

# WaveLynx Technologies Corporation

## EMC TEST REPORT FOR

**Ethos**  
**Model: Ethos U2**

### Tested To The Following Standards:

**FCC Part 15 Subpart C Section(s)**  
**15.207 & 15.225**

**Report No.: 96495-28**

**Date of issue: September 14, 2015**



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 EMC 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.

## 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 .....	5
FCC Part 15 Subpart C .....	6
15.207 AC Conducted Emissions .....	6
15.215(c) 20dB Bandwidth .....	15
15.225 (a)-(c) Field Strength of Fundamental .....	18
15.225(d) Radiated Spurious Emissions .....	24
15.225(e) Frequency Stability .....	29
Supplemental Information .....	32
Emissions Test Details .....	32

## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

WaveLynx Technologies Corporation  
12303 Airport Way, Suite 200  
Broomfield, CO 80021

**REPORT PREPARED BY:**

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

REPRESENTATIVE: Mike Conlin

Project Number: 96495

**DATE OF EQUIPMENT RECEIPT:**

August 24, 2015

**DATE(S) OF TESTING:**

August 24- September 1, 2015

### Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment 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.  
5046 Sierra Pines Drive  
Mariposa, CA 95338

## Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.02.00
EMITest Immunity	5.02.00

## Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Mariposa A	US0103	SL2-IN-E-1147R	3082A-2	90477	A-0136

## SUMMARY OF RESULTS

### Standard / Specification: FCC Part 15 Subpart C

Test Procedure	Description	Modifications	Results
15.207	AC Conducted Emissions	NA	Pass
15.215(c)	20dB Bandwidth	NA	Pass
15.225(a)-(c)	Field Strength of Fundamental	NA	Pass
15.225(d)	Field Strength of Spurious Emissions	NA	Pass
15.225(e)	Frequency Stability	NA	Pass

NA = Not applicable.

### 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

Testing was performed on a fully depopulated PCB with the exception of the 13.56MHz transmitter.

## 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
Ethos	WaveLynx Technologies	Ethos U2	Eng004

#### Support Equipment:

Device	Manufacturer	Model #	S/N
AC-DC Adapter	LG	MCS-01WD	NA

## FCC PART 15 SUBPART C

### 15.207 AC Conducted Emissions

#### Test Setup / Conditions

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Dr. • Mariposa, CA 95338 • (209) 966-5240  
 Customer: **WaveLynx Technologies Corporation**  
 Specification: **15.207 AC Mains - Average**  
 Work Order #: **96495** Date: 8/24/2015  
 Test Type: **Conducted Emissions** Time: 2:54:54 PM  
 Tested By: Chuck Kendall Sequence#: 9  
 Software: EMITest 5.02.00 120V 60Hz

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Tested in accordance with ANSI C63.4 2009

The EUT is taped to a piece of Styrofoam atop a wooden bench 80cm from the floor of a three foot diameter turntable operating at 13.56MHz. It is also located 40cm from a 2m x 2m Vertical Reference Plane. The AC converter is plugged into the LISN that is attached to the ground plane.

Antenna is connected.

Frequencies of Interest: Fundamental (150kHz to 30MHz)  
 RBW = 9Hz; VBW = 27kHz

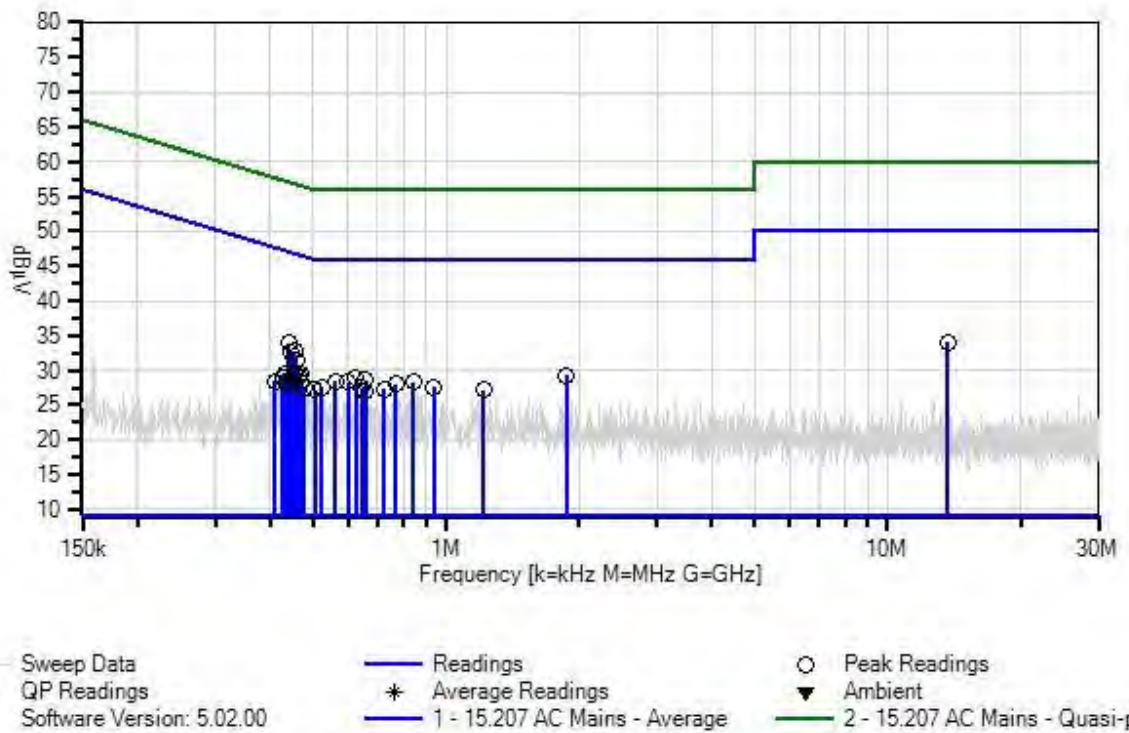
Environmental Conditions:

Temperature: 21°C

Relative Humidity: 20%

Atmospheric Pressure: 97.8kPa

CKC Laboratories, Inc. Date: 8/24/2015 Time: 2:54:54 PM WaveLynx Technologies Corporation WO#: 96495  
 15.207 AC Mains - Average Test Lead: Line 120V 60Hz Sequence#: 9 Ext ATTN: 0 dB



