



**FCC PART 15C**  
**IC RSS-210, ISSUE 7, JUNE 2007**  
**TEST AND MEASUREMENT REPORT**

For

**Fortinet, Inc.**

1090 Kifer Road,  
Sunnyvale, CA 94086, USA

**FCC ID: TVE-0600101**  
**IC: 7280B-0600101**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Dual Band Wi-Fi Module
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\* This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk “\*” (Rev. 2)

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**DOCUMENT REVISION HISTORY**

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1005072-DTS	Original Report	2010-06-09

## 1 General Description

### 1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Fortinet, Inc.* and their product FCC ID: TVE-0600101 IC: 7280B-0600101 model: *WPEA-111N/W*, or the “EUT” as referred in this report is a dual band wireless Module. It supports IEEE 802.11 b/g/n modes in ISM Frequency Bands 2.4 GHz and 802.11a/n modes in 5 GHz band.

### 1.2 Mechanical Description of EUT

The “EUT” measures approximately 30mm (L) x 25mm (W) x 5mm (H), and weighs approximately 4.5g.

*The test data gathered are from typical production sample, Serial number: 10135K1000-150 assigned by the Manufacturer.*

### 1.3 EUT Photo



*Please refer to Exhibit C for more EUT photographs*

### 1.4 Objective

This report is prepared on behalf of *Fortinet, Inc.* in accordance with Part 2, Subpart J, and Part 15, Subparts A, B and C of the Federal Communication Commissions rules and IC RSS-210 Issue 7, June 2007.

The objective is to determine compliance with FCC 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.

## **1.5 Related Submittal(s)/Grant(s)**

FCC ID: PPD-AR5BHB92 and IC: 4104A-AR5BHB92

## **1.6 Test Methodology**

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

## **1.7 Measurement Uncertainty**

All measurements involve certain levels of uncertainties, especially in 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 NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from +2.0 for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## **1.8 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 sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has 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 facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: R-2463 and C-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL 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 EUT was configured for testing according to ANSI C63.4-2003.

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

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

### 2.2 EUT Exercise Software

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

2400~2483.5 MHz Band:

Radio Mode	Bandwidth (MHz)	Frequency/Data rate		
		Low CH (MHz/Mbps)	Mid CH (MHz/Mbps)	High CH (MHz)
802.11b	20	2412/1	2437/1	2462/1
802.11g	20	2412/6	2437/6	2462/6
802.11n	20	2412/6.5	2437/6.5	2462/6.5
802.11n	40	2422/13.5	2437/13.5	2452/13.5

5725~5850 MHz Band:

Radio Mode	Bandwidth (MHz)	Frequency/Data rate		
		Low CH (MHz/Mbps)	Mid CH (MHz/Mbps)	High CH (MHz)
802.11a	20	5745/6	5785/6	5725/6
802.11n	20	5745/6.5	5785/6.5	5725/6.5
802.11n	40	5755/13.5	-	5795/13.5

### 2.3 Equipment Modifications

No modifications were made to the EUT.

### 2.4 Special Accessories

N/A

**2.5 Local Support Equipment**

Manufacturer	Description	Model No.	Serial No.
PCI Express Card	N/A	N/A	N/A
OCZ	Laptop	FL92	EJ04K0001000

**2.6 Interface Ports and Cabling**

Cable Description	Length (m)	From	To
Control Cable	< 0.5	EUT	Express Card

**2.7 EUT Internal Configurations**

Manufacturers	Description	Model No.	Serial No.
Fortinet, Inc.	PCB Assembly	WPEA 111N/W	10135K1000-150



### 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 7.1.4	Antenna Requirement	Compliant
FCC §15.207(a) IC RSS-Gen §7.2.2	Conducted Emissions	N/A*
FCC §15.247(d) IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	N/A*
FCC §15.205 IC RSS-210 §2.2	Restricted Bands	Compliant
FCC §15.247, §15.209 IC RSS-210 §A8.5, §2.6	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) IC RSS-210 §A8.2	6 dB & 99% Occupied Bandwidth	N/A*
FCC §15.247(b)(3) IC RSS-210 §A8.4	Maximum Peak Output Power	N/A*
FCC §15.247(d) IC RSS-210 §A8.5	100 kHz Bandwidth of Frequency Band Edge	N/A*
FCC §15.247(e) IC RSS-210 §A8.2 (b)	Power Spectral Density	N/A*
IC RSS-210 §2.6 & RSS-Gen § 4.10	Receiver Spurious Emission	Compliant

**Note:** N/A\* Please refer to: FCC ID: PPD-AR5BHB92 and IC: 4104A-AR5BHB92, Report Number: 08U11571-1

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

### 4.1 Applicable Standard

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

#### Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	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 <sup>2</sup> )	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

<sup>1</sup> = 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 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 <sup>2</sup> )	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 <sup>0.5</sup>	0.0042 f <sup>0.5</sup>	f / 150	6
1 500 - 15 000	61.4	0.163	10	6
15 000 - 150 000	61.4	0.163	10	616000 / f <sup>1.2</sup>
150 000- 300 000	0.158 f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> f	616000 / f <sup>1.2</sup>

**Note:** f is frequency in MHz

<sup>1</sup> = 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

### 2.4 GHz Band:

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>29.58</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>907.8205</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2437</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>2.5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.778</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>):</u>	<u>0.321</u>
<u>Power density of prediction frequency at 20.0 cm (W/m<sup>2</sup>):</u>	<u>3.21</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>1.0</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (W/m<sup>2</sup>):</u>	<u>10</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.321mW/cm<sup>2</sup> (3.21W/m<sup>2</sup>).Limit is 1 mW/cm<sup>2</sup> (10W/m<sup>2</sup>).

