FCC PART 15 SUBPART C

IC RSS-210, ISSUE 8, DEC 2010

TEST AND MEASUREMENT REPORT

For

Motion Computing, Inc.

8601 Ranch Road 2222 Building II,

Austin, TX 78730, USA

FCC ID: Q3QIHWM6235ANH
IC: 4857A-IM6235AN

Report Type:	**Product Type:**
CIIPC	WLAN/Bluetooth Combo Module

Prepared By: Bo Li

Report Number: R1212071-247 BT

Report Date: 2013-01-28

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1212071-247BT	CIIPC	2013-01-28

1 General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Motion Computing, Inc.*, and their product, FCC ID: *Q3QIHWM6235ANH*, IC: *4587A-IM6235AN*, model: N6235, or the "EUT" as referred to in this report, is a WLAN/Bluetooth combo module which built into Motion Tablet PC with WWAN and GPS Functionalities. Based on the declaration by the manufacture, there're no simultaneous transmissions between WWAN and WLAN + BT radios.

The current Motion Tablet PC J3600, model: T008 is an update version from previous motion tablet PC J3500. The changes made to the current J3600 from the previous J3500 were the WLAN+BT combo card with new antenna type. The WWAN portion remains the same.

1.2 Mechanical Description of EUT

The EUT measures 32cm (L) x 23cm (W) x 2cm (H) and weighs 1750g.

The data gathered are from a production sample provided by the manufacturer, serial number: R1212071-01 (Serial number assigned by BACL)

1.3 Objective

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

The objective is to determine compliance with FCC Part 15.247 and IC RSS-210 rules for Output Power, Antenna Requirements, AC Line Conducted Emissions, and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS with FCC ID: Q3QIHWM6235ANH
FCC Part 15.407 NII with FCC ID: Q3QIHWM6235ANH

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009

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.

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 System Test Configuration

2.1 Justification

The system was configured for testing in accordance with ANSI C63.4-2009.
The EUT was tested in the testing mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The test utility used was DRTU was provided by Motion Computing., and was verified by Bo Li to comply with the standard requirements being tested against.

Radio Mode	Frequency (MHz)		
	Low Channel	Middle Channel	High Channel
Bluetooth	2402	2440	2480

2.3 Special Accessories

N/A.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

N/A

2.6 Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
Delta Electronics Inc	AC/DC Adapter	ADP-50HH REV.B	KOW0819013520

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RF Cable	< 1	EUT	Spectrum Analyzer

2.8 Internal Parts List and Details

Manufacturer	Description	Model	Serial Number
Motion	Main Board	VCX00 L02T	4619lE36L02
Motion	Cellular Board	MC8355	20VM173P4
Intel	Wireless Board	6235ANH	-
Sandisk	SSD	SDSA5DK-256G	124226400059
Samsung	Memory(x2)	M471B1G73BH0-YK0	-
Motion	I/O Borad	VCX00LS9501P	483CAM
Toshiba	FAN	MCF-J15AM05	-
Motion	Battery(x2)	BATKEX00L4	-

3 Summary of Test Results

FCC & IC Rules	Description of Test	Result
FCC §15.247 (i), §2.1093 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirements	Compliant
FCC §15.207 (a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Note
FCC §15.205, §15.209, §15.247(d) IC RSS-210 §2.2, §2.6, RSS-210 §A8.5	Restricted Bands, Spurious Radiated Emissions	Compliant
FCC §15.247 (a)(1) IC RSS-210 §A8.1	20 dB Channel Bandwidth	Note
FCC §15.247 (a)(1) IC RSS-210 §A8.1(b)	Hopping Channel Separation	Note
FCC §15.247 (a)(1) IC RSS-210 §A8.1(d)	Dwell Time	Note
FCC §15.247(a)(1) IC RSS-210 §A8.1	Number of Hopping Channels	Note
FCC §15.247(a) IC RSS-210 §A8.1	Maximum Peak Output Power	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	Band Edge	Note
FCC Part 15.109 IC RSS-Gen §6	Receiver Spurious Emission	Compliant

Note: please Module report with FCC ID: PD96235ANH.

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

4.1 Applicable Standard

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

Per IC RSS-Gen §7.1.2, A transmitter can only be sold or operated with antennas with which it was certified. A transmitter maybe certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in IC RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to IC RSS-210 Annex 8 or RSS-210 Annex 9, the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to IC RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

4.2 Antenna List

Manufacturers	Models/Name	Antenna Gain (dBi) @ 2.4 GHz
Ethertronics	CP001_2_ASM	3.47

Note: The power setting was controlled by manufacture with different antenna configuration. The power setting of the different antenna will be set with the corresponded value and no more then the level reported.

The antenna consists of non-standard (UFL) connectors with less 6 dBi gain; therefore, it complies with the antenna requirement. Please refer to the internal photos.

