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: CNFCHDHN302
IC: 10193A-CHDHN302

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

Prepared By: Bo Li

Report Number: R1307091-247

Report Date: 2013-08-05

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	R1307091-247	Original Report	2013-08-05

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: *CHDHN-302* with FCC ID: CNFCHDHN302, IC: 10193A-CHDHN302 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: HD3WA06137F044B for Conducted Tests.
Serial number: HD3WA06137F02CE 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	-	I130510
Woodman Labs, Inc (dba GoPro)	Main PCB	EP-HD3P-WB-DVT-00	-

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 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: R1307091-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) @ 2.4 GHz
ULUWATU	-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

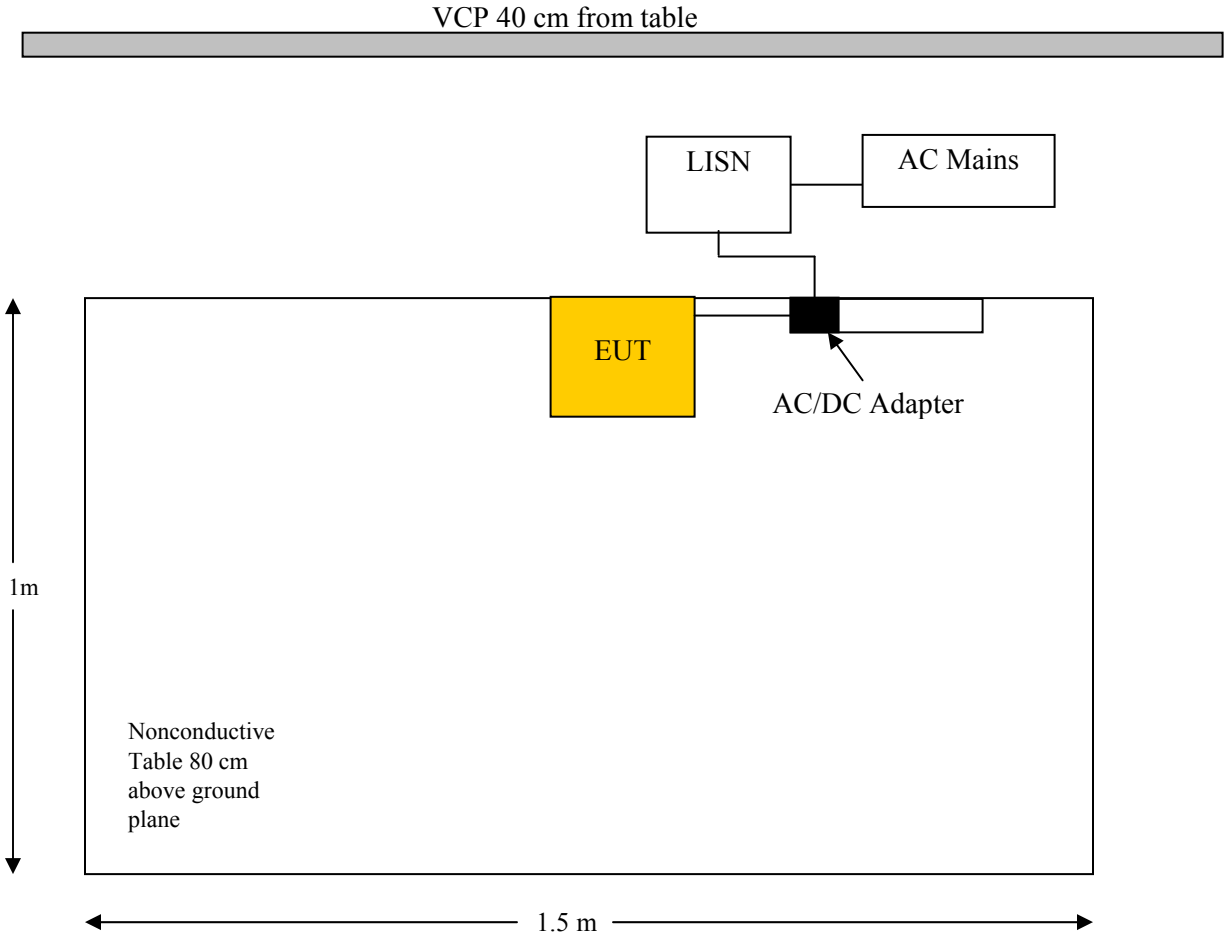
During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cord of the support equipment was connected to LISN-2.

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:	21° C
Relative Humidity:	55 %
ATM Pressure:	101.90 kPa

The testing was performed by Bo Li on 2013-07-23 in 5m chamber3.

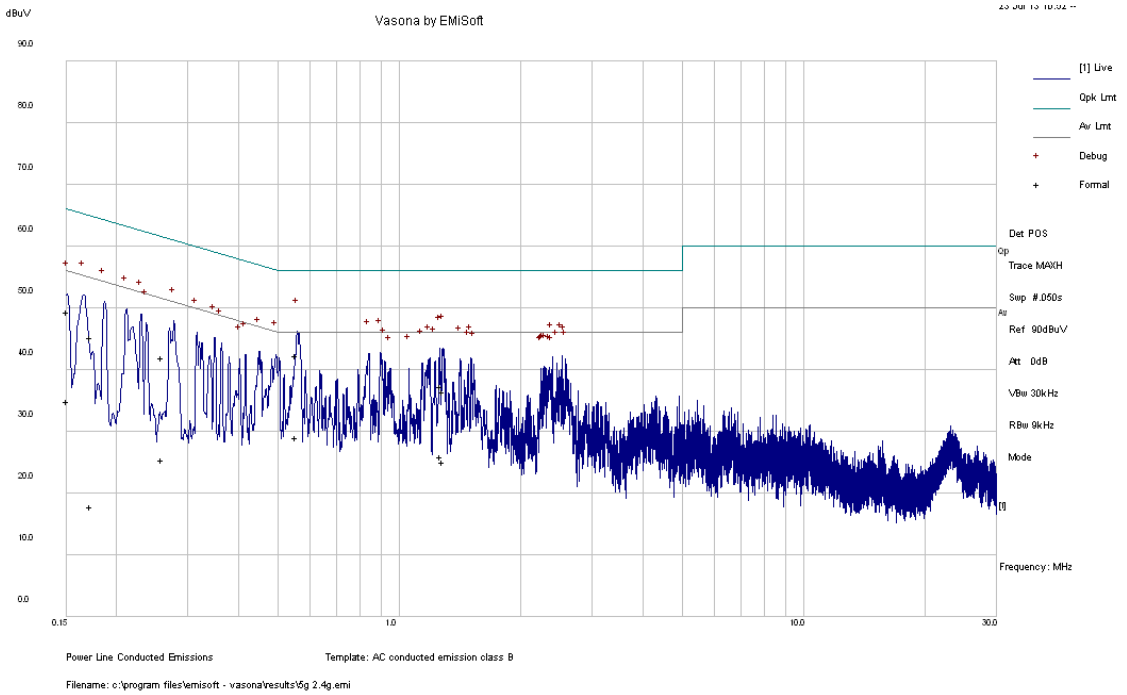
6.8 Summary of Test Results

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)**
-11.23	0.498834	Neutral	0.15-30

6.9 Conducted Emissions Test Plots and Data

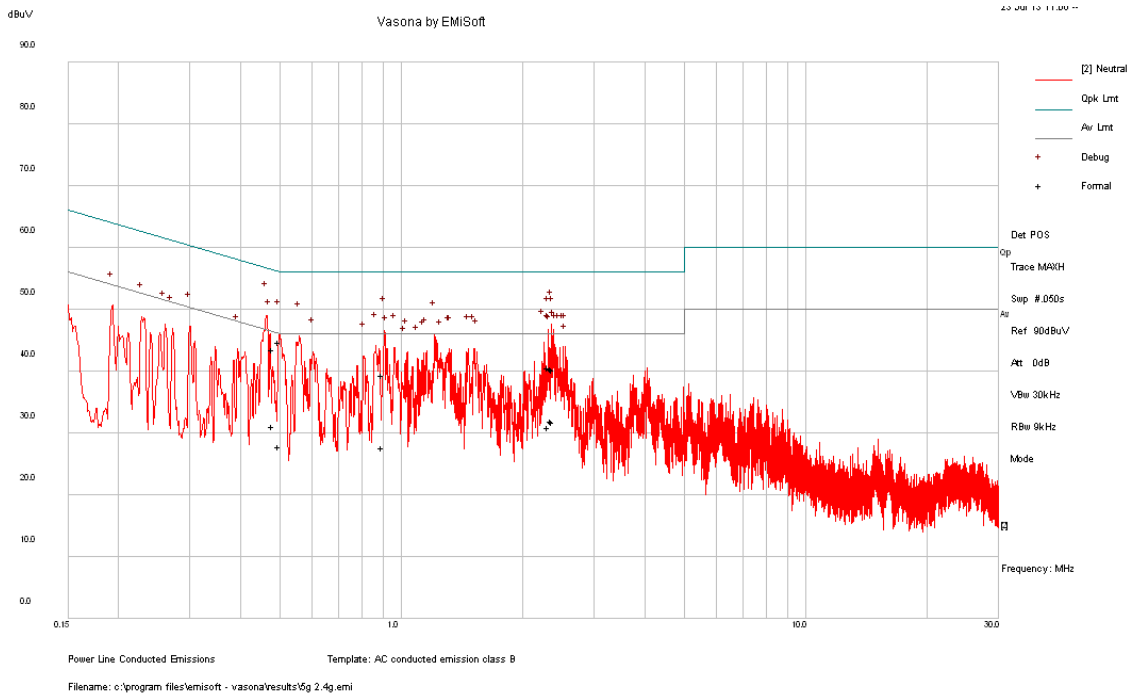
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.556422	42.28	Line	56	-13.72	QP
1.284711	36.46	Line	56	-19.54	QP
1.272105	37.26	Line	56	-18.74	QP
0.258888	41.92	Line	61.47	-19.55	QP
0.151587	49.39	Line	65.91	-16.52	QP
0.172707	45.25	Line	64.83	-19.58	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.556422	29.07	Line	46	-16.93	Ave.
1.284711	25.18	Line	46	-20.82	Ave.
1.272105	26.01	Line	46	-19.99	Ave.
0.258888	25.37	Line	51.47	-26.10	Ave.
0.151587	34.84	Line	55.91	-21.08	Ave.
0.172707	17.87	Line	54.83	-36.96	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.480372	43.62	Neutral	56.33	-12.71	QP
2.351365	40.45	Neutral	56	-15.55	QP
2.37331	40.32	Neutral	56	-15.68	QP
2.309233	40.54	Neutral	56	-15.46	QP
0.899352	39.43	Neutral	56	-16.57	QP
0.498834	44.79	Neutral	56.02	-11.23	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.480372	31.05	Neutral	46.33	-15.29	Ave.
2.351365	31.91	Neutral	46	-14.09	Ave.
2.37331	31.84	Neutral	46	-14.16	Ave.
2.309233	30.99	Neutral	46	-15.01	Ave.
0.899352	27.66	Neutral	46	-18.34	Ave.
0.498834	27.82	Neutral	46.02	-18.2	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:	21 °C
Relative Humidity:	50 %
ATM Pressure:	101.5 kPa

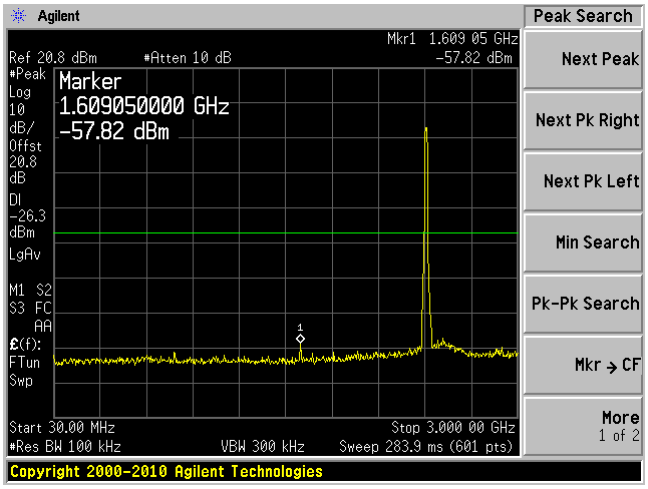
The testing was performed by Bo Li on 2013-7-19 at RF site.

