FCC PART 15.247

IC RSS-210, ISSUE 8, DECEMBER 2010

TEST AND MEASUREMENT REPORT

For

LUMO BodyTech, Inc.

3340 Hillview Avenue, Palo Alto, CA 94304, USA

FCC ID: OS7LB0100
IC: 10507A-LB0100

Report Type:	**Product Type:**
Original Report	Bluetooth Low Energy Wireless Device

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Report Number:	R1207315-247
Report Date:	2012-10-12
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1207315-247	Original Report	2012-10-12

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of LUMO BodyTech, Inc. and their product, FCC ID: OS7LB0100, IC: 10507A-LB0100, model: LB0100-001 or the "EUT" as referred on this report is a Mobile Solution for back health product with Bluetooth 4.0 (LE) technology.

1.2 Mechanical Description of EUT

The "EUT" measures approximately *193 mm (L) x 42 mm (W) x 9mm (H)*, and weighs approximately *35*g.

The test data gathered are from typical production sample, serial number: 1207315-01 assigned by BACL

1.3 Objective

This report is prepared on behalf of *LUMO BodyTech, Inc* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commissions rules and IC RSS-210 Issue 8, Dec 2010.

The objective is to determine compliance with FCC Part 15.247 and IC RSS-210 rules for Output Power, Antenna Requirements, 6 dB Bandwidth, and power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2009.

2.2 EUT Exercise Software

The test utility used was a Bluetooth test app provided by LUMO BodyTech, Inc. and Nordic Semiconductor (the device's Bluetooth chip manufacturer). The test utility was verified by Wei Sun to comply with the standard requirements being tested against.

2.3 Special Equipment

N/A

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Apple, Inc.	iPhone	A1387	-
Samsung	Travel Adapter	ETA060JBE	RT1ZC07AS/7-E

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model No.	Serial No.
LUMO BodyTech, Inc.	Main PCB Board	201022-01	SMT061615-0018

2.7 Interface Ports and Cabling

N/A

2.8 Power Supply List and Details

N/A

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §2.1093 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirement	Compliant
FCC §15.207(a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	Compliant
FCC §15.209 IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205 IC RSS-210 §2.2	Restricted Bands	Compliant
FCC §15.209, §15.247(d) IC RSS-210 §A8.5	Radiated Spurious Emissions	Compliant
FCC §15.247(b)(3) IC RSS-210 §A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(a) (2) IC RSS-210 §A8.2(a)	6 dB & 99%Emission Bandwidth	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247 (e) IC RSS-210 §A8.2(b)	Power Spectral Density	Compliant
IC RSS-Gen §4.10, §6	Receiver Spurious Emission	Compliant

4 FCC §2.1093 & IC RSS-102 RF Exposure

4.1 Applicable Standards

According to FCC §2.1093 and RSS-102 RF exposure evaluation is required for portable device.

4.2 Result

The conducted peak output power of this device is -2.03 dBm = 0.627 mW, Antenna gain is 0.2 dBi. SAR evaluation can be exempt.

5 FCC §15.203 & IC RSS-Gen §7.1.2 – Antenna Requirements

5.1 Applicable Standard

or intentional device, according to FCC Part §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

Per IC RSS-Gen §7.1.2, A transmitter can only be sold or operated with antennas with which it was certified. A transmitter maybe certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in IC RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to IC RSS-210 Annex 8 or RSS-210 Annex 9, the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to IC RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

5.2 Result

The EUT has a integrated antenna with maximum gain of 0.2 dBi, which in accordance to sections FCC Part 15.203 and IC RSS-Gen §7.1.2, is considered sufficient to comply with the provisions of these sections.

6 FCC §15.207 & IC RSS-Gen §7.2.4 – AC Line Conducted Emissions

6.1 Applicable Standard

As per FCC §15.207 & IC RSS-Gen §7.2.4 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 1
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2009 measurement procedure. The specification used was FCC Part15.207 limits and IC RSS-Gen §7.2.4 limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

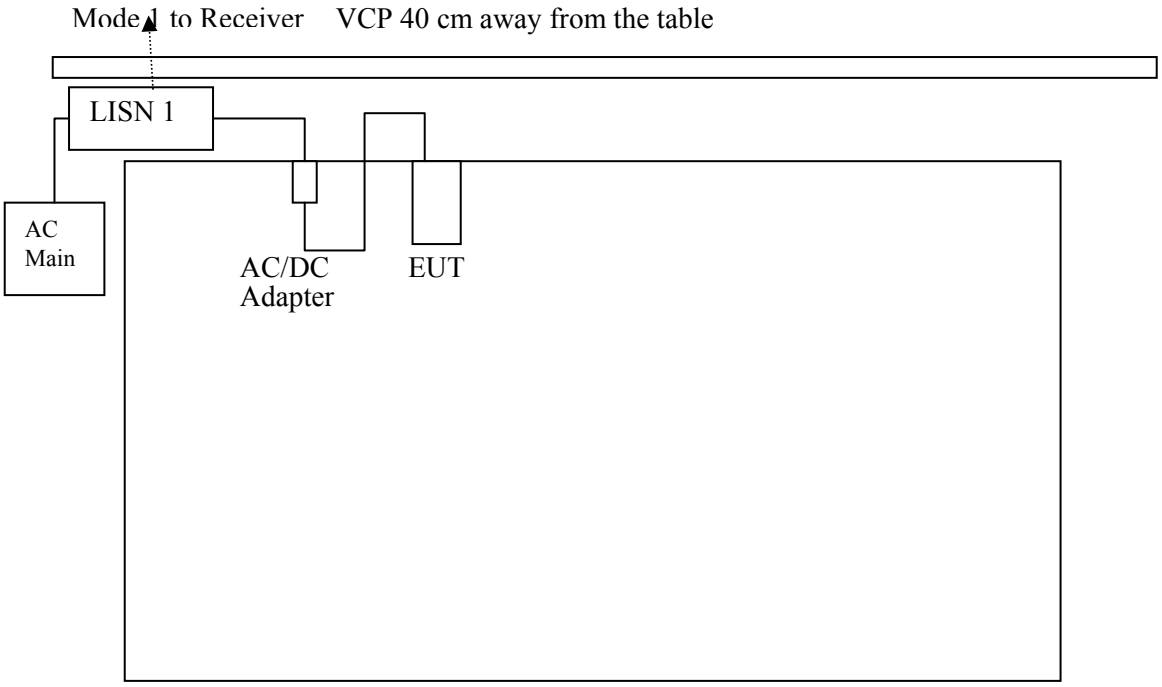
6.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a “QP.” Average readings are distinguished with an “Ave”.

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL) plus the High Pass Filter/Attenuator value (HA) and subtracting the Amplifier Gain (Ga) to the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + CL + HA – Ga

For example, a corrected amplitude (CA) of 36 dBuV = Indicated Amplitude reading (Ai) of 50.0 dBuV + Cable Loss (CL) 1.0 dB + High Pass Filter/Attenuator (IA) 5 dB - Amplifier Gain (Ga) 20 dB

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin (dB) = Corrected Amplitude (dBuV) - Limit (dBuV)

6.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2011-09-14	1 year
Solar Electronics	LISN	9252-50-R-24-N	511213	2012-06-25	1 year
TTE	Filter, High Pass	H962-150K-50-21378	K7133	2012-05-30	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

6.7 Test Environmental Conditions

Temperature:	24°C
Relative Humidity:	52%
ATM Pressure:	101.99kPa

The testing was performed by Wei Sun on 2012-09-05 at 5 meter chamber #3.

