FCC PART 15.407
IC RSS-210, ISSUE 8, DEC 2010
TEST AND MEASUREMENT REPORT

For

Fortinet, Inc.

1090 Kifer Road,

Sunnyvale, CA 94086, USA

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

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

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1207033-407	CIIPC Report	2012-07-05

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, *model: WPEA-111N/W, FCC ID: TVE-0600101, IC: 7280B-0600101* or the "EUT" as referred to this report. The EUT is an 802.11a/b/g/n Wi-Fi module.

1.2 Mechanical Description of EUT

The EUT measures approximately 30 mm **(L)** x 30 mm **(W)** x 3 mm **(H)** and weighs approximately 3.5 g.

The data gathered are from a typical production sample provided by the manufacturer with serial 10535K1001055

1.3 Objective

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

This class II permissive change report is based on the use of a higher gain antenna compare to the original grant. The new antenna has 5.7 dBi on 5.2 GHz, as the original grant only has 5.5dBi on 5.2 GHz band with the same type.

The objective is to determine compliance with FCC Part 15.407 and IC RSS-210 rules for Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

DTS submission with FCC ID: TVE-0600101, IC: 7280B-0600101.

1.5 Test Methodology

FCC Part 2, Part 15.407 and RSS-210, Issue 8, Dec 2010, 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.

1.6 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.

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.

1.7 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.: 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 EUT 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.

2.2 EUT Exercise Software

The software is provided by the customer. The EUT exercise program used during radiated testing was designed to exercise the system components.

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)
802.11a	20	5180/6	5220/6	5240/6
802.11n HT20	20	5180/MCS0	5220/MCS0	5240/MCS0
802.11n HT40	40	5190/MCS0	-	5230/MCS0

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.
HP	Laptop	Tx2500	CNF83210D9
-	Express Card Adapter	-	-

2.6 Host Internal Configuration and Details

Manufacturers	Descriptions	Models	Serial Numbers
-	Supporting PCB	-	PE3B Ver. 1.2
Fortinet, Inc.	WLAN module	WPEA-111N/W	10535K1001055

3 Summary of Test Results

FCC & IC Rules	Description of Test	Results
FCC §15.407(f), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.207 IC RSS-Gen §7.2.4	Conducted Emissions	N/A[1]
FCC §15.209(a), §15.407(b) IC RSS-210 §A9.2	Spurious Radiated Emissions	Compliant
FCC §15.407(a) IC RSS-210 §A9.2	26 dB and 99% Emission Bandwidth	N/A[1]
FCC §407(a) IC RSS-210 §A9.2	Peak Output Power Measurement	N/A[1]
FCC §2.1051, §15.407(b) IC RSS-210 §A9.3	Band Edges	N/A[1]
FCC §15.407(a)(1), (a)(2) IC RSS-5210 §A9.2	Power Spectral Density	N/A[1]
IC RSS-210 §2.3 & RSS-Gen §6	Receiver Spurious Radiated Emissions	Compliant
FCC §2.1051, §15.407(b) IC RSS-210 §A9.2	Spurious Emissions at Antenna Terminals	N/A[1]

Note: N/A[1], Please refer to original FCC ID: TVE-0600101 and IC: 7280B-0600101.

4 FCC §15.407(f), §2.1091 & IC RSS-102 - RF Exposure

4.1 Applicable Standard

According to FCC §15.407(f) 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 (minutes)
0.003 - 1	280	2.19	-	6
1 - 10	280 / f	2.19 / f	-	6
10 - 30	28	2.19 / f	-	6
30 – 300	28	0.073	2*	6
300 – 1 500	$1.585\ f^{0.5}$	$0.0042\ f^{0.5}$	f / 150	6
1 500 – 15 000	61.4	0.163	10	6
15 000 – 150 000	61.4	0.163	10	$616000 / f^{1.2}$
150 000- 300 000	$0.158\ f^{0.5}$	$4.21 \times 10\ -4\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000 / f^{1.2}$

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

4.2 MPE Prediction

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

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

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

4.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	16.89
Maximum peak output power at antenna input terminal (mW):	48.87
Prediction distance (cm):	20
Prediction frequency (MHz):	5230
Maximum Antenna Gain, typical (dBi):	5.7
Maximum Antenna Gain (numeric):	3.72
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.036
Power density of prediction frequency at 20.0 cm (W/m^2):	0.36
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 meet FCC/IC MPE limits at 20 cm distance for uncontrolled exposure environment.

5 FCC §15.209 (a), §15.407(b) & IC RSS-210 §A9.2 – 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 Note 2	3
88 - 216	150 Note 2	3
216 - 960	200 Note 2	3
Above 960	500	3

Note 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 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC Part 15.407 (b)(2), (3) and IC RSS-210

(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band.