7.5 Test Results

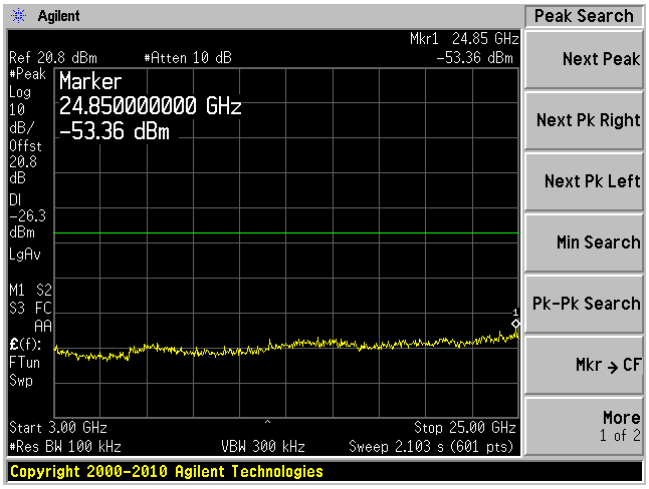
Please refer to following plots of spurious emissions.

802.11b, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

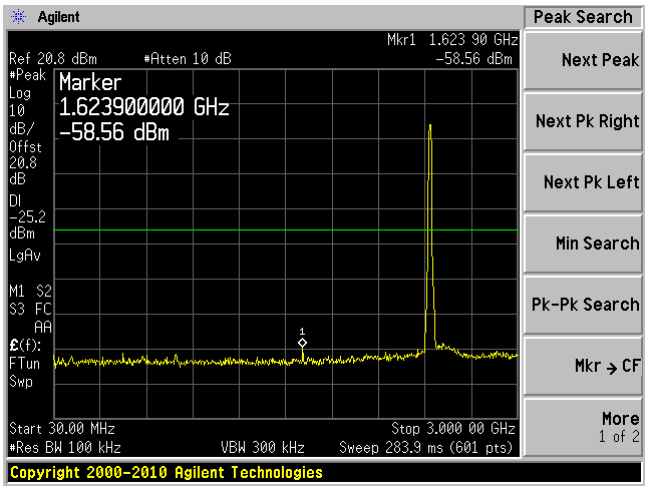


Plot: 3 GHz – 25 GHz

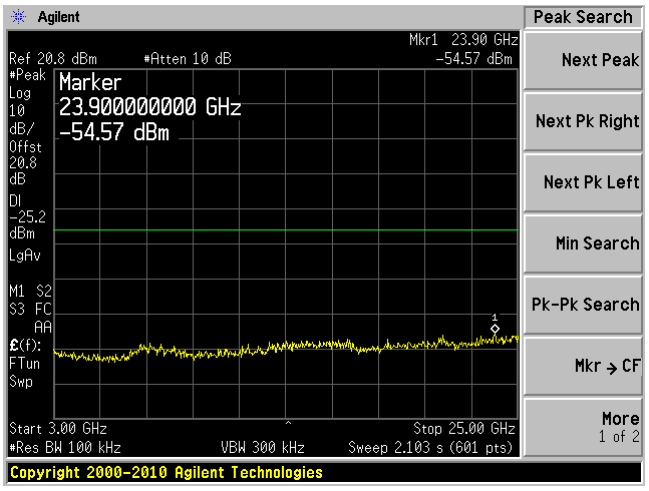


802.11b, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

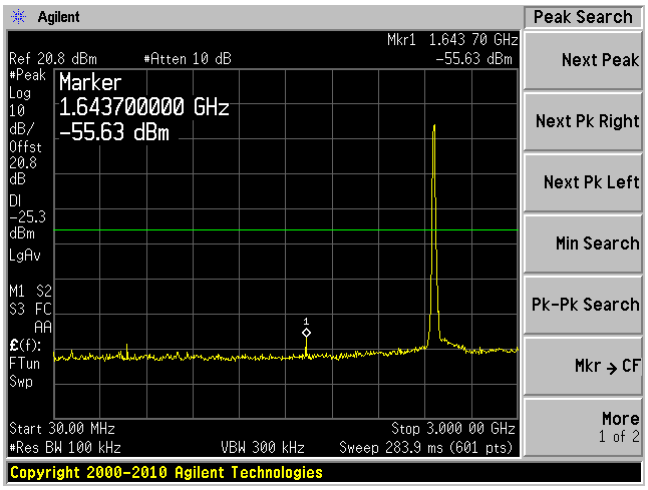


Plot: 3 GHz – 25 GHz

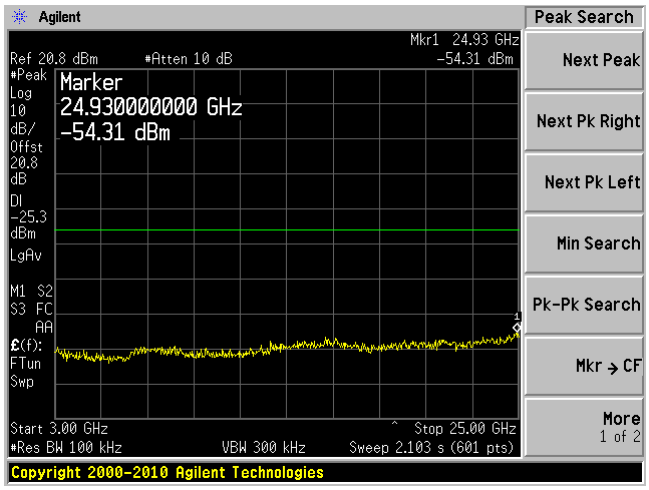


802.11b, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

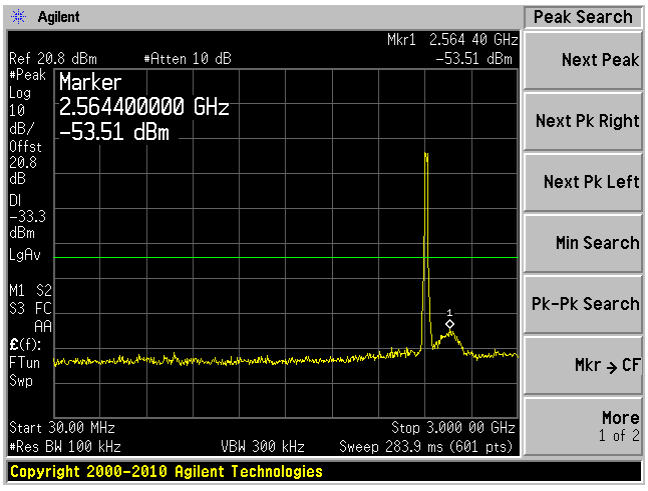


Plot: 3 GHz – 25 GHz

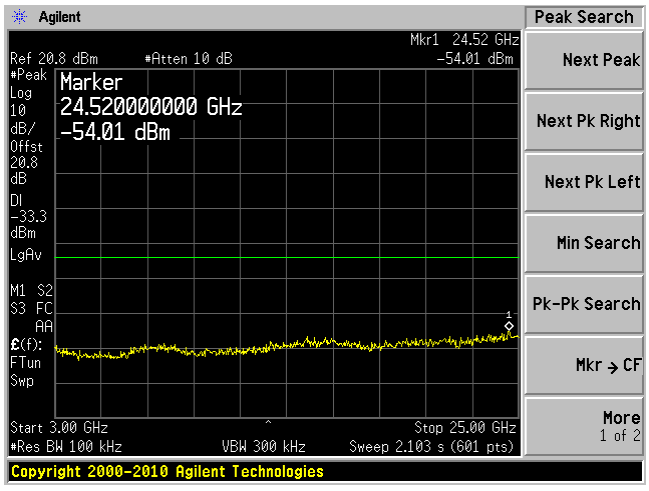


802.11g, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

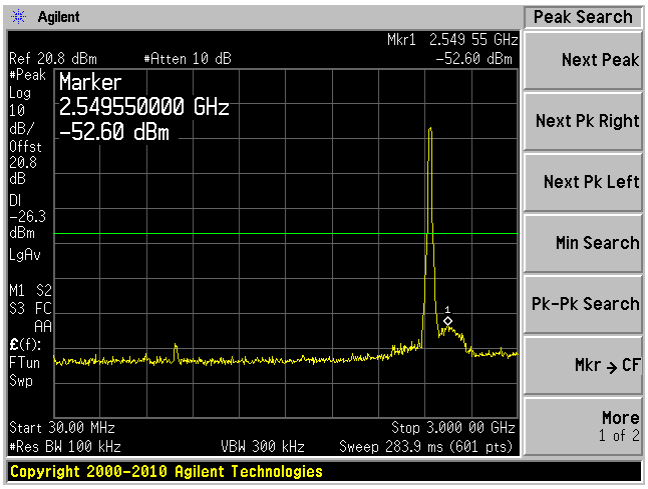


Plot: 3 GHz – 25 GHz

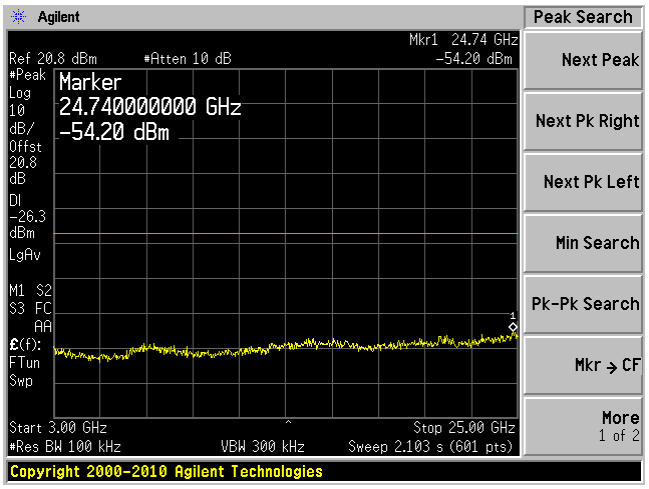


802.11g, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

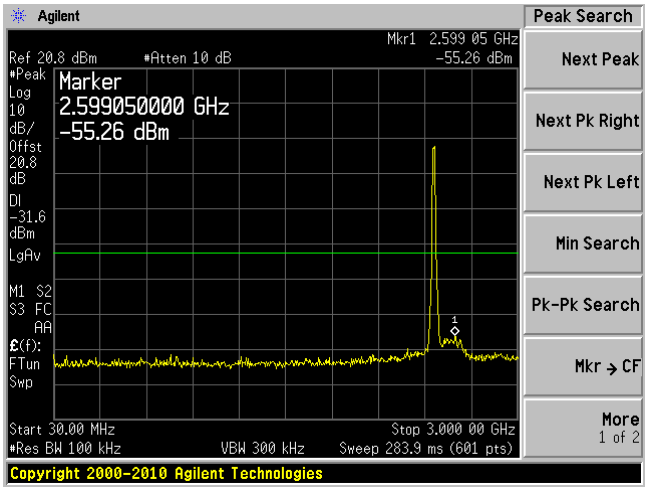


Plot: 3 GHz – 25 GHz

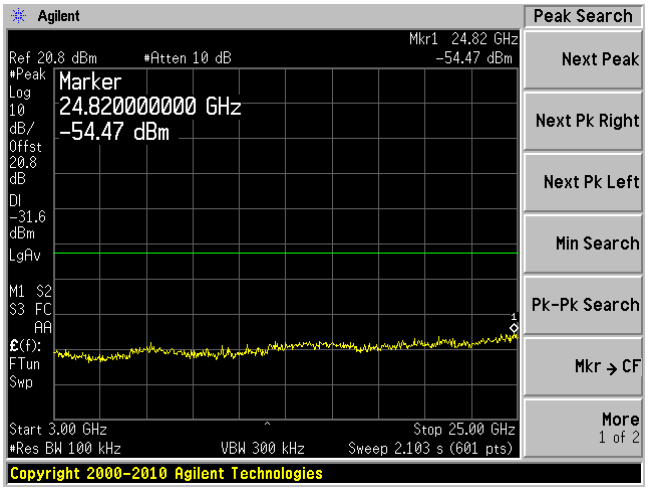


802.11g, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz

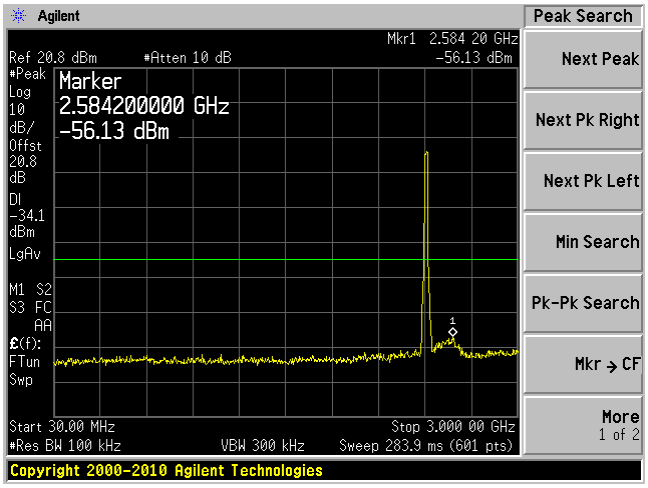


Plot: 3 GHz – 25 GHz

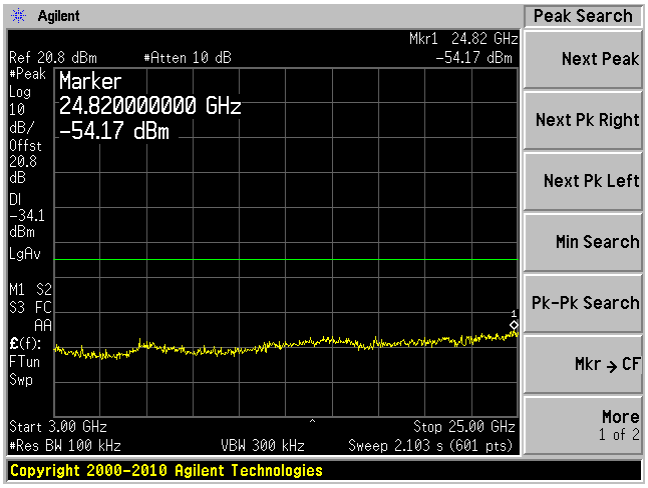


802.11n-HT20, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

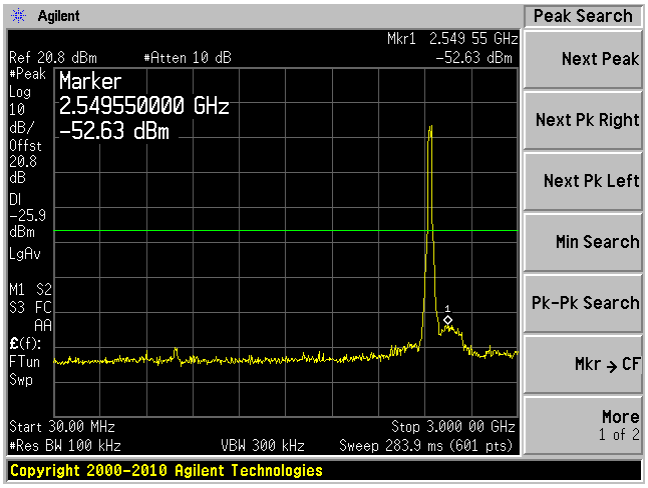


Plot: 3 GHz – 25 GHz

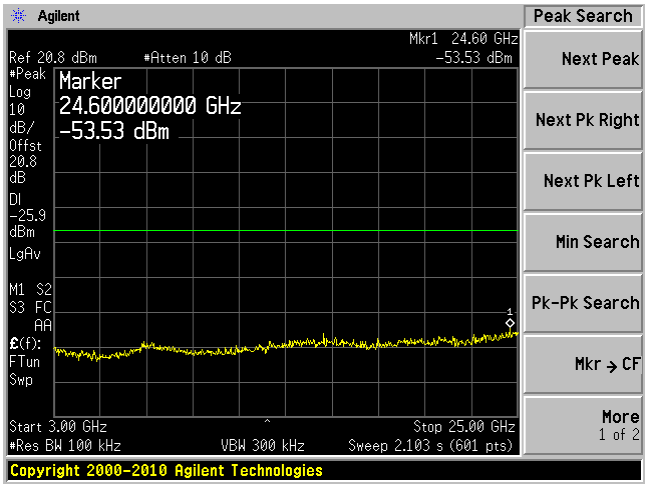


802.11n-HT20, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

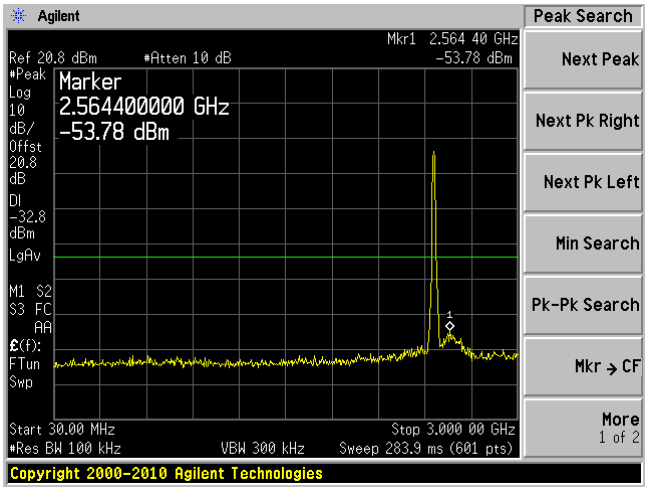


Plot: 3 GHz – 25 GHz

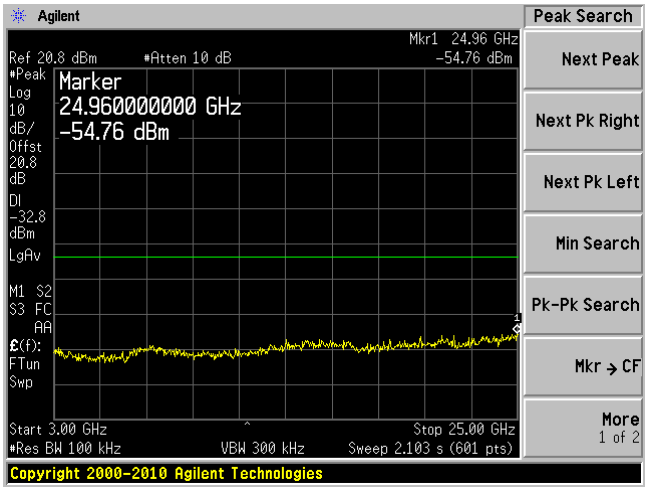


802.11n-HT20, High Channel 2462 MHz

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

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 °C
Relative Humidity:	50 %
ATM Pressure:	101.9 kPa

The testing was performed by Bo Li on 2013-07-22 in 5m chamber3.

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**
-7.2	912.215	Horizontal	802.11b mode Middle Channel

1 – 25 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-0.095	2483.5	Horizontal	802.11n-HT20 mode High Channel

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

8.8 Radiated Emissions Test Results

1)30 MHz – 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)
802.11b mode						
912.215	38.8	100	H	0	46	-7.2
816.185	35.4	100	H	0	46	-10.6
30.97	27.51	200	H	0	40	-12.49
240.005	30.31	100	H	0	46	-15.69
41.155	22.36	100	V	0	40	-17.64
802.11g mode						
912.03025	33.48	99	H	161	46	-12.52
31.276	17.77	368	H	122	40	-22.23
240.00425	27.89	109	H	105	46	-18.11
39.198	11.74	148	V	203	40	-28.26