**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
	AN01248	50uH LISN-Line 1 (neutral) (dB)	8028-50-TS-24-BNC	1/16/2015	1/16/2016
T1	AN01248	50uH LISN-Line 2 (Line) (dB)	8028-50-TS-24-BNC	1/16/2015	1/16/2016
T2	ANSITED INT	Cable	LISN Measurements	11/12/2014	11/12/2016
T3	ANP06770	Attenuator	PE7010-10	1/15/2015	1/15/2017
T4	AN02608	High Pass Filter	HE9615-150K-50-720B	3/25/2014	3/25/2016
	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016

<b>Measurement Data:</b>		Reading listed by margin.						Test Lead: Line			
#	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 Ant
1	440.155k	23.4	+0.1	+0.1	+10.1	+0.2	+0.0	33.9	47.1	-13.2	Line
2	452.517k	22.3	+0.1	+0.1	+10.1	+0.2	+0.0	32.8	46.8	-14.0	Line
3	446.700k	22.2	+0.1	+0.1	+10.1	+0.2	+0.0	32.7	46.9	-14.2	Line
4	459.062k	21.0	+0.1	+0.1	+10.1	+0.2	+0.0	31.5	46.7	-15.2	Line
5	13.697M	23.3	+0.2	+0.4	+10.1	+0.1	+0.0	34.1	50.0	-15.9	Line
6	1.872M	18.9	+0.1	+0.1	+10.1	+0.1	+0.0	29.3	46.0	-16.7	Line
7	467.789k	19.0	+0.1	+0.1	+10.1	+0.2	+0.0	29.5	46.6	-17.1	Line
8	624.865k	18.3	+0.1	+0.1	+10.1	+0.2	+0.0	28.8	46.0	-17.2	Line
9	455.426k	18.9	+0.1	+0.1	+10.1	+0.2	+0.0	29.4	46.8	-17.4	Line
10	655.408k	18.1	+0.1	+0.1	+10.1	+0.2	+0.0	28.6	46.0	-17.4	Line
11	464.880k	18.6	+0.1	+0.1	+10.1	+0.2	+0.0	29.1	46.6	-17.5	Line
12	431.428k	19.1	+0.1	+0.1	+10.1	+0.2	+0.0	29.6	47.2	-17.6	Line
13	561.598k	17.9	+0.1	+0.1	+10.1	+0.2	+0.0	28.4	46.0	-17.6	Line
14	600.867k	17.8	+0.1	+0.1	+10.1	+0.2	+0.0	28.3	46.0	-17.7	Line
15	843.754k	17.8	+0.1	+0.1	+10.1	+0.2	+0.0	28.3	46.0	-17.7	Line
16	449.608k	18.6	+0.1	+0.1	+10.1	+0.2	+0.0	29.1	46.9	-17.8	Line
17	470.697k	18.0	+0.1	+0.1	+10.1	+0.2	+0.0	28.5	46.5	-18.0	Line

18	771.033k	17.5	+0.1	+0.1	+10.1	+0.2	+0.0	28.0	46.0	-18.0	Line
19	425.611k	18.4	+0.1	+0.1	+10.1	+0.2	+0.0	28.9	47.3	-18.4	Line
20	522.329k	17.1	+0.1	+0.1	+10.1	+0.2	+0.0	27.6	46.0	-18.4	Line
21	936.743k	17.1	+0.1	+0.1	+10.1	+0.2	+0.0	27.6	46.0	-18.4	Line
22	643.772k	17.0	+0.1	+0.1	+10.1	+0.2	+0.0	27.5	46.0	-18.5	Line
23	722.311k	16.8	+0.1	+0.1	+10.1	+0.2	+0.0	27.3	46.0	-18.7	Line
24	443.064k	17.7	+0.1	+0.1	+10.1	+0.2	+0.0	28.2	47.0	-18.8	Line
25	504.876k	16.7	+0.1	+0.1	+10.1	+0.2	+0.0	27.2	46.0	-18.8	Line
26	1.217M	16.7	+0.1	+0.1	+10.1	+0.2	+0.0	27.2	46.0	-18.8	Line
27	437.246k	17.7	+0.1	+0.1	+10.1	+0.2	+0.0	28.2	47.1	-18.9	Line
28	477.242k	16.9	+0.1	+0.1	+10.1	+0.2	+0.0	27.4	46.4	-19.0	Line
29	652.499k	16.5	+0.1	+0.1	+10.1	+0.2	+0.0	27.0	46.0	-19.0	Line
30	410.339k	18.0	+0.1	+0.1	+10.1	+0.2	+0.0	28.5	47.6	-19.1	Line

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Dr. • Mariposa, CA 95338 • (209) 966-5240  
 Customer: **WaveLynx Technologies Corporation**  
 Specification: **15.207 AC Mains - Average**  
 Work Order #: **96495** Date: 8/24/2015  
 Test Type: **Conducted Emissions** Time: 2:46:14 PM  
 Tested By: Chuck Kendall Sequence#: 8  
 Software: EMITest 5.02.00 120V 60Hz

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Tested in accordance with ANSI C63.4 2009

The EUT is taped to a piece of Styrofoam atop a wooden bench 80cm from the floor of a three foot diameter turntable operating at 13.56MHz. It is also located 40cm from a 2m x 2m Vertical Reference Plane. The AC converter is plugged into the LISN that is attached to the ground plane.

Antenna is connected.

