Connect Yard

TEST REPORT FOR

Pool Monitor
Model: CY-PM1510-A1

Tested To The Following Standard:

FCC Part 15 Subpart C Section(s)

15.249

Report No.: 98260-4

Date of issue: April 5, 2016

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

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.

Testing the Future
CKC LABORATORIES, INC.

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Connect Yard
380 Portage Ave.
Palo Alto, CA 94306

REPRESENTATIVE: SEL: Paul Carter

REPORT PREPARED BY:

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

Project Number: 98260

DATE OF EQUIPMENT RECEIPT: March 9, 2016
DATE(S) OF TESTING: March 9-24, 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.

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	5.03.02

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Fremont	US0082	SL2-IN-E-1148R	3082B-1	958979	A-0149

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C - 15.249

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

NA = Not Applicable
NA1 = Not applicable because the EUT is operated by an internal battery.

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
Pool Monitor	Connected Yard	CY-PM1510-A1	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Assus	Eee PC Seashell series	NA
USB to UART Translator	Sparkfun	NA	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Modulation Type(s):	GFSK
Maximum Duty Cycle:	100%
Antenna Type(s) and Gain:	-1.8dBi
Antenna Connection Type:	Integral
Nominal Input Voltage:	3.0VDC
Firmware / Software used for Test:	Firmware 0.1.2/ Software Putty

FCC Part 15 Subpart C

15.215(c) Occupied Bandwidth (20dB BW)

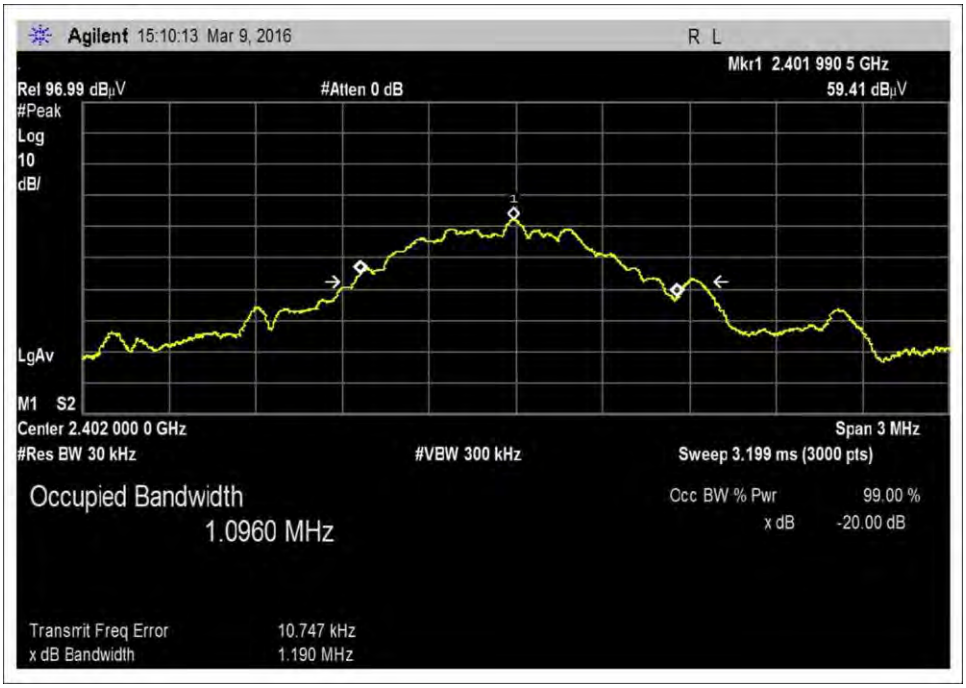
Test Setup/Conditions			
Test Location:	Fremont Lab C3	Test Engineer:	Hieu Song Nguyenpham
Test Method:	ANSI C63.10 (2013)	Test Date(s):	3/9/2016 and 3/24/2016
Configuration:	1		
Test Setup:	The EUT is placed on a non-conducted table and operated by an internal battery at 3.0VDC. The EUT is set to continuously transmitting as intended.		

Environmental Conditions			
Temperature (ºC)	20.5	Relative Humidity (%):	43

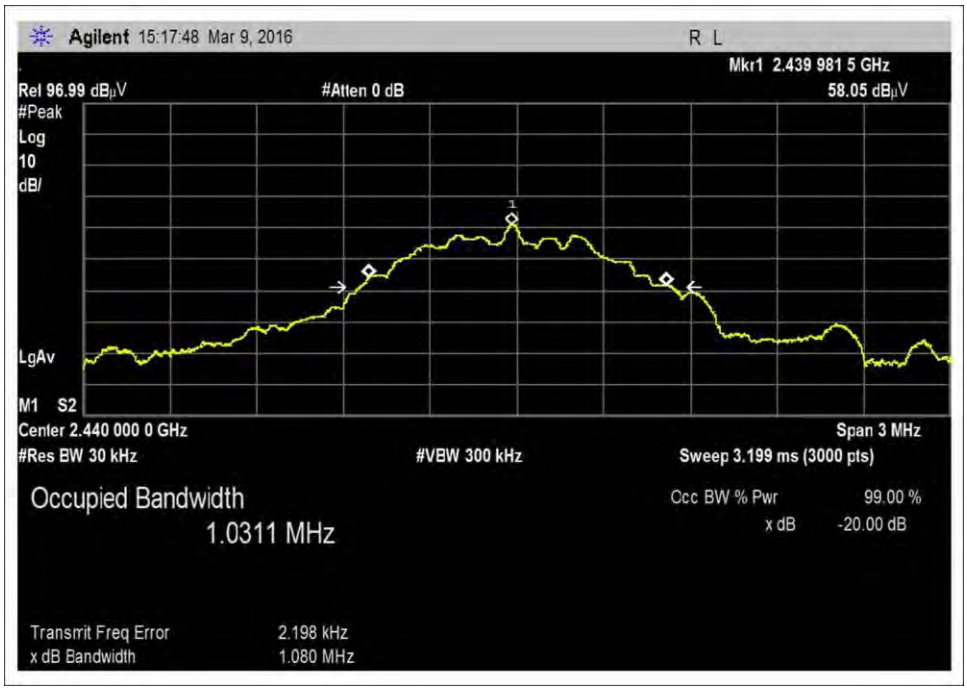
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02113	Horn Antenna	EMC Test Systems	3115	2/3/2015	2/3/2017
P01210	Cable	Andrews	FSJ1P-50A-4A	1/15/2015	1/15/2017
03302	Cable	Astrolab	32026-29094K-29094K-72TC	1/29/2016	1/29/2018
02660	Spectrum Analyzer	Agilent	E4446A	7/9/2015	7/9/2017

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (MHz)**	**Results**
2402	1	GFSK	1.190	83.5	PASS
2440	1	GFSK	1.080	83.5	PASS
2480	1	GFSK	1.655	83.5	PASS

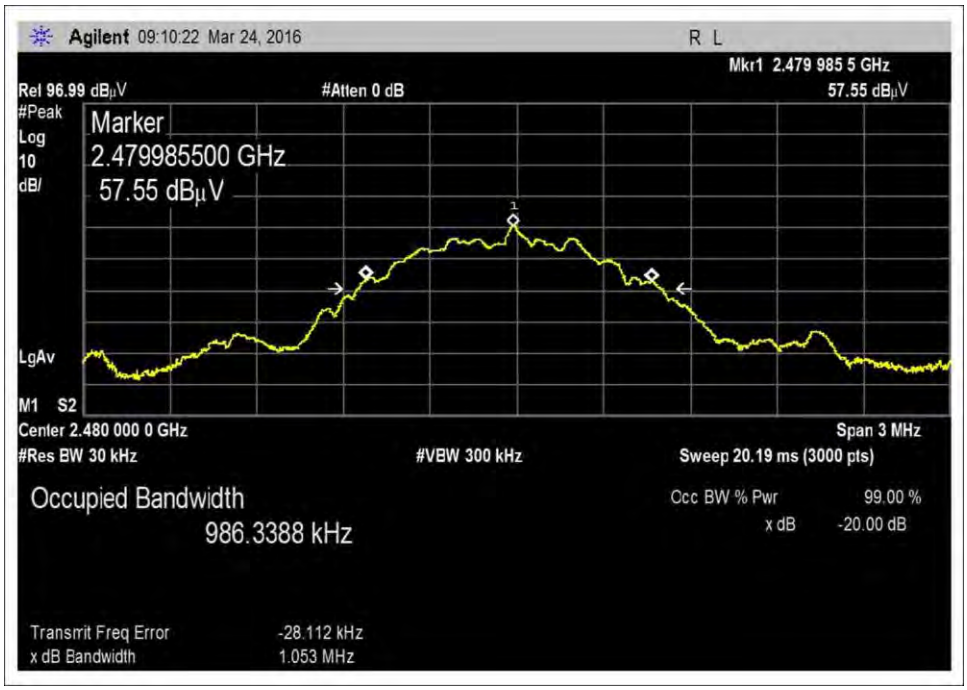
Plots



Low Channel

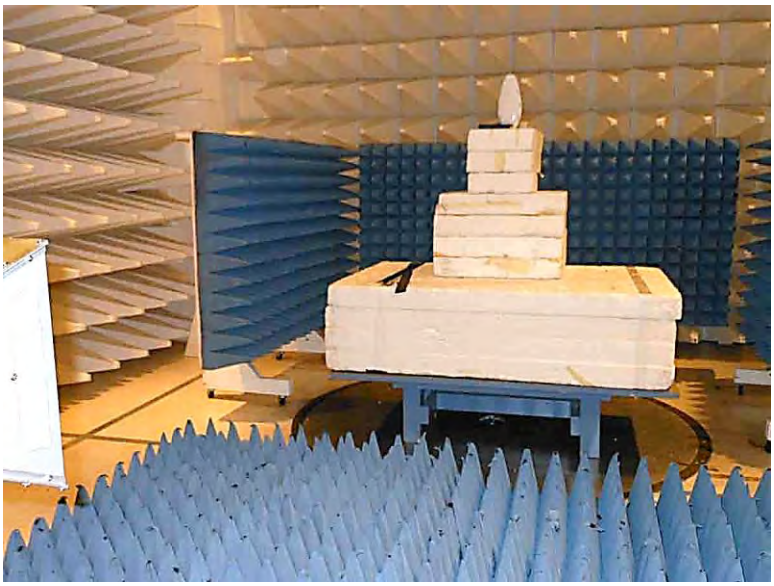


Middle Channel



High Channel

Test Setup Photos



15.249(a) Field Strength of Fundamental

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Connected Yard**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**98260**	Date:	3/24/2016
Test Type:	**Radiated Scan**	Time:	09:05:28
Tested By:	Hieu Song Nguyenpham	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:

