FCC PART 15 SUBPART C

TEST AND MEASUREMENT REPORT

For

Wireless Cable, Inc.

2880 Zanker Road, Stite 203,

San Jose, CA 95134, USA

FCC ID: SQCBLE1K
Model: AIRcable BLE

Report Type:	**Product Type:**
Original Report	Bluetooth 4.0 Low Energy Module

Prepared By: Bo Li

Report Number: R1301253-247

Report Date: 2013-04-10

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1301253-247	Original Report	2013-04-10

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Wireless Cable Inc.* and their product FCC ID: SQCBLE1K, model: *AIRcable BLE* which will henceforth be referred to as the EUT (Equipment Under Testing). The EUT is a Bluetooth 4.0 Low Energy module.

1.2 Mechanical Description of EUT

The EUT measures approximately 31mm (L) x 14.5 mm (W) x 3.5 mm (H) and weighs 1.2g

The test data gathered are from typical production sample provided by the manufacturer, serial number: R5C78S (assigned by the BACL Sunnyvale.)

1.3 Objective

This report is prepared on behalf of *Wireless Cable Inc.* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15.247 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 C63.4-2003, 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 and ANSI C63.10-2009, American National Standard for Testing Unlicensed Wireless Devices.

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.

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.

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

2.2 EUT Exercise Software

The test utility used was WinSSD was provided by *Wireless Cable*, *Inc*., and was verified by *Bo Li* to comply with the standard requirements being tested against.

2.3 Special Equipment

There were no special accessories were required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

N/A

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
Wireless Cable	PCB board	AIRcable BLE	-

2.7 Interface Ports and Cables

Cable Description	Length (m)	To	From
RF Cable	<1.0	PSA	EUT

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.247(i), §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.247 (d)	Spurious Emissions at Antenna Port	Compliant
§15.209, §15.247(d), §15.205	Radiated Spurious Emissions Including Restricted Bands	Compliant
§15.247(a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Peak Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

4 FCC §15.247 (i) & §2.1091– RF Exposure

4.1 Applicable Standard

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	3.48
Maximum peak output power at antenna input terminal (mW):	2.23
Prediction distance (cm):	20
Prediction frequency (MHz):	2480
Maximum Antenna Gain, typical (dBi):	9
Maximum Antenna Gain (numeric):	7.943282
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0035
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure.

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2 Antenna List

Frequency Range (MHz)	Antenna Type/Pattern	Antenna Gain (dBi) @ 2.4 GHz
2400-2500	Omni	9

5.3 Result

The antenna consists of a non-standard (reversed SMA) connector with less 9 dBi gain; therefore, it complies with the antenna requirement.

6 FCC §15.207 - AC Power Line Conducted Emissions

6.1 Applicable Standard

Section 15.207 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 *	56 to 46 *
0.5-5	56	46
5-30	60	50

** Decreases with the logarithm of the frequency.*

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC Part15.207 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 unit was connected with LISN which provided 120 V / 60 Hz AC power.

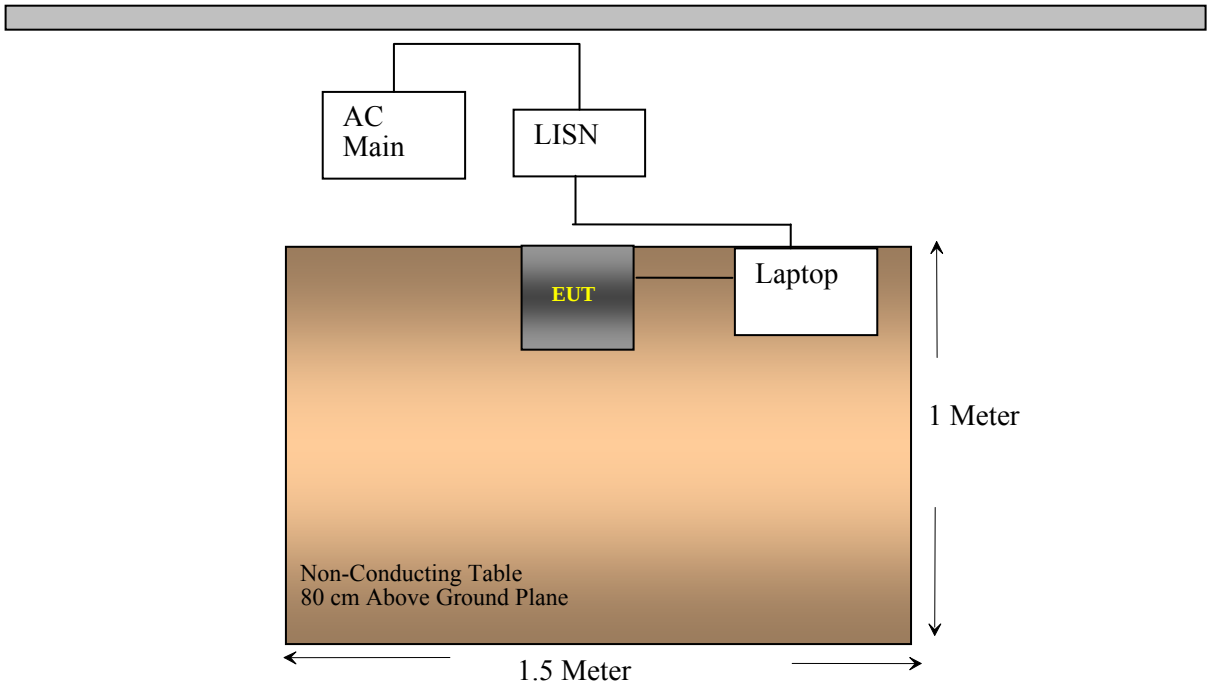
6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2012-04-18	1 year
Solar Electronics	LISN	9252-50-R-24-N	511205	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.*

6.4 Test Setup Block Diagram

Conducted Emissions



6.5 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".

6.6 Test Environmental Conditions

Temperature:	23°C
Relative Humidity:	43%
ATM Pressure:	102kPa

The testing was performed by Bo Li on 2013-02-26 at 5 meter 3.

6.7 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Part 15.207 standard's conducted emissions limits, with the *worst* margin reading of:

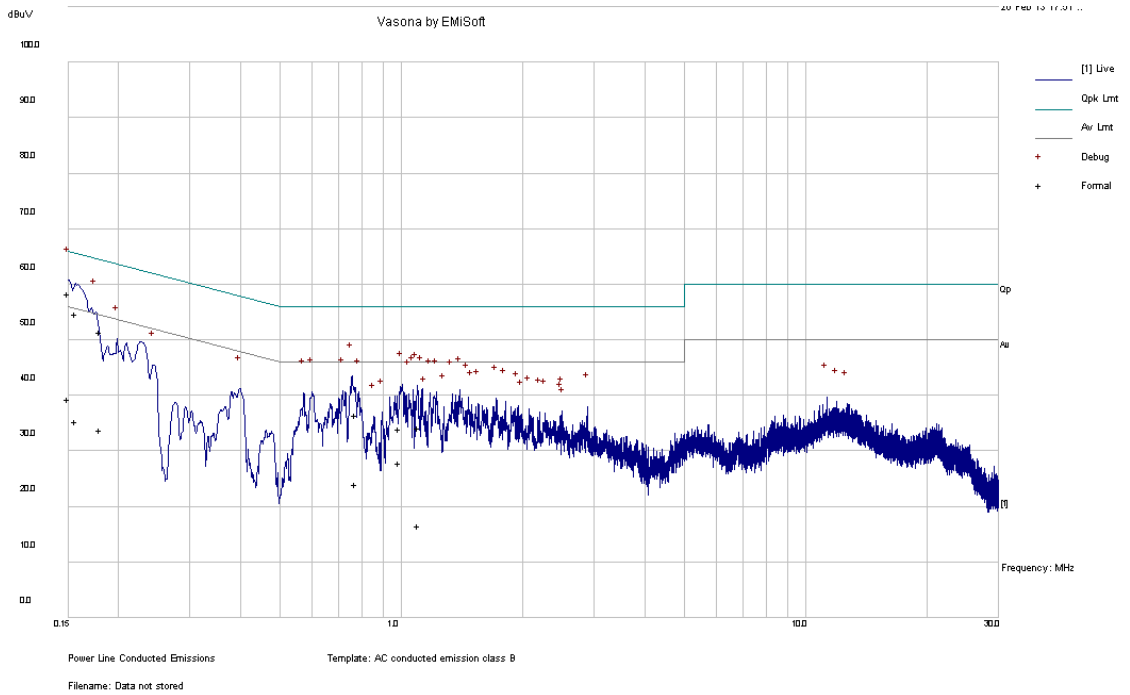
Connection: AC/DC adapter connected to 120 V/60 Hz AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-7.67	0.15022	Line	0.15 to 30

6.8 Conducted Emissions Test Plots and Data

Please refer to the following plots and tables.

