

Lat-Lon, LLC

TEST REPORT FOR

**Small Wireless Sensor
Model: X200**

Tested To The Following Standards:

FCC Part 15 Subpart C Section(s)

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

Report No.: 98017-7

Date of issue: April 8, 2016



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.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Lat-Lon, LLC
2300 S Jason St.
Denver, CO 80223

Representative: Jonathan Bean
Customer Reference Number: 2834

DATE OF EQUIPMENT RECEIPT:**DATE(S) OF TESTING:****REPORT PREPARED BY:**

Morgan Tramontin
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 98017

February 16, 2016

February 16 - April 1, 2016

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.

A handwritten signature in black ink, reading "Steve Behm", is positioned above a horizontal line.

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	5.03.02

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Mariposa A	US0103	SL2-IN-E-1147R	3082A-2	90477	A-0136
Mariposa D	US0103	SL2-IN-E-1147R	3082A-1	784962	A-0136

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 is battery operated only.

NA2 = Not applicable because the EUT is battery operated with built in solar charger.

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	Manufacturer	Model #	S/N
Small Wireless Sensor	Lat-Lon, LLC	X200	NA

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:	IEEE-802.15.4e
Operating Frequency Range:	2405 – 2475 MHz
Modulation Type(s):	OQPSK
Maximum Duty Cycle:	100%
Number of TX Chains:	15 channels
Antenna Type(s) and Gain:	PCB Trace/5dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral
Nominal Input Voltage:	3.4 VDC from built-in solar charger/ 2.5 VDC internal battery
Firmware / Software used for Test:	SmartMesh IP

FCC Part 15 Subpart C

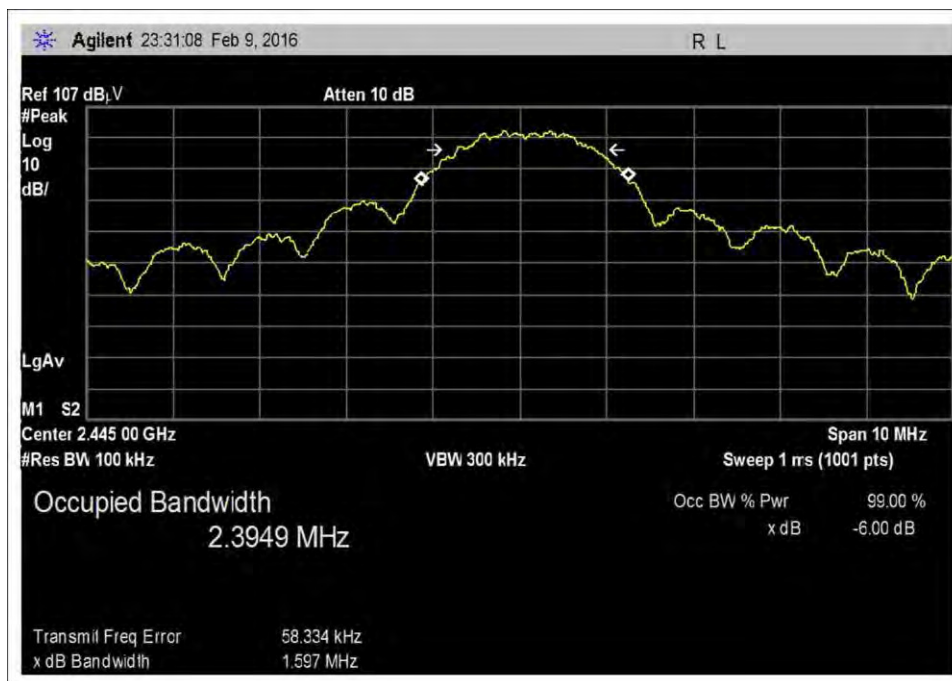
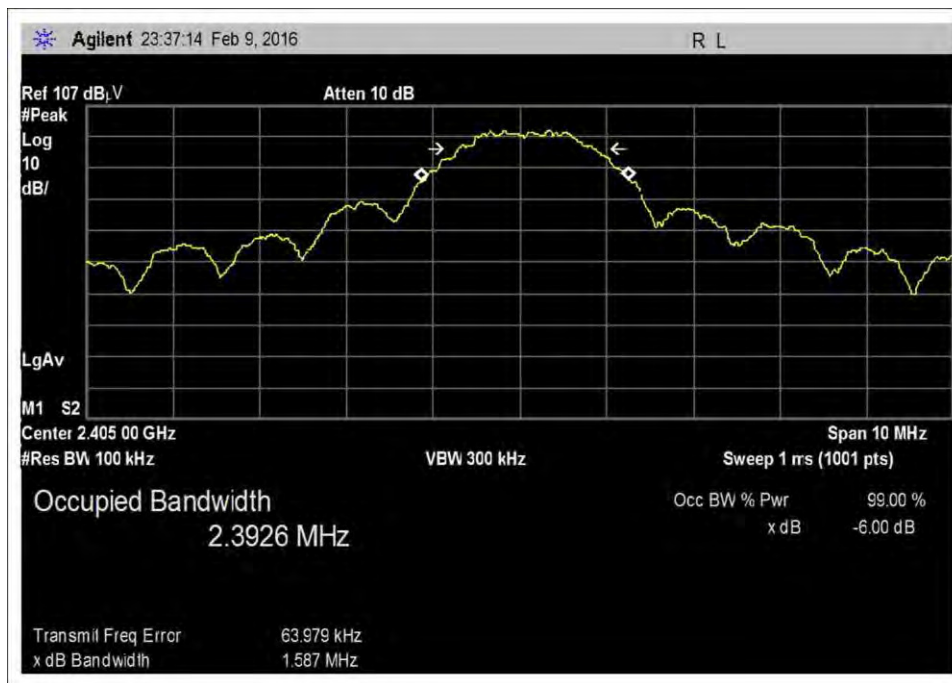
15.247(a)(2) 6dB Bandwidth

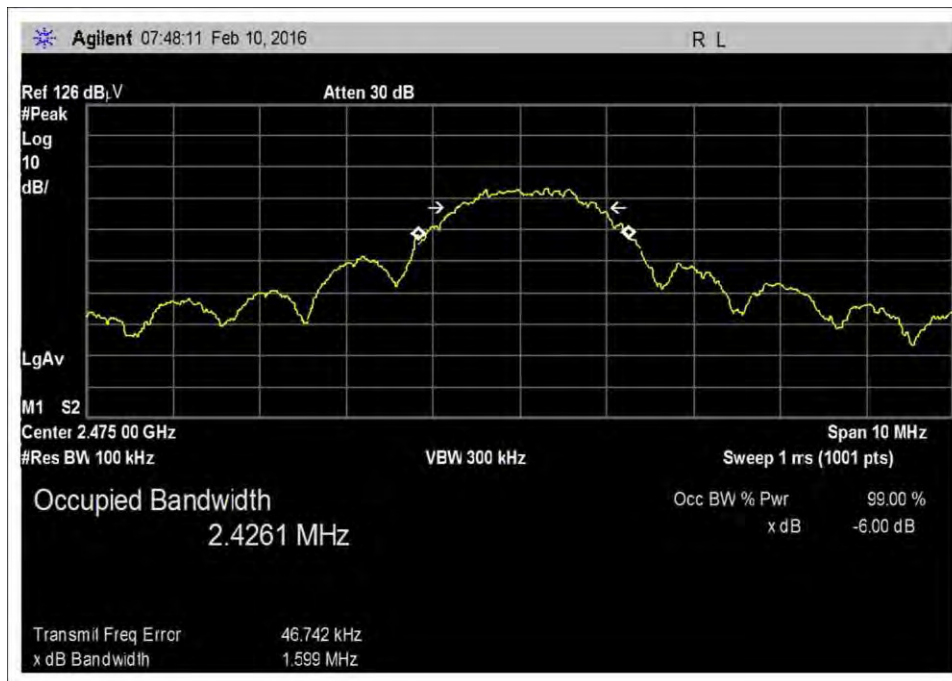
Test Setup/Conditions			
Test Location:	Mariposa Lab A	Test Engineer:	Chuck Kendall
Test Method:	ANSI C63.10 (2013), KDB 558074 v03r04	Test Date(s):	3/3/2016
Configuration:	1		
Test Setup:	The EUT is set up on Styrofoam insulation 1.5 m above the ground plane. The EUT is set to 2405/2445/2475 MHz respectively. Frequencies of Interest: 2405 MHz to 2475 MHz RBW = 100 kHz; VBW = 300 kHz Environmental Conditions: Temperature = 20°C Relative Humidity = 40% Atmospheric Pressure = 97.4 kPa		

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02668	Spectrum Analyzer	Agilent	E4446A	8/14/2015	8/14/2016
03155	Preamplifier	HP	83017A	6/30/2015	6/30/2017
P01403	Cable	Semflex	58758-23	12/8/2014	12/8/2016
03355	Cable	AstroLab	32026-2-29094K-48TC	12/8/2014	12/8/2016
P05904	Cable	AstroLab	32022-2-29094K-144TC	12/8/2014	12/8/2016
01273	Horn Antenna	EMCO	3115	2/3/2015	2/3/2017
03362	Cable	Astrolab	32022-2-29094-48TC	12/8/2014	12/8/2016

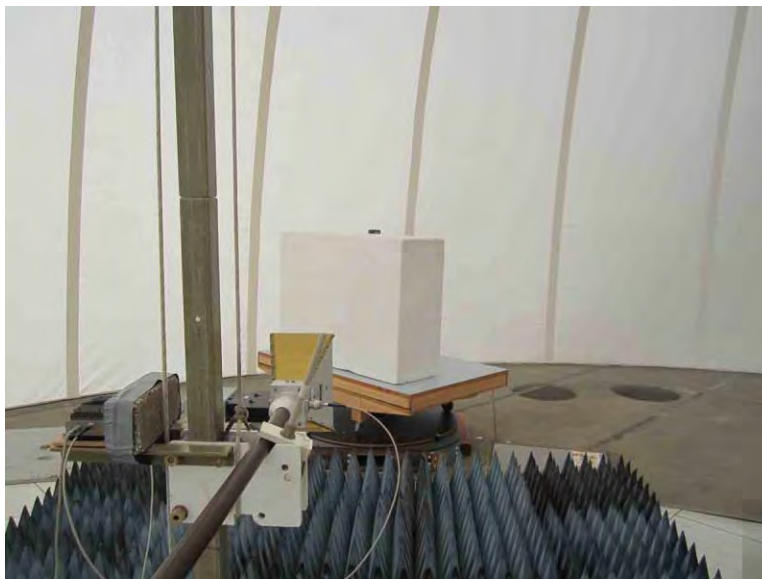
Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2405	1	OQPSK	1587	≥500	Pass
2445	1	OQPSK	1597	≥500	Pass
2475	1	OQPSK	1599	≥500	Pass

Plots





Test Setup Photo



15.247(b)(3) Output Power

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa, CA 95338 • (209) 966-5240
 Customer: **Lat-Lon, LLC**
 Specification: **15.247(b) Power Output (2400-2483.5 MHz DTS)**
 Work Order #: **98017** Date: 3/3/2016
 Test Type: **Maximized Emissions** Time: 16:19:02
 Tested By: Chuck Kendall Sequence#: 1
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

ANSI C63.10 2013

The EUT is set up on Styrofoam insulation 1.5 m above the ground plane.
 The EUT is set to 2445 MHz.
 Three orthogonal axes were investigated and the Z Axis was found to be the worst case.
 This equipment is battery powered. Power output tests were performed using a fresh battery. A solar battery charger inputs a 3.4 VDC nominal input to charge the batteries and the unit can operate while the built-in solar charger is charging the batteries, so this 3.4 VDC input was cut and an external dc power supply was applied to these leads and its voltage was varied $\hat{A}\pm 15\%$ while monitoring the output power. No changes in the output power were noted during this variation.

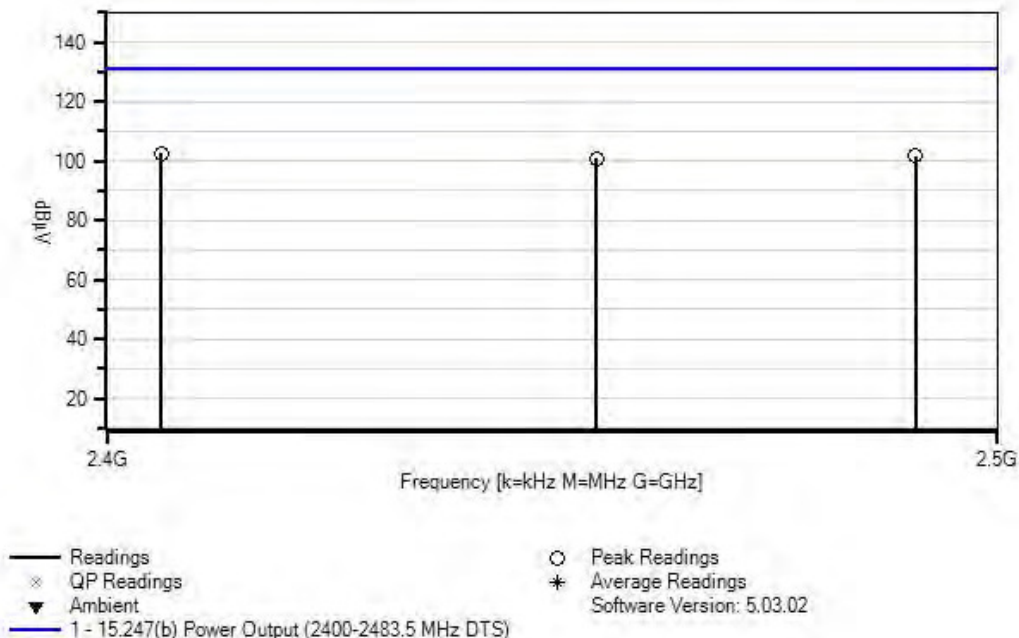
The EUT is fully modulated (100%) during testing at its full output power.

