FCC PART 15, SUBPART C
IC RSS-210, ISSUE 8, DECEMBER 2010

TEST AND MEASUREMENT REPORT

For

Woodman Labs, Inc. (dba GoPro)

3000 Clearview Way, Bldg. E,

San Mateo, CA 94402, USA

FCC ID: CNFCHDHX302
IC: 10193A-CHDHX302

Report Type:	**Product Type:**
Original Report	Portable Camera

Prepared By:	Bo Li
Report Number:	R1306191-247
Report Date:	2013-07-16
Reviewed By:	Quinn Jiang

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732-9164

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1306191-247	Original Report	2013-07-16

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Woodman Labs, Inc. (dba GoPro)*, and their product model: *CHDHX-302* with FCC ID: CNFCHDHX302, IC: 10193A-CHDHX302 for the "EUT" as referred on this report is a Portable Camera with 802.11 b/g/n20 Technologies.

1.2 Mechanical Description of EUT

The EUT measures approximately 57 mm (L) x 40 mm (W) x 20 mm (H) and weighs approximately 74.5g.

The test data gathered are from typical production sample
Serial number: R1306191-1 for Conducted Tests.
Serial number: R1306191-2 for Radiated Tests

Provided by BACL

1.3 Objective

This report is prepared on behalf of *Woodman Labs, Inc. (dba GoPro)*. 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, AC Line Conducted Emissions, 6 dB Bandwidth, 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.

1.7 Test Facility

Bay area compliance Laboratories Corp. (BACL) is:
1- An independent Commercial Test Laboratory accredited to **ISO 17025: 2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminares and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65:1996** by **A2LA** to certify:
1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).
6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

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 C63.4-2009, 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.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

The software used for test were Putty provided by BACL, 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

Manufacturer	Description	Model No.	Serial No.
DELL	Laptop	PP18L	PF329 A03

2.6 EUT Internal Configuration Details

Manufacturer	Description	Type	Serial Number
Woodman Labs, Inc (dba GoPro)	Front Panel PCB	-	130531
Woodman Labs, Inc (dba GoPro)	Main PCB	AT&S MX3 SH 2013 94V-B	-

2.7 Interface Ports and Cables

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

2.8 Power Supply List and Details

Manufacturer	Description	Model	Part Number
GoPro	AC/DC adapter	AWALC-001(TSC-5D)	WALCD0213020015

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §15.247(i), §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 §15.247 (d) 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(a)(2) IC RSS-210 §A8.2	6 dB Emission Bandwidth	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
FCC §15.247(e) IC RSS-210 §A8.2(b)	Power Spectral Density	Compliant
IC RSS-210 §2.3 & RSS-Gen §6.1	Receiver Spurious Emission	Compliant

4 FCC §15.247 (i), §2.1093 & IC RSS 102– RF Exposure

4.1 Applicable Standard

FCC §15.247(i), §2.1093 & IC RSS-102

4.2 Test Result

Please refer to SAR report, report number: R1306191 FCC SAR.

5 FCC §15.203 & IC RSS-Gen §7.1.2 – 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.

According to IC RSS-Gen §7.1.2: Transmitter Antenna

A transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be 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 RSS-210 or RSS-310 for devices of RF output powers of 10 mW or less. For devices of output powers greater than 10 mW, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

5.2 Antenna List

Antenna Model	Antenna Gain (dBi)
BAWA	-3.0

The antenna is permanently soldered onto the PCB and the gain is less than 6 dBi; therefore, it complies with the antenna requirement.

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

6.1 Applicable Standards

As per FCC §15.207 and 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 *	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 C63.4-2009 measurement procedure. The specification used was FCC §15.207 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

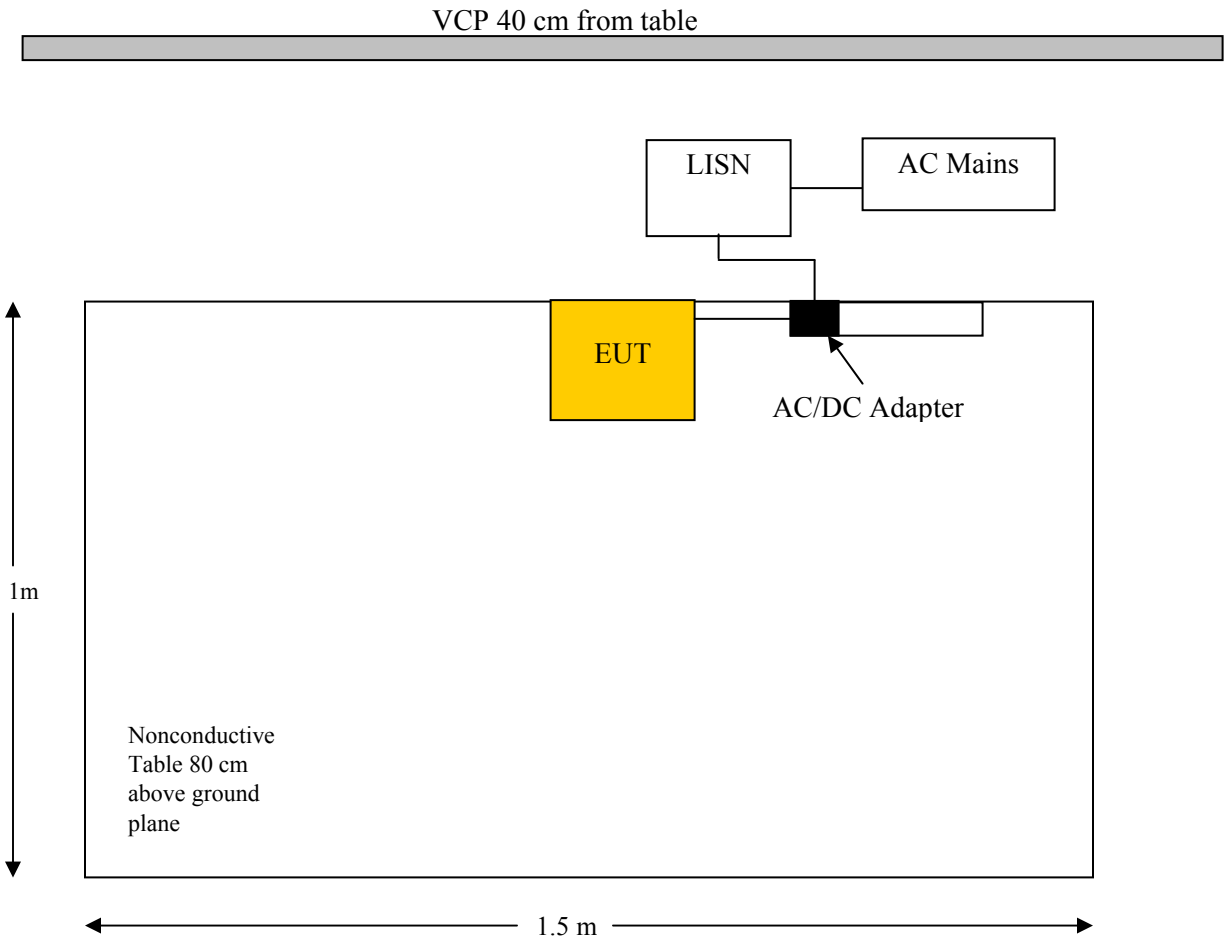
During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cord of the support equipment was connected to LISN-2.

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

AC/DC Adaptor:



6.5 Corrected Amplitude & Margin Calculation

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

CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (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 = Corrected Amplitude - Limit

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2013-03-28	1 year
Solar Electronics	LISN	9252-50-R-24-N	511205	2013-06-25	1 year
TTE	Filter, High Pass	H9962-150K-50-21378	K7133	2013-05-30	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:	22º C
Relative Humidity:	50 %
ATM Pressure:	101.60 kPa

The testing was performed by Bo Li on 2013-06-25 in 5m chamber3.

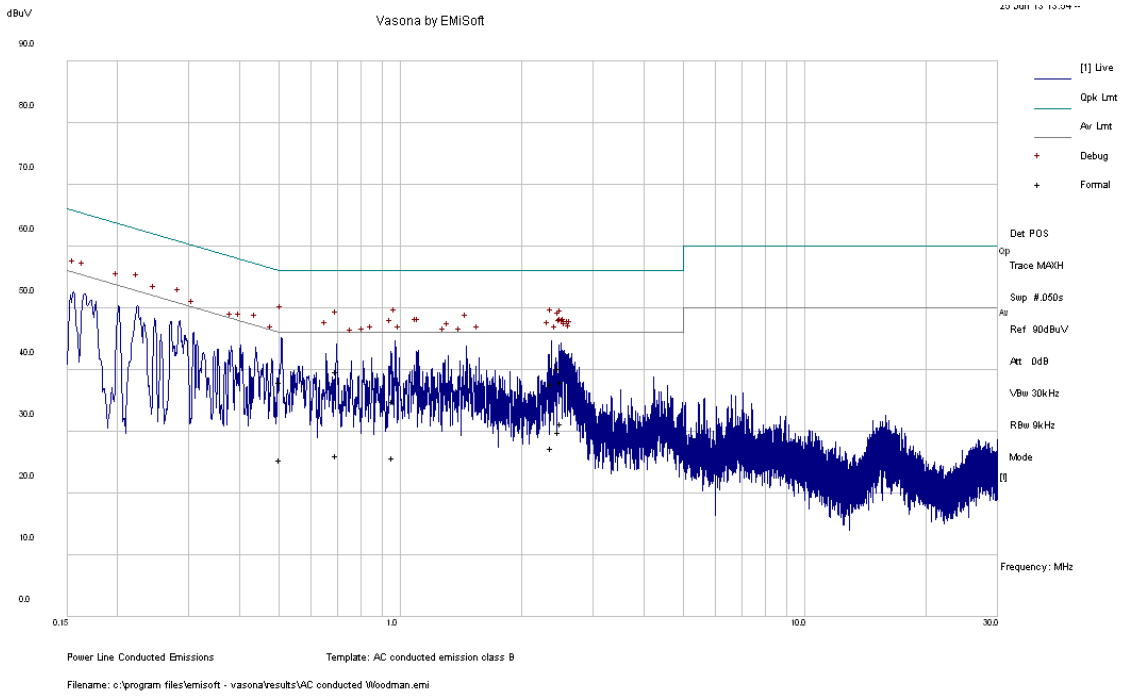
6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15C and IC RSS-210 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 Mode (Line/Neutral)**	**Range (MHz)**
-12.06	0.455838	Neutral	0.15-30

6.9 Conducted Emissions Test Plots and Data

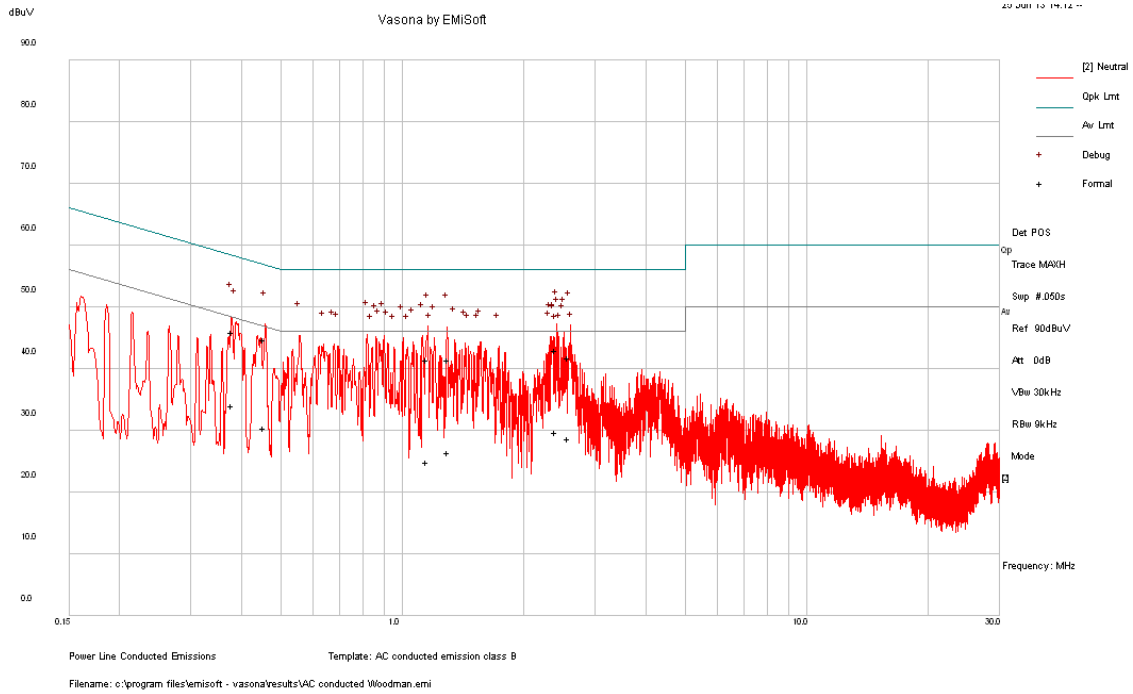
120 V, 60 Hz – Line, AC/DC Adaptor



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.50604	38.01	Line	56	-17.99	QP
2.371819	37.75	Line	56	-18.25	QP
0.962508	34.89	Line	56	-21.11	QP
2.498484	38.03	Line	56	-17.97	QP
0.6966	39.81	Line	56	-16.19	QP
2.47691	40.28	Line	56	-15.72	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.50604	25.41	Line	46	-20.59	Ave.
2.371819	27.41	Line	46	-18.59	Ave.
0.962508	25.78	Line	46	-20.22	Ave.
2.498484	31.3	Line	46	-14.7	Ave.
0.6966	26.06	Line	46	-19.94	Ave.
2.47691	29.93	Line	46	-16.07	Ave.

