Lab Code: 200167-0

FCC PART 15 SUBPART C
IC RSS-210 ISSUE 8, DEC 2010
TEST AND MEASUREMENT REPORT

For

Westell Inc.

750 N. Common Drive,

Aurora, IL 60504, USA

FCC ID: CH8HC02
IC: 619A-HC02

Report Type:	**Product Type:**
CIIPC	802.11b/g/n 2.4 GHz Module

Test Engineer:	Jack Liu
Report Number:	R1106201-247
Report Date:	2012-05-03
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1106201-247	Original Report	2012-05-03

1 General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Westell Inc.* and their product, *model: AR5B97, FCC ID: CH8HC02, IC: 619A-HC02* or the "EUT" as referred to this report. The EUT is an 802.11 b/g/n module operates in 2.4 GHz ISM band.

1.2 Mechanical Description of EUT

The EUT measures approximately 30mm (L) x 27mm (W) x 3.75mm (H) and weighs approximately 3.5 g.

The data gathered are from a typical production sample provided by the manufacturer with Serial Number E244417 provided by Westell Inc.

1.3 Objective

This report is prepared on behalf of *Westell Inc.* 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.

This CIIPC is for adding the higher gain antenna which described in Section 4 of this report and the evaluation the co-location with other module (FCC ID: CH8HC05) in Westell host (Model: A90-8300DHM-00).

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 C63.4-2003

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

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 C63.4-2003, 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.: R-3729, C-4176, G-469, and T-1206. 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 a National Institute of Standards and Technology (NIST) accredited laboratory under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2001670.htm

2 System Test Configuration

2.1 Justification

The system was configured for testing in accordance with ANSI C63.4-2003.

The EUT was tested in the testing mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The software used, was provided by client and verified by Jack Liu to comply with the standard requirements being tested against.

2.3 Special Accessories

N/A.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
DELL	Laptop	PP18L	-

2.6 Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
CUI Inc.	AC/DC Adapter	3A-161WU05A	-

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RF Cable	< 1	EUT	Spectrum Analyzer
RJ 45	1	EUT	Laptop
USB	1	EUT	Laptop

2.8 Internal Parts List and Details

Manufacturers	Descriptions	Models	Serial Numbers
Qualcomm Atheros	Controller Board	250-01139-050	AR5BTB-00039A
Qualcomm Atheros	Supporting Board	PB92-021-D0685	AR5BPB-0092BA
Airgain	Antenna	M2445J	-

3 Summary of Test Results

FCC & IC Rules	Description of Test	Result
FCC §15.247 (i), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirements	Compliant
FCC §15.207 (a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	N/A[1]
FCC §15.247(d) IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205, §15.209, §15.247(d) IC RSS-210 §2.2, §A8.5	Restricted Bands, Spurious Radiated Emissions	Compliant
FCC §15.247 (a)(2) IC RSS-210 §A8.2 (a)	99% & 6 dB Channel Bandwidth	N/A[1]
FCC §15.247(b)(2) IC RSS-210 §A8.4 (1)	Maximum Peak Output Power	N/A[1]
FCC §15.247(d) IC RSS-210 §A8.5	Band Edge	N/A[1]
FCC §15.247(e) IC RSS-210 §A8.2(a)	Power Spectral Density	N/A[1]
FCC Part 15.109 IC RSS-Gen §6	Receiver Spurious Emission	Compliant

Note 1: share with share with FCC ID: CH8HC02 and IC: 619A-HC02.