802.11n-HT20 mode						
912.036	32.11	169	H	150	46	-13.89
33.33075	17.27	205	V	148	40	-22.73
39.69525	11.48	103	V	360	40	-28.52
240.002	25.97	102	H	119	46	-20.03

Note: All 30 MHz – 1 GHz spurious are 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	76.89	294	100	V	28.956	3.12	0	108.966	N/A	N/A	Peak
2412	76.76	195	202	H	28.956	3.12	0	108.836	N/A	N/A	Peak
2412	72.9	294	100	V	28.956	3.12	0	104.976	N/A	N/A	Ave
2412	73.22	195	202	H	28.956	3.12	0	105.296	N/A	N/A	Ave
2390	27.85	294	100	V	28.956	3.12	0	59.926	74	-14.074	Peak
2390	27.96	195	203	H	28.956	3.12	0	60.036	74	-13.964	Peak
2390	16.17	294	100	V	28.956	3.12	0	48.246	54	-5.754	Ave
2390	15.43	195	203	H	28.956	3.12	0	47.506	54	-6.494	Ave
4824	34.96	305	100	V	33.097	4.56	27.7	44.917	74	-29.083	Peak
4824	35.42	312	100	H	33.097	4.56	27.7	45.377	74	-28.623	Peak
4824	24.23	305	100	V	33.097	4.56	27.7	34.187	54	-19.813	Ave
4824	26.94	312	100	H	33.097	4.56	27.7	36.897	54	-17.103	Ave
*7236	33.24	0	100	V	35.928	5.49	27.58	47.078	88.966	-41.888	Peak
*7236	32.57	0	100	H	35.928	5.49	27.58	46.408	88.836	-42.428	Peak
*7236	18.8	0	100	V	35.928	5.49	27.58	32.638	84.976	-52.338	Ave
*7236	18.73	0	100	H	35.928	5.49	27.58	32.568	85.296	-52.728	Ave
*9648	31.34	0	100	V	37.954	6.54	27.06	48.774	88.966	-40.192	Peak
*9648	31.01	0	100	H	37.954	6.54	27.06	48.444	88.836	-40.392	Peak
*9648	17.34	0	100	V	37.954	6.54	27.06	34.774	84.976	-50.202	Ave
*9648	17.3	0	100	H	37.954	6.54	27.06	34.734	85.296	-50.562	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	76.81	271	100	V	28.956	3.12	0	108.886	N/A	N/A	Peak
2437	79.21	193	120	H	28.956	3.12	0	111.286	N/A	N/A	Peak
2437	73.28	271	100	V	28.956	3.12	0	105.356	N/A	N/A	Ave
2437	75.7	193	120	H	28.956	3.12	0	107.776	N/A	N/A	Ave
4874	33.15	305	100	V	33.327	4.54	27.76	43.257	74	-30.743	Peak
4874	35.13	300	100	H	33.327	4.54	27.76	45.237	74	-28.763	Peak
4874	19.51	305	100	V	33.327	4.54	27.76	29.617	54	-24.383	Ave
4874	21.43	300	100	H	33.327	4.54	27.76	31.537	54	-22.463	Ave
*7311	33.05	0	100	V	36.369	5.57	27.51	47.479	74	-26.521	Peak
*7311	32.72	0	100	H	36.369	5.57	27.51	47.149	74	-26.851	Peak
*7311	18.88	0	100	V	36.369	5.57	27.51	33.309	54	-20.691	Ave
*7311	18.78	0	100	H	36.369	5.57	27.51	33.209	54	-20.791	Ave
*9748	31.33	0	100	V	38.087	6.62	26.98	49.057	88.886	-39.829	Peak
*9748	31.68	0	100	H	38.087	6.62	26.98	49.407	91.286	-41.879	Peak
*9748	17.92	0	100	V	38.087	6.62	26.98	35.647	85.356	-49.709	Ave
*9748	17.61	0	100	H	38.087	6.62	26.98	35.337	87.776	-52.439	Ave

