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

TEST AND MEASUREMENT REPORT

For

GainSpan Corporation

3590 North First Street, Suite 300, San Jose, CA 95134, USA

FCC ID: YOPGS2011MIE
IC: 9154A-GS2011MIE

Report Type:	**Product Type:**
Original Report	Low Power Wi-Fi Module with 802.11b/g/n

Prepared By:	Ken Bai
Report Number:	R1402132-247 Rev A
Report Date:	2014-04-21
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1402132-247	Original Report	2014-04-07
1	R1402132-247 Rev A	Revised report with updated model number and serial number	2014-04-21

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: *GS2011MIE, FCC ID: YOPGS2011MIE, IC: 9154A-GS2011MIE* or the "EUT" as referred to in this report. The EUT is a Low Power Wi-Fi Module with 802.11 b/g/n.

1.2 Mechanical Description of EUT

The EUT measures approximately 3.25 cm (L) x 2.28 cm (W) x 0.363 cm (H) and weighs 22 g.

The test data gathered are from typical production sample, MAC: 001DC914D57A assigned by Client.

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)

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 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.

2.2 EUT Exercise Software

The test utility used was *Tera Term* was provided by GainSpan Corporation., and was verified by *Ken Bai* to comply with the standard requirements being tested against.

2.3 Special Equipment

There were no special accessories 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	Latitude E5420	-

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
GainSpan	Motherboard	GS_Module-Daughter Card Rev2	-
GainSpan	Wifi-Module	Gainspan GS2011MIE Rev 3.1	-

2.7 Interface Ports and Cables

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

2.8 Power Supply List and Details

Manufacturer	Description	Model	Part Number
GainSpan	Power Supply cord	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 §15.247 (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 §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

For Dipole Antenna:

Maximum peak output power at antenna input terminal (dBm):	20.44
Maximum peak output power at antenna input terminal (mW):	110.6624
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	2.0
Maximum Antenna Gain (numeric):	1.584
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.034892
Power density of prediction frequency at 20.0 cm (W/m^2):	0.348923
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 0.035 mW/c m^2 (0.35 W/ m^2).

For PCB Antenna:

Maximum peak output power at antenna input terminal (dBm):	20.44
Maximum peak output power at antenna input terminal (mW):	110.6624
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	1.0
Maximum Antenna Gain (numeric):	1.258
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.027716
Power density of prediction frequency at 20.0 cm (W/m^2):	0.27716
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 0.028 mW/cm^2 (0. 28 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	1.0
GainSpan	Dipole	2.0

Note: The power setting was controlled by manufacture with different antenna configuration. The power setting of the different antenna will be set with the corresponded value and no more then the level reported.

The antenna consists of non-standard (UFL) connectors with less 6 dBi gain; therefore, it complies with the antenna requirement. Please refer to the internal photos.

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.

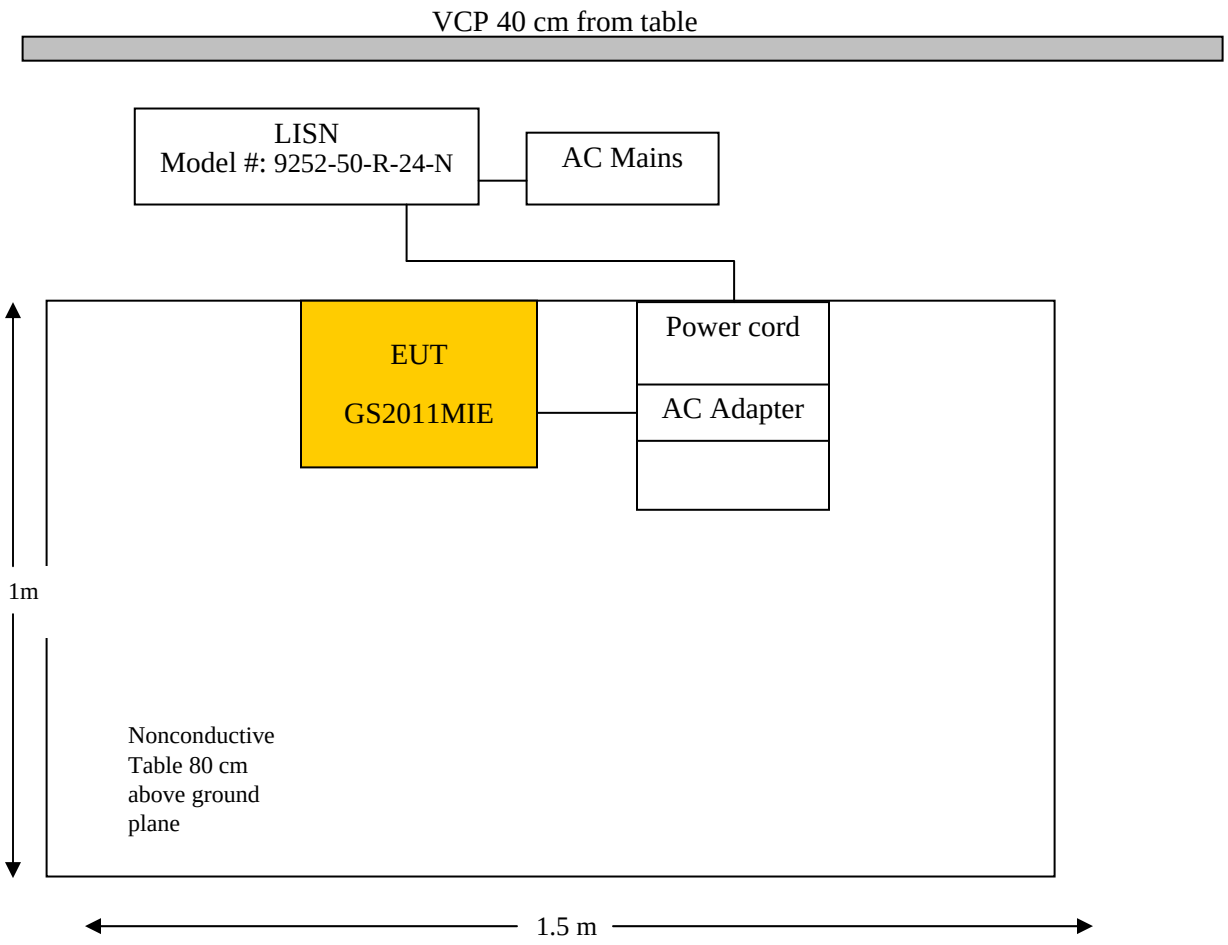
6.3 Test Procedure

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

CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

6.6 Test Equipment List and Details

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

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

6.7 Test Environmental Conditions

Temperature:	22º C
Relative Humidity:	52 %
ATM Pressure:	101.89 kPa

The testing was performed by Ken Bai on 2014-02-24 in 5 m chamber 2.

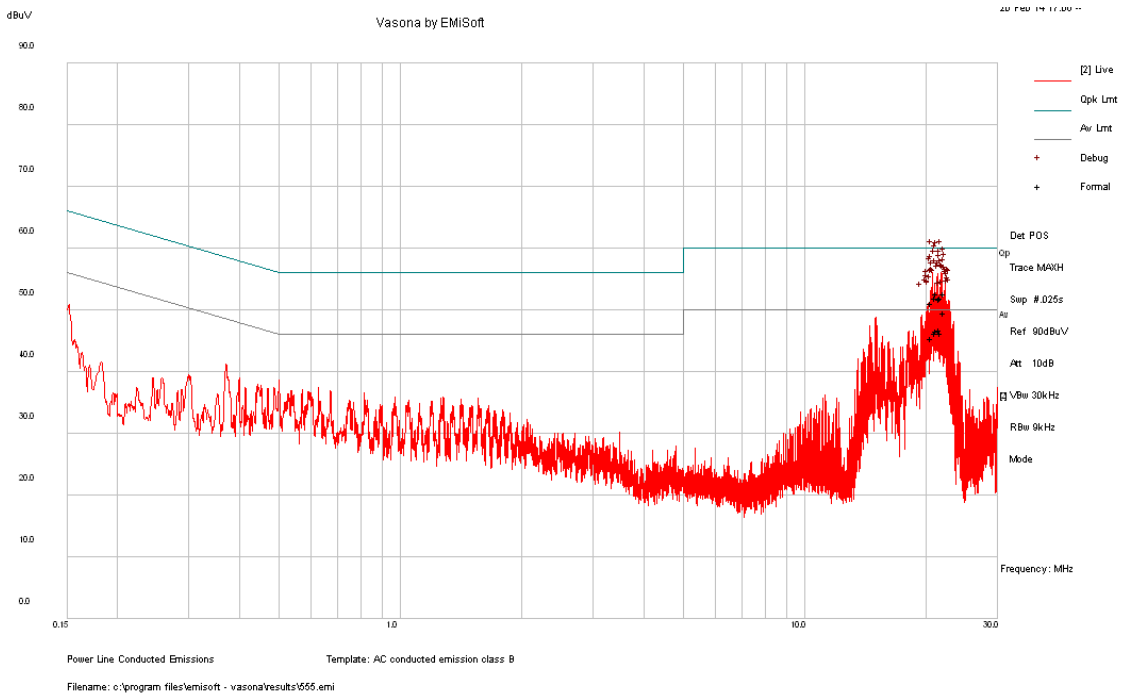
6.8 Summary of Test Results

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

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-0.40	22.17711	Line	0.15 to 30 MHz

6.9 Conducted Emissions Test Plots and Data

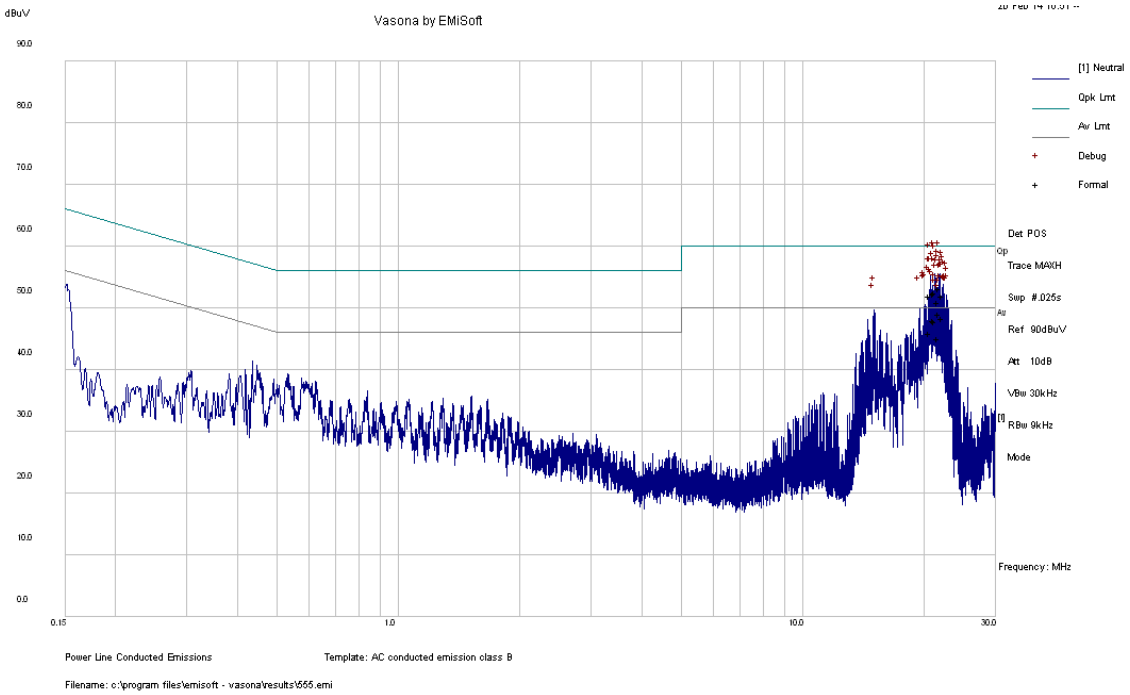
120 V, 60 Hz – Line, AC/DC Adaptor



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
21.25848	52.65	Line	60	-7.35	QP
22.17711	52.64	Line	60	-7.36	QP
21.77799	51.96	Line	60	-8.04	QP
21.15717	51.93	Line	60	-8.07	QP
21.66578	51.8	Line	60	-8.20	QP
20.64765	51.06	Line	60	-8.94	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
22.17711	49.6	Line	50	-0.40	Ave.
21.66578	46.87	Line	50	-3.13	Ave.
21.25848	46.62	Line	50	-3.38	Ave.
21.15717	46.31	Line	50	-3.69	Ave.
21.77799	46.29	Line	50	-3.71	Ave.
20.64765	45.36	Line	50	-4.64	Ave.

120 V, 60 Hz – Neutral, AC/DC Adaptor



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
21.7679	53.26	Neutral	60	-6.74	QP
21.26482	52.53	Neutral	60	-7.47	QP
21.16348	52.4	Neutral	60	-7.60	QP
20.64953	51.95	Neutral	60	-8.05	QP
22.17896	51.95	Neutral	60	-8.05	QP
21.66442	51.03	Neutral	60	-8.97	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
21.7679	49.1	Neutral	50	-0.90	Ave.
22.17896	48.33	Neutral	50	-1.67	Ave.
21.16348	47.96	Neutral	50	-2.04	Ave.
21.26482	47.92	Neutral	50	-2.08	Ave.
20.64953	45.95	Neutral	50	-4.05	Ave.
21.66442	45.09	Neutral	50	-4.91	Ave.

7 FCC §2.1051, §15.247(d) & IC RSS-210 §A8.5 – Spurious Emissions at Antenna Terminals

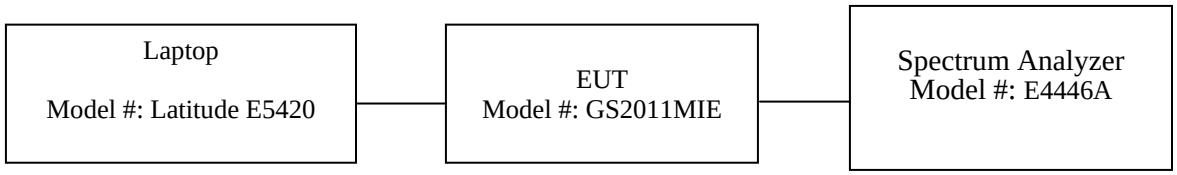
7.1 Applicable Standard

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 Meas Guidance v03r01: 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 Setup Block Diagram



7.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
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.*

7.5 Test Environmental Conditions

Temperature:	22-24° C
Relative Humidity:	42-45 %
ATM Pressure:	101-102 kPa

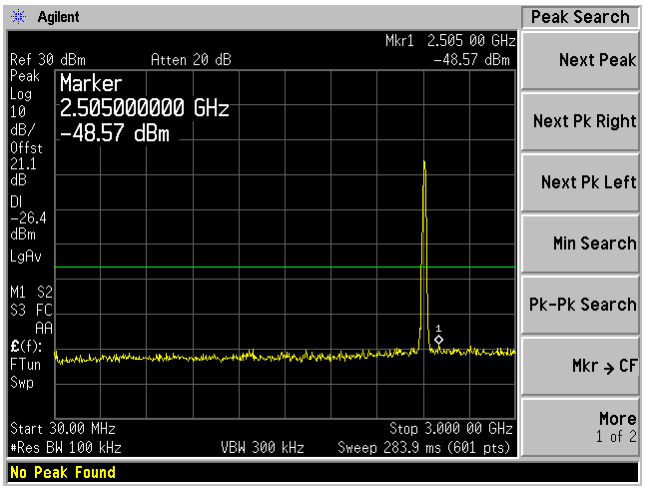
The testing was performed by Ken Bai from 2014-2-24 at RF site.

7.6 Test Results

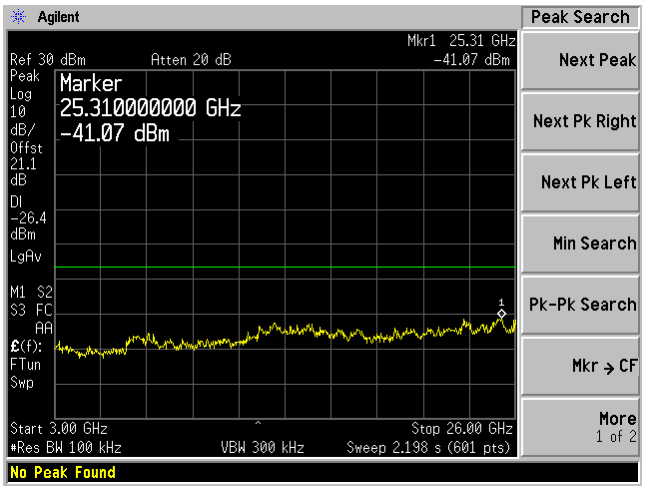
Please refer to following plots of spurious emissions.

