Lab Code: 200167-0

FCC PART 15.247

TEST AND MEASUREMENT REPORT

For

CentraLite Systems, Inc.

6420 Wall Street,

Mobile, AL 36695, USA

FCC ID: T3L-JS004

Report Type:	Product Type:
Original Report	Zigbee Transceiver

Test Engineers:	Lionel Lara
Report Number:	R1112063-247
Report Date:	2012-03-01
Reviewed By:	Victor Zhang EMC/RF Lead
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1112063-247	Original Report	2012-03-01

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *CentraLite Systems* and their product, *model: 4256050-ZHA, FCC ID: T3L-JS004* or the "EUT" as referred to in this report. The EUT is Zigbee transceiver operating in the 2.4 GHz band.

1.2 Mechanical Description of EUT

The EUT measures approximately 55 mm **(L)** x 35 mm **(W)** x 75 mm **(H)** and weighs approximately 1.5 g.

The data gathered are from a typical production sample provided by the manufacturer with serial S3E8SG provided by the manufacturer.

1.3 Objective

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

The objective is to determine compliance with FCC Part 15, Subpart B and C and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

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 C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in 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.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test 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.: R-3729, C-4176, G-469, and T-1206. 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 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 EUT was configured for testing according to ANSI C63.4-2003.

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

2.2 EUT Exercise Software

N/A

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Special Accessories

N/A

2.5 Local Support Equipment

N/A.

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
CentraLite Systems, Inc.	PCB Board	Megamouth Rev. C	-

2.7 Interface Ports and Cabling

N/A.

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 Information	Compliant
§15.203	Antenna Requirement	Compliant
§15.207	AC Line Conducted Emissions	Compliant
§15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209 §15.247 (d)	Restricted Bands, Radiated Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB & 99% Emission Bandwidth	Compliant
§15.247 (b)(3)	Maximum Peak Output Power	Compliant
§15.247 (e)	Power Spectral Density	Compliant
§15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant

4 FCC §15.247 (i) & §2.1091 - RF Exposure Information

4.1 Applicable Standards

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):	4.48
Maximum peak output power at antenna input terminal (mW):	2.81
Prediction distance (cm):	20
Prediction frequency (MHz):	2440
Maximum Antenna Gain, typical (dBi):	2.73
Maximum Antenna Gain (numeric):	1.87
Power density of prediction frequency at 20 cm (mW/cm^2):	0.001
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device meets FCC MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.001 mW/cm^2, the 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 Connector Construction

The EUT has one Transmitter integral antenna, The Transmitter antenna has a max gain of 2.73 dBi which fulfills the requirements of FCC §15.203.

Frequency Band (MHz)	Antenna Gain (dBi)
2400-2483.5	2.73

6 FCC §15.207 – AC Line Conducted Emissions

6.1 Applicable Standard

As per FCC §15.207, 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

1) Note: 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 Part 15.207 limits.

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

The EUT was connected with LISN-1 which provided 120 V/60 Hz AC power.

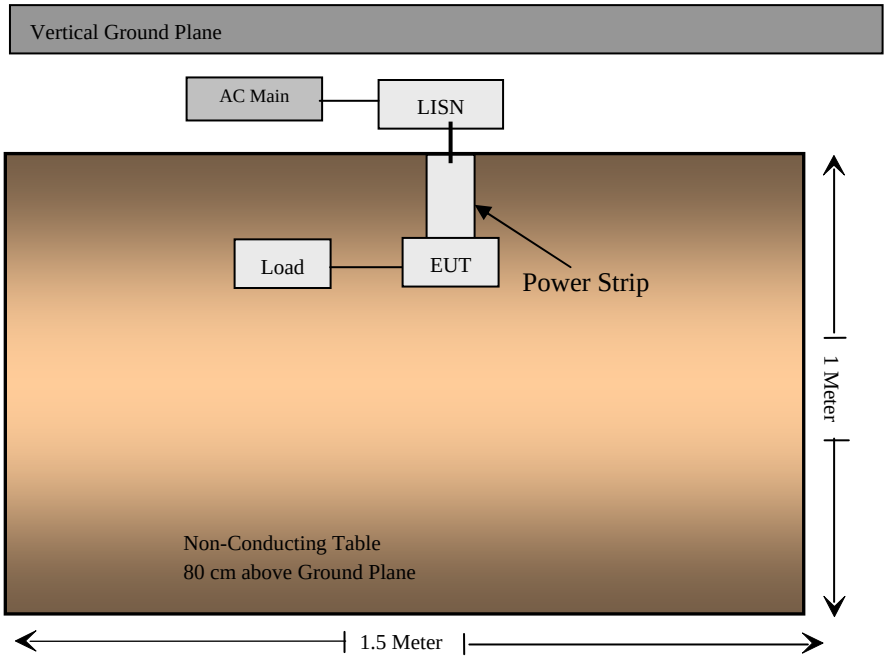
6.3 Test Procedure

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 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 + CL + Atten – Ga

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. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Solar Electronics	LISN	9252-R-24-BNC	511205	2011-06-25
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2011-03-21

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

6.7 Test Environmental Conditions

Temperature:	20-21 °C
Relative Humidity:	38-40 %
ATM Pressure:	101.2 kPa

The testing was performed by LionelLara on 02-01-2012 in 5 meter chamber 3.

