Lab Code: 200167-0

FCC PART 15.249

TEST AND MEASUREMENT REPORT

For

Actiontec Electronics, Inc.

760 North Mary Ave.,

Sunnyvale, CA 94085, USA

FCC ID: LNQSG200

Report Type:	**Product Type:**
Original Report	Gateway Device with 802.11b/g/n and Z-Wave Home Control

Test Engineers:	Jerry Huang
Report Number:	R1103282-249
Report Date:	2011-04-27
Reviewed By:	Victor Zhang RF Lead
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1103282-249	Original Report	2011-04-27

1 General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Actiontec Electronics, Inc*., and their product model: *SG200 Rev B (FCC ID: LNQSG200)* or the "EUT" as referred to in this report. The EUT is a Wireless 802.11b/g/n gateway device with Z-Wave Home Control. Operation frequency range is 2400-2483.5MHz for 802.11b/g/n Wi-Fi, 908.4 MHz for Z-Wave control.

1.2 Mechanical Description of EUT

The "EUT" measures approximately *16cm (L) x 12.5cm (W) x 3cm (H)*, and weighs approximately *275*g.

The test data gathered are from typical production sample, serial number: CSGA1122800028, provided by the manufacturer.

1.3 Objective

This type approval report is prepared on behalf of *Actiontec Electronics, Inc*. in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for section 15.203, 15.205, 15.207, 15.209 and 15.249.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submission with same FCC ID.

1.5 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.

1.6 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 $\pm$2.0 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.

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.

1.7 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 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: C-2463 and R-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 host system was configured for testing according to ANSI C63.4-2003.

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

2.2 EUT Exercise Software

Microsoft Hyper Terminal Version 5.1

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Dell	Laptop	-	-

2.5 Power Supply and Line Filters

Manufacturer	Description	Model No.	Serial No.
Actiontec	Power Adapter Input:100-120VAC 50/60Hz, 0.45A Output: 10VDC 1.6A	STD-10016U	C4613704

2.6 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RS232 Cable	< 1m	EUT	Laptop
Ethernet Cable	< 1m	EUT	Laptop

2.7 Internal Configuration

Manufacturer	Description	Model No.	Serial No.
Actiontec	PCB Board	SG200(T002929)	GSG3003A101EC110219321200021

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.20, §15.209 §15.249	Radiated Emissions	Compliant

4 FCC §15.203 – Antenna Requirements

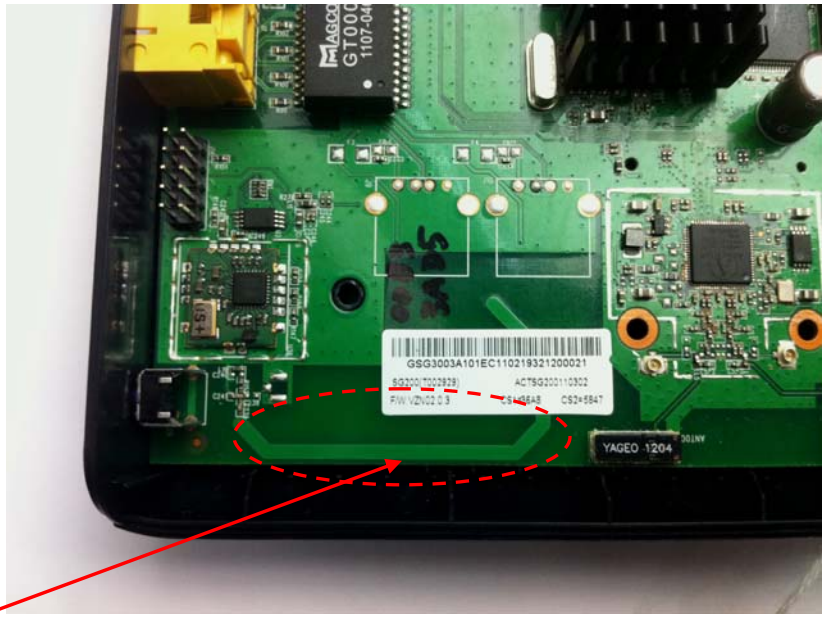
4.1 Applicable Standard

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.