802.11b, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

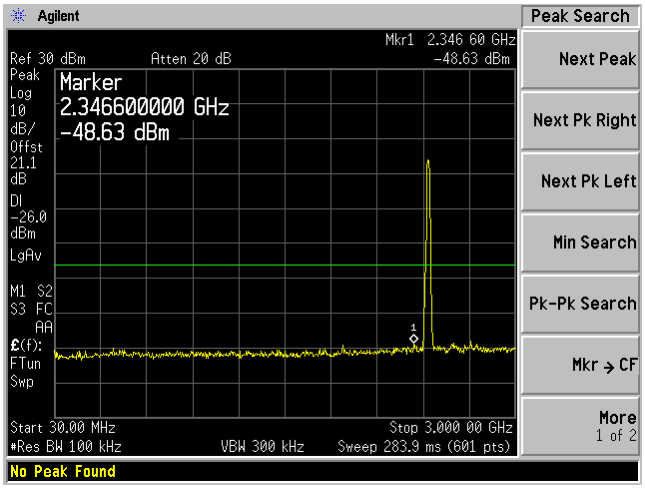


Plot: 3 GHz – 25 GHz

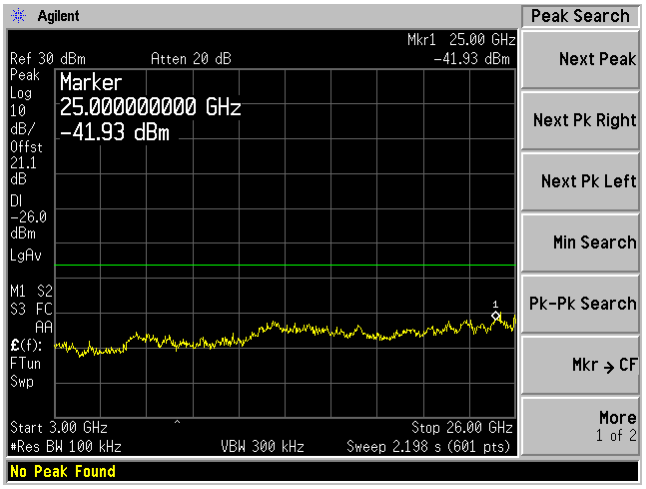


802.11b, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

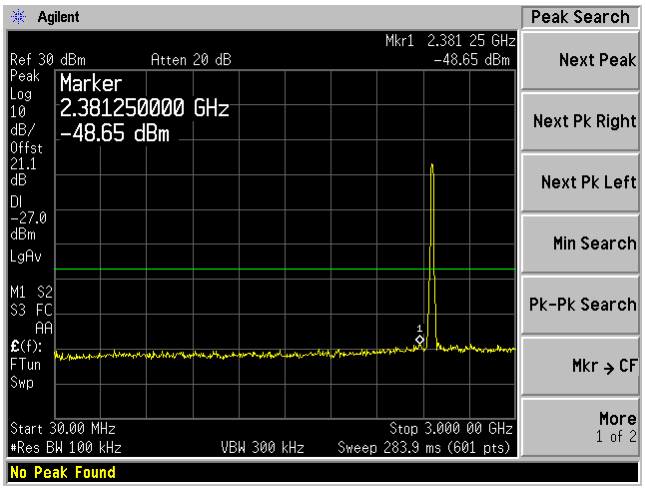


Plot: 3 GHz – 25 GHz

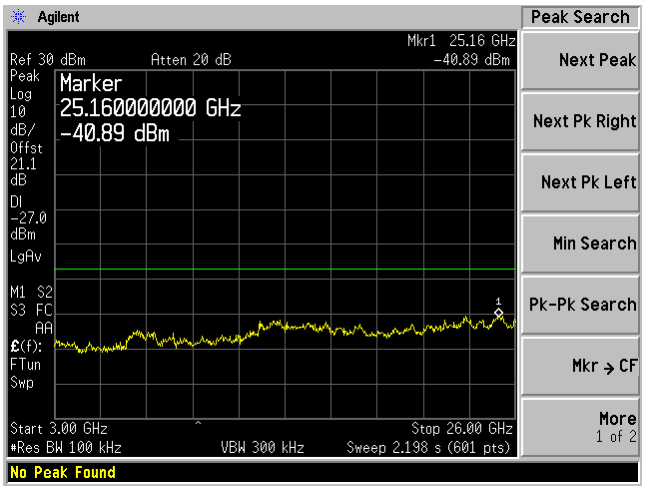


802.11b, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

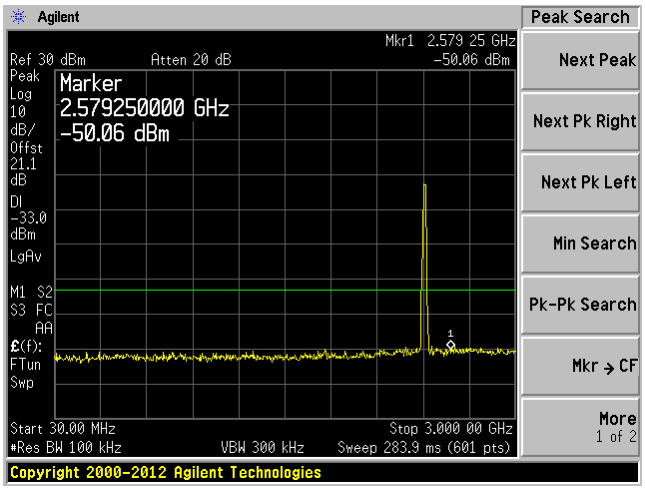


Plot: 3 GHz – 25 GHz

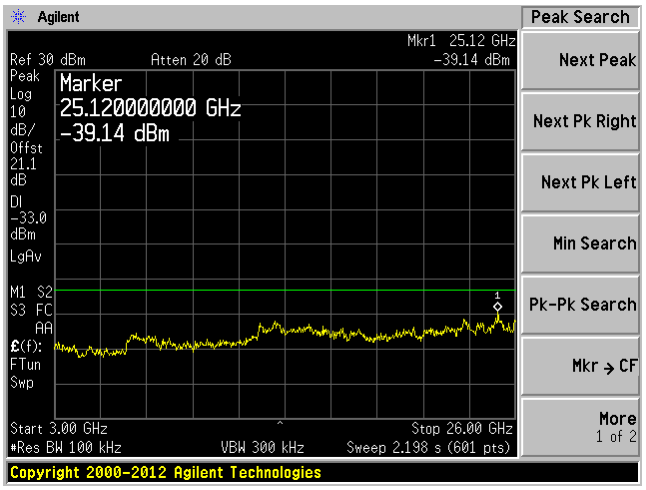


802.11g, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

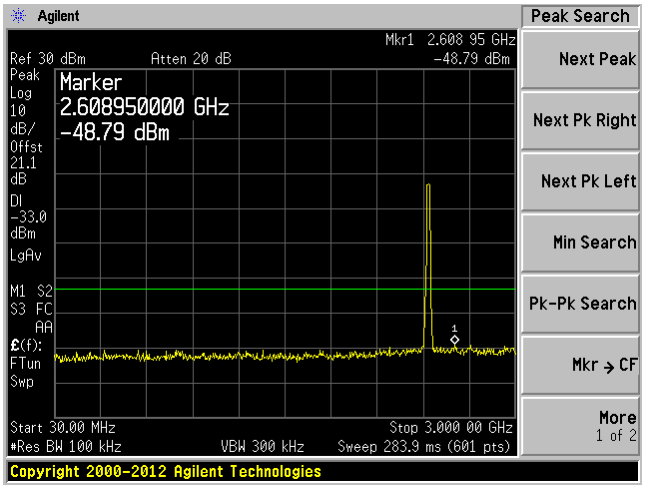


Plot: 3 GHz – 25 GHz

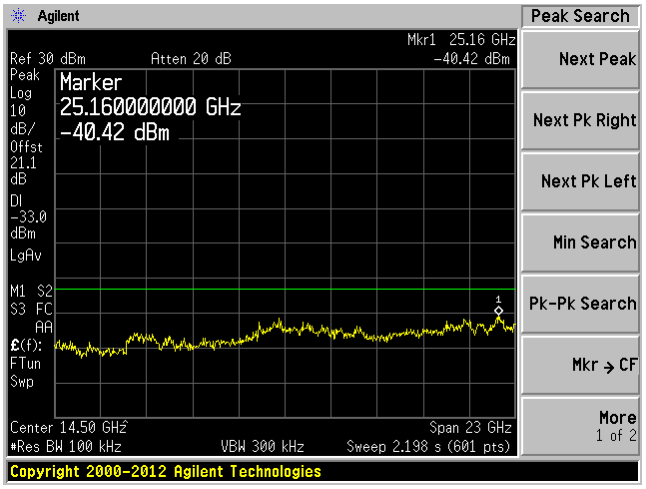


802.11g, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

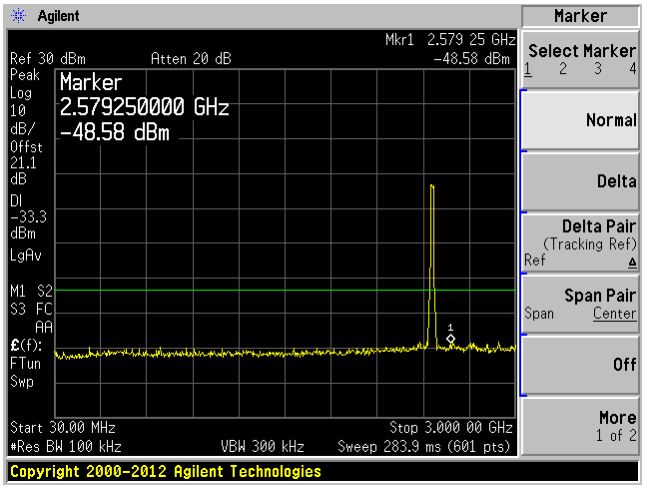


Plot: 3 GHz – 25 GHz

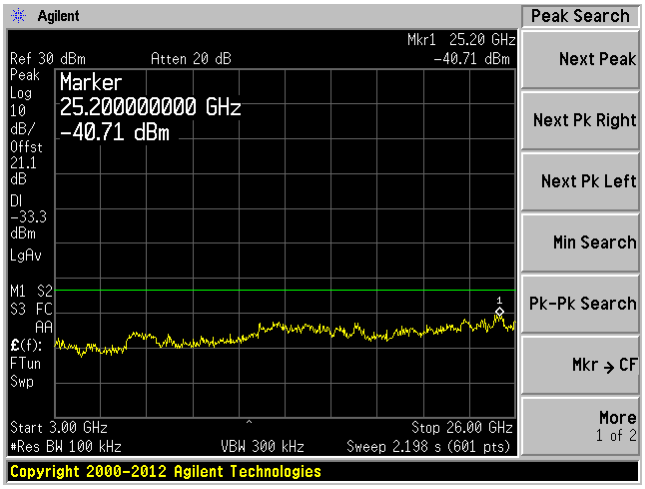


802.11g, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz

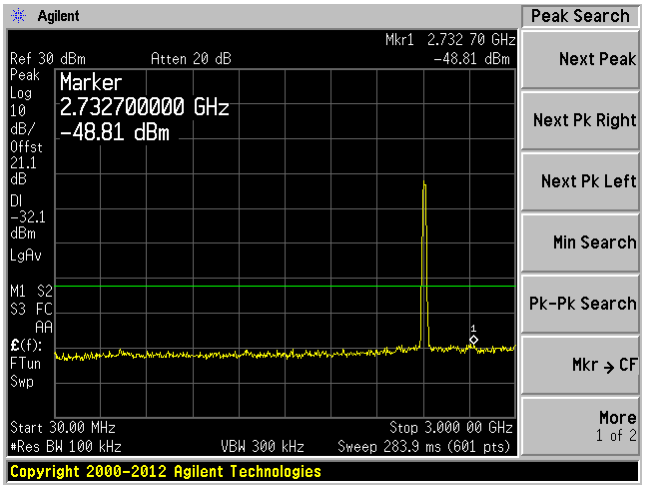


Plot: 3 GHz – 25 GHz

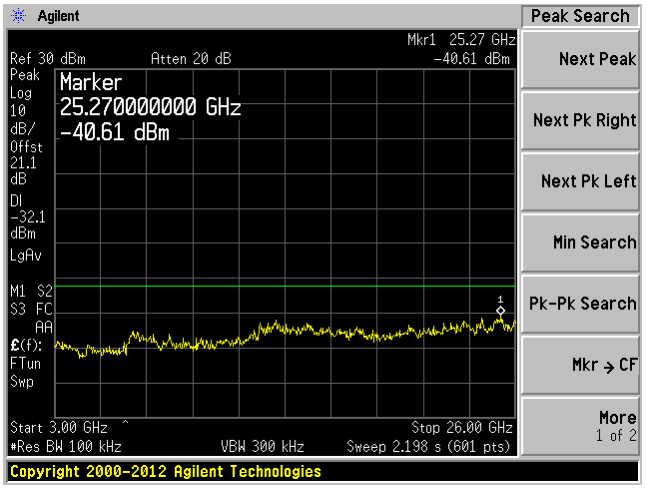


802.11n-HT20, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

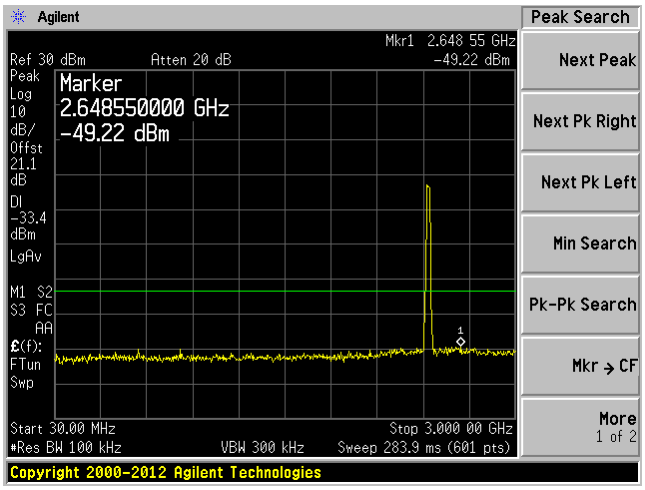


Plot: 3 GHz – 25 GHz

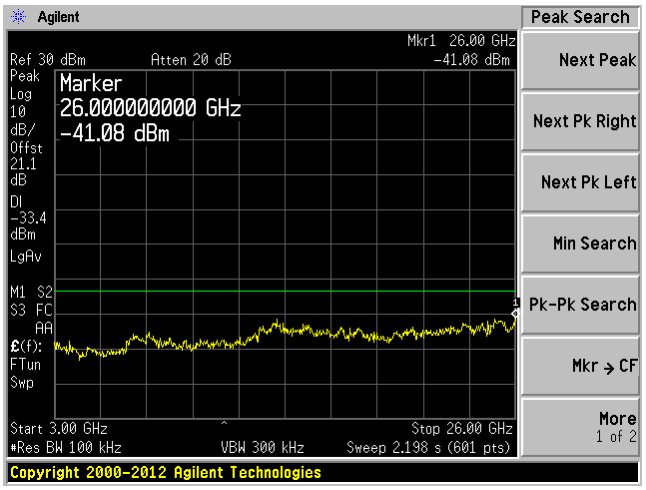


802.11n-HT20, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

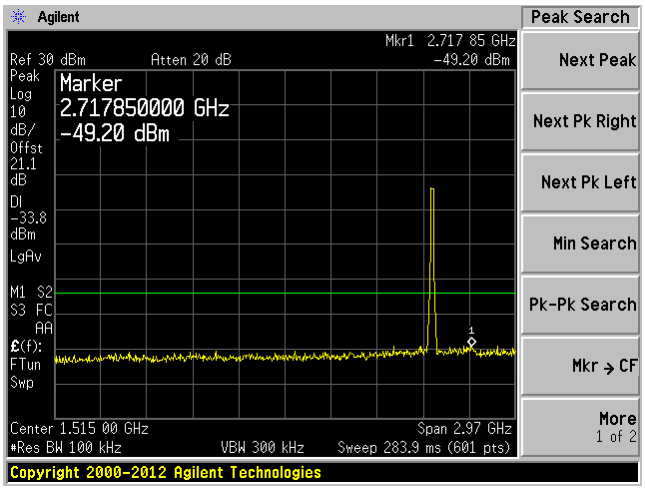


Plot: 3 GHz – 25 GHz

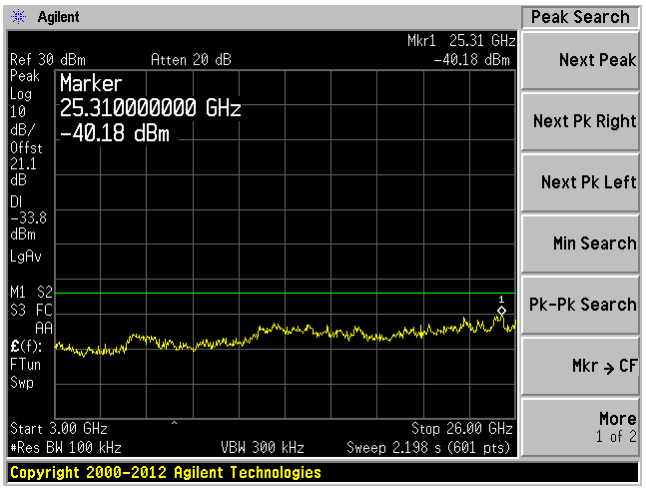


802.11n-HT20, High Channel 2462 MHz

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 10 centimeters.

