Lab Code: 200167-0

FCC PART 15.247

TEST AND MEASUREMENT REPORT

For

Amp'ed RF Technology, Inc

1879 Lundy Ave, Suite 138,

San Jose, CA 95131, USA

FCC ID: X3ZBTMOD1
Model: BT11

Report Type:	**Product Type:**
Original Report	Bluetooth Intercom Module

Test Engineer:	Kevin Li
Report Number:	R0912015-247
Report Date:	2010-01-06
Reviewed By:	Boni Baniqued EMC/RF Supervisor
Prepared By: (84)	Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732 9164

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R0912015-247	Original Report	2009-12-18
1	R0912015-247	Updated Photos	2010-01-04
2	R0912015-247	Updated FCC ID	2010-01-06

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

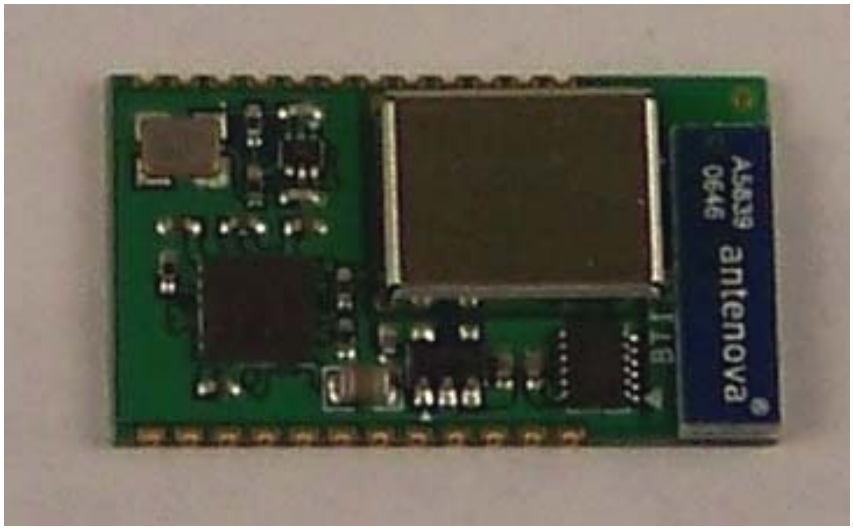
This test report was prepared on behalf of *Amp'ed RF Technology, Inc* and their product model: BT11 FCC ID: X3ZBTMOD1 or the "EUT" as referred to in this report. The EUT is a surface mount Bluetooth module supplied on a 24 pin, 6-layer PCB.

1.2 Mechanical Description of EUT

The *Amp'ed RF Technology, Inc* product, *model: TB11*, measures approximately 60 mm(L) x 30 mm(W) x 15 mm(H) and weighs approximately 17 g.

** The test data gathered are from typical production sample, serial number: 09120151, assigned by BACL.*

1.3 EUT Photograph



Please refer to Exhibit C for more EUT photographs.

1.4 Objective

This type approval report is prepared on behalf of *Amp'ed RF Technology, Inc* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C.

1.5 Related Submittal(s)/Grant(s)

N/A

1.6 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003.

1.7 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.

1.8 Test Facility

The semi-anechoic chambers used by BACL to collect radiated and conducted emissions measurement data is located in the building at it's facility in Sunnyvale, California, USA.

BACL's test sites 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 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 facility complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464 and VCCI Registration No.: C-2698 and R-2463. 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 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/ts/htdocs/210/214/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 Justification

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

Radio Mode	Low Channel (MHz)	Middle Channel (MHz)	High Channel (MHz)
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 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RF Cable	< 3 m	EUT	PSA

3 SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§15.203	Antenna Requirements	Compliant
§15.207(a)	Conducted Emissions	Compliant
§15.205, §15.209 & §15.247(d)	Radiated Spurious Emissions	Compliant
§15.247(a) (1)	Channel Bandwidth	Compliant
§15.247(a) (1)	Hopping Channel Separation	Compliant
§15.247(a)(1)(iii)	Number of Hopping Frequencies Used	Compliant
§15.247(a)(1)(iii)	Dwell Time	Compliant
§15.247(b)(1)	Maximum Peak Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(i) & §2.1093	RF Exposure	Compliant

4 FCC §15.203 - ANTENNA REQUIREMENT

4.1 Applicable Standard

According to §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.

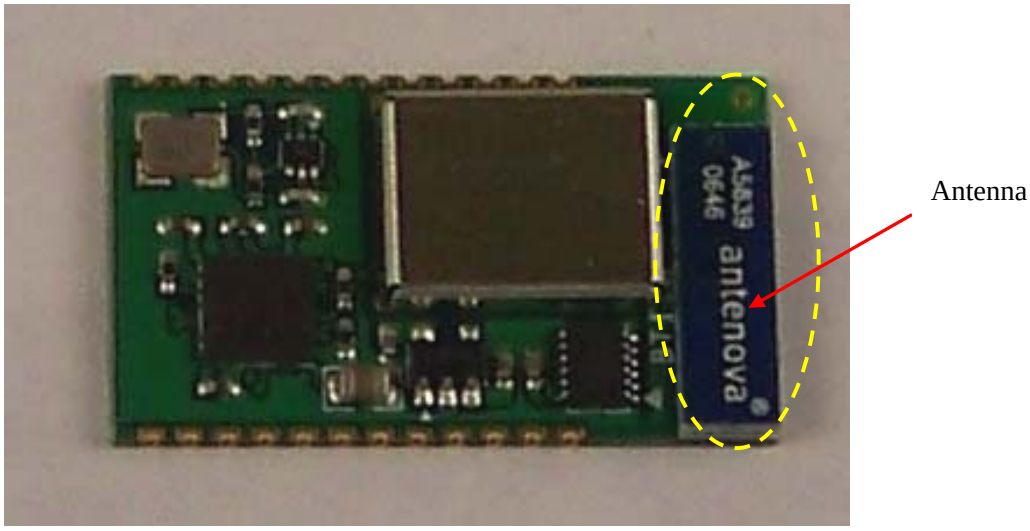
Refer to statement below for compliance.

"The antenna for this device is an integral antenna that the end user cannot access. Furthermore the device is for indoor/outdoor use as detailed in the Users Manual and Operational Description".

4.2 Antenna Connected Construction

The antenna for this device is an integral antenna that the end user cannot access. It is fully enclosed by the EUT chassis and removal/modification would result in irreparable damage to the device.

☒ **Compliant** ☐ **N/A**



5 FCC §15.207 – Conducted Emissions

5.1 Applicable Standard

According to FCC §15.207 (a) Except as shown in paragraphs (b) and (c) of this section, 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 EUT Setup

The conducted emissions tests were performed in the 5-meter test chamber, using the setup in accordance with ANSI C63.4-2003 measurement procedures. The specifications used were in accordance with FCC Part 15.207 limits.

The adapter of EUT' was connected to a 120 V, 60 Hz AC mains power source.

5.3 Test Procedure

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

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

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

5.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Solar Electronics	LISN	9252-R-24-BNC	511205	2009-03-11
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2009-04-21

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

5.5 Test Environmental Conditions

Temperature:	22 ºC
Relative Humidity:	44 %
ATM Pressure:	101.2kPa

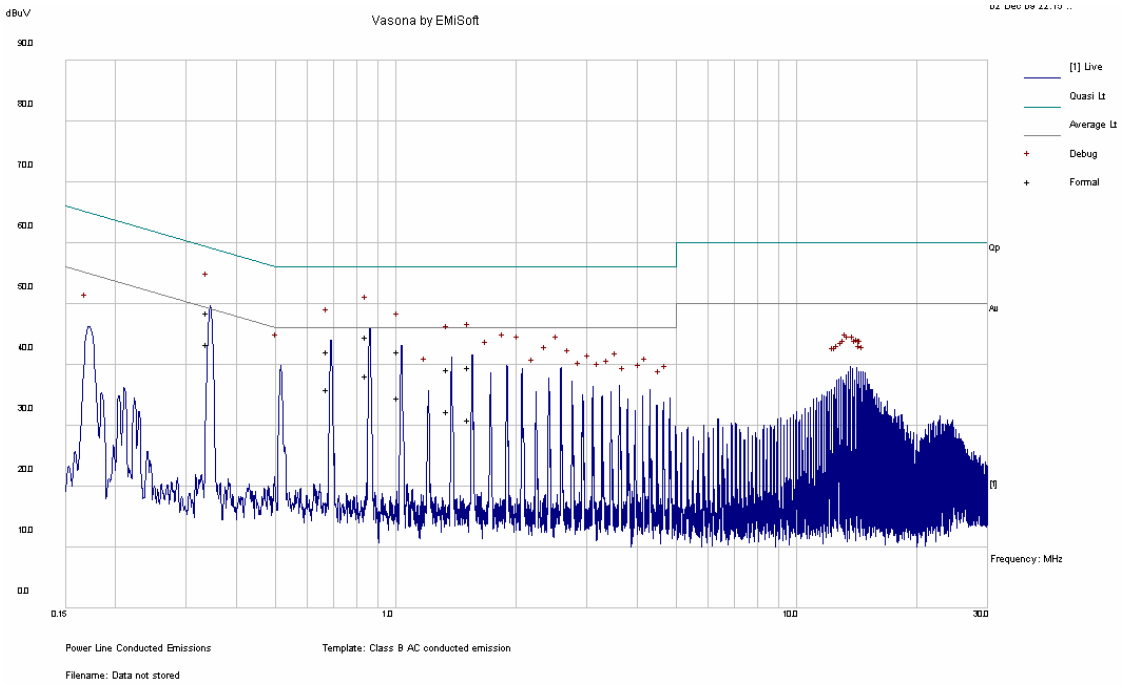
**Testing was performed by Kevin Li on 2009-12-02 in 5 meter Chamber #2.*

