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

TEST AND MEASUREMENT REPORT

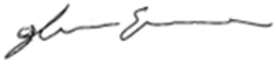
For

GainSpan Corporation

3590 N. First Street, Suite 300,

San Jose, CA 95134, USA

FCC ID: YOPGS2100MIP
IC: 9154A-GS2100MIP

Report Type:	**Product Type:**	
Original Report	802.11 b/g/n20 Wi-Fi Module	
Prepared By	Glenn Escano	
Report Number	R1404032-247 Rev A	
Report Date	2014-06-17	
Reviewed By	Bo Li Test Engineer	
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1404032-247	Original Report	2014-05-05
1	R1404032-247 Rev A	Revised Report	2014-06-17

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *GainSpan Corporation.*, and their product model: GS2100MIP, FCC ID: YOPGS2100MIP, IC: 9154A-GS2100MIP, or the "EUT" as referred on this report. The EUT is a Low Power Wi-Fi Module with 802.11 b/g/n20.

1.2 Mechanical Description of EUT

The "EUT" measures approximately *"2.5"cm (L) x "1.8"cm (W) x "0.3"cm (H),* and weighs approximately *2.3*g

The test data gathered are from typical production sample, serial number: 20F85EA9A6F5, provided by the manufacturer.

1.3 Objective

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

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

1.4 Related Submittal(s)/Grant(s)

No Related Submittals.

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 and FCC KDB 558074 D01 DTS Meas Guidance v03r01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

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.

The following calculation follows the procedures as set forth in clause 7.2.3, ETSI TR 100 028-1 V1.4.1 (2001-12), the expression of Uncertainty in Radiated RF Testing is in accordance to ISO/IEC 17025 and TR 100 028-1 V1.4.1 (2001-12).

The expanded Measurement Uncertainty value having a confidence factor of 95%, is within a range of 5.48 dB. This means that the value of conducted RF carrier power test will be within +/- 2.74 dB of the measuring radiated emissions power versus the expected value.
The expected value is defined as the power at the antenna of the Transmitter under Test.

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 and FCC KDB 558074 D01 DTS Meas Guidance v03r01 .

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.

The EUT had been tested with the following data rate settings (worst case):

Radio Mode	Bandwidth (MHz)	Frequency/Data Rate		
		Low CH (MHz/Mbps)	Mid CH (MHz/Mbps)	High CH (MHz/Mbps)
802.11b	16.5	2412/1	2437/6	2462/11
802.11g	16.5	2412/1	2437/6	2462/11
802.11n20	17.5	2412/1	2412/6	2462/11

2.2 EUT Exercise Software

The test utility used was “Tera Term” was provided by GainSpan Corporation., and was verified Glenn Escano 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	Serial Number
Dell	Laptop	D650	-

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
GainSpan	Motherboard	GS2100M-Daughter Card Rev 0	-
GainSpan	Module	GS2100MIP Rev 3.1	-

2.7 Interface Ports and Cables

Cable Description	Length (m)	To	From
RS-232/USB	<1.0	EUT	Laptop

2.8 External I/O Cabling List and AC Cord

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

2.9 Power Supply List and Details

Manufacturer	Description	Model	Serial Number
PHIHONG	Switching Power Supply	PSA05R-033	-

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §15.247(i), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirement	Compliant
FCC §15.207(a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	Compliant
FCC §15.209 IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205 IC RSS-210 §2.2	Restricted Bands	Compliant
FCC §15.209, §15.247 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 §4.10	Receiver Spurious Emission	Compliant

4 FCC §15.247 (i), §2.1091 & IC RSS-102 – RF Exposure

4.1 Applicable Standard

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

Limits for General Population/Uncontrolled Exposure

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

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

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF fields.

According to IC RSS-102 Issue 2 section 4.1, RF limits used for general public will be applied to the EUT.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Time Averaging (min)
0.003 - 1	280	2.19	-	6
1 - 10	280 / f	2.19 / f	-	6
10 - 30	28	2.19 / f	-	6
30 – 300	28	0.073	2*	6
300 – 1 500	$1.585\ f^{0.5}$	$0.0042\ f^{0.5}$	f / 150	6
1 500 – 15 000	61.4	0.163	10	6
15 000 – 150 000	61.4	0.163	10	$616000 / f^{1.2}$
150 000- 300 000	$0.158\ f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000 / f^{1.2}$

Note: *f* is frequency in MHz
* = Power density limit is applicable at frequencies greater than 100 MHz

4.2 MPE Prediction

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

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

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

4.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	19.57
Maximum peak output power at antenna input terminal (mW):	90.5732
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	2.26
Maximum Antenna Gain (numeric):	1.682674
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.03032
Power density of prediction frequency at 20.0 cm (W/m^2):	0.3032
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	10

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.03032 mW/cm^2 (0.3032 W/m^2).Limit is 1.0 mW/cm^2 (10 W/m^2).

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

Manufacturers	Antenna Type/Pattern	Antenna Gain (dBi) @ 2.4 GHz
GainSpan	PCB	2.26

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.

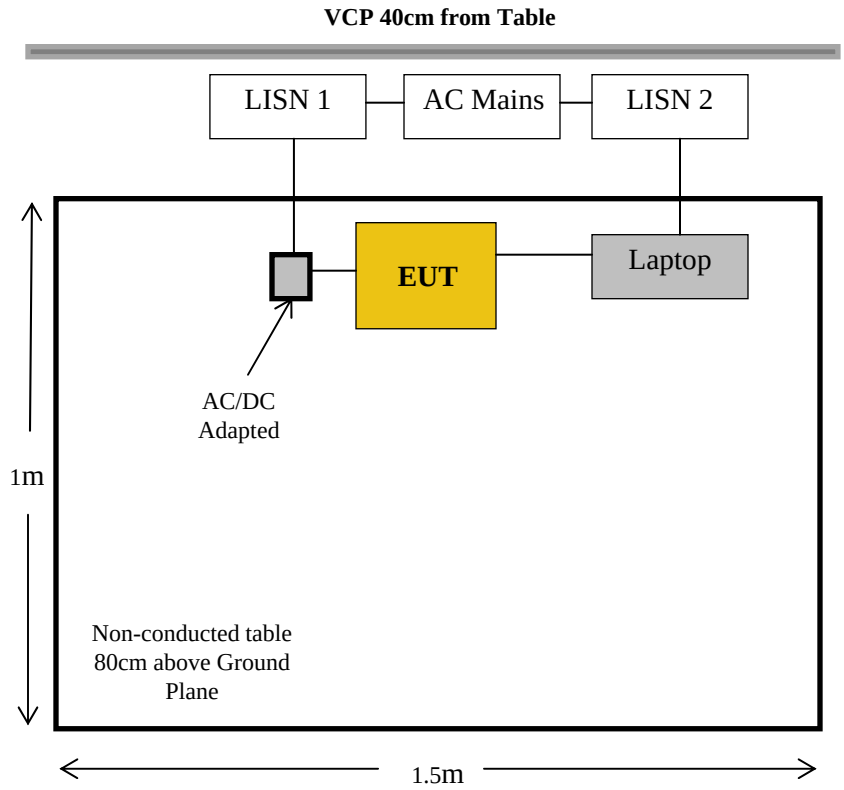
6.3 Test Procedure

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

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

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

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the 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

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100044	2013-10-29	1 year
TTE	High Pass Filter	H962-150k-50-21378	K7133	2013-05-30	1 year
Solar Electronics	LISN	9252-50-R-24-N	511213	2013-06-25	1 year
Solar Electronics	LISN	9252-50-R-24-N	511205	2013-06-25	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:	41 %
ATM Pressure:	101.89 kPa

The testing was performed by Glenn Escano on 2014-04-17in 5m chamber 2.

6.8 Summary of Test Results

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

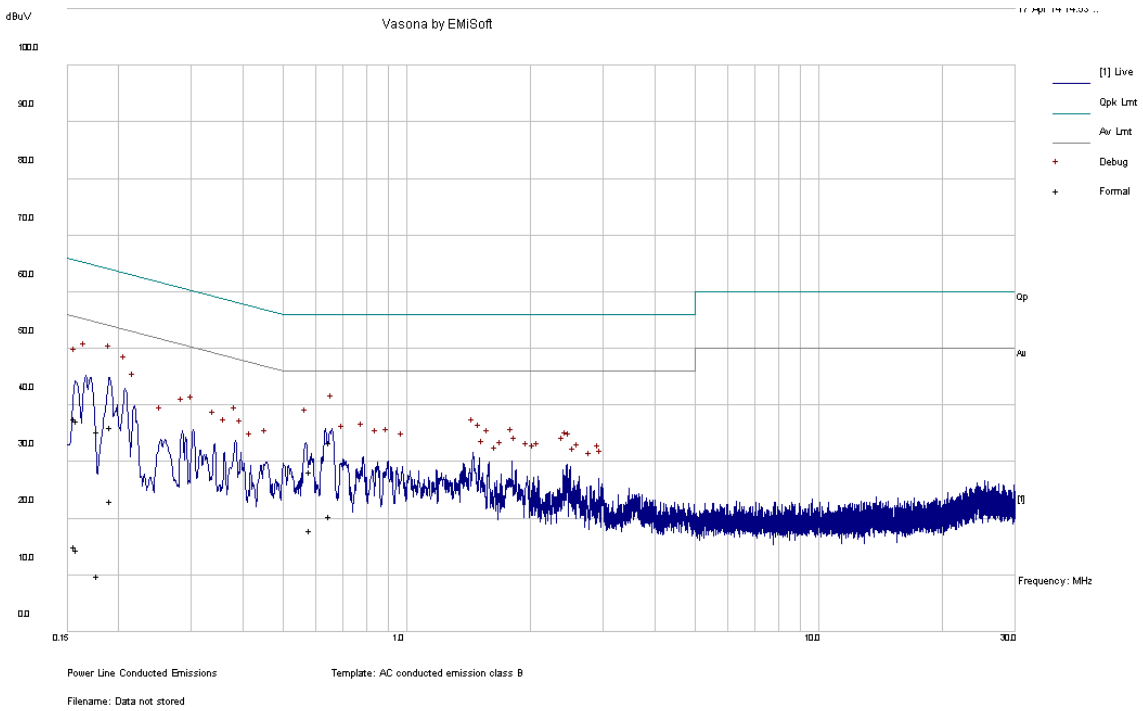
Transmitting Mode the Worst Case: 802.11 b Low channel

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-21.03	0.579456	Neutral	0.15-30

6.9 Conducted Emissions Test Plots and Data

Transmitting Mode the Worst Case: 802.11 b High channel

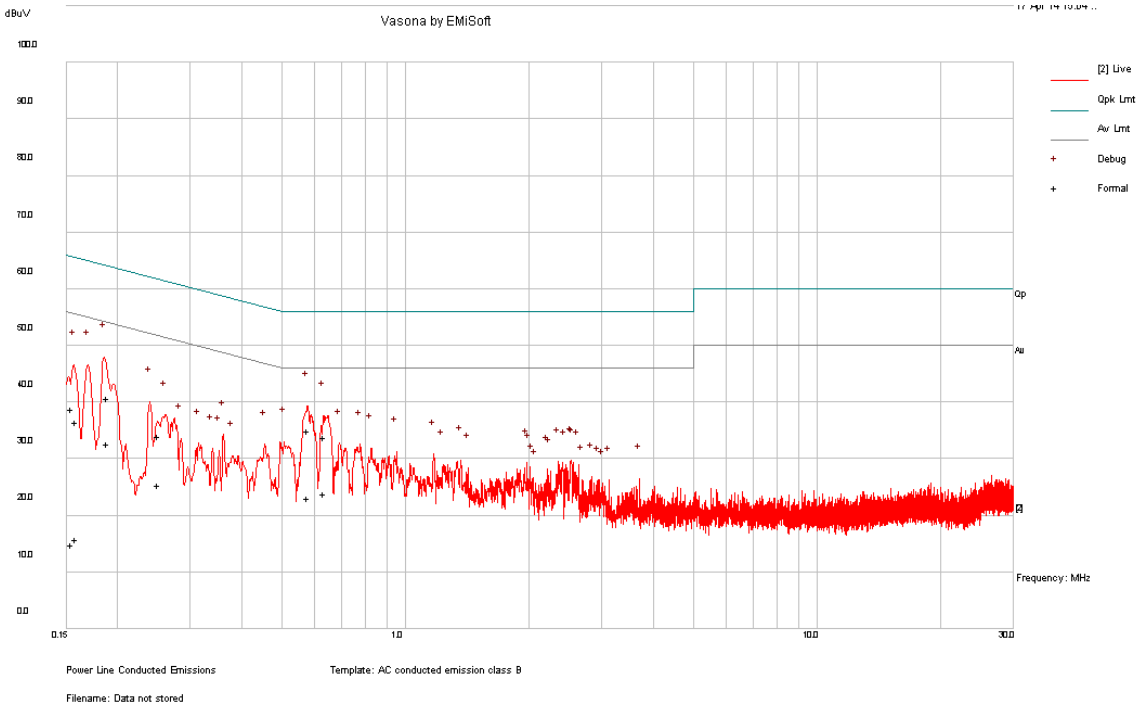
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave)
0.650586	33.47	Line	56	-22.53	QP
0.191253	36.18	Line	63.98	-27.80	QP
0.585495	28.18	Line	56	-27.82	QP
0.157239	37.74	Line	65.61	-27.87	QP
0.159213	37.28	Line	65.5	-28.23	QP
0.177879	35.4	Line	64.58	-29.19	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave)
0.650586	20.38	Line	46	-25.62	Ave
0.191253	18	Line	46	-28.00	Ave
0.585495	23.1	Line	53.98	-30.88	Ave
0.157239	15.02	Line	55.61	-40.59	Ave
0.159213	14.54	Line	55.5	-40.97	Ave
0.177879	9.79	Line	54.58	-44.80	Ave

