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: YOPGS2100MIE
IC: 9154A-GS2100MIE

Report Type:	**Product Type:**
Original Report	802.11 b/g/n20 Wi-Fi Module

Prepared By	Glenn Escano
Report Number	R1404031-247
Report Date	2014-06-17
Reviewed By	Bo Li Test Engineer
	Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1404031-247	Original Report	2014-05-05
Rev A	R1404031-247	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: GS2100MIE, FCC ID: YOPGS2100MIE, IC: 9154A-GS2100MIE or the "EUT" as referred on this report. The EUT is a Wi-Fi Module with 802.11 b/g/n20 technology.

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: 20F85EA9ACFE 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 Measurement Guidance

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	GS2100MIE 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 Standards

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

With Dipole Antenna (2 dBi)

Maximum peak output power at antenna input terminal (dBm):	19.77
Maximum peak output power at antenna input terminal (mW):	94.8418
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	2
Maximum Antenna Gain (numeric):	1.5849
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0299
Power density of prediction frequency at 20.0 cm (W/m^2):	0.2990
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

With PCB Antenna (1 dBi)

Maximum peak output power at antenna input terminal (dBm):	19.77
Maximum peak output power at antenna input terminal (mW):	94.8418
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	1
Maximum Antenna Gain (numeric):	1.2589
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0237
Power density of prediction frequency at 20.0 cm (W/m^2):	0.2375
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 at the distance of 20cm.

5 FCC §15.203 & IC RSS-Gen §7.1.2 – Antenna Requirements

5.1 Applicable Standards

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.

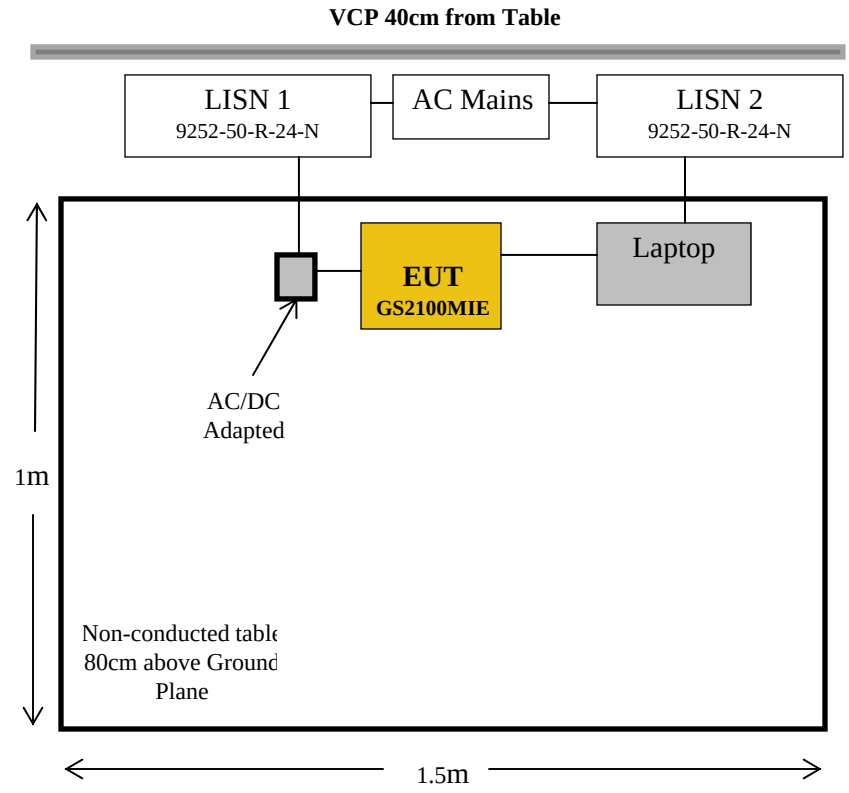
6.3 Test Procedure

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	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:	22° C
Relative Humidity:	42 %
ATM Pressure:	101.69 kPa

The testing was performed by Glenn Escano on 2014-04-11 in 5m chamber 2.

6.8 Summary of Test Results

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

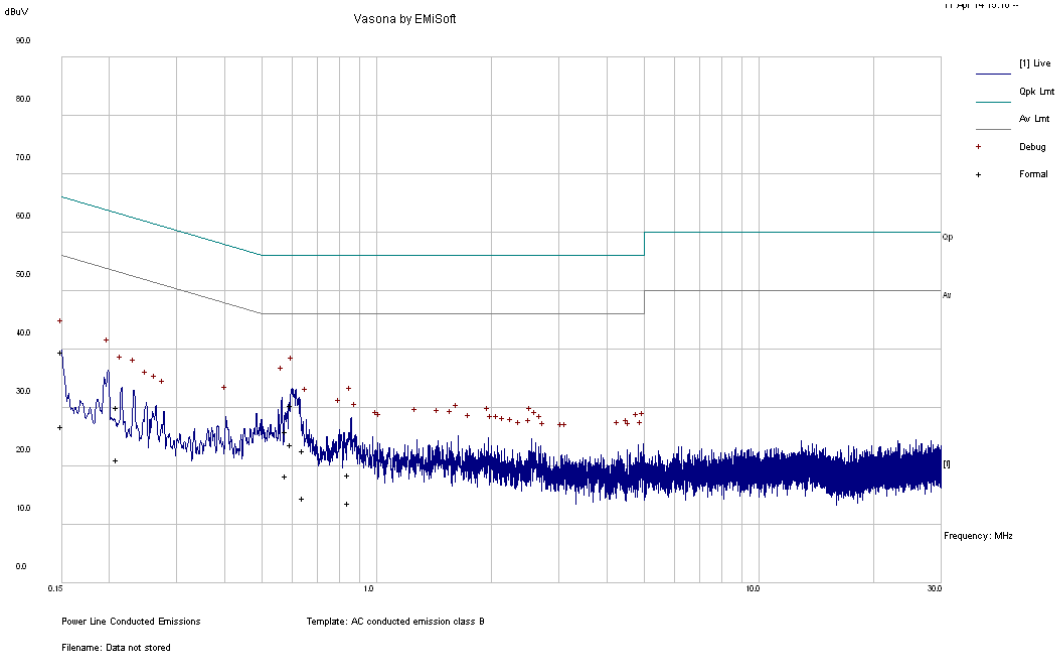
Transmitting Mode the Worst Case: 802.11 b Low channel

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-22.26	0.598257	Line	0.15 to 30

6.9 Conducted Emissions Test Plots and Data

Transmitting Mode the Worst Case: 802.11 b High channel

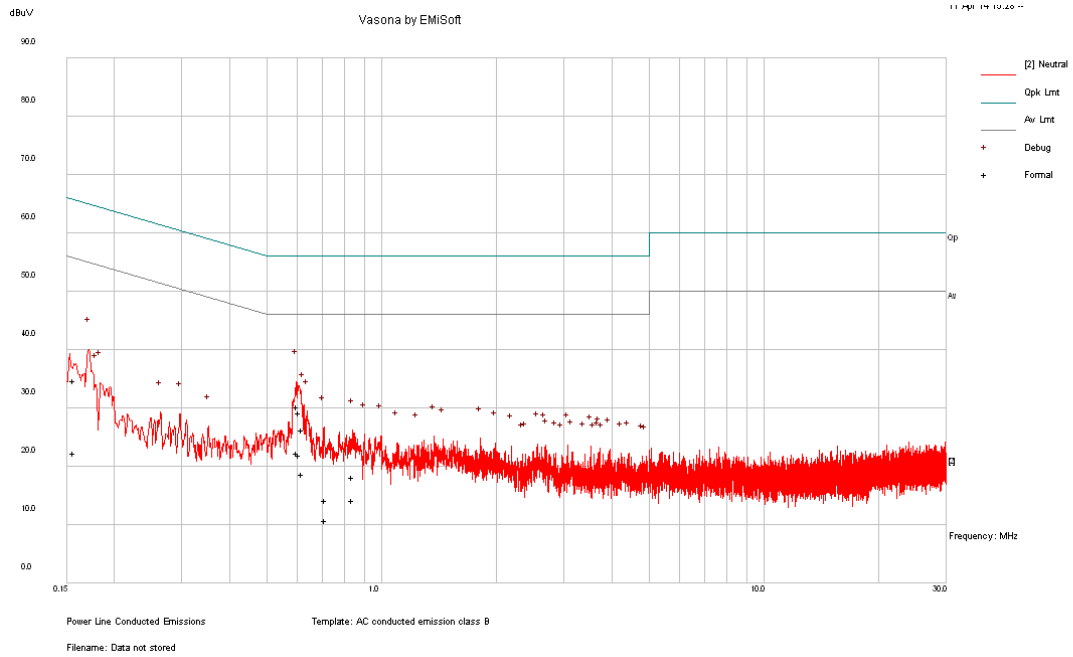
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (PK/QP/Ave)
0.598257	30.45	Line	56	-25.55	QP
0.150322	39.52	Line	65.98	-26.46	QP
0.580899	25.92	Line	56	-30.08	QP
0.209622	30.04	Line	63.22	-33.18	QP
0.644046	22.76	Line	56	-33.24	QP
0.84303	18.59	Line	56	-37.41	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (PK/QP/Ave)
0.598257	23.74	Line	46	-22.26	Ave.
0.580899	18.34	Line	46	-27.66	Ave.
0.150322	26.82	Line	55.98	-29.16	Ave.
0.644046	14.52	Line	46	-31.48	Ave.
0.209622	21.07	Line	53.22	-32.15	Ave.
0.84303	13.63	Line	46	-32.37	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (PK/QP/Ave)
0.600861	30.28	Neutral	56	-25.72	QP
0.609831	29.32	Neutral	56	-26.68	QP
0.622317	26.26	Neutral	56	-29.74	QP
0.157275	34.69	Neutral	65.61	-30.91	QP
0.83997	18.17	Neutral	56	-37.83	QP
0.714366	14.24	Neutral	56	-41.76	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (PK/QP/Ave)
0.600861	22.32	Neutral	46	-23.68	Ave.
0.609831	21.96	Neutral	46	-24.04	Ave.
0.622317	18.72	Neutral	46	-27.28	Ave.
0.83997	14.21	Neutral	46	-31.79	Ave.
0.157275	22.32	Neutral	55.61	-33.29	Ave.
0.714366	10.78	Neutral	46	-35.22	Ave.

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

7.1 Applicable Standards

For FCC §15.247(d) and IC RSS-210 §A8.5 in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

7.2 Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	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

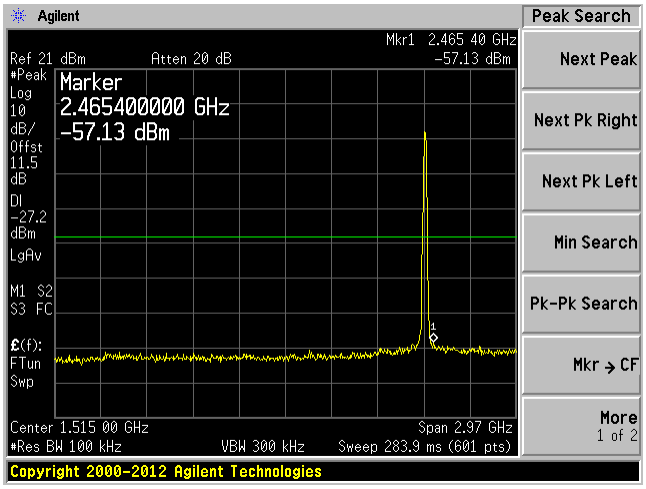
The testing was performed by Glenn Escano on 2014-04-10 in RF Test Site.

7.5 Test Results

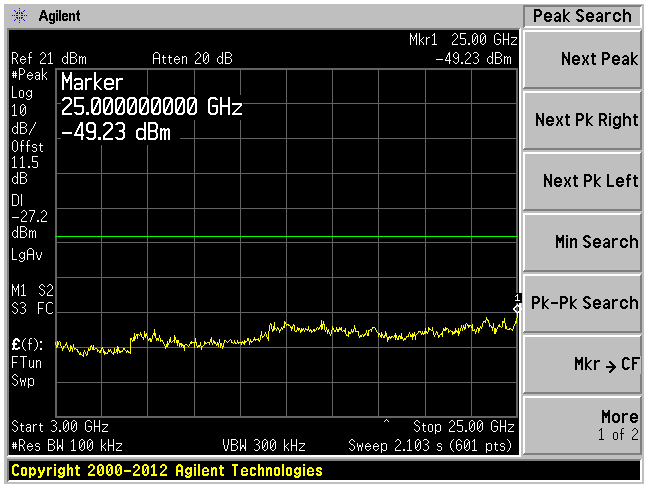
Please refer to following plots of spurious emissions.