### 5 GHz Band:

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>29.85</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>966.05</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>5755</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>5.0</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>3.16</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>):</u>	<u>0.607</u>
<u>Power density of prediction frequency at 20.0 cm (W/m<sup>2</sup>):</u>	<u>6.07</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>1.0</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (W/m<sup>2</sup>):</u>	<u>10</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.607mW/cm<sup>2</sup> (6.07W/m<sup>2</sup>).Limit is 1 mW/cm<sup>2</sup> (10W/m<sup>2</sup>).

## 5 FCC §15.203 & IC RSS-Gen §7.1.4 – Antenna Requirement

### 5.1 Applicable Standard

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

As per IC RSS-Gen §7.1.4: 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 milliwatts or less. For devices of output powers greater than 10 milliwatts, 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 Gain

EUT has one Two Transmitter/Receiver antenna which is external antenna, and its maximum antenna gain is 5 dBi which fulfills the requirements of FCC rule 15.203 and IC RSS-Gen §7.1.4

Frequency Band	Antenna Gain (dBi)
2400-2483.5 MHz	2.5
5725MHz – 5850 MHz	5.0

## 6 FCC §15.207 & IC RSS-Gen §7.2.2- Conducted Emissions

### 6.1 Applicable Standards

As per FCC §15.207 & IC RSS-Gen §7.2.2 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  $\mu$ H/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 Results

*Refer to following test report for test results:*

FCC ID: PPD-AR5BHB92 and IC: 4104A-AR5BHB92  
Report Number: 08U11571-1

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

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### **7.1 Applicable Standard**

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

### **7.2 Test Results**

*Refer to following test report for test results:*

FCC ID: PPD-AR5BHB92 and IC: 4104A-AR5BHB92  
Report Number: 08U11571-1

## 8 FCC §15.205, §15.209 & §15.247(c), IC RSS-Gen §4.9 – Spurious Radiated Emissions

### 8.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a) and RSS-210: Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 <sup>2</sup>	3
88 - 216	150 <sup>2</sup>	3
216 - 960	200 <sup>2</sup>	3
Above 960	500	3

2 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 –	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.52525	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	3332 – 3339	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3345.8 – 3358	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3600 – 4400	31.2 – 31.8
12.51975 – 12.52025	240 – 285		36.43 – 36.5
12.57675 – 12.57725	322 – 335.4		Above 38.6
13.36 – 13.41	399.9 – 410		
	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)).

## 8.2 Test Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15C and IC RSS-210 limits.

The spacing between the peripherals was 3 centimeters.

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

## 8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2009-06-29
Rohde & Schwarz	EMI Test Receiver	1166.5950K03	100337	2010-03-24
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-2	2009-08-20
HP	Amplifier, Pre	1-26.5GHz	3147A00400	2010-01-29
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2009-09-23

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



## 8.4 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:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000 MHz:

- (1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
- (2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

## 8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Cable Loss, and Attenuator Factor adding to the Indicated Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Cable Loss} + \text{Attenuator Factor}$$

For example, a Corrected Amplitude of 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10dB)

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:

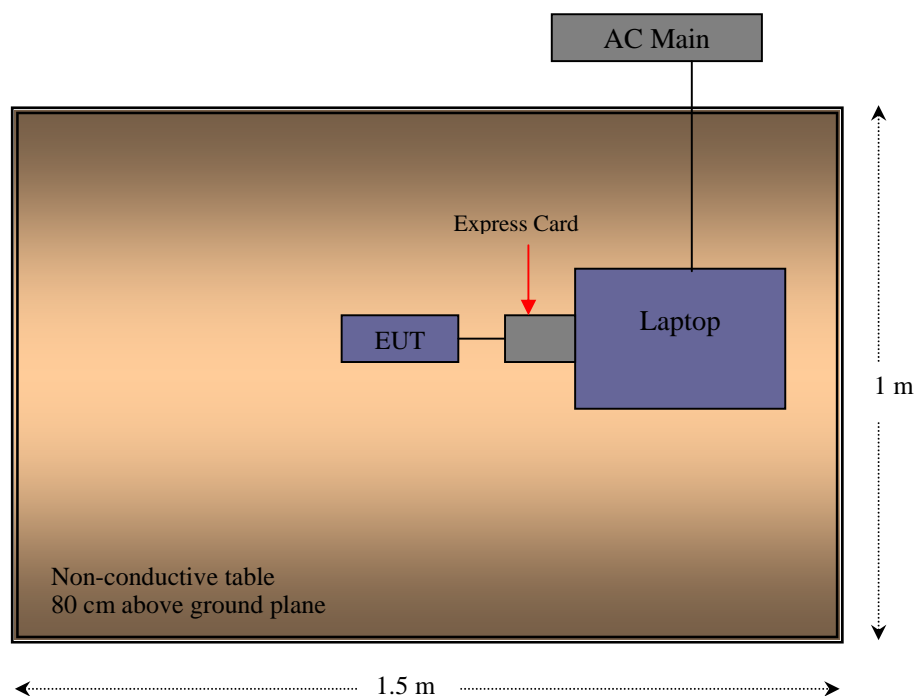
$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

## 8.6 Test Environmental Conditions

<b>Temperature:</b>	20~23 °C
<b>Relative Humidity:</b>	50~55 %
<b>ATM Pressure:</b>	99-102.2kPa

\* The testing was performed by Jerry Huang from 2010-05-17 to 2010-05-19.