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave)
0.189432	40.81	Neutral	64.06	-23.25	QP
0.579456	34.97	Neutral	56	-21.03	QP
0.63594	33.86	Neutral	56	-22.14	QP
0.154869	38.75	Neutral	65.73	-26.99	QP
0.158889	36.51	Neutral	65.52	-29.01	QP
0.250944	34.1	Neutral	61.73	-27.62	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave)
0.189432	32.6	Neutral	54.06	-21.46	Ave
0.579456	23.12	Neutral	46	-22.88	Ave
0.63594	23.88	Neutral	46	-22.12	Ave
0.154869	14.9	Neutral	55.73	-40.83	Ave
0.158889	15.73	Neutral	55.52	-39.79	Ave
0.250944	25.46	Neutral	51.73	-26.26	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 measurements are base on FCC KDB 558074 D01 DTS Measure Guidance: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 11: Emissions in non-restricted frequency bands and section 12: Emissions in restricted frequency bands.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2013-08-29	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:	20° C
Relative Humidity:	42 %
ATM Pressure:	101.89 kPa

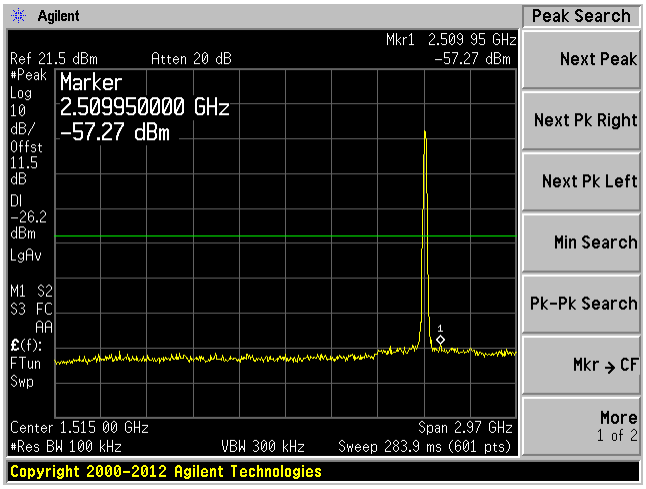
The testing was performed by Glenn Escano on 2014-04-15 in RF Test Site.

7.5 Test Results

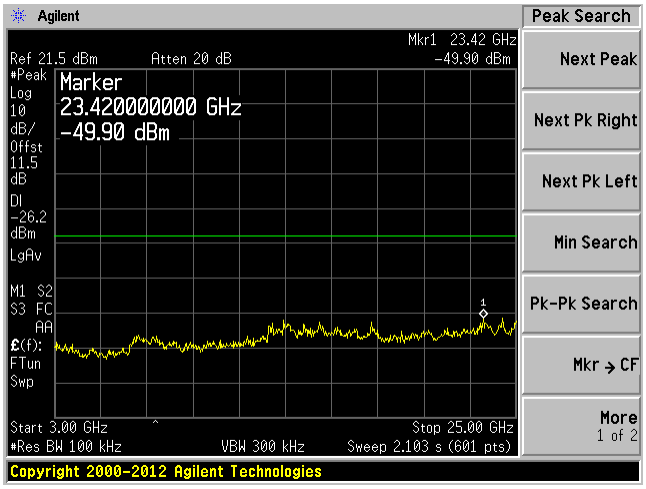
Please refer to following plots of spurious emissions.