6.8 Summary of Test Results

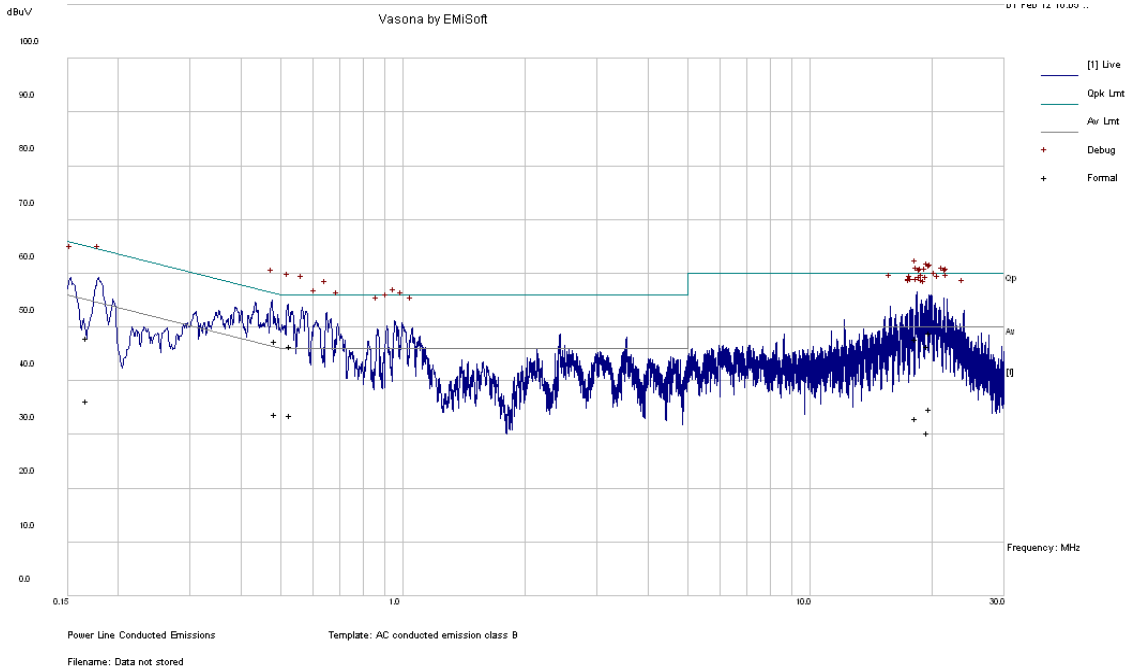
According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits, with the margin reading of:

Transmitting Mode (Worst channel)

Connection: Connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-5.80	0.44805	Neutral	0.15 to 30

6.9 Conducted Emissions Test Plots and Data

120 V, 60 Hz – Line



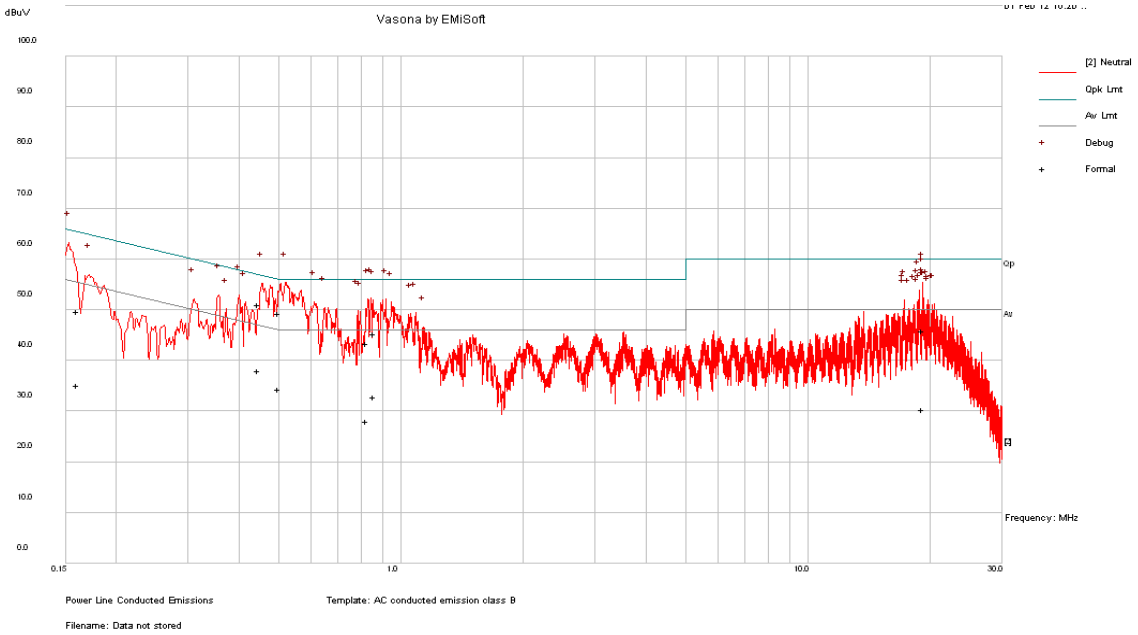
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.487851	47.36	Line	56.2	-8.84
0.530205	46.48	Line	56	-9.52
19.79406	48.97	Line	60	-11.03
18.28518	47.76	Line	60	-12.24
19.56403	46.49	Line	60	-13.51
0.167943	48.06	Line	65.06	-17.00