## 8.7 Test Setup Diagram



## 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:

Band: 2400–2483.5 MHz			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel, mode, Range
-1.13	336.0055	Vertical	Low, 802.11b, 30MHz – 1000MHz
-2.4	4924	Vertical	High, 802.11b, 1GHz – 25GHz

Band: 5725–5850 MHz			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel, mode, Range
-0.37	5420	Vertical	High, 802.11n, 1GHz – 25GHz

*Please refer to the following table and plots for test results.*

## 8.9 Radiated Emissions Test Result Data

### Radiated Emission at 3 meters, 30 MHz – 1 GHz

2.4 GHz Band - 802.11b Mode Low Channel (Worst Case)

Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)
336.0055	45.37	102	V	336	46.5	-1.13
832.9214	41.94	100	V	319	46.5	-4.56
497.864	41.34	101	V	355	46.5	-5.16
233.214	39.03	124	H	255	46.5	-7.47
899.5215	37.89	103	V	326	46.5	-8.61
432.0943	36.33	100	V	285	46.5	-10.17

### 2.4 GHz Band, Radiated Emission at 3 meters, 1 GHz – 25 GHz

802.11b Mode:

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
			Height (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11b mode, Low Channel 2412 MHz											
4824	46.44	226	1.0	V	33.3	4.52	36.07	48.2	54	-5.8	Ave
4824	37.58	307	1.0	H	33.3	4.52	36.07	39.3	54	-14.7	Ave
4986.6	56.43	56	1.0	V	33.5	4.46	36.04	58.4	74	-15.7	Peak
4986.6	36.05	56	1.0	V	33.5	4.46	36.04	38.0	54	-16.0	Ave
4986.6	34.67	231	1.0	H	33.5	4.46	36.04	36.6	54	-17.4	Ave
4986.6	53.31	231	1.0	H	33.5	4.46	36.04	55.2	74	-18.8	Peak
4824	51.22	226	1.0	V	33.3	4.52	36.07	53.0	74	-21.0	Peak
4824	47.41	307	1.0	H	33.3	4.52	36.07	49.2	74	-24.8	Peak
802.11b mode, Middle channel 2437 MHz											
4874	47.54	225	1.31	V	33.3	4.52	36.07	49.3	54	-4.7	Ave
4986.6	56.13	55	1.09	V	33.5	4.46	36.04	58.1	74	-16.0	Peak
4986.6	35.97	55	1.09	V	33.5	4.46	36.04	37.9	54	-16.1	Ave
4874	35.67	217	1.0	H	33.3	4.52	36.07	37.4	54	-16.6	Ave
4986.6	33.99	231	1.0	H	33.5	4.46	36.04	35.9	54	-18.1	Ave
4986.6	53.62	231	1.0	H	33.5	4.46	36.04	55.5	74	-18.5	Peak
4874	51.4	225	1.31	V	33.3	4.52	36.07	53.2	74	-20.9	Peak
4874	45.98	217	1.0	H	33.3	4.52	36.07	47.7	74	-26.3	Peak

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 (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11b mode, High Channel 2462 MHz											
4924	49.86	225	1.27	V	33.3	4.53	36.07	51.6	54	-2.4	Ave
4986.6	55.62	55	1.09	V	33.5	4.46	36.04	57.5	74	-16.5	Peak
4986.6	35.45	55	1.09	V	33.5	4.46	36.04	37.4	54	-16.6	Ave
4986.6	33.53	231	1.0	H	33.5	4.46	36.04	35.5	54	-18.6	Ave
4924	53.23	225	1.27	V	33.3	4.53	36.07	55.0	74	-19.0	Peak
4924	32.72	90	1.0	H	33.3	4.53	36.07	34.5	54	-19.5	Ave
4986.6	52.56	231	1.0	H	33.5	4.46	36.04	54.5	74	-19.5	Peak
4924	45.81	90	1.0	H	33.3	4.53	36.07	47.6	74	-26.4	Peak

## 802.11g Mode:

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
			Height (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11g mode, Low Channel 2412 MHz											
4986.6	56.43	56	1.0	V	33.5	4.46	36.04	58.4	74	-15.7	Peak
4986.6	36.05	56	1.0	V	33.5	4.46	36.04	38.0	54	-16.0	Ave
4986.6	34.67	231	1.0	H	33.5	4.46	36.04	36.6	54	-17.4	Ave
4986.6	53.31	231	1.0	H	33.5	4.46	36.04	55.2	74	-18.8	Peak
802.11g mode, Middle channel 2437 MHz											
4986.6	56.13	55	1.09	V	33.5	4.46	36.04	58.1	74	-16.0	Peak
4986.6	35.97	55	1.09	V	33.5	4.46	36.04	37.9	54	-16.1	Ave
4986.6	33.99	231	1.0	H	33.5	4.46	36.04	35.9	54	-18.1	Ave
4986.6	53.62	231	1.0	H	33.5	4.46	36.04	55.5	74	-18.5	Peak
802.11g mode, High Channel 2462 MHz											
4986.6	55.62	55	1.09	V	33.5	4.46	36.04	57.5	74	-16.5	Peak
4986.6	35.45	55	1.09	V	33.5	4.46	36.04	37.4	54	-16.6	Ave
4986.6	33.53	231	1.0	H	33.5	4.46	36.04	35.5	54	-18.6	Ave
4986.6	52.56	231	1.0	H	33.5	4.46	36.04	54.5	74	-19.5	Peak