4.2 Antenna Connector Construction

The EUT antenna is integrated into the PCB construction, which in accordance to §15.203, is considered sufficient to comply with the provisions of this section.

Result: Compliant.



5 FCC §15.207 – AC Line Conducted Emissions

5.1 Applicable Standard

Per FCC §15.207 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

** Decreases with the logarithm of the frequency.*

5.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC Part15.207 limits.

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

The EUT was connected to the laptop via the USB cable; the AC/DC power adapter of the laptop was connected with LISN-1 which provided 120 V / 60 Hz AC power.

5.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a "QP." Average readings are distinguished with an "Ave."

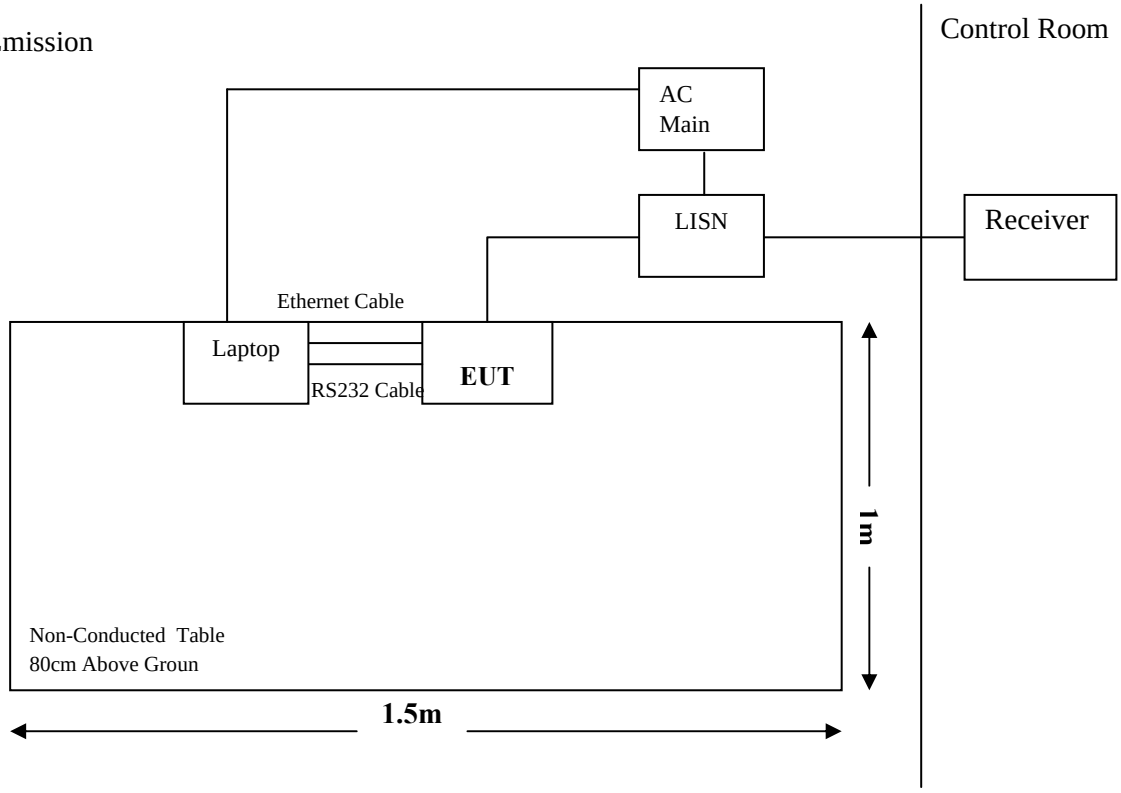
5.4 Test Equipment List and Details

Manufacturers	Description	Model No.	Serial No.	Calibration Dates
Solar Electronics	LISN	9252-R-24-BNC	511205	2010-06-25
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2010-06-24