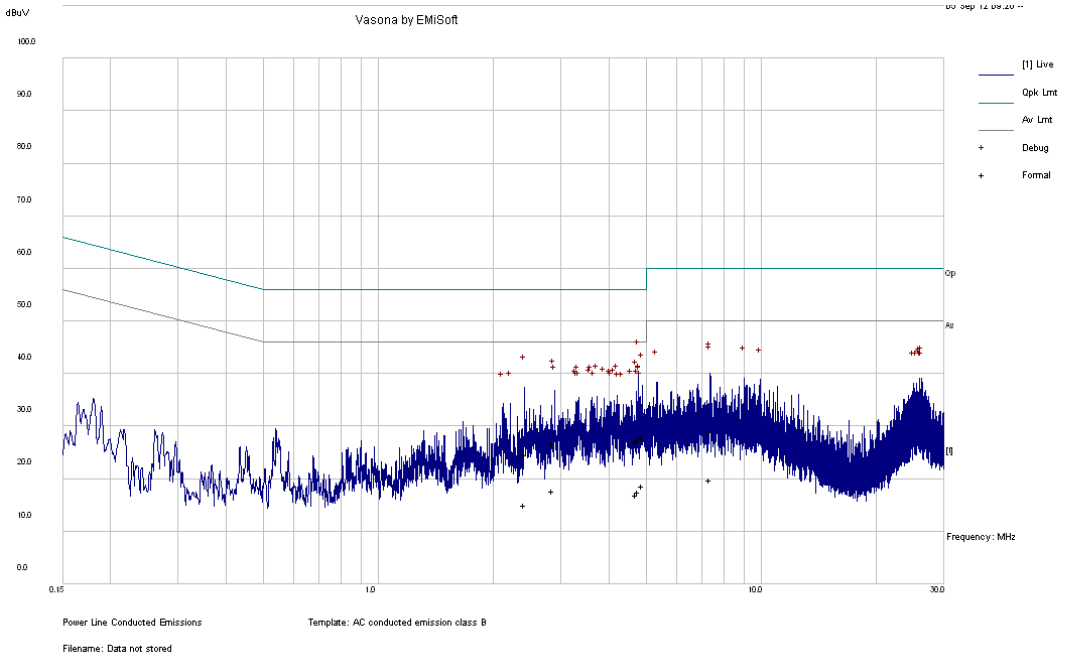
6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC & IC standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-21.27	4.510649	Neutral	0.15-30

6.9 Conducted Emissions Test Plots and Data

120 V, 60 Hz – Line



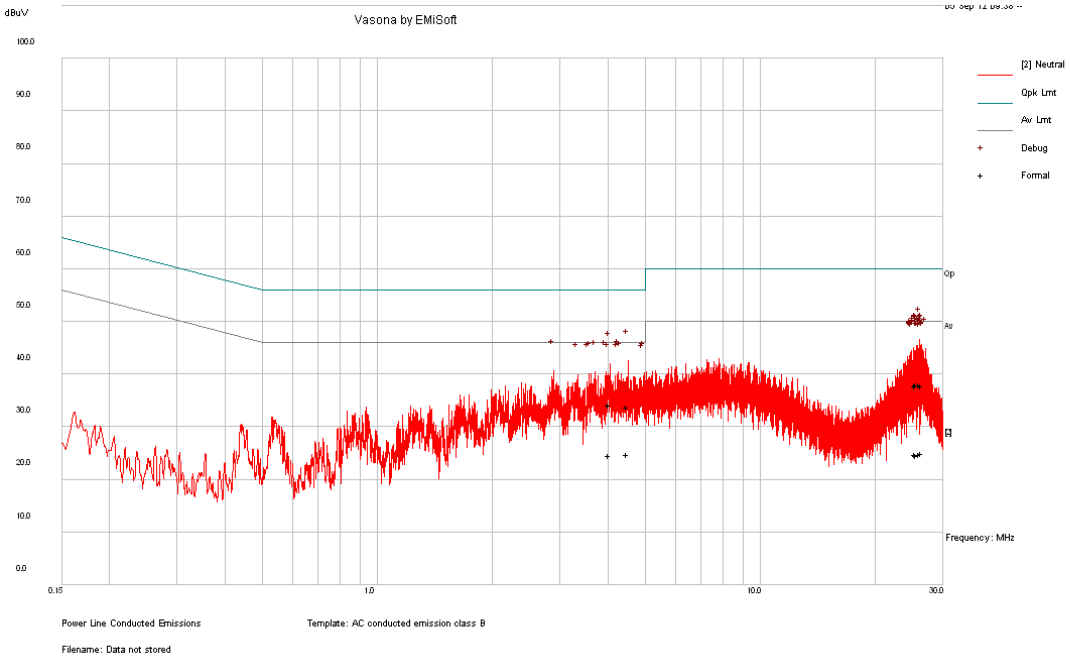
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
4.791185	27.28	Line	56	-28.72
4.901408	27.93	Line	56	-28.07
2.408853	24.56	Line	56	-31.44
2.863864	26.68	Line	56	-29.32
4.731248	27.11	Line	56	-28.89
7.34486	29	Line	60	-31

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
4.791185	17.62	Line	46	-28.38
4.901408	18.59	Line	46	-27.41
2.408853	15.08	Line	46	-30.92
2.863864	17.74	Line	46	-28.26
4.731248	16.99	Line	46	-29.01
7.34486	19.91	Line	50	-30.09

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
26.0485	38.07	Neutral	60	-21.93
4.510649	33.76	Neutral	56	-22.24
4.037285	34.2	Neutral	56	-21.8
26.37053	37.84	Neutral	60	-22.16
25.49208	37.94	Neutral	60	-22.06
25.68406	37.98	Neutral	60	-22.02

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
26.0485	24.81	Neutral	50	-25.19
4.510649	24.73	Neutral	46	-21.27
4.037285	24.68	Neutral	46	-21.32
26.37053	24.95	Neutral	50	-25.05
25.49208	24.76	Neutral	50	-25.24
25.68406	24.65	Neutral	50	-25.35

7 FCC §2.1051, §15.247(d) & IC RSS-210 §A8.5 – Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

For FCC §15.247(d) and IC RSS-210 §A8.5 in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

7.2 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	49%
ATM Pressure:	101.97kPa

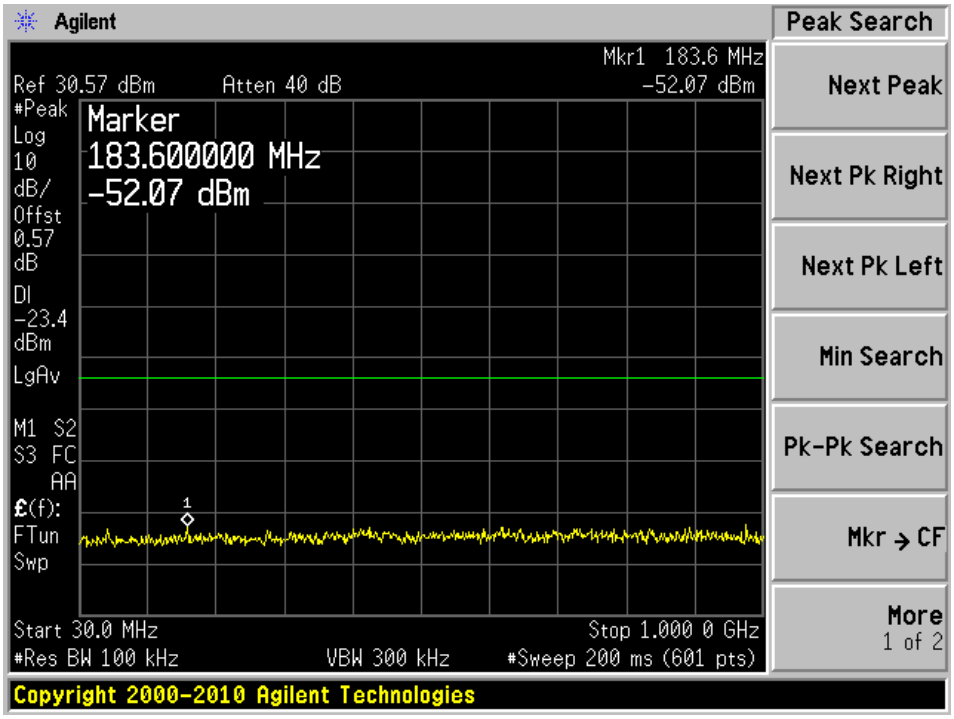
The testing was performed by Wei Sun on 2012-08-30 at RF Site.

7.5 Test Results

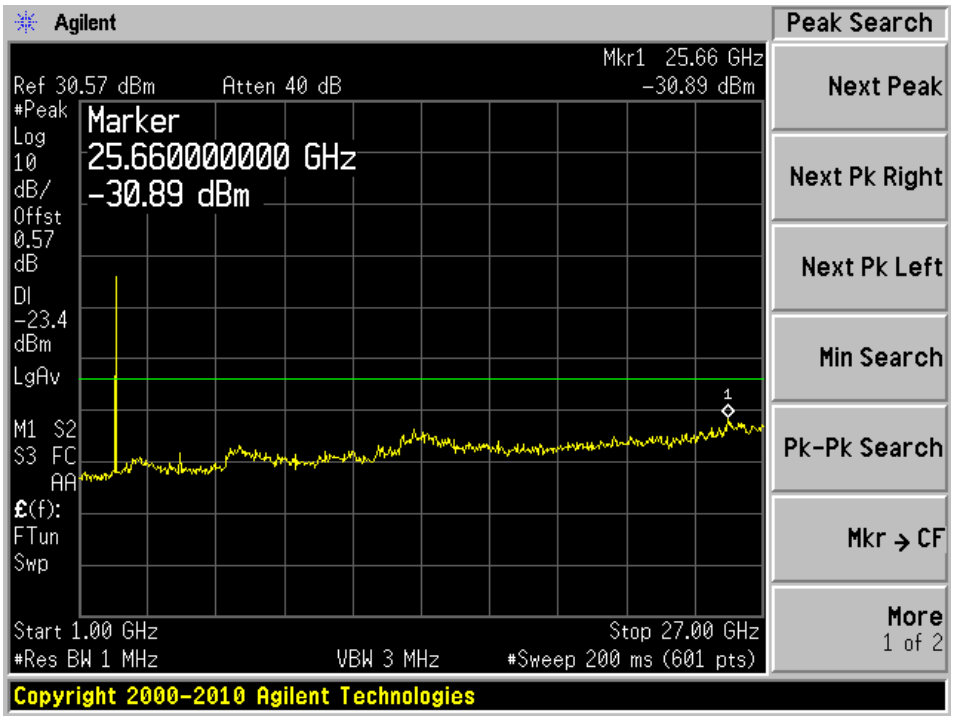
Please refer to following plots of spurious emissions.