Frequencies of Interest: 2405 MHz to 2475 MHz
 RBW = 3 MHz; VBW = 8 MHz

Environmental Conditions:
 Temperature = 20°C
 Relative Humidity = 40%
 Atmospheric Pressure = 97.4 kPa

Highest Clock = 20 MHz
 Highest frequency generated = 2475 MHz

Lat-Lon, LLC, WO#: 98017 Sequence#: 1 Date: 3/3/2016
15.247(b) Power Output (2400-2483.5 MHz DTS) Test Distance: 3 Meters Horiz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016
T2	AN03155	Preamplifier	83017A	6/30/2015	6/30/2017
T3	ANP01403	Cable	58758-23	12/8/2014	12/8/2016
T4	AN03355	Cable	32026-2-29094K-48TC	12/8/2014	12/8/2016
T5	ANP05904	Cable	32022-2-29094K-144TC	12/8/2014	12/8/2016
T6	AN01273	Horn Antenna	3115	2/3/2015	2/3/2017
T7	AN03362	Cable	32022-2-29094-48TC	12/8/2014	12/8/2016

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6	T7						
			dB	dB	dB	dB	Table	dBμV	dBμV	dB	Ant
1	2405.050M	103.6	+0.0	-33.3	+2.3	+0.8	+0.0	102.6	131.2	-28.6	Horiz
			+2.4	+26.1	+0.7				cw Z Axis		
2	2475.720M	102.4	+0.0	-33.3	+2.4	+0.8	+0.0	101.7	131.2	-29.5	Horiz
			+2.4	+26.3	+0.7				cm Z Axis		
3	2445.550M	101.7	+0.0	-33.3	+2.3	+0.8	+0.0	100.8	131.2	-30.4	Horiz
			+2.4	+26.2	+0.7				cm Z Axis		

Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using a fresh battery. A solar battery charger inputs a 3.4 VDC nominal input to charge the batteries and the unit can operate while the solar charger is charging the batteries, so this 3.4 VDC input was varied $\pm 15\%$ while monitoring the output power. There was no change in the output when the input power was varied.

Parameter Definitions:

Measurements performed at input voltage $V_{\text{nominal}} \pm 15\%$.

Parameter	Value
V_{Nominal} :	3.40 VDC
V_{Minimum} :	2.96 VDC
V_{Maximum} :	3.91 VDC

Power Output Test Data Summary - Radiated Measurement

Measurement Option: PKPM1

Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Field Strength (dBuV/m @3m)	Calculated (dBm)	Limit (dBm)	Results
2405	OQPSK	PCB/5	102.6	2.37	≤ 30	Pass
2445	OQPSK	PCB/5	100.8	0.57	≤ 30	Pass
2475	OQPSK	PCB/5	101.7	1.47	≤ 30	Pass

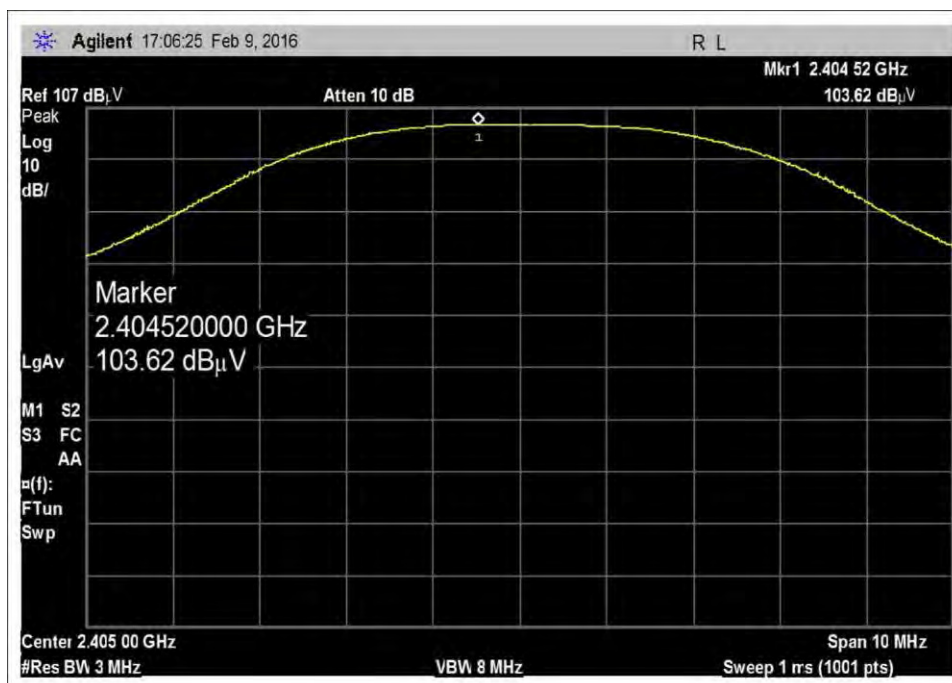
Conducted RF output power calculated in accordance with ANSI C63.10.

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

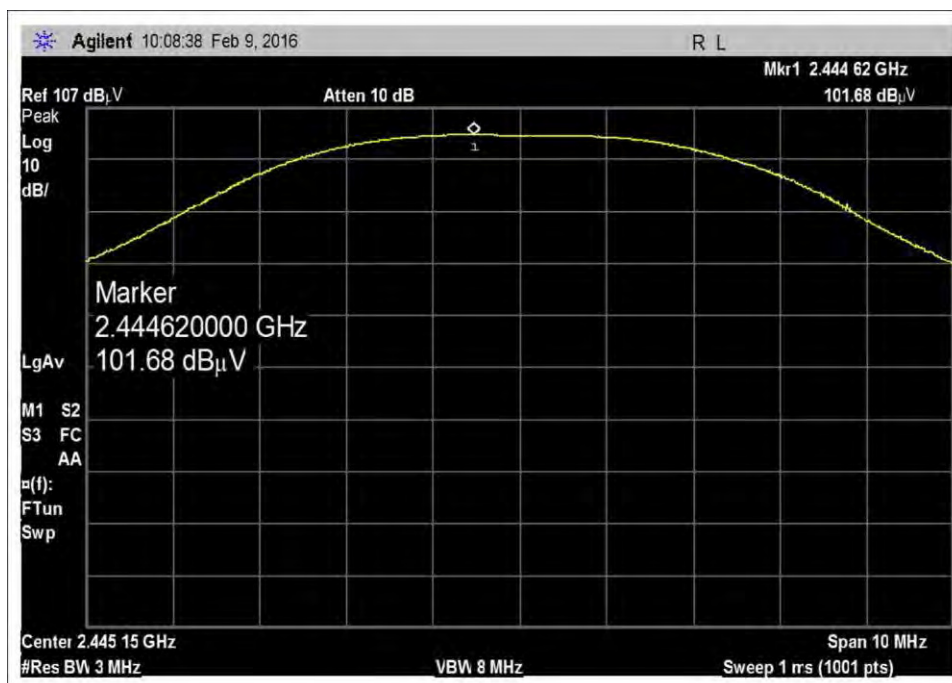
Or equivalently, in logarithmic form:

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

Plot Data

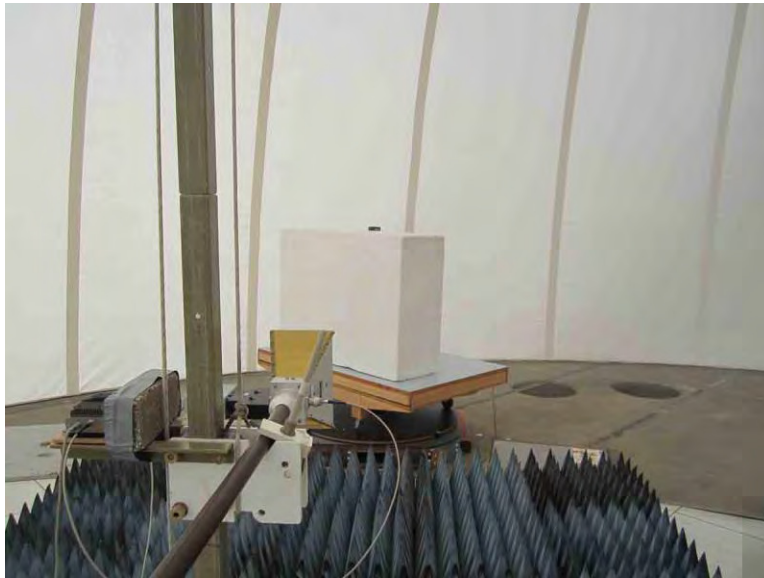


2405MHz



2445MHz

Test Setup Photo



15.247(e) Power Spectral Density

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa, CA 95338 • (209) 966-5240
 Customer: **Lat-Lon, LLC**
 Specification: **15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)**
 Work Order #: **98017** Date: 3/3/2016
 Test Type: **Maximized Emissions** Time: 16:31:54
 Tested By: Chuck Kendall Sequence#: 1
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

ANSI C63.10 2013

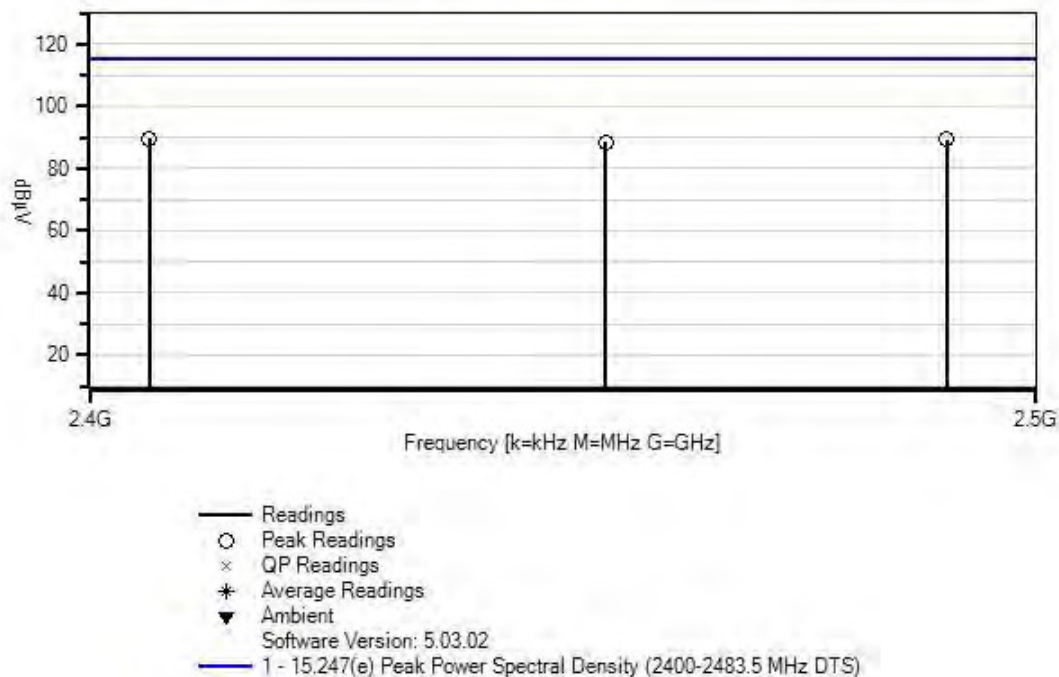
The EUT is set up on Styrofoam insulation 1.5 m above the ground plane.
 The EUT is set to 2405/2445/2475 MHz respectively.
 Three orthogonal axis were investigated but the Z axis was found to be worst case (flat on the foam).
 Since there is a solar charger connected and it can operate while charging; the leads were removed and the nominal 3.4 VDC $\pm$ 15% power was applied via an external dc power supply to note the change in output power.
 No change in the output was observed during the variation of input power.