802.11b, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

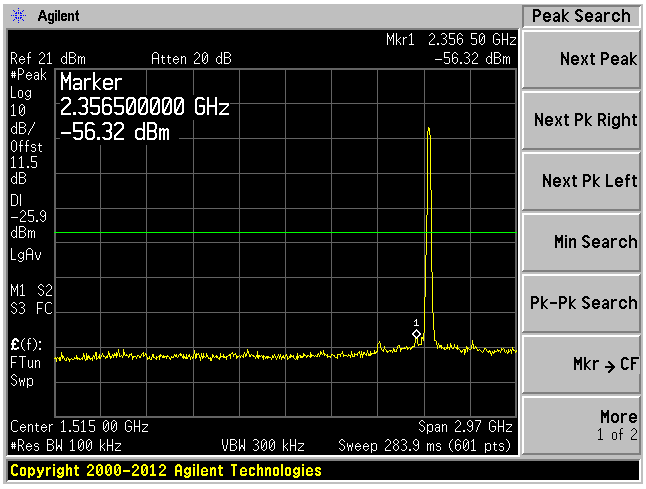


Plot: 3 GHz – 25 GHz

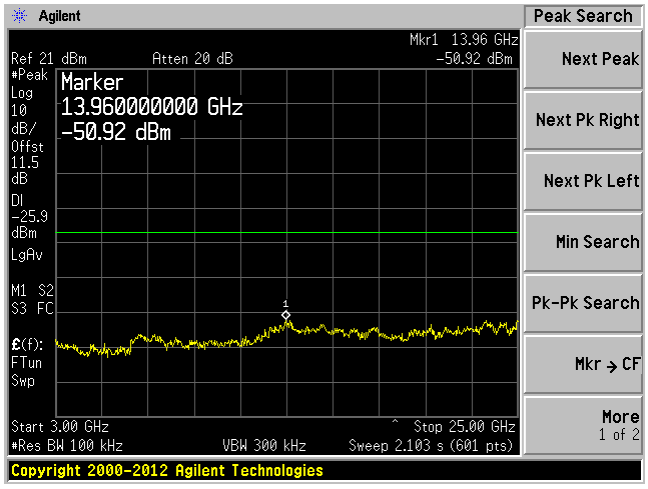


802.11b, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

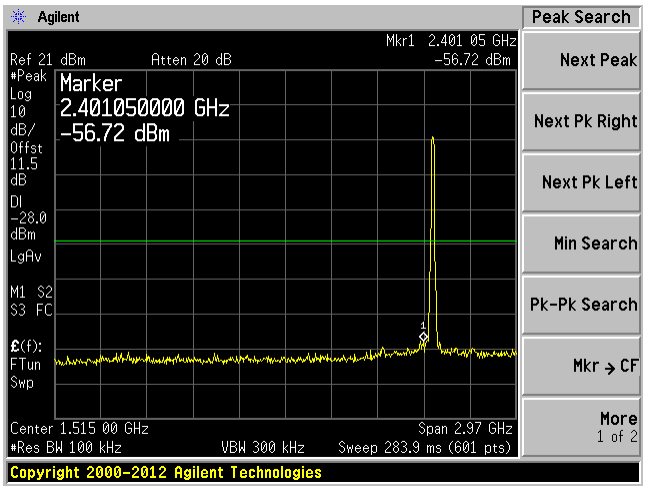


Plot: 3 GHz – 25 GHz

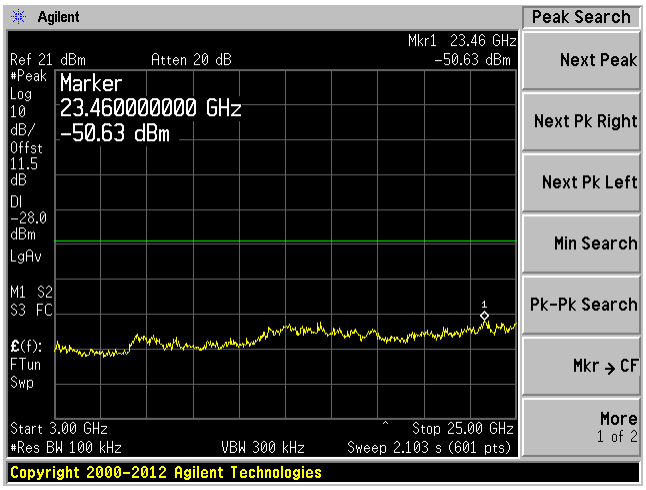


802.11b, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

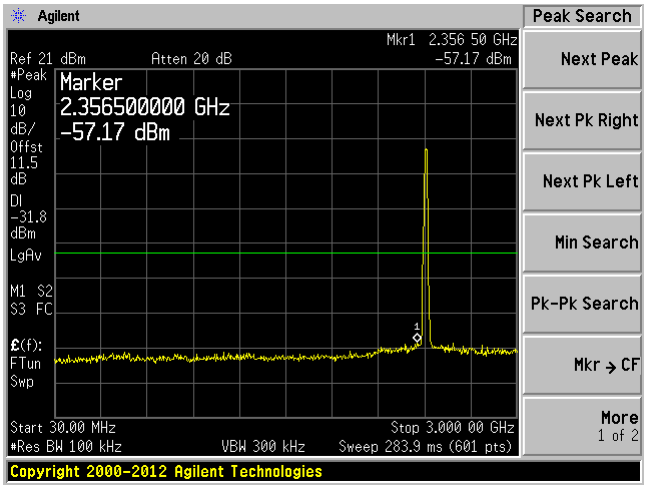


Plot: 3 GHz – 25 GHz

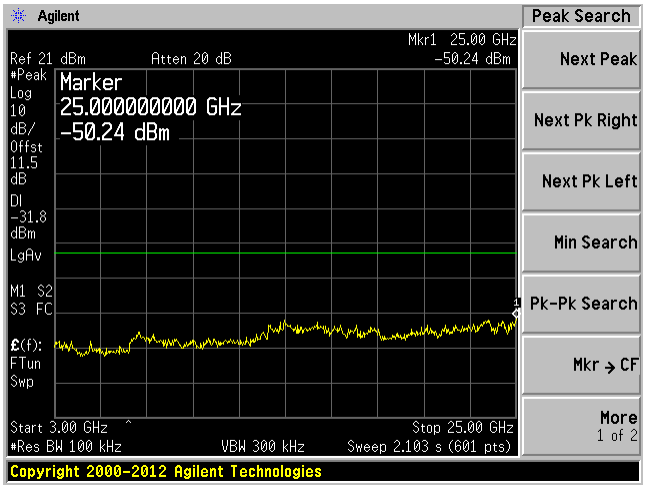


802.11g, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

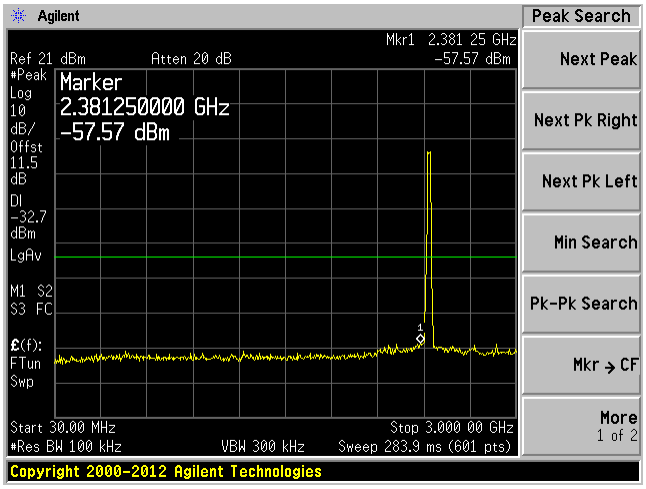


Plot: 3 GHz – 25 GHz

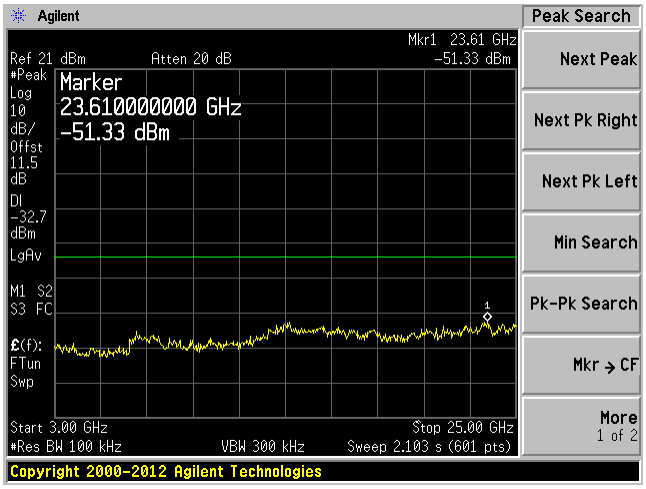


802.11g, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

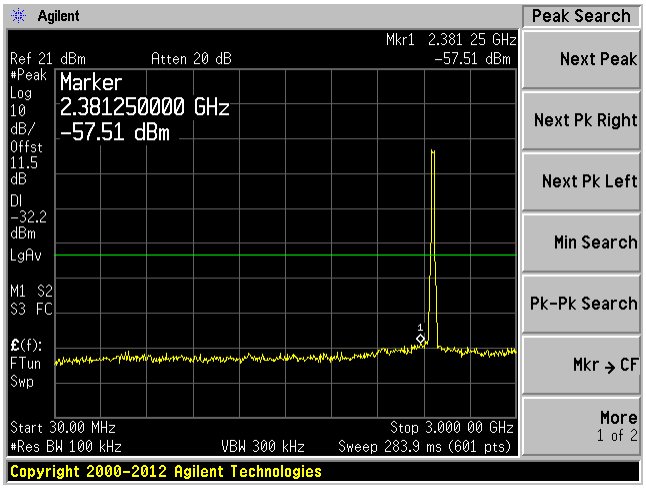


Plot: 3 GHz – 25 GHz

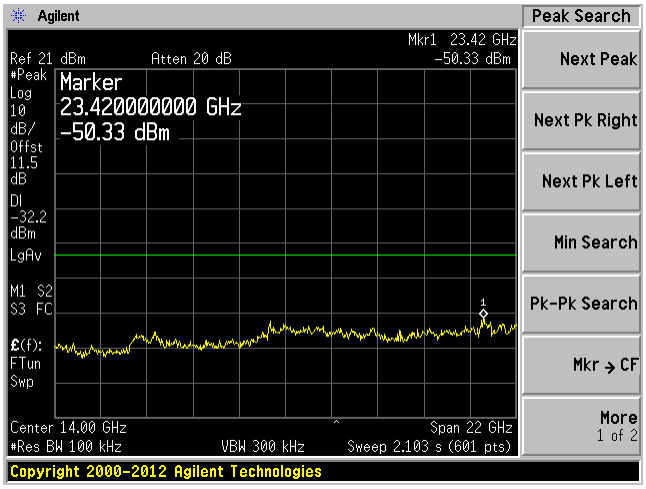


802.11g, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz

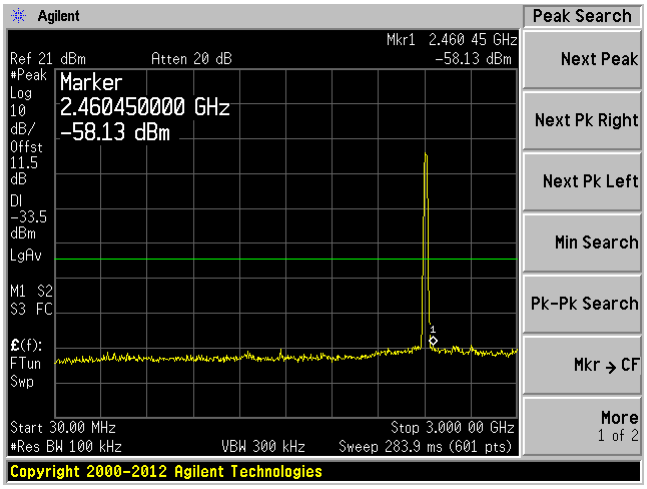


Plot: 3 GHz – 25 GHz

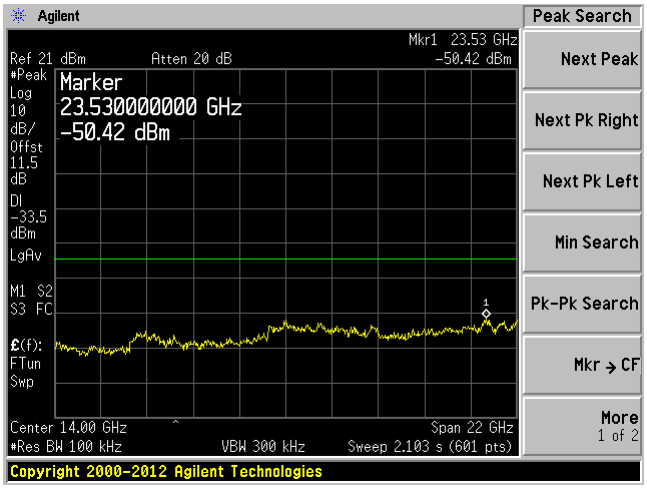


802.11n HT20, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

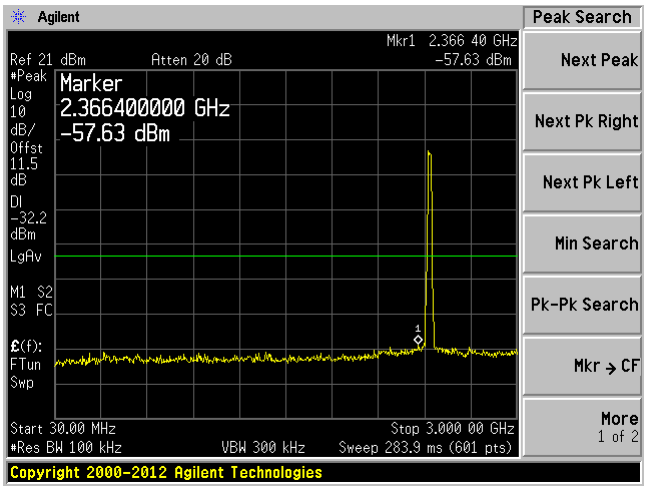


Plot: 3 GHz – 25 GHz

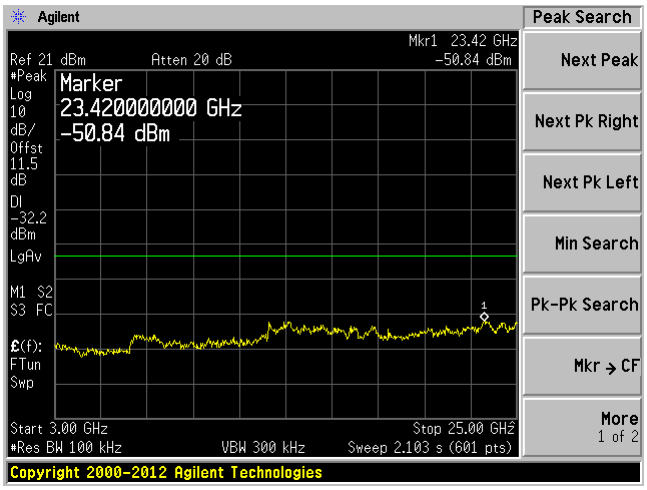


802.11n HT20, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

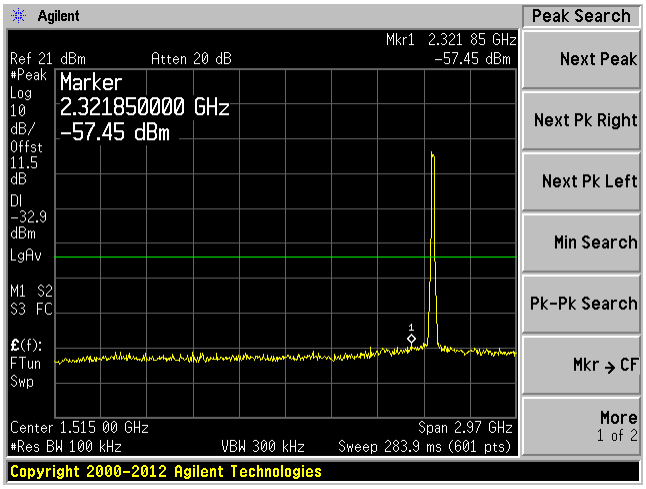


Plot: 3 GHz – 25 GHz

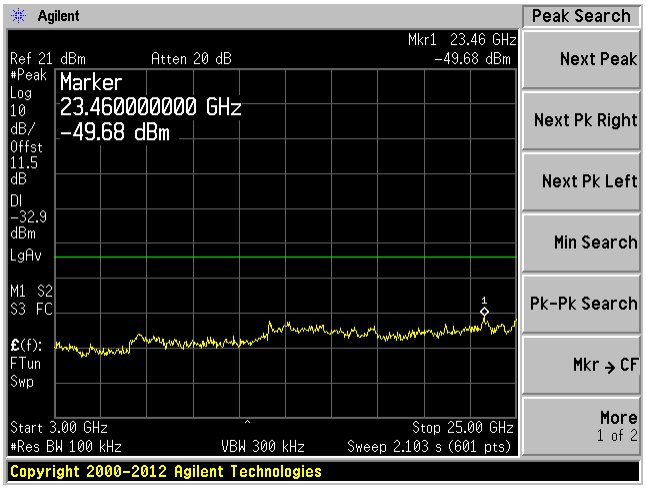


802.11n HT20, High Channel 2462 MHz

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 Standards

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 10 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

