FCC PART 15, SUBPART C

TEST AND MEASUREMENT REPORT

For

SecureALL Corporation

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Mountain View, CA 94040, USA

FCC ID: Y29SA-MDR

Report Type:	Product Type:
Original Report	Wireless Security Door Reader

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Report Number:	R1204301-247 DTS
Report Date:	2012-08-15
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1204301-247 DTS	Original Report	2012-08-15

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *SecureALL Corporation*, and their product, model: *SA-MDR, FCC ID: Y29SA-MDR,* which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is a door reader; it has both FHSS and DSSS communication. The EUT has four CBSA antennas, which is essentially one RF antenna with one common cavity and tow orthogonal slots for V-pol and H-pol. The PCB board has an RF switch to connect and excite only one slot at a time to produce either V-pol or H-pol. DSSS can work at both sides (inside and outside) while FHSS can only work at the outside. The product has two identical transceivers IC5 and IC11 located on PCB mounted on inside-escutcheon and outside-escutcheon respectively.

1.2 Mechanical Description of EUT

The "EUT" measures approximately 26 *cm (L) x 16 cm (W) x 16 cm (H)*, and weighs approximately *2.75 k*g (including handles).

The test data gathered are from typical production sample provided by the manufacturer. Serial number: R1204301-1 assigned by BACL.

1.3 Objective

This report is prepared on behalf of *SecureALL Corporation.* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15.247 rules for Output Power, Antenna Requirements, 6 dB Bandwidth, and power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

No Related Submittals.

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

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 EUT was configured for testing according to ANSI C63.4-2009.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test. Since two transceivers are identical, the conducted testing was performed at IC5.

2.2 EUT Exercise Software

The test utility used was RF Diagnostics Tool V2 was provided by client and was verified Ning Ma to comply with the standard requirements being tested against.

2.3 Special Equipment

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

N/A

2.6 EUT Internal Configuration Details

Manufacturers	Descriptions	Model No.	Serial Numbers
SecureAll	PCB Board 114	710-000114	-
SecureAll	CBSA Antenna	710-000109	-
SecureAll	PCB Board 115	710-000115	-

2.7 Power Supply List and Details

Manufacturer	Description	Model No.	Serial Number
V.INFINITY	Power Supply	EPS050100	-

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.247(i), §2.1091	RF Exposure Evaluation	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209	Restricted Bands	Compliant
§15.209, §15.247 (d)	Radiated Spurious Emissions	Compliant
§15.247(a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Peak Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

4 FCC §15.247 (i) & §2.1091 – RF Exposure Evaluation

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.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	5.01
Maximum peak output power at antenna input terminal (mW):	3.17
Prediction distance (cm):	20
Prediction frequency (MHz):	2405
Maximum Antenna Gain, typical (dBi):	5.0
Maximum Antenna Gain (numeric):	3.16
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.002
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.002 mW/cm^2, Limit is 1.0 mW/cm^2.

5 FCC §15.203 – Antenna Requirements

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.

5.2 Antenna Information

The unit has four CBSA antennas per following table, The IC5 (or IC11) radio is connected to one of the 4 antenna, by suitably biasing PIN switches: D6/D9 (or D5/D7), on the main board and PIN diode on CBSA Antenna PCB.

Antenna Model	Antenna Gain (dBi)
CBSA Antenna – V Pol	5 dBi
CBSA Antenna – H Pol	5 dBi

An embodiment of EDL antenna system, two antennas to define outside operating range, and two antennas looking inside to discriminate E-key located inside room. The bottom antennas (located on inside and outside escutcheons) are connected using a coaxial cable (J1, J2). The net cable loss is approximately 1dB. The top antennas (located on inside and outside escutcheons) are connected to PCB containing radio transceiver using a connector pins. The net connector loss is approximately 0.1 dB. Pleas refer to the EUT internal photos.

6 FCC §15.207 – AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 Conducted limits:

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

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 [1]	56 to 46 [1]
0.5-5	56	46
5-30	60	50

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

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2009 measurement procedure. The specification used was FCC §15.207 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 Supported Board was connected with LISN-1 which provided 120 V/60 Hz AC power.

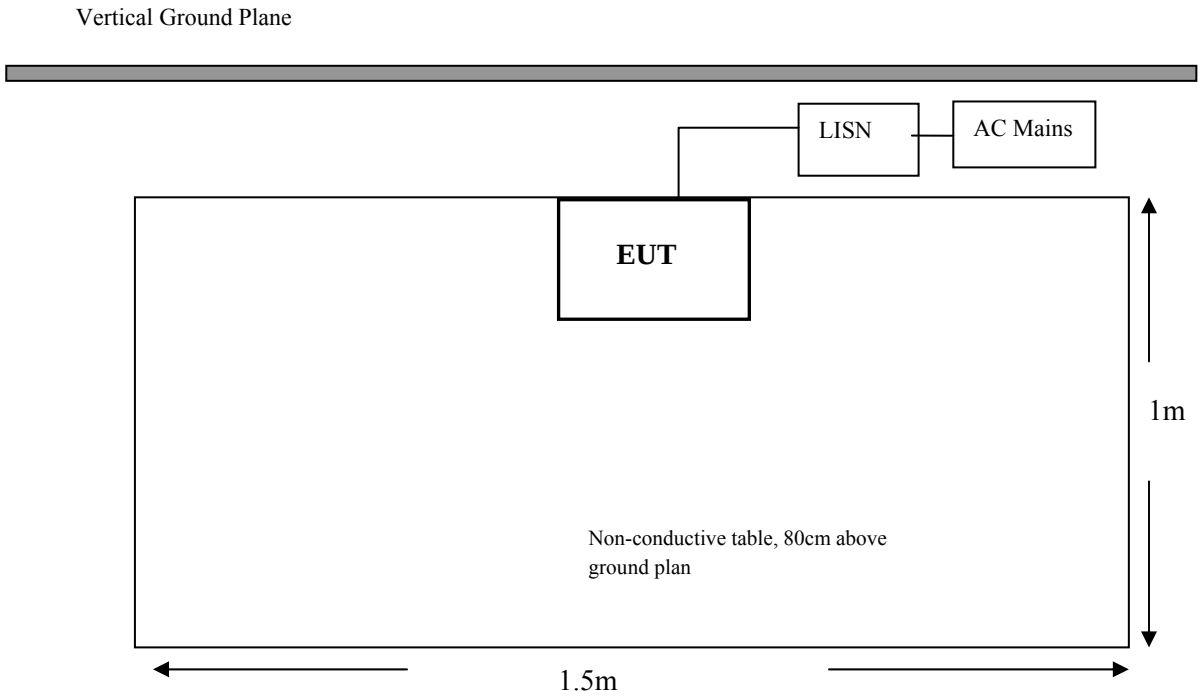
6.3 Test Procedure

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

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

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

6.4 Test Setup Block Diagram



6.5 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

6.6 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Solar Electronics	LISN	9252-R-24-BNC	511205	2011-06-25	1 year
TTE	Filter, High Pass	H9962-150K-50-21378	K7133	2011-06-10	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2011-09-14	1 year

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

6.7 Test Environmental Conditions

Temperature:	20.57 °C
Relative Humidity:	36.77 %
ATM Pressure:	102.6 kPa

The testing was performed by Ning Ma on 2012-05-05 at Chamber2.

