

Actigraph, LLC

TEST REPORT FOR

Ambulatory Activity Monitor, wGT3X+

Tested To The Following Standards:

FCC Part 15 Subpart C Sections 15.207, 15.249
and
RSS 210 Issue 8

Report No.: 92567-10

Date of issue: February 22, 2012



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

TABLE OF CONTENTS

Administrative Information	3
Test Report Information	3
Report Authorization	3
Test Facility Information	4
Site Registration & Accreditation Information	4
Summary of Results	5
Conditions During Testing	5
Equipment Under Test	6
Peripheral Devices	6
FCC Part 15 Subpart C	7
15.31(e) Voltage Variations	7
15.207 AC Conducted Emissions	9
15.247 RF Power Output	16
-20dBc Occupied Bandwidth	21
Bandedge	25
15.249(b) / (d) Field Strength of Harmonics / Spurious Emissions	29
RSS-210	33
99 % Bandwidth	33
Supplemental Information	37
Measurement Uncertainty	37
Emissions Test Details	37

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Actigraph, LLC
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Pensacola, FL 32502

REPORT PREPARED BY:

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CKC Laboratories, Inc.
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Mariposa, CA 95338

Representative: Adam Simon / Erin Littell (F-Squared)
Customer Reference Number: 2161

Project Number: 92567

DATE OF EQUIPMENT RECEIPT:

February 8, 2012

DATE(S) OF TESTING:

February 8-13, 2012

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 that reads "Steve Behm".

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.
110 Olinda Place
Brea, CA 92823

Site Registration & Accreditation Information

Location	CB #	Japan	Canada	FCC
Brea A	US0060	R-2945, C-3248 & T-1572	3082D-1	90473

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C and RSS 210 Issue 8

Description	Test Procedure/Method	Results
Voltage Variation	FCC Part 15 Subpart C Section 15.31(e)	Pass
Conducted Emissions	FCC Part 15 Subpart C Section 15.207 / ANSI C63.4 (2003)	Pass
RF Power Output	FCC Part 15 Subpart C Section 15.249(a)	Pass
-20dBc Occupied Bandwidth	FCC Part 15 Subpart C	Pass
Bandedge	FCC Part 15 Subpart C	Pass
Field Strength of Harmonics / Spurious Emissions	FCC Part 15 Subpart C Section 15.249(b) / (d)	Pass
99% Bandwidth	RSS 210 Issue 8	Pass

Conditions During Testing

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

EQUIPMENT UNDER TEST

Ambulatory Activity Monitor

Manuf: Actigraph, LLC

Model: wGT3X+

Serial: NA

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

Laptop

Manuf: Toshiba

Model: PSAA8U-2000U

Serial: 36622146Q

FCC PART 15 SUBPART C

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) 47 CFR 15C requirements for Unlicensed Radio Frequency Devices, Subpart C - Intentional Radiators.

15.31(e) Voltage Variations

Test Conditions / Setup

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. A section of USB cable is connected to the USB port of the EUT.

Antenna gain=0 dBi. The EUT is set in constant transmit mode. Power setting=0 dBm.

Freq= 2403- 2480MHz

24003 2442, 2480MHz

Emission profile of the EUT rotated along the three orthogonal axes was investigated. Worse case emission was presented. The device can be powered via internal rechargeable battery and USB power.

15.31(e) A freshly charged EUT was tested. In addition, the USB 5V voltage was varied 115 % and 85%, No change in emission level was observed.

Frequency range of measurement = Fundamental

1000 MHz-25000 MHz; RBW=1 MHz, VBW=1 MHz.

Test environment conditions: 14°C, 56% relative humidity, 101 kPa

Engineer Name: E. Wong

Test Equipment					
Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02672	Spectrum Analyzer	E4446A	Agilent	8/9/10	8/9/12
AN00309	Preamp	8447D	HP	5/7/10	5/7/12
AN01995	Biconilog Antenna	CBL6111C	Chase	3/8/10	3/8/12
ANP05050	Cable	RG223/U	Pasternack	3/21/11	3/21/13
ANP05198	Cable	8268	Belden	12/21/10	12/21/12
AN00849	Horn Antenna	3115	ETS	4/23/10	4/23/12
AN00786	Preamp	83017A	HP	8/5/10	8/5/12
AN03239	Cable	32022-2-29094K-24TC	AstroLab	8/30/11	8/30/13
ANP05563	Cable	ANDL-1-PNMN-48	Andrews	9/3/10	9/3/12
ANP05421	Cable	Sucoflex 104A	Huber & Suhner	2/12/10	2/12/12
AN00314	Loop Antenna	6502	EMCO	6/30/10	6/30/12
AN02744	High Pass Filter	11SH10-3000/T10000-O/O	K & L	3/5/10	3/5/12
AN01413	Horn Antenna-ANSI C63.5 Antenna Factors (dB)	84125-80008	HP	12/2/10	12/2/12
AN01413	Horn Antenna-1 Meter Antenna Factors (dB) - SAE ARP 958	84125-80008	HP	12/2/10	12/2/12

Test Setup Photos



15.207 AC Conducted Emissions

Test Data Sheets

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **Actigraph, LLC**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **92567** Date: 2/9/2012
 Test Type: **Conducted Emissions** Time: 15:28:46
 Equipment: **Ambulatory Activity Monitor** Sequence#: 7
 Manufacturer: Actigraph, LLC Tested By: E. Wong
 Model: wGT3X+ 110V 60Hz
 S/N: NA

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012
T1	AN02610	High Pass Filter	HE9615-150K-50-720B	11/21/2011	11/21/2013
T2	ANP06084	Attenuator	SA18N10W-06	12/8/2010	12/8/2012
T3	ANP04358	Cable	RG142	5/7/2010	5/7/2012
T4	AN00847.1	50uH LISN-Line 1 (dB)	3816/2NM	12/21/2010	12/21/2012
	AN00847.1	50uH LISN-Line 2 (dB)	3816/2NM	12/21/2010	12/21/2012

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Ambulatory Activity Monitor*	Actigraph, LLC	wGT3X+	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	PSAA8U-2000U	36622146Q

Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. A section of USB cable is connected to the USB port of the EUT and a support laptop.
 Antenna gain=0 dBi.