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

4.1 Applicable Standard

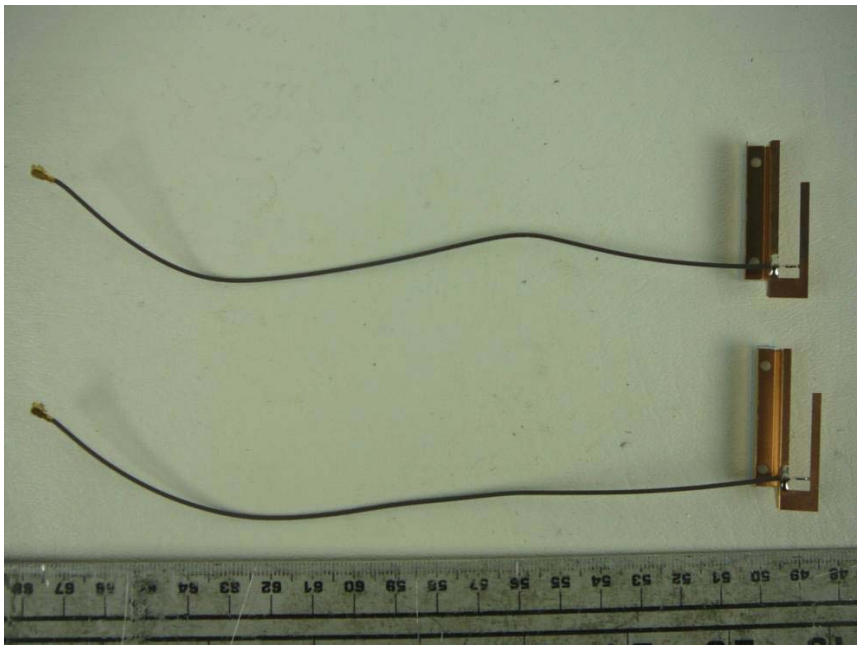
For intentional device, according to FCC Part §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

Per IC RSS-Gen §7.1.2, A transmitter can only be sold or operated with antennas with which it was certified. A transmitter maybe 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 IC RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to IC RSS-210 Annex 8 or RSS-210 Annex 9, the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to IC RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

4.2 Result

The EUT has maximum gain of 4.5 dBi antenna, which in accordance to sections FCC Part 15.203 and IC RSS-Gen §7.1.2, is considered sufficient to comply with the provisions of these sections. Please refer to the EUT photos.



5 FCC §15.205, §15.209, §15.247(d) & IC RSS-210 §2.2, §A8.5 – Spurious Radiated Emissions

5.1 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.

5.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15C 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.

5.3 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

5.4 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 the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, the Corrected Amplitude (CA) of 40.3 dBuV/m = indicated Amplitude reading (Ai) 32.5 dBuV + Antenna Factor (AF) 23.5dB + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 dB - Amplifier Gain (Ga) 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

5.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
A.H Systems	Antenna, Horn	SAS-200/571	261	2010-12-21
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2011-06-09
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2010-08-10
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2011-03-21
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Agilent	PSA Spectrum Analyzer	E4440A	MY44303352	2011-05-10
HP	Pre-amplifier	8449B	3147A00400	2011-02-03

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

5.6 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	33 %
ATM Pressure:	101.7kPa

The testing was performed by Jack Liu on 2011-06-27 in 5 meter chamber2.

5.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15C and IC RSS-210 standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz: n 40 MHz mode Middle Channel

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-0.18	399.98825	Horizontal	Mid, 30 MHz– 1 GHz

Above 1 GHz: b mode Middle Channel

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-1.55	4874	Horizontal	High, 1GHz – 25GHz