6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Part 15.207 standard's conducted emissions limits, with the margin reading of:

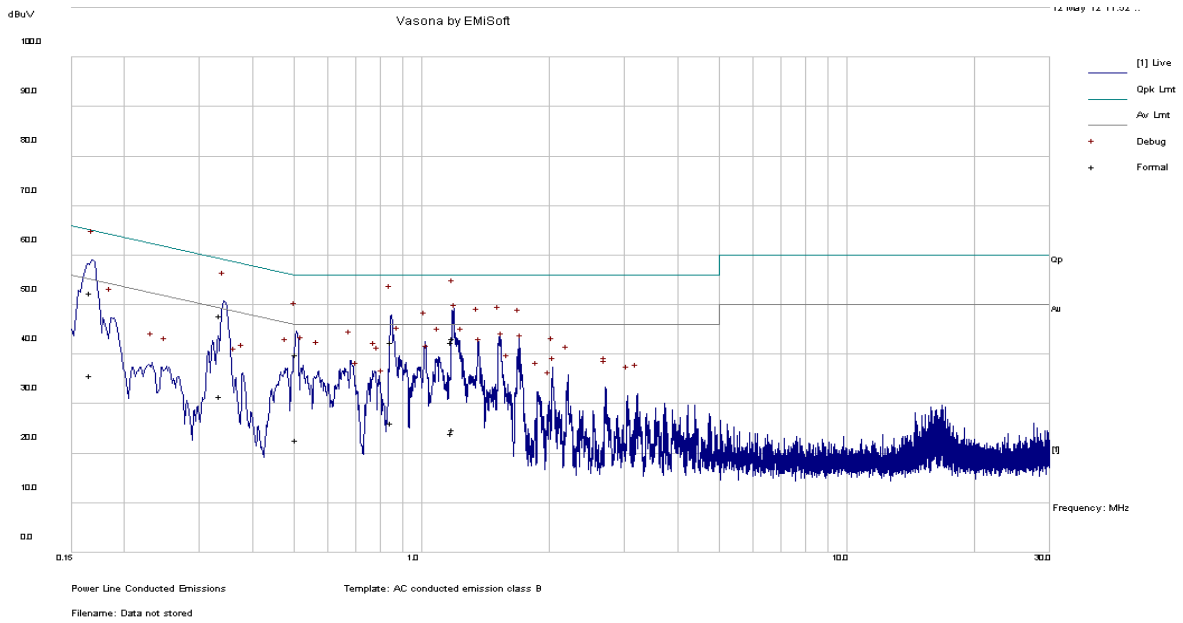
Transmitting Mode the Worst Case:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-11.53	0.337161	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

Transmitting Mode the Worst Case: Low channel

120 V, 60 Hz – Line



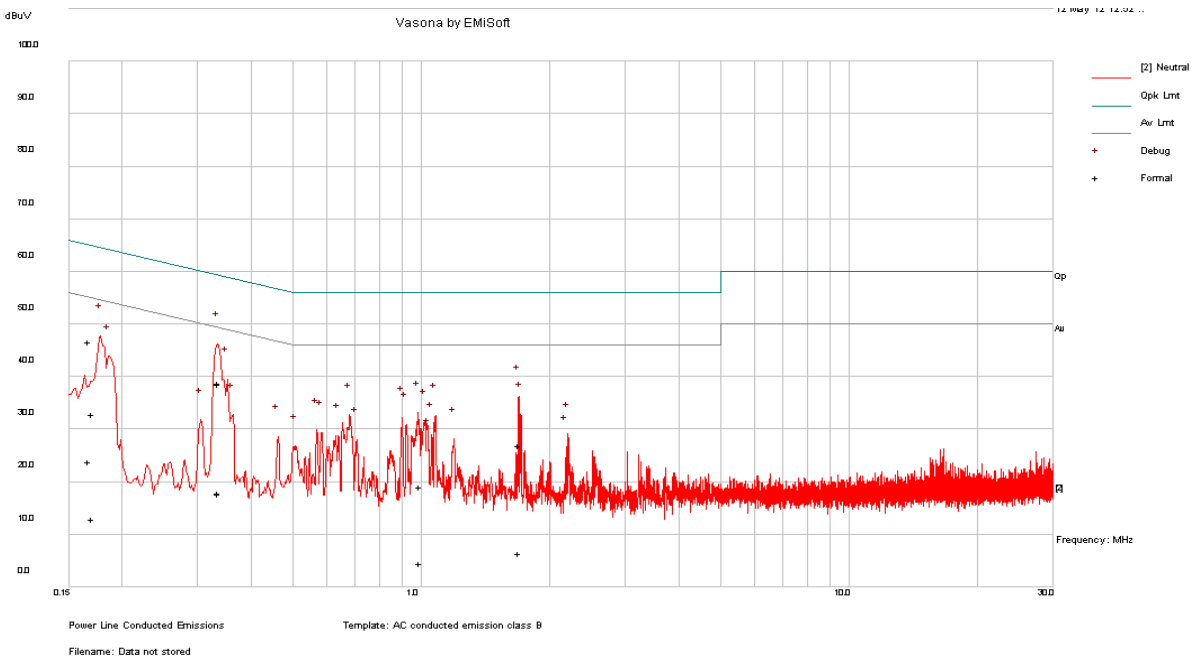
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.337161	47.75	Line	59.27	-11.53
0.166153	52.39	Line	65.15	-12.76
1.184761	43.12	Line	56	-12.88
1.182442	42.52	Line	56	-13.48
0.849839	42.37	Line	56	-13.63
0.507625	39.94	Line	56	-16.06

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.337161	31.57	Line	49.27	-17.71
0.166153	35.71	Line	55.15	-19.44
0.849839	26.15	Line	46	-19.85
1.184761	24.86	Line	46	-21.14
1.182442	24.13	Line	46	-21.87
0.507625	22.7	Line	46	-23.30

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.167885	46.7	Neutral	65.06	-18.37
0.337367	38.81	Neutral	59.27	-20.46
0.336966	38.59	Neutral	59.28	-20.69
1.691954	26.88	Neutral	56	-29.12
0.171081	32.89	Neutral	64.91	-32.01
0.993245	19.07	Neutral	56	-36.93

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.167885	23.77	Neutral	55.06	-31.29
0.337367	17.84	Neutral	49.27	-31.43
0.336966	17.77	Neutral	49.28	-31.51
1.691954	6.49	Neutral	46	-39.51
0.993245	4.46	Neutral	46	-41.54
0.171081	13	Neutral	54.91	-41.91

7 FCC §2.1051 & §15.247(d) – Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

For 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.

7.2 Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-04-10	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:	23.7 °C
Relative Humidity:	41.2 %
ATM Pressure:	101.7 kPa

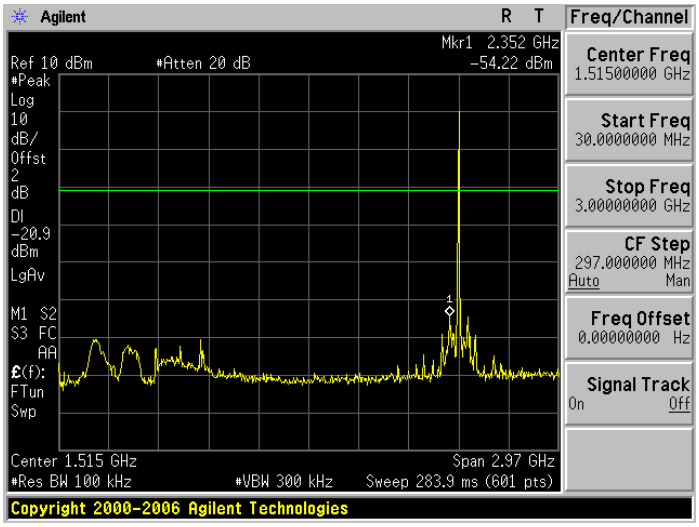
The testing was performed by Ning Ma on 2012-05-01.

7.5 Test Results

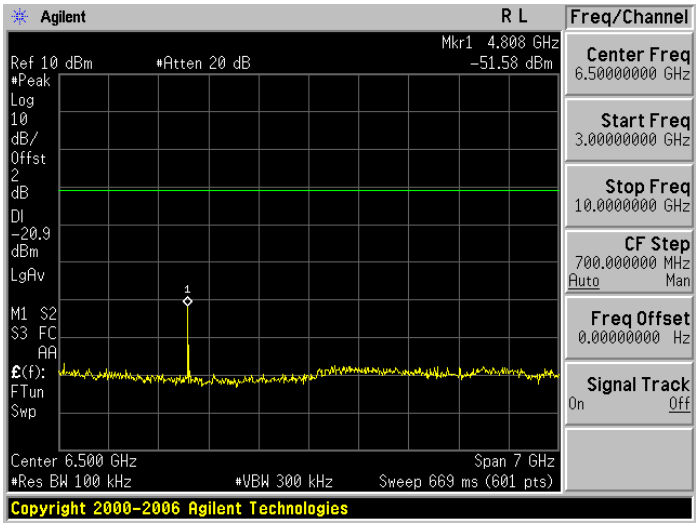
Please refer to following plots of spurious emissions.