Frequency: 2480 MHz (worst case)

120 V, 60 Hz – Line



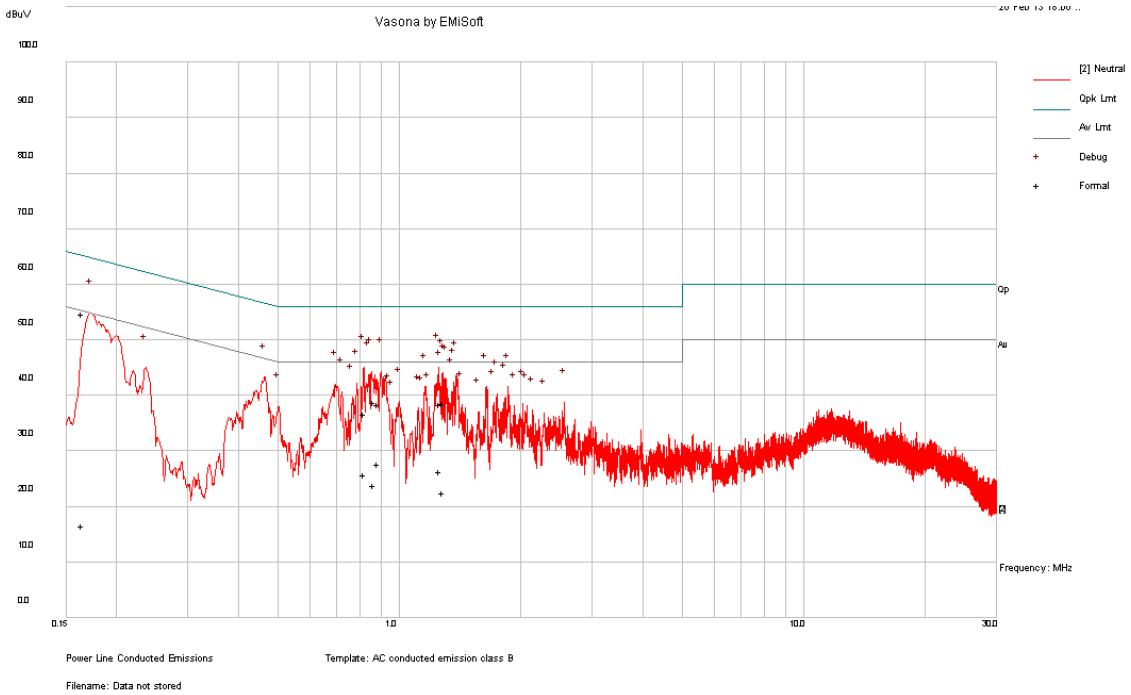
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.15022	58.31	Line	65.99	-7.67
0.157245	54.73	Line	65.61	-10.87
0.18075	51.54	Line	64.45	-12.92
0.771897	36.48	Line	56	-19.52
1.104189	34.3	Line	56	-21.70
0.988683	33.95	Line	56	-22.05

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.15022	39.47	Line	55.99	-16.52
0.988683	27.85	Line	46	-18.15
0.157245	35.3	Line	55.61	-20.31
0.18075	33.74	Line	54.45	-20.72
0.771897	24.02	Line	46	-21.98
1.104189	16.54	Line	46	-29.46

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.164364	54.62	Neutral	65.24	-10.62
0.867939	38.71	Neutral	56	-17.29
1.283811	38.52	Neutral	56	-17.48
1.25775	38.51	Neutral	56	-17.49
0.888123	38.44	Neutral	56	-17.56
0.82005	36.66	Neutral	56	-19.34

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.888123	27.65	Neutral	46	-18.35
1.25775	26.41	Neutral	46	-19.59
0.82005	25.85	Neutral	46	-20.15
0.867939	23.92	Neutral	46	-22.08
1.283811	22.47	Neutral	46	-23.53
0.164364	16.53	Neutral	55.24	-38.71

7 FCC §2.1051 & §15.247(d) – Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

For 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.

Requirements: CFR 47, §2.1051.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1057.

7.2 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.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	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:	23°C
Relative Humidity:	42%
ATM Pressure:	102kPa

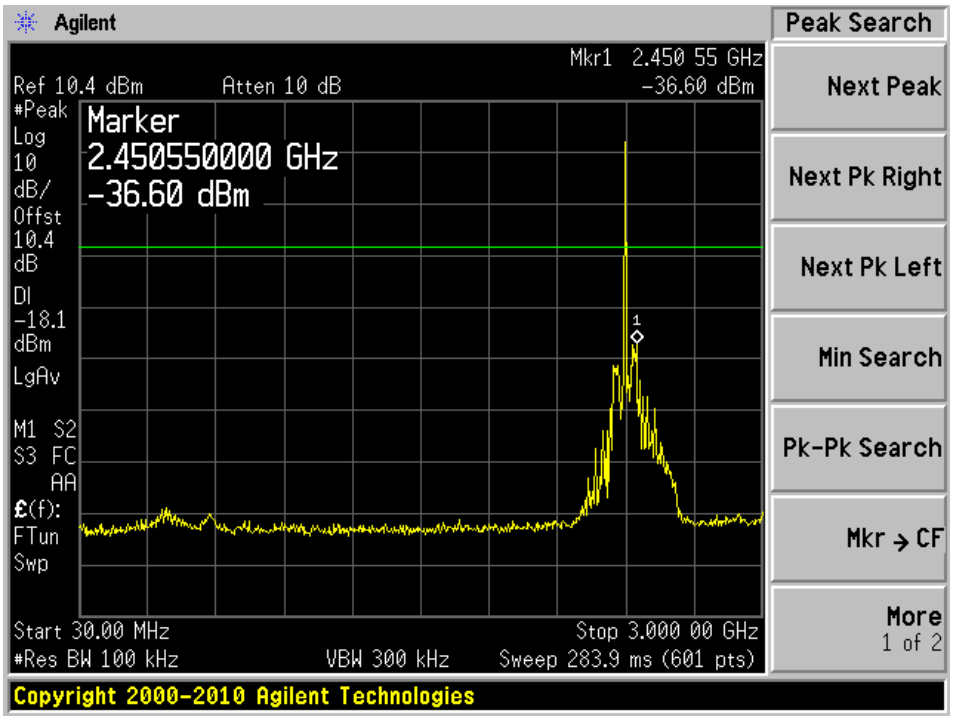
The testing was performed by Bo Li on 2013-02-27 at RF site.

7.5 Test Results

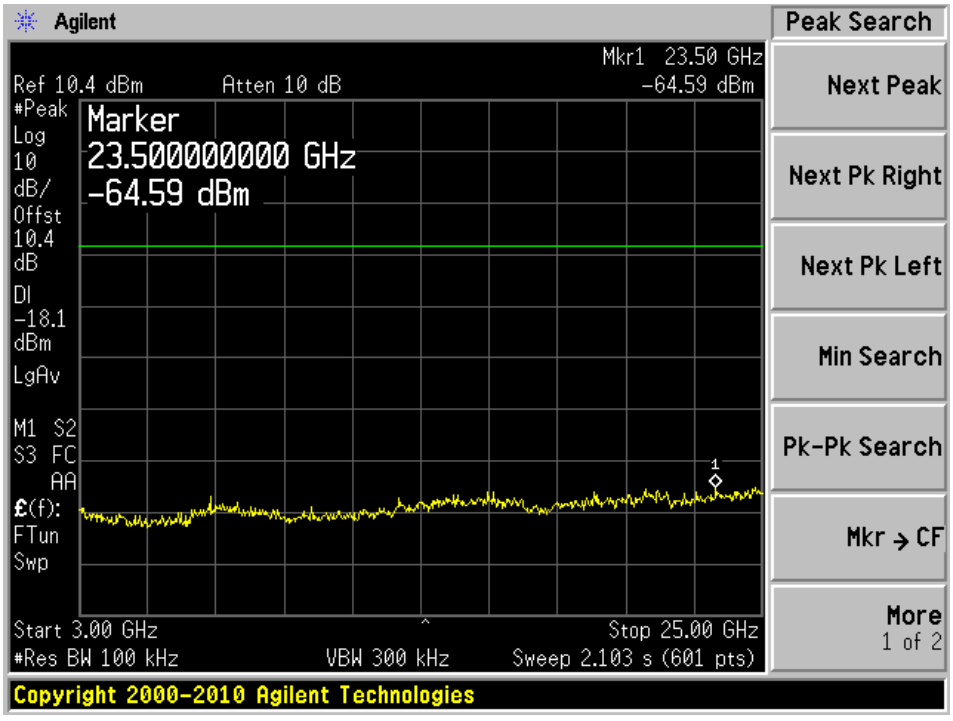
Please refer to following plots of spurious emissions.