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.487851	33.86	Line	46.2	-12.34
0.530205	33.56	Line	46	-12.44
19.79406	34.84	Line	50	-15.16
18.28518	33.07	Line	50	-16.93
0.167943	36.33	Line	55.06	-18.73
19.56403	30.39	Line	50	-19.61

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.44805	51.11	Neutral	56.91	-5.80
0.503334	49.32	Neutral	56	-6.68
0.862062	45.41	Neutral	56	-10.59
0.823803	43.38	Neutral	56	-12.62
19.1287	45.92	Neutral	60	-14.08
0.160413	49.74	Neutral	65.44	-15.7

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.44805	38.01	Neutral	46.91	-8.90
0.503334	34.32	Neutral	46	-11.68
0.862062	32.94	Neutral	46	-13.06
0.823803	28.06	Neutral	46	-17.94
19.1287	30.33	Neutral	50	-19.67
0.160413	35.09	Neutral	55.44	-20.35

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

7.1 Applicable Standard

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.

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
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10

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

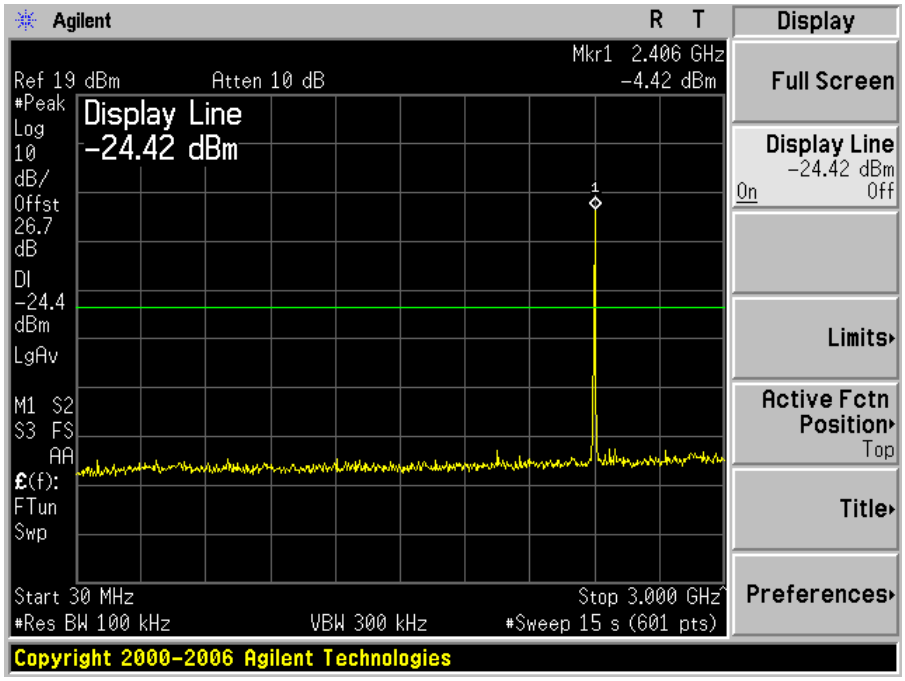
Temperature:	20-21 °C
Relative Humidity:	38-40 %
ATM Pressure:	101.2 kPa

The testing was performed by LionelLara on 01-18-2012 to 01-20-2012 in RF site.