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

5.8 Radiated Emissions Test Result Data

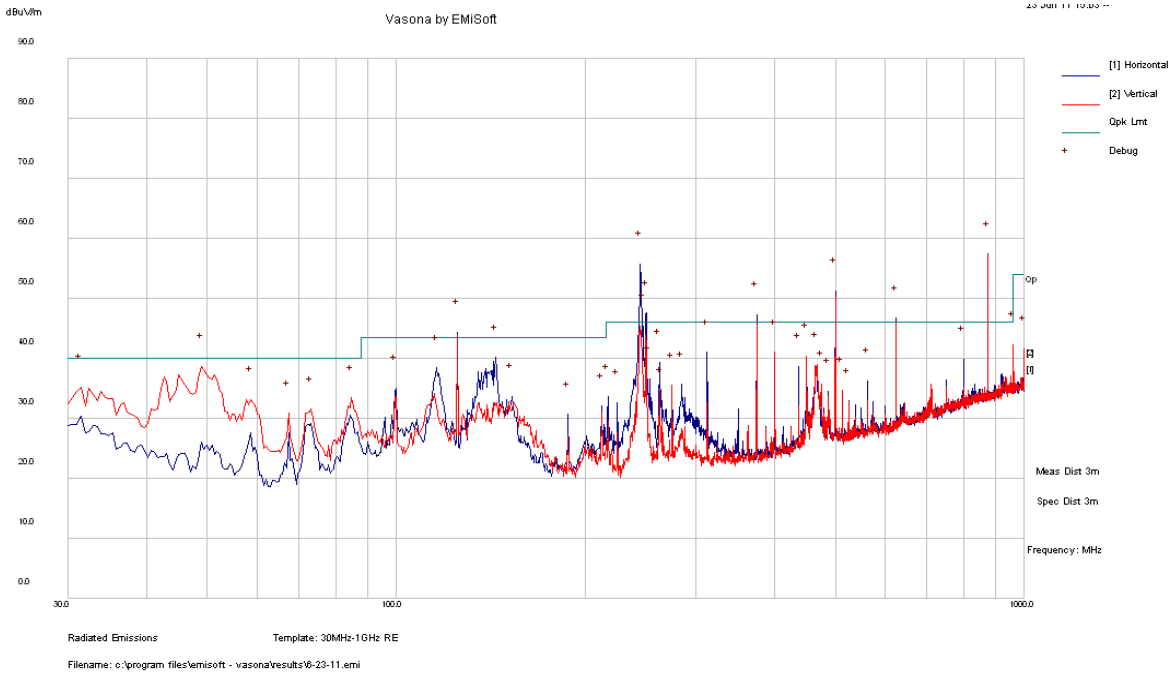
1) Below 1 GHz, Radiated Spurious Emissions Measured at 3 meters

(a) Stand Alone Worst Case: 802.11n 40 MHz Mode, Middle Channel

Frequency (MHz)	**Corrected Amplitude (dB)**	**Antenna Height (cm)**	**Antenna Polarity (H/V)**	**Turntable Azimuth (degrees)**	**Limit (dBµV/m)**	**Margin (dB)**
156.0955	42.49	145	V	268	43.5	-1.01
204.131	39.57	113	V	20	43.5	-3.93
399.9883	45.82	214	H	122	46	-0.18
96.0445	40.34	401	H	371	43.5	-3.16
216.1135	41.25	401	H	370	46	-4.75
750.0038	41.57	119	H	68	46	-4.43

(b) Co-located with FCC ID: CH8HC05

Worst Case: CH8HC02: 802.11b Mode CH 6 with CH8HC05 5 GHz CH 40 802.11n HT20



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
144.056	40.11	200	H	0	43.5	-3.39
31.455	35.27	100	V	0	40	-4.73
400.055	41.02	100	V	0	46	-4.98
312.27	41	100	H	0	46	-5.00
115.845	38.42	300	H	0	43.5	-5.08
49.0845	31.96	138	V	65	40	-8.04

