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

Prepared By: Lionel Lara

Report Number: R1204233-407

Report Date: 2012-05-25

Reviewed By: Victor Zhang
RF/EMC Lead

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732 9164

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1204233-407	CIIPC Report	2012-05-25

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 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 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)

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.
Lenovo	Laptop	Thinkpad T61	L3-B1515
-	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):	5.5
Maximum Antenna Gain (numeric):	3.55
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.035
Power density of prediction frequency at 20.0 cm (W/m^2):	0.35
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	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 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	2944A06639	2011-06-09
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
EMCO	Horn antenna	3115	9511-4627	2011-10-03
Mini-Circuits	Pre-amplifier	ZVA-183-S	667400960	2011-08-10

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

5.6 Test Environmental Conditions

Temperature:	20-23 °C
Relative Humidity:	38-45%
ATM Pressure:	101.1-101.4kPa

The testing was performed by Lionel Lara from 2012-05-08 to 2012-05-11 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**
-3.89	167.9735	Horizontal	Worst Channel, 5.2 GHz, 802.11a mode, 30-1000 MHz

1 – 50 GHz:

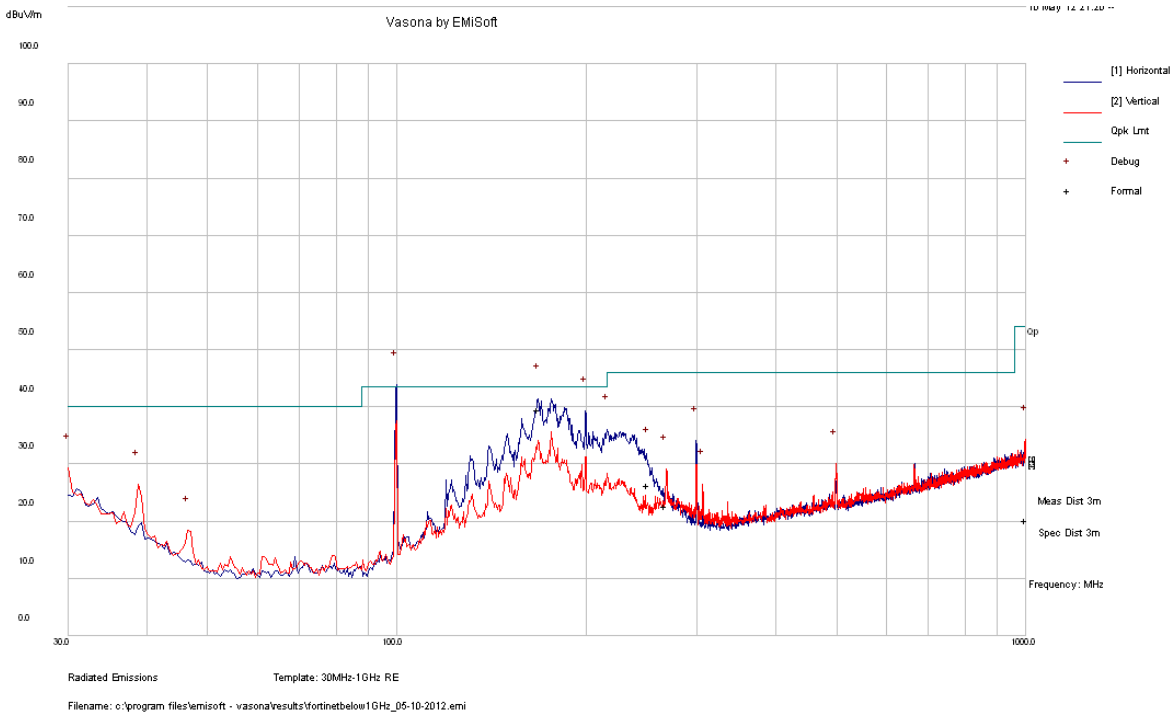
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-0.99	5150	Vertical	Low Channel, 5.2 GHz, 802.11n HT40 mode, 1-50 GHz