(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

5.2 EUT Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification limits were in accordance with FCC 15E 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 placed on a turntable, 0.8 meter above ground plane. The turntable shall be rotated 360 degrees to determine the highest emission with the antenna in both horizontal and vertical polarizations.

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 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

5.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2011-09-14
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2012-03-08
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28
A.H. Systems	Horn antenna	SAS-200/571	261	2011-10-03
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09

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

5.6 Test Environmental Conditions

Temperature:	20-23 °C
Relative Humidity:	40-42%
ATM Pressure:	101.1-101.3kPa

The testing was performed by Lionel Lara from 2012-07-02 to 2012-07-03 at 5 meter chamber 3.

5.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15, Subpart C, section 15.205, 15.209 and 15.247 & IC RSS-210, RSS-Gen standard's radiated emissions limits, with a worst case margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-13.19	131.4	Horizontal	Worst Channel, 5.2 GHz, 802.11HT20 mode, 30-1000 MHz

Above 1 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-0.19	5147.8	Vertical	Low Channel, 5.2 GHz, 802.11n HT40 mode, 1-40 GHz

Please refer to the following tables for specific test result details

5.8 Radiated Emissions Test Data

1) 30 MHz–1 GHz, Measured at 3 meters

Quasi-Peak Measurements

802.11n HT20 Mode, Low channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	FCC/IC Limit (dBµV/m)	Margin (dB)
131.4	30.07	295	H	0	43.5	-13.43
996.3	31.11	100	V	190	54	-22.89
268	24.66	202	V	195	46	-21.34

802.11n HT20 Mode, Middle channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	FCC/IC Limit (dBµV/m)	Margin (dB)
131.4	30.10	302	H	0	43.5	-13.40
996.3	31.30	100	V	189	54	-22.70
268	23.65	196	V	198	46	-22.35

802.11n HT20 Mode, High channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	FCC/IC Limit (dBµV/m)	Margin (dB)
131.4	30.31	301	H	0	43.5	-13.19
996.3	30.87	100	V	185	54	-23.13
268	23.01	200	V	200	46	-22.99

802.11n HT40 Mode, Low channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	FCC/IC Limit (dBµV/m)	Margin (dB)
131.4	29.52	300	H	0	43.5	-13.98
996.3	30.06	100	V	191	54	-23.94
268	23.81	195	V	198	46	-22.19

802.11n HT40 Mode, High channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	FCC/IC Limit (dBµV/m)	Margin (dB)
131.4	29.24	300	H	0	43.5	-14.26
996.3	31.96	100	V	190	54	-22.04
268	23.88	196	V	196	46	-22.12

