

# Tonal

## TEST REPORT FOR

### Bar Control\*

**Model: 110-0013\***

**\*(See Appendix A for Manufacturer's Declaration)**

**Tested to The Following Standards:**

**FCC Part 15 Subpart C Section(s)**

**15.207 & 15.247  
(DTS 2400-2483.5 MHz)**

**Report No.: 104296-4**

**Date of issue: October 22, 2020**



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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## TABLE OF CONTENTS

Administrative Information .....	3
Test Report Information .....	3
Report Authorization .....	3
Test Facility Information .....	4
Software Versions .....	4
Site Registration & Accreditation Information .....	4
Summary of Results .....	5
Modifications During Testing .....	5
Conditions During Testing .....	5
Equipment Under Test .....	6
General Product Information .....	6
FCC Part 15 Subpart C .....	11
15.247(a)(2) 6dB Bandwidth .....	11
15.247(b)(3) Output Power .....	15
15.247(e) Power Spectral Density .....	19
15.247(d) RF Conducted Emissions & Band Edge .....	23
15.247(d) Radiated Emissions & Band Edge .....	35
15.207 AC Conducted Emissions .....	61
Appendix A: Manufacturer Declaration .....	69
Supplemental Information .....	70
Measurement Uncertainty .....	70
Emissions Test Details .....	70



## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

Tonal  
325 Vermont Street  
San Francisco CA 94103

Representative: Nate Pickslay  
Customer Reference Number: PO693

**REPORT PREPARED BY:**

Terri Rayle  
CKC Laboratories, Inc.  
5046 Sierra Pines Drive  
Mariposa, CA 95338

Project Number: 104296

**DATE OF EQUIPMENT RECEIPT:**  
**DATE(S) OF TESTING:**

September 29, 2020  
September 29-30, 2020

### 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.  
1120 Fulton Place  
Fremont, CA 94539

## Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.19

## 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	Pass
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	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

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

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 Name	Manufacturer	Model #	S/N
Bar Control*	Tonal	110-00013*	020000004

\*= See Appendix A for Manufacturer Statement

**Support Equipment:**

Device Name	Manufacturer	Model #	S/N
Laptop	Apple	MacBook Pro A1278	C1MMF2KDDV30
Laptop Power Supply	Apple	ADP-60AD T	E131881

### Configuration 2

**Equipment Tested:**

Device Name	Manufacturer	Model #	S/N
Bar Control*	Tonal	110-00013*	020000327

\*= See Appendix A for Manufacturer Statement

**Support Equipment:**

Device Name	Manufacturer	Model #	S/N
Laptop	Apple	MacBook Pro A1278	C1MMF2KDDV30
Laptop Power Supply	Apple	ADP-60AD T	E131881

## General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Bluetooth
Operating Frequency Range:	2402-2480MHz
Modulation Type(s):	GFSK
Maximum Duty Cycle:	100%
Number of TX Chains:	1
Antenna Type(s) and Gain:	1.5dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral
Nominal Input Voltage:	5VDC from the laptop
Software used for Test:	Putty version 0.74



**EUT and Accessory Photo(s)**



**Support Equipment Photo(s)**



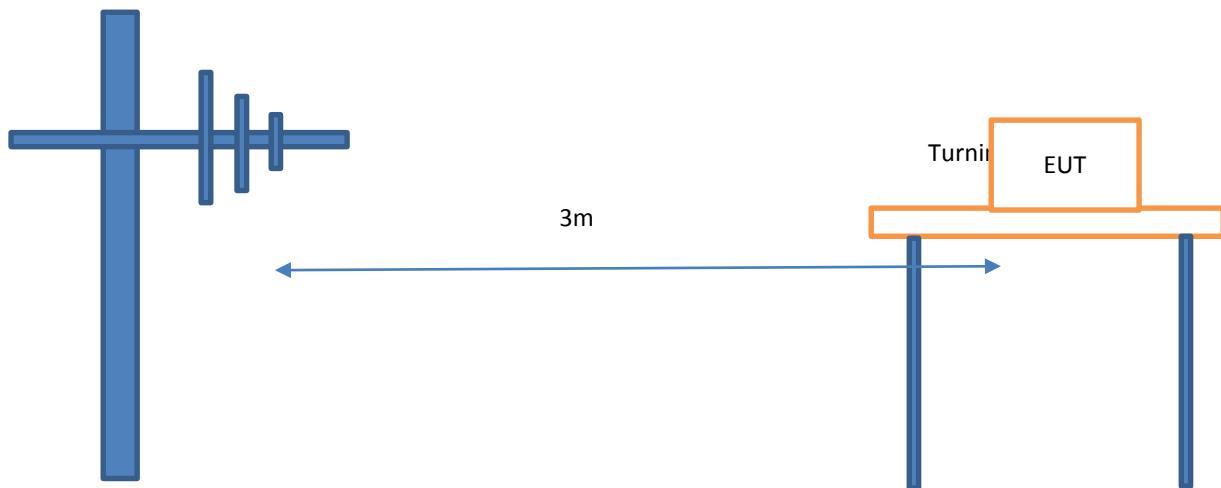
Laptop



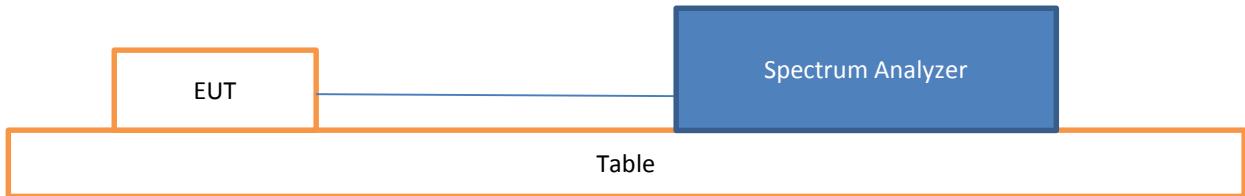
AC/DC Adapter for Laptop

## Block Diagram of Test Setup(s)

Radiated Method Setup



Conducted Method Setup



## FCC Part 15 Subpart C

### 15.247(a)(2) 6dB Bandwidth

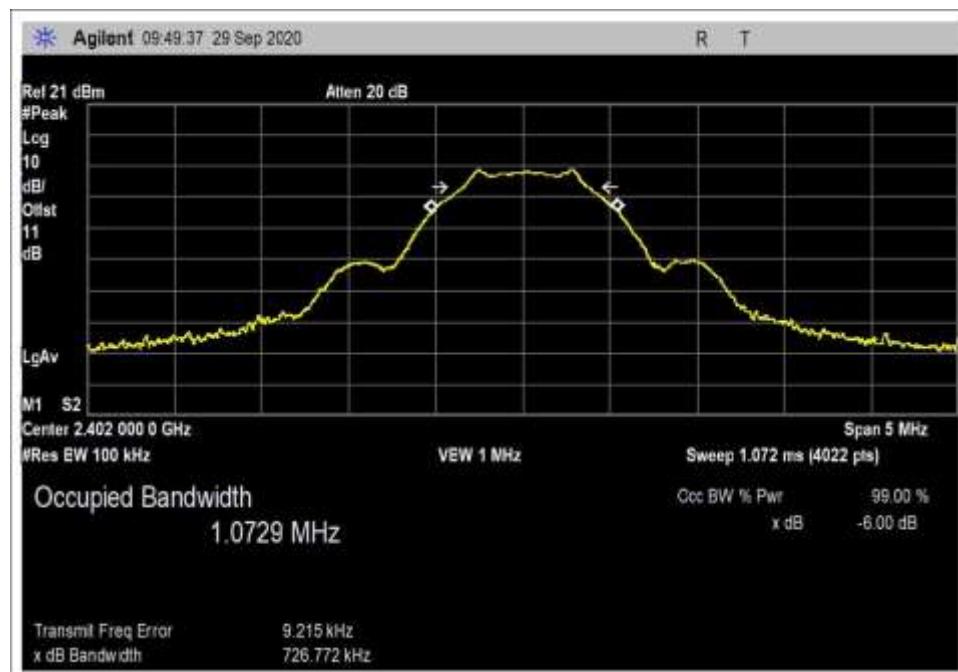
Test Setup/Conditions			
Test Location:	Fremont Lab C3	Test Engineer:	Hoang Cao/Hieu Song Nguyenpham
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 v05r02 04/02/2019	Test Date(s):	9/29/2020
Configuration:	1		
Test Setup:	The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer. The EUT is powered from the laptop which it sits next to.		

Environmental Conditions			
Temperature (°C)	22.9	Relative Humidity (%):	43

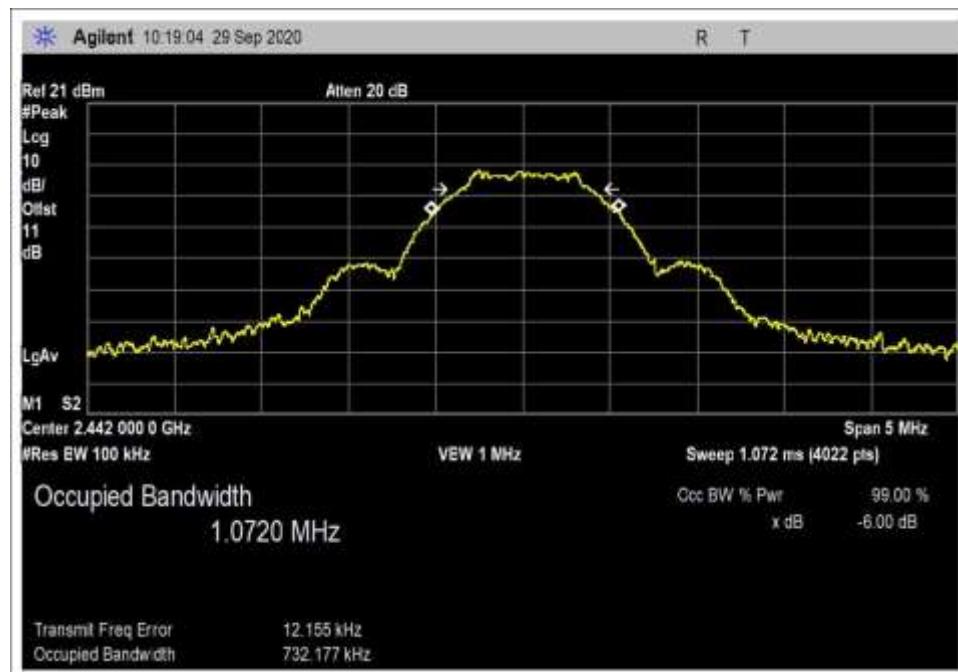
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
P05411	Attenuator	Weinschel	54A-10	11/27/2019	11/27/2021
P06904	Cable	Astrolab	32022-29094K-29094K-36TC	1/7/2020	1/7/2022
02668	Spectrum Analyzer	Agilent	E4446A	12/17/2019	12/17/2020

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2402	1	GFSK	726.772	≥500	Pass
2442	1	GFSK	732.177	≥500	Pass
2480	1	GFSK	733.158	≥500	Pass

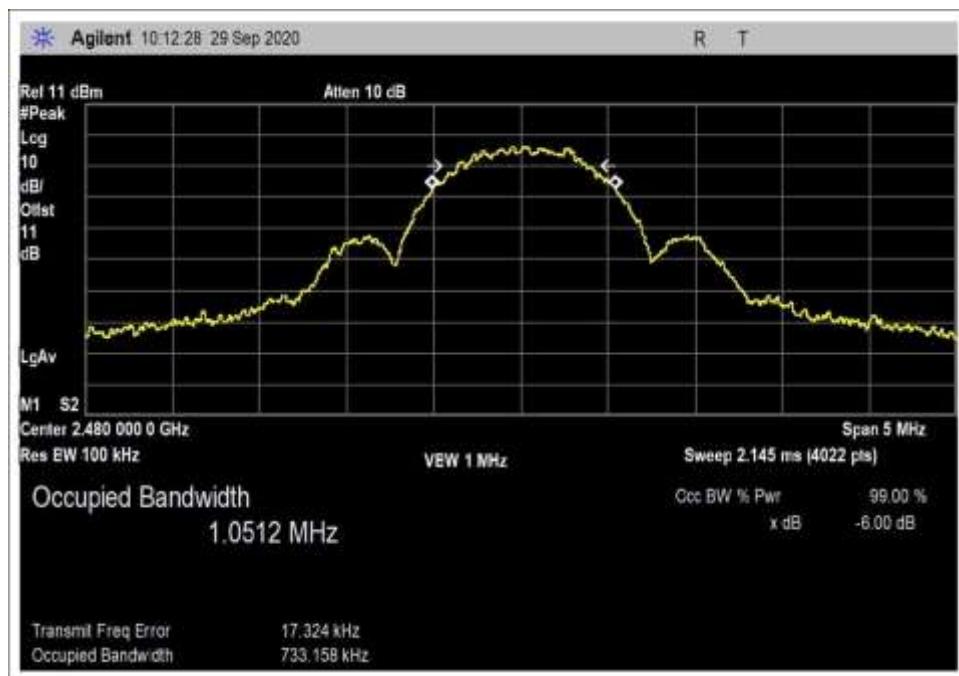
## Plot(s)



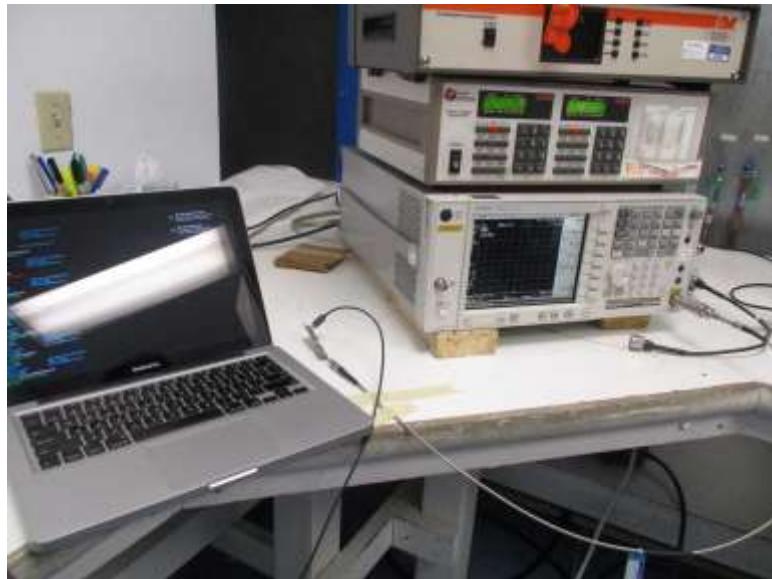
Low Channel



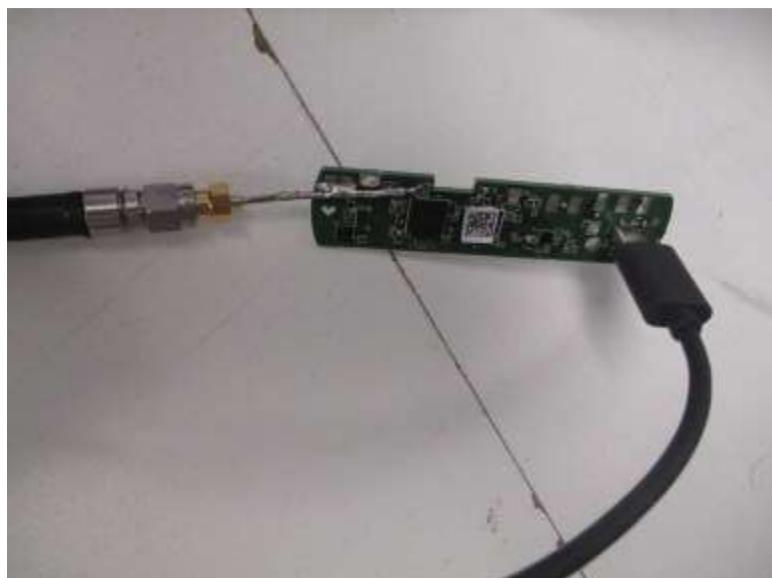
Middle Channel



**Test Setup Photo(s)**



Test Setup



Test Setup Close-up

## 15.247(b)(3) Output Power

Test Setup/Conditions			
Test Location:	Fremont Lab C3	Test Engineer:	Hoang Cao/Hieu Song Nguyenpham
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 v05r02 04/02/2019	Test Date(s):	9/29/2020
Configuration:	1		
Test Setup:	The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer. The EUT is powered from the laptop which it sits next to.		