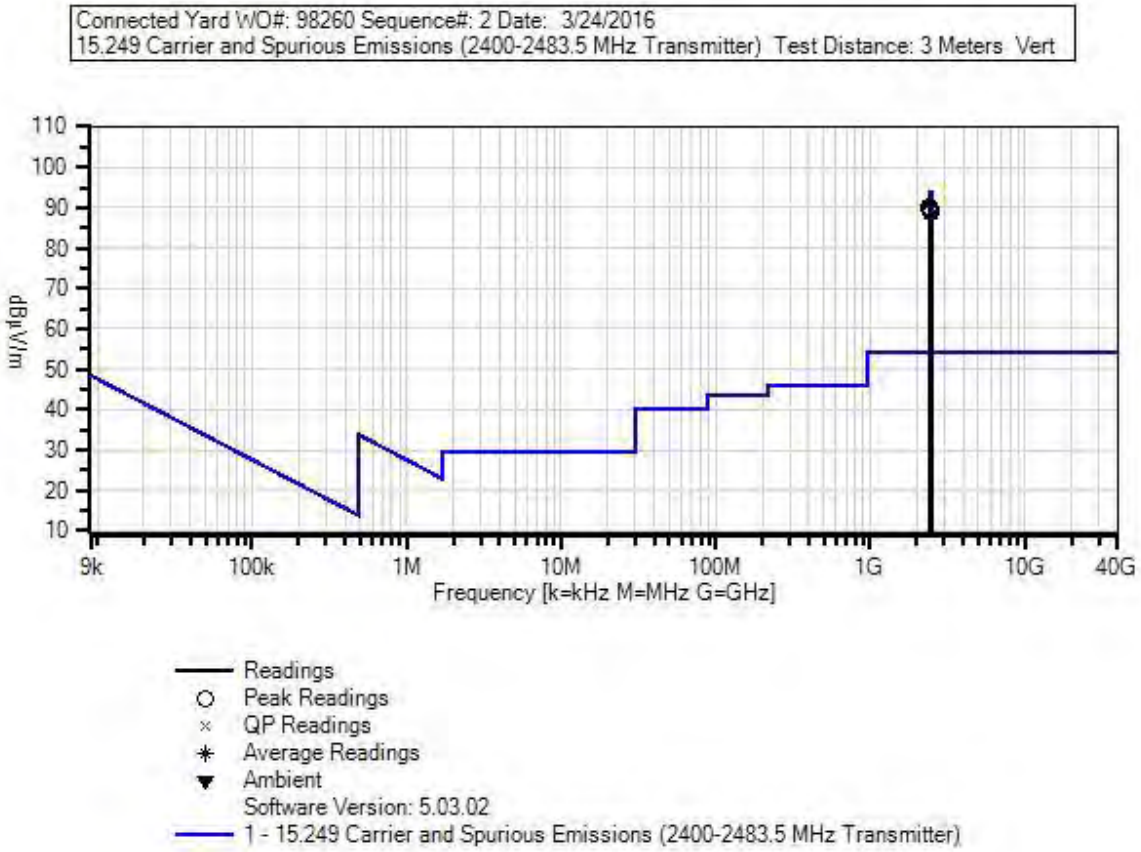
Firmware: 0.1.2
Application: Putty

Temperature: 20.5°C
Humidity: 43 %
Atmospheric Pressure: 101.8 kPa

Highest Generation Frequency: 2.48GHz
Gain of antenna = -1.8dBi
RF Output set =0dBm
Method: ANSI C 63.10 2013

RBW=3MHz
VBW=8MHz

The EUT is placed on a non-conducted table and operated by an internal battery at 3.0VDC.
The EUT is set to continuously transmitting as intended.


Connected Yard WO#: 98260 Sequence#: 2 Date: 3/24/2016
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters Vert
110
100
90
80
70
60
50
40
30
20
10
dBµV/m
9k
100k
1M
10M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.02
1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02113	Horn Antenna	3115	2/3/2015	2/3/2017
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/29/2016	1/29/2018
T3	ANP01210	Cable	FSJ1P-50A-4A	1/15/2015	1/15/2017
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017

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

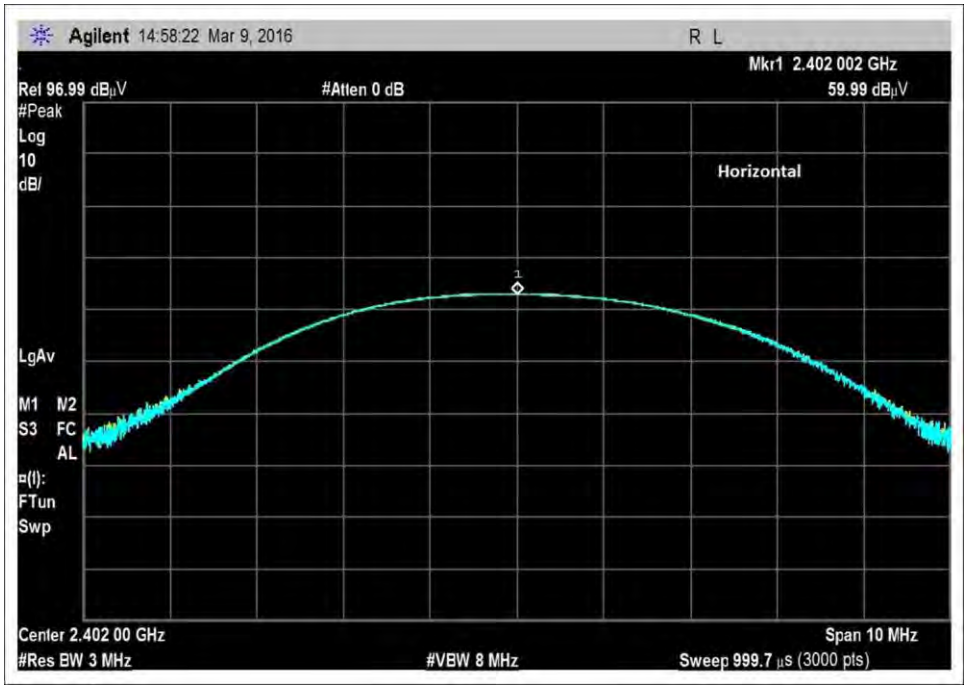
#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	2402.005M	60.2	+26.0	+1.3	+2.6		+0.0	90.1	94.0	-3.9	Vert
2	2402.002M	60.0	+26.0	+1.3	+2.6		+0.0	89.9	94.0	-4.1	Horiz
3	2440.002M	59.5	+26.1	+1.3	+2.6		+0.0	89.5	94.0	-4.5	Horiz
4	2440.002M	59.3	+26.1	+1.3	+2.6		+0.0	89.3	94.0	-4.7	Vert
5	2479.988M	58.7	+26.3	+1.3	+2.6		+0.0	88.9	94.0	-5.1	Vert
6	2479.988M	58.4	+26.3	+1.3	+2.6		+0.0	88.6	94.0	-5.4	Horiz

Test Data Summary - Voltage Variations

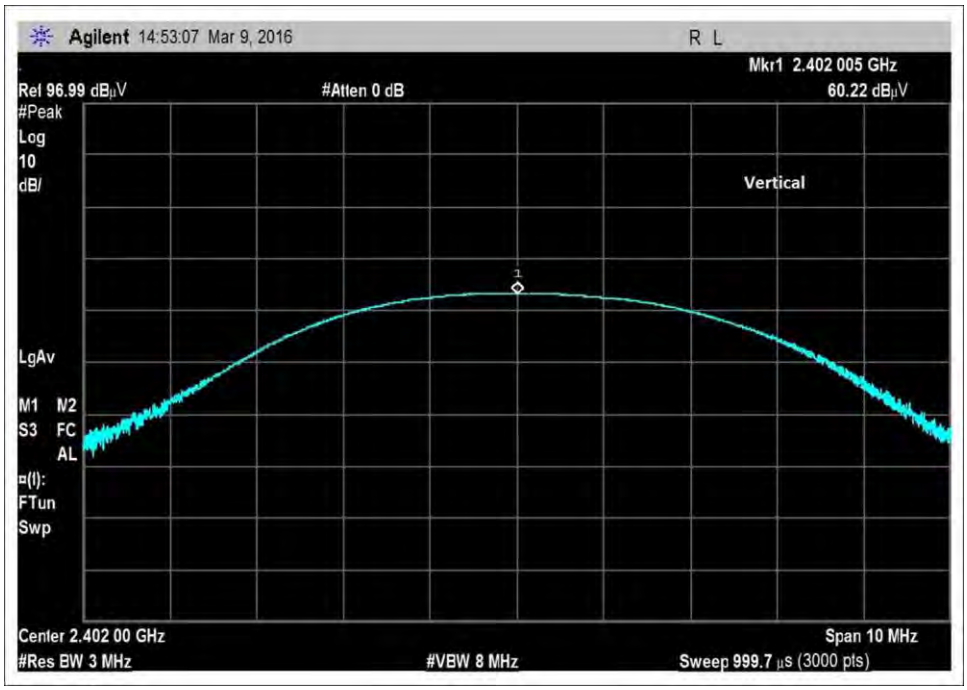
This equipment is battery powered. Power output tests were performed using a fresh battery.

Fundamental Test Data Summary – Radiated Field Strength Measurement					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Measured (dBuV/m @ 3m)**	**Limit (dBuV/m @ 3m)**	**Results**
2402 Horizontal	GFSK	Integral	89.9	≤94	Pass
2402 Vertical	GFSK	Integral	90.1	≤94	Pass
2440 Horizontal	GFSK	Integral	89.5	≤94	Pass
2440 Vertical	GFSK	Integral	89.3	≤94	Pass
2480 Horizontal	GFSK	Integral	88.6	≤94	Pass
2480 Vertical	GFSK	Integral	88.9	≤94	Pass