Note*: noise floor level

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	77.1	272	100	V	29.155	3.25	0	109.505	N/A	N/A	Peak
2462	77.88	193	119	H	29.155	3.25	0	110.285	N/A	N/A	Peak
2462	73.04	272	100	V	29.155	3.25	0	105.445	N/A	N/A	Ave
2462	74.37	193	119	H	29.155	3.25	0	106.775	N/A	N/A	Ave
2483.5	29.19	274	100	V	29.155	3.25	0	61.595	74	-12.405	Peak
2483.5	29.91	193	119	H	29.155	3.25	0	62.315	74	-11.685	Peak
2483.5	17.42	100	100	V	29.155	3.25	0	49.825	54	-4.175	Ave
2483.5	18.04	193	119	H	29.155	3.25	0	50.445	54	-3.555	Ave
4924	33.24	310	100	V	33.327	4.52	27.75	43.337	74	-30.663	Peak
4924	33.01	300	100	H	33.327	4.52	27.75	43.107	74	-30.893	Peak
4924	21.58	310	100	V	33.327	4.52	27.75	31.677	54	-22.323	Ave
4924	18.92	300	100	H	33.327	4.52	27.75	29.017	54	-24.983	Ave
*7386	32.88	0	100	V	36.565	5.62	27.51	47.555	74	-26.445	Peak
*7386	32.24	0	100	H	36.565	5.62	27.51	46.915	74	-27.085	Peak
*7386	18.61	0	100	V	36.565	5.62	27.51	33.285	54	-20.715	Ave
*7386	18.67	0	100	H	36.565	5.62	27.51	33.345	54	-20.655	Ave
*9848	32.5	0	100	V	38.287	6.55	26.98	50.357	88.225	-37.868	Peak
*9848	32.08	0	100	H	38.287	6.55	26.98	49.937	90.605	-40.668	Peak
*9848	17.89	0	100	V	38.287	6.55	26.98	35.747	85.235	-49.488	Ave
*9848	17.57	0	100	H	38.287	6.55	26.98	35.427	87.905	-52.478	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	72.39	291	100	V	28.956	3.12	0	104.466	N/A	N/A	Peak
2412	74.62	193	125	H	28.956	3.12	0	106.696	N/A	N/A	Peak
2412	61.23	291	100	V	28.956	3.12	0	93.306	N/A	N/A	Ave
2412	63.91	193	125	H	28.956	3.12	0	95.986	N/A	N/A	Ave
2390	34.23	291	100	V	28.956	3.12	0	66.306	74	-7.694	Peak
2390	35.09	189	132	H	28.956	3.12	0	67.166	74	-6.834	Peak
2390	17.06	291	100	V	28.956	3.12	0	49.136	54	-4.864	Ave
2390	17.59	189	132	H	28.956	3.12	0	49.666	54	-4.334	Ave
*4824	32.92	0	100	V	33.097	4.56	27.7	42.877	74	-31.123	Peak
*4824	33.66	0	100	H	33.097	4.56	27.7	43.617	74	-30.383	Peak
*4824	19.06	0	100	V	33.097	4.56	27.7	29.017	54	-24.983	Ave
*4824	18.73	0	100	H	33.097	4.56	27.7	28.687	54	-25.313	Ave
*7236	32.77	0	100	V	35.928	5.49	27.58	46.608	84.466	-37.858	Peak
*7236	32.64	0	100	H	35.928	5.49	27.58	46.478	86.696	-40.218	Peak
*7236	18.7	0	100	V	35.928	5.49	27.58	32.538	73.306	-40.768	Ave
*7236	18.65	0	100	H	35.928	5.49	27.58	32.488	75.986	-43.498	Ave
*9648	31.33	0	100	V	37.954	6.54	27.06	48.764	84.466	-35.702	Peak
*9648	31.47	0	100	H	37.954	6.54	27.06	48.904	86.696	-37.792	Peak
*9648	17.44	0	100	V	37.954	6.54	27.06	34.874	73.306	-38.432	Ave
*9648	17.45	0	100	H	37.954	6.54	27.06	34.884	75.986	-41.102	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	77.81	271	100	V	28.956	3.12	0	109.886	N/A	N/A	Peak
2437	78.87	193	120	H	28.956	3.12	0	110.946	N/A	N/A	Peak
2437	73.88	271	100	V	28.956	3.12	0	105.956	N/A	N/A	Ave
2437	75.67	193	120	H	28.956	3.12	0	107.746	N/A	N/A	Ave
4874	34.01	0	100	V	33.327	4.54	27.76	44.117	74	-29.883	Peak
4874	35.7	303	107	H	33.327	4.54	27.76	45.807	74	-28.193	Peak
4874	19.41	0	100	V	33.327	4.54	27.76	29.517	54	-24.483	Ave
4874	21.31	303	107	H	33.327	4.54	27.76	31.417	54	-22.583	Ave
*7311	32.57	0	100	V	36.369	5.57	27.51	46.999	74	-27.001	Peak
*7311	33.5	0	100	H	36.369	5.57	27.51	47.929	74	-26.071	Peak
*7311	18.28	0	100	V	36.369	5.57	27.51	32.709	54	-21.291	Ave
*7311	18.42	0	100	H	36.369	5.57	27.51	32.849	54	-21.151	Ave
*9748	31.75	0	100	V	38.087	6.62	26.98	49.477	89.886	-40.409	Peak
*9748	31.43	0	100	H	38.087	6.62	26.98	49.157	90.946	-41.789	Peak
*9748	17.35	0	100	V	38.087	6.62	26.98	35.077	85.956	-50.879	Ave
*9748	17.14	0	100	H	38.087	6.62	26.98	34.867	87.746	-52.879	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	75.17	272	100	V	29.155	3.25	0	107.575	N/A	N/A	Peak
2462	76.45	192	120	H	29.155	3.25	0	108.855	N/A	N/A	Peak
2462	64.06	272	100	V	29.155	3.25	0	96.465	N/A	N/A	Ave
2462	65.83	192	120	H	29.155	3.25	0	98.235	N/A	N/A	Ave
2483.5	38.57	271	100	V	29.155	3.25	0	70.975	74	-3.025	Peak
2483.5	39.73	192	121	H	29.155	3.25	0	72.135	74	-1.865	Peak
2483.5	20.84	271	100	V	29.155	3.25	0	53.245	54	-0.755	Ave
2483.5	21.47	192	121	H	29.155	3.25	0	53.875	54	-0.125	Ave
4924	32.34	0	100	V	33.327	4.52	27.75	42.437	74	-31.563	Peak
4924	32.67	0	100	H	33.327	4.52	27.75	42.767	74	-31.233	Peak
4924	18.35	0	100	V	33.327	4.52	27.75	28.447	54	-25.553	Ave
4924	19.1	0	100	H	33.327	4.52	27.75	29.197	54	-24.803	Ave
*7386	32.27	0	100	V	36.565	5.62	27.51	46.945	74	-27.055	Peak
*7386	33.07	0	100	H	36.565	5.62	27.51	47.745	74	-26.255	Peak
*7386	18.67	0	100	V	36.565	5.62	27.51	33.345	54	-20.655	Ave
*7386	18.6	0	100	H	36.565	5.62	27.51	33.275	54	-20.725	Ave
*9848	31.39	0	100	V	38.287	6.55	26.98	49.247	87.575	-38.328	Peak
*9848	31.41	0	100	H	38.287	6.55	26.98	49.267	88.855	-39.588	Peak
*9848	17.57	0	100	V	38.287	6.55	26.98	35.427	76.465	-41.038	Ave
*9848	17.56	0	100	H	38.287	6.55	26.98	35.417	78.235	-42.818	Ave