802.11b, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

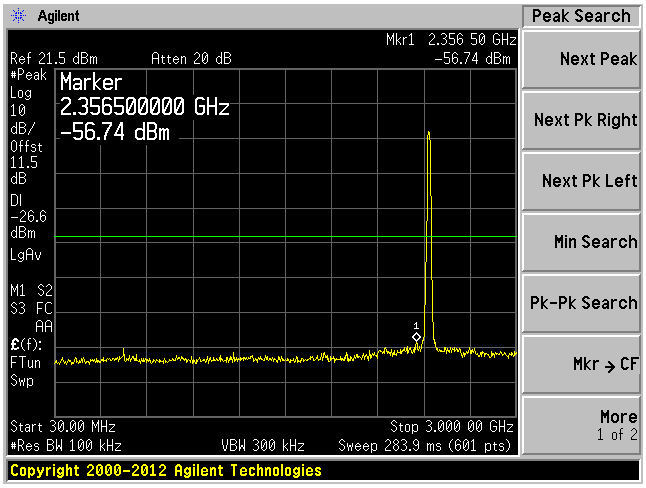


Plot: 3 GHz – 25 GHz

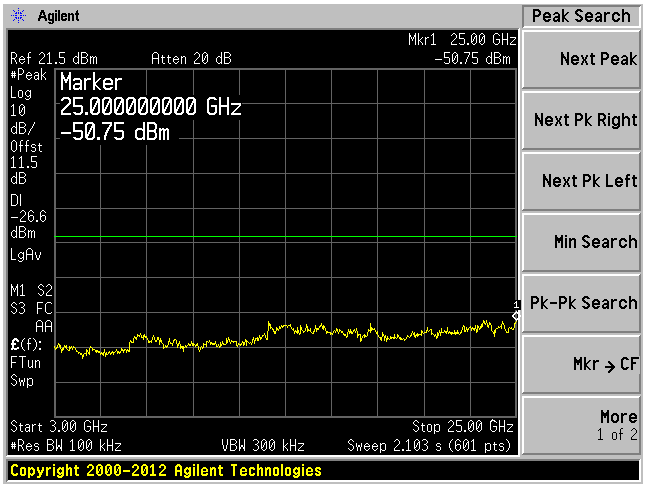


802.11b, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

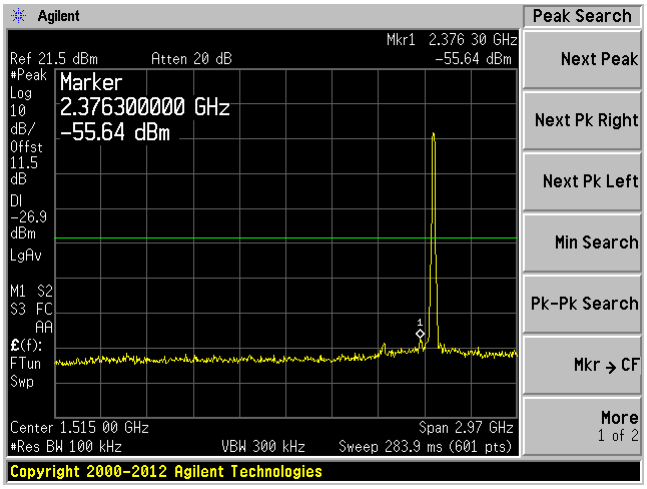


Plot: 3 GHz – 25 GHz

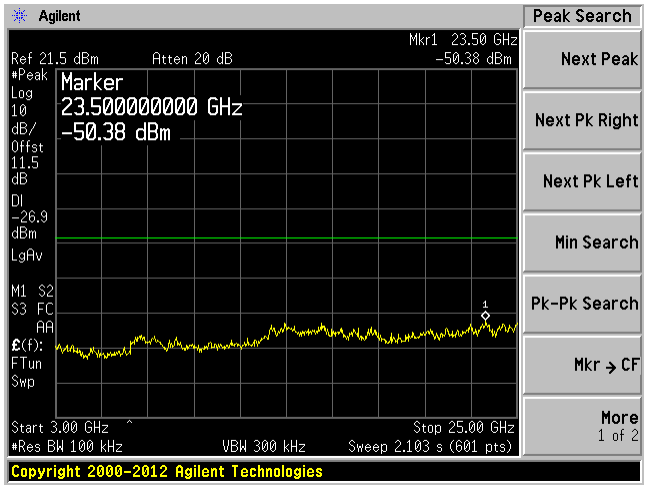


802.11b, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

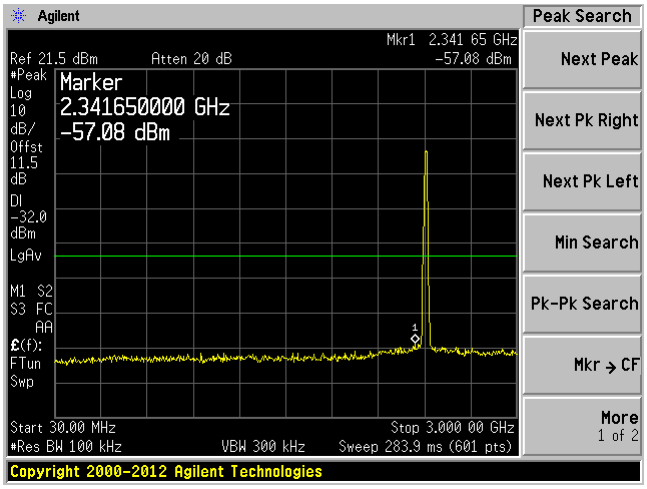


Plot: 3 GHz – 25 GHz

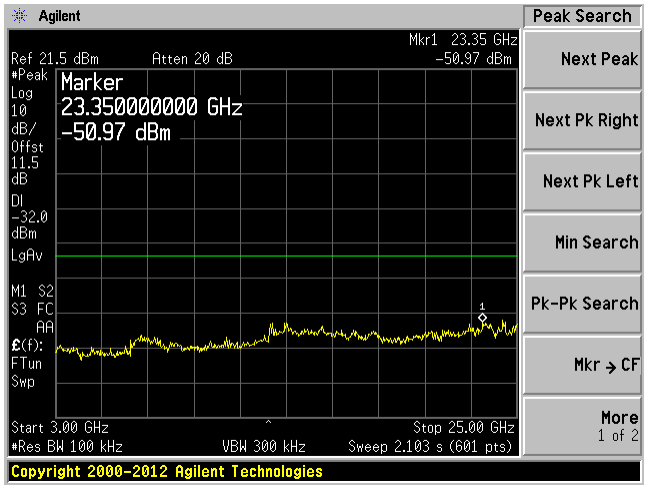


802.11g, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

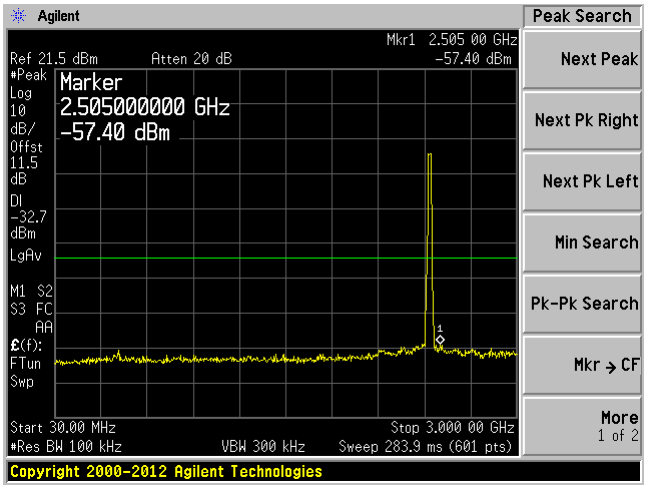


Plot: 3 GHz – 25 GHz

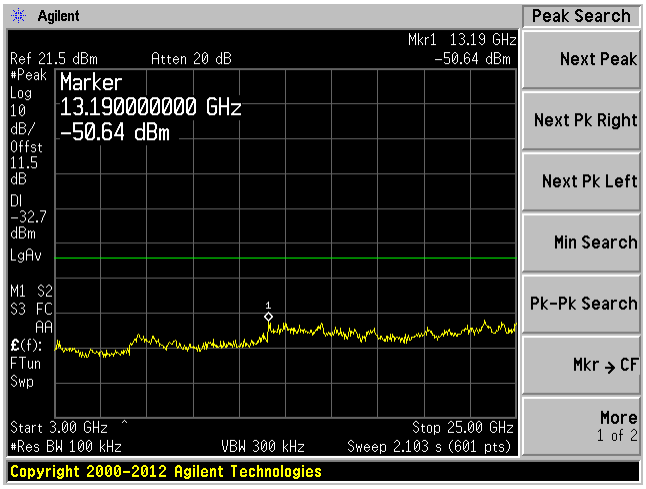


802.11g, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

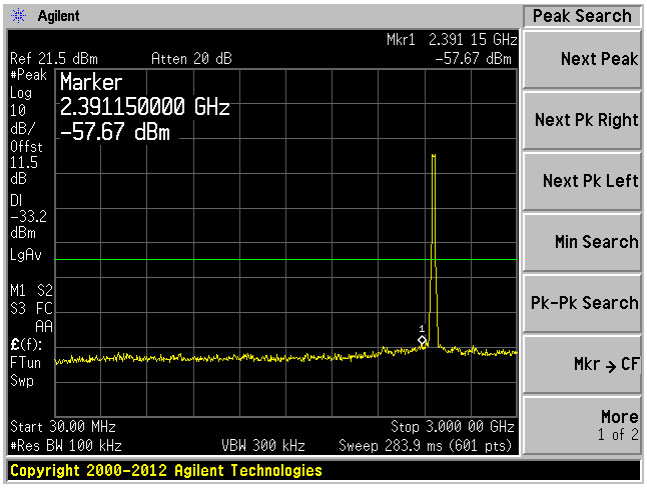


Plot: 3 GHz – 25 GHz

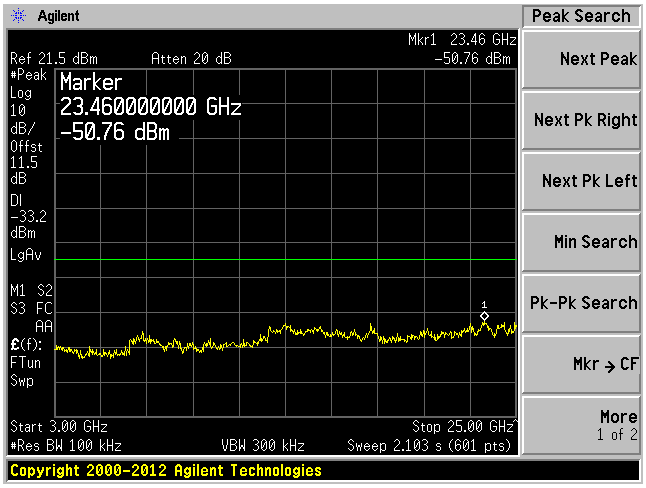


802.11g, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz

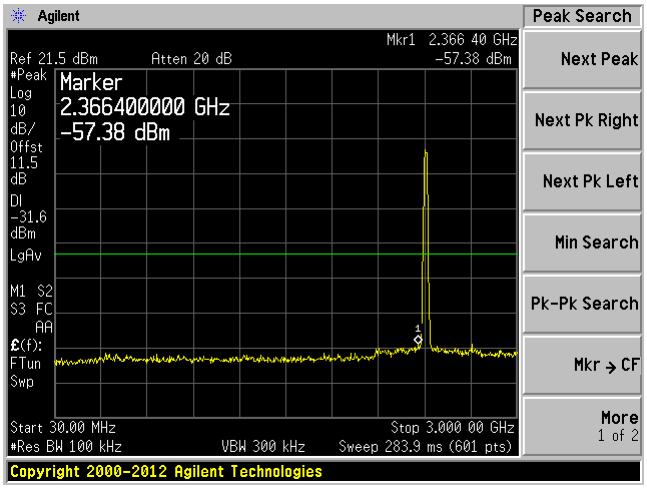


Plot: 3 GHz – 25 GHz

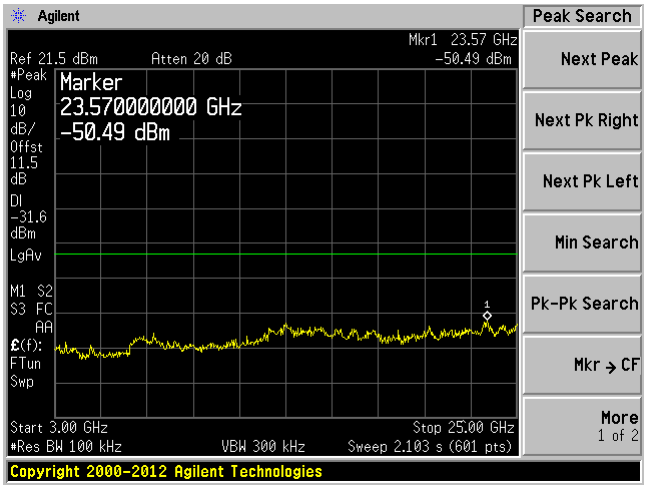


802.11n HT20, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

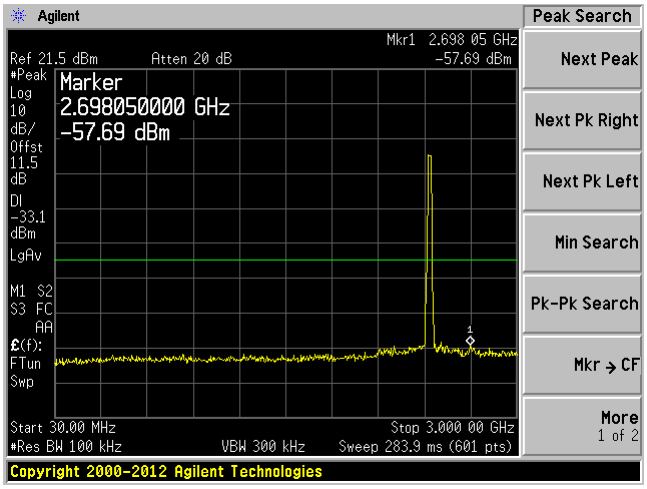


Plot: 3 GHz – 25 GHz

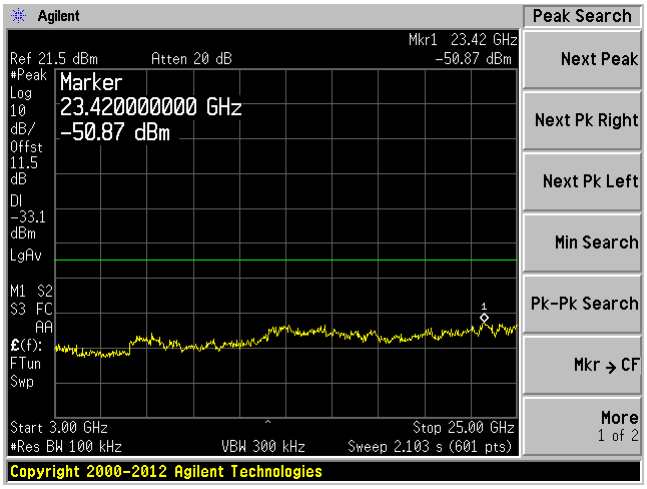


802.11n HT20, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

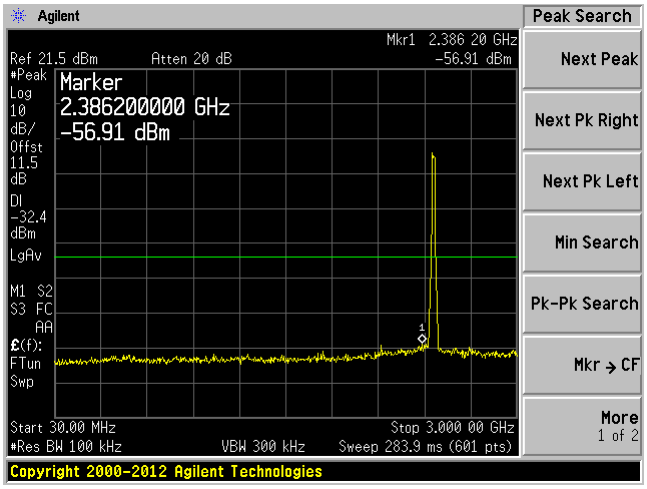


Plot: 3 GHz – 25 GHz

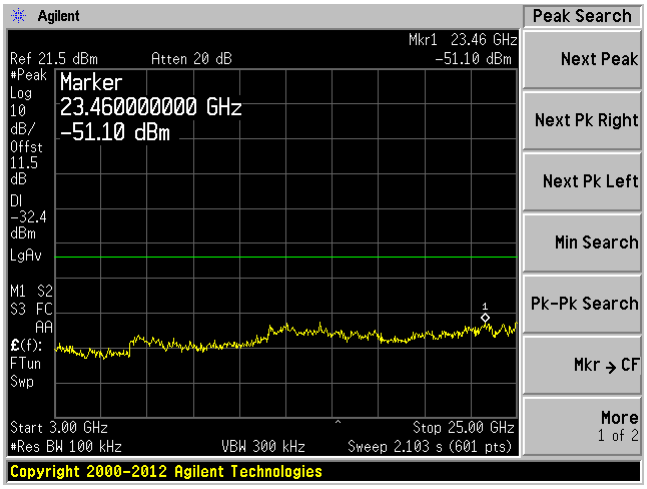


802.11n HT20, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz



Plot: 3 GHz – 25 GHz



8 FCC §15.205, §15.209 & §15.247(c) & 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) and IC RSS-210 §8.5, 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. 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

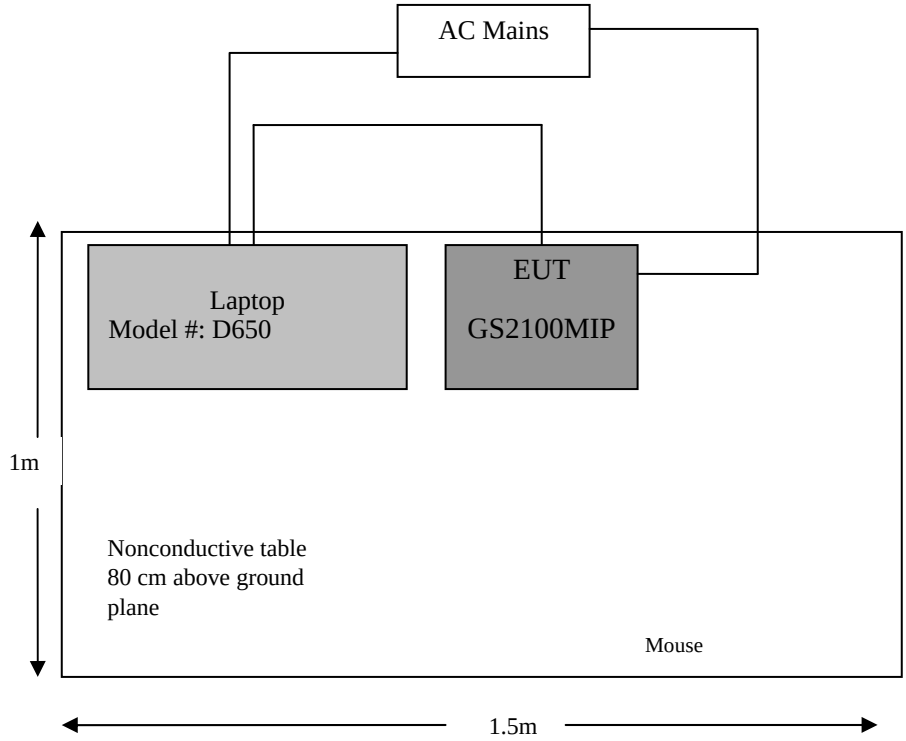
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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:

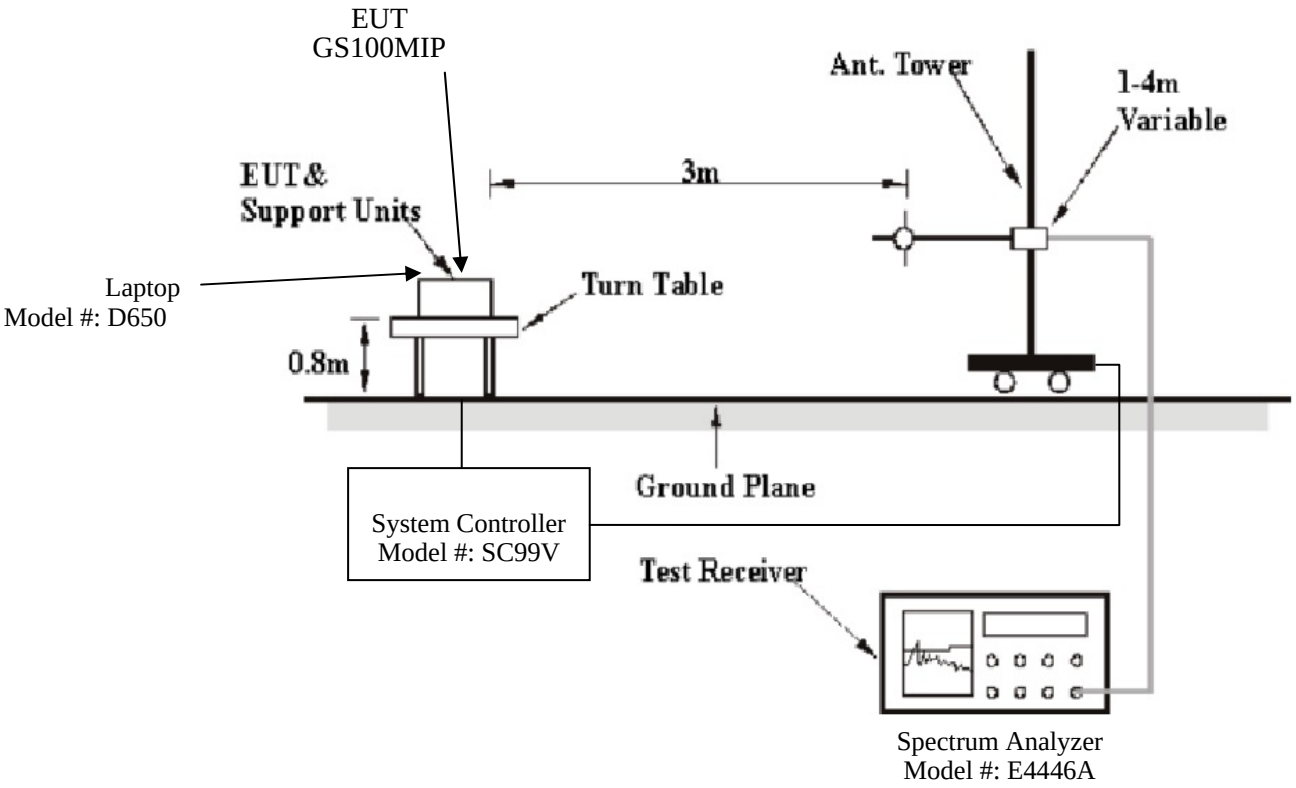
Margin = Corrected Amplitude - Limit

8.5 Test Setup Block Diagram

Block Diagram #1



Block Diagram #2



8.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100044	2013-10-29	1 Year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2013-06-09	1 Year
Sunol Sciences Corp	Antenna, Biconical Log	JB3	A020106-3	2013-07-11	1 Year
Sunol Sciences Corp	System Controller	SC99V	011003-1	N/R	N/R
Agilent	Spectrum Analyzer	E4446A	MY48250238	2013-08-29	1 year
EMCO	Horn antenna	3115	9511-4627	2014-1-7	1 Year
Hewlett Packard	Amplifier, Pre	8449B OPT H02	3008A01103	2014-03-10	1 Year

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

8.7 Test Environmental Conditions

Temperature:	21° C
Relative Humidity:	41 %
ATM Pressure:	101.89 kPa

The testing was performed by Glenn Escano on 2014-04-17in 5m chamber 2.

8.8 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**
-8.42	215.7975	Horizontal	802.11g

1-25 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-3.248	2483.5	Vertical	802.11n HT20, High Channel

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

8.9 Radiated Emissions Test Data and Plots

1) 30 MHz -1 GHz, Quasi-Peak 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						
60.0055	28.51	147	V	44	40	-11.49
84.68575	26.82	118	V	177	40	-13.18
216.239	32.11	98	H	261	46	-13.89
802.11g mode						
215.7975	35.08	153	H	285	43.5	-8.42
59.98275	27.96	287	H	194	40	-12.04
166.297	28.52	166	H	256	43.5	-14.98
802.11n-HT20 mode						
215.7525	34.31	102	H	272	43.5	-9.19
60.0155	29.59	99	V	76	40	-10.41
85.16225	22.96	162	V	123	40	-17.04

2) 1–25 GHz, Measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
802.11b, Low Channel 2412 MHz											
2412	56.26	306	100	V	28.67	3.358	0	88.288	-	-	Peak/Fund
2412	60.73	317	100	H	28.67	3.358	0	92.758	-	-	Peak/Fund
2412	51.33	306	100	V	28.67	3.358	0	83.358	-	-	Ave/Fund
2412	59.96	317	100	H	28.67	3.358	0	91.988	-	-	Ave/Fund
2390	28.13	306	100	V	28.67	3.358	0	60.158	74	-13.842	Peak
2390	27.6	317	100	H	28.67	3.358	0	59.628	74	-14.372	Peak
2390	13.31	306	100	V	28.67	3.358	0	45.338	54	-8.662	Ave
2390	14.19	317	100	H	28.67	3.358	0	46.218	54	-7.782	Ave
4824	49.19	78	100	V	33.46	5.231	36.45	51.431	74	-22.569	Peak
4824	50.12	329	102	H	33.46	5.231	36.45	52.361	74	-21.639	Peak
4824	41.44	78	100	V	33.46	5.231	36.45	43.681	54	-10.319	Ave
4824	42.03	329	102	H	33.46	5.231	36.45	44.271	54	-9.729	Ave
7236	46.9	0	100	V	37.72	6.829	36.68	54.769	68.288	-13.519	Peak
7236	46.32	0	100	H	37.72	6.829	36.68	54.189	72.758	-18.569	Peak
7236	31.77	0	100	V	37.72	6.829	36.68	39.639	63.358	-23.719	Ave
7236	31.61	0	100	H	37.72	6.829	36.68	39.479	71.988	-32.509	Ave
9648	47.07	0	100	V	38.45	8.176	36.83	56.866	68.288	-11.422	Peak
9648	47.41	0	100	H	38.45	8.176	36.83	57.206	72.758	-15.552	Peak
9648	32.7	0	100	V	38.45	8.176	36.83	42.496	63.358	-20.862	Ave
9648	32.75	0	100	H	38.45	8.176	36.83	42.546	71.988	-29.442	Ave
802.11b, Middle Channel 2437 MHz											
2437	55.29	306	114	V	28.99	3.591	0	87.871	-	-	Peak/Fund
2437	60.3	317	100	H	28.99	3.591	0	92.881	-	-	Peak/Fund
2437	51.31	306	114	V	28.99	3.591	0	83.891	-	-	Ave/Fund
2437	57.14	317	100	H	28.99	3.591	0	89.721	-	-	Ave/Fund
4874	49.04	78	100	V	33.57	5.169	36.34	51.439	74	-22.561	Peak
4874	49.97	319	100	H	33.57	5.169	36.34	52.369	74	-21.631	Peak
4874	39.97	78	100	V	33.57	5.169	36.34	42.369	54	-11.631	Ave
4874	41.28	319	100	H	33.57	5.169	36.34	43.679	54	-10.321	Ave
7311	44.95	0	100	V	37.54	6.907	36.69	52.707	74	-21.293	Peak
7311	45.21	0	100	H	37.54	6.907	36.69	52.967	74	-21.033	Peak
7311	31.74	0	100	V	37.54	6.907	36.69	39.497	54	-14.503	Ave
7311	31.81	0	100	H	37.54	6.907	36.69	39.567	54	-14.433	Ave
9748	47.2	0	100	V	38.31	8.35	37.03	56.83	67.871	-11.041	Peak
9748	46.92	0	100	H	38.31	8.35	37.03	56.55	72.881	-16.331	Peak
9748	32.75	0	100	V	38.31	8.35	37.03	42.38	63.891	-21.511	Ave
9748	32.21	0	100	H	38.31	8.35	37.03	41.84	69.721	-27.881	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)	
802.11b, High Channel 2462 MHz											
2462	55.38	22	100	V	28.99	3.642	0	88.012	-	-	Peak/Fund
2462	61.83	317	100	H	28.99	3.642	0	94.462	-	-	Peak/Fund
2462	51.6	22	100	V	28.99	3.642	0	84.232	-	-	Ave/Fund
2462	58.51	317	100	H	28.99	3.642	0	91.142	-	-	Ave/Fund
2483.5	27.67	22	100	V	28.99	3.642	0	60.302	74	-13.698	Peak
2483.5	29.21	317	100	H	28.99	3.642	0	61.842	74	-12.158	Peak
2483.5	13.72	22	100	V	28.99	3.642	0	46.352	54	-7.648	Ave
2483.5	15.23	317	100	H	28.99	3.642	0	47.862	54	-6.138	Ave
4924	48.79	23	100	V	33.77	5.151	36.4	51.311	74	-22.689	Peak
4924	49.84	322	100	H	33.77	5.151	36.4	52.361	74	-21.639	Peak
4924	39.93	23	100	V	33.77	5.151	36.4	42.451	54	-11.549	Ave
4924	40.99	322	100	H	33.77	5.151	36.4	43.511	54	-10.489	Ave
7386	45.62	0	100	V	37.12	6.717	36.61	52.847	74	-21.153	Peak
7386	47.2	0	100	H	37.12	6.717	36.61	54.427	74	-19.573	Peak
7386	32.35	0	100	V	37.12	6.717	36.61	39.577	54	-14.423	Ave
7386	32.43	0	100	H	37.12	6.717	36.61	39.657	54	-14.343	Ave
9848	46.9	0	100	V	38.07	8.445	37.46	55.955	68.012	-12.057	Peak
9848	47.53	0	100	H	38.07	8.445	37.46	56.585	74.462	-17.877	Peak
9848	33.51	0	100	V	38.07	8.445	37.46	42.565	64.232	-21.667	Ave
9848	33.61	0	100	H	38.07	8.445	37.46	42.665	71.142	-28.477	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)	
802.11g, Low Channel 2412 MHz											
2412	53.58	306	118	V	28.67	3.358	0	85.608	-	-	Peak/Fund
2412	59.46	322	100	H	28.67	3.358	0	91.488	-	-	Peak/Fund
2412	42.98	306	118	V	28.67	3.358	0	75.008	-	-	Ave/Fund
2412	49.2	322	100	H	28.67	3.358	0	81.228	-	-	Ave/Fund
2390	26.97	306	118	V	28.67	3.358	0	58.998	74	-15.002	Peak
2390	27.35	322	100	H	28.67	3.358	0	59.378	74	-14.622	Peak
2390	12.65	306	118	V	28.67	3.358	0	44.678	54	-9.322	Ave
2390	12.86	322	100	H	28.67	3.358	0	44.888	54	-9.112	Ave
4824	48.97	81	100	V	33.46	5.231	36.45	51.211	74	-22.789	Peak
4824	50.25	313	100	H	33.46	5.231	36.45	52.491	74	-21.509	Peak
4824	39.53	81	100	V	33.46	5.231	36.45	41.771	54	-12.229	Ave
4824	41.89	313	100	H	33.46	5.231	36.45	44.131	54	-9.869	Ave
7236	45.69	0	100	V	37.72	6.829	36.68	53.559	65.608	-12.049	Peak
7236	45.49	0	100	H	37.72	6.829	36.68	53.359	71.488	-18.129	Peak
7236	32.2	0	100	V	37.72	6.829	36.68	40.069	55.008	-14.939	Ave
7236	32.15	0	100	H	37.72	6.829	36.68	40.019	61.228	-21.209	Ave
9648	46.96	0	100	V	38.45	8.176	36.83	56.756	65.608	-8.852	Peak
9648	47.38	0	100	H	38.45	8.176	36.83	57.176	71.488	-14.312	Peak
9648	33.08	0	100	V	38.45	8.176	36.83	42.876	55.008	-12.132	Ave
9648	33.19	0	100	H	38.45	8.176	36.83	42.986	61.228	-18.242	Ave
802.11g, Middle Channel 2437 MHz											
2437	54.48	306	114	V	28.99	3.591	0	87.061	-	-	Peak/Fund
2437	61.07	317	100	H	28.99	3.591	0	93.651	-	-	Peak/Fund
2437	44.04	306	114	V	28.99	3.591	0	76.621	-	-	Ave/Fund
2437	50.6	317	100	H	28.99	3.591	0	83.181	-	-	Ave/Fund
4874	49.04	81	100	V	33.57	5.169	36.34	51.439	74	-22.561	Peak
4874	50.15	312	100	H	33.57	5.169	36.34	52.549	74	-21.451	Peak
4874	39.08	81	100	V	33.57	5.169	36.34	41.479	54	-12.521	Ave
4874	42.08	312	100	H	33.57	5.169	36.34	44.479	54	-9.521	Ave
7311	45.38	0	100	V	37.54	6.907	36.69	53.137	74	-20.863	Peak
7311	45.82	0	100	H	37.54	6.907	36.69	53.577	74	-20.423	Peak
7311	31.85	0	100	V	37.54	6.907	36.69	39.607	54	-14.393	Ave
7311	31.79	0	100	H	37.54	6.907	36.69	39.547	54	-14.453	Ave
9748	46.52	0	100	V	38.31	8.35	37.03	56.15	67.061	-10.911	Peak
9748	46.63	0	100	H	38.31	8.35	37.03	56.26	73.651	-17.391	Peak
9748	33.18	0	100	V	38.31	8.35	37.03	42.81	56.621	-13.811	Ave
9748	33.09	0	100	H	38.31	8.35	37.03	42.72	63.181	-20.461	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)	
802.11g, High Channel 2462 MHz											
2462	56.35	22	100	V	28.99	3.642	0	88.982	-	-	Peak/Fund
2462	62.83	317	100	H	28.99	3.642	0	95.462	-	-	Peak/Fund
2462	45.27	22	100	V	28.99	3.642	0	77.902	-	-	Ave/Fund
2462	52.3	317	100	H	28.99	3.642	0	84.932	-	-	Ave/Fund
2483.5	28.91	22	100	V	28.99	3.642	0	61.542	74	-12.458	Peak
2483.5	33.76	317	100	H	28.99	3.642	0	66.392	74	-7.608	Peak
2483.5	13.82	22	100	V	28.99	3.642	0	46.452	54	-7.548	Ave
2483.5	17.2	317	100	H	28.99	3.642	0	49.832	54	-4.168	Ave
4924	49.67	33	100	V	33.77	5.151	36.4	52.191	74	-21.809	Peak
4924	50.92	313	100	H	33.77	5.151	36.4	53.441	74	-20.559	Peak
4924	40.51	33	100	V	33.77	5.151	36.4	43.031	54	-10.969	Ave
4924	43.58	313	100	H	33.77	5.151	36.4	46.101	54	-7.899	Ave
7386	46.66	0	100	V	37.12	6.717	36.61	53.887	74	-20.113	Peak
7386	46.65	0	100	H	37.12	6.717	36.61	53.877	74	-20.123	Peak
7386	32.41	0	100	V	37.12	6.717	36.61	39.637	54	-14.363	Ave
7386	32.35	0	100	H	37.12	6.717	36.61	39.577	54	-14.423	Ave
9848	48.04	0	100	V	38.07	8.445	37.46	57.095	68.982	-11.887	Peak
9848	47.47	0	100	H	38.07	8.445	37.46	56.525	75.462	-18.937	Peak
9848	33.58	0	100	V	38.07	8.445	37.46	42.635	57.902	-15.267	Ave
9848	33.41	0	100	H	38.07	8.445	37.46	42.465	64.932	-22.467	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)	
802.11n-HT20, Low Channel 2412 MHz											
2412	53.15	306	100	V	28.67	3.358	0	85.178	-	-	Peak/Fund
2412	59.39	322	100	H	28.67	3.358	0	91.418	-	-	Peak/Fund
2412	42.12	306	100	V	28.67	3.358	0	74.148	-	-	Ave/Fund
2412	48.67	322	100	H	28.67	3.358	0	80.698	-	-	Ave/Fund
2390	27.02	306	100	V	28.67	3.358	0	59.048	74	-14.952	Peak
2390	26.67	322	100	H	28.67	3.358	0	58.698	74	-15.302	Peak
2390	12.72	306	100	V	28.67	3.358	0	44.748	54	-9.252	Ave
2390	13.12	322	100	H	28.67	3.358	0	45.148	54	-8.852	Ave
4824	49.9	83	100	V	33.46	5.231	36.45	52.141	74	-21.859	Peak
4824	50.27	313	100	H	33.46	5.231	36.45	52.511	74	-21.489	Peak
4824	40.11	83	100	V	33.46	5.231	36.45	42.351	54	-11.649	Ave
4824	42.2	313	100	H	33.46	5.231	36.45	44.441	54	-9.559	Ave
7236	46.46	0	100	V	37.72	6.829	36.68	54.329	65.178	-10.849	Peak
7236	46.28	0	100	H	37.72	6.829	36.68	54.149	71.418	-17.269	Peak
7236	32.28	0	100	V	37.72	6.829	36.68	40.149	54.148	-13.999	Ave
7236	32.1	0	100	H	37.72	6.829	36.68	39.969	60.698	-20.729	Ave
9648	47.85	0	100	V	38.45	8.176	36.83	57.646	65.178	-7.532	Peak
9648	47.9	0	100	H	38.45	8.176	36.83	57.696	71.418	-13.722	Peak
9648	33.09	0	100	V	38.45	8.176	36.83	42.886	54.148	-11.262	Ave
9648	33.17	0	100	H	38.45	8.176	36.83	42.966	60.698	-17.732	Ave
802.11n-HT20, Middle Channel 2437 MHz											
2437	54.58	306	116	V	28.99	3.591	0	87.161	-	-	Peak/Fund
2437	60.44	321	100	H	28.99	3.591	0	93.021	-	-	Peak/Fund
2437	44.15	306	116	V	28.99	3.591	0	76.731	-	-	Ave/Fund
2437	50.28	321	100	H	28.99	3.591	0	82.861	-	-	Ave/Fund
4874	49.5	34	100	V	33.57	5.169	36.34	51.899	74	-22.101	Peak
4874	50.09	313	100	H	33.57	5.169	36.34	52.489	74	-21.511	Peak
4874	40.54	34	100	V	33.57	5.169	36.34	42.939	54	-11.061	Ave
4874	42.63	313	100	H	33.57	5.169	36.34	45.029	54	-8.971	Ave
7311	45.69	0	100	V	37.54	6.907	36.69	53.447	74	-20.553	Peak
7311	45.75	0	100	H	37.54	6.907	36.69	53.507	74	-20.493	Peak
7311	31.81	0	100	V	37.54	6.907	36.69	39.567	54	-14.433	Ave
7311	31.85	0	100	H	37.54	6.907	36.69	39.607	54	-14.393	Ave
9748	47.41	0	100	V	38.31	8.35	37.03	57.04	67.161	-10.121	Peak
9748	47.22	0	100	H	38.31	8.35	37.03	56.85	73.021	-16.171	Peak
9748	33.2	0	100	V	38.31	8.35	37.03	42.83	56.731	-13.901	Ave
9748	33.08	0	100	H	38.31	8.35	37.03	42.71	62.861	-20.151	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)	
802.11n-HT20, High Channel 2462 MHz											
2462	57.65	218	109	V	28.99	3.642	0	90.282	-	-	Peak/Fund
2462	62.68	318	100	H	28.99	3.642	0	95.312	-	-	Peak/Fund
2462	46.8	218	109	V	28.99	3.642	0	79.432	-	-	Ave/Fund
2462	51.81	318	100	H	28.99	3.642	0	84.442	-	-	Ave/Fund
2483.5	32.22	218	109	V	28.99	3.642	0	64.852	74	-9.148	Peak
2483.5	37.86	318	100	H	28.99	3.642	0	70.492	74	-3.508	Peak
2483.5	15.09	218	109	V	28.99	3.642	0	47.722	54	-6.278	Ave
2483.5	18.12	318	100	H	28.99	3.642	0	50.752	54	-3.248	Ave
4924	49.71	22	100	V	33.77	5.151	36.4	52.231	74	-21.769	Peak
4924	50.61	320	100	H	33.77	5.151	36.4	53.131	74	-20.869	Peak
4924	37.4	22	100	V	33.77	5.151	36.4	39.921	54	-14.079	Ave
4924	41.52	320	100	H	33.77	5.151	36.4	44.041	54	-9.959	Ave
7386	47.22	0	100	V	37.12	6.717	36.61	54.447	74	-19.553	Peak
7386	45.92	0	100	H	37.12	6.717	36.61	53.147	74	-20.853	Peak
7386	31.96	0	100	V	37.12	6.717	36.61	39.187	54	-14.813	Ave
7386	31.89	0	100	H	37.12	6.717	36.61	39.117	54	-14.883	Ave
9848	47.77	0	100	V	38.07	8.445	37.46	56.825	70.282	-13.457	Peak
9848	47.34	0	100	H	38.07	8.445	37.46	56.395	75.312	-18.917	Peak
9848	33.22	0	100	V	38.07	8.445	37.46	42.275	59.432	-17.157	Ave
9848	33.17	0	100	H	38.07	8.445	37.46	42.225	64.442	-22.217	Ave