5 FCC §15.207 & IC RSS-Gen §7.2.4 - AC Line Conducted Emissions

5.1 Applicable Standards

As per FCC §15.207 & IC RSS-Gen §7.2.4 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

***Note* [1]:** *Decreases with the logarithm of the frequency.*

5.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2009 measurement procedure. The specification used was FCC Part15.207 and IC RSS-Gen limits.

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

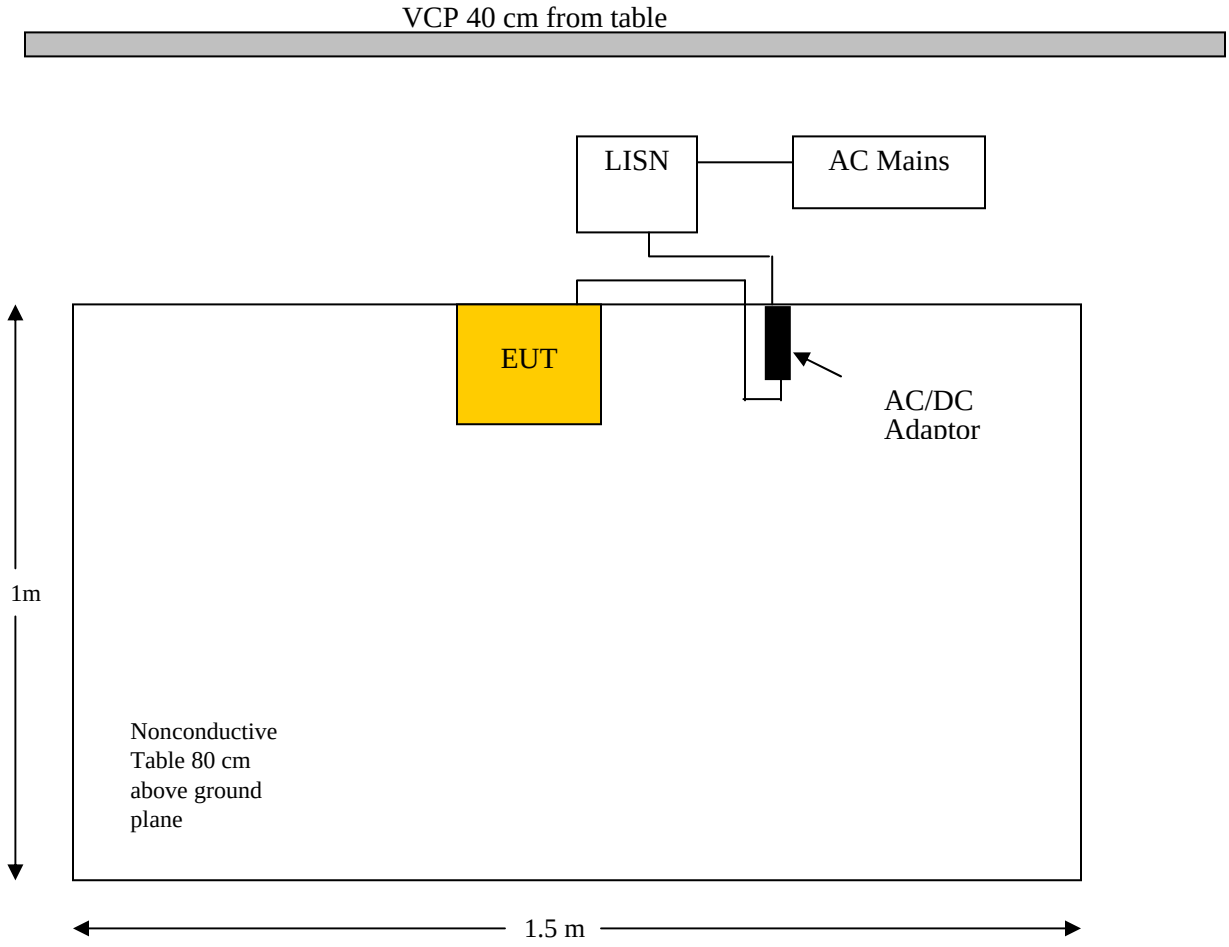
The AC/DC power adapter of the host PC was connected with LISN-1 which provided 120 V/60 Hz AC power.

5.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2012-04-18	1 year
Solar Electronics	LISN	9252-R-24-BNC	511205	2012-06-25	1 year
TTE	Filter, High Pass	H9962-150K-50-21378	K7133	2012-05-30	1 year

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

5.4 Test Setup Block Diagram



5.5 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".

5.6 Test Environmental Conditions

Temperature:	22 ºC
Relative Humidity:	44%
ATM Pressure:	102.28 kPa

The testing was performed by BO LI on 2012-01-15and 2013-01-15 in 5 m chamber 3.