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

5.5 Test Setup Block Diagrams

Conducted Emission



5.6 Test Environmental Conditions

Temperature:	21°C
Relative Humidity:	43 %
ATM Pressure:	102.0kPa

The testing was performed by Quinn Jiang on 2011-04-15 in chamber #3

5.7 Test Results

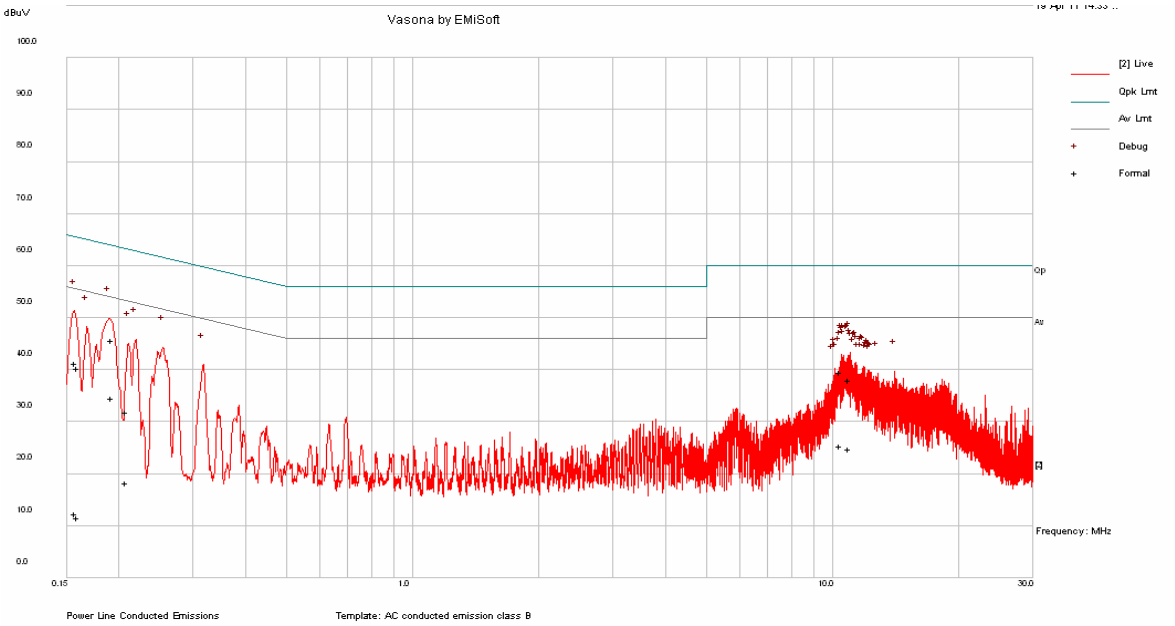
According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits for consumer devices, with the *worst* margin reading of:

Connection: 5 Vdc from AC/DC adapter connected to 120V/60Hz			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-19.26	0.191364	Neutral	0.15 to 30 MHz

Please refer to the following plots and data:

5.8 Conducted Emission Data & Plots

120V/60 Hz Line:



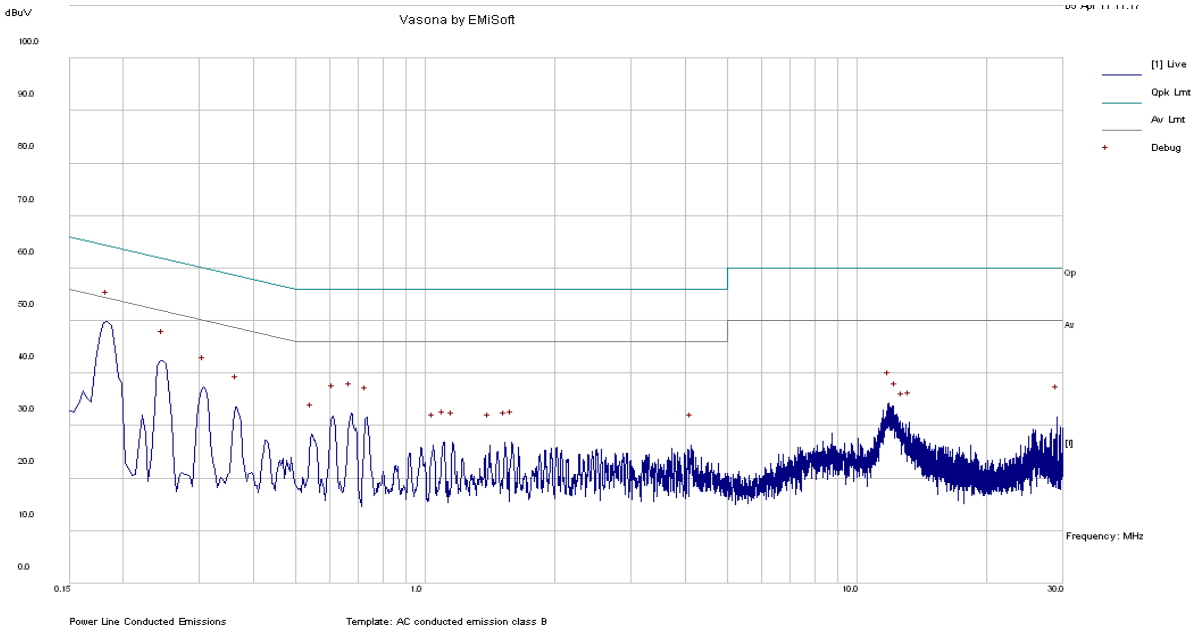
Quasi-Peak Measurement:

Frequency (MHz)	Corrected Amplitude (dBµV)	Measurement Type	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.192156	45.79	Quasi-Peak	Line	63.94	-18.16
10.47265	39.61	Quasi-Peak	Line	60	-20.39
10.97589	38.09	Quasi-Peak	Line	60	-21.91
0.157467	41.2	Quasi-Peak	Line	65.6	-24.39
0.160149	40.35	Quasi-Peak	Line	65.46	-25.10
0.208908	31.87	Quasi-Peak	Line	63.25	-31.38

Average Measurement:

Frequency (MHz)	Corrected Amplitude (dBµV)	Measurement Type	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.192156	34.57	Average	Line	53.94	-19.37
10.47265	25.3	Average	Line	50	-24.70
10.97589	24.74	Average	Line	50	-25.26
0.208908	18.29	Average	Line	53.25	-34.96
0.157467	12.45	Average	Line	55.6	-43.15
0.160149	11.65	Average	Line	55.46	-43.81

120V/60 Hz Neutral:



Quasi-Peak Measurement:

Frequency (MHz)	Corrected Amplitude (dBµV)	Measurement Type	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.191364	44.33	Quasi-Peak	Neutral	63.98	-19.65
10.84466	40.1	Quasi-Peak	Neutral	60	-19.90
10.39571	38.92	Quasi-Peak	Neutral	60	-21.08
10.79694	37.31	Quasi-Peak	Neutral	60	-22.69
10.91646	35.02	Quasi-Peak	Neutral	60	-24.98
0.16428	39.12	Quasi-Peak	Neutral	65.24	-26.12

Average Measurement:

Frequency (MHz)	Corrected Amplitude (dBµV)	Measurement Type	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.191364	34.72	Average	Neutral	53.98	-19.26
10.84466	27.41	Average	Neutral	50	-22.59
10.79694	25.5	Average	Neutral	50	-24.50
10.39571	24.66	Average	Neutral	50	-25.34
10.91646	22.91	Average	Neutral	50	-27.09
0.16428	11.59	Average	Neutral	55.24	-43.65

6 FCC §15.205, §15.209 & §15.249 - Radiated Emissions

6.1 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): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As Per 15.249(a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation

6.2 Test Setup

The radiated emissions tests were performed in the 3-meter open area test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

6.3 EUT Setup

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

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.