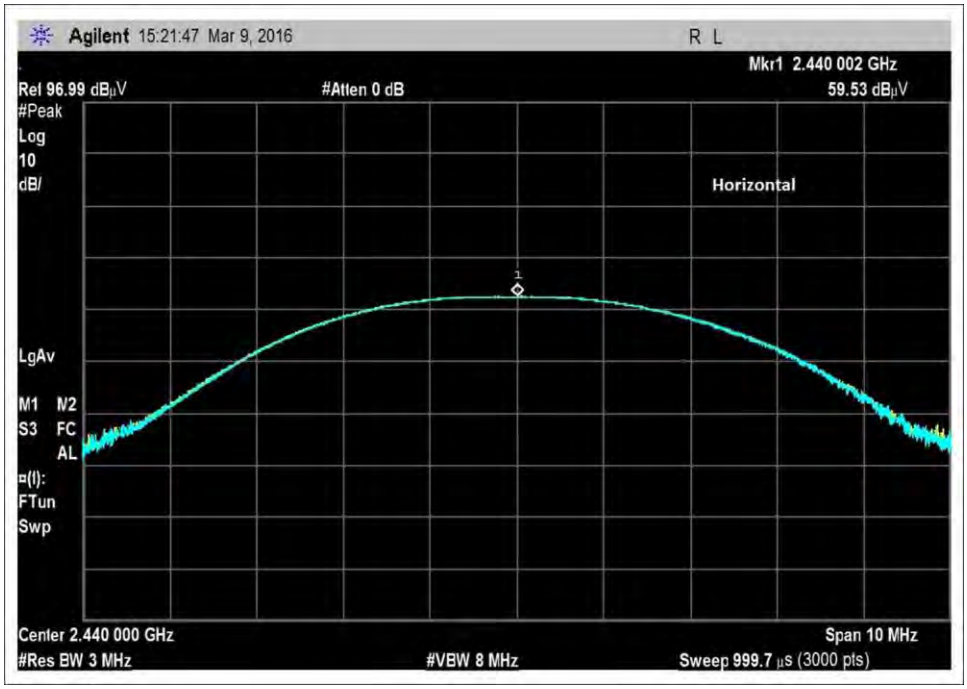
Plot Data



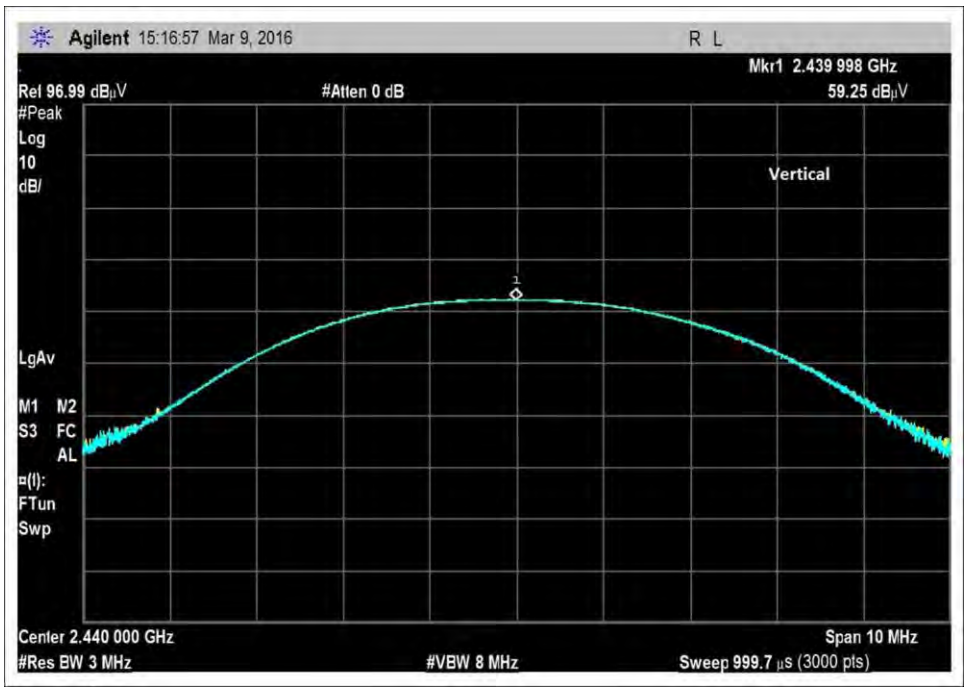
Low Channel, Horizontal



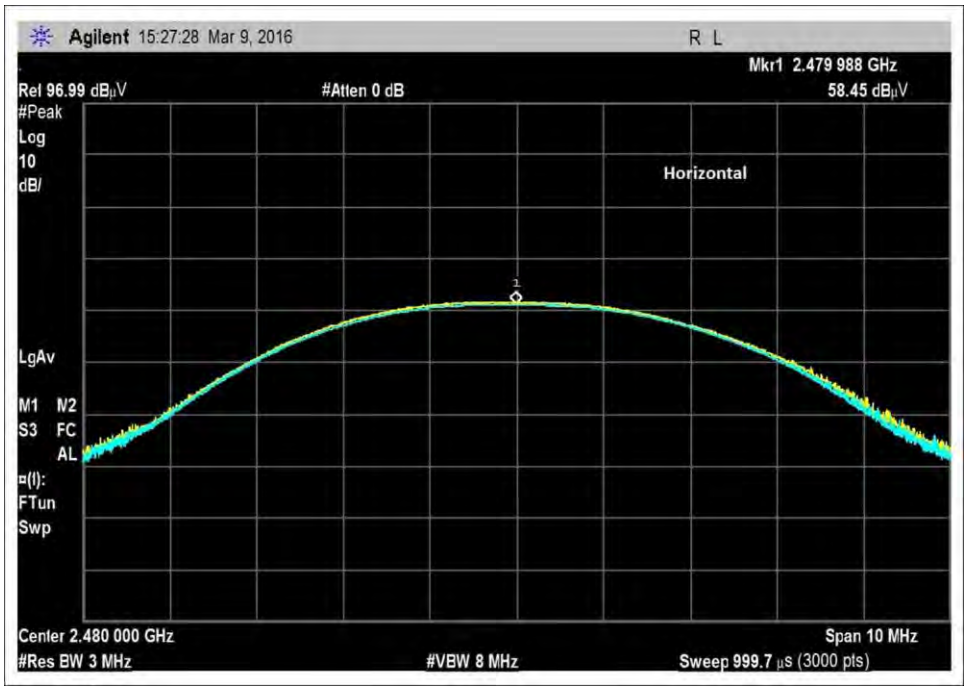
Low Channel, Vertical



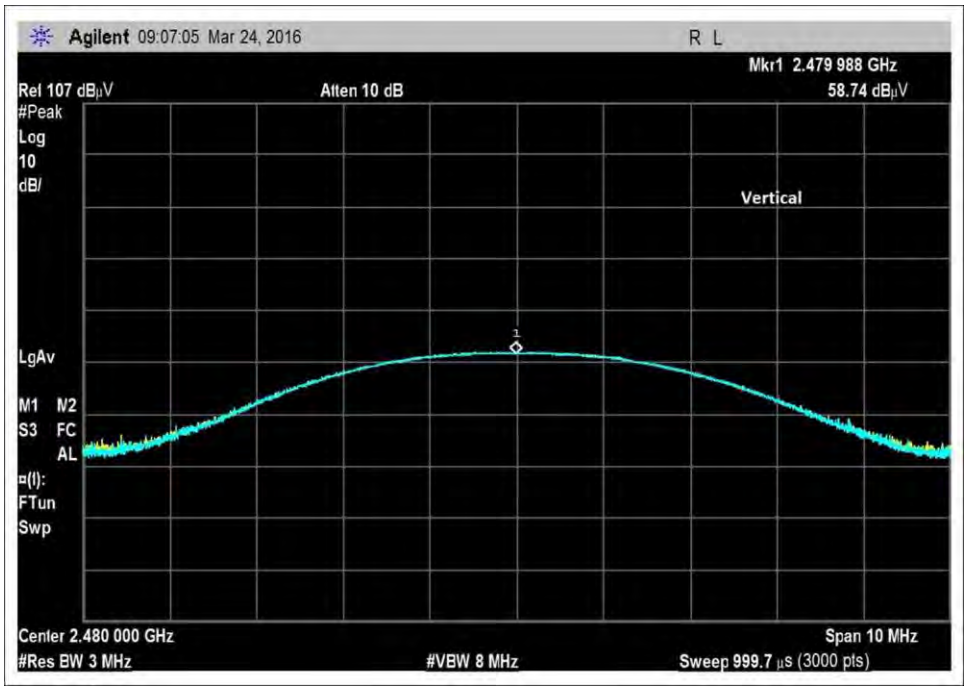
Middle Channel, Horizontal



Middle Channel, Vertical

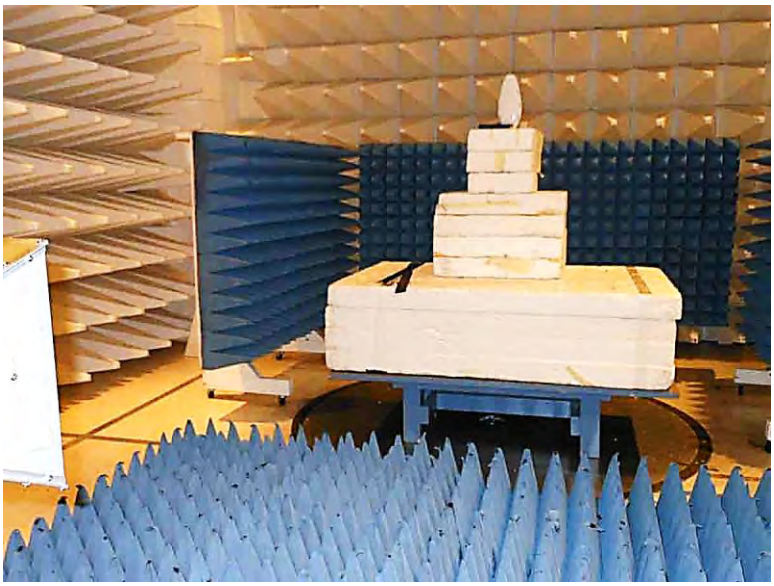


High Channel, Horizontal



High Channel, Vertical

Test Setup Photos



15.249(a) Radiated Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Connected Yard**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**98260**	Date:	3/24/2016
Test Type:	**Radiated Scan**	Time:	15:04:22
Tested By:	Hieu Song Nguyenpham	Sequence#:	17
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:

Radiated Spurious Emission
Frequency Range:9kHz to 1000MHz

Firmware: 0.1.2
Application: Putty

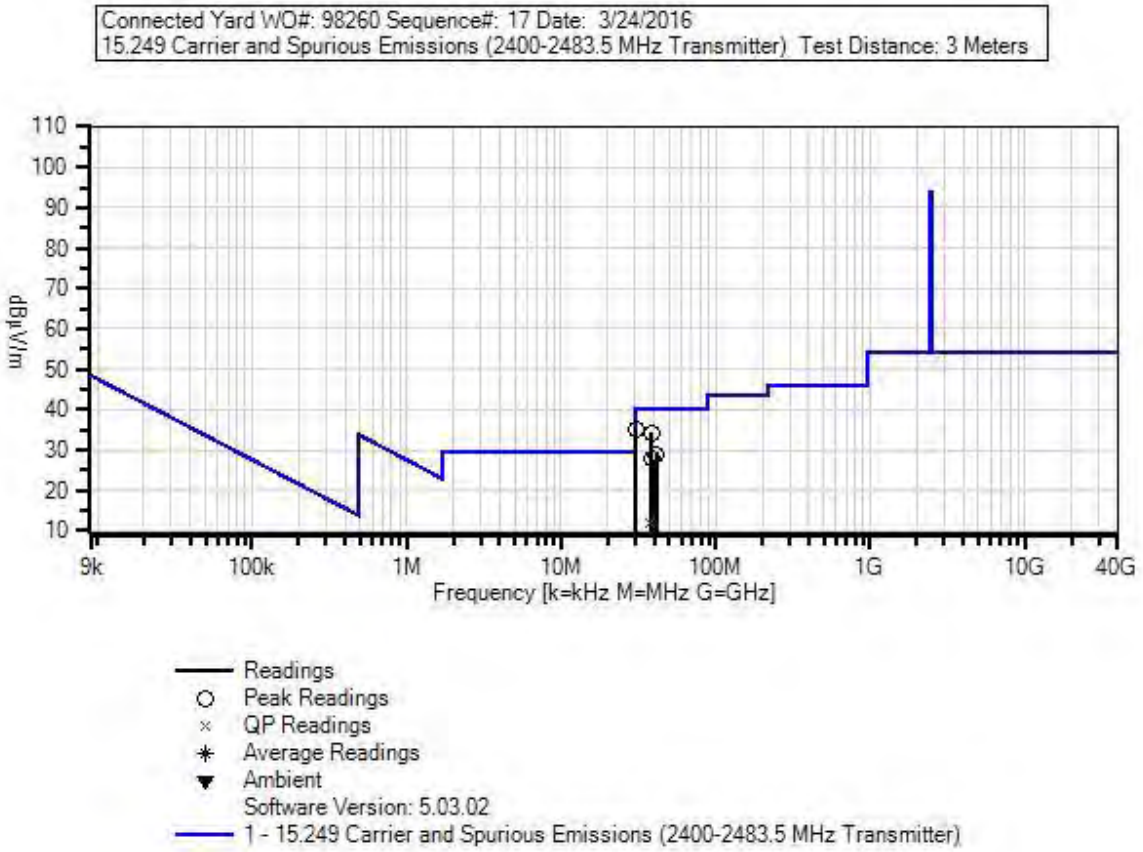
Temperature: 20.5°C
Humidity: 43 %
Atmospheric Pressure: 101.8 kPa

Highest Generation Frequency: 2.48GHz
RF Output set =0dBm
Gain of the antenna for Bluetooth= -1.8dBi
Method: ANSI C 63.10 2013

9 kHz -150 kHz; RBW=200 Hz,VBW=200 Hz;
150 kHz-30 MHz; RBW=9 kHz,VBW=9 kHz;
30 MHz-1000 MHz; RBW=120 kHz,VBW=120 kHz,
1000 MHz-25000MHz; RBW=1 MHz,VBW=1 MHz

The EUT is placed on a non-conducted table and operated by an internal battery at 3.0VDC.
The EUT is set to continuously transmitting as intended.