Frequencies of Interest: 2405 MHz to 2475 MHz
 RBW = 3 kHz; VBW = 9.1 kHz

Environmental Conditions:
 Temperature = 20°C
 Relative Humidity = 40%
 Atmospheric Pressure = 97.4 kPa

Highest Clock = 20 MHz
 Highest frequency generated = 2475 MHz

Lat-Lon, LLC. WO#: 98017 Sequence#: 1 Date: 3/3/2016
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS) Test Distance: 3 Meters Horiz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016
T2	AN03155	Preamp	83017A	6/30/2015	6/30/2017
T3	ANP01403	Cable	58758-23	12/8/2014	12/8/2016
T4	AN03355	Cable	32026-2-29094K-48TC	12/8/2014	12/8/2016
T5	ANP05904	Cable	32022-2-29094K-144TC	12/8/2014	12/8/2016
T6	AN01273	Horn Antenna	3115	2/3/2015	2/3/2017
T7	AN03362	Cable	32022-2-29094-48TC	12/8/2014	12/8/2016

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6	T7						
			dB	dB	dB	dB	Table	dBμV	dBμV	dB	Ant
1	2405.166M	90.7	+0.0	-33.3	+2.3	+0.8	+0.0	89.7	115.0	-25.3	Horiz
			+2.4	+26.1	+0.7				Z Axis 2405 MHz		
2	2475.517M	89.9	+0.0	-33.3	+2.4	+0.8	+0.0	89.2	115.0	-25.8	Horiz
			+2.4	+26.3	+0.7				Z Axis 2405 MHz		
3	2445.172M	89.4	+0.0	-33.3	+2.3	+0.8	+0.0	88.5	115.0	-26.5	Horiz
			+2.4	+26.2	+0.7				Z Axis 2405 MHz		

PSD Test Data Summary - Radiated Measurement						
Measurement Method: PKPSD						
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Field Strength (dBuV/m @3m)	Calculated (dBm/3kHz)	Limit (dBm/3kHz)	Results
2405	OQPSK	PCB/5	89.7	-10.53	≤8	Pass
2445	OQPSK	PCB/5	88.5	-11.73	≤8	Pass
2475	OQPSK	PCB/5	89.2	-11.03	≤8	Pass

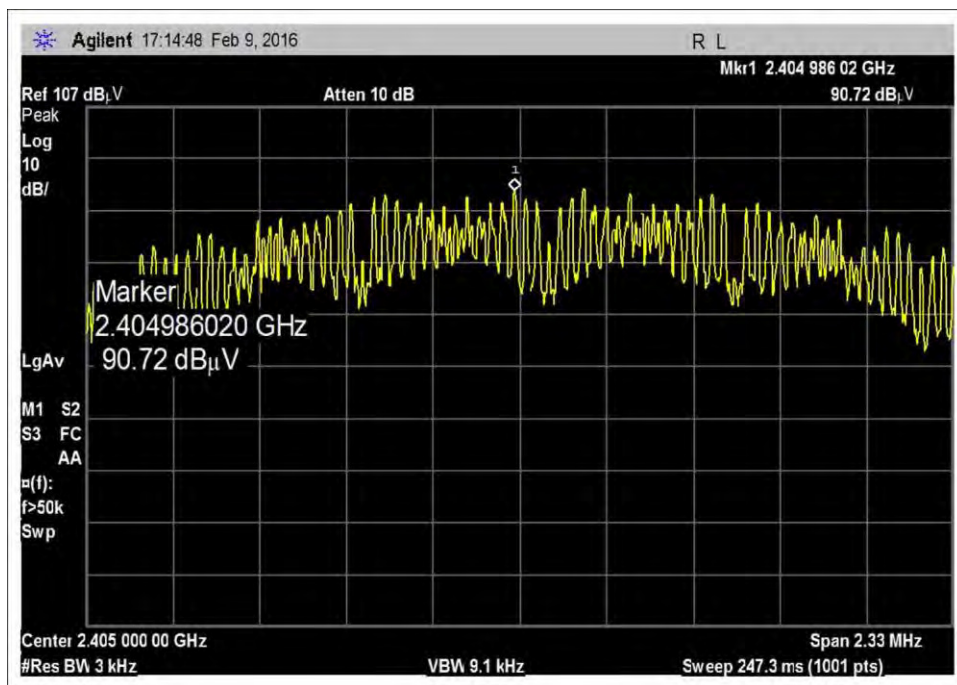
Conducted RF output power calculated in accordance with ANSI C63.10.

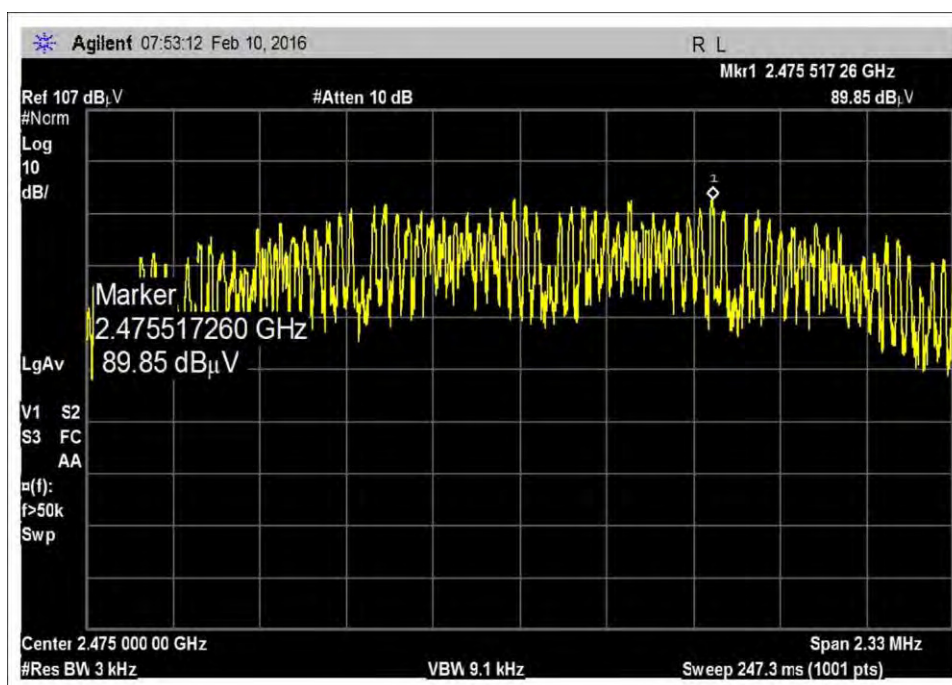
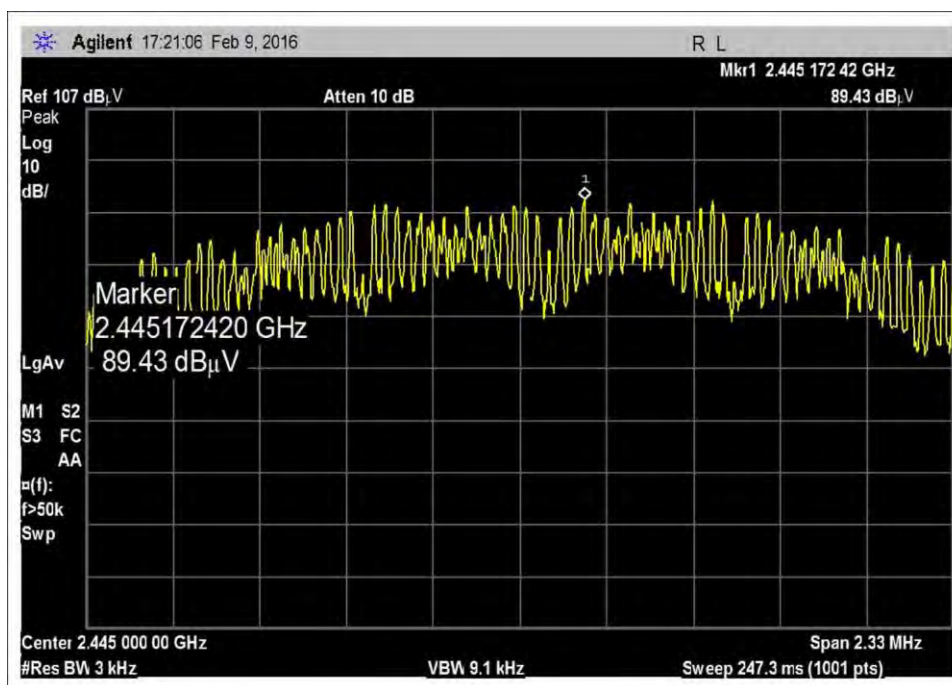
$$P(W) = \frac{(E \cdot d)^2}{30 G}$$

Or equivalently, in logarithmic form:

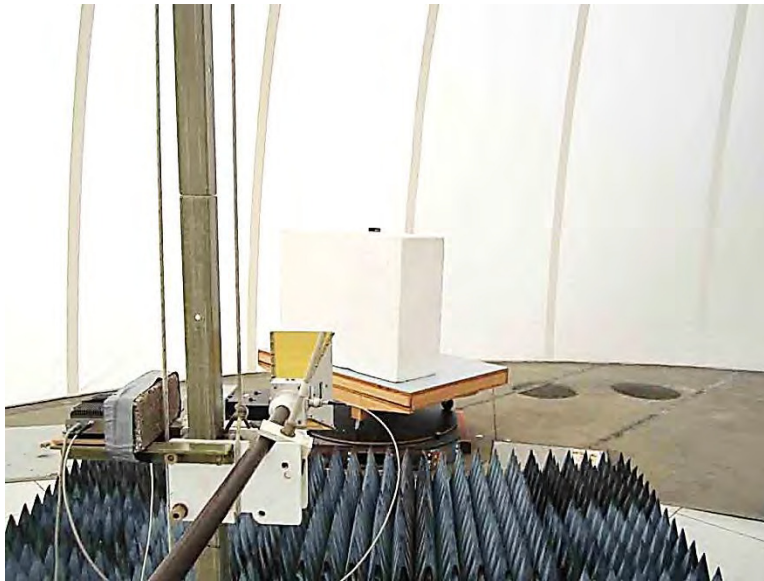
$$P(dBm) = E(dBuV/m) + 20LOG(d) - G - 104.77$$

Plots





Test Setup Photo



15.247(d) Radiated Emissions & Band Edge

Test Data

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa, CA 95338 • (209) 966-5240
 Customer: **Lat-Lon, LLC**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **98017** Date: 2/16/2016
 Test Type: **Maximized Emissions** Time: 16:11:37
 Tested By: Chuck Kendall Sequence#: 2
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

ANSI C63.10 2013
 The EUT is setting atop a piece of Styrofoam insulation on a wooden test bench 80 cm atop a 3m diameter flush-mounted turntable.
 The EUT is battery operated and will be investigated in three different axes; X, Y, & Z.
 The EUT is transmitting on 2445MHz Preliminary investigation proved this to be the worst case frequency for these spurs.

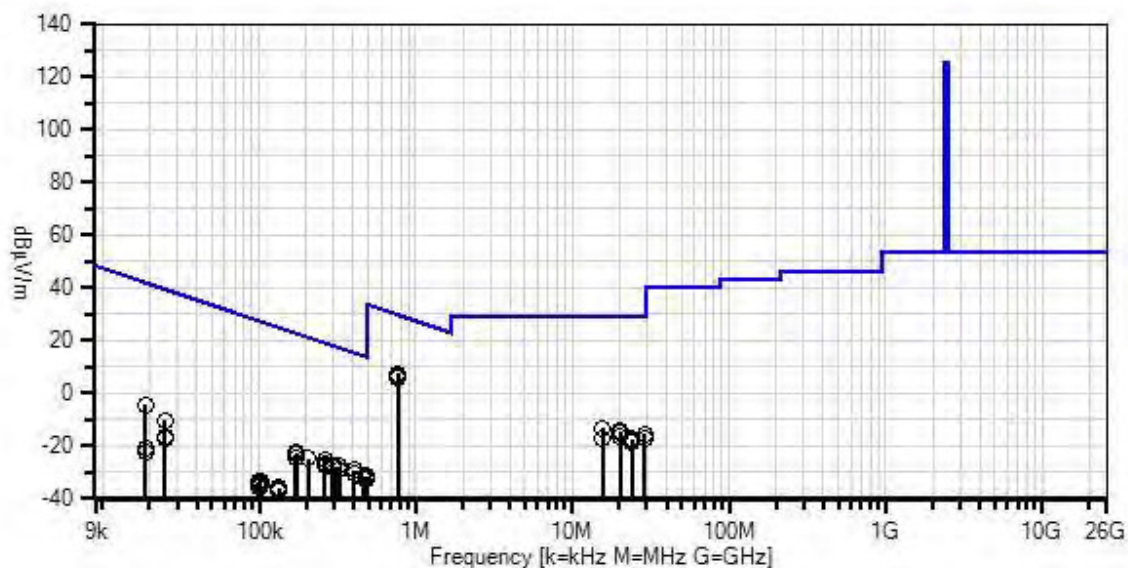
Frequencies investigated are: 9 kHz to 30 MHz

From 9kHz to 150kHz
 RBW= 200Hz; VBW = 600kHz
 From 150kHz to 30MHz
 RBW=9kHz; VBW = 27kHz

Environmental Conditions:
 Temperature = 19.5°C
 Relative Humidity = 40%
 Atmospheric Pressure = 97.7kPa

Highest Clock = 20 MHz
 Highest Frequency = 2475 MHz

Lat-Lon, LLC. W/O#: 98017 Sequence#: 2 Date: 2/16/2016
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



— Readings
× QP Readings
▼ Ambient
— 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

○ Peak Readings
* Average Readings
Software Version: 5.03.02

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016
T2	ANP06885	Cable	P06885	10/27/2015	10/27/2017
T3	ANSITED 3M	Cable		11/15/2014	11/15/2016
T4	AN00226	Loop Antenna	6502	3/28/2014	3/28/2016

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	773.240k	36.7	+0.0	+0.0	+0.1	+10.8	-40.0	7.6	29.8 Tx at 2445 MHz Z axis	-22.2	Vert
2	773.040k	35.5	+0.0	+0.0	+0.1	+10.8	-40.0	6.4	29.9 Tx at 2445 MHz Y axis	-23.5	Vert
3	772.960k	34.7	+0.0	+0.0	+0.1	+10.8	-40.0	5.6	29.9 Tx at 2445 MHz X axis	-24.3	Vert
4	15.686M	16.6	+0.0	+0.1	+0.7	+9.4	-40.0	-13.2	29.5 Tx at 2445 MHz X axis	-42.7	Vert
5	20.263M	16.5	+0.0	+0.1	+0.8	+8.2	-40.0	-14.4	29.5 Tx at 2445 MHz Z axis	-43.9	Vert
6	261.720k	44.7	+0.0	+0.0	+0.1	+10.2	-80.0	-25.0	19.2 Tx at 2445 MHz Y axis	-44.2	Vert
7	20.265M	16.0	+0.0	+0.1	+0.8	+8.2	-40.0	-14.9	29.5 Tx at 2445 MHz X axis	-44.4	Vert
8	405.340k	40.5	+0.0	+0.0	+0.1	+10.2	-80.0	-29.2	15.4 Tx at 2445 MHz Y axis	-44.6	Vert
9	28.904M	16.8	+0.0	+0.1	+1.0	+6.8	-40.0	-15.3	29.5 Tx at 2445 MHz Y axis	-44.8	Vert
10	323.500k	42.1	+0.0	+0.0	+0.1	+10.2	-80.0	-27.6	17.4 Tx at 2445 MHz Y axis	-45.0	Vert
11	174.660k	47.2	+0.0	+0.0	+0.1	+10.3	-80.0	-22.4	22.8 Tx at 2445 MHz X axis	-45.2	Vert
12	319.480k	42.0	+0.0	+0.0	+0.1	+10.2	-80.0	-27.7	17.5 Tx at 2445 MHz Z axis	-45.2	Vert
13	484.620k	38.5	+0.0	+0.0	+0.1	+10.1	-80.0	-31.3	13.9 Tx at 2445 MHz Z axis	-45.2	Vert
14	20.265M	14.9	+0.0	+0.1	+0.8	+8.2	-40.0	-16.0	29.5 Tx at 2445 MHz Y axis	-45.5	Vert