6.4 Test Procedure

For the radiated emissions test, the EUT was connected to the DC power source, 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 meters away from the testing antenna, which is varied from 1-4 meters, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

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

6.5 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:

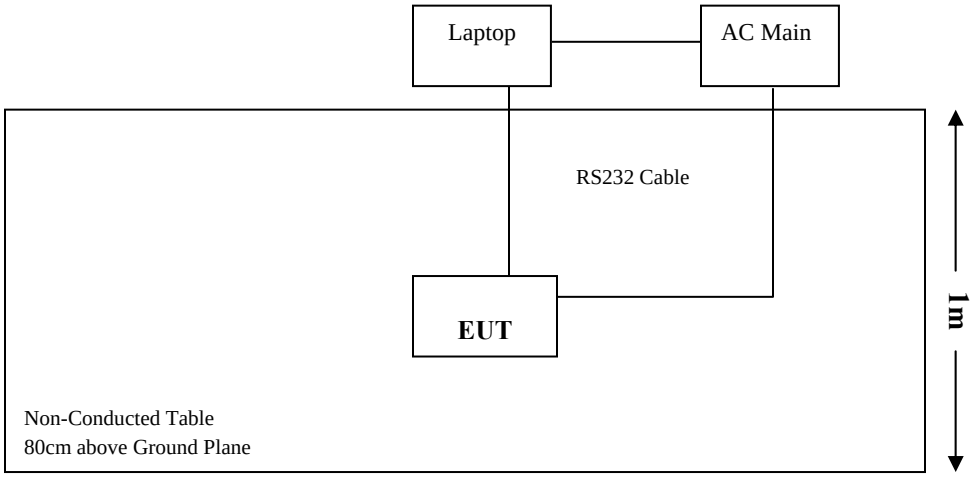
Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

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:

Margin = Corrected Amplitude - Limit

6.6 Test Setup Block Diagram

Radiated Emissions



6.7 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Pre amplifier	8447D	2944A06639	2010-06-18
Sunol Science Corp.	Combination Antenna	JB1 Antenna	A103105-1	2010-05-28
Mini-circuit	Pre Amplifier	ZCA-183-S	570400946	2010-05-10
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100337	2011-03-21
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09
A.R.A.	Antenna, Horn	DRG-118/A	1132	2010-11-29

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

6.8 Test Environmental Conditions

Temperature:	22°C
Relative Humidity:	44 %
ATM Pressure:	103.1kPa

The testing was performed by Jerry Huang on 2011-04-13.