Low Channel, 2402 MHz

30 MHz – 3 GHz

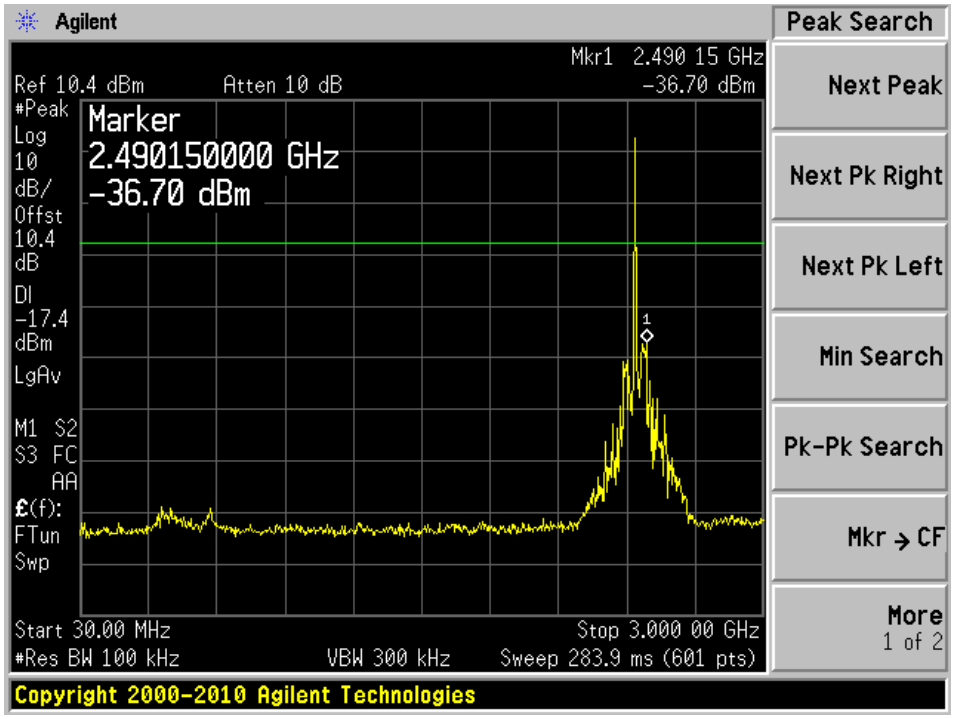


3 GHz – 25 GHz

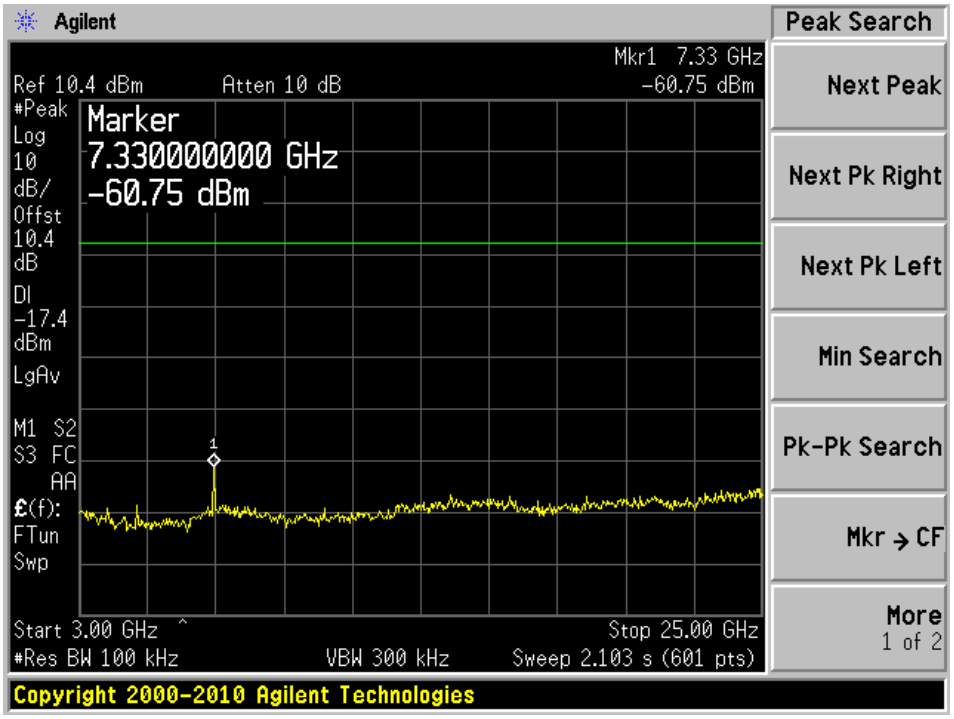


Middle Channel, 2440 MHz

30 MHz – 3 GHz

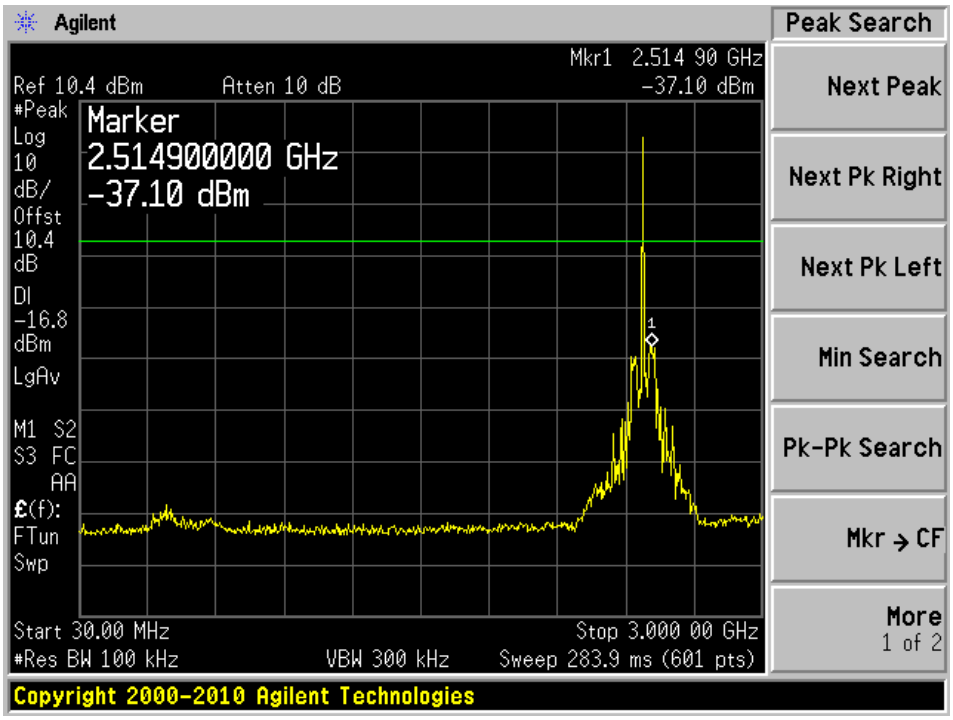


3 GHz – 25 GHz

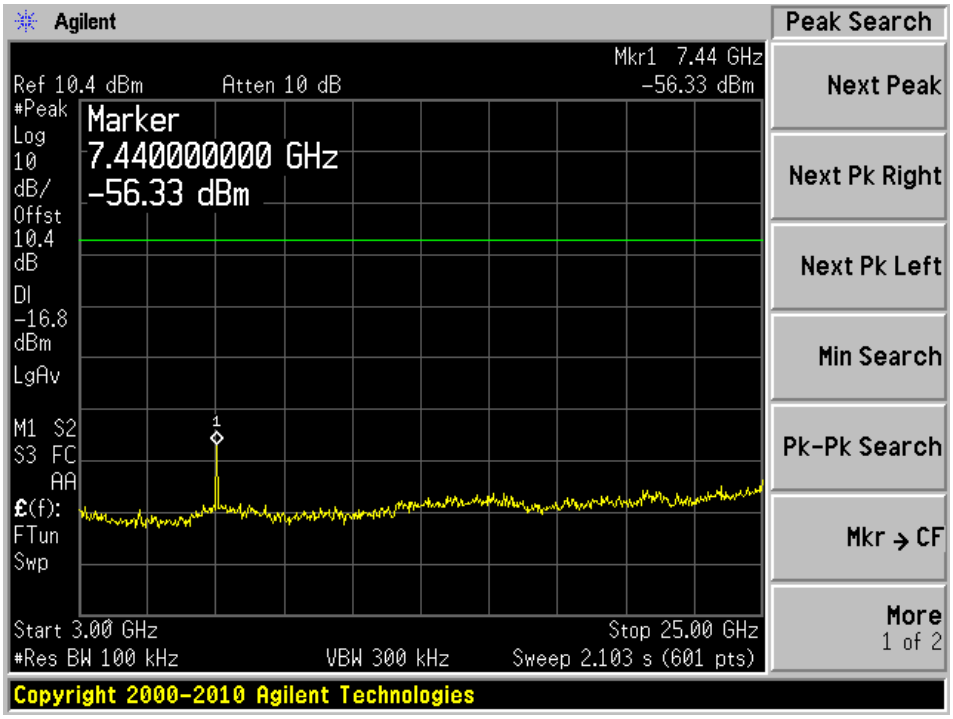


High Channel, 2480 MHz

30 MHz – 3 GHz



3 GHz – 25 GHz



8 FCC §15.205, §15.209 & §15.247(d) – 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	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	156.52480 – 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).

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

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 indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (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 = Corrected Amplitude - Limit

8.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 year
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year
