FCC PART 15, SUBPART C

IC RSS-210, ISSUE 8, DEC 2010

TEST AND MEASUREMENT REPORT

For

Fitbit, Inc.

625 Market Street, Suite 1400,

San Francisco, CA 94105, USA

FCC ID: XRAFB150
IC: 8542A-FB150

Report Type:	**Product Type:**
Original Report	Bluetooth LE Dongle

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Report Number:	R12061116-247
Report Date:	2012-11-05
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R12061116-247	Original Report	2012-11-05

1 General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Fitbit, Inc.* and their product, *model: FB150, FCC ID: XRAFB150, IC: 8542A-FB150* or the "EUT" as referred to this report. The EUT is a Bluetooth 4.0 LE Dongle with one antenna type.

1.2 Mechanical Description of EUT

The EUT measures approximately 22 mm **(L)** x 18 mm **(W)** x 8 mm **(H)** and weighs approximately 4 g.

The data gathered are from a typical production sample provided by the manufacturer with serial number: 004 for the conducted testing and serial numbers: 001 for the radiated testing provided by the manufacture.

1.3 Objective

This report is prepared on behalf of *Fitbit, 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.

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.

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 system was configured for testing in accordance with ANSI C63.4-2009.

The EUT was tested in the testing mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The software is provided by customer. The EUT exercise program used during radiated testing was designed to exercise the system components.

Radio Mode	Frequency (MHz)		
	Low Channel	Middle Channel	High Channel
Bluetooth 4.0	2402	2440	2480

2.3 Special Accessories

N/A

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Lenovo	Laptop	0679	CB08585694

2.6 Power Supply and Line Filters

N/A

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RF Cable	< 1	EUT	Spectrum Analyzer

2.8 Internal Parts List and Details

Manufacturers	Descriptions	Models	Serial Numbers
Fitbit, Inc.	Galileo Dongle PCB	CC2540	MDL12-0016

3 Summary of Test Results

FCC & IC Rules	Description of Test	Result
FCC §15.247 (i), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirements	Compliant
FCC §15.207 (a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	Compliant
FCC §15.209 IC RSS-210 §8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205, §15.209, §15.247(d) IC RSS-210 §2.2, §A8.5	Restricted Bands, Spurious Radiated Emissions	Compliant
FCC §15.247(a)(2) IC RSS-210 §A8.2	6 dB Emission Bandwidth	Compliant
FCC §15.247(e) IC RSS-210 §A8.2(b)	Power Spectral Density	Compliant
FCC §15.247(b)(3) IC RSS-210 §A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
IC RSS-210 §2.6 & RSS-Gen §4.10	Receiver Spurious Emission	Compliant

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

4.1 Applicable Standard

For 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.

4.2 Result

The EUT has maximum gain of 3.3 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. Please refer to the EUT photos.

5 FCC §15.207 & RSS-Gen §7.2.4 - AC Line Conducted Emissions

5.1 Applicable Standards

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 [1]	56 to 46 [1]
0.5-5	56	46
5-30	60	50

***Note* [1]:** *Decreases with the logarithm of the frequency.*

5.2 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 and IC RSS-Gen limits.

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

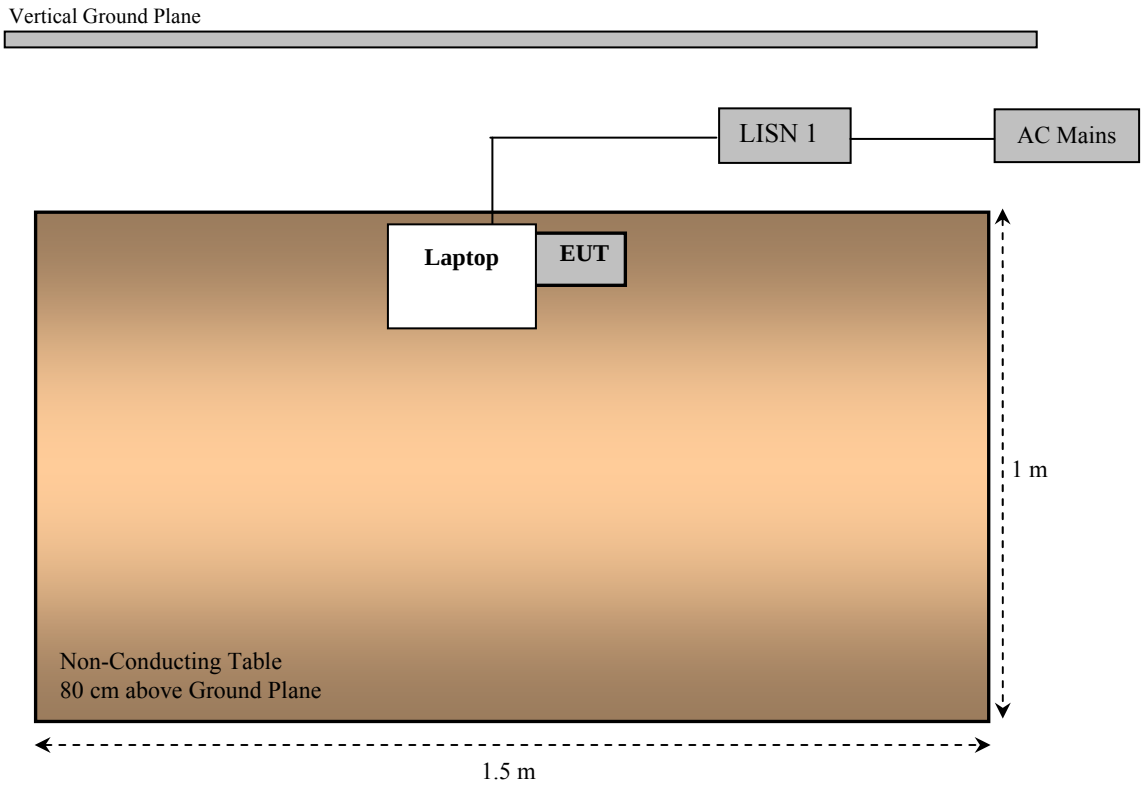
The AC/DC power adapter of the host PC was connected with LISN-1 which provided 120 V/60 Hz AC power.

5.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22	1 Year
Solar Electronics	LISN	9252-R-24-BNC	511205	2012-06-25	1 Year
TTE	High Pass Filter	H985-150K-50-720N	M1149	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.

5.4 Test Setup Block Diagram



5.5 Test Procedure

During the conducted emissions test, the power cord of the laptop was connected to the mains outlet of the LISN-1.

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".

5.6 Corrected Amplitude & Margin Calculation

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

CA = Ai + CL + Atten

For example, the Corrected Amplitude (CA) of 46.2 dBuV = indicated Amplitude reading (Ai) 32.5 dBuV + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 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)

5.7 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: Laptop connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-7.16	0.15468	Line	0.15-30

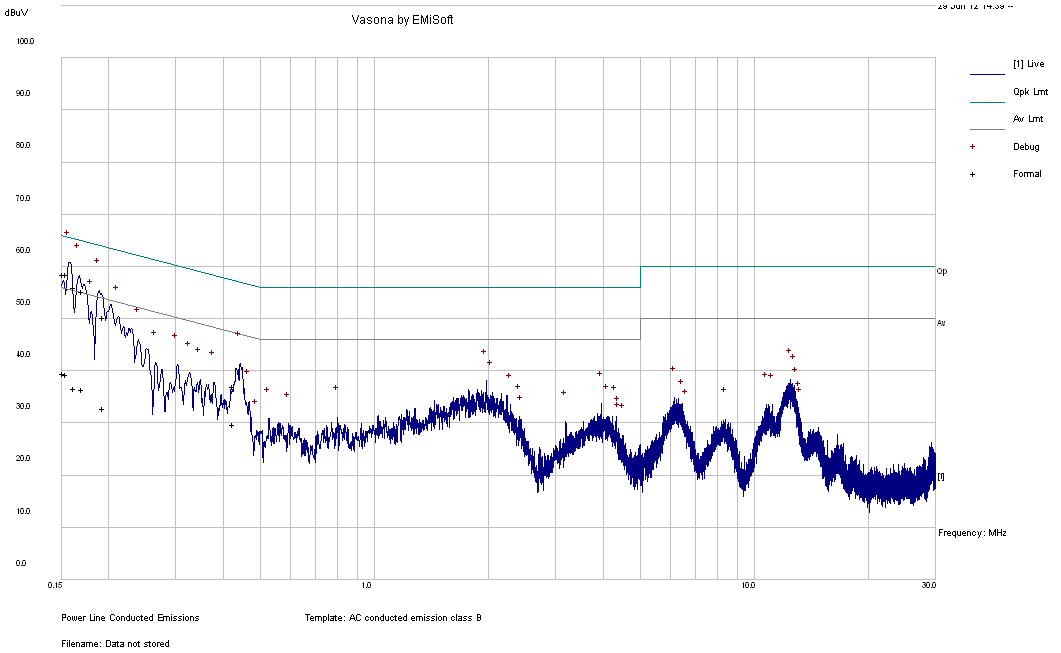
5.8 Test Environmental Conditions

Temperature:	20 °C
Relative Humidity:	58 %
ATM Pressure:	101.3kPa

The testing was performed by Lionel Lara on 2012-06-29 in 5 meter chamber 3.