Test Result: According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C section 15.207 standard's Conducted emissions limits and had the worst margin of:

-5.71 dB at 0.344262 MHz in the Neutral conductor, 120V/60Hz

5.6 Conducted Emissions Test Data

Line:



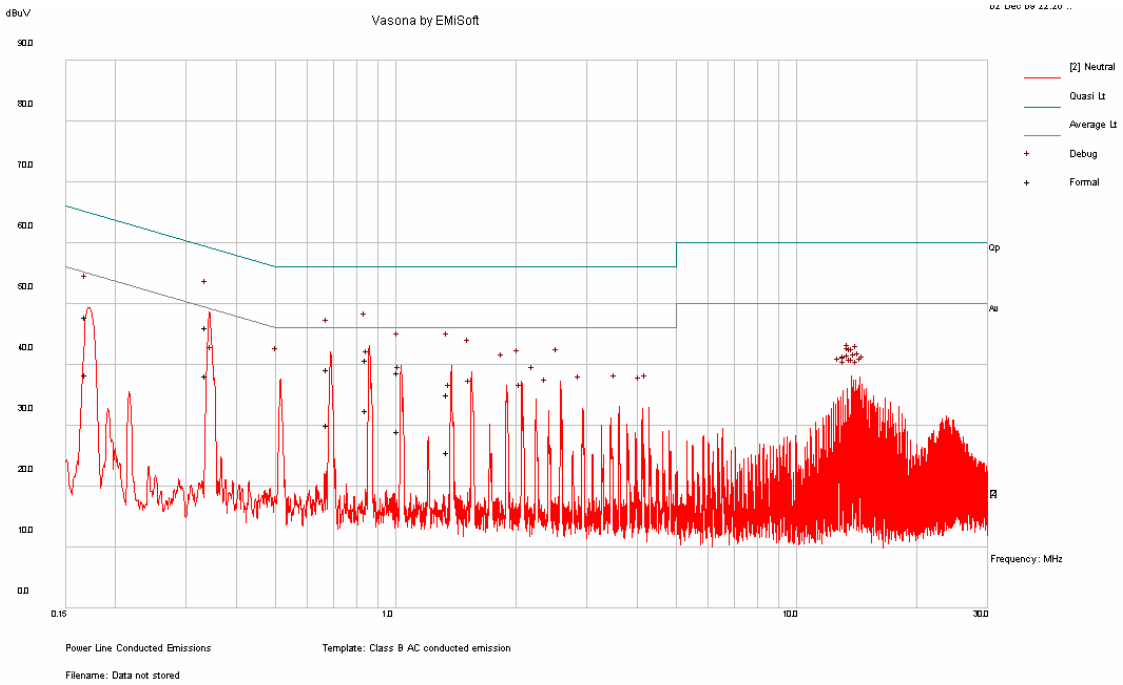
QP Measurement Results

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (L/N)	Limit (dBµV)	Margin (dB)
0.344262	48.60	L	59.1	-10.50
0.86019	44.49	L	56.0	-11.51
0.68796	42.24	L	56.0	-13.76
1.033155	42.15	L	56.0	-13.85
1.549569	39.56	L	56.0	-16.44
1.376733	39.18	L	56.0	-16.82

Average Measurement Results

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (L/N)	Limit (dBµV)	Margin (dB)
0.344262	43.39	L	49.1	-5.71
0.860190	38.17	L	46.0	-7.83
0.687960	36.01	L	46.0	-9.99
1.033155	34.61	L	46.0	-11.39
1.549569	30.99	L	46.0	-15.01
1.376733	32.38	L	46.0	-13.62

Neutral:



QP Measurement Results

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (L/N)	Limit (dBµV)	Margin (dB)
0.300398	50.69	N	60.23	-9.55
1.365566	46.41	N	56.00	-9.59
1.092885	43.94	N	56.00	-12.06
1.927358	40.91	N	56.00	-15.09
1.490679	40.69	N	56.00	-15.31
1.183607	38.06	N	56.00	-17.94

Average Measurement Results

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (L/N)	Limit (dBµV)	Margin (dB)
0.343512	38.28	N	49.12	-10.84
0.860883	32.59	N	46.00	-13.41
0.686886	30.11	N	46.00	-15.89
0.171855	38.44	N	54.87	-16.43
1.031976	28.99	N	46.00	-17.01
1.376718	25.58	N	46.00	-20.42

6 FCC §15.205, §15.209 & 15.247(D) - RADIATED EMISSIONS

6.1 Applicable Standard:

As per FCC §15.205 Restricted bands of operation

(a) Except as shown in 15.205 paragraphs (d), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	MHz	GHz	GHz
0.090 – 0.110	8.291 – 8.294	16.69475 – 16.69525	156.7 – 156.9	1435 – 1626.5	3.332 – 3.339	10.6 – 12.7
0.495 – 0.505	8.362 – 8.366	25.5 – 25.67	162.0125 –167.17	1645.5 – 1646.5	3.3458 – 3.358	13.25 – 13.4
2.1735 – 2.1905	8.37625 – 8.38675	37.5 – 38.25	167.72 – 173.2	1660 – 1710	3.600 – 4.400	14.47 – 14.5
4.125 – 4.128	8.41425 – 8.41475	73 – 74.6	240 – 285	1718.8 – 1722.2	4.5 – 5.15	15.35 – 16.2
4.17725 – 4.17775	12.29 – 12.293	74.8 – 75.2	322 – 335.4	2200 – 2300	5.35 – 5.46	17.7 – 21.4
4.20725 – 4.20775	12.51975 – 12.52025	108 – 121.94	399.9 – 410	2310 – 2390	7.25 – 7.75	22.01 – 23.12
6.215 – 6.218	12.57675 – 12.57725	123 – 138	608 – 614	2483.5 – 2500	8.025 – 8.5	23.6 – 24.0
6.26775 – 6.26825	13.36 – 13.41	149.9 – 150.05	960 – 1240	2690 – 2900	9.0 – 9.2	31.2 – 31.8
6.31175 – 6.31225	16.42 – 16.423	156.52475 – 156.52525	1300 – 1427	3260 – 3267	9.3 – 9.5	36.43 – 36.5
						Above 38.6

(b) Except as provided in 15.205 paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator.

As per FCC §15.209 Radiated emission limits, general requirements.

(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 (microvolts/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

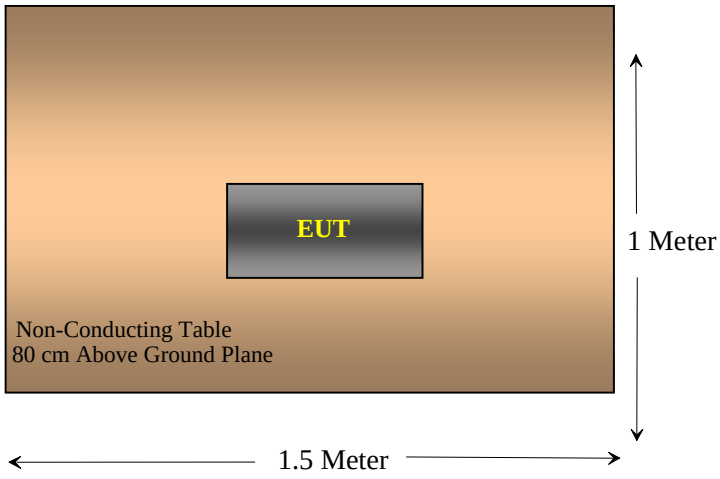
*** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this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

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)).

6.2 Test Setup

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

6.3 Test Setup Diagram



6.4 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 meter away from the testing antenna, which is varied from 1-4 mete, 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:

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

6.5 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 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10dB)

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.