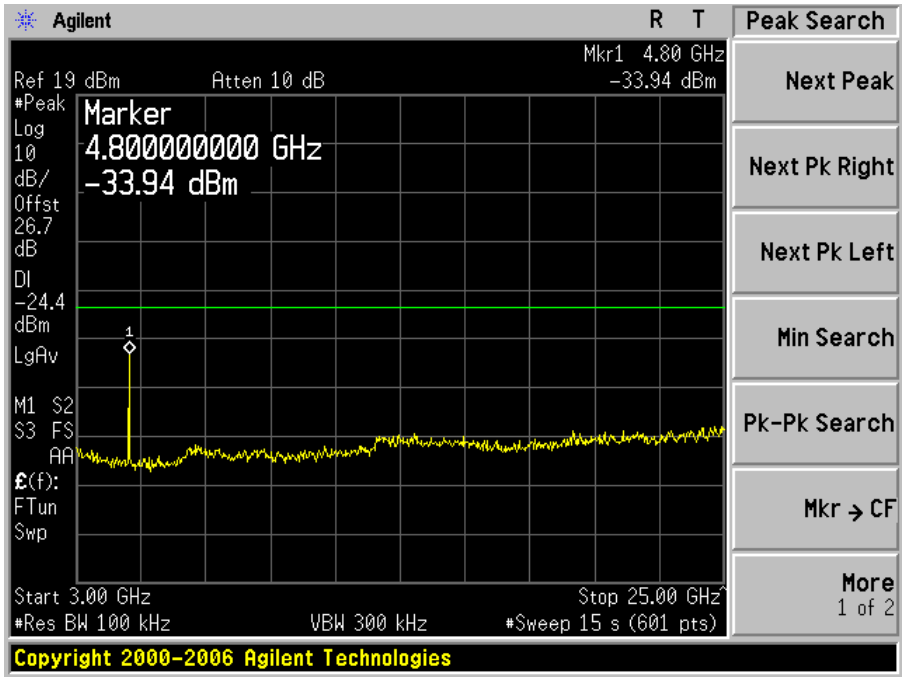
7.5 Test Results

Please refer to following plots.