Low Channel, 2405 MHz

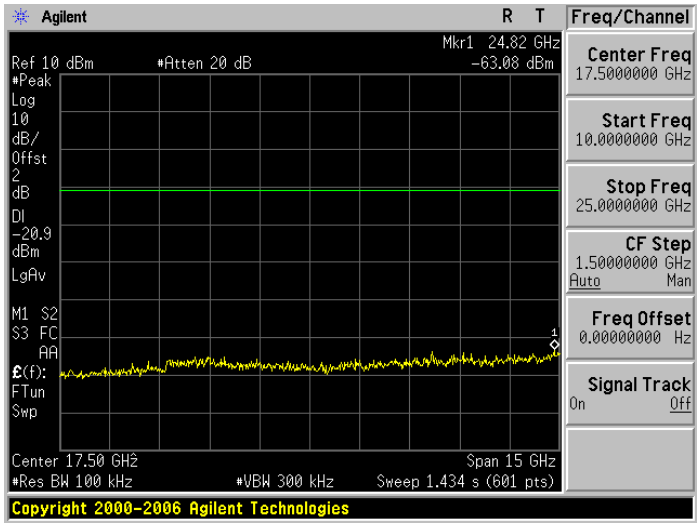
Plot: 30 MHz – 3 GHz



Plot: 3 GHz – 10 GHz

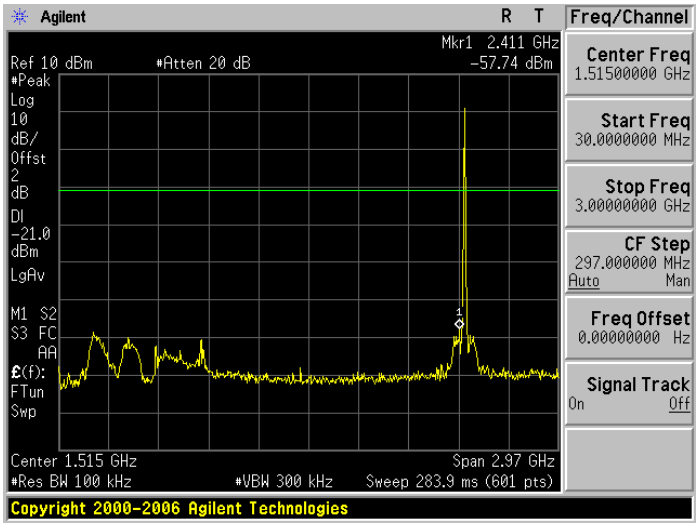


Plot: 10 GHz – 26 GHz

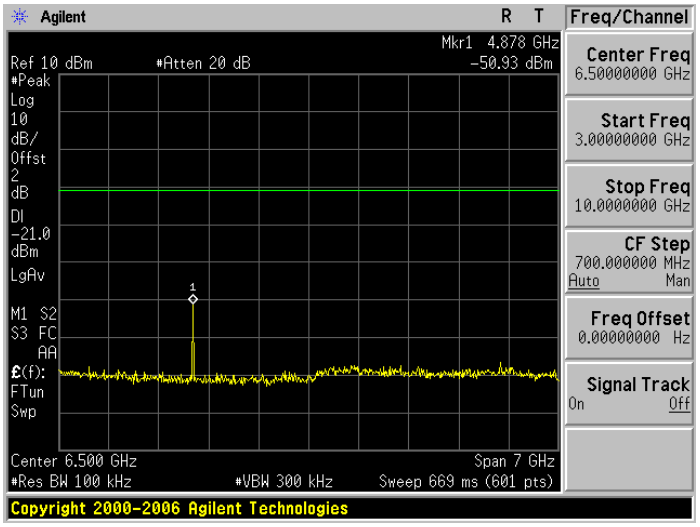


Middle Channel, 2440 MHz

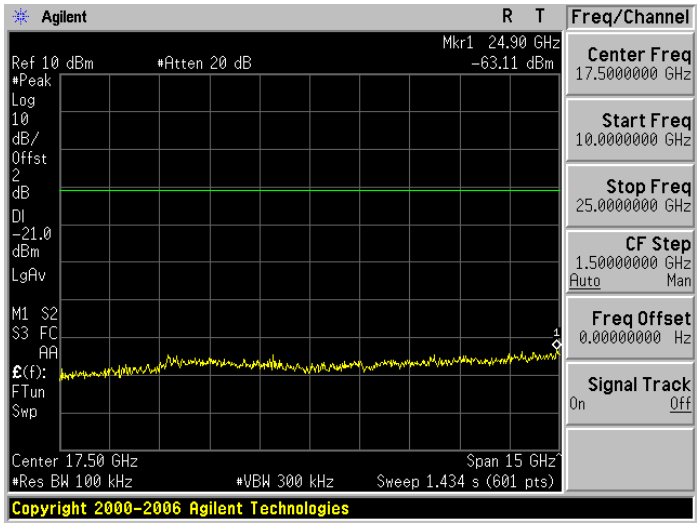
Plot: 30 MHz – 3 GHz



Plot: 3 GHz – 10 GHz

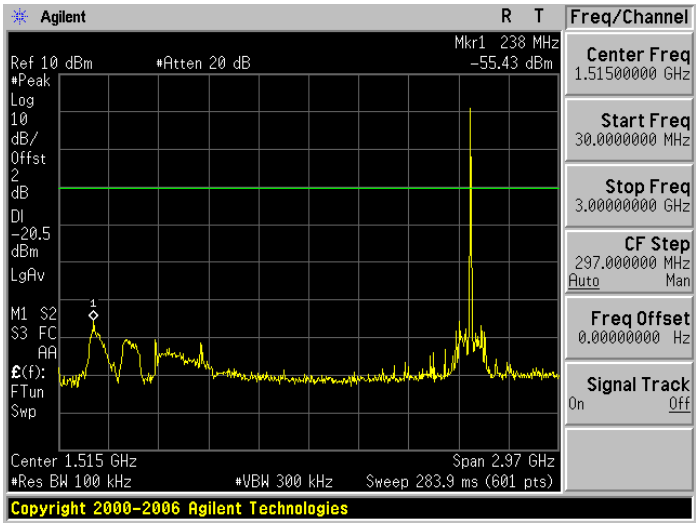


Plot: 10 GHz – 26 GHz

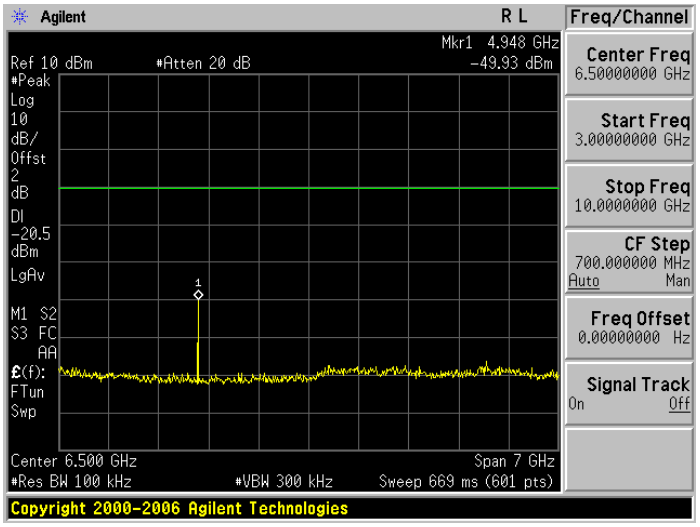


High Channel, 2475 MHz

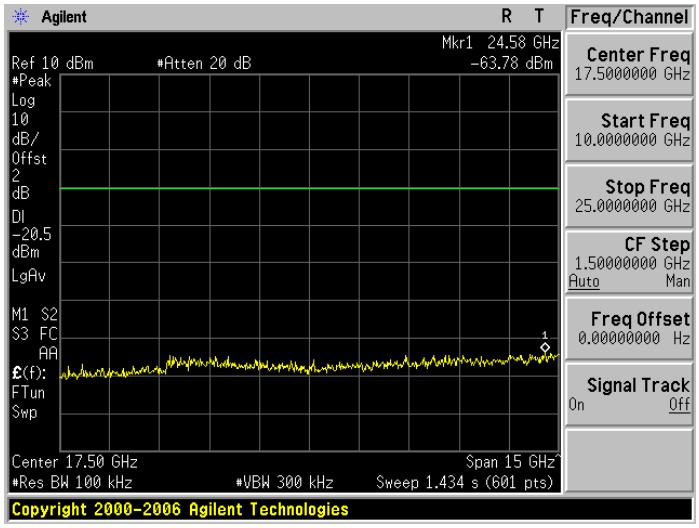
Plot: 30 MHz – 3 GHz



Plot: 3 GHz – 10 GHz



Plot: 10 GHz – 26 GHz



8 FCC §15.205, §15.209 & §15.247(d) – Spurious Radiated Emissions

8.1 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).

8.2 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 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.