15	296.620k	42.4	+0.0	+0.0	+0.1	+10.2	-80.0	-27.3	18.2	-45.5	Vert
									Tx at 2445 MHz X axis		
16	297.440k	42.2	+0.0	+0.0	+0.1	+10.2	-80.0	-27.5	18.1	-45.6	Vert
									Tx at 2445 MHz Y axis		
17	483.940k	37.9	+0.0	+0.0	+0.1	+10.1	-80.0	-31.9	13.9	-45.8	Vert
									Tx at 2445 MHz X axis		
18	206.720k	45.0	+0.0	+0.0	+0.1	+10.3	-80.0	-24.6	21.3	-45.9	Vert
									Tx at 2445 MHz X axis		
19	261.720k	43.0	+0.0	+0.0	+0.1	+10.2	-80.0	-26.7	19.2	-45.9	Vert
									Tx at 2445 MHz X axis		
20	172.040k	46.6	+0.0	+0.0	+0.1	+10.3	-80.0	-23.0	22.9	-45.9	Vert
									Tx at 2445 MHz Y axis		
21	458.480k	38.2	+0.0	+0.0	+0.1	+10.1	-80.0	-31.6	14.4	-46.0	Vert
									Tx at 2445 MHz X axis		
22	406.700k	39.1	+0.0	+0.0	+0.1	+10.2	-80.0	-30.6	15.4	-46.0	Vert
									Tx at 2445 MHz X axis		
23	323.840k	41.1	+0.0	+0.0	+0.1	+10.2	-80.0	-28.6	17.4	-46.0	Vert
									Tx at 2445 MHz X axis		
24	28.903M	15.4	+0.0	+0.1	+1.0	+6.8	-40.0	-16.7	29.5	-46.2	Vert
									Tx at 2445 MHz Z axis		
25	18.807k	61.8	+0.0	+0.0	+0.0	+14.1	-80.0	-4.1	42.1	-46.2	Vert
									Tx at 2445 MHz X axis		
26	15.687M	13.1	+0.0	+0.1	+0.7	+9.4	-40.0	-16.7	29.5	-46.2	Vert
									Tx at 2445 MHz Y axis		
27	405.060k	39.0	+0.0	+0.0	+0.1	+10.2	-80.0	-30.7	15.5	-46.2	Vert
									Tx at 2445 MHz Z axis		
28	460.600k	37.9	+0.0	+0.0	+0.1	+10.1	-80.0	-31.9	14.3	-46.2	Vert
									Tx at 2445 MHz Z axis		
29	459.560k	37.9	+0.0	+0.0	+0.1	+10.1	-80.0	-31.9	14.4	-46.3	Vert
									Tx at 2445 MHz Y axis		
30	28.906M	15.1	+0.0	+0.1	+1.0	+6.8	-40.0	-17.0	29.5	-46.5	Vert
									Tx at 2445 MHz X axis		
31	485.020k	37.1	+0.0	+0.0	+0.1	+10.1	-80.0	-32.7	13.9	-46.6	Vert
									Tx at 2445 MHz Y axis		

32	296.680k	41.3	+0.0	+0.0	+0.1	+10.2	-80.0	-28.4	18.2	-46.6	Vert
									Tx at 2445 MHz Z axis		
33	15.687M	12.7	+0.0	+0.1	+0.7	+9.4	-40.0	-17.1	29.5	-46.6	Vert
									Tx at 2445 MHz Z axis		
34	23.985M	13.9	+0.0	+0.1	+0.9	+7.9	-40.0	-17.2	29.5	-46.7	Vert
									Tx at 2445 MHz X axis		
35	261.180k	42.2	+0.0	+0.0	+0.1	+10.2	-80.0	-27.5	19.3	-46.8	Vert
									Tx at 2445 MHz Z axis		
36	23.980M	13.6	+0.0	+0.1	+0.9	+7.9	-40.0	-17.5	29.5	-47.0	Vert
									Tx at 2445 MHz Y axis		
37	171.520k	45.0	+0.0	+0.0	+0.1	+10.3	-80.0	-24.6	22.9	-47.5	Vert
									Tx at 2445 MHz Z axis		
38	23.979M	12.9	+0.0	+0.1	+0.9	+7.9	-40.0	-18.2	29.5	-47.7	Vert
									Tx at 2445 MHz Z axis		
39	25.182k	56.9	+0.0	+0.0	+0.0	+12.9	-80.0	-10.2	39.6	-49.8	Vert
									Tx at 2445 MHz X axis		
40	25.182k	56.9	+0.0	+0.0	+0.0	+12.9	-80.0	-10.2	39.6	-49.8	Vert
									Tx at 2445 MHz X axis		
41	25.167k	50.5	+0.0	+0.0	+0.0	+12.9	-80.0	-16.6	39.6	-56.2	Vert
									Tx at 2445 MHz Y axis		
42	25.227k	49.8	+0.0	+0.0	+0.0	+12.9	-80.0	-17.3	39.6	-56.9	Vert
									Tx at 2445 MHz Z axis		
43	102.761k	36.0	+0.0	+0.0	+0.1	+10.8	-80.0	-33.1	27.4	-60.5	Vert
									Tx at 2445 MHz Z axis		
44	134.294k	33.5	+0.0	+0.0	+0.1	+10.7	-80.0	-35.7	25.0	-60.7	Vert
									Tx at 2445 MHz X axis		
45	99.630k	35.7	+0.0	+0.0	+0.1	+10.7	-80.0	-33.5	27.6	-61.1	Vert
									Tx at 2445 MHz Y axis		
46	134.664k	32.8	+0.0	+0.0	+0.1	+10.7	-80.0	-36.4	25.0	-61.4	Vert
									Tx at 2445 MHz Z axis		
47	100.991k	35.2	+0.0	+0.0	+0.1	+10.8	-80.0	-33.9	27.5	-61.4	Vert
									Tx at 2445 MHz X axis		
48	135.004k	32.2	+0.0	+0.0	+0.1	+10.7	-80.0	-37.0	25.0	-62.0	Vert
									Tx at 2445 MHz Y axis		

49	103.321k	34.1	+0.0	+0.0	+0.1	+10.9	-80.0	-34.9	27.3	-62.2	Vert
									Tx at 2445 MHz Y axis		
50	18.862k	45.3	+0.0	+0.0	+0.0	+14.1	-80.0	-20.6	42.1	-62.7	Vert
									Tx at 2445 MHz Y axis		
51	98.935k	34.1	+0.0	+0.0	+0.1	+10.7	-80.0	-35.1	27.7	-62.8	Vert
									Tx at 2445 MHz Z axis		
52	99.800k	33.9	+0.0	+0.0	+0.1	+10.7	-80.0	-35.3	27.6	-62.9	Vert
									Tx at 2445 MHz X axis		
53	18.832k	43.8	+0.0	+0.0	+0.0	+14.1	-80.0	-22.1	42.1	-64.2	Vert
									Tx at 2445 MHz Z axis		

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa, CA 95338 • (209) 966-5240
 Customer: **Lat-Lon, LLC**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **98017** Date: 2/16/2016
 Test Type: **Maximized Emissions** Time: 15:15:45
 Tested By: Chuck Kendall Sequence#: 1
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

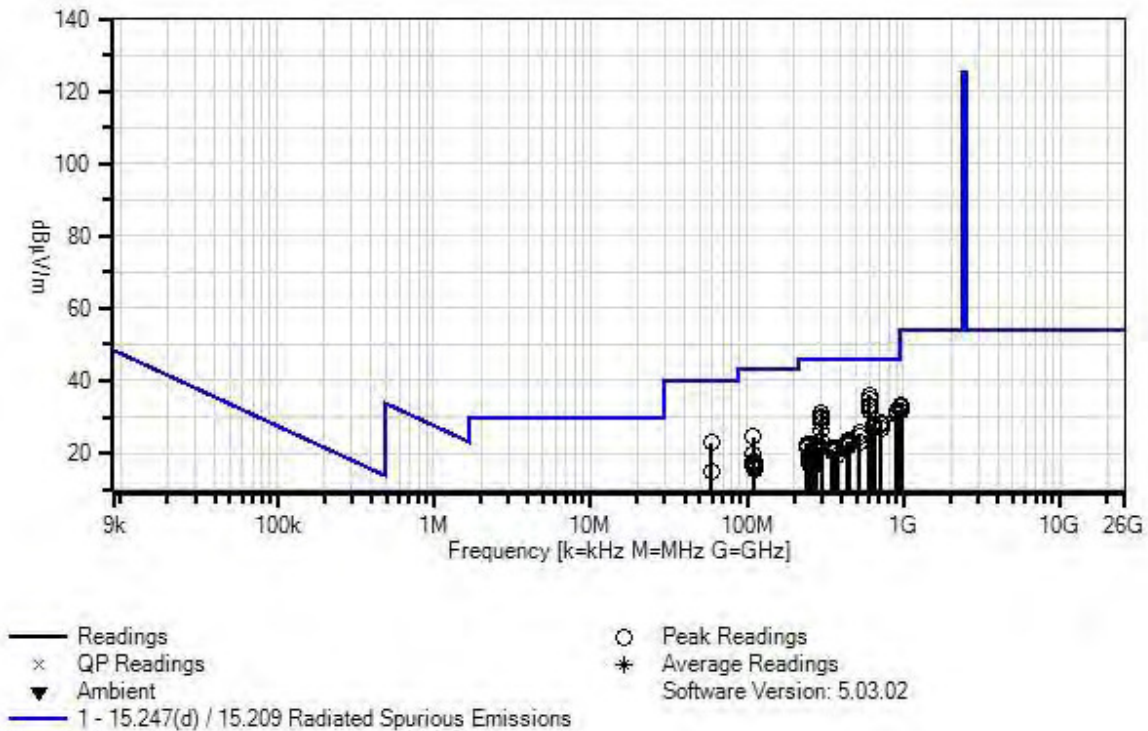
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

ANSI C63.10 2013 The EUT is setting atop a piece of Styrofoam insulation on a wooden test bench 80 cm atop a 3m diameter flush-mounted turntable. The EUT is battery operated and will be investigated in three different axes; X, Y, & Z. The EUT is transmitting on 2445 MHz which appears to be the worst case for these measurements. Frequencies investigated are: 30 MHz to 1000 MHz RBW= 120kHz; VBW = 300kHz Environmental Conditions: Temperature = 20°C Relative Humidity = 40% Atmospheric Pressure = 97.7kPa Highest Clock = 20 MHz Highest Frequency = 2475 MHz
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Lat-Lon, LLC WO#: 98017 Sequence#: 1 Date: 2/16/2016
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016
T2	ANP06885	Cable	P06885	10/27/2015	10/27/2017
T3	AN01994	Biconilog Antenna	CBL6111C	3/7/2014	3/7/2016
T4	AN00282	Preamp	8447D	4/7/2014	4/7/2016
T5	ANP06884	Cable	LMR195-FR-4	10/27/2015	10/27/2017
T6	ANSITED 3M	Cable		11/15/2014	11/15/2016

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	600.011M	38.2	+0.0 +0.4	+0.5 +5.1	+20.2	-28.4	+0.0	36.0	46.0 Tx at 2445MHz X axis	-10.0	Horiz
2	600.027M	37.2	+0.0 +0.4	+0.5 +5.1	+20.2	-28.4	+0.0	35.0	46.0 Tx at 2445 MHz Z axis	-11.0	Vert
3	599.996M	35.7	+0.0 +0.4	+0.5 +5.1	+20.2	-28.4	+0.0	33.5	46.0 Tx at 2445MHz Y axis	-12.5	Vert
4	600.029M	35.4	+0.0 +0.4	+0.5 +5.1	+20.2	-28.4	+0.0	33.2	46.0 Tx at 2445MHz Y axis	-12.8	Horiz
5	600.027M	34.7	+0.0 +0.4	+0.5 +5.1	+20.2	-28.4	+0.0	32.5	46.0 Tx at 2445 MHz Z axis	-13.5	Horiz
6	913.643M	28.6	+0.0 +0.6	+0.6 +6.5	+23.6	-28.0	+0.0	31.9	46.0 Tx at 2445MHz Y axis	-14.1	Vert
7	913.550M	28.6	+0.0 +0.6	+0.6 +6.5	+23.6	-28.0	+0.0	31.9	46.0 Tx at 2445 MHz Z axis	-14.1	Vert
8	600.013M	34.0	+0.0 +0.4	+0.5 +5.1	+20.2	-28.4	+0.0	31.8	46.0 Tx at 2445MHz X axis	-14.2	Vert
9	913.688M	28.4	+0.0 +0.6	+0.6 +6.5	+23.6	-28.0	+0.0	31.7	46.0 Tx at 2445MHz X axis	-14.3	Vert
10	913.632M	28.4	+0.0 +0.6	+0.6 +6.5	+23.6	-28.0	+0.0	31.7	46.0 Tx at 2445MHz Y axis	-14.3	Horiz
11	913.738M	28.3	+0.0 +0.6	+0.6 +6.5	+23.6	-28.0	+0.0	31.6	46.0 Tx at 2445MHz X axis	-14.4	Horiz
12	898.220M	28.6	+0.0 +0.5	+0.6 +6.5	+23.4	-28.0	+0.0	31.6	46.0 Tx at 2445MHz Y axis	-14.4	Vert