EMCO	Horn Antenna	3315	9511-4627	2012-10-17	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22	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:	22-23°C
Relative Humidity:	43%
ATM Pressure:	102kPa

The testing was performed by Bo Li on 2013-02-26 and 2013-02-27 at 5M chamber 2 and 5M chamber 3.

8.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel**
-6.11	399.99925	Horizontal	High Channel

1 – 25 GHz:

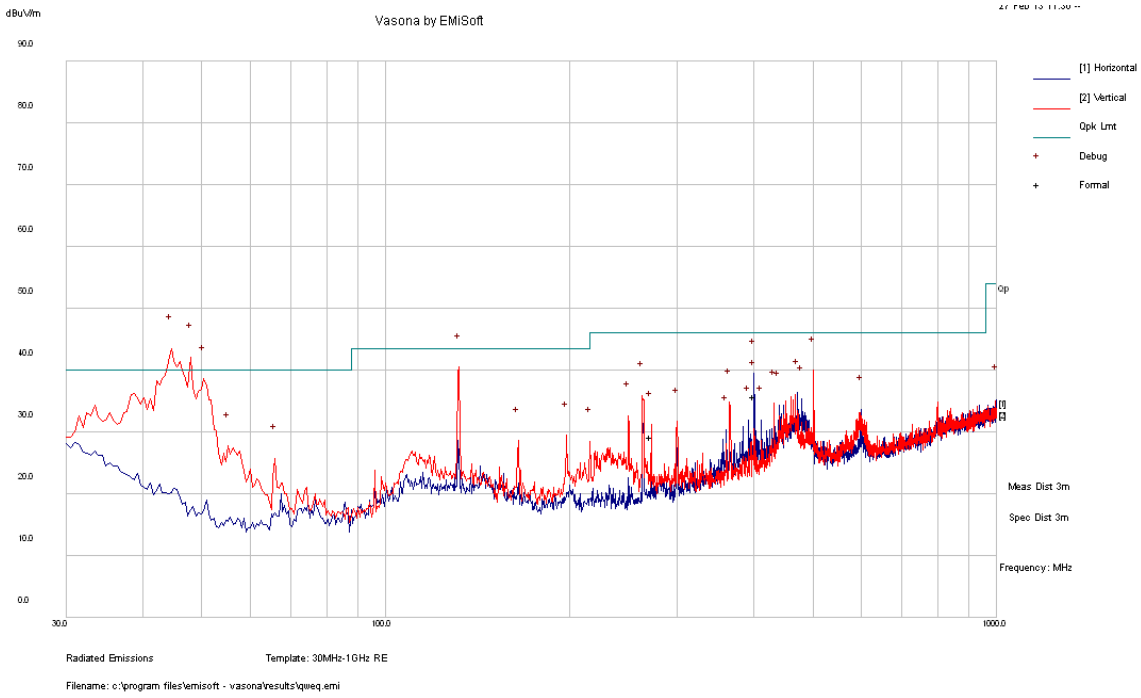
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel**
-0.358	2354	Vertical	Low Channel

Please refer to the following table for specific test result details

8.8 Radiated Emissions Test Data and Plots

1) 30-1000 MHz, measured at 3 meters distance

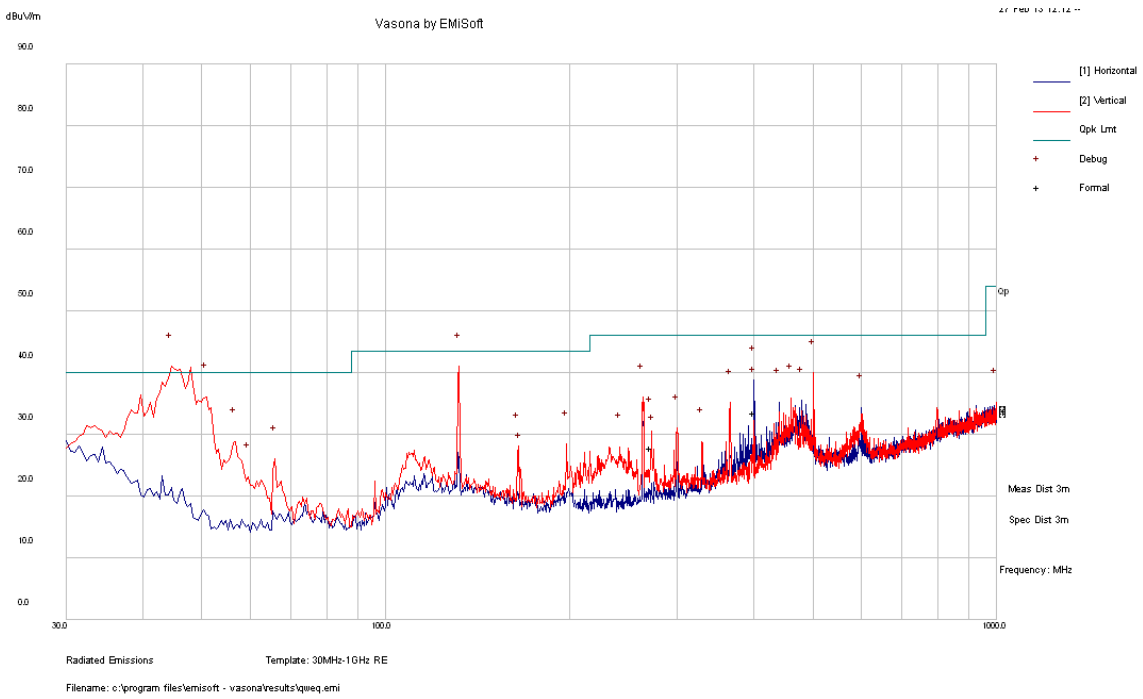
Low Channel: 2402 MHz



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBuV)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBuV)	Margin (dB)
400.88925	35.81	214	H	321	46	-10.19
271.87575	29.29	101	V	360	46	-16.71