Please refer to the following tables for specific test result details

5.8 Radiated Emissions Test Result Data:

1) 30 MHz – 1 GHz, Measured at 3 meters

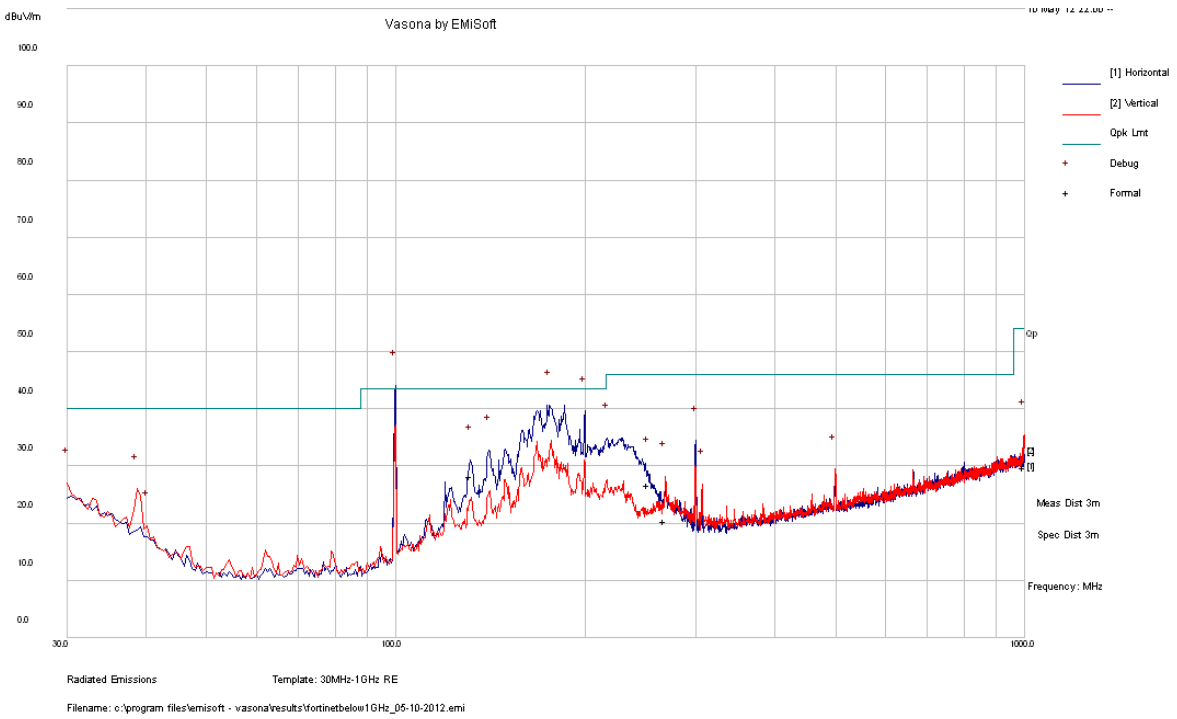
5.2 GHz, 802.11a Mode, Worst channel



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	FCC.IC Limit (dBµV/m)	Margin (dB)
167.9735	39.61	137	H	4	43.5	-3.89
250.8238	26.27	155	H	352	46	-19.73
267.6635	22.64	213	V	150	46	-23.36
1000	20.16	233	V	251	54	-33.84