5.9 Conducted Emissions Test Plots and Data

120V/60 Hz Line:



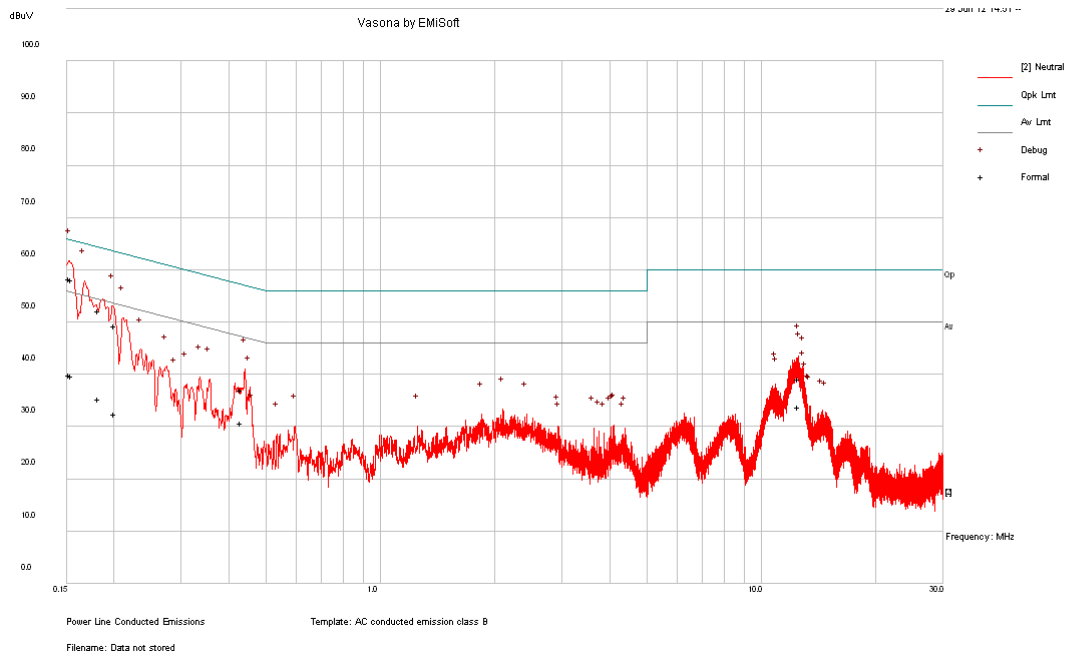
Quasi-Peak Measurement

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.15468	58.59	Quasi-Peak	Line	65.74	-7.16
0.151725	58.55	Quasi-Peak	Line	65.91	-7.35
0.162954	56.02	Quasi-Peak	Line	65.31	-9.29
0.170523	55.23	Quasi-Peak	Line	64.93	-9.70
0.193938	50.35	Quasi-Peak	Line	63.87	-13.51
0.426888	37.11	Quasi-Peak	Line	57.31	-20.21

Average Measurement

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.15468	39.4	Average	Line	55.74	-16.35
0.151725	39.52	Average	Line	55.91	-16.38
0.426888	29.72	Average	Line	47.31	-17.59
0.170523	36.44	Average	Line	54.93	-18.49
0.162954	36.69	Average	Line	55.31	-18.63
0.193938	32.87	Average	Line	53.87	-21.00

120V/60 Hz Neutral:



Quasi-Peak Measurement

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.155112	58.16	Quasi-Peak	Neutral	65.72	-7.56
0.153141	58.26	Quasi-Peak	Neutral	65.83	-7.57
0.182766	52.3	Quasi-Peak	Neutral	64.36	-12.06
0.200832	49.42	Quasi-Peak	Neutral	63.58	-14.15
0.43125	37.09	Quasi-Peak	Neutral	57.23	-20.14
12.52205	39.11	Quasi-Peak	Neutral	60	-20.89

Average Measurement

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.153141	39.92	Average	Neutral	55.83	-15.91
0.155112	39.69	Average	Neutral	55.72	-16.03
12.52205	33.8	Average	Neutral	50	-16.20
0.43125	30.68	Average	Neutral	47.23	-16.55
0.182766	35.39	Average	Neutral	54.36	-18.97
0.200832	32.51	Average	Neutral	53.58	-21.06

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

6.1 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) and RSS-210: 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	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

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 device is operating, the RF 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square 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 field strength limits specified in RSS-Gen is not required.

6.2 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.

6.3 Test Procedure

For the radiated emissions test, the EUT 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 meters away from the testing antenna, which is varied from 1-4 meters, 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

6.4 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)

6.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
EMCO	Horn Antenna	3115	9511-4627	2011-10-17	1 Year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 Year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 Year
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2011-10-16	1 Year
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10	1 Year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22	1 Year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	-

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

6.6 Test Environmental Conditions

Temperature:	20 °C
Relative Humidity:	58 %
ATM Pressure:	101.3kPa

The testing was performed by Lionel Lara on 2012-06-29 in 5 meter chamber 3.

6.7 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:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-23.48	900	Horizontal	Middle, 30 MHz– 1 GHz

Above 1 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-2.91	2483.5	Horizontal	High, 1GHz – 25GHz

6.8 Radiated Emissions Test Result Data

1) 30 MHz – 1 GHz, Radiated Spurious Emissions Measured at 3 meters

Quasi-Peak Measurement:

Low Channel (2402 MHz)

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
100	3.35	100	H	0	43.5	-40.15
500	15.15	100	H	0	46	-30.85
900	22.40	100	H	0	46	-23.60

Middle Channel (2440 MHz)

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
100	3.22	100	H	0	43.5	-40.28
500	15.21	100	H	0	46	-30.79
900	22.52	100	H	0	46	-23.48

High Channel (2480 MHz)

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
100	3.25	100	H	0	43.5	-40.25
500	15.12	100	H	0	46	-30.88
900	22.47	100	H	0	46	-23.53

2) 1 – 25 GHz, Radiated Spurious Emissions Measured at 3 meters

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)											
2402	72.04	39	100	H	28.16	3.74	0	103.94	Fund.	-	Peak
2402	68.75	229	125	V	28.12	3.74	0	100.61	Fund.	-	Peak
2402	71.44	39	100	H	28.16	3.74	0	103.34	Fund.	-	Ave
2402	68.12	229	125	V	28.12	3.74	0	99.98	Fund.	-	Ave
4804	39.21	0	100	H	32.63	5.06	27.78	49.12	74	-24.88	Peak
4804	39.21	0	100	V	32.6	5.06	27.78	49.09	74	-24.91	Peak
4804	24.62	0	100	H	32.63	5.06	27.78	34.53	54	-19.47	Ave
4804	24.62	0	100	V	32.6	5.06	27.78	34.5	54	-19.50	Ave
7206	42.57	207	100	H	35.48	6.43	27.59	56.89	83	-26.11	Peak
7206	41.49	130	100	V	35.45	6.43	27.59	55.78	83	-27.22	Peak
7206	30.19	207	100	H	35.48	6.43	27.59	44.51	83	-38.49	Ave
7206	28.49	130	100	V	35.45	6.43	27.59	42.78	83	-40.22	Ave
9608	40.02	0	100	H	37.66	7.25	27.05	57.88	83	-25.12	Peak
9608	40.02	0	100	V	37.66	7.25	27.05	57.88	83	-25.12	Peak
9608	24.9	0	100	H	37.66	7.25	27.05	42.76	83	-40.24	Ave
9608	24.9	0	100	V	37.66	7.25	27.05	42.76	83	-40.24	Ave