Frequencies of Interest: Fundamental (150kHz to 30MHz)  
 RBW = 9Hz; VBW = 27kHz

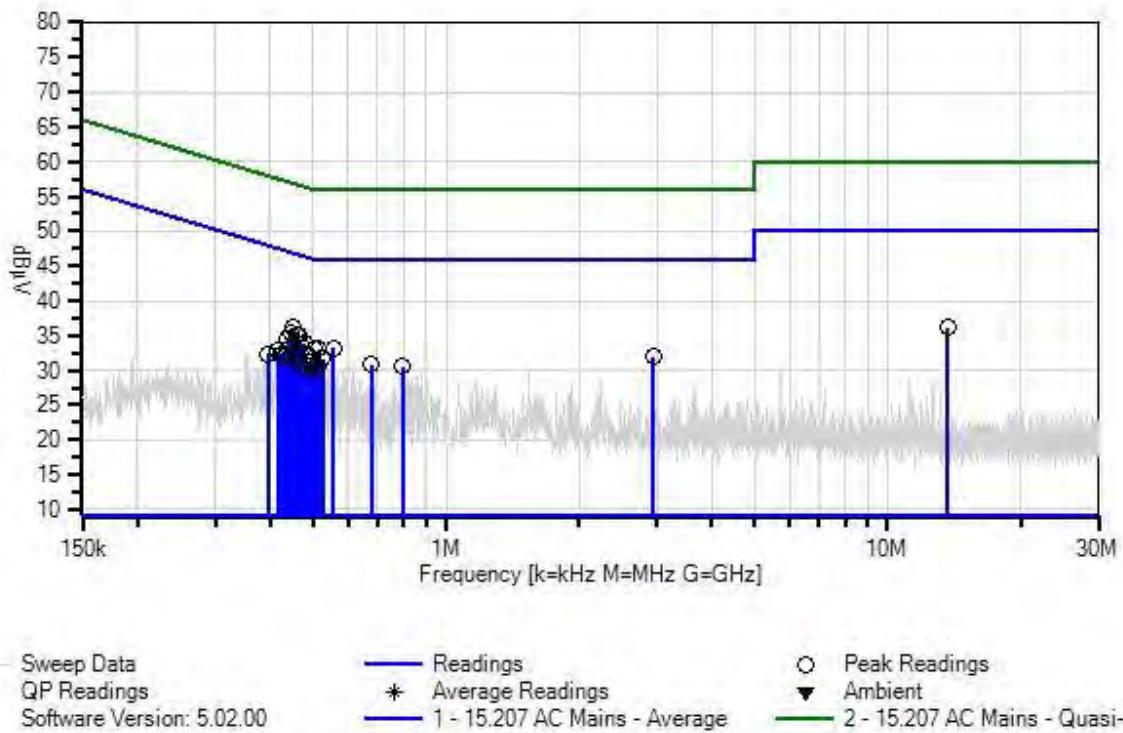
Environmental Conditions:

Temperature: 19°C

Relative Humidity: 45%

Atmospheric Pressure: 97.8kPa

CKC Laboratories, Inc. Date: 8/24/2015 Time: 2:46:14 PM WaveLynx Technologies Corporation WO#: 96495  
 15.207 AC Mains - Average Test Lead: Rtn 120V 60Hz Sequence#: 8 Ext ATTN: 0 dB



**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN01248	50uH LISN-Line 1 (neutral) (dB)	8028-50-TS-24-BNC	1/16/2015	1/16/2016
	AN01248	50uH LISN-Line 2 (Line) (dB)	8028-50-TS-24-BNC	1/16/2015	1/16/2016
T2	ANSITED INT	Cable	LISN Measurements	11/12/2014	11/12/2016
T3	ANP06770	Attenuator	PE7010-10	1/15/2015	1/15/2017
T4	AN02608	High Pass Filter	HE9615-150K-50-720B	3/25/2014	3/25/2016
	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016

**Measurement Data:** Reading listed by margin.

Test Lead: Rtn

#	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 Ant
1	451.789k	25.6	+0.1	+0.1	+10.1	+0.2	+0.0	36.1	46.8	-10.7	Rtn
2	457.607k	24.7	+0.1	+0.1	+10.1	+0.2	+0.0	35.2	46.7	-11.5	Rtn
3	463.424k	24.6	+0.1	+0.1	+10.1	+0.2	+0.0	35.1	46.6	-11.5	Rtn
4	445.244k	24.8	+0.1	+0.1	+10.1	+0.2	+0.0	35.3	47.0	-11.7	Rtn
5	475.787k	23.4	+0.1	+0.1	+10.1	+0.2	+0.0	33.9	46.4	-12.5	Rtn
6	436.518k	23.9	+0.1	+0.1	+10.1	+0.2	+0.0	34.4	47.1	-12.7	Rtn
7	469.969k	23.2	+0.1	+0.1	+10.1	+0.2	+0.0	33.7	46.5	-12.8	Rtn
8	555.052k	22.7	+0.1	+0.1	+10.1	+0.2	+0.0	33.2	46.0	-12.8	Rtn
9	501.239k	22.6	+0.1	+0.1	+10.1	+0.2	+0.0	33.1	46.0	-12.9	Rtn
10	515.056k	22.6	+0.1	+0.1	+10.1	+0.2	+0.0	33.1	46.0	-12.9	Rtn
11	13.706M	25.3	+0.2	+0.4	+10.1	+0.1	+0.0	36.1	50.0	-13.9	Rtn
12	439.426k	22.6	+0.1	+0.1	+10.1	+0.2	+0.0	33.1	47.1	-14.0	Rtn
13	481.604k	21.7	+0.1	+0.1	+10.1	+0.2	+0.0	32.2	46.3	-14.1	Rtn
14	2.944M	21.4	+0.1	+0.2	+10.1	+0.1	+0.0	31.9	46.0	-14.1	Rtn
15	524.510k	21.1	+0.1	+0.1	+10.1	+0.2	+0.0	31.6	46.0	-14.4	Rtn
16	460.515k	21.7	+0.1	+0.1	+10.1	+0.2	+0.0	32.2	46.7	-14.5	Rtn
17	415.429k	22.3	+0.1	+0.1	+10.1	+0.2	+0.0	32.8	47.5	-14.7	Rtn