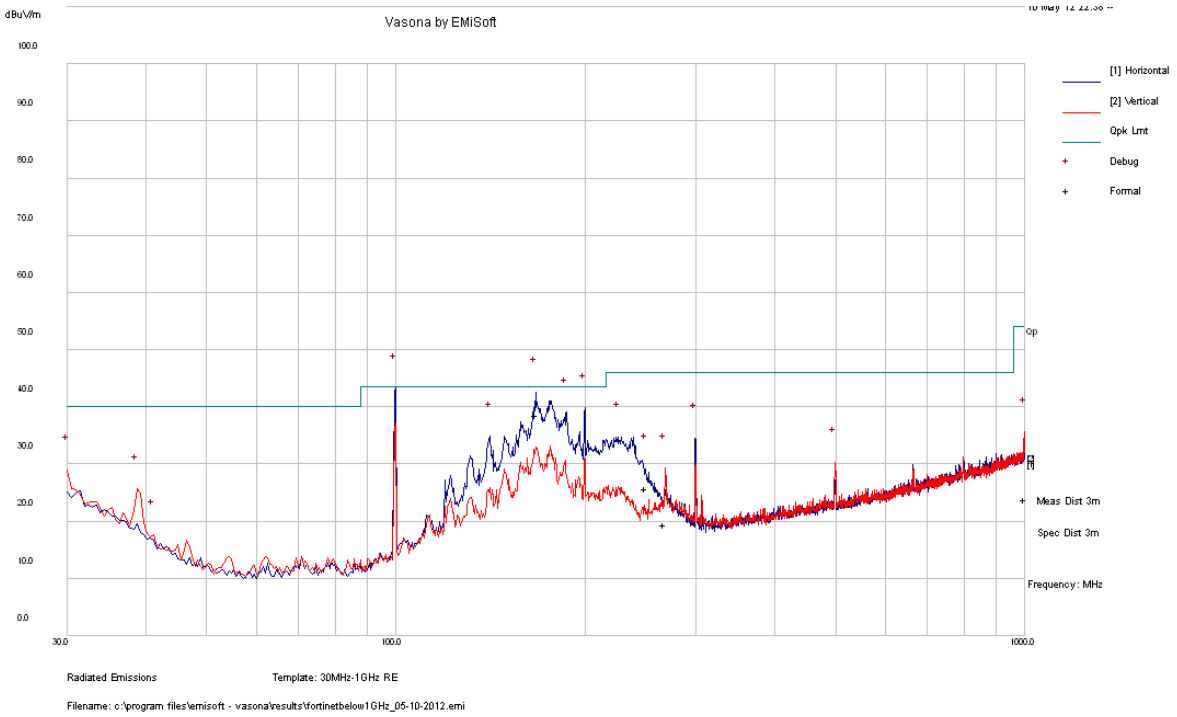
5.2 GHz, 802.11n HT20 Mode, Worst channel



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	FCC/IC Limit (dBµV/m)	Margin (dB)
131.2308	28.34	242	H	0	43.5	-15.16
251.8745	26.78	100	H	344	46	-19.22
997.5015	29.82	100	V	184	54	-24.18
267.6208	20.44	299	V	189	46	-25.56

5.2 GHz, 802.11n HT40 Mode, Worst channel



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	FCC/IC Limit (dBµV/m)	Margin (dB)
166.9268	38.59	182	H	360	43.5	-4.91
249.7705	25.84	111	H	181	46	-20.16
267.655	19.48	242	V	4	46	-26.52
1000	23.91	140	V	167	54	-30.09