6.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Mini-Circuits	Pre amplifier	ZKL-2	7786100643	2009-03-03
HP	Pre amplifier	8449B	3147A00400	2008-10-20
Sunol Science Corp	Combination Antenna	JB1 Antenna	A103105-3	2009-03-25
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2008-07-01
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27
A.R.A.	Antenna, Horn	DRG-118/A	1132	2008-07-28

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

6.7 Test Environmental Conditions

Temperature:	22.3 ºC
Relative Humidity:	43 %
ATM Pressure:	101.7kPa

**Testing was performed by Kevin Li on 2009-12-02 in 5 meter Chamber #2.*

6.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247 standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-6.03	37.7744	Vertical	Low, 30-1000 MHz
-24.98	32.32996	Vertical	Middle, 30-1000 MHz
-7.16	37.77632	Vertical	High, 30-1000 MHz

Above 1 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-0.13	4804	Vertical	Low, 1-25 GHz
-0.4	4884	Vertical	Mid, 1-25 GHz
-0.43	4960	Vertical	High, 1-25 GHz

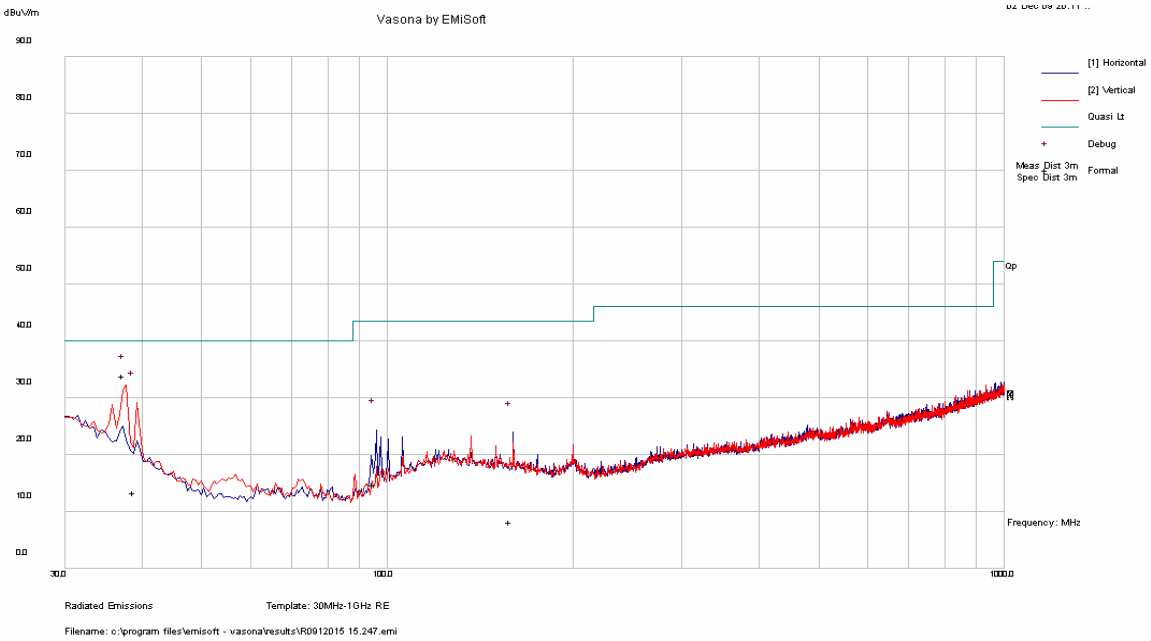
Please refer to the following table and plots for specific test result details

6.9 Radiated Emissions Test Result Data:

30 MHz – 1 GHz:

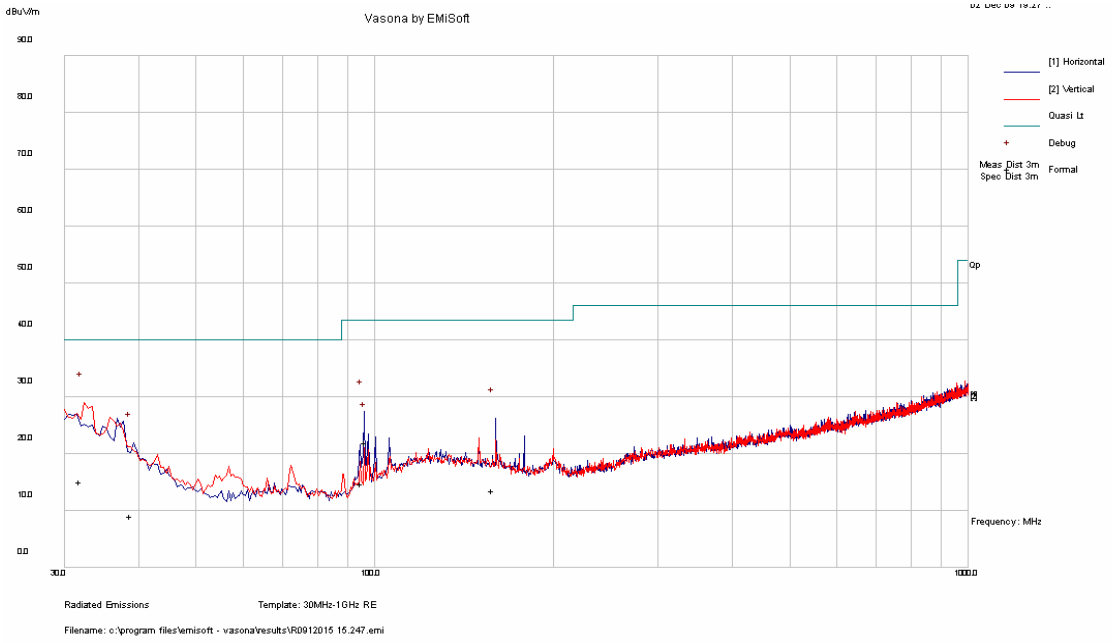
Measured at 3 meter

Low Channel (2402 MHz)



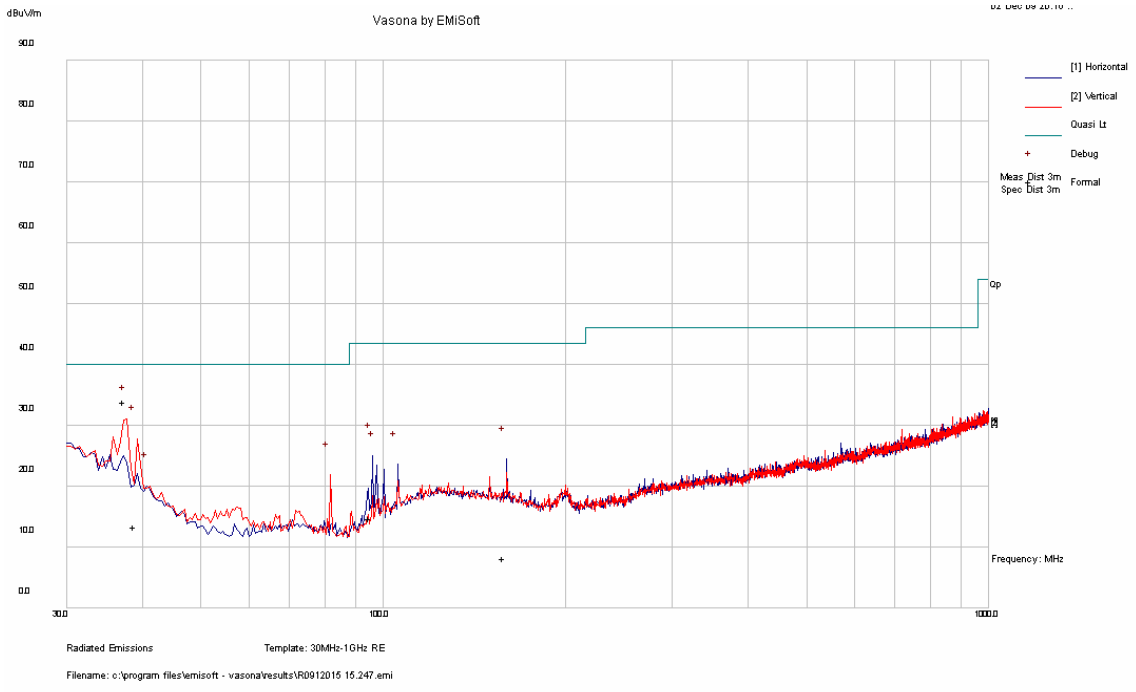
Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
37.7744	33.97	172	V	255	40	-6.03
39.3026	13.42	184	V	78	40	-26.58
95.98904	14.78	138	H	35	43.5	-28.72
160.0782	8.25	140	H	321	43.5	-35.25

Middle Channel (2440 MHz)



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
32.32996	15.02	256	V	300	40	-24.98
96.03608	14.72	165	H	201	43.5	-28.78
160.0143	13.53	97	H	184	43.5	-29.97
39.35276	9.06	145	H	61	40	-30.94

High Channel (2480 MHz)



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
37.77632	32.84	207	V	248	40	-7.16
39.43796	14.10	172	V	206	40	-25.90
96.02408	13.12	275	H	163	43.5	-30.38
81.83668	3.73	127	V	115	40	-36.27

1 – 25 GHz:

Low Channel 2402 MHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4804	56.85	335	100	V	32	9.79	36.54	62.1	74	-11.90	peak
4804	49.97	202	100	H	32	9.79	36.54	55.22	74	-18.78	peak
4804	48.62	335	100	V	32	9.79	36.54	53.87	54	-0.13	Ave
4804	46.2	202	100	H	32	9.79	36.54	51.45	54	-2.55	Ave

Middle channel 2440 MHz measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4880	53.68	315	100	V	32	9.79	36.54	58.93	74	-15.07	peak
4880	48.97	202	100	H	32	9.79	36.54	54.22	74	-19.78	peak
4880	48.35	217	100	V	32	9.79	36.54	53.60	54	-0.40	Ave
4880	40.78	202	100	H	32	9.79	36.54	46.03	54	-7.97	Ave