Low Channel, 2402 MHz

Plot #1 30 MHz – 1 GHz

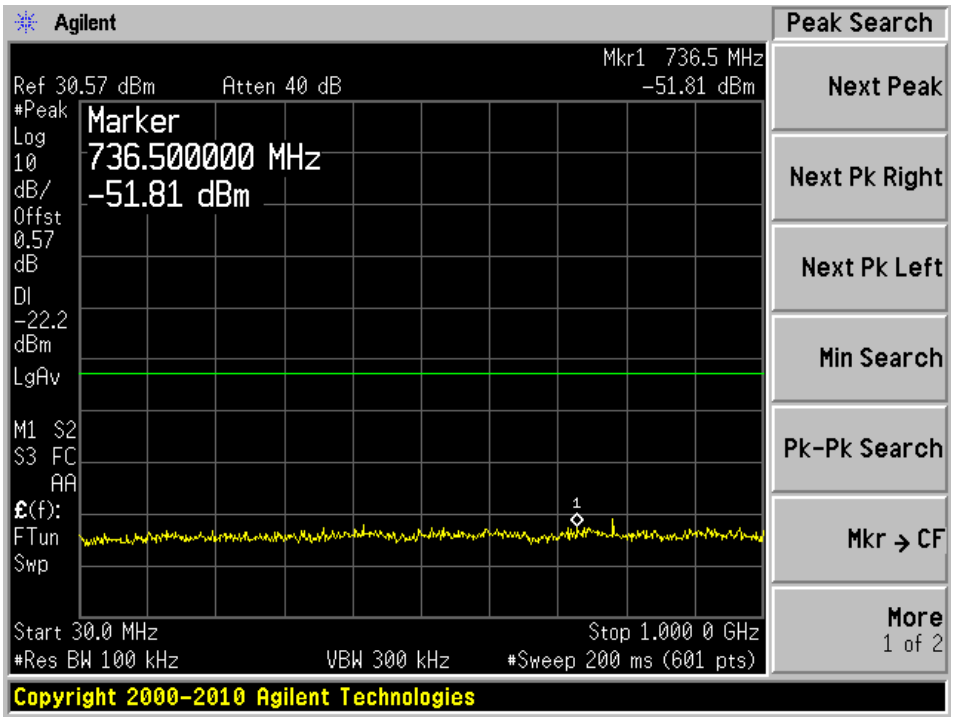


Plot #2 1 GHz – 27 GHz

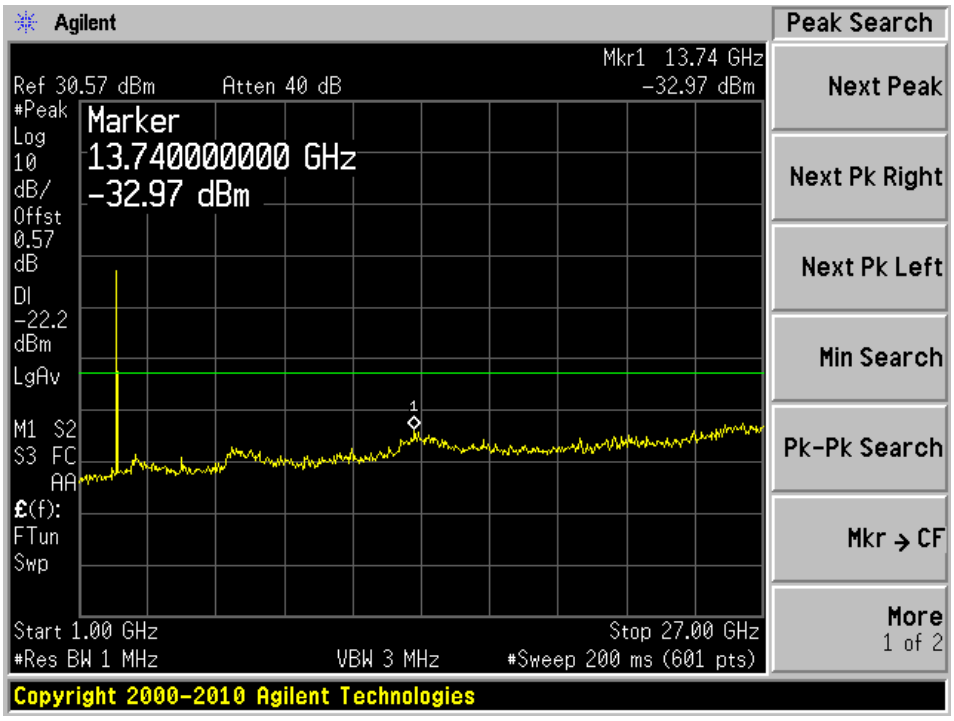


Middle Channel, 2440 MHz

Plot #1 30 MHz – 1 GHz

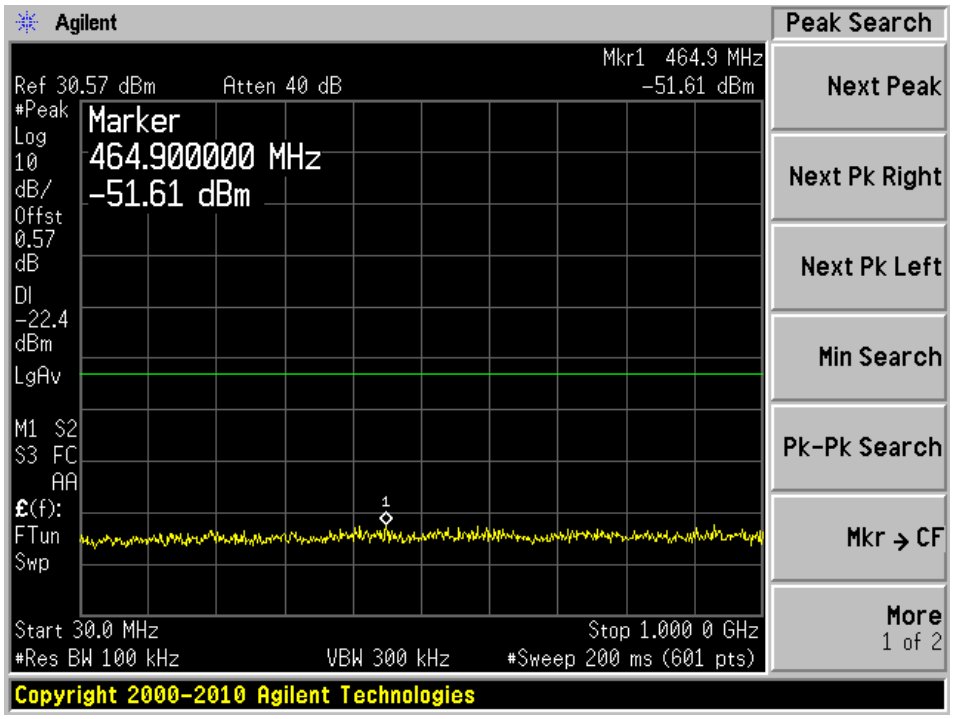


Plot #2 1 GHz – 27 GHz

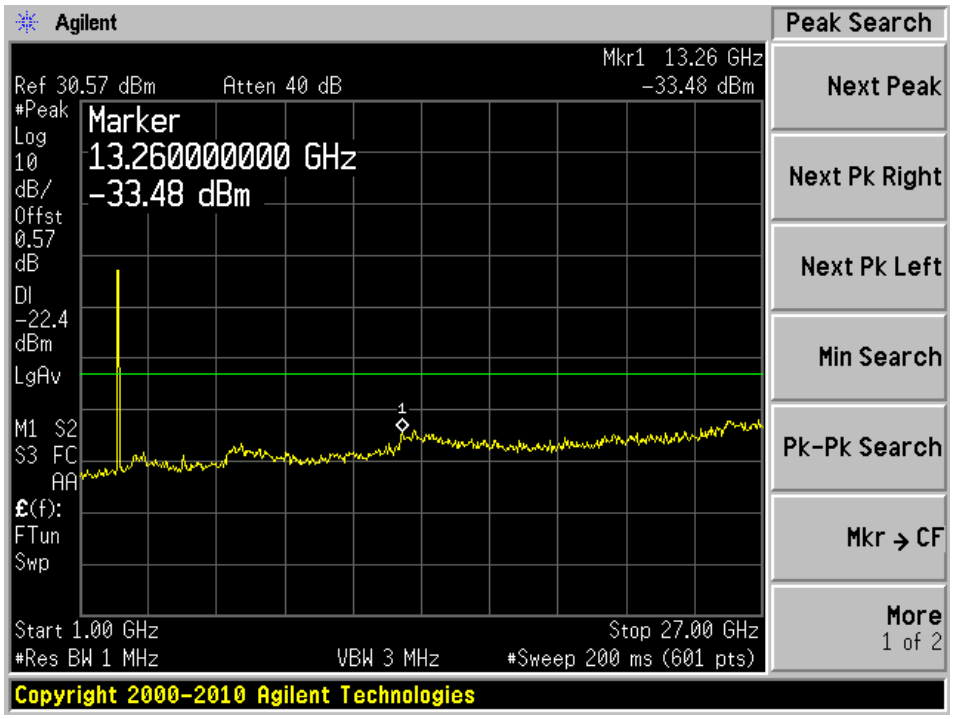


High Channel, 2480 MHz

Plot #1 30 MHz – 1 GHz



Plot #2 1 GHz – 27 GHz



8 FCC §15.205, §15.209, §15.247(d) & IC RSS-210 §2.2, §2.6, §A8.5 – Spurious Radiated Emissions

8.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

As per IC RSS-210 §A8.5 in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15C and IC RSS-210 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

8.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

8.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, the Corrected Amplitude (CA) of 40.3 dBuV/m = indicated Amplitude reading (Ai) 32.5 dBuV + Antenna Factor (AF) 23.5dB + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 dB - Amplifier Gain (Ga) 29.4 dB

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin (dB) = Corrected Amplitude (dBuV/m) - Limit (dBuV/m)

8.5 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Hewlett Packard	Pre-amplifier	8447D	2944A07030	2012-04-08	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2012-04-18	1 year
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2012-06-18	1 year
HP	Pre-amplifier	8449B	3147A00400	2012-02-03	1 year
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year
A.R.A Inc.	Horn antenna	DRG-1181A	1132	2012-01-04	1 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

8.6 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52%
ATM Pressure:	101.99kPa

The testing was performed by Wei Sun on 2012-09-05 at 5 meter chamber #3.

8.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15C and IC RSS-210 standard's radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-4.86	9760	Vertical	30MHz – 25GHz

Please refer to the following table for specific test result details

8.8 Radiated Emissions Test Result Data

Radiated Emission at 3 meters, 30 MHz – 25 GHz

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel ,2402 MHz, measured at 3 meters											
2402	49.86	119	100	V	28.53	3.12	0	81.51	-	-	Fund/Peak
2402	30.67	119	100	V	28.53	3.12	0	62.32	-	-	Fund/Ave
2402	64.81	302	111	H	28.53	3.12	0	96.46	-	-	Fund/Peak
2402	38.5	302	111	H	28.53	3.12	0	70.15	-	-	Fund/Ave
4804	39.57	159	100	V	33.59	4.56	27.78	49.94	74	-24.06	Harm/Peak
4804	25.62	159	100	V	33.59	4.56	27.78	35.99	54	-18.01	Harm/Ave