8.3 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

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 List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2011-09-14	1 year
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	-
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10	1 year
EMCO	Horn antenna	3115	9511-4627	2011-10-03	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2011-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	667400960	2011-05-08	1 year

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

8.6 Test Environmental Conditions

Temperature:	22.7 °C
Relative Humidity:	43.6 %
ATM Pressure:	102.3 kPa

The testing was performed by Ning Ma on 2012-05-03 at 5m Chamber 3.

8.7 Radiated Emissions Test Data

30 MHz – 25 GHz, Measured at 3 meters

Front Radio, Vertical Antenna

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2405 MHz, measured at 3 meters											
2405	68.87	0	100	V	28.53	2.92	0	100.32	-	-	Fund/Peak
2405	63.9	0	110	V	28.53	2.92	0	95.35	-	-	Fund/Ave
4810	31.16	0	100	V	33.59	4.75	27.78	41.72	74	-32.28	Harm/Peak
4810	19.22	0	100	V	33.59	4.75	27.78	29.78	54	-24.22	Harm/Ave
7215	31.82	0	100	V	38.65	6.54	27.59	49.42	78.83	-29.41	Harm/Peak
7215	18.98	0	100	V	38.65	6.54	27.59	36.58	78.25	-41.67	Harm/Ave
9620	32.26	0	100	V	38.54	7.34	27.05	51.09	78.83	-27.74	Harm/Peak
9620	19.65	0	100	V	38.54	7.34	27.05	38.48	78.25	-39.77	Harm/Ave
4810	31.16	0	100	V	33.59	4.75	27.78	41.72	74	-32.28	Harm/Peak
4810	19.22	0	100	V	33.59	4.75	27.78	29.78	54	-24.22	Harm/Ave
981	7.93	0	100	V	23.6	13.78	25.32	19.99	54	-34.01	Spur/QP
38.67	8.59	56	100	V	15.2	10.02	25.21	8.6	40	-31.4	Spur/QP
Middle channel 2440 MHz measured at 3 meters											
2440	68.71	0	100	V	28.53	2.92	0	100.16	-	-	Fund/Peak
2440	69.76	0	100	V	28.53	2.92	0	101.21	-	-	Fund/Ave
4880	35.77	0	100	V	33.59	4.92	27.67	46.61	74	-27.39	Harm/Peak
4880	20.13	0	100	V	33.59	4.92	27.67	30.97	54	-23.03	Harm/Ave
7320	34.95	0	100	V	38.33	6.75	27.51	52.52	74	-21.48	Harm/Peak
7320	21.13	0	100	V	38.33	6.75	27.51	38.7	54	-15.3	Harm/Ave
9760	32.1	0	100	V	38.15	7.67	26.98	50.94	80.16	-29.22	Harm/Peak
9760	19.11	0	100	V	38.15	7.67	26.98	37.95	81.21	-43.26	Harm/Ave
981	7.67	0	100	V	23.6	13.78	25.32	19.99	54	-34.23	Spur/QP
38.67	9.09	56	100	V	15.2	10.02	25.21	9.1	40	-30.9	Spur/QP
High Channel 2475 MHz, measured at 3 meters											
2475	67.95	0	100	V	29.12	3.04	0	100.11	-	-	Fund/Peak
2475	62.48	0	100	V	29.12	3.04	0	94.64	-	-	Fund/Peak
4950	31.22	0	100	V	33.59	4.92	27.67	42.06	74	-31.94	Harm/Peak
4950	16.02	0	100	V	33.59	4.92	27.67	26.86	54	-27.14	Harm/Ave
7440	33.18	0	100	V	38.33	6.75	27.51	50.75	74	-23.25	Harm/Peak
7440	21.69	0	100	V	38.33	6.75	27.51	39.26	54	-14.74	Harm/Ave
9900	31.26	0	100	V	38.15	7.67	26.98	50.1	80.11	-30.01	Harm/Peak
9900	19.02	0	100	V	38.15	7.67	26.98	37.86	83.06	-45.2	Harm/Ave
2483.5	26.49	0	100	V	29.12	3.04	0	58.65	74	-13.55	Spur/Peak
2483.5	12.68	0	100	V	29.12	3.04	0	44.84	54	-5.88	Spur/Ave
981	7.82	0	100	V	23.6	13.78	25.32	19.88	54	-34.12	Spur/QP
38.67	8.15	56	100	V	15.2	10.02	25.21	8.16	40	-31.84	Spur/QP

Front Radio, Horizontal Antenna

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2405 MHz, measured at 3 meters											
2405	70.66	0	100	H	28.53	2.92	0	102.11	-	-	Fund/Peak
2405	62.24	0	110	H	28.53	2.92	0	93.69	-	-	Fund/Ave
4810	30.64	0	100	H	33.59	4.75	27.78	41.2	74	-32.8	Harm/Peak
4810	20.02	0	100	H	33.59	4.75	27.78	30.58	54	-23.42	Harm/Ave
7215	32.69	0	100	H	38.65	6.54	27.59	50.29	85.99	-35.7	Harm/Peak
7215	19.71	0	100	H	38.65	6.54	27.59	37.31	84.97	-47.66	Harm/Ave
9620	31.55	0	100	H	38.54	7.34	27.05	50.38	85.99	-35.61	Harm/Peak
9620	19.23	0	100	H	38.54	7.34	27.05	38.06	84.97	-46.91	Harm/Ave
2390	27.76	0	100	H	28.53	2.92	0	59.21	74	-14.79	Spur/Peak
2390	17.82	0	100	H	28.53	2.92	0	49.27	54	-4.73	Spur/Ave
981	7.92	0	100	H	23.6	13.78	25.32	19.98	54	-34.02	Spur/QP
38.67	9.7	56	100	V	15.2	10.02	25.21	9.71	40	-30.29	Spur/QP
Middle channel 2440 MHz measured at 3 meters											
2440	69.76	0	110	H	28.53	2.92	0	101.21	-	-	Fund/Ave
2440	63.92	0	110	H	28.53	2.92	0	95.37	-	-	Fund/Ave
4880	36.21	0	100	H	33.59	4.92	27.67	47.05	74	-26.95	Harm/Peak
4880	20.66	0	100	H	33.59	4.92	27.67	31.5	54	-22.5	Harm/Ave
7320	34.02	0	100	H	38.33	6.75	27.51	51.59	74	-22.41	Harm/Peak
7320	20.08	0	100	H	38.33	6.75	27.51	37.65	54	-16.35	Harm/Ave
9760	32.16	0	100	H	38.15	7.67	26.98	51	81.21	-30.21	Harm/Peak
9760	19.7	0	100	H	38.15	7.67	26.98	38.54	75.37	-36.83	Harm/Ave
981	7.87	0	100	H	23.6	13.78	25.32	19.93	54	-34.07	Spur/QP
38.67	8.9	56	100	V	15.2	10.02	25.21	8.91	40	-31.09	Spur/QP
High Channel 2475 MHz, measured at 3 meters											
2475	70.9	0	110	H	29.12	3.04	0	103.06	-	-	Fund/Ave
2475	63.12	0	110	H	29.12	3.04	0	95.28	-	-	Fund/Ave
4950	30.84	0	100	H	33.59	4.92	27.67	41.68	74	-32.32	Harm/Peak
4950	15.02	0	100	H	33.59	4.92	27.67	25.86	54	-28.14	Harm/Ave
7440	31.59	0	100	H	38.33	6.75	27.51	49.16	74	-24.84	Harm/Peak
7440	19.89	0	100	H	38.33	6.75	27.51	37.46	54	-16.54	Harm/Ave
9900	33.61	0	100	H	38.15	7.67	26.98	52.45	83.06	-30.61	Harm/Peak
9900	21.26	0	100	H	38.15	7.67	26.98	40.1	75.28	-35.18	Harm/Ave
2483.5	27.95	0	100	H	29.12	3.04	0	60.11	74	-13.85	Spur/Peak
2483.5	14.14	0	100	H	29.12	3.04	0	46.3	54	-5.96	Spur/Ave
981	7.56	0	100	V	23.6	13.78	25.32	19.62	54	-34.38	Spur/QP
38.67	9.07	56	100	V	15.2	10.02	25.21	9.08	40	-30.92	Spur/QP