5.7 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:

Corrected Amplitude = Indicated Reading + Cable Loss + Attenuator Factor

For example, a Corrected Amplitude of 34.07 dBuV = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10 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

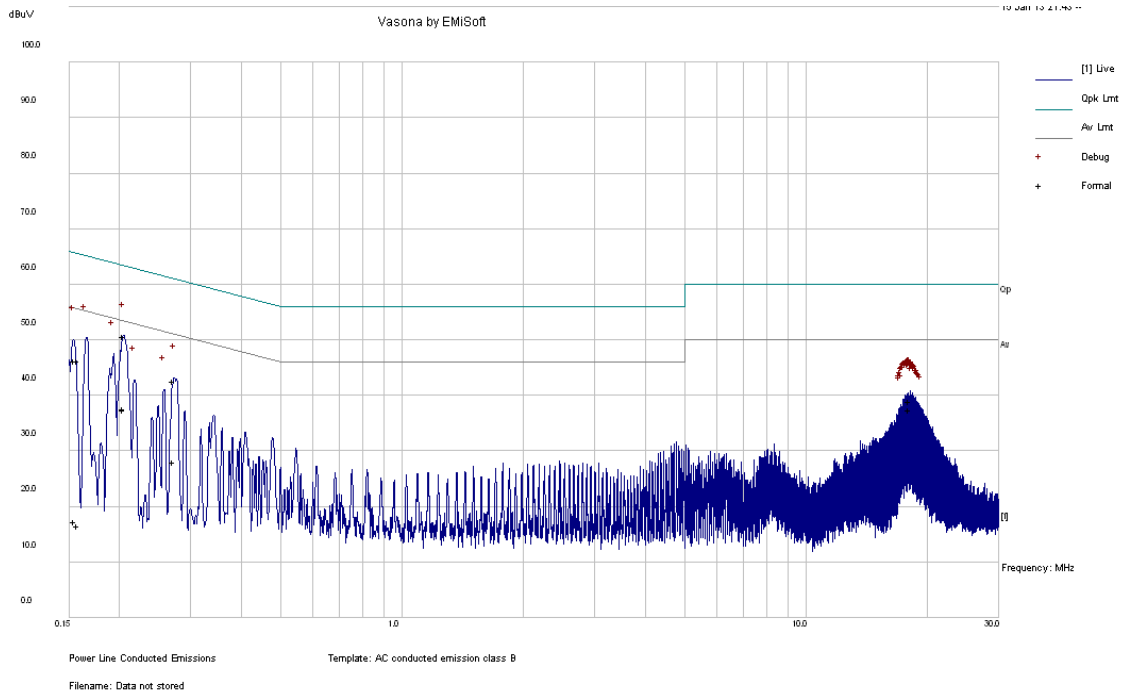
5.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC/IC standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-12.29	18.480461	Neutral	0.15 to 30