High channel 2480 MHz measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4960	53.03	31	100	V	32	9.79	36.54	58.28	74	-15.72	peak
4960	49.23	337	100	H	32	9.79	36.54	54.48	74	-19.52	peak
4960	48.32	217	100	V	32	9.79	36.54	53.57	54	-0.43	Ave
4960	46.61	202	100	H	32	9.79	36.54	51.86	54	-2.14	Ave

Restricted Band:

Lowest Channel

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
2389.75	39.97	258	1.28	V	29	3.68	39.02	33.63	54	-20.37	Ave
2389.03	39.91	208	1.17	H	29	3.68	39.02	32.57	54	-21.43	Ave
2389.75	50.03	258	1.28	V	29	3.68	39.02	43.69	74	-30.31	Peak
2389.03	49.61	208	1.17	H	29	3.68	39.02	43.27	74	-30.73	Peak

Highest Channel

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
2493.2	39.66	208	1.00	V	29.2	3.72	39.25	33.33	54	-20.67	Ave
2493.4	40.49	243	1.39	H	29.2	3.72	39.25	34.16	54	-19.84	Ave
2493.2	51.65	208	1.00	V	29.2	3.72	39.25	45.32	74	-28.68	Peak
2493.4	49.95	243	1.39	H	29.2	3.72	39.25	43.62	74	-30.38	Peak

7 FCC §15.247(a)(1) – HOPPING CHANNEL BANDWIDTH

7.1 Applicable Standard

According to §15.247(a) (l), the maximum 20 dB bandwidth of the hopping channel shall be presented.

7.2 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 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 20 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

7.4 Test Environmental Conditions

Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

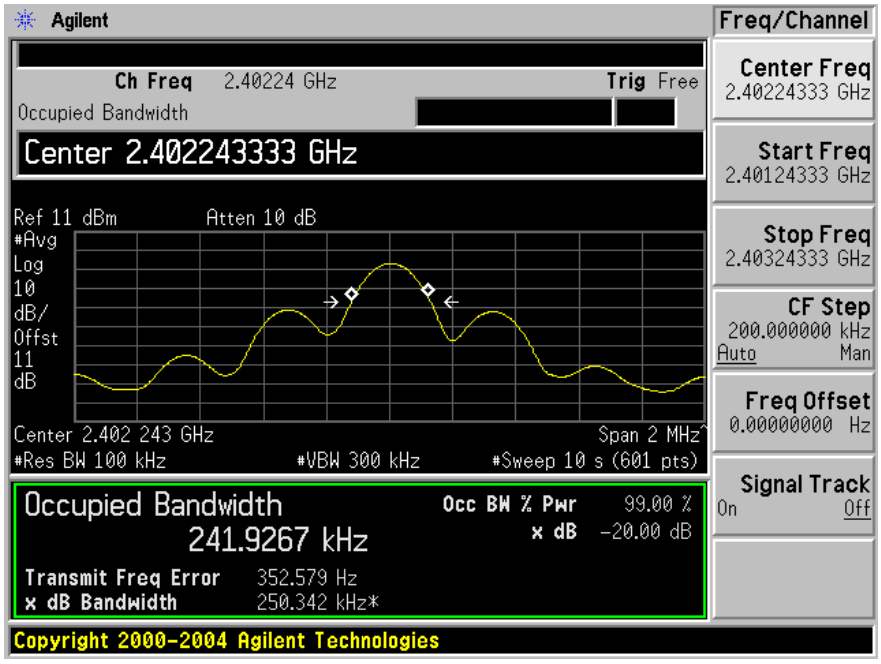
** Testing was performed by Kevin Li on 2009-12-02 .in RF Site.*

7.5 Measurement Results

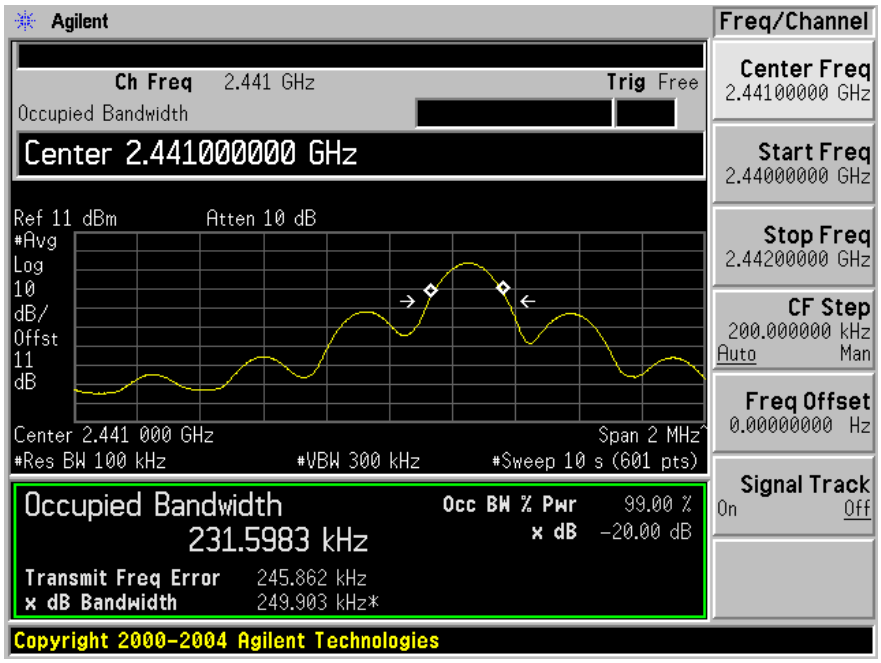
Channel	Frequency (MHz)	20 dB Channel Bandwidth (kHz)
Low	2402	250.342
Mid	2441	249.903
High	2480	250.239

Please refer to the following plots.

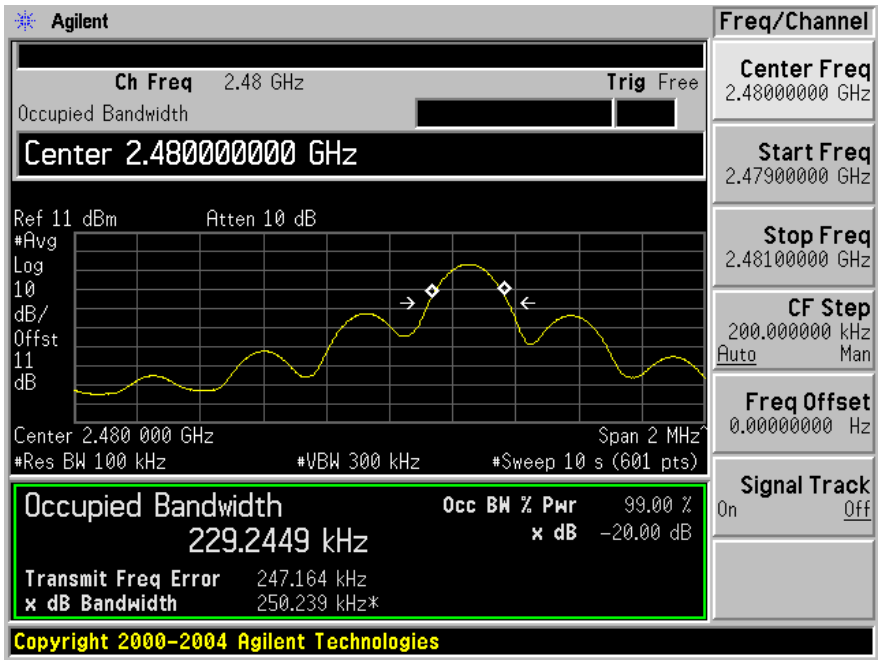
Low Channel



Middle Channel



High Channel



8 FCC §15.247(a)(1) - HOPPING CHANNEL SEPARATION

8.1 Applicable Standard

According to §15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument Turn on the EUT and set it to any one convenient frequency within its operating range.
3. By using the Max-Hold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function, and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

8.4 Test Environmental Conditions

Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

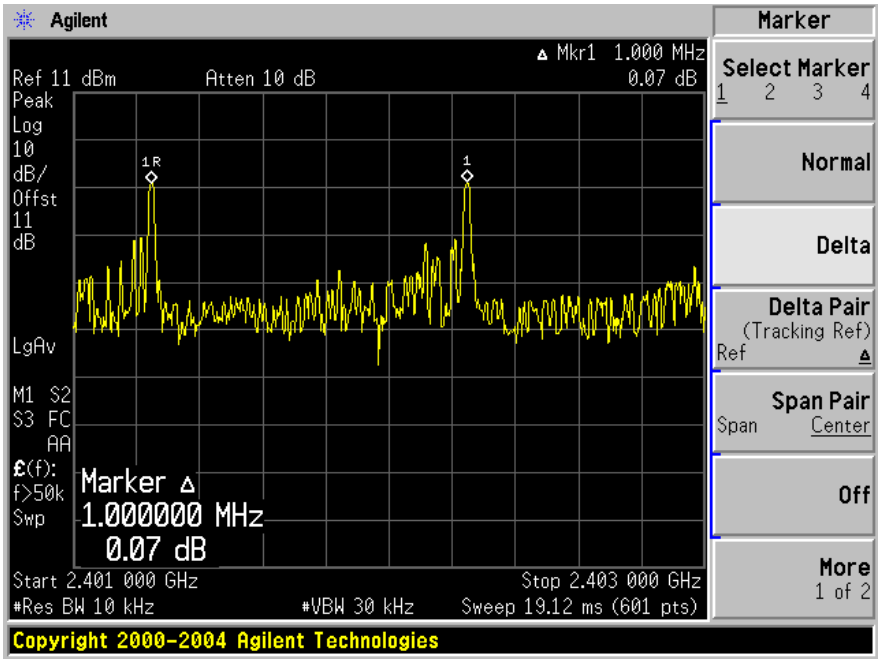
** Testing was performed by Kevin Li on 2009-12-02 .in RF Site.*