Environmental Conditions			
Temperature (°C)	22.9	Relative Humidity (%):	43

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
P05411	Attenuator	Weinschel	54A-10	11/27/2019	11/27/2021
P06904	Cable	Astrolab	32022-29094K-29094K-36TC	1/7/2020	1/7/2022
02668	Spectrum Analyzer	Agilent	E4446A	12/17/2019	12/17/2020

### Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed with the device powered from the USB port of a laptop to simulate a fresh battery.

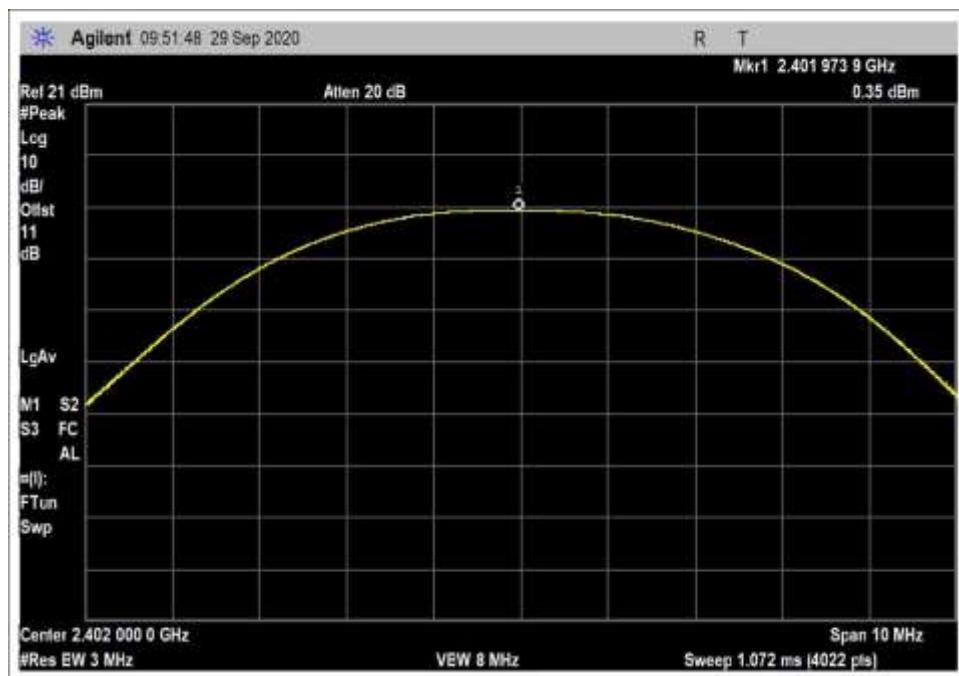
RF Conducted Measurement					
Measurement Option: RBW > DTS Bandwidth					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2402	GFSK	Integral/1.5	0.35	≤30	Pass
2440	GFSK	Integral/1.5	0.06	≤30	Pass
2480	GFSK	Integral/1.5	-0.14	≤30	Pass

For fixed point-to-point antennas, the limit is calculated in accordance with 15.247(c)(1):

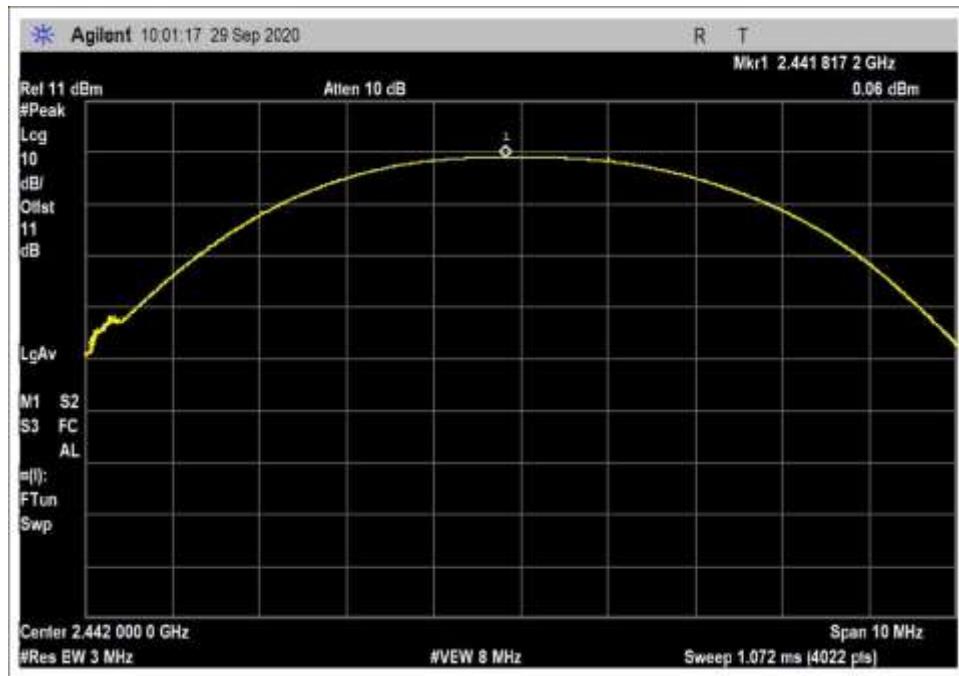
$$Limit = 30 - Roundup\left(\frac{G-6}{3}\right)$$

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

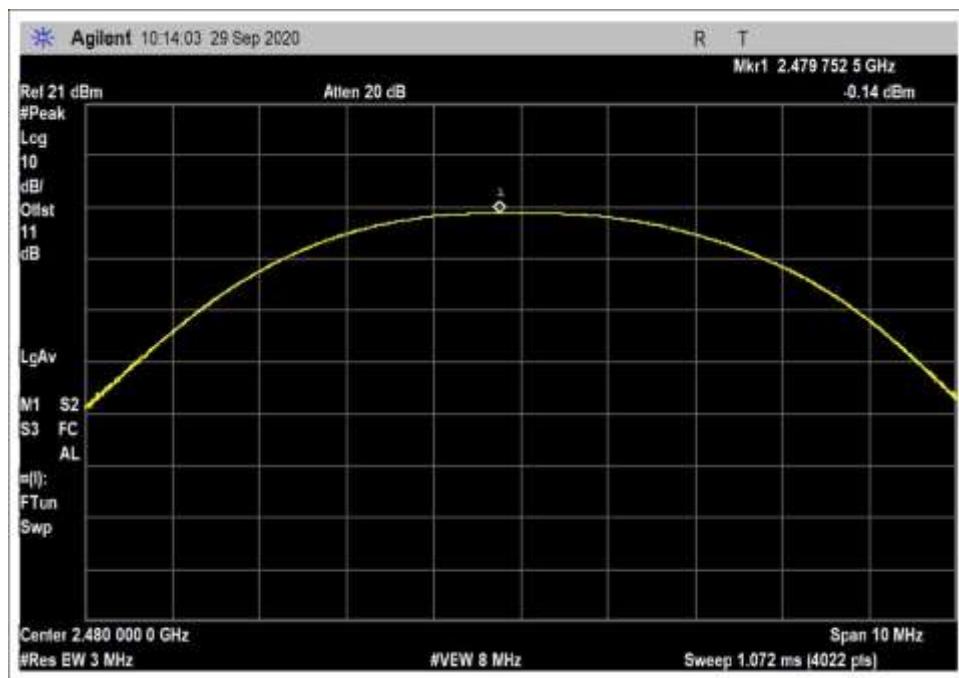
## Plots



Low Channel

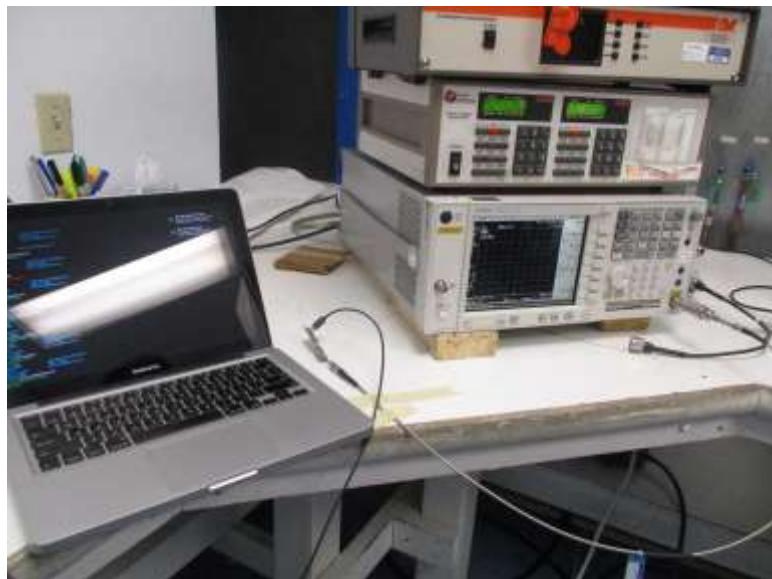


Middle Channel



High Channel

**Test Setup Photo(s)**



Test Setup



Test Setup Close-up

## 15.247(e) Power Spectral Density

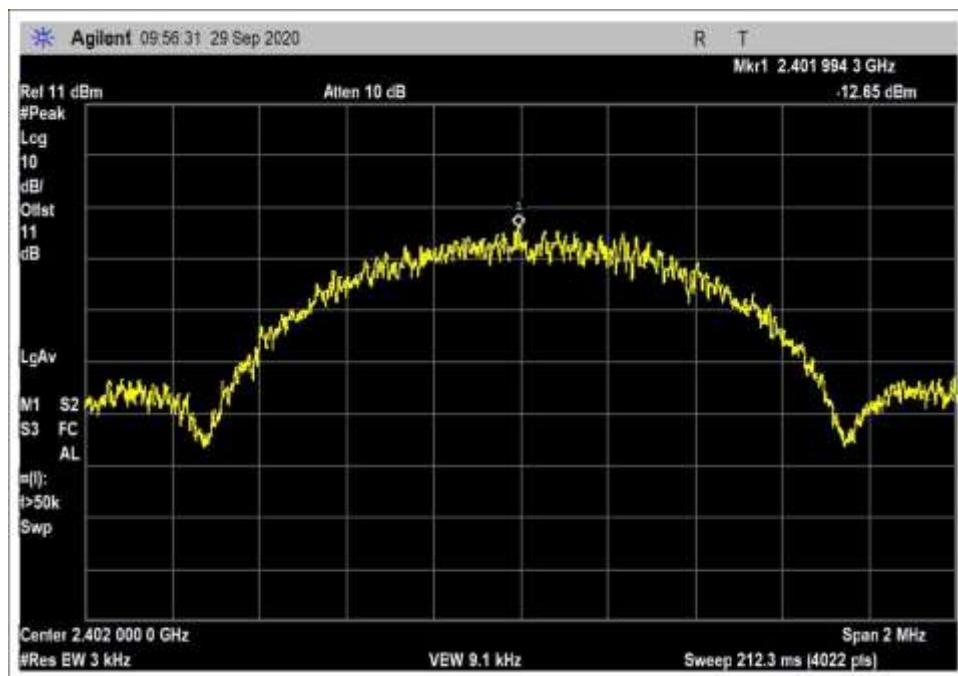
Test Setup/Conditions			
Test Location:	Fremont Lab C3	Test Engineer:	Hoang Cao/Hieu Song Nguyenpham
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 v05r02 04/02/2019	Test Date(s):	9/29/2020
Configuration:	1		
Test Setup:	The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer. The EUT is powered from the laptop which it sits next to.		

Environmental Conditions			
Temperature (°C)	22.9	Relative Humidity (%):	43

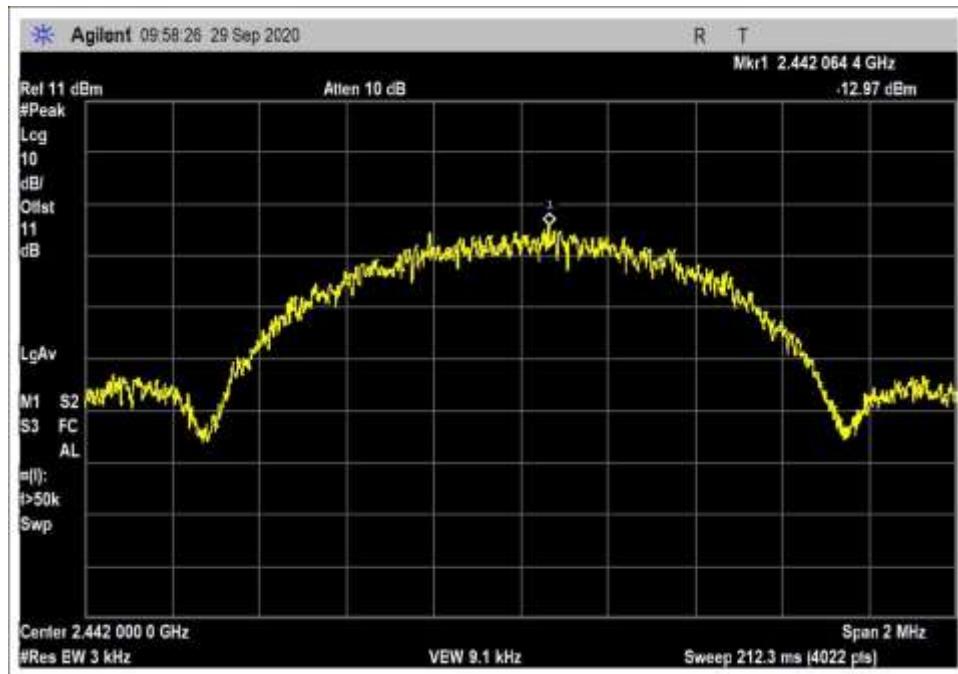
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
P05411	Attenuator	Weinschel	54A-10	11/27/2019	11/27/2021
P06904	Cable	Astrolab	32022-29094K-29094K-36TC	1/7/2020	1/7/2022
02668	Spectrum Analyzer	Agilent	E4446A	12/17/2019	12/17/2020