120 V, 60 Hz – Neutral, AC/DC Adaptor



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
2.395792	43.02	Neutral	56	-12.98	QP
2.582807	41.75	Neutral	56	-14.25	QP
1.154424	41.51	Neutral	56	-14.49	QP
1.300569	41.49	Neutral	56	-14.51	QP
0.455838	44.71	Neutral	56.77	-12.06	QP
0.378768	45.98	Neutral	58.31	-12.32	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
2.395792	29.67	Neutral	46	-16.33	Ave.
2.582807	28.79	Neutral	46	-17.21	Ave.
1.154424	24.98	Neutral	46	-21.02	Ave.
1.300569	26.52	Neutral	46	-19.48	Ave.
0.455838	30.45	Neutral	46.77	-16.31	Ave.
0.378768	34.14	Neutral	48.31	-14.17	Ave.

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 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	E4446A	US44300386	2012-09-29	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:	22 °C
Relative Humidity:	40 %
ATM Pressure:	101.5 kPa

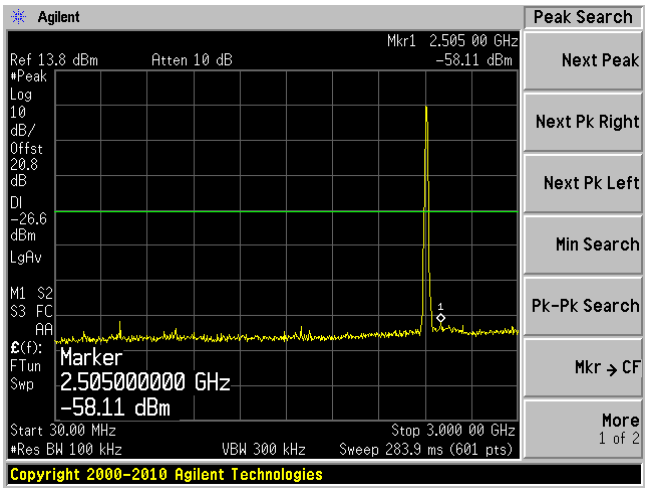
The testing was performed by Bo Li on 2013-6-20 at RF site.

7.5 Test Results

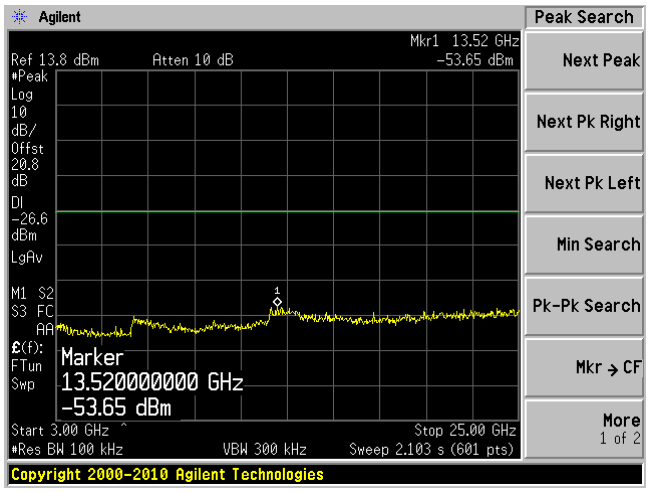
Please refer to following plots of spurious emissions.