Back Radio, Vertical Antenna

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2405 MHz, measured at 3 meters											
2405	69.26	0	100	V	28.53	2.92	0	100.71	-	-	Fund/Peak
2405	61.03	0	110	V	28.53	2.92	0	92.48	-	-	Fund/Ave
4810	30.22	0	100	V	33.59	4.75	27.78	40.78	74	-33.22	Harm/Peak
4810	20.16	0	100	V	33.59	4.75	27.78	30.72	54	-23.28	Harm/Ave
7215	32.01	0	100	V	38.65	6.54	27.59	49.61	80.71	-31.1	Harm/Peak
7215	18.13	0	100	V	38.65	6.54	27.59	35.73	72.48	-36.75	Harm/Ave
9620	31.56	0	100	V	38.54	7.34	27.05	50.39	20.78	29.61	Harm/Peak
9620	20.33	0	100	V	38.54	7.34	27.05	39.16	10.72	28.44	Harm/Ave
2390	25.87	0	100	V	28.53	2.92	0	57.32	74	-16.68	Spur/Peak
2390	11.18	0	100	V	28.53	2.92	0	42.63	54	-11.37	Spur/Ave
981	7.59	0	100	V	23.6	13.78	25.32	19.65	54	-34.35	Spur/QP
38.67	9.11	56	100	V	15.2	10.02	25.21	9.12	40	-30.88	Spur/QP
Middle channel 2440 MHz measured at 3 meters											
2440	70.13	0	100	V	28.53	2.92	0	101.58	-	-	Fund/Peak
2440	64.31	0	100	V	28.53	2.92	0	95.76	-	-	Fund/Ave
4880	33.5	0	100	V	33.59	4.92	27.67	44.34	74	-29.66	Harm/Peak
4880	20.11	0	100	V	33.59	4.92	27.67	30.95	54	-23.05	Harm/Ave
7320	34.26	0	100	V	38.33	6.75	27.51	51.83	74	-22.17	Harm/Peak
7320	19.39	0	100	V	38.33	6.75	27.51	36.96	54	-17.04	Harm/Ave
9760	32.14	0	100	V	38.15	7.67	26.98	50.98	81.58	-30.6	Harm/Peak
9760	19.67	0	100	V	38.15	7.67	26.98	38.51	75.76	-37.25	Harm/Ave
981	7.47	0	100	V	23.6	13.78	25.32	19.53	54	-34.47	Spur/QP
38.67	9.08	56	100	V	15.2	10.02	25.21	9.09	40	-30.91	Spur/QP
High Channel 2475 MHz, measured at 3 meters											
2475	69.34	0	100	V	29.12	3.04	0	101.5	-	-	Fund/Peak
2475	61.29	0	100	V	29.12	3.04	0	93.45	-	-	Fund/Peak
4950	33.99	0	100	V	33.59	4.92	27.67	42.06	74	-31.94	Harm/Peak
4950	20.18	0	100	V	33.59	4.92	27.67	26.86	54	-27.14	Harm/Ave
7440	32.85	0	100	V	38.33	6.75	27.51	50.75	74	-23.25	Harm/Peak
7440	20.79	0	100	V	38.33	6.75	27.51	39.26	54	-14.74	Harm/Ave
9900	33.65	0	100	V	38.15	7.67	26.98	50.1	80.11	-30.01	Harm/Peak
9900	21.33	0	100	V	38.15	7.67	26.98	37.86	83.06	-45.2	Harm/Ave
2483.5	25.78	0	100	V	29.12	3.04	0	57.94	74	-16.06	Spur/Peak
2483.5	13.23	0	100	V	29.12	3.04	0	45.39	54	-8.61	Spur/Ave
981	7.75	0	100	V	23.6	13.78	25.32	19.81	54	-34.19	Spur/QP
38.67	9.87	56	100	V	15.2	10.02	25.21	9.88	40	-30.12	Spur/QP

Back Radio, Horizontal Antenna

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2405 MHz, measured at 3 meters											
2405	70.11	0	100	H	28.53	2.92	0	101.56	-	-	Fund/Peak
2405	65.39	0	110	H	28.53	2.92	0	96.84	-	-	Fund/Ave
4810	31.25	0	100	H	33.59	4.75	27.78	41.81	74	-32.19	Harm/Peak
4810	20.16	0	100	H	33.59	4.75	27.78	30.72	54	-23.28	Harm/Ave
7215	33.96	0	100	H	38.65	6.54	27.59	51.56	81.56	-30	Harm/Peak
7215	20.11	0	100	H	38.65	6.54	27.59	37.71	76.84	-39.13	Harm/Ave
9620	33.69	0	100	H	38.54	7.34	27.05	52.52	81.56	-29.04	Harm/Peak
9620	21.54	0	100	H	38.54	7.34	27.05	40.37	76.84	-36.47	Harm/Ave
2390	27.34	0	100	H	28.53	2.92	0	58.79	74	-15.21	Spur/Peak
2390	17.32	0	100	H	28.53	2.92	0	48.77	54	-5.23	Spur/Ave
981	7.95	0	100	V	23.6	13.78	25.32	20.01	54	-33.99	Spur/QP
38.67	10.1	56	100	V	15.2	10.02	25.21	10.11	40	-29.89	Spur/QP
Middle channel 2440 MHz measured at 3 meters											
2440	68.99	0	110	H	28.53	2.92	0	100.44	-	-	Fund/Ave
2440	63.48	0	110	H	28.53	2.92	0	94.93	-	-	Fund/Ave
4880	35.96	0	100	H	33.59	4.92	27.67	46.8	74	-27.2	Harm/Peak
4880	21.02	0	100	H	33.59	4.92	27.67	31.86	54	-22.14	Harm/Ave
7320	35.66	0	100	H	38.33	6.75	27.51	53.23	74	-20.77	Harm/Peak
7320	19.79	0	100	H	38.33	6.75	27.51	37.36	54	-16.64	Harm/Ave
9760	34.26	0	100	H	38.15	7.67	26.98	53.1	80.44	-27.34	Harm/Peak
9760	20.13	0	100	H	38.15	7.67	26.98	38.97	74.93	-35.96	Harm/Ave
981	8.07	0	100	V	23.6	13.78	25.32	20.13	54	-33.87	Spur/QP
38.67	10.25	56	100	V	15.2	10.02	25.21	10.26	40	-29.74	Spur/QP
High Channel 2475 MHz, measured at 3 meters											
2475	69.89	0	110	H	29.12	3.04	0	102.05	-	-	Fund/Ave
2475	62.22	0	110	H	29.12	3.04	0	94.38	-	-	Fund/Ave
4950	31.58	0	100	H	33.59	4.92	27.67	42.42	74	-31.58	Harm/Peak
4950	20.02	0	100	H	33.59	4.92	27.67	30.86	54	-23.14	Harm/Ave
7440	32.02	0	100	H	38.33	6.75	27.51	49.59	74	-24.41	Harm/Peak
7440	20.11	0	100	H	38.33	6.75	27.51	37.68	54	-16.32	Harm/Ave
9900	34.51	0	100	H	38.15	7.67	26.98	53.35	74.64	-21.29	Harm/Peak
9900	21.03	0	100	H	38.15	7.67	26.98	39.87	75.28	-35.41	Harm/Ave
2483.5	26.63	0	100	H	29.12	3.04	0	58.79	74	-15.21	Spur/Peak
2483.5	13.61	0	100	H	29.12	3.04	0	45.77	54	-8.23	Spur/Ave
981	7.89	0	100	V	23.6	13.78	25.32	19.95	54	-34.05	Spur/Ave
38.67	9.98	56	100	V	15.2	10.02	25.21	9.99	40	-30.01	Spur/QP

9 FCC §15.247(a) (2) – 6 dB & 99% Emission Bandwidth

9.1 Applicable Standard

According to FCC §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

9.2 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.
4. Repeat above procedures until all frequencies measured were complete.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-04-10	1 year

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:	24.1 °C
Relative Humidity:	41.5 %
ATM Pressure:	102.3 kPa