2) 1–40 GHz, Measured at 3 meters

5.2 GHz 802.11a 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											
1000	43.54	30	100	H	23.79	1.95	27.19	42.09	74	-31.91	Peak
1000	54.46	182	100	V	24.18	1.95	27.19	53.4	74	-20.6	Peak
1000	24.35	30	100	H	23.79	1.95	27.19	22.9	54	-31.1	Ave
1000	30.48	182	100	V	24.18	1.95	27.19	29.42	54	-24.58	Ave
2494	46.21	76	167	H	28.42	3.3	27.61	50.32	74	-23.68	Peak
2494	45.79	201	106	V	28.27	3.3	27.61	49.75	74	-24.25	Peak
2494	27.07	76	167	H	28.42	3.3	27.61	31.18	54	-22.82	Ave
2494	26.99	201	106	V	28.27	3.3	27.61	30.95	54	-23.05	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)	
Middle Channel 5220 MHz, measured at 3 meters											
1000	42.87	30	100	H	23.79	1.95	27.19	41.42	74	-32.58	Peak
1000	54.28	182	100	V	24.18	1.95	27.19	53.22	74	-20.78	Peak
1000	24.32	30	100	H	23.79	1.95	27.19	22.87	54	-31.13	Ave
1000	29.87	182	100	V	24.18	1.95	27.19	28.81	54	-25.19	Ave
2494	46.85	76	167	H	28.42	3.3	27.61	50.96	74	-23.04	Peak
2494	46.23	201	106	V	28.27	3.3	27.61	50.19	74	-23.81	Peak
2494	27.26	76	167	H	28.42	3.3	27.61	31.37	54	-22.63	Ave
2494	27.12	201	106	V	28.27	3.3	27.61	31.08	54	-22.92	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											
1000	43.35	30	100	H	23.79	1.95	27.19	41.9	74	-32.1	Peak
1000	54.89	182	100	V	24.18	1.95	27.19	53.83	74	-20.17	Peak
1000	24.66	30	100	H	23.79	1.95	27.19	23.21	54	-30.79	Ave
1000	30.25	182	100	V	24.18	1.95	27.19	29.19	54	-24.81	Ave
2494	47.13	76	167	H	28.42	3.3	27.61	51.24	74	-22.76	Peak
2494	46.54	201	106	V	28.27	3.3	27.61	50.5	74	-23.5	Peak
2494	27.53	76	167	H	28.42	3.3	27.61	31.64	54	-22.36	Ave
2494	27.28	201	106	V	28.27	3.3	27.61	31.24	54	-22.76	Ave

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											
1000	41.95	30	100	H	23.79	1.95	27.19	40.5	74	-33.5	Peak
1000	53.11	182	100	V	24.18	1.95	27.19	52.05	74	-21.95	Peak
1000	23.05	30	100	H	23.79	1.95	27.19	21.6	54	-32.4	Ave
1000	29.66	182	100	V	24.18	1.95	27.19	28.6	54	-25.4	Ave
2494	45.32	76	167	H	28.42	3.3	27.61	49.43	74	-24.57	Peak
2494	44.69	201	106	V	28.27	3.3	27.61	48.65	74	-25.35	Peak
2494	26.54	76	167	H	28.42	3.3	27.61	30.65	54	-23.35	Ave
2494	26.34	201	106	V	28.27	3.3	27.61	30.3	54	-23.7	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)	
Middle Channel 5220 MHz, measured at 3 meters											
1000	44.16	30	100	H	23.79	1.95	27.19	42.71	74	-31.29	Peak
1000	54.93	182	100	V	24.18	1.95	27.19	53.87	74	-20.13	Peak
1000	25.21	30	100	H	23.79	1.95	27.19	23.76	54	-30.24	Ave
1000	30.36	182	100	V	24.18	1.95	27.19	29.3	54	-24.7	Ave
2494	47.21	76	167	H	28.42	3.3	27.61	51.32	74	-22.68	Peak
2494	46.33	201	106	V	28.27	3.3	27.61	50.29	74	-23.71	Peak
2494	27.42	76	167	H	28.42	3.3	27.61	31.53	54	-22.47	Ave
2494	27.35	201	106	V	28.27	3.3	27.61	31.31	54	-22.69	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											
1000	43.44	30	100	H	23.79	1.95	27.19	41.99	74	-32.01	Peak
1000	54.61	182	100	V	24.18	1.95	27.19	53.55	74	-20.45	Peak
1000	24.46	30	100	H	23.79	1.95	27.19	23.01	54	-30.99	Ave
1000	30.67	182	100	V	24.18	1.95	27.19	29.61	54	-24.39	Ave
2494	46.13	76	167	H	28.42	3.3	27.61	50.24	74	-23.76	Peak
2494	45.85	201	106	V	28.27	3.3	27.61	49.81	74	-24.19	Peak
2494	26.98	76	167	H	28.42	3.3	27.61	31.09	54	-22.91	Ave
2494	27.15	201	106	V	28.27	3.3	27.61	31.11	54	-22.89	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											
1000	46.23	30	100	H	23.79	1.95	27.19	44.78	74	-29.22	Peak
1000	55.87	182	100	V	24.18	1.95	27.19	54.81	74	-19.19	Peak
1000	25.86	30	100	H	23.79	1.95	27.19	24.41	54	-29.59	Ave
1000	31.73	182	100	V	24.18	1.95	27.19	30.67	54	-23.33	Ave
2494	47.31	76	167	H	28.42	3.3	27.61	51.42	74	-22.58	Peak
2494	44.99	201	106	V	28.27	3.3	27.61	48.95	74	-25.05	Peak
2494	26.88	76	167	H	28.42	3.3	27.61	30.99	54	-23.01	Ave
2494	26.65	201	106	V	28.27	3.3	27.61	30.61	54	-23.39	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											
1000	43.89	30	100	H	23.79	1.95	27.19	42.44	74	-31.56	Peak
1000	54.96	182	100	V	24.18	1.95	27.19	53.9	74	-20.1	Peak
1000	24.68	30	100	H	23.79	1.95	27.19	23.23	54	-30.77	Ave
1000	30.94	182	100	V	24.18	1.95	27.19	29.88	54	-24.12	Ave
2494	46.11	76	167	H	28.42	3.3	27.61	50.22	74	-23.78	Peak
2494	45.63	201	106	V	28.27	3.3	27.61	49.59	74	-24.41	Peak
2494	26.82	76	167	H	28.42	3.3	27.61	30.93	54	-23.07	Ave
2494	26.76	201	106	V	28.27	3.3	27.61	30.72	54	-23.28	Ave