Test Data Summary - RF Conducted Measurement				
Measurement Method: PKPSD				
Frequency (MHz)	Modulation	Measured (dBm/3kHz)	Limit (dBm/3kHz)	Results
2402	GFSK	-12.65	≤8	Pass
2440	GFSK	-12.97	≤8	Pass
2480	GFSK	-13.41	≤8	Pass

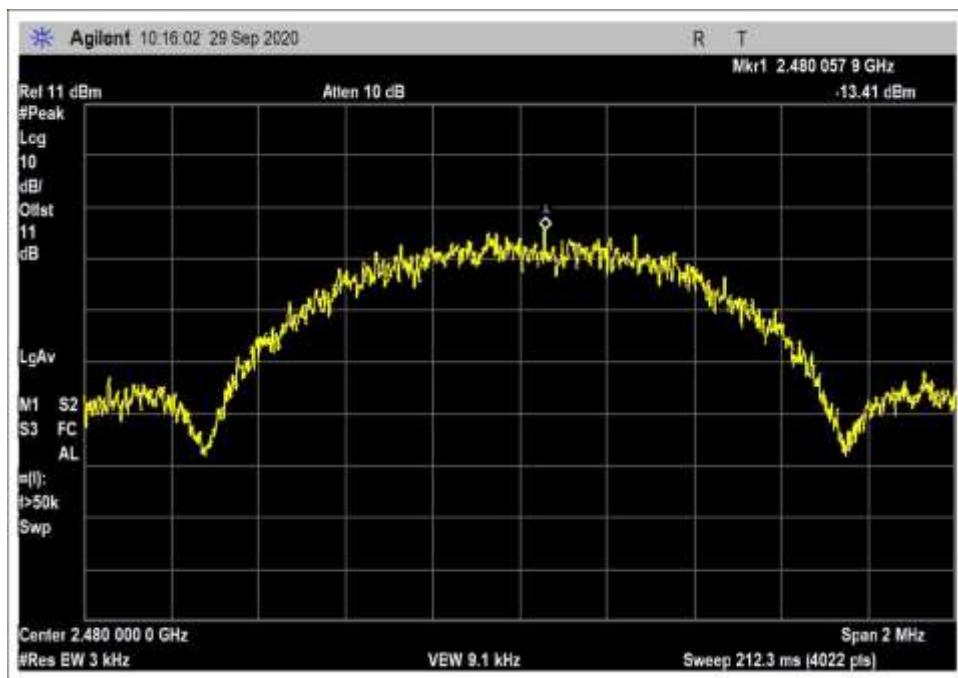
## Plots



Low Channel

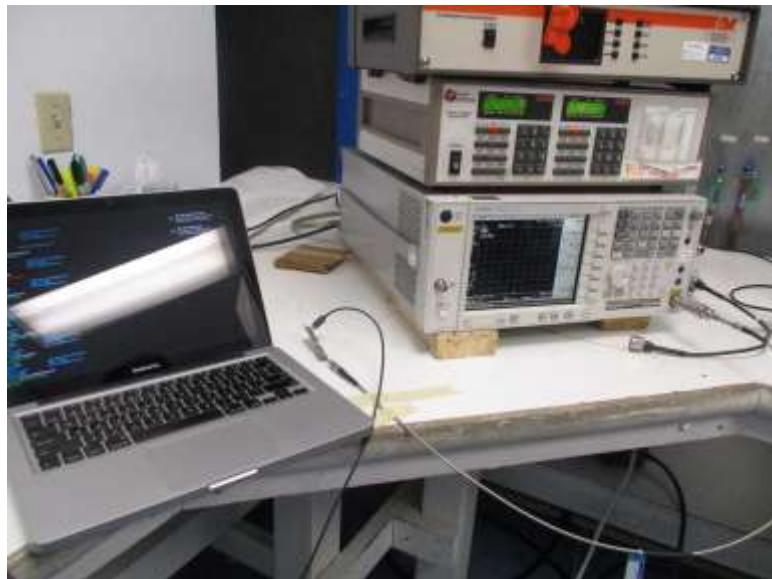


Middle Channel



High Channel

**Test Setup Photo(s)**



Test Setup



Test Setup Close-up

## 15.247(d) RF Conducted Emissions & Band Edge

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
 Customer: **Tonal**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **104296** Date: 9/29/2020  
 Test Type: **Conducted Emission** Time: 10:49:28 AM  
 Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 1  
 Cao/Jonathan Wharton  
 Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

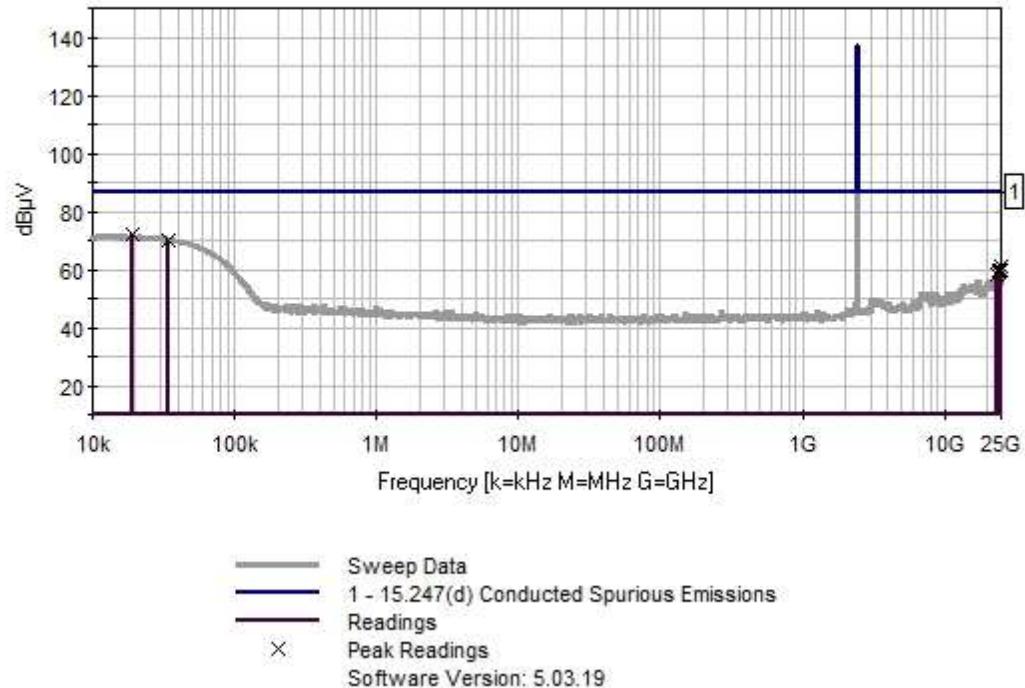
Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Conducted Spurious Emission  
 Frequency Range: 9kHz to 25GHz  
 Temperature: 22.9°C  
 Humidity: 43%  
 Atmospheric Pressure: 101.5kPa  
 Software: Putty version 0.74  
 Highest Generated Frequency: 2.48GHz  
 Method: ANSI C63.10 2013

The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer.  
 The EUT is powered from the laptop which it sits next to.

**Low Channel**

Tonal WO#: 104296 Sequence#: 1 Date: 9/29/2020  
 15.247(d) Conducted Spurious Emissions Test Distance: None None

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05411	Attenuator	54A-10	11/27/2019	11/27/2021
T2	ANP06904	Cable	32022-29094K- 29094K-36TC	1/7/2020	1/7/2022
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020

<b>Measurement Data:</b>			Reading listed by margin.			Test Distance: None				
#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	18.952k	62.6	+9.3	+0.0		+0.0	71.9	86.4	-14.5	None
2	34.214k	61.1	+9.2	+0.0		+0.0	70.3	86.4	-16.1	None
3	24855.665M	48.1	+10.4	+2.6		+0.0	61.1	86.4	-25.3	None
4	24245.015M	47.1	+10.3	+2.5		+0.0	59.9	86.4	-26.5	None
5	24911.178M	46.8	+10.5	+2.6		+0.0	59.9	86.4	-26.5	None
6	24356.042M	46.7	+10.3	+2.5		+0.0	59.5	86.4	-26.9	None
7	24278.323M	46.5	+10.3	+2.5		+0.0	59.3	86.4	-27.1	None
8	24122.885M	46.4	+10.3	+2.5		+0.0	59.2	86.4	-27.2	None
9	24100.679M	45.9	+10.3	+2.5		+0.0	58.7	86.4	-27.7	None
10	23323.488M	45.4	+10.4	+2.5		+0.0	58.3	86.4	-28.1	None



Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
Customer: **Tonal**  
Specification: **15.247(d) Conducted Spurious Emissions**  
Work Order #: **104296** Date: 9/29/2020  
Test Type: **Conducted Emission** Time: 10:58:35 AM  
Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 2  
Cao/Jonathan Wharton  
Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

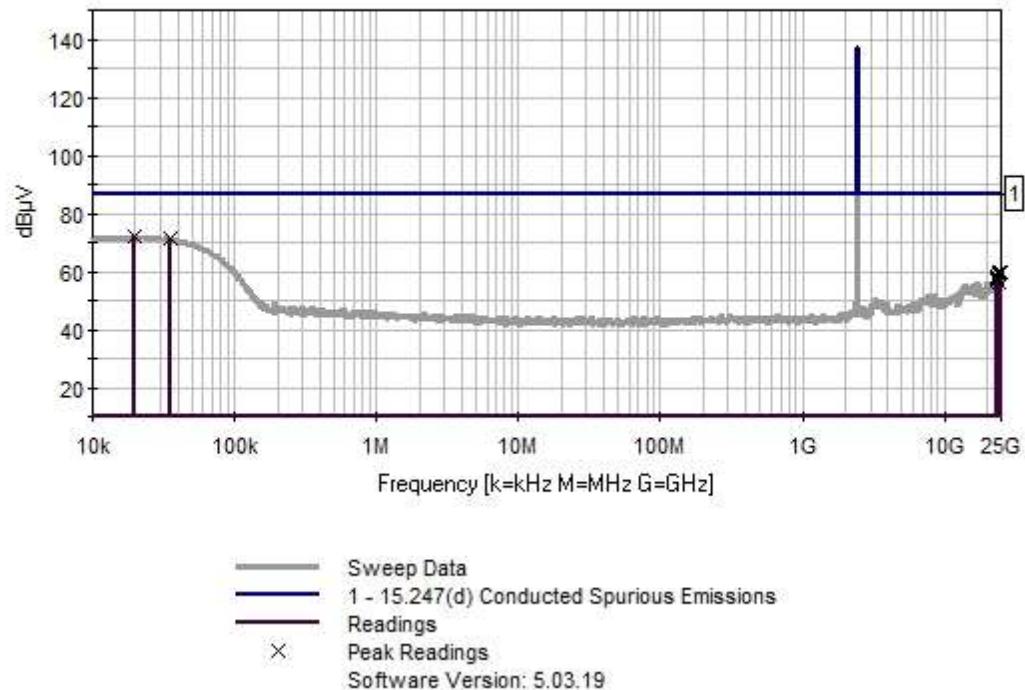
Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Conducted Spurious Emission  
Frequency Range: 9kHz to 25GHz  
  
Temperature: 22.9°C  
Humidity: 43%  
Atmospheric Pressure: 101.5kPa  
Software: Putty version 0.74  
Highest Generated Frequency: 2.48GHz  
Method: ANSI C63.10 2013

The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer. The EUT is powered from the laptop which it sits next to.

**Middle Channel**

Tonal WO#: 104296 Sequence#: 2 Date: 9/29/2020  
 15.247(d) Conducted Spurious Emissions Test Distance: None None

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05411	Attenuator	54A-10	11/27/2019	11/27/2021
T2	ANP06904	Cable	32022-29094K- 29094K-36TC	1/7/2020	1/7/2022
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020

<b>Measurement Data:</b>			Reading listed by margin.			Test Distance: None				
#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	T3 dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	19.507k	62.6	+9.3	+0.0		+0.0	71.9	86.4	-14.5	None
2	35.614k	61.9	+9.2	+0.0		+0.0	71.1	86.4	-15.3	None
3	24966.692M	46.9	+10.5	+2.6		+0.0	60.0	86.4	-26.4	None
4	24300.528M	46.6	+10.3	+2.5		+0.0	59.4	86.4	-27.0	None
5	24411.555M	46.3	+10.3	+2.5		+0.0	59.1	86.4	-27.3	None
6	23545.543M	45.5	+10.4	+2.5		+0.0	58.4	86.4	-28.0	None
7	23245.769M	44.6	+10.3	+2.5		+0.0	57.4	86.4	-29.0	None
8	23279.077M	44.2	+10.4	+2.5		+0.0	57.1	86.4	-29.3	None
9	23101.434M	43.8	+10.3	+2.5		+0.0	56.6	86.4	-29.8	None
10	24566.994M	43.5	+10.3	+2.5		+0.0	56.3	86.4	-30.1	None



Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
Customer: **Tonal**  
Specification: **15.247(d) Conducted Spurious Emissions**  
Work Order #: **104296** Date: 9/29/2020  
Test Type: **Conducted Emission** Time: 11:04:39 AM  
Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 3  
Cao/Jonathan Wharton  
Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

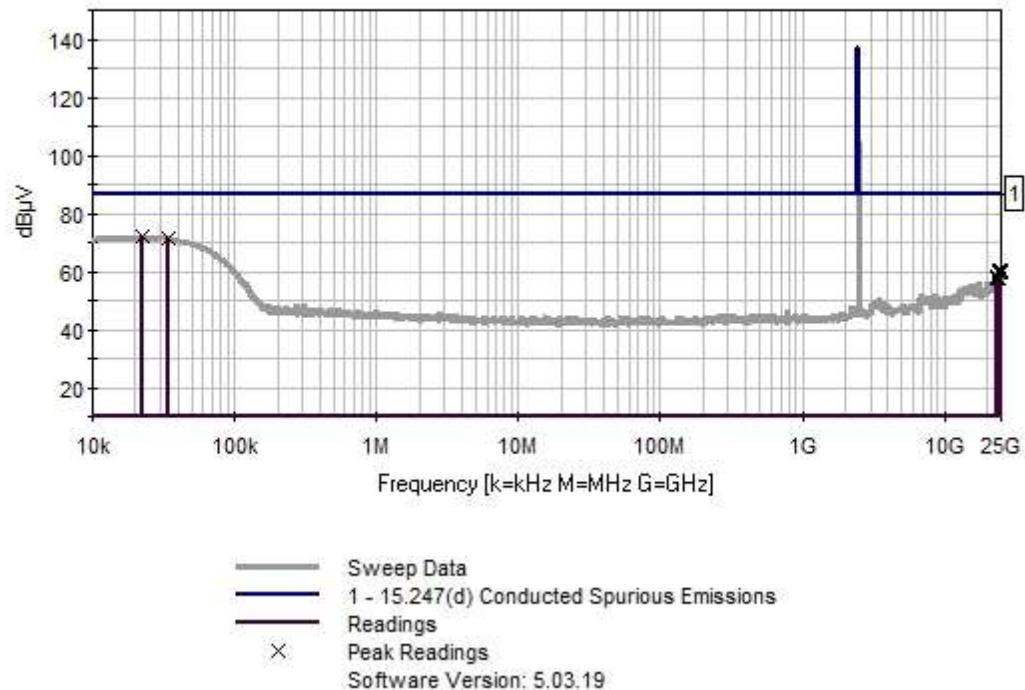
Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Conducted Spurious Emission  
Frequency Range: 9kHz to 25GHz  
  
Temperature: 22.9°C  
Humidity: 43%  
Atmospheric Pressure: 101.5kPa  
Software: Putty version 0.74  
Highest Generated Frequency: 2.48GHz  
Method: ANSI C63.10 2013

The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer. The EUT is powered from the laptop which it sits next to.