5.9 Conducted Emissions Test Plots and Data

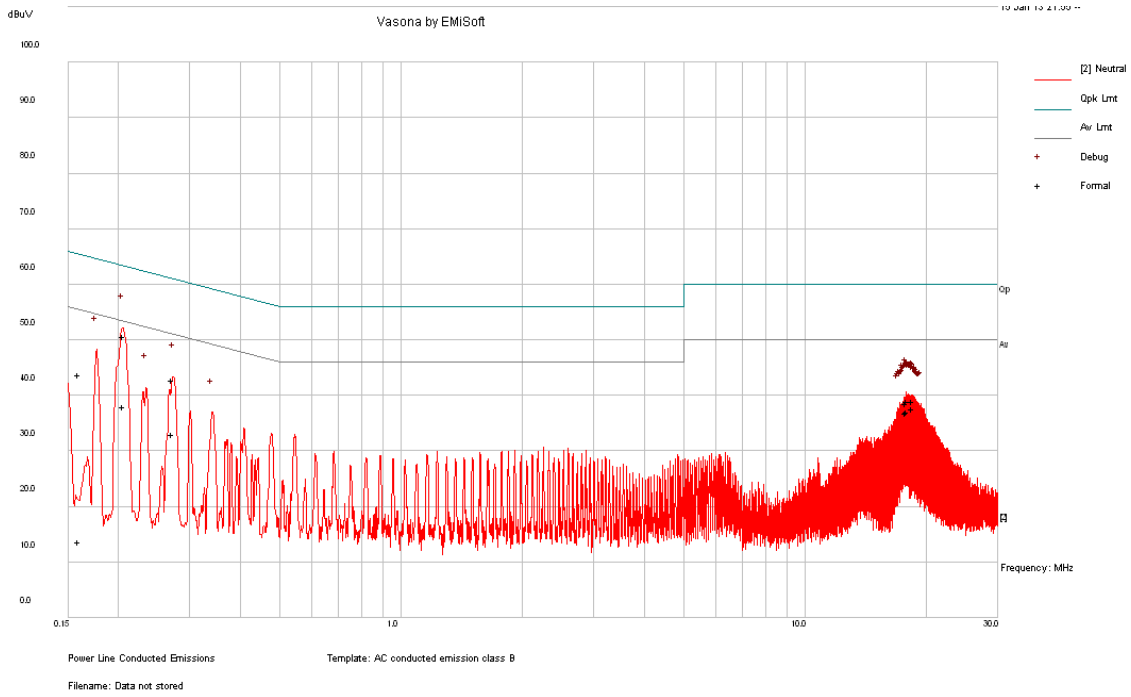
120 V, 60 Hz – Line, AC/DC Adaptor



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.205155	50.59	Line	63.4	-12.81	QP
0.15483	46.26	Line	65.74	-19.48	QP
0.157836	46.29	Line	65.58	-19.28	QP
0.204348	50.66	Line	63.43	-12.77	QP
0.272598	42.68	Line	61.04	-18.36	QP
18.074196	38.97	Line	60	-21.03	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.205155	37.51	Line	53.4	-15.89	Ave.
0.15483	17.37	Line	55.74	-38.37	Ave.
0.157836	16.55	Line	55.58	-39.03	Ave.
0.204348	37.58	Line	53.43	-15.85	Ave.
0.272598	28.14	Line	51.04	-22.9	Ave.
18.074196	37.44	Line	50	-12.56	Ave.

120 V, 60 Hz – Neutral, AC/DC Adaptor



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.205659	50.72	Neutral	63.38	-12.66	QP
0.15969	43.84	Neutral	65.48	-21.64	QP
0.27249	42.88	Neutral	61.04	-18.16	QP
17.798541	38.58	Neutral	60	-21.42	QP
17.937825	39.04	Neutral	60	-20.96	QP
18.480461	38.92	Neutral	60	-21.08	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.205659	38.03	Neutral	53.38	-15.35	Ave.
0.15969	13.78	Neutral	55.48	-41.7	Ave.
0.27249	33.11	Neutral	51.04	-17.93	Ave.
17.798541	36.8	Neutral	50	-13.2	Ave.
17.937825	37.15	Neutral	50	-12.85	Ave.
18.480461	37.71	Neutral	50	-12.29	Ave.

6 FCC §15.205, §15.209, §15.247(d) & IC RSS-210 §2.2, §A8.5 – Spurious 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) and RSS-210: Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

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

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

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

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

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

As per IC RSS-210 A8.5 Out-of-band Emissions, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the
attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

6.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15 Subpart C 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.

6.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

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

Above 1000 MHz:

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

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 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

6.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 year
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year
EMCO	Horn Antenna	3315	9511-4627	2012-10-17	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22	1 year

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

6.6 Test Environmental Conditions

Temperature:	24°C
Relative Humidity:	47%
ATM Pressure:	103kPa

The testing was performed by Bo Li on 2013-01-17 at 5 meter 3.

6.7 Summary of Test Results

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

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-16.8	266.29275	Horizontal	GFSK Low Channel

Above 1 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-4.108	2483.5	Horizontal	GFSK High Channel

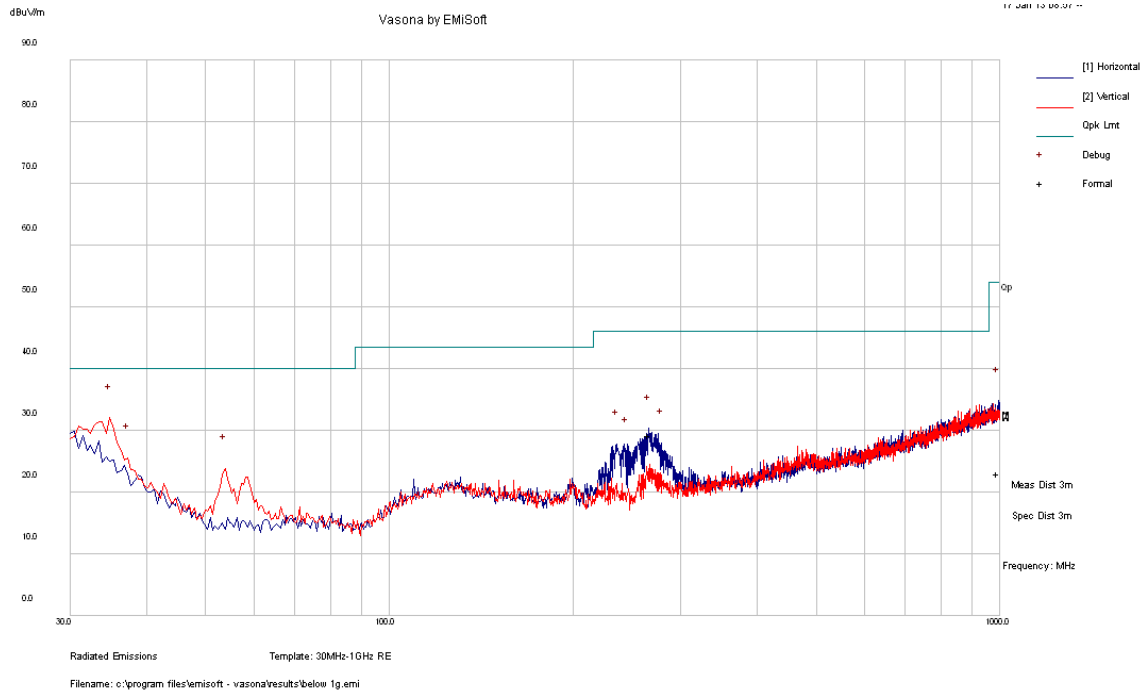
Please refer to the following table for specific test result details