18	493.967k	20.8	+0.1	+0.1	+10.1	+0.2	+0.0	31.3	46.1	-14.8	Rtn
19	421.246k	21.9	+0.1	+0.1	+10.1	+0.2	+0.0	32.4	47.4	-15.0	Rtn
20	433.609k	21.7	+0.1	+0.1	+10.1	+0.2	+0.0	32.2	47.2	-15.0	Rtn
21	488.149k	20.6	+0.1	+0.1	+10.1	+0.2	+0.0	31.1	46.2	-15.1	Rtn
22	675.768k	20.3	+0.1	+0.1	+10.1	+0.2	+0.0	30.8	46.0	-15.2	Rtn
23	429.973k	21.4	+0.1	+0.1	+10.1	+0.2	+0.0	31.9	47.3	-15.4	Rtn
24	495.421k	20.2	+0.1	+0.1	+10.1	+0.2	+0.0	30.7	46.1	-15.4	Rtn
25	485.240k	20.2	+0.1	+0.1	+10.1	+0.2	+0.0	30.7	46.2	-15.5	Rtn
26	512.147k	20.0	+0.1	+0.1	+10.1	+0.2	+0.0	30.5	46.0	-15.5	Rtn
27	797.212k	20.0	+0.1	+0.1	+10.1	+0.2	+0.0	30.5	46.0	-15.5	Rtn
28	394.340k	21.9	+0.1	+0.1	+10.1	+0.2	+0.0	32.4	48.0	-15.6	Rtn
29	466.333k	20.4	+0.1	+0.1	+10.1	+0.2	+0.0	30.9	46.6	-15.7	Rtn
30	503.421k	19.8	+0.1	+0.1	+10.1	+0.2	+0.0	30.3	46.0	-15.7	Rtn

## Test Setup Photos



## 15.215(c) 20 dB Bandwidth

### Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa CA 95338 • (209) 966-5240  
 Customer: **WaveLynx Technologies Corporation**  
 Specification: **15.225(c) -20dB Occupied Bandwidth**  
 Work Order #: **97495** Date: 9/01/2015  
 Test Type: **Maximized Emissions** Time: 18:51:03  
 Tested By: Chuck Kendall Sequence#: 1  
 Software: EMITest 5.02.00

#### Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

#### Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

#### Test Conditions / Notes:

Tested in accordance with ANSI C63.4 2009..

The EUT is placed at the center of a 40' diameter turntable operating at 13.56MHz.

The EUT was investigated about three orthogonal axes.

The data presented represents the worst-case orientation..

The EUT is powered with +5VDC via USB cable..

Frequency Range of Interest: 0.009-30MHz..

0.15-30MHz: RBW = 9kHz; VBW > RBW..

Environmental Conditions:.

Temperature: 19°C.

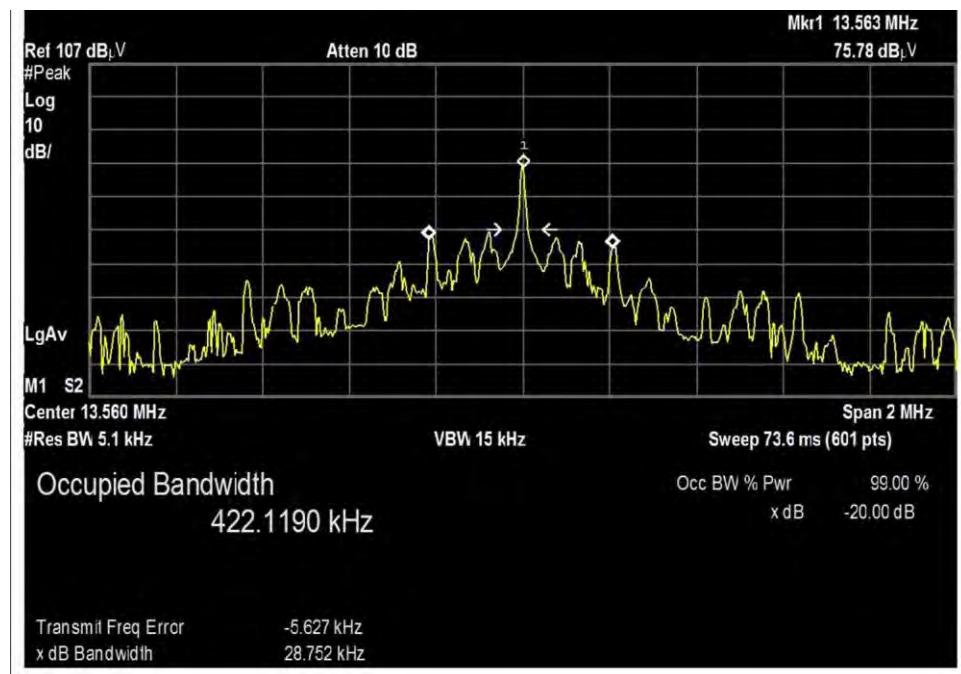
Relative Humidity: 25%.

Atmospheric Pressure: 97.8kPa

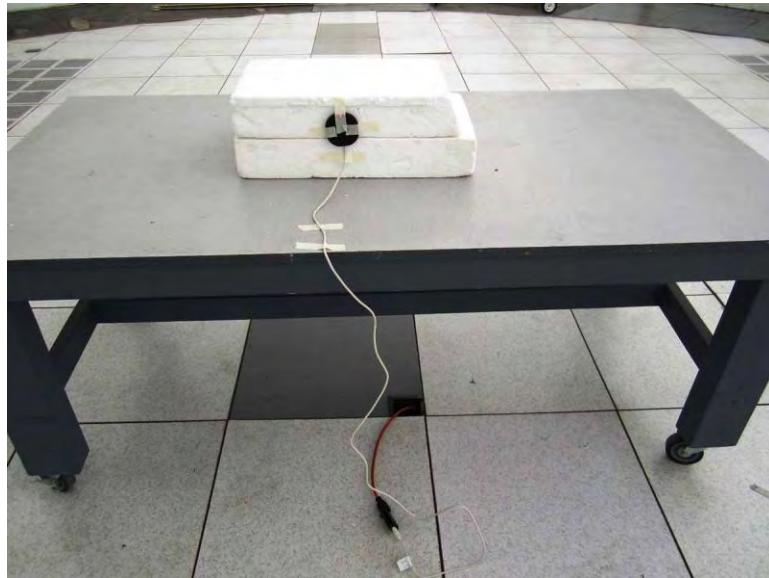
#### Test Equipment:

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN00226	Loop Antenna	6502	3/28/2014	3/28/2016
T2	ANMA10M	Cable		8/26/2014	8/26/2016
	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016

Plot



## Test Setup Photos



## 15.225(a)-(c) Field Strength of Fundamental

### Test Conditions / Setup / Data

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa CA 95338 • (209) 966-5240  
 Customer: **WaveLynx Technologies Corporation**  
 Specification: **15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)**  
 Work Order #: **97495** Date: 9/2/2015  
 Test Type: **Maximized Emissions** Time: 10:56:17  
 Tested By: Chuck Kendall Sequence#: 1  
 Software: EMITest 5.02.00

#### *Equipment Tested:*

Device	Manufacturer	Model #	S/N
Configuration 1			

#### *Support Equipment:*

Device	Manufacturer	Model #	S/N
Configuration 1			

#### *Test Conditions / Notes:*

Tested in accordance with ANSI C63.4 2009

The EUT is placed at the center of a 40' diameter turntable operating at 13.56MHz.  
 The EUT was investigated about three orthogonal axes.  
 The data presented represents the worst-case orientation.