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

8.3 Test Procedure

The measurements are base on FCC KDB 558074 D01 DTS Meas Guidance v03r01: 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. As well as ANSI C63.4: 2009 as described below:

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

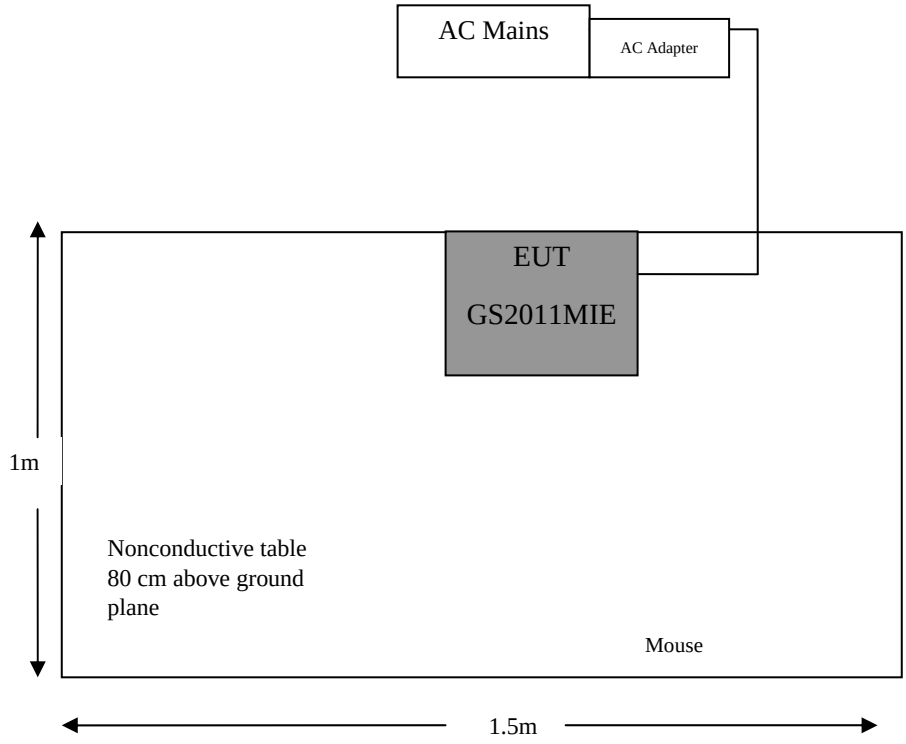
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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:

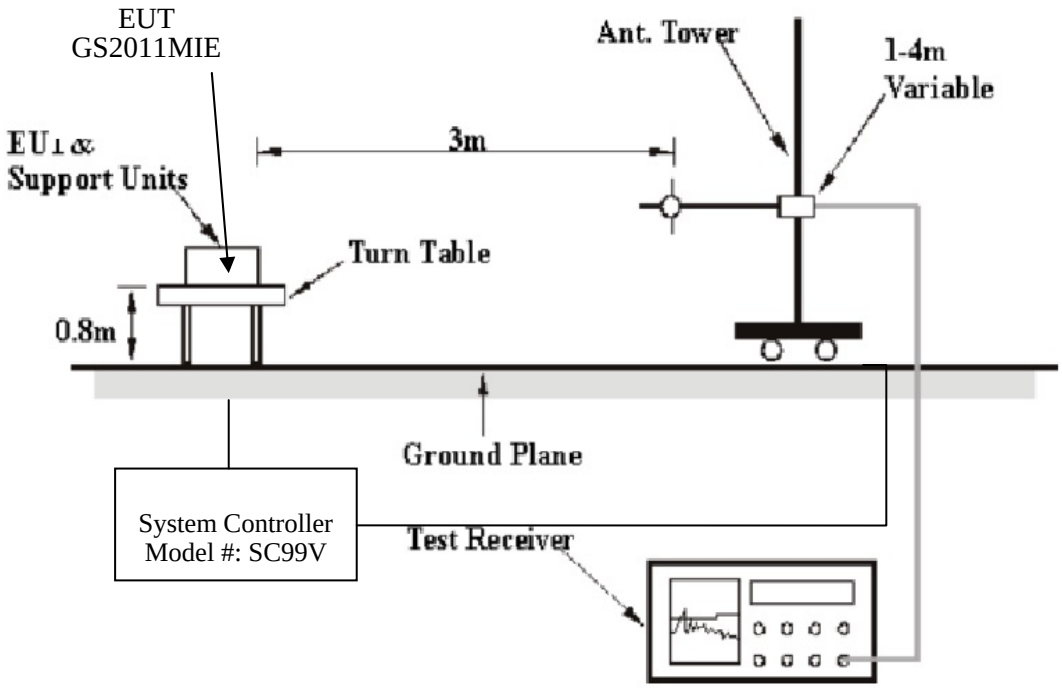
Margin = Corrected Amplitude - Limit

8.5 Test Setup Block Diagram

Block Diagram #1



Block Diagram #2



8.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
Agilent	Spectrum Analyzer	E4446A	MY48250238	2013-08-29	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2013-07-11	1 Year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2013-06-09	1 Year
EMCO	Horn antenna	3115	9511-4627	2014-1-7	1 Year
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2013-05-09	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:	22º C
Relative Humidity:	52 %
ATM Pressure:	101.89 kPa

The testing was performed by Ken Bai on 2014-03-25 in 5 m chamber 3.

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:

For Dipole Antenna

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode**
-7.56	50.23175	Vertical	802.11b

1-25 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-0.084	2390	Vertical	802.11b, Low CH

For PCB Antenna

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode**
-5.88	3.0	Vertical	802.11b

1-25 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-0.534	2390	Horizontal	802.11n-HT20, Low CH

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

8.9 Radiated Emissions Test Data

1) 30 MHz–1 GHz, Measured at 3 meters, Quasi-Peak Measurements

For Dipole Antenna:

802.11b mode

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
50.23175	32.44	188	V	307	40	-7.56
34.139	25.33	291	V	0	40	-14.67
712.727	20.55	326	V	16	46	-25.45
59.37625	28.63	149	V	360	40	-11.37

802.11g mode

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
712.9403	17.32	386	V	323	46	-28.68
48.28175	31.54	103	V	360	40	-8.46
52.4955	23.88	113	H	201	40	-16.12
708.0608	15.22	128	V	198	46	-30.78

802.11n-HT20 mode

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
30	29.93	118	V	152	40	-10.07
711.207	34.21	113	V	163	46	-11.79
34.827	27.87	99	V	0	40	-12.13
709.2218	17.07	364	V	262	46	-28.93
109.663	32.33	99	H	23	43.5	-11.17

In 30-1000 MHz range, all spurious are digital, other emissions are on the noise floor level. The worst case result was reported.

For PCB Antenna:

802.11b mode

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
712.7713	32.3	248	V	134	46	-13.7
30	34.12	114	V	3	40	-5.88
109.8925	32.44	106	V	251	43.5	-11.06
63.404	29.11	131	V	252	40	-10.89

802.11g mode

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
30.38925	31.88	99	V	11	40	-8.12
109.3228	32.77	99	V	172	43.5	-10.73
62.994	28.11	106	V	259	40	-11.89
35.27325	24.91	128	V	240	40	-15.09

802.11n-HT20 mode

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
712.4048	17.14	99	H	321	46	-28.86
706.385	32.85	109	V	93	46	-13.15
708.7633	26.33	100	H	360	46	-19.67
710.795	21.07	142	H	83	46	-24.93

In 30-1000 MHz range, all 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

For dipole antenna:

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	78.53	134	100	V	28.956	3.12	0	110.606	N/A	N/A	Peak
2412	68.78	347	100	H	28.956	3.12	0	100.856	N/A	N/A	Peak
2412	75.38	134	100	V	28.956	3.12	0	107.456	N/A	N/A	Ave
2412	65.2	347	100	H	28.956	3.12	0	97.276	N/A	N/A	Ave
2390	33.45	296	100	V	28.956	3.12	0	65.526	74	-8.474	Peak
2390	28.1	0	100	H	28.956	3.12	0	60.176	74	-13.824	Peak
2390	21.84	296	100	V	28.956	3.12	0	53.916	54	-0.084	Ave
2390	15.44	0	100	H	28.956	3.12	0	47.516	54	-6.484	Ave
4824	39.8	222	100	V	33.097	4.56	27.7	49.757	74	-24.243	Peak
4824	39.95	330	100	H	33.097	4.56	27.7	49.907	74	-24.093	Peak
4824	35.26	222	100	V	33.097	4.56	27.7	45.217	54	-8.783	Ave
4824	35.12	330	100	H	33.097	4.56	27.7	45.077	54	-8.923	Ave
7236	34.49	0	100	V	35.928	5.49	27.58	48.328	90.606	-42.278	Peak
7236	34.35	0	100	H	35.928	5.49	27.58	48.188	80.856	-32.668	Peak
7236	20.19	0	100	V	35.928	5.49	27.58	34.028	87.456	-53.428	Ave
7236	19.96	0	100	H	35.928	5.49	27.58	33.798	77.276	-43.478	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	79.17	232	100	V	28.956	3.12	0	111.246	N/A	N/A	Peak
2437	70.47	255	100	H	28.956	3.12	0	102.546	N/A	N/A	Peak
2437	75.91	232	100	V	28.956	3.12	0	107.986	N/A	N/A	Ave
2437	66.79	255	100	H	28.956	3.12	0	98.866	N/A	N/A	Ave
4874	38.38	236	100	V	33.327	4.54	27.76	48.487	74	-25.513	Peak
4874	37.19	326	100	H	33.327	4.54	27.76	47.297	74	-26.703	Peak
4874	32.21	236	100	V	33.327	4.54	27.76	42.317	54	-11.683	Ave
4874	32.16	326	100	H	33.327	4.54	27.76	42.267	54	-11.733	Ave
7311	34.12	0	100	V	36.369	5.57	27.51	48.549	74	-25.451	Peak
7311	33.89	0	100	H	36.369	5.57	27.51	48.319	74	-25.681	Peak
7311	20.19	0	100	V	36.369	5.57	27.51	34.619	54	-19.381	Ave
7311	20.06	0	100	H	36.369	5.57	27.51	34.489	54	-19.511	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	76.86	286	100	V	29.155	3.25	0	109.265	N/A	N/A	Peak
2462	68.4	46	100	H	29.155	3.25	0	100.805	N/A	N/A	Peak
2462	73.32	286	100	V	29.155	3.25	0	105.725	N/A	N/A	Ave
2462	64.67	46	100	H	29.155	3.25	0	97.075	N/A	N/A	Ave
2483.5	32.13	286	100	V	29.155	3.25	0	64.535	74	-9.465	Peak
2483.5	27.95	0	100	H	29.155	3.25	0	60.355	74	-13.645	Peak
2483.5	21.5	286	100	V	29.155	3.25	0	53.905	54	-0.095	Ave
2483.5	12.41	0	100	H	29.155	3.25	0	44.815	54	-9.185	Ave
4924	37.89	234	100	V	33.327	4.52	27.75	47.987	74	-26.013	Peak
4924	37.63	330	100	H	33.327	4.52	27.75	47.727	74	-26.273	Peak
4924	32.76	234	100	V	33.327	4.52	27.75	42.857	54	-11.143	Ave
4924	32.31	330	100	H	33.327	4.52	27.75	42.407	54	-11.593	Ave
7386	34.12	0	100	V	36.565	5.62	27.51	48.795	74	-25.205	Peak
7386	33.79	0	100	H	36.565	5.62	27.51	48.465	74	-25.535	Peak
7386	20.87	0	100	V	36.565	5.62	27.51	35.545	54	-18.455	Ave
7386	20.01	0	100	H	36.565	5.62	27.51	34.685	54	-19.315	Ave

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	79.47	264	100	V	28.956	3.12	0	111.546	N/A	N/A	Peak
2412	69.8	290	100	H	28.956	3.12	0	101.876	N/A	N/A	Peak
2412	69.78	264	100	V	28.956	3.12	0	101.856	N/A	N/A	Ave
2412	65.83	290	100	H	28.956	3.12	0	97.906	N/A	N/A	Ave
2390	39.43	264	100	V	28.956	3.12	0	71.506	74	-2.494	Peak
2390	30.83	130	100	H	28.956	3.12	0	62.906	74	-11.094	Peak
2390	21.28	264	100	V	28.956	3.12	0	53.356	54	-0.644	Ave
2390	22.06	130	100	H	28.956	3.12	0	54.136	54	0.136	Ave
4824	39.42	322	100	V	33.097	4.56	27.7	49.377	74	-24.623	Peak
4824	39.17	299	100	H	33.097	4.56	27.7	49.127	74	-24.873	Peak
4824	34.88	322	100	V	33.097	4.56	27.7	44.837	54	-9.163	Ave
4824	34.37	299	100	H	33.097	4.56	27.7	44.327	54	-9.673	Ave
7236	34.44	0	100	V	35.928	5.49	27.58	48.278	74	-25.722	Peak
7236	34.28	0	100	H	35.928	5.49	27.58	48.118	74	-25.882	Peak
7236	20.72	0	100	V	35.928	5.49	27.58	34.558	54	-19.442	Ave
7236	20.38	0	100	H	35.928	5.49	27.58	34.218	54	-19.782	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	79.05	264	100	V	28.956	3.12	0	111.126	N/A	N/A	Peak
2437	67.64	141	100	H	28.956	3.12	0	99.716	N/A	N/A	Peak
2437	69.65	264	100	V	28.956	3.12	0	101.726	N/A	N/A	Ave
2437	56.88	141	100	H	28.956	3.12	0	88.956	N/A	N/A	Ave
4874	37.97	298	100	V	33.327	4.54	27.76	48.077	74	-25.923	Peak
4874	37.75	300	100	H	33.327	4.54	27.76	47.857	74	-26.143	Peak
4874	32.29	298	100	V	33.327	4.54	27.76	42.397	54	-11.603	Ave
4874	32.11	300	100	H	33.327	4.54	27.76	42.217	54	-11.783	Ave
7311	34.88	0	100	V	36.369	5.57	27.51	49.309	74	-24.691	Peak
7311	34.68	0	100	H	36.369	5.57	27.51	49.109	74	-24.891	Peak
7311	20.75	0	100	V	36.369	5.57	27.51	35.179	54	-18.821	Ave
7311	20.04	0	100	H	36.369	5.57	27.51	34.469	54	-19.531	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	78.09	262	100	V	29.155	3.25	0	110.495	N/A	N/A	Peak
2462	65.2	43	100	H	29.155	3.25	0	97.605	N/A	N/A	Peak
2462	67.51	262	100	V	29.155	3.25	0	99.915	N/A	N/A	Ave
2462	56.27	43	100	H	29.155	3.25	0	88.675	N/A	N/A	Ave
2483.5	41.54	219	100	V	29.155	3.25	0	73.945	74	-0.055	Peak
2483.5	31.05	43	100	H	29.155	3.25	0	63.455	74	-10.545	Peak
2483.5	20.17	219	100	V	29.155	3.25	0	52.575	54	-1.425	Ave
2483.5	13.88	43	100	H	29.155	3.25	0	46.285	54	-7.715	Ave
4924	38.02	290	100	V	33.327	4.52	27.75	48.117	74	-25.883	Peak
4924	37.83	330	100	H	33.327	4.52	27.75	47.927	74	-26.073	Peak
4924	31.86	290	100	V	33.327	4.52	27.75	41.957	54	-12.043	Ave
4924	31.78	330	100	H	33.327	4.52	27.75	41.877	54	-12.123	Ave
7386	34.93	0	100	V	36.565	5.62	27.51	49.605	74	-24.395	Peak
7386	34.12	0	100	H	36.565	5.62	27.51	48.795	74	-25.205	Peak
7386	19.88	0	100	V	36.565	5.62	27.51	34.555	54	-19.445	Ave
7386	19.23	0	100	H	36.565	5.62	27.51	33.905	54	-20.095	Ave

802.11n-HT20 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	77.95	255	100	V	28.956	3.12	0	110.026	N/A	N/A	Peak
2412	65.79	246	100	H	28.956	3.12	0	97.866	N/A	N/A	Peak
2412	68.25	255	100	V	28.956	3.12	0	100.326	N/A	N/A	Ave
2412	55.99	246	100	H	28.956	3.12	0	88.066	N/A	N/A	Ave
2390	42.73	255	100	V	28.956	3.12	0	74.806	74	0.806	Peak
2390	32.91	246	100	H	28.956	3.12	0	64.986	74	-9.014	Peak
2390	21.73	255	100	V	28.956	3.12	0	53.806	54	-0.194	Ave
2390	14.77	246	100	H	28.956	3.12	0	46.846	54	-7.154	Ave
4824	38.25	0	100	V	33.097	4.56	27.7	48.207	74	-25.793	Peak
4824	38.08	300	100	H	33.097	4.56	27.7	48.037	74	-25.963	Peak
4824	32.77	0	100	V	33.097	4.56	27.7	42.727	54	-11.273	Ave
4824	32.58	300	100	H	33.097	4.56	27.7	42.537	54	-11.463	Ave
7236	34.83	0	100	V	35.928	5.49	27.58	48.668	74	-25.332	Peak
7236	34.65	0	100	H	35.928	5.49	27.58	48.488	74	-25.512	Peak
7236	21.03	0	100	V	35.928	5.49	27.58	34.868	54	-19.132	Ave
7236	20.87	0	100	H	35.928	5.49	27.58	34.708	54	-19.292	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	78.75	256	100	V	28.3	3.5	0	105.81	N/A	N/A	Peak
2437	67.24	42	100	H	28.3	3.5	0	108.85	N/A	N/A	Peak
2437	68.53	256	100	V	28.3	3.5	0	102.5	N/A	N/A	Ave
2437	57.47	42	100	H	28.3	3.5	0	105.51	N/A	N/A	Ave
4874	37.89	298	100	V	33.327	4.54	27.76	47.187	74	-26.813	Peak
4874	36.09	286	100	H	33.327	4.54	27.76	48.187	74	-25.813	Peak
4874	32.07	298	100	V	33.327	4.54	27.76	40.707	54	-13.293	Ave
4874	28.27	286	100	H	33.327	4.54	27.76	43.377	54	-10.623	Ave
7311	34.63	0	100	V	36.369	5.57	27.51	46.509	74	-27.491	Peak
7311	34.17	0	100	H	36.369	5.57	27.51	47.029	74	-26.971	Peak
7311	20.47	0	100	V	36.369	5.57	27.51	34.549	54	-19.451	Ave
7311	20.16	0	100	H	36.369	5.57	27.51	34.689	54	-19.311	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	76.68	268	100	V	29.155	3.25	0	109.085	N/A	N/A	Peak
2462	65.15	312	100	H	29.155	3.25	0	97.555	N/A	N/A	Peak
2462	65.34	268	100	V	29.155	3.25	0	97.745	N/A	N/A	Ave
2462	54.69	312	100	H	29.155	3.25	0	87.095	N/A	N/A	Ave
2483.5	39.31	368	100	V	29.155	3.25	0	71.715	74	-2.285	Peak
2483.5	29.63	312	100	H	29.155	3.25	0	62.035	74	-11.965	Peak
2483.5	19.55	268	100	V	29.155	3.25	0	51.955	54	-2.045	Ave
2483.5	13.62	312	100	H	29.155	3.25	0	46.025	54	-7.975	Ave
4924	37.73	295	100	V	33.327	4.52	27.75	47.827	74	-26.173	Peak
4924	37.04	320	100	H	33.327	4.52	27.75	47.137	74	-26.863	Peak
4924	30.79	295	100	V	33.327	4.52	27.75	40.887	54	-13.113	Ave
4924	30.48	320	100	H	33.327	4.52	27.75	40.577	54	-13.423	Ave
7386	33.89	0	100	V	36.565	5.62	27.51	48.565	74	-25.435	Peak
7386	33.12	0	100	H	36.565	5.62	27.51	47.795	74	-26.205	Peak
7386	19.94	0	100	V	36.565	5.62	27.51	34.615	54	-19.385	Ave
7386	19.89	0	100	H	36.565	5.62	27.51	34.565	54	-19.435	Ave