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)											
2440	71.34	39	100	H	28.16	3.74	0	103.24	Fund.	-	Peak
2440	68.18	300	100	V	28.12	3.74	0	100.04	Fund.	-	Peak
2440	70.67	39	100	H	28.16	3.74	0	102.57	Fund.	-	Ave
2440	67.71	300	100	V	28.12	3.74	0	99.57	Fund.	-	Ave
4880	39.02	0	100	H	32.8	5.1	27.67	49.25	74	-24.75	Peak
4880	39.02	0	100	V	32.73	5.1	27.67	49.18	74	-24.82	Peak
4880	25.03	0	100	H	32.8	5.1	27.67	35.26	54	-18.74	Ave
4880	25.03	0	100	V	32.73	5.1	27.67	35.19	54	-18.81	Ave
7320	41.95	216	100	H	36.02	6.22	27.51	56.68	74	-17.32	Peak
7320	41.69	131	100	V	32.73	6.22	27.51	53.13	74	-20.87	Peak
7320	27.32	216	100	H	36.02	6.22	27.51	42.05	54	-11.95	Ave
7320	27.06	131	100	V	32.73	6.22	27.51	38.5	54	-15.50	Ave
9760	39.65	0	100	H	38.06	7.13	26.98	57.86	83	-25.14	Peak
9760	39.65	0	100	V	38.02	7.13	26.98	57.82	83	-25.18	Peak
9760	24.35	0	100	H	38.06	7.13	26.98	42.56	82	-39.44	Ave
9760	24.35	0	100	V	38.02	7.13	26.98	42.52	82	-39.48	Ave

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)											
2480	69.89	38	100	H	28.42	3.81	0	102.12	Fund.	-	Peak
2480	66.57	299	100	V	28.27	3.81	0	98.65	Fund.	-	Peak
2480	69.17	38	100	H	28.42	3.81	0	101.4	Fund.	-	Ave
2480	66.23	299	100	V	28.27	3.81	0	98.31	Fund.	-	Ave
4960	39.5	0	100	H	33.06	5.21	27.7	50.07	74	-23.93	Peak
4960	39.5	0	100	V	32.97	5.21	27.7	49.98	74	-24.02	Peak
4960	23.95	0	100	H	33.06	5.21	27.7	34.52	54	-19.48	Ave
4960	23.95	0	100	V	32.97	5.21	27.7	34.43	54	-19.57	Ave
7440	41.25	0	100	H	36.14	6.24	27.53	56.1	74	-17.90	Peak
7440	41.25	0	100	V	36.05	6.24	27.53	56.01	74	-17.99	Peak
7440	25.93	0	100	H	36.14	6.24	27.53	40.78	54	-13.22	Ave
7440	25.93	0	100	V	36.05	6.24	27.53	40.69	54	-13.31	Ave
9920	39.29	0	100	H	38.28	7.18	27.01	57.74	82	-24.26	Peak
9920	39.29	0	100	V	38.19	7.18	27.01	57.65	82	-24.35	Peak
9920	24.07	0	100	H	38.28	7.18	27.01	42.52	81	-38.48	Ave
9920	24.07	0	100	V	38.19	7.18	27.01	42.43	81	-38.57	Ave

3) Spurious Emissions in Restricted Band

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)	
(Near Band Edge) Lowest Channel											
2389.7	26.98	39	100	H	28.16	3.74	0	58.88	74	-15.12	Peak
2389.7	26.96	229	125	V	28.12	3.74	0	58.82	74	-15.18	Peak
2389.7	12.7	39	100	H	28.16	3.74	0	44.6	54	-9.40	Ave
2389.7	12.37	229	125	V	28.12	3.74	0	44.23	54	-9.77	Ave
(Near Band Edge): Highest Channel											
2483.5	30.95	38	100	H	28.42	3.81	0	63.18	74	-10.82	Peak
2483.5	30.06	299	100	V	28.27	3.81	0	62.14	74	-11.86	Peak
2483.5	18.86	38	100	H	28.42	3.81	0	51.09	54	-2.91	Ave
2483.5	17.06	299	100	V	28.27	3.81	0	49.14	54	-4.86	Ave

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

7.1 Applicable Standard

According to FCC §15.247(a)(2) and 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

7.2 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.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2011-10-16	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:	21 °C
Relative Humidity:	54 %
ATM Pressure:	101.5kPa

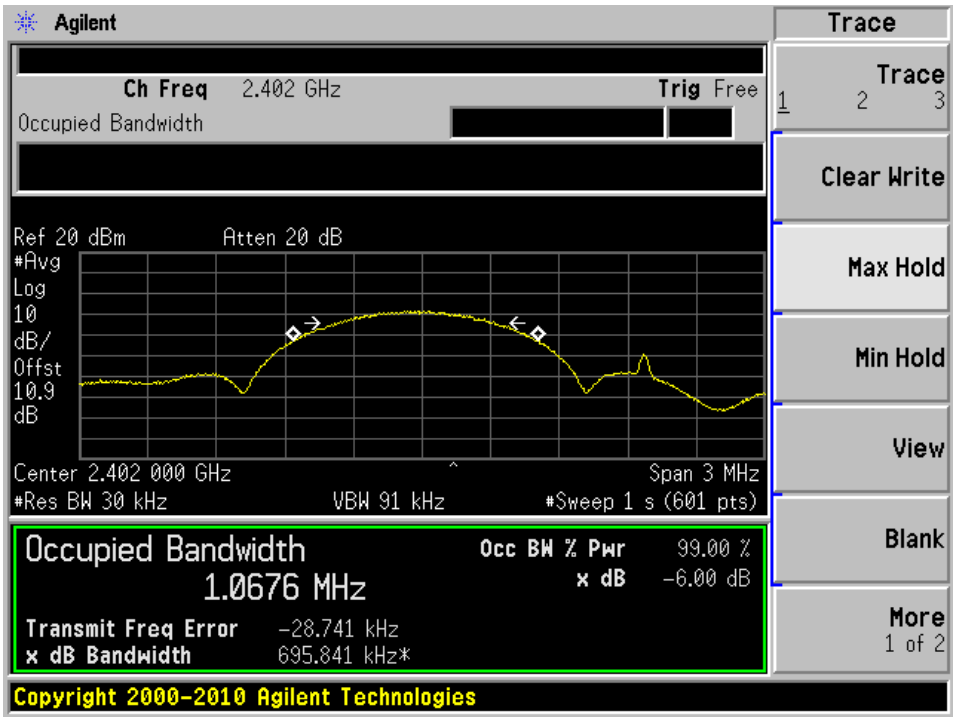
The testing was performed by Lionel Lara on 2012-06-20 at RF test site.

7.5 Test Results

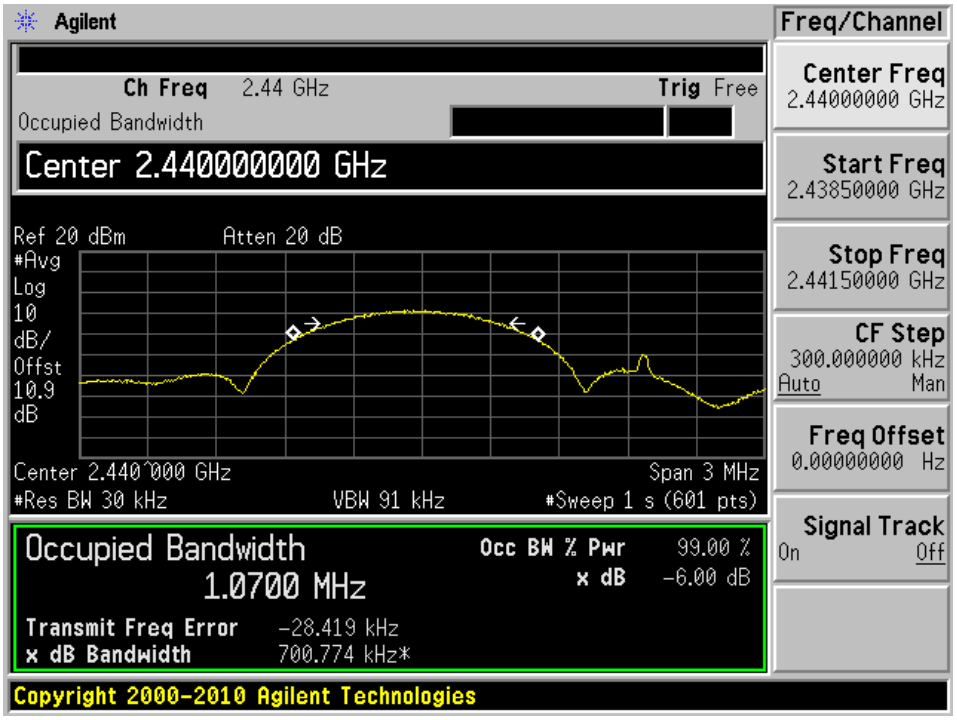
Channel	Frequency (MHz)	99% Emission Bandwidth (kHz)	6 dB Emission Bandwidth (kHz)	Limit (kHz)	Result (kHz)
Low	2402	1067.6	695.8	> 500	Compliant
Mid	2440	1070.0	700.8	> 500	Compliant
High	2480	1070.0	690.7	> 500	Compliant

Please refer to the following plots.