Note*: noise floor level

802.11n-HT20mode

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	72.04	291	100	V	28.956	3.12	0	104.116	N/A	N/A	Peak
2412	74.49	193	123	H	28.956	3.12	0	106.566	N/A	N/A	Peak
2412	61.45	291	100	V	28.956	3.12	0	93.526	N/A	N/A	Ave
2412	63.66	193	123	H	28.956	3.12	0	95.736	N/A	N/A	Ave
2390	39.46	292	100	V	28.956	3.12	0	71.536	74	-2.464	Peak
2390	40.21	190	127	H	28.956	3.12	0	72.286	74	-1.714	Peak
2390	19.42	292	100	V	28.956	3.12	0	51.496	54	-2.504	Ave
2390	20.55	190	127	H	28.956	3.12	0	52.626	54	-1.374	Ave
*4824	33.46	0	100	V	33.097	4.56	27.7	43.417	74	-30.583	Peak
*4824	33.56	0	100	H	33.097	4.56	27.7	43.517	74	-30.483	Peak
*4824	18.99	0	100	V	33.097	4.56	27.7	28.947	54	-25.053	Ave
*4824	19.07	0	100	H	33.097	4.56	27.7	29.027	54	-24.973	Ave
*7236	32.28	0	100	V	35.928	5.49	27.58	46.118	84.116	-37.998	Peak
*7236	32.39	0	100	H	35.928	5.49	27.58	46.228	86.566	-40.338	Peak
*7236	18.45	0	100	V	35.928	5.49	27.58	32.288	73.526	-41.238	Ave
*7236	18.52	0	100	H	35.928	5.49	27.58	32.358	75.736	-43.378	Ave
*9648	31.18	0	100	V	37.954	6.54	27.06	48.614	84.116	-35.502	Peak
*9648	30.67	0	100	H	37.954	6.54	27.06	48.104	86.566	-38.462	Peak
*9648	17.17	0	100	V	37.954	6.54	27.06	34.604	73.526	-38.922	Ave
*9648	17.09	0	100	H	37.954	6.54	27.06	34.524	75.736	-41.212	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	79.56	291	100	V	28.956	3.12	0	111.636	N/A	N/A	Peak
2437	81.43	193	120	H	28.956	3.12	0	113.506	N/A	N/A	Peak
2437	68.66	291	100	V	28.956	3.12	0	100.736	N/A	N/A	Ave
2437	70.45	193	120	H	28.956	3.12	0	102.526	N/A	N/A	Ave
4874	34.38	321	100	V	33.327	4.54	27.76	44.487	74	-29.513	Peak
4874	35.48	300	100	H	33.327	4.54	27.76	45.587	74	-28.413	Peak
4874	20.53	321	100	V	33.327	4.54	27.76	30.637	54	-23.363	Ave
4874	20.9	300	100	H	33.327	4.54	27.76	31.007	54	-22.993	Ave
*7311	32.67	0	100	V	36.369	5.57	27.51	47.099	74	-26.901	Peak
*7311	32.65	0	100	H	36.369	5.57	27.51	47.079	74	-26.921	Peak
*7311	18.74	0	100	V	36.369	5.57	27.51	33.169	54	-20.831	Ave
*7311	18.61	0	100	H	36.369	5.57	27.51	33.039	54	-20.961	Ave
*9748	31.29	0	100	V	38.087	6.62	26.98	49.017	91.636	-42.619	Peak
*9748	31.41	0	100	H	38.087	6.62	26.98	49.137	93.506	-44.369	Peak
*9748	17.54	0	100	V	38.087	6.62	26.98	35.267	80.736	-45.469	Ave
*9748	17.46	0	100	H	38.087	6.62	26.98	35.187	82.526	-47.339	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	74.4	291	100	V	29.155	3.25	0	106.805	N/A	N/A	Peak
2462	75.93	195	121	H	29.155	3.25	0	108.335	N/A	N/A	Peak
2462	63.54	291	100	V	29.155	3.25	0	95.945	N/A	N/A	Ave
2462	64.41	195	121	H	29.155	3.25	0	96.815	N/A	N/A	Ave
2483.5	38.11	291	100	V	29.155	3.25	0	70.515	74	-3.485	Peak
2483.5	39.7	195	121	H	29.155	3.25	0	72.105	74	-1.895	Peak
2483.5	19.54	291	100	V	29.155	3.25	0	51.945	54	-2.055	Ave
2483.5	21.5	195	121	H	29.155	3.25	0	53.905	54	-0.095	Ave
4924	32.5	0	100	V	33.327	4.52	27.75	42.597	74	-31.403	Peak
4924	32.69	0	100	H	33.327	4.52	27.75	42.787	74	-31.213	Peak
4924	18.51	0	100	V	33.327	4.52	27.75	28.607	54	-25.393	Ave
4924	18.29	0	100	H	33.327	4.52	27.75	28.387	54	-25.613	Ave
*7386	32.73	0	100	V	36.565	5.62	27.51	47.405	74	-26.595	Peak
*7386	32.28	0	100	H	36.565	5.62	27.51	46.955	74	-27.045	Peak
*7386	18.49	0	100	V	36.565	5.62	27.51	33.165	54	-20.835	Ave
*7386	18.52	0	100	H	36.565	5.62	27.51	33.195	54	-20.805	Ave
*9848	31.26	0	100	V	38.287	6.55	26.98	49.117	86.805	-37.688	Peak
*9848	31.06	0	100	H	38.287	6.55	26.98	48.917	88.335	-39.418	Peak
*9848	17.45	0	100	V	38.287	6.55	26.98	35.307	75.945	-40.638	Ave
*9848	17.34	0	100	H	38.287	6.55	26.98	35.197	76.815	-41.618	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:	21 °C
Relative Humidity:	50 %
ATM Pressure:	101.5 kPa

The testing was performed by Bo Li on 2013-7-19 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	10.063	14.0628	> 0.5	Compliant
Middle	2437	10.063	14.1045	> 0.5	Compliant
High	2462	10.097	14.1302	> 0.5	Compliant

802.11 g mode:

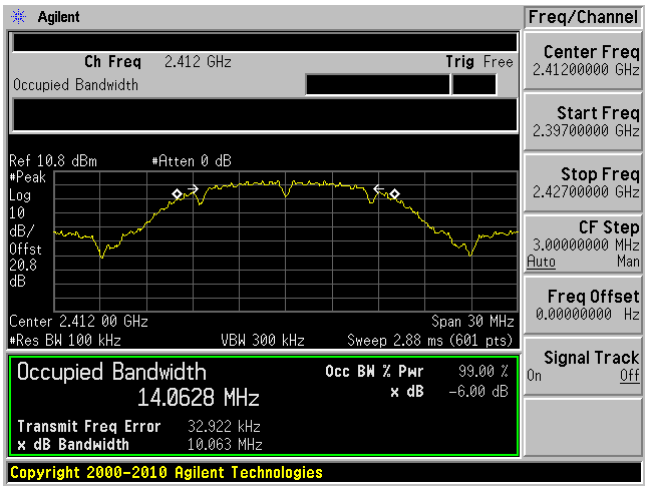
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	16.210	16.4475	> 0.5	Compliant
Middle	2437	16.357	16.5435	> 0.5	Compliant
High	2462	16.340	16.4845	> 0.5	Compliant

802.11n-HT20 mode:

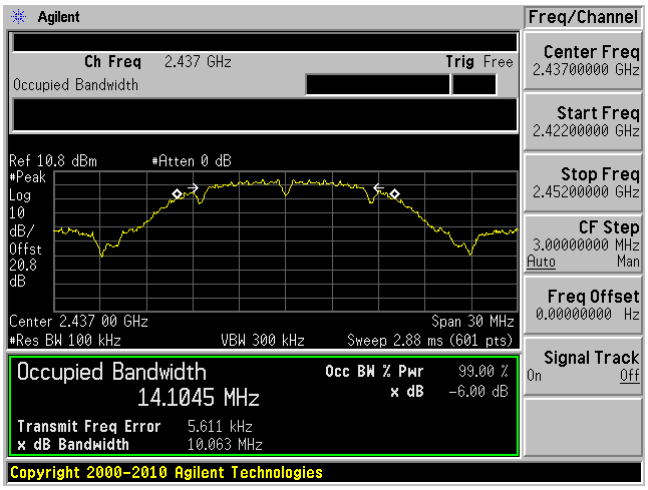
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	17.288	17.6345	> 0.5	Compliant
Middle	2437	17.574	17.7290	> 0.5	Compliant
High	2462	17.281	17.6410	> 0.5	Compliant