2) Above 1 GHz, Radiated Spurious Emissions Measured at 3 meters

802.11 b 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)											
4824	45	241	211	V	32.9	5.53	27.4	56.03	74	-17.97	Peak
4824	43.64	181	100	H	32.9	5.53	27.4	54.67	74	-19.33	Peak
4824	38.03	241	211	V	32.9	5.53	27.4	49.06	54	-4.94	Ave
4824	38.31	181	100	H	32.9	5.53	27.4	49.34	54	-4.66	Ave
Middle Channel (2437 MHz)											
4874	45.54	34	100	V	32.9	5.53	27.4	56.57	74	-17.43	Peak
4874	46.6	217	100	H	32.9	5.53	27.4	57.63	74	-16.37	Peak
4874	40.98	34	100	V	32.9	5.53	27.4	52.01	54	-1.99	Ave
4874	41.82	217	100	H	32.9	5.53	27.4	52.85	54	-1.15	Ave
High Channel (2462 MHz)											
4924	42.54	34	100	V	33.4	5.53	27.4	54.07	74	-19.93	peak
4924	43.26	312	100	H	33.4	5.53	27.4	54.79	74	-19.21	peak
4924	37	34	100	V	33.4	5.53	27.4	48.53	54	-5.47	Ave
4924	36.89	312	100	H	33.4	5.53	27.4	48.42	54	-5.58	Ave

802.11 g 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)											
4824	49.54	37	102	V	32.9	5.53	27.4	60.57	74	-13.43	Peak
4824	43.89	219	100	H	32.9	5.53	27.4	54.92	74	-19.08	Peak
4824	32.46	37	102	V	32.9	5.53	27.4	43.49	54	-10.51	Ave
4824	30.06	219	100	H	32.9	5.53	27.4	41.09	54	-12.91	Ave
Middle Channel (2437 MHz)											
4874	48.68	34	126	V	32.9	5.53	27.4	59.71	74	-14.29	Peak
4874	46.33	219	100	H	32.9	5.53	27.4	57.36	74	-16.64	Peak
4874	32.75	34	126	V	32.9	5.53	27.4	43.78	54	-10.22	Ave
4874	31.98	219	100	H	32.9	5.53	27.4	43.01	54	-10.99	Ave
High Channel (2462 MHz)											
4924	44.98	39	186	V	33.4	5.53	27.4	56.51	74	-17.49	Peak
4924	44.36	312	100	H	33.4	5.53	27.4	55.89	74	-18.11	Peak
4924	30.92	39	186	V	33.4	5.53	27.4	42.45	54	-11.55	Ave
4924	30.11	312	100	H	33.4	5.53	27.4	41.64	54	-12.36	Ave

802.11 n 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)											
4824	48.21	33	122	V	32.9	5.53	27.4	59.24	74	-14.76	Peak
4824	44.1	220	100	H	32.9	5.53	27.4	55.13	74	-18.87	Peak
4824	31.18	33	122	V	32.9	5.53	27.4	42.21	54	-11.79	Ave
4824	29.02	220	100	H	32.9	5.53	27.4	40.05	54	-13.95	Ave
Middle Channel (2437 MHz)											
4874	48.51	88	103	V	32.9	5.53	27.4	59.54	74	-14.46	Peak
4874	47.08	189	100	H	32.9	5.53	27.4	58.11	74	-15.89	Peak
4874	32.9	88	103	V	32.9	5.53	27.4	43.93	54	-10.07	Ave
4874	29.51	189	100	H	32.9	5.53	27.4	40.54	54	-13.46	Ave
High Channel (2462 MHz)											
4924	45.47	34	132	V	33.4	5.53	27.4	57	74	-17	Peak
4924	44.15	310	100	H	33.4	5.53	27.4	55.68	74	-18.32	Peak
4924	29.22	34	132	V	33.4	5.53	27.4	40.75	54	-13.25	Ave
4924	28.61	310	100	H	33.4	5.53	27.4	40.14	54	-13.86	Ave