Low Channel


Connected Yard WO#: 98260 Sequence#: 17 Date: 3/24/2016
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters
dBµV/m
110
100
90
80
70
60
50
40
30
20
10
9k
100k
1M
10M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.02
1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00971A	Preamp	8447D	2/5/2016	2/5/2018
	AN00432	Loop Antenna	6502	5/8/2015	5/8/2017
T2	AN00852	Biconilog Antenna	CBL 6111C	11/24/2014	11/24/2016
T3	ANP00880	Cable	RG214U	6/13/2014	6/13/2016
T4	ANP01187	Cable	CNT-195	12/30/2014	12/30/2016
T5	ANP06691	Cable	PE3062-180	8/8/2014	8/8/2016
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	30.266M	43.6	-28.0 +0.2	+18.8	+0.4	+0.1	+0.0	35.1	40.0	-4.9	Horiz
2	38.119M	46.7	-28.0 +0.2	+14.7	+0.5	+0.1	+0.0	34.2	40.0	-5.8	Vert
3	41.380M	43.2	-28.0 +0.2	+13.0	+0.5	+0.1	+0.0	29.0	40.0	-11.0	Vert
4	39.117M	40.7	-28.0 +0.2	+14.2	+0.5	+0.1	+0.0	27.7	40.0	-12.3	Horiz
5	37.587M QP	23.9	-28.0 +0.2	+15.0	+0.5	+0.1	+0.0	11.7	40.0	-28.3	Horiz
^	37.587M	50.7	-28.0 +0.2	+15.0	+0.5	+0.1	+0.0	38.5	40.0	-1.5	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Connected Yard**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**98260**	Date:	3/24/2016
Test Type:	**Radiated Scan**	Time:	10:50:47
Tested By:	Hieu Song Nguyenpham	Sequence#:	11
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:

Radiated Spurious Emission
Frequency Range: 1000MHz to 25000MHz

Firmware: 0.1.2
Application: Putty

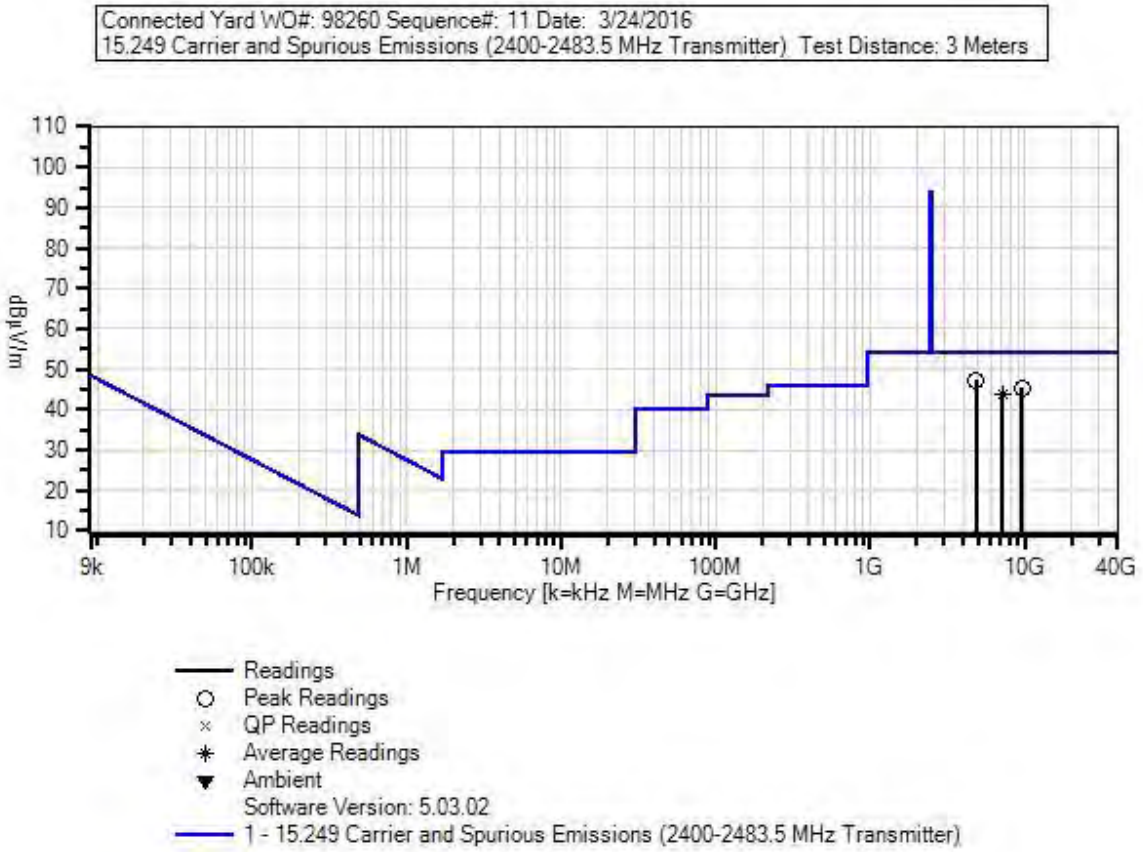
Temperature: 20.5° C
Humidity: 43 %
Atmospheric Pressure: 101.8 kPa

Highest Generation Frequency: 2.48GHz
RF Output set =0dBm
Gain of the antenna for Bluetooth= -1.8dBi
Method: ANSI C 63.10 2013

9 kHz -150 kHz; RBW=200 Hz,VBW=200 Hz;
150 kHz-30 MHz; RBW=9 kHz,VBW=9 kHz;
30 MHz-1000 MHz; RBW=120 kHz,VBW=120 kHz,
1000 MHz-25000MHz; RBW=1 MHz,VBW=1 MHz

The EUT is placed on a non-conducted table and operated by an internal battery at 3.0VDC.
The EUT is set to continuously transmitting as intended.

Low Channel


Connected Yard WO#: 98260 Sequence#: 11 Date: 3/24/2016
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters
dBµV/m
110
100
90
80
70
60
50
40
30
20
10
9k
100k
1M
10M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.02
1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02113	Horn Antenna	3115	2/3/2015	2/3/2017
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/29/2016	1/29/2018
T3	ANP01210	Cable	FSJ1P-50A-4A	1/15/2015	1/15/2017
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017
T4	AN03114	Preamp	AMF-7D-00101800-30-10P	4/22/2015	4/22/2017
T5	ANP06900	Cable	32022-29094K-29094K-36TC	12/30/2015	12/30/2017
T6	AN03309	High Pass Filter	11SH10-3000/T10000-O/O	1/18/2016	1/18/2018
	AN02693	Active Horn Antenna-ANSI C63.5 3m	AMFW-5F-12001800-20-10P	5/6/2015	5/6/2017
	AN02694	Horn Antenna-ANSI C63.5 3m	AMFW-5F-18002650-20-10P	5/7/2015	5/7/2017
	AN03143	Cable	32022-29094K-144TC	3/18/2015	3/18/2017
	ANP00928	Cable	various	1/25/2016	1/25/2018
	ANP00929	Cable	various	1/25/2016	1/25/2018
	ANP06138	Cable	32022-29094K-29094K-72TC	3/18/2015	3/18/2017

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4803.238M	67.7	+30.8 +0.8	+1.8 +0.3	+3.8	-57.8	+0.0	47.4	54.0	-6.6	Horiz
2	9606.965M	58.3	+34.8 +1.1	+2.6 +0.3	+5.4	-57.2	+0.0	45.3	54.0	-8.7	Vert
3	7205.887M Ave	59.5	+34.1 +1.0	+2.2 +0.3	+5.0	-58.3	+0.0	43.8	54.0	-10.2	Horiz
^	7205.887M	69.2	+34.1 +1.0	+2.2 +0.3	+5.0	-58.3	+0.0	53.5	54.0	-0.5	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Connected Yard**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**98260**	Date:	3/24/2016
Test Type:	**Radiated Scan**	Time:	15:22:16
Tested By:	Hieu Song Nguyenpham	Sequence#:	20
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:

Radiated Spurious Emission
Frequency Range:9kHz to 1000MHz

Firmware: 0.1.2
Application: Putty

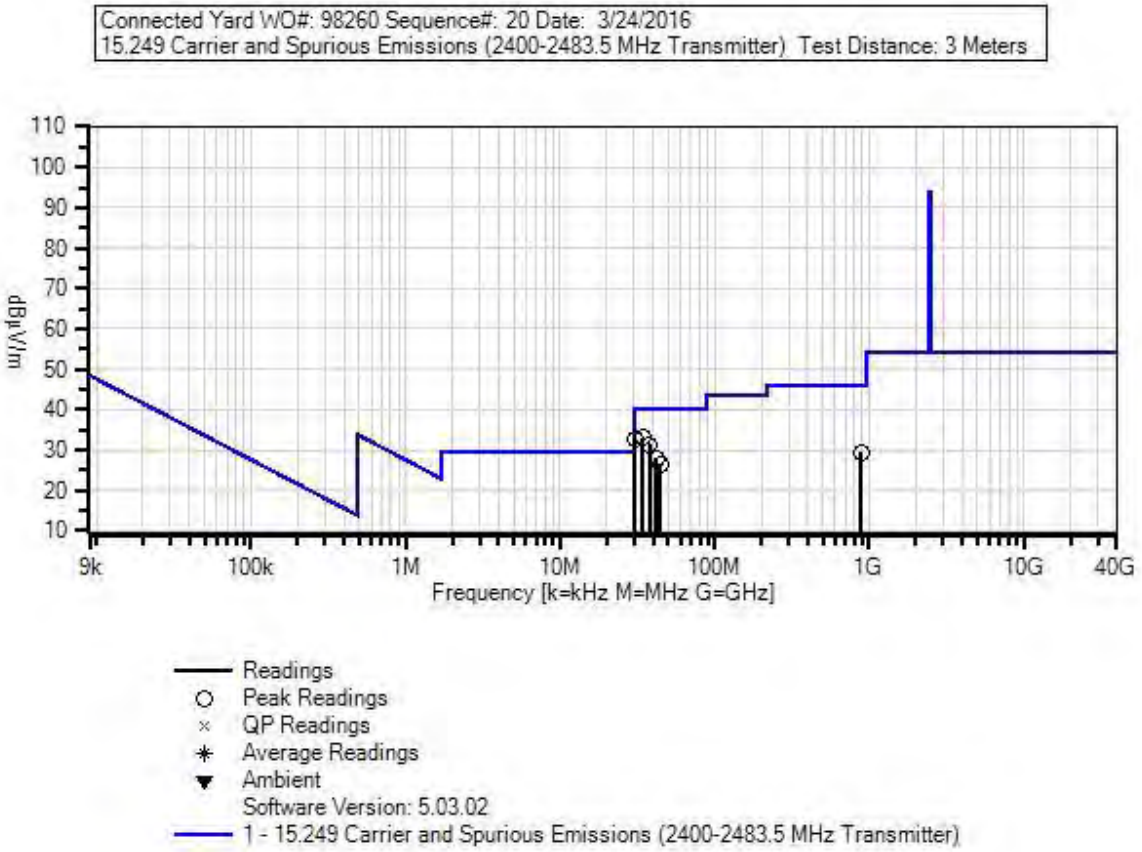
Temperature: 20.5°C
Humidity: 43 %
Atmospheric Pressure: 101.8 kPa