802.11b mode

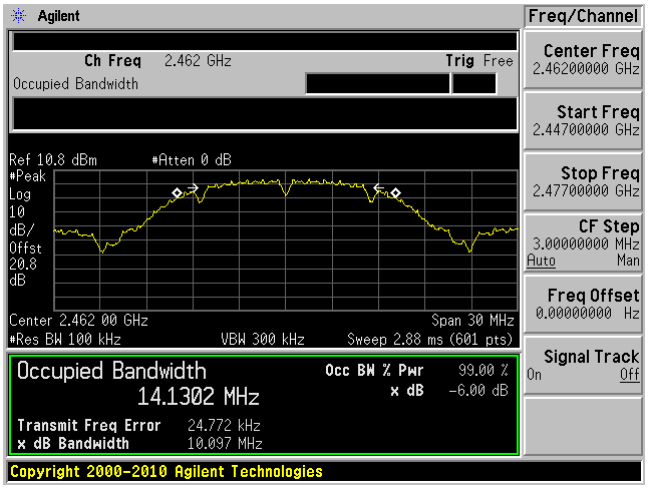
Low channel: 2412 MHz



Middle channel: 2437 MHz

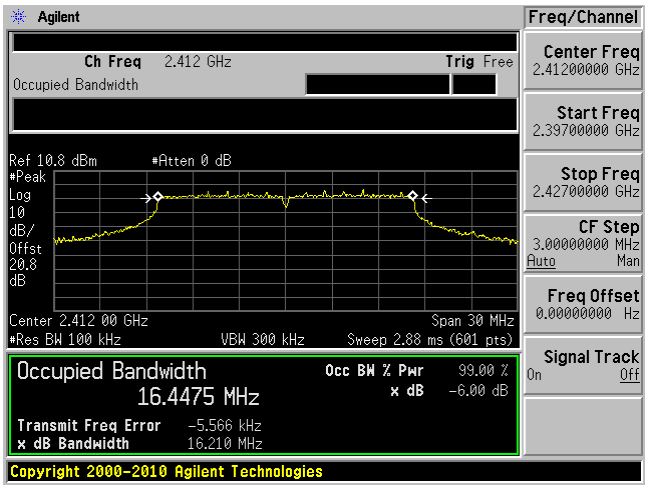


High channel: 2462 MHz

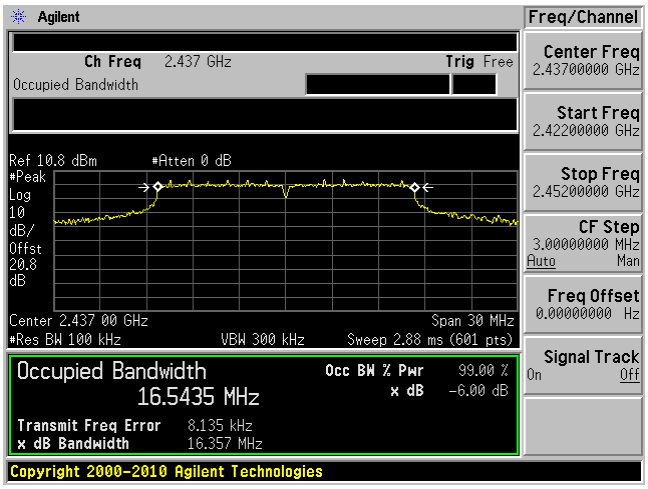


802.11g mode

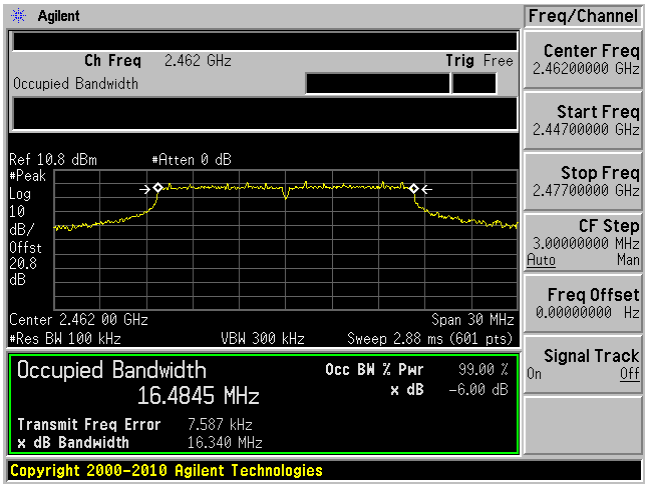
Low channel: 2412 MHz



Middle channel: 2437 MHz

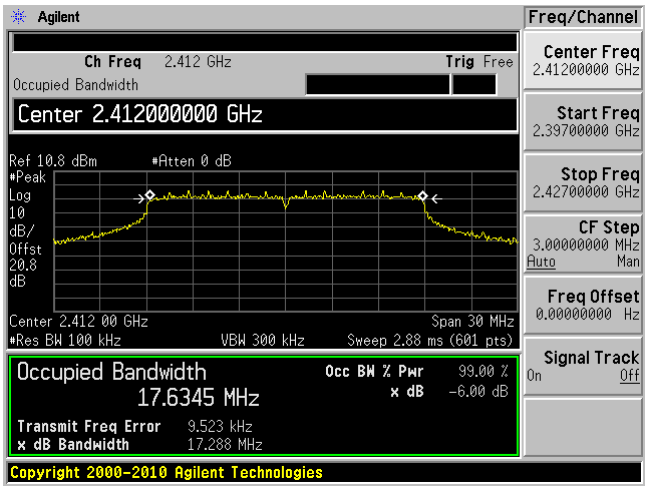


High channel: 2462 MHz

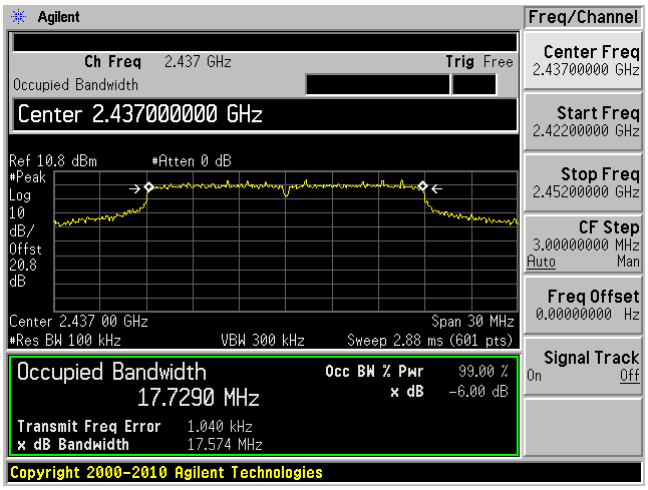


802.11n-HT20 mode

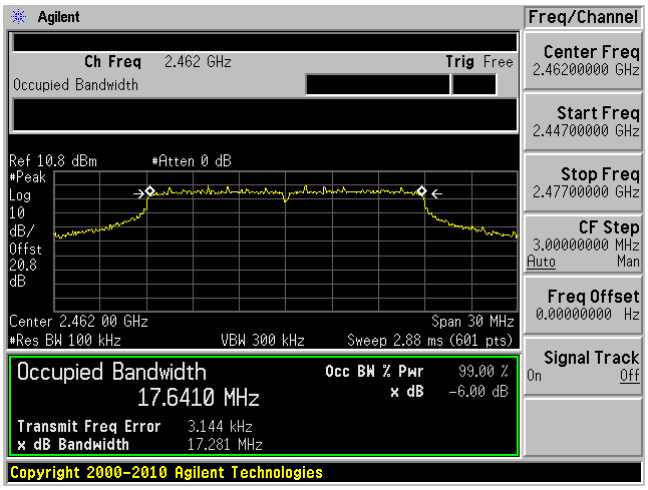
Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz



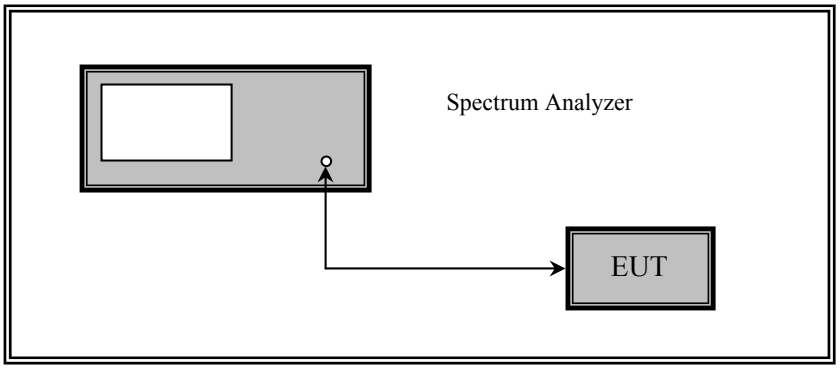
10 FCC §15.247(b) & IC RSS-210 §A8.4 – Peak Output Power Measurement

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:	21 °C
Relative Humidity:	50 %
ATM Pressure:	101.5 kPa

The testing was performed by Bo Li on 2013-7-19 at RF site.

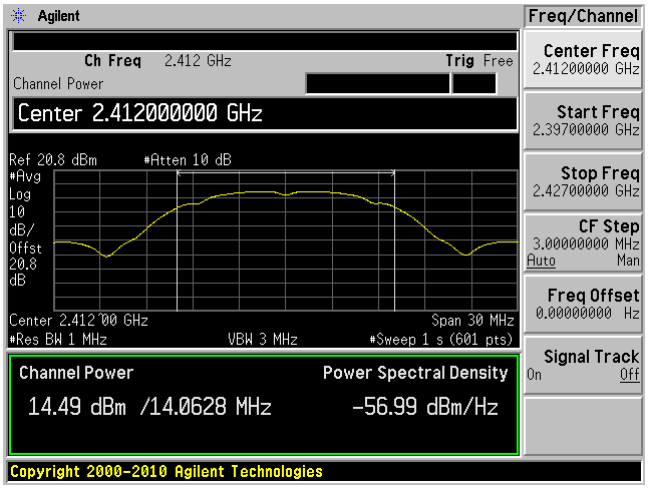
10.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b mode				
Low	2412	14.49	30	-15.51
Middle	2437	15.42	30	-14.58
High	2462	14.93	30	-15.07
802.11g mode				
Low	2412	8.11	30	-21.89
Middle	2437	15.65	30	-14.35
High	2462	10.52	30	-19.48
802.11n-HT20 mode				
Low	2412	8.03	30	-21.97
Middle	2437	15.60	30	-14.4
High	2462	9.54	30	-20.46

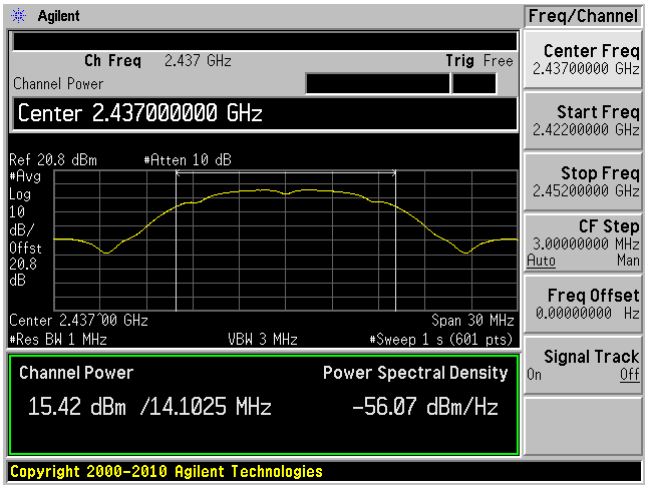
Please refer to the following plots.