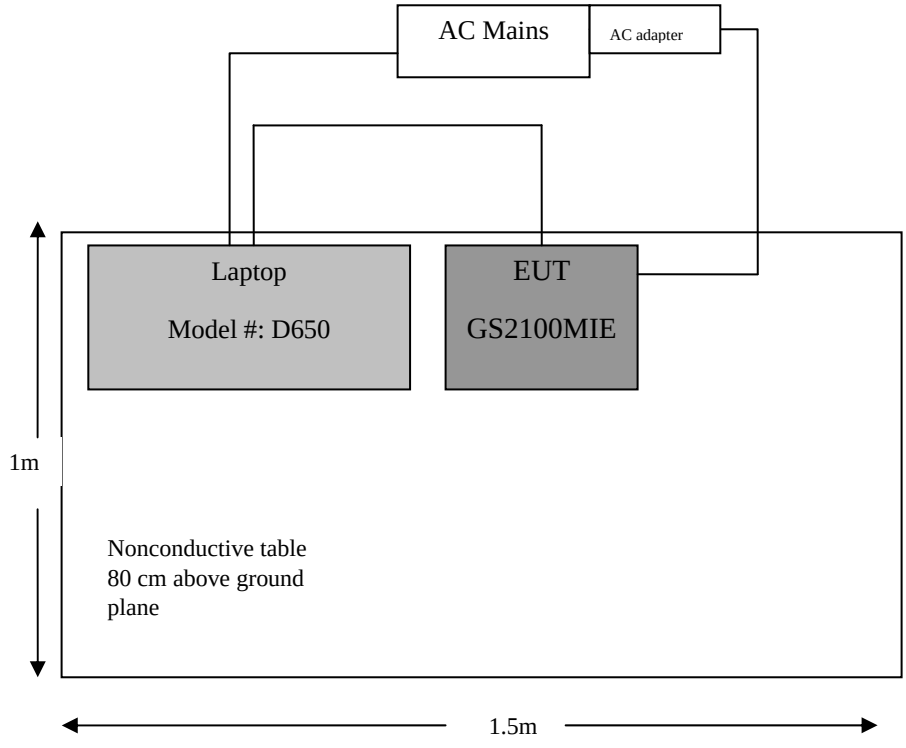
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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:

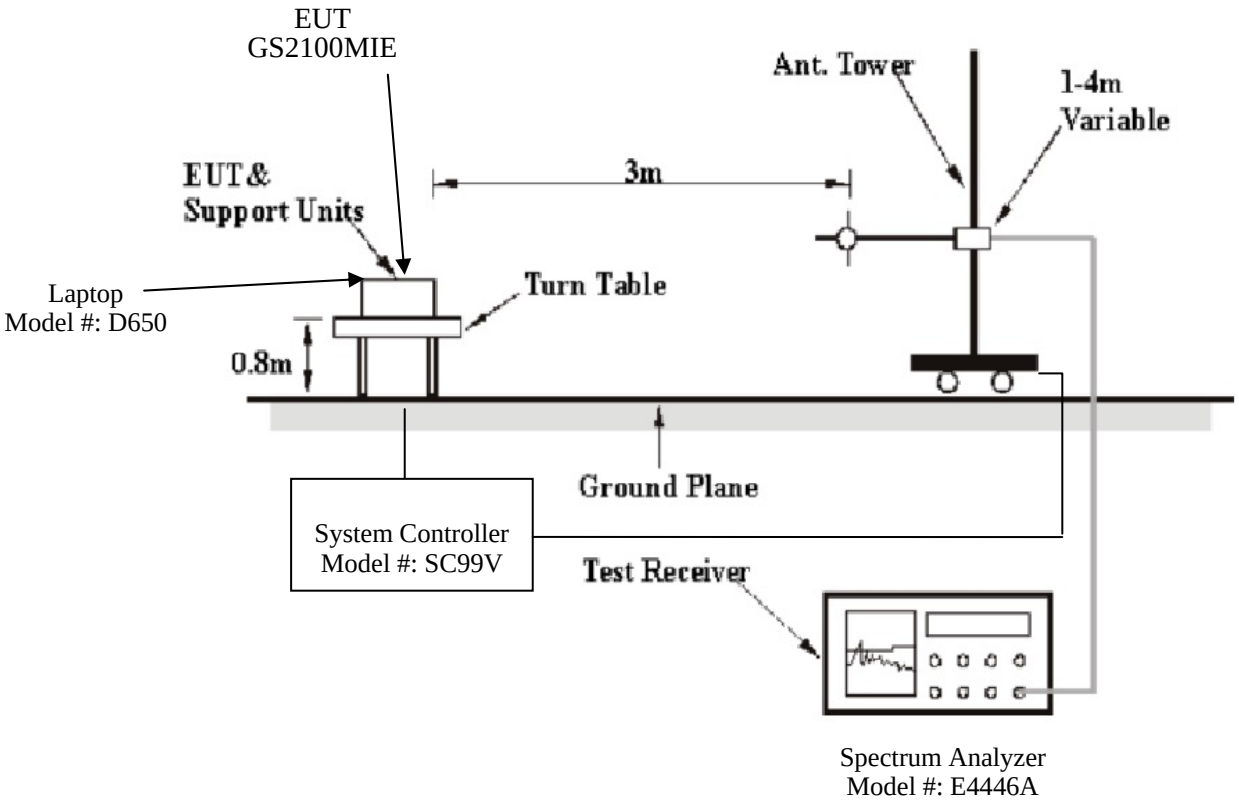
Margin = Corrected Amplitude - Limit

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:	20-24° C
Relative Humidity:	40-44 %
ATM Pressure:	101-102 kPa

The testing was performed by Glenn Escano on 2014-04-07 and 2014-04-09 in 5m 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:

With Dipole Antenna (2 dBi)

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode**
30-1000 MHz			
-5.01	215.837	Horizontal	802.11n-HT20
1-25 GHz			
-0.411	2390	Vertical	802.11n-HT20, Low Channel

With PCB Antenna (1 dBi)

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode**
30-1000 MHz			
-3.44	215.7688	Horizontal	802.11b
1-25 GHz			
-0.571	2390	Horizontal	802.11b, Low channel

8.9 Radiated Emissions Test Data

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

With Dipole Antenna (2 dBi)

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
802.11b mode						
215.633	37.83	139	H	256	43.5	-5.67
95.801	35.11	118	V	44	43.5	-8.39
44.337	31.45	99	V	348	40	-8.55
59.6285	31.35	99	V	277	40	-8.65
802.11g mode						
215.8628	36.54	98	H	279	43.5	-6.96
59.551	29.77	123	V	265	40	-10.23
83.73675	28.99	134	V	155	40	-11.01
52.63675	25.83	211	V	271	40	-14.17
802.11n-HT20 mode						
215.837	38.49	121	H	264	43.5	-5.01
59.57175	31.73	104	V	272	40	-8.27
44.3185	30.55	152	V	228	40	-9.45
51.796	29.12	142	V	315	40	-10.88

With PCB Antenna (1 dBi)

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
802.11b mode						
215.7688	40.06	134	H	272	43.5	-3.44
59.5645	31.01	106	V	303	40	-8.99
44.3715	28.78	155	V	107	40	-11.22
84.63875	27.9	175	V	138	40	-12.1
802.11g mode						
44.03825	32.06	98	V	154	40	-7.94
59.58325	31.55	98	V	231	40	-8.45
221.462	36.5	114	H	280	46	-9.5
95.8485	30.78	138	V	71	43.5	-12.72
802.11n-HT20 mode						
59.708	32.5	104	V	289	40	-7.5
215.1595	35.64	102	H	275	43.5	-7.86
44.33925	30.67	138	V	151	40	-9.33
50.1925	26.8	127	V	246	40	-13.2

2) 1–25 GHz, Measured at 3 meters

With Dipole Antenna (2 dBi)