Highest Generation Frequency: 2.48GHz
RF Output set =0dBm
Gain of the antenna for Bluetooth= -1.8dBi
Method: ANSI C 63.10 2013

9 kHz -150 kHz; RBW=200 Hz,VBW=200 Hz;
150 kHz-30 MHz; RBW=9 kHz,VBW=9 kHz;
30 MHz-1000 MHz; RBW=120 kHz,VBW=120 kHz,
1000 MHz-25000MHz; RBW=1 MHz,VBW=1 MHz

The EUT is placed on a non-conducted table and operated by an internal battery at 3.0VDC.
The EUT is set to continuously transmitting as intended.

Middle Channel


Connected Yard WO#: 98260 Sequence#: 20 Date: 3/24/2016
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters
dBµV/m
110
100
90
80
70
60
50
40
30
20
10
9k
100k
1M
10M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.02
1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00971A	Preamp	8447D	2/5/2016	2/5/2018
	AN00432	Loop Antenna	6502	5/8/2015	5/8/2017
T2	AN00852	Biconilog Antenna	CBL 6111C	11/24/2014	11/24/2016
T3	ANP00880	Cable	RG214U	6/13/2014	6/13/2016
T4	ANP01187	Cable	CNT-195	12/30/2014	12/30/2016
T5	ANP06691	Cable	PE3062-180	8/8/2014	8/8/2016
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	34.208M	43.4	-28.0 +0.2	+16.9	+0.5	+0.1	+0.0	33.1	40.0	-6.9	Vert
2	30.337M	41.4	-28.0 +0.2	+18.7	+0.4	+0.1	+0.0	32.8	40.0	-7.2	Vert
3	37.996M	43.8	-28.0 +0.2	+14.8	+0.5	+0.1	+0.0	31.4	40.0	-8.6	Horiz
4	41.699M	42.2	-28.0 +0.2	+12.9	+0.5	+0.1	+0.0	27.9	40.0	-12.1	Vert
5	44.561M	42.0	-28.0 +0.2	+11.6	+0.6	+0.1	+0.0	26.5	40.0	-13.5	Horiz
6	883.820M	29.0	-27.8 +1.4	+23.0	+3.1	+0.6	+0.0	29.3	46.0	-16.7	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Connected Yard**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**98260**	Date:	3/24/2016
Test Type:	**Radiated Scan**	Time:	10:31:21
Tested By:	Hieu Song Nguyenpham	Sequence#:	8
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:

Radiated Spurious Emission
Frequency Range: 1000MHz to 25000MHz

Firmware: 0.1.2
Application: Putty

Temperature: 20.5°C
Humidity: 43 %
Atmospheric Pressure: 101.8 kPa

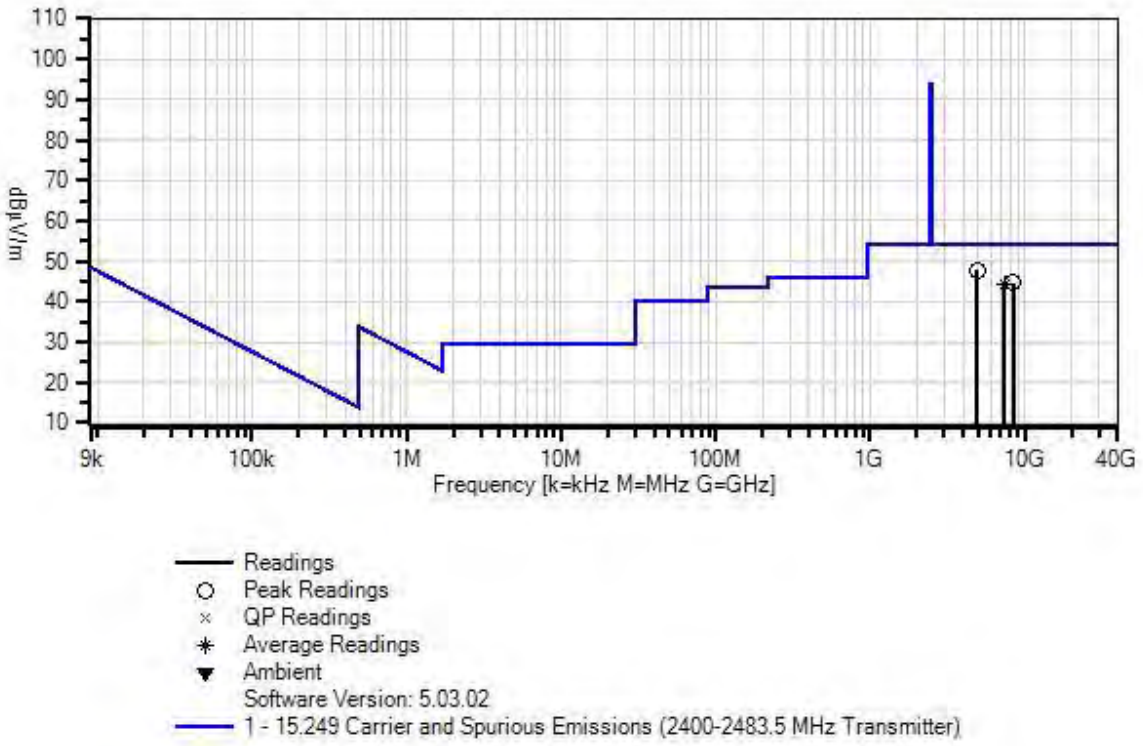
Highest Generation Frequency: 2.48GHz
RF Output set =0dBm
Gain of the antenna for Bluetooth= -1.8dBi
Method: ANSI C 63.10 2013

9 kHz -150 kHz; RBW=200 Hz,VBW=200 Hz;
150 kHz-30 MHz; RBW=9 kHz,VBW=9 kHz;
30 MHz-1000 MHz; RBW=120 kHz,VBW=120 kHz,
1000 MHz-25000MHz; RBW=1 MHz,VBW=1 MHz

The EUT is placed on a non-conducted table and operated by an internal battery at 3.0VDC.
The EUT is set to continuously transmitting as intended.

Middle Channel

Connected Yard WO#: 98260 Sequence#: 8 Date: 3/24/2016
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02113	Horn Antenna	3115	2/3/2015	2/3/2017
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/29/2016	1/29/2018
T3	ANP01210	Cable	FSJ1P-50A-4A	1/15/2015	1/15/2017
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017
T4	AN03114	Preamp	AMF-7D-00101800-30-10P	4/22/2015	4/22/2017
T5	ANP06900	Cable	32022-29094K-29094K-36TC	12/30/2015	12/30/2017
T6	AN03309	High Pass Filter	11SH10-3000/T10000-O/O	1/18/2016	1/18/2018
	AN02693	Active Horn Antenna-ANSI C63.5 3m	AMFW-5F-12001800-20-10P	5/6/2015	5/6/2017
	AN02694	Horn Antenna-ANSI C63.5 3m	AMFW-5F-18002650-20-10P	5/7/2015	5/7/2017
	AN03143	Cable	32022-29094K-144TC	3/18/2015	3/18/2017
	ANP00928	Cable	various	1/25/2016	1/25/2018
	ANP00929	Cable	various	1/25/2016	1/25/2018
	ANP06138	Cable	32022-29094K-29094K-72TC	3/18/2015	3/18/2017

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4879.878M	67.7	+30.9 +0.8	+1.8 +0.3	+3.8	-57.6	+0.0	47.7	54.0	-6.3	Horiz
2	8441.436M	56.2	+36.0 +1.0	+2.4 +0.3	+5.2	-56.4	+0.0	44.7	54.0	-9.3	Horiz
3	7319.880M Ave	59.9	+34.3 +1.0	+2.3 +0.3	+5.0	-58.3	+0.0	44.5	54.0	-9.5	Horiz
^	7319.880M	69.6	+34.3 +1.0	+2.3 +0.3	+5.0	-58.3	+0.0	54.2	54.0	+0.2	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Connected Yard**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**98260**	Date:	3/24/2016
Test Type:	**Radiated Scan**	Time:	15:47:25
Tested By:	Hieu Song Nguyenpham	Sequence#:	23
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:

Radiated Spurious Emission
Frequency Range:9kHz to 1000MHz

Firmware: 0.1.2
Application: Putty

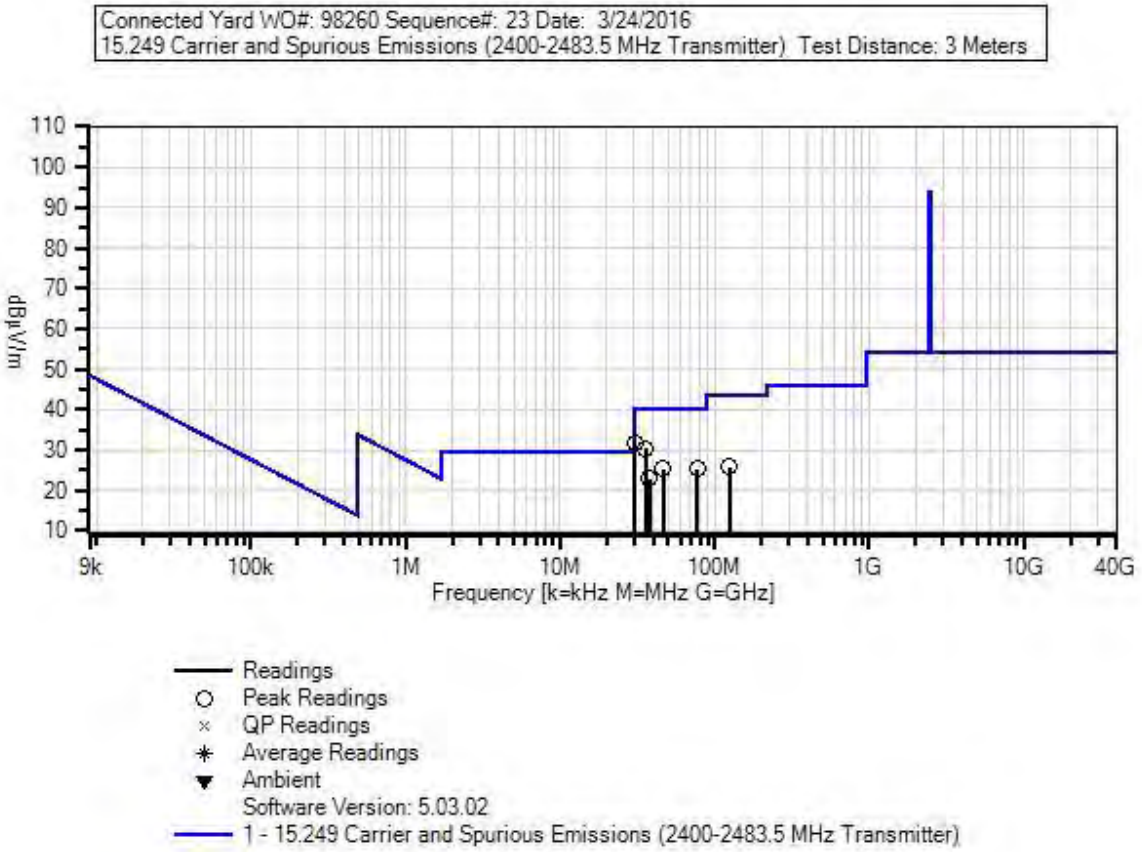
Temperature: 20.5°C
Humidity: 43 %
Atmospheric Pressure: 101.8 kPa

Highest Generation Frequency: 2.48GHz
RF Output set =0dBm
Gain of the antenna for Bluetooth= -1.8dBi
Method: ANSI C 63.10 2013

9 kHz -150 kHz; RBW=200 Hz,VBW=200 Hz;
150 kHz-30 MHz; RBW=9 kHz,VBW=9 kHz;
30 MHz-1000 MHz; RBW=120 kHz,VBW=120 kHz,
1000 MHz-25000MHz; RBW=1 MHz,VBW=1 MHz

The EUT is placed on a non-conducted table and operated by an internal battery at 3.0VDC.
The EUT is set to continuously transmitting as intended.

High Channel


Connected Yard WO#: 98260 Sequence#: 23 Date: 3/24/2016
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters
dBµV/m
110
100
90
80
70
60
50
40
30
20
10
9k
100k
1M
10M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.02
1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00971A	Preamp	8447D	2/5/2016	2/5/2018
	AN00432	Loop Antenna	6502	5/8/2015	5/8/2017
T2	AN00852	Biconilog Antenna	CBL 6111C	11/24/2014	11/24/2016
T3	ANP00880	Cable	RG214U	6/13/2014	6/13/2016
T4	ANP01187	Cable	CNT-195	12/30/2014	12/30/2016
T5	ANP06691	Cable	PE3062-180	8/8/2014	8/8/2016
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	30.463M	40.5	-28.0 +0.2	+18.7	+0.4	+0.1	+0.0	31.9	40.0	-8.1	Horiz
2	35.513M	41.4	-28.0 +0.2	+16.2	+0.5	+0.1	+0.0	30.4	40.0	-9.6	Horiz
3	77.545M	44.7	-27.8 +0.3	+7.2	+0.8	+0.2	+0.0	25.4	40.0	-14.6	Vert
4	46.581M	41.7	-27.9 +0.2	+10.6	+0.6	+0.1	+0.0	25.3	40.0	-14.7	Horiz
5	37.828M	35.2	-28.0 +0.2	+14.9	+0.5	+0.1	+0.0	22.9	40.0	-17.1	Vert
6	125.274M	40.1	-27.7 +0.4	+11.8	+1.0	+0.2	+0.0	25.8	43.5	-17.7	Vert

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Connected Yard**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**98260**	Date:	3/24/2016
Test Type:	**Radiated Scan**	Time:	10:03:50
Tested By:	Hieu Song Nguyenpham	Sequence#:	5
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:

Radiated Spurious Emission
Frequency Range: 1000MHz to 25000MHz

Firmware: 0.1.2
Application: Putty

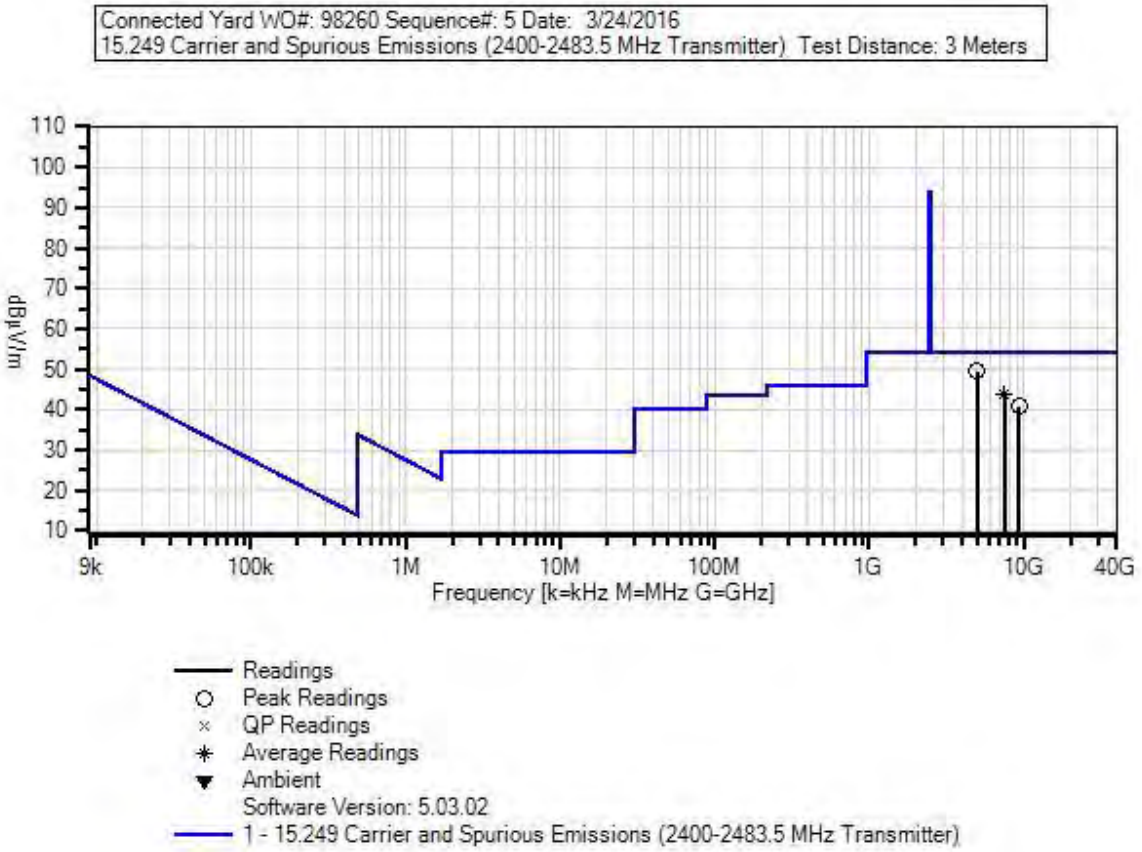
Temperature: 20.5°C
Humidity: 43 %
Atmospheric Pressure: 101.8 kPa

Highest Generation Frequency: 2.48GHz
RF Output set =0dBm
Gain of the antenna for Bluetooth= -1.8dBi
Method: ANSI C 63.10 2013

9 kHz -150 kHz; RBW=200 Hz,VBW=200 Hz;
150 kHz-30 MHz; RBW=9 kHz,VBW=9 kHz;
30 MHz-1000 MHz; RBW=120 kHz,VBW=120 kHz,
1000 MHz-25000MHz; RBW=1 MHz,VBW=1 MHz

The EUT is placed on a non-conducted table and operated by an internal battery at 3.0VDC.
The EUT is set to continuously transmitting as intended.

High Channel


Connected Yard WO#: 98260 Sequence#: 5 Date: 3/24/2016
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters
dBµV/m
110
100
90
80
70
60
50
40
30
20
10
9k
100k
1M
10M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.02
1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02113	Horn Antenna	3115	2/3/2015	2/3/2017
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/29/2016	1/29/2018
T3	ANP01210	Cable	FSJ1P-50A-4A	1/15/2015	1/15/2017
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017
T4	AN03114	Preamp	AMF-7D-00101800-30-10P	4/22/2015	4/22/2017
T5	ANP06900	Cable	32022-29094K-29094K-36TC	12/30/2015	12/30/2017
T6	AN03309	High Pass Filter	11SH10-3000/T10000-O/O	1/18/2016	1/18/2018
	AN02693	Active Horn Antenna-ANSI C63.5 3m	AMFW-5F-12001800-20-10P	5/6/2015	5/6/2017
	AN02694	Horn Antenna-ANSI C63.5 3m	AMFW-5F-18002650-20-10P	5/7/2015	5/7/2017
	AN03143	Cable	32022-29094K-144TC	3/18/2015	3/18/2017
	ANP00928	Cable	various	1/25/2016	1/25/2018
	ANP00929	Cable	various	1/25/2016	1/25/2018
	ANP06138	Cable	32022-29094K-29094K-72TC	3/18/2015	3/18/2017

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4959.958M	69.0	+31.1 +0.8	+1.8 +0.3	+3.8	-57.3	+0.0	49.5	54.0	-4.5	Horiz
2	7439.935M Ave	59.0	+34.4 +1.0	+2.3 +0.3	+5.1	-58.2	+0.0	43.9	54.0	-10.1	Horiz
^	7439.935M	68.7	+34.4 +1.0	+2.3 +0.3	+5.1	-58.2	+0.0	53.6	54.0	-0.4	Horiz
4	9257.900M	53.4	+34.9 +1.1	+2.5 +0.4	+5.2	-56.7	+0.0	40.8	54.0	-13.2	Horiz

Band Edge

Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2400	GFSK	Integral	44.8	<54	Pass
2483.5	GFSK	Integral	43.8	<54	Pass

Band Edge Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
Customer: **Connected Yard**
Specification: **15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**
Work Order #: **98260** Date: 3/24/2016
Test Type: **Radiated Scan** Time: 09:05:28
Tested By: Hieu Song Nguyenpham 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			