8.5 Measurement Results

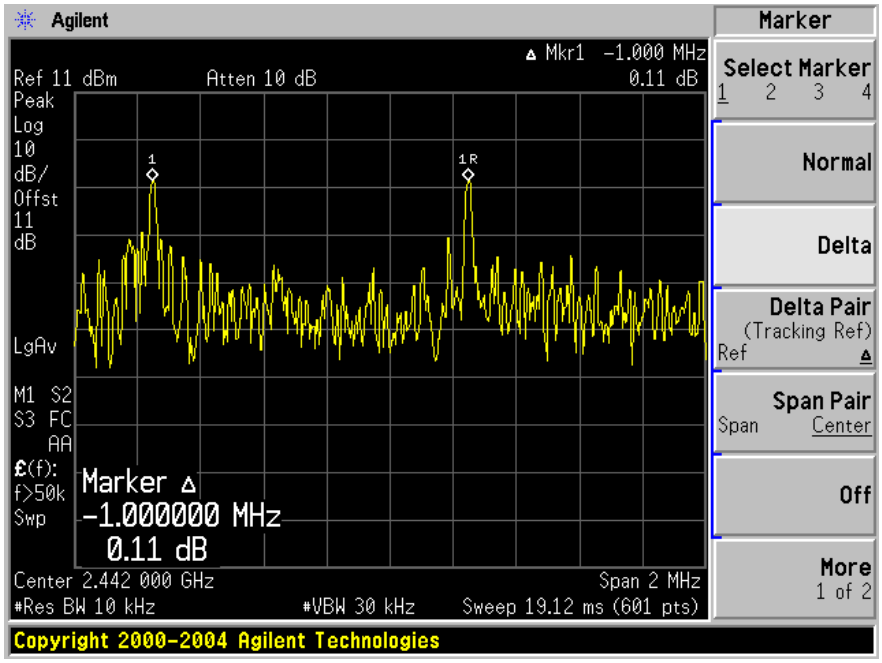
Channel	Frequency (MHz)	Channel Separation (kHz)	Limit > 2/3 20 dB BW (kHz)
Low	2402	1000	166.9
Mid	2440	1000	166.6
High	2480	1000	166.8

Please refer to the following plots.

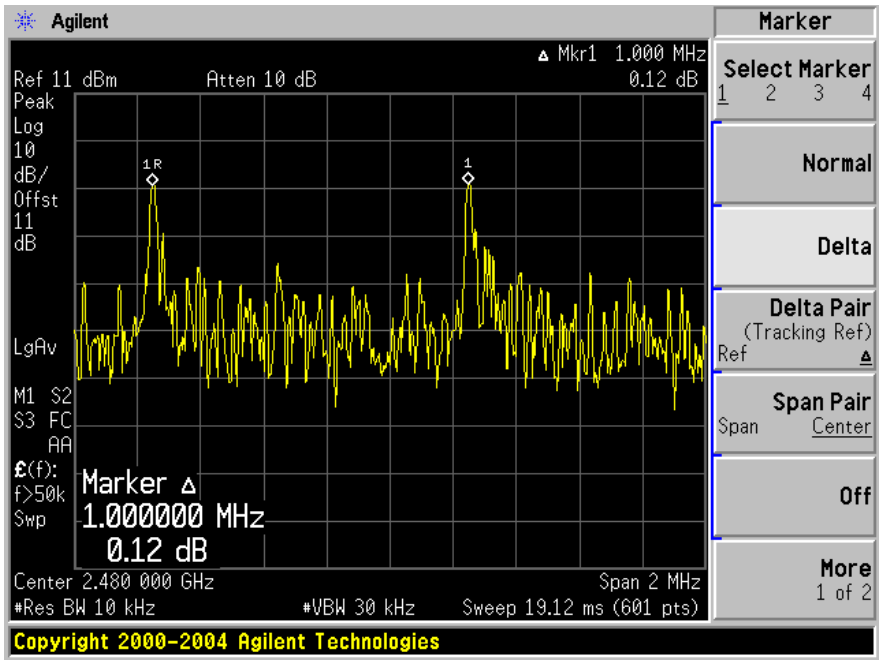
Low Channel



Middle Channel



High Channel



9 FCC §15.247(a)(1)(iii) - NUMBER OF HOPPING FREQUENCIES USED

9.1 Applicable Standard

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

9.2 Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

9.4 Test Environmental Conditions

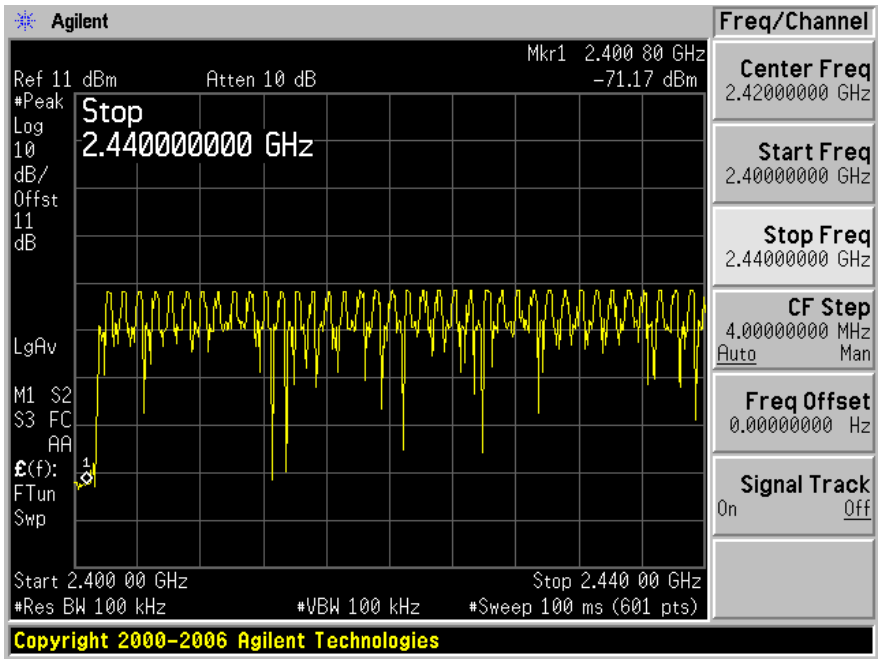
Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

** Testing was performed by Kevin Li on 2009-12-02 .in RF Site.*

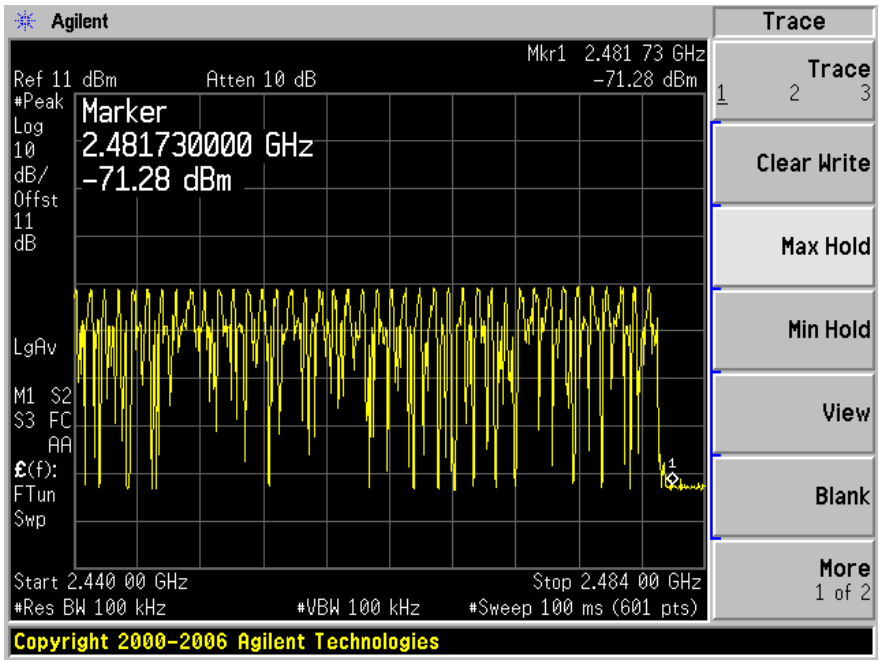
9.5 Measurement Result

79 channels, please refer to the following plots.