2) Above 1 GHz, Measured at 3 meters

5.2 GHz 802.11n HT20 mode

Frequency (MHz)	S.A. Reading (dBµV)	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 5180 MHz, measured at 3 meters											
5180	66.63	320	101	H	34.41	4.52	0	105.56	Fund	-	Peak
5180	73.87	10	100	V	34.4	4.52	0	112.79	Fund	-	Peak
5180	55.48	320	101	H	34.41	4.52	0	94.41	Fund	-	Ave
5180	62.51	10	100	V	34.4	4.52	0	101.43	Fund	-	Ave
10360	40.2	0	100	H	38.74	6.14	26.98	58.1	88.2	-30.1	Peak
10360	40.2	0	100	V	38.8	6.14	26.98	58.16	88.2	-30.04	Peak
10360	24.88	0	100	H	38.74	6.14	26.98	42.78	68.2	-25.42	Ave
10360	24.88	0	100	V	38.8	6.14	26.98	42.84	68.2	-25.36	Ave
15540	42.05	0	100	H	39.84	7.47	25.92	63.44	74	-10.56	Peak
15540	42.05	0	100	V	39.76	7.47	25.92	63.36	74	-10.64	Peak
15540	26.61	0	100	H	39.84	7.47	25.92	48	54	-6	Ave
15540	26.61	0	100	V	39.76	7.47	25.92	47.92	54	-6.08	Ave
2494	47.19	51	152	H	29.12	3.01	27.8	51.52	74	-22.48	Peak
2494	50.39	348	100	V	29.12	3.01	27.8	54.72	74	-19.28	Peak
2494	28.11	51	152	H	29.12	3.01	27.8	32.44	54	-21.56	Ave
2494	29.4	348	100	V	29.12	3.01	27.8	33.73	54	-20.27	Ave
Middle Channel 5220 MHz, measured at 3 meters											
5220	66.59	330	100	H	34.41	4.52	0	105.52	Fund	-	Peak
5220	73.75	9	100	V	34.4	4.52	0	112.67	Fund	-	Peak
5220	55.56	330	100	H	34.41	4.52	0	94.49	Fund	-	Ave
5220	63.31	9	100	V	34.4	4.52	0	102.23	Fund	-	Ave
10440	40.26	0	100	H	39.04	6.14	26.92	58.52	88.2	-29.68	Peak
10440	40.26	0	100	V	38.8	6.14	26.92	58.28	88.2	-29.92	Peak
10440	24.9	0	100	H	39.04	6.14	26.92	43.16	68.2	-25.04	Ave
10440	24.9	0	100	V	38.8	6.14	26.92	42.92	68.2	-25.28	Ave
15660	42.06	0	100	H	39.86	7.47	25.94	63.45	74	-10.55	Peak
15660	42.06	0	100	V	39.83	7.47	25.94	63.42	74	-10.58	Peak
15660	26.58	0	100	H	39.86	7.47	25.94	47.97	54	-6.03	Ave
15660	26.58	0	100	V	39.83	7.47	25.94	47.94	54	-6.06	Ave
2494	47.13	50	149	H	29.12	3.01	27.8	51.46	74	-22.54	Peak
2494	50.31	346	100	V	29.12	3.01	27.8	54.64	74	-19.36	Peak
2494	27.99	50	149	H	29.12	3.01	27.8	32.32	54	-21.68	Ave
2494	29.36	346	100	V	29.12	3.01	27.8	33.69	54	-20.31	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 5240 MHz, measured at 3 meters											
5240	67.22	331	100	H	34.41	4.52	0	106.15	Fund	-	Peak
5240	76.19	132	128	V	34.4	4.52	0	115.11	Fund	-	Peak
5240	56	331	100	H	34.41	4.52	0	94.93	Fund	-	Ave
5240	65.63	132	128	V	34.4	4.52	0	104.55	Fund	-	Ave
10480	40.21	0	100	H	39.05	6.14	26.93	58.47	88.2	-29.73	Peak
10480	40.21	0	100	V	39.07	6.14	26.93	58.49	88.2	-29.71	Peak
10480	24.87	0	100	H	39.05	6.14	26.93	43.13	68.2	-25.07	Ave
10480	24.87	0	100	V	39.07	6.14	26.93	43.15	68.2	-25.05	Ave
15720	42.08	0	100	H	39.86	7.47	25.97	63.44	74	-10.56	Peak
15720	42.08	0	100	V	39.83	7.47	25.97	63.41	74	-10.59	Peak
15720	26.64	0	100	H	39.86	7.47	25.97	48	54	-6	Ave
15720	26.64	0	100	V	39.83	7.47	25.97	47.97	54	-6.03	Ave
2494	46.84	50	150	H	29.12	3.01	27.8	51.17	74	-22.83	Peak
2494	50.42	346	100	V	29.12	3.01	27.8	54.75	74	-19.25	Peak
2494	27.73	50	150	H	29.12	3.01	27.8	32.06	54	-21.94	Ave
2494	29.38	346	100	V	29.12	3.01	27.8	33.71	54	-20.29	Ave

5.2 GHz 802.11n HT40 mode

Frequency (MHz)	S.A. Reading (dBµV)	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 5190 MHz, measured at 3 meters											
5240	67.22	331	100	H	34.41	4.52	0	106.15	Fund	-	Peak
5240	76.19	132	128	V	34.4	4.52	0	115.11	Fund	-	Peak
5240	56	331	100	H	34.41	4.52	0	94.93	Fund	-	Ave
5240	65.63	132	128	V	34.4	4.52	0	104.55	Fund	-	Ave
10380	39.24	0	100	H	38.74	6.14	26.98	57.14	88.2	-31.06	Peak
10380	39.24	0	100	V	38.8	6.14	26.98	57.2	88.2	-31	Peak
10380	24.77	0	100	H	38.74	6.14	26.98	42.67	68.2	-25.53	Ave
10380	24.77	0	100	V	38.8	6.14	26.98	42.73	68.2	-25.47	Ave
15570	41.06	0	100	H	39.8	7.47	25.92	62.41	74	-11.59	Peak
15570	41.06	0	100	V	39.71	7.47	25.92	62.32	74	-11.68	Peak
15570	26.84	0	100	H	39.8	7.47	25.92	48.19	54	-5.81	Ave
15570	26.84	0	100	V	39.71	7.47	25.92	48.1	54	-5.9	Ave
2494	47.02	50	150	H	29.12	3.01	27.8	51.35	74	-22.65	Peak
2494	50.43	346	100	V	29.12	3.01	27.8	54.76	74	-19.24	Peak
2494	27.9	50	150	H	29.12	3.01	27.8	32.23	54	-21.77	Ave
2494	29.45	346	100	V	29.12	3.01	27.8	33.78	54	-20.22	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 5230 MHz, measured at 3 meters											
5230	62.73	332	100	H	34.41	4.52	0	101.66	Fund	-	Peak
5230	69.03	10	100	V	34.4	4.52	0	107.95	Fund	-	Peak
5230	51.35	332	100	H	34.41	4.52	0	90.28	Fund	-	Ave
5230	58.44	10	100	V	34.4	4.52	0	97.36	Fund	-	Ave
10460	39.3	0	100	H	39.05	6.14	26.93	57.56	88.2	-30.64	Peak
10460	39.3	0	100	V	39.07	6.14	26.93	57.58	88.2	-30.62	Peak
10460	24.8	0	100	H	39.05	6.14	26.93	43.06	68.2	-25.14	Ave
10460	24.8	0	100	V	39.07	6.14	26.93	43.08	68.2	-25.12	Ave
15690	41.02	0	100	H	39.86	7.47	25.97	62.38	74	-11.62	Peak
15690	41.02	0	100	V	39.83	7.47	25.97	62.35	74	-11.65	Peak
15690	26.83	0	100	H	39.86	7.47	25.97	48.19	54	-5.81	Ave
15690	26.83	0	100	V	39.83	7.47	25.97	48.16	54	-5.84	Ave
2494	46.82	52	147	H	29.12	3.01	27.8	51.15	74	-22.85	Peak
2494	50.16	346	100	V	29.12	3.01	27.8	54.49	74	-19.51	Peak
2494	27.1	52	147	H	29.12	3.01	27.8	31.43	54	-22.57	Ave
2494	29.38	346	100	V	29.12	3.01	27.8	33.71	54	-20.29	Ave