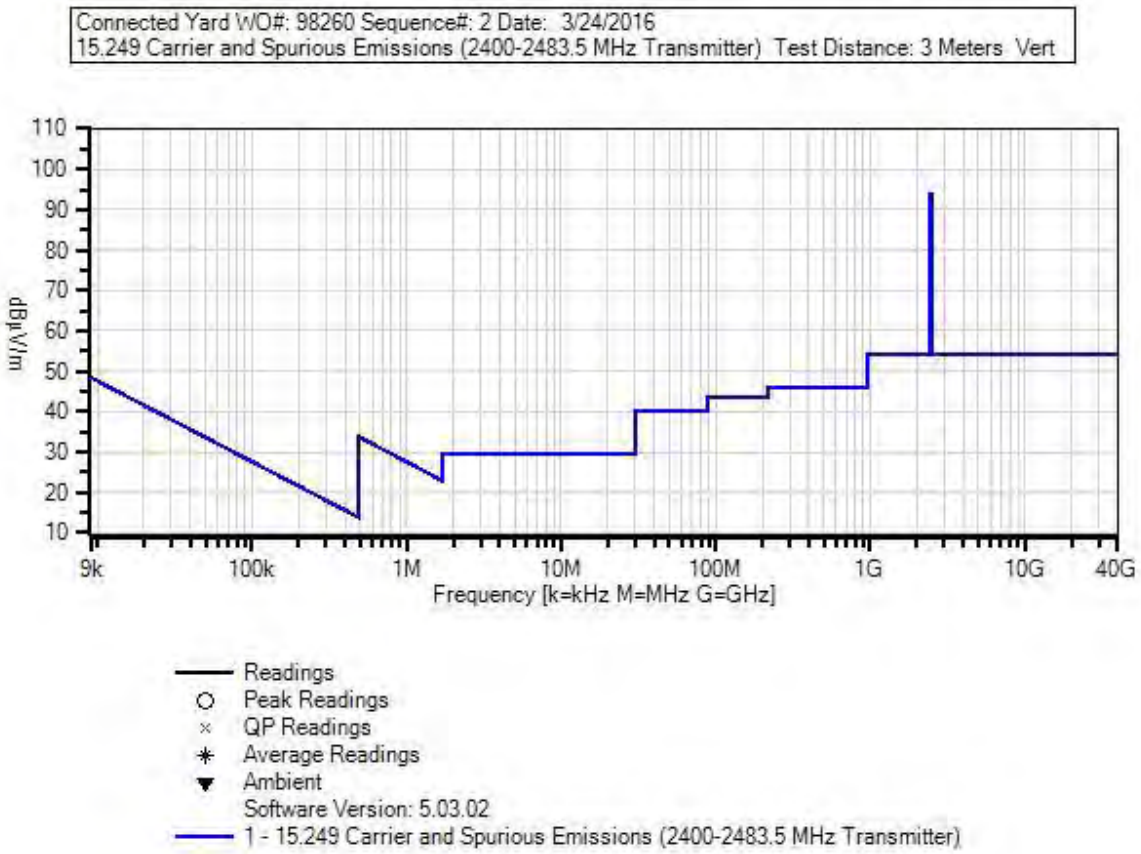
Test Conditions / Notes:

Firmware: 0.1.2
Application: Putty

Temperature: 20.5°C
Humidity: 43 %
Atmospheric Pressure: 101.8 kPa

Highest Generation Frequency: 2.48GHz
Gain of antenna = -1.8dBi
RF Output set =0dBm
Method: ANSI C 63.10 2013

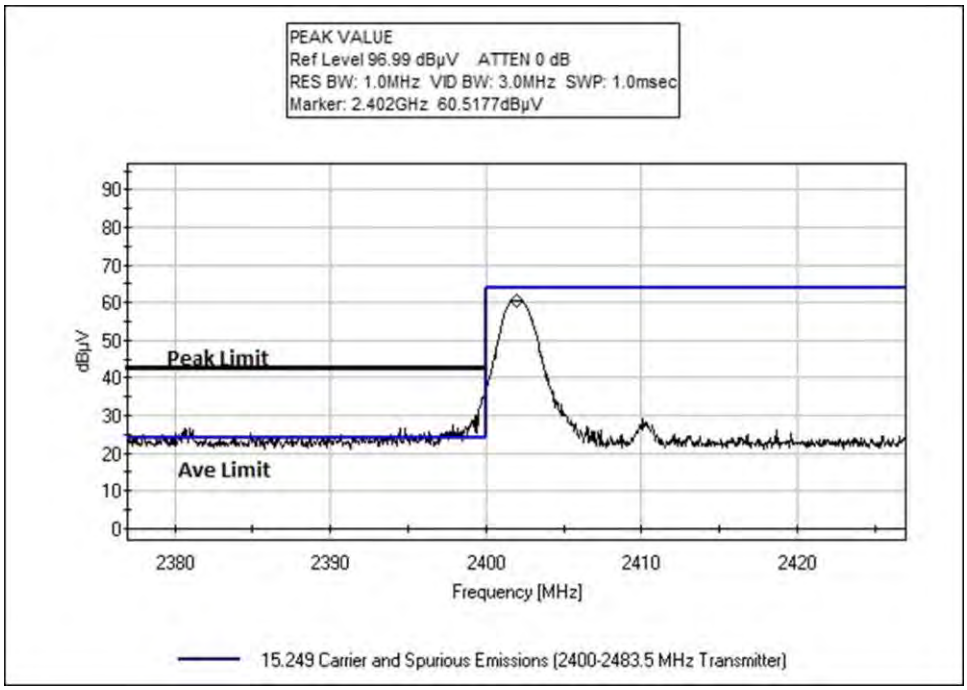
The EUT is placed on a non-conducted table and operated by an internal battery at 3.0VDC.
The EUT is set to continuously transmitting as intended.

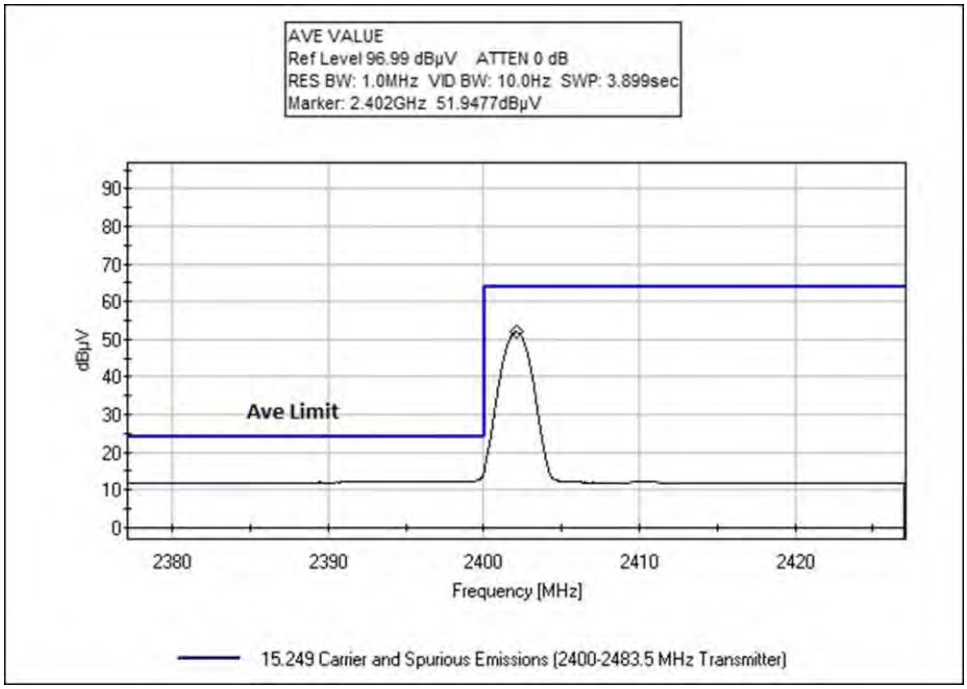


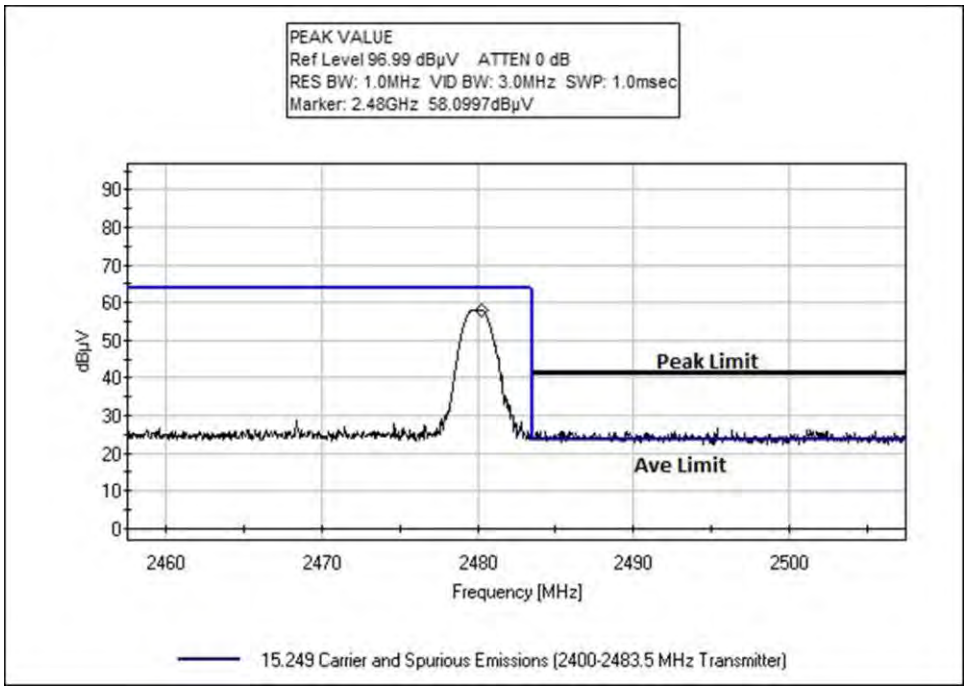
Test Equipment:

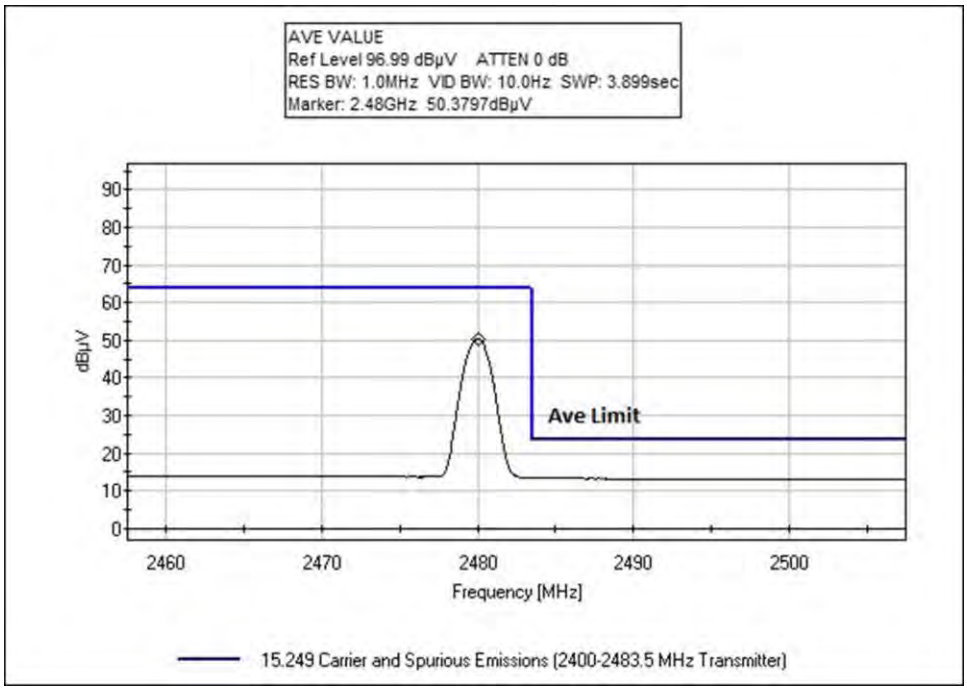
ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02113	Horn Antenna	3115	2/3/2015	2/3/2017
	AN03302	Cable	32026-29094K-29094K-72TC	1/29/2016	1/29/2018
	ANP01210	Cable	FSJ1P-50A-4A	1/15/2015	1/15/2017
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017