**High Channel**

Tonal WO#: 104296 Sequence#: 3 Date: 9/29/2020  
 15.247(d) Conducted Spurious Emissions Test Distance: None None

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05411	Attenuator	54A-10	11/27/2019	11/27/2021
T2	ANP06904	Cable	32022-29094K- 29094K-36TC	1/7/2020	1/7/2022
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020

<b>Measurement Data:</b>			Reading listed by margin.			Test Distance: None				
#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	22.452k	62.8	+9.3	+0.0		+0.0	72.1	86.4	-14.3	None
2	34.626k	62.2	+9.2	+0.0		+0.0	71.4	86.4	-15.0	None
3	24167.295M	47.3	+10.3	+2.5		+0.0	60.1	86.4	-26.3	None
4	24966.692M	47.0	+10.5	+2.6		+0.0	60.1	86.4	-26.3	None
5	24811.254M	47.0	+10.4	+2.6		+0.0	60.0	86.4	-26.4	None
6	24300.528M	47.1	+10.3	+2.5		+0.0	59.9	86.4	-26.5	None
7	23412.310M	45.5	+10.4	+2.5		+0.0	58.4	86.4	-28.0	None
8	24489.275M	45.1	+10.3	+2.5		+0.0	57.9	86.4	-28.5	None
9	23279.077M	44.6	+10.4	+2.5		+0.0	57.5	86.4	-28.9	None
10	23245.769M	44.5	+10.3	+2.5		+0.0	57.3	86.4	-29.1	None

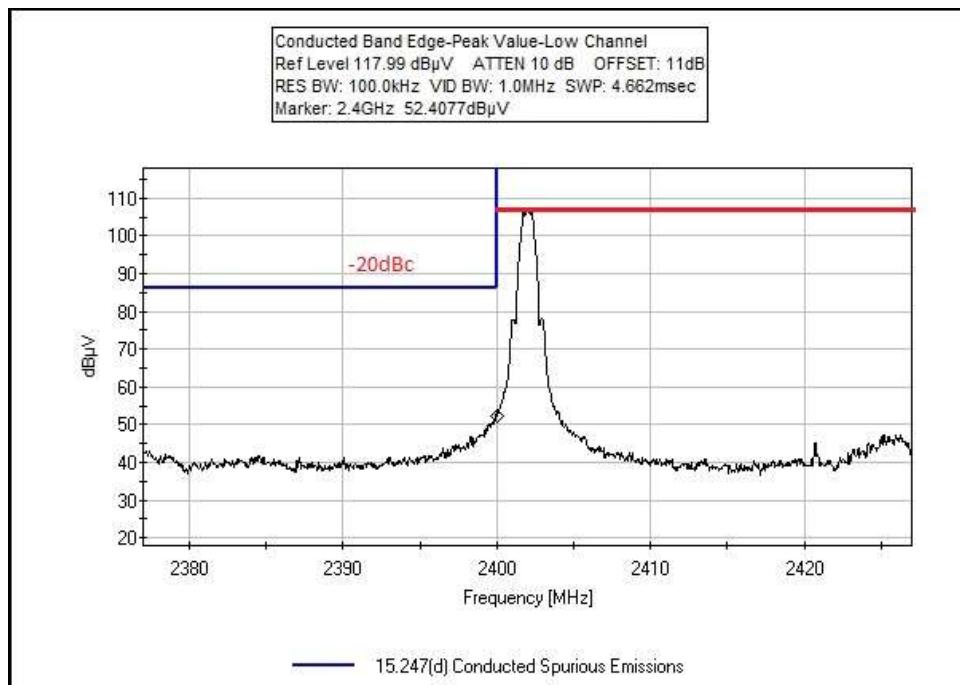
## Band Edge

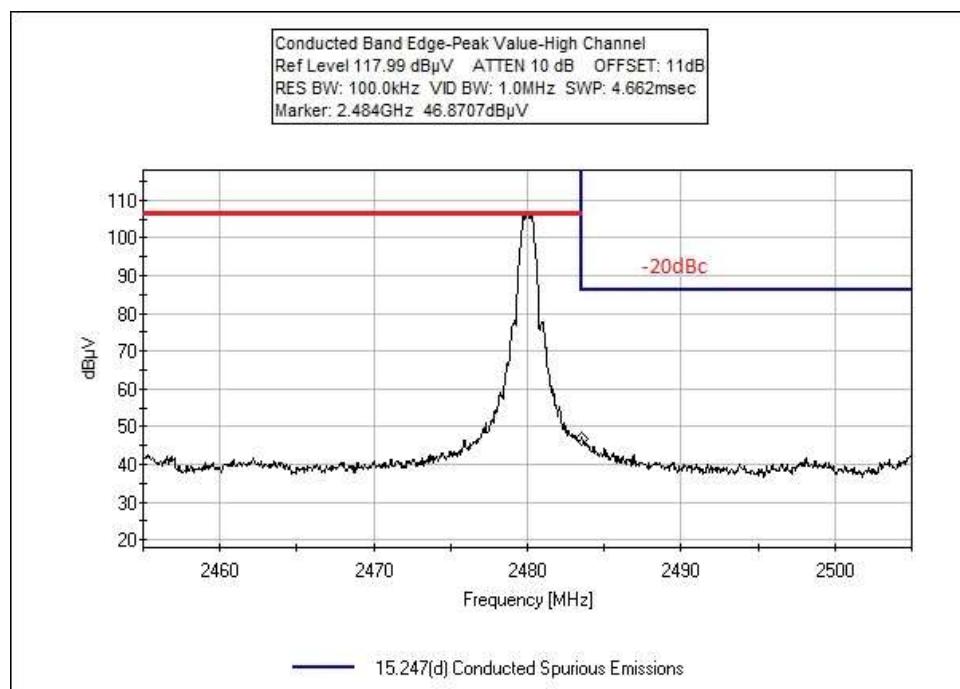
### Band Edge Summary

Limit applied: Max Power/100kHz - 20dB

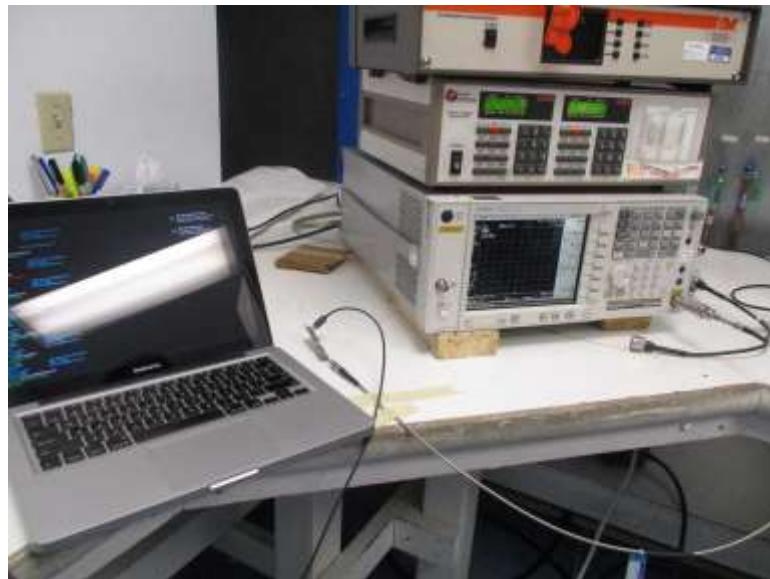
Frequency (MHz)	Modulation	Measured (dBuV)	Limit (dBuV)	Results
2400.0	GFSK	52.4077	<86.4	Pass
2483.5	GFSK	46.8707	<86.4	Pass

### Band Edge Plots





**Test Setup Photo(s)**



Test Setup



Test Setup Close-up

## 15.247(d) Radiated Emissions & Band Edge

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
 Customer: **Tonal**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **104296** Date: 9/30/2020  
 Test Type: **Radiated Emission** Time: 11:26:13  
 Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 31  
 Cao/Jonathan Wharton  
 Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

Radiated Spurious Emission

Frequency Range: 9kHz to 1GHz

Temperature: 22.9°C

Humidity: 43%

Atmospheric Pressure: 101.5kPa

Software: Putty version 0.74

Highest Generated Frequency: 2.48GHz

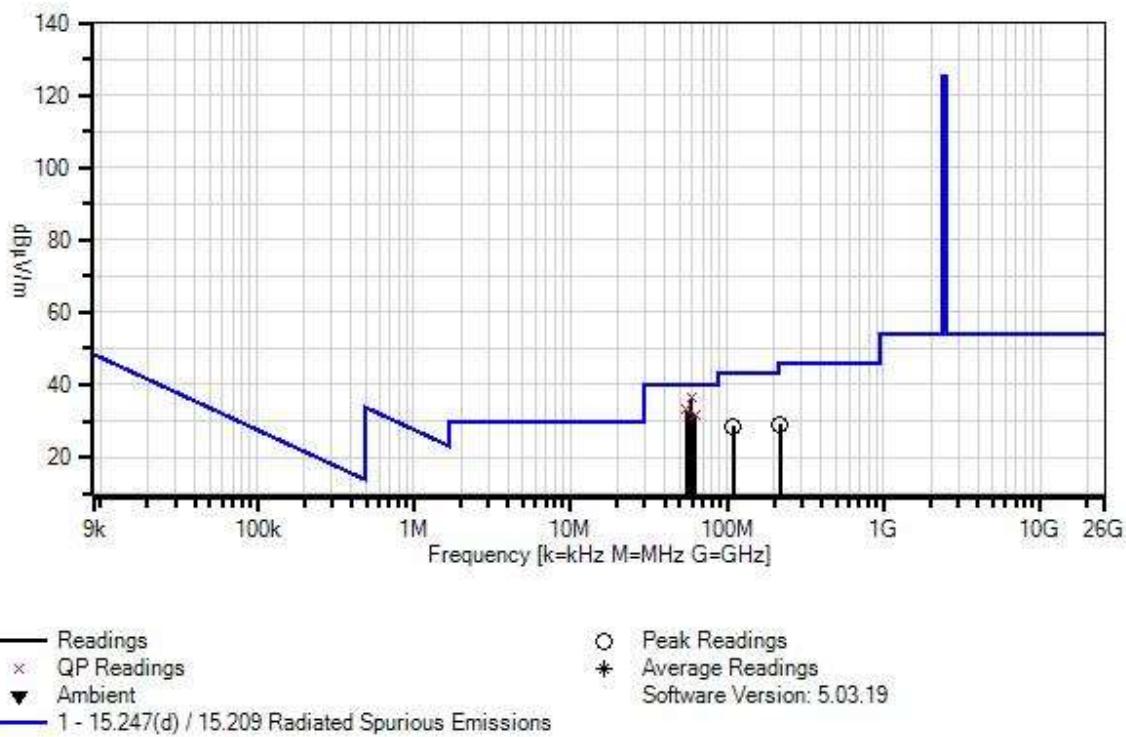
Method: ANSI C63.10 2013

The EUT is set up as intended. It is connected to the laptop which is on the table. The laptop is used to set the EUT to generate intentional signals and charge the EUT during exposure.

3 orthogonal such as perpendicular, parallel and ground parallel are measured from 9kHz to 30MHz

**Low Channel.**

**No Emission from the EUT has been found in 20dB from the limit**

Tonal WO#: 104296 Sequence#: 31 Date: 9/30/2020  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020
T1	ANP07508	Preamp	310N	7/9/2020	7/9/2022
T2	AN00852	Biconilog Antenna	CBL 6111C	4/14/2020	4/14/2022
T3	ANP06049	Attenuator	PE7002-6	5/11/2020	5/11/2022
T4	ANP00880	Cable	RG214U	3/25/2020	3/25/2022
T5	ANP01187	Cable	CNT-195	7/6/2020	7/6/2022
T6	ANP06691	Cable	PE3062-180	3/25/2020	3/25/2022
	AN00432	Loop Antenna	6502	2/19/2019	2/19/2021

<b>Measurement Data:</b>			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6			Table	dB $\mu$ V/m	dB $\mu$ V/m		
			MHz	dB $\mu$ V	dB	dB	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	59.627M	54.5	-32.0	+6.9	+5.9	+0.7	+0.0	36.3	40.0	-3.7	Vert
	QP		+0.1	+0.2							
^	59.627M	57.8	-32.0	+6.9	+5.9	+0.7	+0.0	39.6	40.0	-0.4	Vert
			+0.1	+0.2							
3	55.249M	50.5	-32.1	+7.7	+5.9	+0.7	+0.0	33.0	40.0	-7.0	Vert
	QP		+0.1	+0.2							
^	55.249M	54.6	-32.1	+7.7	+5.9	+0.7	+0.0	37.1	40.0	-2.9	Vert
			+0.1	+0.2							
5	62.573M	50.2	-32.0	+6.6	+5.9	+0.7	+0.0	31.7	40.0	-8.3	Vert
	QP		+0.1	+0.2							
^	62.573M	54.8	-32.0	+6.6	+5.9	+0.7	+0.0	36.3	40.0	-3.7	Vert
			+0.1	+0.2							
7	109.499M	42.2	-32.0	+11.1	+5.9	+0.9	+0.0	28.5	43.5	-15.0	Horiz
			+0.1	+0.3							
8	217.669M	42.3	-31.9	+10.5	+5.9	+1.4	+0.0	29.0	46.0	-17.0	Horiz
			+0.3	+0.5							

Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
 Customer: **Tonal**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **104296** Date: 9/30/2020  
 Test Type: **Radiated Emission** Time: 11:51:54  
 Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 34  
 Cao/Jonathan Wharton  
 Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

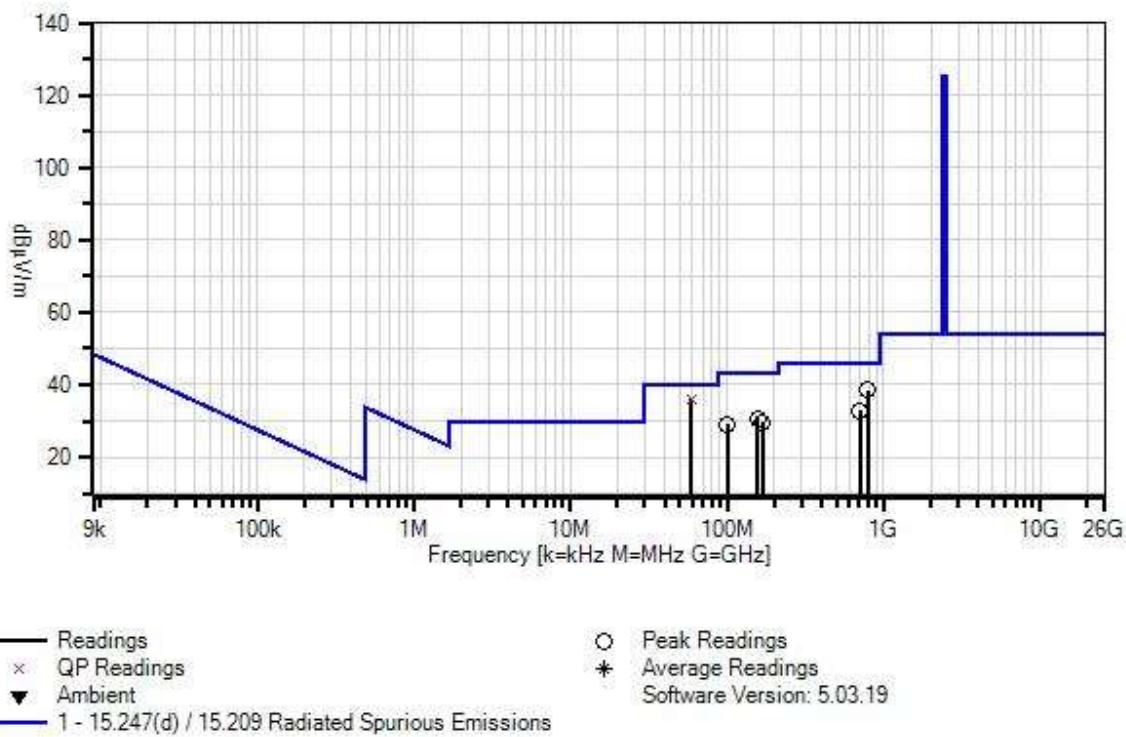
Radiated Spurious Emission  
 Frequency Range: 9kHz to 1GHz  
 Temperature: 22.9°C  
 Humidity: 43%  
 Atmospheric Pressure: 101.5kPa  
 Software: Putty version 0.74  
 Highest Generated Frequency: 2.48GHz  
 Method: ANSI C63.10 2013

The EUT is set up as intended. It is connected to the laptop which is on the table. The laptop is used to set the EUT to generate intentional signals and charge the EUT during exposure.