802.11 n HT40 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 (2422 MHz)											
4844	44.65	38	119	V	32.9	5.53	27.4	55.68	74	-18.32	Peak
4844	41.85	218	100	H	32.9	5.53	27.4	52.88	74	-21.12	Peak
4844	29.07	38	119	V	32.9	5.53	27.4	40.1	54	-13.9	Ave
4844	28.05	218	100	H	32.9	5.53	27.4	39.08	54	-14.92	Ave
Middle Channel (2437 MHz)											
4874	44.55	36	121	V	32.9	5.53	27.4	55.58	74	-18.42	Peak
4874	42.73	218	100	H	32.9	5.53	27.4	53.76	74	-20.24	Peak
4874	29.44	36	121	V	32.9	5.53	27.4	40.47	54	-13.53	Ave
4874	29.75	218	100	H	32.9	5.53	27.4	40.78	54	-13.22	Ave
High Channel (2452 MHz)											
4904	43.65	86	102	V	33.4	5.53	27.4	55.18	74	-18.82	Peak
4904	42.64	310	100	H	33.4	5.53	27.4	54.17	74	-19.83	Peak
4904	28.53	86	102	V	33.4	5.53	27.4	40.06	54	-13.94	Ave
4904	28.35	310	100	H	33.4	5.53	27.4	39.88	54	-14.12	Ave

3) Restricted Bands

802.11 b 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)											
2390	37.25	231	116	V	27.8	3.01	27.8	40.26	74	-33.74	Peak
2390	37.77	168	133	H	27.8	3.01	27.8	40.78	74	-33.22	Peak
2390	23.61	231	116	V	27.8	3.01	27.8	26.62	54	-27.38	Ave
2390	23.58	168	133	H	27.8	3.01	27.8	26.59	54	-27.41	Ave
High Channel (2462 MHz)											
2483.5	46.48	240	107	V	28.5	3.21	27.9	50.29	74	-23.71	Peak
2483.5	51.18	176	132	H	28.5	3.21	27.9	54.99	74	-19.01	Peak
2483.5	35.56	240	107	V	28.5	3.21	27.9	39.37	54	-14.63	Ave
2483.5	38.86	176	132	H	28.5	3.21	27.9	42.67	54	-11.33	Ave

802.11 g 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)											
2390	37.78	232	113	V	27.8	3.01	27.8	40.79	74	-33.21	Peak
2390	37.49	168	133	H	27.8	3.01	27.8	40.5	74	-33.5	Peak
2390	23.6	232	113	V	27.8	3.01	27.8	26.61	54	-27.39	Ave
2390	23.63	168	133	H	27.8	3.01	27.8	26.64	54	-27.36	Ave
High Channel (2462 MHz)											
2483.5	54.45	240	107	V	28.5	3.21	27.9	58.26	74	-15.74	Peak
2483.5	54.8	176	132	H	28.5	3.21	27.9	58.61	74	-15.39	Peak
2483.5	35.31	240	107	V	28.5	3.21	27.9	39.12	54	-14.88	Ave
2483.5	37.87	176	132	H	28.5	3.21	27.9	41.68	54	-12.32	Ave

802.11 n 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)											
2390	37.42	232	113	V	27.8	3.01	27.8	40.43	74	-33.57	Peak
2390	36.17	168	133	H	27.8	3.01	27.8	39.18	74	-34.82	Peak
2390	23.76	232	113	V	27.8	3.01	27.8	26.77	54	-27.23	Ave
2390	23.8	168	133	H	27.8	3.01	27.8	26.81	54	-27.19	Ave
High Channel (2462 MHz)											
2483.5	52.08	40	100	V	28.5	3.21	27.9	55.89	74	-18.11	Peak
2483.5	55.87	153	107	H	28.5	3.21	27.9	59.68	74	-14.32	Peak
2483.5	34.57	40	100	V	28.5	3.21	27.9	38.38	54	-15.62	Ave
2483.5	35.98	153	107	H	28.5	3.21	27.9	39.79	54	-14.21	Ave

802.11 n HT40 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 (2422 MHz)											
2390	39.39	218	117	V	27.8	3.01	27.8	42.4	74	-31.6	Peak
2390	39.88	181	132	H	27.8	3.01	27.8	42.89	74	-31.11	Peak
2390	24.06	218	117	V	27.8	3.01	27.8	27.07	54	-26.93	Ave
2390	24.38	181	132	H	27.8	3.01	27.8	27.39	54	-26.61	Ave
High Channel (2452 MHz)											
2483.5	61.33	240	107	V	28.5	3.21	27.9	65.14	74	-8.86	Peak
2483.5	66.78	176	132	H	28.5	3.21	27.9	70.59	74	-3.41	Peak
2483.5	37.38	240	107	V	28.5	3.21	27.9	41.19	54	-12.81	Ave
2483.5	41.78	176	132	H	28.5	3.21	27.9	45.59	54	-8.41	Ave