13	898.315M	28.5	+0.0 +0.5	+0.6 +6.5	+23.4	-28.0	+0.0	31.5	46.0 Tx at 2445MHz Y axis	-14.5	Horiz
14	898.201M	28.5	+0.0 +0.5	+0.6 +6.5	+23.4	-28.0	+0.0	31.5	46.0 Tx at 2445MHz X axis	-14.5	Horiz
15	898.125M	28.5	+0.0 +0.5	+0.6 +6.5	+23.4	-28.0	+0.0	31.5	46.0 Tx at 2445MHz X axis	-14.5	Vert
16	913.554M	28.2	+0.0 +0.6	+0.6 +6.5	+23.6	-28.0	+0.0	31.5	46.0 Tx at 2445 MHz Z axis	-14.5	Horiz
17	898.359M	28.3	+0.0 +0.5	+0.6 +6.5	+23.4	-28.0	+0.0	31.3	46.0 Tx at 2445 MHz Z axis	-14.7	Horiz
18	300.002M	40.6	+0.0 +0.4	+0.4 +3.5	+13.6	-27.2	+0.0	31.3	46.0 Tx at 2445MHz X axis	-14.7	Horiz
19	898.420M	27.6	+0.0 +0.5	+0.6 +6.5	+23.4	-28.0	+0.0	30.6	46.0 Tx at 2445 MHz Z axis	-15.4	Vert
20	300.004M	39.1	+0.0 +0.4	+0.4 +3.5	+13.6	-27.2	+0.0	29.8	46.0 Tx at 2445MHz Y axis	-16.2	Vert
21	300.014M	38.9	+0.0 +0.4	+0.4 +3.5	+13.6	-27.2	+0.0	29.6	46.0 Tx at 2445MHz Y axis	-16.4	Horiz
22	59.250M	43.0	+0.0 +0.1	+0.2 +1.5	+6.0	-28.0	+0.0	22.8	40.0 Tx at 2445 MHz Z axis	-17.2	Vert
23	720.871M	29.3	+0.0 +0.5	+0.6 +5.6	+21.0	-28.4	+0.0	28.6	46.0 Tx at 2445MHz Y axis	-17.4	Horiz
24	300.020M	37.8	+0.0 +0.4	+0.4 +3.5	+13.6	-27.2	+0.0	28.5	46.0 Tx at 2445 MHz Z axis	-17.5	Horiz
25	720.616M	29.1	+0.0 +0.5	+0.6 +5.6	+21.0	-28.4	+0.0	28.4	46.0 Tx at 2445MHz X axis	-17.6	Horiz
26	720.788M	28.8	+0.0 +0.5	+0.6 +5.6	+21.0	-28.4	+0.0	28.1	46.0 Tx at 2445 MHz Z axis	-17.9	Horiz
27	637.489M	29.9	+0.0 +0.4	+0.5 +5.2	+20.4	-28.4	+0.0	28.0	46.0 Tx at 2445 MHz Z axis	-18.0	Horiz
28	637.523M	29.9	+0.0 +0.4	+0.5 +5.2	+20.4	-28.4	+0.0	28.0	46.0 Tx at 2445MHz Y axis	-18.0	Horiz
29	646.588M	29.6	+0.0 +0.5	+0.5 +5.3	+20.4	-28.4	+0.0	27.9	46.0 Tx at 2445MHz X axis	-18.1	Vert

30	720.800M	28.5	+0.0 +0.5	+0.6 +5.6	+21.0	-28.4	+0.0	27.8	46.0 Tx at 2445MHz Y axis	-18.2	Vert
31	720.707M	28.4	+0.0 +0.5	+0.6 +5.6	+21.0	-28.4	+0.0	27.7	46.0 Tx at 2445MHz X axis	-18.3	Vert
32	637.528M	29.6	+0.0 +0.4	+0.5 +5.2	+20.4	-28.4	+0.0	27.7	46.0 Tx at 2445MHz X axis	-18.3	Horiz
33	646.704M	29.4	+0.0 +0.5	+0.5 +5.3	+20.4	-28.4	+0.0	27.7	46.0 Tx at 2445 MHz Z axis	-18.3	Horiz
34	646.685M	29.3	+0.0 +0.5	+0.5 +5.3	+20.4	-28.4	+0.0	27.6	46.0 Tx at 2445MHz Y axis	-18.4	Vert
35	646.734M	29.3	+0.0 +0.5	+0.5 +5.3	+20.4	-28.4	+0.0	27.6	46.0 Tx at 2445 MHz Z axis	-18.4	Vert
36	646.747M	29.3	+0.0 +0.5	+0.5 +5.3	+20.4	-28.4	+0.0	27.6	46.0 Tx at 2445MHz Y axis	-18.4	Horiz
37	646.528M	29.2	+0.0 +0.5	+0.5 +5.3	+20.4	-28.4	+0.0	27.5	46.0 Tx at 2445MHz X axis	-18.5	Horiz
38	637.502M	29.4	+0.0 +0.4	+0.5 +5.2	+20.4	-28.4	+0.0	27.5	46.0 Tx at 2445 MHz Z axis	-18.5	Vert
39	637.566M	29.4	+0.0 +0.4	+0.5 +5.2	+20.4	-28.4	+0.0	27.5	46.0 Tx at 2445MHz X axis	-18.5	Vert
40	109.985M	38.9	+0.0 +0.2	+0.3 +2.0	+10.9	-27.9	+0.0	24.4	43.5 Tx at 2445 MHz Z axis	-19.1	Vert
41	637.481M	28.7	+0.0 +0.4	+0.5 +5.2	+20.4	-28.4	+0.0	26.8	46.0 Tx at 2445MHz Y axis	-19.2	Vert
42	720.828M	27.4	+0.0 +0.5	+0.6 +5.6	+21.0	-28.4	+0.0	26.7	46.0 Tx at 2445 MHz Z axis	-19.3	Vert
43	300.020M	35.8	+0.0 +0.4	+0.4 +3.5	+13.6	-27.2	+0.0	26.5	46.0 Tx at 2445 MHz Z axis	-19.5	Vert
44	525.675M	29.8	+0.0 +0.4	+0.5 +4.7	+18.6	-28.4	+0.0	25.6	46.0 Tx at 2445MHz Y axis	-20.4	Vert
45	974.410M	28.7	+0.0 +0.6	+0.7 +6.7	+24.3	-27.8	+0.0	33.2	54.0 Tx at 2445MHz X axis	-20.8	Horiz
46	974.444M	28.5	+0.0 +0.6	+0.7 +6.7	+24.3	-27.8	+0.0	33.0	54.0 Tx at 2445MHz Y axis	-21.0	Vert

47	974.313M	28.5	+0.0 +0.6	+0.7 +6.7	+24.3	-27.8	+0.0	33.0	54.0 Tx at 2445MHz X axis	-21.0	Vert
48	525.691M	29.1	+0.0 +0.4	+0.5 +4.7	+18.6	-28.4	+0.0	24.9	46.0 Tx at 2445MHz X axis	-21.1	Vert
49	525.638M	29.0	+0.0 +0.4	+0.5 +4.7	+18.6	-28.4	+0.0	24.8	46.0 Tx at 2445MHz X axis	-21.2	Horiz
50	525.766M	28.9	+0.0 +0.4	+0.5 +4.7	+18.6	-28.4	+0.0	24.7	46.0 Tx at 2445MHz Y axis	-21.3	Horiz
51	525.821M	28.8	+0.0 +0.4	+0.5 +4.7	+18.6	-28.4	+0.0	24.6	46.0 Tx at 2445 MHz Z axis	-21.4	Horiz
52	974.452M	28.0	+0.0 +0.6	+0.7 +6.7	+24.3	-27.8	+0.0	32.5	54.0 Tx at 2445 MHz Z axis	-21.5	Horiz
53	974.452M	28.0	+0.0 +0.6	+0.7 +6.7	+24.3	-27.8	+0.0	32.5	54.0 Tx at 2445MHz Y axis	-21.5	Horiz
54	974.450M	27.4	+0.0 +0.6	+0.7 +6.7	+24.3	-27.8	+0.0	31.9	54.0 Tx at 2445 MHz Z axis	-22.1	Vert
55	440.457M	29.1	+0.0 +0.4	+0.5 +4.3	+17.0	-28.0	+0.0	23.3	46.0 Tx at 2445MHz Y axis	-22.7	Vert
56	299.992M	32.7	+0.0 +0.4	+0.4 +3.4	+13.6	-27.2	+0.0	23.3	46.0 Tx at 2445MHz X axis	-22.7	Vert
57	446.870M	29.0	+0.0 +0.4	+0.5 +4.3	+17.1	-28.1	+0.0	23.2	46.0 Tx at 2445MHz Y axis	-22.8	Horiz
58	440.500M	29.0	+0.0 +0.4	+0.5 +4.3	+17.0	-28.0	+0.0	23.2	46.0 Tx at 2445 MHz Z axis	-22.8	Vert
59	446.779M	28.9	+0.0 +0.4	+0.5 +4.3	+17.1	-28.1	+0.0	23.1	46.0 Tx at 2445 MHz Z axis	-22.9	Horiz
60	525.818M	27.1	+0.0 +0.4	+0.5 +4.7	+18.6	-28.4	+0.0	22.9	46.0 Tx at 2445 MHz Z axisv	-23.1	Vert
61	446.830M	28.7	+0.0 +0.4	+0.5 +4.3	+17.1	-28.1	+0.0	22.9	46.0 Tx at 2445MHz X axis	-23.1	Vert
62	280.004M	32.9	+0.0 +0.3	+0.4 +3.3	+13.2	-27.2	+0.0	22.9	46.0 Tx at 2445MHz Y axis	-23.1	Vert
63	440.617M	28.5	+0.0 +0.4	+0.5 +4.3	+17.0	-28.0	+0.0	22.7	46.0 Tx at 2445MHz X axis	-23.3	Vert

64	440.633M	28.5	+0.0 +0.4	+0.5 +4.3	+17.0	-28.0	+0.0	22.7	46.0 Tx at 2445MHz X axis	-23.3	Horiz
65	446.834M	28.5	+0.0 +0.4	+0.5 +4.3	+17.1	-28.1	+0.0	22.7	46.0 Tx at 2445MHz X axis	-23.3	Horiz
66	440.556M	28.5	+0.0 +0.4	+0.5 +4.3	+17.0	-28.0	+0.0	22.7	46.0 Tx at 2445 MHz Z axis	-23.3	Horiz
67	240.010M	34.3	+0.0 +0.3	+0.4 +3.1	+11.9	-27.3	+0.0	22.7	46.0 Tx at 2445 MHz Z axis	-23.3	Vert
68	446.850M	28.4	+0.0 +0.4	+0.5 +4.3	+17.1	-28.1	+0.0	22.6	46.0 Tx at 2445MHz Y axis	-23.4	Vert
69	240.006M	34.0	+0.0 +0.3	+0.4 +3.1	+11.9	-27.3	+0.0	22.4	46.0 Tx at 2445MHz Y axis	-23.6	Vert
70	109.988M	34.4	+0.0 +0.2	+0.3 +2.0	+10.9	-27.9	+0.0	19.9	43.5 Tx at 2445 MHz Z axis	-23.6	Horiz
71	239.985M	34.0	+0.0 +0.3	+0.4 +3.1	+11.9	-27.3	+0.0	22.4	46.0 Tx at 2445MHz Y axis	-23.6	Horiz
72	440.472M	28.2	+0.0 +0.4	+0.5 +4.3	+17.0	-28.0	+0.0	22.4	46.0 Tx at 2445MHz Y axis	-23.6	Horiz
73	279.973M	32.1	+0.0 +0.3	+0.4 +3.3	+13.2	-27.2	+0.0	22.1	46.0 Tx at 2445MHz Y axis	-23.9	Horiz
74	446.700M	27.8	+0.0 +0.4	+0.5 +4.3	+17.1	-28.1	+0.0	22.0	46.0 Tx at 2445 MHz Z axis	-24.0	Vert
75	240.005M	33.5	+0.0 +0.3	+0.4 +3.1	+11.9	-27.3	+0.0	21.9	46.0 Tx at 2445MHz X axis	-24.1	Horiz
76	239.990M	33.4	+0.0 +0.3	+0.4 +3.1	+11.9	-27.3	+0.0	21.8	46.0 Tx at 2445 MHz Z axis	-24.2	Horiz
77	239.995M	33.2	+0.0 +0.3	+0.4 +3.1	+11.9	-27.3	+0.0	21.6	46.0 Tx at 2445MHz X axis	-24.4	Vert
78	280.027M	31.5	+0.0 +0.3	+0.4 +3.3	+13.2	-27.2	+0.0	21.5	46.0 Tx at 2445 MHz Z axis	-24.5	Vert
79	279.990M	31.5	+0.0 +0.3	+0.4 +3.3	+13.2	-27.2	+0.0	21.5	46.0 Tx at 2445MHz X axis	-24.5	Horiz
80	375.348M	28.7	+0.0 +0.4	+0.4 +3.9	+15.6	-27.7	+0.0	21.3	46.0 Tx at 2445 MHz Z axis	-24.7	Horiz