802.11b, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

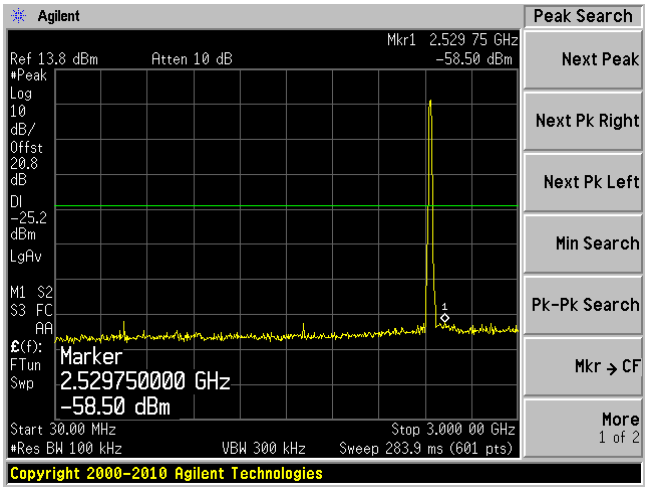


Plot: 3 GHz – 25 GHz

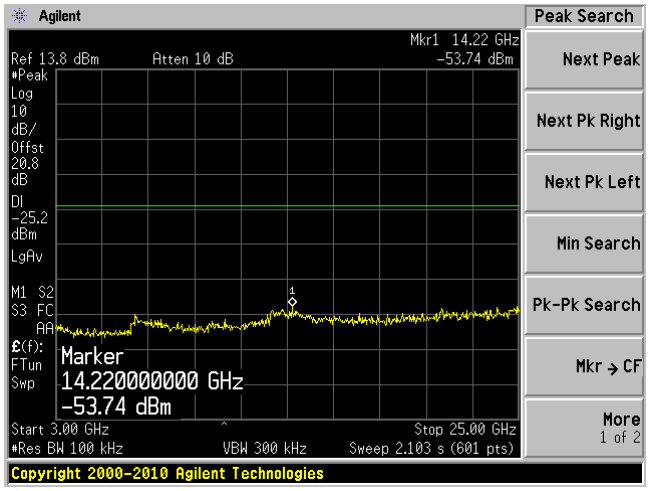


802.11b, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

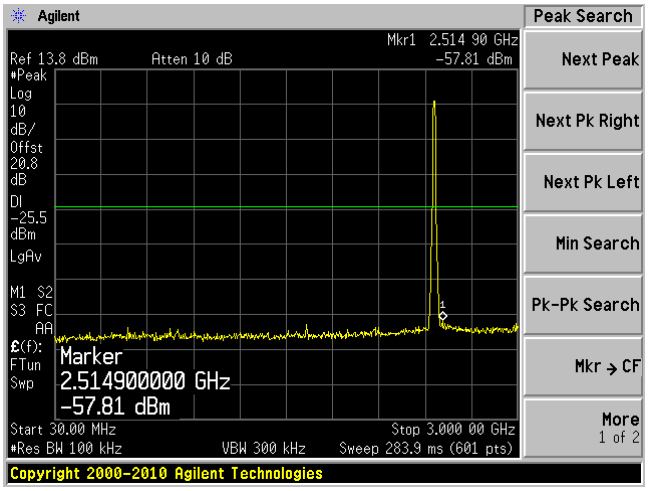


Plot: 3 GHz – 25 GHz

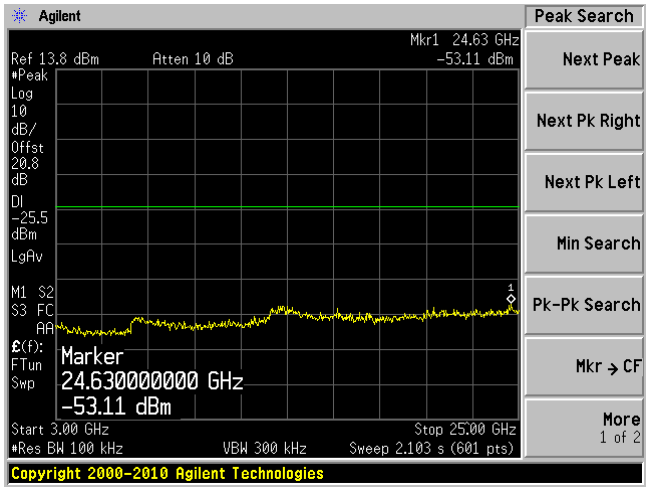


802.11b, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

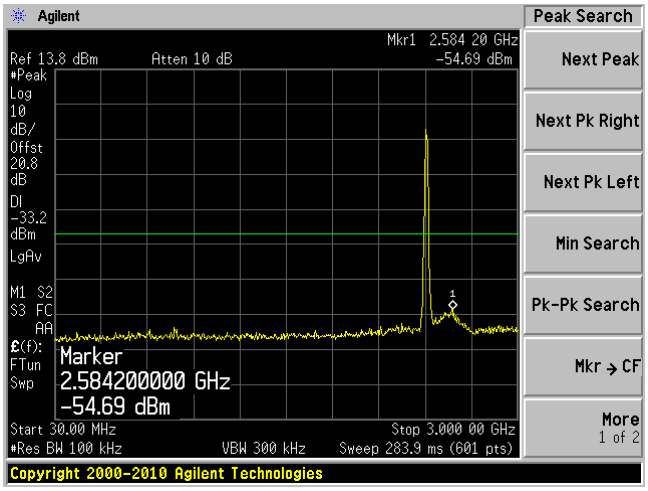


Plot: 3 GHz – 25 GHz

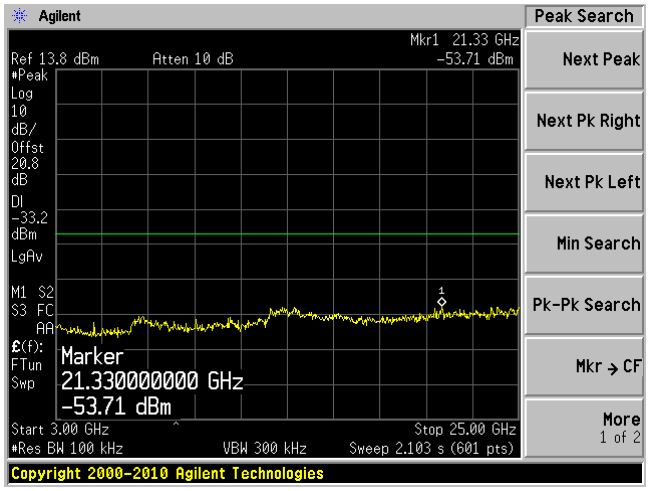


802.11g, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

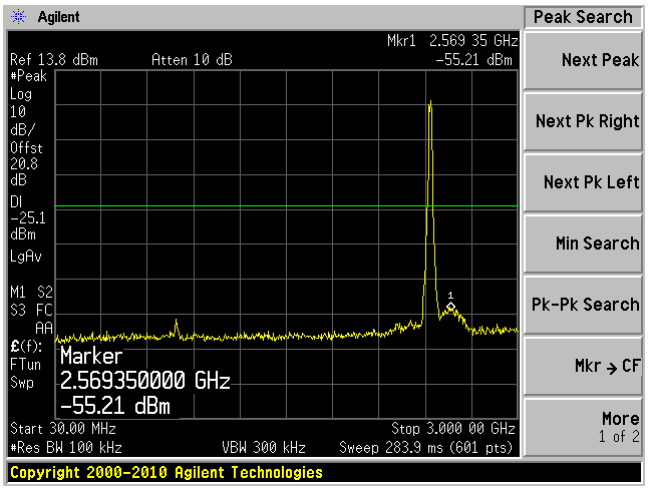


Plot: 3 GHz – 25 GHz

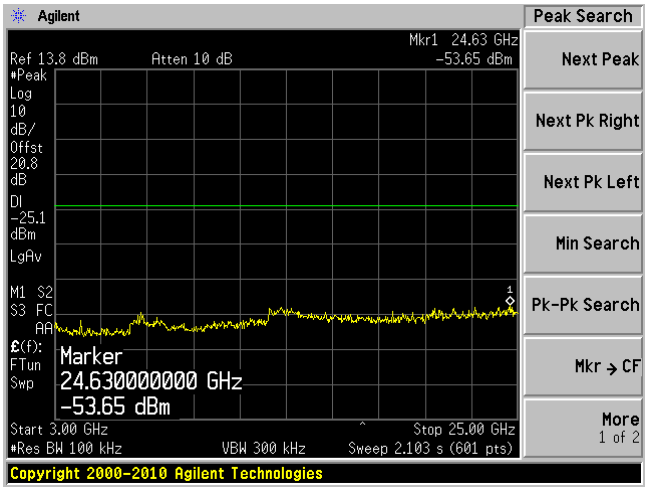


802.11g, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

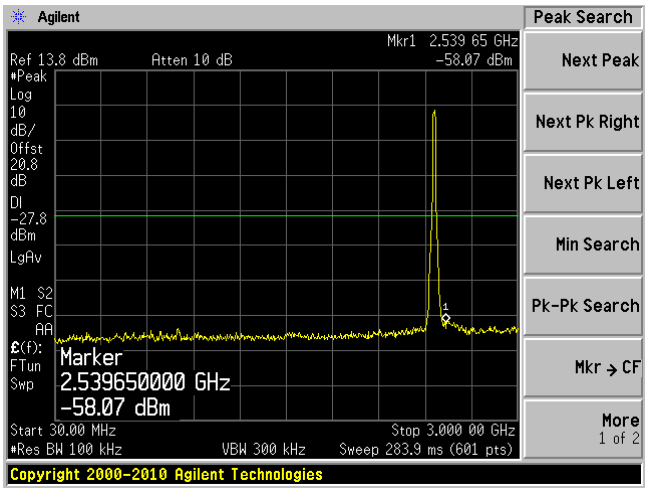


Plot: 3 GHz – 25 GHz

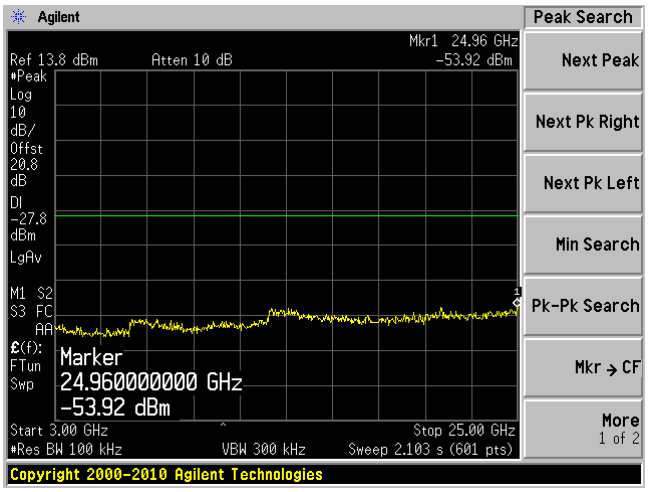


802.11g, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz

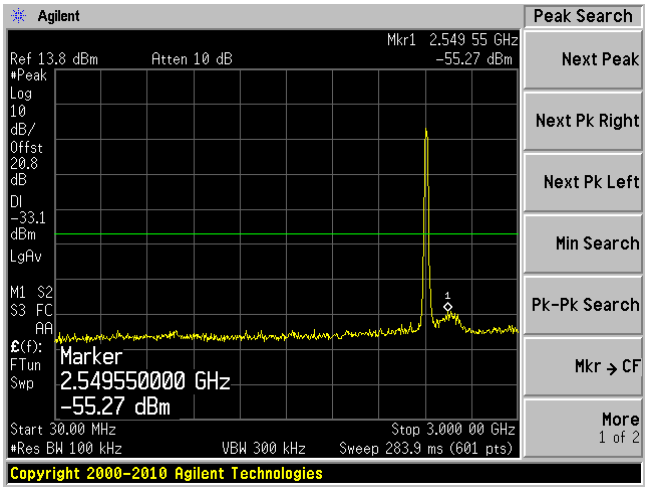


Plot: 3 GHz – 25 GHz

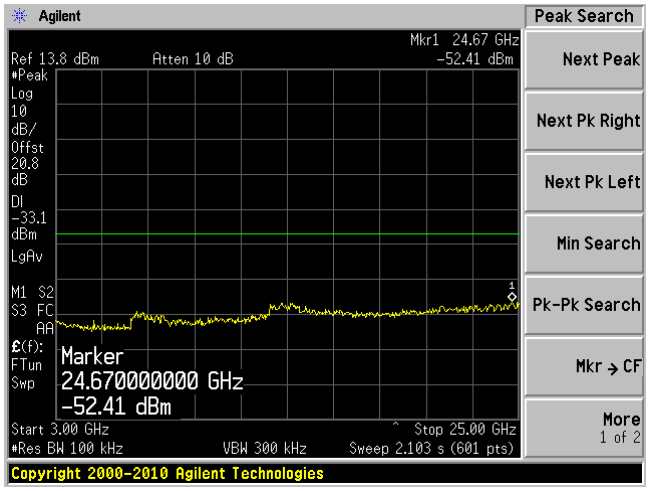


802.11n HT20, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

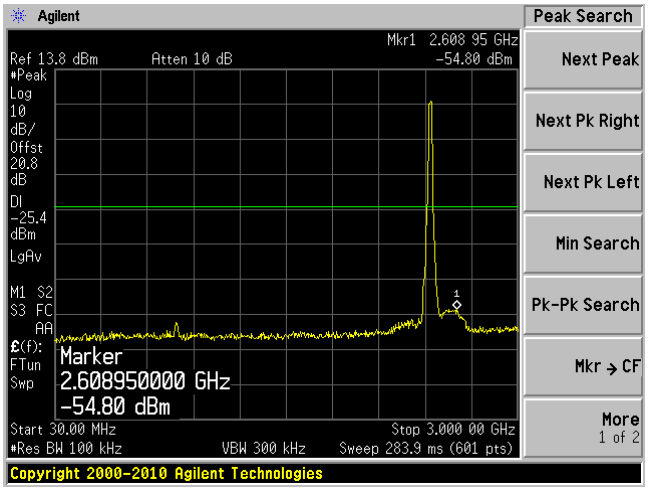


Plot: 3 GHz – 25 GHz

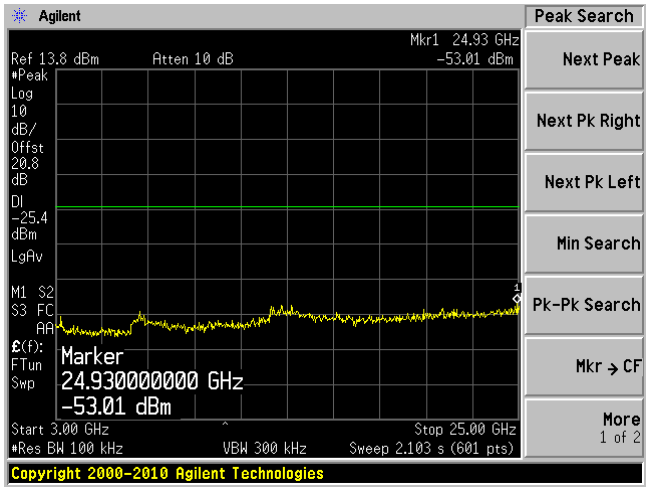


802.11n HT20, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

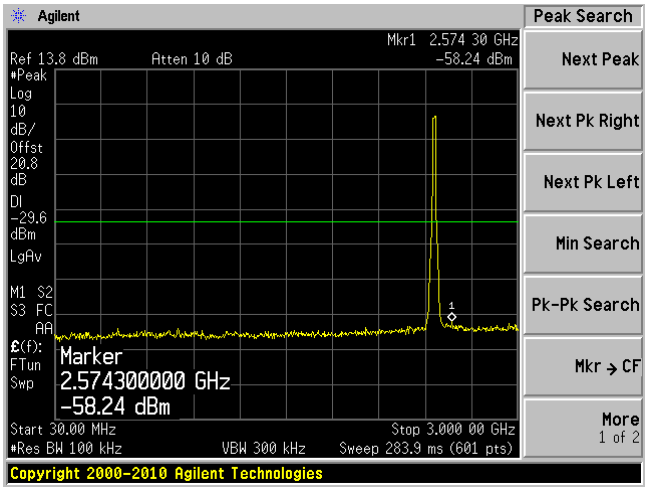


Plot: 3 GHz – 25 GHz

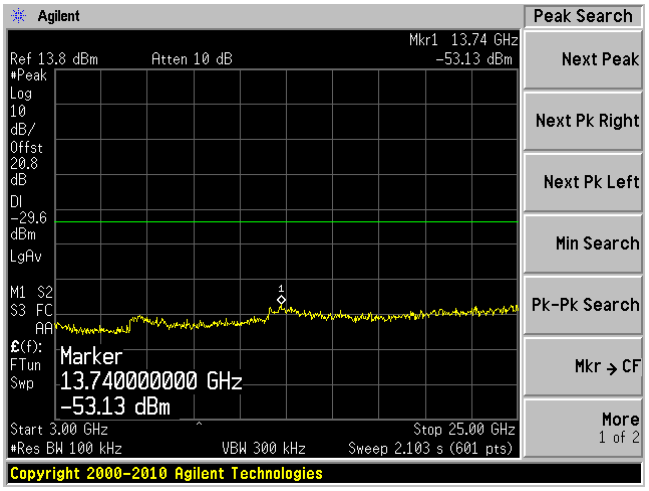


802.11n HT20, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz



Plot: 3 GHz – 25 GHz



8 FCC §15.205, §15.209 & §15.247(d) & IC RSS-210 §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) 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 Out-of-band Emissions, 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.

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 15 Subpart C and IC RSS-210 limits.

The spacing between the peripherals was 3 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 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	A020106-3	2013-06-18	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2013-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2013-05-09	1 year
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 year
EMCO	Horn Antenna	3315	9511-4627	2012-10-17	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2013-03-28	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	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:	21-22°C
Relative Humidity:	50-55%
ATM Pressure:	101.6-101.8kPa

The testing was performed by Bo Li from 2013-6-24 to 2013-6-25 at 5 meter 3.

8.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, 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)**	**Mode, Channel**
-19.12	33.21975	Vertical	802.11 HT20 mode Middle Channel

1 – 25 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-0.685	2483.5	**Vertical**	802.11 HT20 mode High Channel

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

8.8 Radiated Emissions Test Data and Plots

1) 30 MHz – 1 GHz, Measured at 3 meters

2.4 GHz Band, Quasi-Peak Measurements

802.11b mode

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
87.22725	11.68	206	V	142	40	-28.32
31.694	17.51	401	V	73	40	-22.49
84.9675	15.73	322	V	0	40	-24.27
80.0035	19.08	351	V	183	40	-20.92
64.46225	6.21	331	V	147	40	-33.79
38.0615	12.6	369	V	22	40	-27.4
130.3505	12	169	H	242	43.5	-31.5

802.11g mode

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
33.14125	20.14	225	V	140	40	-19.86
504.19975	15.46	173	V	143	46	-30.54
88.4295	13.92	352	V	0	43.5	-29.58
37.14025	13.53	375	V	360	40	-26.47
130.47925	12.51	150	H	227	43.5	-30.99

802.11n HT20 mode

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
33.21975	20.88	118	V	316	40	-19.12
504.13425	15.57	101	V	360	46	-30.43
37.47125	13.14	224	H	284	40	-26.86
130.93375	12.29	211	H	260	43.5	-31.21
52.37425	5.61	290	V	143	40	-34.39

Note: All 30 MHz-1 GHz spurious is digital, other emissions are on the noise floor level. The worst case result was reported.