**802.11n HT20 Mode:**

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
			Height (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11n HT20 mode, Low Channel 2412 MHz											
4986.6	30.32	144	1.0	H	33.5	4.46	36.04	32.2	54	-21.8	Ave
4986.6	30.21	356	1.0	V	33.5	4.46	36.04	32.1	54	-21.9	Ave
4986.6	48.46	356	1.0	V	33.5	4.46	36.04	50.4	74	-23.6	Peak
4986.6	47.55	144	1.0	H	33.5	4.46	36.04	49.5	74	-24.5	Peak
802.11n HT20 mode, Middle channel 2437 MHz											
4986.6	29.99	354	1.0	V	33.5	4.46	36.04	31.9	54	-22.1	Ave
4986.6	29.9	144	1.0	H	33.5	4.46	36.04	31.8	54	-22.2	Ave
4986.6	46.76	354	1.0	V	33.5	4.46	36.04	48.7	74	-25.3	Peak
4986.6	46.51	144	1.	H	33.5	4.46	36.04	48.4	74	-25.6	Peak
802.11n HT20 mode, High Channel 2462 MHz											
4986.6	30.06	355	1.0	V	33.5	4.46	36.04	32.0	54	-22.0	Ave
4986.6	29.97	144	1.0	H	33.5	4.46	36.04	31.9	54	-22.1	Ave
4986.6	47.04	355	1.0	V	33.5	4.46	36.04	49.0	74	-25.0	Peak
4986.6	46.8	144	1.0	H	33.5	4.46	36.04	48.7	74	-25.3	Peak

**802.11n 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 (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11n HT40 mode, Low Channel 2422 MHz											
4986.6	30.36	144	1.0	H	33.5	4.46	36.04	32.3	54	-21.7	Ave
4986.6	30.01	356	1.0	V	33.5	4.46	36.04	31.9	54	-22.1	Ave
4986.6	48.22	356	1.0	V	33.5	4.46	36.04	50.1	74	-23.9	Peak
4986.6	48.1	144	1.0	H	33.5	4.46	36.04	50.0	74	-24.0	Peak
802.11n HT40 mode, Middle channel 2437 MHz											
4986.6	30.09	354	1.0	V	33.5	4.46	36.04	32.0	54	-22.0	Ave
4986.6	30	144	1.0	H	33.5	4.46	36.04	31.9	54	-22.1	Ave
4986.6	46.32	144	1.0	H	33.5	4.46	36.04	48.2	74	-25.8	Peak
4986.6	46.26	354	1.0	V	33.5	4.46	36.04	48.2	74	-25.8	Peak
802.11n HT40 mode, High Channel 2452 MHz											
4986.6	30.2	355	1.0	V	33.5	4.46	36.04	32.1	54	-21.9	Ave
4986.6	29.44	144	1.0	H	33.5	4.46	36.04	31.4	54	-22.6	Ave
4986.6	47.55	355	1.0	V	33.5	4.46	36.04	49.5	74	-24.5	Peak
4986.6	47.2	144	1.0	H	33.5	4.46	36.04	49.1	74	-24.9	Peak