For PCB antenna:

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	73.81	309	100	V	28.956	3.12	0	105.886	N/A	N/A	Peak
2412	76.45	186	100	H	28.956	3.12	0	108.526	N/A	N/A	Peak
2412	70.43	309	100	V	28.956	3.12	0	102.506	N/A	N/A	Ave
2412	73.1	186	100	H	28.956	3.12	0	105.176	N/A	N/A	Ave
2390	28.22	309	100	V	28.956	3.12	0	60.296	74	-13.704	Peak
2390	28.53	186	100	H	28.956	3.12	0	60.606	74	-13.394	Peak
2390	18.73	309	100	V	28.956	3.12	0	50.806	54	-3.194	Ave
2390	19.42	186	100	H	28.956	3.12	0	51.496	54	-2.504	Ave
4824	38.12	221	100	V	33.097	4.56	27.7	48.077	74	-25.923	Peak
4824	39.03	301	100	H	33.097	4.56	27.7	48.987	74	-25.013	Peak
4824	32.65	221	100	V	33.097	4.56	27.7	42.607	54	-11.393	Ave
4824	34.05	301	100	H	33.097	4.56	27.7	44.007	54	-9.993	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	74.01	309	100	V	28.3	3.5	0	105.81	N/A	N/A	Peak
2437	77.05	186	100	H	28.3	3.5	0	108.85	N/A	N/A	Peak
2437	70.7	309	100	V	28.3	3.5	0	102.5	N/A	N/A	Ave
2437	73.71	186	100	H	28.3	3.5	0	105.51	N/A	N/A	Ave
4874	37.08	295	100	V	33.327	4.54	27.76	47.187	74	-26.813	Peak
4874	38.08	300	100	H	33.327	4.54	27.76	48.187	74	-25.813	Peak
4874	30.6	295	100	V	33.327	4.54	27.76	40.707	54	-13.293	Ave
4874	33.27	300	100	H	33.327	4.54	27.76	43.377	54	-10.623	Ave
7311	32.08	0	100	V	36.369	5.57	27.51	46.509	74	-27.491	Peak
7311	32.6	0	100	H	36.369	5.57	27.51	47.029	74	-26.971	Peak
7311	20.12	0	100	V	36.369	5.57	27.51	34.549	54	-19.451	Ave
7311	20.26	0	100	H	36.369	5.57	27.51	34.689	54	-19.311	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	71.9	310	100	V	29.155	3.25	0	104.305	N/A	N/A	Peak
2462	75.05	186	100	H	29.155	3.25	0	107.455	N/A	N/A	Peak
2462	73.32	310	100	V	29.155	3.25	0	105.725	N/A	N/A	Ave
2462	71.43	186	100	H	29.155	3.25	0	103.835	N/A	N/A	Ave
2483.5	28.59	310	100	V	29.155	3.25	0	60.995	74	-13.005	Peak
2483.5	28.54	186	100	H	29.155	3.25	0	60.945	74	-13.055	Peak
2483.5	15.97	310	100	V	29.155	3.25	0	48.375	54	-5.625	Ave
2483.5	18.91	186	100	H	29.155	3.25	0	51.315	54	-2.685	Ave
4924	37.85	307	100	V	33.327	4.52	27.75	47.947	74	-26.053	Peak
4924	38.01	299	100	H	33.327	4.52	27.75	48.107	74	-25.893	Peak
4924	31.54	307	100	V	33.327	4.52	27.75	41.637	54	-12.363	Ave
4924	31.77	299	100	H	33.327	4.52	27.75	41.867	54	-12.133	Ave
7386	32.11	0	100	V	36.565	5.62	27.51	46.785	74	-27.215	Peak
7386	32.36	0	100	H	36.565	5.62	27.51	47.035	74	-26.965	Peak
7386	19.56	0	100	V	36.565	5.62	27.51	34.235	54	-19.765	Ave
7386	19.88	0	100	H	36.565	5.62	27.51	34.555	54	-19.445	Ave

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	74.6	310	100	V	28.956	3.12	0	106.676	N/A	N/A	Peak
2412	77.27	186	100	H	28.956	3.12	0	109.346	N/A	N/A	Peak
2412	64.68	310	100	V	28.956	3.12	0	96.756	N/A	N/A	Ave
2412	66.83	186	100	H	28.956	3.12	0	98.906	N/A	N/A	Ave
2390	37.21	310	100	V	28.956	3.12	0	69.286	74	-4.714	Peak
2390	38.39	186	100	H	28.956	3.12	0	70.466	74	-3.534	Peak
2390	17.29	310	100	V	28.956	3.12	0	49.366	54	-4.634	Ave
2390	18.22	186	100	H	28.956	3.12	0	50.296	54	-3.704	Ave
4824	39.28	316	100	V	33.097	4.56	27.7	49.237	74	-24.763	Peak
4824	39.85	331	100	H	33.097	4.56	27.7	49.807	74	-24.193	Peak
4824	33.57	316	100	V	33.097	4.56	27.7	43.527	54	-10.473	Ave
4824	34.41	331	100	H	33.097	4.56	27.7	44.367	54	-9.633	Ave
7236	32.94	0	100	V	35.928	5.49	27.58	46.778	74	-27.222	Peak
7236	33.66	0	100	H	35.928	5.49	27.58	47.498	74	-26.502	Peak
7236	20.85	0	100	V	35.928	5.49	27.58	34.688	54	-19.312	Ave
7236	21.01	0	100	H	35.928	5.49	27.58	34.848	54	-19.152	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	72.97	310	100	V	28.3	3.5	0	105.81	N/A	N/A	Peak
2437	76.7	186	100	H	28.3	3.5	0	108.85	N/A	N/A	Peak
2437	63.04	310	100	V	28.3	3.5	0	102.5	N/A	N/A	Ave
2437	66.7	186	100	H	28.3	3.5	0	105.51	N/A	N/A	Ave
4874	38.16	195	100	V	33.327	4.54	27.76	47.187	74	-26.813	Peak
4874	38.41	331	100	H	33.327	4.54	27.76	48.187	74	-25.813	Peak
4874	32.44	195	100	V	33.327	4.54	27.76	40.707	54	-13.293	Ave
4874	33.74	331	100	H	33.327	4.54	27.76	43.377	54	-10.623	Ave
7311	33.88	0	100	V	36.369	5.57	27.51	46.509	74	-27.491	Peak
7311	34.32	0	100	H	36.369	5.57	27.51	47.029	74	-26.971	Peak
7311	19.32	0	100	V	36.369	5.57	27.51	34.549	54	-19.451	Ave
7311	19.68	0	100	H	36.369	5.57	27.51	34.689	54	-19.311	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	71.06	310	100	V	29.155	3.25	0	103.465	N/A	N/A	Peak
2462	74.75	186	100	H	29.155	3.25	0	107.155	N/A	N/A	Peak
2462	61.16	310	100	V	29.155	3.25	0	93.565	N/A	N/A	Ave
2462	64.34	186	100	H	29.155	3.25	0	96.745	N/A	N/A	Ave
2483.5	33.1	310	100	V	29.155	3.25	0	65.505	74	-8.495	Peak
2483.5	36.15	186	100	H	29.155	3.25	0	68.555	74	-5.445	Peak
2483.5	13.86	310	100	V	29.155	3.25	0	46.265	54	-7.735	Ave
2483.5	15.72	186	100	H	29.155	3.25	0	48.125	54	-5.875	Ave
4924	37.49	309	100	V	33.327	4.52	27.75	47.587	74	-26.413	Peak
4924	37.87	337	100	H	33.327	4.52	27.75	47.967	74	-26.033	Peak
4924	31.74	309	100	V	33.327	4.52	27.75	41.837	54	-12.163	Ave
4924	32.18	337	100	H	33.327	4.52	27.75	42.277	54	-11.723	Ave
7386	32.11	0	100	V	36.565	5.62	27.51	46.785	74	-27.215	Peak
7386	32.69	0	100	H	36.565	5.62	27.51	47.365	74	-26.635	Peak
7386	19.11	0	100	V	36.565	5.62	27.51	33.785	54	-20.215	Ave
7386	19.95	0	100	H	36.565	5.62	27.51	34.625	54	-19.375	Ave

802.11n-HT20 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	73.81	310	100	V	28.956	3.12	0	105.886	N/A	N/A	Peak
2412	75.88	186	100	H	28.956	3.12	0	107.956	N/A	N/A	Peak
2412	63.49	310	100	V	28.956	3.12	0	95.566	N/A	N/A	Ave
2412	66.23	186	100	H	28.956	3.12	0	98.306	N/A	N/A	Ave
2390	38.86	310	100	V	28.956	3.12	0	70.936	74	-3.064	Peak
2390	41.39	186	100	H	28.956	3.12	0	73.466	74	-0.534	Peak
2390	17.49	310	100	V	28.956	3.12	0	49.566	54	-4.434	Ave
2390	18.67	186	100	H	28.956	3.12	0	50.746	54	-3.254	Ave
4824	40.44	284	100	V	33.097	4.56	27.7	50.397	74	-23.603	Peak
4824	38.96	332	100	H	33.097	4.56	27.7	48.917	74	-25.083	Peak
4824	36.32	284	100	V	33.097	4.56	27.7	46.277	54	-7.723	Ave
4824	33.96	332	100	H	33.097	4.56	27.7	43.917	54	-10.083	Ave
7236	35.22	0	100	V	35.928	5.49	27.58	49.058	74	-24.942	Peak
7236	35.25	0	100	H	35.928	5.49	27.58	49.088	74	-24.912	Peak
7236	20.92	0	100	V	35.928	5.49	27.58	34.758	54	-19.242	Ave
7236	20.95	0	100	H	35.928	5.49	27.58	34.788	54	-19.212	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	78.75	310	100	V	28.3	3.5	0	105.81	N/A	N/A	Peak
2437	76.17	186	100	H	28.3	3.5	0	108.85	N/A	N/A	Peak
2437	68.53	310	100	V	28.3	3.5	0	102.5	N/A	N/A	Ave
2437	66.45	186	100	H	28.3	3.5	0	105.51	N/A	N/A	Ave
4874	33.2	0	100	V	33.327	4.54	27.76	47.187	74	-26.813	Peak
4874	33.3	0	100	H	33.327	4.54	27.76	48.187	74	-25.813	Peak
4874	19.46	0	100	V	33.327	4.54	27.76	40.707	54	-13.293	Ave
4874	19.59	0	100	H	33.327	4.54	27.76	43.377	54	-10.623	Ave
7311	33.6	0	100	V	36.369	5.57	27.51	46.509	74	-27.491	Peak
7311	33.41	0	100	H	36.369	5.57	27.51	47.029	74	-26.971	Peak
7311	20.78	0	100	V	36.369	5.57	27.51	34.549	54	-19.451	Ave
7311	20.81	0	100	H	36.369	5.57	27.51	34.689	54	-19.311	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	70.06	310	100	V	29.155	3.25	0	102.465	N/A	N/A	Peak
2462	73.71	172	100	H	29.155	3.25	0	106.115	N/A	N/A	Peak
2462	60.24	310	100	V	29.155	3.25	0	92.645	N/A	N/A	Ave
2462	64.35	172	100	H	29.155	3.25	0	96.755	N/A	N/A	Ave
2483.5	30.91	310	100	V	29.155	3.25	0	63.315	74	-10.685	Peak
2483.5	32.05	172	100	H	29.155	3.25	0	64.455	74	-9.545	Peak
2483.5	14.38	310	100	V	29.155	3.25	0	46.785	54	-7.215	Ave
2483.5	16.08	172	100	H	29.155	3.25	0	48.485	54	-5.515	Ave
4924	39.67	283	100	V	33.327	4.52	27.75	49.767	74	-24.233	Peak
4924	37.4	338	100	H	33.327	4.52	27.75	47.497	74	-26.503	Peak
4924	35.72	283	100	V	33.327	4.52	27.75	45.817	54	-8.183	Ave
4924	31.31	338	100	H	33.327	4.52	27.75	41.407	54	-12.593	Ave
7386	33.47	0	100	V	36.565	5.62	27.51	48.145	74	-25.855	Peak
7386	33.25	0	100	H	36.565	5.62	27.51	47.925	74	-26.075	Peak
7386	19.52	0	100	V	36.565	5.62	27.51	34.195	54	-19.805	Ave
7386	19.6	0	100	H	36.565	5.62	27.51	34.275	54	-19.725	Ave

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

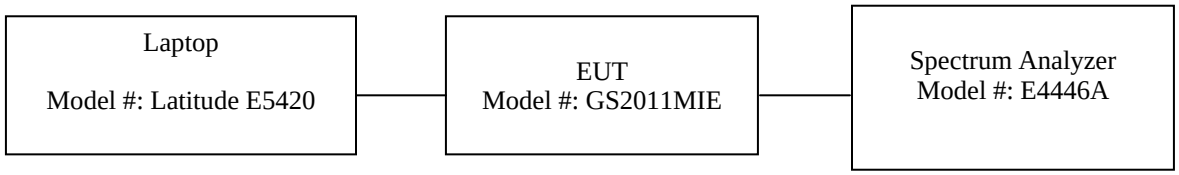
9.1 Applicable Standard

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 Meas Guidance v03r01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8: DTS bandwidth

9.3 Test Setup Block Diagram



9.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
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.*

9.5 Test Environmental Conditions

Temperature:	22-24° C
Relative Humidity:	42-45 %
ATM Pressure:	101-102 kPa

The testing was performed by Ken Bai from 2014-2-24 at RF site.

9.6 Test Results

802.11b mode:

Channel	Frequency (MHz)	6 dB OBW (MHz)	99% OBW (MHz)	Limit (MHz)	Results
Low	2412	13.157	16.488	> 0.5	Compliant
Middle	2437	13.155	16.499	> 0.5	Compliant
High	2462	13.153	16.461	> 0.5	Compliant

802.11g mode:

Channel	Frequency (MHz)	6 dB OBW (MHz)	99% OBW (MHz)	Limit (MHz)	Results
Low	2412	16.466	16.425	> 0.5	Compliant
Middle	2437	16.478	16.423	> 0.5	Compliant
High	2462	16.482	16.414	> 0.5	Compliant

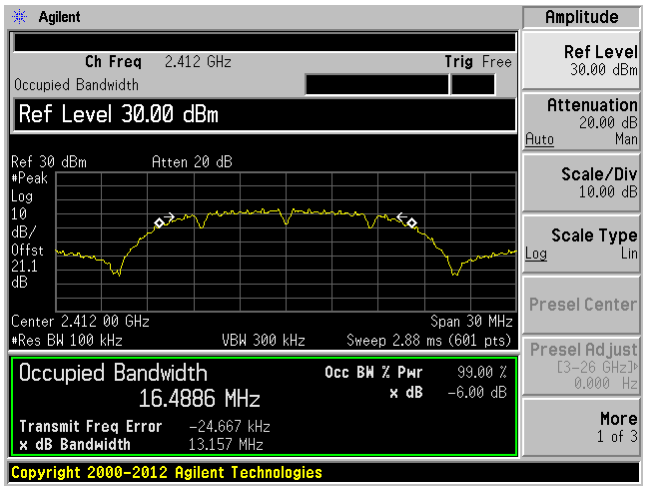
802.11n-HT20 mode:

Channel	Frequency (MHz)	6 dB OBW (MHz)	99% OBW (MHz)	Limit (MHz)	Results
Low	2412	17.605	17.504	> 0.5	Compliant
Middle	2437	17.089	17.513	> 0.5	Compliant
High	2462	17.385	17.492	> 0.5	Compliant

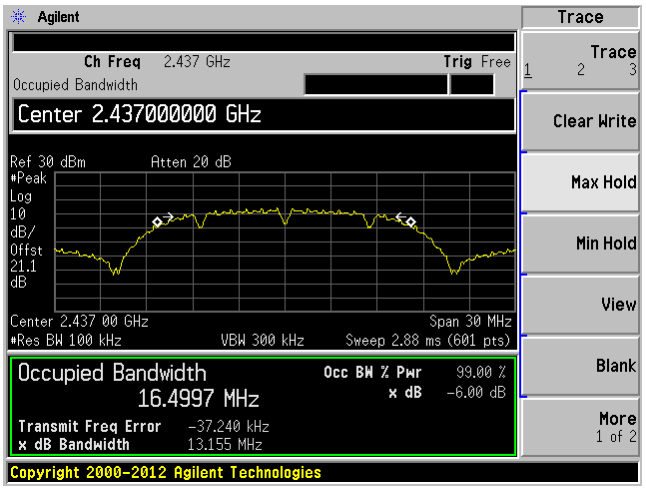
Please refer to the following plots for detailed test results