3 orthogonal such as perpendicular, parallel and ground parallel are measured from 9kHz to 30MHz

**Middle Channel.**

**No Emission from the EUT has been found in 20dB from the limit**

Tonal WO#: 104296 Sequence#: 34 Date: 9/30/2020  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020
T1	ANP07508	Preamp	310N	7/9/2020	7/9/2022
T2	AN00852	Biconilog Antenna	CBL 6111C	4/14/2020	4/14/2022
T3	ANP06049	Attenuator	PE7002-6	5/11/2020	5/11/2022
T4	ANP00880	Cable	RG214U	3/25/2020	3/25/2022
T5	ANP01187	Cable	CNT-195	7/6/2020	7/6/2022
T6	ANP06691	Cable	PE3062-180	3/25/2020	3/25/2022
	AN00432	Loop Antenna	6502	2/19/2019	2/19/2021

<b>Measurement Data:</b>			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6			Table	dB $\mu$ V/m	dB $\mu$ V/m		
			MHz	dB $\mu$ V	dB	dB	dB	dB $\mu$ V/m	dB $\mu$ V/m		Ant
1	59.543M	54.2	-32.0	+6.9	+5.9	+0.7	+0.0	36.0	40.0	-4.0	Vert
	QP		+0.1	+0.2							
^	59.543M	56.7	-32.0	+6.9	+5.9	+0.7	+0.0	38.5	40.0	-1.5	Vert
			+0.1	+0.2							
3	796.830M	37.1	-31.9	+22.5	+5.9	+3.1	+0.0	38.5	46.0	-7.5	Vert
			+0.7	+1.1							
4	157.632M	44.0	-32.0	+10.9	+6.0	+1.2	+0.0	30.7	43.5	-12.8	Horiz
			+0.2	+0.4							
5	705.170M	33.2	-32.0	+21.1	+6.0	+2.8	+0.0	32.8	46.0	-13.2	Horiz
			+0.6	+1.1							
6	167.643M	43.7	-32.0	+10.1	+6.0	+1.2	+0.0	29.6	43.5	-13.9	Horiz
			+0.2	+0.4							
7	100.095M	43.4	-32.0	+10.4	+5.9	+0.9	+0.0	29.0	43.5	-14.5	Vert
			+0.1	+0.3							

Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
 Customer: **Tonal**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **104296** Date: 9/30/2020  
 Test Type: **Radiated Emission** Time: 13:10:10  
 Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 37  
 Cao/Jonathan Wharton  
 Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

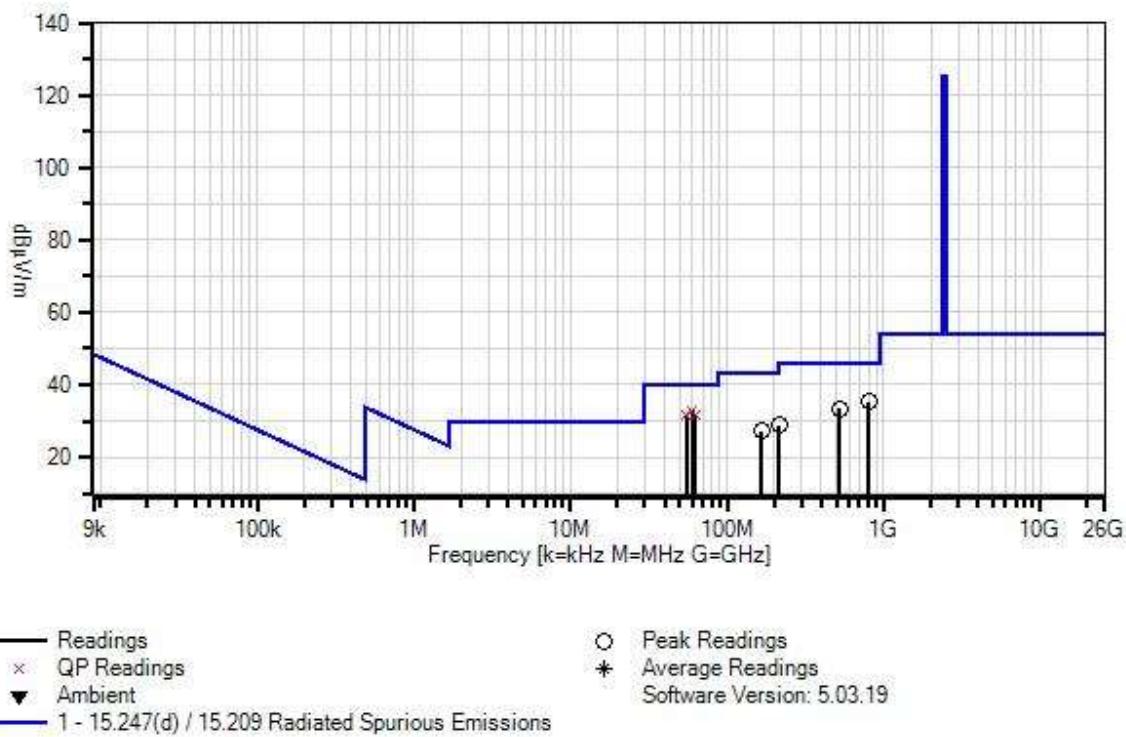
Radiated Spurious Emission  
 Frequency Range: 9kHz to 1GHz  
 Temperature: 22.9°C  
 Humidity: 43%  
 Atmospheric Pressure: 101.5kPa  
 Software: Putty version 0.74  
 Highest Generated Frequency: 2.48GHz  
 Method: ANSI C63.10 2013

The EUT is set up as intended. It is connected to the laptop which is on the table. The laptop is used to set the EUT to generate intentional signals and charge the EUT during exposure.

3 orthogonal such as perpendicular, parallel and ground parallel are measured from 9kHz to 30MHz

**High Channel**

**No Emission from the EUT has been found in 20dB from the limit**

Tonal WO#: 104296 Sequence#: 37 Date: 9/30/2020  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020
T1	ANP07508	Preamp	310N	7/9/2020	7/9/2022
T2	AN00852	Biconilog Antenna	CBL 6111C	4/14/2020	4/14/2022
T3	ANP06049	Attenuator	PE7002-6	5/11/2020	5/11/2022
T4	ANP00880	Cable	RG214U	3/25/2020	3/25/2022
T5	ANP01187	Cable	CNT-195	7/6/2020	7/6/2022
T6	ANP06691	Cable	PE3062-180	3/25/2020	3/25/2022
	AN00432	Loop Antenna	6502	2/19/2019	2/19/2021

<b>Measurement Data:</b>			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6			Table	dB $\mu$ V/m	dB $\mu$ V/m		
			MHz	dB $\mu$ V	dB	dB	dB	dB $\mu$ V/m	dB $\mu$ V/m		Ant
1	60.127M	51.2	-32.0	+6.8	+5.9	+0.7	+0.0	32.9	40.0	-7.1	Vert
	QP		+0.1	+0.2							
^	60.127M	57.1	-32.0	+6.8	+5.9	+0.7	+0.0	38.8	40.0	-1.2	Vert
			+0.1	+0.2							
3	55.104M	49.1	-32.1	+7.7	+5.9	+0.7	+0.0	31.6	40.0	-8.4	Vert
	QP		+0.1	+0.2							
^	55.104M	53.6	-32.1	+7.7	+5.9	+0.7	+0.0	36.1	40.0	-3.9	Vert
			+0.1	+0.2							
5	62.321M	49.9	-32.0	+6.6	+5.9	+0.7	+0.0	31.4	40.0	-8.6	Vert
	QP		+0.1	+0.2							
^	62.321M	54.4	-32.0	+6.6	+5.9	+0.7	+0.0	35.9	40.0	-4.1	Vert
			+0.1	+0.2							
7	799.749M	33.9	-31.9	+22.5	+5.9	+3.1	+0.0	35.3	46.0	-10.7	Vert
			+0.7	+1.1							
8	524.770M	37.1	-31.9	+18.6	+5.9	+2.4	+0.0	33.5	46.0	-12.5	Vert
			+0.5	+0.9							
9	166.127M	41.1	-32.0	+10.2	+6.0	+1.2	+0.0	27.1	43.5	-16.4	Horiz
			+0.2	+0.4							
10	216.697M	42.2	-31.9	+10.4	+5.9	+1.4	+0.0	28.8	46.0	-17.2	Horiz
			+0.3	+0.5							



Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
Customer: **Tonal**  
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
Work Order #: **104296** Date: 9/29/2020  
Test Type: **Radiated Emission** Time: 16:10:25  
Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 7  
Cao/Jonathan Wharton  
Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

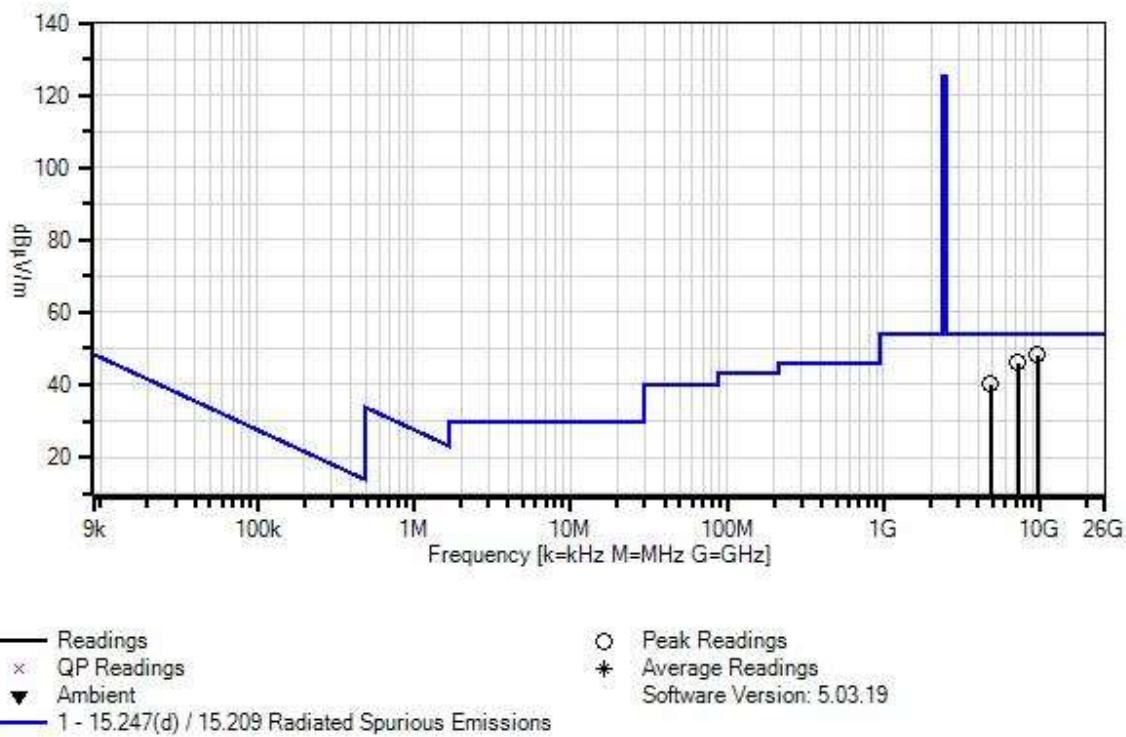
Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Radiated Spurious Emission  
Frequency Range: 1GHz to 25GHz  
  
Temperature: 22.9°C  
Humidity: 43%  
Atmospheric Pressure: 101.5kPa  
Software: Putty version 0.74  
Highest Generated Frequency: 2.48GHz  
Method: ANSI C63.10 2013

The EUT is set up as intended. It is connected to the laptop which is on the table. The laptop is used to set the EUT to generate intentional signals and charge the EUT during exposure.