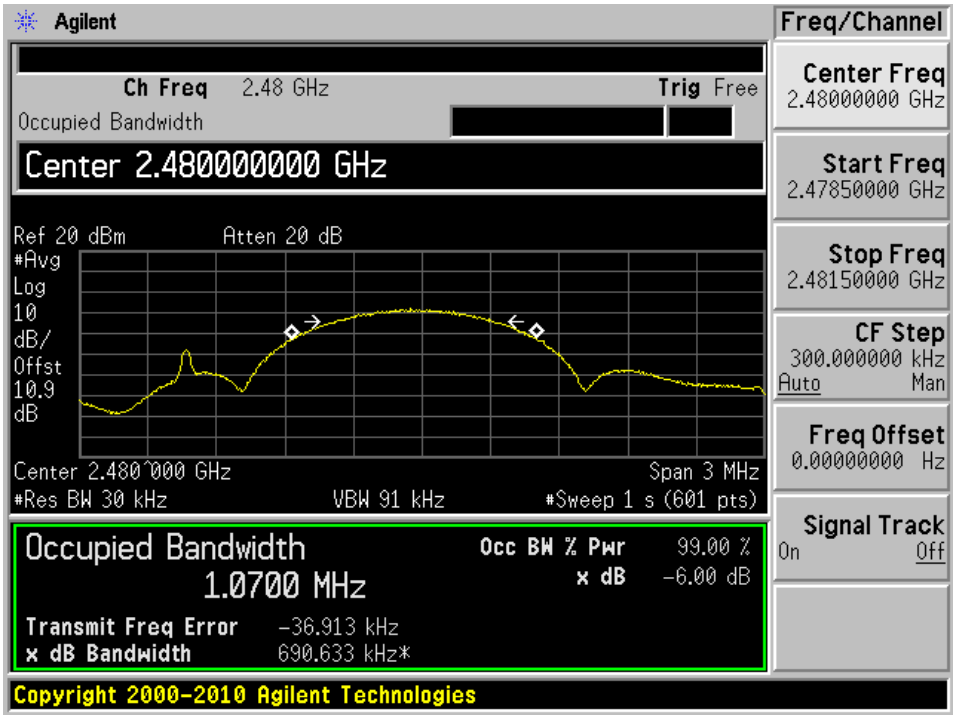
Low Channel



Middle Channel



High Channel



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

8.1 Applicable Standard

According to FCC §15.247(e) and 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.

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position and set 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. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. Additionally set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2011-10-16	1 Year

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

8.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	54 %
ATM Pressure:	101.5kPa

The testing was performed by Lionel Lara on 2012-06-20 at RF test site.

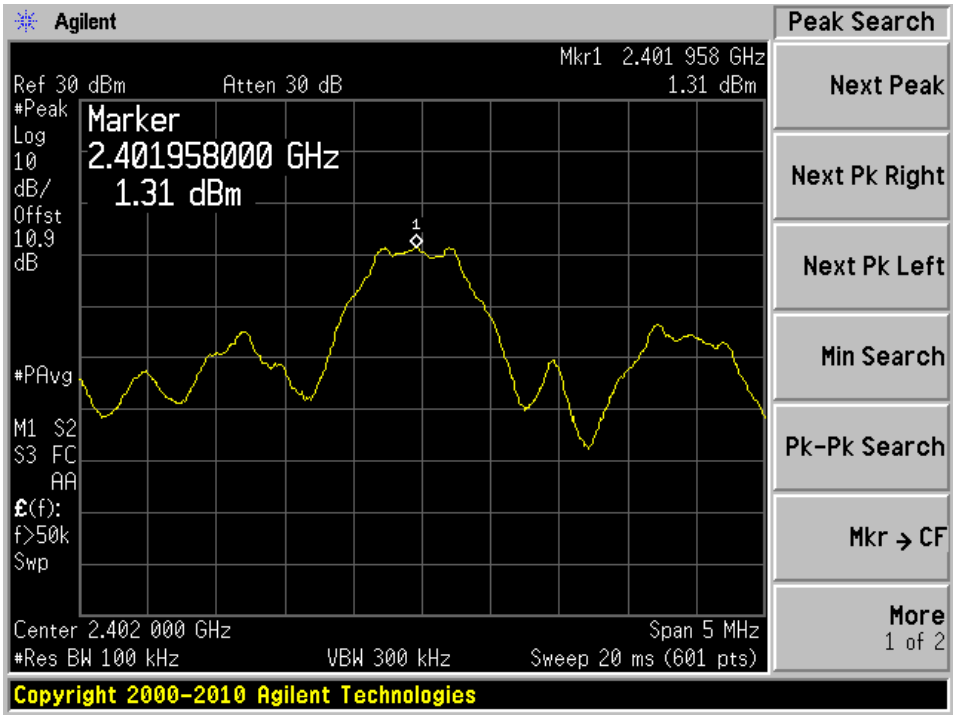
8.5 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm/100 kHz)	Corrected Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Results
Low	2402	1.31	-13.89	8	Compliant
Middle	2440	1.48	-13.72	8	Compliant
High	2480	1.83	-13.37	8	Compliant

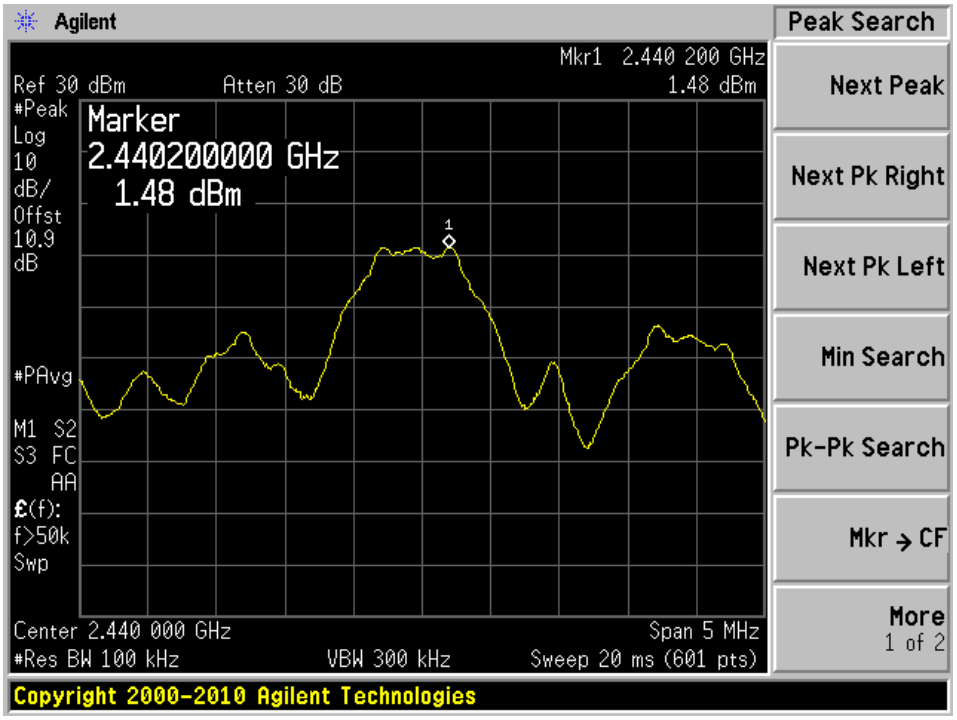
*BWCF (Bandwidth Correction Factor) =10*log (3 kHz/100kHz) =-15. 2dB*

Please refer to the following plots for detailed test results:

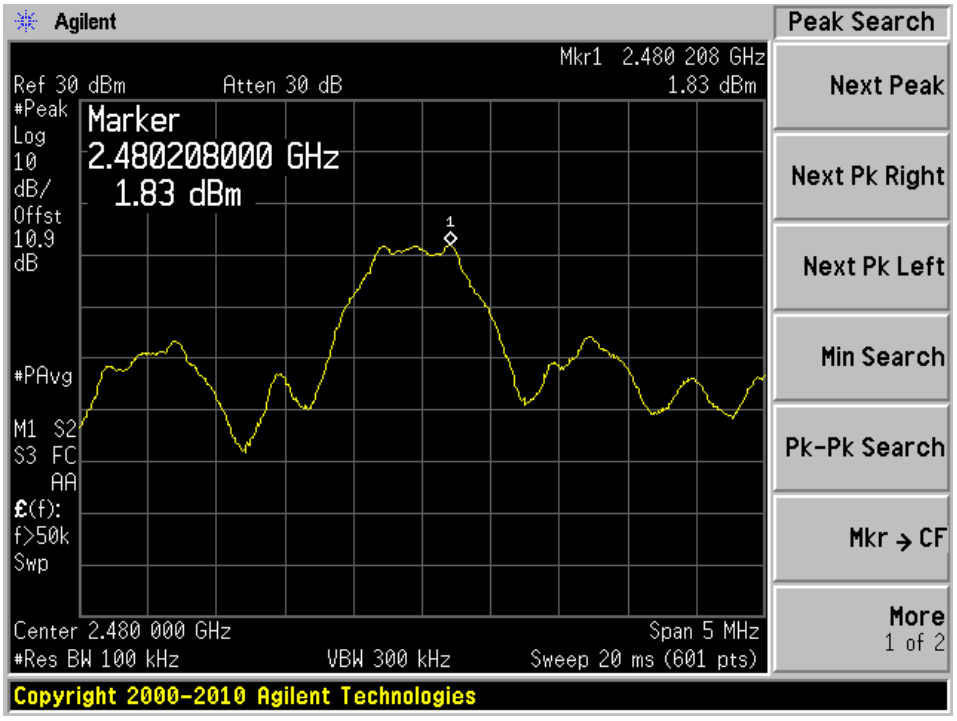
Low Channel



Middle Channel



High Channel



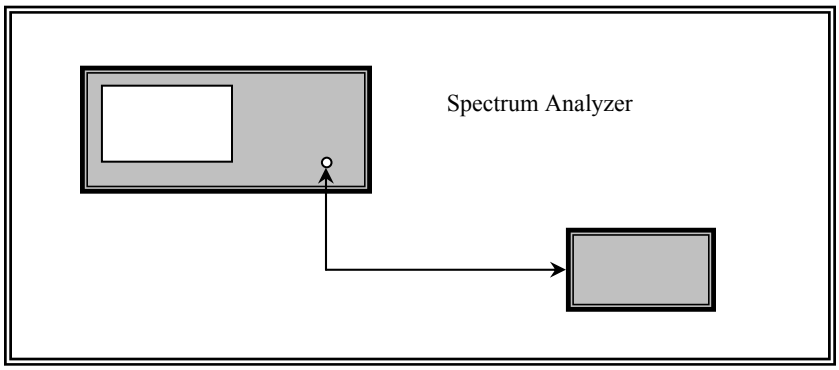
9 FCC §15.247(b) & IC RSS-210 §A8.4 – Maximum Peak Output Power

9.1 Applicable Standard

According to FCC §15.247(b) and 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.

9.2 Measurement 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.



9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2011-10-16	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:	21 °C
Relative Humidity:	54 %
ATM Pressure:	101.5kPa

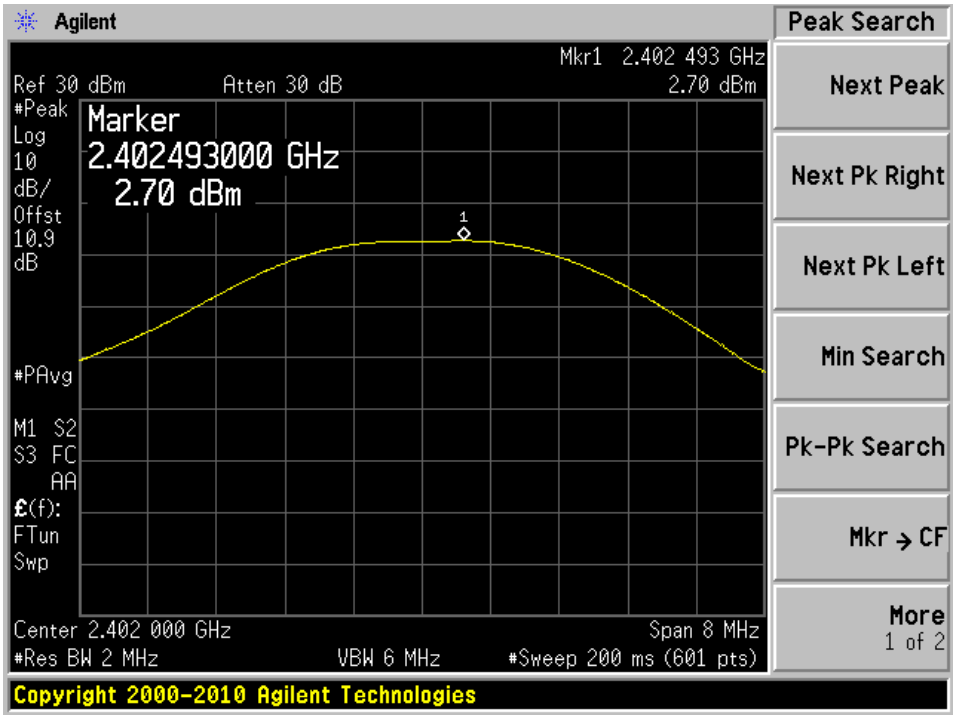
The testing was performed by Lionel Lara on 2012-06-20 at RF test site.

9.5 Test Results

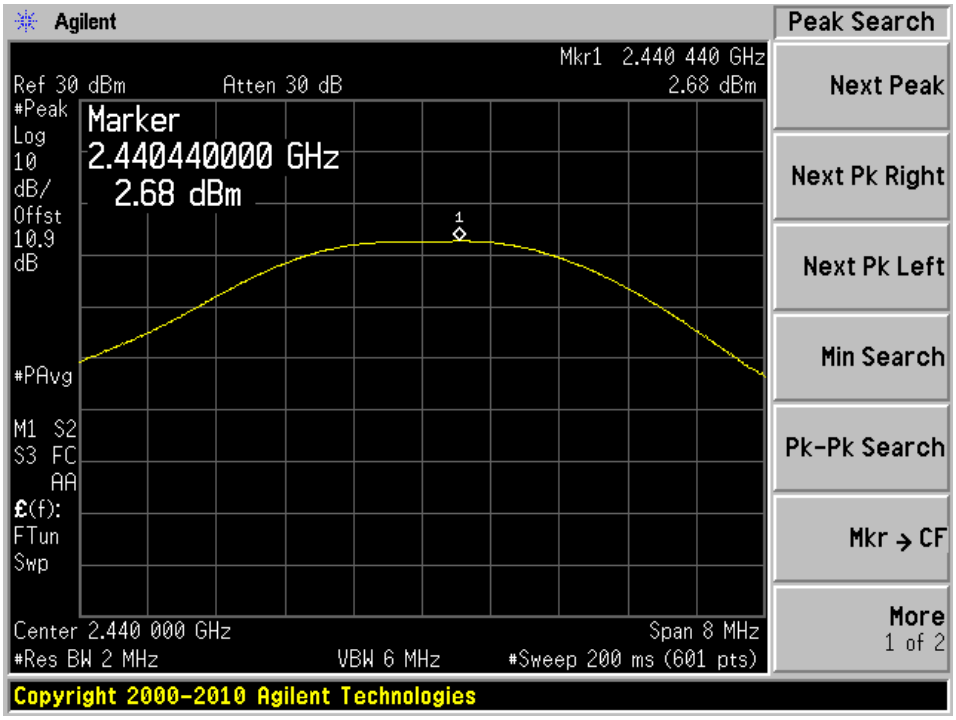
Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	2.70	1.86	1000	Pass
Mid	2440	2.68	1.85	1000	Pass
High	2480	2.86	1.93	1000	Pass

Please refer to the following plots.