The EUT is set in constant transmit mode. Power setting =0dBm
 Freq= 2403- 2480MHz
 2442MHz

Frequency range of measurement = 150kHz- 30MHz.
 150 kHz-30 MHz; RBW=9 kHz, VBW=9kHz

Test environment conditions: 14°C, 56% relative humidity, 101 kPa

Ext Attn: 0 dB

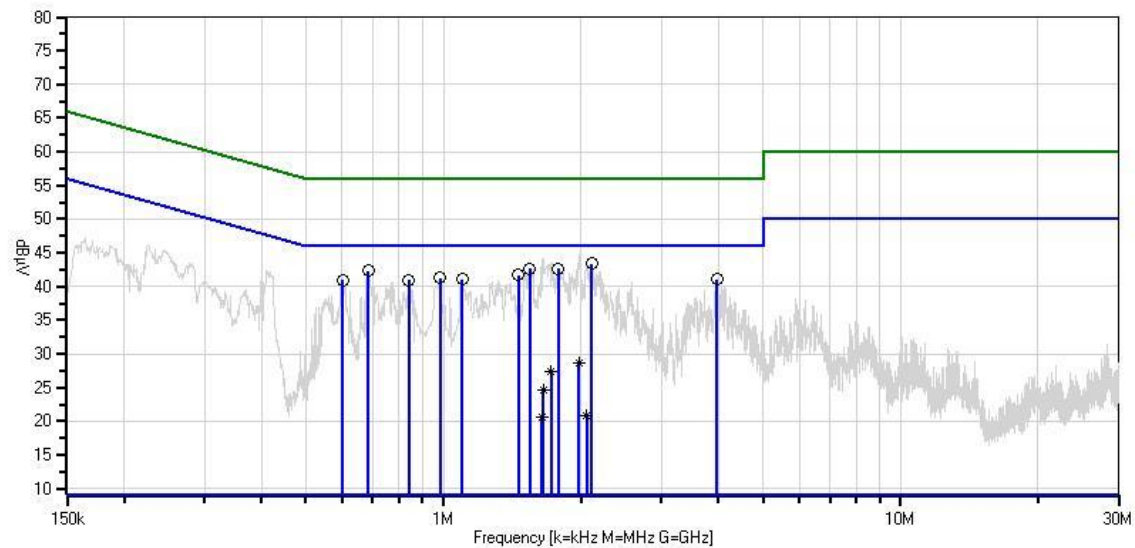
Measurement Data:

Reading listed by margin.

Test Lead: Black

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	2.106M	37.3	+0.2	+5.8	+0.1	+0.0	+0.0	43.4	46.0	-2.6	Black
2	1.545M	36.6	+0.2	+5.8	+0.1	+0.0	+0.0	42.7	46.0	-3.3	Black
3	1.783M	36.5	+0.2	+5.8	+0.1	+0.0	+0.0	42.6	46.0	-3.4	Black
4	684.495k	36.2	+0.2	+5.8	+0.1	+0.0	+0.0	42.3	46.0	-3.7	Black
5	1.460M	35.6	+0.2	+5.8	+0.1	+0.0	+0.0	41.7	46.0	-4.3	Black
6	983.523k	35.2	+0.2	+5.8	+0.1	+0.0	+0.0	41.3	46.0	-4.7	Black
7	1.098M	35.0	+0.2	+5.8	+0.1	+0.0	+0.0	41.1	46.0	-4.9	Black
8	3.969M	34.9	+0.1	+5.8	+0.2	+0.1	+0.0	41.1	46.0	-4.9	Black
9	601.594k	34.9	+0.2	+5.8	+0.1	+0.0	+0.0	41.0	46.0	-5.0	Black
10	838.663k	34.9	+0.2	+5.8	+0.1	+0.0	+0.0	41.0	46.0	-5.0	Black
11	1.979M	22.5	+0.2	+5.8	+0.1	+0.0	+0.0	28.6	46.0	-17.4	Black
^	1.979M	38.7	+0.2	+5.8	+0.1	+0.0	+0.0	44.8	46.0	-1.2	Black
13	1.719M	21.2	+0.2	+5.8	+0.1	+0.0	+0.0	27.3	46.0	-18.7	Black
^	1.719M	37.4	+0.2	+5.8	+0.1	+0.0	+0.0	43.5	46.0	-2.5	Black
15	1.655M	18.5	+0.2	+5.8	+0.1	+0.0	+0.0	24.6	46.0	-21.4	Black
^	1.655M	38.1	+0.2	+5.8	+0.1	+0.0	+0.0	44.2	46.0	-1.8	Black
17	2.055M	14.8	+0.2	+5.8	+0.1	+0.0	+0.0	20.9	46.0	-25.1	Black
^	2.055M	37.9	+0.2	+5.8	+0.1	+0.0	+0.0	44.0	46.0	-2.0	Black
19	1.643M	14.6	+0.2	+5.8	+0.1	+0.0	+0.0	20.7	46.0	-25.3	Black
^	1.643M	38.1	+0.2	+5.8	+0.1	+0.0	+0.0	44.2	46.0	-1.8	Black

CKC Laboratories, Inc. Date: 2/9/2012 Time: 15:28:46 Actigraph, LLC WO#: 92567
15.207 AC Mains - Average Test Lead: Black 110V 60Hz Sequence#: 7 Ext ATTN: 0 dB



— Sweep Data	— Readings
○ Peak Readings	× QP Readings
* Average Readings	▼ Ambient
— 1 - 15.207 AC Mains - Average	— 2 - 15.207 AC Mains - Quasi-peak

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **Actigraph, LLC**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **92567**
 Test Type: **Conducted Emissions**
 Equipment: **Ambulatory Activity Monitor**
 Manufacturer: **Actigraph, LLC**
 Model: **wGT3X+**
 S/N: **NA**

Date: 2/9/2012
 Time: 15:22:07
 Sequence#: 6
 Tested By: E. Wong
 110V 60Hz

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012
T1	AN02610	High Pass Filter	HE9615-150K-50-720B	11/21/2011	11/21/2013
T2	ANP06084	Attenuator	SA18N10W-06	12/8/2010	12/8/2012
T3	ANP04358	Cable	RG142	5/7/2010	5/7/2012
	AN00847.1	50uH LISN-Line 1 (dB)	3816/2NM	12/21/2010	12/21/2012
T4	AN00847.1	50uH LISN-Line 2 (dB)	3816/2NM	12/21/2010	12/21/2012

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Ambulatory Activity Monitor*	Actigraph, LLC	wGT3X+	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	PSAA8U-2000U	36622146Q

Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. A section of USB cable is connected to the USB port of the EUT and a support laptop.
 Antenna gain=0 dBi.

The EUT is set in constant transmit mode. Power setting =0dBm
 Freq= 2403- 2480MHz
 2442MHz

Frequency range of measurement = 150kHz- 30MHz.
 150 kHz-30 MHz; RBW=9 kHz, VBW=9kHz
 Test environment conditions: 14°C, 56% relative humidity, 101 kPa

Ext Attn: 0 dB

Measurement Data:

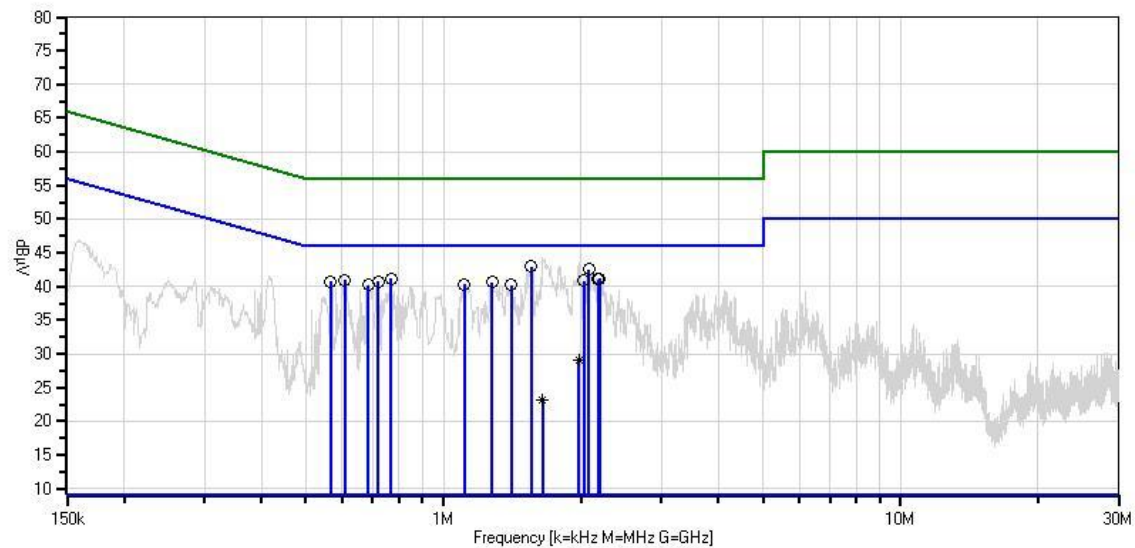
Reading listed by margin.

Test Lead: White

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	1.558M	36.8	+0.2	+5.8	+0.1	+0.1	+0.0	43.0	46.0	-3.0	White
2	2.076M	36.3	+0.2	+5.8	+0.1	+0.1	+0.0	42.5	46.0	-3.5	White
3	767.397k	35.1	+0.2	+5.8	+0.1	+0.0	+0.0	41.2	46.0	-4.8	White

4	2.196M	35.0	+0.2	+5.8	+0.1	+0.1	+0.0	41.2	46.0	-4.8	White
5	2.179M	34.9	+0.2	+5.8	+0.1	+0.1	+0.0	41.1	46.0	-4.9	White
6	608.866k	34.9	+0.2	+5.8	+0.1	+0.0	+0.0	41.0	46.0	-5.0	White
7	2.025M	34.7	+0.2	+5.8	+0.1	+0.1	+0.0	40.9	46.0	-5.1	White
8	565.961k	34.7	+0.2	+5.8	+0.1	+0.0	+0.0	40.8	46.0	-5.2	White
9	719.401k	34.6	+0.2	+5.8	+0.1	+0.0	+0.0	40.7	46.0	-5.3	White
10	1.277M	34.4	+0.2	+5.8	+0.1	+0.1	+0.0	40.6	46.0	-5.4	White
11	1.111M	34.2	+0.2	+5.8	+0.1	+0.0	+0.0	40.3	46.0	-5.7	White
12	685.223k	34.1	+0.2	+5.8	+0.1	+0.0	+0.0	40.2	46.0	-5.8	White
13	1.409M	34.0	+0.2	+5.8	+0.1	+0.1	+0.0	40.2	46.0	-5.8	White
14	1.979M	22.9	+0.2	+5.8	+0.1	+0.1	+0.0	29.1	46.0	-16.9	White
Ave											
^	1.979M	37.4	+0.2	+5.8	+0.1	+0.1	+0.0	43.6	46.0	-2.4	White
16	1.647M	16.9	+0.2	+5.8	+0.1	+0.1	+0.0	23.1	46.0	-22.9	White
Ave											
^	1.647M	38.1	+0.2	+5.8	+0.1	+0.1	+0.0	44.3	46.0	-1.7	White

CKC Laboratories, Inc. Date: 2/9/2012 Time: 15:22:07 Actigraph, LLC WO#: 92567
15.207 AC Mains - Average Test Lead: White 110V 60Hz Sequence#: 6 Ext ATTN: 0 dB



— Sweep Data
○ Peak Readings
* Average Readings
— Readings
× QP Readings
▼ Ambient
— 1 - 15.207 AC Mains - Average
— 2 - 15.207 AC Mains - Quasi-peak

Test Setup Photos



15.247 RF Power Output

Test Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **Actigraph, LLC**
 Specification: **15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**
 Work Order #: **92567** Date: 2/9/2012
 Test Type: **Maximized Emissions** Time: 10:33:39
 Equipment: **Ambulatory Activity Monitor** Sequence#: 1
 Manufacturer: Actigraph, LLC Tested By: E. Wong
 Model: wGT3X+
 S/N: NA

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012
T2	AN00849	Horn Antenna	3115	4/23/2010	4/23/2012
T3	AN00786	Preamp	83017A	8/5/2010	8/5/2012
T4	AN03239	Cable	32022-2-29094K-24TC	8/30/2011	8/30/2013
T5	ANP05563	Cable	ANDL-1-PNMN-48	9/3/2010	9/3/2012
T6	ANP05421	Cable	Sucoflex 104A	2/12/2010	2/12/2012

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Ambulatory Activity Monitor*	Actigraph, LLC	wGT3X+	NA

Support Devices:

Function	Manufacturer	Model #	S/N
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Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. A section of USB cable is connected to the USB port of the EUT.
 Antenna gain=0 dBi.
 The EUT is set in constant transmit mode. Power setting=0 dBm.
 Freq= 2403- 2480MHz
 24003 2442, 2480MHz
 Emission profile of the EUT rotated along the three orthogonal axes was investigated. Worse case emission was presented.
 The device can be powered via internal rechargeable battery and USB power.
 15.31(e) A freshly charged EUT was tested. In addition, the USB 5V voltage was varied 115 % and 85%, No change in emission level was observed.

 Frequency range of measurement = Fundamental
 1000 MHz-25000 MHz; RBW=1 MHz, VBW=1 MHz.
 Test environment conditions: 14°C, 56% relative humidity, 101 kPa