The EUT is powered with +5VDC via USB cable.

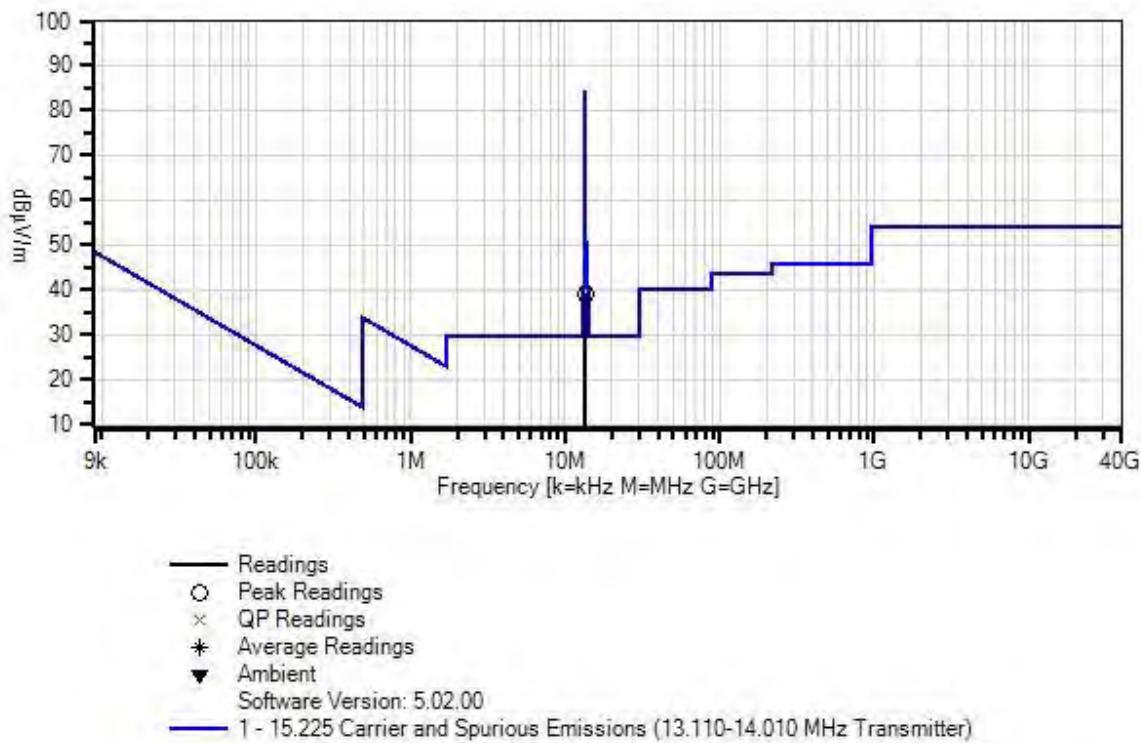
Frequency Range of Interest: 0.009-30MHz  
 0.15-30MHz: RBW = 9kHz; VBW > RBW

Environmental Conditions:

Temperature: 29°C

Relative Humidity: 20%

Atmospheric Pressure: 104.8kPa

WaveLynx Corp. WO#: 97495 Sequence#: 1 Date: 9/2/2015  
 15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter) Test Distance: 10 Meters Vert

**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN00226	Loop Antenna	6502	3/28/2014	3/28/2016
T2	ANMA10M	Cable		8/26/2014	8/26/2016
	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016

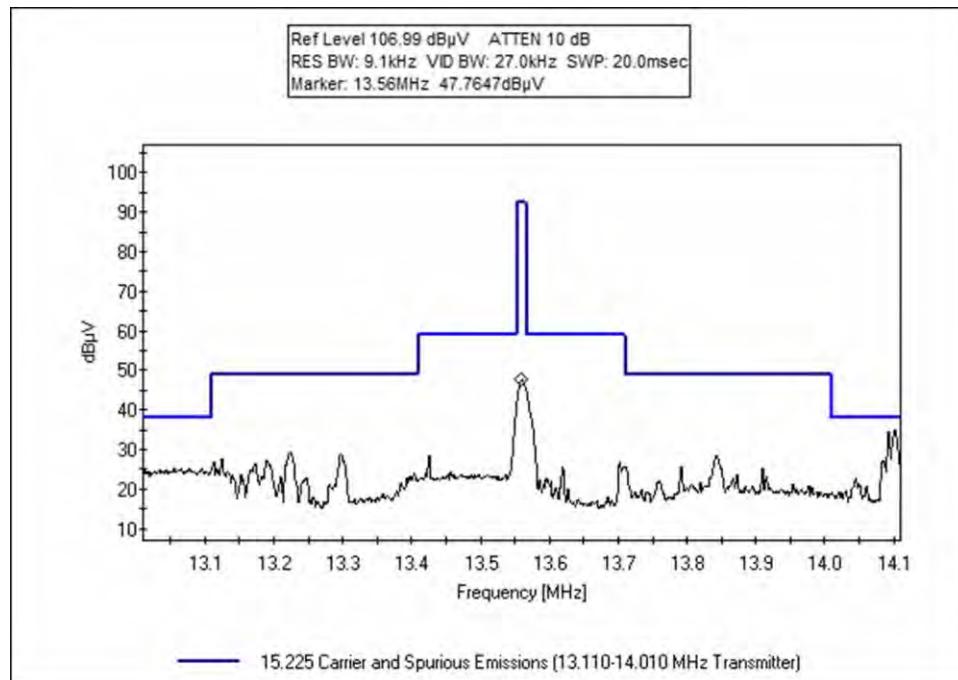
**Measurement Data:**

Reading listed by margin.