**Low Channel**

Tonal WO#: 104296 Sequence#: 7 Date: 9/29/2020  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/15/2019	1/15/2021
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T3	ANP01210	Cable	FSJ1P-50A-4A	8/31/2020	8/31/2022
T4	ANP06904	Cable	32022-29094K-29094K-36TC	1/7/2020	1/7/2022
T5	AN03309	High Pass Filter	11SH10-3000/T10000-O/O	3/26/2020	3/26/2022
T6	AN03713	Preamp	01001800-221055-202525	5/22/2019	5/22/2021
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	8/15/2019	8/15/2021
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	8/15/2019	8/15/2021
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP06899	Cable	32022-29094K-29094K-72TC	1/7/2020	1/7/2022
	AN03619	Cable	OKOCQoCQ177.2	11/5/2019	11/5/2021

<b>Measurement Data:</b>			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6			Table	dB $\mu$ V/m	dB $\mu$ V/m		
			MHz	dB $\mu$ V	dB	dB	dB	dB $\mu$ V/m	dB $\mu$ V/m		Ant
1	9609.000M	53.0	+39.2 +0.5	+2.6 -55.9	+7.1	+1.6	+0.0	48.1	54.0	-5.9	Horiz
2	7207.600M	58.1	+36.0 +0.4	+2.3 -57.2	+5.1	+1.3	+0.0	46.0	54.0	-8.0	Horiz
3	4806.600M	55.5	+33.3 +0.4	+1.8 -56.8	+4.8	+1.0	+0.0	40.0	54.0	-14.0	Horiz



Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
Customer: **Tonal**  
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
Work Order #: **104296** Date: 9/29/2020  
Test Type: **Radiated Emission** Time: 16:43:13  
Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 10  
Cao/Jonathan Wharton  
Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

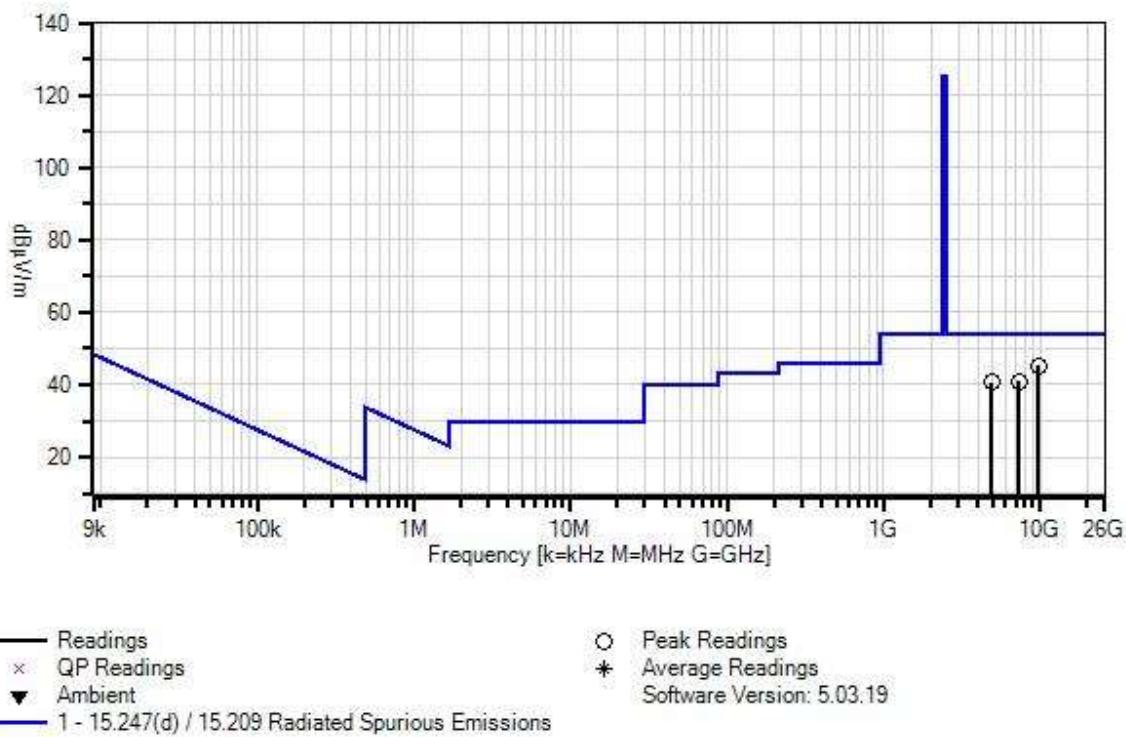
Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Radiated Spurious Emission  
Frequency Range: 1GHz to 25GHz  
  
Temperature: 22.9°C  
Humidity: 43%  
Atmospheric Pressure: 101.5kPa  
Software: Putty version 0.74  
Highest Generated Frequency: 2.48GHz  
Method: ANSI C63.10 2013

The EUT is set up as intended. It is connected to the laptop which is on the table. The laptop is used to set the EUT to generate intentional signals and charge the EUT during exposure.

**Middle Channel**

Tonal WO#: 104296 Sequence#: 10 Date: 9/29/2020  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/15/2019	1/15/2021
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T3	ANP01210	Cable	FSJ1P-50A-4A	8/31/2020	8/31/2022
T4	ANP06904	Cable	32022-29094K-29094K-36TC	1/7/2020	1/7/2022
T5	AN03309	High Pass Filter	11SH10-3000/T10000-O/O	3/26/2020	3/26/2022
T6	AN03713	Preamp	01001800-221055-202525	5/22/2019	5/22/2021
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	8/15/2019	8/15/2021
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	8/15/2019	8/15/2021
	AN03619	Cable	OKOCQoCQ177.2	11/5/2019	11/5/2021
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP06899	Cable	32022-29094K-29094K-72TC	1/7/2020	1/7/2022

<b>Measurement Data:</b>			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6			Table	dB $\mu$ V/m	dB $\mu$ V/m		
			MHz	dB $\mu$ V	dB	dB	dB	dB $\mu$ V/m	dB $\mu$ V/m		Ant
1	9768.000M	50.5	+39.3 +0.4	+2.6 -55.8	+6.7	+1.6	+0.0	45.3	54.0	-8.7	Horiz
2	7326.000M	52.5	+36.5 +0.4	+2.3 -57.2	+5.2	+1.3	+0.0	41.0	54.0	-13.0	Vert
3	4884.000M	55.6	+33.5 +0.4	+1.8 -56.5	+4.8	+1.1	+0.0	40.7	54.0	-13.3	Vert



Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
Customer: **Tonal**  
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
Work Order #: **104296** Date: 9/29/2020  
Test Type: **Radiated Emission** Time: 17:05:46  
Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 13  
Cao/Jonathan Wharton  
Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

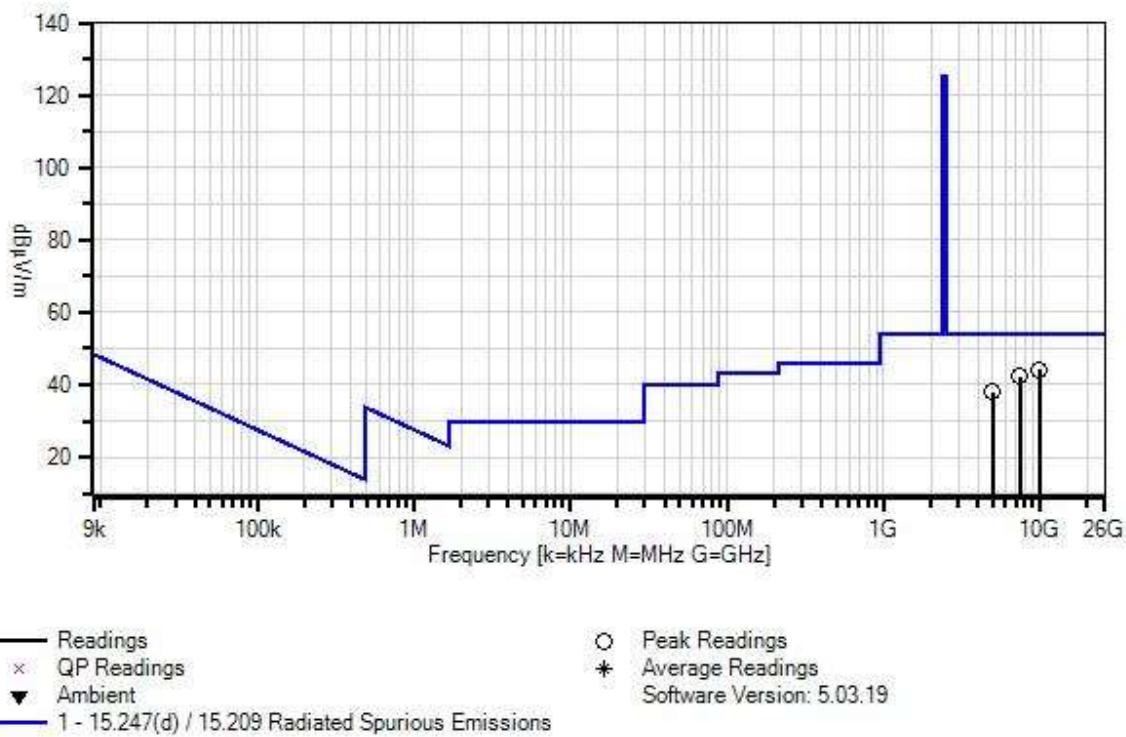
Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Radiated Spurious Emission  
Frequency Range: 1GHz to 25GHz  
  
Temperature: 22.9°C  
Humidity: 43%  
Atmospheric Pressure: 101.5kPa  
Software: Putty version 0.74  
Highest Generated Frequency: 2.48GHz  
Method: ANSI C63.10 2013

The EUT is set up as intended. It is connected to the laptop which is on the table. The laptop is used to set the EUT to generate intentional signals and charge the EUT during exposure.

**High Channel**

Tonal WO#: 104296 Sequence#: 13 Date: 9/29/2020  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/15/2019	1/15/2021
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T3	ANP01210	Cable	FSJ1P-50A-4A	8/31/2020	8/31/2022
T4	ANP06904	Cable	32022-29094K-29094K-36TC	1/7/2020	1/7/2022
T5	AN03309	High Pass Filter	11SH10-3000/T10000-O/O	3/26/2020	3/26/2022
T6	AN03713	Preamp	01001800-221055-202525	5/22/2019	5/22/2021
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	8/15/2019	8/15/2021
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	8/15/2019	8/15/2021
	AN03619	Cable	OKOCQoCQ177.2	11/5/2019	11/5/2021
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP06899	Cable	32022-29094K-29094K-72TC	1/7/2020	1/7/2022

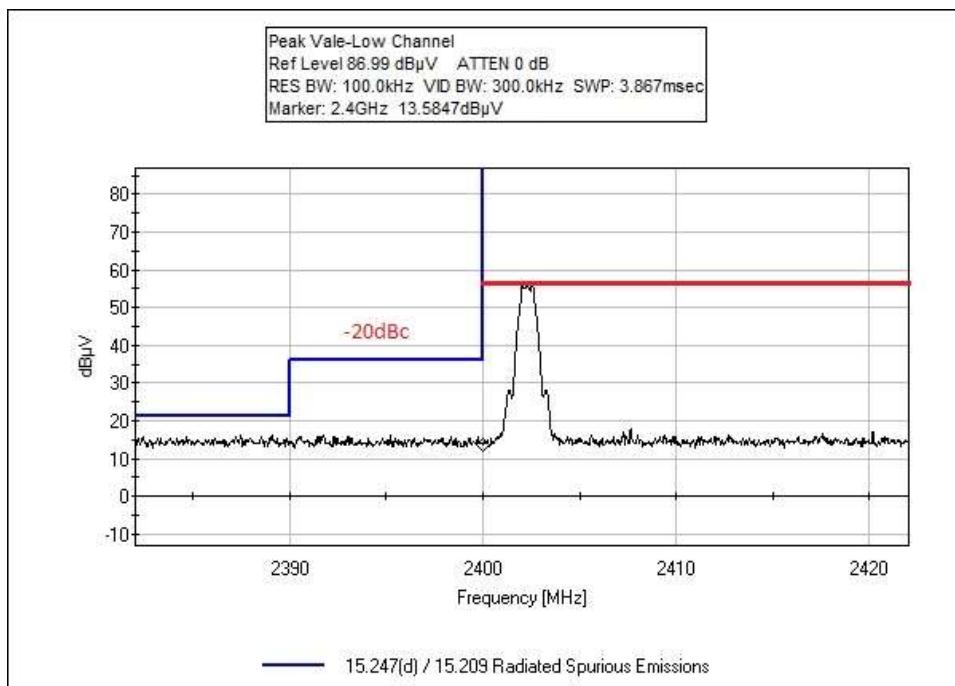
<b>Measurement Data:</b>			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6			Table	dB $\mu$ V/m	dB $\mu$ V/m		
	MHz	dB $\mu$ V	dB	dB	dB	dB	Table	dB $\mu$ V/m	dB $\mu$ V/m		Ant
1	9902.000M	49.4	+39.4	+2.7	+6.6	+1.6	+0.0	44.1	54.0	-9.9	Vert
			+0.4	-56.0							
2	7444.000M	53.3	+36.9	+2.3	+5.4	+1.4	+0.0	42.4	54.0	-11.6	Vert
			+0.4	-57.3							
3	4960.000M	52.4	+33.7	+1.8	+4.8	+1.1	+0.0	38.0	54.0	-16.0	Vert
			+0.4	-56.2							

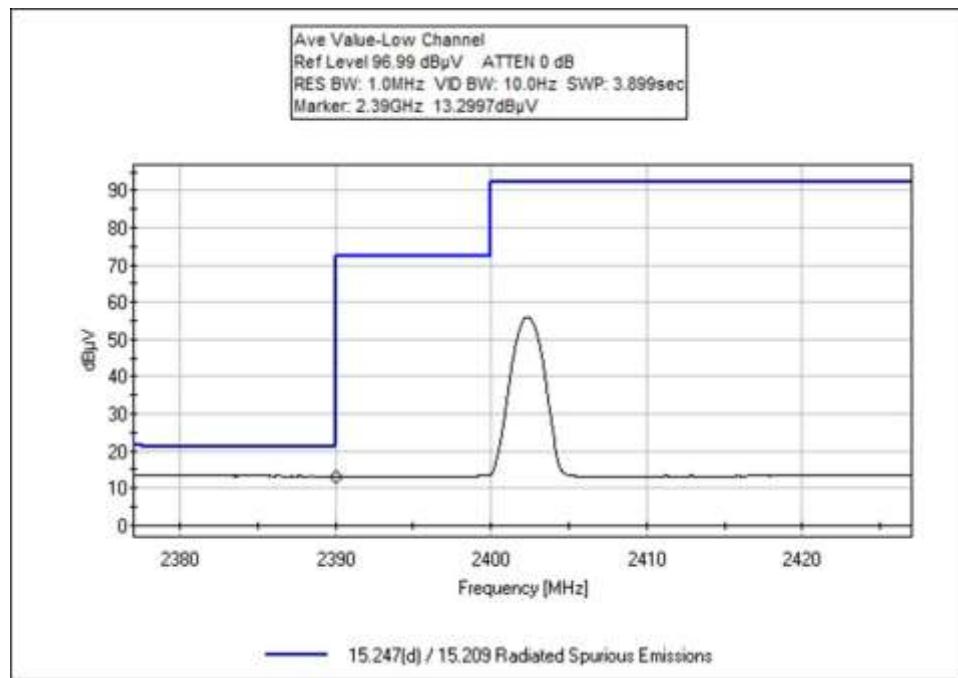
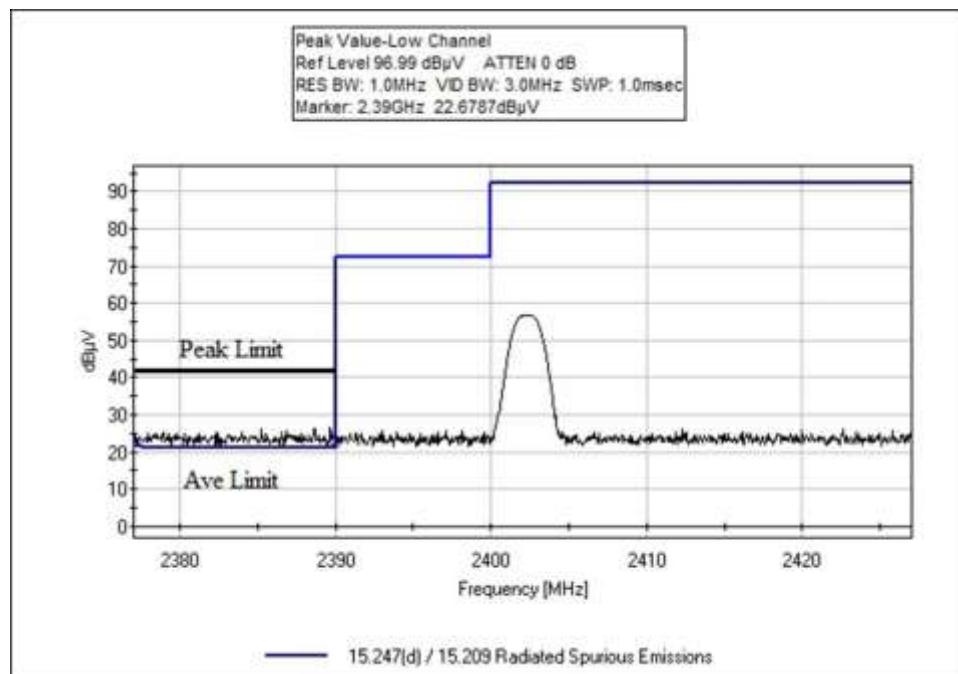
## Band Edge