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	76.02	89	100	V	28.341	3.358	0	107.719	-	-	Peak/Fund
2412	68.31	86	100	H	28.341	3.358	0	100.009	-	-	Peak/Fund
2412	72.46	89	100	V	28.341	3.358	0	104.159	-	-	Ave/Fund
2412	64.7	86	100	H	28.341	3.358	0	96.399	-	-	Ave/Fund
2390	31.96	89	100	V	28.341	3.358	0	63.659	74	-10.341	Peak
2390	30.79	86	100	H	28.341	3.358	0	62.489	74	-11.511	Peak
2390	21.08	89	100	V	28.341	3.358	0	52.779	54	-1.221	Ave
2390	20.26	86	100	H	28.341	3.358	0	51.959	54	-2.041	Ave
4824	51.18	302	117	V	32.871	5.231	36.45	52.832	74	-21.168	Peak
4824	51.06	358	121	H	32.871	5.231	36.45	52.712	74	-21.288	Peak
4824	43.43	302	117	V	32.871	5.231	36.45	45.082	54	-8.918	Ave
4824	44.22	358	121	H	32.871	5.231	36.45	45.872	54	-8.128	Ave
7236	47.37	0	100	V	35.7	6.829	36.68	53.219	87.719	-34.5	Peak
7236	47.07	0	100	H	35.7	6.829	36.68	52.919	80.009	-27.09	Peak
7236	32.6	0	100	V	35.7	6.829	36.68	38.449	84.159	-45.71	Ave
7236	32.54	0	100	H	35.7	6.829	36.68	38.389	76.399	-38.01	Ave
802.11b, Middle Channel 2437 MHz											
2437	78.61	296	100	V	28.341	3.591	0	110.542	-	-	Peak/Fund
2437	67.78	297	113	H	28.341	3.591	0	99.712	-	-	Peak/Fund
2437	74.87	296	100	V	28.341	3.591	0	106.802	-	-	Ave/Fund
2437	64.16	297	113	H	28.341	3.591	0	96.092	-	-	Ave/Fund
4874	51.22	223	112	V	33.166	5.169	36.34	53.215	74	-20.785	Peak
4874	51.62	326	114	H	33.166	5.169	36.34	53.615	74	-20.385	Peak
4874	43.41	223	112	V	33.166	5.169	36.34	45.405	54	-8.595	Ave
4874	44.82	326	114	H	33.166	5.169	36.34	46.815	54	-7.185	Ave
7311	46.49	0	100	V	36.134	6.907	36.69	52.841	74	-21.159	Peak
7311	46.9	0	100	H	36.134	6.907	36.69	53.251	74	-20.749	Peak
7311	32.13	0	100	V	36.134	6.907	36.69	38.481	54	-15.519	Ave
7311	32.2	0	100	H	36.134	6.907	36.69	38.551	54	-15.449	Ave
9748	47.49	0	100	V	37.908	8.35	37.03	56.718	90.542	-33.824	Peak
9748	46.79	0	100	H	37.908	8.35	37.03	56.018	79.712	-23.694	Peak
9748	32.54	0	100	V	37.908	8.35	37.03	41.768	86.802	-45.034	Ave
9748	32.49	0	100	H	37.908	8.35	37.03	41.718	76.092	-34.374	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	77.68	87	124	V	28.373	3.642	0	109.695	-	-	Peak/Fund
2462	68.95	316	100	H	28.373	3.642	0	100.965	-	-	Peak/Fund
2462	73.9	87	124	V	28.373	3.642	0	105.915	-	-	Ave/Fund
2462	64.53	316	100	H	28.373	3.642	0	96.545	-	-	Ave/Fund
2483.5	32.46	87	1224	V	28.373	3.642	0	64.475	74	-9.525	Peak
2483.5	28.19	316	100	H	28.373	3.642	0	60.205	74	-13.795	Peak
2483.5	21.32	87	124	V	28.373	3.642	0	53.335	54	-0.665	Ave
2483.5	15.37	316	100	H	28.373	3.642	0	47.385	54	-6.615	Ave
4924	51.12	231	100	V	33.166	5.151	36.4	53.037	74	-20.963	Peak
4924	51.09	312	100	H	33.166	5.151	36.4	53.007	74	-20.993	Peak
4924	42.22	231	100	V	33.166	5.151	36.4	44.137	54	-9.863	Ave
4924	43.89	312	100	H	33.166	5.151	36.4	45.807	54	-8.193	Ave
7386	47.34	0	100	V	36.327	6.717	36.61	53.774	74	-20.226	Peak
7386	46.69	0	100	H	36.327	6.717	36.61	53.124	74	-20.876	Peak
7386	32.26	0	100	V	36.327	6.717	36.61	38.694	54	-15.306	Ave
7386	32.22	0	100	H	36.327	6.717	36.61	38.654	54	-15.346	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	78.54	297	100	V	28.341	3.358	0	110.239	-	-	Peak/Fund
2412	68.32	315	100	H	28.341	3.358	0	100.019	-	-	Peak/Fund
2412	68.11	297	100	V	28.341	3.358	0	99.809	-	-	Ave/Fund
2412	57.32	315	100	H	28.341	3.358	0	89.019	-	-	Ave/Fund
2390	39.31	297	100	V	28.341	3.358	0	71.009	74	-2.991	Peak
2390	29.09	315	100	H	28.341	3.358	0	60.789	74	-13.211	Peak
2390	19.62	297	100	V	28.341	3.358	0	51.319	54	-2.681	Ave
2390	13.11	315	100	H	28.341	3.358	0	44.809	54	-9.191	Ave
4824	51.1	295	100	V	32.871	5.231	36.45	52.752	74	-21.248	Peak
4824	51.24	311	100	H	32.871	5.231	36.45	52.892	74	-21.108	Peak
4824	43.49	295	100	V	32.871	5.231	36.45	45.142	54	-8.858	Ave
4824	41.78	311	100	H	32.871	5.231	36.45	43.432	54	-10.568	Ave
7236	46.02	0	100	V	35.7	6.829	36.68	51.869	90.239	-38.37	Peak
7236	46.3	0	100	H	35.7	6.829	36.68	52.149	80.019	-27.87	Peak
7236	31.79	0	100	V	35.7	6.829	36.68	37.639	79.809	-42.17	Ave
7236	31.9	0	100	H	35.7	6.829	36.68	37.749	69.019	-31.27	Ave
802.11g, Middle Channel 2437 MHz											
2437	79.1	297	100	V	28.341	3.591	0	111.032	-	-	Peak/Fund
2437	68.75	321	100	H	28.341	3.591	0	100.682	-	-	Peak/Fund
2437	68.55	297	100	V	28.341	3.591	0	100.482	-	-	Ave/Fund
2437	58.62	321	100	H	28.341	3.591	0	90.552	-	-	Ave/Fund
4874	50.67	227	112	V	33.166	5.169	36.34	52.665	74	-21.335	Peak
4874	50.31	312	113	H	33.166	5.169	36.34	52.305	74	-21.695	Peak
4874	44.35	227	112	V	33.166	5.169	36.34	46.345	54	-7.655	Ave
4874	41.85	312	113	H	33.166	5.169	36.34	43.845	54	-10.155	Ave
7311	45.69	0	100	V	36.134	6.907	36.69	52.041	74	-21.959	Peak
7311	45.79	0	100	H	36.134	6.907	36.69	52.141	74	-21.859	Peak
7311	31.93	0	100	V	36.134	6.907	36.69	38.281	54	-15.719	Ave
7311	32.04	0	100	H	36.134	6.907	36.69	38.391	54	-15.609	Ave
9748	46.77	0	100	V	37.908	8.35	37.03	55.998	91.032	-35.034	Peak
9748	46.65	0	100	H	37.908	8.35	37.03	55.878	80.682	-24.804	Peak
9748	32.33	0	100	V	37.908	8.35	37.03	41.558	80.482	-38.924	Ave
9748	32.4	0	100	H	37.908	8.35	37.03	41.628	70.552	-28.924	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	78.45	295	100	V	28.373	3.642	0	110.465	-	-	Peak/Fund
2462	68.56	315	100	H	28.373	3.642	0	100.575	-	-	Peak/Fund
2462	68.34	295	100	V	28.373	3.642	0	100.355	-	-	Ave/Fund
2462	58.11	315	100	H	28.373	3.642	0	90.125	-	-	Ave/Fund
2483.5	39.95	295	100	V	28.373	3.642	0	71.965	74	-2.035	Peak
2483.5	30.99	315	100	H	28.373	3.642	0	63.005	74	-10.995	Peak
2483.5	19.7	295	100	V	28.373	3.642	0	51.715	54	-2.285	Ave
2483.5	14.39	315	100	H	28.373	3.642	0	46.405	54	-7.595	Ave
4924	50.33	226	125	V	33.166	5.151	36.4	52.247	74	-21.753	Peak
4924	50.64	312	100	H	33.166	5.151	36.4	52.557	74	-21.443	Peak
4924	42.79	226	125	V	33.166	5.151	36.4	44.707	54	-9.293	Ave
4924	43.21	312	100	H	33.166	5.151	36.4	45.127	54	-8.873	Ave
7386	45.68	0	100	V	36.327	6.717	36.61	52.114	74	-21.886	Peak
7386	45.8	0	100	H	36.327	6.717	36.61	52.234	74	-21.766	Peak
7386	31.92	0	100	V	36.327	6.717	36.61	38.354	54	-15.646	Ave
7386	31.98	0	100	H	36.327	6.717	36.61	38.414	54	-15.586	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	77.21	297	100	V	28.341	3.358	0	108.909	-	-	Peak/Fund
2412	66.79	271	137	H	28.341	3.358	0	98.489	-	-	Peak/Fund
2412	67.44	297	100	V	28.341	3.358	0	99.139	-	-	Ave/Fund
2412	56.59	271	137	H	28.341	3.358	0	88.289	-	-	Ave/Fund
2390	41.89	297	100	V	28.341	3.358	0	73.589	74	-0.411	Peak
2390	29.59	271	137	H	28.341	3.358	0	61.289	74	-12.711	Peak
2390	19.84	297	100	V	28.341	3.358	0	51.539	54	-2.461	Ave
2390	13.72	271	137	H	28.341	3.358	0	45.419	54	-8.581	Ave
4824	50.75	228	100	V	32.871	5.231	36.45	52.402	74	-21.598	Peak
4824	50.55	310	100	H	32.871	5.231	36.45	52.202	74	-21.798	Peak
4824	43.16	228	100	V	32.871	5.231	36.45	44.812	54	-9.188	Ave
4824	42.87	310	100	H	32.871	5.231	36.45	44.522	54	-9.478	Ave
7236	46.58	0	100	V	35.7	6.829	36.68	52.429	88.909	-36.48	Peak
7236	47.22	0	100	H	35.7	6.829	36.68	53.069	78.489	-25.42	Peak
7236	32.45	0	100	V	35.7	6.829	36.68	38.299	79.139	-40.84	Ave
7236	32.52	0	100	H	35.7	6.829	36.68	38.369	68.289	-29.92	Ave
802.11n-HT20, Middle Channel 2437 MHz											
2437	78.8	296	100	V	28.341	3.591	0	110.732	-	-	Peak/Fund
2437	67.78	239	100	H	28.341	3.591	0	99.712	-	-	Peak/Fund
2437	68.88	296	100	V	28.341	3.591	0	100.812	-	-	Ave/Fund
2437	57.62	239	100	H	28.341	3.591	0	89.552	-	-	Ave/Fund
4874	50.23	234	100	V	33.166	5.169	36.34	52.225	74	-21.775	Peak
4874	50.75	327	100	H	33.166	5.169	36.34	52.745	74	-21.255	Peak
4874	42.09	234	100	V	33.166	5.169	36.34	44.085	54	-9.915	Ave
4874	43	327	100	H	33.166	5.169	36.34	44.995	54	-9.005	Ave
7311	46.11	0	100	V	36.134	6.907	36.69	52.461	74	-21.539	Peak
7311	46.67	0	100	H	36.134	6.907	36.69	53.021	74	-20.979	Peak
7311	32.09	0	100	V	36.134	6.907	36.69	38.441	54	-15.559	Ave
7311	32.17	0	100	H	36.134	6.907	36.69	38.521	54	-15.479	Ave
9748	46.38	0	100	V	37.908	8.35	37.03	55.608	90.732	-35.124	Peak
9748	46.15	0	100	H	37.908	8.35	37.03	55.378	79.712	-24.334	Peak
9748	32.41	0	100	V	37.908	8.35	37.03	41.638	80.812	-39.174	Ave
9748	32.34	0	100	H	37.908	8.35	37.03	41.568	69.552	-27.984	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	78.08	294	100	V	28.373	3.642	0	110.095	-	-	Peak/Fund
2462	68.26	240	100	H	28.373	3.642	0	100.275	-	-	Peak/Fund
2462	67.81	294	100	V	28.373	3.642	0	99.825	-	-	Ave/Fund
2462	57.49	240	100	H	28.373	3.642	0	89.505	-	-	Ave/Fund
2483.5	40.56	294	100	V	28.373	3.642	0	72.575	74	-1.425	Peak
2483.5	31.02	240	100	H	28.373	3.642	0	63.035	74	-10.965	Peak
2483.5	20.87	294	100	V	28.373	3.642	0	52.885	54	-1.115	Ave
2483.5	14.88	240	100	H	28.373	3.642	0	46.895	54	-7.105	Ave
4924	50.4	225	124	V	33.166	5.151	36.4	52.317	74	-21.683	Peak
4924	50.62	312	111	H	33.166	5.151	36.4	52.537	74	-21.463	Peak
4924	42.14	225	124	V	33.166	5.151	36.4	44.057	54	-9.943	Ave
4924	43.03	312	111	H	33.166	5.151	36.4	44.947	54	-9.053	Ave
7386	45.57	0	100	V	36.327	6.717	36.61	52.004	74	-21.996	Peak
7386	45.45	0	100	H	36.327	6.717	36.61	51.884	74	-22.116	Peak
7386	31.95	0	100	V	36.327	6.717	36.61	38.384	54	-15.616	Ave
7386	32.01	0	100	H	36.327	6.717	36.61	38.444	54	-15.556	Ave

With PCB Antenna (1 dBi)