Low Channel, 2405 MHz

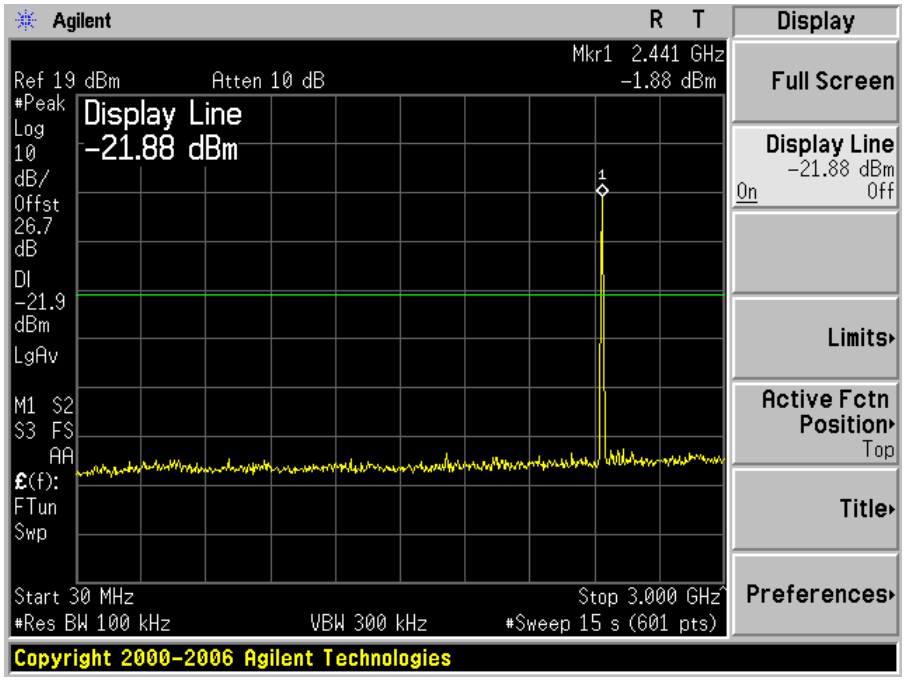


30 MHz to 3 GHz

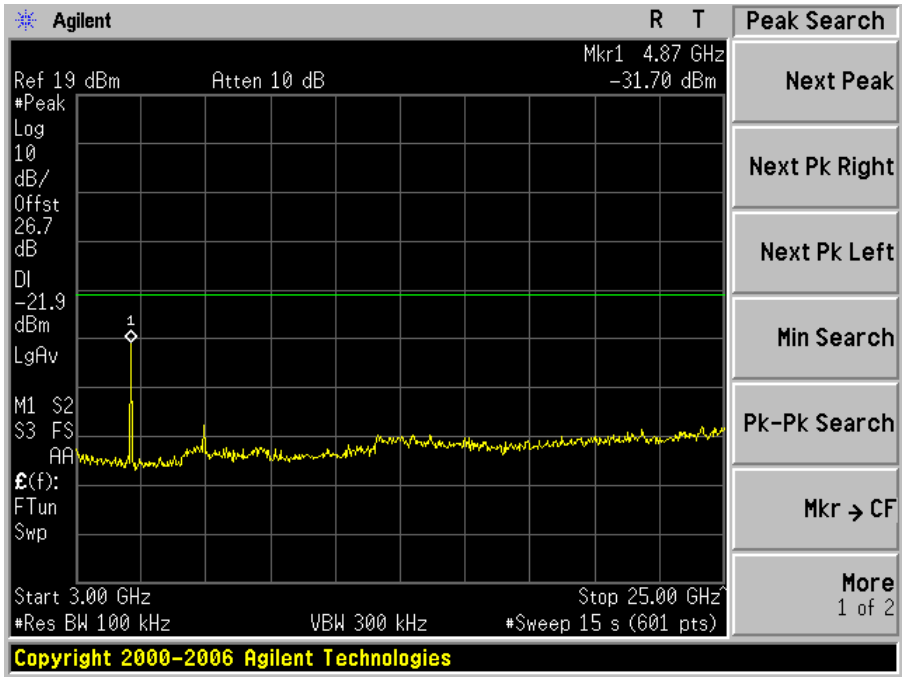


3 GHz to 25 GHz

Middle Channel, 2440 MHz

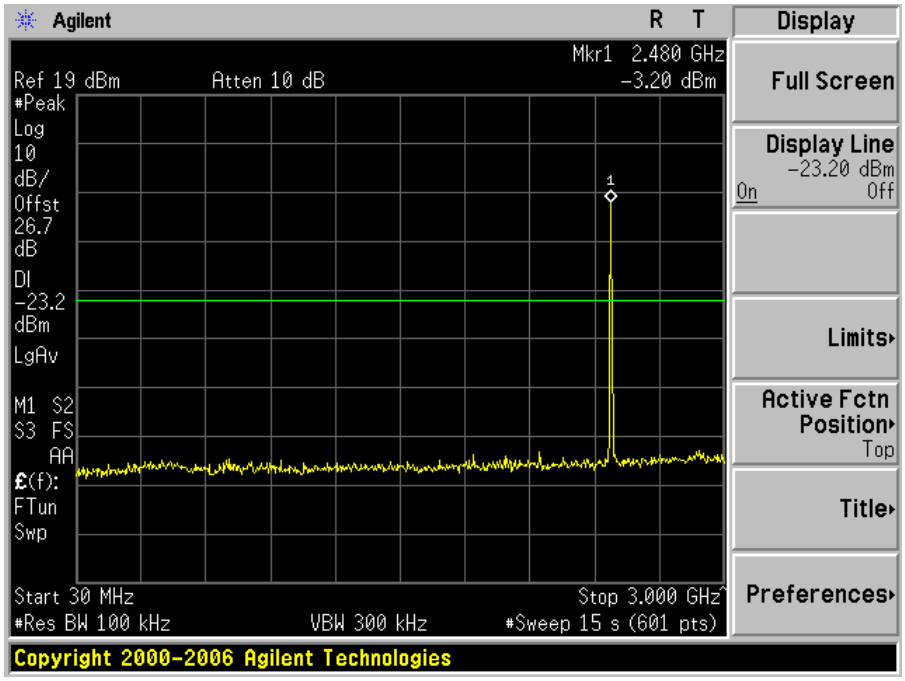


30 MHz to 3 GHz

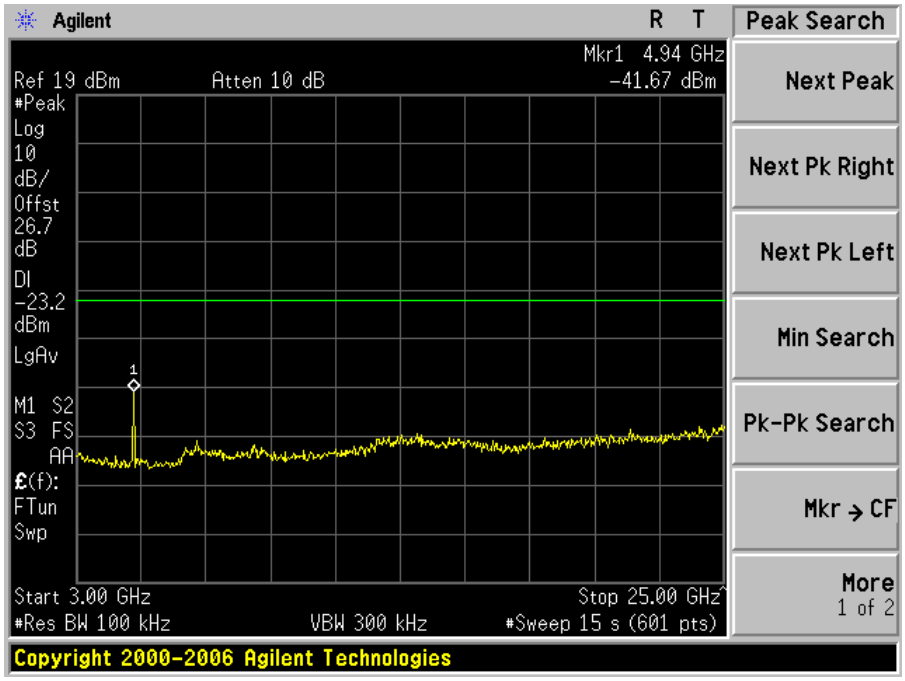


3 GHz to 25 GHz

High Channel, 2480 MHz



30 MHz to 3 GHz



3 GHz to 25 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): 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[1]	3
88 - 216	150[1]	3
216 - 960	200[1]	3
Above 960	500	3

1) Note: 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).