6.8 Radiated Emissions Test Result Data

1) 30 MHz – 1 GHz, Radiated Spurious Emissions Measured at 3 meters

GFSK (Worst Case)

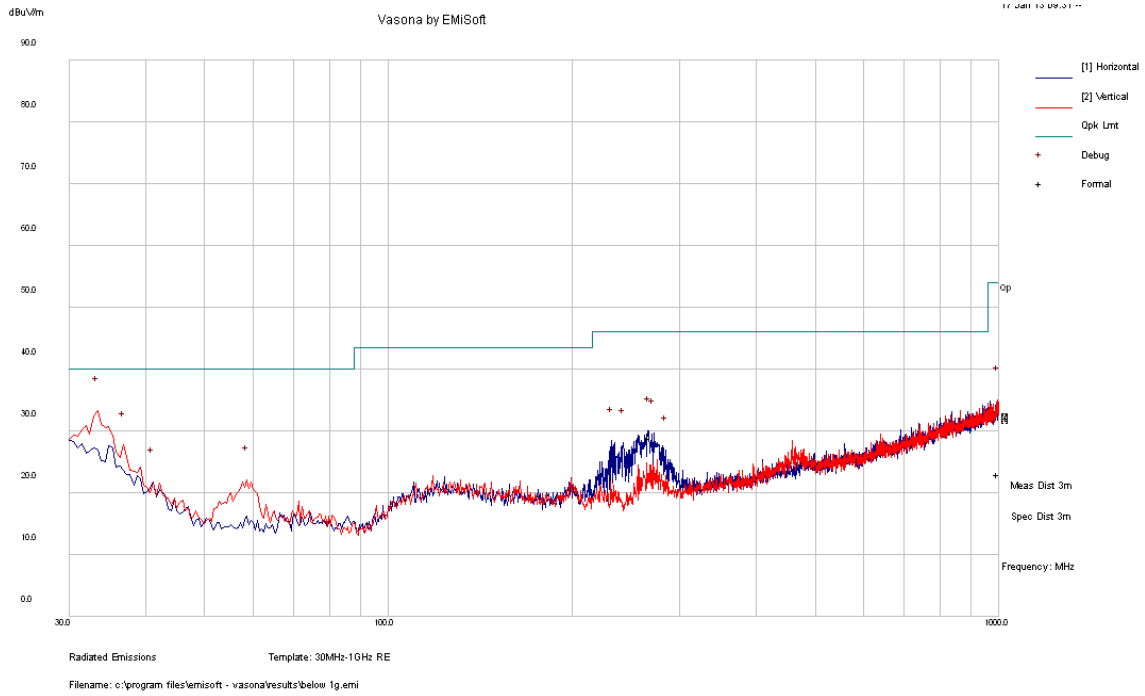
GFSK Low channel (2402 MHz)



Quasi-Peak Measurement:

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
266.29275	29.2	119	H	180	46	-16.8
993.07025	23.01	164	H	296	54	-30.99