Hopping Channel Number



38 Channels between 2400 to 2440 MHz



41 Channels between 2440 to 2483.5 MHz

10 FCC §15.247(a)(1)(iii) - DWELL TIME

10.1 Applicable Standard

According to §15.247 (a)(1)(iii), the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

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 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. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

10.4 Test Environmental Conditions

Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

** Testing was performed by Kevin Li on 2009-12-02 .in RF Site.*

10.5 Measurement Results:

Channel	Frequency (MHz)	Pulse Width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Results
Low	2402	0.620	0.02	0.4	Compliant
Mid	2440	0.620	0.02	0.4	Compliant
High	2480	0.620	0.02	0.4	Compliant

Note:

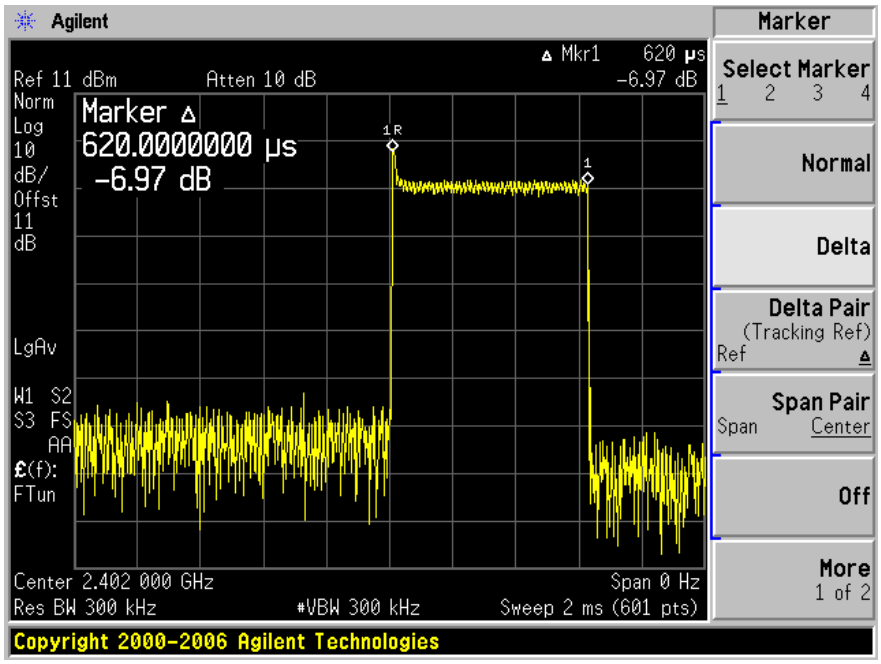
Dwell time = Pulse time*(hop rate/2/number of channels)*6.4 sec

• Hop Rate = 800
• Number of Channels = 79

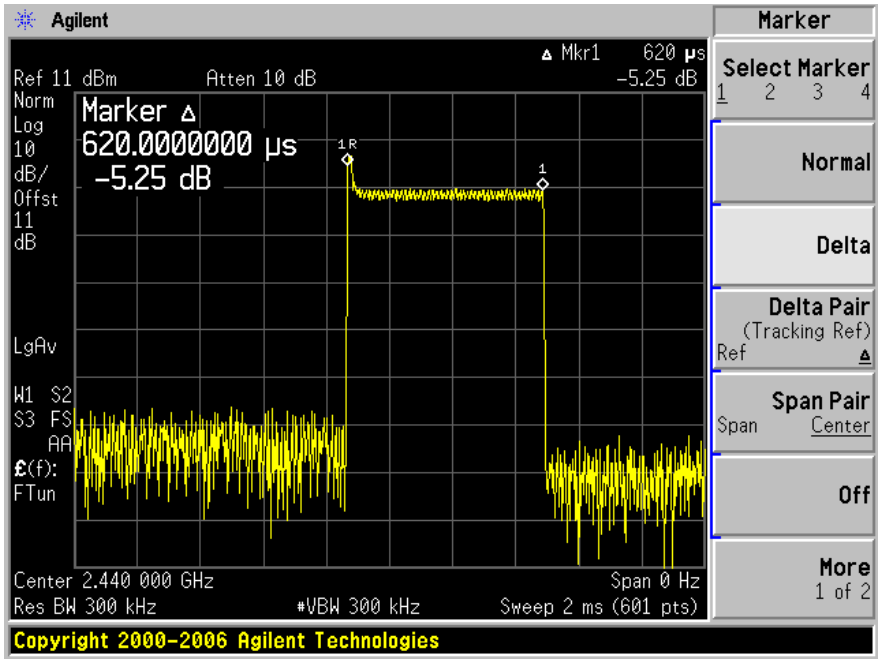
Dwell time = Pulse time*(800/2/79)*6.4 sec

Please refer the following plots.

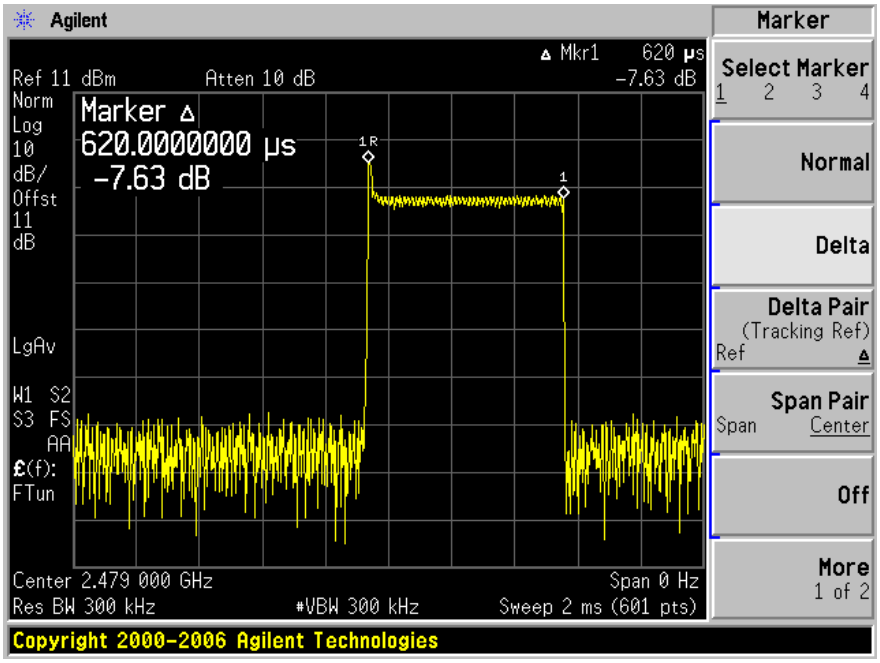
Low Channel



Middle Channel



High Channel



11 FCC §15.247(b)(1) - MAXIMUM PEAK OUTPUT POWER

11.1 Applicable Standard

According to §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.

11.2 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.

11.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

11.4 Test Environmental Conditions

Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

** Testing was performed by Kevin Li on 2009-12-02 .in RF Site.*

11.5 Measurement Result

Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	1.29	1.35	125	Pass
Mid	2442	0.04	1.01	125	Pass
High	2480	-0.92	0.81	125	Pass

12 FCC §15.247(d) - 100 kHz BANDWIDTH OF BAND EDGES

12.1 Applicable Standard

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band 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. Attenuation below the general limits specified in §15.209(a) is not required.

12.2 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 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 100kHz 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.

12.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

12.4 Test Environmental Conditions

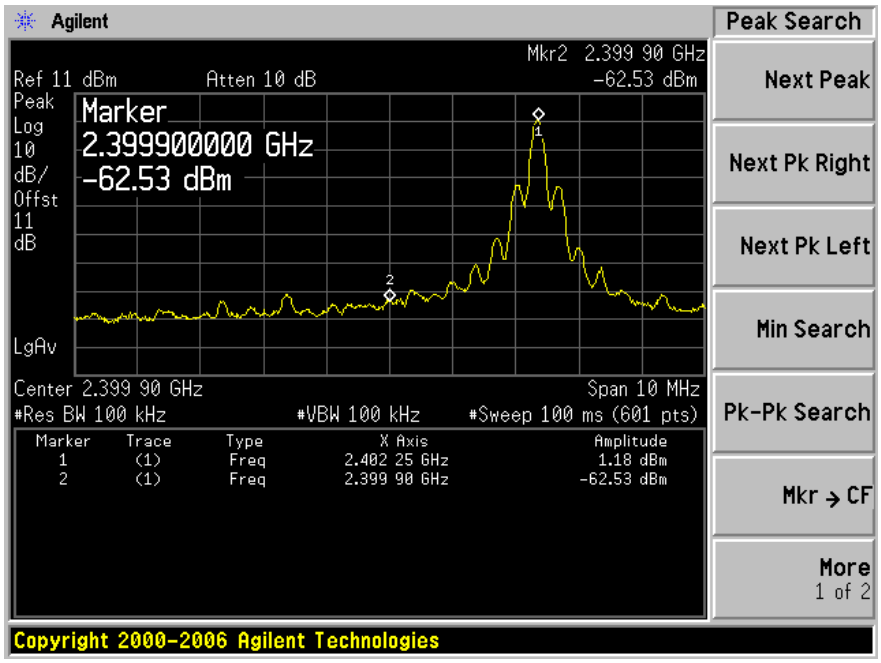
Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