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	73.49	109	100	V	28.341	3.358	0	105.189	-	-	Peak/Fund
2412	78.43	49	111	H	28.341	3.358	0	110.129	-	-	Peak/Fund
2412	70.21	109	100	V	28.341	3.358	0	101.909	-	-	Ave/Fund
2412	75.05	49	111	H	28.341	3.358	0	106.749	-	-	Ave/Fund
2390	28.51	109	100	V	28.341	3.358	0	60.209	74	-13.791	Peak
2390	31.99	49	111	H	28.341	3.358	0	63.689	74	-10.311	Peak
2390	17.71	109	100	V	28.341	3.358	0	49.409	54	-4.591	Ave
2390	21.73	49	111	H	28.341	3.358	0	53.429	54	-0.571	Ave
4824	49.63	49	100	V	32.871	5.231	36.45	51.282	74	-22.718	Peak
4824	50.35	342	106	H	32.871	5.231	36.45	52.002	74	-21.998	Peak
4824	39.81	49	100	V	32.871	5.231	36.45	41.462	54	-12.538	Ave
4824	41.42	342	106	H	32.871	5.231	36.45	43.072	54	-10.928	Ave
7236	47.49	0	100	V	35.7	6.829	36.68	53.339	85.189	-31.85	Peak
7236	47.03	0	100	H	35.7	6.829	36.68	52.879	90.129	-37.25	Peak
7236	33.12	0	100	V	35.7	6.829	36.68	38.969	81.909	-42.94	Ave
7236	33.04	0	100	H	35.7	6.829	36.68	38.889	86.749	-47.86	Ave
802.11b, Middle Channel 2437 MHz											
2437	72.57	110	100	V	28.341	3.591	0	104.502	-	-	Peak/Fund
2437	77.45	49	109	H	28.341	3.591	0	109.382	-	-	Peak/Fund
2437	69.22	110	100	V	28.341	3.591	0	101.152	-	-	Ave/Fund
2437	74.23	49	109	H	28.341	3.591	0	106.162	-	-	Ave/Fund
4874	49.7	306	115	V	33.166	5.169	36.34	51.695	74	-22.305	Peak
4874	50.08	3	115	H	33.166	5.169	36.34	52.075	74	-21.925	Peak
4874	39.85	306	115	V	33.166	5.169	36.34	41.845	54	-12.155	Ave
4874	41.78	3	115	H	33.166	5.169	36.34	43.775	54	-10.225	Ave
7311	45.93	0	100	V	36.134	6.907	36.69	52.281	74	-21.719	Peak
7311	46.2	0	100	H	36.134	6.907	36.69	52.551	74	-21.449	Peak
7311	32.11	0	100	V	36.134	6.907	36.69	38.461	54	-15.539	Ave
7311	32.09	0	100	H	36.134	6.907	36.69	38.441	54	-15.559	Ave
9748	45.91	0	100	V	37.908	8.35	37.03	55.138	84.502	-29.364	Peak
9748	45.55	0	100	H	37.908	8.35	37.03	54.778	89.382	-34.604	Peak
9748	32.06	0	100	V	37.908	8.35	37.03	41.288	81.152	-39.864	Ave
9748	31.98	0	100	H	37.908	8.35	37.03	41.208	86.162	-44.954	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	70.33	111	100	V	28.373	3.642	0	102.345	-	-	Peak/Fund
2462	76.57	50	106	H	28.373	3.642	0	108.585	-	-	Peak/Fund
2462	65.74	111	100	V	28.373	3.642	0	97.755	-	-	Ave/Fund
2462	72.91	50	106	H	28.373	3.642	0	104.925	-	-	Ave/Fund
2483.5	28.25	111	100	V	28.373	3.642	0	60.265	74	-13.735	Peak
2483.5	31.52	50	106	H	28.373	3.642	0	63.535	74	-10.465	Peak
2483.5	14.6	111	100	V	28.373	3.642	0	46.615	54	-7.385	Ave
2483.5	19.73	50	106	H	28.373	3.642	0	51.745	54	-2.255	Ave
4924	49.89	26	100	V	33.166	5.151	36.4	51.807	74	-22.193	Peak
4924	50.87	325	113	H	33.166	5.151	36.4	52.787	74	-21.213	Peak
4924	41.7	26	100	V	33.166	5.151	36.4	43.617	54	-10.383	Ave
4924	44.78	325	113	H	33.166	5.151	36.4	46.697	54	-7.303	Ave
7386	45.1	0	100	V	36.327	6.717	36.61	51.534	74	-22.466	Peak
7386	46.23	0	100	H	36.327	6.717	36.61	52.664	74	-21.336	Peak
7386	31.46	0	100	V	36.327	6.717	36.61	37.894	54	-16.106	Ave
7386	31.56	0	100	H	36.327	6.717	36.61	37.994	54	-16.006	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	73.23	247	100	V	28.341	3.358	0	104.929	-	-	Peak/Fund
2412	79.2	48	115	H	28.341	3.358	0	110.899	-	-	Peak/Fund
2412	63.03	247	100	V	28.341	3.358	0	94.729	-	-	Ave/Fund
2412	68.87	48	115	H	28.341	3.358	0	100.569	-	-	Ave/Fund
2390	34.22	247	100	V	28.341	3.358	0	65.919	74	-8.081	Peak
2390	40	48	115	H	28.341	3.358	0	71.699	74	-2.301	Peak
2390	15.96	247	100	V	28.341	3.358	0	47.659	54	-6.341	Ave
2390	20.3	48	115	H	28.341	3.358	0	51.999	54	-2.001	Ave
4824	50.06	45	100	V	32.871	5.231	36.45	51.712	74	-22.288	Peak
4824	49.13	245	100	H	32.871	5.231	36.45	50.782	74	-23.218	Peak
4824	41.97	45	100	V	32.871	5.231	36.45	43.622	54	-10.378	Ave
4824	38.24	245	100	H	32.871	5.231	36.45	39.892	54	-14.108	Ave
7236	47.13	0	100	V	35.7	6.829	36.68	52.979	84.929	-31.95	Peak
7236	45.7	0	100	H	35.7	6.829	36.68	51.549	90.899	-39.35	Peak
7236	31.93	0	100	V	35.7	6.829	36.68	37.779	74.729	-36.95	Ave
7236	31.89	0	100	H	35.7	6.829	36.68	37.739	80.569	-42.83	Ave
802.11g, Middle Channel 2437 MHz											
2437	72.43	111	100	V	28.341	3.591	0	104.362	-	-	Peak/Fund
2437	77.34	50	109	H	28.341	3.591	0	109.272	-	-	Peak/Fund
2437	62.14	111	100	V	28.341	3.591	0	94.072	-	-	Ave/Fund
2437	67.44	50	109	H	28.341	3.591	0	99.372	-	-	Ave/Fund
4874	49.69	236	112	V	33.166	5.169	36.34	51.685	74	-22.315	Peak
4874	49.91	54	100	H	33.166	5.169	36.34	51.905	74	-22.095	Peak
4874	41.14	236	112	V	33.166	5.169	36.34	43.135	54	-10.865	Ave
4874	40.99	54	100	H	33.166	5.169	36.34	42.985	54	-11.015	Ave
7311	45.73	0	100	V	36.134	6.907	36.69	52.081	74	-21.919	Peak
7311	45.75	0	100	H	36.134	6.907	36.69	52.101	74	-21.899	Peak
7311	31.55	0	100	V	36.134	6.907	36.69	37.901	54	-16.099	Ave
7311	31.61	0	100	H	36.134	6.907	36.69	37.961	54	-16.039	Ave
9748	46.28	0	100	V	37.908	8.35	37.03	55.508	84.362	-28.854	Peak
9748	45.72	0	100	H	37.908	8.35	37.03	54.948	89.272	-34.324	Peak
9748	31.9	0	100	V	37.908	8.35	37.03	41.128	74.072	-32.944	Ave
9748	31.79	0	100	H	37.908	8.35	37.03	41.018	79.372	-38.354	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	71.09	247	100	V	28.373	3.642	0	103.105	-	-	Peak/Fund
2462	77.02	48	108	H	28.373	3.642	0	109.035	-	-	Peak/Fund
2462	61.01	247	100	V	28.373	3.642	0	93.025	-	-	Ave/Fund
2462	66.76	48	108	H	28.373	3.642	0	98.775	-	-	Ave/Fund
2483.5	31.94	247	100	V	28.373	3.642	0	63.955	74	-10.045	Peak
2483.5	38.88	48	108	H	28.373	3.642	0	70.895	74	-3.105	Peak
2483.5	14.3	247	100	V	28.373	3.642	0	46.315	54	-7.685	Ave
2483.5	18.54	48	108	H	28.373	3.642	0	50.555	54	-3.445	Ave
4924	50.77	47	100	V	33.166	5.151	36.4	52.687	74	-21.313	Peak
4924	48.65	246	100	H	33.166	5.151	36.4	50.567	74	-23.433	Peak
4924	43.74	47	100	V	33.166	5.151	36.4	45.657	54	-8.343	Ave
4924	36.9	246	100	H	33.166	5.151	36.4	38.817	54	-15.183	Ave
7386	45.38	0	100	V	36.327	6.717	36.61	51.814	74	-22.186	Peak
7386	44.77	0	100	H	36.327	6.717	36.61	51.204	74	-22.796	Peak
7386	31.33	0	100	V	36.327	6.717	36.61	37.764	54	-16.236	Ave
7386	31.37	0	100	H	36.327	6.717	36.61	37.804	54	-16.196	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	72.03	246	100	V	28.341	3.358	0	103.729	-	-	Peak/Fund
2412	78.29	49	110	H	28.341	3.358	0	109.989	-	-	Peak/Fund
2412	61.61	246	100	V	28.341	3.358	0	93.309	-	-	Ave/Fund
2412	68.04	49	110	H	28.341	3.358	0	99.739	-	-	Ave/Fund
2390	35.76	246	100	V	28.341	3.358	0	67.459	74	-6.541	Peak
2390	41.65	49	110	H	28.341	3.358	0	73.349	74	-0.651	Peak
2390	15.65	246	100	V	28.341	3.358	0	47.349	54	-6.651	Ave
2390	20.15	49	110	H	28.341	3.358	0	51.849	54	-2.151	Ave
4824	50.12	46	101	V	32.871	5.231	36.45	51.772	74	-22.228	Peak
4824	50.52	22	100	H	32.871	5.231	36.45	52.172	74	-21.828	Peak
4824	42.67	46	101	V	32.871	5.231	36.45	44.322	54	-9.678	Ave
4824	42.25	22	100	H	32.871	5.231	36.45	43.902	54	-10.098	Ave
7236	45.8	0	100	V	35.7	6.829	36.68	51.649	83.729	-32.08	Peak
7236	46.09	0	100	H	35.7	6.829	36.68	51.939	89.989	-38.05	Peak
7236	31.63	0	100	V	35.7	6.829	36.68	37.479	73.309	-35.83	Ave
7236	31.8	0	100	H	35.7	6.829	36.68	37.649	79.739	-42.09	Ave
802.11n-HT20, Middle Channel 2437 MHz											
2437	72.5	110	100	V	28.341	3.591	0	104.432	-	-	Peak/Fund
2437	77	49	112	H	28.341	3.591	0	108.932	-	-	Peak/Fund
2437	62.11	110	100	V	28.341	3.591	0	94.042	-	-	Ave/Fund
2437	66.63	49	112	H	28.341	3.591	0	98.562	-	-	Ave/Fund
4874	49.79	45	100	V	33.166	5.169	36.34	51.785	74	-22.215	Peak
4874	49.32	54	100	H	33.166	5.169	36.34	51.315	74	-22.685	Peak
4874	40.52	45	100	V	33.166	5.169	36.34	42.515	54	-11.485	Ave
4874	39.87	54	100	H	33.166	5.169	36.34	41.865	54	-12.135	Ave
7311	45.8	0	100	V	36.134	6.907	36.69	52.151	74	-21.849	Peak
7311	46.18	0	100	H	36.134	6.907	36.69	52.531	74	-21.469	Peak
7311	31.46	0	100	V	36.134	6.907	36.69	37.811	54	-16.189	Ave
7311	31.34	0	100	H	36.134	6.907	36.69	37.691	54	-16.309	Ave
9748	45.51	0	100	V	37.908	8.35	37.03	54.738	84.432	-29.694	Peak
9748	45.75	0	100	H	37.908	8.35	37.03	54.978	88.932	-33.954	Peak
9748	31.74	0	100	V	37.908	8.35	37.03	40.968	74.042	-33.074	Ave
9748	31.78	0	100	H	37.908	8.35	37.03	41.008	78.562	-37.554	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	71.1	247	100	V	28.373	3.642	0	103.115	-	-	Peak/Fund
2462	76.78	48	108	H	28.373	3.642	0	108.795	-	-	Peak/Fund
2462	60.56	247	100	V	28.373	3.642	0	92.575	-	-	Ave/Fund
2462	66.63	48	108	H	28.373	3.642	0	98.645	-	-	Ave/Fund
2483.5	33.21	247	100	V	28.373	3.642	0	65.225	74	-8.775	Peak
2483.5	40.74	48	108	H	28.373	3.642	0	72.755	74	-1.245	Peak
2483.5	15.02	247	100	V	28.373	3.642	0	47.035	54	-6.965	Ave
2483.5	20.04	48	108	H	28.373	3.642	0	52.055	54	-1.945	Ave
4924	51.02	45	100	V	33.166	5.151	36.4	52.937	74	-21.063	Peak
4924	49.76	41	112	H	33.166	5.151	36.4	51.677	74	-22.323	Peak
4924	44.36	45	100	V	33.166	5.151	36.4	46.277	54	-7.723	Ave
4924	43.03	41	112	H	33.166	5.151	36.4	44.947	54	-9.053	Ave
7386	45.55	0	100	V	36.327	6.717	36.61	51.984	74	-22.016	Peak
7386	45.26	0	100	H	36.327	6.717	36.61	51.694	74	-22.306	Peak
7386	31.26	0	100	V	36.327	6.717	36.61	37.694	54	-16.306	Ave
7386	31.34	0	100	H	36.327	6.717	36.61	37.774	54	-16.226	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 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 2014-04-10 in RF Test Site.

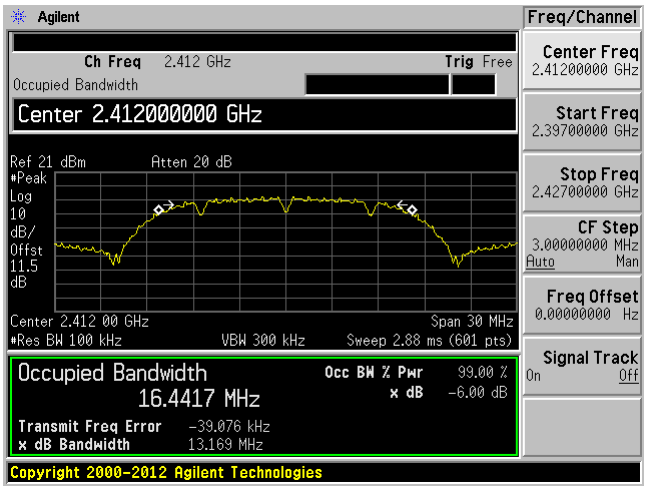
9.5 Test Results

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
802.11b mode					
Low	2412	13.169	16.4417	>0.5	Compliant
Middle	2437	13.175	16.4299	>0.5	Compliant
High	2462	13.182	16.4264	>0.5	Compliant
802.11g mode					
Low	2412	16.487	16.4084	>0.5	Compliant
Middle	2437	16.492	16.4025	>0.5	Compliant
High	2462	16.517	16.4056	>0.5	Compliant
802.11n-HT20 mode					
Low	2412	17.576	17.4838	>0.5	Compliant
Middle	2437	17.574	17.4725	>0.5	Compliant
High	2462	17.336	17.4797	>0.5	Compliant

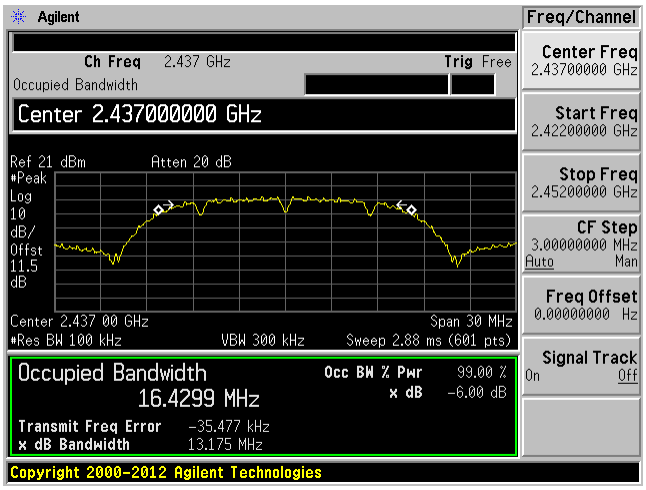
Please refer to the following plots for detailed test results