3) Restricted Band Emissions

5.2 GHz 802.11a 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											
4795	27.08	236	100	H	33.06	4.57	0	64.71	74	-9.29	Peak
4800	27.32	130	101	V	32.97	4.57	0	64.86	74	-9.14	Peak
4795	13.16	236	100	H	33.06	4.57	0	50.79	54	-3.21	Ave
4800	13.45	130	101	V	32.97	4.57	0	50.99	54	-3.01	Ave

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											
4847	26.95	244	100	H	33.06	4.57	0	64.58	74	-9.42	Peak
5147	28.48	0	113	V	32.97	4.57	0	66.02	74	-7.98	Peak
4847	13.07	244	100	H	33.06	4.57	0	50.7	54	-3.3	Ave
5147	13.52	0	113	V	32.97	4.57	0	51.06	54	-2.94	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											
5142	27.89	238	100	H	33.06	4.57	0	65.52	74	-8.48	Peak
5150	28.83	292	100	V	32.97	4.57	0	66.37	74	-7.63	Peak
5142	13.49	238	100	H	33.06	4.57	0	51.12	54	-2.88	Ave
5150	15.47	292	100	V	32.97	4.57	0	53.01	54	-0.99	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	2944A06639	2011-06-09
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
EMCO	Horn antenna	3115	9511-4627	2011-10-03
Mini-Circuits	Pre-amplifier	ZVA-183-S	667400960	2011-08-10

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

6.6 Test Environmental Conditions

Temperature:	20-23 °C
Relative Humidity:	38-45%
ATM Pressure:	101.1-101.4kPa

The testing was performed by Lionel Lara from 2012-05-08 to 2012-05-11 at 5 meter chamber 3.