81	351.042M	29.2	+0.0 +0.4	+0.4 +3.8	+15.0	-27.5	+0.0	21.3	46.0 Tx at 2445 MHz Z axis	-24.7	Vert
82	351.055M	29.1	+0.0 +0.4	+0.4 +3.8	+15.0	-27.5	+0.0	21.2	46.0 Tx at 2445 MHz Z axis	-24.8	Horiz
83	59.245M	35.3	+0.0 +0.1	+0.2 +1.5	+6.0	-28.0	+0.0	15.1	40.0 Tx at 2445 MHz Z axis	-24.9	Horiz
84	375.193M	28.4	+0.0 +0.4	+0.4 +3.9	+15.6	-27.7	+0.0	21.0	46.0 Tx at 2445MHz X axis	-25.0	Vert
85	375.169M	28.2	+0.0 +0.4	+0.4 +3.9	+15.6	-27.7	+0.0	20.8	46.0 Tx at 2445MHz Y axis	-25.2	Vert
86	280.010M	30.8	+0.0 +0.3	+0.4 +3.3	+13.2	-27.2	+0.0	20.8	46.0 Tx at 2445 MHz Z axis	-25.2	Horiz
87	375.262M	28.2	+0.0 +0.4	+0.4 +3.9	+15.6	-27.7	+0.0	20.8	46.0 Tx at 2445MHz Y axis	-25.2	Horiz
88	350.981M	28.7	+0.0 +0.4	+0.4 +3.8	+15.0	-27.5	+0.0	20.8	46.0 Tx at 2445MHz Y axis	-25.2	Horiz
89	350.956M	28.7	+0.0 +0.4	+0.4 +3.8	+15.0	-27.5	+0.0	20.8	46.0 Tx at 2445MHz X axis	-25.2	Vert
90	351.003M	28.6	+0.0 +0.4	+0.4 +3.8	+15.0	-27.5	+0.0	20.7	46.0 Tx at 2445MHz Y axis	-25.3	Vert
91	359.800M	28.4	+0.0 +0.4	+0.4 +3.8	+15.2	-27.6	+0.0	20.6	46.0 Tx at 2445 MHz Z axis	-25.4	Vert
92	375.101M	28.0	+0.0 +0.4	+0.4 +3.9	+15.6	-27.7	+0.0	20.6	46.0 Tx at 2445MHz X axis	-25.4	Horiz
93	351.006M	28.3	+0.0 +0.4	+0.4 +3.8	+15.0	-27.5	+0.0	20.4	46.0 Tx at 2445MHz X axis	-25.6	Horiz
94	279.964M	30.4	+0.0 +0.3	+0.4 +3.3	+13.2	-27.2	+0.0	20.4	46.0 Tx at 2445MHz X axis	-25.6	Vert
95	110.075M	32.2	+0.0 +0.2	+0.3 +2.0	+10.9	-27.9	+0.0	17.7	43.5 Tx at 2445MHz Y axis	-25.8	Vert
96	111.318M	32.1	+0.0 +0.2	+0.3 +2.0	+11.0	-27.9	+0.0	17.7	43.5 Tx at 2445 MHz Z axis	-25.8	Vert
97	267.873M	30.3	+0.0 +0.3	+0.4 +3.2	+13.0	-27.2	+0.0	20.0	46.0 Tx at 2445MHz Y axis	-26.0	Horiz

98	267.815M	30.1	+0.0 +0.3	+0.4 +3.2	+13.0	-27.2	+0.0	19.8	46.0 Tx at 2445MHz X axis	-26.2	Horiz
99	110.051M	31.7	+0.0 +0.2	+0.3 +2.0	+10.9	-27.9	+0.0	17.2	43.5 Tx at 2445MHz X axis	-26.3	Horiz
100	271.974M	29.8	+0.0 +0.3	+0.4 +3.3	+13.1	-27.2	+0.0	19.7	46.0 Tx at 2445MHz X axis	-26.3	Vert
101	111.196M	31.6	+0.0 +0.2	+0.3 +2.0	+11.0	-27.9	+0.0	17.2	43.5 Tx at 2445MHz X axis	-26.3	Vert
102	110.075M	31.3	+0.0 +0.2	+0.3 +2.0	+10.9	-27.9	+0.0	16.8	43.5 Tx at 2445MHz Y axis	-26.7	Horiz
103	375.400M	26.7	+0.0 +0.4	+0.4 +3.9	+15.6	-27.7	+0.0	19.3	46.0 Tx at 2445 MHz Z axis	-26.7	Vert
104	111.223M	31.2	+0.0 +0.2	+0.3 +2.0	+11.0	-27.9	+0.0	16.8	43.5 Tx at 2445MHz Y axis	-26.7	Horiz
105	250.764M	30.1	+0.0 +0.3	+0.4 +3.1	+12.6	-27.3	+0.0	19.2	46.0 Tx at 2445 MHz Z axis	-26.8	Horiz
106	267.793M	29.5	+0.0 +0.3	+0.4 +3.2	+13.0	-27.2	+0.0	19.2	46.0 Tx at 2445MHz Y axis	-26.8	Vert
107	267.969M	29.3	+0.0 +0.3	+0.4 +3.2	+13.0	-27.2	+0.0	19.0	46.0 Tx at 2445 MHz Z axis	-27.0	Horiz
108	267.835M	29.1	+0.0 +0.3	+0.4 +3.2	+13.0	-27.2	+0.0	18.8	46.0 Tx at 2445MHz X axis	-27.2	Vert
109	110.125M	30.8	+0.0 +0.2	+0.3 +2.0	+10.9	-27.9	+0.0	16.3	43.5 Tx at 2445MHz X axis	-27.2	Vert
110	111.194M	30.5	+0.0 +0.2	+0.3 +2.0	+11.0	-27.9	+0.0	16.1	43.5 Tx at 2445MHz Y axis	-27.4	Vert
111	250.762M	29.4	+0.0 +0.3	+0.4 +3.1	+12.6	-27.3	+0.0	18.5	46.0 Tx at 2445 MHz Z axis	-27.5	Vert
112	271.872M	28.2	+0.0 +0.3	+0.4 +3.3	+13.1	-27.2	+0.0	18.1	46.0 Tx at 2445 MHz Z axis	-27.9	Horiz
113	272.003M	28.1	+0.0 +0.3	+0.4 +3.3	+13.1	-27.2	+0.0	18.0	46.0 Tx at 2445MHz X axis	-28.0	Horiz
114	250.769M	28.8	+0.0 +0.3	+0.4 +3.1	+12.6	-27.3	+0.0	17.9	46.0 Tx at 2445MHz X axis	-28.1	Vert

115	271.950M	28.0	+0.0 +0.3	+0.4 +3.3	+13.1	-27.2	+0.0	17.9	46.0 Tx at 2445MHz Y axis	-28.1	Horiz
116	111.136M	29.8	+0.0 +0.2	+0.3 +2.0	+11.0	-27.9	+0.0	15.4	43.5 Tx at 2445MHz X axis	-28.1	Horiz
117	250.773M	28.7	+0.0 +0.3	+0.4 +3.1	+12.6	-27.3	+0.0	17.8	46.0 Tx at 2445MHz Y axis	-28.2	Horiz
118	111.318M	29.6	+0.0 +0.2	+0.3 +2.0	+11.0	-27.9	+0.0	15.2	43.5 Tx at 2445 MHz Z axis	-28.3	Horiz
119	272.020M	27.8	+0.0 +0.3	+0.4 +3.3	+13.1	-27.2	+0.0	17.7	46.0 Tx at 2445MHz Y axis	-28.3	Vert
120	250.669M	28.5	+0.0 +0.3	+0.4 +3.1	+12.6	-27.3	+0.0	17.6	46.0 Tx at 2445MHz X axis	-28.4	Horiz
121	271.862M	27.4	+0.0 +0.3	+0.4 +3.3	+13.1	-27.2	+0.0	17.3	46.0 Tx at 2445 MHz Z axis	-28.7	Vert
122	250.784M	28.2	+0.0 +0.3	+0.4 +3.1	+12.6	-27.3	+0.0	17.3	46.0 Tx at 2445MHz Y axis	-28.7	Vert
123	267.962M	27.0	+0.0 +0.3	+0.4 +3.2	+13.0	-27.2	+0.0	16.7	46.0 Tx at 2445 MHz Z axis	-29.3	Vert

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa, CA 95338 • (209) 966-5240
 Customer: **Lat-Lon, LLC**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **98017** Date: 3/17/2016
 Test Type: **Maximized Emissions** Time: 13:23:49
 Tested By: Chuck Kendall Sequence#: 1
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

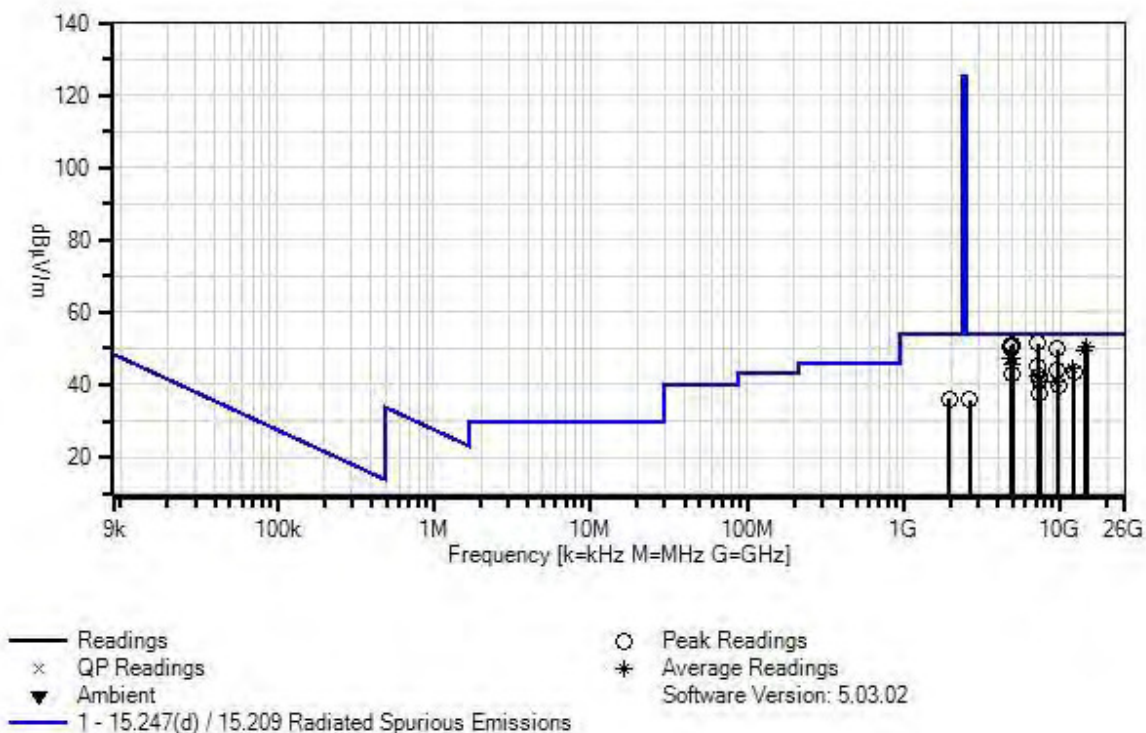
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

ANSI C63.10 2013 The EUT is set up on Styrofoam insulation 1.5 m above the ground plane. The EUT is set to either 2405, 2445, or 2475MHz. Three orthogonal axes were investigated and the Z Axis was found to be the worst case. Frequencies of Interest: 1GHz to 25 GHz RBW = 1 MHz; VBW = 3 MHz Environmental Conditions: Temperature = 20°C Relative Humidity = 40% Atmospheric Pressure = 97.4 kPa Highest Clock = 20 MHz Highest frequency generated = 2475 MHz

Lat-Lon, LLC. WO#: 98017 Sequence#: 1 Date: 3/17/2016
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016
T2	AN03155	Preamp	83017A	6/30/2015	6/30/2017
T3	ANP01403	Cable	58758-23	12/8/2014	12/8/2016
T4	AN03355	Cable	32026-2-29094K-48TC	12/8/2014	12/8/2016
T5	ANP05904	Cable	32022-2-29094K-144TC	12/8/2014	12/8/2016
T6	AN01273	Horn Antenna	3115	2/3/2015	2/3/2017
T7	AN03362	Cable	32022-2-29094-48TC	12/8/2014	12/8/2016

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	7214.120M	40.5	+0.0 +4.2	-33.3 +32.9	+4.3 +1.3	+1.5	+0.0	51.4	54.0 Set to 2405 MHz Z Axis	-2.6	Horiz
2	4959.100M	43.9	+0.0 +3.4	-32.7 +30.8	+3.4 +1.1	+1.2	+0.0	51.1	54.0 Set to 2480 MHz Z Axis	-2.9	Horiz
3	4811.120M	43.9	+0.0 +3.4	-32.8 +30.5	+3.4 +1.1	+1.2	+0.0	50.7	54.0 Set at 2405 MHz Z Axis	-3.3	Horiz
4	14669.520 M Ave	28.3	+0.0 +6.3	-33.4 +38.4	+6.8 +1.9	+2.2	+0.0	50.5	54.0 Set to 2445 MHz Z Axis	-3.5	Horiz
5	4889.100M	43.2	+0.0 +3.4	-32.7 +30.7	+3.4 +1.1	+1.2	+0.0	50.3	54.0 Set to 2445 MHz Z Axis	-3.7	Horiz
6	14670.000 M Ave	28.1	+0.0 +6.3	-33.4 +38.4	+6.8 +1.9	+2.2	+0.0	50.3	54.0 Set to 2445 MHz Z Axis	-3.7	Horiz
^	14670.000 M	30.3	+0.0 +6.3	-33.4 +38.4	+6.8 +1.9	+2.2	+0.0	52.5	54.0 Set to 2445 MHz Z Axis	-1.5	Horiz
8	9619.120M	34.9	+0.0 +4.9	-33.0 +34.8	+5.1 +1.5	+1.7	+0.0	49.9	54.0 Set to 2405 MHz Z Axis	-4.1	Horiz
9	14432.025 M Ave	27.2	+0.0 +6.3	-33.4 +38.8	+6.6 +1.9	+2.2	+0.0	49.6	54.0 Set at 2405 MHz Z Axis	-4.4	Horiz