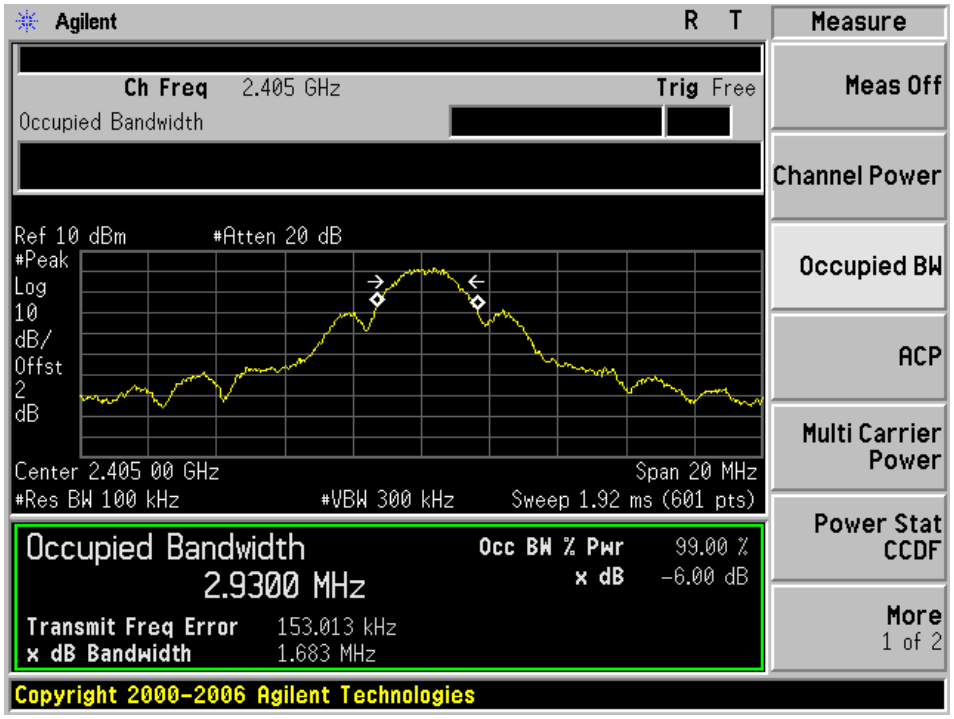
The testing was performed by Ning Ma on 2012-05-02.

9.5 Test Results

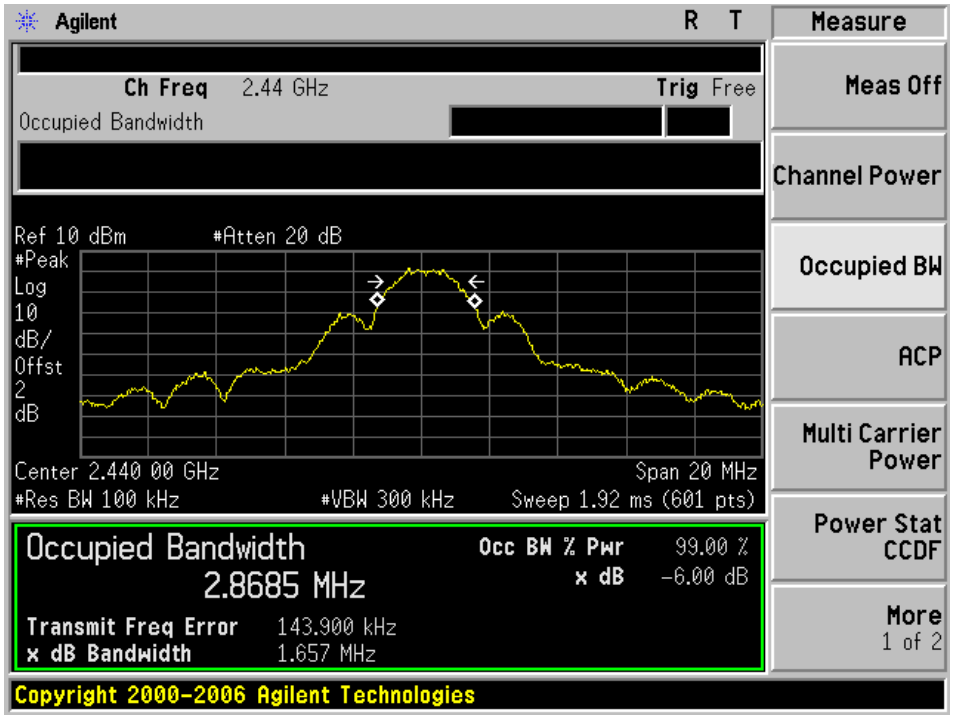
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2405	1.683	2.9389	> 0.5	Compliant
Middle	2440	1.657	2.8390	> 0.5	Compliant
High	2475	1.659	2.9191	> 0.5	Compliant

Please refer to the following plots for detailed test results

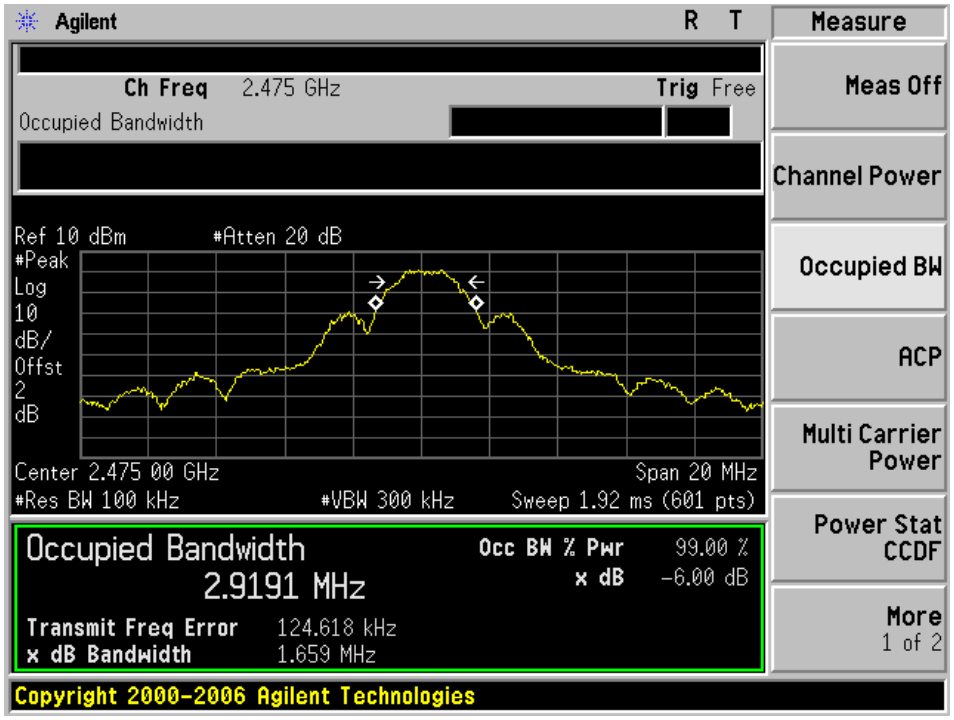
Low Channel 2405 MHz



Middle Channel 2440 MHz



High Channel 2475 MHz



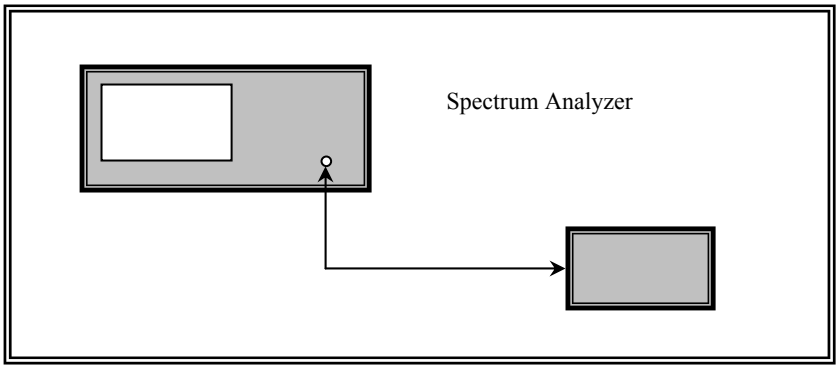
10 FCC §15.247(b) – Peak Output Power Measurement

10.1 Applicable Standard

According to FCC §15.247(b) for systems using digital modulation in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands: 1 Watt.

10.2 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. Add a correction factor to the display.