4804	40.78	325	100	H	33.59	4.56	27.78	51.15	74	-22.85	Harm/Peak
4804	27.08	325	100	H	33.59	4.56	27.78	37.45	54	-16.55	Harm/Ave
7206	34.04	0	100	V	38.65	5.49	27.59	50.59	61.51	-10.92	Harm/Peak
7206	20.51	0	100	V	38.65	5.49	27.59	37.06	42.32	-5.26	Harm/Ave
7206	34.11	0	100	H	38.65	5.49	27.59	50.66	76.46	-25.8	Harm/Peak
7206	20.44	0	100	H	38.65	5.49	27.59	36.99	50.15	-13.16	Harm/Ave
9608	32.91	0	100	V	38.54	6.54	27.05	50.94	61.51	-10.57	Harm/Peak
9608	19.65	0	100	V	38.54	6.54	27.05	37.68	42.32	-4.64	Harm/Ave
9608	32.88	0	100	H	38.54	6.54	27.05	50.91	76.46	-25.55	Harm/Peak
9608	19.61	0	100	H	38.54	6.54	27.05	37.64	50.15	-12.51	Harm/Ave
2390	28.16	0	100	V	28.53	3.12	27.8	32.01	74	-41.99	Spur/Peak
2390	28.06	0	100	H	28.53	3.12	27.8	31.91	74	-42.09	Spur/Peak
2390	15.82	0	100	V	28.53	3.12	27.8	19.67	54	-34.33	Spur/Ave
2390	15.91	0	100	H	28.53	3.12	27.8	19.76	54	-34.24	Spur/Ave
119.96775	21.99	287	100	V	19.02	0.66	30.18	11.49	43.5	-32.01	Spur/QP
119.96775	28.64	148	100	H	19.02	0.66	30.18	18.14	43.5	-25.36	Spur/QP
967.94075	17.15	71	164	V	28.3	3.66	29.79	19.32	54	-34.68	Spur/QP
967.94075	11.2	333	151	H	28.3	3.66	29.79	13.37	54	-40.63	Spur/QP

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle channel, 2440 MHz measured at 3 meters											
2440	48.54	146	100	V	28.53	3.25	0	80.32	-	-	Fund/Peak
2440	36.14	327	100	H	28.53	3.25	0	67.92	-	-	Fund/Ave
2440	29.94	146	100	V	28.53	3.25	0	61.72	-	-	Fund/Peak
2440	60.35	327	100	H	28.53	3.25	0	92.13	-	-	Fund/Ave
4880	40.52	156	100	V	33.59	4.54	27.67	50.98	74	-23.02	Harm/Peak
4880	27.27	156	100	V	33.59	4.54	27.67	37.73	54	-16.27	Harm/Ave
4880	39.84	315	100	H	33.59	4.54	27.67	50.3	74	-23.7	Harm/Peak
4880	25.22	315	100	H	33.59	4.54	27.67	35.68	54	-18.32	Harm/Ave
7320	34.78	0	100	V	38.33	5.57	27.51	51.17	74	-22.83	Harm/Peak
7320	20	0	100	V	38.33	5.57	27.51	36.39	54	-17.61	Harm/Ave
7320	34.02	0	100	H	38.33	5.57	27.51	50.41	74	-23.59	Harm/Peak
7320	20.08	0	100	H	38.33	5.57	27.51	36.47	54	-17.53	Harm/Ave
9760	32.1	0	100	V	38.15	6.58	26.98	49.85	60.32	-10.47	Harm/Peak
9760	19.11	0	100	V	38.15	6.58	26.98	36.86	41.72	-4.86	Harm/Ave
9760	32.16	0	100	H	38.15	6.58	26.98	49.91	70.13	-20.22	Harm/Peak
9760	19.7	0	100	H	38.15	6.58	26.98	37.45	47.92	-10.47	Harm/Ave
119.96	21.41	267	131	V	19.02	0.66	30.18	10.91	43.5	-32.59	Spur/QP
119.96	28.03	329	146	H	19.02	0.66	30.18	17.53	43.5	-25.97	Spur/QP
994.4225	10.01	188	100	H	28.3	3.8	29.79	12.32	54	-41.68	Spur/QP
994.4225	17.09	204	108	V	28.3	3.8	29.79	19.4	54	-34.6	Spur/QP