802.11b mode

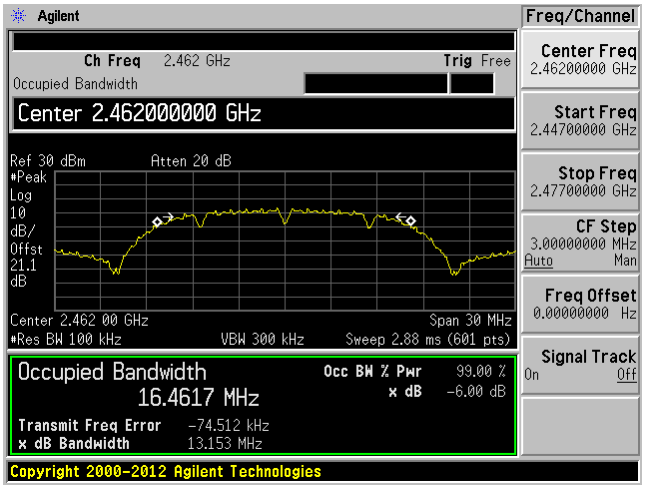
Low channel: 2412 MHz



Middle channel: 2437 MHz

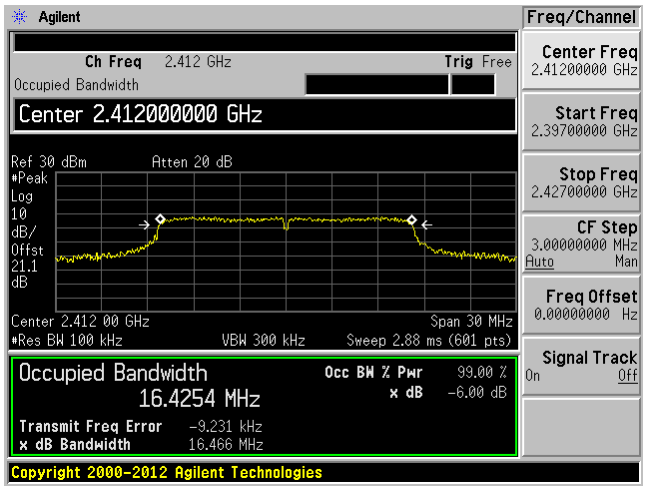


High channel: 2462 MHz

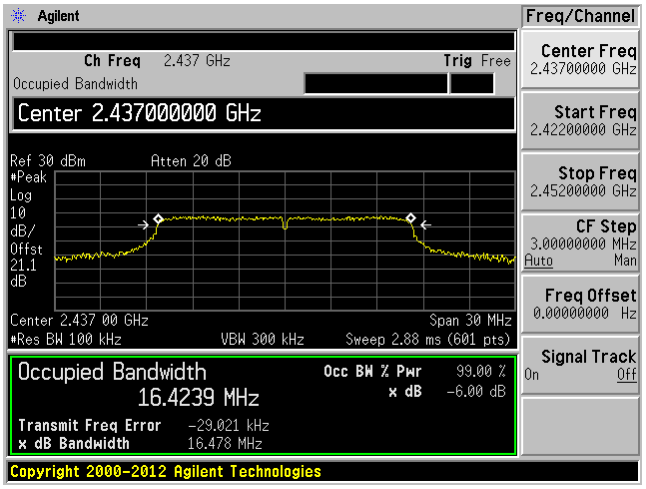


802.11g mode

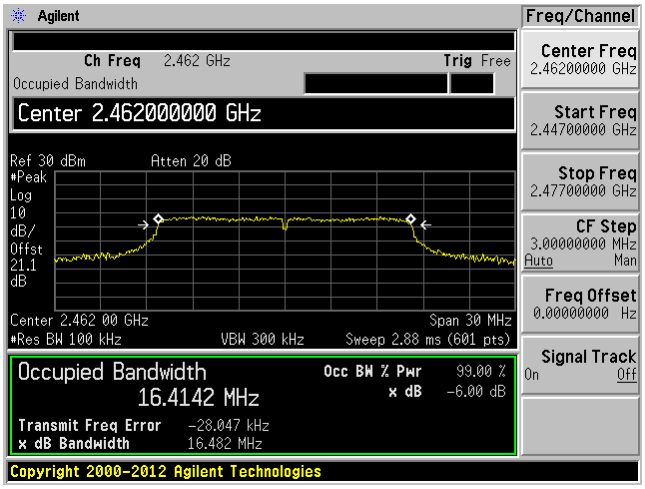
Low channel: 2412 MHz



Middle channel: 2437 MHz

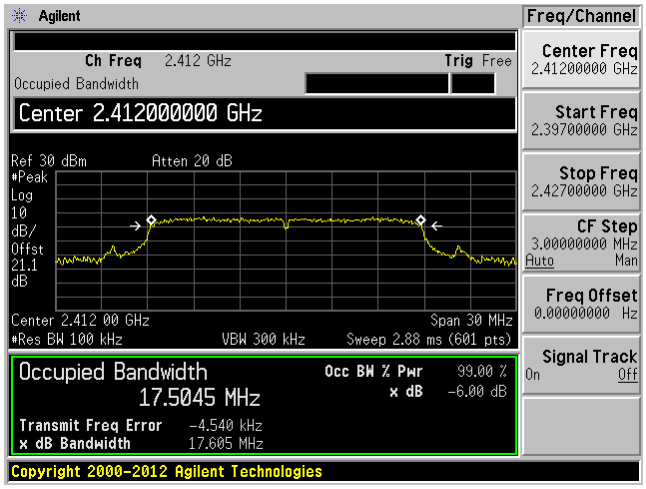


High channel: 2462 MHz

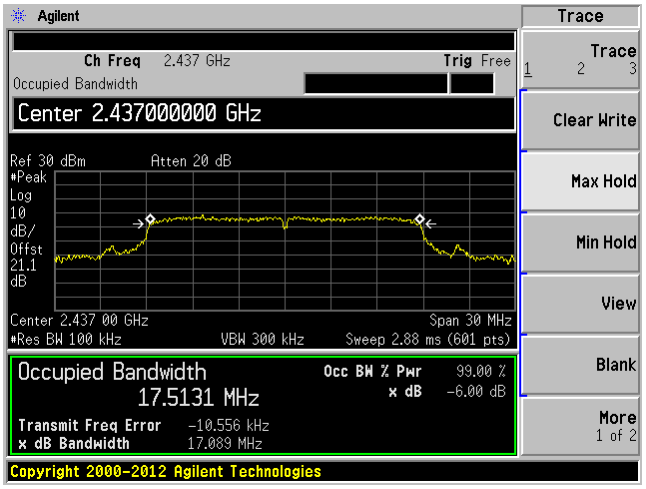


802.11n-HT20 mode

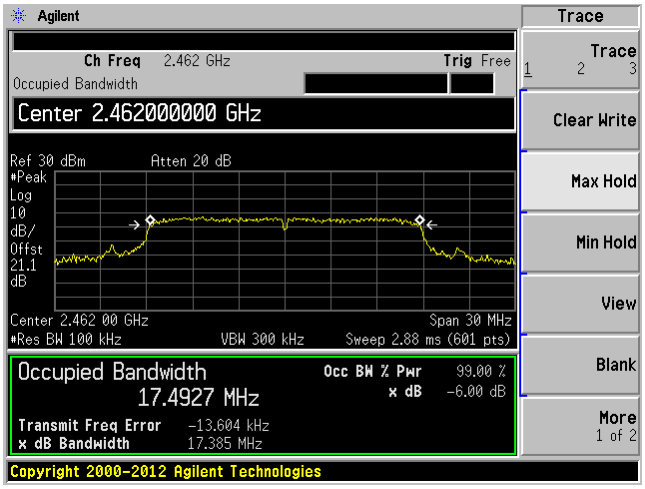
Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz



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

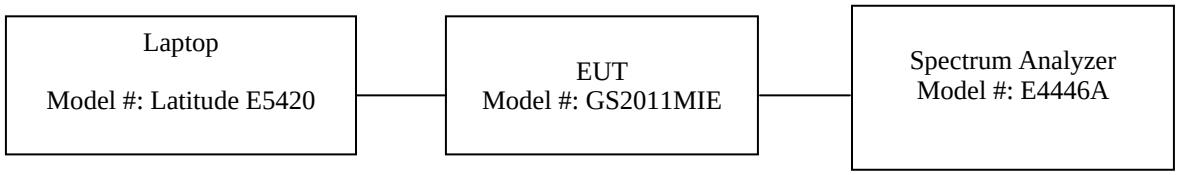
10.1 Applicable Standard

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 Meas Guidance v03r01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 9: Fundamental emission output power

10.3 Test Setup Block Diagram



10.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
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.*

10.5 Test Environmental Conditions

Temperature:	22-24° C
Relative Humidity:	42-45 %
ATM Pressure:	101-102 kPa

The testing was performed by Ken Bai from 2014-2-24 at RF site.

10.6 Test Results

802.11b mode

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)	Power Setting
Low	2412	18.78	30	-11.22	19
Middle	2437	18.73	30	-11.27	20
High	2462	18.28	30	-11.72	19

802.11g mode

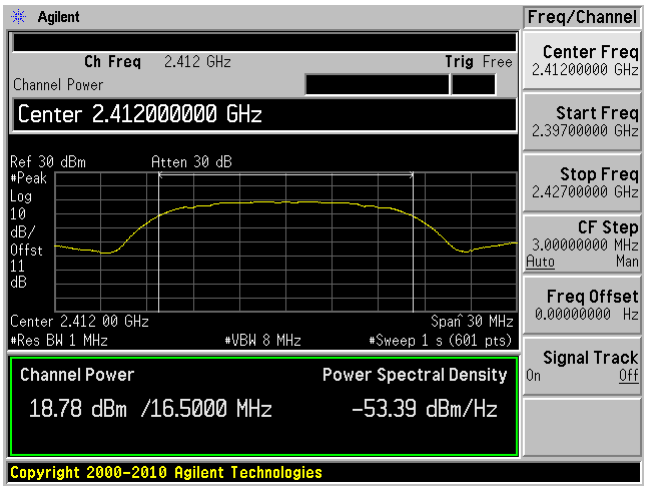
Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)	Power Setting
Low	2412	20.44	30	-9.56	24
Middle	2437	19.91	30	-10.09	24
High	2462	18.68	30	-11.32	23

802.11n-HT20 mode

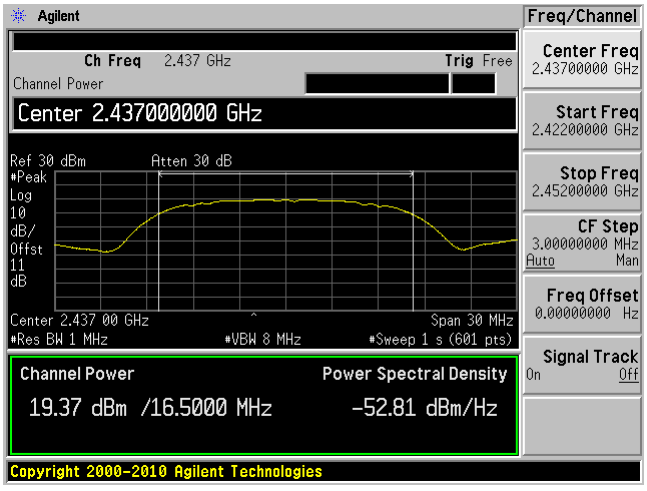
Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)	Power Setting
Low	2412	19.41	30	-10.59	23
Middle	2437	20	30	-10.00	24
High	2462	17.54	30	-12.46	22

802.11b mode

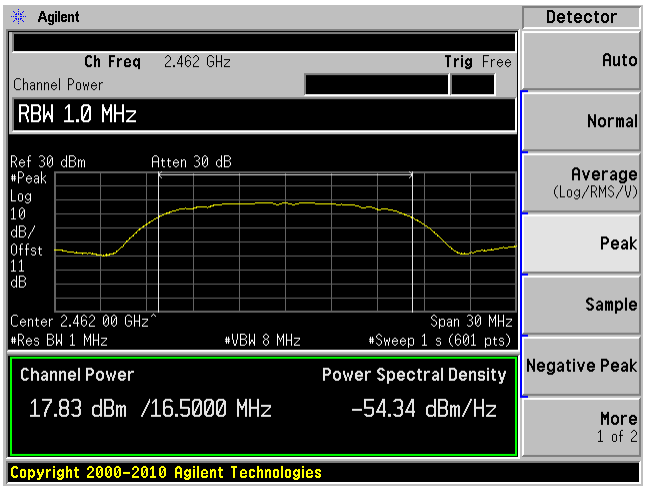
Low channel: 2412 MHz



Middle channel: 2437 MHz

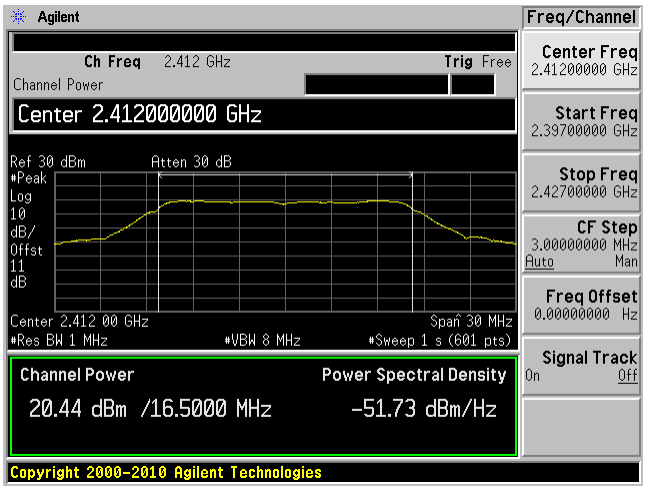


High channel: 2462 MHz

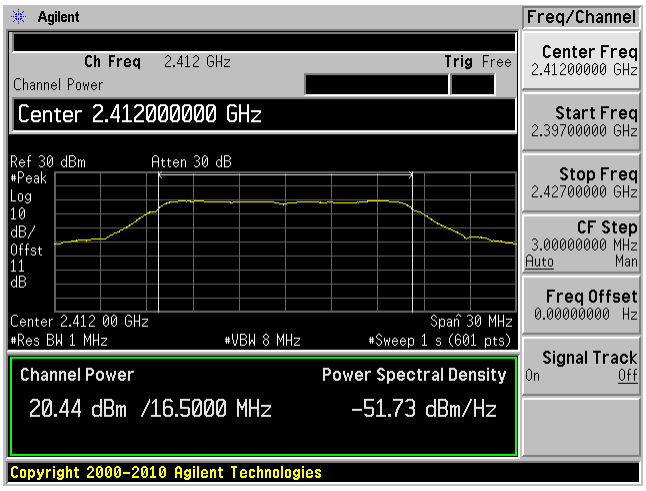


802.11g mode

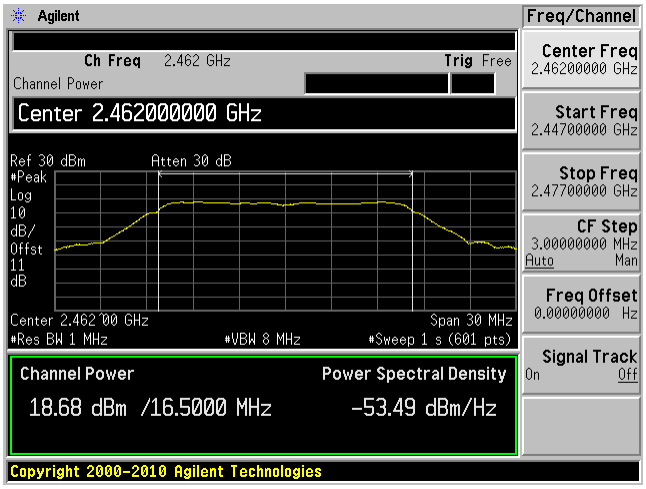
Low channel: 2412 MHz



Middle channel: 2437 MHz

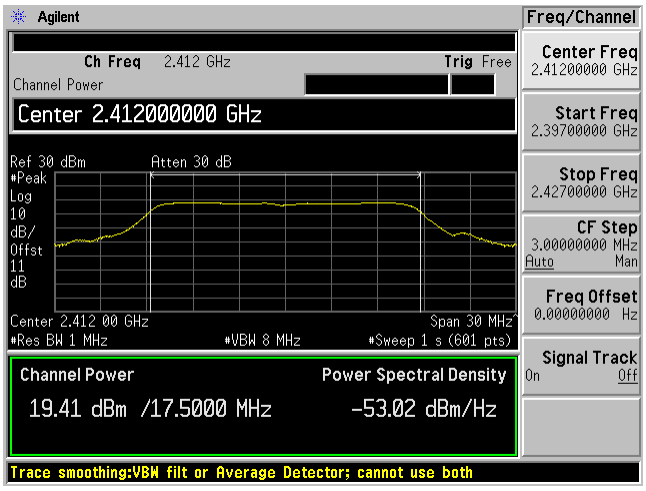


High channel: 2462 MHz

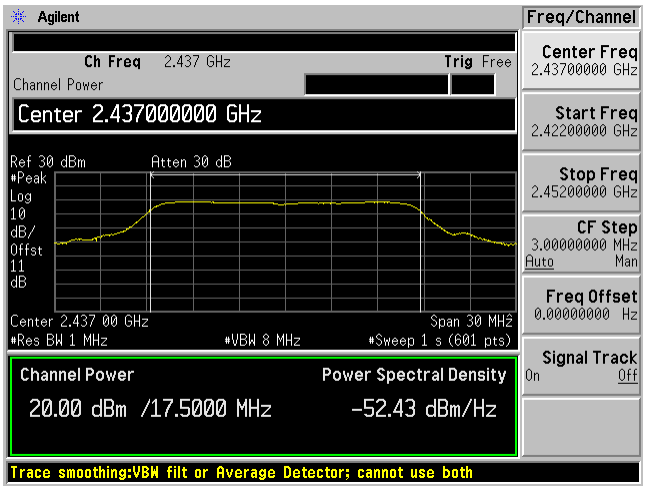


802.11n-HT20 mode

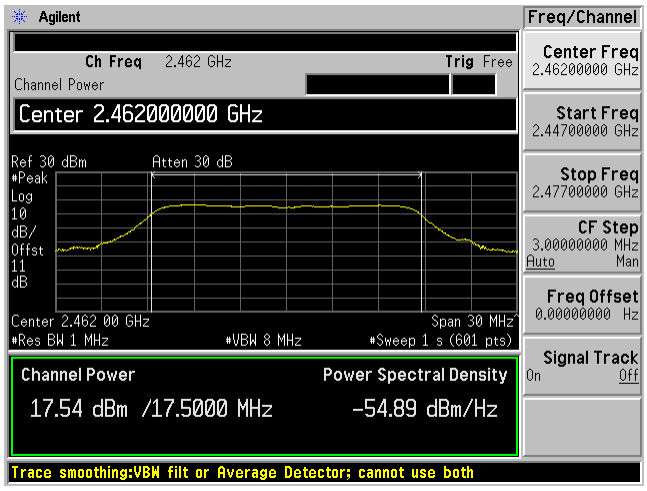
Low channel: 2412 MHz



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

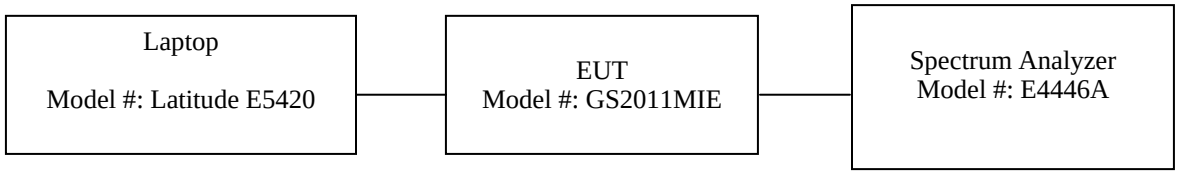
According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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 Meas Guidance v03r01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 13: Band-edge measurements

11.3 Test Setup Block Diagram



11.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
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.*

11.5 Test Environmental Conditions

Temperature:	22-24° C
Relative Humidity:	42-45 %
ATM Pressure:	101-102 kPa

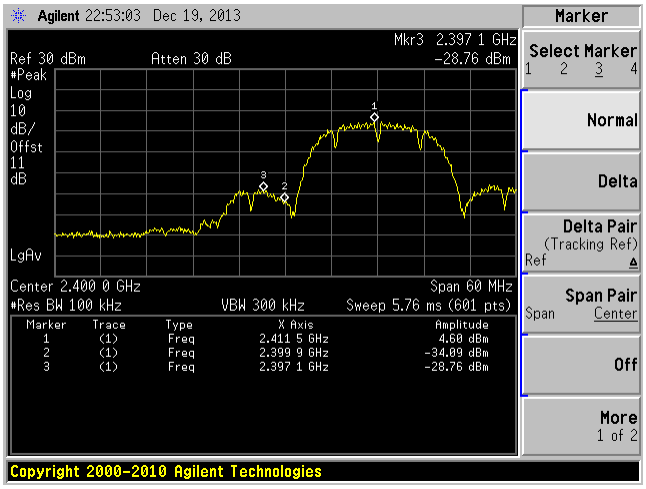
The testing was performed by Ken Bai on 2014-3-24 at RF site.