**5725-5875 MHz Band****802.11a 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 (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11a mode, Low Channel 5745 MHz											
5420	43.97	249	1.0	V	34.8	4.64	34.81	48.6	54	-5.4	Ave
1480	55.48	80	1.0	V	25	3.21	35.5	48.19	54	-5.81	Ave
1000	59.14	113	1.0	H	23.7	2.02	37.09	47.77	54	-6.23	Ave
2500	61.61	132	2.56	V	34.8	4.64	34.81	66.24	74	-7.76	Peak
2500	40.69	132	2.56	V	34.8	4.64	34.81	45.32	54	-8.68	Ave
1000	56.67	267	1.0	V	23.7	2.02	37.09	45.3	54	-8.7	Ave
2500	60.24	347	1.0	H	34.8	4.64	34.81	64.87	74	-9.13	Peak
1480	52.07	198	1.0	H	25	3.21	35.5	44.78	54	-9.22	Ave
2500	39.61	347	1.0	H	34.8	4.64	34.81	44.24	54	-9.76	Ave
5420	58.65	149	1.0	V	34.8	4.64	34.81	63.28	74	-10.72	Peak
1480	67.82	80	1.0	V	25	3.21	35.5	60.53	74	-13.47	Peak
5420	35.09	279	1.1	H	34.8	4.64	34.81	39.72	54	-14.28	Ave
1000	70.87	113	1.0	H	23.7	2.02	37.09	59.5	74	-14.5	Peak
1000	70.27	267	1.0	V	23.7	2.02	37.09	58.9	74	-15.1	Peak
1480	64.12	198	1.0	H	25	3.21	35.5	56.83	74	-17.17	Peak
1960	60.81	354	1.0	V	26.4	3.02	35.48	54.75	74	-19.25	Peak
5420	48	279	1.1	H	34.8	4.64	34.81	52.63	74	-21.37	Peak
1960	36.96	354	1.0	V	26.4	3.02	35.48	30.9	54	-23.1	Ave
1960	35.65	241	1.0	H	26.4	3.02	35.48	29.59	54	-24.41	Ave
1960	55.4	241	1.0	H	26.4	3.02	35.48	49.34	74	-24.66	Peak
802.11a mode, Middle channel 5785 MHz											
1000	59.76	106	1.0	H	23.7	2.02	37.09	48.39	54	-5.61	Ave
1480	55.55	82	1.0	V	25	3.21	35.5	48.26	54	-5.74	Ave
2500	62.13	132	1.0	V	34.8	4.64	34.81	66.76	74	-7.24	Peak
1000	57.48	269	1.0	V	23.7	2.02	37.09	46.11	54	-7.89	Ave
2500	40.79	132	1.0	V	34.8	4.64	34.81	45.42	54	-8.58	Ave
1480	51.59	192	1.0	H	25	3.21	35.5	44.3	54	-9.7	Ave
2500	59.22	0	1.97	H	34.8	4.64	34.81	63.85	74	-10.15	Peak
2500	38.99	0	1.97	H	34.8	4.64	34.81	43.62	54	-10.38	Ave
1480	68.06	82	1.0	V	25	3.21	35.5	60.77	74	-13.23	Peak
1000	71.01	106	1.0	H	23.7	2.02	37.09	59.64	74	-14.36	Peak
1000	70.23	269	1.0	V	23.7	2.02	37.09	58.86	74	-15.14	Peak
1480	63.56	199	1.0	H	25	3.21	35.5	56.27	74	-17.73	Peak
1960	58.97	355	1.0	V	26.4	3.02	35.48	52.91	74	-21.09	Peak
1960	56.99	285	1.0	H	26.4	3.02	35.48	50.93	74	-23.07	Peak
1960	36.81	355	1.0	V	26.4	3.02	35.48	30.75	54	-23.25	Ave
1960	34.65	285	1.0	H	26.4	3.02	35.48	28.59	54	-25.41	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 (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11a mode, High Channel 5825 MHz											
1000	59.69	110	1.0	H	23.7	2.02	37.09	48.32	54	-5.68	Ave
1480	52.54	102	1.0	V	25	3.21	35.5	45.25	54	-8.75	Ave
1480	51.65	192	1.0	V	25	3.21	35.5	44.36	54	-9.64	Ave
1480	68.65	102	1.0	V	25	3.21	35.5	61.36	74	-12.64	Peak
1000	52.65	214	1.0	V	23.7	2.02	37.09	41.28	54	-12.72	Ave
1000	70.79	110	1.0	H	23.7	2.02	37.09	59.42	74	-14.58	Peak
1480	64.45	192	1.0	V	25	3.21	35.5	57.16	74	-16.84	Peak
2500	62.31	212	1.03	V	26.4	3.02	35.48	56.25	74	-17.75	Peak
1000	67.03	214	1.0	V	23.7	2.02	37.09	55.66	74	-18.34	Peak
2500	40.36	212	1.03	V	26.4	3.02	35.48	34.3	54	-19.7	Ave
2500	59.99	31	1.77	V	26.4	3.02	35.48	53.93	74	-20.07	Peak
2500	39.4	31	1.77	V	26.4	3.02	35.48	33.34	54	-20.66	Ave

**802.11n HT20 Mode:**

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
			Height (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11n HT20 mode, Low Channel 5745 MHz											
5420	47.91	192	1.16	V	34.8	4.64	34.81	52.54	54	-1.46	Ave
1480	56.56	79	1.0	V	25	3.21	35.5	49.27	54	-4.73	Ave
1000	60.53	107	1.0	H	23.7	2.02	37.09	49.16	54	-4.84	Ave
1480	52.97	194	1.0	H	25	3.21	35.5	45.68	54	-8.32	Ave
1000	56.19	173	1.09	V	23.7	2.02	37.09	44.82	54	-9.18	Ave
1000	76.16	173	1.09	V	23.7	2.02	37.09	64.79	74	-9.21	Peak
5420	59.59	192	1.16	V	34.8	4.64	34.81	64.22	74	-9.78	Peak
5420	36.5	110	1.28	H	34.8	4.64	34.81	41.13	54	-12.87	Ave
1480	67.02	79	1.0	V	25	3.21	35.5	59.73	74	-14.27	Peak
1000	70.3	107	1.0	H	23.7	2.02	37.09	58.93	74	-15.07	Peak
1480	65.05	194	1.0	H	25	3.21	35.5	57.76	74	-16.24	Peak
2500	41.27	131	1.0	V	26.4	3.02	35.48	35.21	54	-18.79	Ave
2500	60.83	131	1.0	V	26.4	3.02	35.48	54.77	74	-19.23	Peak
2500	40.45	10	1.7	H	26.4	3.02	35.48	34.39	54	-19.61	Ave
2500	59.68	10	1.7	H	26.4	3.02	35.48	53.62	74	-20.38	Peak
5420	47.54	110	1.28	H	34.8	4.64	34.81	52.17	74	-21.83	Peak