8.2 Test 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.

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 the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, the Corrected Amplitude (CA) of 40.3 dBuV/m = indicated Amplitude reading (Ai) 32.5 dBuV + Antenna Factor (AF) 23.5dB + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 dB - Amplifier Gain (Ga) 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
HP	Pre-amplifier	8447D	2944A06639	2011-06-09
Sunol Science Corp.	Combination Antenna	JB3 Antenna	A020106-2	2011-08-10
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
EMCO	Antenna, Horn	3115	9511-4627	2011-10-03

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

8.6 Test Environmental Conditions

Temperature:	20-21 °C
Relative Humidity:	38-40 %
ATM Pressure:	101.2 kPa

The testing was performed by Lionel Lara on 01-12-2012 in 5 meter chamber 3.

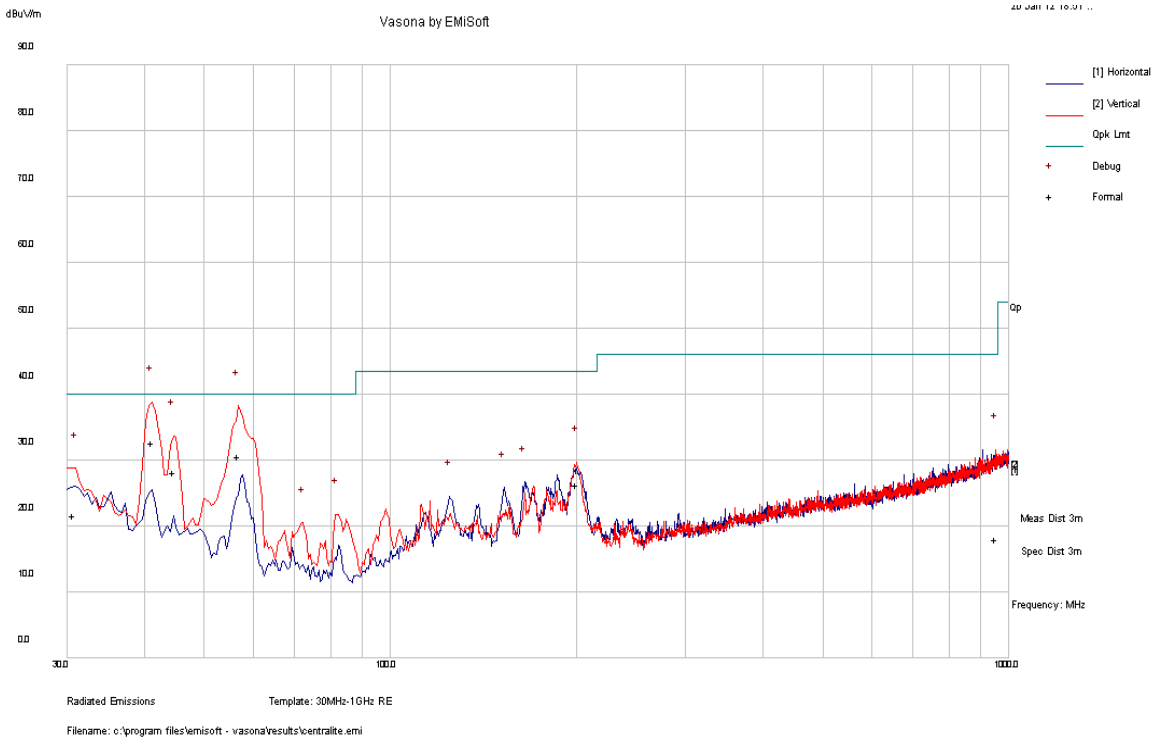
8.7 Summary of Test Results

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

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel, Range
-7.39	41.222	Vertical	Middle Channel, 30 MHz – 1GHz
-0.10	2483.5	Horizontal	High Channel, Above 1 GHz

8.8 Radiated Spurious Emissions Test Results

1) Radiated Emission at 3 meters, 30 MHz – 1 GHz (Worst Channel: Middle Channel)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Test Antenna		Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
		Height (cm)	Polarity (H/V)			
41.222	32.61	137	V	360	40	-7.39
56.86775	30.56	103	V	100	40	-9.44
44.76325	28.18	160	V	44	40	-11.82
200.3448	26.32	98	V	144	43.5	-17.18
30.7585	21.69	98	V	149	40	-18.31
952.308	18.06	245	V	143	46	-27.94

2) Radiated Emission at 3 meters, 1 – 25 GHz

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											
4810	44.67	187	134	H	32.63	4.06	27.71	53.65	74	-20.35	Peak
4810	42.08	154	100	V	32.6	4.06	27.71	51.03	74	-22.97	Peak
4810	33.5	187	134	H	32.63	4.06	27.71	42.48	54	-11.52	Ave
4810	29.57	154	100	V	32.6	4.06	27.71	38.52	54	-15.48	Ave
Middle channel 2440 MHz measured at 3 meters											
4880	44.31	187	131	H	32.8	4.1	27.71	53.5	74	-20.5	Peak
4880	42.1	155	100	V	32.73	4.1	27.71	51.22	74	-22.78	Peak
4880	33.01	187	131	H	32.8	4.1	27.71	42.2	54	-11.8	Ave
4880	30.37	155	100	V	32.73	4.1	27.71	39.49	54	-14.51	Ave
High channel 2480 MHz measured at 3 meters											
4960	43.12	184	124	H	33.06	4.21	27.51	52.88	74	-21.12	Peak
4960	41.91	158	125	V	32.97	4.21	27.51	51.58	74	-22.42	Peak
4960	31.27	184	124	H	33.06	4.21	27.51	41.03	54	-12.97	Ave
4960	30.81	158	125	V	32.97	4.21	27.51	40.48	54	-13.52	Ave

