FCC PART 15.247

INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007

MEASUREMENT AND TEST REPORT

For

Aerielle, Inc.

625 Ellis Street, Suite 206
Mountain View, CA 94043

FCC ID: RKVI2I200
IC ID: 7351A-I2I200
Model: I2I200

Report Type: ☒ Original Report	**Product Type:** 2.4 GHz Wireless Audio Transceiver
Test Engineer(s):	Xiao Ming Hu
Report Number:	R0801161
Testing Date(s):	2008-01-22, 2008-01-23
Report Date:	2007-01-31
Reviewed By:	Boni Baniqued, Sr. RF Test Engineer
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TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *Aerielle, Inc.* product, *FCC ID: RKVI2I200, IC: 7351A-I2I200, model: I2I200* or the "EUT" as referred to this report is a 2.4 GHz transceiver device. It is designed to attach to a digital music player and either broadcast the audio from that player or receive audio when other users are broadcasting. The EUT operates in the 2.4 GHz ISM band, employs QPSK modulation and uses a maximum of 3 channels. It is a hand portable device for consumer use.

** Testing was preformed on a post production sample provided by Aerielle, Inc. with the serial number: S123107A037311*

1.2 Mechanical Description of EUT

The *Aerielle, Inc.* product, *FCC ID:RKVI2I200, IC:7351A-I2I200, model:I2I200, is* of plastic construction and measures approximately 65 mm **(L)** x 33 mm **(W)** x 22 mm **(H)**, weighing approximately 35 g.

1.3 Antenna Description

Item Number	Model/Type	
Antenna	Model number:	NA
	Manufacturer:	Arielle, Inc.
	Frequency Range:	2.4-2.4835 GHz
	Connector Type/ Maximum Gain	Integrated onto PCB Board/ 0.5 dBi gain
	Antenna Type/ Pattern:	Wire antenna/ Omnidirectional
	Measurement:	1 mm (D) x 10 mm (L)

1.4 EUT Photo

Please refer to Exhibit C for addition EUT photographs.

1.5 Objective

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

The objective is to determine compliance with FCC and IC standards, rules and limits for this device including:

- RF Exposure
- Antenna Requirement
- Conducted Emissions
- Spurious Emissions at Antenna Port
- Radiated Spurious Emissions
- Restricted Band
- Receiver Spurious Emissions
- 6 dB Bandwidth & 99% Bandwidth
- Maximum Peak Output Power
- 100 kHz Bandwidth of Frequency Band Edge
- Power Spectral Density

1.6 Related Submittal(s)/Grant(s)

No related submittals.

1.7 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.

1.8 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.

1.9 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

The EUT is programmed with the following data rate settings that were used during testing:

Channel	Low	Middle	High
Frequency (MHz)	2412	2438	2464

2.3 Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

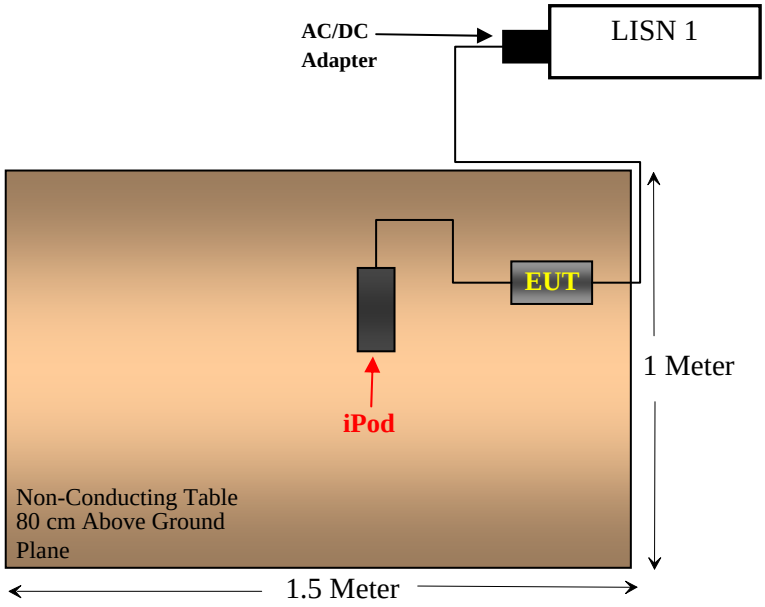
Manufacturer	Description	Model	Serial Number
Apple	iPod Digital Music Player	A113	YM546874TK3
Ktec	AC/DC adapter	KSUFB0500100W1US	NA

2.6 Interface Ports and Cabling

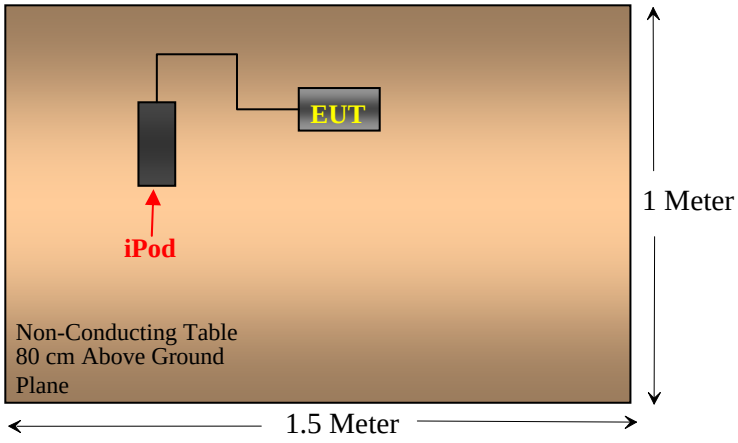
Cable Description	Length (m)	From	To
Audio cable	1	EUT	iPod

2.7 Test Setup Block Diagrams

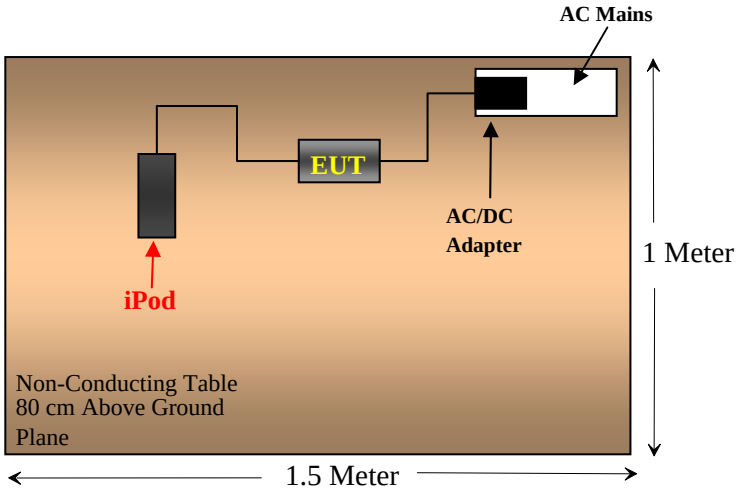
Conducted Emissions



Receiver Radiated Emissions



Transmitter Spurious Radiated Emissions



3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC & RSS-210 Rules	Description of Test	Result	Note
FCC §15.247 (i) and §2.1091, IC RSS-Gen 5.5 & RSS-102	RF Exposure	Compliant	-
FCC §15.203, IC RSS-Gen §7.1.4	Antenna Requirement	Compliant	-
FCC §15.207, IC RSS-Gen §7.2.2	Conducted Emissions	Compliant	-
FCC §2.1051 & §15.247(d), RSS210 § A8.5 § RSS-Gen §7.2	Spurious Emissions at Antenna Port	NA	*EUT has integral antenna, no ant. port*
FCC §15.109, §15.205, §15.209 & §15.247(c), IC RSS-Gen §4.9	Radiated Spurious Emissions	Compliant	-
FCC §15.205, RSS 2.6	Restricted Band	Compliant	-
§15.109, 15.209 (a) & §15.247(d), RSS-Gen §6(a)	Spurious Emissions	Compliant	-
§15.247 (a)(2), RSS-210 §A8.2 (a)	6 dB Bandwidth & 99% Bandwidth	Compliant	-
§15.247 (b)(3), RSS210 § A8.4	Maximum Peak Output Power	Compliant	-
§ 15.247 (d), RSS210 § A8.5	100 kHz Bandwidth of Frequency Band Edge	Compliant	-
§15.247 (e), RSS-210 §A8.2 (b)	Power Spectral Density	Compliant	-

4 FCC §15.247 (i) and §2.1091, IC RSS-Gen 5.5 & RSS-102 - RF EXPOSURE

4.1 Applicable Standard

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

According to FCC §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

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)**
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

According to IC RSS-102 Issue 2, November 2005 §2.5.2 exception from Routine Evaluation Limits- RF Exposure Evaluation:

RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm, except when the device operates:

1) below 1.5 GHz and its e.i.r.p. is equal to or less than 2.5 W;
2) at or above 1.5 GHz and the e.i.r.p. of the device is equal to or less than 5 W.