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High channel, 2480 MHz measured at 3 meters											
2480	48.62	270	108	V	29.12	3.25	0	80.99	-	-	Fund/Peak
2480	61.8	307	108	H	29.12	3.25	0	94.17	-	-	Fund/Ave
2480	29.96	270	108	V	29.12	3.25	0	62.33	-	-	Fund/Peak
2480	36.98	307	108	H	29.12	3.25	0	69.35	-	-	Fund/Ave
4960	38.43	13	100	V	33.91	4.52	27.67	49.19	74	-24.81	Harm/Peak
4960	25.32	13	100	V	33.91	4.52	27.67	36.08	54	-17.92	Harm/Ave
4960	39.66	321	100	H	33.91	4.52	27.67	50.42	74	-23.58	Harm/Peak
4960	26.26	321	100	H	33.91	4.52	27.67	37.02	54	-16.98	Harm/Ave
7440	34.51	0	100	V	38.28	5.66	27.51	50.94	74	-23.06	Harm/Peak
7440	20.09	0	100	V	38.28	5.66	27.51	36.52	54	-17.48	Harm/Ave
7440	33.9	0	100	H	38.28	5.66	27.51	50.33	74	-23.67	Harm/Peak
7440	20.41	0	100	H	38.28	5.66	27.51	36.84	54	-17.16	Harm/Ave
9920	32.51	0	100	V	37.9	6.67	26.98	50.1	60.99	-10.89	Harm/Peak
9920	19.2	0	100	V	37.9	6.67	26.98	36.79	42.33	-5.54	Harm/Ave
9920	32.18	0	100	H	37.9	6.67	26.98	49.77	74.17	-24.4	Harm/Peak
9920	19	0	100	H	37.9	6.67	26.98	36.59	49.35	-12.76	Harm/Ave
2483.5	28.29	0	100	V	29.03	3.25	27.8	32.77	74	-41.23	Spur/Peak
2483.5	27.99	0	100	H	29.03	3.25	27.8	32.47	74	-41.53	Spur/Peak
2483.5	15.96	0	100	V	29.03	3.25	27.8	20.44	54	-33.56	Spur/Ave
2483.5	15.88	0	100	H	29.03	3.25	27.8	20.36	54	-33.64	Spur/Ave
119.9738	22.18	29	117	V	19.02	0.66	30.18	11.68	43.5	-31.82	Spur/QP
119.9738	29.48	14	146	H	19.02	0.66	30.18	18.98	43.5	-24.52	Spur/QP
993.3215	10.93	271	100	V	28.3	3.8	29.79	13.24	54	-40.76	Spur/QP
993.3215	17.15	355	106	H	28.3	3.8	29.79	19.46	54	-34.54	Spur/QP

9 FCC §15.247(a)(2) & IC RSS-210 §A8.2 – 6 dB & 99% Emission Bandwidth

9.1 Applicable Standard

According to FCC §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

According to IC RSS-210 A8.2 (a), systems using digital modulation techniques may operate in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

9.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

9.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	49%
ATM Pressure:	101.97kPa

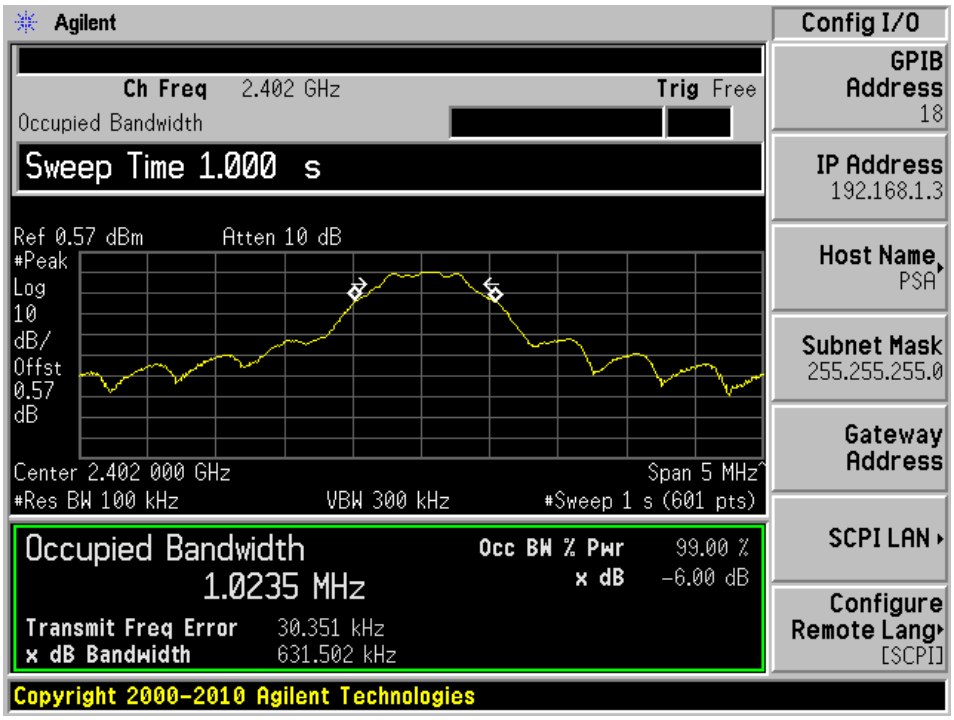
The testing was performed by Wei Sun on 2012-08-30 at RF Site.

9.5 Test Results

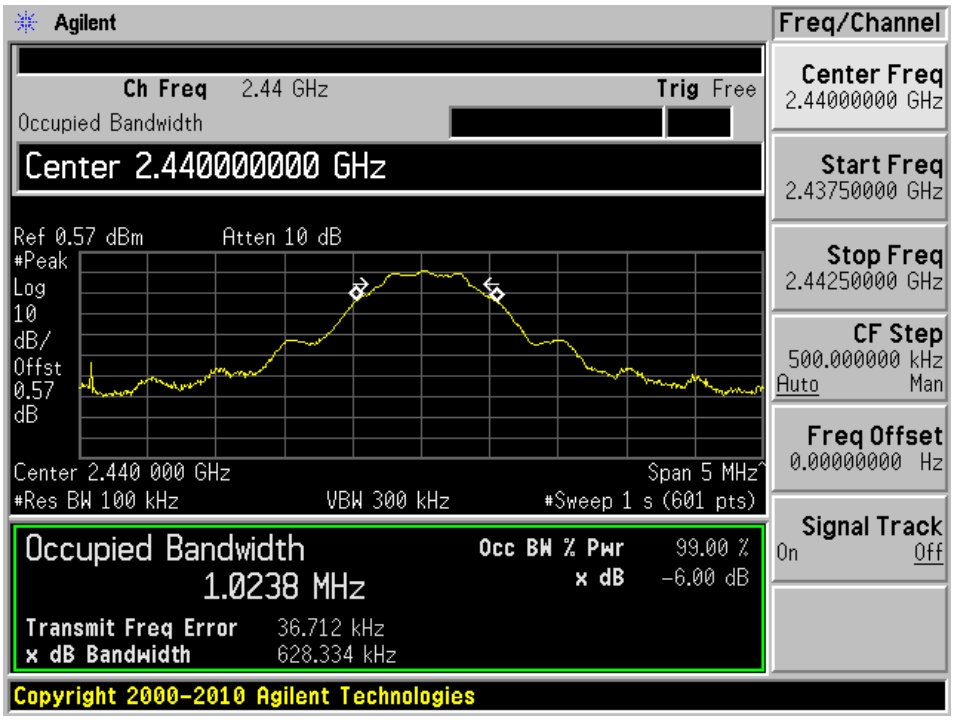
Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	99% Emission Bandwidth (kHz)	Limit (kHz)	Results
Low	2402	631.502	1023.5	500	Compliance
Middle	2440	628.334	1023.8	500	Compliance
High	2480	628.324	1200.3	500	Compliance

Please refer to the following plots for detailed test results:

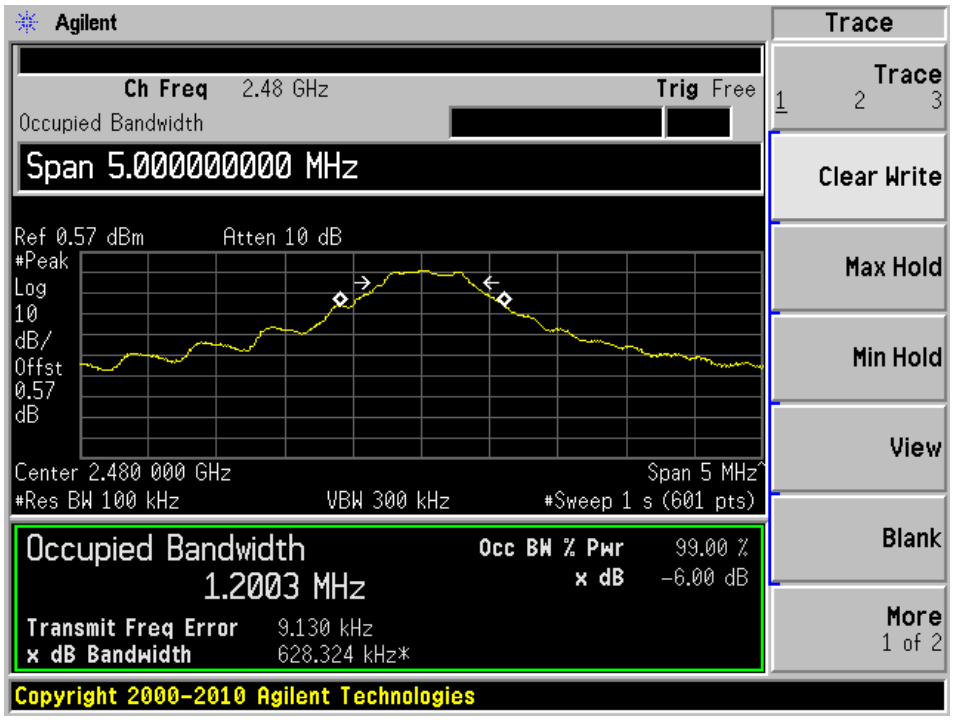
Low Channel, 2412 MHz



Middle Channel 2440 MHz



High Channel 2480 MHz



10 FCC §15.247(b) & IC RSS-210 §A8.4 – Peak Output Power Measurement

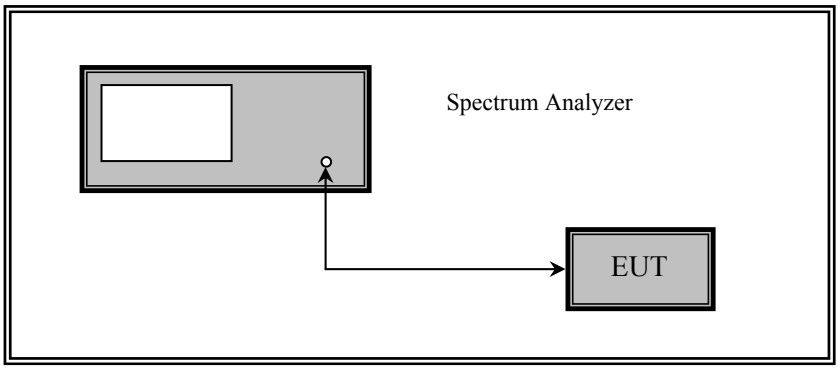
10.1 Applicable Standard

According to FCC §15.247(b) (3) for systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

According to IC RSS-210 §A8.4 (4) for systems using digital modulation in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands: 1 Watt.

10.2 Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.



10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

10.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52%
ATM Pressure:	101.99kPa

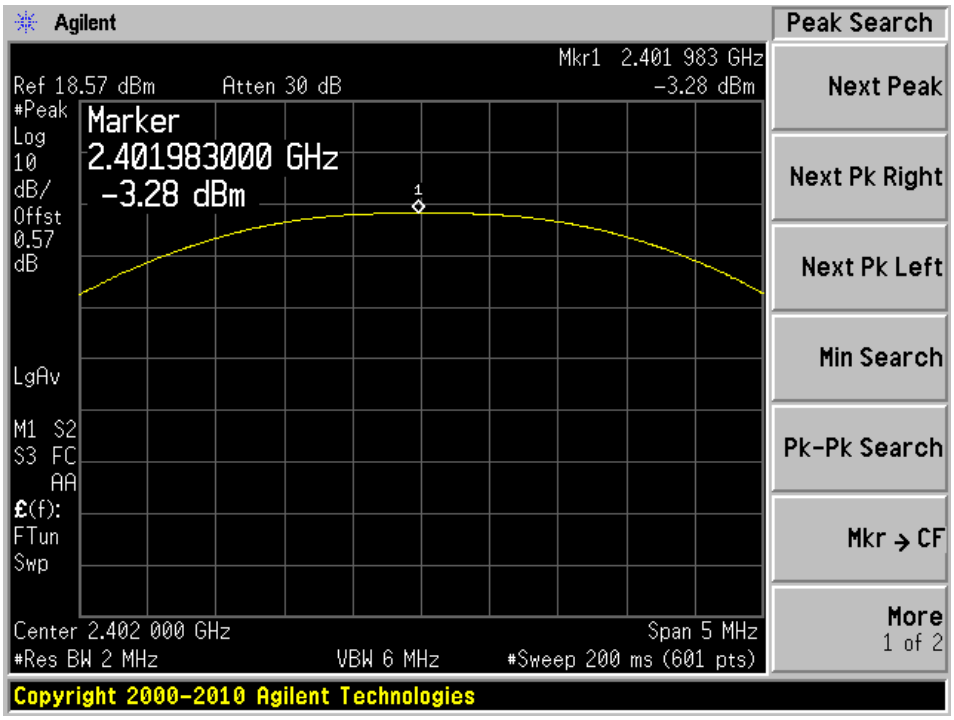
The testing was performed by Wei Sun on 2012-08-30 at RF Site.

10.5 Test Results

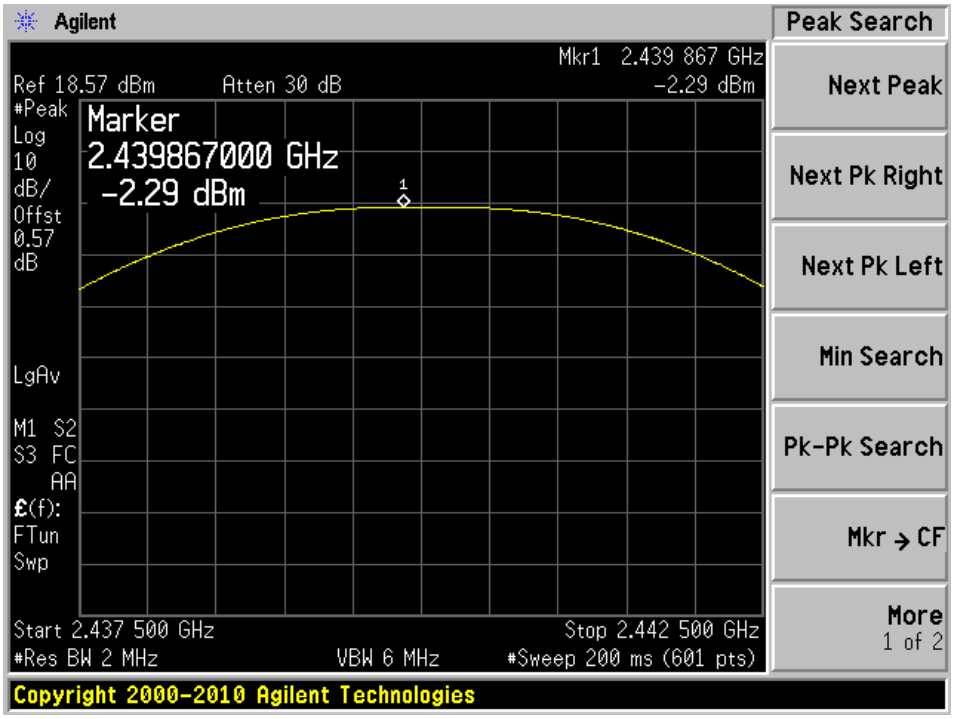
Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	-3.28	0.47	1000	Pass
Mid	2440	-2.29	0.59	1000	Pass
High	2480	-2.03	0.627	1000	Pass

Please refer to the following plots for detailed test results:

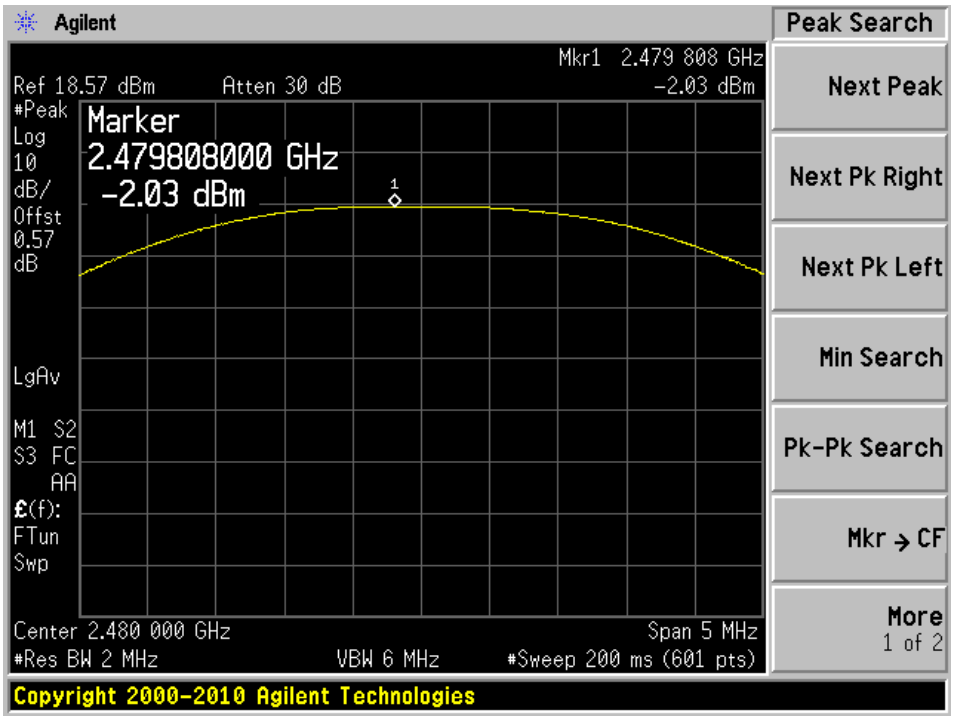
Low Channel, 2402 MHz



Middle Channel, 2440 MHz



High Channel, 2480 MHz



11 FCC §15.247(d) & IC RSS-210 §A 8.5 – 100 kHz Bandwidth of Band Edges

11.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required.