11.6 Test Results

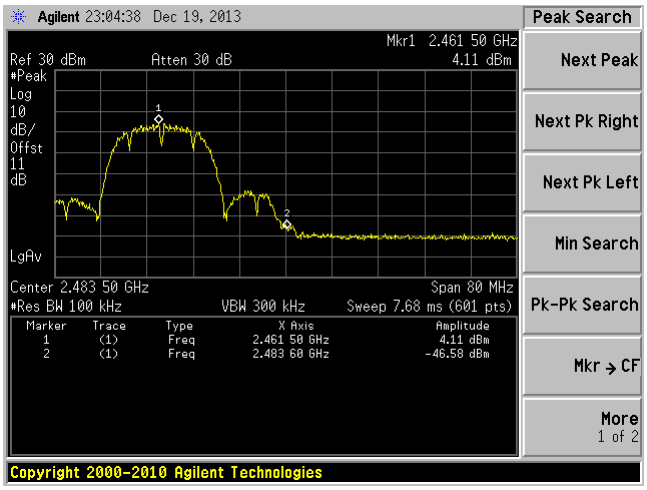
Please refer to following plots.

802.11b mode

802.11b, Low Band Edge

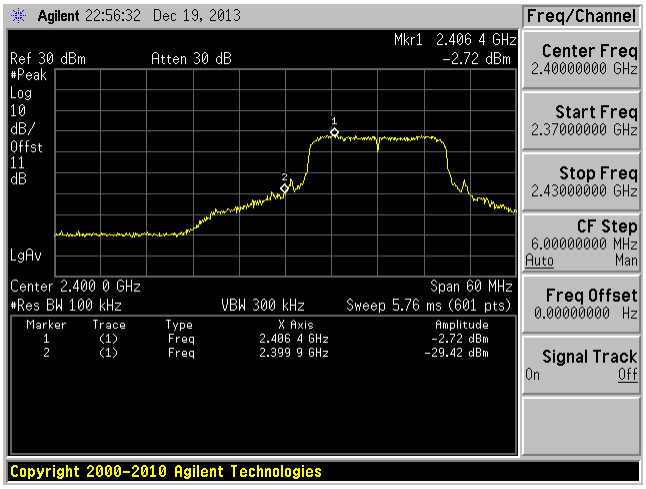


802.11b, High Band Edge

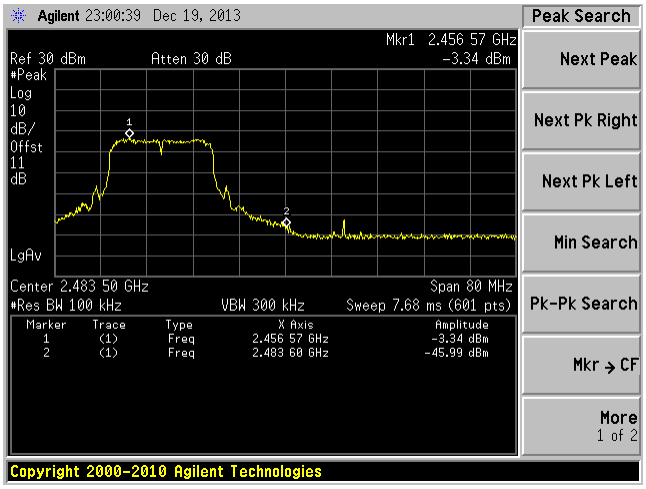


802.11g mode

802.11g, Low Band Edge

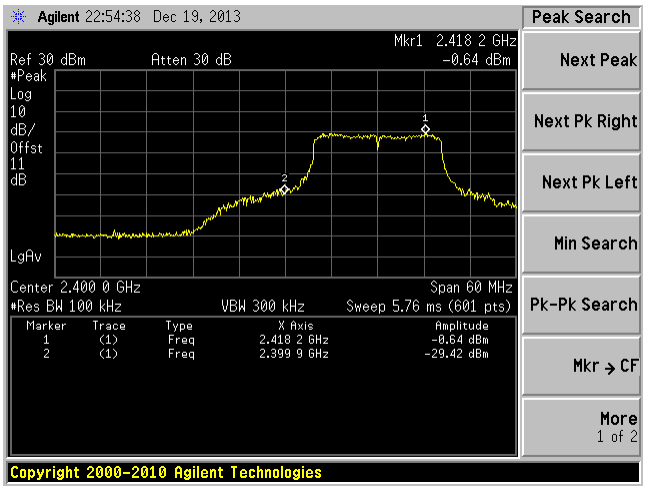


802.11g, High Band Edge

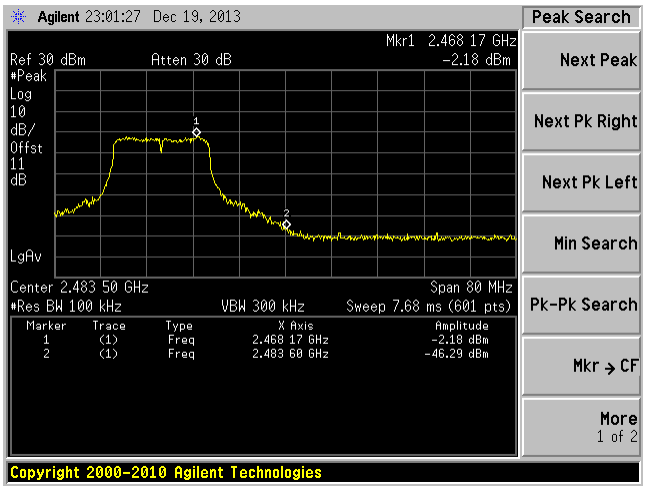


802.11n-HT20 mode

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

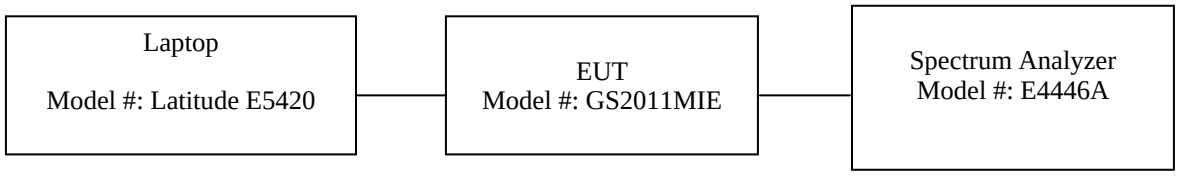
12.1 Applicable Standard

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

The measurements are base on FCC KDB 558074 D01 DTS Meas Guidance v03r01: 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 Setup Block Diagram



12.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
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.*

12.5 Test Environmental Conditions

Temperature:	22-24° C
Relative Humidity:	42-45 %
ATM Pressure:	101-102 kPa

The testing was performed by Ken Bai on 2014-3-24 at RF site.

12.6 Test Results

802.11b mode

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-13.82	8	-21.82
Middle	2437	-14.02	8	-22.02
High	2462	-15.03	8	-23.03

802.11g mode

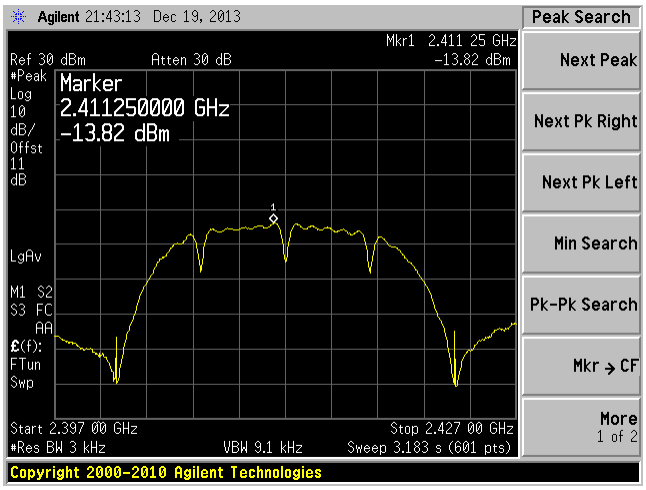
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-13.33	8	-21.33
Middle	2437	-13.81	8	-25.81
High	2462	-16.74	8	-24.74

802.11n-HT20 mode

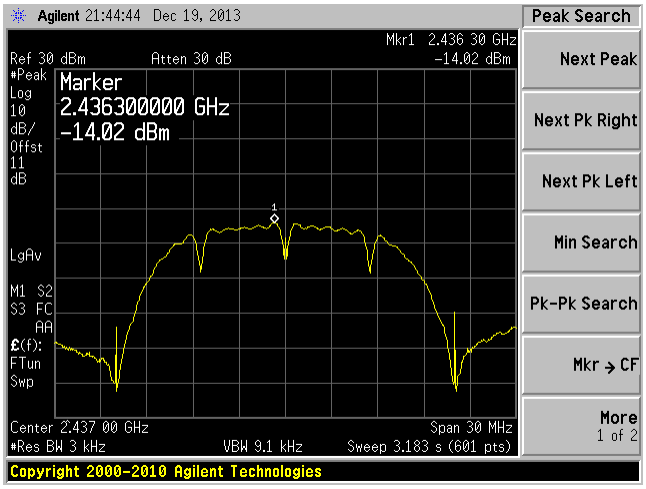
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-13.62	8	-21.62
Middle	2437	-13.31	8	-21.31
High	2462	-16.91	8	-24.91