RF limits for device used by the general public is provided hereinafter table:

Frequency Range (MHz)	**Electric Field (V/M rms)**	**Magnetic Field (A/m rms)**	**Power Density (W/m^2)**	**Time Averaging (min)**
0.003 – 1	280	2.19	-	6
1 – 10	280 / f	2.19 / f	-	6
10 – 30	28	2.19 / f	-	6
30 – 300	28	0.073	2*	6
300 - 1500	$1.585\ f^{0.5}$	$0.0042\ f^{0.5}$	f / 150	6
1500 – 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	$f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$

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

4.2 MPE Prediction

Prediction of MPE limit at a given distance

Equation from page 10 of OET Bulletin 65 supplement B, Edition 97-01

$$S = \frac{E^2}{3770} = 37.7H^2$$

Where: S = power density (mW/cm2)
E = electric field strength (V/m)
H = magnetic field strength (A/m)

Maximum Field Strength (dBuV/m):	102.84
Maximum Field Strength (V/m):	0.1387
Prediction distance (cm):	20
Prediction frequency (MHz):	2438
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.000005
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

4.3 Test Result

Compliant: the power density level at 20 cm is 0.000005 mW/cm^2, which is below the uncontrolled exposure limit of 1.0 mW/cm^2.

5 FCC §15.203, IC RSS-Gen §7.1.4 – ANTENNA REQUIREMENT

5.1 Applicable Standard

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

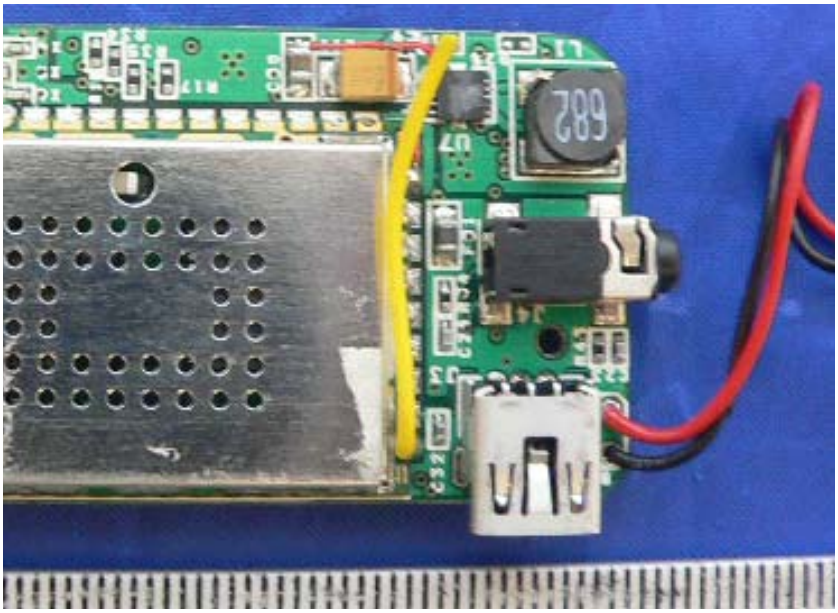
And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

As per IC RSS-Gen §7.1.4: Transmitter Antenna, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

5.2 Result

The Antenna is not accessible to the end user and is permanently attached to the PCB with a max gain of 0.5 dBi; it complies with the FCC and IC requirements.

☒ **Compliant** ☐ **N/A**



6 FCC §15.207, IC RSS-Gen §7.2.2 - CONDUCTED EMISSIONS

6.1 Section 15.207 & RSS-Gen 7.2.2 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 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.*

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC/IC consumer device limits.

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

The EUT was powered by 5 VDC via mini USB AC/DC adapter connected to 120 V/60 Hz provided by LISN-1.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Solar Electronics	LISN	9252-R-24-BNC	511205	2007-07-07
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100338	2007-04-05

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

6.4 Test Procedure

During the conducted emissions test, the power cord of the system was connected to the main outlet of the LISN-1.

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".

6.5 Environmental Conditions

Temperature:	16 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

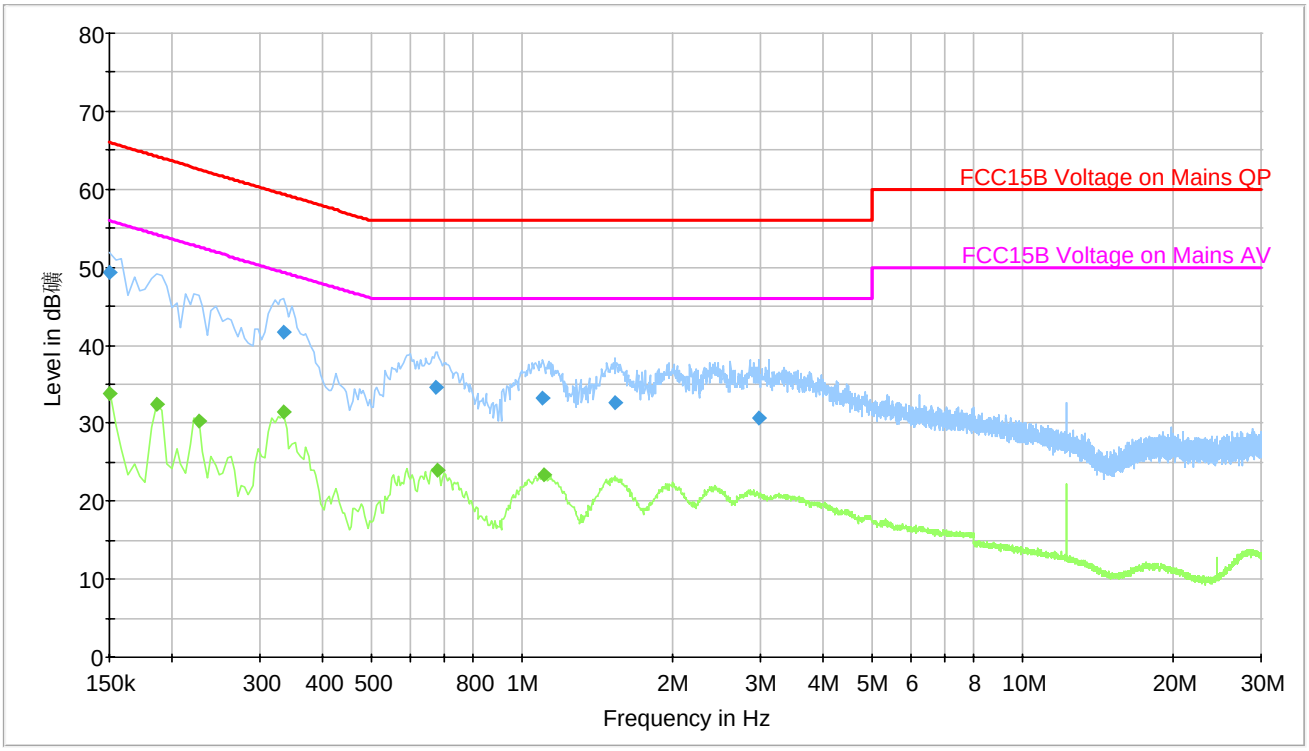
**The testing was performed by Xiao Ming Hu from 2008-01-23.*

6.6 Summary of Test Results

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

Connection: 5 VDC from AC/DC adapter connected to 120 V/ 60 Hz			
Margin (dB)	**Frequency (MHz)**	**Conductor (Hot/Neutral)**	**Range (MHz)**
-16.7	0.150000	Hot	0.150 MHz to 30 MHz

120V/60 Hz Hot:



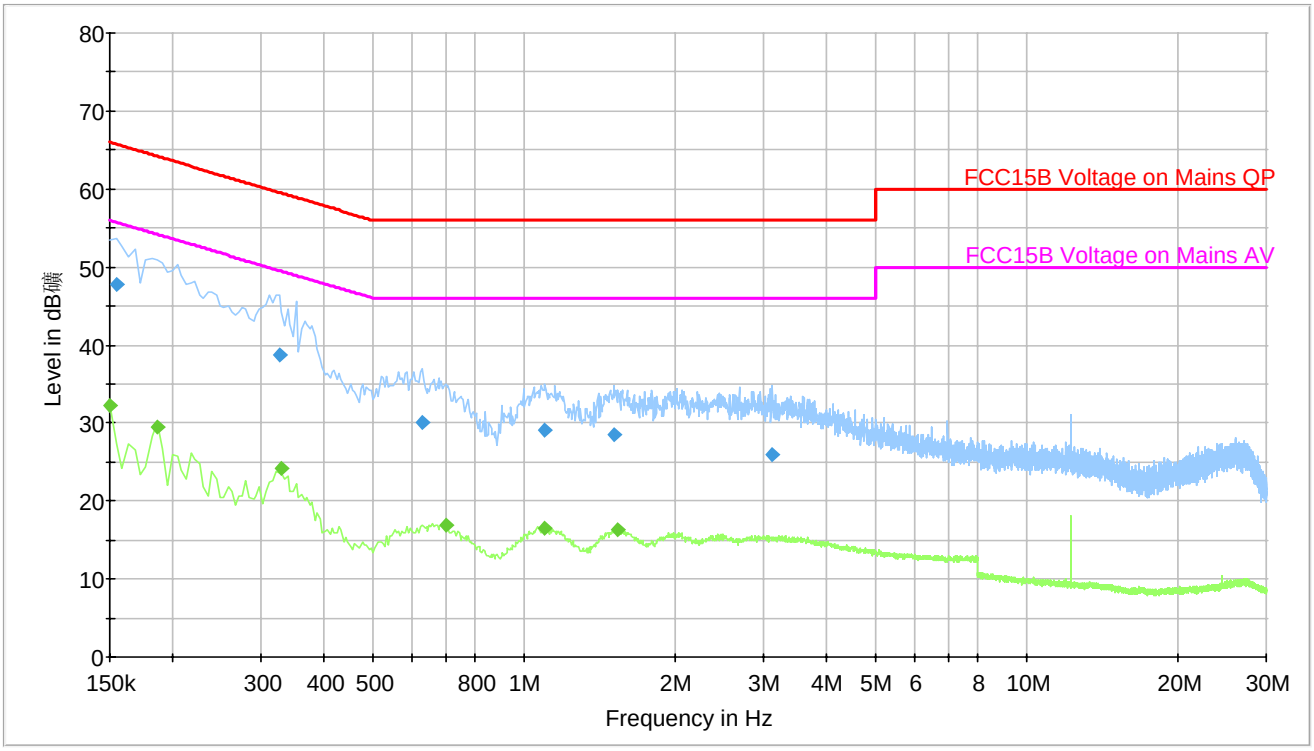
Final Measurement Quasi-Peak Detector

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
0.150000	49.3	H	66.0	-16.7
0.334500	41.7	H	59.3	-17.6
0.672000	34.7	H	56.0	-21.3
1.099500	33.2	H	56.0	-22.8
1.536000	32.6	H	56.0	-23.4
2.976000	30.6	H	56.0	-25.4

Final Measurement Average Detector

Frequency (MHz)	Average (dBµV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
0.334500	31.5	H	49.3	-17.9
0.186000	32.5	H	54.2	-21.7
0.681000	23.9	H	46.0	-22.1
0.150000	33.8	H	56.0	-22.2
0.226500	30.3	H	52.6	-22.3
1.104000	23.4	H	46.0	-22.6

120V/60 Hz Neutral:



Final Measurement Quasi-Peak Detector

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
0.154500	47.9	N	65.8	-17.9
0.325500	38.7	N	59.6	-20.9
0.627000	30.0	N	56.0	-26.0
1.099500	29.1	N	56.0	-26.9
1.513500	28.5	N	56.0	-27.5
3.129000	26.0	N	56.0	-30.0

Final Measurement Average Detector

Frequency (MHz)	Average (dBµV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
0.150000	32.3	N	56.0	-23.7
0.186000	29.4	N	54.2	-24.8
0.330000	24.1	N	49.5	-25.3
0.699000	16.9	N	46.0	-29.1
1.099500	16.5	N	46.0	-29.5
1.540500	16.3	N	46.0	-29.7

7 FCC §15.109, §15.205, §15.209 & §15.247(c), IC RSS-Gen §4.9 - SPURIOUS RADIATED EMISSIONS

7.1 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 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 §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)).

IC RSS-GEN §4.9 the measurement method shall be described in the test report. The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

7.2 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.

7.3 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 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.

7.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma Instruments	Pre amplifier	317	260407	2007-04-26
HP	Pre amplifier	8449B	3147A00400	2006-08-21
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
A.R.A	Antenna Horn	DRG-118/A	1132	2007-06-18
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

7.5 Test Procedure

For the radiated emissions test, the EUT, 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 1000MHz:

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

Above 1000MHz:

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

7.6 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 -7dB means the emission is 7dB below the maximum limit.
The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

7.7 Environmental Conditions

Temperature:	16 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Xiao Ming Hu on 2008-01-22, 2008-01-23.*

7.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC and IC requirements, and had the worst margin readings of:

Unintentional Emissions, (30-1000 MHz):

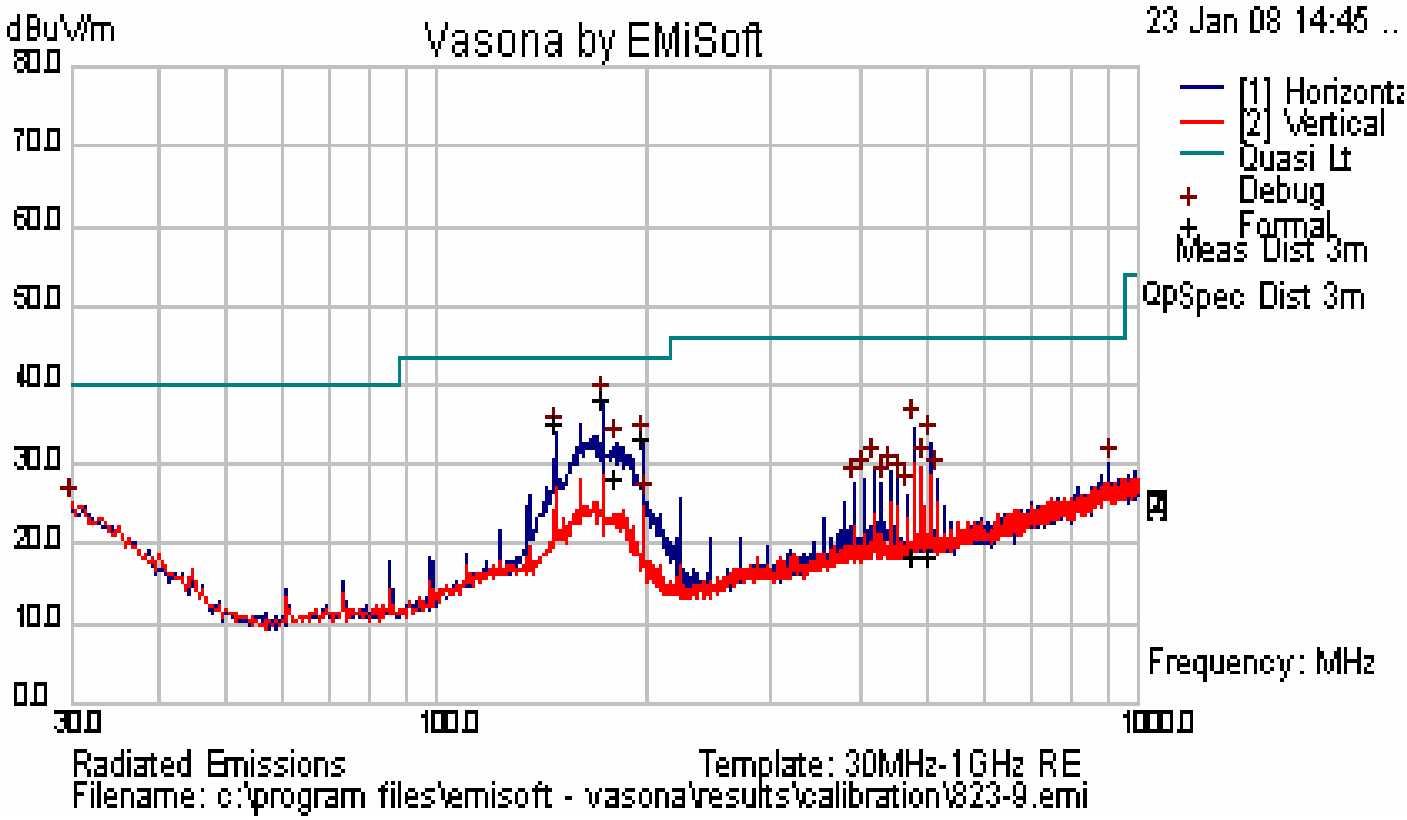
Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-7.67	172.033	Horizontal	30 MHz to 1000 MHz

Out of Band Emissions:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-1.0	4824.00	Vertical	Low, 30 MHz – 25GHz
-3.4	4876.00	Vertical	Mid, 30 MHz – 25GHz
-1.8	4928.00	Horizontal	High, 30 MHz – 25GHz