Co-located with FCC ID: CH8HC05 Scan from 1GHz to 40GHz

Worst Case: CH8HC02: 802.11b Mode CH 6 with CH8HC05 5 GHz 802.11n HT20CH 40

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)	
-	-	-	-	-	-	-	-	-	54	-	-

** Note: All co-located emissions are 20 dB below the limit and/or under noise floor level*

6 IC RSS-Gen §6 - Receiver Radiated Spurious Emissions

6.1 Applicable Standards

According to IC RSS-Gen §6, receiver spurious emission shall not exceed the radiated limits shown in the table below:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.2 EUT Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2003.

6.3 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.

6.4 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 the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, the Corrected Amplitude (CA) of 40.3 dBuV/m = indicated Amplitude reading (Ai) 32.5 dBuV + Antenna Factor (AF) 23.5dB + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 dB - Amplifier Gain (Ga) 29.4 dB

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

Margin = Corrected Amplitude - Limit

6.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
A.H Systems	Antenna, Horn	SAS-200/571	261	2010-12-21
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2011-06-09
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2010-08-10
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2011-03-21
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Agilent	PSA Spectrum Analyzer	E4440A	MY44303352	2011-05-10
HP	Pre-amplifier	8449B	3147A00400	2011-02-03

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

6.6 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	33 %
ATM Pressure:	101.7kPa

The testing was performed by Jack Liu on 2011-06-28 in 10 meter chamber #1.

6.7 Summary of Test Results

According to the test data,, the EUT complied with the FCC Part 15.109 and IC RSS-Gen, with the closest margins from the limit listed below:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-0.21	156.092	Vertical	30 MHz to 12000 MHz

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

6.8 Test Results

1) Below 1 GHz, measured at 3 meters

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
156.092	43.29	98	V	252	43.5	-0.21
399.99175	41.4	312	H	130	46	-4.6
249.9533	43.17	324	V	92	46	-2.83
96.05075	40.33	394	V	370	43.5	-3.17
204.119	40	127	V	28	43.5	-3.5
59.72025	30.67	382	V	238	40	-9.33

2) Above 1 GHz, measured at 3 meters

802.11 n 40 MHz 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)	
-	-	-	-	-	-	-	-	-	54	-	-

Note: All emissions are 20 dB below the limit and/or under noise floor level

7 FCC §15.247(i), § 2.1091 & IC RSS-102 - RF Exposure Information

7.1 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

7.2 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

7.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	27.07
Maximum peak output power at antenna input terminal (mW):	509.854
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Antenna Gain, typical (dBi):	4.5
Maximum Antenna Gain (numeric):	2.82
Power density at predication frequency and distance (mW/cm^2):	0.286
MPE limit for uncontrolled exposure at predication frequency (mW/cm2):	1.0

Radio Type	Operating Frequency (MHz)	MPE Limit	Conducted Power (mW)	Duty Cycle	Antenna Gain (dBi)	Gain (numeric)	Power Density at 20 cm (mW/cm^2)	% of MPE	Co-located % of MPE
FCC ID: CH8HC02									
802.11 b/g/n Radio	2412	1.0	509.854	100%	4.5	2.82	0.2860	28.60	-
FCC ID: CH8HC05									
802.11 a/b/g/n Radio	5475	1.0	965.15	100%	3.5	2.24	0.4301	43.01	-
Both Radio On									
Co-located for CH8HC02 and CH8HC05								-	71.61

7.4 Test Results

This device complies with the MPE limit at 20cm for uncontrolled exposure and could be able to co-locate with FCC ID: CH8HC05 (802.11 a/b/g/n wireless Radio)