2) 1–25 GHz, Measured at 3 meters

802.11b mode

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 2412 MHz, measured at 3 meters											
2412	75	286	160	V	28.956	3.12	0	107.076	N/A	N/A	Peak
2412	73.45	189	160	H	28.956	3.12	0	105.526	N/A	N/A	Peak
2412	71.42	286	160	V	28.956	3.12	0	103.496	N/A	N/A	Ave
2412	69.82	189	160	H	28.956	3.12	0	101.896	N/A	N/A	Ave
2390	28.17	283	160	V	28.956	3.12	0	60.246	74	-13.754	Peak
2390	26.87	186	160	H	28.956	3.12	0	58.946	74	-15.054	Peak
2390	15.31	283	160	V	28.956	3.12	0	47.386	54	-6.614	Ave
2390	13.92	186	160	H	28.956	3.12	0	45.996	54	-8.004	Ave
4824	35.26	326	100	V	33.097	4.56	27.7	45.217	74	-28.783	Peak
4824	36.66	309	121	H	33.097	4.56	27.7	46.617	74	-27.383	Peak
4824	27.24	326	100	V	33.097	4.56	27.7	37.197	54	-16.803	Ave
4824	30.42	309	121	H	33.097	4.56	27.7	40.377	54	-13.623	Ave
7236*	33.14	0	100	V	35.928	5.49	27.58	46.978	74	-27.022	Peak
7236*	33.27	0	100	H	35.928	5.49	27.58	47.108	74	-26.892	Peak
7236*	18.82	0	100	V	35.928	5.49	27.58	32.658	54	-21.342	Ave
7236*	18.84	0	100	H	35.928	5.49	27.58	32.678	54	-21.322	Ave
9648*	31.57	0	100	V	37.954	6.54	27.06	49.004	74	-24.996	Peak
9648*	31.51	0	100	H	37.954	6.54	27.06	48.944	74	-25.056	Peak
9648*	17.09	0	100	V	37.954	6.54	27.06	34.524	54	-19.476	Ave
9648*	17.04	0	100	H	37.954	6.54	27.06	34.474	54	-19.526	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	75.78	282	163	V	28.956	3.12	0	107.856	N/A	N/A	Peak
2437	75.5	192	156	H	28.956	3.12	0	107.576	N/A	N/A	Peak
2437	72.12	282	163	V	28.956	3.12	0	104.196	N/A	N/A	Ave
2437	71.83	192	156	H	28.956	3.12	0	103.906	N/A	N/A	Ave
4874	34.38	226	100	V	33.327	4.54	27.76	44.487	74	-29.513	Peak
4874	35.79	63	100	H	33.327	4.54	27.76	45.897	74	-28.103	Peak
4874	22.89	226	100	V	33.327	4.54	27.76	32.997	54	-21.003	Ave
4874	27.97	63	100	H	33.327	4.54	27.76	38.077	54	-15.923	Ave
7311*	33.48	0	100	V	36.369	5.57	27.51	47.909	74	-26.091	Peak
7311*	33.35	0	100	H	36.369	5.57	27.51	47.779	74	-26.221	Peak
7311*	18.84	0	100	V	36.369	5.57	27.51	33.269	54	-20.731	Ave
7311*	18.88	0	100	H	36.369	5.57	27.51	33.309	54	-20.691	Ave
9748*	32.09	0	100	V	38.087	6.62	26.98	49.817	74	-24.183	Peak
9748*	32.49	0	100	H	38.087	6.62	26.98	50.217	74	-23.783	Peak
9748*	17.29	0	100	V	38.087	6.62	26.98	35.017	54	-18.983	Ave
9748*	17.29	0	100	H	38.087	6.62	26.98	35.017	54	-18.983	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 2462 MHz, measured at 3 meters											
2462	75.42	279	157	V	29.155	3.25	0	107.825	N/A	N/A	Peak
2462	75.19	193	149	H	29.155	3.25	0	107.595	N/A	N/A	Peak
2462	71.84	279	157	V	29.155	3.25	0	104.245	N/A	N/A	Ave
2462	75.19	193	149	H	29.155	3.25	0	107.595	N/A	N/A	Ave
2483.5	30.5	280	147	V	29.155	3.25	0	62.905	74	-11.095	Peak
2483.5	30.04	195	147	H	29.155	3.25	0	62.445	74	-11.555	Peak
2483.5	18.14	280	147	V	29.155	3.25	0	50.545	54	-3.455	Ave
2483.5	17.9	195	147	H	29.155	3.25	0	50.305	54	-3.695	Ave
4924	33.55	42	100	V	33.327	4.52	27.75	43.647	74	-30.353	Peak
4924	34.11	312	100	H	33.327	4.52	27.75	44.207	74	-29.793	Peak
4924	21.77	42	100	V	33.327	4.52	27.75	31.867	54	-22.133	Ave
4924	23.48	312	100	H	33.327	4.52	27.75	33.577	54	-20.423	Ave
7386*	34.18	0	100	V	36.565	5.62	27.51	48.855	74	-25.145	Peak
7386*	33.65	0	100	H	36.565	5.62	27.51	48.325	74	-25.675	Peak
7386*	18.289	0	100	V	36.565	5.62	27.51	32.964	54	-21.036	Ave
7386*	18.82	0	100	H	36.565	5.62	27.51	33.495	54	-20.505	Ave
9848*	31.89	0	100	V	38.287	6.55	26.98	49.747	74	-24.253	Peak
9848*	31.75	0	100	H	38.287	6.55	26.98	49.607	74	-24.393	Peak
9848*	17.59	0	100	V	38.287	6.55	26.98	35.447	54	-18.553	Ave
9848*	17.5	0	100	H	38.287	6.55	26.98	35.357	54	-18.643	Ave

Note*: noise floor level

802.11g mode

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 2412 MHz, measured at 3 meters											
2412	71.24	283	165	V	28.956	3.12	0	103.316	N/A	N/A	Peak
2412	71.19	185	196	H	28.956	3.12	0	103.266	N/A	N/A	Peak
2412	60.96	283	165	V	28.956	3.12	0	93.036	N/A	N/A	Ave
2412	60.32	185	196	H	28.956	3.12	0	92.396	N/A	N/A	Ave
2390	33.28	279	164	V	28.956	3.12	0	65.356	74	-8.644	Peak
2390	32.98	185	196	H	28.956	3.12	0	65.056	74	-8.944	Peak
2390	16.33	279	164	V	28.956	3.12	0	48.406	54	-5.594	Ave
2390	16.61	185	196	H	28.956	3.12	0	48.686	54	-5.314	Ave
4824	35	39	100	V	33.097	4.56	27.7	44.957	74	-29.043	Peak
4824	36.37	65	100	H	33.097	4.56	27.7	46.327	74	-27.673	Peak
4824	19.91	39	100	V	33.097	4.56	27.7	29.867	54	-24.133	Ave
4824	20.18	65	100	H	33.097	4.56	27.7	30.137	54	-23.863	Ave
7236*	33.18	0	100	V	35.928	5.49	27.58	47.018	74	-26.982	Peak
7236*	34.29	0	100	H	35.928	5.49	27.58	48.128	74	-25.872	Peak
7236*	18.8	0	100	V	35.928	5.49	27.58	32.638	54	-21.362	Ave
7236*	18.87	0	100	H	35.928	5.49	27.58	32.708	54	-21.292	Ave
9648*	31.32	0	100	V	37.954	6.54	27.06	48.754	74	-25.246	Peak
9648*	31.78	0	100	H	37.954	6.54	27.06	49.214	74	-24.786	Peak
9648*	17	0	100	V	37.954	6.54	27.06	34.434	54	-19.566	Ave
9648*	17.09	0	100	H	37.954	6.54	27.06	34.524	54	-19.476	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	78.47	278	163	V	28.956	3.12	0	110.546	N/A	N/A	Peak
2437	79.22	190	192	H	28.956	3.12	0	111.296	N/A	N/A	Peak
2437	67.68	278	163	V	28.956	3.12	0	99.756	N/A	N/A	Ave
2437	68.09	190	192	H	28.956	3.12	0	100.166	N/A	N/A	Ave
4874	35.2	41	107	V	33.327	4.54	27.76	45.307	74	-28.693	Peak
4874	36.74	63	100	H	33.327	4.54	27.76	46.847	74	-27.153	Peak
4874	21.48	41	107	V	33.327	4.54	27.76	31.587	54	-22.413	Ave
4874	22.24	63	100	H	33.327	4.54	27.76	32.347	54	-21.653	Ave
7311*	34.09	0	100	V	36.369	5.57	27.51	48.519	74	-25.481	Peak
7311*	33.91	0	100	H	36.369	5.57	27.51	48.339	74	-25.661	Peak
7311*	18.46	0	100	V	36.369	5.57	27.51	32.889	54	-21.111	Ave
7311*	18.89	0	100	H	36.369	5.57	27.51	33.319	54	-20.681	Ave
9748*	31.87	0	100	V	38.087	6.62	26.98	49.597	74	-24.403	Peak
9748*	32.75	0	100	H	38.087	6.62	26.98	50.477	74	-23.523	Peak
9748*	17.3	0	100	V	38.087	6.62	26.98	35.027	54	-18.973	Ave
9748*	17.55	0	100	H	38.087	6.62	26.98	35.277	54	-18.723	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 2462 MHz, measured at 3 meters											
2462	73.72	280	115	V	29.155	3.25	0	106.125	N/A	N/A	Peak
2462	72.82	199	183	H	29.155	3.25	0	105.225	N/A	N/A	Peak
2462	63.14	280	115	V	29.155	3.25	0	95.545	N/A	N/A	Ave
2462	62.1	199	183	H	29.155	3.25	0	94.505	N/A	N/A	Ave
2483.5	37.47	279	146	V	29.155	3.25	0	69.875	74	-4.125	Peak
2483.5	36.7	204	186	H	29.155	3.25	0	69.105	74	-4.895	Peak
2483.5	20.03	279	146	V	29.155	3.25	0	52.435	54	-1.565	Ave
2483.5	20.24	204	186	H	29.155	3.25	0	52.645	54	-1.355	Ave
4924*	33.36	0	100	V	33.327	4.52	27.75	43.457	74	-30.543	Peak
4924*	33.71	0	100	H	33.327	4.52	27.75	43.807	74	-30.193	Peak
4924*	18.98	0	100	V	33.327	4.52	27.75	29.077	54	-24.923	Ave
4924*	19.19	0	100	H	33.327	4.52	27.75	29.287	54	-24.713	Ave
7386*	33.4	0	100	V	36.565	5.62	27.51	48.075	74	-25.925	Peak
7386*	33.37	0	100	H	36.565	5.62	27.51	48.045	74	-25.955	Peak
7386*	18.78	0	100	V	36.565	5.62	27.51	33.455	54	-20.545	Ave
7386*	18.83	0	100	H	36.565	5.62	27.51	33.505	54	-20.495	Ave