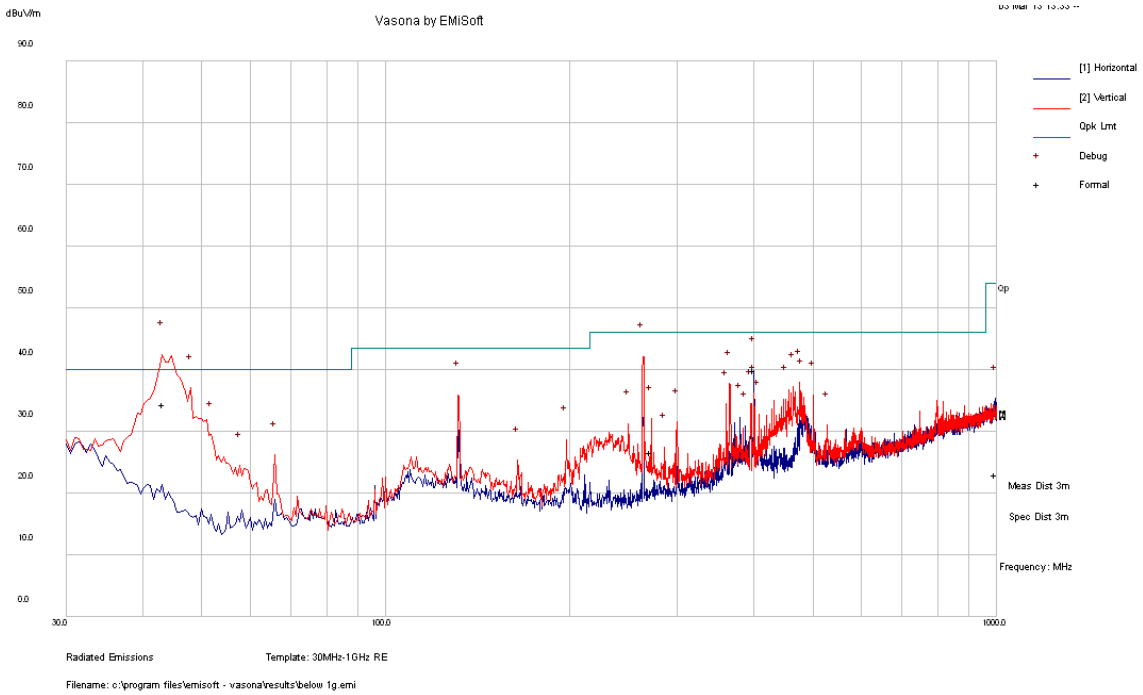
Middle Channel: 2440 MHz



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBuV)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBuV)	Margin (dB)
400.91375	33.5	281	H	320	46	-12.50
271.846	27.79	112	V	334	46	-18.21

High Channel: 2480 MHz



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBuV)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBuV)	Margin (dB)
399.99925	39.89	302	H	35	46	-6.11
271.8745	26.66	134	V	77	46	-19.34
994.83975	23.06	401	H	307	54	-30.94

2) 1 – 25 GHz, measured at 3 meters distance

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2402 MHz, measured at 3 meters											
2402	70.42	267	100	V	28.956	3.12	0	102.496	-	-	Fun/Peak
2402	61.23	72	100	H	28.956	3.12	0	93.306	-	-	Fun/Peak
2402	50.1	267	100	V	28.956	3.12	0	82.176	-	-	Fun/Ave
2402	44.1	72	100	H	28.956	3.12	0	76.176	-	-	Fun/Ave
2354	32.03	264	100	V	28.192	3.12	0	63.342	74	-10.658	Peak
2354	28.67	72	100	H	28.192	3.12	0	59.982	74	-14.018	Peak
2354	22.33	264	100	V	28.192	3.12	0	53.642	54	-0.358	Ave
2354	17.09	72	100	H	28.192	3.12	0	48.402	54	-5.598	Ave
4804	32.35	0	100	V	33.097	4.56	27.7	42.307	74	-31.693	Peak
4804	32.27	0	100	H	33.097	4.56	27.7	42.227	74	-31.773	Peak
4804	18.02	0	100	V	33.097	4.56	27.7	27.977	54	-26.023	Ave
4804	17.71	0	100	H	33.097	4.56	27.7	27.667	54	-26.333	Ave
7206	40.02	164	137	V	35.928	5.49	27.58	53.858	82.496	-28.638	Peak
7206	35.56	338	100	H	35.928	5.49	27.58	49.398	73.306	-23.908	Peak
7206	27.96	164	137	V	35.928	5.49	27.58	41.798	62.176	-20.378	Ave
7206	23.49	338	100	H	35.928	5.49	27.58	37.328	56.176	-18.848	Ave
9608	31.31	0	100	V	37.954	6.54	27.06	48.744	82.496	-33.752	Peak
9608	31.1	0	100	H	37.954	6.54	27.06	48.534	73.306	-24.772	Peak
9608	16.26	0	100	V	37.954	6.54	27.06	33.694	62.176	-28.482	Ave
9608	16.27	0	100	H	37.954	6.54	27.06	33.704	56.176	-22.472	Ave
Middle Channel 2440 MHz, measured at 3 meters											
2440	71.4	268	100	V	28.956	3.12	0	103.476	-	-	Fun/Peak
2440	61.4	72	100	H	28.956	3.12	0	93.476	-	-	Fun/Peak
2440	50.71	268	100	V	28.956	3.12	0	82.786	-	-	Fun/Ave
2440	44.31	72	100	H	28.956	3.12	0	76.386	-	-	Fun/Ave
4880	32.94	0	100	V	33.327	4.54	27.76	43.047	74	-30.953	Peak
4880	33.32	0	100	H	33.327	4.54	27.76	43.427	74	-30.573	Peak
4880	20.01	0	100	V	33.327	4.54	27.76	30.117	54	-23.883	Ave
4880	17.94	0	100	H	33.327	4.54	27.76	28.047	54	-25.953	Ave
7320	43.03	325	100	V	36.369	5.57	27.51	57.459	74	-16.541	Peak
7320	38.59	15	100	H	36.369	5.57	27.51	53.019	74	-20.981	Peak
7320	31.1	325	100	V	36.369	5.57	27.51	45.529	54	-8.471	Ave
7320	27.04	15	100	H	36.369	5.57	27.51	41.469	54	-12.531	Ave
9760	30.92	0	100	V	38.287	6.62	26.98	48.847	83.476	-34.629	Peak
9760	31.43	0	100	H	38.287	6.62	26.98	49.357	73.476	-24.119	Peak
9760	16.55	0	100	V	38.287	6.62	26.98	34.477	62.786	-28.309	Ave
9760	16.865	0	100	H	38.287	6.62	26.98	34.792	56.386	-21.594	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 2480 MHz, measured at 3 meters											
2480	70.91	282	100	V	29.155	3.25	0	103.315	-	-	Fun/Peak
2480	62.24	72	100	H	29.155	3.25	0	94.645	-	-	Fun/Peak
2480	50.79	282	100	V	29.155	3.25	0	83.195	-	-	Fun/Ave
2480	44.49	72	100	H	29.155	3.25	0	76.895	-	-	Fun/Ave
2483.5	38.94	258	100	V	29.155	3.25	0	71.345	74	-2.655	Peak
2483.5	34.01	219	100	H	29.155	3.25	0	66.415	74	-7.585	Peak
2483.5	20.22	258	100	V	29.155	3.25	0	52.625	54	-1.375	Ave
2483.5	16.65	219	100	H	29.155	3.25	0	49.055	54	-4.945	Ave
4960	33.7	14	100	V	33.327	4.52	27.75	43.797	74	-30.203	Peak
4960	32.8	0	100	H	33.327	4.52	27.75	42.897	74	-31.103	Peak
4960	21.74	14	100	V	33.327	4.52	27.75	31.837	54	-22.163	Ave
4960	17.69	0	100	H	33.327	4.52	27.75	27.787	54	-26.213	Ave
7440	44.4	337	107	V	36.565	5.62	27.51	59.075	74	-14.925	Peak
7440	40.34	6	100	H	36.565	5.62	27.51	55.015	74	-18.985	Peak
7440	32.09	337	107	V	36.565	5.62	27.51	46.765	54	-7.235	Ave
7440	28.77	6	100	H	36.565	5.62	27.51	43.445	54	-10.555	Ave
9920	31.02	0	100	V	38.287	6.55	26.98	48.877	88.225	-39.348	Peak
9920	31.16	0	100	H	38.287	6.55	26.98	49.017	90.605	-41.588	Peak
9920	16.97	0	100	V	38.287	6.55	26.98	34.827	85.235	-50.408	Ave
9920	16.46	0	100	H	38.287	6.55	26.98	34.317	87.905	-53.588	Ave

9 FCC §15.247(a)(2) – 6 dB & 99% Emission Bandwidth

9.1 Applicable Standard

According to §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

9.2 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 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	US42221851	2012-02-28	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:	23°C
Relative Humidity:	42%
ATM Pressure:	102kPa