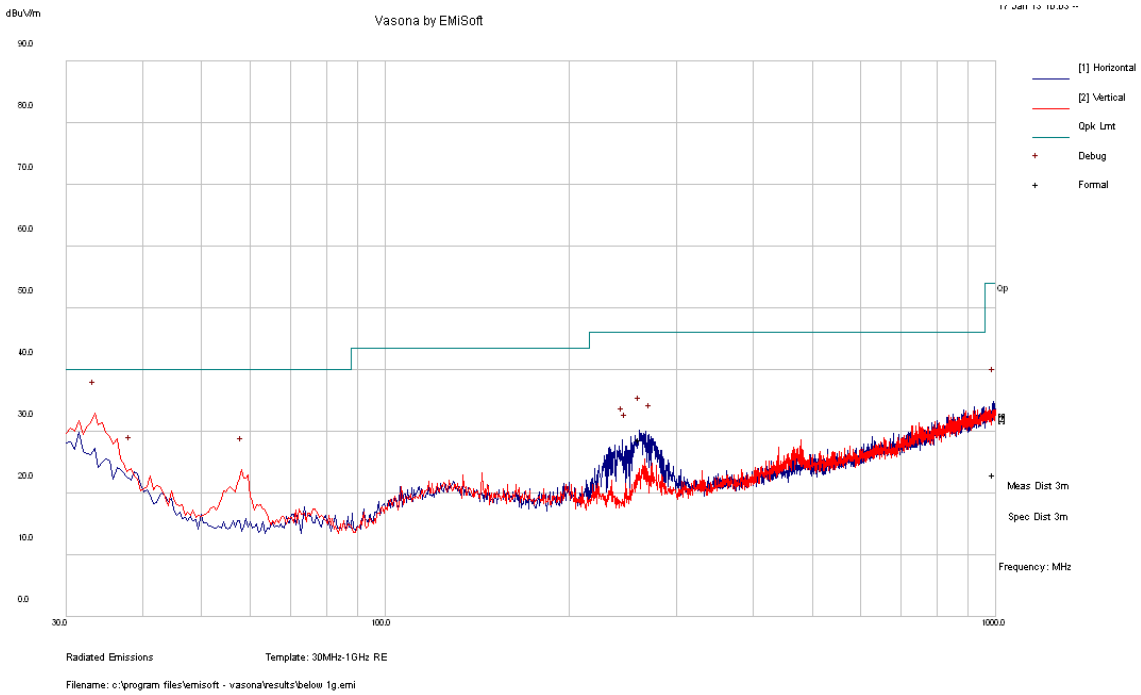
GFSK Middle channel (2440 MHz)



Quasi-Peak Measurement:

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
267.1515	28.81	98	H	334	46	-17.19
994.68975	22.97	324	V	211	54	-31.03

GFSK High channel (2480 MHz)



Quasi-Peak Measurement:

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
261.09525	28.65	106	H	225	46	-17.35
991.666	23.06	369	H	182	54	-30.94