3) Restricted Band Emissions

5.2 GHz 802.11n HT20 mode

Frequency (MHz)	S.A. Reading (dBµV)	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 5180 MHz, measured at 3 meters											
4901	27.02	320	101	H	33.57	4.1	0	64.69	74	-9.31	Peak
5105	27.25	10	100	V	34.4	4.38	0	66.03	74	-7.97	Peak
4901	12.94	320	101	H	33.57	4.1	0	50.61	54	-3.39	Ave
5105	13.43	10	100	V	34.4	4.38	0	52.21	54	-1.79	Ave

5.2 GHz 802.11n HT40 mode

Frequency (MHz)	S.A. Reading (dBµV)	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 5190 MHz, measured at 3 meters											
5148.9	27.18	321	102	H	34.38	4.38	0	65.94	74	-8.06	Peak
5147.8	30.01	10	100	V	34.4	4.38	0	68.79	74	-5.21	Peak
5148.9	13.58	321	102	H	34.38	4.38	0	52.34	54	-1.66	Ave
5147.8	15.03	10	100	V	34.4	4.38	0	53.81	54	-0.19	Ave

6 IC RSS-210 §2.3 & RSS-Gen §6 - Receiver Spurious Radiated Emissions

6.1 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.

The receiver spurious emissions limits were specified in Table 2 of RSS-Gen §6.

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

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 Lists and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2011-09-14
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2012-03-08
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28
A.H. Systems	Horn antenna	SAS-200/571	261	2011-10-03
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09

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

6.6 Test Environmental Conditions

Temperature:	20-23 °C
Relative Humidity:	40-42%
ATM Pressure:	101.1-101.3kPa

The testing was performed by Lionel Lara from 2012-07-02 to 2012-07-03 at 5 meter chamber 3.

6.7 Summary of Test Results

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

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-0.41	18000	Horizontal	30 to 25000

6.8 Radiated Emissions Test Data and Plots

1) 30-1000 MHz, Measured at 3 meters

Receiving mode, Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
99.90	41.69	245	H	295	43.5	-1.81
176.3	39.16	150	H	206	43.5	-4.34
199.8	36.58	168	H	22	43.5	-6.92

2) Above 1 GHz Measured at 3 meters

Receiving 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)	
2494	47.68	325	100	H	29.12	3.01	27.8	52.01	74	-21.99	Peak
2494	51.75	352	100	V	29.12	3.01	27.8	56.08	74	-17.92	Peak
2494	28.45	325	100	H	29.12	3.01	27.8	32.78	54	-21.22	Ave
2494	30.12	352	100	V	29.12	3.01	27.8	34.45	54	-19.55	Ave
4988	42.87	36	112	H	33.95	4.21	27.73	53.3	74	-20.7	Peak
4988	43.68	137	169	V	33.91	4.21	27.73	54.07	74	-19.93	Peak
4988	25.1	36	112	H	33.95	4.21	27.73	35.53	54	-18.47	Ave
4988	25.56	137	169	V	33.91	4.21	27.73	35.95	54	-18.05	Ave
18000	39.41	0	100	H	44.49	8.47	25.33	67.04	74	-6.96	Peak
18000	39.41	0	100	V	44.04	8.47	25.33	66.59	74	-7.41	Peak
18000	25.96	0	100	H	44.49	8.47	25.33	53.59	54	-0.41	Ave
18000	25.96	0	100	V	44.04	8.47	25.33	53.14	54	-0.86	Ave