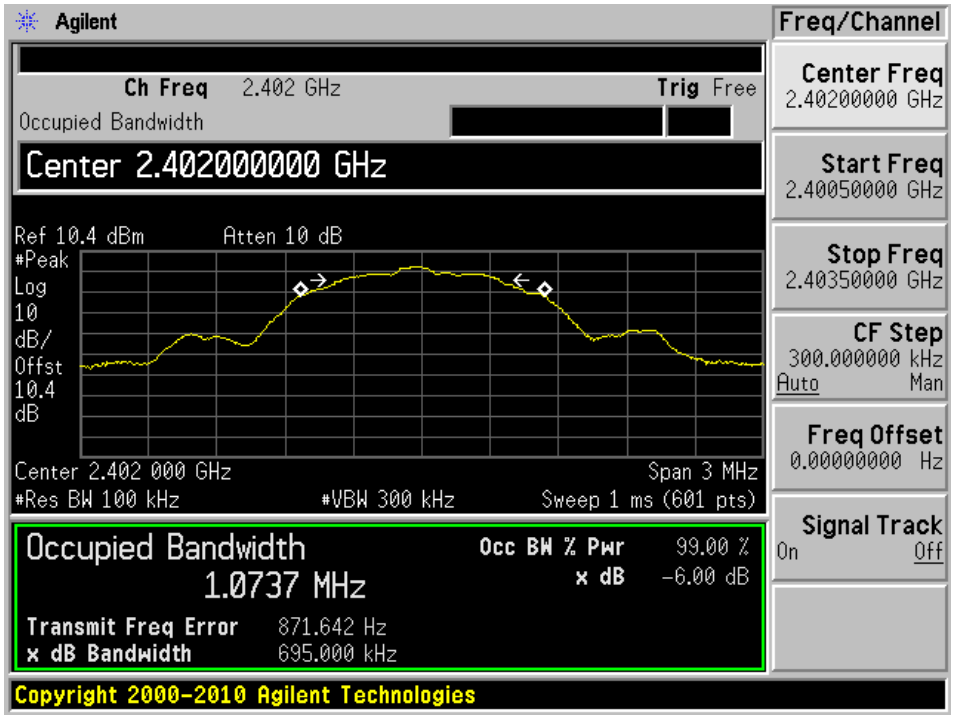
The testing was performed by Bo Li on 2013-02-27 at RF site.

9.5 Test Results

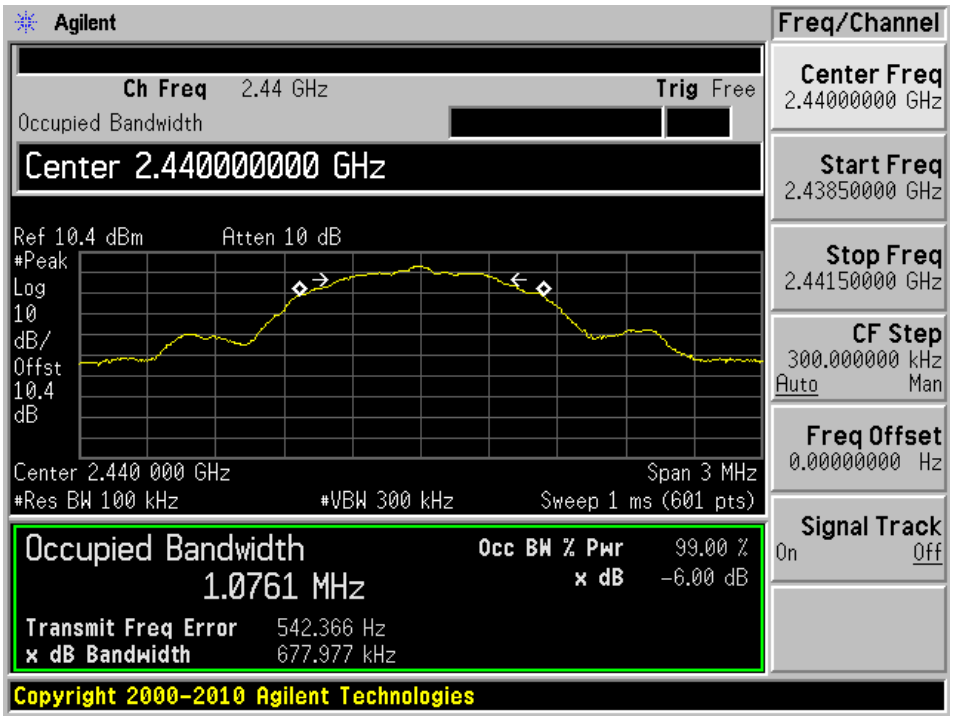
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (kHz)	6 dB OBW Limit (MHz)	Results
Low	2402	1.0737	695	> 0.5	Compliant
Middle	2440	1.0761	677.977	> 0.5	Compliant
High	2480	1.0800	674.973	> 0.5	Compliant

Please refer to the following plots for detailed test results

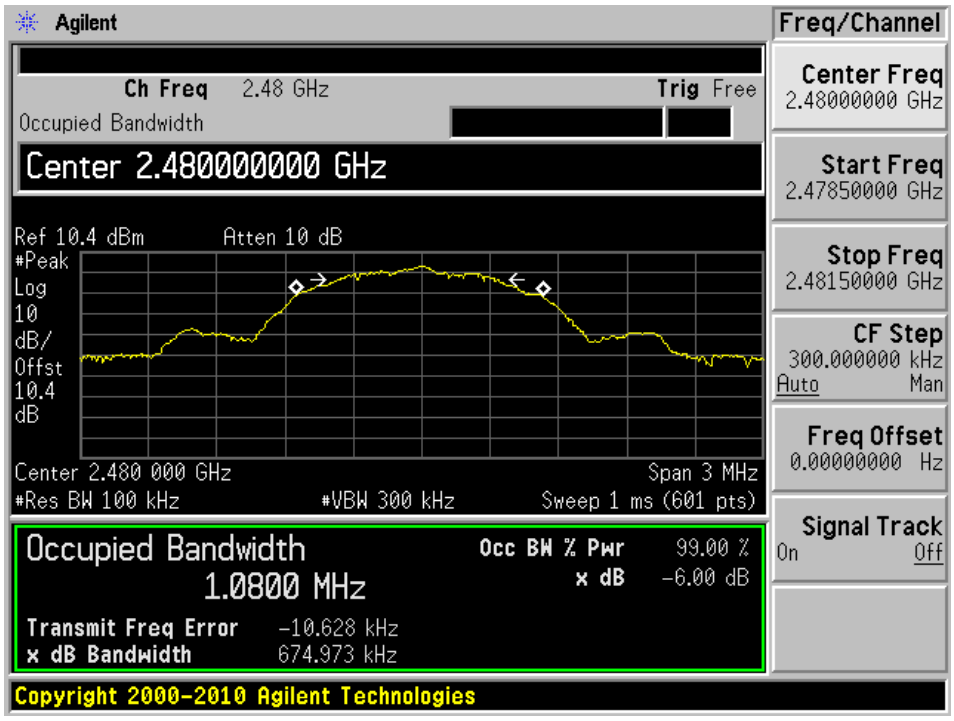
Low channel: 2402 MHz



Middle channel: 2440 MHz



High channel: 2480 MHz



10 FCC §15.247(b) – Peak Output Power Measurement

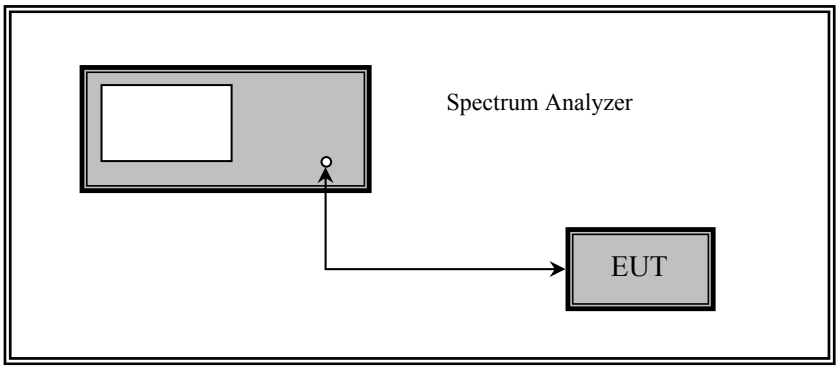
10.1 Applicable Standard

FCC §15.247(b) the maximum peak output power of the intentional radiator shall not exceed the following:

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.

10.2 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.



10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	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:	23°C
Relative Humidity:	42%
ATM Pressure:	102kPa

The testing was performed by Bo Li on 2013-02-27 at RF site.