7.9 Radiated Emissions Test plot & data:

Primary scan 30MHz -1GHz



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Correction Factor (dB)	Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
172.033	35.83	155	-17.08	H	362	43.5	-7.67
147.464	32.73	214	-16.06	H	359	43.5	-10.77
196.583	31.11	161	-16.59	H	162	43.5	-12.39
179.456	26.14	171	-17.48	H	4	43.5	-17.36
479.356	16.33	100	-12.46	H	161	46	-29.67
504.564	16.02	192	-12.22	H	332	46	-29.98

7.10 Radiated Spurious Emissions Test Data

2412 - 2464 MHz, Measured at 3 meters, 1 GHz – 25 GHz

Low channel 2412 MHz

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. H / V	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
2412.00	97.5	91	1.4	H	29.3	5.1	31.5	100.4			Fund/Peak
2412.00	95.5	339	1.0	V	29.3	5.1	31.5	98.4			Fund/Peak
2412.00	95.0	91	1.4	H	29.3	5.1	31.5	97.9			Fund/Ave.
2412.00	92.1	339	1.0	V	29.3	5.1	31.5	95.0			Fund/Ave.
4824.00	46.3	205	1.0	V	33.6	8.0	34.9	53.0	54	-1.0	Ave.
4824.00	41.0	164	1.0	H	33.6	8.0	34.9	47.7	54	-6.3	Ave.
4824.00	49.8	205	1.0	V	33.6	8.0	34.9	56.5	74	-17.5	Peak
4824.00	47.3	164	1.0	H	33.6	8.0	34.9	54.0	74	-20.0	Peak

Middle channel 2438 MHz

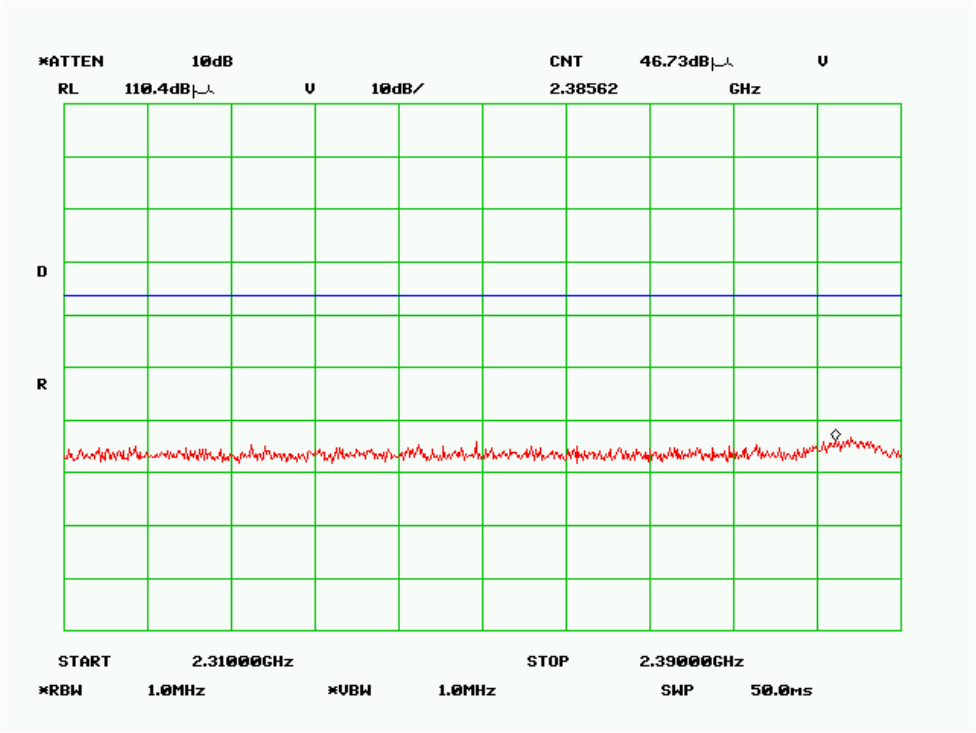
Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. H / V	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
2438.00	98.1	199	1.0	H	29.3	5.4	31.5	101.4			Fund/Peak
2438.00	97.5	159	1.1	V	29.3	5.4	31.5	100.7			Fund/Peak
2438.00	95.0	199	1.0	H	29.3	5.4	31.5	98.2			Fund/Ave.
2438.00	94.0	159	1.1	V	29.3	5.4	31.5	97.2			Fund/Ave.
4876.00	44.3	214	1.7	V	33.0	8.2	34.9	50.6	54	-3.4	Ave.
4876.00	42.1	352	1.0	H	33.0	8.2	34.9	48.4	54	-5.6	Ave.
4876.00	49.0	214	1.7	V	33.0	8.2	34.9	55.3	74	-18.7	Peak
4876.00	47.6	352	1.0	H	33.0	8.2	34.9	53.9	74	-20.1	Peak

High channel 2464 MHz

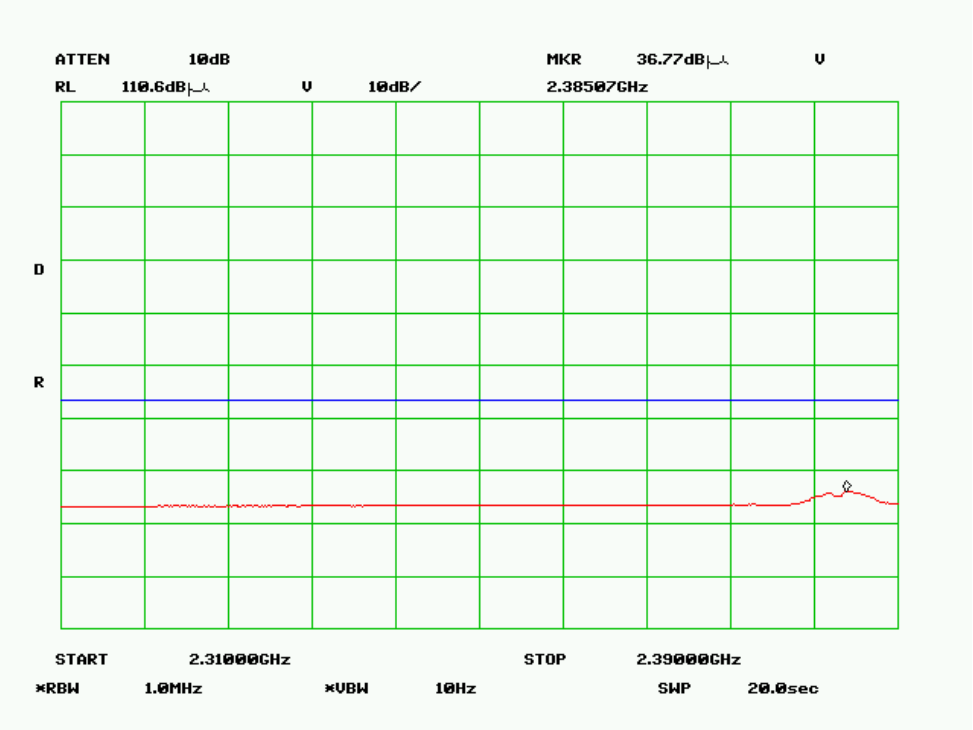
Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. H / V	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
2464.00	96.6	89	1.0	H	29.3	5.8	31.5	100.2			Fund/Peak
2464.00	97.3	134	1.1	V	29.3	5.8	31.5	100.9			Fund/Peak
2464.00	93.3	89	1.0	H	29.3	5.8	31.5	96.9			Fund/Ave.
2464.00	93.6	134	1.1	V	29.3	5.8	31.5	97.2			Fund/Ave.
4928.00	45.8	346	1.0	H	33.0	8.3	34.9	52.2	54	-1.8	Ave.
4928.00	43.6	139	1.5	V	33.0	8.3	34.9	50.0	54	-4.0	Ave.
4928.00	49.6	346	1.0	H	33.0	8.3	34.9	56.0	74	-18.0	Peak
4928.00	48.3	139	1.5	V	33.0	8.3	34.9	54.7	74	-19.3	Peak

