 12107 520	20.4	+0.0	+0.0	.7.1	.0.0	.0.0	25.7	54.0	20.2	II!
25 12197.530	30.4	+0.0	+1.0	+/.1	+0.0	+0.0	25.7	54.0	-28.3	Horiz
NI A		+0.0	+0.0	+0.0	+0.0			M: J	-1	
Ave		+0.0	+0.0	+0.0	+0.0			Mid, while	charging	
		+0.0	$^{+0.0}_{+0.0}$	$\pm 0.0$	+0.0					
^ 12197.450	41.7	+0.0	+1.0	+0.0	+0.0	+0.0	36.8	54.0	-17.2	Horiz
М		+0.0	+0.0	+0.0	+0.0					
		+6.9	+0.0	+0.0	+0.0			Mid		
		-12.8	+0.0	+0.0	+0.0					
		+0.0	+0.0							
^ 12197.530	40.1	+0.0	+1.0	+7.1	+0.0	+0.0	35.4	54.0	-18.6	Horiz
М		+0.0	+0.0	+0.0	+0.0					
		+0.0	+0.0	+0.0	+0.0			Mid, while	charging	
		-12.8	+0.0	+0.0	+0.0					
		+0.0	+0.0							
28 12397.550	30.5	+0.0	+1.1	+0.0	+0.0	+0.0	25.6	54.0	-28.4	Horiz
М		+0.0	+0.0	+0.0	+0.0					
Ave		+7.0	+0.0	+0.0	+0.0			High		
		-13.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							
29 12397.510	30.0	+0.0	+1.1	+0.0	+0.0	+0.0	25.1	54.0	-28.9	Vert
М		+0.0	+0.0	+0.0	+0.0					
Ave		+7.0	+0.0	+0.0	+0.0			High		
		-13.0	+0.0	+0.0	+0.0					
		+0.0	+0.0							



30	20016.000	23.7	+0.0	+0.0	+0.0	+0.0	+0.0	23.7	54.0	-30.3	Vert
	М		+0.0	+0.0	+0.0	+0.0					
	Ave		+0.0	+0.0	+0.0	+0.0					
			+0.0	+2.3	-13.1	+8.6					
			+2.2	+0.0							
^	20016.000	36.7	+0.0	+0.0	+0.0	+0.0	+0.0	36.7	54.0	-17.3	Vert
	Μ		+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+2.3	-13.1	+8.6					
			+2.2	+0.0							
32	12.380M	10.9	+0.0	+0.0	+0.0	+0.0	-40.0	-19.8	29.5	-49.3	Perp
			+0.0	+0.0	+0.0	+0.0					
			+0.2	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+9.1							
33	10.200M	10.2	+0.0	+0.0	+0.0	+0.0	-40.0	-20.4	29.5	-49.9	Groun
			+0.0	+0.0	+0.0	+0.0					
			+0.2	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+9.2							
34	6.418M	9.6	+0.0	+0.0	+0.0	+0.0	-40.0	-20.8	29.5	-50.3	Para
	QP		+0.0	+0.0	+0.0	+0.0					
			+0.1	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+9.5							
^	6.418M	15.3	+0.0	+0.0	+0.0	+0.0	-40.0	-15.1	29.5	-44.6	Para
			+0.0	+0.0	+0.0	+0.0					
			+0.1	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+9.5							
36	24.400M	10.1	+0.0	+0.1	+0.0	+0.0	-40.0	-22.4	29.5	-51.9	Groun
			+0.0	+0.0	+0.0	+0.0					
			+0.3	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+7.1							



## Band Edge

	Band Edge Summary										
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results						
2390.0 (Peak)	OQPSK	Patch/6dBi	49.2	<74	Pass						
2390.0 (Average)	OQPSK	Patch/6dBi	36.7	<54	Pass						
2400.0 (Peak)	OQPSK	Patch/6dBi	51.9	<96	Pass						
2400.0 (Average)	OQPSK	Patch/6dBi	41.5	<76	Pass						
2483.5 (Peak)	OQPSK	Patch/6dBi	60.8	<74	Pass						
2483.5 (Average)	OQPSK	Patch/6dBi	52.7	<54	Pass						

## **Band Edge Plots**

















## Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Dr	ive SE, Suite A • Bothell, V	WA 98021 •	1-800-500-4EMC (4362)
Customer:	Ossia, Inc.			
Specification:	15.247(d) / 15.209 Radiated Spur	ious Emissions (AVERA	AGE)	
Work Order #:	102778	Date:	7/1/2019	
Test Type:	Maximized Emissions	Time:	08:47:51	
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 fresh battery installed. Investigated L and H channels, EUT is investigated in X, Y, & Z Axis, horizontal and vertical polarities investigated with worst case reported.



Ossia, Inc. WO#: 102778 Sequence#: 12 Date: 7/1/2019 15.247(d) / 15.209 Radiated Spurious Emissions (AVERAGE) Test Distance: 3 Meters Vert





#### Test Equipment:

ID	Asset #/Serial	Description	Model	Calibration	Cal Due
	#			Date	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
Т3	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
Т7	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019

Meas	urement Data:	Re	Reading listed by margin. Test Distance: 3 Meters								
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7						
	MHz	dBµV	dB	dB	dB	dB	Table	$dB\mu V/m$	$dB\mu V/m$	dB	Ant
1	2483.500M	48.9	+0.0	+0.4	+5.8	+2.7	+0.0	52.7	54.0	-1.3	Vert
	Ave		-34.2	+1.0	+28.1						
^	2483.500M	57.0	+0.0	+0.4	+5.8	+2.7	+0.0	60.8	74.0	-13.2	Vert
			-34.2	+1.0	+28.1						
3	2400.000M	37.9	+0.0	+0.4	+5.8	+2.6	+0.0	41.5	54.0	-12.5	Vert
	Ave		-34.3	+1.0	+28.1						
^	2400.000M	48.3	+0.0	+0.4	+5.8	+2.6	+0.0	51.9	74.0	-22.1	Vert
			-34.3	+1.0	+28.1						
5	5 2390.000M	33.1	+0.0	+0.4	+5.8	+2.6	+0.0	36.7	54.0	-17.3	Vert
	Ave		-34.3	+1.0	+28.1						
^	2390.000M	45.6	+0.0	+0.4	+5.8	+2.6	+0.0	49.2	74.0	-24.8	Vert
			-34.3	+1.0	+28.1						



## 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. 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 dB $\mu$ V/m, the spectrum analyzer reading in dB $\mu$ V 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.