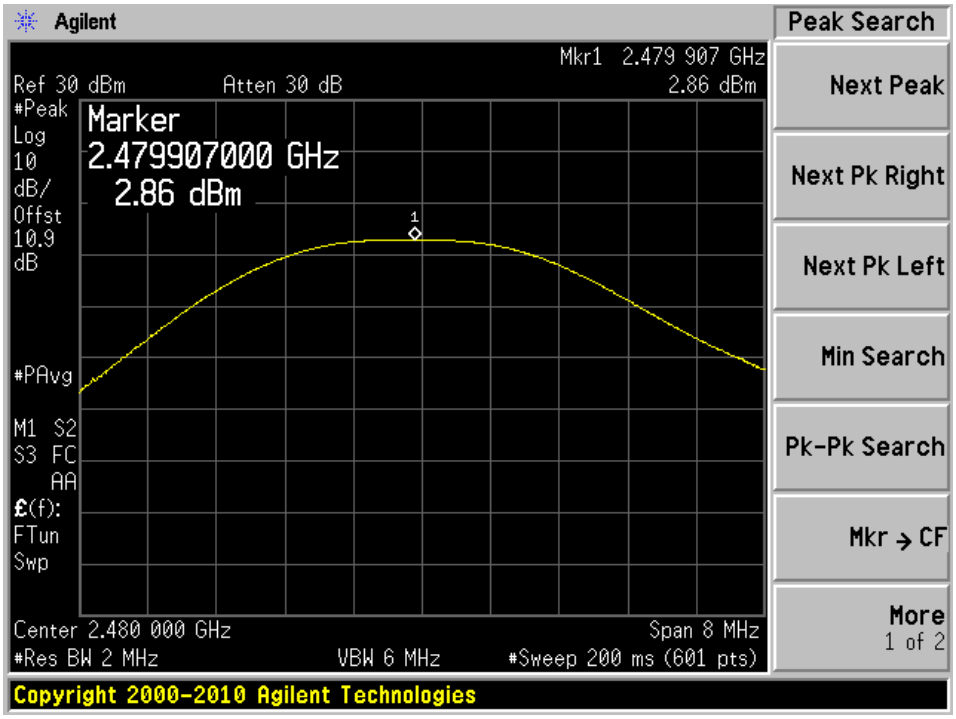
Low Channel



Middle Channel



High Channel



10 FCC §15.247(d) & IC RSS-210 §A8.5 - 100 kHz Bandwidth of Band Edges

10.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

According to IC RSS-210 §A8.5, 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.

10.2 Measurement 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.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2011-10-16	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

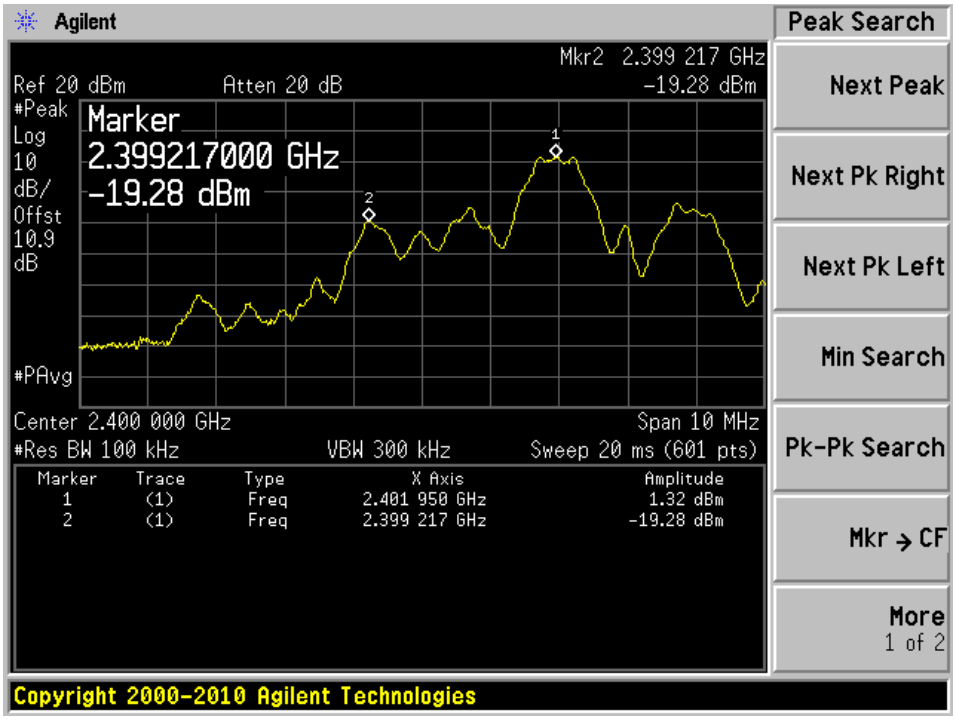
Temperature:	21 °C
Relative Humidity:	54 %
ATM Pressure:	101.5kPa

The testing was performed by Lionel Lara on 2012-06-20 at RF test site.

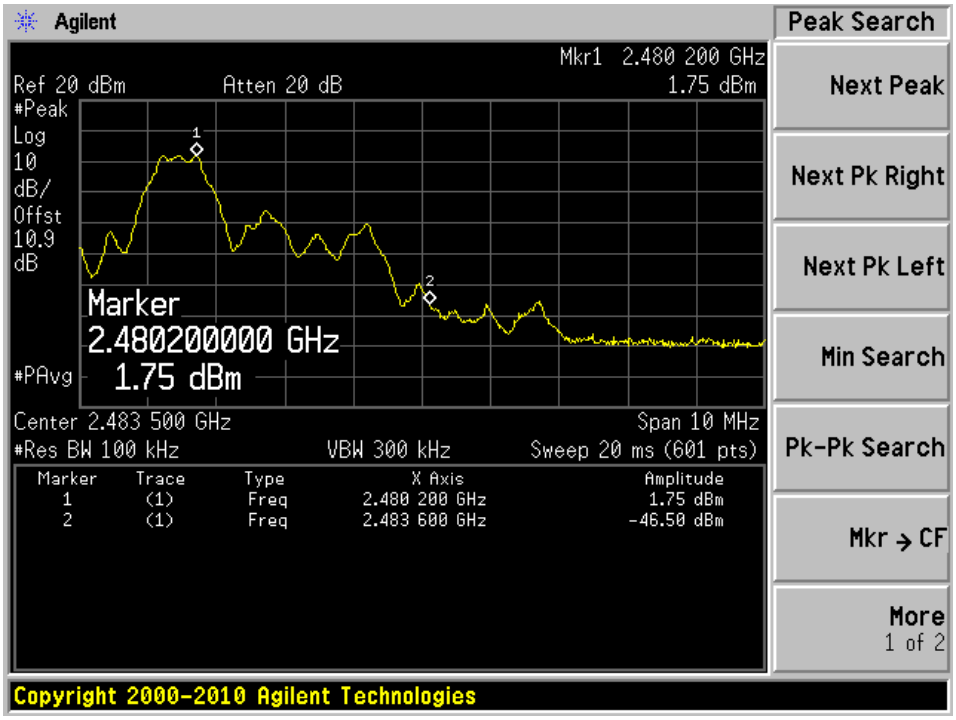
10.5 Test Results

Please refer to the following plots.

Low Channel



High Channel



11 FCC §15.247(d) & IC RSS-210 §A8.5 - Spurious Emissions at Antenna Terminals

11.1 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.

11.2 Measurement 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.

11.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2011-10-16	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

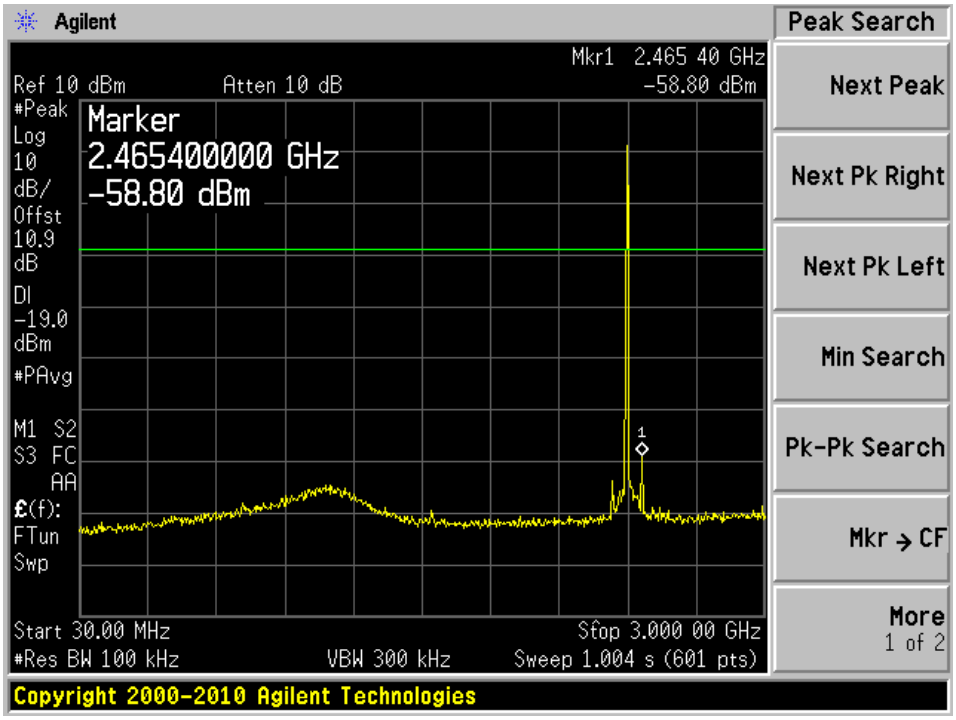
Temperature:	21 °C
Relative Humidity:	54 %
ATM Pressure:	101.5kPa