Ext Attn: 0 dB

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	2442.000M	95.2	+0.0 +3.1	+28.4 +1.2	-37.9	+0.4	+0.0	90.4	94.0 Z	-3.6	Horiz
2	2403.000M	94.3	+0.0 +3.1	+28.4 +1.2	-38.0	+0.4	+0.0	89.4	94.0 X	-4.6	Horiz
3	2442.000M	94.1	+0.0 +3.1	+28.4 +1.2	-37.9	+0.4	+0.0	89.3	94.0 X	-4.7	Horiz
4	2480.000M	93.7	+0.0 +3.2	+28.5 +1.3	-37.9	+0.4	+0.0	89.2	94.0 X	-4.8	Horiz
5	2442.000M	93.1	+0.0 +3.1	+28.4 +1.2	-37.9	+0.4	+0.0	88.3	94.0 Z	-5.7	Vert
6	2480.000M	92.7	+0.0 +3.2	+28.5 +1.3	-37.9	+0.4	+0.0	88.2	94.0 Z	-5.8	Vert
7	2442.000M	92.8	+0.0 +3.1	+28.4 +1.2	-37.9	+0.4	+0.0	88.0	94.0 Y	-6.0	Horiz
8	2480.000M	92.2	+0.0 +3.2	+28.5 +1.3	-37.9	+0.4	+0.0	87.7	94.0 Y	-6.3	Horiz
9	2403.000M	92.5	+0.0 +3.1	+28.4 +1.2	-38.0	+0.4	+0.0	87.6	94.0 Z	-6.4	Vert
10	2403.000M	92.4	+0.0 +3.1	+28.4 +1.2	-38.0	+0.4	+0.0	87.5	94.0 Y	-6.5	Vert
11	2403.000M	92.0	+0.0 +3.1	+28.4 +1.2	-38.0	+0.4	+0.0	87.1	94.0 Y	-6.9	Horiz
12	2442.000M	91.3	+0.0 +3.1	+28.4 +1.2	-37.9	+0.4	+0.0	86.5	94.0 Y	-7.5	Vert
13	2480.000M	90.7	+0.0 +3.2	+28.5 +1.3	-37.9	+0.4	+0.0	86.2	94.0 Z	-7.8	Horiz
14	2480.000M	90.7	+0.0 +3.2	+28.5 +1.3	-37.9	+0.4	+0.0	86.2	94.0 Y	-7.8	Vert
15	2442.000M	90.1	+0.0 +3.1	+28.4 +1.2	-37.9	+0.4	+0.0	85.3	94.0 X	-8.7	Vert
16	2480.000M	87.9	+0.0 +3.2	+28.5 +1.3	-37.9	+0.4	+0.0	83.4	94.0 X	-10.6	Vert
17	2403.000M	87.2	+0.0 +3.1	+28.4 +1.2	-38.0	+0.4	+0.0	82.3	94.0 X	-11.7	Vert
18	2403.000M	84.9	+0.0 +3.1	+28.4 +1.2	-38.0	+0.4	+0.0	80.0	94.0 Z	-14.0	Horiz

Test Setup Photos





X AXIS



Y AXIS



Z AXIS

-20dBc Occupied Bandwidth

Test Conditions / Setup

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. A section of USB cable is connected to the USB port of the EUT. Antenna gain=0 dBi.

The EUT is set in constant transmit mode. Power setting=0 dBm.

Freq= 2403- 2480MHz

24003 2442, 2480MHz

Emission profile of the EUT rotated along the three orthogonal axes was investigated. Worse case emission was presented.

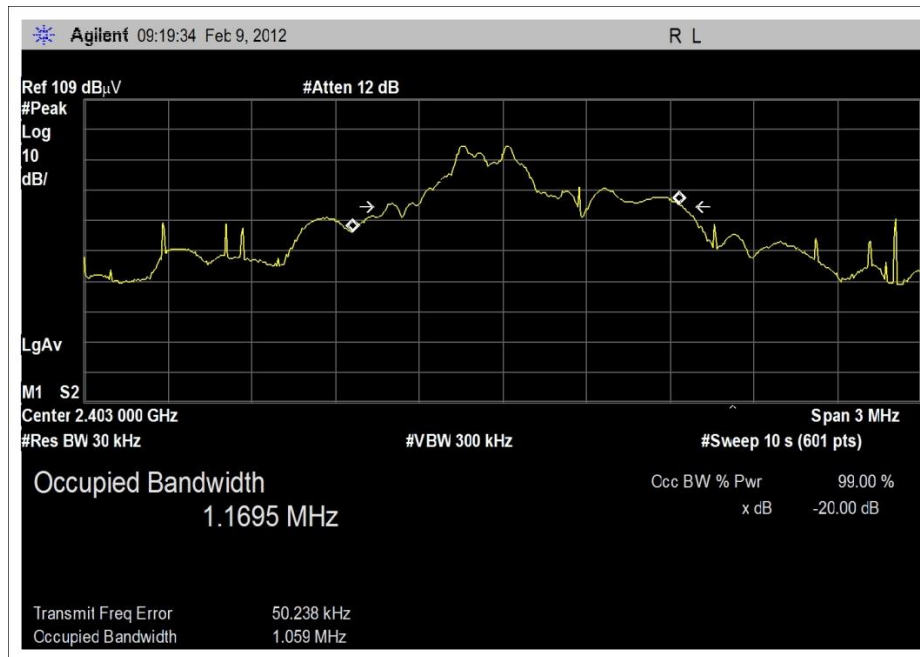
Frequency range of measurement = Fundamental

Test environment conditions: 14°C, 56% relative humidity, 101 kPa

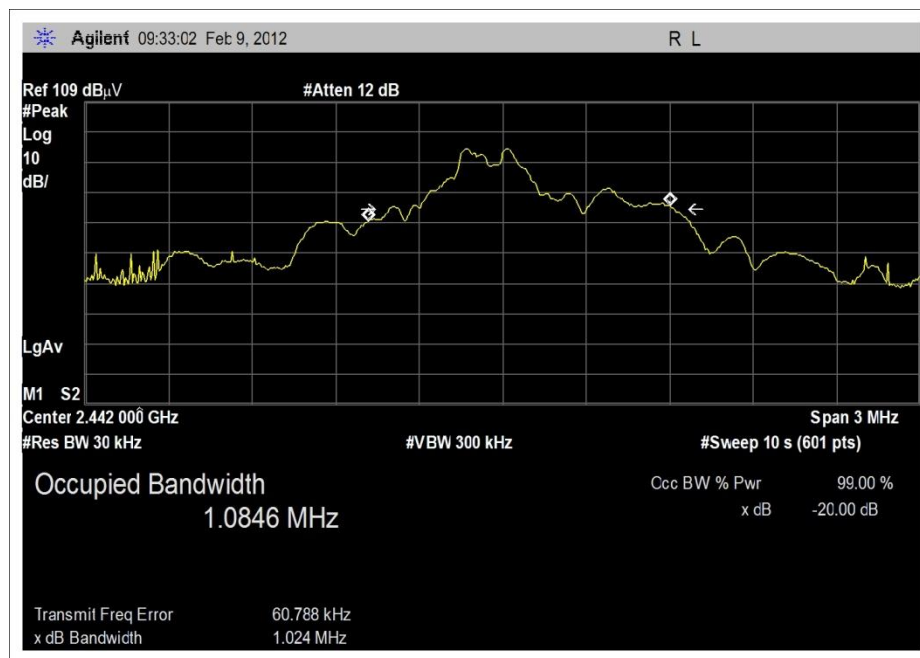
Engineer Name: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02672	Spectrum Analyzer	E4446A	Agilent	8/9/2010	8/9/2012
AN00849	Horn Antenna	3115	ETS	4/23/2010	4/23/2012
AN00786	Preamp	83017A	HP	8/5/2010	8/5/2012
AN03239	Cable	32022-2-29094K-24TC	AstroLAB	8/30/2011	8/30/2013
ANP05563	Cable	ANDL-1-PNMN-48	Andrews	9/3/2010	9/3/2012
ANP05421	Cable	Sucoflex 104A	Huber & Suhner	2/12/2010	2/12/2012