6.7 Summary of Test Results

According to the test data,, the EUT complied with the with the RSS-210, with a worst case margin of:

30-1000 MHz:

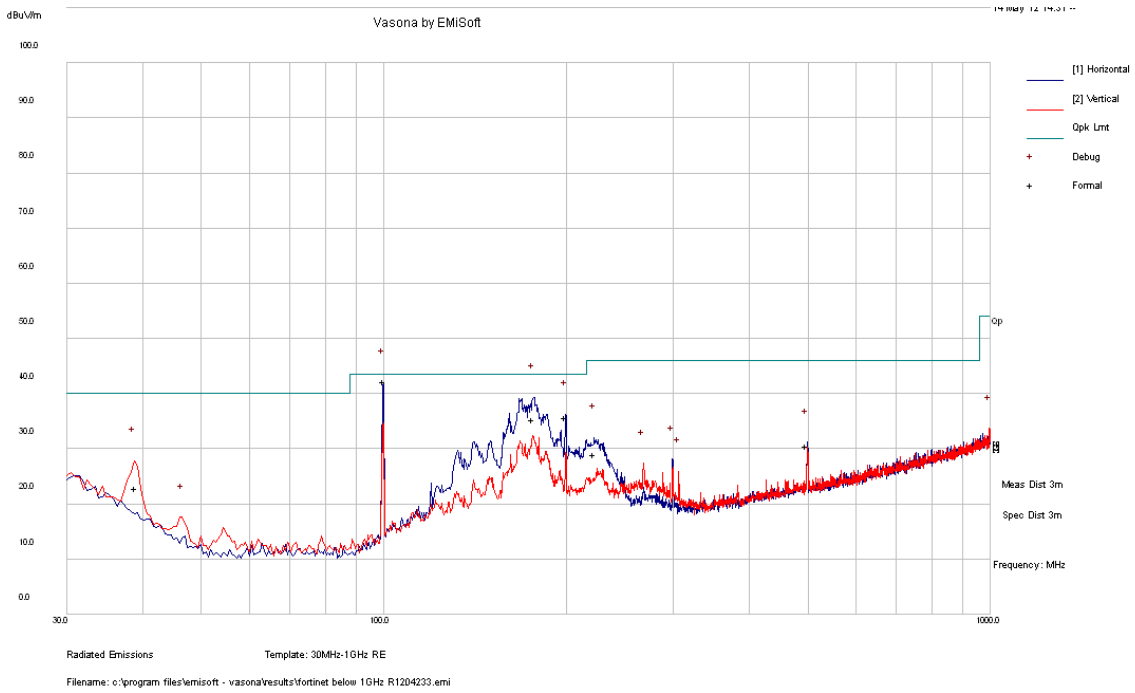
Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-1.23	99.893	Horizontal	30 to 1000

1 – 40 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range**
-16.83	2491	Horizontal	1 to 40 GHz

6.8 Radiated Emissions Test Data and Plots

1) 30-1000 MHz, Measured at 3 meters



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
99.893	42.27	301	H	199	43.5	-1.23
199.1805	35.7	166	H	354	43.5	-7.80
176.443	35.38	154	H	225	43.5	-8.12
497.8865	30.5	173	H	229	46	-15.50
221.97	29.01	105	H	197	46	-16.99
38.93675	22.86	148	V	157	40	-17.14

2) Above 1 GHz Measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
2491	53.06	42	104	H	28.42	3.3	27.61	57.17	74	-16.83	Peak
2491	52.46	232	105	V	28.27	3.3	27.61	56.42	74	-17.58	Peak
2491	31.55	42	104	H	28.42	3.3	27.61	35.66	54	-18.34	Ave
2491	31.06	232	105	V	28.27	3.3	27.61	35.02	54	-18.98	Ave
4980	44.5	44	100	H	33.55	4.55	27.5	55.1	74	-18.9	Peak
4980	46.61	39	120	V	33.42	4.55	27.5	57.08	74	-16.92	Peak
4980	25.94	44	100	H	33.55	4.55	27.5	36.54	54	-17.46	Ave
4980	26.64	39	120	V	33.42	4.55	27.5	37.11	54	-16.89	Ave