Band Edge Plots

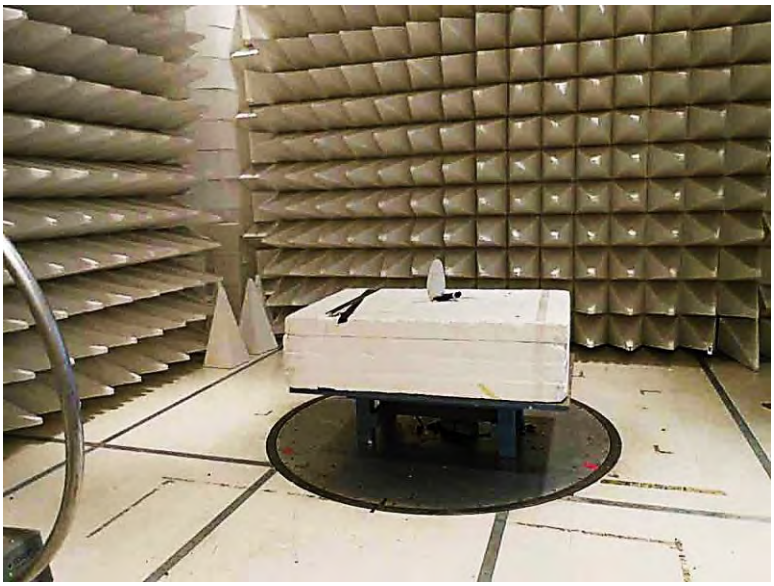




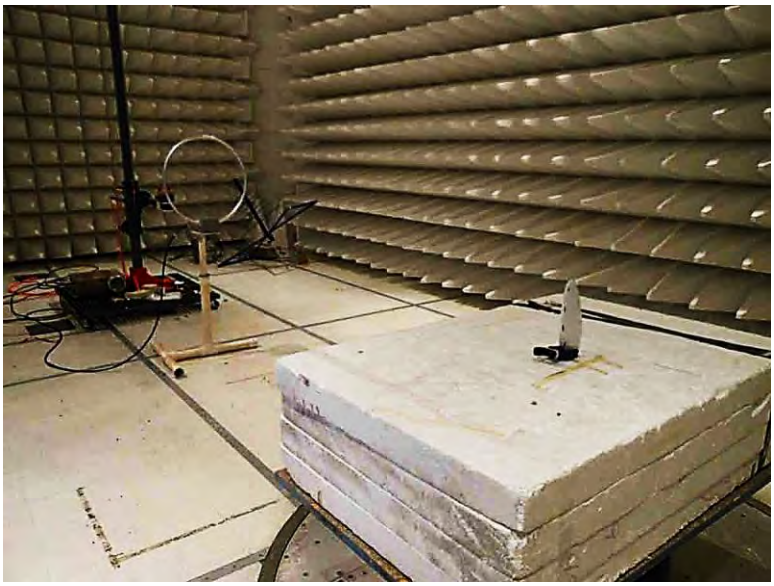

PEAK VALUE
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 1.0msec
Marker: 2.48GHz 58.0997dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)


AVE VALUE
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 3.899sec
Marker: 2.48GHz 50.3797dBµV
dBµV
Ave Limit
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

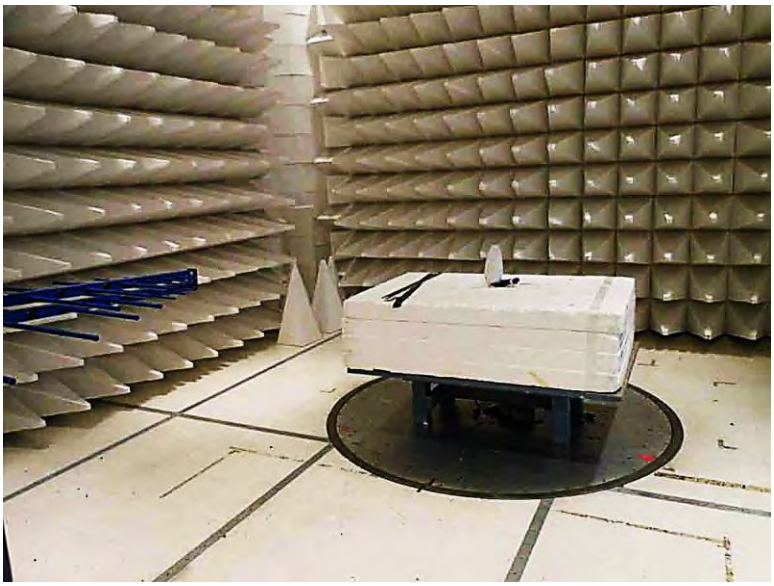
Test Setup Photos



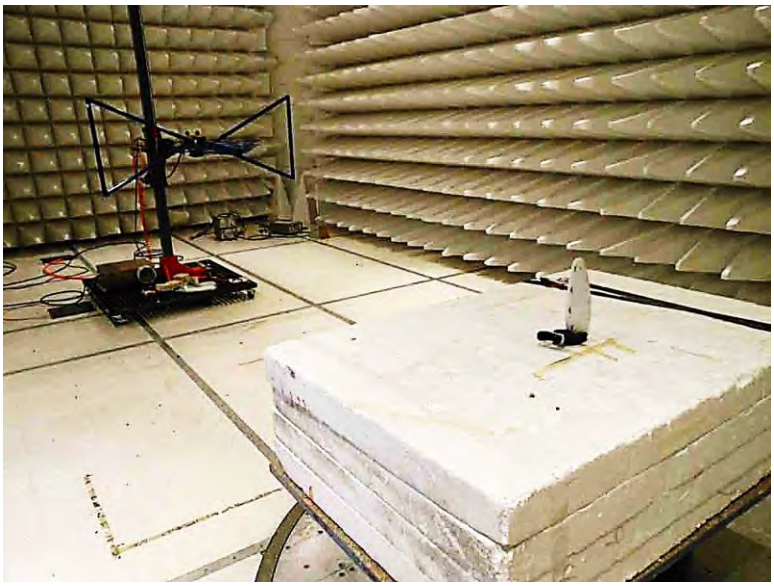
9kHz – 30MHz



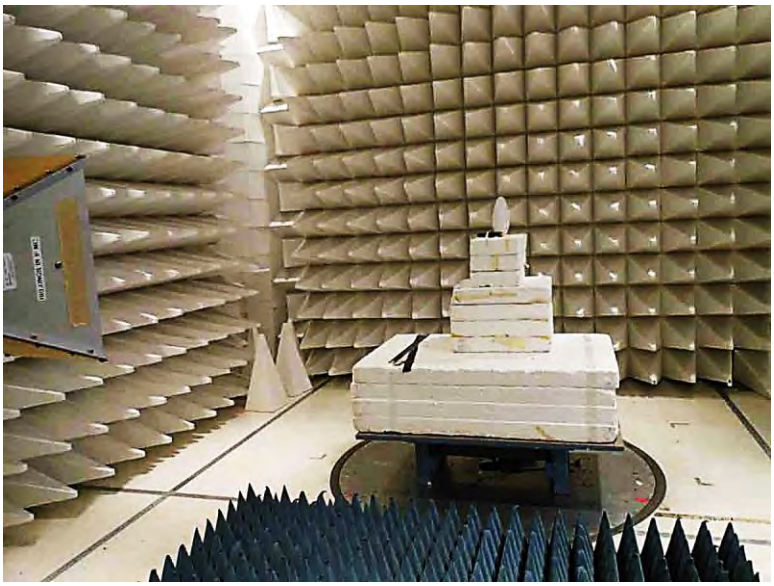
9kHz – 30MHz



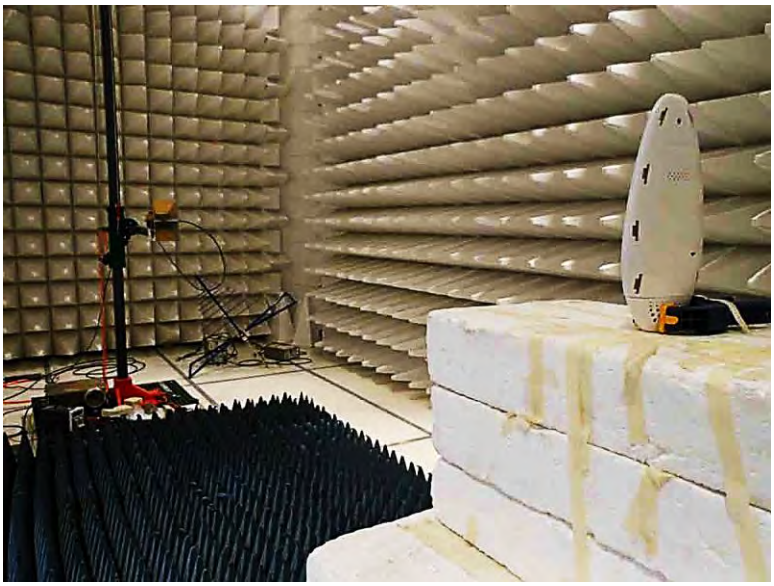
30MHz – 1GHz



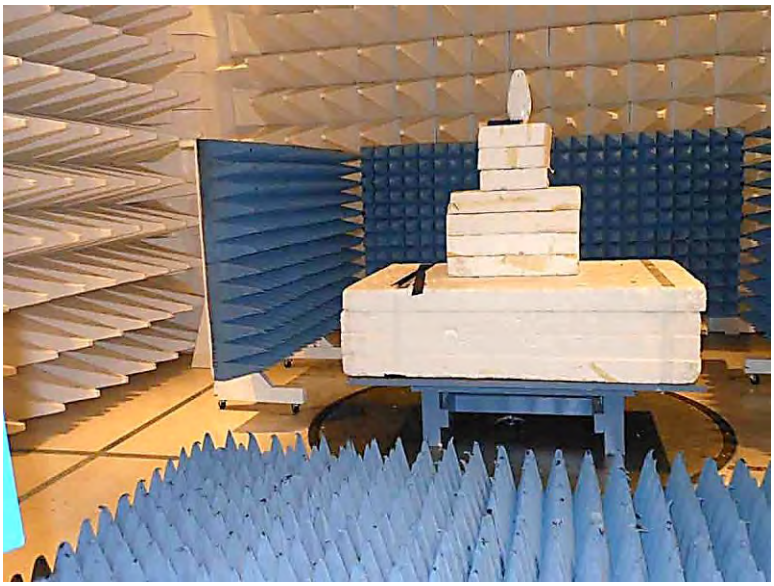
30MHz – 1GHz



1 – 12GHz



1 – 12GHz



12 – 25GHz

12 – 25GHz

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 dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on 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	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.