** Testing was performed by Kevin Li on 2009-12-02 .in RF Site.*

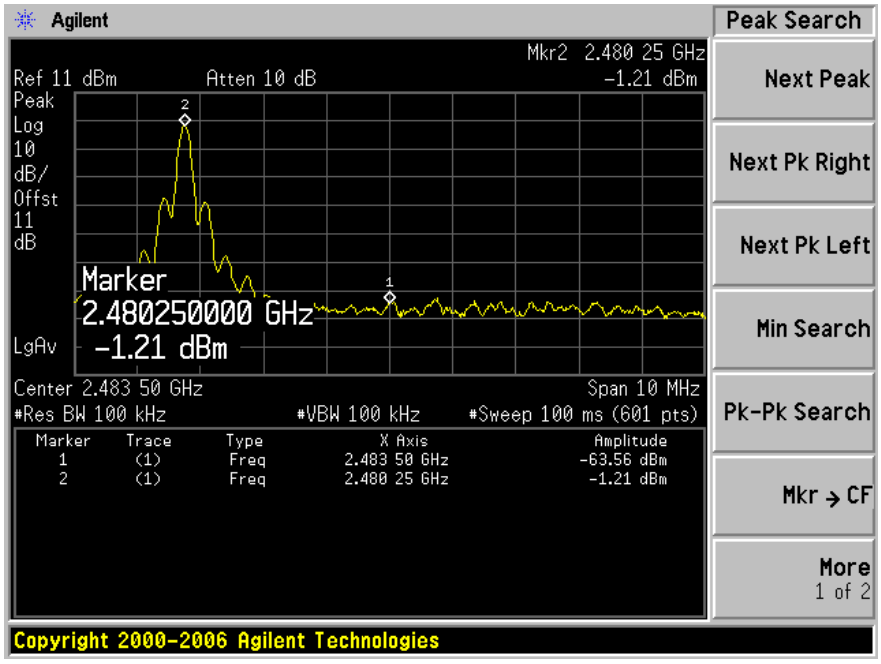
12.5 Measurement Results

Please refer to the following plots.

Band Edge: Lowest Channel



Band Edge: Highest Channel



13 FCC §2.1051 & §15.247 (d) SPURIOUS EMISSIONS AT ANTENNA PORT

13.1 Applicable Standard

According to §15.209 (f) and §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band 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. Attenuation below the general limits specified in §15.209(a) is not required.

13.2 Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Position the EUT on a bench 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 the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.

4. Set the SA on View mode and then plot the result on SA screen.

5. Repeat above procedures until all frequencies measured were complete.

13.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

13.4 Test Environmental Conditions

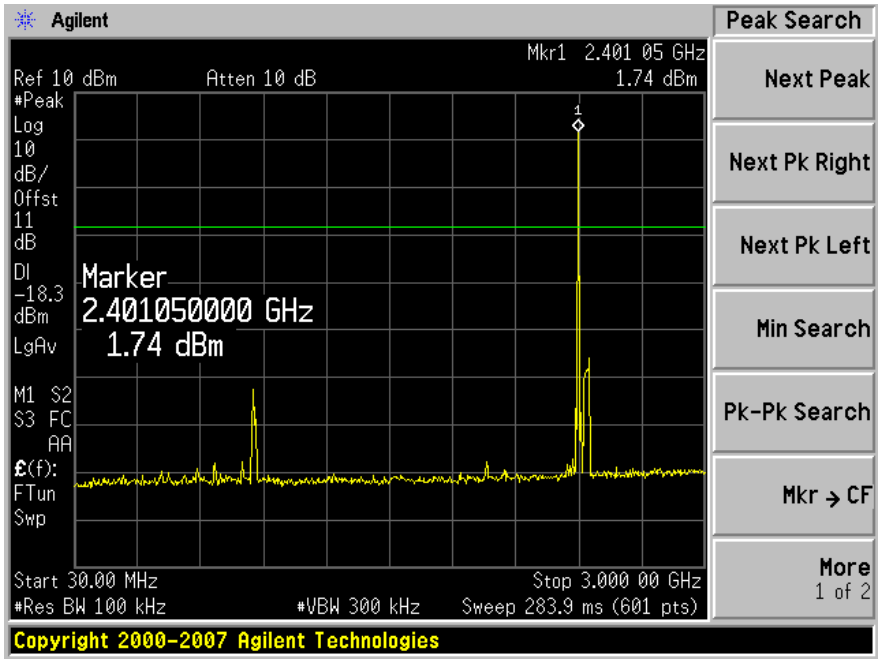
Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

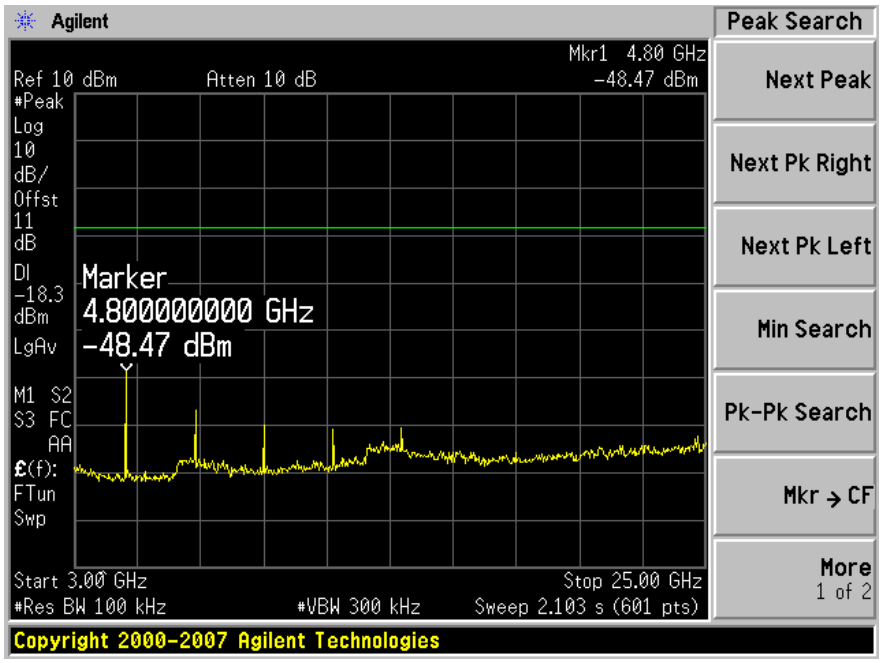
** Testing was performed by Kevin Li on 2009-12-02 .in RF Site.*

13.5 Measurement Result

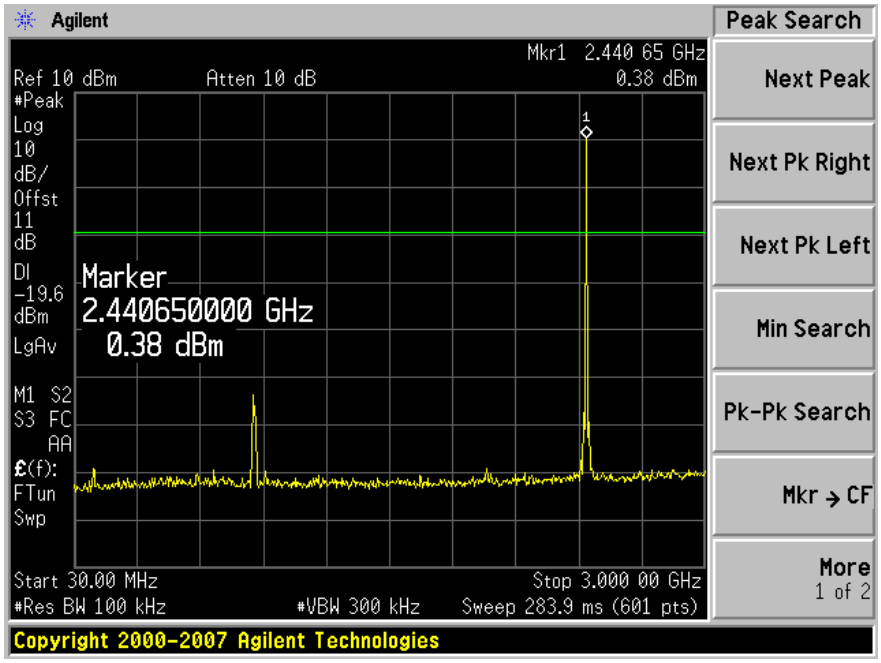
Please refer to the following plots.