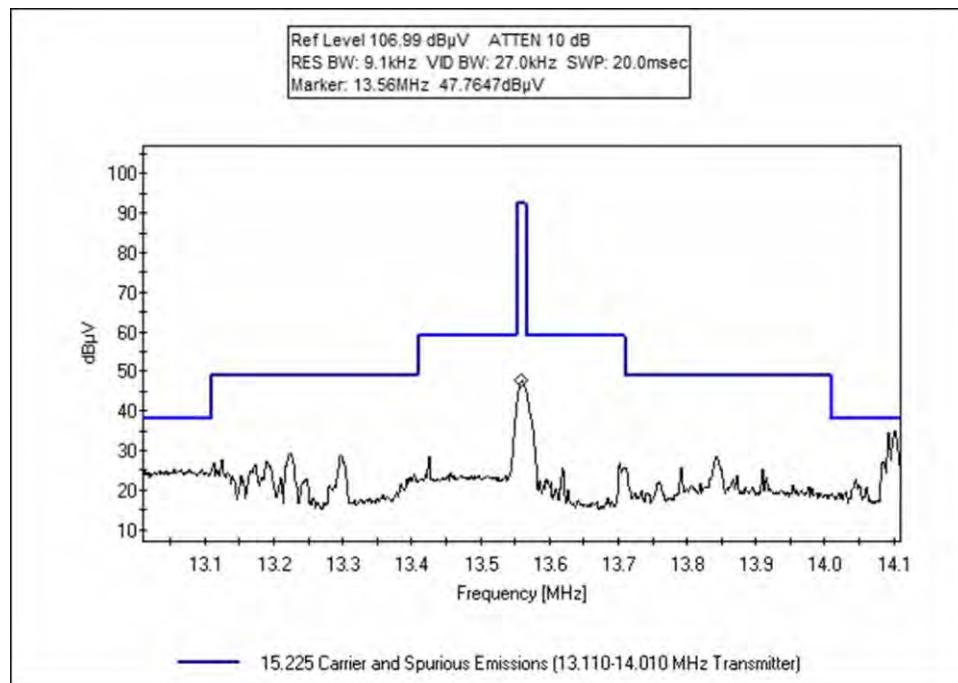
Test Distance: 10 Meters

#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	dB	Dist Table	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar Ant
1	13.560M	47.8	+9.7	+0.8		-19.1	39.2	84.0	-44.8	Vert