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

The measurements are base on FCC KDB 558074 D01 DTS Measure Guidance: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8: DTS bandwidth

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2013-08-29	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:	20° C
Relative Humidity:	42 %
ATM Pressure:	101.89 kPa

The testing was performed by Glenn Escano on 2014-04-15 in RF Test Site.

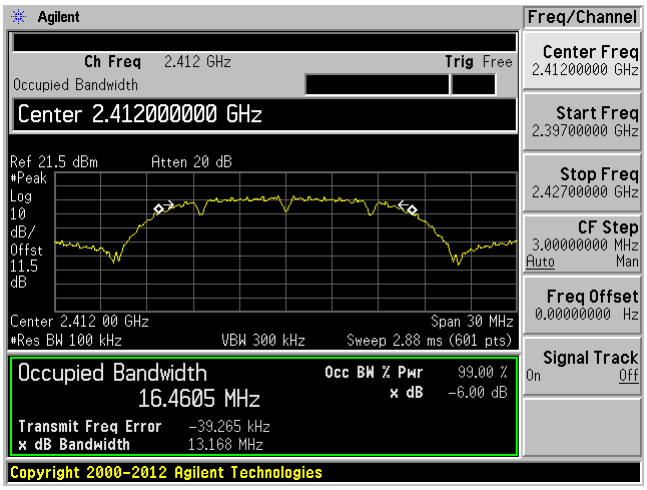
9.5 Test Results

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
802.11b mode					
Low	2412	13.168	16.4605	>0.5	Compliant
Middle	2437	13.166	16.4582	>0.5	Compliant
High	2462	13.187	16.4167	>0.5	Compliant
802.11g mode					
Low	2412	16.481	16.4084	>0.5	Compliant
Middle	2437	16.520	16.4064	>0.5	Compliant
High	2462	16.505	16.4029	>0.5	Compliant
802.11n-HT20 mode					
Low	2412	17.333	17.4923	>0.5	Compliant
Middle	2437	17.569	17.4747	>0.5	Compliant
High	2462	17.587	17.4829	>0.5	Compliant

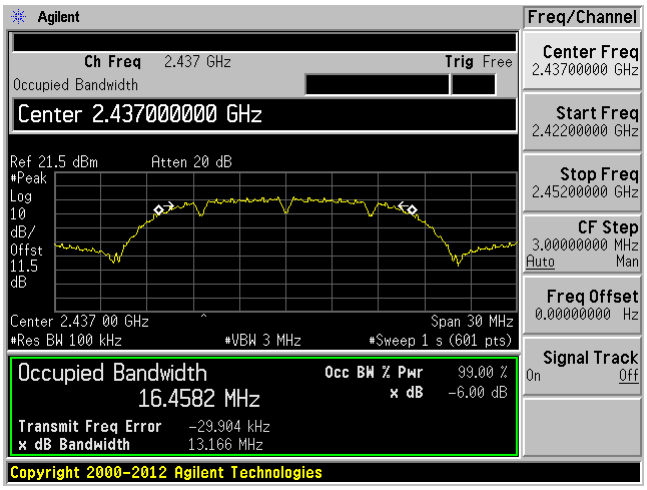
Please refer to the following plots for detailed test results