^	14431.985 M	30.7	+0.0 +6.3	-33.4 +38.8	+6.6 +1.9	+2.2	+0.0	53.1	54.0	-0.9	Horiz
									Set at 2405 MHz Z Axis		
11	4809.210M Ave	40.6	+0.0 +3.4	-32.8 +30.5	+3.4 +1.1	+1.2	+0.0	47.4	54.0	-6.6	Horiz
									Set to 2405 MHz Z Axis		
^	4809.120M	49.4	+0.0 +3.4	-32.8 +30.5	+3.4 +1.1	+1.2	+0.0	56.2	54.0	+2.2	Horiz
									Set to 2405 MHz Z Axis		
^	4809.175M	43.3	+0.0 +3.4	-32.8 +30.5	+3.4 +1.1	+1.2	+0.0	50.1	54.0	-3.9	Horiz
									Set at 2405 MHz Z Axis		
14	4959.202M Ave	40.0	+0.0 +3.4	-32.7 +30.8	+3.4 +1.1	+1.2	+0.0	47.2	54.0	-6.8	Horiz
									Set to 2475 MHz Z Axis		
15	4889.500M Ave	38.3	+0.0 +3.4	-32.7 +30.7	+3.4 +1.1	+1.2	+0.0	45.4	54.0	-8.6	Horiz
									Set to 2445 MHz Z Axis		
16	7216.535M	34.4	+0.0 +4.2	-33.4 +32.9	+4.3 +1.3	+1.5	+0.0	45.2	54.0	-8.8	Horiz
									Set at 2405 MHz Z Axis		
17	12024.431 M Ave	27.2	+0.0 +5.6	-33.7 +35.7	+6.0 +1.7	+2.0	+0.0	44.5	54.0	-9.5	Horiz
									Set to 2405 MHz Z Axis		
^	12024.430 M	30.0	+0.0 +5.6	-33.7 +35.7	+6.0 +1.7	+2.0	+0.0	47.3	54.0	-6.7	Horiz
									Set at 2405 MHz Z Axis		
19	9620.580M	28.9	+0.0 +4.9	-33.0 +34.8	+5.1 +1.5	+1.7	+0.0	43.9	54.0	-10.1	Horiz
									Set at 2405 MHz Z Axis		
20	12225.000 M	26.1	+0.0 +5.6	-33.6 +35.7	+6.1 +1.7	+2.0	+0.0	43.6	54.0	-10.4	Horiz
									Set to 2445 MHz Z Axis		
21	4890.000M	36.0	+0.0 +3.4	-32.7 +30.7	+3.4 +1.1	+1.2	+0.0	43.1	54.0	-10.9	Horiz
									Set to 2445 MHz Z Axis		
22	7438.600M	31.8	+0.0 +4.2	-33.5 +33.0	+4.3 +1.3	+1.5	+0.0	42.6	54.0	-11.4	Horiz
									Set to 2480 MHz Z Axis		
23	7213.812M Ave	31.4	+0.0 +4.2	-33.3 +32.9	+4.3 +1.3	+1.5	+0.0	42.3	54.0	-11.7	Horiz
									Set to 2405 MHz Z Axis		
24	7334.100M	30.2	+0.0 +4.2	-33.4 +33.0	+4.3 +1.3	+1.5	+0.0	41.1	54.0	-12.9	Horiz
									Set to 2445 MHz Z Axis		
25	9618.627M Ave	25.8	+0.0 +4.9	-33.0 +34.8	+5.1 +1.5	+1.7	+0.0	40.8	54.0	-13.2	Horiz
									Set to 2405 MHz Z Axis		

26	7439.034M Ave	29.8	+0.0 +4.2	-33.5 +33.0	+4.3 +1.3	+1.5	+0.0	40.6	54.0 Set tp 2475 MHz Z Axis	-13.4	Horiz
^	7439.000M	42.7	+0.0 +4.2	-33.5 +33.0	+4.3 +1.3	+1.5	+0.0	53.5	54.0 Set to 2475 MHz Z Axis	-0.5	Horiz
28	9780.000M	24.7	+0.0 +5.0	-33.1 +34.9	+5.1 +1.5	+1.8	+0.0	39.9	54.0 Set to 2445 MHz Z Axis	-14.1	Horiz
29	7335.000M	26.8	+0.0 +4.2	-33.4 +33.0	+4.3 +1.3	+1.5	+0.0	37.7	54.0 Set to 2445 MHz Z Axis	-16.3	Horiz
30	1967.150M	38.7	+0.0 +2.2	-33.5 +25.2	+2.1 +0.7	+0.7	+0.0	36.1	54.0 Set to 2405 MHz Z Axis	-17.9	Horiz
31	2655.000M	35.4	+0.0 +2.5	-33.3 +26.9	+2.5 +0.8	+0.9	+0.0	35.7	54.0 Set to 2405 MHz Z Axis	-18.3	Horiz

Band Edge

Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	OQPSK	PCB trace	47.61 peak/30.23 avg	<54	Pass
2400.0	OQPSK	PCB trace	63.15 peak/45.8 avg	<54	Pass
2483.5	OQPSK	PCB trace	49.12 peak/38.42 avg	<54	Pass

Lower Band Edge readings were obtained using the "Marker Delta" method: Using CISPR bandwidth a peak reading of the fundamental was made (103.698 dBuV/m) and an average reading of the fundamental was also made (86.3107dBuV/m). Next a reduced bandwidth of 30kHz was taken showing both the fundamental and the reading at the band edge together. The relative difference in amplitude between the fundamental and the band edge reading at 2400 MHz was then obtained. This relative difference of 39.55dB was then subtracted from both initials readings of peak and average resulting in a peak reading of 64.15dBuV/m and an average reading of 46.76dBuV/m. A similar method was used for the band edge at 2390 MHz; the marker delta now being 55.08dB between the fundamental and the band edge. Subtracting this from the originally obtained peak and average readings provided us with a band edge peak reading of 48.61dBuV/m and an average reading of 31.23dBuV/m. Upper band edge readings were obtained using CISPR bandwidths.

Band Edge Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa, CA 95338 • (209) 966-5240
 Customer: **Lat-Lon, LLC**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **98017** Date: 4/1/2016
 Test Type: **Maximized Emissions** Time: 09:11:51
 Tested By: Chuck Kendall Sequence#: 1
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

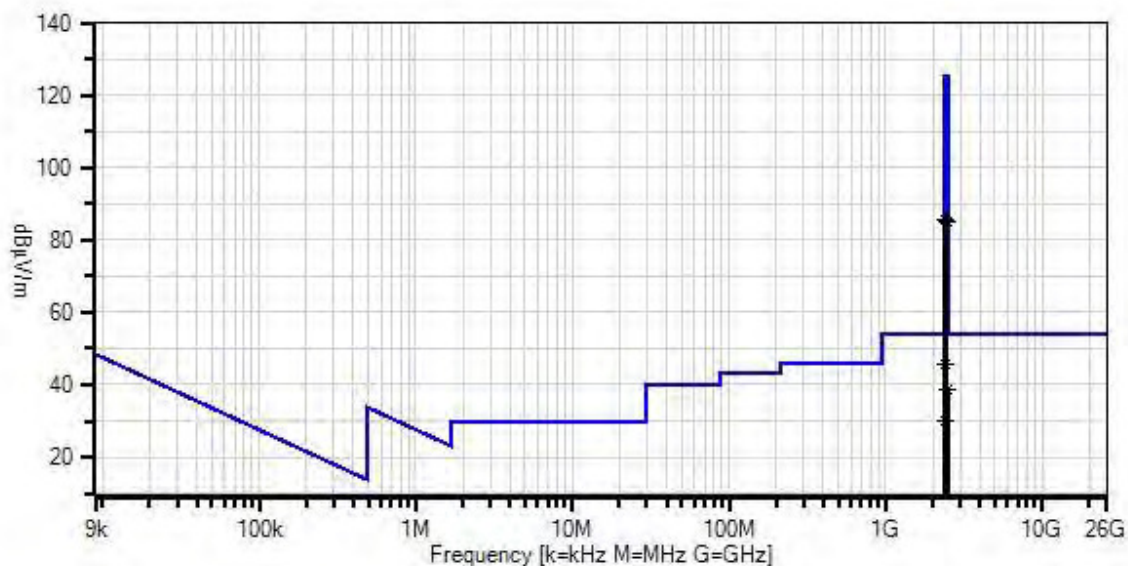
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

ANSI C63.10 2013 The EUT is set up on Styrofoam insulation 1.5 m above the ground plane. The EUT is set to either 2405 or 2475 MHz. Three axes were investigated which determined the worst case that was presented here. Peak readings did not exceed 20 dB over the average limit. The EUT is fully modulated at 100% and at its full output. The EUT has a built-in PCB trace antenna with a 5 dBi gain. Frequencies of Interest: 2.390 GHz to 2.4835 GHz RBW = 1 MHz; VBW = 3 MHz Environmental Conditions: Temperature = 21.2°C Relative Humidity = 43% Atmospheric Pressure = 97.5 kPa Highest clock: 20 MHz Highest frequency: 2475 MHz

Lat-Lon, LLC. WO#: 98017 Sequence#: 1 Date: 4/1/2016
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



— Readings
× QP Readings
▼ Ambient
— 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

○ Peak Readings
* Average Readings
Software Version: 5.03.02

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02668	Spectrum Analyzer	E4446A	8/14/2015	8/14/2016
T2	AN03155	Preamp	83017A	6/30/2015	6/30/2017
T3	ANP01403	Cable	58758-23	12/8/2014	12/8/2016
T4	AN03355	Cable	32026-2-29094K-48TC	12/8/2014	12/8/2016
T5	ANP05904	Cable	32022-2-29094K-144TC	12/8/2014	12/8/2016
T6	AN01273	Horn Antenna	3115	2/3/2015	2/3/2017
T7	AN03362	Cable	32022-2-29094-48TC	12/8/2014	12/8/2016