3) Restricted Band Emissions

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											
2372.7	28.31	336	163	H	28.42	3.01	0	59.74	74	-14.26	Peak
2383	28.65	200	100	V	28.12	3.01	0	59.78	74	-14.22	Peak
2372.7	13.6	336	163	H	28.42	3.01	0	45.03	54	-8.97	Ave
2383	13.55	200	100	V	28.12	3.01	0	44.68	54	-9.32	Ave
High channel 2480 MHz measured at 3 meters											
2483.5	34.51	336	153	H	28.42	3.01	0	65.94	74	-8.06	Peak
2483.5	33.15	285	134	V	28.12	3.01	0	64.28	74	-9.72	Peak
2483.5	22.47	336	153	H	28.42	3.01	0	53.9	54	-0.1	Ave
2483.5	21.38	285	134	V	28.12	3.01	0	52.51	54	-1.49	Ave

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

9.1 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.

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 20 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
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10

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:	20-21 °C
Relative Humidity:	38-40 %
ATM Pressure:	101.2 kPa

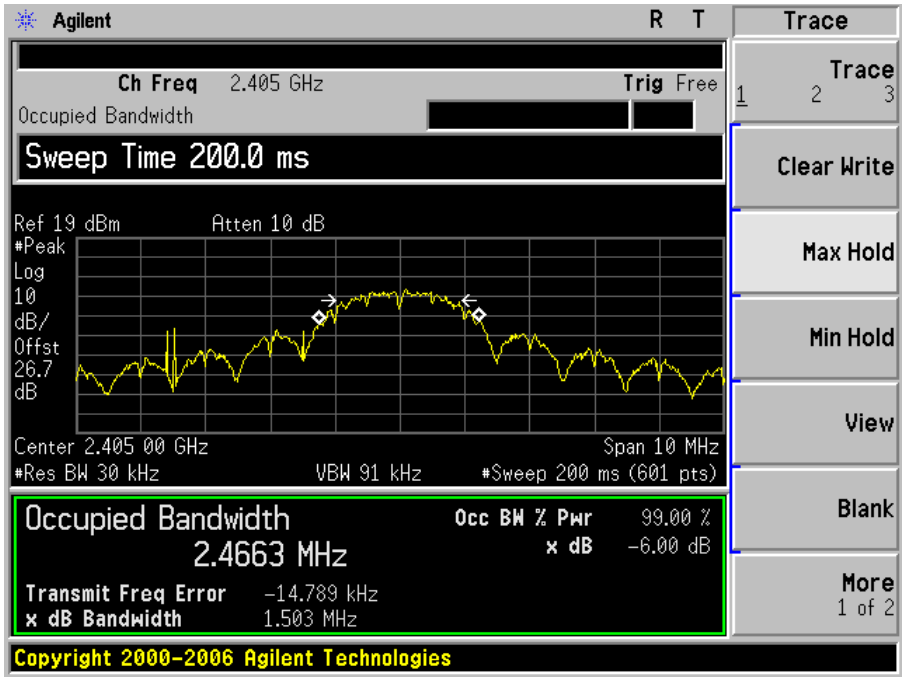
The testing was performed by Lionel Lara on 01-18-2012 to 01-20-2012 in RF site.

9.5 Test Results

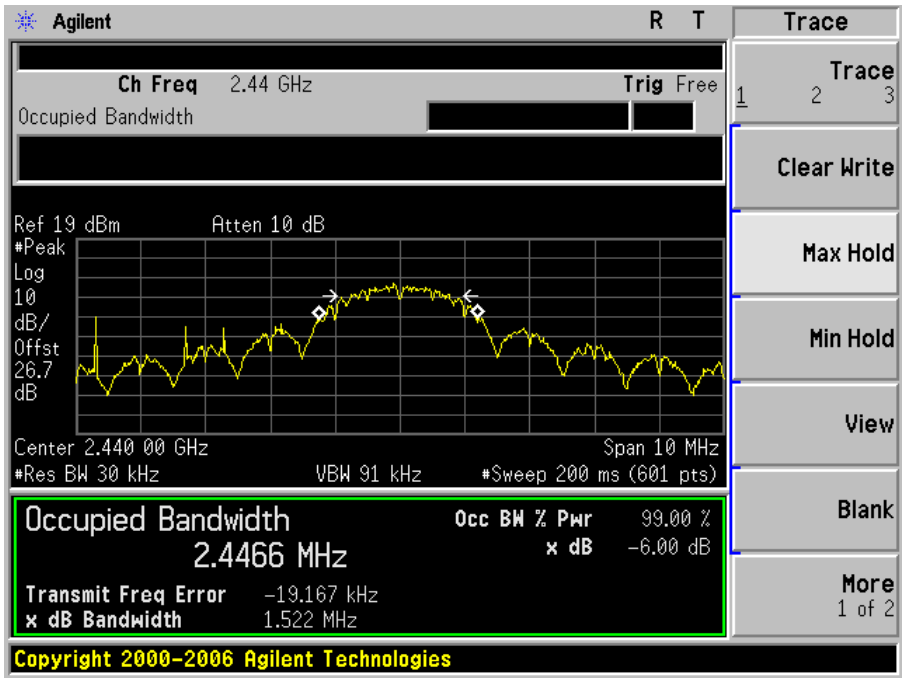
Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	99% Emission Bandwidth (kHz)	Limit (kHz)	Results
Low	2405	1503	2466	> 500	Compliant
Middle	2440	1522	2447	> 500	Compliant
High	2480	1703	2527	> 500	Compliant