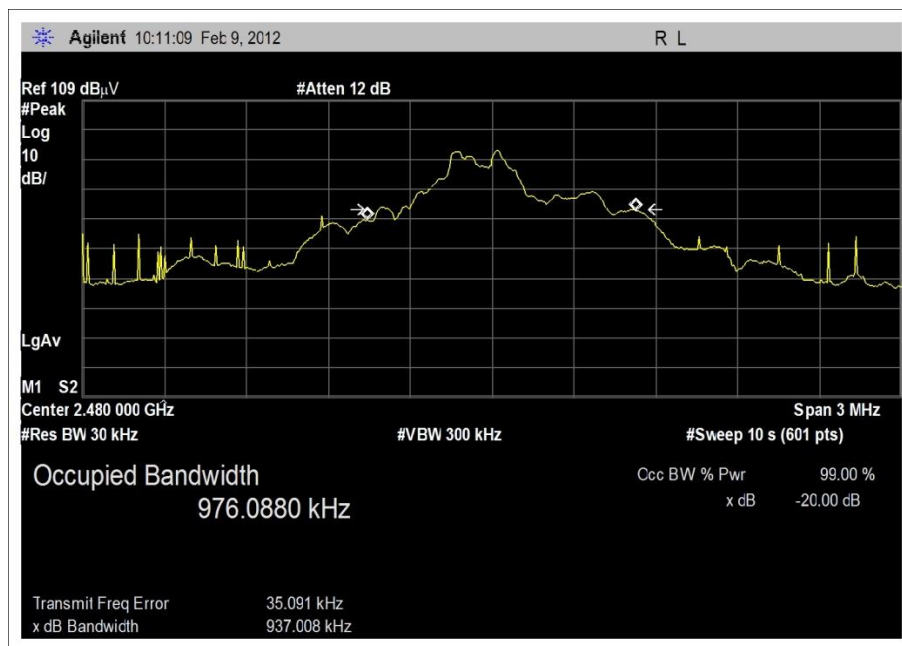
Test Plots



LOW



MIDDLE



HIGH

Test Setup Photos





Bandedge

Test Conditions / Setup

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. A section of USB cable is connected to the USB port of the EUT. Antenna gain=0 dBi.

The EUT is set in constant transmit mode. Power setting=0 dBm.

Freq= 2403- 2480MHz

24003 2442, 2480MHz

Emission profile of the EUT rotated along the three orthogonal axes was investigated. Worse case emission was presented.

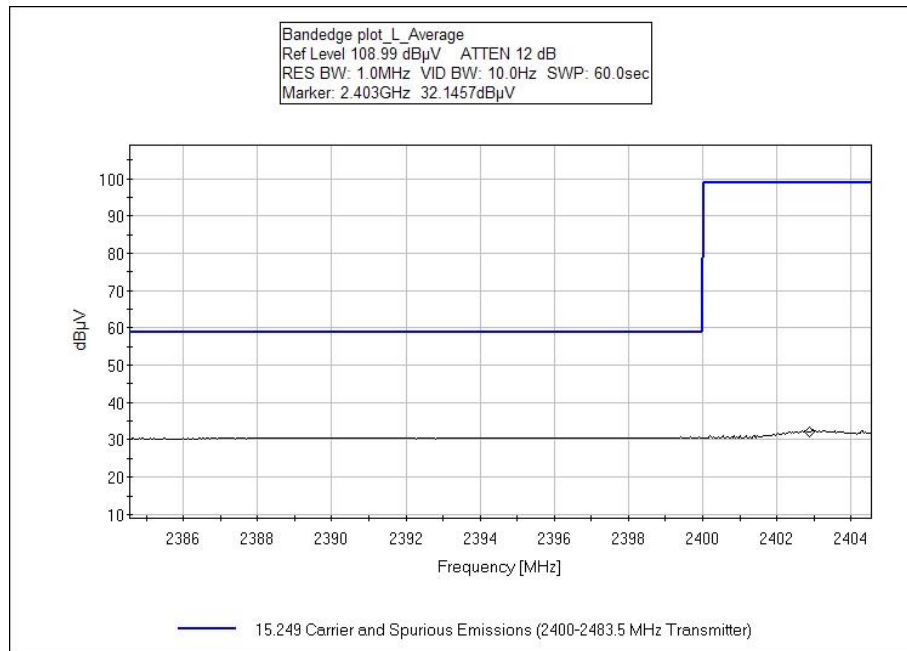
Frequency range of measurement = Fundamental

Test environment conditions: 14°C, 56% relative humidity, 101 kPa

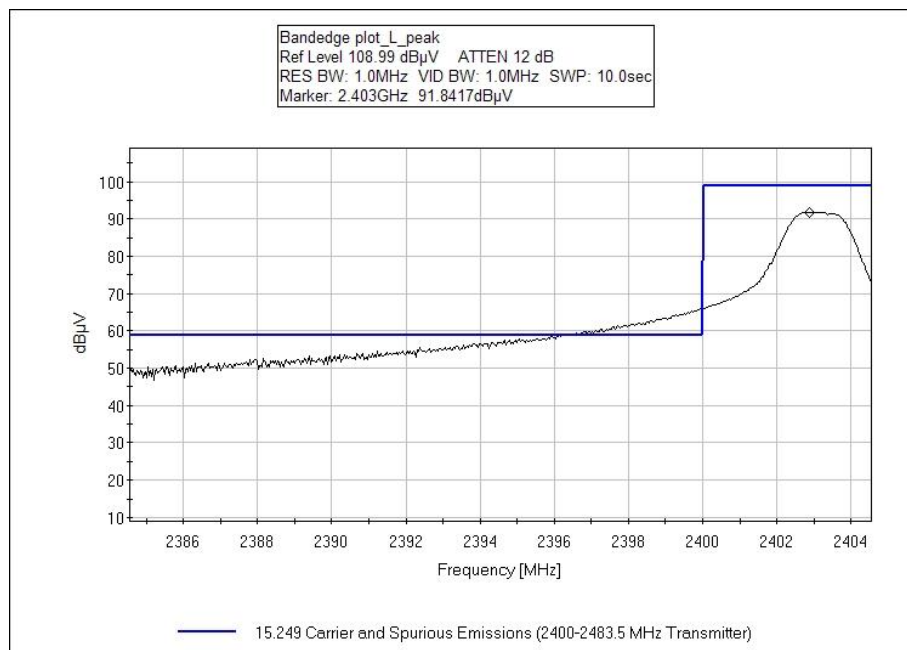
Engineer Name: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02672	Spectrum Analyzer	E4446A	Agilent	8/9/2010	8/9/2012
AN00849	Horn Antenna	3115	ETS	4/23/2010	4/23/2012
AN00786	Preamp	83017A	HP	8/5/2010	8/5/2012
AN03239	Cable	32022-2-29094K-24TC	AstroLab	8/30/2011	8/30/2013
ANP05563	Cable	ANDL-1-PNMN-48	Andrews	9/3/2010	9/3/2012
ANP05421	Cable	Sucoflex 104A	Huber & Suhner	2/12/2010	2/12/2012