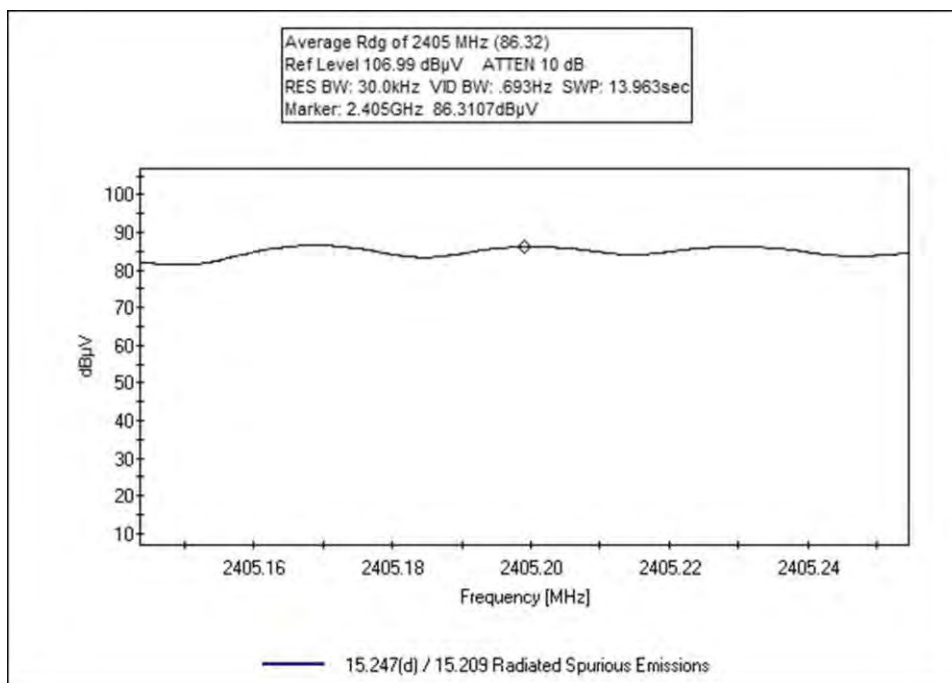
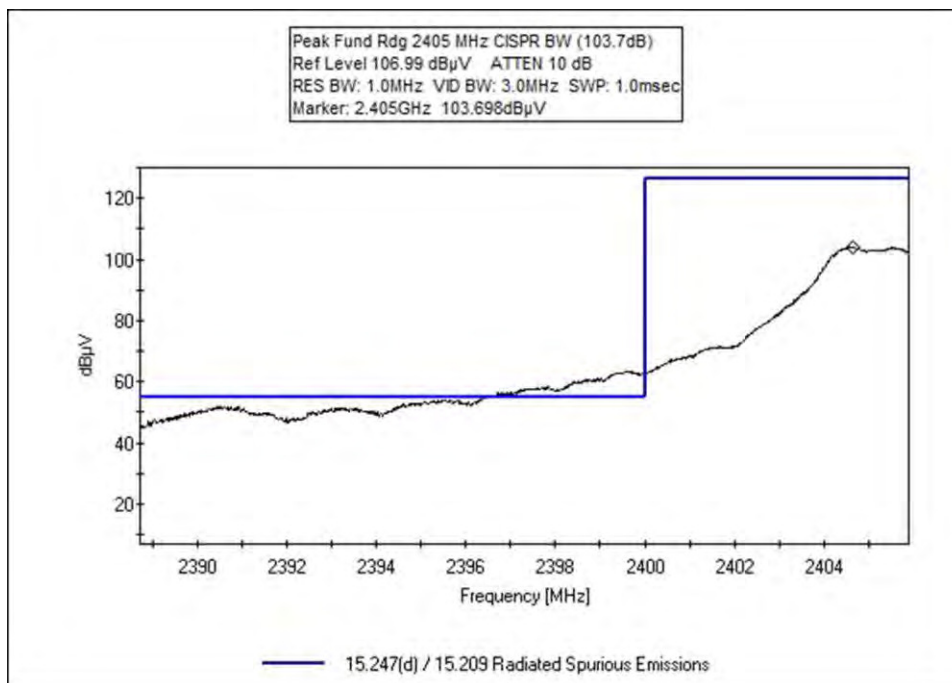
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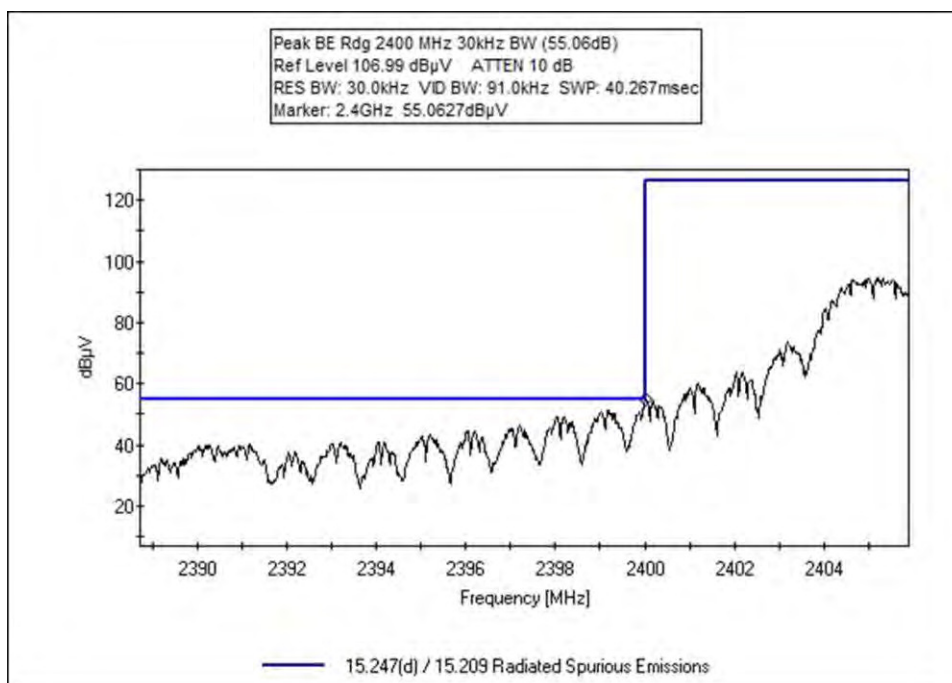
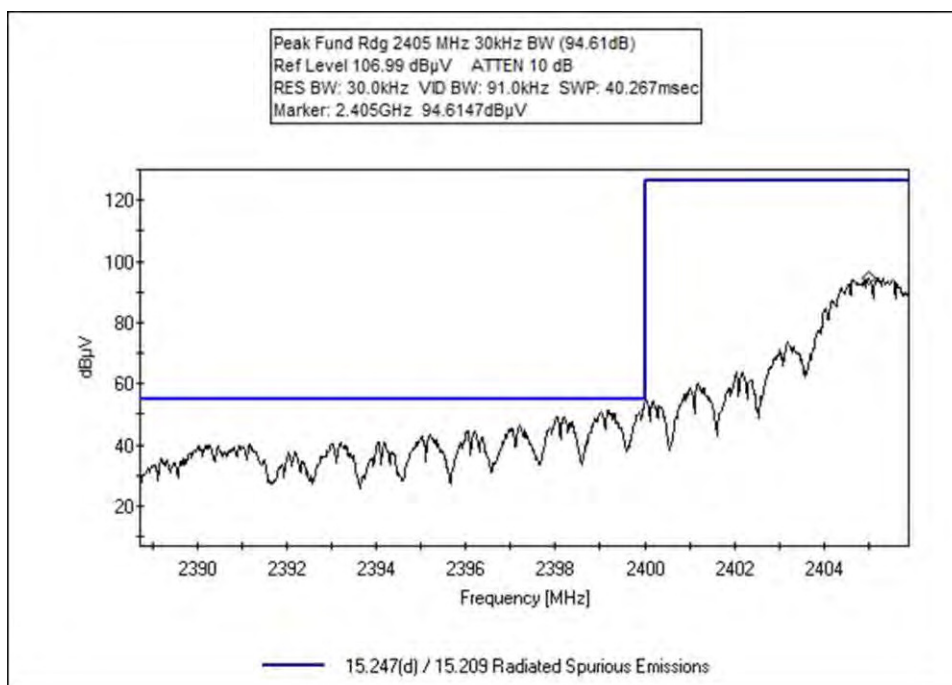
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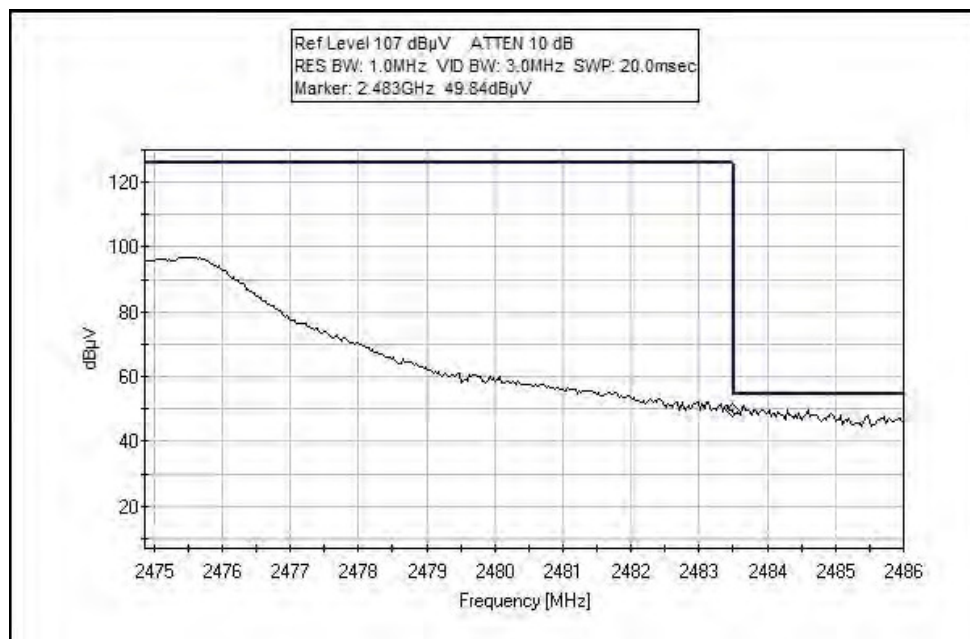
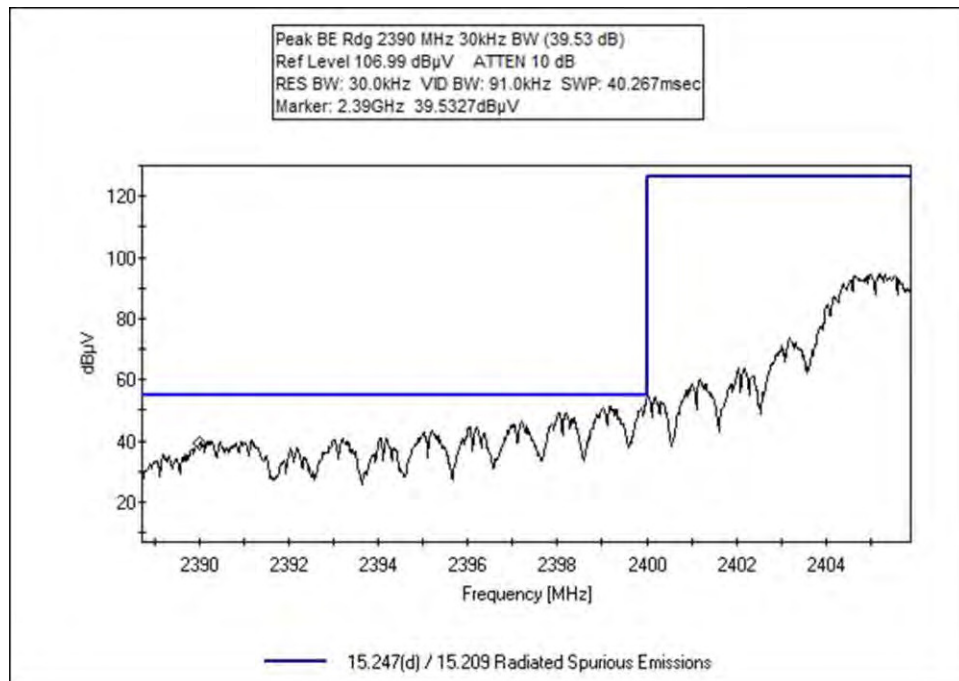
Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	2400.000M Ave	46.8	+0.0 +2.4	-33.3 +26.1	+2.3 +0.7	+0.8	+0.0	45.8	54.0 Using Marker Delta of 39.552 dB	-8.2	Horiz
^	2400.000M	64.1	+0.0 +2.4	-33.3 +26.1	+2.3 +0.7	+0.8	+0.0	63.1	54.0 Using Marker Delta of 39.552 dB	+9.1	Horiz
3	2483.500M Ave	39.1	+0.0 +2.4	-33.3 +26.3	+2.4 +0.7	+0.8	+0.0	38.4	54.0	-15.6	Horiz
^	2483.500M	49.8	+0.0 +2.4	-33.3 +26.3	+2.4 +0.7	+0.8	+0.0	49.1	54.0	-4.9	Horiz
5	2390.000M Ave	31.2	+0.0 +2.4	-33.3 +26.1	+2.3 +0.7	+0.8	+0.0	30.2	54.0 Using Marker Delta of 55.082 dB	-23.8	Horiz
^	2390.000M	48.6	+0.0 +2.4	-33.3 +26.1	+2.3 +0.7	+0.8	+0.0	47.6	54.0 Using Marker Delta of 55.082 dB	-6.4	Horiz
7	2405.000M Ave	86.3	+0.0 +2.4	-33.3 +26.1	+2.3 +0.7	+0.8	+0.0	85.3	125.2	-39.9	Horiz
^	2405.000M	103.7	+0.0 +2.4	-33.3 +26.1	+2.3 +0.7	+0.8	+0.0	102.7	125.2	-22.5	Horiz
9	2475.000M Ave	85.6	+0.0 +2.4	-33.3 +26.3	+2.4 +0.7	+0.8	+0.0	84.9	125.2	-40.3	Horiz
^	2475.000M	102.8	+0.0 +2.4	-33.3 +26.3	+2.4 +0.7	+0.8	+0.0	102.1	125.2	-23.1	Horiz

Band Edge Plots







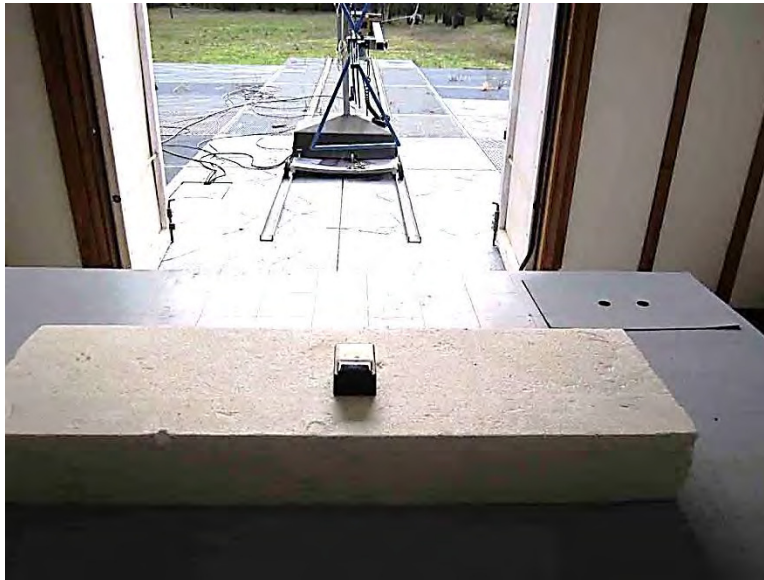
Test Setup Photos



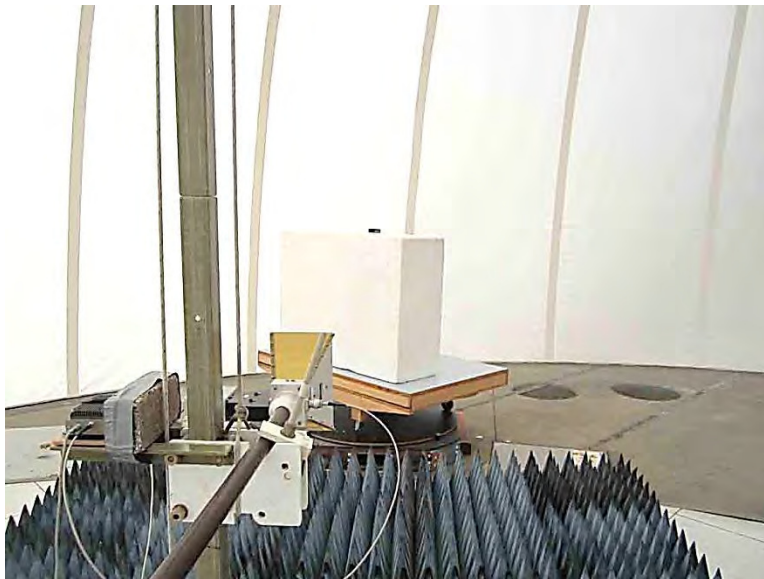
Low Frequency



Low Frequency



Middle Frequency



High Frequency

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

Reported uncertainties 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 $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ 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 the limit value subtracting the corrected measured value; a negative margin represents a measurement less than the limit while a positive margin represents a measurement exceeding the limit.

SAMPLE CALCULATIONS		
	Meter reading	($\text{dB}\mu\text{V}$)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	($\text{dB}\mu\text{V}/\text{m}$)

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.