10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-04-10	1 year

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

10.4 Test Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	41.5 %
ATM Pressure:	102.3 kPa

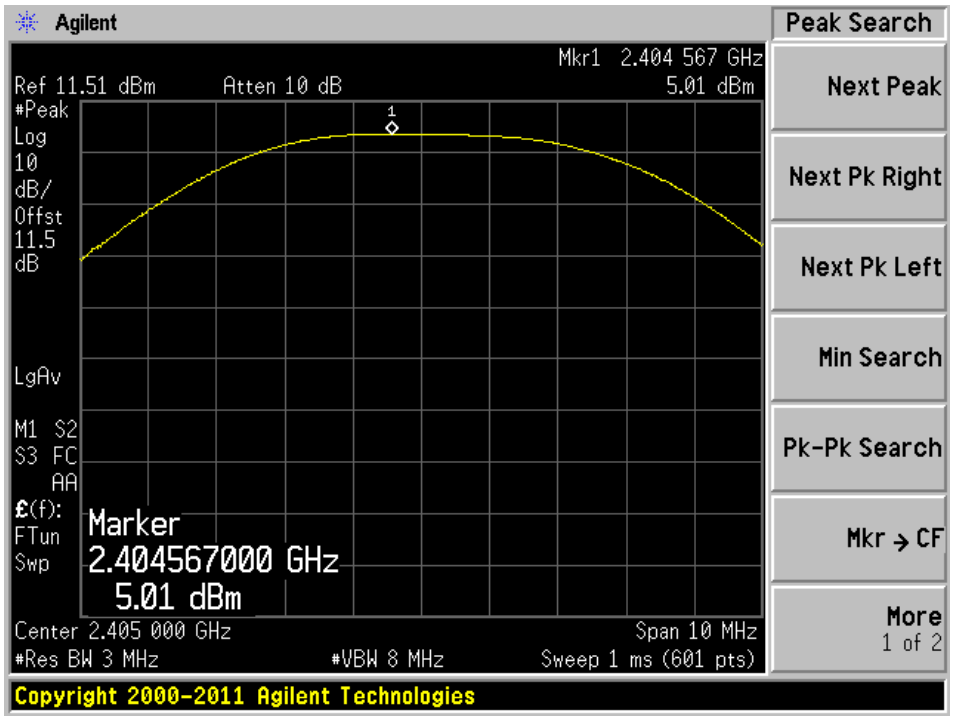
The testing was performed by Ning Ma on 2012-05-02.

10.5 Test Results

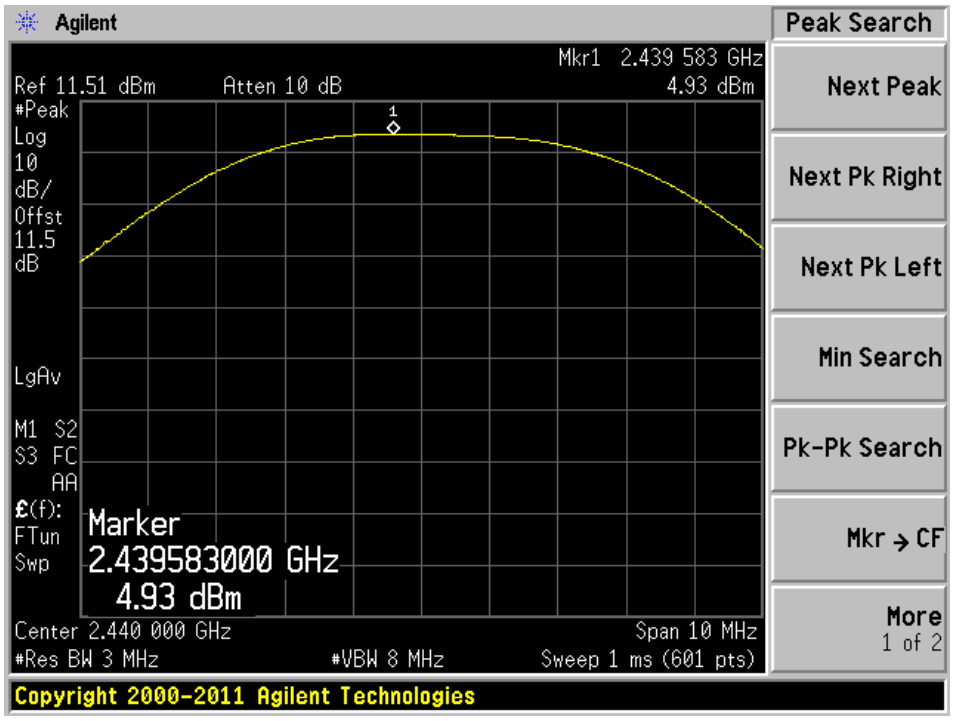
Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	FCC Limit (dBm)	Margin (dB)
Low	2405	5.01	30	24.99
Middle	2440	4.93	30	25.18
High	2475	4.89	30	25.14

Please refer to following pages for plots of band edge.

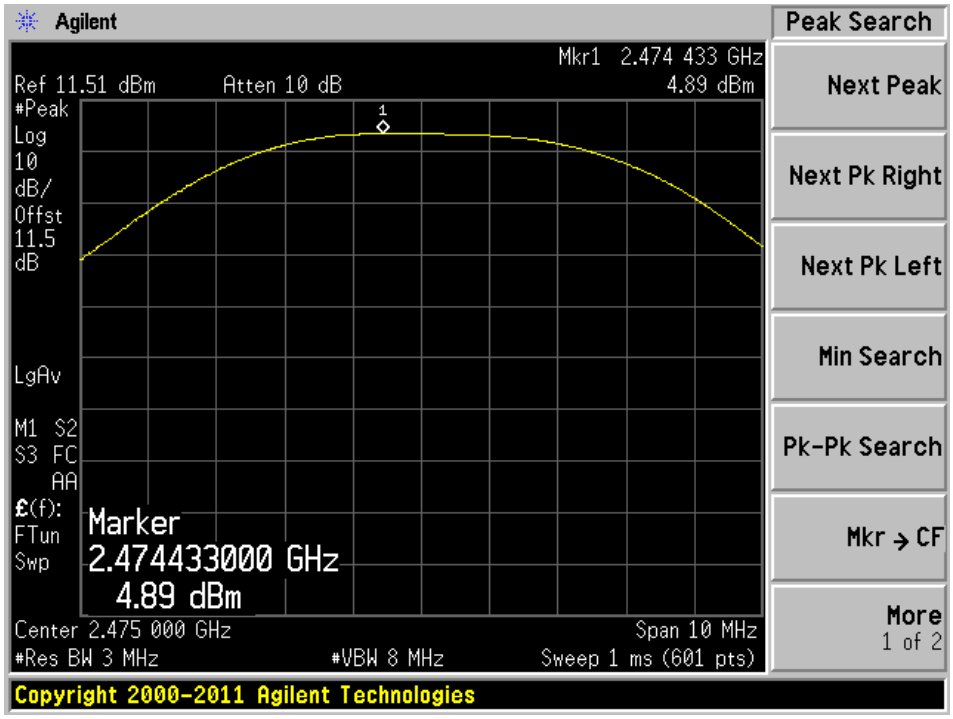
Low Channel 2405 MHz



Middle Channel 2440 MHz



High Channel 2475 MHz



11 FCC §15.247(d) – 100 kHz Bandwidth of Band Edges

11.1 Applicable Standard

According to FCC §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).

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 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.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-04-10	1 year

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

11.4 Test Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	41.5 %
ATM Pressure:	102.3 kPa

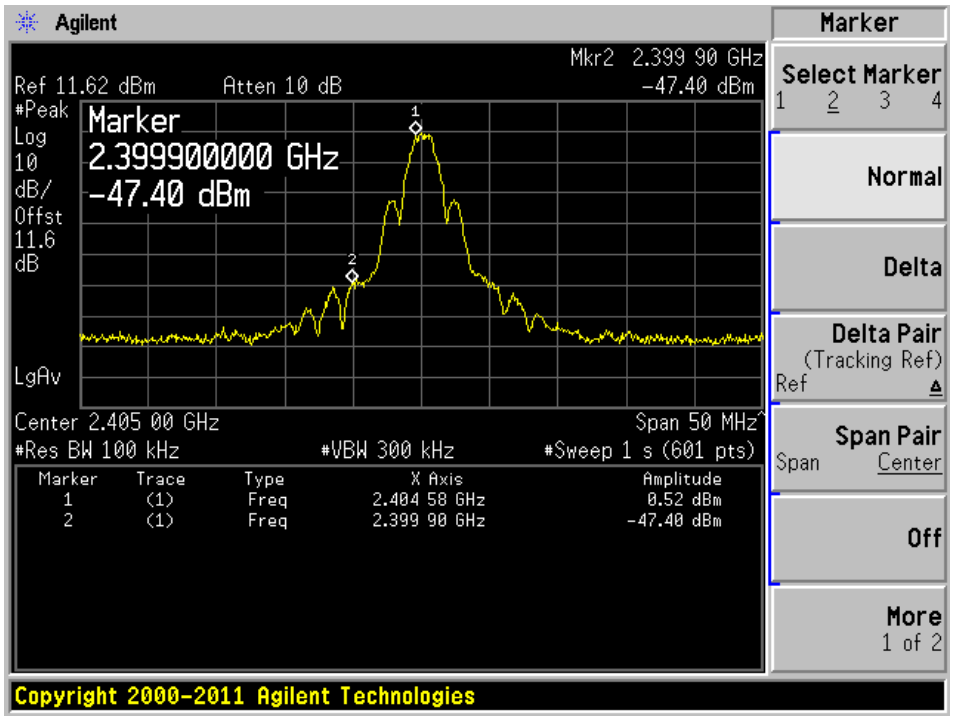
The testing was performed by Ning Ma on 2012-05-02.