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 (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11n HT20 mode, Middle Channel 5785 MHz											
5420	48.19	167	1.26	V	34.8	4.64	34.81	52.82	54	-1.18	Ave
1000	60.66	116	1.0	H	23.7	2.02	37.09	49.29	54	-4.71	Ave
1480	55.38	77	1.0	V	25	3.21	35.5	48.09	54	-5.91	Ave
1000	59.18	267	1.63	V	23.7	2.02	37.09	47.81	54	-6.19	Ave
1000	77.02	267	1.63	V	23.7	2.02	37.09	65.65	74	-8.35	Peak
1480	52.8	194	1.0	H	25	3.21	35.5	45.51	54	-8.49	Ave
5420	59.96	167	1.26	V	34.8	4.64	34.81	64.59	74	-9.41	Peak
5420	36.58	104	1.45	H	34.8	4.64	34.81	41.21	54	-12.79	Ave
1480	68.18	77	1.0	V	25	3.21	35.5	60.89	74	-13.11	Peak
1000	71.26	116	1.0	H	23.7	2.02	37.09	59.89	74	-14.11	Peak
1480	65.02	194	1.0	H	25	3.21	35.5	57.73	74	-16.27	Peak
2500	62.56	126	1.07	V	26.4	3.02	35.48	56.5	74	-17.5	Peak
2500	41.87	126	1.07	V	26.4	3.02	35.48	35.81	54	-18.19	Ave
2500	41.24	6	2.0	H	26.4	3.02	35.48	35.18	54	-18.82	Ave
2500	60.87	6	2.0	H	26.4	3.02	35.48	54.81	74	-19.19	Peak
5420	48.02	104	1.45	H	34.8	4.64	34.81	52.65	74	-21.35	Peak
802.11n HT20 mode, High Channel 5825 MHz											
5420	49	333	1.1	V	34.8	4.64	34.81	53.63	54	-0.37	Ave
1000	59.26	112	1.0	H	23.7	2.02	37.09	47.89	54	-6.11	Ave
5420	60.99	333	1.1	V	34.8	4.64	34.81	65.62	74	-8.38	Peak
1000	55.68	168	1.21	V	23.7	2.02	37.09	44.31	54	-9.69	Ave
5420	37.61	104	1.49	H	34.8	4.64	34.81	42.24	54	-11.76	Ave
1320	48.13	252	1.0	H	25	3.21	35.5	40.84	54	-13.16	Ave
1320	47.27	0	1.0	V	25	3.21	35.5	39.98	54	-14.02	Ave
1000	71.32	112	1.0	H	23.7	2.02	37.09	59.95	74	-14.05	Peak
1320	66.42	0	1.0	V	25	3.21	35.5	59.13	74	-14.87	Peak
1000	69.7	168	1.21	V	23.7	2.02	37.09	58.33	74	-15.67	Peak
2500	42.69	212	1.0	V	26.4	3.02	35.48	36.63	54	-17.37	Ave
2500	62.55	212	1.0	V	26.4	3.02	35.48	56.49	74	-17.51	Peak
2500	41.1	6	2.05	H	26.4	3.02	35.48	35.04	54	-18.96	Ave
2500	60.98	6	2.05	H	26.4	3.02	35.48	54.92	74	-19.08	Peak
5420	49.23	104	1.49	H	34.8	4.64	34.81	53.86	74	-20.14	Peak
1320	60.5	252	1.0	H	25	3.21	35.5	53.21	74	-20.79	Peak



**802.11n 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 (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
802.11n HT40 mode, Low Channel 5755 MHz											
5420	48.43	170	1.25	V	34.8	4.64	34.81	53.06	54	-0.94	Ave
1480	56.03	77	1.0	V	25	3.21	35.5	48.74	54	-5.26	Ave
1000	58.58	121	1.0	H	23.7	2.02	37.09	47.21	54	-6.79	Ave
1000	56.61	271	1.0	V	23.7	2.02	37.09	45.24	54	-8.76	Ave
1480	52.35	192	1.0	H	25	3.21	35.5	45.06	54	-8.94	Ave
1480	71.62	77	1.0	V	25	3.21	35.5	64.33	74	-9.67	Peak
5420	59.64	170	1.25	V	34.8	4.64	34.81	64.27	74	-9.73	Peak
5420	36.43	103	1.49	H	34.8	4.64	34.81	41.06	54	-12.94	Ave
1000	71.17	121	1.0	H	23.7	2.02	37.09	59.8	74	-14.2	Peak
1000	70.14	271	1.0	V	23.7	2.02	37.09	58.77	74	-15.23	Peak
1480	64.52	192	1.0	H	25	3.21	35.5	57.23	74	-16.77	Peak
2500	60.98	161	1.0	V	26.4	3.02	35.48	54.92	74	-19.08	Peak
2500	40.79	161	1.0	V	26.4	3.02	35.48	34.73	54	-19.27	Ave
2500	40.27	10	1.66	H	26.4	3.02	35.48	34.21	54	-19.79	Ave
2500	60.06	10	1.66	H	26.4	3.02	35.48	54	74	-20	Peak
5420	48.09	103	1.49	H	34.8	4.64	34.81	52.72	74	-21.28	Peak
802.11n HT40 mode, High Channel 5795 MHz											
5420	47.78	198	1.24	V	34.8	4.64	34.81	52.41	54	-1.59	Ave
1480	56.39	78	1.0	V	25	3.21	35.5	49.1	54	-4.9	Ave
1000	60.43	114	1.0	H	23.7	2.02	37.09	49.06	54	-4.94	Ave
1000	58.71	268	1.55	V	23.7	2.02	37.09	47.34	54	-6.66	Ave
1480	53.08	199	1.0	H	25	3.21	35.5	45.79	54	-8.21	Ave
5420	59.06	198	1.24	V	34.8	4.64	34.81	63.69	74	-10.31	Peak
5420	36.88	104	1.51	H	34.8	4.64	34.81	41.51	54	-12.49	Ave
1480	67.9	78	1.0	V	25	3.21	35.5	60.61	74	-13.39	Peak
1000	71.27	114	1.0	H	23.7	2.02	37.09	59.9	74	-14.1	Peak
1000	71.11	268	1.55	V	23.7	2.02	37.09	59.74	74	-14.26	Peak
1480	64.97	199	1.0	H	25	3.21	35.5	57.68	74	-16.32	Peak
2500	61.22	159	1.0	V	26.4	3.02	35.48	55.16	74	-18.84	Peak
2500	41.1	159	1.	V	26.4	3.02	35.48	35.04	54	-18.96	Ave
2500	61	11	1.96	H	26.4	3.02	35.48	54.94	74	-19.06	Peak
2500	40.05	11	1.96	H	26.4	3.02	35.48	33.99	54	-20.01	Ave
5420	48.26	104	1.51	H	34.8	4.64	34.81	52.89	74	-21.11	Peak