Note*: noise floor level

802.11HT 20mode

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 2412 MHz, measured at 3 meters											
2412	73.07	289	100	V	28.956	3.12	0	105.146	N/A	N/A	Peak
2412	65.23	264	100	H	28.956	3.12	0	97.306	N/A	N/A	Peak
2412	61.71	289	100	V	28.956	3.12	0	93.786	N/A	N/A	Ave
2412	53.95	264	100	H	28.956	3.12	0	86.026	N/A	N/A	Ave
2390	39.64	287	100	V	28.956	3.12	0	71.716	74	-2.284	Peak
2390	32.36	264	100	H	28.956	3.12	0	64.436	74	-9.564	Peak
2390	15.87	287	100	V	28.956	3.12	0	47.946	54	-6.054	Ave
2390	14.66	264	100	H	28.956	3.12	0	46.736	54	-7.264	Ave
4824	35.17	137	100	V	33.097	4.56	27.7	45.127	74	-28.873	Peak
4824	36.27	75	100	H	33.097	4.56	27.7	46.227	74	-27.773	Peak
4824	19.7	137	100	V	33.097	4.56	27.7	29.657	54	-24.343	Ave
4824	19.481	75	100	H	33.097	4.56	27.7	29.438	54	-24.562	Ave
7236*	32.96	0	100	V	35.928	5.49	27.58	46.798	74	-27.202	Peak
7236*	33.31	0	100	H	35.928	5.49	27.58	47.148	74	-26.852	Peak
7236*	18.37	0	100	V	35.928	5.49	27.58	32.208	54	-21.792	Ave
7236*	18.4	0	100	H	35.928	5.49	27.58	32.238	54	-21.762	Ave
9648*	31.69	0	100	V	37.954	6.54	27.06	49.124	74	-24.876	Peak
9648*	31.88	0	100	H	37.954	6.54	27.06	49.314	74	-24.686	Peak
9648*	16.61	0	100	V	37.954	6.54	27.06	34.044	54	-19.956	Ave
9648*	16.6	0	100	H	37.954	6.54	27.06	34.034	54	-19.966	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	78.44	298	100	V	28.956	3.12	0	110.516	N/A	N/A	Peak
2437	78.26	181	192	H	28.956	3.12	0	110.336	N/A	N/A	Peak
2437	66.88	298	100	V	28.956	3.12	0	98.956	N/A	N/A	Ave
2437	67.61	181	192	H	28.956	3.12	0	99.686	N/A	N/A	Ave
4874	34.84	301	100	V	33.327	4.54	27.76	44.947	74	-29.053	Peak
4874	37	64	100	H	33.327	4.54	27.76	47.107	74	-26.893	Peak
4874	20.88	301	100	V	33.327	4.54	27.76	30.987	54	-23.013	Ave
4874	22.41	64	100	H	33.327	4.54	27.76	32.517	54	-21.483	Ave
7311*	34.24	0	100	V	36.369	5.57	27.51	48.669	74	-25.331	Peak
7311*	34.56	0	100	H	36.369	5.57	27.51	48.989	74	-25.011	Peak
7311*	18.98	0	100	V	36.369	5.57	27.51	33.409	54	-20.591	Ave
7311*	19.01	0	100	H	36.369	5.57	27.51	33.439	54	-20.561	Ave
9748*	31.92	0	100	V	38.087	6.62	26.98	49.647	74	-24.353	Peak
9748*	32.5	0	100	H	38.087	6.62	26.98	50.227	74	-23.773	Peak
9748*	17.34	0	100	V	38.087	6.62	26.98	35.067	54	-18.933	Ave
9748*	17.46	0	100	H	38.087	6.62	26.98	35.187	54	-18.813	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 2462 MHz, measured at 3 meters											
2462	73.91	277	100	V	29.155	3.25	0	106.315	N/A	N/A	Peak
2462	73.91	206	152	H	29.155	3.25	0	106.315	N/A	N/A	Peak
2462	61.9	277	100	V	29.155	3.25	0	94.305	N/A	N/A	Ave
2462	62.36	206	152	H	29.155	3.25	0	94.765	N/A	N/A	Ave
2483.5	38.83	277	153	V	29.155	3.25	0	71.235	74	-2.765	Peak
2483.5	37.14	205	153	H	29.155	3.25	0	69.545	74	-4.455	Peak
2483.5	20.91	277	153	V	29.155	3.25	0	53.315	54	-0.685	Ave
2483.5	20.2	205	153	H	29.155	3.25	0	52.605	54	-1.395	Ave
4924*	33.58	0	100	V	33.327	4.52	27.75	43.677	74	-30.323	Peak
4924*	34.09	0	100	H	33.327	4.52	27.75	44.187	74	-29.813	Peak
4924*	18.91	0	100	V	33.327	4.52	27.75	29.007	54	-24.993	Ave
4924*	19.03	0	100	H	33.327	4.52	27.75	29.127	54	-24.873	Ave
7386*	33.66	0	100	V	36.565	5.62	27.51	48.335	74	-25.665	Peak
7386*	33.24	0	100	H	36.565	5.62	27.51	47.915	74	-26.085	Peak
7386*	18.3	0	100	V	36.565	5.62	27.51	32.975	54	-21.025	Ave
7386*	18.34	0	100	H	36.565	5.62	27.51	33.015	54	-20.985	Ave

Note*: noise floor level

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) 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

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	E4446A	US44300386	2012-09-29	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:	22 °C
Relative Humidity:	40 %
ATM Pressure:	101.5 kPa

The testing was performed by Bo Li on 2013-6-20 at RF site.

9.5 Test Results

802.11 b mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	10.058	14.1735	> 0.5	Compliant
Middle	2437	10.044	14.2438	> 0.5	Compliant
High	2462	10.107	14.3542	> 0.5	Compliant

802.11 g mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	16.304	16.4525	> 0.5	Compliant
Middle	2437	16.292	16.5974	> 0.5	Compliant
High	2462	16.336	16.5387	> 0.5	Compliant

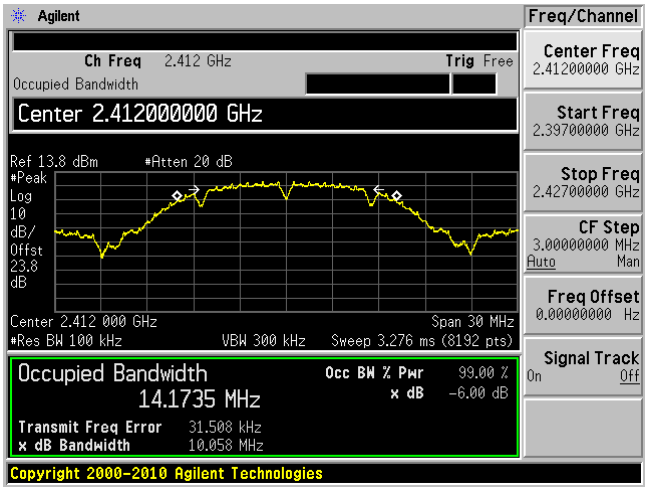
802.11n HT20 mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	16.953	17.6432	> 0.5	Compliant
Middle	2437	17.164	17.7534	> 0.5	Compliant
High	2462	17.284	17.6519	> 0.5	Compliant

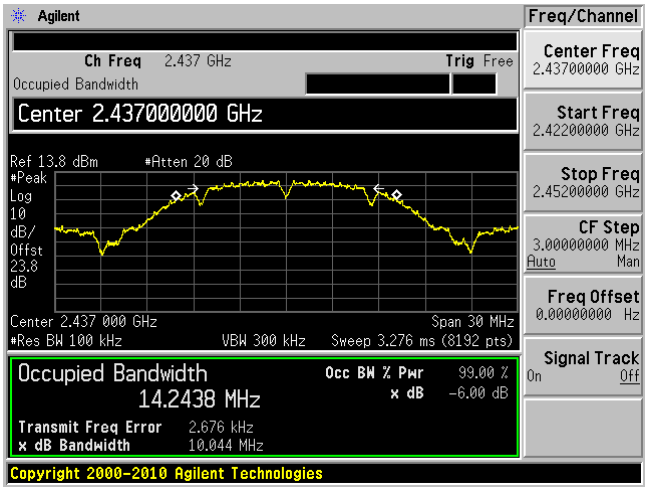
Please refer to the following plots.