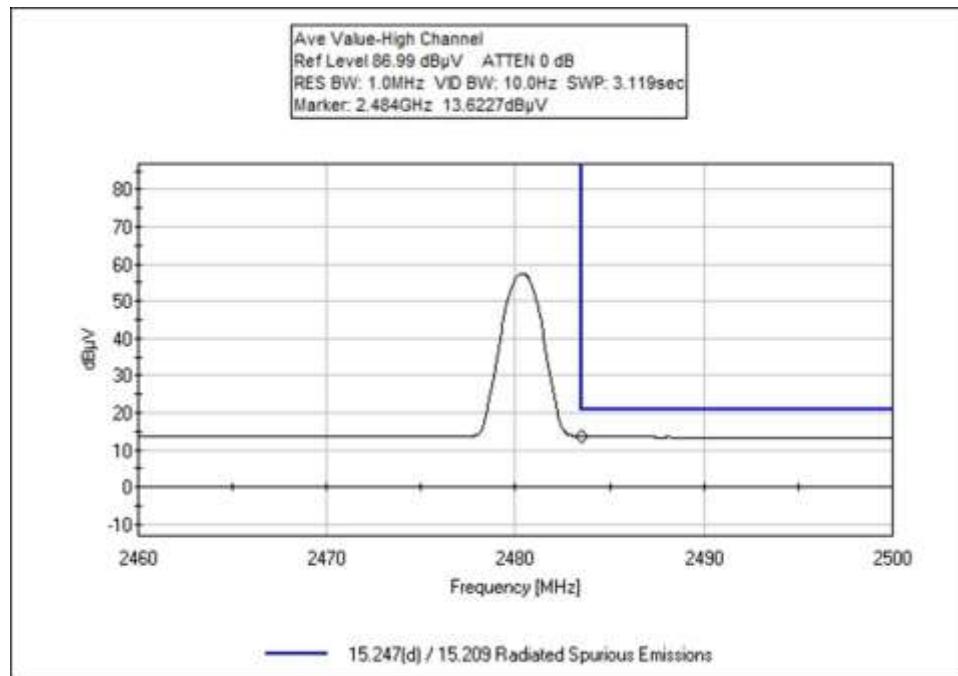
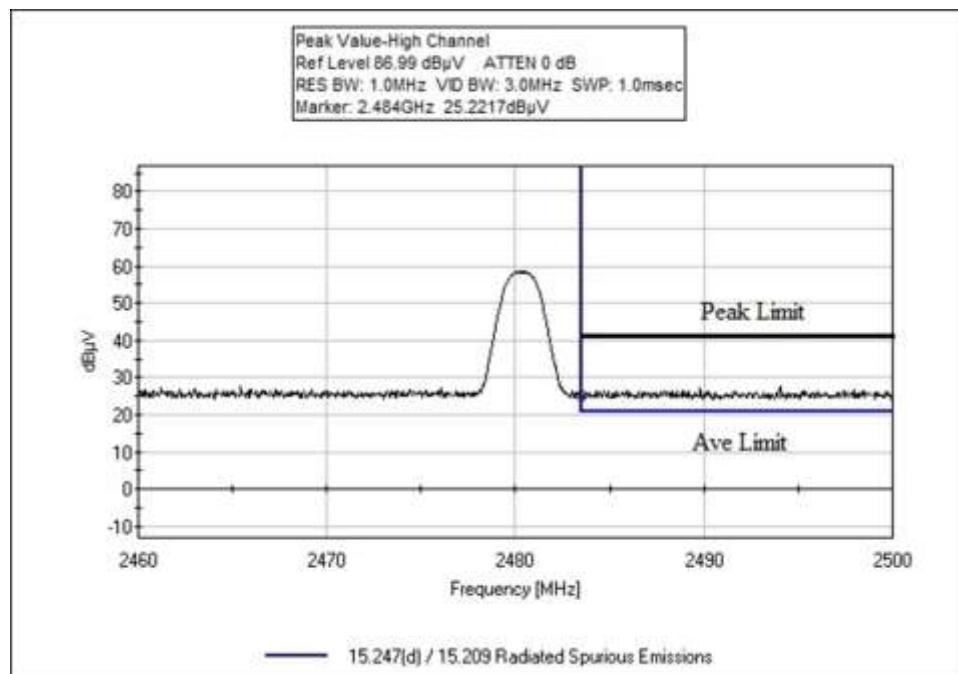
### Band Edge Summary

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	GFSK	Integral	46.0	<54	Pass
2400.0	GFSK	Integral	46.3	<68.7	Pass
2483.5	GFSK	Integral	46.7	<54	Pass

### Band Edge Plots







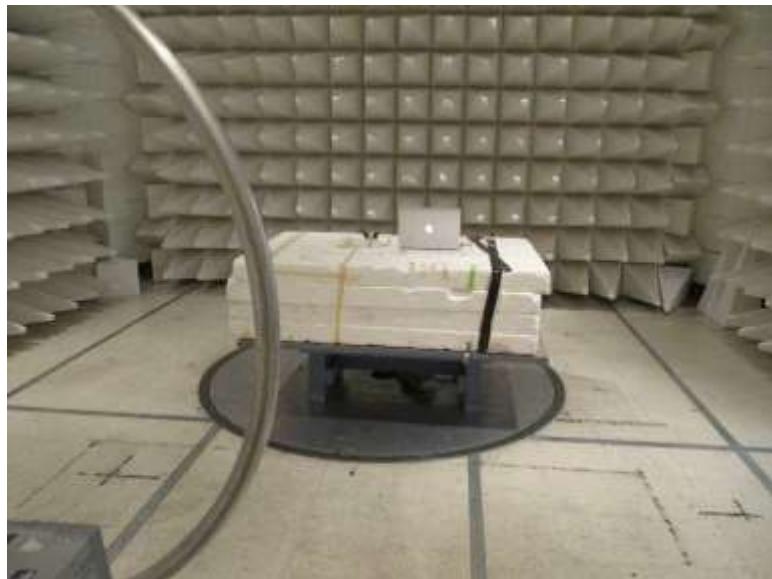
Test Setup/Conditions			
Test Location:	Fremont Lab C3	Test Engineer:	Hieu Song Nguyenpham/Hoang Cao/Jonathan Wharton
Test Method:	ANSI C63.10 (2013)	Test Date(s):	9/29/2020
Configuration:	2		
Test Setup:	Software: Putty version 0.74 Highest Generated Frequency: 2.48GHz Method: ANSI C63.10 2013		
	The EUT is set up as intended. It is connected to the laptop which is on the table. The laptop is used to set the EUT to generate intentional signals and charge the EUT during exposure.		

Environmental Conditions					
Temperature (°C)	22.9	Relative Humidity (%):	43	Pressure (kPa)	101.5

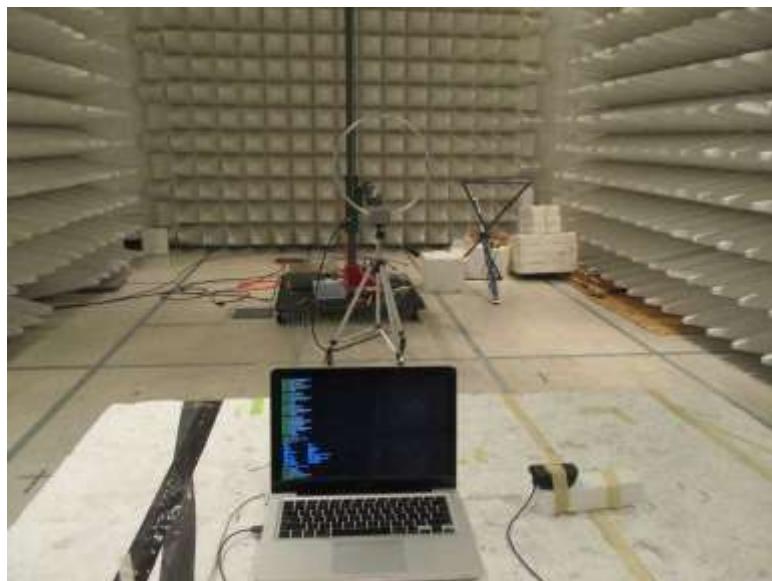
**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/15/2019	1/15/2021
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T3	ANP01210	Cable	FSJ1P-50A-4A	8/31/2020	8/31/2022

**Test Setup Photo(s)**



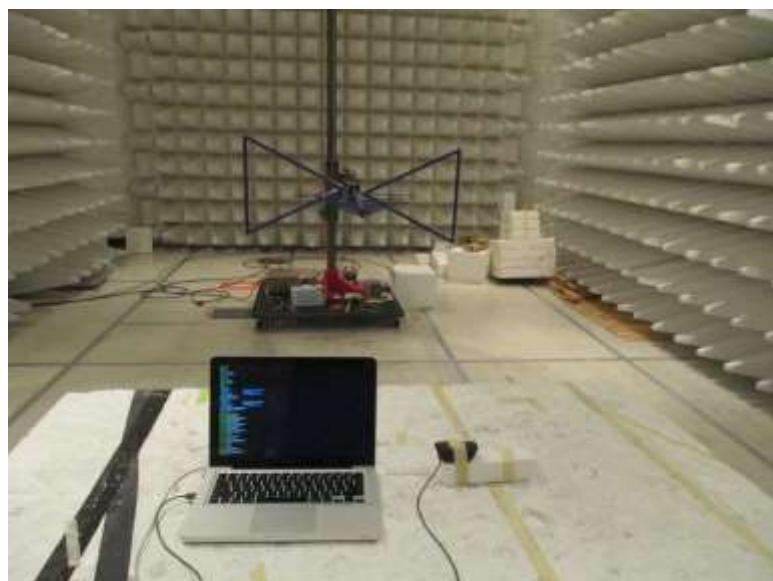
9kHz-30MHz



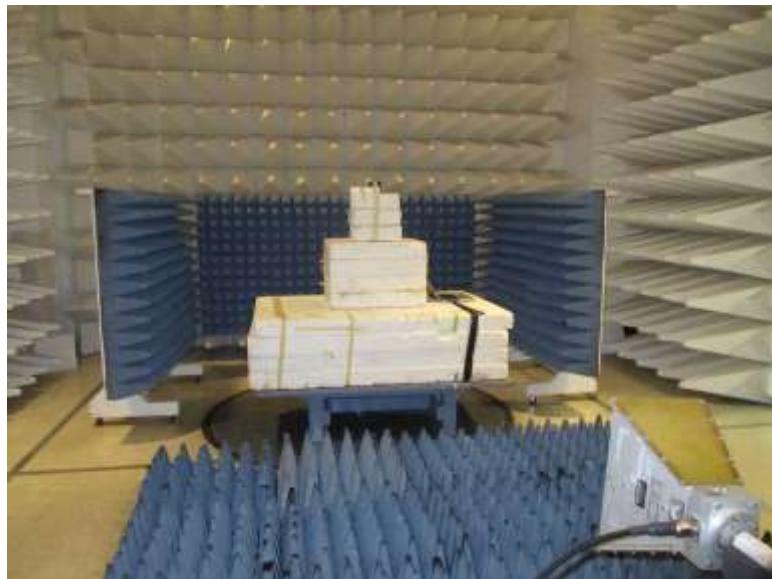
9kHz-30MHz



30MHz-1GHz



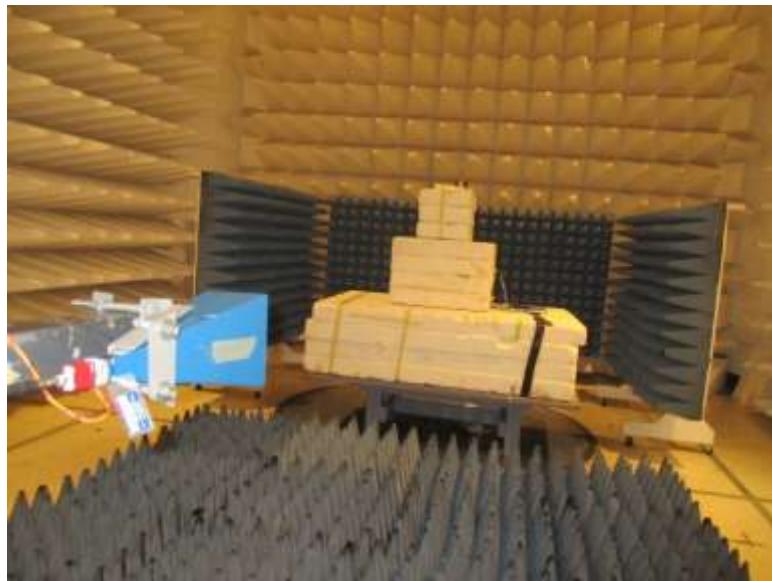
30MHz-1GHz



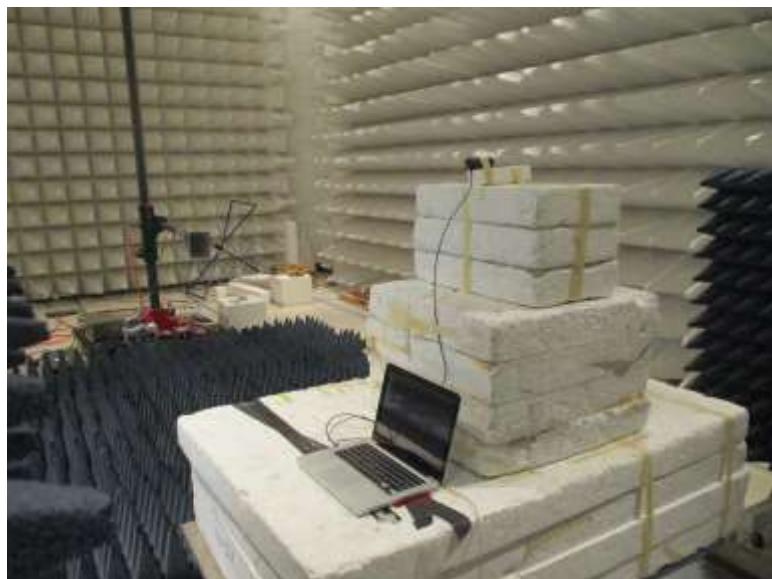
1-12GHz



1-12GHz



12-25GHz



12-25GHz

## 15.207 AC Conducted Emissions

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
 Customer: **Tonal**  
 Specification: **15.207 AC Mains - Average**  
 Work Order #: **104296** Date: 9/30/2020  
 Test Type: **Conducted Emissions** Time: 15:24:18  
 Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 50  
 Cao/Jonathan Wharton  
 Software: EMITest 5.03.19 120V 60Hz