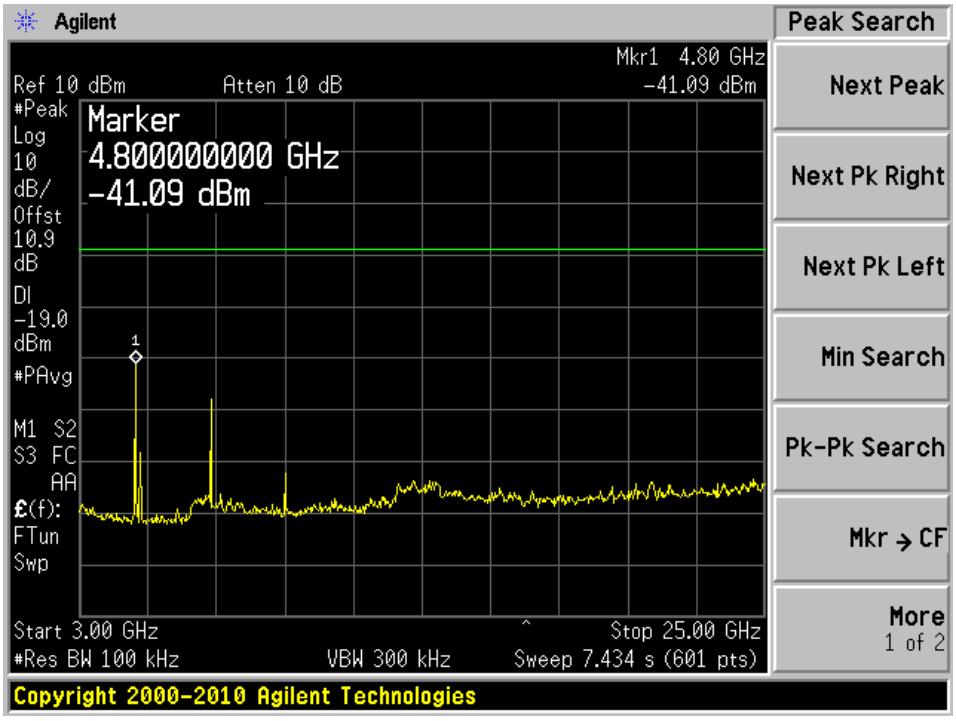
The testing was performed by Lionel Lara on 2012-06-20 at RF test site.

11.5 Test Results

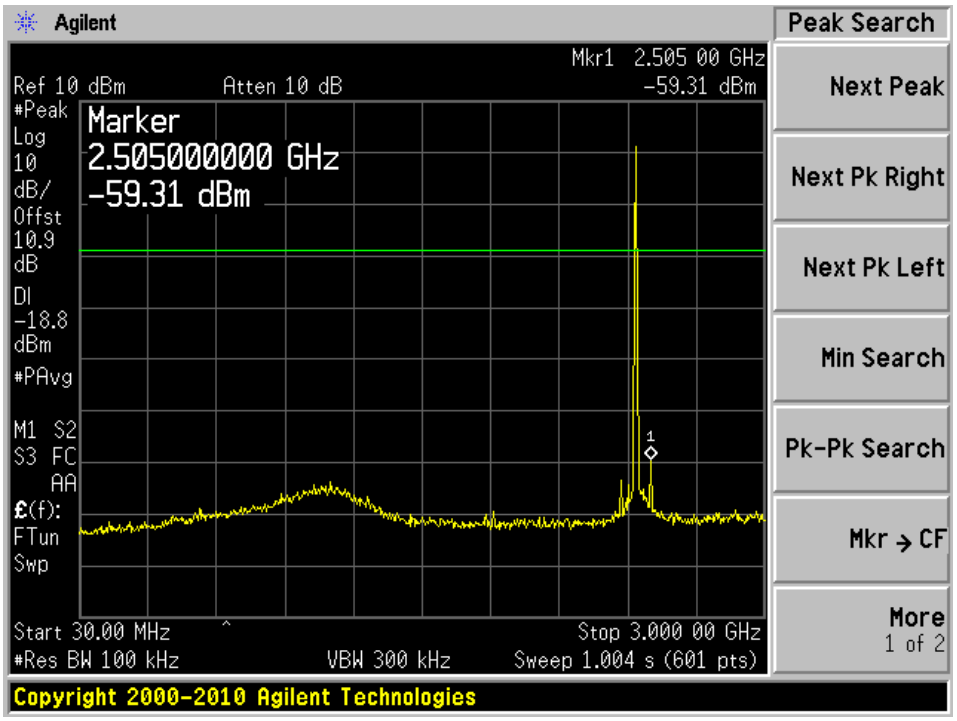
Please refer to the following plots.

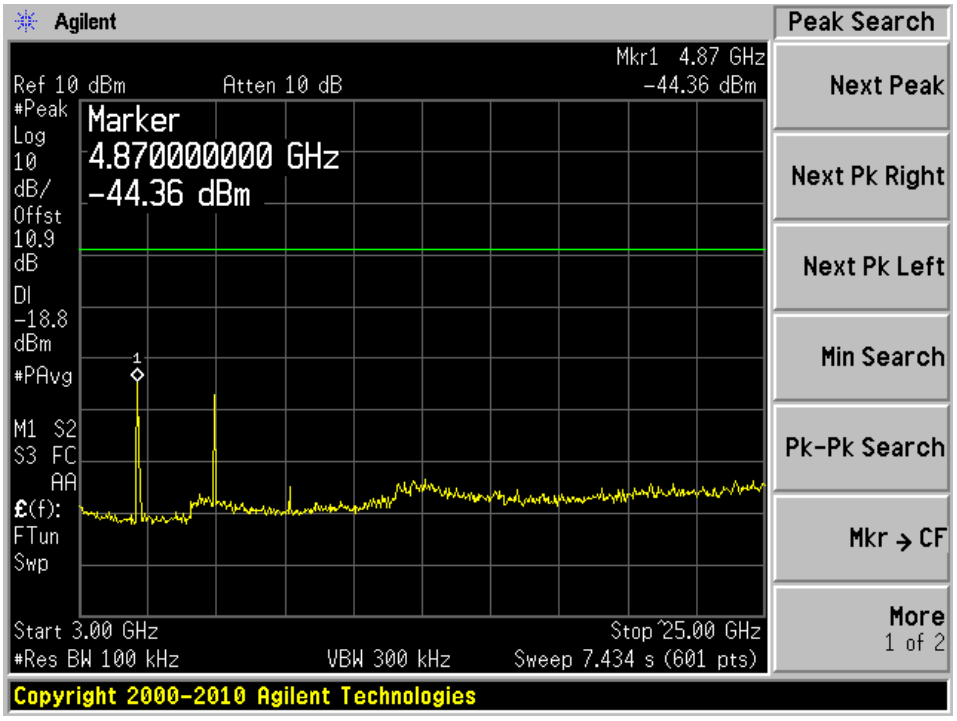
Low Channel


Agilent
Peak Search
Mkr1 2.465 40 GHz
Ref 10 dBm
Atten 10 dB
-58.80 dBm
#Peak
Log
10
dB/
Offst
10.9
dB
Dl
-19.0
dBm
#PAvg
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Marker
2.465400000 GHz
-58.80 dBm
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 30.00 MHz
#Res BW 100 kHz
VBW 300 kHz
Stop 3.000 00 GHz
Sweep 1.004 s (601 pts)
Copyright 2000-2010 Agilent Technologies