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

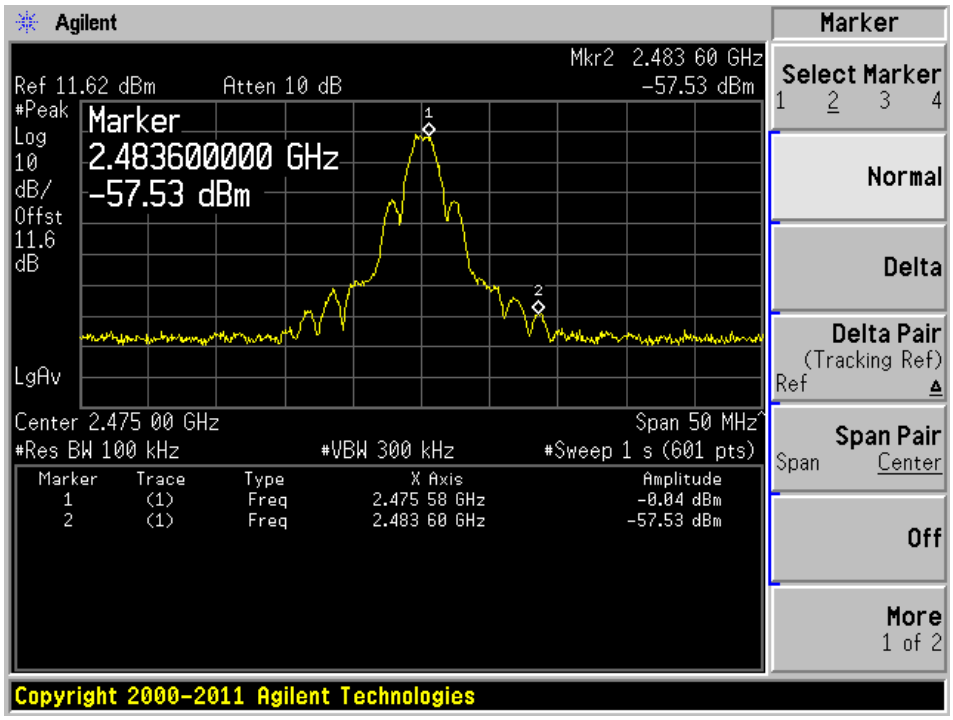
11.5 Test Results

Please refer to following pages for plots of band edge.

Low Channel Band Edge



High Channel Band Edge



12 FCC §15.247(e) – Power Spectral Density

12.1 Applicable Standard

According to FCC §15.247(e), 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.

12.2 Measurement Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ 300 kHz.
4. Set the span to 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log (3 kHz/100 kHz = -15.2 dB).
11. The resulting peak PSD level must be ≤ 8 dBm.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-04-10	1 year

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

12.4 Test Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	41.5 %
ATM Pressure:	102.3 kPa

The testing was performed by Ning Ma on 2012-05-02.

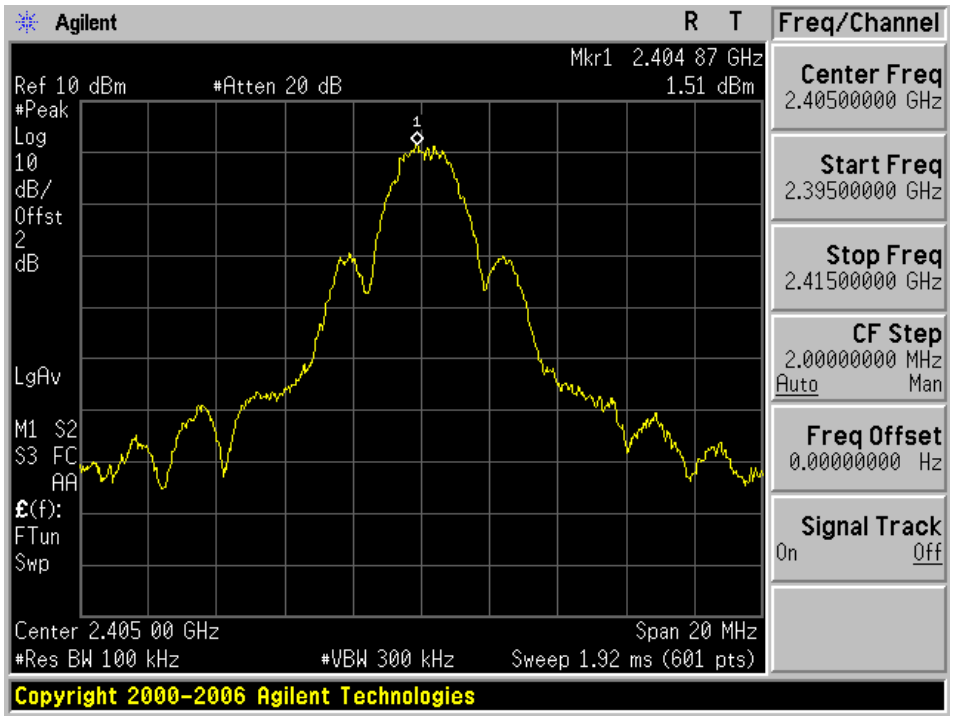
12.5 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm/100 kHz)	Corrected PSD (dBm)	FCC Limit (dBm/3 kHz)	Results
Low	2405	1.51	-13.51	8	Compliant
Mid	2440	0.90	-14.3	8	Compliant
High	2475	1.11	-14.09	8	Compliant

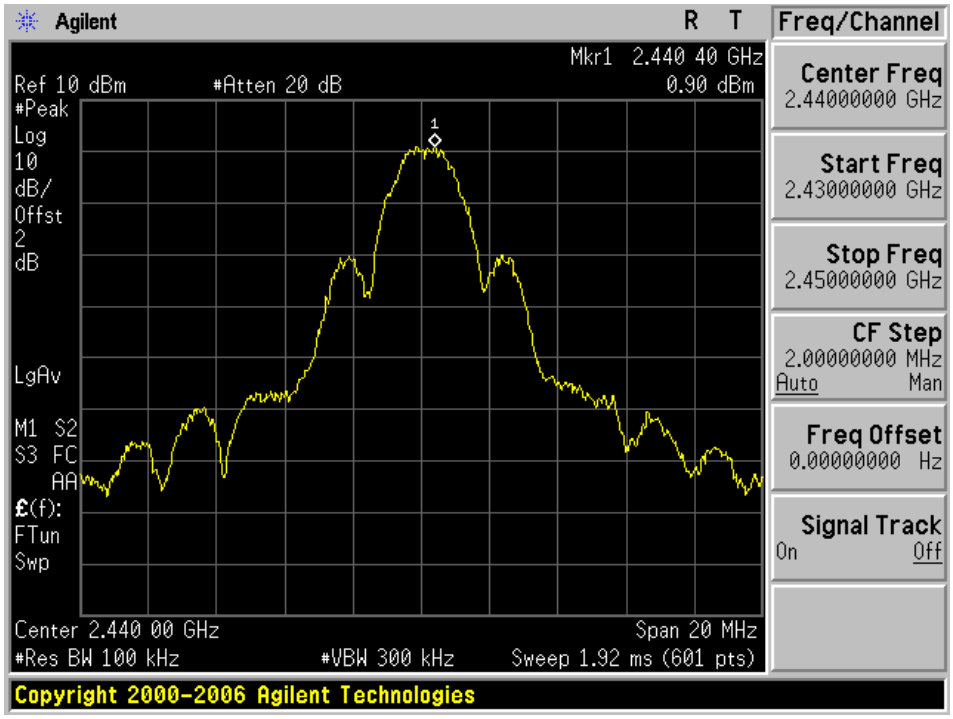
Note: All the data can be scaled to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF=10log (3 kHz/100 kHz=-15.2 dB).

Please refer to the following plots for detailed test results.

Low Channel 2405 MHz



Middle Channel 2440 MHz



High Channel 2475 MHz