Restricted Band Edge *(EUT Tested stand alone, no charger)*

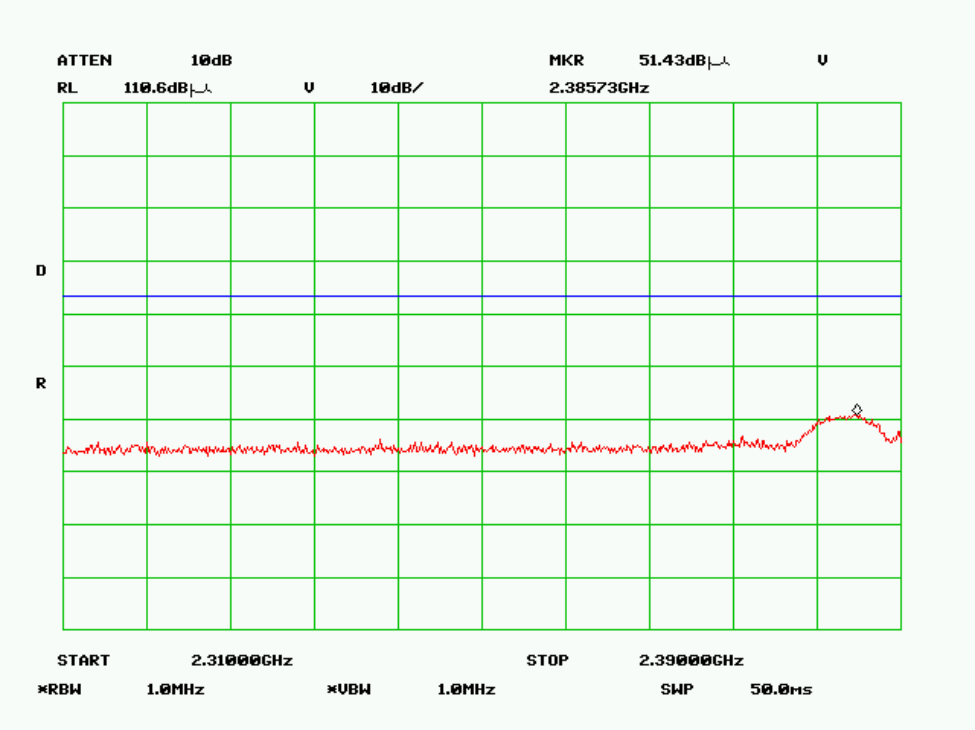
Low Channel – Peak, Horizontal



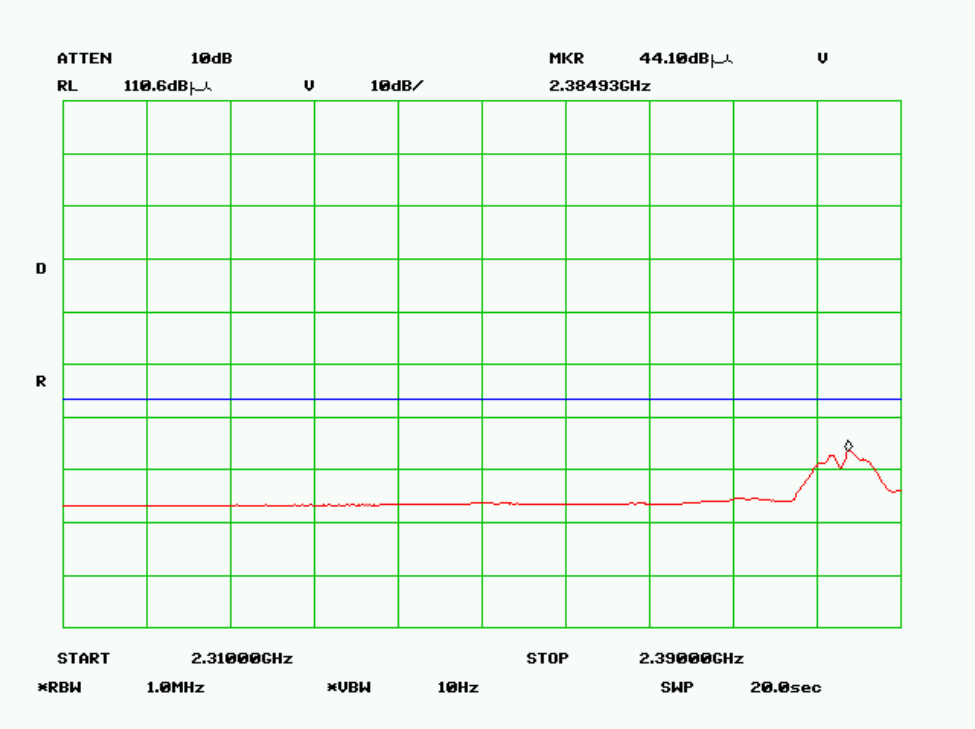
Low Channel – Average, Horizontal



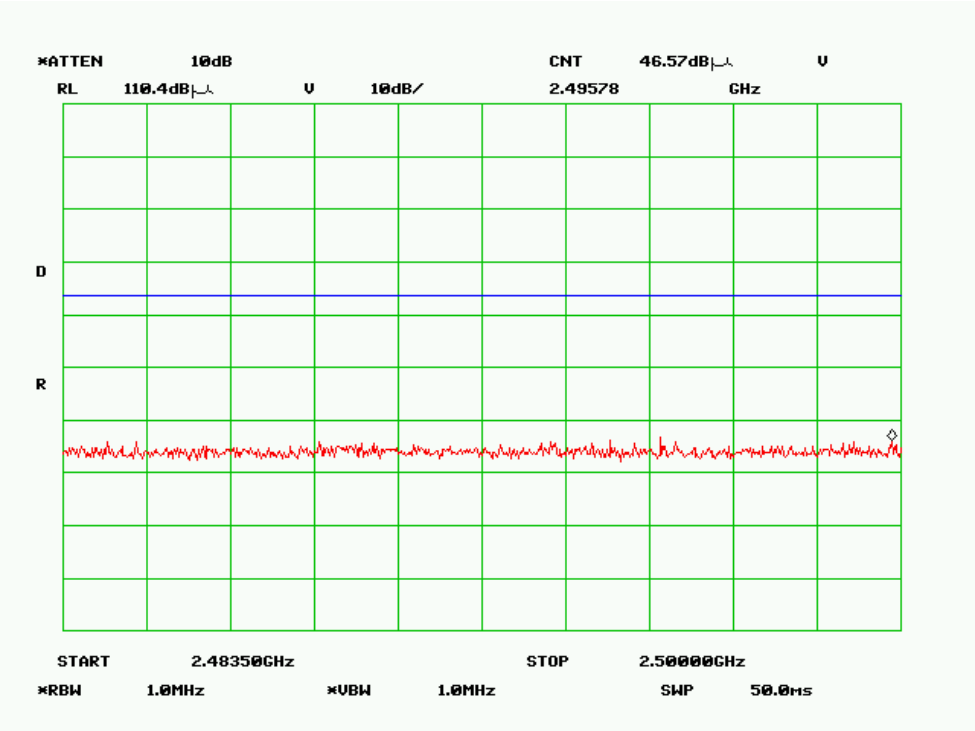
Low Channel – Peak, Vertical



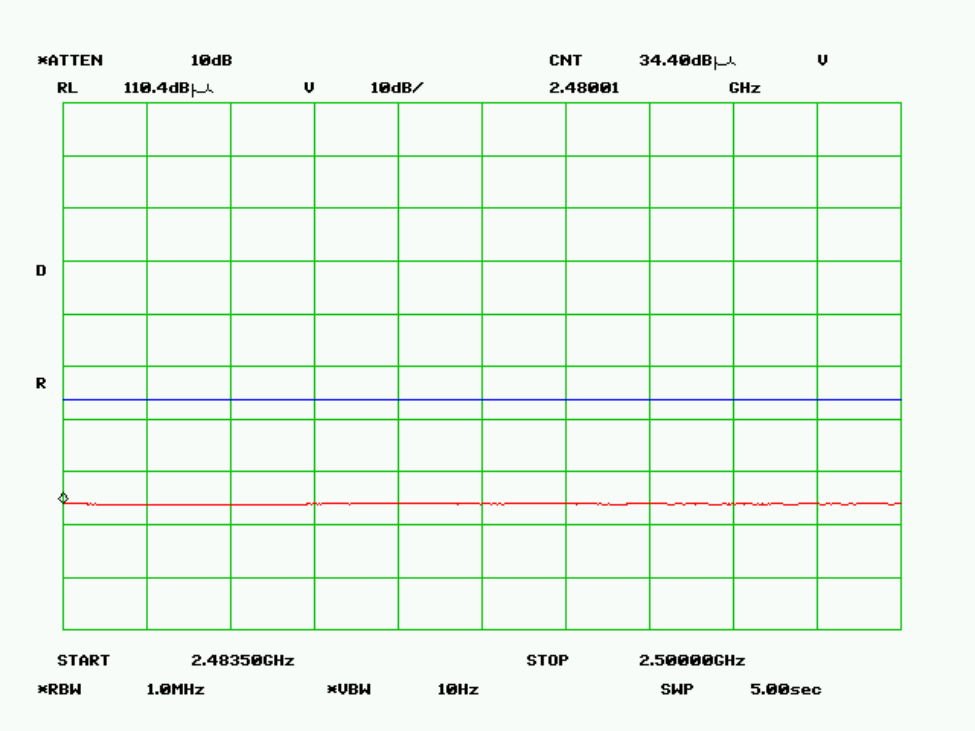
Low Channel – Average, Vertical



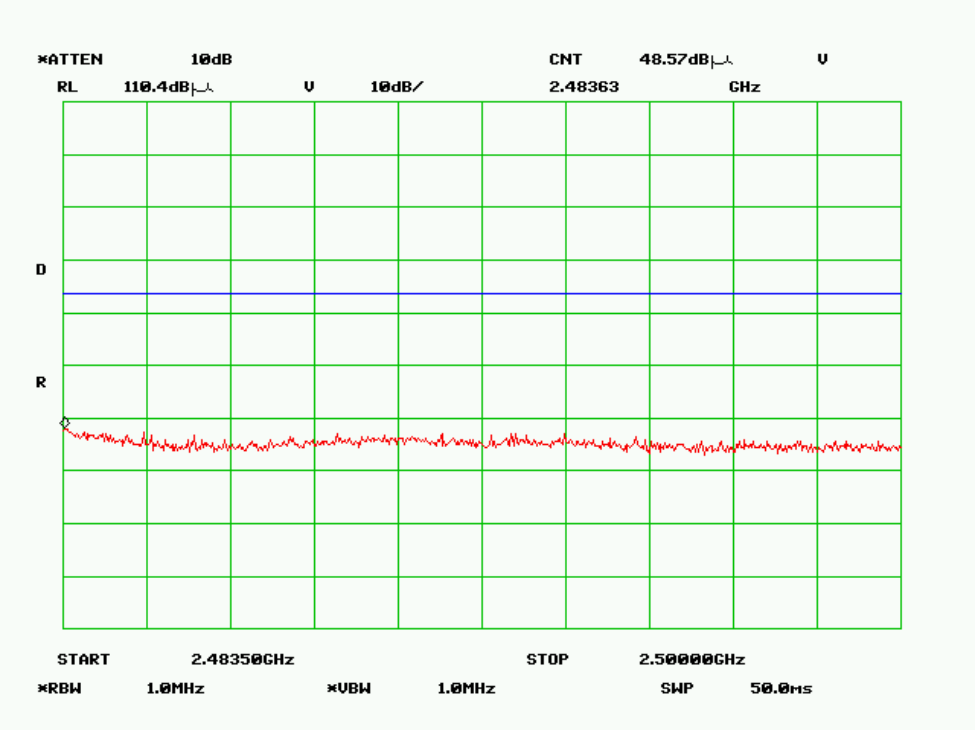
High Channel – Peak, Horizontal



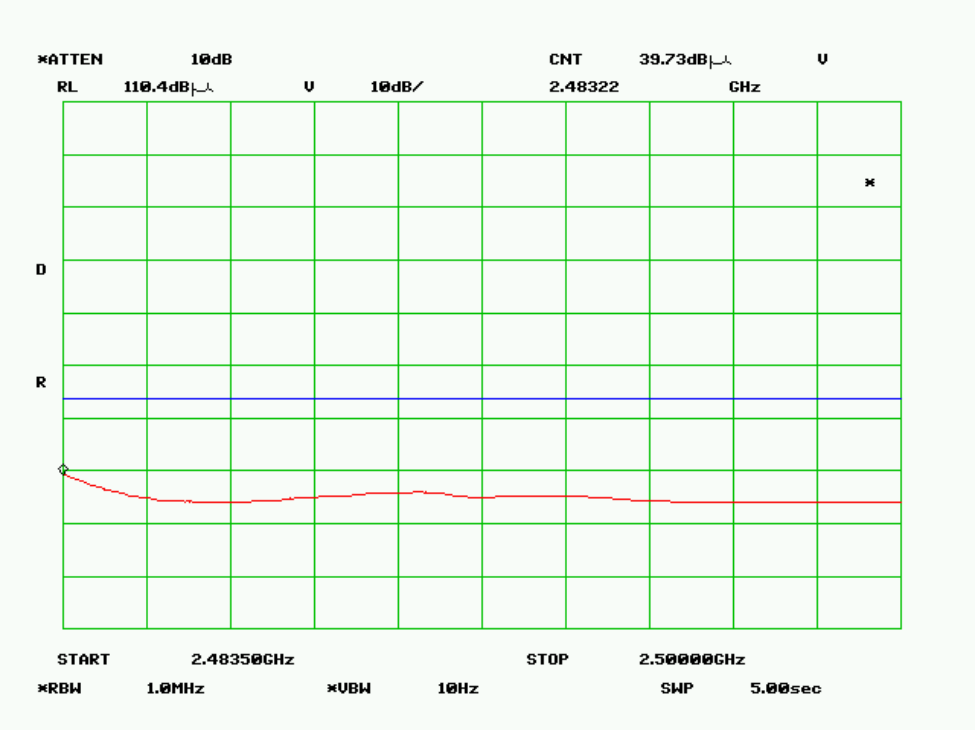
High Channel – Average, Horizontal



High Channel – Peak, Vertical



High Channel – Average, Vertical



8 FCC §15.247(a) (2), RSS-210 § A8.2 (a) – 6 dB BANDWIDTH & OCCUPIED BANDWIDTH