6.9 Summary of Test Results

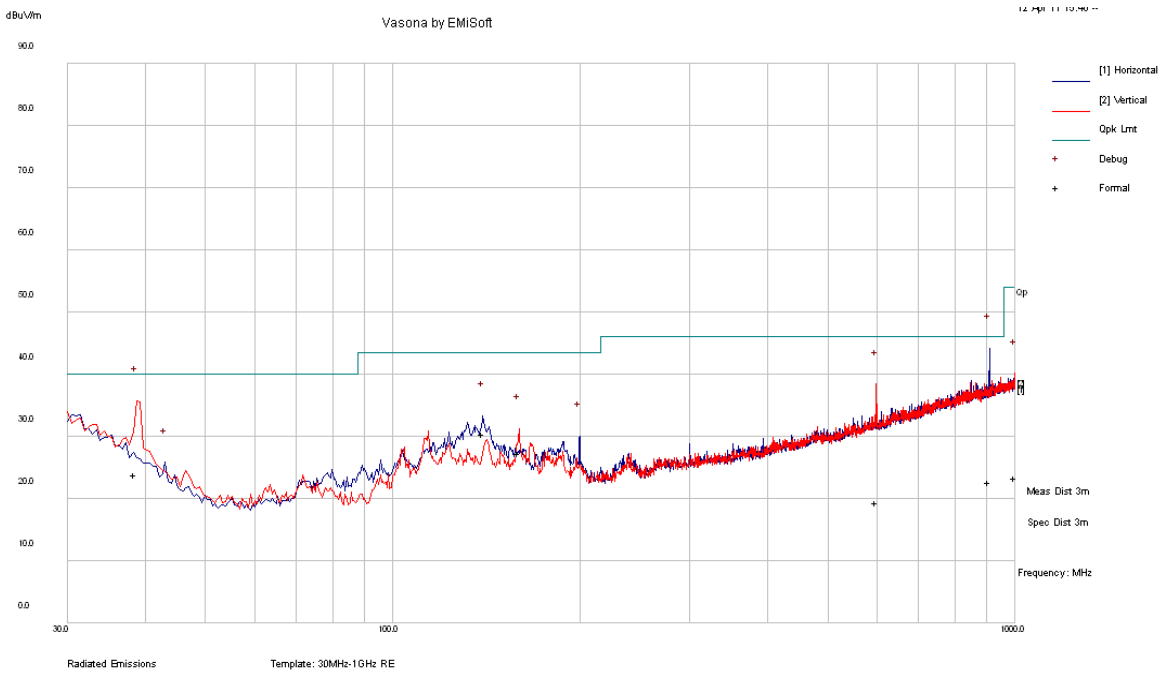
According to the data hereinafter, the EUT complied with the limits presented in FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.249, and had the worst margin of:

Z-Wave: 908.4 MHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-0.89	908.4	Horizontal	Fundamental
-13.11	139.649	Horizontal	30 to 1000 MHz
-22.63	2724	Vertical	Above 1 GHz

6.10 Radiated Emissions Test Plot & Data

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



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
139.649	30.39	H	161	171	43.5	-13.11
38.504	23.88	V	152	186	40	-16.12
159.6208	27.3	V	100	158	43.5	-16.2
908.6983	22.62	H	135	26	46	-23.38
598.2735	19.43	V	100	317	46	-26.57
998.81	23.45	V	100	322	54	-30.55

2) Fundamental measured at 3 meters

Freq. (MHz)	S.A. Reading (dBuV)	Detector PK/QP/AV	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	FCC Part 15.249		
				Height (cm)	Polar. (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	Comment
908.4	72.9	Peak	218	119	V	23.1	12.78	20.8	87.98	114	-26.02	Fund.
908.4	80.64	Peak	19	100	H	23.1	12.78	20.8	95.72	114	-18.28	Fund.
908.4	70.24	Ave	218	119	V	23.1	12.78	20.8	85.32	94	-8.68	Fund.
908.4	78.03	Ave	19	100	H	23.1	12.78	20.8	93.11	94	-0.89	Fund.

3) Above 1 GHz, Measured at 3 meters

Freq. (MHz)	S.A. Reading (dBuV)	Detector PK/QP/AV	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	FCC Part 15.249/15.209		
				Height (cm)	Polar. (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	Comment
2724	26.5	Ave	157	100	V	29.5	3.27	27.9	31.37	54	-22.63	Spurious
2724	25.19	Ave	142	195	H	29.5	3.27	27.9	30.06	54	-23.94	Spurious
2724	44.63	Peak	157	100	V	29.5	3.27	27.9	49.5	74	-24.5	Spurious
1997	27.16	Ave	273	100	V	26.2	2.94	27.5	28.8	54	-25.2	Spurious
1997	26.04	Ave	180	100	H	26.2	2.94	27.5	27.68	54	-26.32	Spurious
1997	45.86	Peak	273	100	V	26.2	2.94	27.5	47.5	74	-26.5	Spurious
2724	40.78	Peak	142	195	H	29.5	3.27	27.9	45.65	74	-28.35	Spurious
1997	42.46	Peak	180	100	H	26.2	2.94	27.5	44.1	74	-29.9	Spurious