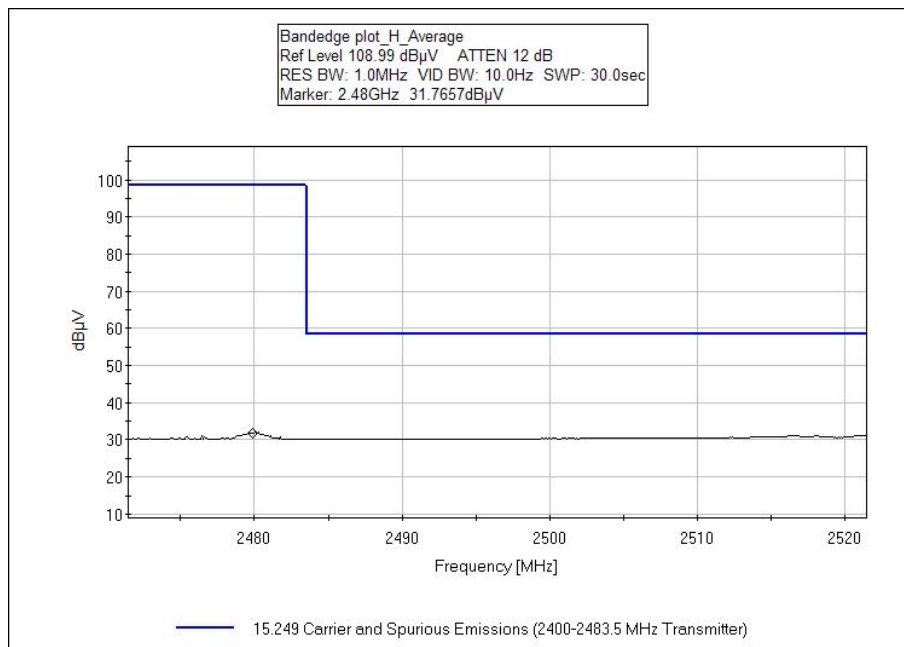
Test Data



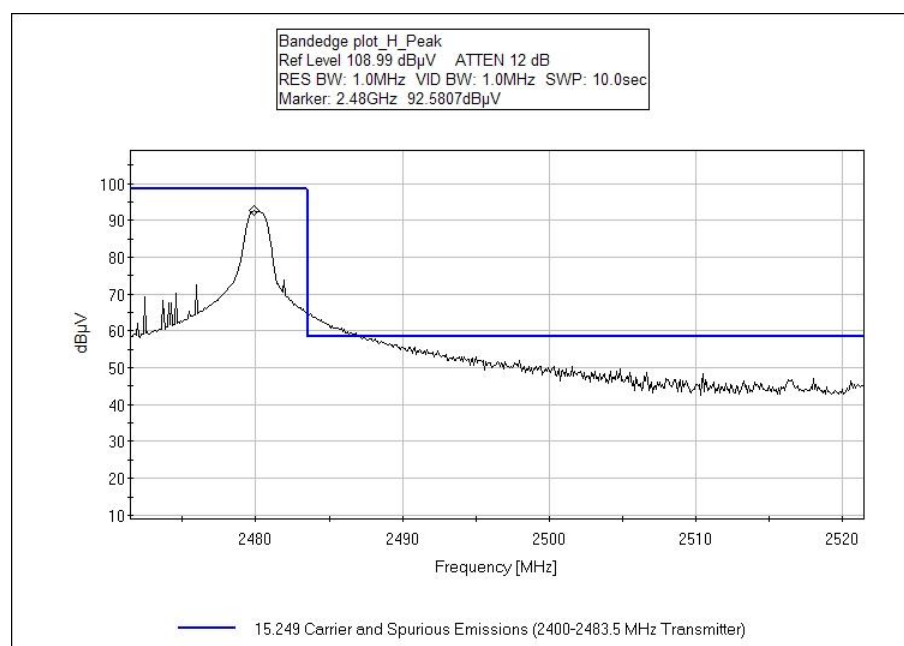
LOW AVERAGE



LOW PEAK



HIGH AVERAGE



HIGH PEAK

Test Setup Photos



15.249(b) / (d) Field Strength of Harmonics / Spurious Emissions

Test Data Sheets

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **Actigraph, LLC**

Specification: **15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**

Work Order #: **92567**

Date: 2/9/2012

Test Type: **Maximized Emissions**

Time: 11:51:36

Equipment: **Ambulatory Activity Monitor**

Sequence#: 2

Manufacturer: Actigraph, LLC

Tested By: E. Wong

Model: wGT3X+

S/N: NA

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012
	AN00309	Preamp	8447D	5/7/2010	5/7/2012
	AN01995	Biconilog Antenna	CBL6111C	3/8/2010	3/8/2012
	ANP05050	Cable	RG223/U	3/21/2011	3/21/2013
	ANP05198	Cable	8268	12/21/2010	12/21/2012
T2	AN00849	Horn Antenna	3115	4/23/2010	4/23/2012
T3	AN00786	Preamp	83017A	8/5/2010	8/5/2012
T4	AN03239	Cable	32022-2-29094K-24TC	8/30/2011	8/30/2013
T5	ANP05563	Cable	ANDL-1-PNMN-48	9/3/2010	9/3/2012
T6	ANP05421	Cable	Sucoflex 104A	2/12/2010	2/12/2012
T7	AN02744	High Pass Filter	11SH10-3000/T10000-O/O	3/5/2010	3/5/2012
	AN00314	Loop Antenna	6502	6/30/2010	6/30/2012
	AN01413	Horn Antenna-ANSI C63.5 Antenna Factors (dB)	84125-80008	12/2/2010	12/2/2012
	AN01413	Horn Antenna-1 Meter Antenna Factors (dB) - SAE ARP 958	84125-80008	12/2/2010	12/2/2012

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Ambulatory Activity Monitor*	Actigraph, LLC	wGT3X+	NA

Support Devices:

Function	Manufacturer	Model #	S/N
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Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. A section of USB cable is connected to the USB port of the EUT.
Antenna gain=0 dBi.

The EUT is set in constant transmit mode. Power setting=0 dBm.

Freq= 2403- 2480MHz
2403, 2442, 2480MHz

Emission profile of the EUT rotated along the three orthogonal axes was investigated. Worse case emission was presented.

13.32(e) A freshly charged EUT was tested.

Frequency range of measurement = 9 kHz- 25 GHz.
9 kH -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-25000 MHz; RBW=1 MHz, VBW=1 MHz.