802.11b mode

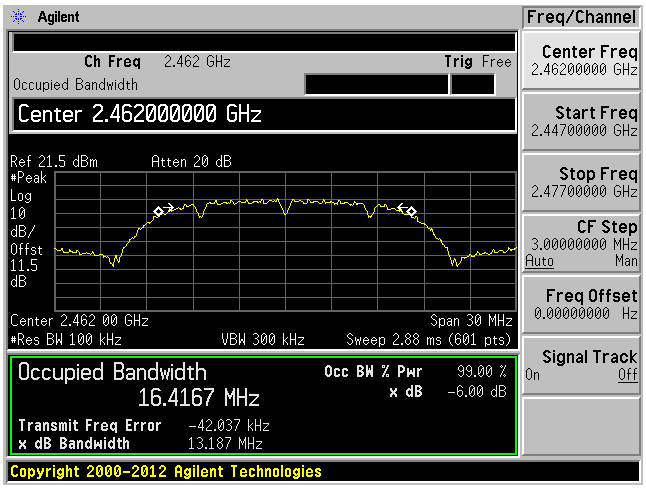
Low channel: 2412 MHz



Middle channel: 2437 MHz

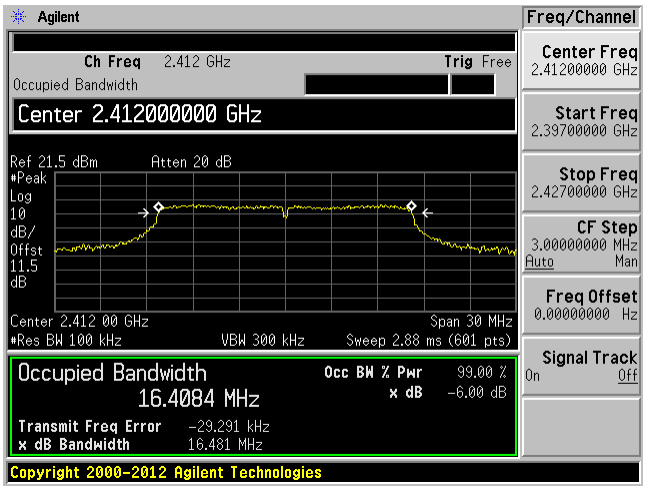


High channel: 2462 MHz

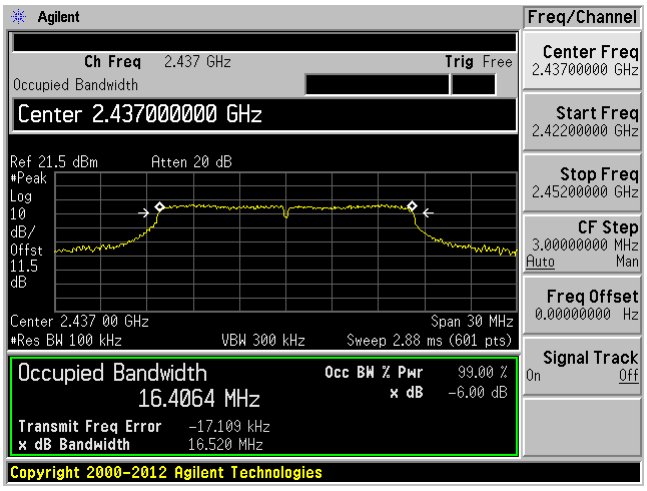


802.11g mode

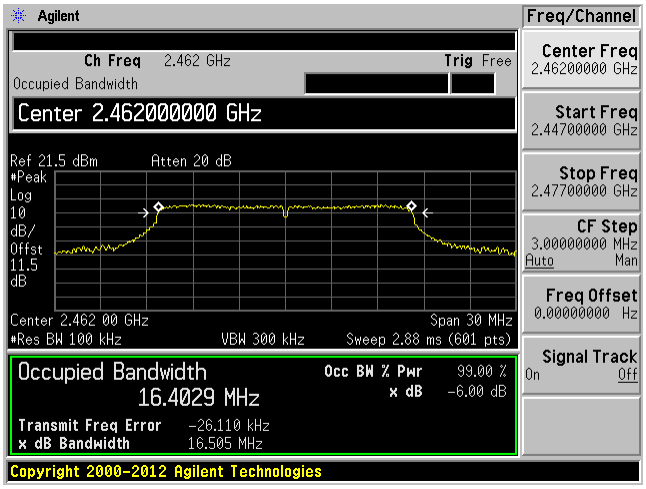
Low channel: 2412 MHz



Middle channel: 2437 MHz

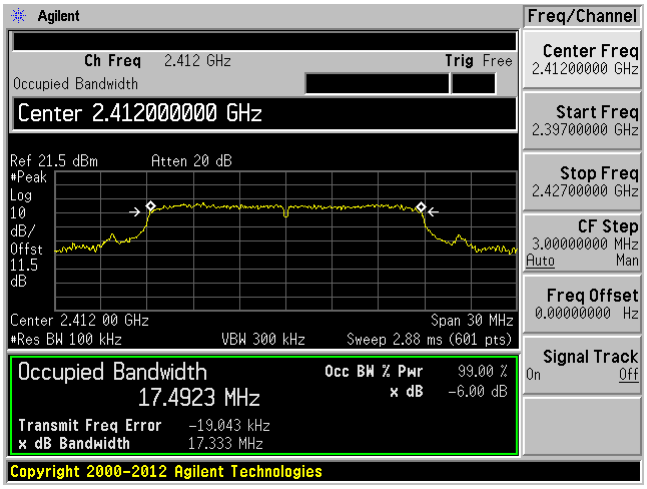


High channel: 2462 MHz

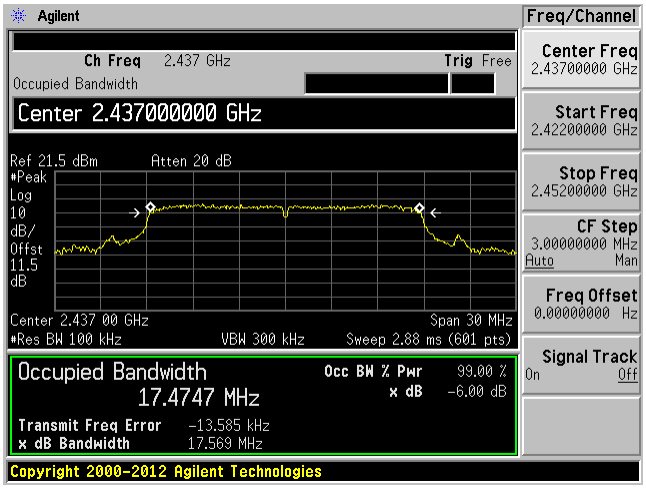


802.11n HT20 mode

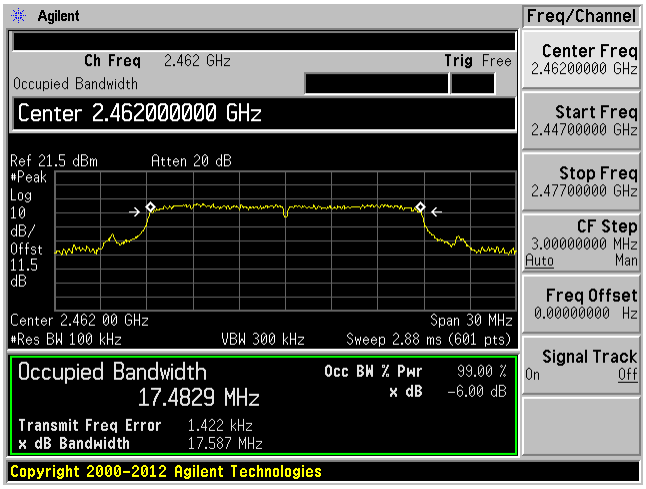
Low channel: 2412 MHz



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

The measurements are base on FCC KDB 558074 D01 DTS Measure Guidance: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 9: Fundamental emission output power

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2013-08-29	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:	20° C
Relative Humidity:	42 %
ATM Pressure:	101.89 kPa

The testing was performed by Glenn Escano on 2014-04-15 in RF Test Site.

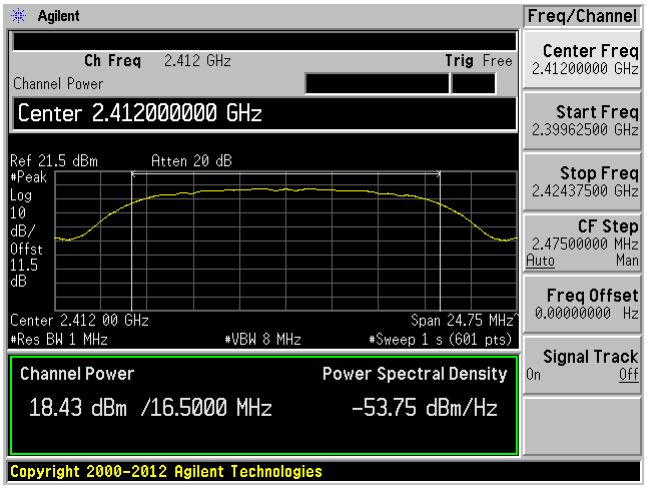
10.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	FCC/IC Limit (dBm)	Margin (dB)	Power Settings
802.11b mode					
Low	2412	18.43	30	-12.01	19
Middle	2437	17.93	30	-11.83	20
High	2462	17.86	30	-13.26	19
802.11g mode					
Low	2412	19.57	30	-10.23	24
Middle	2437	19.29	30	-10.67	24
High	2462	18.66	30	-11.20	24
802.11n-HT20 mode					
Low	2412	19.52	30	-11.10	23
Middle	2437	19.05	30	-10.64	24
High	2462	19.05	30	-11.06	24

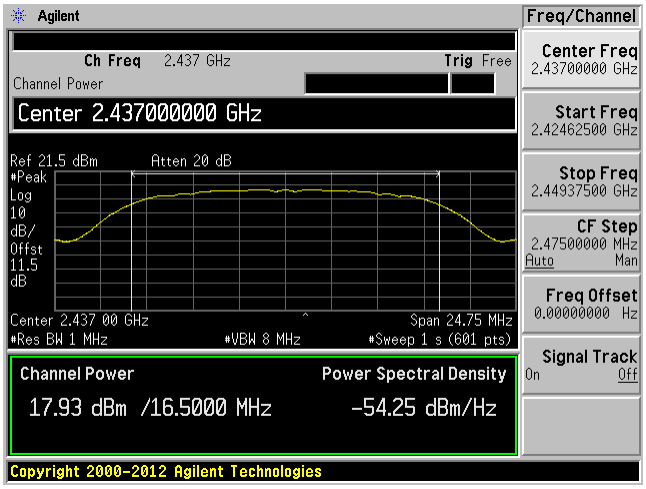
Please refer to the Plots below:

802.11b mode

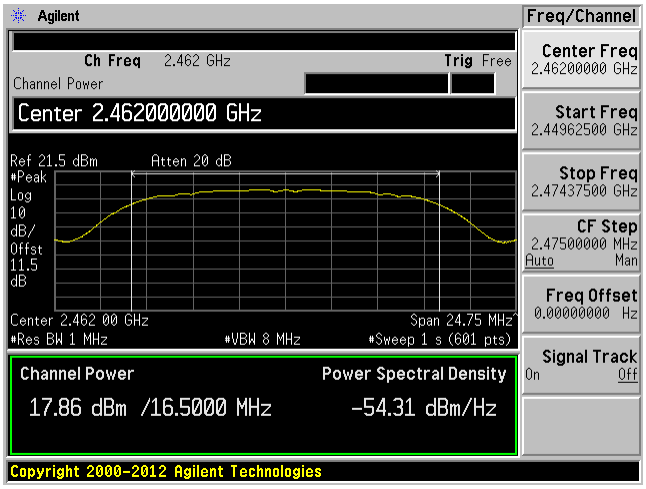
Low channel: 2412 MHz



Middle channel: 2437 MHz

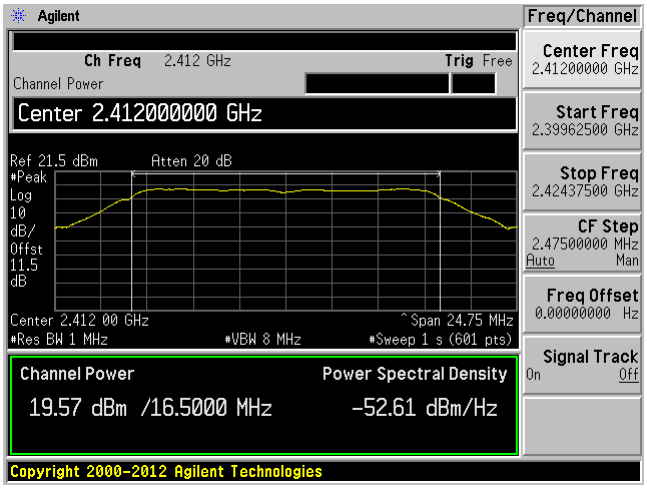


High channel: 2462 MHz

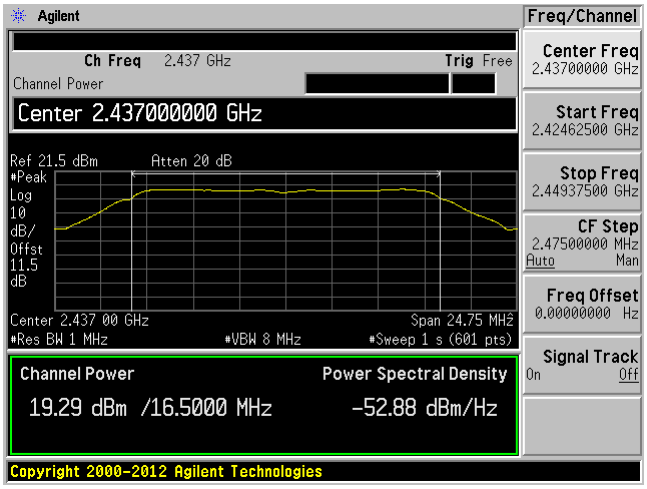


802.11g mode

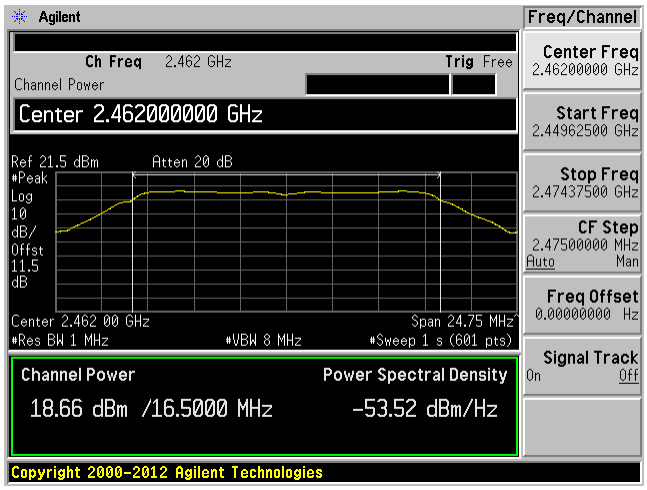
Low channel: 2412 MHz



Middle channel: 2437 MHz

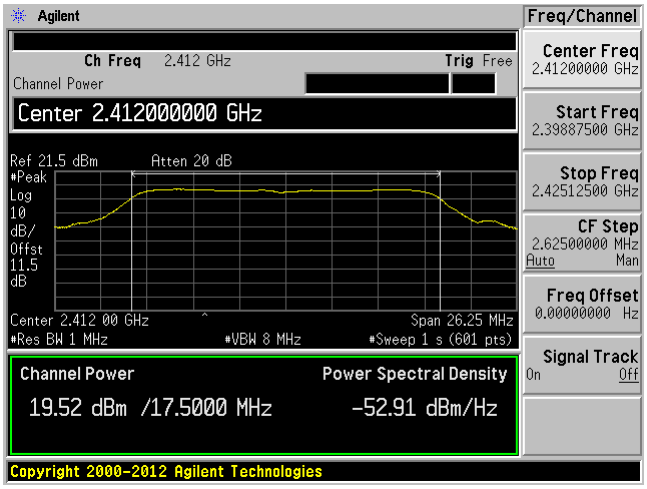


High channel: 2462 MHz

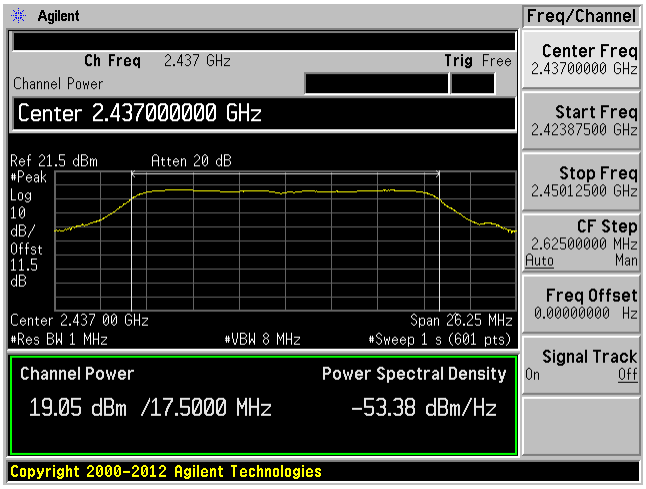


802.11n-HT20 mode

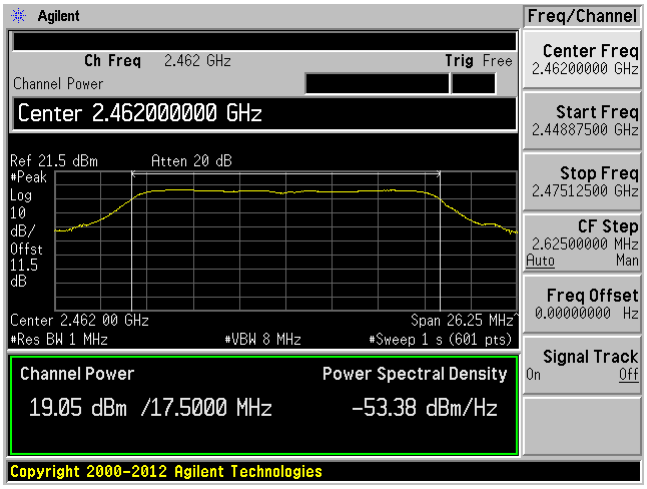
Low channel: 2412 MHz



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

The measurements are base on FCC KDB 558074 D01 DTS Measure Guidance: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 13: Band-edge measurements

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2013-08-29	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:	20° C
Relative Humidity:	42 %
ATM Pressure:	101.89 kPa

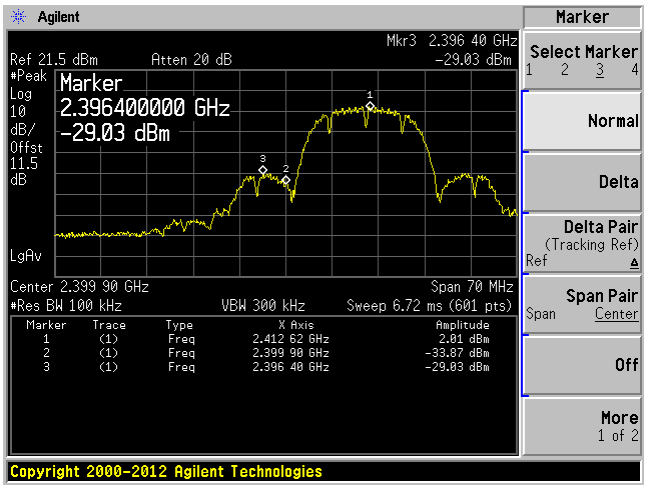
The testing was performed by Glenn Escano on 2014-04-15 in RF Test Site.

11.5 Test Results

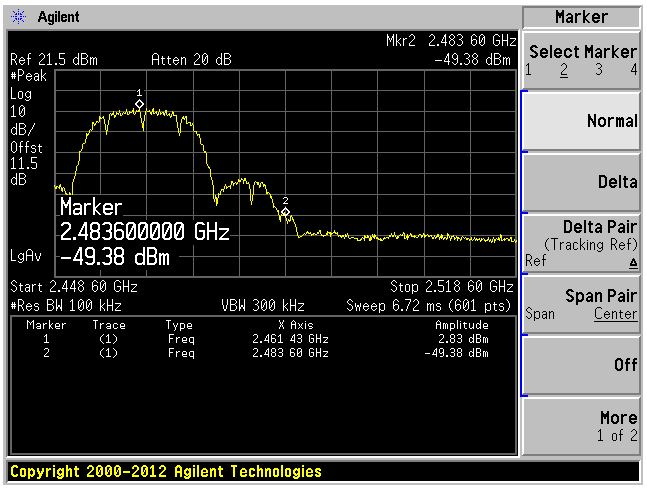
Please refer to following pages for plots of band edge.

802.11b Mode

Low Channel Band Edge

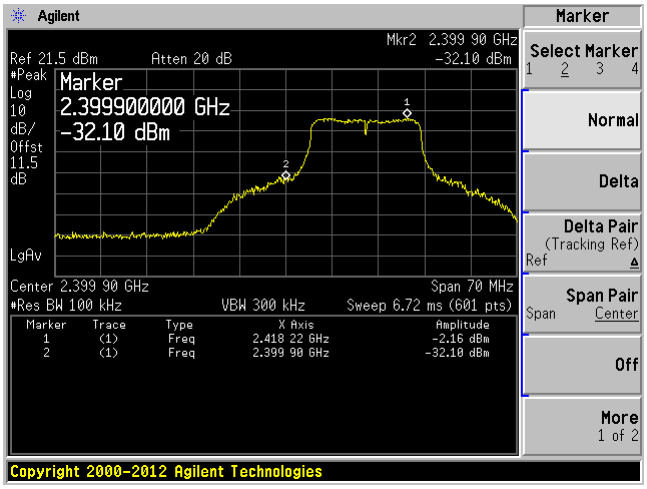


High Channel Band Edge

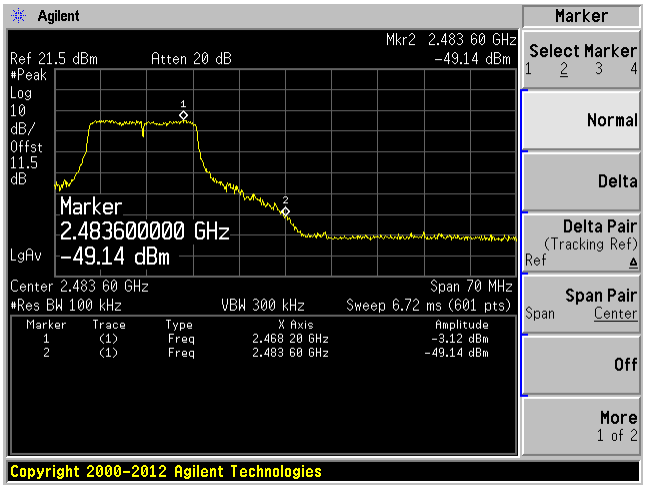


802.11g Mode

Low Channel Band Edge

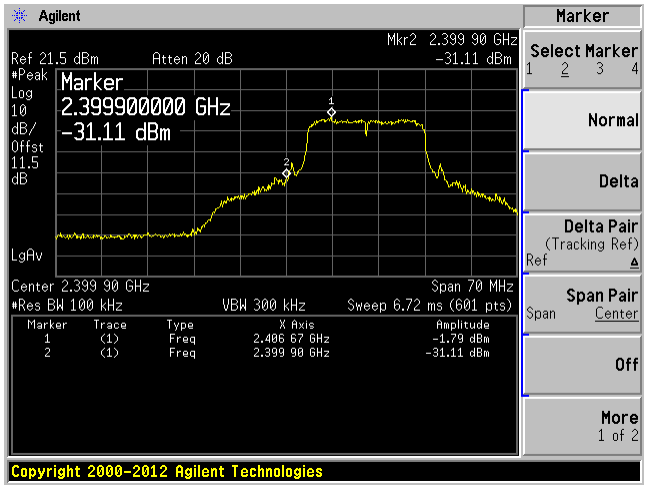


High Channel Band Edge

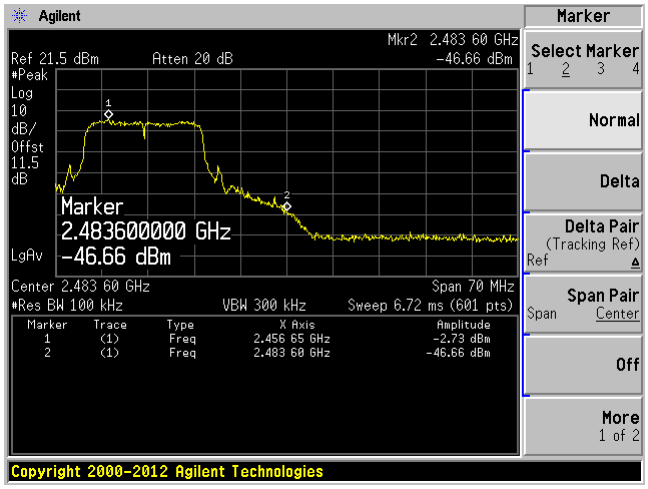


802.11n-HT20 Mode

Low Channel Band Edge



High Channel 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

The measurements are base on FCC KDB 558074 D01 DTS Measure Guidance: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10: Maximum power spectral density level in the fundamental emission

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2013-08-29	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:	20° C
Relative Humidity:	42 %
ATM Pressure:	101.89 kPa

The testing was performed by Glenn Escano on 2014-04-15 in RF Test Site.

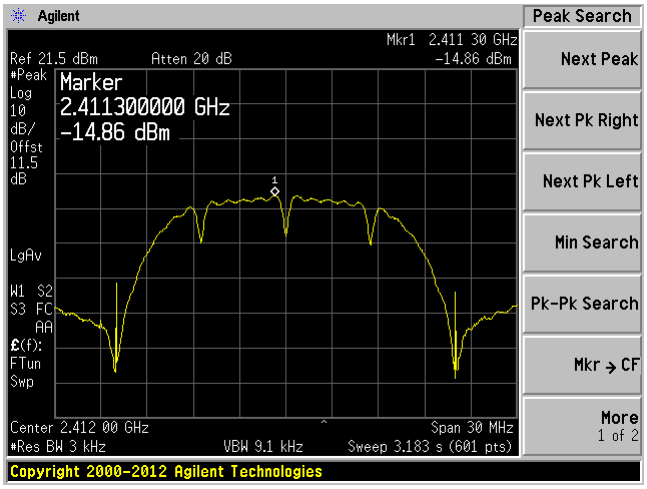
12.5 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm)	FCC/IC Limit (dBm)	Margin (dB)
802.11b mode				
Low	2412	-14.86	8	-23.52
Mid	2437	-14.94	8	-23.46
High	2462	-15.83	8	-24.35
802.11g mode				
Low	2412	-16.01	8	-25.76
Mid	2437	-16.55	8	-25.67
High	2462	-17.65	8	-25.81
802.11n-HT20 mode				
Low	2412	-15.63	8	-25.79
Mid	2437	-16.84	8	-24.97
High	2462	-17.46	8	-24.28

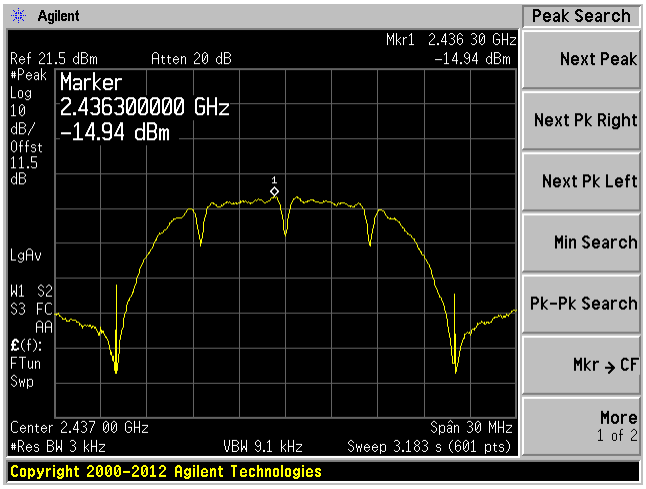
Please refer to the following plots for detailed test results:

802.11b mode

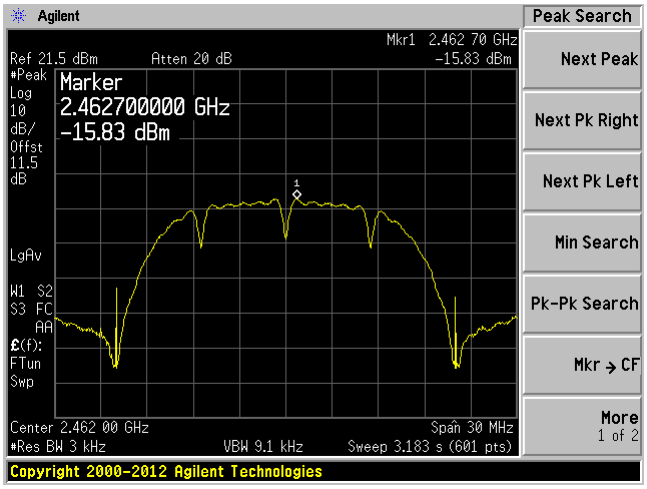
Low channel: 2412 MHz



Middle channel: 2437 MHz

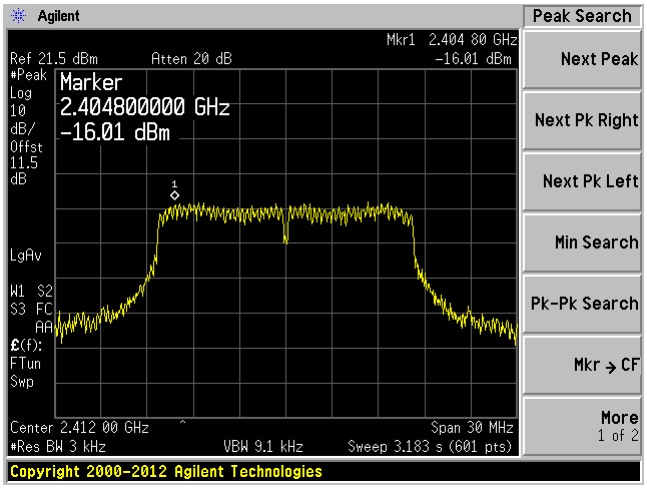


High channel: 2462 MHz

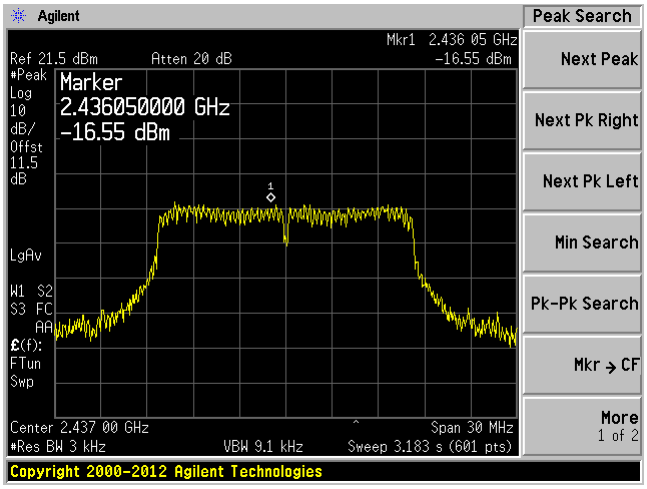


802.11g mode

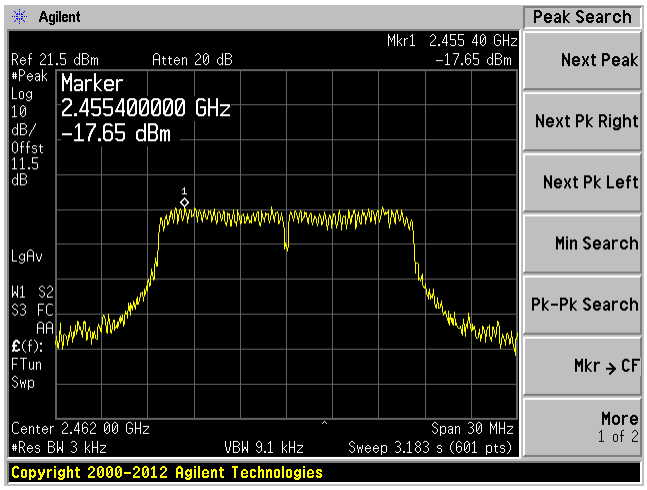
Low channel: 2412 MHz



Middle channel: 2437 MHz

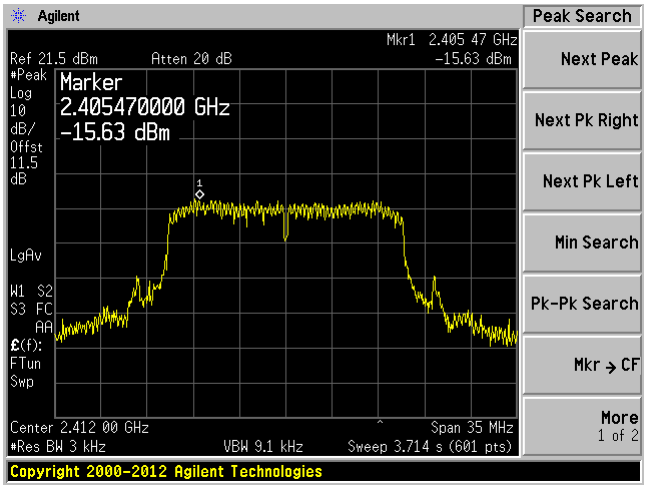


High channel: 2462 MHz

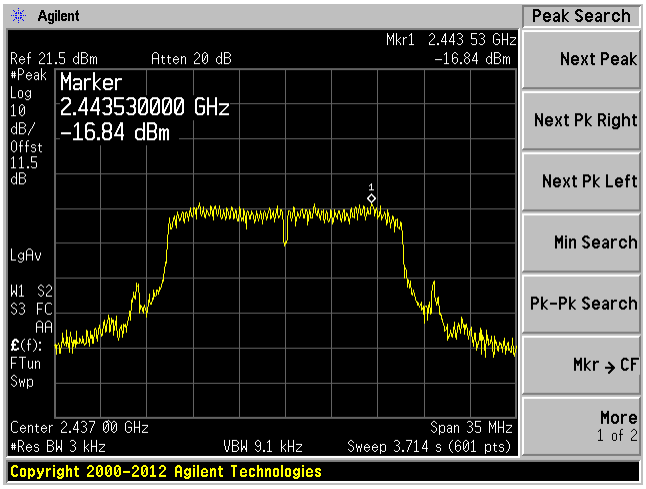


802.11n-HT20 mode

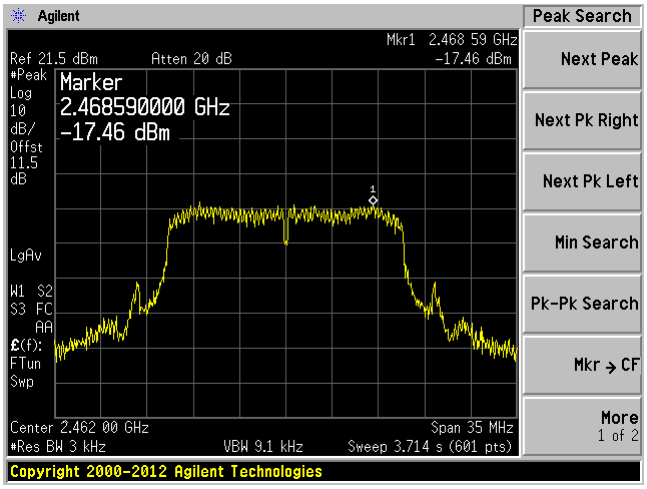
Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz



13 IC RSS-210 §2.3 & RSS-Gen §4.10 – Receiver Spurious Radiated Emissions

13.1 Applicable Standard

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

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

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

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

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

According to RSS-Gen §6.1, Tables 2 show the general field strength limits of receiver spurious emissions

Table 2: Radiated Limits of Receiver Spurious Emissions

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

13.2 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 List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-3	2013-07-11	1 Year
HP	Pre Amplifier	8447D	2443A04374	2013-06-08	1 Year
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2014-01-20	1 Year
Sunol Sciences	Controller, System	SC104V	113005-1	N/R	N/R
Sunol Sciences	Motor, Tower	TWR95-4	113005-3	N/R	N/R
Agilent	Spectrum Analyzer	E4446A	MY48250238	2013-08-29	1 Year
A.H. Systems	Horn antenna	SAS-200/571	261	2014-1-30	1 Year
Hewlett Packard	Amplifier, Pre	8449B OPT H02	3008A01103	2014-03-10	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° C
Relative Humidity:	41 %
ATM Pressure:	101.89 kPa

The testing was performed by Glenn Escano on 2014-04-17in 5m chamber 2.

13.7 Summary of Test Results

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

30 MHz to 1 GHz

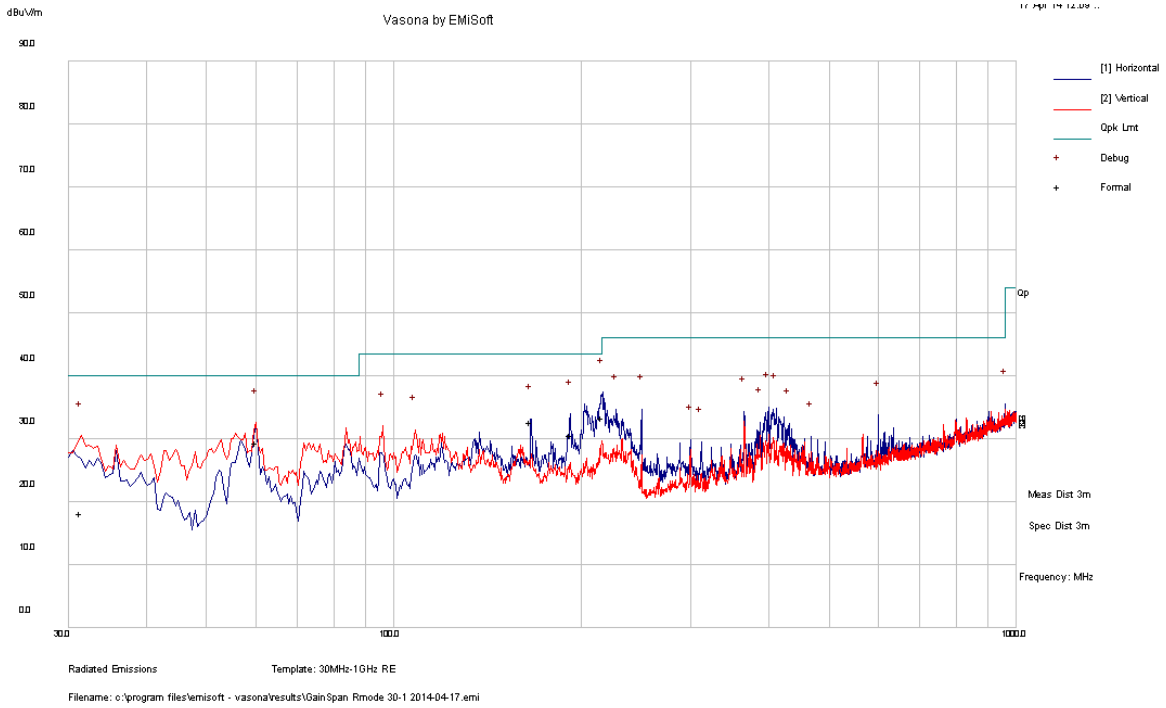
Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-10.52	60.02525	Vertical	30 - 1000

1 to 25 GHz

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-18.74	1350	Vertical	1000 - 25,000

13.8 Test data 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 (PK/QP/Ave.)
60.02525	29.48	101	V	47	40	-10.52	QP
165.9878	32.66	118	H	282	43.5	-10.84	QP
216.0685	33.3	125	H	278	46	-12.70	QP
192.0065	30.58	134	H	270	43.5	-12.92	QP
31.441	18.25	132	V	10	40	-21.75	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
1350	55.26	100	V	0	74	-18.74	Peak
1350	53.6	100	H	334	74	-20.40	Peak
1350	33.42	100	V	0	54	-20.58	Ave
1350	33.45	100	H	334	54	-20.55	Ave
3511	46.84	100	V	0	74	-27.16	Peak
3511	46.25	100	H	0	74	-27.75	Peak
3511	31.99	100	V	0	54	-22.01	Ave
3511	31.95	100	H	0	54	-22.05	Ave
7152	47.522	100	V	0	74	-26.478	Peak
7152	47.292	100	H	0	74	-26.708	Peak
7152	33.152	100	V	0	54	-20.848	Ave
7152	33.062	100	H	0	54	-20.938	Ave