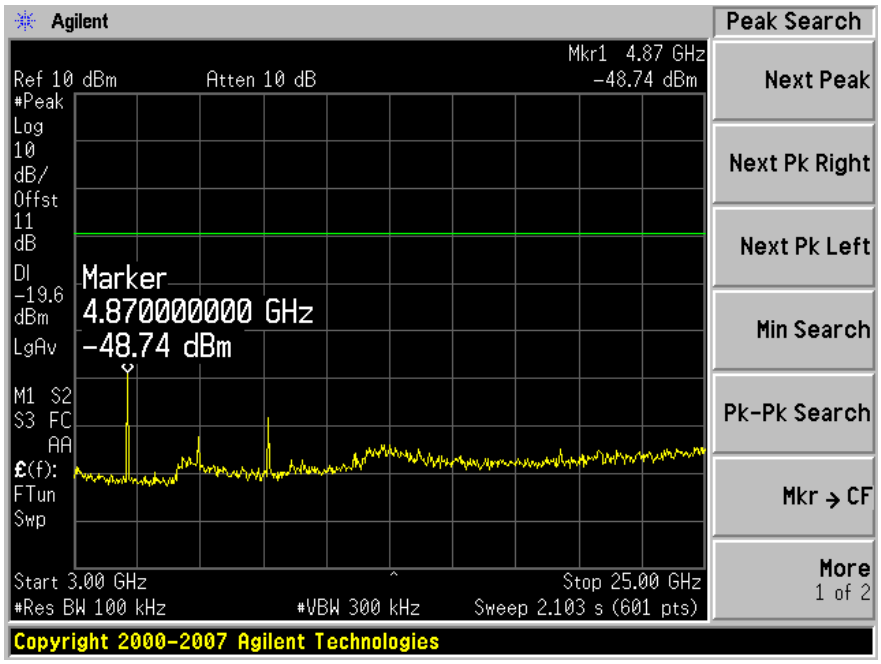
Low Channel



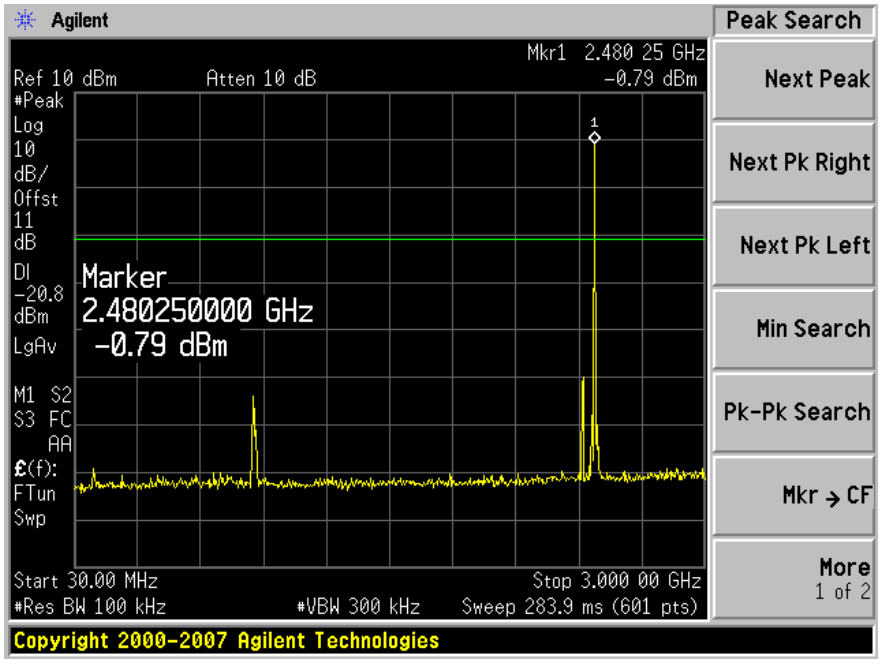


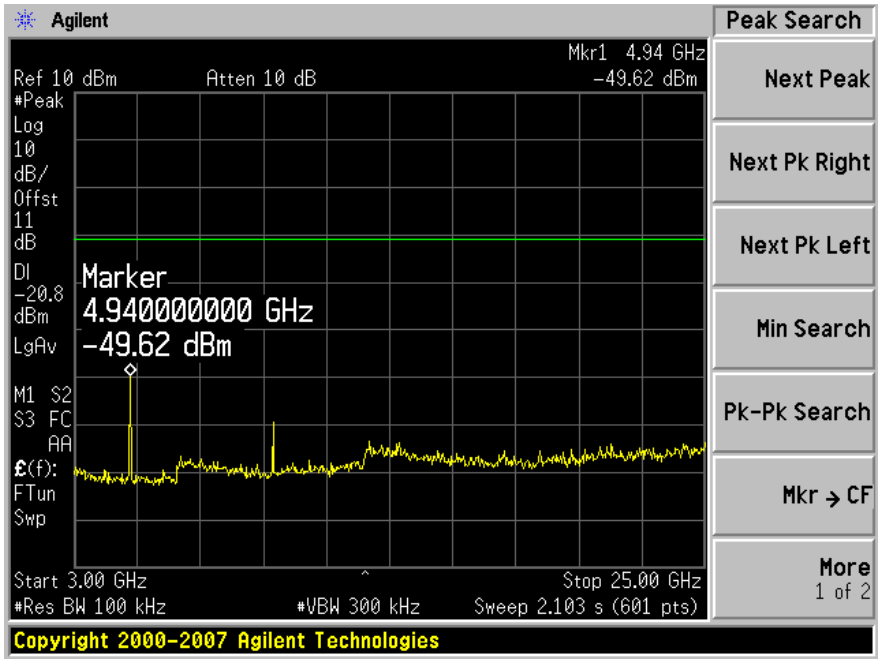
Middle Channel





High Channel





14 FCC §15.109 – SPURIOUS EMISSIOS

14.1 Applicable Standard

As per FCC §15.109: Radiated Emission Limits

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength (µV/m)
30-88	100
88-216	150
216-960	200
Above 960	500

(g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement."

Note: The CISPR 22 §6 standard, Class B limits are applied to the test data hereinafter.

14.2 Test Setup

The radiated emissions tests were performed in the 10-meter test chamber, using the setup in accordance with ANSI C63.4-2003 measurement procedures. The specifications used were in accordance with CISPR 22 standard, Class B limits for frequencies between 30 MHz and 1 GHz, and FCC Part 15 standard, Class B limits for frequencies above 1 GHz.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required

The EUT was powered by an AC/DC adapter connected to a 120 V, 60 Hz AC line power source.

14.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma Instruments	Pre-amplifier	317	260407	2009-04-29
Sunol Science Corp.	Broadband Antenna	JB3 Antenna	A020106-1 / S010293	2009-04-04
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950 K03	100337	2009-04-24
Sunol Science Corp.	System Controller	SC99V	011003-1	N/R

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

14.4 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions readings to ensure the EUT is compliant with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings were performed only when an emission was found to be marginal (within -4 dB of specification limits).

14.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna and Attenuator Factor, Cable Loss and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

> Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Loss + Attenuator Factor – Amplifier Gain.

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 for Class B. The equation for margin calculation is as follows:

> Margin = Corrected Amplitude - Class B Limit

14.6 Test Environmental Conditions

Temperature:	24.56 °C
Relative Humidity:	36.23 %
ATM Pressure:	102.2kPa

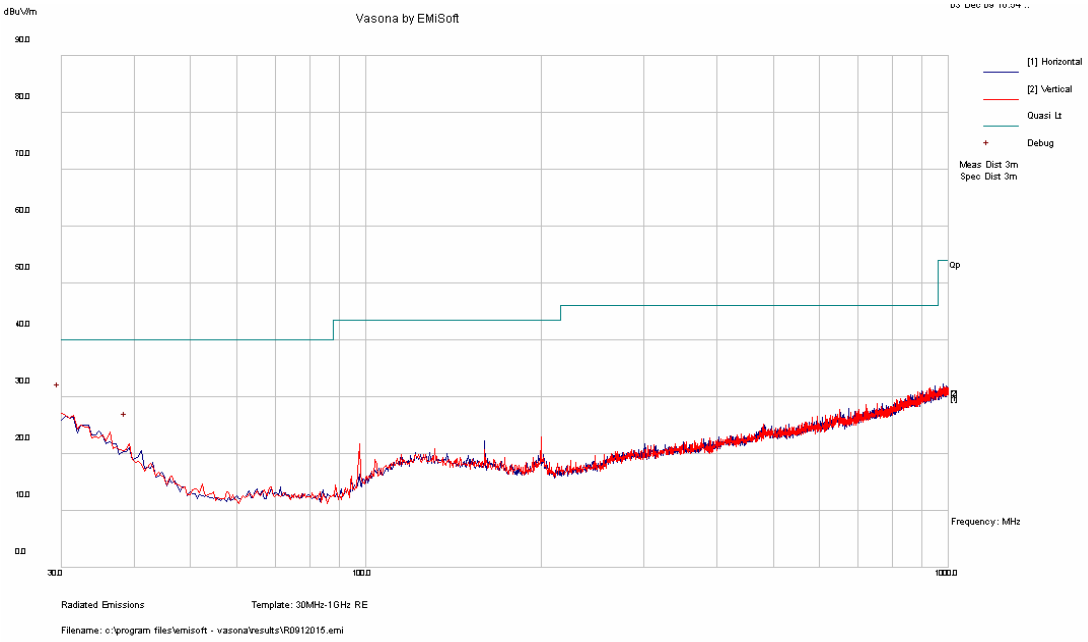
**Testing was performed by Kevin Li on 2009-12-02 in 5 meter Chamber #2.*

14.7 Summary of Test Results

According to the recorded data, the EUT complied with FCC §15.109 Standard, Class B limits, and had the worst margin readings – when calculated using CISPR 22 standard, Class B limits – of:

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)
-23.68	30.00826	Vertical

14.8 Radiated Emissions Test Data



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
30.00826	16.32	287	V	234	40	-23.68
39.23468	9.26	239	V	120	40	-30.74