802.11b mode

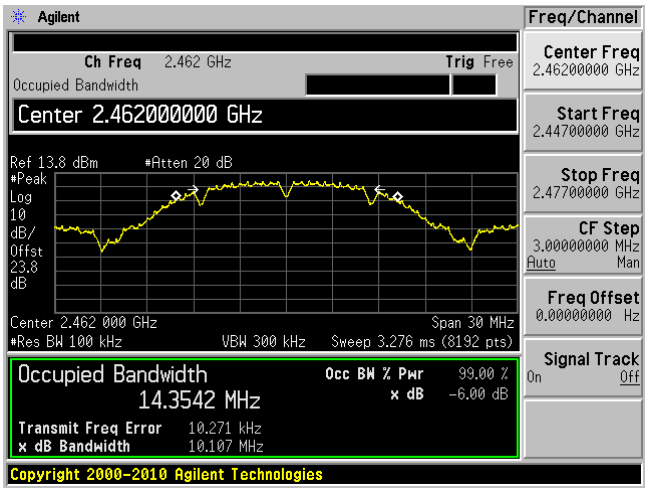
Low channel: 2412 MHz



Middle channel: 2437 MHz

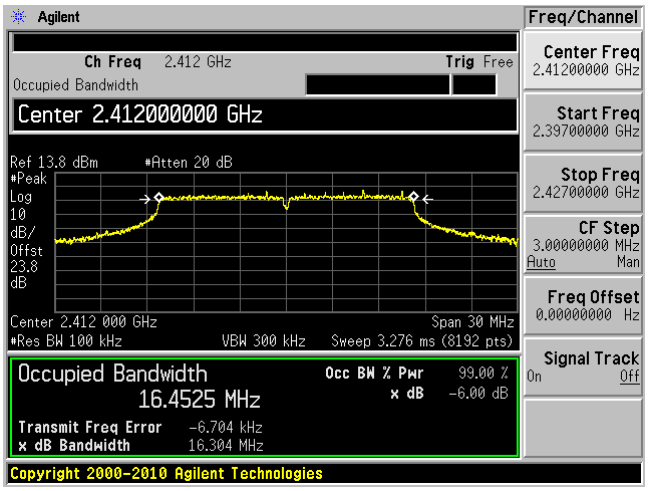


High channel: 2462 MHz

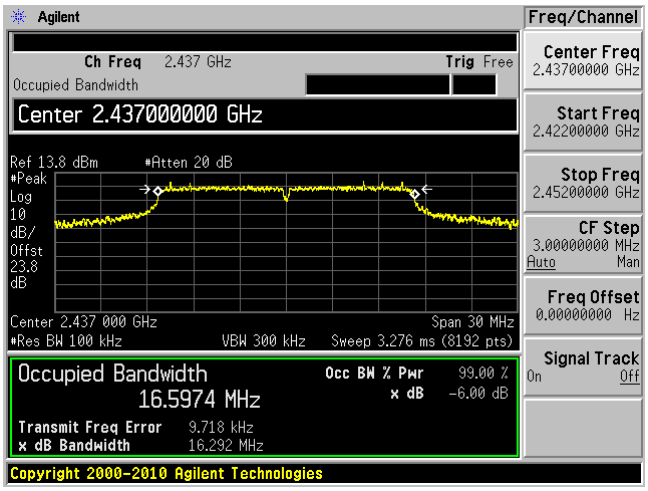


802.11g mode

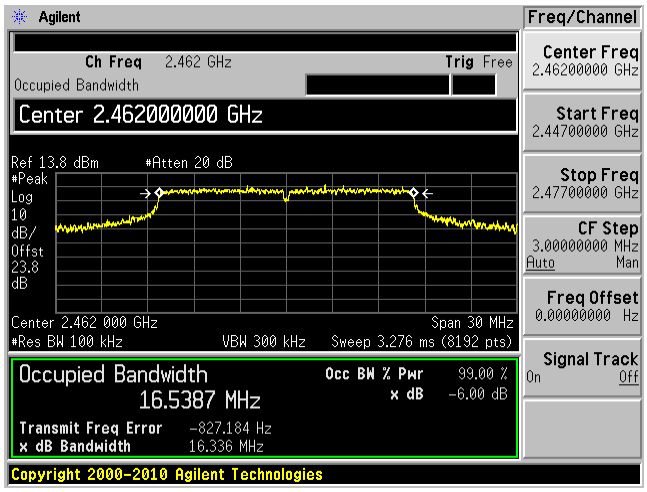
Low channel: 2412 MHz



Middle channel: 2437 MHz

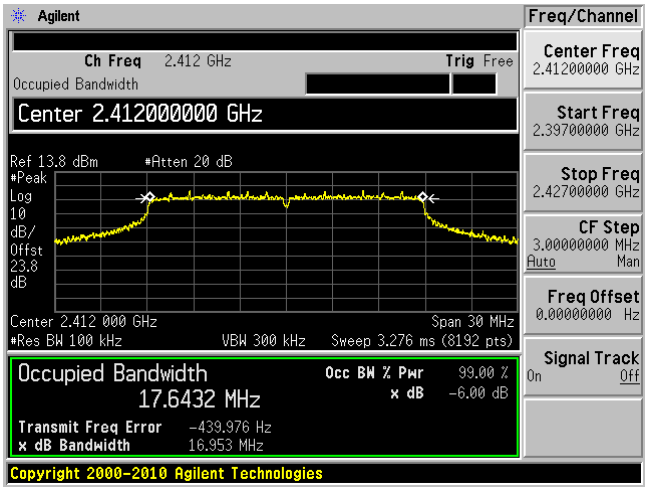


High channel: 2462 MHz

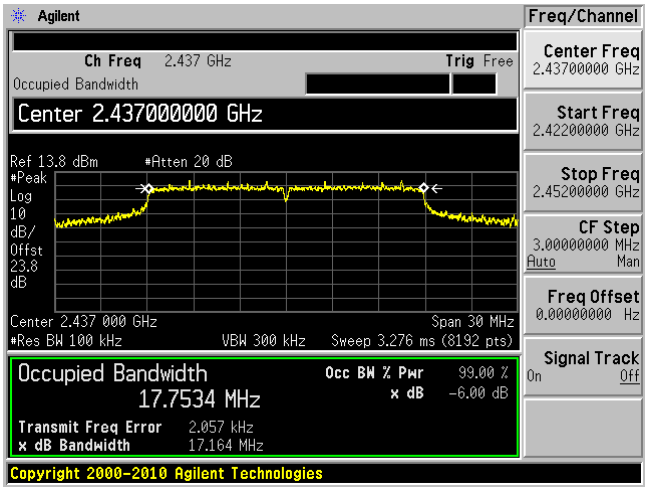


802.11n HT20 mode

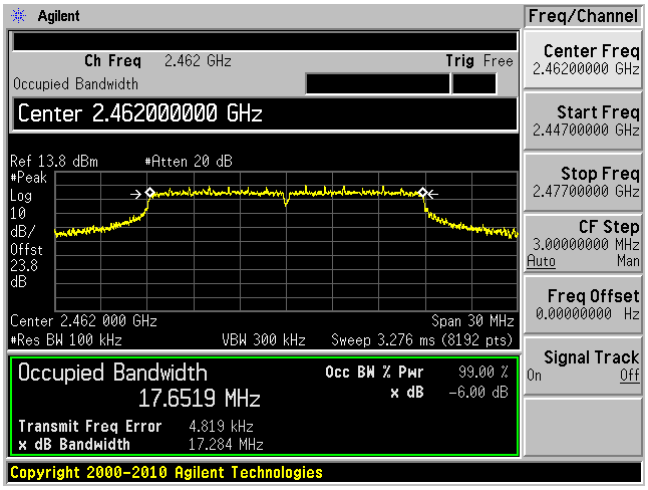
Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz



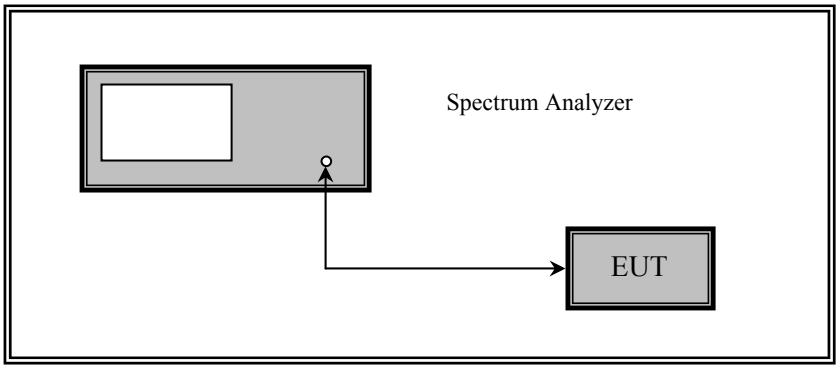
10 FCC §15.247(b) & IC RSS-210 §A8.4 – Peak Output Power Measurement

10.1 Applicable Standard

According to FCC §15.247(b) 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.

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	E4446A	US44300386	2012-09-29	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:	22 °C
Relative Humidity:	40 %
ATM Pressure:	101.5 kPa

The testing was performed by Bo Li on 2013-6-20 at RF site.

10.5 Test Results

802.11b mode

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	14.29	30	-15.71
Middle	2437	15.32	30	-14.68
High	2462	15.28	30	-14.72

802.11g mode

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	8.58	30	-21.42
Middle	2437	15.03	30	-14.97
High	2462	11.04	30	-18.96

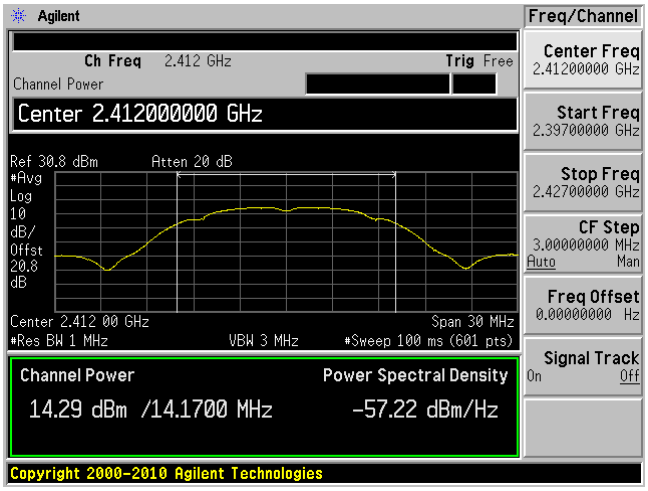
802.11n HT20 mode

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	8.33	30	-21.67
Middle	2437	15.04	30	-14.96
High	2462	10.03	30	-19.97

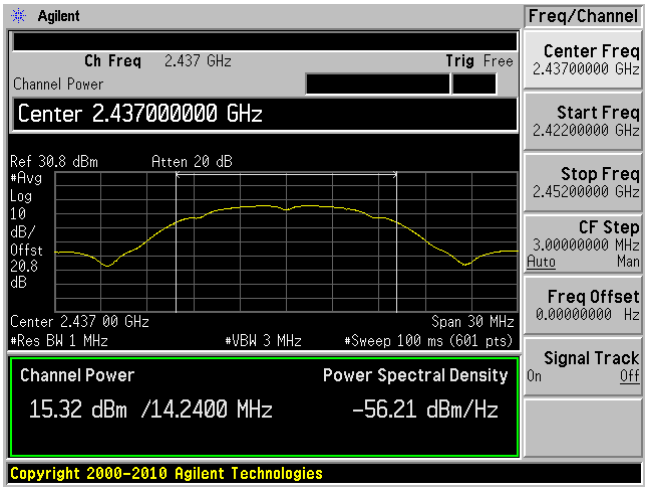
Please refer to the following plots.