According to IC RSS-210 §A 8.5.In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

11.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

11.4 Test Environmental Conditions

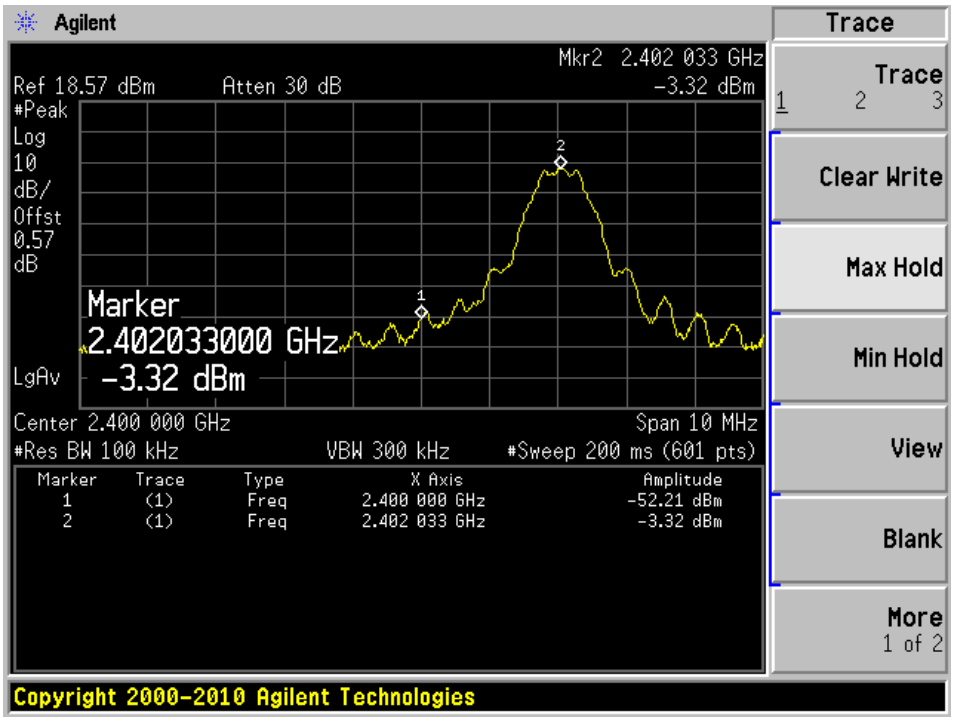
Temperature:	24 °C
Relative Humidity:	49 %
ATM Pressure:	101.97kPa

The testing was performed by Wei Sun on 2012-08-30 at RF Site.

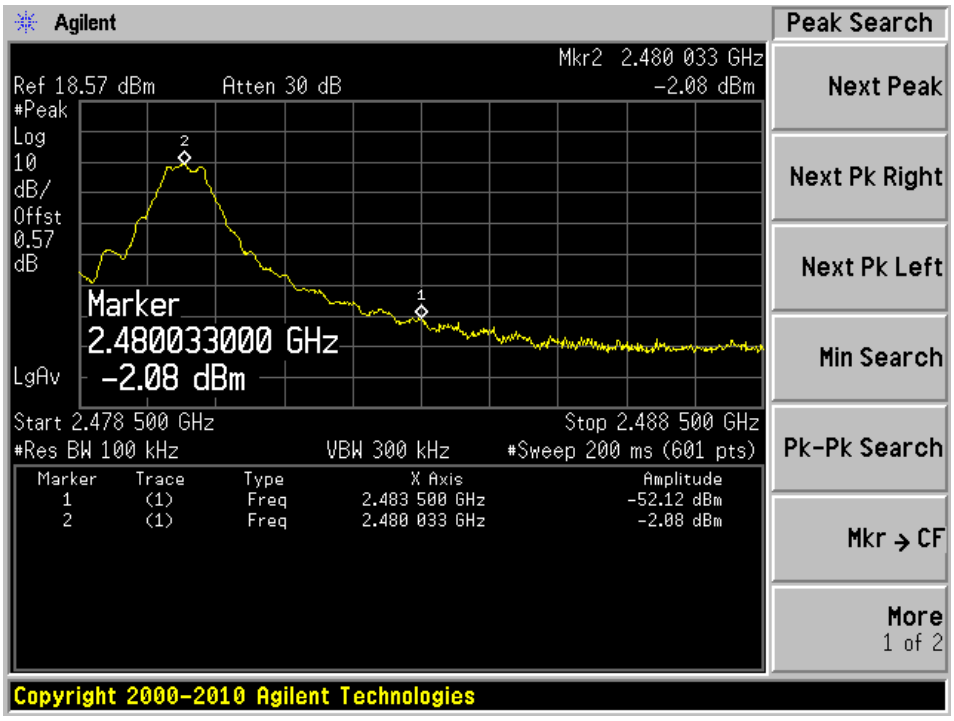
11.5 Test Results

Please refer to the following plots.

Low Band Edge



High Band Edge



12 FCC §15.247(e) & IC RSS-210 §A8.2 (b) – Power Spectral Density

12.1 Applicable Standard

According to FCC §15.247 (e) , for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

According to RSS-210 §A8.2 (b) , for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

12.2 Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ 300 kHz.
4. Set the span to 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log (3 kHz/100 kHz = -15.2 dB).
11. The resulting peak PSD level must be ≤ 8 dBm

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

12.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	49 %
ATM Pressure:	101.97kPa

The testing was performed by Wei Sun on 2012-08-30 at RF Site.

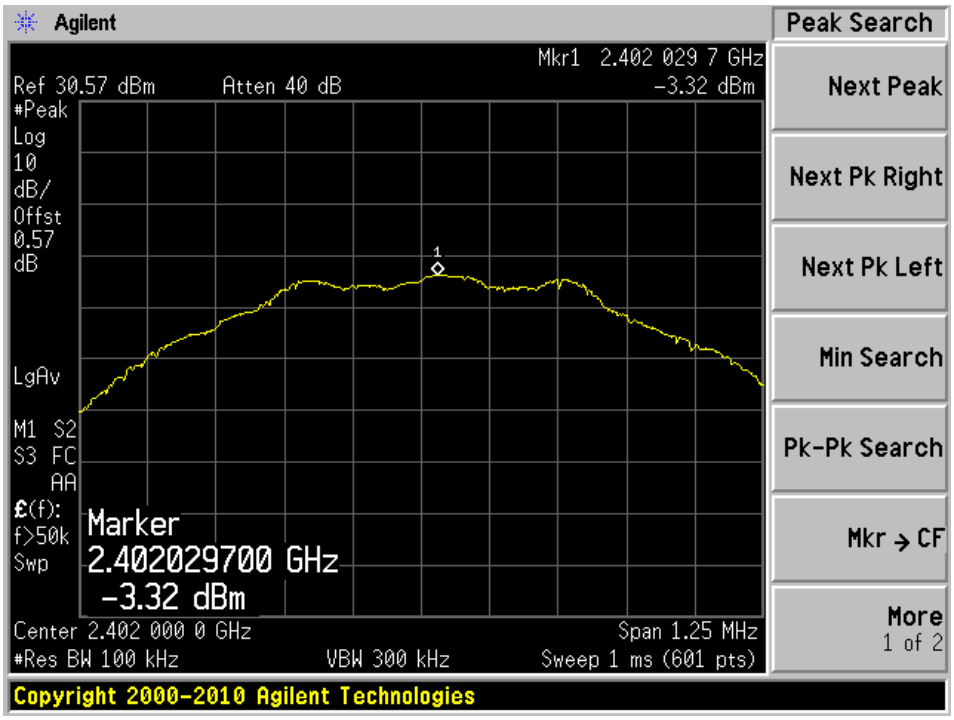
12.5 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm/100 kHz)	Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)
Low	2402	-3.32	-18.52	8
Mid	2440	-2.46	-17.66	8
High	2480	-2.11	-17.31	8