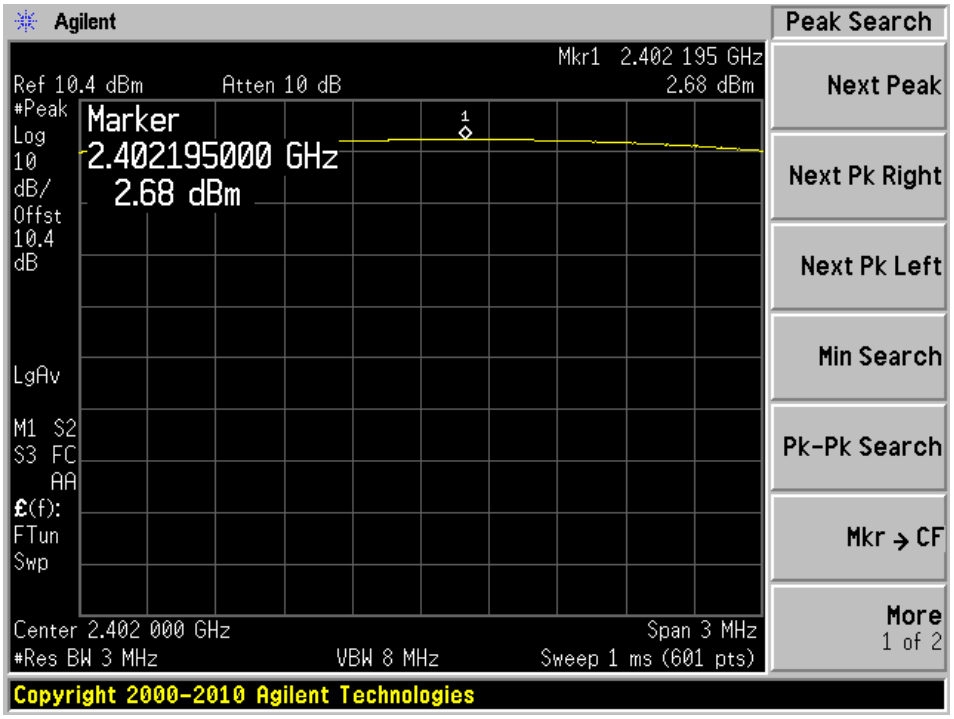
10.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	FCC Limit (dBm)	Margin (dB)
Low	2402	2.68	27	-24.32
Middle	2440	3.38	27	-23.62
High	2480	3.48	27	-23.52

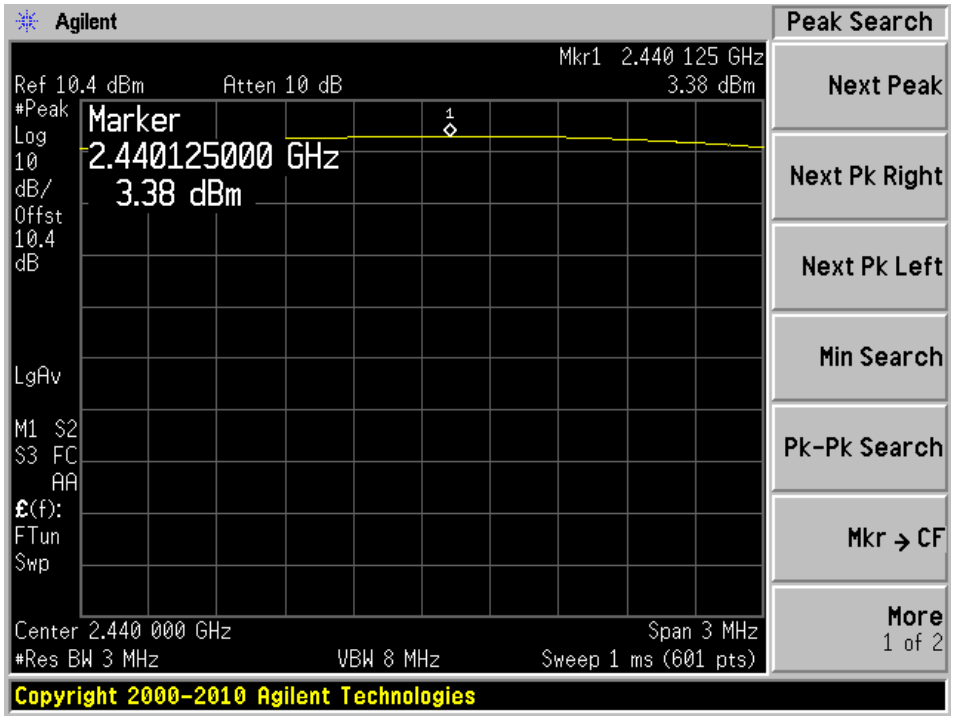
Note: The antenna gain is 9 dBi which is over 6 dBi, the conducted output power limit need to be reduced to 27 dBm.

Please refer to the following plots.

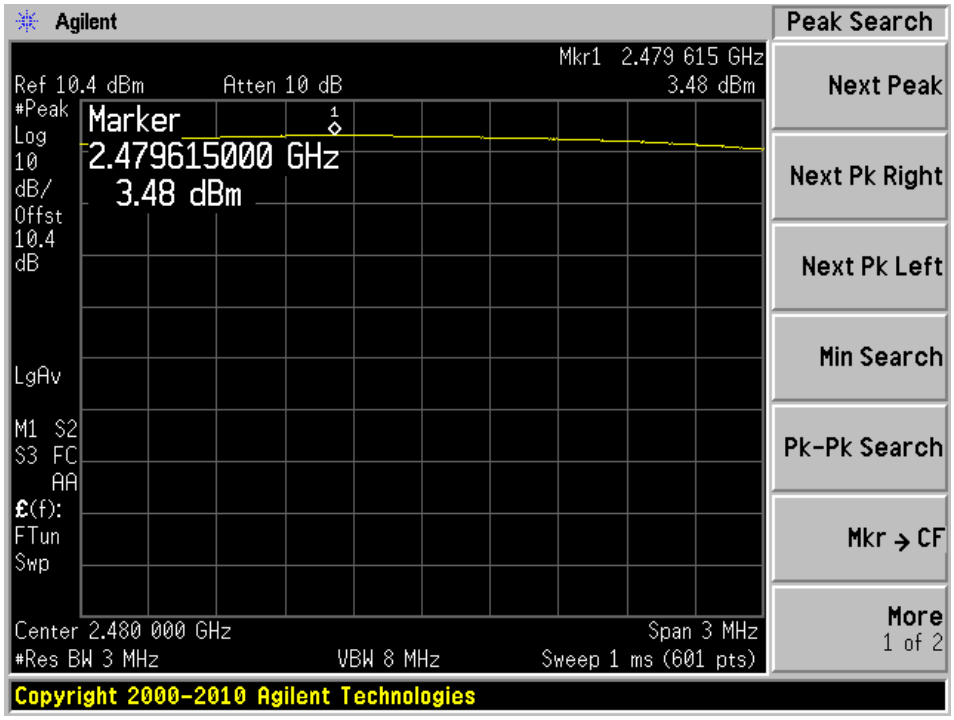
Low channel: 2402 MHz



Middle channel: 2440 MHz



High channel: 2480 MHz



11 FCC §15.247(d) – 100 kHz Bandwidth of Band Edges

11.1 Applicable Standard

According to §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)).

11.2 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.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	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

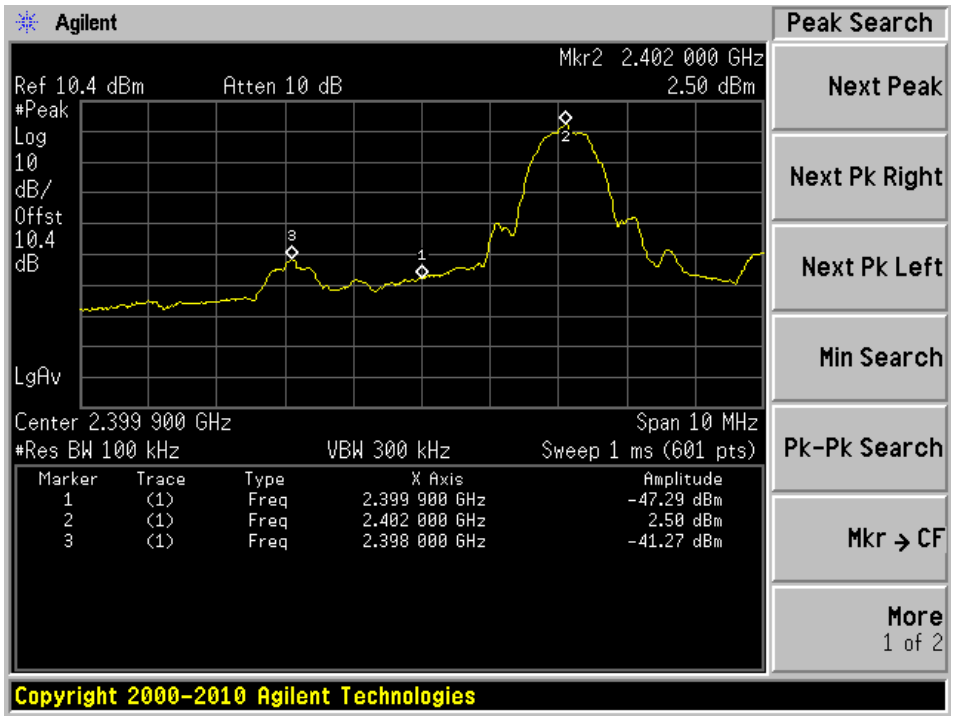
Temperature:	23°C
Relative Humidity:	42%
ATM Pressure:	102kPa

The testing was performed by Bo Li on 2013-02-27 at RF site.