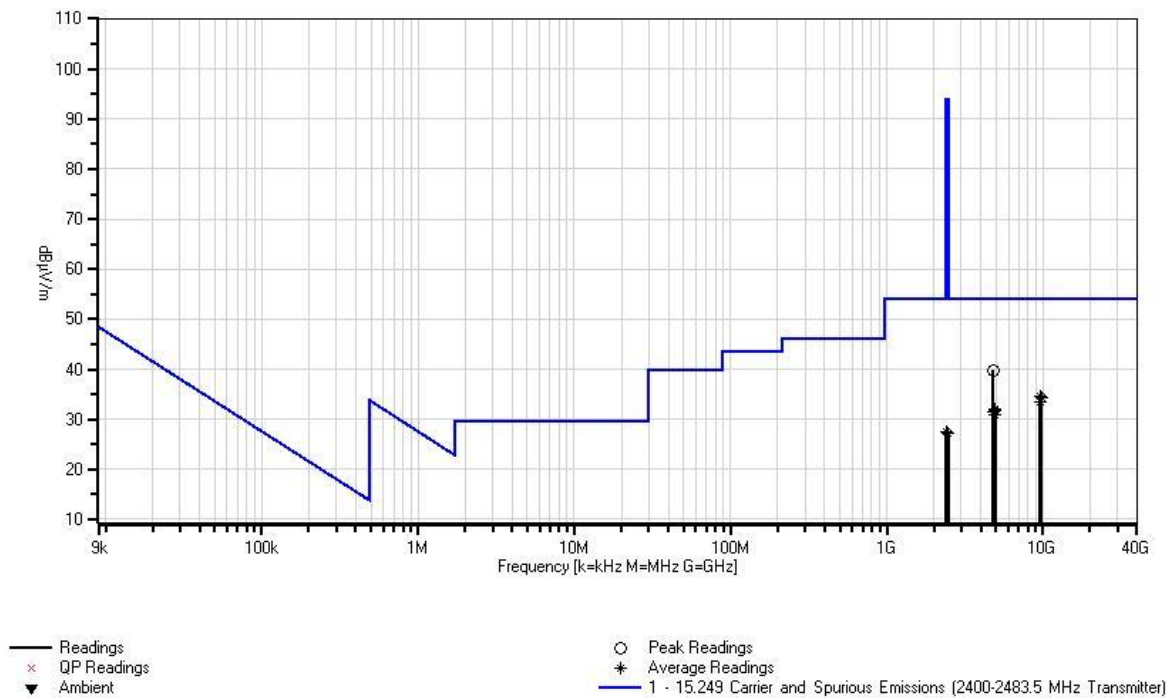
Test environment conditions: 14°C, 56% relative humidity, 101 kPa

Ext Attn: 0 dB

Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	T5	T6	T7		Table	dB μ V/m	dB μ V/m	dB	Ant
1	4805.700M	36.6	+0.0	+33.0	-37.1	+0.5	+0.0	39.8	54.0	-14.2	Vert
			+4.4	+1.9	+0.5						
2	9611.470M	21.1	+0.0	+37.7	-35.2	+0.7	+0.0	34.6	54.0	-19.4	Vert
	Ave		+7.0	+2.7	+0.6						
^	9611.470M	33.8	+0.0	+37.7	-35.2	+0.7	+0.0	47.3	54.0	-6.7	Vert
			+7.0	+2.7	+0.6						
^	9611.400M	29.2	+0.0	+37.7	-35.2	+0.7	+0.0	42.7	54.0	-11.3	Vert
			+7.0	+2.7	+0.6						
5	9767.950M	21.5	+0.0	+37.5	-35.5	+0.7	+0.0	34.4	54.0	-19.6	Horiz
	Ave		+7.0	+2.7	+0.5						
^	9767.950M	32.5	+0.0	+37.5	-35.5	+0.7	+0.0	45.4	54.0	-8.6	Horiz
			+7.0	+2.7	+0.5						
7	9612.000M	20.1	+0.0	+37.7	-35.2	+0.7	+0.0	33.6	54.0	-20.4	Horiz
	Ave		+7.0	+2.7	+0.6						
^	9612.000M	34.5	+0.0	+37.7	-35.2	+0.7	+0.0	48.0	54.0	-6.0	Horiz
			+7.0	+2.7	+0.6						
9	4959.683M	28.5	+0.0	+33.2	-37.0	+0.5	+0.0	32.0	54.0	-22.0	Horiz
	Ave		+4.5	+1.9	+0.4						
^	4959.683M	45.6	+0.0	+33.2	-37.0	+0.5	+0.0	49.1	54.0	-4.9	Horiz
			+4.5	+1.9	+0.4						
11	4959.683M	28.4	+0.0	+33.2	-37.0	+0.5	+0.0	31.9	54.0	-22.1	Vert
	Ave		+4.5	+1.9	+0.4						
^	4959.683M	49.0	+0.0	+33.2	-37.0	+0.5	+0.0	52.5	54.0	-1.5	Vert
			+4.5	+1.9	+0.4						

13	4806.000M	28.3	+0.0	+33.0	-37.1	+0.5	+0.0	31.5	54.0	-22.5	Horiz
	Ave		+4.4	+1.9	+0.5						
^	4806.000M	41.8	+0.0	+33.0	-37.1	+0.5	+0.0	45.0	54.0	-9.0	Horiz
			+4.4	+1.9	+0.5						
15	4884.000M	27.5	+0.0	+33.1	-37.1	+0.5	+0.0	30.8	54.0	-23.2	Horiz
	Ave		+4.5	+1.9	+0.4						
^	4884.000M	42.0	+0.0	+33.1	-37.1	+0.5	+0.0	45.3	54.0	-8.7	Horiz
			+4.5	+1.9	+0.4						
17	2400.000M	32.3	+0.0	+28.4	-38.0	+0.4	+0.0	27.4	54.0	-26.6	Horiz
	Ave		+3.1	+1.2	+0.0				bandedge L		
^	2400.000M	70.8	+0.0	+28.4	-38.0	+0.4	+0.0	65.9	54.0	+11.9	Horiz
			+3.1	+1.2	+0.0				bandedge L		
19	2483.500M	31.6	+0.0	+28.5	-37.9	+0.4	+0.0	27.1	54.0	-26.9	Horiz
	Ave		+3.2	+1.3	+0.0				Bandedge H		
^	2483.500M	65.8	+0.0	+28.5	-37.9	+0.4	+0.0	61.3	54.0	+7.3	Horiz
			+3.2	+1.3	+0.0				Bandedge H		

CKC Laboratories, Inc. Date: 2/9/2012 Time: 11:51:36 Actigraph, LLC WO#: 92567
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters Sequence#: 2 Ext
ATTN: 0 dB



Test Setup Photos



RSS-210

99 % Bandwidth

Test Conditions / Setup

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. A section of USB cable is connected to the USB port of the EUT. Antenna gain=0 dBi.

The EUT is set in constant transmit mode. Power setting=0 dBm.

Freq= 2403- 2480MHz

24003 2442, 2480MHz

Emission profile of the EUT rotated along the three orthogonal axes was investigated. Worse case emission was presented.