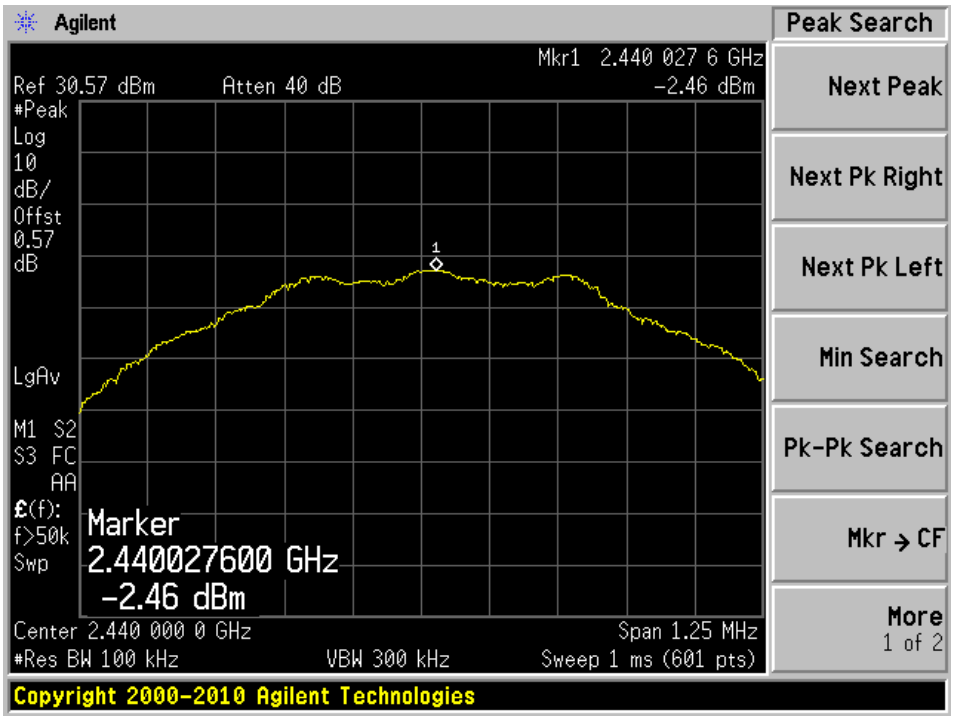
Note: All the data can be scaled to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF=10log (3 kHz/100 kHz=-15. 2dB).

Please refer to the following plots.

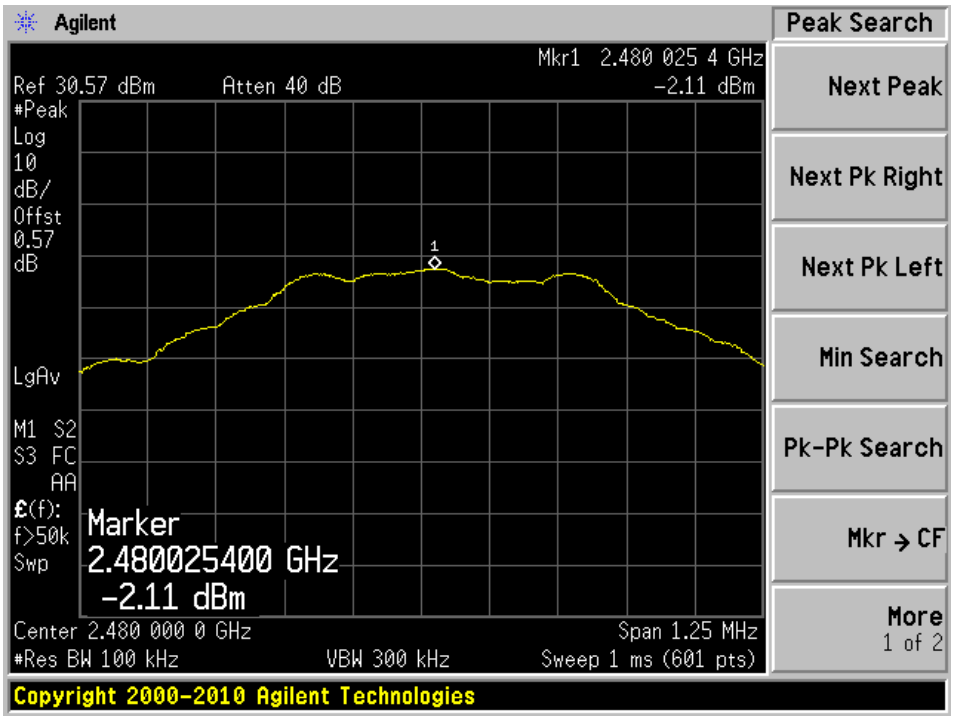
Low Channel, 2402 MHz



Middle Channel, 2440 MHz



High Channel, 2480 MHz



13 IC RSS-210 §2.3 & RSS-Gen §6 – Receiver Spurious Emissions

13.1 Applicable Standard

According to IC RSS-Gen §4.10, the receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate.

Unless otherwise specified in the applicable RSS, the radiated emission measurement is the standard measurement method (with the device's antenna in place) to measure receiver spurious emissions.

Radiated emission measurements are to be performed using a calibrated open-area test site.

For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tuneable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

For emissions below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector with the same measurement bandwidth as that for CISPR quasi-peak measurements. Above 1 GHz, measurements shall be performed using an average detector and a resolution bandwidth of 300 kHz to 1 MHz.

According to RSS-Gen §6, Tables 2 show the general field strength limits of receiver spurious emissions.

Table 2:Radiated Limits of Receiver Spurious Emissions

Frequency (MHz)	Field Strength (Microvolts/m at 3 meters)
30-88	100
88-216	150
216-960	200
Above 960	500

13.2 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emissions was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

13.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Hewlett Packard	Pre-amplifier	8447D	2944A07030	2012-04-08	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2012-04-18	1 year
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2012-06-18	1 year
HP	Pre-amplifier	8449B	3147A00400	2012-02-03	1 year
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year
A.R.A Inc.	Horn antenna	DRG-1181A	1132	2012-01-04	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

13.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52%
ATM Pressure:	101.99kPa

The testing was performed by Wei Sun on 2012-09-05 in 5 meters chamber 3.

13.5 Summary of Test Results

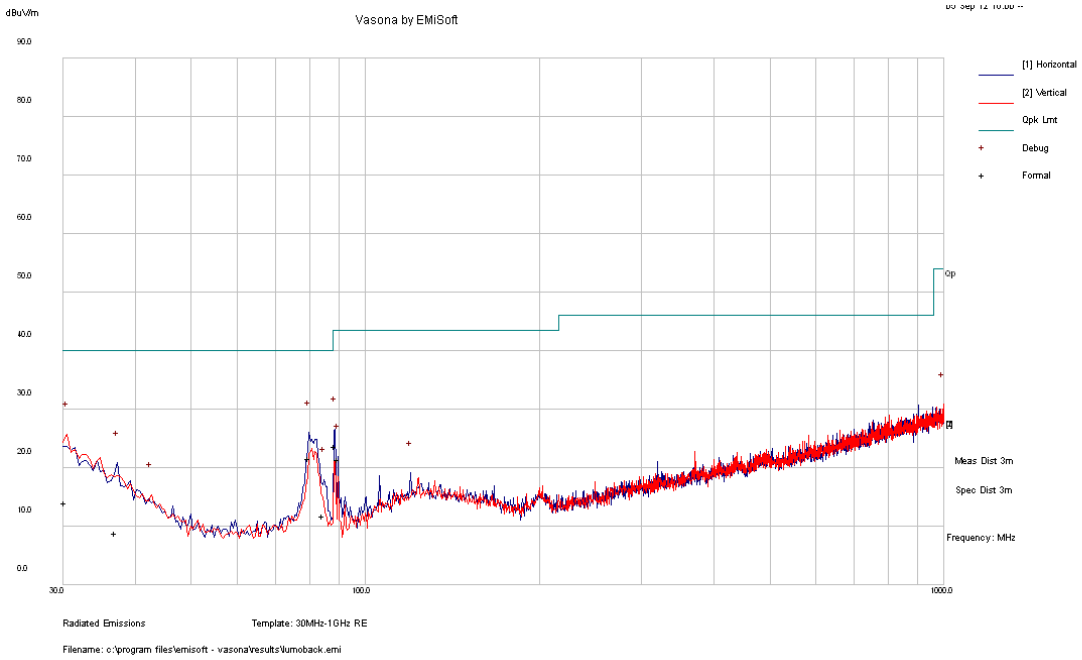
According to the test data, the EUT complied with IC RSS-210/RSS-Gen, with the closest margins from the limit listed below:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-18.35	80.014	Horizontal	30 to 25000

13.6 Test Results and Plots

Receiving Mode

1) 30-1000 MHz, Measured at 3 meters



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (PK/QP)
80.014	21.65	123	H	158	40	-18.35	QP
30.23725	14.14	116	V	273	40	-25.86	QP
88.54925	23.76	104	H	332	43.5	-19.74	QP
37.057	8.91	163	H	137	40	-31.09	QP
89.67125	21.53	123	H	52	43.5	-21.97	QP
84.5785	11.78	116	H	166	40	-28.22	QP

2) Above 1 GHz Measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Reading (dBµV/m)	IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
-	-	-	-	-	-	-	-	-	-	-	-

Note: All other Emissions are under noise floor level.