## Emissions Mask Plot

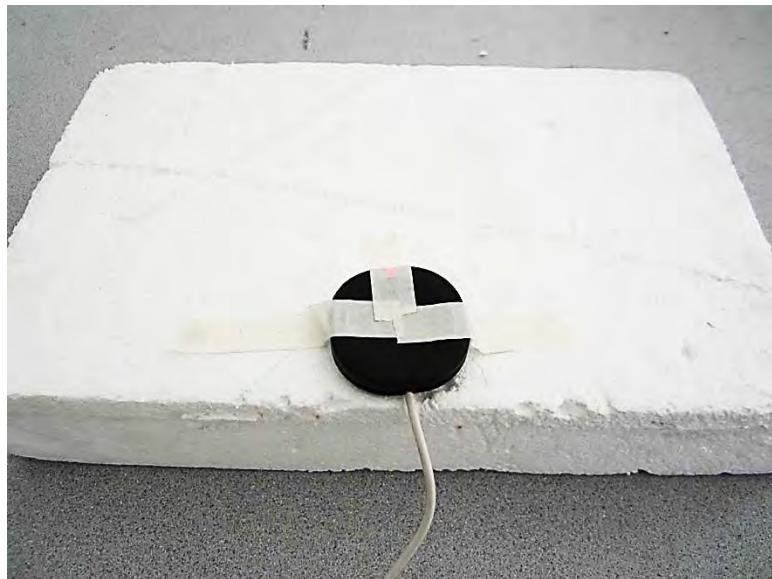


## Test Plots

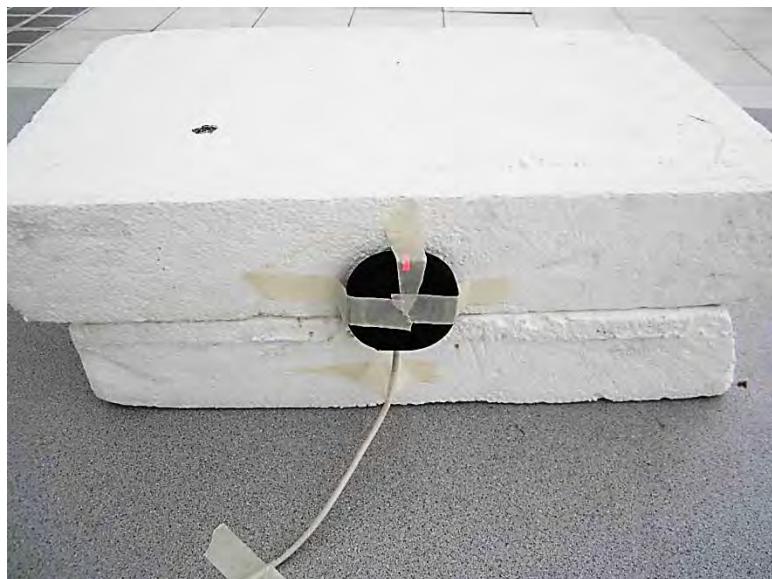


## Test Setup Photos

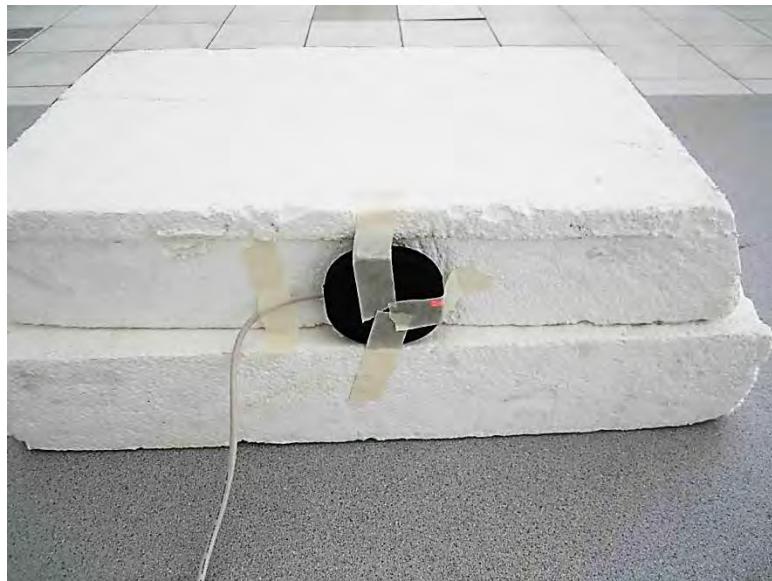




X Axis



Y Axis



Z Axis

## 15.225(d) Radiated Spurious Emissions

### Test Conditions / Setup / Data

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Dr. • Mariposa, CA 95338 • (209) 966-5240  
 Customer: **WaveLynx Technologies Corporation**  
 Specification: **15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)**  
 Work Order #: **96495** Date: 8/24/2015  
 Test Type: **Maximized Emissions** Time: 13:56:37  
 Tested By: Chuck Kendall Sequence#: 1  
 Software: EMITest 5.02.00

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Tested in accordance with ANSI C63.4 2009

The EUT is placed at the center of a 40' diameter turntable operating at 13.56MHz.

The EUT was investigated about three orthogonal axes.

The data presented represents the worst-case orientation.

The EUT is powered with +5VDC via USB cable.

Frequency Range of Interest: 0.009-1000MHz

0.009-0.15MHz: RBW = 200Hz; VBW > RBW

0.15-30MHz: RBW = 9kHz; VBW > RBW

30-1000MHz: RBW = 120kHz; VBW > RBW

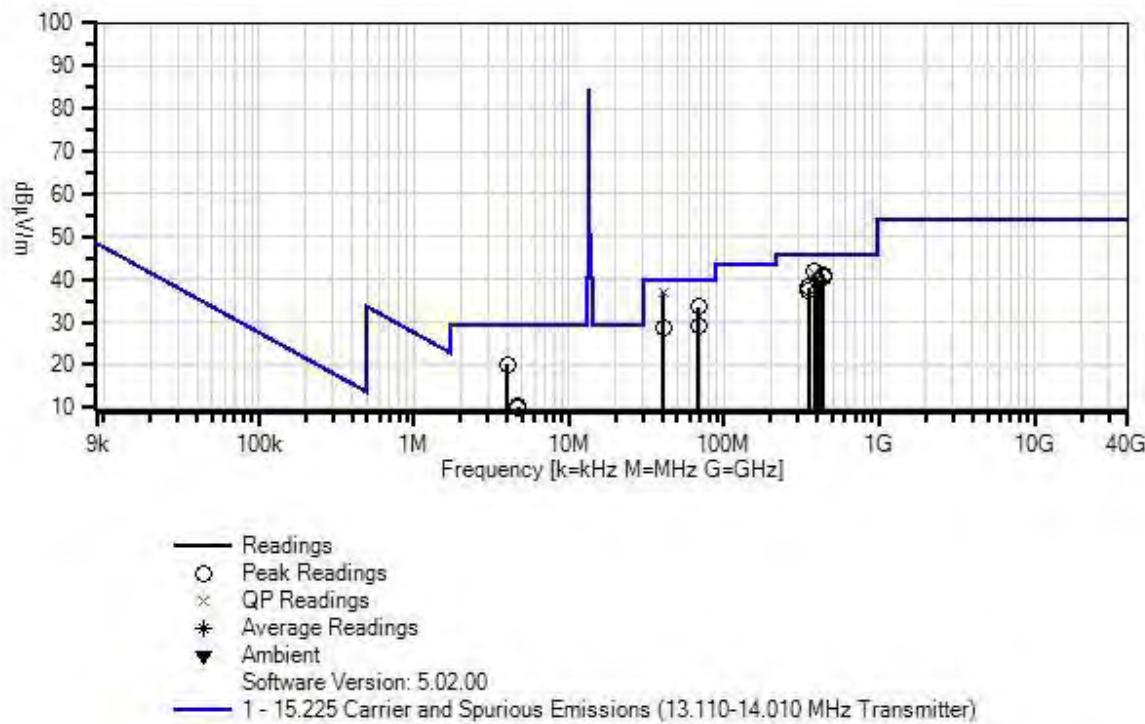
Environmental Conditions:

Temperature: 26°C

Relative Humidity: 19%

Atmospheric Pressure: 97.4kPa

CKC Laboratories, Inc. Date: 8/24/2015 Time: 13:56:37 WaveLynx Technologies Corporation WO#: 96495  
15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter) Test Distance: 10 Meters Sequence#: 1 Ext  
ATTN: 0 dB



**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN00226	Loop Antenna	6502	3/28/2014	3/28/2016
	ANMACOND	Cable		8/26/2014	8/26/2016
T2	ANP05922	Cable	RG/214	9/5/2014	9/5/2016
T3	ANP06232	Cable	CXTA04A-35	9/5/2014	9/5/2016
T4	AN00449	Preamp-Bottom Amp (dB)	8447F	4/7/2014	4/7/2016
T5	AN01991	Biconilog Antenna	CBL6111C	3/7/2014	3/7/2016
T6	ANMA10M	Cable		8/26/2014	8/26/2016
T7	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016