8.1 Applicable Standard

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

Channel	Frequency (MHz)	Occupied BW (kHz)	Limit (kHz)	Result
Low	2412	17183.0	>500	Compliant
Middle	2438	15830.5	>500	Compliant
High	2464	15654.2	>500	Compliant

Channel	Frequency (MHz)	6dB BW (kHz)
Low	2412	9848
Middle	2438	9710
High	2464	9697

8.2 Measurement Procedure

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

8.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

8.4 Environmental Conditions

Temperature:	16 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

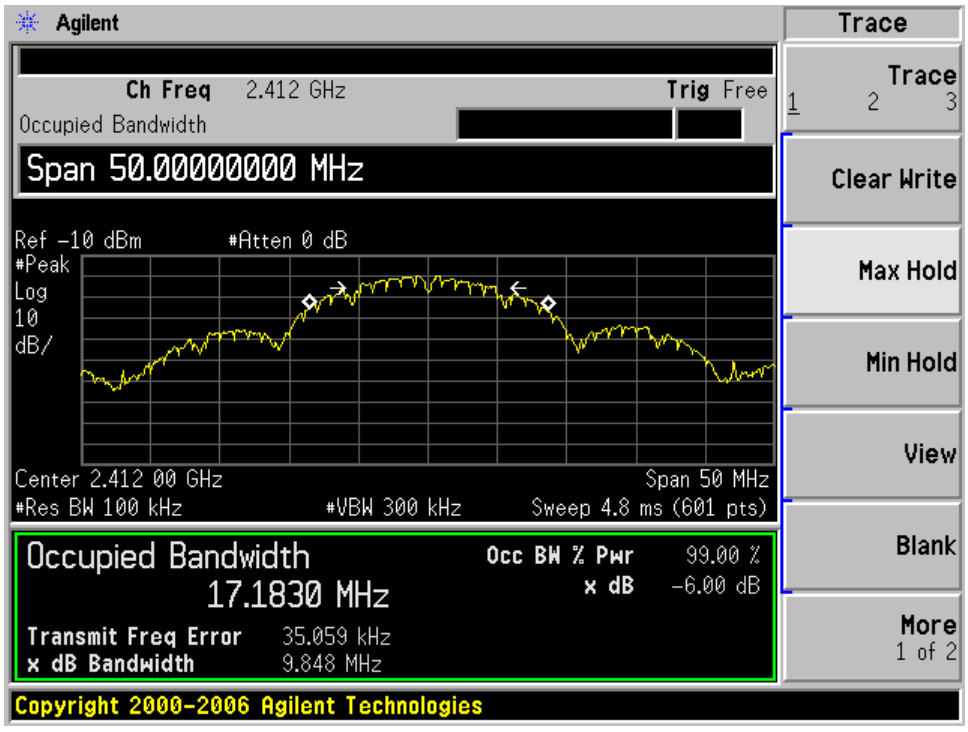
**The testing was performed by Xiao Ming Hu on 2008-01-23.*