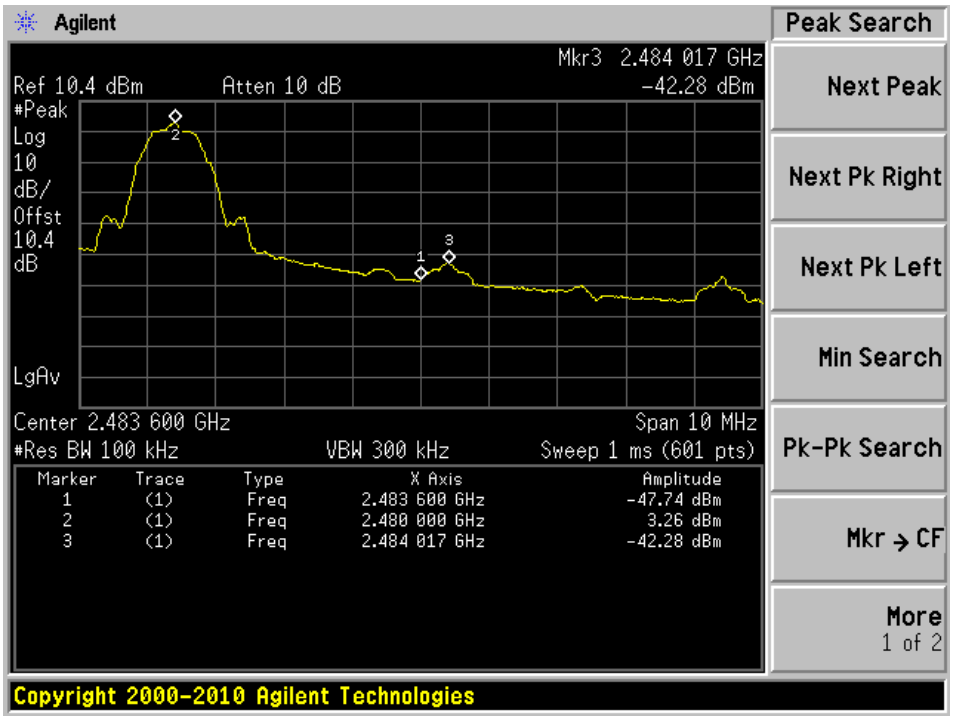
11.5 Test Results

Please refer to following pages for plots of band edge.

Low Band Edge



High Band Edge



12 FCC §15.247(e) – 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.

12.2 Measurement Procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW ≥ 3 kHz.
4. Set the VBW ≥ 3 x RBW.
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 amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	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:	23°C
Relative Humidity:	42%
ATM Pressure:	102kPa

The testing was performed by Bo Li on 2013-02-27 at RF site.

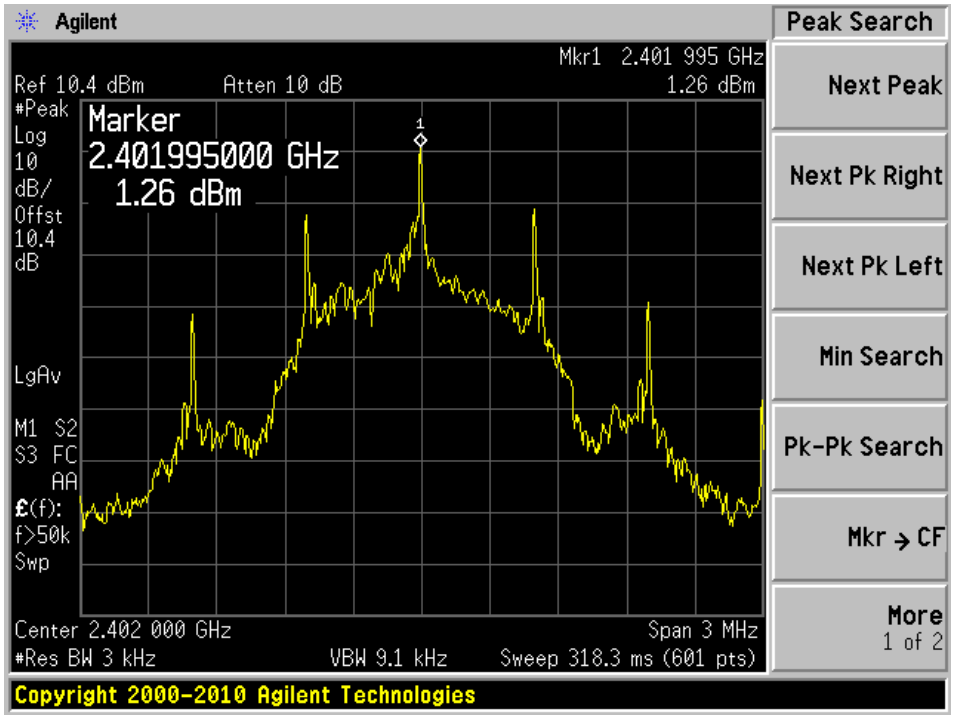
12.5 Test Results

Channel	Frequency (MHz)	PSD (dBm)	FCC Limit (dBm)	Margin (dB)
Low	2402	1.26	5	-3.74
Middle	2440	1.95	5	-3.05
High	2480	2.1	5	-2.9

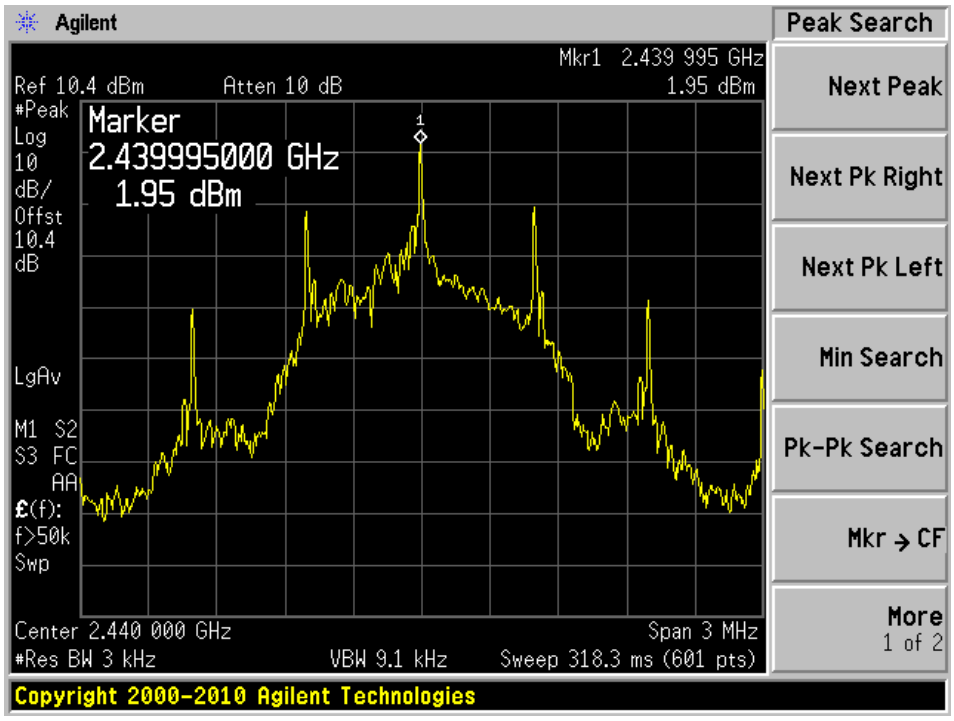
Note: The antenna gain is 9 dBi which is over 6 dBi, the PSD limit need to be reduced to 5 dBm.

Please refer to the following plots for detailed test results:

Low channel: 2402 MHz



Middle channel: 2440 MHz



High channel: 2480 MHz