802.11b mode

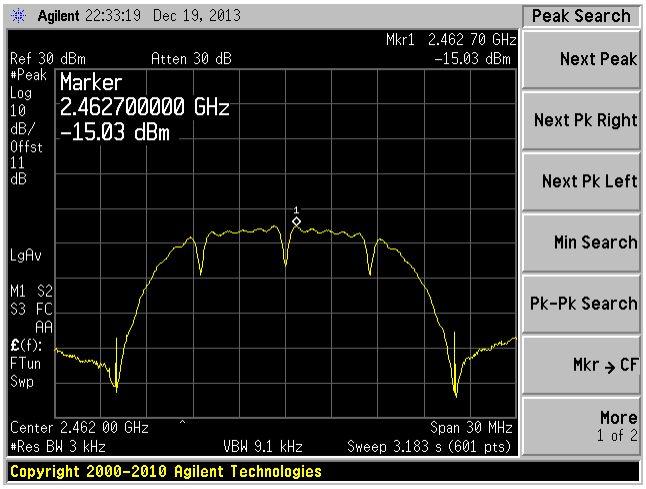
Low channel: 2412 MHz



Middle channel: 2437 MHz

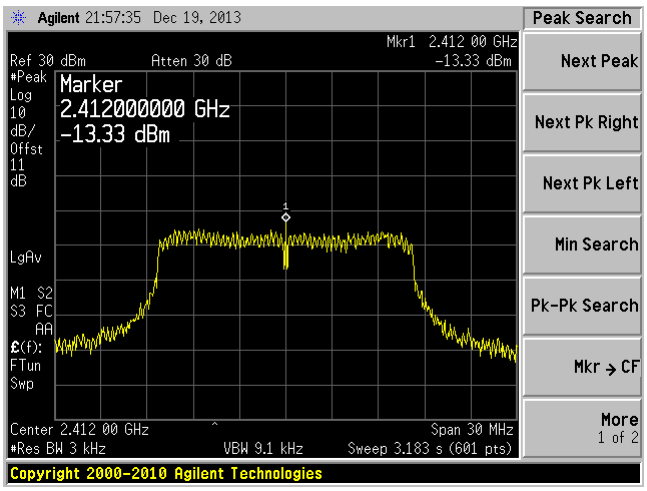


High channel: 2462 MHz

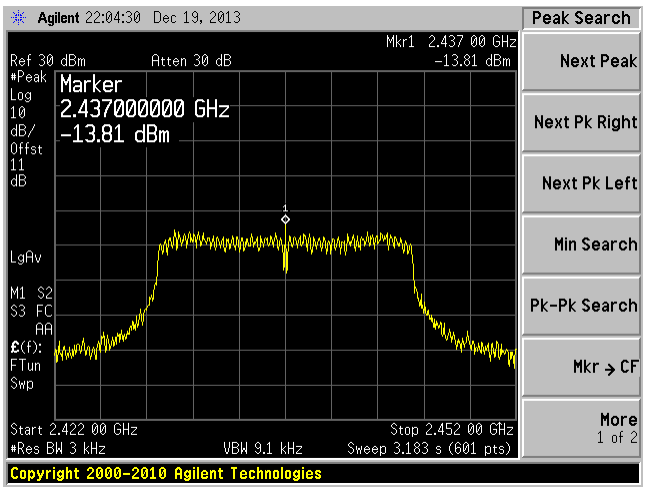


802.11g mode

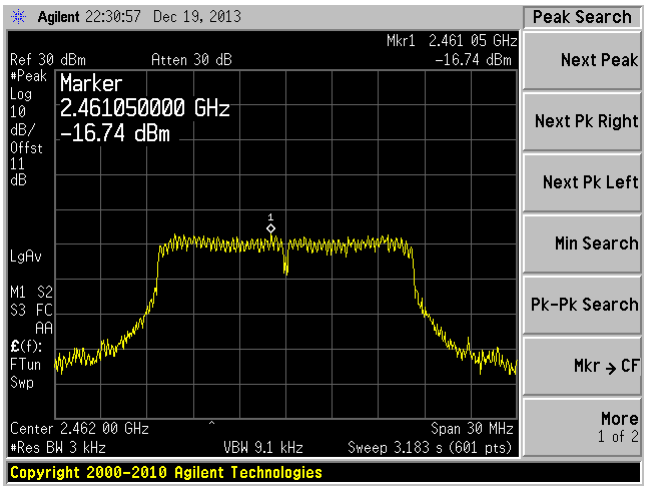
Low channel: 2412 MHz



Middle channel: 2437 MHz

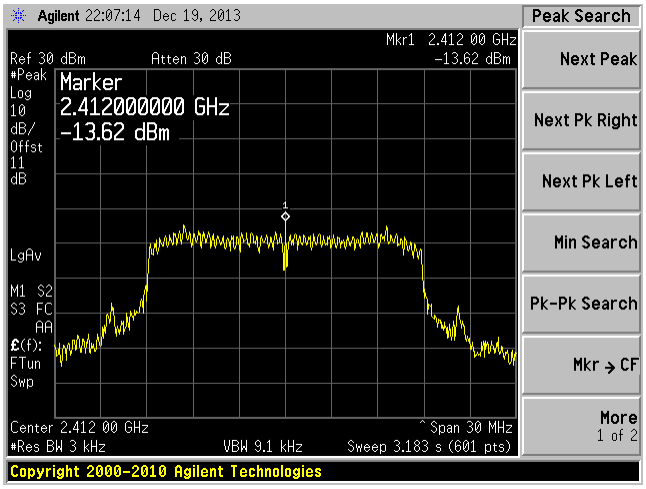


High channel: 2462 MHz

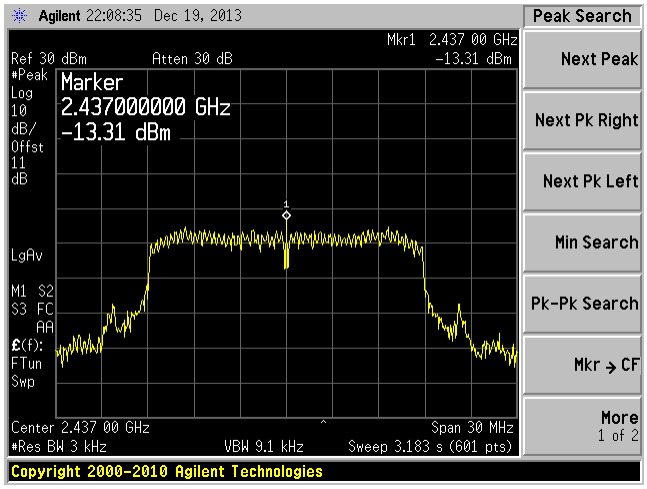


802.11n-HT20 mode

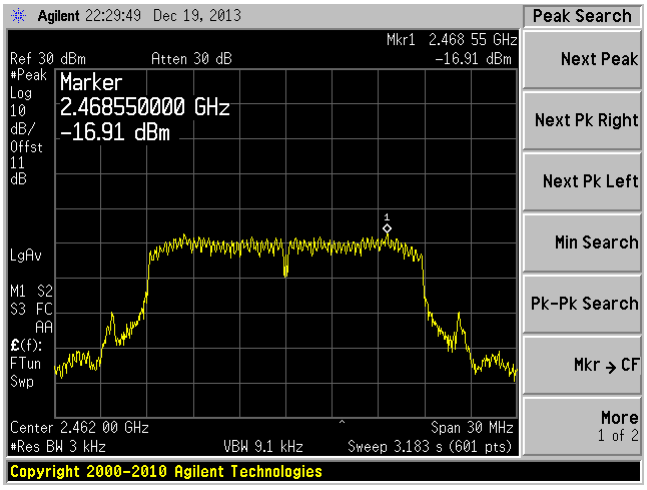
Low channel: 2412 MHz



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

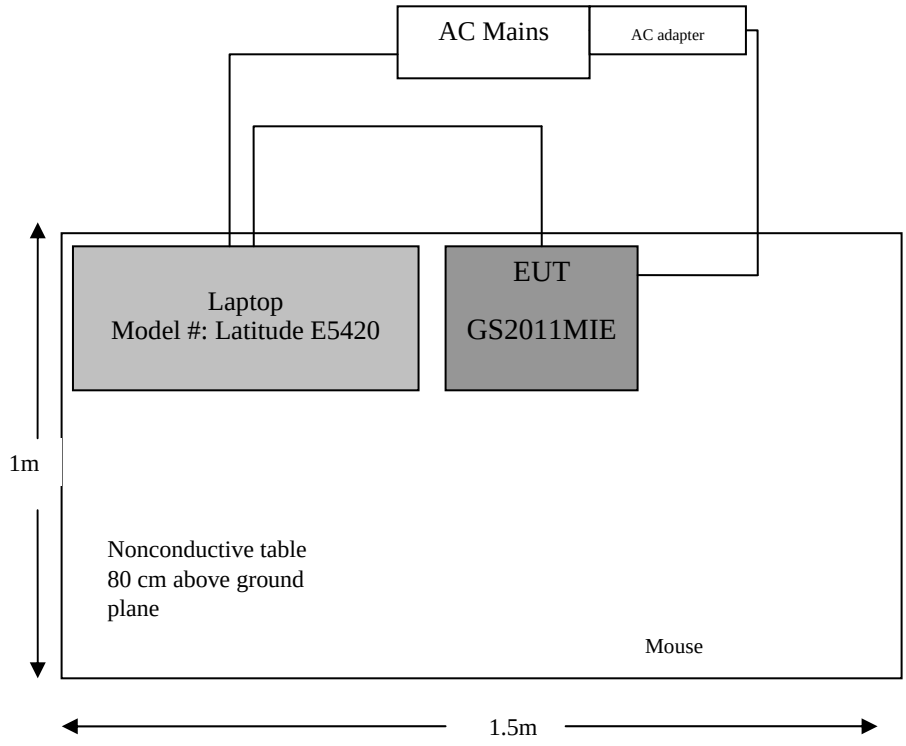
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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:

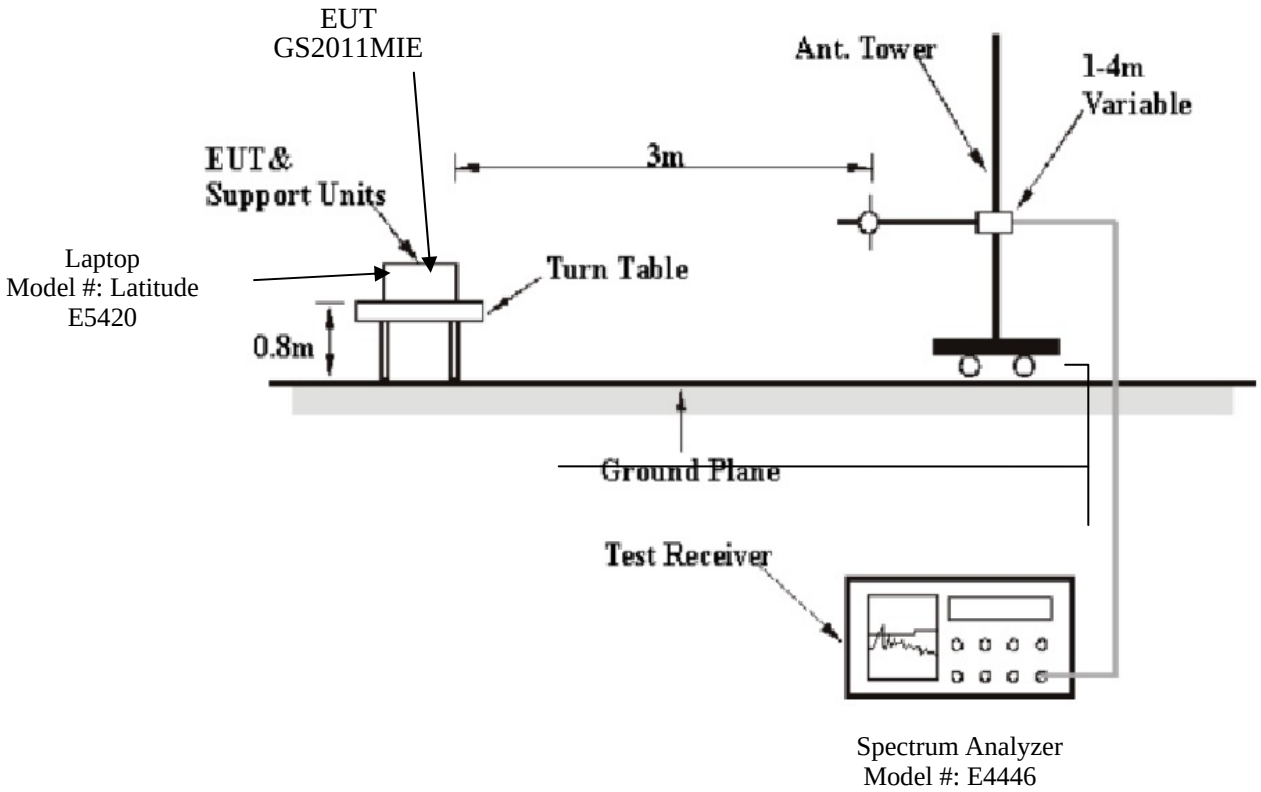
Margin = Corrected Amplitude - Limit

13.5 Test Setup Block Diagram

Block Diagram #1



Block Diagram #2



13.6 Test Equipment Lists and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
Agilent	Spectrum Analyzer	E4446A	MY48250238	2013-08-29	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2013-07-11	1 Year
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2013-03-08	1 Year
EMCO	Horn antenna	3115	9511-4627	2014-01-07	1 Year
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2013-05-09	1 Year

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

13.7 Test Environmental Conditions

Temperature:	22° C
Relative Humidity:	47 %
ATM Pressure:	102.1 kPa

The testing was performed by Ken Bai from 2014-2-24 at 5 meter 3.

13.8 Summary of Test Results

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

For Dipole Antenna:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-8.47	708.4833	Vertical	RX

1 – 25 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-14.757	13200	Vertical	RX

For PCB Antanna:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-10.08	31.59375	Vertical	RX

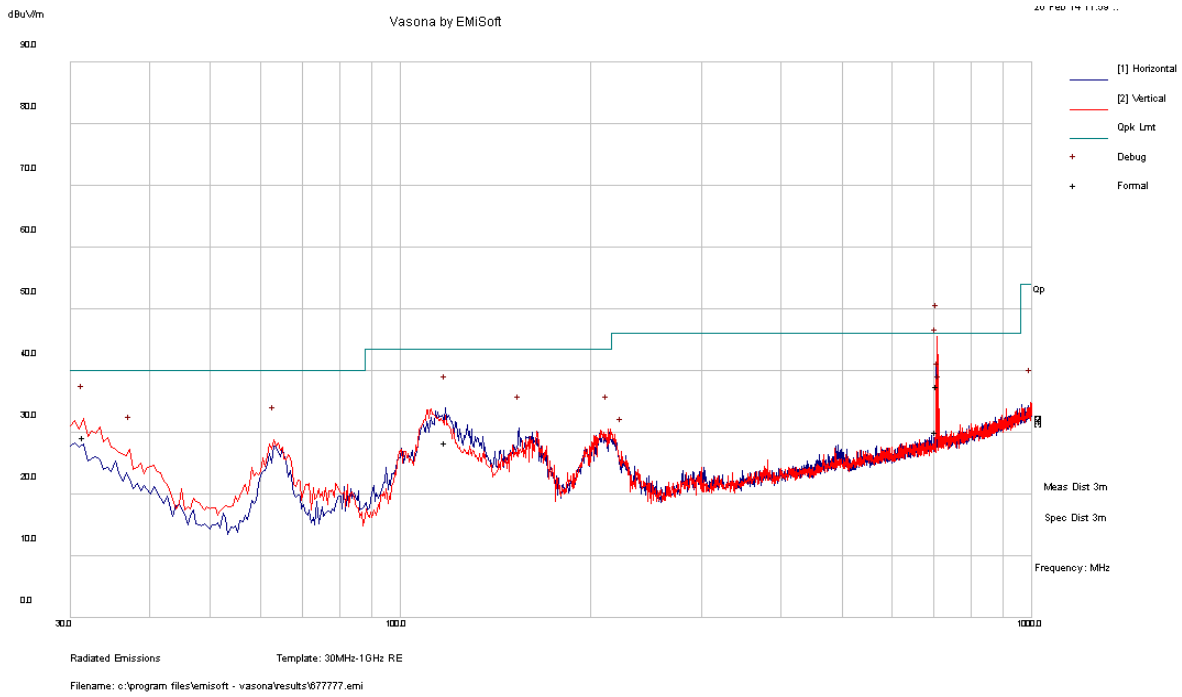
1 – 25 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-14.754	13200	Vertical	RX

13.9 Test Results and Plots

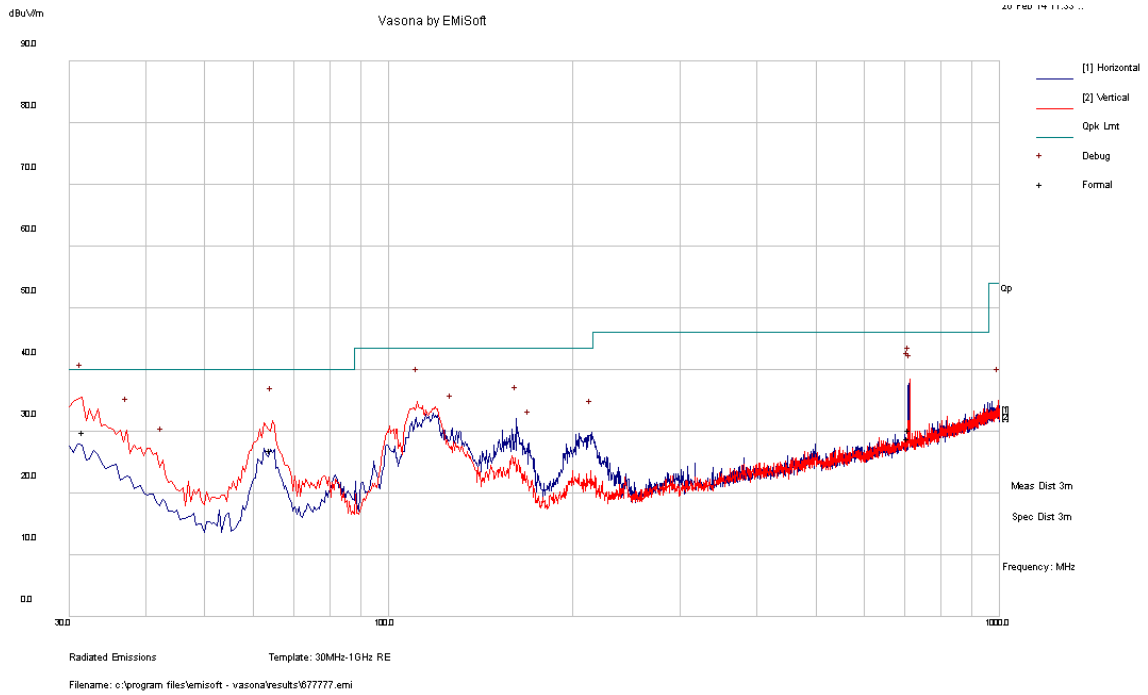
1) 30-1000 MHz, Measured at 3 meters

For Dipole antenna



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (QP/Ave.)
708.4833	37.53	170	V	302	46	-8.47	QP
31.573	29.16	99	V	360	40	-10.84	QP
118.0333	28.43	253	H	319	43.5	-15.07	QP
705.712	30.09	121	H	345	46	-15.91	QP

For PCB antenna



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (QP/Ave.)
31.59375	29.92	99	V	104	40	-10.08	QP
64.213	27.07	100	V	251	40	-12.93	QP
712.0278	30.2	315	V	360	46	-15.80	QP
708.5343	28.82	406	H	14	46	-17.18	QP

2) Above 1 GHz Measured at 3 meters

For Dipole Antenna

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
1320	35.976	100	V	40	74	-38.024	Peak
1320	35.637	100	H	81	74	-38.363	Peak
1320	22.226	100	V	40	54	-31.774	Ave
1320	22.027	100	H	81	54	-31.973	Ave
3480	40.779	100	V	0	74	-33.221	Peak
3480	40.248	100	H	0	74	-33.752	Peak
3480	26.579	100	V	0	54	-27.421	Ave
3480	26.488	100	H	0	54	-27.512	Ave
13200	53.983	100	V	0	74	-20.017	Peak
13200	53.858	100	H	0	74	-20.142	Peak
13200	39.243	100	V	0	54	-14.757	Ave
13200	39.188	100	H	0	54	-14.812	Ave

For PCB Antenna

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
1320	36.246	100	V	40	74	-37.754	Peak
1320	36.697	100	H	81	74	-37.303	Peak
1320	22.466	100	V	40	54	-31.534	Ave
1320	22.457	100	H	81	54	-31.543	Ave
3480	39.749	100	V	0	74	-34.251	Peak
3480	39.488	100	H	0	74	-34.512	Peak
3480	26.509	100	V	0	54	-27.491	Ave
3480	26.538	100	H	0	54	-27.462	Ave
13200	53.013	100	V	0	74	-20.987	Peak
13200	52.588	100	H	0	74	-21.412	Peak
13200	39.243	100	V	0	54	-14.754	Ave
13200	39.238	100	H	0	54	-14.762	Ave

14 Exhibit A – FCC & IC Equipment Labeling Requirements

14.1 FCC ID Label Requirements

As per FCC §2.925,

(a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID: XXX123

Where: XXX—Grantee Code, 123—Equipment Product Code

As per FCC §15.19,

(a) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labeled as follows:

(3) All other devices shall bear the following statement in a conspicuous location on the device:
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified above is required to be affixed only to the main control unit. If the EUT is integrated within another device then a label affixed to the host shall also state, “Contains FCC ID: XXXXXX”

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

14.2 IC Label Requirements

As per IC RSS-Gen §5.2, the certification number shall appear as follows:

IC: XXXXXX-YYYYYYYY

Where:

- "XXXXXX-YYYYYYYY" is the certification number
- "XXXXXX" is the Certificate Holder Number (CHN), made of at most 6 alphanumeric characters (A-Z, 0-9), assigned by Industry Canada; and
- "YYYYYYYY" is the Unique Product Number (UPN), made of at most 11 alphanumeric characters (A-Z, 0-9) assigned by the applicant.
- Note 1: The term "IC" before the equipment certification number only signifies that the Industry Canada technical specifications were met.
- Note 2: Note 1 shall be conspicuously placed in the equipment user manual.
- Note 3: Permitted alphanumeric characters used in the CHN and UPN are limited to capital letters (A-Z) and digits (0-9). Other characters, such as "#", "/" or "-", shall not be used.

As per RSS-Gen §5.2 Equipment Labeling:

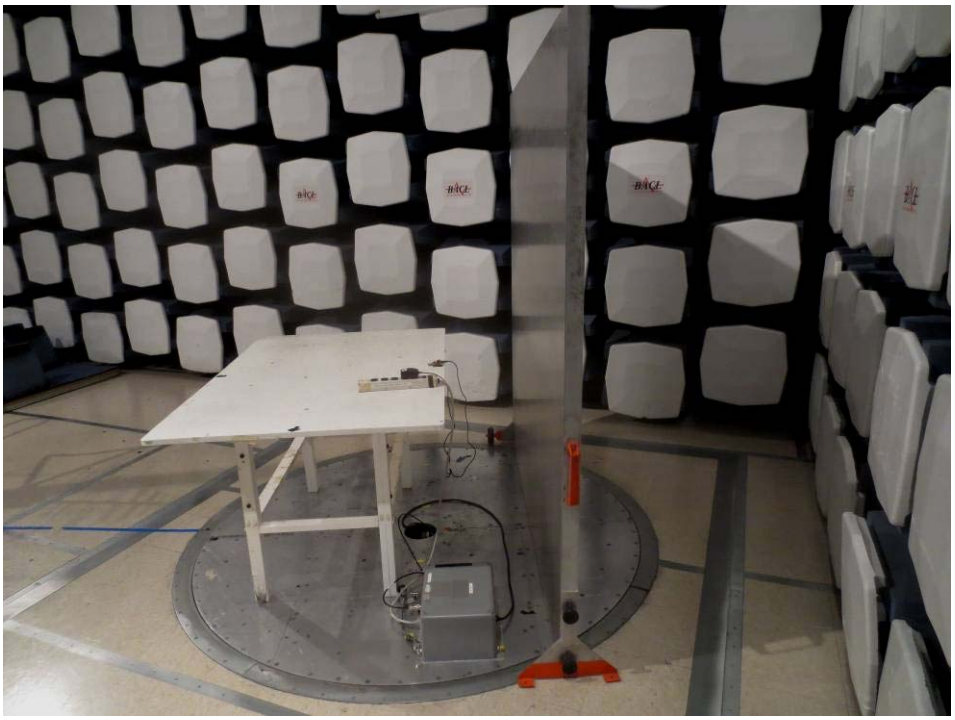
Equipment subject to certification under the applicable RSS, shall be permanently labeled on each item, or as an inseparable combination. The label must contain the following information for full compliance:
(a) the certification number, prefixed by the term "IC:";
(b) the manufacturer's name, trade name or brand name; and
(c) a model name or number.
Equipment for which a certificate has been issued is not considered certified if it is not properly labeled.
The information on the Canadian label can be combined with the manufacturer's other labeling requirements.
If the device size is too small to put a label, the label can be included in the user's manual, upon agreement with Industry Canada.