2) 1 – 25 GHz, Radiated Spurious Emissions Measured at 3 meters

GFSK

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2402 MHz, measured at 3 meters											
2402	71.19	77	100	V	28.98	3.12	0	103.29	-	-	Peak
2402	74.55	119	100	H	28.98	3.12	0	106.65	-	-	Peak
2402	50.15	77	100	V	28.98	3.12	0	82.25	-	-	Ave
2402	51.78	119	100	H	28.98	3.12	0	83.88	-	-	Ave
2322	27.25	86	100	V	28.98	3.12	0	59.35	74	-14.65	Peak
2322	27.72	117	100	H	28.055	3.12	0	58.895	74	-15.105	Peak
2322	14.24	86	100	V	28.055	3.12	0	45.415	54	-8.585	Ave
2322	15.49	117	100	H	28.055	3.12	0	46.665	54	-7.335	Ave
4804	34.69	315	100	V	32.711	4.56	27.78	44.181	74	-29.819	Peak
4804	35.89	154	100	H	32.711	4.56	27.78	45.381	74	-28.619	Peak
4804	23.19	315	100	V	32.711	4.56	27.78	32.681	54	-21.319	Ave
4804	24.36	154	100	H	32.711	4.56	27.78	33.851	54	-20.149	Ave
7206	34.42	344	100	V	36.523	5.49	27.59	48.843	83.29	-34.447	Peak
7206	35.45	10	100	H	36.523	5.49	27.59	49.873	86.65	-36.777	Peak
7206	21.91	344	100	V	36.523	5.49	27.59	36.333	62.25	-25.917	Ave
7206	23.28	10	100	H	36.523	5.49	27.59	37.703	63.88	-26.177	Ave
9608	31.85	0	100	V	37.355	6.54	27.05	48.695	83.29	-34.595	Peak
9608	32	0	100	H	37.355	6.54	27.05	48.845	86.65	-37.805	Peak
9608	16.74	0	100	V	37.355	6.54	27.05	33.585	62.25	-28.665	Ave
9608	16.73	0	100	H	37.355	6.54	27.05	33.575	63.88	-30.305	Ave
Middle Channel 2440 MHz, measured at 3 meters											
2440	70.41	86	100	V	28.98	3.25	0	102.64	-	-	Peak
2440	73.52	115	100	H	28.98	3.25	0	105.75	-	-	Peak
2440	49.65	86	100	V	28.98	3.25	0	81.88	-	-	Ave
2440	51.94	115	100	H	28.98	3.25	0	84.17	-	-	Ave
4880	34.69	31	128	V	32.858	4.54	27.67	44.418	74	-29.582	Peak
4880	35.98	176	100	H	32.858	4.54	27.67	45.708	74	-28.292	Peak
4880	23.14	31	128	V	32.858	4.54	27.67	32.868	54	-21.132	Ave
4880	23.56	176	100	H	32.858	4.54	27.67	33.288	54	-20.712	Ave
7320	33.6	349	100	V	36.523	5.57	27.51	48.183	74	-25.817	Peak
7320	34.22	10	100	H	36.523	5.57	27.51	48.803	74	-25.197	Peak
7320	20.01	349	100	V	36.523	5.57	27.51	34.593	54	-19.407	Ave
7320	22.06	10	100	H	36.523	5.57	27.51	36.643	54	-17.357	Ave
9760	31.57	0	100	V	37.394	6.62	26.98	48.604	82.64	-34.036	Peak
9760	31.28	0	100	H	37.394	6.62	26.98	48.314	85.75	-37.436	Peak
9760	16.51	0	100	V	37.394	6.62	26.98	33.544	61.88	-28.336	Ave
9760	16.54	0	100	H	37.394	6.62	26.98	33.574	64.17	-30.596	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 (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 2480 MHz, measured at 3 meters											
2480	71.84	83	100	V	29.122	3.25	0	104.212	-	-	Peak
2480	75.75	115	113	H	29.122	3.25	0	108.122	-	-	Peak
2480	50.99	83	100	V	29.122	3.25	0	83.362	-	-	Ave
2480	53.77	115	113	H	29.122	3.25	0	86.142	-	-	Ave
2483.5	29.4	81	100	V	29.122	3.25	0	61.772	74	-12.228	Peak
2483.5	31.9	119	113	H	29.122	3.25	0	64.272	74	-9.728	Peak
2483.5	15.62	81	100	V	29.122	3.25	0	47.992	54	-6.008	Ave
2483.5	17.52	119	113	H	29.122	3.25	0	49.892	54	-4.108	Ave
4960	33.75	171	100	V	33.097	4.52	27.7	43.667	74	-30.333	Peak
4960	34.26	174	170	H	33.097	4.52	27.7	44.177	74	-29.823	Peak
4960	19.82	171	100	V	33.097	4.52	27.7	29.737	54	-24.263	Ave
4960	22.27	174	170	H	33.097	4.52	27.7	32.187	54	-21.813	Ave
7440	34.48	343	100	V	36.433	5.66	27.53	49.043	74	-24.957	Peak
7440	34.69	10	100	H	36.433	5.66	27.53	49.253	74	-24.747	Peak
7440	21.6	343	100	V	36.433	5.66	27.53	36.163	54	-17.837	Ave
7440	22.31	10	100	H	36.433	5.66	27.53	36.873	54	-17.127	Ave
9920	31.3	0	100	V	37.557	6.67	27.01	48.517	88.225	-39.708	Peak
9920	31.58	0	100	H	37.557	6.67	27.01	48.797	90.605	-41.808	Peak
9920	16.51	0	100	V	37.557	6.67	27.01	33.727	85.235	-51.508	Ave
9920	16.63	0	100	H	37.557	6.67	27.01	33.847	87.905	-54.058	Ave

7 FCC §15.247(b) & IC RSS-210 §A8.4 – Maximum Peak Output Power

7.1 Applicable Standard

According to FCC §15.247(b) (1), for frequency hopping systems in the 2400-2483.5MHz band employing at least 75 hopping channels, and all direct sequence systems, the maximum peak output power of the transmitter shall not exceed 1 Watt. For all other frequency hopping system in the 2400 – 2483.5 MHz band, the maximum peak output power of the transmitter shall not exceed 0.125 Watt.

According to IC RSS-210 §8.4(2), For frequency hopping systems operating in the band 2400-2483.5 MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

7.2 Measurement Procedure

1. Place the EUT on the turntable and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year

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

7.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	44 %
ATM Pressure:	102kPa

The testing was performed by Bo Li on 2013-01-10 at RF site.

7.5 Test Results

Modulation GFSK:

Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	6.02	4	125	Pass
Mid	2440	6.56	4.53	125	Pass
High	2480	6.74	4.72	125	Pass

Modulation QPSK:

Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	3.06	2.2	125	Pass
Mid	2440	3.86	2.43	125	Pass
High	2480	3.74	2.37	125	Pass

Modulation 8PSK:

Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	2.92	1.96	125	Pass
Mid	2440	3.96	2.49	125	Pass
High	2480	3.78	2.39	125	Pass

8 FCC §15.109 & IC RSS-Gen §6 - Receiver Radiated Spurious Emissions

8.1 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-Gen §6.1, Tables 2 show the general field strength limits of receiver spurious emissions

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

8.2 EUT Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2009.

8.3 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.