802.11b mode

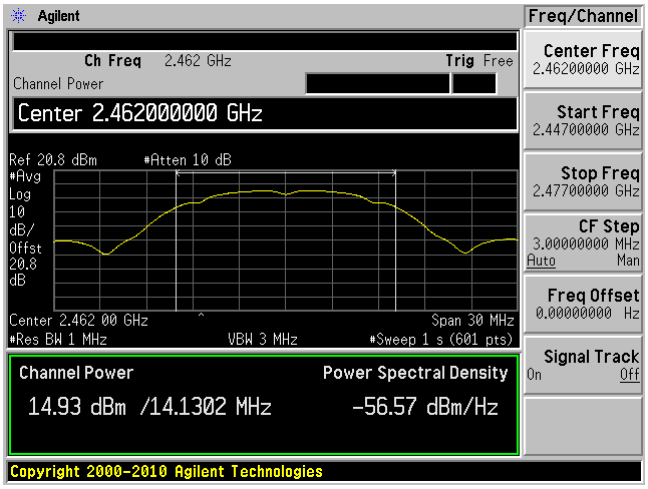
Low channel: 2412 MHz



Middle channel: 2437 MHz

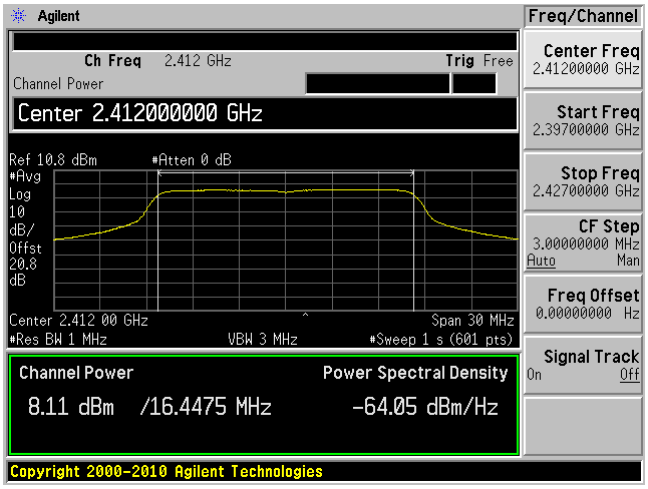


High channel: 2462 MHz

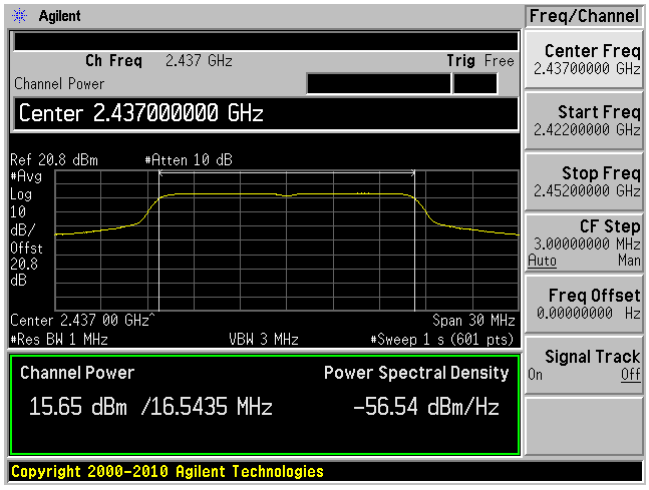


802.11g mode

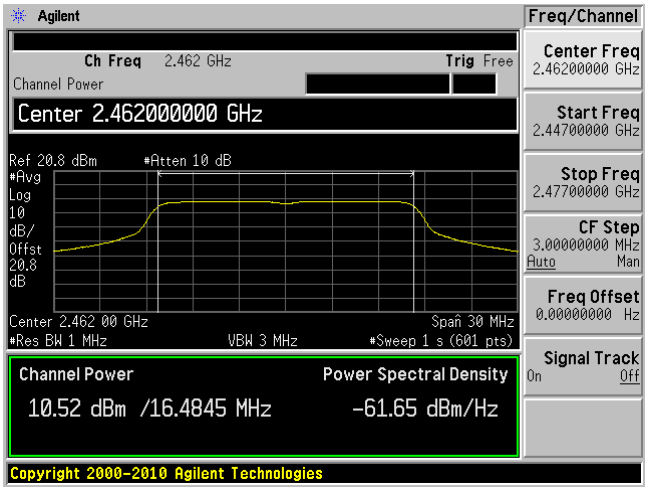
Low channel: 2412 MHz



Middle channel: 2437 MHz

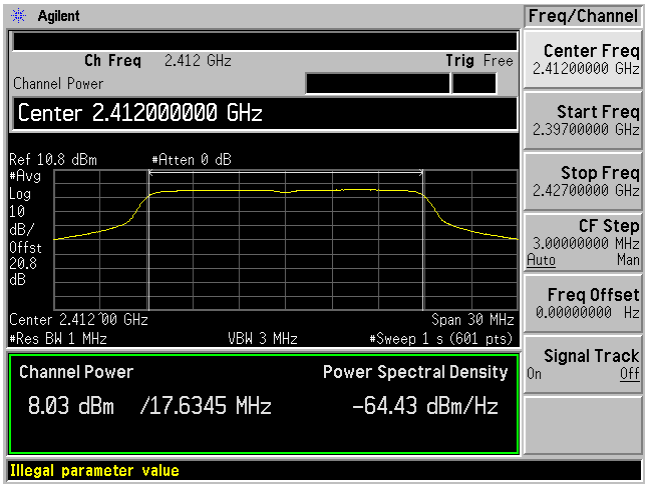


High channel: 2462 MHz

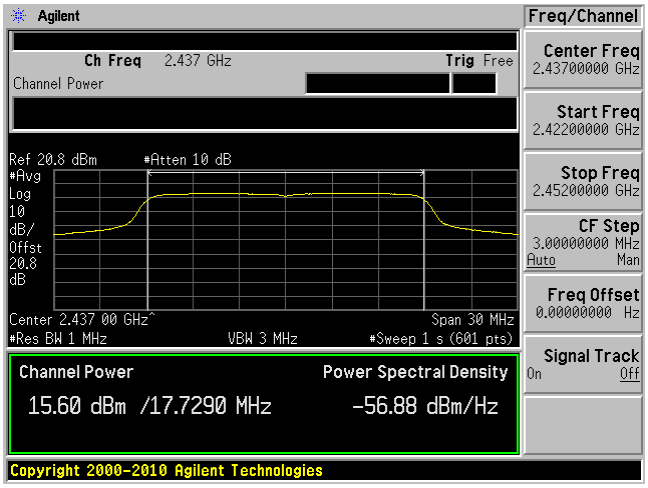


802.11n-HT20 mode

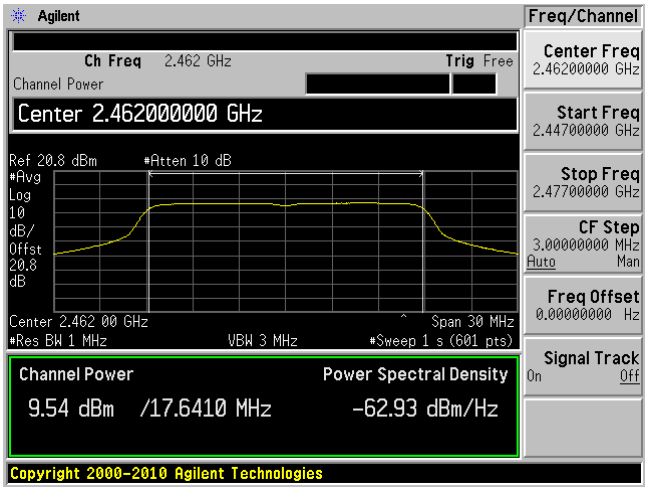
Low channel: 2412 MHz



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:	21 °C
Relative Humidity:	50 %
ATM Pressure:	101.5 kPa

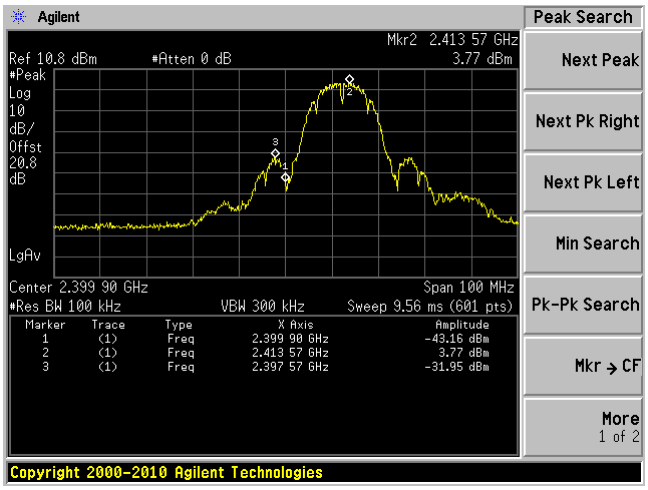
The testing was performed by Bo Li on 2013-7-19 at RF site.

11.5 Test Results

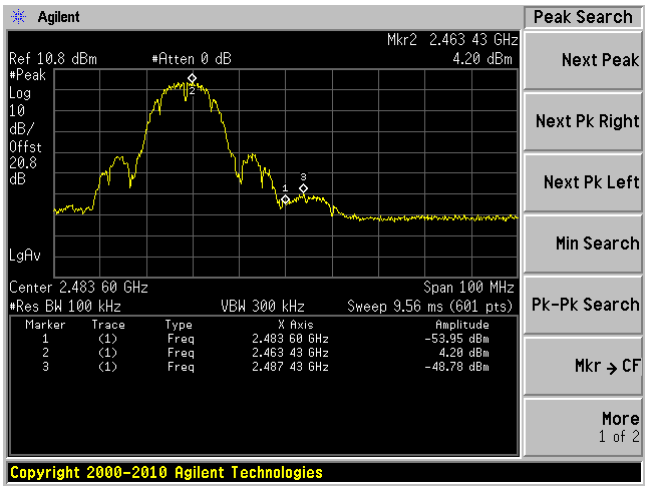
Please refer to following pages for plots of band edge.

802.11b mode

802.11b, Low Band Edge

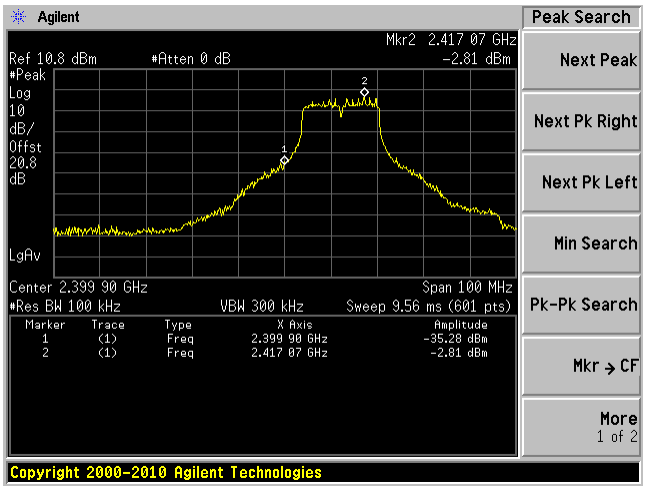


802.11b, High Band Edge

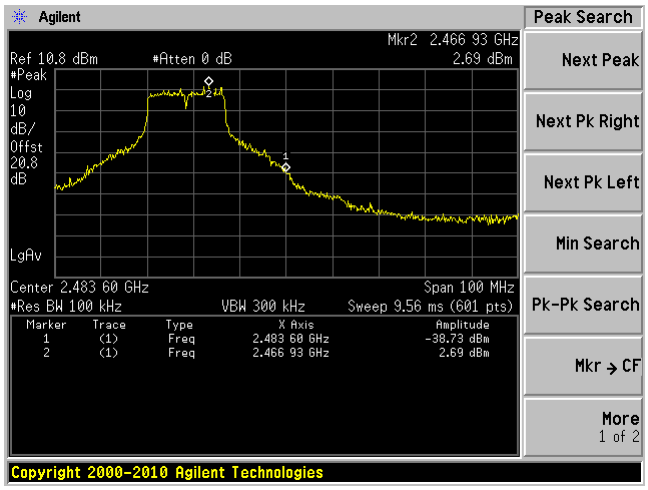


802.11g mode

802.11g, Low Band Edge

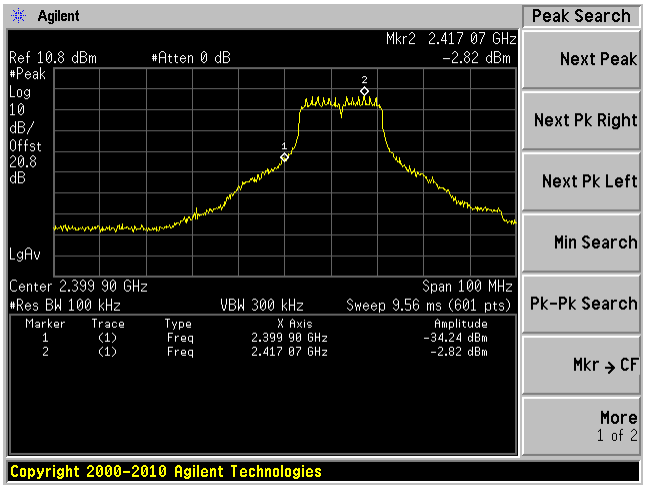


802.11g, High Band Edge

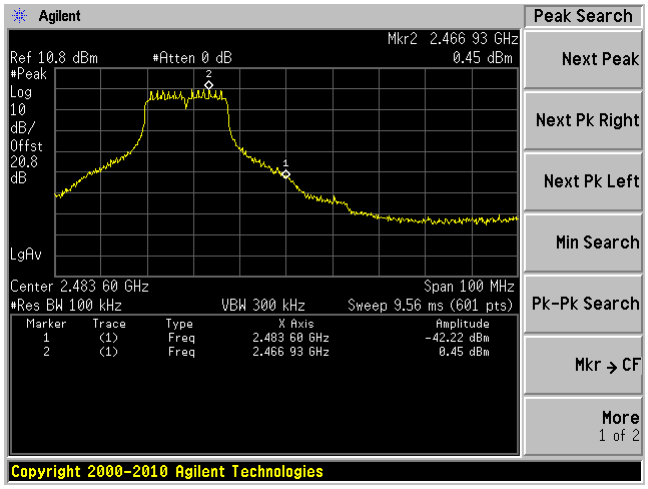


802.11n-HT20 mode

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:	21 °C
Relative Humidity:	50 %
ATM Pressure:	101.5 kPa

The testing was performed by Bo Li on 2013-7-19 at RF site.

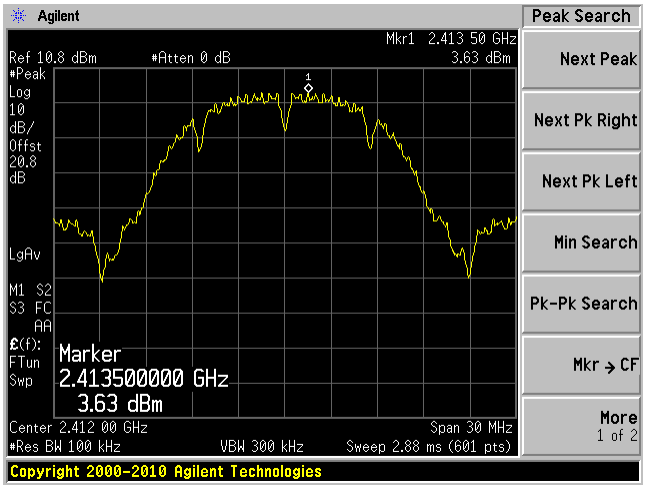
12.5 Test Results

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
802.11b mode				
Low	2412	3.63	8	-4.37
Middle	2437	4.30	8	-3.7
High	2462	4.27	8	-3.73
802.11g mode				
Low	2412	-2.96	8	-10.96
Middle	2437	4.80	8	-3.2
High	2462	-0.49	8	-8.49
802.11n-HT20 mode				
Low	2412	-3.0	8	-11
Middle	2437	4.73	8	-3.27
High	2462	-1.51	8	-9.51

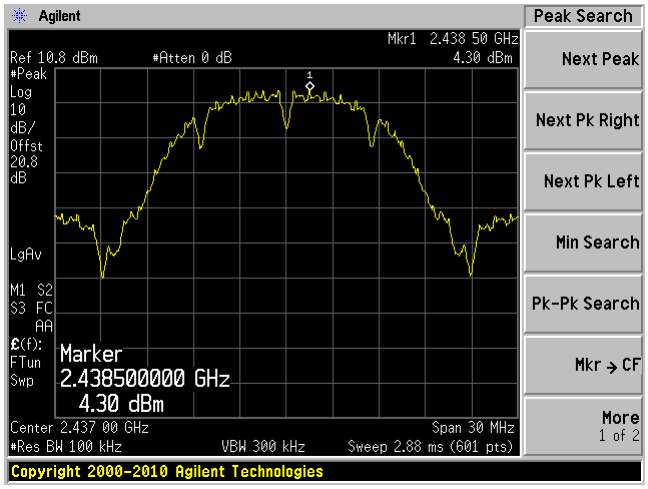
Please refer to the following plots.