8.5 Summary of Test Results

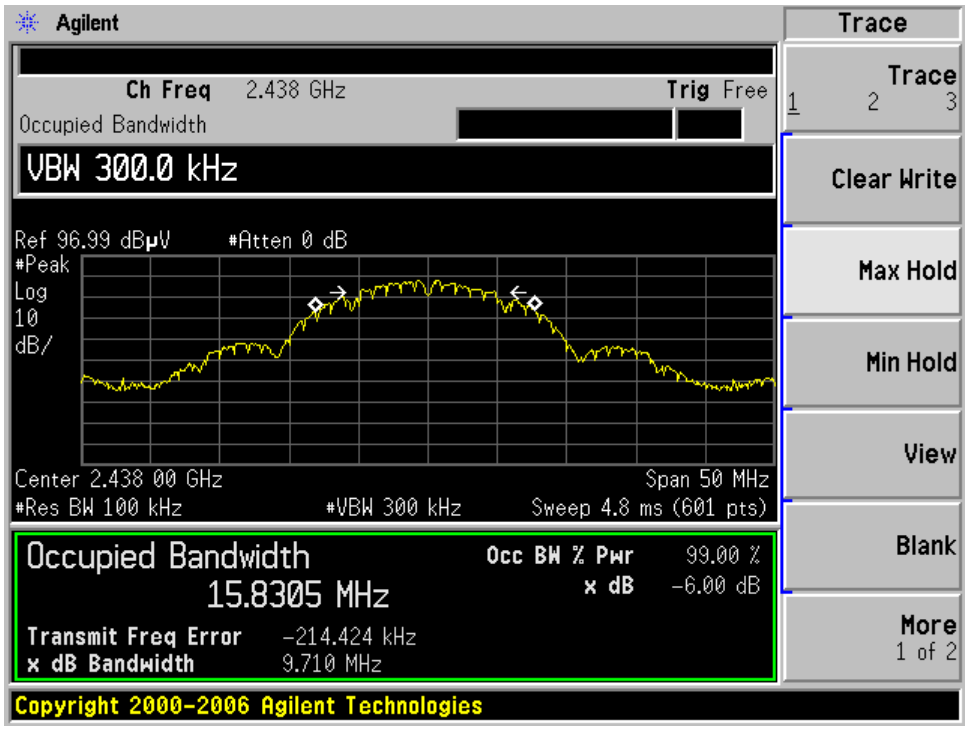
Channel	Frequency (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth (MHz)
Low	2412	17.1830	9.848
Middle	2438	15.8305	9.710
High	2464	15.6542	9.697

Please refer to the following plots for detailed test results

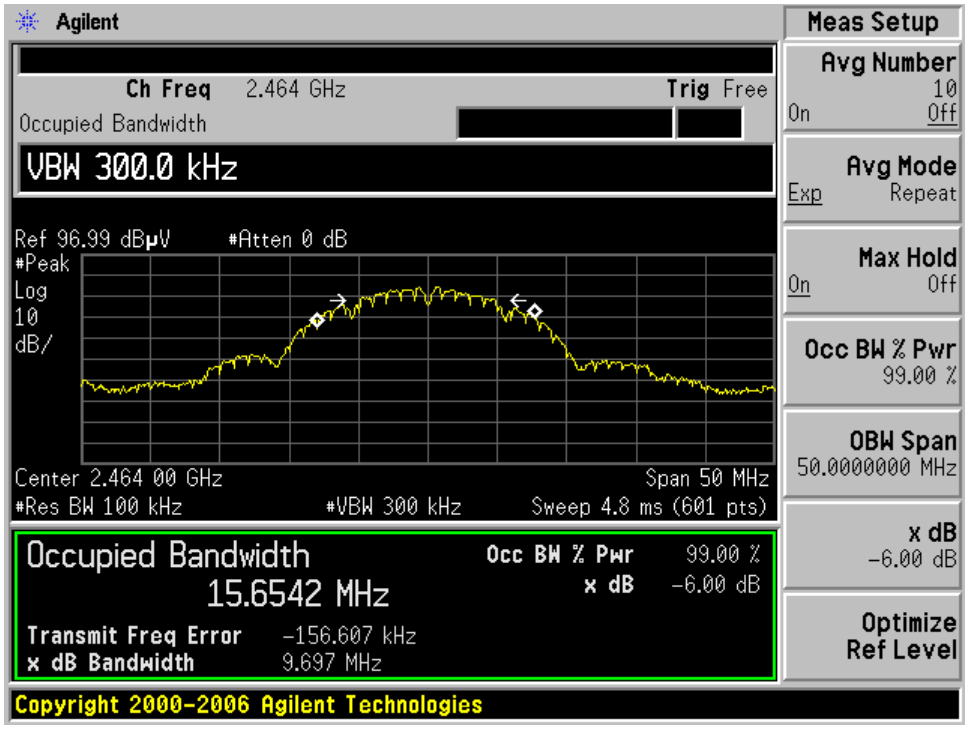
Low Channel



Middle Channel



High Channel



9 FCC §15.247(b), RSS210 § A8.4 - PEAK OUTPUT POWER MEASUREMENT

9.1 Applicable Standard

§15.247(b) the maximum peak output power of the intentional radiator shall not exceed the following:

§15.247(b) (3) and RSS210 § A8.4 (4) for systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

§15.247(b) (4) (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

9.2 Measurement Procedure

1. Place the EUT on a bench 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 a spectrum analyzer.
3. If antenna conducted tests cannot be performed on this device, radiated tests to show compliance with the various conducted requirements of Section 15.247 are acceptable. As stated previously, a pre-amp must be used in making the following measurements.
4. Calculate the transmitter's peak power using the following equation:

   Where: E = the measured maximum field strength in V/m.

   Set the RBW > 6dB bandwidth of the emission or use a peak power meter.

   P = (E x d) squared / (30 x G)

   G = the numeric gain of the transmitting antenna over an isotropic radiator.

   d = the distance in meters from which the field strength was measured.

   P = the power in watts for which you are solving:

9.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma Instruments	Pre amplifier	317	260407	2007-04-26
HP	Pre amplifier	8449B	3147A00400	2006-08-21
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
A.R.A	Antenna Horn	DRG-118/A	1132	2007-06-18
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

9.4 Environmental Conditions

Temperature:	16 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Xiao Ming Hu from 2008-01-23.*

9.5 Summary of Test Results

Channel	Frequency (MHz)	Max Power (dBm)	Max Power (mW)	Limit (mW)	Result
Low	2412	7	5.14	1000.000	Compliant
Mid	2438	6	4.08	1000.000	Compliant
High	2464	2	1.51	1000.000	Compliant

10 FCC §15.247(d), RSS-210 § A8.5 - 100 kHz BANDWIDTH OF BAND EDGES

10.1 Applicable Standard

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

RSS210§ A8.5: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emissions limits specified in Tables 2 and 3.

10.2 Measurement Procedure

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

10.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma Instruments	Pre amplifier	317	260407	2007-04-26
HP	Pre amplifier	8449B	3147A00400	2006-08-21
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
A.R.A	Antenna Horn	DRG-118/A	1132	2007-06-18
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