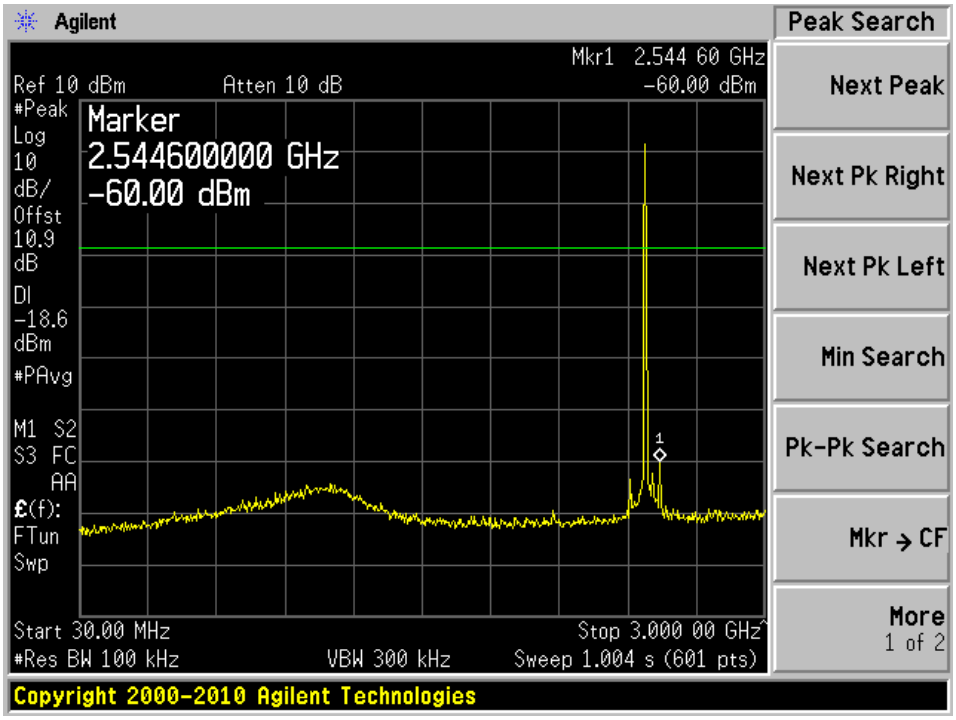

Agilent
Peak Search
Mkr1 4.80 GHz
Ref 10 dBm
Atten 10 dB
-41.09 dBm
#Peak
Log
10
dB/
Offst
10.9
dB
Dl
-19.0
dBm
#PAvg
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Marker
4.800000000 GHz
-41.09 dBm
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 3.00 GHz
#Res BW 100 kHz
VBW 300 kHz
Stop 25.00 GHz
Sweep 7.434 s (601 pts)
Copyright 2000-2010 Agilent Technologies

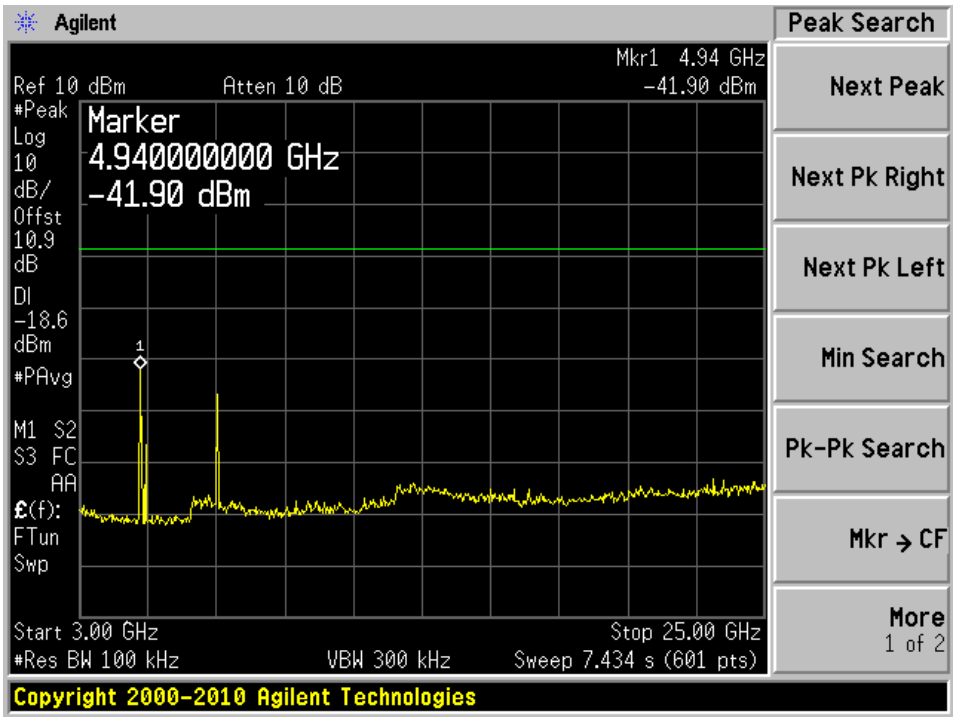
Middle Channel





High Channel





12 FCC §15.109 & IC RSS-Gen §6 - Receiver Radiated Spurious Emissions

12.1 Applicable Standards

FCC §15.109 and IC RSS-Gen §6

12.2 EUT Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2009.

12.3 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.

12.4 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)

12.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
EMCO	Horn Antenna	3115	9511-4627	2011-10-17	1 Year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 Year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 Year
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2011-10-16	1 Year
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10	1 Year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22	1 Year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	-

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

12.6 Test Environmental Conditions

Temperature:	20 °C
Relative Humidity:	58 %
ATM Pressure:	101.3kPa

The testing was performed by Lionel Lara on 2012-06-29 in 5 meter chamber 3.

12.7 Summary of Test Results

According to the test data,, the EUT complied with the FCC Part 15.109 and IC RSS-Gen, with the closest margins from the limit listed below:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-23.29	588.95	Horizontal	30 MHz to 1000 MHz
-10.33	12500	Horizontal	1 – 25 GHz

Please refer to the following table and plots for specific test result details

12.8 Test Results

1) 30 MHz -1 GHz, measured at 3 meters

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
100	5.59	100	H	0	43.5	-37.91
588.95	22.71	308	H	199	46	-23.29
900	22.28	100	H	0	46	-23.72

2) 1 – 25 GHz, measured at 3 meters

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)	
1100	38.81	0	100	H	24.69	1.88	27.03	38.35	74	-35.65	Peak
1100	38.81	0	100	V	24.18	1.88	27.03	37.84	74	-36.16	Peak
1100	23.96	0	100	H	24.69	1.88	27.03	23.5	54	-30.50	Ave
1100	23.96	0	100	V	24.18	1.88	27.03	22.99	54	-31.01	Ave
12500	41.02	0	100	H	38.31	6.47	26.9	58.9	74	-15.10	Peak
12500	41.02	0	100	V	38.26	6.47	26.9	58.85	74	-15.15	Peak
12500	25.79	0	100	H	38.31	6.47	26.9	43.67	54	-10.33	Ave
12500	25.79	0	100	V	38.26	6.47	26.9	43.62	54	-10.38	Ave

13 FCC §15.247(i), § 2.1093 & IC RSS-102 - RF Exposure Information

13.1 Applicable Standards

FCC §2.1093, §15.247(i).

According to FCC KDB 447498 section 1)

General test requirements and specific FCC test procedures

a) When required, portable devices must be evaluated using the *specific FCC test procedures*, and the SAR measurement techniques of OET Bulletin 65 Supplement C 01-01 and IEEE Std. 1528-2003.

b) When routine evaluation is required for SAR and the output power is $\leq 60/f_{(GHz)}$ mW, the test reduction and test exclusion procedures given herein, or in KDB 616217 and its supplement or KDB 648474, are applicable.[4]

c) Unless excluded by *specific FCC test procedures*, portable devices with output power $> 60/f_{(GHz)}$ mW shall include SAR data for equipment approval. The FCC Laboratory may be contacted if SAR is expected to be very low, especially for devices operating below 300 MHz, to determine if SAR evaluation is necessary.[5]

d) When applicable, 802.11 a/b/g devices should be tested according to the antenna diversity procedures in KDB 248227.[6] Contact the FCC Laboratory for antenna diversity test requirements, such as MIMO and beam-forming, in other product configurations.

13.2 Evaluation Result

The maximum conducted output power of this device is 2.86 dBm, the antenna gain is 3.3 dBi, the maximum e.i.r.p. is 2.86 + 3.3 = 6.16 dBm, i.e. 4.13 mW mW which is less than the SAR threshold of 10 mw (FCC KDB 447498 D01 Appendix A), and 20 mw (IC RSS-102 §2.5.1). SAR evaluation is not required.