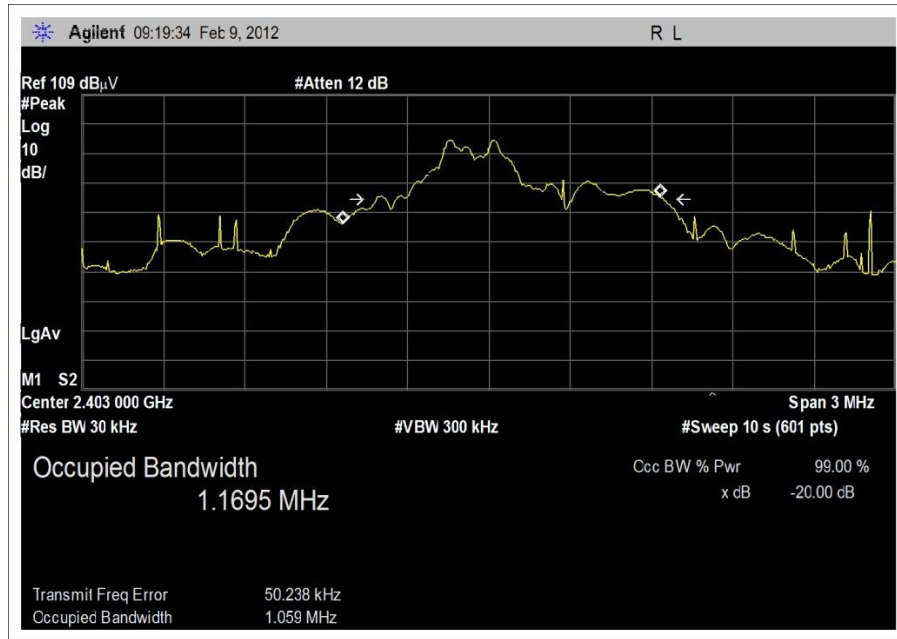
Frequency range of measurement = Fundamental

Test environment conditions: 14°C, 56% relative humidity, 101 kPa

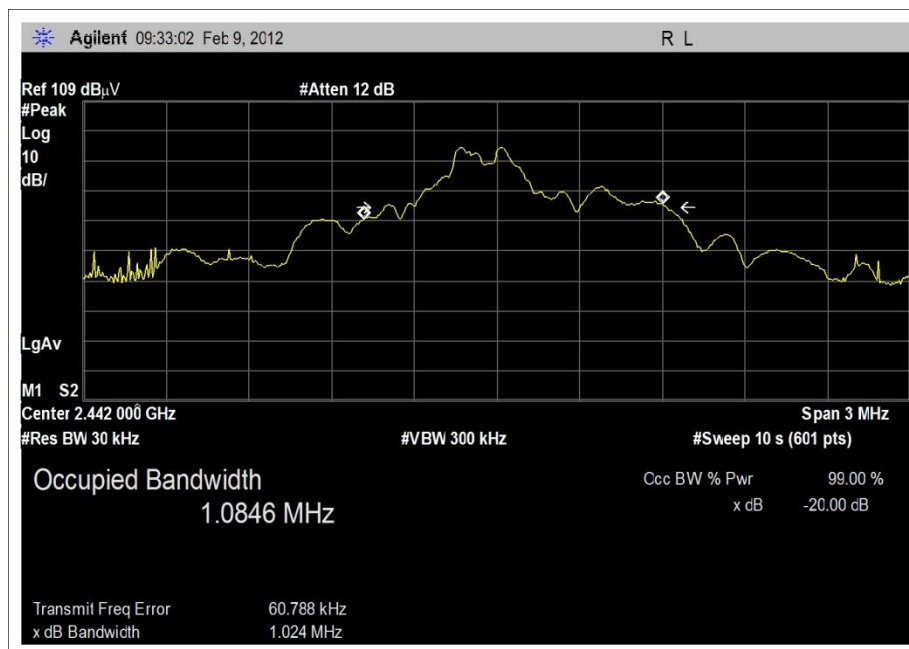
Engineer Name: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02672	Spectrum Analyzer	E4446A	Agilent	8/9/2010	8/9/2012
AN00849	Horn Antenna	3115	ETS	4/23/2010	4/23/2012
AN00786	Preamp	83017A	HP	8/5/2010	8/5/2012
AN03239	Cable	32022-2-29094K-24TC	AstroLab	8/30/2011	8/30/2013
ANP05563	Cable	ANDL-1-PNMN-48	Andrews	9/3/2010	9/3/2012
ANP05421	Cable	Sucoflex 104A	Huber & Suhner	2/12/2010	2/12/2012

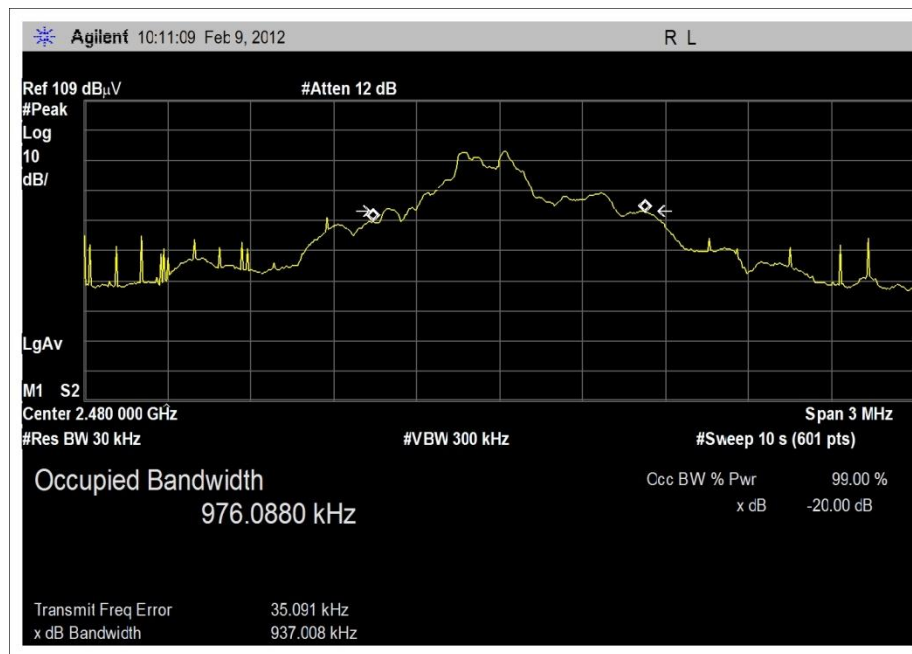
Test Data



LOW



MIDDLE



HIGH

Test Setup Photos





SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

The reported measurement uncertainties are calculated based on the worst case of all laboratory environments from CKC Laboratories, Inc. test sites. Only those parameters which require estimation of measurement uncertainty are reported. The reported worst case measurement uncertainty is less than the maximum values derived in CISPR 16-4-2. 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 dB μ V/m, the spectrum analyzer reading in dB μ V was corrected by using the following formula. This reading was then compared to the applicable specification limit.

SAMPLE CALCULATIONS		
	Meter reading	(dB μ V)
+	Antenna Factor	(dB)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dB μ V/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

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

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

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

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

Peak

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

Quasi-Peak

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

Average

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