802.11b mode

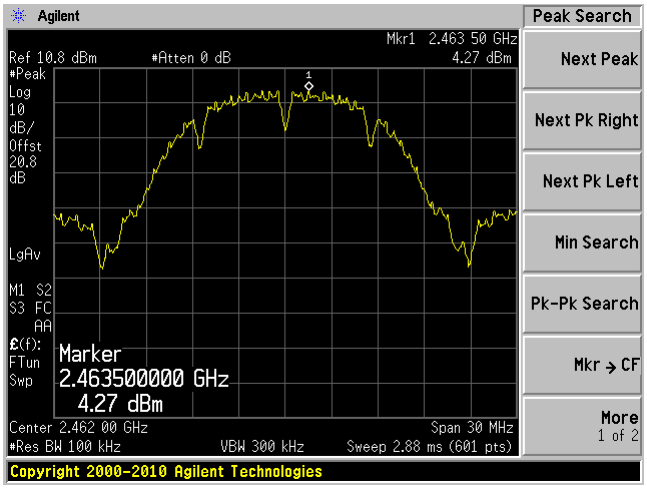
Low channel: 2412 MHz



Middle channel: 2437 MHz

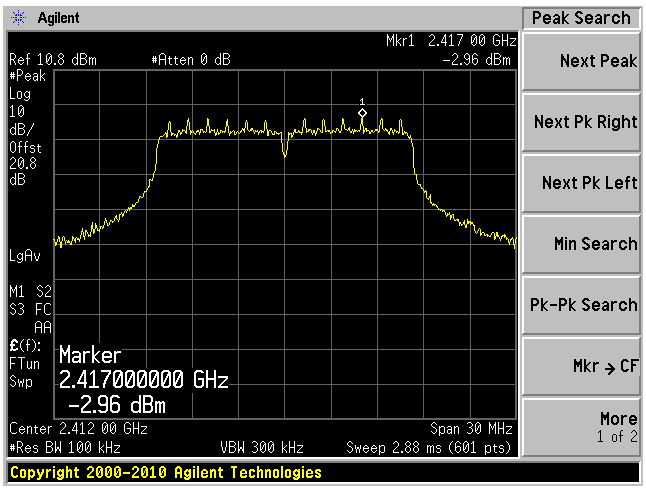


High channel: 2462 MHz

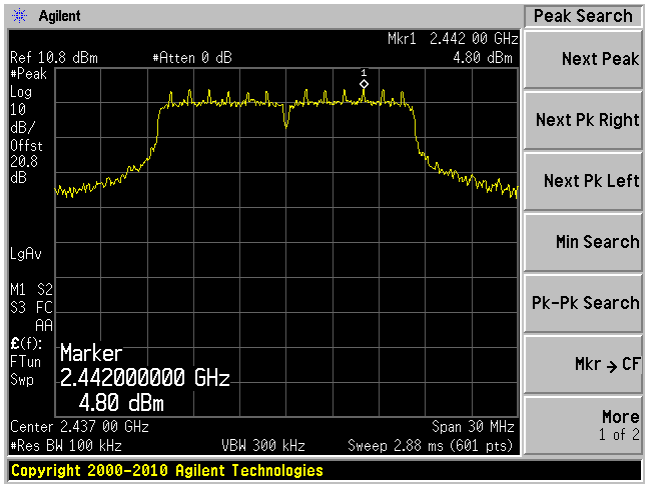


802.11g mode

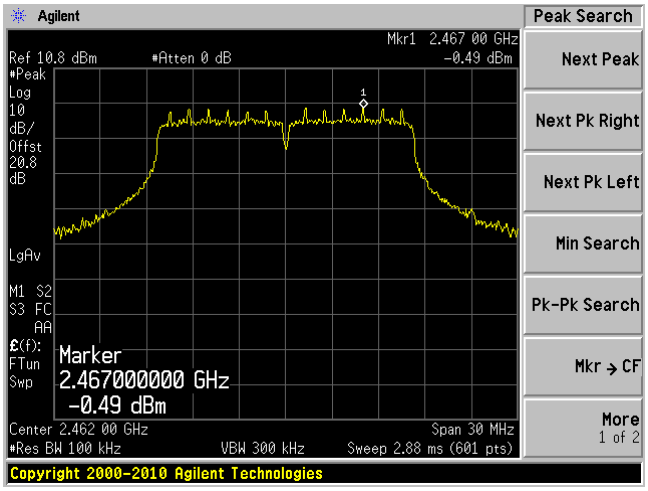
Low channel: 2412 MHz



Middle channel: 2437 MHz

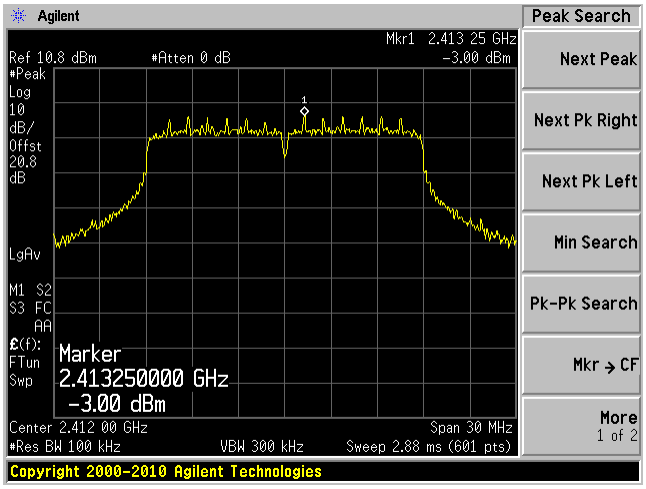


High channel: 2462 MHz

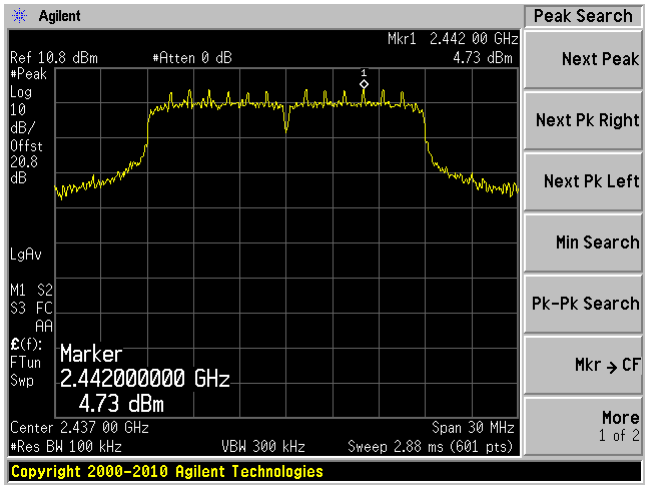


802.11n-HT20 mode

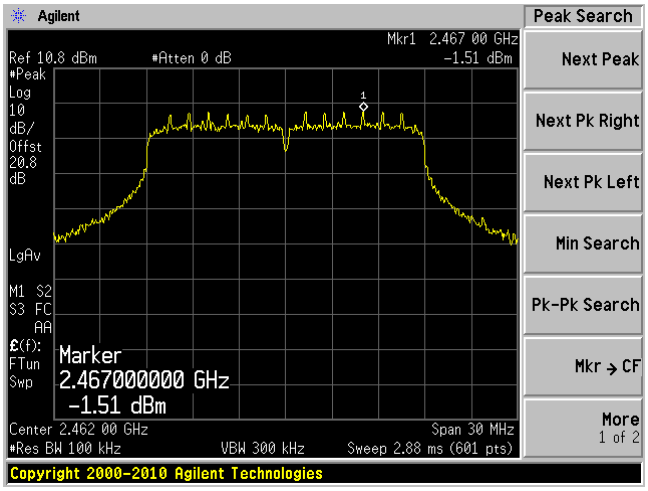
Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz



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:	22º C
Relative Humidity:	50 %
ATM Pressure:	101.9 kPa

The testing was performed by Bo Li on 2013-07-22 in 5m chamber3.

13.7 Summary of Test Results

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

Below 1 GHz:

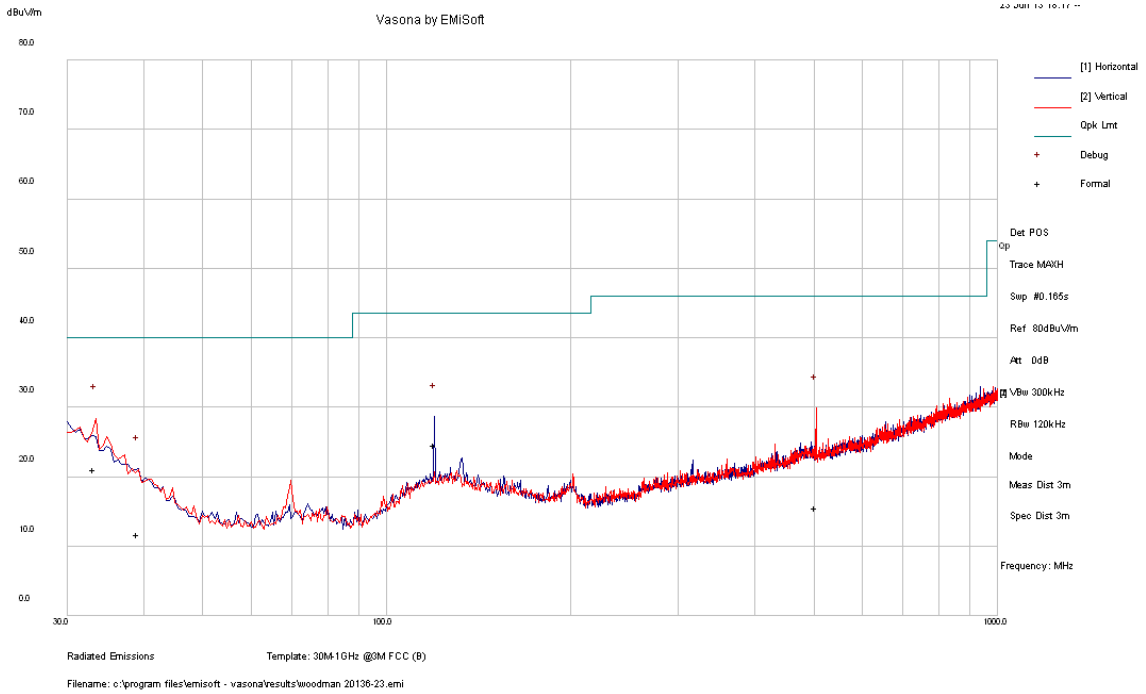
Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-17.85	119.9978	Horizontal	30-1000

Above 1 GHz:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-20.263	1584	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.)
33.211	21.22	350	V	154	40	-18.78	QP
119.9978	25.75	120	H	240	43.5	-17.85	QP
504.1788	15.99	155	V	157	46	-30.01	QP
39.1557	12.17	270	H	20	40	-27.83	QP
33.472	21.01	330	V	150	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
2100	39.215	100	V	0	74	-34.785	Peak
2100	38.995	100	H	0	74	-35.005	Peak
2100	25.415	100	V	0	54	-28.585	Ave
2100	25.275	100	H	0	54	-28.725	Ave
1584	36.907	100	V	0	74	-37.093	Peak
1584	41.877	100	H	109	74	-32.123	Peak
1584	22.437	100	V	0	54	-31.563	Ave
1584	33.737	100	H	109	54	-20.263	Ave