802.11b mode

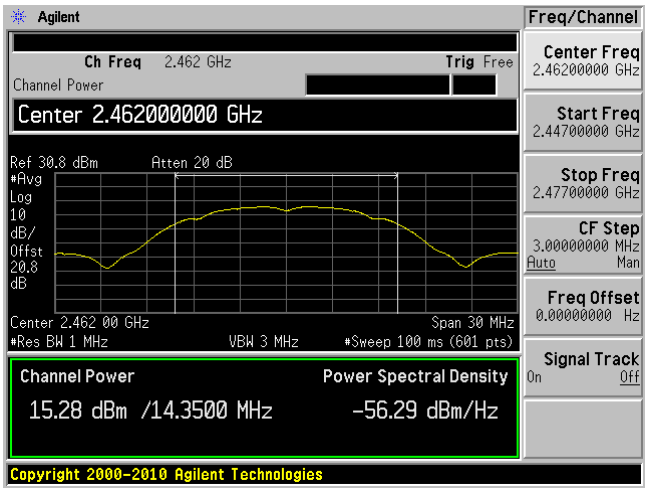
Low channel: 2412 MHz



Middle channel: 2437 MHz

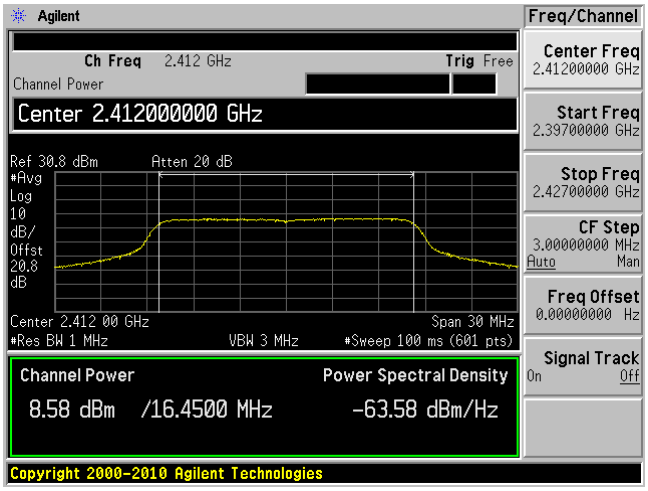


High channel: 2462 MHz

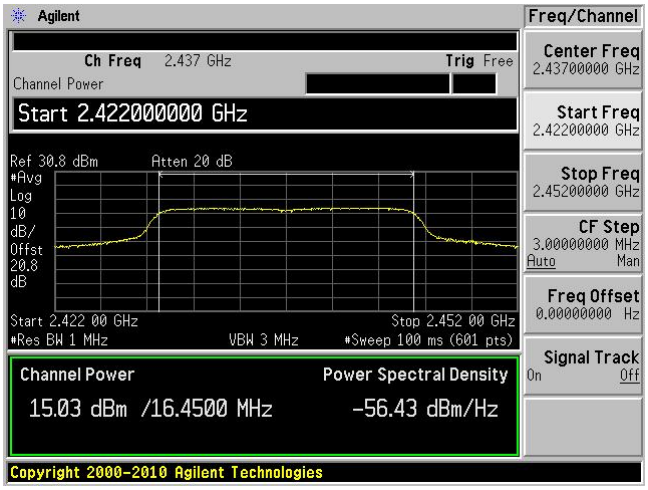


802.11g mode

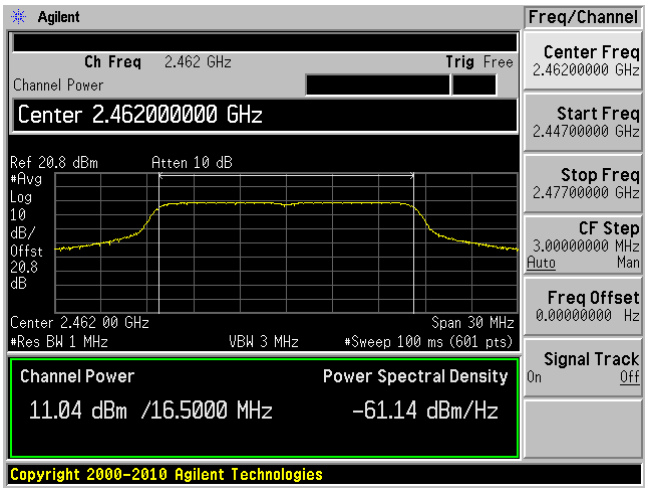
Low channel: 2412 MHz



Middle channel: 2437 MHz

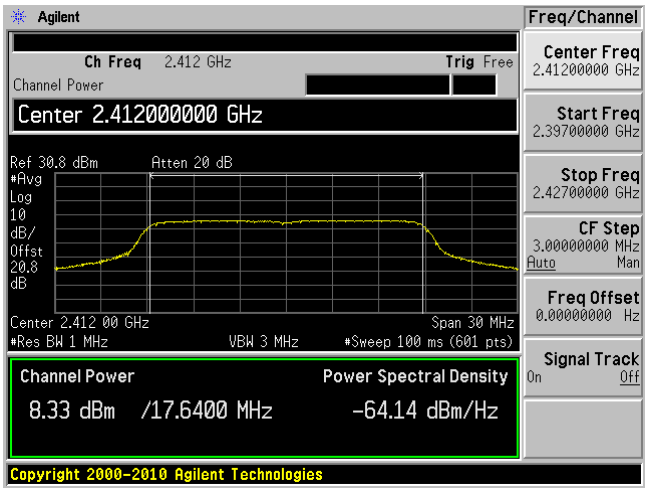


High channel: 2462 MHz

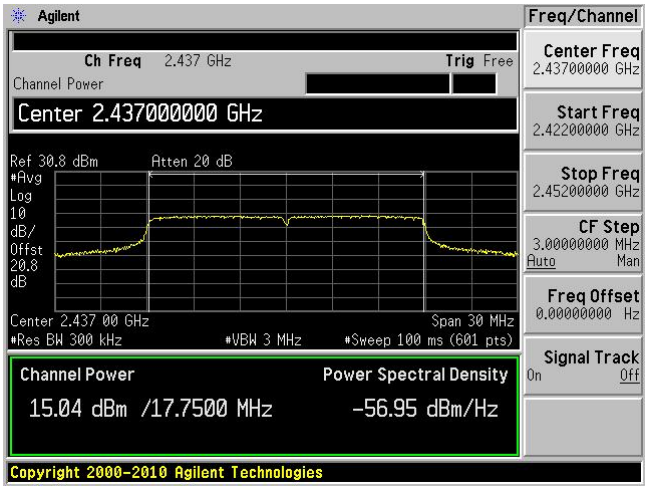


802.11n HT20 mode

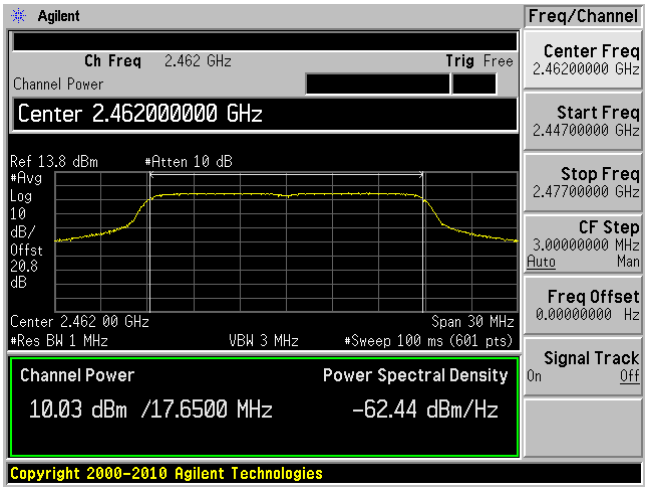
Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz



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

11.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency 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.

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	E4446A	US44300386	2012-09-29	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:	22 °C
Relative Humidity:	40 %
ATM Pressure:	101.5 kPa

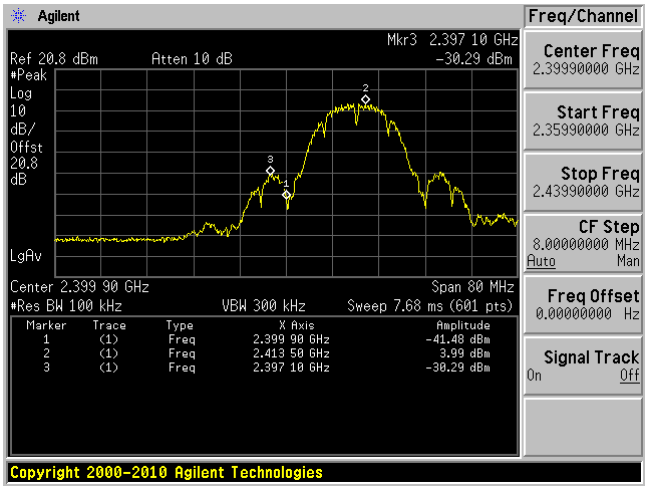
The testing was performed by Bo Li on 2013-6-20 at RF site.

11.5 Test Results

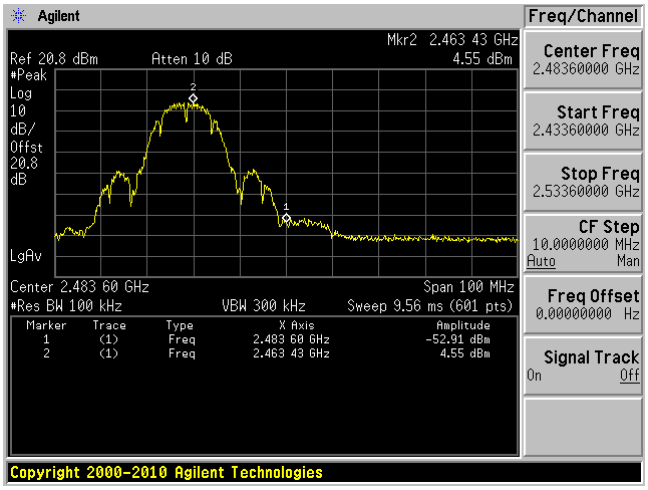
Please refer to following pages for plots of band edge.

802.11b mode

802.11b, Low Band Edge

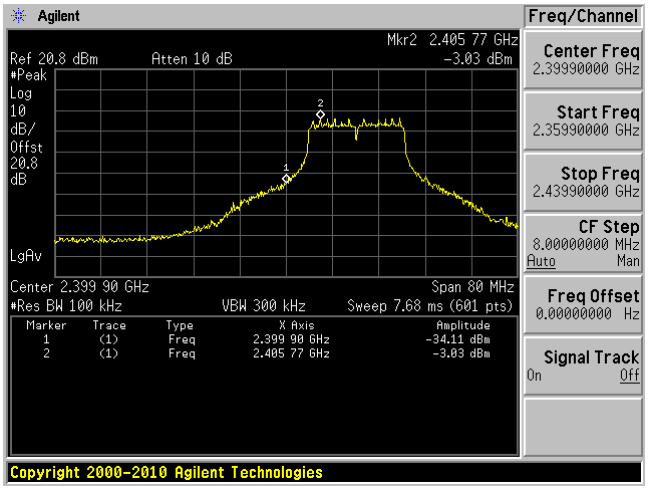


802.11b, High Band Edge

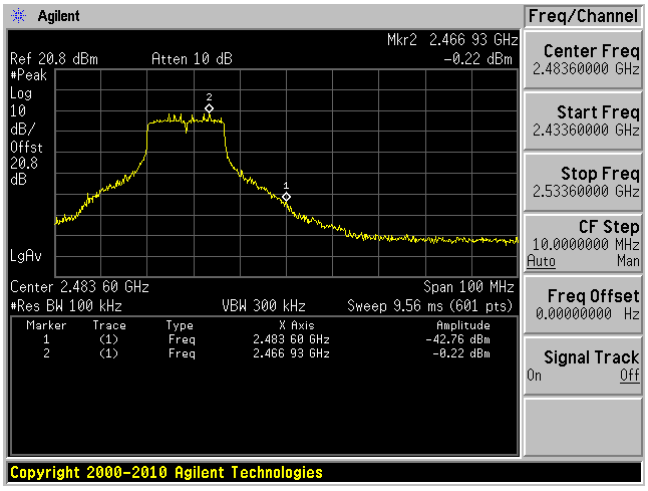


802.11g mode

802.11g, Low Band Edge

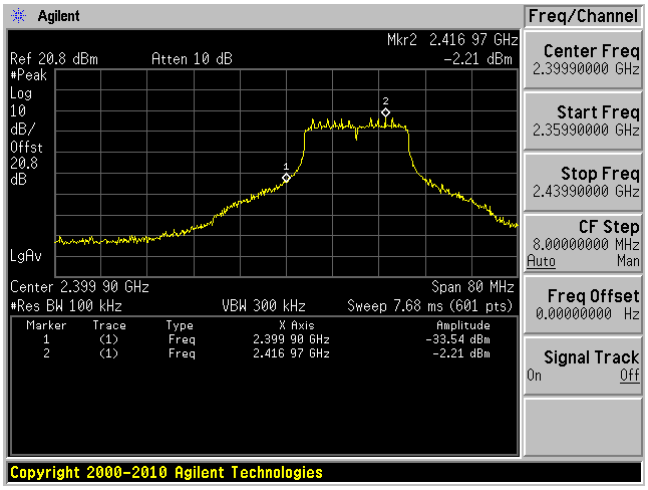


802.11g, High Band Edge

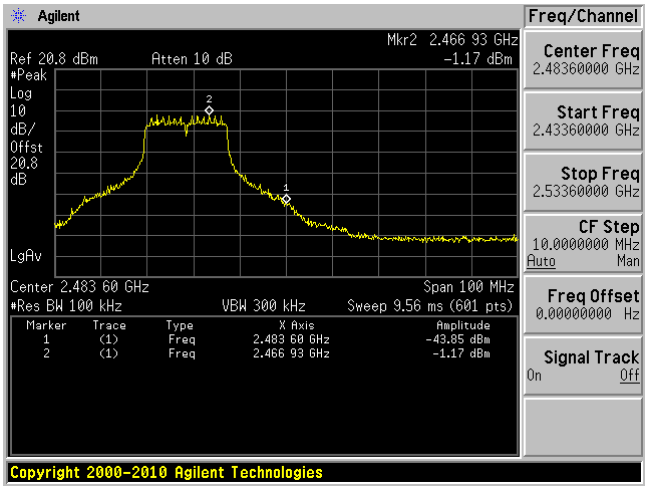


802.11n HT20 mode

802.11n HT20, Low Band Edge



802.11n HT20, 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) 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.

12.2 Measurement Procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 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 within the RBW.
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	E4446A	US44300386	2012-09-29	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:	22 °C
Relative Humidity:	40 %
ATM Pressure:	101.5 kPa

The testing was performed by Bo Li on 2013-6-20 at RF site.

12.5 Test Results

802.11b mode

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	3.75	8	-4.25
Middle	2437	4.86	8	-3.14
High	2462	4.66	8	-3.34

802.11 g mode

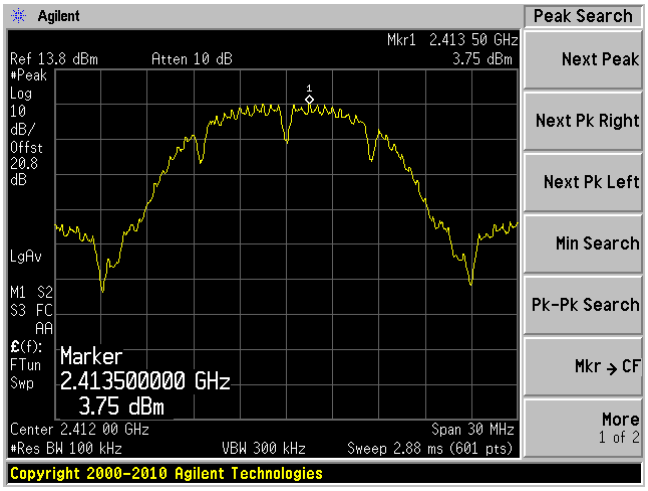
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-2.95	8	-10.95
Middle	2437	5.06	8	-2.94
High	2462	0.24	8	-7.76

802.11n HT20 mode

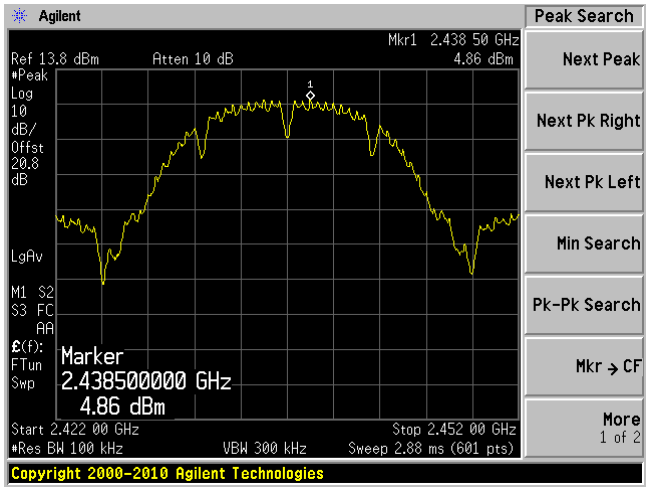
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-2.48	8	-10.48
Middle	2437	4.87	8	-3.13
High	2462	-1.17	8	-9.17