**Measurement Data:**

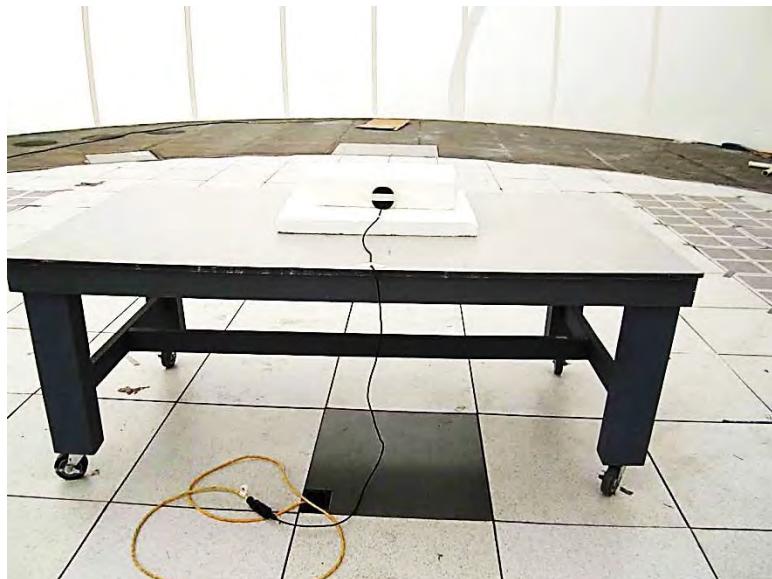
Reading listed by margin.

Test Distance: 10 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	dB	dB	dB	dB	Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	40.678M	33.0	+0.0	+0.0	+0.5	-22.3	+10.5	36.9	40.0	-3.1	Vert
	QP		+13.7	+1.5	+0.0						
^	40.678M	35.6	+0.0	+0.0	+0.5	-22.3	+10.5	39.5	40.0	-0.5	Vert
			+13.7	+1.5	+0.0						
3	379.692M	31.3	+0.0	+0.1	+1.6	-22.9	+10.5	41.8	46.0	-4.2	Vert
			+15.7	+5.5	+0.0						
4	379.680M	30.8	+0.0	+0.1	+1.6	-22.9	+10.5	41.3	46.0	-4.7	Horiz
	QP		+15.7	+5.5	+0.0						
^	379.680M	32.1	+0.0	+0.1	+1.6	-22.9	+10.5	42.6	46.0	-3.4	Horiz
			+15.7	+5.5	+0.0						
6	433.900M	28.6	+0.0	+0.2	+1.7	-23.1	+10.5	40.8	46.0	-5.2	Horiz
			+16.9	+6.0	+0.0						
7	433.908M	28.4	+0.0	+0.2	+1.7	-23.1	+10.5	40.6	46.0	-5.4	Vert
			+16.9	+6.0	+0.0						
8	67.806M	36.6	+0.0	+0.0	+0.6	-22.3	+10.5	33.6	40.0	-6.4	Vert
			+6.2	+2.0	+0.0						
9	406.801M	28.2	+0.0	+0.1	+1.7	-23.0	+10.5	39.6	46.0	-6.4	Vert
			+16.3	+5.8	+0.0						
10	352.550M	28.7	+0.0	+0.1	+1.5	-22.8	+10.5	38.2	46.0	-7.8	Horiz
			+14.9	+5.3	+0.0						
11	352.552M	27.7	+0.0	+0.1	+1.5	-22.8	+10.5	37.2	46.0	-8.8	Vert
			+14.9	+5.3	+0.0						

12	4.000M	28.7	+10.0 +0.0	+0.0 +0.4	+0.0 +0.0	+0.0 -22.3	-19.1 +10.5	20.0	29.5	-9.5	Vert
13	67.805M	32.2	+0.0 +6.2	+0.0 +2.0	+0.6 +0.0	-22.3	+10.5	29.2	40.0	-10.8	Horiz
14	40.676M	24.8	+0.0 +13.7	+0.0 +1.5	+0.5 +0.0	-22.3	+10.5	28.7	40.0	-11.3	Horiz
15	4.710M	19.0	+10.0 +0.0	+0.0 +0.5	+0.0 +0.0	+0.0	-19.1	10.4	29.5	-19.1	Horiz
16	4.710M	18.4	+10.0 +0.0	+0.0 +0.5	+0.0 +0.0	+0.0	-19.1	9.8	29.5	-19.7	Vert
17	4.000M	17.0	+10.0 +0.0	+0.0 +0.4	+0.0 +0.0	+0.0	-19.1	8.3	29.5	-21.2	Horiz
18	19.843M	16.3	+8.2 +0.0	+0.0 +1.0	+0.0 +0.0	+0.0	-19.1	6.4	29.5	-23.1	Vert
19	27.120M	16.2	+7.2 +0.0	+0.0 +1.2	+0.0 +0.0	+0.0	-19.1	5.5	29.5	-24.0	Vert

## Test Setup Photos



## 15.225(e) Frequency Stability

### Test Conditions / Setup

Test Date: 8/24/2015  
 Test Engineer: Chuck Kendall  
 Test Specification FCC 15.225  
 Operating Voltage: +5VDC  
 Frequency Limit: 0.01%

Tested in accordance with ANSI C63.10 (2009).  
 The EUT is placed inside the temperature chamber.  
 The EUT is supplied with 5VDC via AC-DC adapter.  
 RBW = 200Hz; VBW > RBW

### Test Equipment

Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
1879	Temperature Chamber	S-1.2 Min.	Thermotron	12/5/2014	12/5/2016
3197	Thermometer	HH-26K	Omega	9/12/2014	9/12/2016
2668	Spectrum Analyzer	E4446A	Agilent	8/14/2015	8/14/2016

## Test Data

Temperature Variations			
		Channel 1 (MHz)	Dev. (%)
Channel Frequency:		13.56	
Temp (C)	Voltage		
-30	5.0	13.56000	0.00000
-20	+5	13.56000	0.00000
-10	+5	13.56000	0.00000
0	+5	13.56000	0.00000
10	+5	13.56000	0.00000
20	+5	13.56000	0.00000
30	+5	13.56000	0.00000
40	+5	13.56000	0.00000
50	+5	13.55979	0.00155

Voltage Variations ( $\pm 15\%$ )			
20	4.25	13.56000	0.00000
20	+5	13.56000	0.00000
20	5.75	13.55975	0.00184
Max Deviation (%)			<b>0.00184</b>
			<b>PASS</b>

**Test Setup Photo**



## SUPPLEMENTAL INFORMATION

### 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.

<b>SAMPLE CALCULATIONS</b>	
Meter reading	(dB $\mu$ V)
+ Antenna Factor	(dB)
+ 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.

<b>MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE</b>			
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 carrot ("") 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.