8.4 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

8.5 Test Equipment Lists and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 year
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year
EMCO	Horn Antenna	3315	9511-4627	2012-10-17	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22	1 year

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

8.6 Test Environmental Conditions

Temperature:	21°C
Relative Humidity:	45%
ATM Pressure:	102.2kPa

The testing was performed by Bo Li on 2013-01-15 at 5 meter 3.

8.7 Summary of Test Results

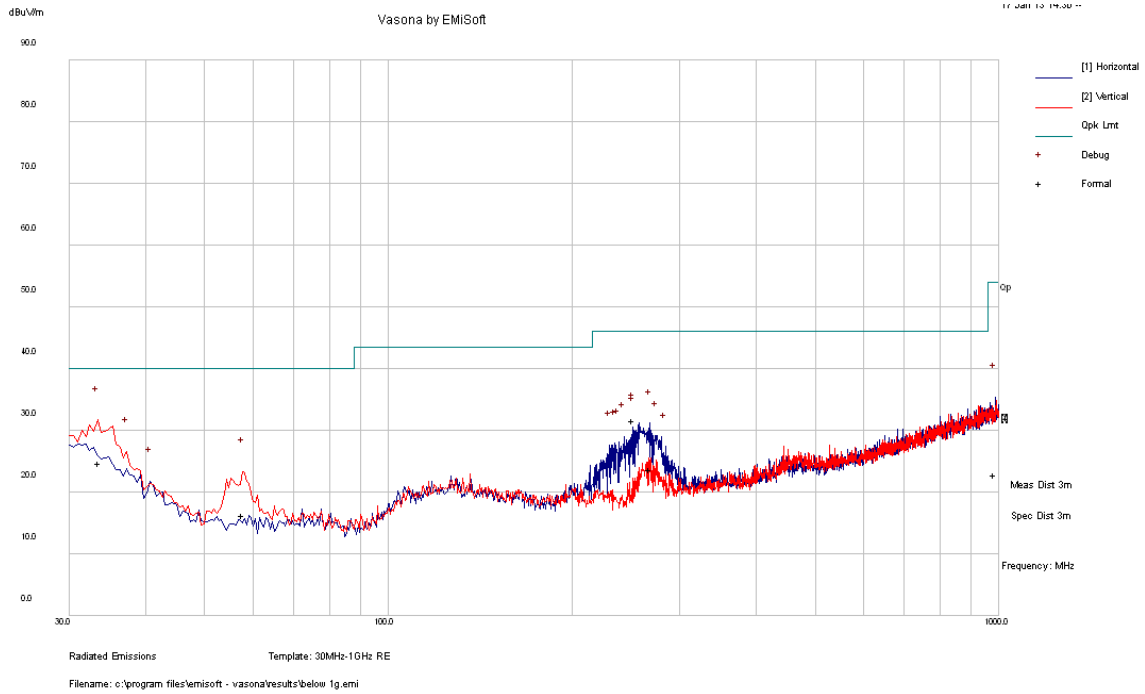
According to the test data, the EUT complied with the RSS-210, with the closest margins from the limit listed below:

GFSK

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-1.88	25299.43	Horizontal	30-26000

8.8 Test Results

1) 30 MHz -1 GHz, measured at 3 meters



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
33.606	24.75	135	V	28	40	-15.25
268.076	23.77	98	H	106	46	-22.23
251.255	31.62	98	H	248	46	-14.38
57.80425	16.36	165	V	341	40	-23.64
985.177	22.82	89	H	309	54	-31.18

2) 1 – 25 GHz, measured at 3 meters

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
1096.5	44.950	121	V	0	74	-29.05	Peak
1096.5	41.950	153	H	142	74	-32.05	Peak
1096.5	21.320	121	V	0	54	-32.68	Ave
1096.5	21.270	153	H	142	54	-32.73	Ave
2822.9	45.131	100	V	7	74	-28.869	Peak
2822.9	43.061	100	H	330	74	-30.939	Peak
2822.9	32.171	100	V	7	54	-21.829	Ave
2822.9	29.581	100	H	330	54	-24.419	Ave
25299.43	66.610	100	V	0	74	-7.39	Peak
25299.43	66.630	100	H	0	74	-7.37	Peak
25299.43	52.100	100	V	0	54	-1.9	Ave
25299.43	52.120	100	H	0	54	-1.88	Ave

9 FCC §15.247(i), §2.1093 & IC RSS-102 - RF Exposure Information

9.1 Applicable Standards

FCC §2.1093, §15.247(i) and FCC KDB 447498 D01 Appendix A
IC RSS-102 §2.5.1

9.2 Evaluation Result

The peak conducted output power of this device is 6.74 dBm (4.72 mW) which is less than 10 mw.

Stand along SAR evaluation for Bluetooth antenna is not required.