802.11b mode

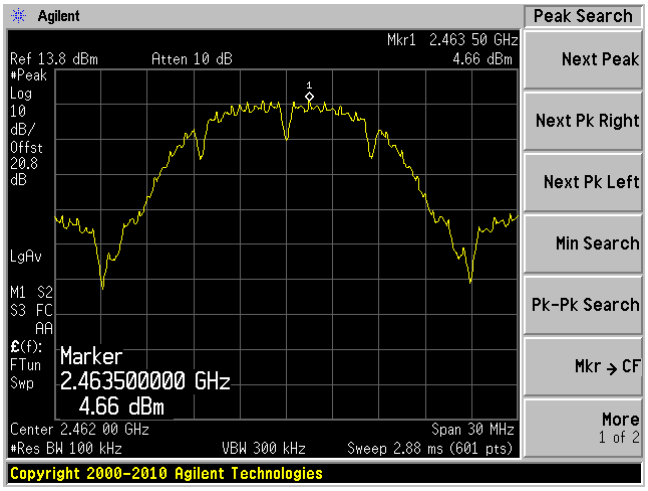
Low channel: 2412 MHz



Middle channel: 2437 MHz

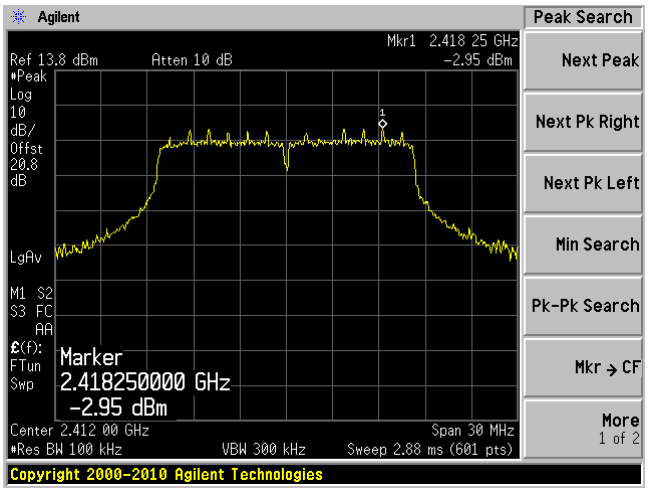


High channel: 2462 MHz

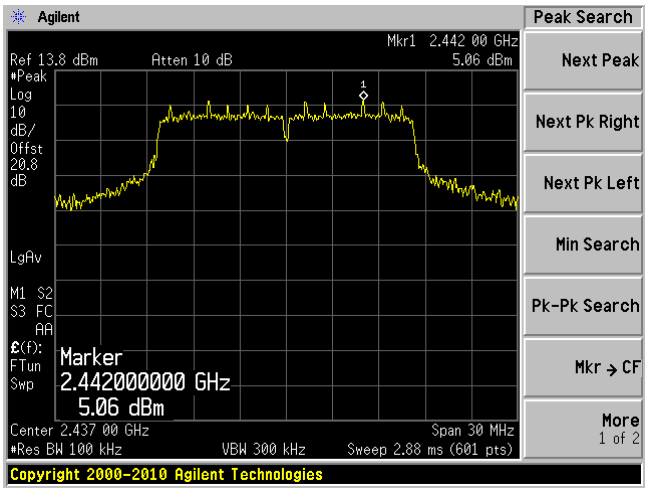


802.11g mode

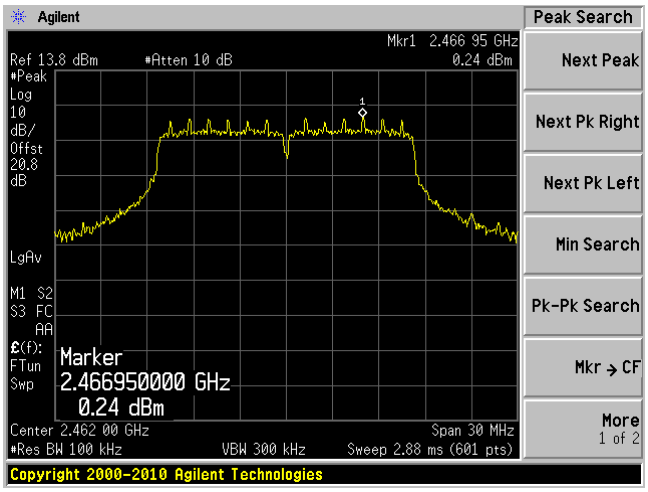
Low channel: 2412 MHz



Middle channel: 2437 MHz

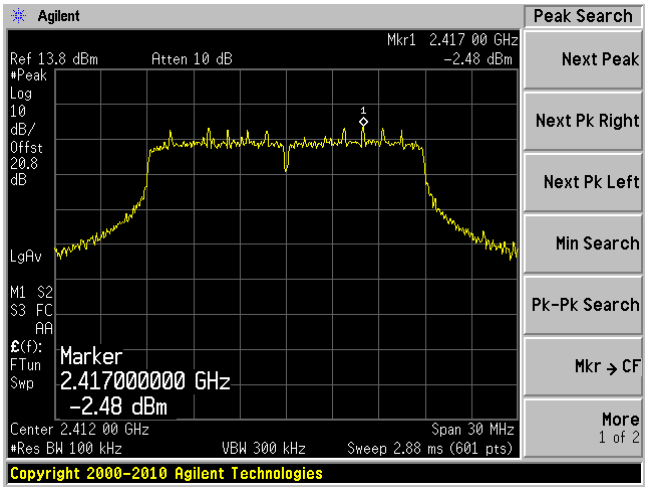


High channel: 2462 MHz

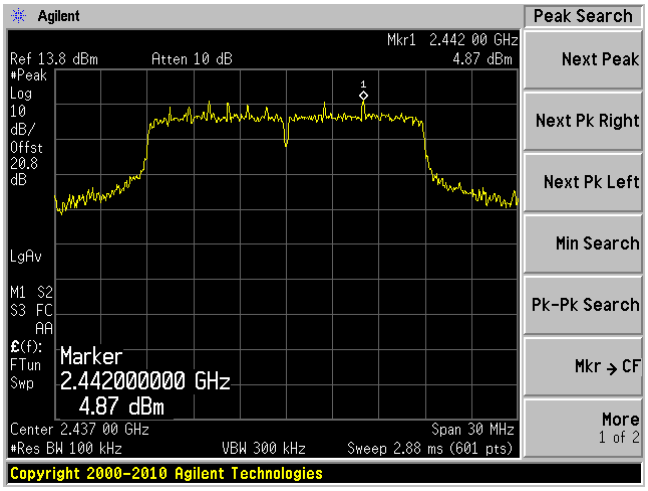


802.11n HT20 mode

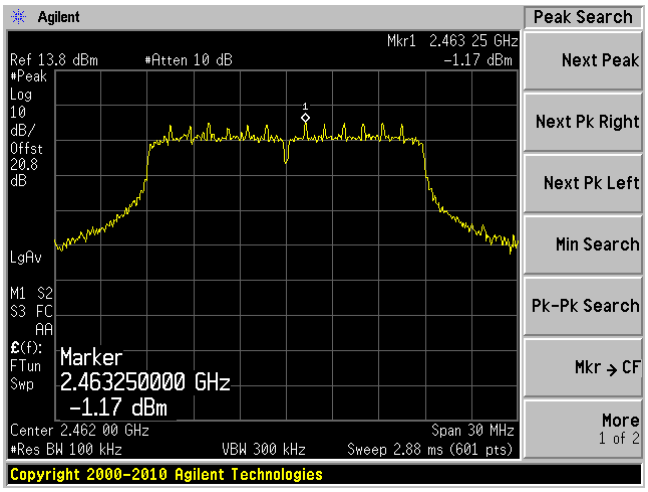
Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz



13 IC RSS-210 §2.3 & RSS-Gen §6.1 – Receiver Spurious Radiated Emissions

13.1 Applicable Standard

According to IC RSS-Gen §6.1, spurious emissions from receivers shall not exceed the radiated limits shown in the table below.

Table 2: General Field Strength Limits for Transmitters and Receivers at Frequencies above 30 MHz

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

13.2 EUT Setup

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

13.3 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.

13.4 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

13.5 Test Equipment Lists 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	A020106-3	2013-06-18	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2013-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2013-05-09	1 year
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 year
EMCO	Horn Antenna	3315	9511-4627	2012-10-17	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2013-03-28	1 year

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

13.6 Test Environmental Conditions

Temperature:	21-25 °C
Relative Humidity:	43-46 %
ATM Pressure:	101-103 kPa

The testing was performed by Bo Li from 2013-5-6 to 2013-5-9 at 5 meter 3.

13.7 Summary of Test Results

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

Below 1 GHz:

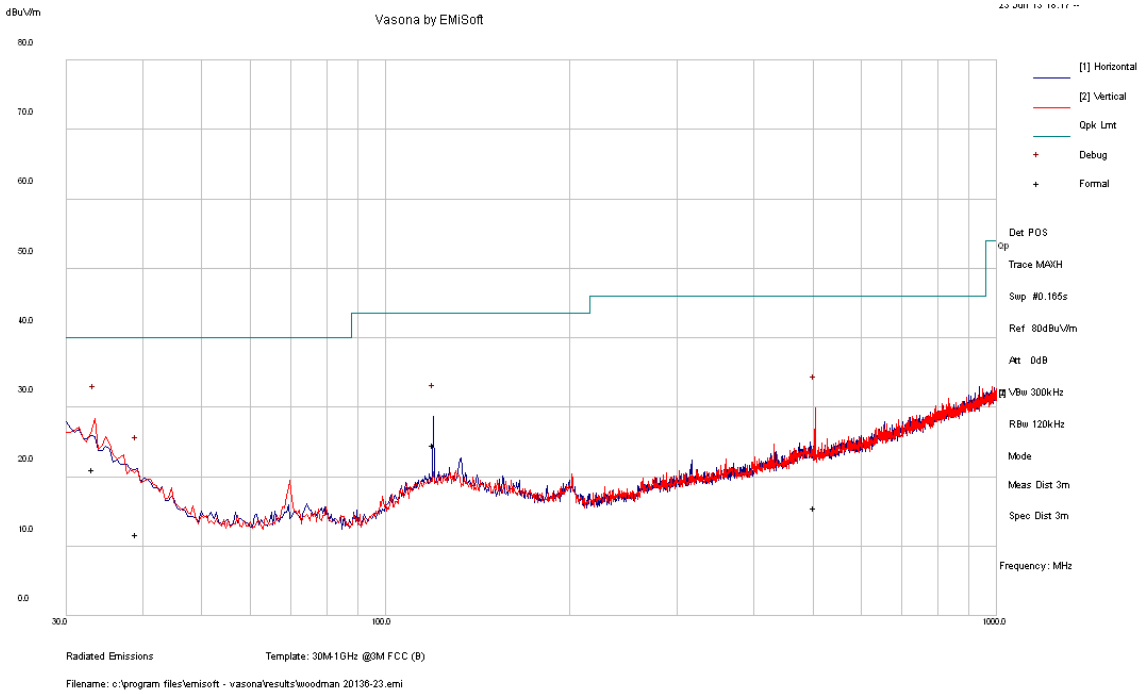
Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-18.86	24.64	Horizontal	30-1000

Above 1 GHz:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-10.54	13700	Horizontal	1000-18000

13.8 Test Results and Plots

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 (QP/Ave.)
33.252	21.01	361	V	148	40	-18.99	QP
119.9725	24.64	103	H	203	43.5	-18.86	QP
504.0995	15.5	152	V	172	46	-30.5	QP
39.14425	11.78	215	H	48	40	-28.22	QP
33.252	21.01	361	V	148	40	-18.99	QP

2) Above 1 GHz 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)	Comment
1680	38.93	100	V	261	74	-35.07	Peak
1680	50.88	100	H	257	74	-23.12	Peak
1680	23.41	100	V	261	54	-30.59	Ave
1680	28.64	100	H	257	54	-25.36	Ave
13700	57.96	100	V	0	74	-16.04	Peak
13700	57.69	100	H	0	74	-16.31	Peak
13700	43.43	100	V	0	54	-10.57	Ave
13700	43.46	100	H	0	54	-10.54	Ave