**Restricted Band Emissions****2.4 GHz Band**

802.11b Mode:

Frequency (MHz)	S.A. Reading (dBμV)	Test Antenna		Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
		Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
2390	49.12	H	30.3	3.01	36.48	45.95	74	-28.05	Peak
2390	48.08	V	30.3	3.01	36.48	44.91	74	-29.09	Peak
2390	34.58	H	30.3	3.01	36.48	31.41	54	-22.59	Ave
2390	34.58	V	30.3	3.01	36.48	31.41	54	-22.59	Ave
2483.6	46.87	H	30.3	3.21	36.46	43.92	74	-30.08	Peak
2483.6	46.86	V	30.3	3.21	36.46	43.91	74	-30.09	Peak
2483.6	32.23	H	30.3	3.21	36.46	29.28	54	-24.72	Ave
2483.6	32.2	V	30.3	3.21	36.46	29.25	54	-24.75	Ave

802.11g Mode:

Frequency (MHz)	S.A. Reading (dBμV)	Test Antenna		Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
		Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
2390	48.48	H	30.3	3.01	36.48	45.31	74	-28.69	Peak
2390	48.9	V	30.3	3.01	36.48	45.73	74	-28.27	Peak
2390	34.52	H	30.3	3.01	36.48	31.35	54	-22.65	Ave
2390	34.48	V	30.3	3.01	36.48	31.31	54	-22.69	Ave
2483.6	45.7	H	30.3	3.21	36.46	42.75	74	-31.25	Peak
2483.6	46.76	V	30.3	3.21	36.46	43.81	74	-30.19	Peak
2483.6	32.24	H	30.3	3.21	36.46	29.29	54	-24.71	Ave
2483.6	32.23	V	30.3	3.21	36.46	29.28	54	-24.72	Ave

802.11n HT20 Mode:

Frequency (MHz)	S.A. Reading (dBμV)	Test Antenna		Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
		Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
2390	48.62	H	30.3	3.01	36.48	45.45	74	-28.55	Peak
2390	48.51	V	30.3	3.01	36.48	45.34	74	-28.66	Peak
2390	34.01	H	30.3	3.01	36.48	30.84	54	-23.16	Ave
2390	34.06	V	30.3	3.01	36.48	30.89	54	-23.11	Ave
2483.6	46.81	H	30.3	3.21	36.46	43.86	74	-30.14	Peak
2483.6	47.61	V	30.3	3.21	36.46	44.66	74	-29.34	Peak
2483.6	32.39	H	30.3	3.21	36.46	29.44	54	-24.56	Ave
2483.6	32.29	V	30.3	3.21	36.46	29.34	54	-24.66	Ave

802.11n HT40 Mode:

Frequency (MHz)	S.A. Reading (dBμV)	Test Antenna		Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
		Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
2390	48.24	H	30.3	3.01	36.48	45.07	74	-28.93	Peak
2390	48.82	V	30.3	3.01	36.48	45.65	74	-28.35	Peak
2390	34.02	H	30.3	3.01	36.48	30.85	54	-23.15	Ave
2390	34.03	V	30.3	3.01	36.48	30.86	54	-23.14	Ave
2483.6	47.14	H	30.3	3.21	36.46	44.19	74	-29.81	Peak
2483.6	46.68	V	30.3	3.21	36.46	43.73	74	-30.27	Peak
2483.6	32.24	H	30.3	3.21	36.46	29.29	54	-24.71	Ave
2483.6	32.03	V	30.3	3.21	36.46	29.08	54	-24.92	Ave

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

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### **9.1 Applicable Standard**

According to FCC §15.247(a)(2) and IC RSS-210 §A8.2 (a), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