14.3 FCC ID & IC Label Contents and Location

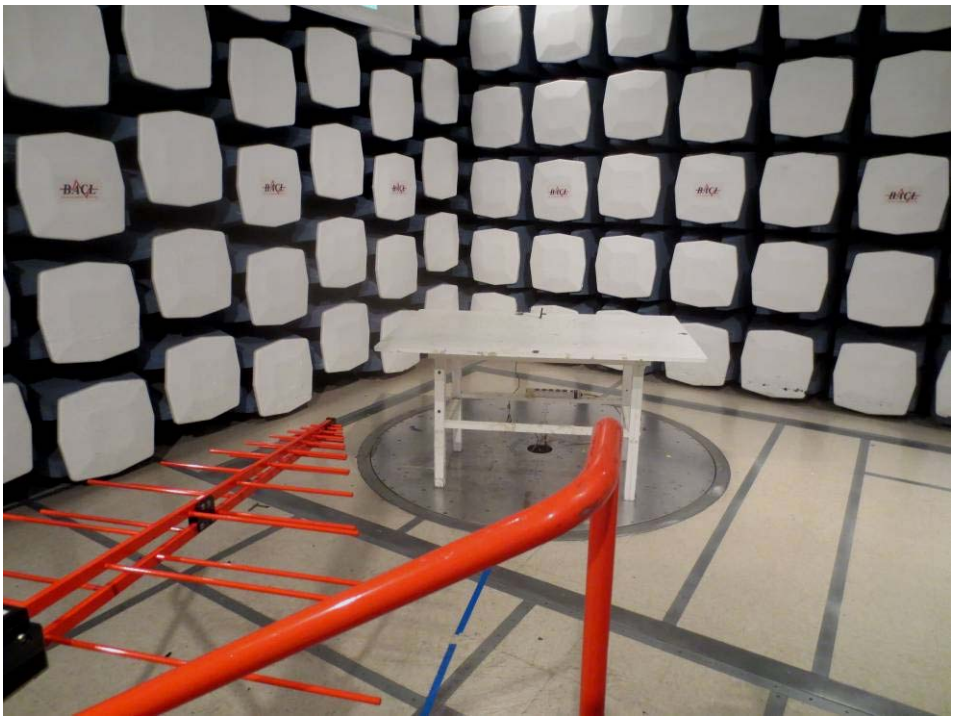
15 Exhibit B – Test Setup Photographs

15.1 Conducted Emissions - AC/DC Adapter Powered Front View

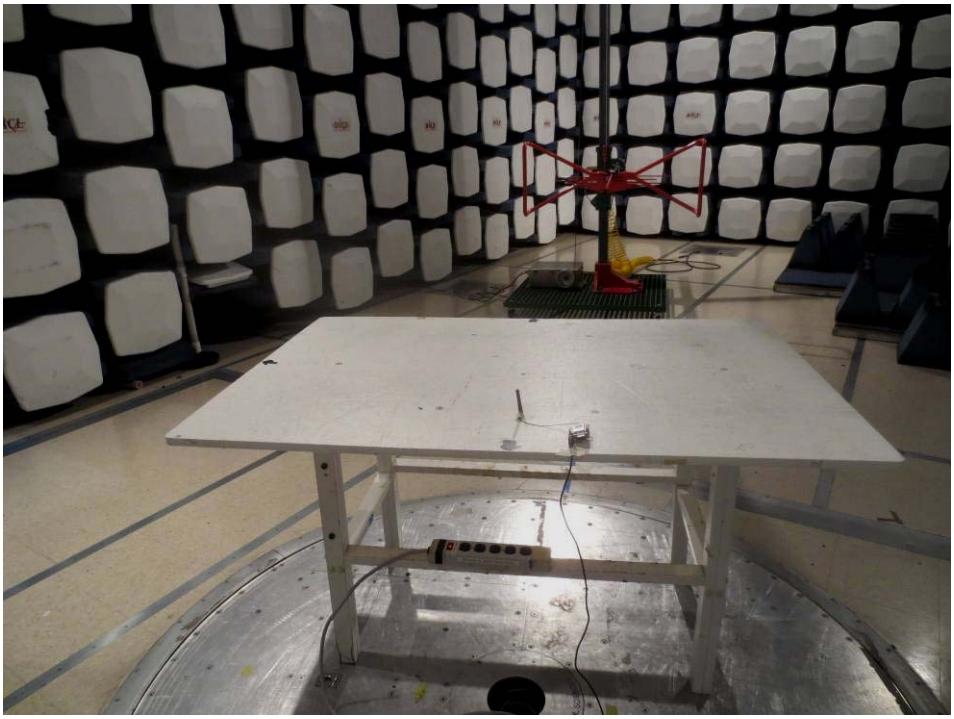
15.2 Conducted Emissions AC/DC Adapter Powered Side View



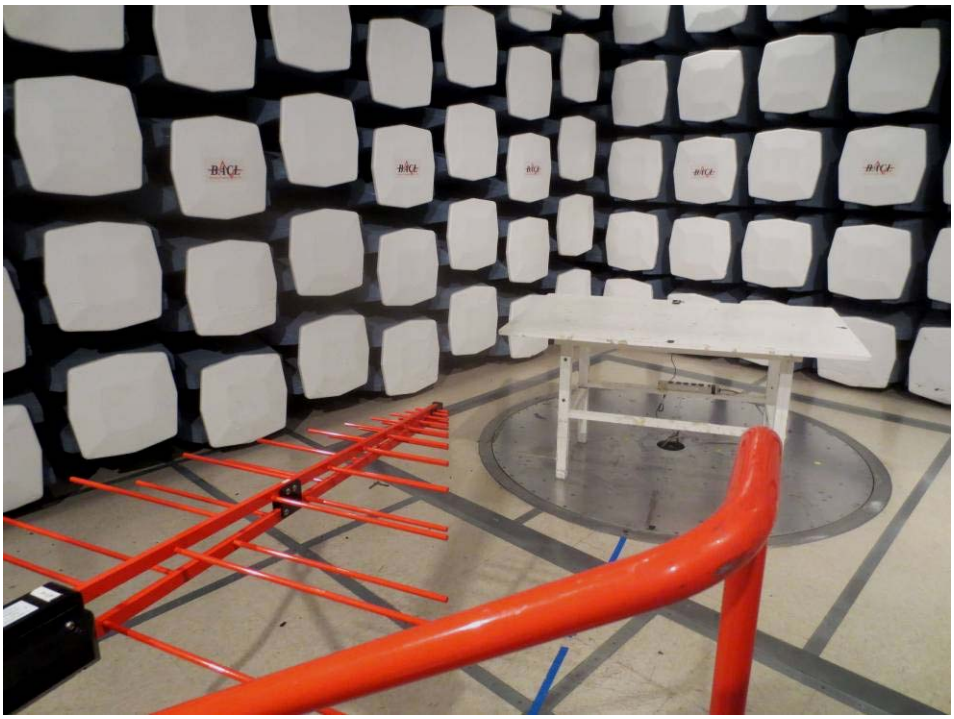
15.3 Radiated Emission Below 1 GHz Front View at 3 Meter For Dipole Antenna



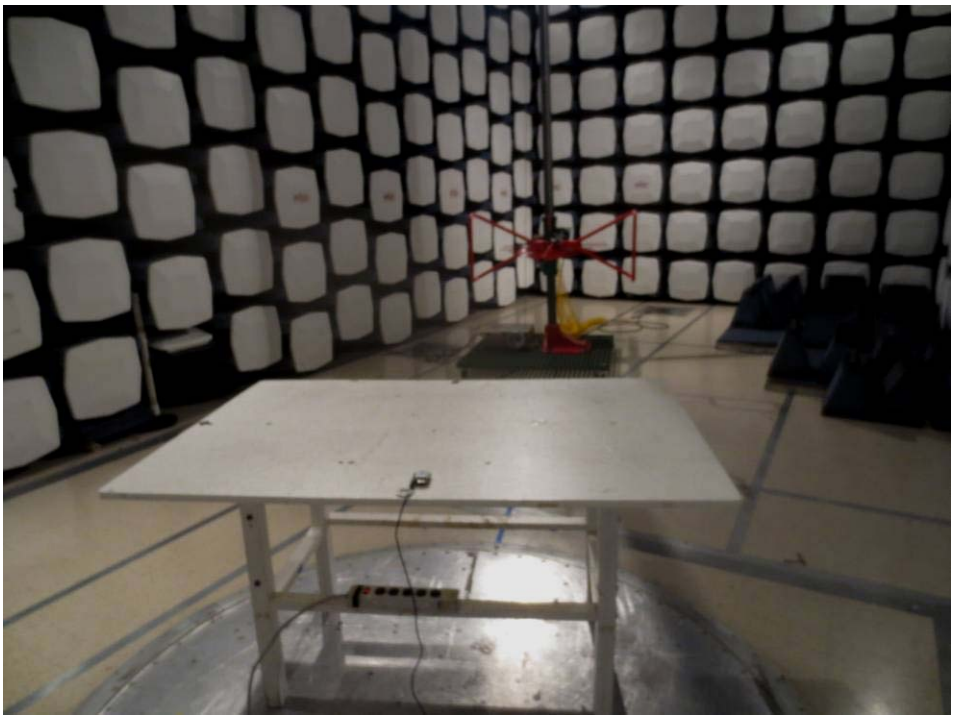
15.4 Radiated Emission Below 1 GHz Rear View at 3 Meter For Dipole Antenna



15.5 Radiated Emission Below 1 GHz Front View at 3 Meter For PCB Antenna



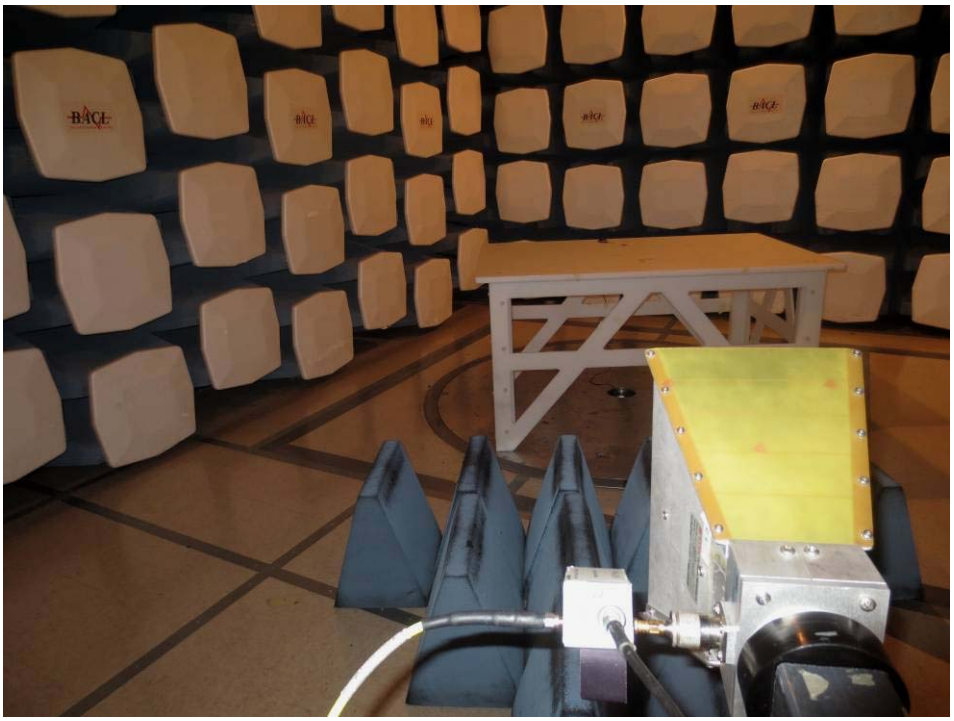
15.6 Radiated Emission Below 1 GHz Rear View at 3 Meter For PCB Antenna



15.7 Radiated Emission Above 1 GHz Front View at 3 Meter For Dipole Antenna

15.8 Radiated Emission Above 1 GHz Rear View at 3 Meter For Dipole Antenna

15.9 Radiated Emission Above 1 GHz Front View at 3 Meter For PCB Antenna



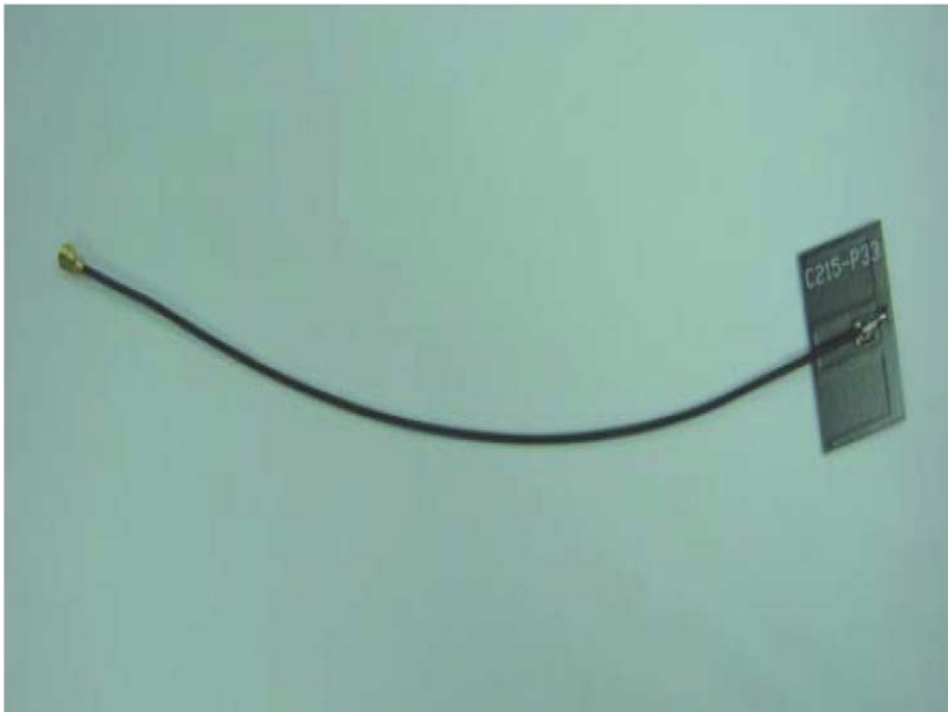
15.10 Radiated Emission Above 1 GHz Rear View at 3 Meter For PCB Antenna

16 Exhibit C – EUT Photographs

16.1 EUT Front View

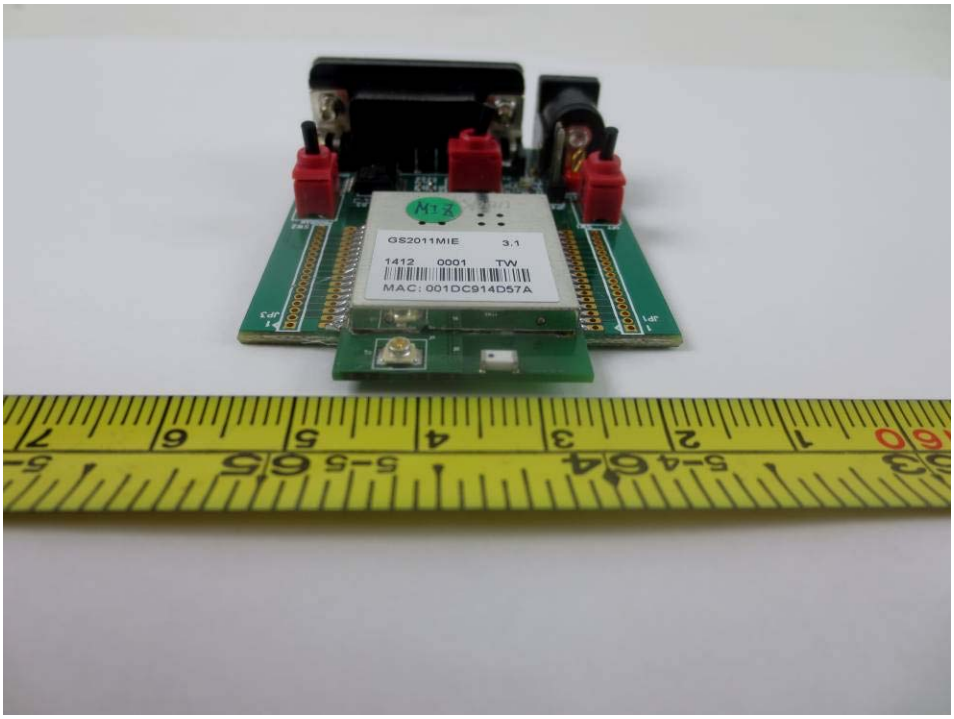
16.2 EUT Bottom View

16.3 PCB Antenna



16.4 Dipole Antenna

16.5 EUT with Support Board View



16.6 AC/DC Adaptor

16.7 Module without shielding

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