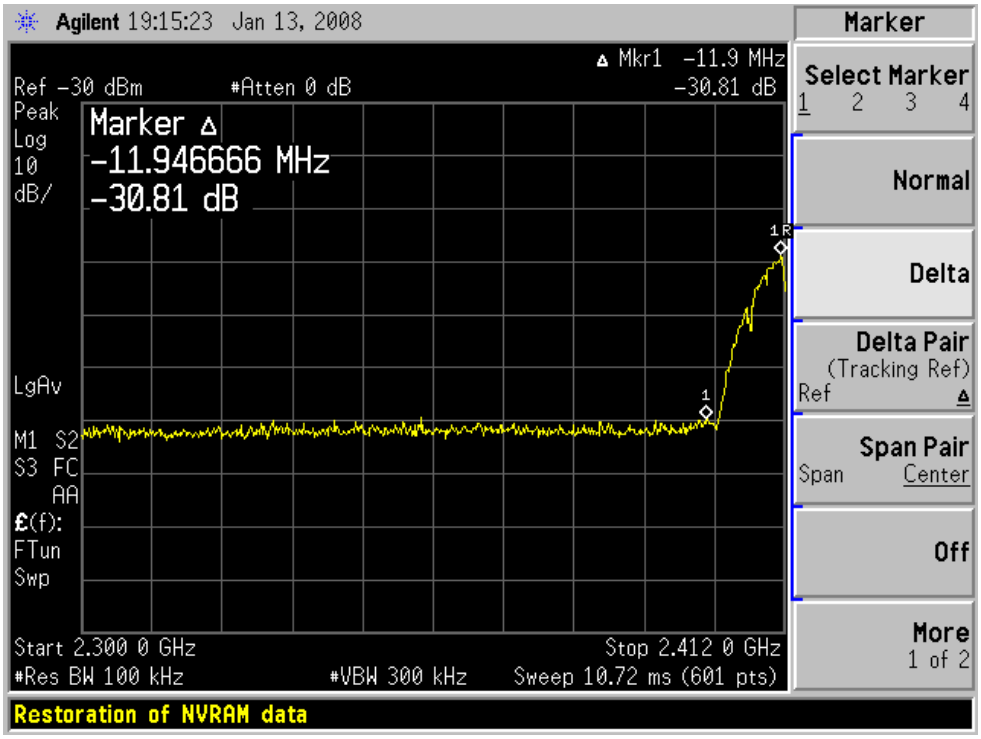
10.4 Environmental Conditions

Temperature:	16 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

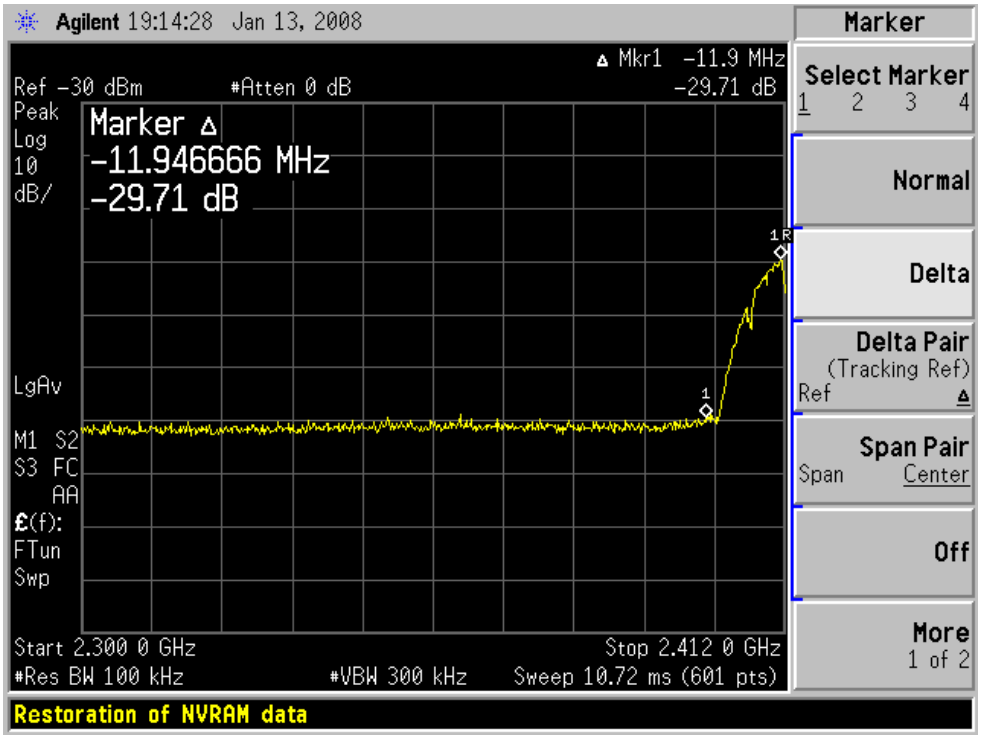
**The testing was performed by Xiao Ming Hu from 2008-01-23.*

Please Refer to the Following Plots

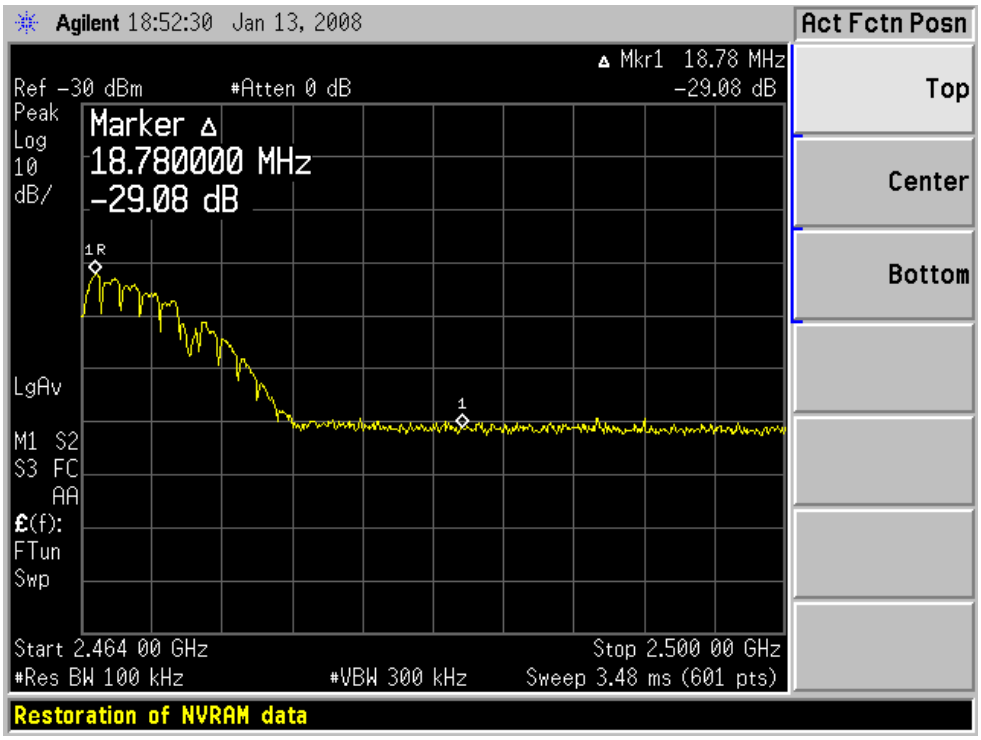
Lowest Channel – Horizontal



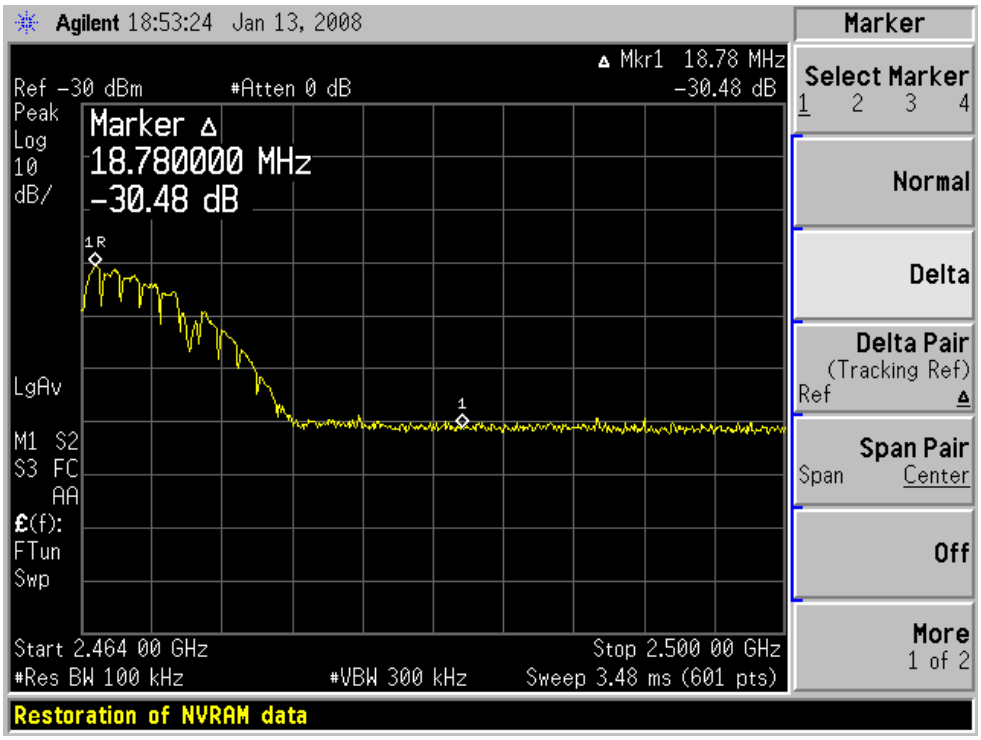
Lowest Channel – Vertical



Highest Channel – Horizontal



Highest Channel – Vertical



11 FCC §15.247(e), RSS-210 § A8.2 (b) - POWER SPECTRAL DENSITY

11.1 Applicable Standard

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

11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Measure the power spectral density as follows:
   A. Tune the analyzer to the highest point of the maximized fundamental emission. Reset the analyzer to a RBW = 3 kHz, VBW > RBW, span = 300 kHz, sweep = 100 sec.
   B. From the peak level obtained in (A), derive the field strength, E, by applying the appropriate antenna factor, cable loss, pre-amp gain, etc.
4. P = (E x d) squared / (30 x G)
   G = the numeric gain of the transmitting antenna over an isotropic radiator.
   d = the distance in meters from which the field strength was measured.
   P = the power in watts for which you are solving:
5. Using the equation listed in (4), calculate a power level for comparison to the + 8 dBm limit.

11.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma Instruments	Pre amplifier	317	260407	2007-04-26
HP	Pre amplifier	8449B	3147A00400	2006-08-21
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
A.R.A	Antenna Horn	DRG-118/A	1132	2007-06-18
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

11.4 Environmental Conditions

Temperature:	16 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Xiao Ming Hu from 2008-01-23.*

11.5 Summary of Test Results

Frequency (MHz)	PPSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-16.16	8	Compliant
2438	-16.98	8	Compliant
2464	-16.31	8	Compliant