### **9.2 Measurement Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### **9.3 Test Results**

*Refer to following test report for test results:*

FCC ID: PPD-AR5BHB92 and IC: 4104A-AR5BHB92  
Report Number: 08U11571-1

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

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### **10.1 Applicable Standard**

According to FCC §15.247(b) (3) and IC RSS-210 §A8.4, for systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

### **10.2 Test Results**

*Refer to following test report for test results:*

FCC ID: PPD-AR5BHB92 and IC: 4104A-AR5BHB92  
Report Number: 08U11571-1

## **11 FCC §15.247(d) & IC RSS-210 §A8.5 - 100 kHz Bandwidth of Band Edges**

### **11.1 Applicable Standard**

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

According to IC Rss-210 §A8.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

### **11.2 Measurement Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### **11.3 Test Results**

*Refer to following test report for test results:*

FCC ID: PPD-AR5BHB92 and IC: 4104A-AR5BHB92  
Report Number: 08U11571-1

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## **12 FCC §15.247(e) & IC RSS-210 §A8.2 (b) - Power Spectral Density**

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### **12.1 Applicable Standard**

According to FCC §15.247 (e) and IC RSS-210 §A8.2( b) , for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### **12.2 Measurement Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

### **12.3 Test Results**

*Refer to following test report for test results:*

FCC ID: PPD-AR5BHB92 and IC: 4104A-AR5BHB92  
Report Number: 08U11571-1

## 13 IC RSS-210 §2.6 & RSS-Gen §4.10-Receiver Spurious Radiated Emissions

### 13.1 Applicable Standard

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

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

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

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

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

According to RSS-210 §2.6, Tables 2 and 3 show the general field strength limits of unwanted emissions, where applicable, for transmitters and receivers operating in accordance with the provisions specified in this RSS. Transmitters whose wanted emissions are also within the limits shown in Tables 2 and 3 may operate in any of the frequency bands of Tables 2 and 3, other than the restricted bands of Table 1 and the TV bands, and shall be certified under RSS-210.

Table 2: General Field Strength Limits for Transmitters and Receivers at Frequencies above 30 MHz <sup>(Note)</sup>

Frequency (MHz)	Field Strength Microvolts/m at 3 meters (watts, e.i.r.p.)	
	Transmitters	Receivers
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

**Note:** Transmitting devices are not permitted in Table 1 bands or in TV bands (54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz, and 614-806 MHz). Prohibition of operation in TV bands does not apply to momentary devices, or to medical telemetry devices in the band 174-216 MHz, and to perimeter protection systems in the bands 54-72 and 76-88 MHz. The perimeter protection devices are to meet Table 3 field strengths limits.



Table 3: General Field Strength Limits for Transmitters at Frequencies below 30 MHz (Transmit)

Frequency (fundamental or spurious)	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1.705-30 MHz	30	N/A	30

**Note:** The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

### 13.2 Test Procedure

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

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.

### 13.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with 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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

### 13.4 Test Equipment Lists and Details

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2009-06-29
Rohde & Schwarz	EMI Test Reciever	1166.5950K03	100337	2010-03-24
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-2	2009-08-20
HP	Amplifier, Pre	1-26.5GHz	3147A00400	2010-01-29
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2009-09-23

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

### 13.5 Test Environmental Conditions

<b>Temperature:</b>	20~23 °C
<b>Relative Humidity:</b>	50~55 %
<b>ATM Pressure:</b>	99-102.2kPa

\* The testing was performed by Jerry Huang from 2010-05-17 to 2010-05-19.

### 13.6 Summary of Test Results

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

Unwanted Emissions and Receiving Spurious Emission, (30-1000 MHz):

Mode: Receiving			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-5.54	232.4063	Horizontal	30 to 1000 MHz
-6.51	1000	Horizontal	1000 to 25000 MHz

**Radiated Emission at 3 meters, 30 MHz -1GHz****Receive Mode – Worst Case**

Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)
232.4063	40.96	152	H	260	46.5	-5.54
410.6967	38.98	100	H	332	46.5	-7.52
994.8224	44.27	95	H	108	54.0	-9.73
322.8963	36.47	93	H	245	46.5	-10.03
240.2383	32.17	117	H	92	46.5	-14.33
277.0044	31.70	112	H	225	46.5	-14.8

**Radiated Emission at 3 meters, 1 – 25 GHz**

Frequency (MHz)	S.A. Reading (dBμV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBμV/m)	IC		Comments
			Height (m)	Polarity (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	
1000	58.66	112	1.0	H	23.7	2.02	37.09	47.49	54	-6.51	Ave
2500	61.99	212	1.0	V	34.8	4.64	34.81	66.98	74	-7.02	Peak
2500	42.59	212	1.0	V	34.8	4.64	34.81	46.21	54	-7.79	Ave
1000	56.02	270	1.54	V	23.7	2.02	37.09	45.35	54	-8.65	Ave
2500	61.57	7	1.64	H	34.8	4.64	34.81	64.9	74	-9.10	Peak
2500	39.61	7	1.64	H	34.8	4.64	34.81	44.44	54	-9.56	Ave
1000	70	112	1.0	H	23.7	2.02	37.09	59.09	74	-14.91	Peak
1000	69.05	270	1.54	V	23.7	2.02	37.09	58.28	74	-15.72	Peak

\* All other Restricted Band Frequencies were below the noise level and/or more than 20 dB below the margin