802.11b mode

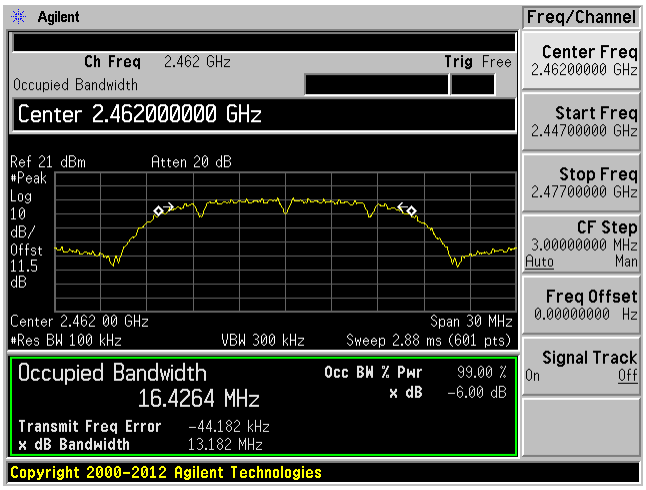
Low channel: 2412 MHz



Middle channel: 2437 MHz

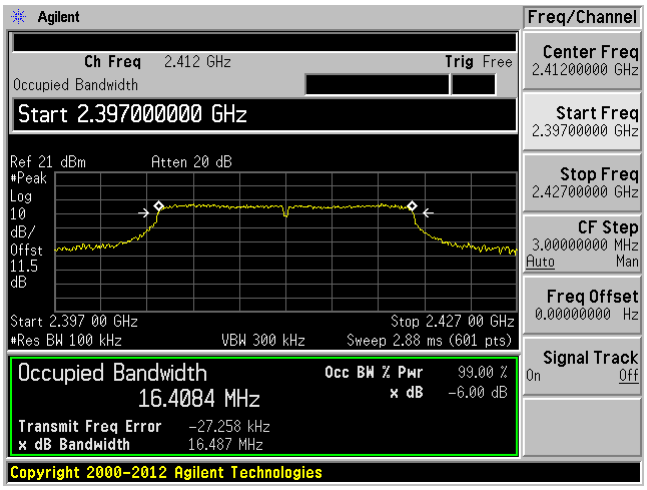


High channel: 2462 MHz

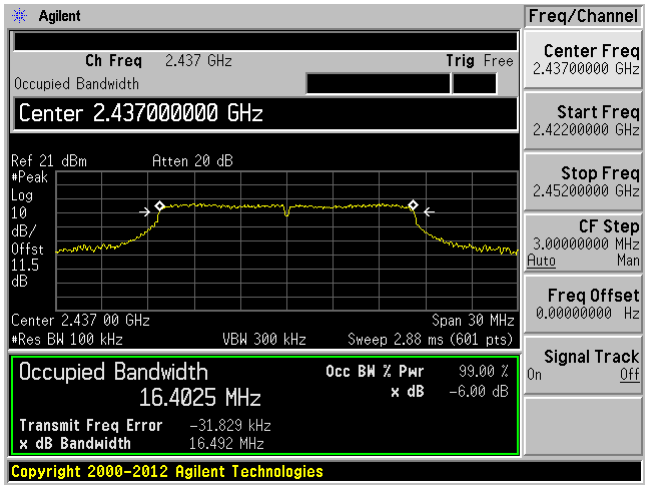


802.11g mode

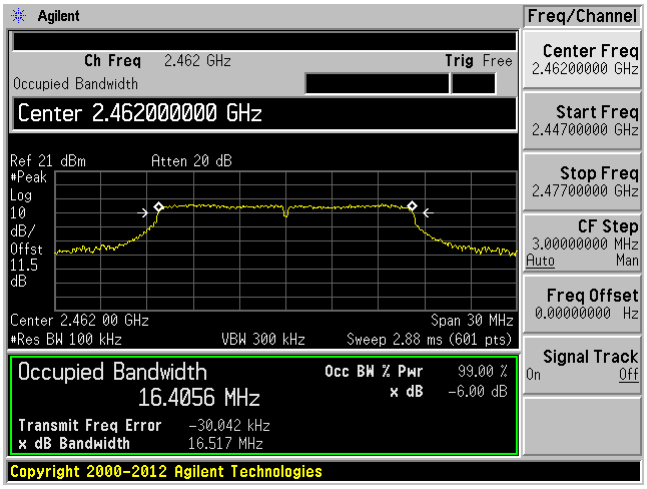
Low channel: 2412 MHz



Middle channel: 2437 MHz

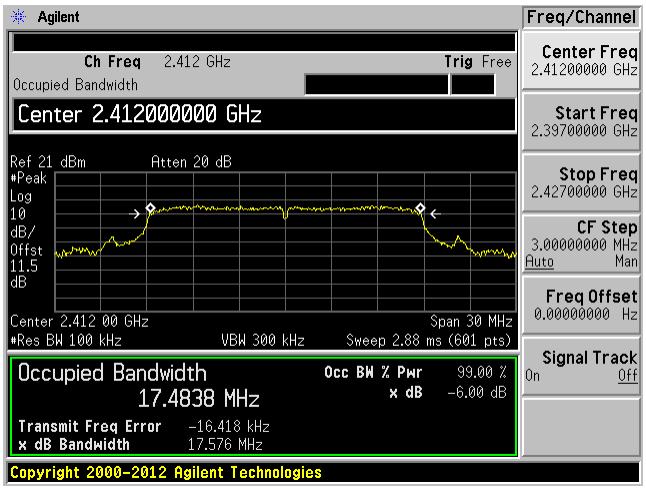


High channel: 2462 MHz

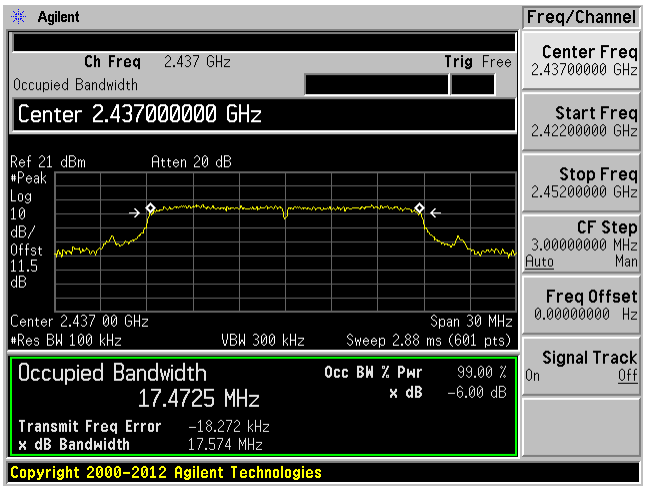


802.11n-HT20 mode

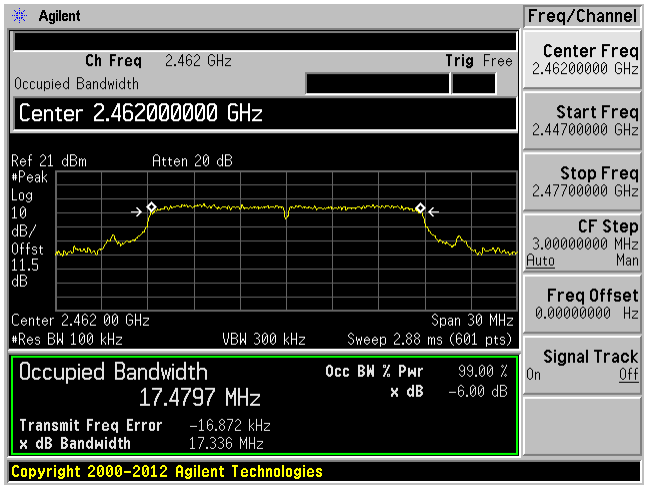
Low channel: 2412 MHz



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 Standards

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 2014-04-10 in RF Test Site.

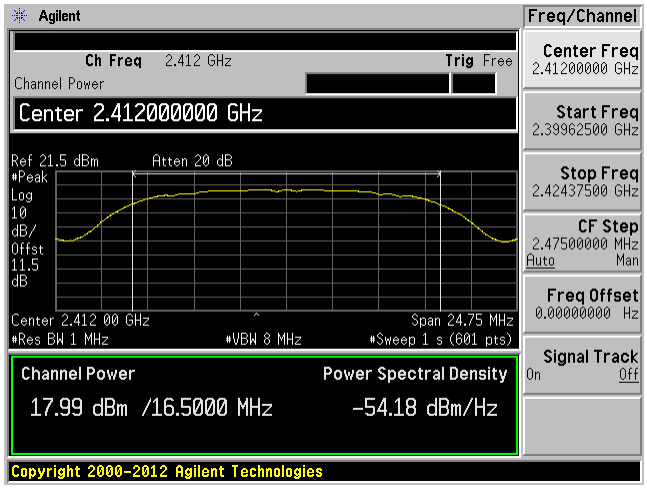
10.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	FCC/IC Limit (dBm)	Margin (dB)	Power Settings
802.11b mode					
Low	2412	17.99	30	-12.01	19
Middle	2437	18.17	30	-11.83	20
High	2462	16.74	30	-13.26	19
802.11g mode					
Low	2412	19.77	30	-10.23	24
Middle	2437	19.33	30	-10.67	24
High	2462	18.80	30	-11.20	24
802.11n-HT20 mode					
Low	2412	18.90	30	-11.10	23
Middle	2437	19.36	30	-10.64	24
High	2462	18.94	30	-11.06	24

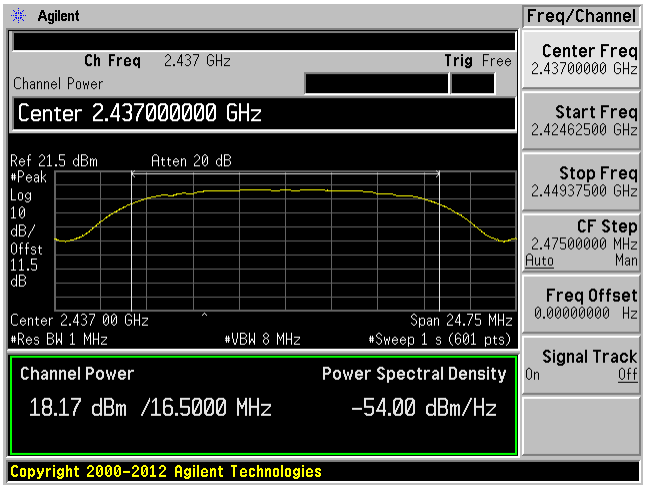
Please refer to the Plots below:

802.11b mode

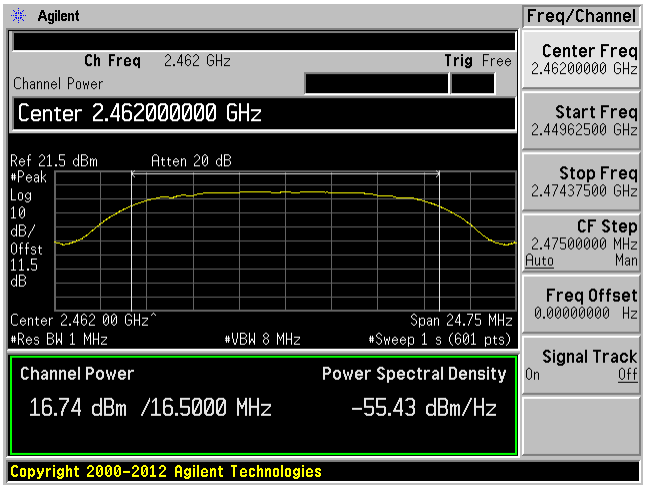
Low channel: 2412 MHz



Middle channel: 2437 MHz

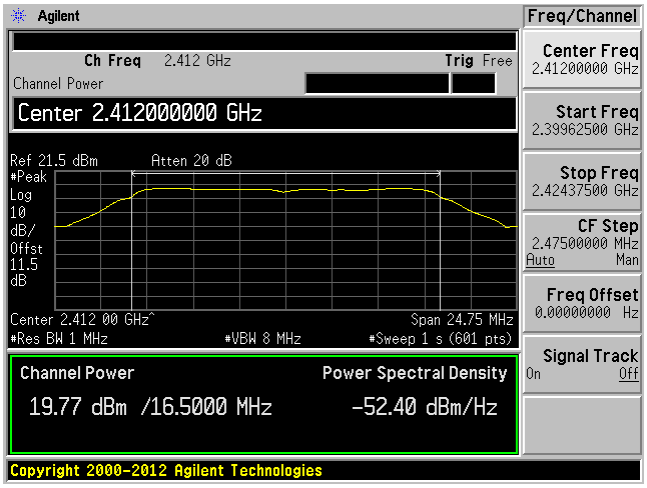


High channel: 2462 MHz

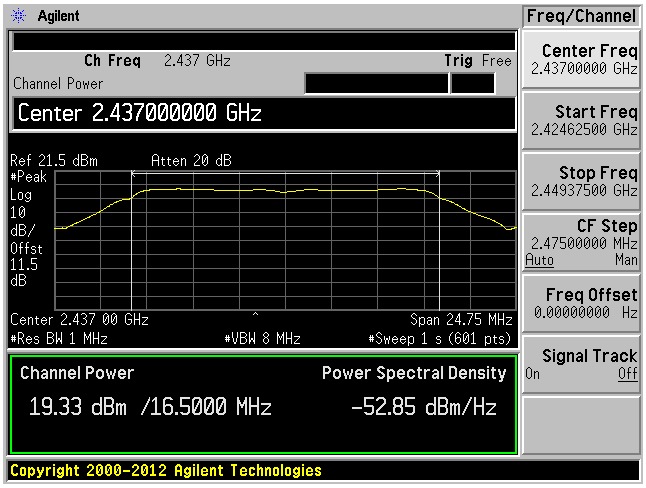


802.11g mode

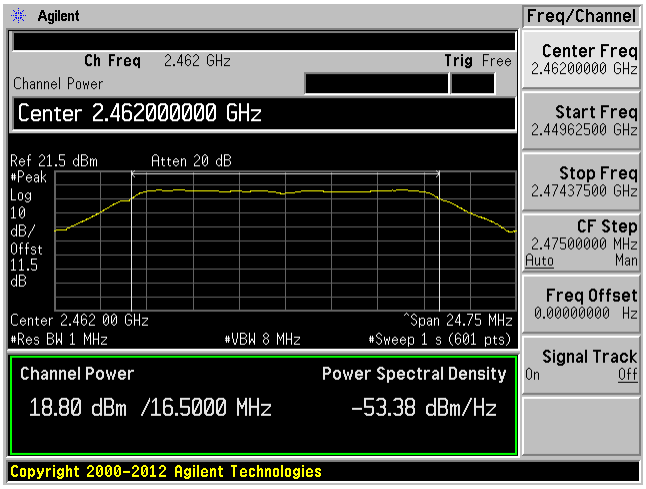
Low channel: 2412 MHz



Middle channel: 2437 MHz

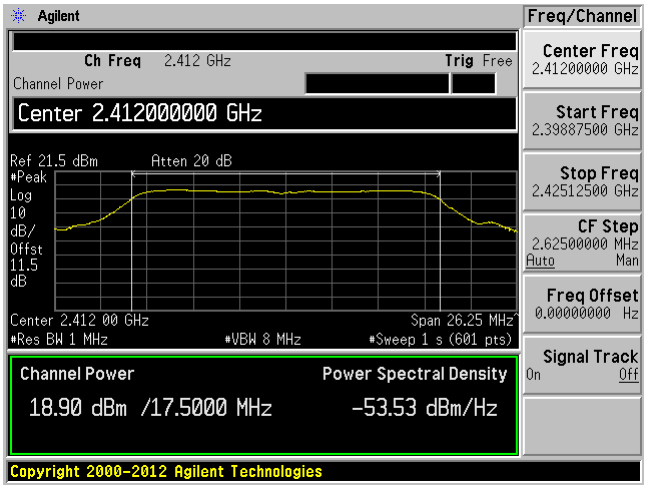


High channel: 2462 MHz

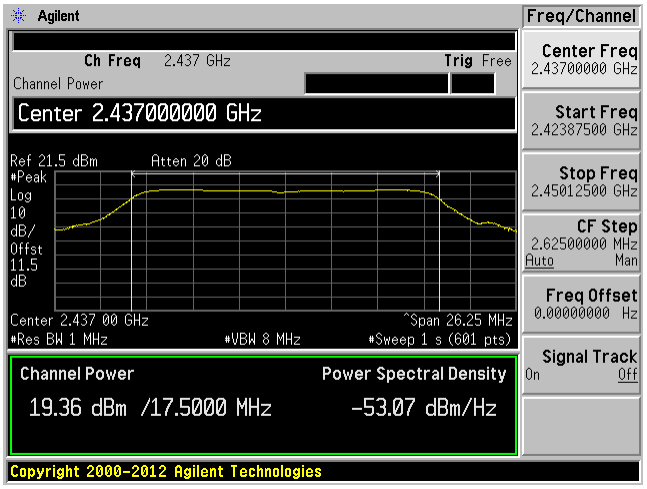


802.11n-HT20 mode

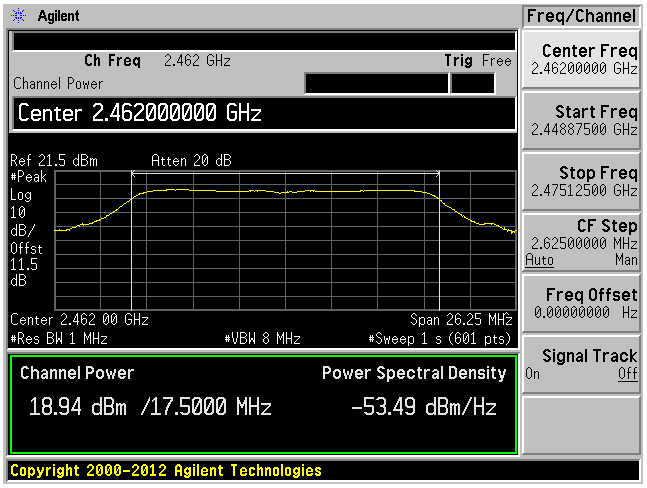
Low channel: 2412 MHz



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 Standards

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 based 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

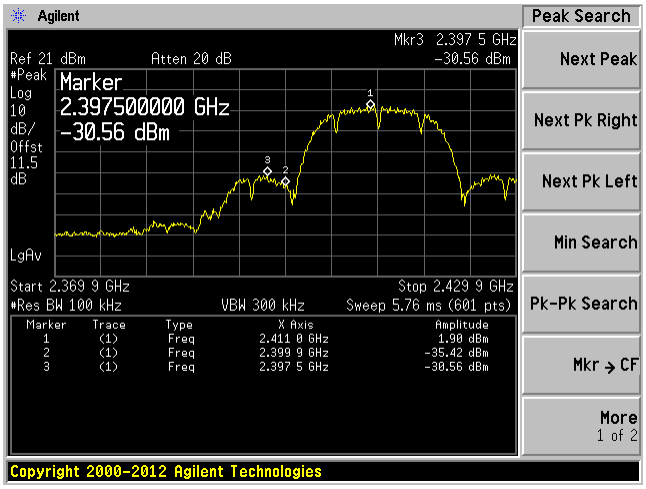
The testing was performed by Glenn Escano on 2014-04-10 in RF Test Site.

11.5 Test Results

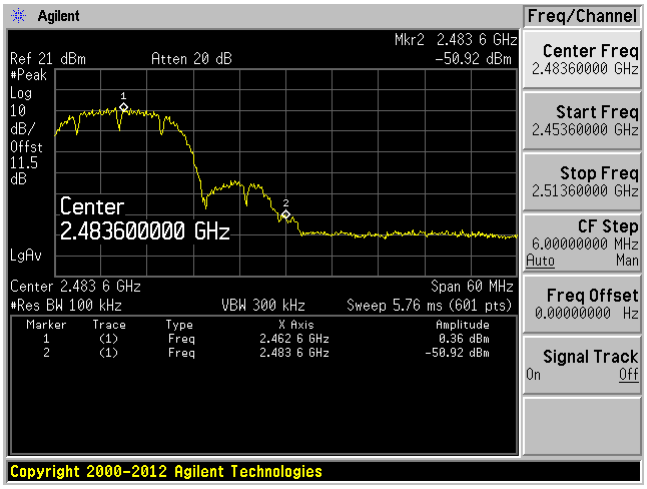
Please refer to following pages for plots of band edge.

802.11b Mode

Low Channel Band Edge

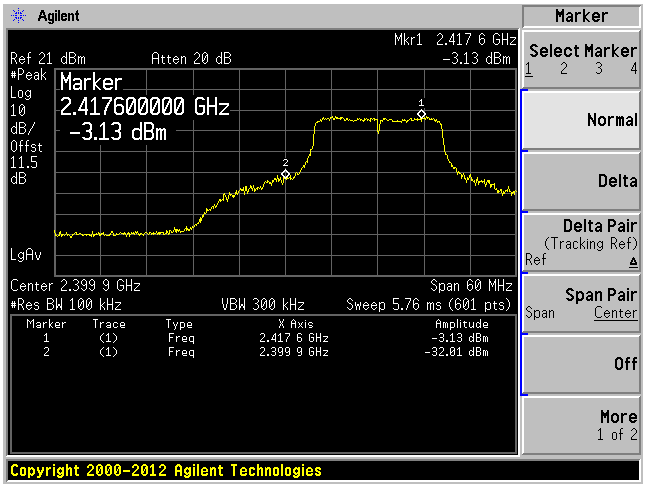


High Channel Band Edge

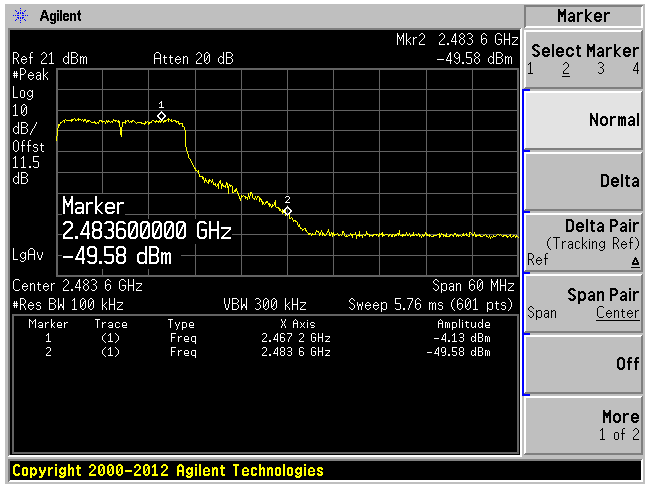


802.11g Mode

Low Channel Band Edge

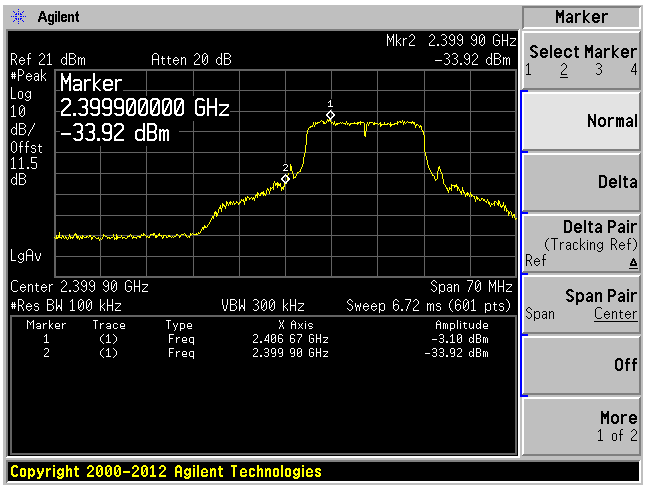


High Channel Band Edge

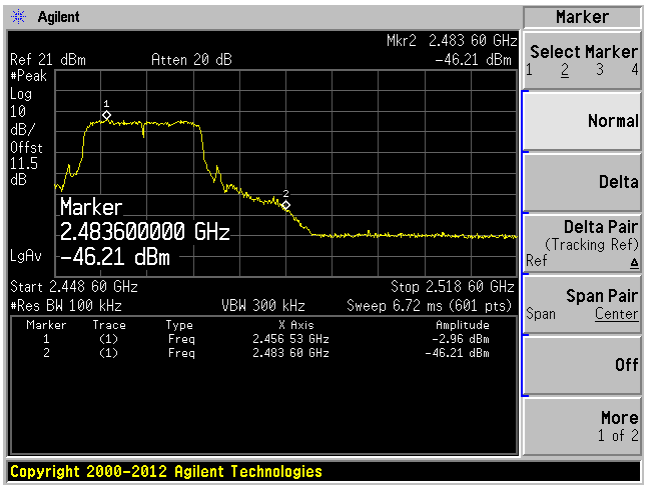


802.11n-HT20 Mode

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 Standards

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 Measurement 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 2014-04-10 in RF Test Site.

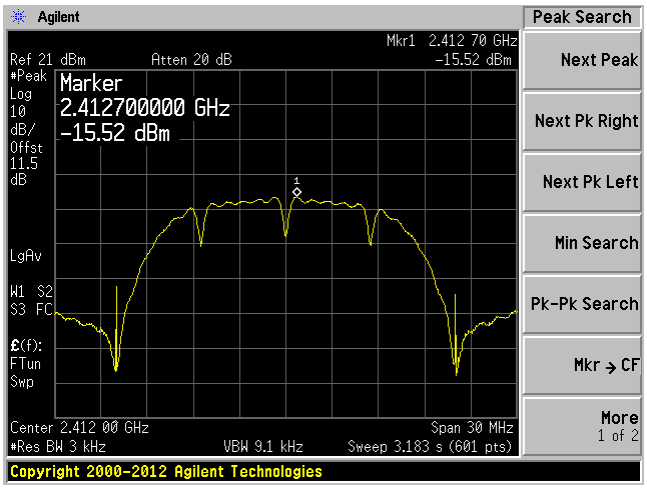
12.5 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm)	FCC/IC Limit (dBm)	Margin (dB)
802.11b mode				
Low	2412	-15.52	8	-23.52
Mid	2437	-15.46	8	-23.46
High	2462	-16.35	8	-24.35
802.11g mode				
Low	2412	-17.76	8	-25.76
Mid	2437	-17.67	8	-25.67
High	2462	-17.81	8	-25.81
802.11n-HT20 mode				
Low	2412	-17.79	8	-25.79
Mid	2437	-16.97	8	-24.97
High	2462	-16.28	8	-24.28

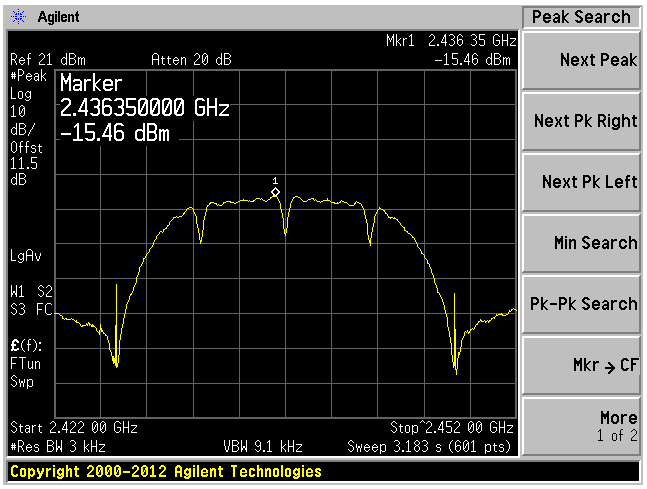
Please refer to the following plots for detailed test results:

802.11b mode

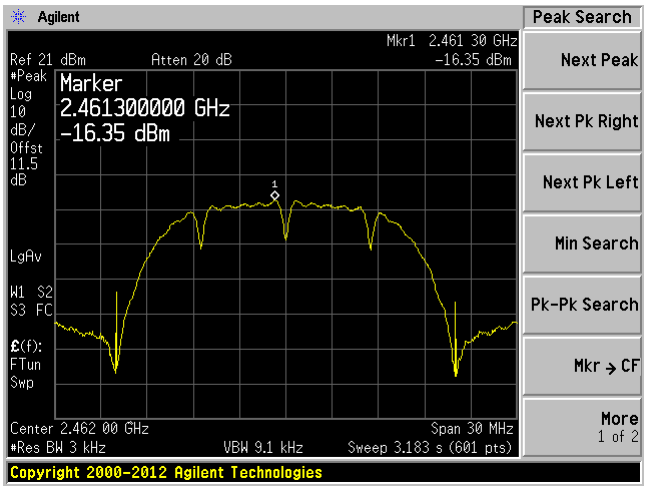
Low channel: 2412 MHz



Middle channel: 2437 MHz

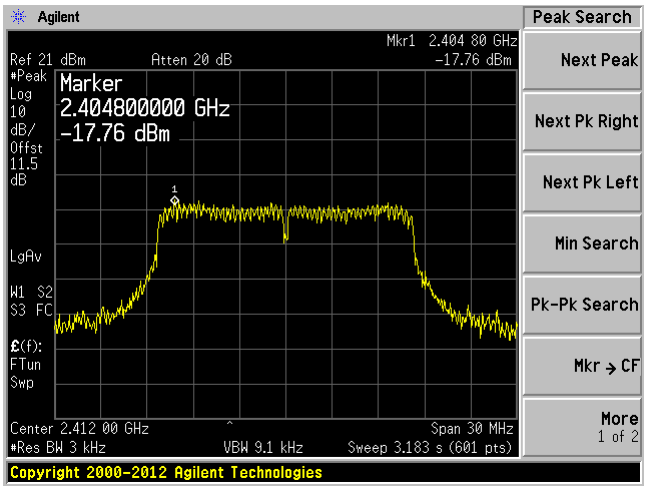


High channel: 2462 MHz

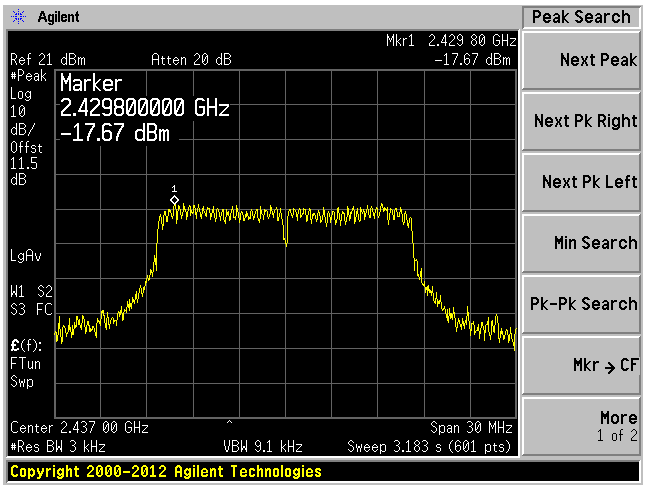


802.11g mode

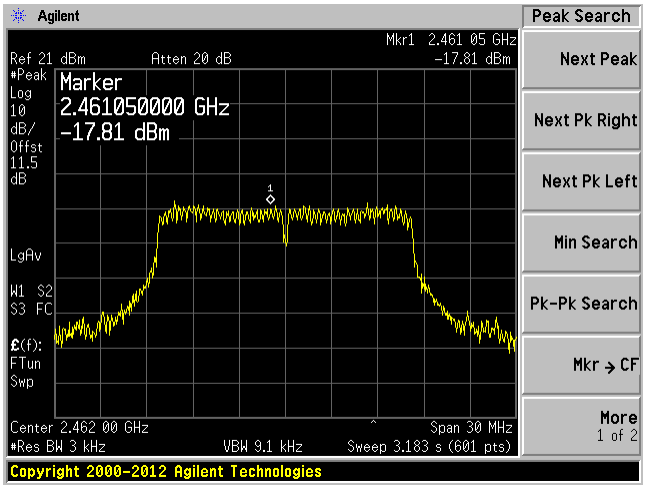
Low channel: 2412 MHz



Middle channel: 2437 MHz

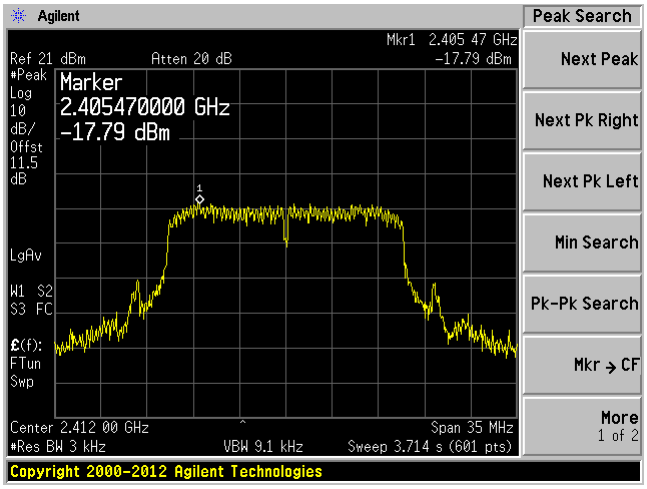


High channel: 2462 MHz

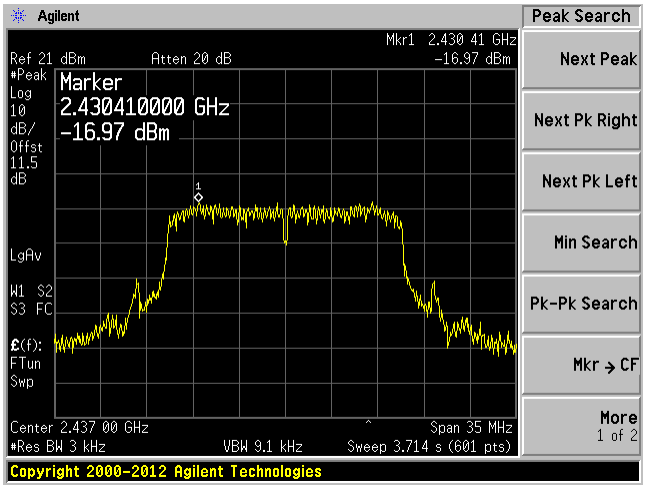


802.11n-HT20 mode

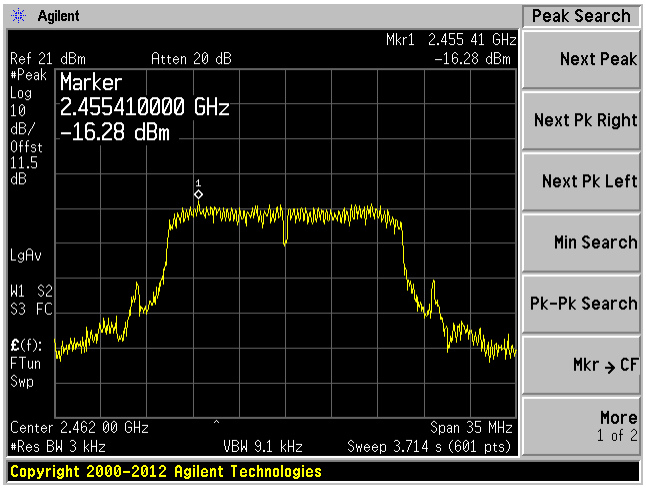
Low channel: 2412 MHz



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 Standards

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 Lists 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.

13.6 Test Environmental Conditions

Temperature:	22° C
Relative Humidity:	42 %
ATM Pressure:	101.69 kPa

The testing was performed by Glenn Escano on 2014-04-11 in 5m chamber 3.

13.7 Summary of Test Results

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

With Dipole Antenna (2 dBi)

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-13.66	62.9935	Vertical	30-1000
-19.348	7152	Vertical	1000-25,000

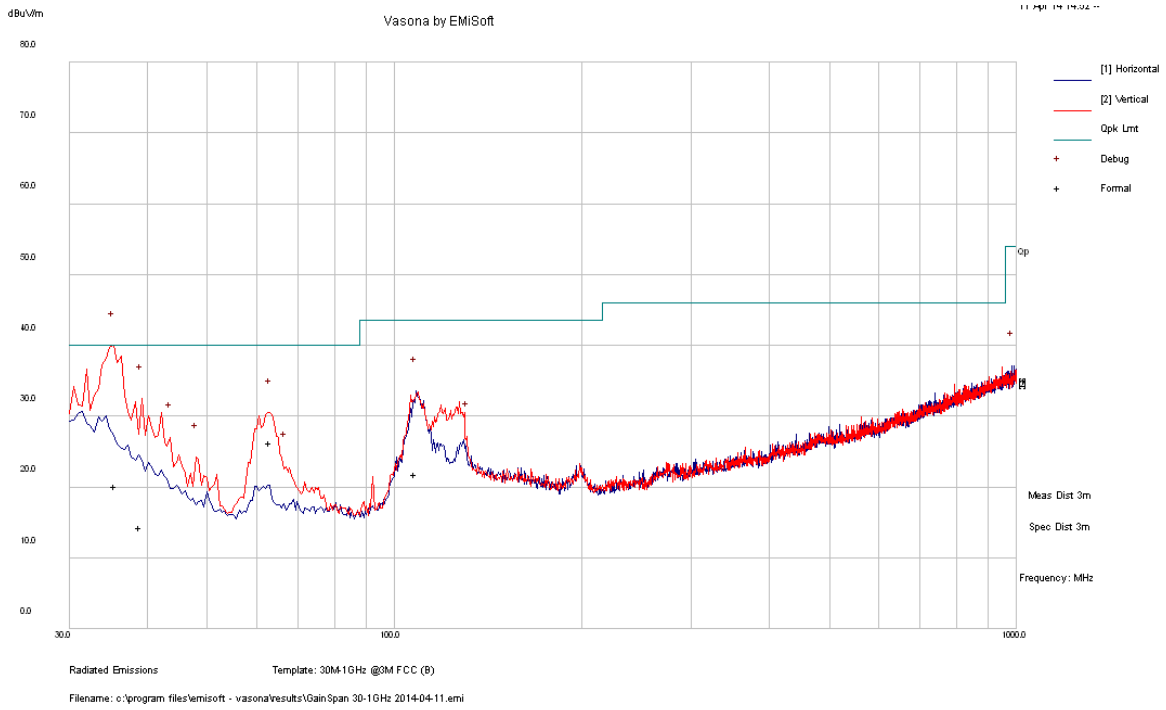
With PCB Antenna (1 dBi)

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-16.56	62.94225	Vertical	30-1000
-19.408	7152	Horizontal	1000-25,000

13.8 Test Results

With Dipole Antenna (2 dBi)

1) 30-1000 MHz, Measured at 3 meters



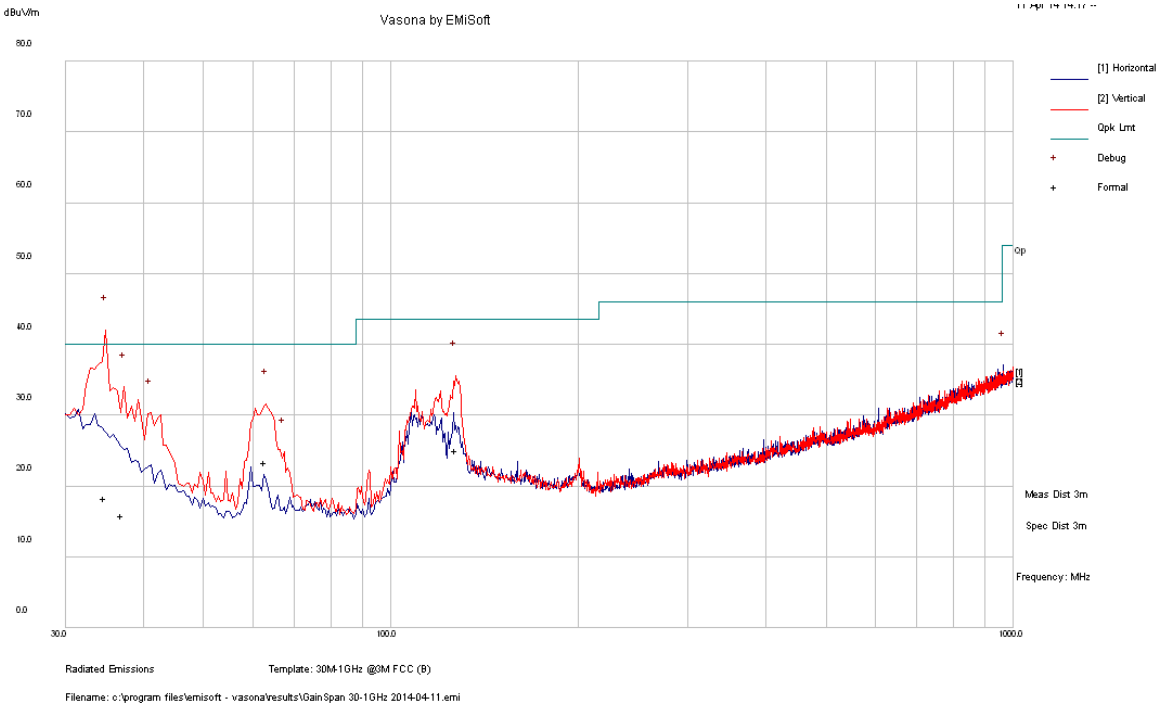
Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (PK/QP/Ave.)
62.9935	26.34	120	V	28	40	-13.66	QP
35.4855	20.21	235	V	50	40	-19.79	QP
108.007	21.87	232	H	187	43.5	-21.63	QP
39.01775	14.32	278	V	76	40	-25.68	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)	Detector (PK/QP/Ave.)
2327	51.24	100	V	0	74	-22.76	Peak
2327	51.56	100	H	0	74	-22.44	Peak
2327	33.03	100	V	0	54	-20.97	Ave
2327	34.55	100	H	0	54	-19.45	Ave
3511	47.12	100	V	0	74	-26.88	Peak
3511	46.98	100	H	0	74	-27.02	Peak
3511	32.96	100	V	0	54	-21.04	Ave
3511	32.9	100	H	0	54	-21.1	Ave
7152	48.682	100	V	0	74	-25.318	Peak
7152	48.852	100	H	0	74	-25.148	Peak
7152	34.652	100	V	0	54	-19.348	Ave
7152	34.622	100	H	0	54	-19.378	Ave

With PCB Antenna (1 dBi)

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.)
62.94225	23.44	245	V	31	40	-16.56	QP
127.1583	25.07	161	V	269	43.5	-18.43	QP
34.77	18.35	161	V	112	40	-21.65	QP
37.044	15.92	124	V	95	40	-24.08	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)	Detector (PK/QP/Ave.)
2327	50.08	100	V	0	74	-23.92	Peak
2327	51.13	100	H	0	74	-22.87	Peak
2327	33.6	100	V	0	54	-20.4	Ave
2327	34.51	100	H	0	54	-19.49	Ave
3511	46.74	100	V	0	74	-27.26	Peak
3511	46.64	100	H	0	74	-27.36	Peak
3511	32.93	100	V	0	54	-21.07	Ave
3511	32.87	100	H	0	54	-21.13	Ave
7152	48.552	100	V	0	74	-25.448	Peak
7152	48.972	100	H	0	74	-25.028	Peak
7152	34.532	100	V	0	54	-19.468	Ave
7152	34.592	100	H	0	54	-19.408	Ave