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Support Equipment:***

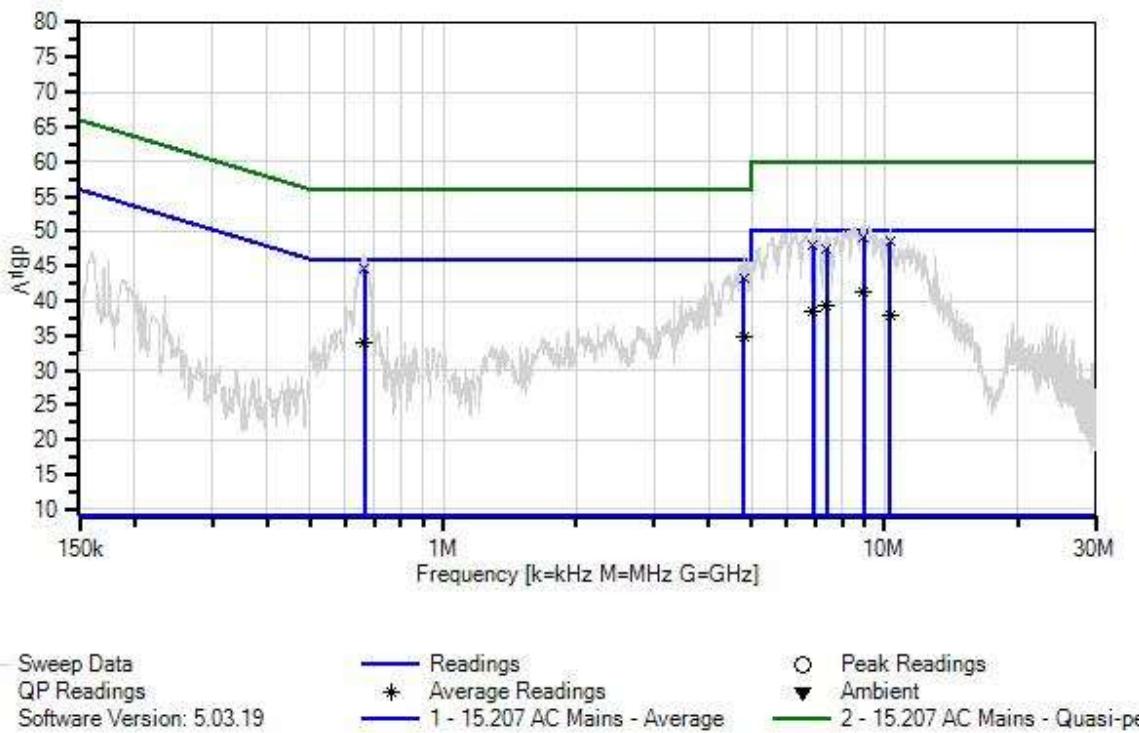
Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

Conducted Emission  
 Frequency Range: 150kHz to 30MHz  
 Temperature: 22.9°C  
 Humidity: 43%  
 Atmospheric Pressure: 101.5kPa  
 Software: Putty version 0.74  
 Highest Generated Frequency: 2.48GHz  
 Method: ANSI C63.10 2013

The EUT is set up as intended. It is connected to the laptop which is on the table. The laptop is used to set the EUT to generate intentional signals and charge the EUT during exposure.

**Middle Channel in TX Mode**

Tonal WO#: 104296 Sequence#: 50 Date: 9/30/2020  
 15.207 AC Mains - Average Test Lead: 120V 60Hz Line

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020
T1	ANP01211	Attenuator	23-10-34	2/22/2019	2/22/2021
T2	ANP00880	Cable	RG214U	3/25/2020	3/25/2022
T3	ANP06691	Cable	PE3062-180	3/25/2020	3/25/2022
T4	AN00494	50uH LISN-Line Loss (dB)	3816/NM	3/11/2019	3/11/2021
	AN00494	50uH LISN-Return Loss (dB)	3816/NM	3/11/2019	3/11/2021
T5	ANP05258	High Pass Filter	HE9615-150K-50-720B	7/6/2020	7/6/2022

<b>Measurement Data:</b>			Reading listed by margin.				Test Lead: Line				
#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			MHz	dB $\mu$ V	dB	dB	dB	Table	dB $\mu$ V	dB $\mu$ V	dB
											Ant
1	8.966M	30.5	+9.9 +0.1	+0.2	+0.1	+0.4	+0.0	41.2	50.0	-8.8	Line
	Ave										
2	7.387M	28.6	+9.9 +0.1	+0.2	+0.1	+0.4	+0.0	39.3	50.0	-10.7	Line
	Ave										
3	8.966M	38.4	+9.9 +0.1	+0.2	+0.1	+0.4	+0.0	49.1	60.0	-10.9	Line
	QP										
^	8.966M	41.6	+9.9 +0.1	+0.2	+0.1	+0.4	+0.0	52.3	50.0	+2.3	Line
5	4.789M	24.0	+9.9 +0.1	+0.2	+0.1	+0.4	+0.0	34.7	46.0	-11.3	Line
	Ave										
6	6.900M	28.0	+9.8 +0.1	+0.2	+0.1	+0.4	+0.0	38.6	50.0	-11.4	Line
	Ave										
7	663.353k	34.1	+9.9 +0.2	+0.1	+0.0	+0.3	+0.0	44.6	56.0	-11.4	Line
	QP										
8	10.297M	37.8	+9.8 +0.1	+0.3	+0.1	+0.4	+0.0	48.5	60.0	-11.5	Line
	QP										
9	663.353k	23.6	+9.9 +0.2	+0.1	+0.0	+0.3	+0.0	34.1	46.0	-11.9	Line
	Ave										
^	663.353k	36.5	+9.9 +0.2	+0.1	+0.0	+0.3	+0.0	47.0	46.0	+1.0	Line
11	10.297M	27.3	+9.8 +0.1	+0.3	+0.1	+0.4	+0.0	38.0	50.0	-12.0	Line
	Ave										
^	10.297M	39.7	+9.8 +0.1	+0.3	+0.1	+0.4	+0.0	50.4	50.0	+0.4	Line
13	6.900M	37.3	+9.8 +0.1	+0.2	+0.1	+0.4	+0.0	47.9	60.0	-12.1	Line
	QP										
^	6.900M	45.7	+9.8 +0.1	+0.2	+0.1	+0.4	+0.0	56.3	50.0	+6.3	Line
15	7.387M	36.8	+9.9 +0.1	+0.2	+0.1	+0.4	+0.0	47.5	60.0	-12.5	Line
	QP										
^	7.387M	40.7	+9.9 +0.1	+0.2	+0.1	+0.4	+0.0	51.4	50.0	+1.4	Line
17	4.789M	32.7	+9.9 +0.1	+0.2	+0.1	+0.4	+0.0	43.4	56.0	-12.6	Line
	QP										
^	4.789M	38.8	+9.9 +0.1	+0.2	+0.1	+0.4	+0.0	49.5	46.0	+3.5	Line



Test Location: CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • 510 249-1170  
Customer: **Tonal**  
Specification: **15.207 AC Mains - Average**  
Work Order #: **104296** Date: 9/30/2020  
Test Type: **Conducted Emissions** Time: 15:34:46  
Tested By: Hieu Song Nguyenpham/Hoang Sequence#: 51  
Cao/Jonathan Wharton  
Software: EMITest 5.03.19 120V 60Hz

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

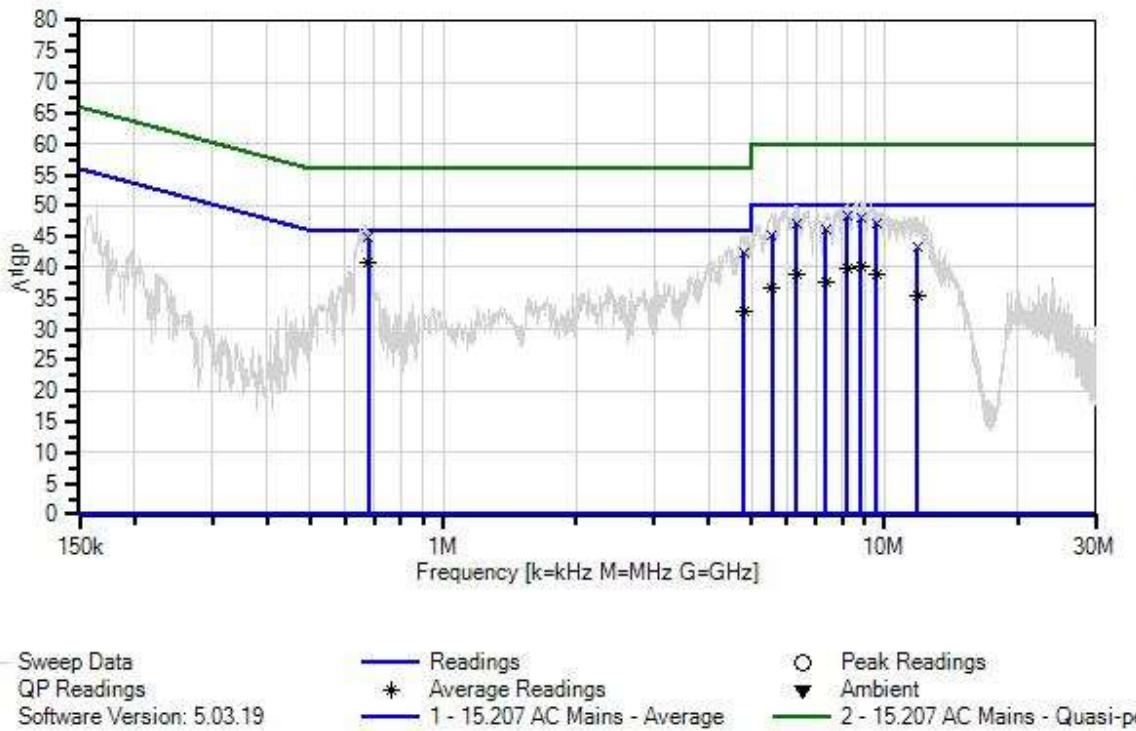
***Test Conditions / Notes:***

Conducted Emission  
Frequency Range: 150kHz to 30MHz  
  
Temperature: 22.9°C  
Humidity: 43%  
Atmospheric Pressure: 101.5kPa  
Software: Putty version 0.74  
Highest Generated Frequency: 2.48GHz  
Method: ANSI C63.10 2013

The EUT is set up as intended. It is connected to the laptop which is on the table. The laptop is used to set the EUT to generate intentional signals and charge the EUT during exposure.

**Middle Channel in TX Mode**

Tonal WO#: 104296 Sequence#: 51 Date: 9/30/2020  
 15.207 AC Mains - Average Test Lead: 120V 60Hz Neutral


**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	12/17/2019	12/17/2020
T1	ANP01211	Attenuator	23-10-34	2/22/2019	2/22/2021
T2	ANP00880	Cable	RG214U	3/25/2020	3/25/2022
T3	ANP06691	Cable	PE3062-180	3/25/2020	3/25/2022
	AN00494	50uH LISN-Line Loss (dB)	3816/NM	3/11/2019	3/11/2021
T4	AN00494	50uH LISN-Return Loss (dB)	3816/NM	3/11/2019	3/11/2021
T5	ANP05258	High Pass Filter	HE9615-150K-50-720B	7/6/2020	7/6/2022

<b>Measurement Data:</b>			Reading listed by margin.				Test Lead: Neutral				
#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar
1	676.244k Ave	30.3 +0.2	+9.9	+0.1	+0.0	+0.2	+0.0	40.7	46.0	-5.3	Neutr
2	8.851M Ave	29.6 +0.1	+9.9	+0.2	+0.1	+0.3	+0.0	40.2	50.0	-9.8	Neutr
3	8.220M Ave	29.3 +0.1	+9.9	+0.2	+0.1	+0.3	+0.0	39.9	50.0	-10.1	Neutr
4	6.328M Ave	28.5 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	39.0	50.0	-11.0	Neutr
5	676.244k QP	34.5 +0.2	+9.9	+0.1	+0.0	+0.2	+0.0	44.9	56.0	-11.1	Neutr
^	676.244k	35.6 +0.2	+9.9	+0.1	+0.0	+0.2	+0.0	46.0	46.0	+0.0	Neutr
7	9.590M Ave	28.2 +0.1	+9.8	+0.3	+0.1	+0.3	+0.0	38.8	50.0	-11.2	Neutr
8	8.220M QP	37.6 +0.1	+9.9	+0.2	+0.1	+0.3	+0.0	48.2	60.0	-11.8	Neutr
^	8.220M	39.7 +0.1	+9.9	+0.2	+0.1	+0.3	+0.0	50.3	50.0	+0.3	Neutr
10	8.851M QP	37.4 +0.1	+9.9	+0.2	+0.1	+0.3	+0.0	48.0	60.0	-12.0	Neutr
^	8.851M	40.2 +0.1	+9.9	+0.2	+0.1	+0.3	+0.0	50.8	50.0	+0.8	Neutr
12	7.346M Ave	27.1 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	37.6	50.0	-12.4	Neutr
13	9.590M QP	36.6 +0.1	+9.8	+0.3	+0.1	+0.3	+0.0	47.2	60.0	-12.8	Neutr
^	9.590M	40.9 +0.1	+9.8	+0.3	+0.1	+0.3	+0.0	51.5	50.0	+1.5	Neutr
15	6.328M QP	36.7 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	47.2	60.0	-12.8	Neutr
^	6.328M	42.6 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	53.1	50.0	+3.1	Neutr
17	4.798M Ave	22.3 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	32.8	46.0	-13.2	Neutr
18	5.574M Ave	26.3 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	36.8	50.0	-13.2	Neutr
19	4.798M QP	31.9 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	42.4	56.0	-13.6	Neutr
^	4.798M	35.2 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	45.7	46.0	-0.3	Neutr
21	7.346M QP	35.8 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	46.3	60.0	-13.7	Neutr
^	7.346M	40.6 +0.1	+9.9	+0.2	+0.1	+0.2	+0.0	51.1	50.0	+1.1	Neutr
23	11.833M Ave	24.8 +0.1	+9.8	+0.3	+0.1	+0.2	+0.0	35.3	50.0	-14.7	Neutr

24	5.574M	34.7	+9.9	+0.2	+0.1	+0.2	+0.0	45.2	60.0	-14.8	Neutr
QP			+0.1								
^	5.574M	42.7	+9.9	+0.2	+0.1	+0.2	+0.0	53.2	50.0	+3.2	Neutr
			+0.1								
26	11.833M	32.8	+9.8	+0.3	+0.1	+0.2	+0.0	43.3	60.0	-16.7	Neutr
QP			+0.1								
^	11.833M	37.7	+9.8	+0.3	+0.1	+0.2	+0.0	48.2	50.0	-1.8	Neutr
			+0.1								

**Test Setup Photo(s)**





## APPENDIX A: MANUFACTURER DECLARATION

The following device has been tested by CKC Laboratories: **Bar Control Module (BCM) Model: 500-1101 rev004**

The manufacturer declares the device name given at the time of testing was in error and should have been referenced as: **Bar Control, Model: 110-0013**

The manufacturer declares that any differences between the names does not affect their EMC characteristics and therefore meets the level of testing equivalent to the tested device name.

## 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	(dB $\mu$ V)
+ Antenna Factor	(dB/m)
+ Cable Loss	(dB)
- Distance Correction	(dB)
- Preamplifier Gain	(dB)
= Corrected Reading	(dB $\mu$ V/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.