Please refer to the following plots:

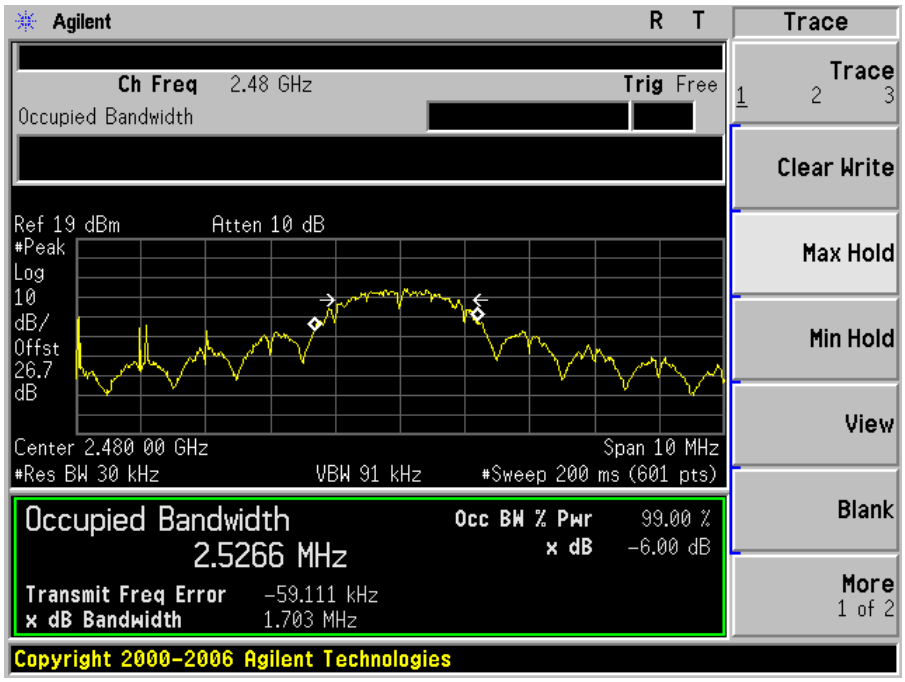
Low Channel, 2405 MHz



Middle Channel, 2440 MHz



High Channel, 2480 MHz



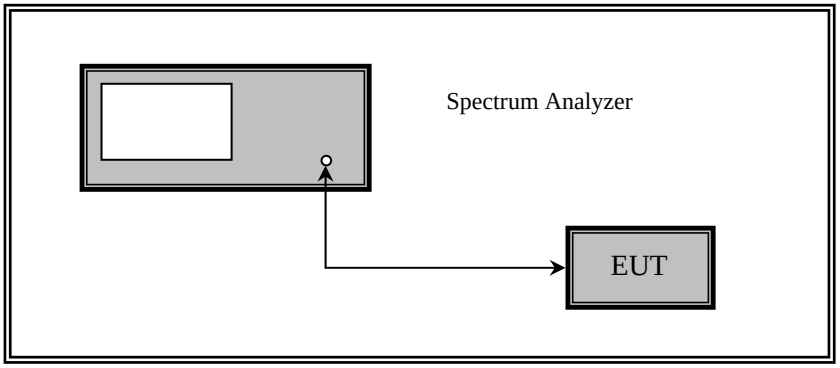
10 FCC §15.247(b) - Peak Output Power Measurement

10.1 Applicable Standard

According to FCC §15.247(b)(3) 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
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10

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:	20-21 °C
Relative Humidity:	38-40 %
ATM Pressure:	101.2 kPa

The testing was performed by Lionel Lara on 01-18-2012 to 01-20-2012 in RF site.

10.5 Test Results

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)	Result
Low	2405	1.91	30	Pass
Mid	2440	4.48	30	Pass
High	2480	2.78	30	Pass

11 FCC §15.247(e) - Power Spectral Density

11.1 Applicable Standard

According to §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.

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. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10

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:	20-21 °C
Relative Humidity:	38-40 %
ATM Pressure:	101.2 kPa

The testing was performed by Lionel Lara on 01-18-2012 to 01-20-2012 in RF site.

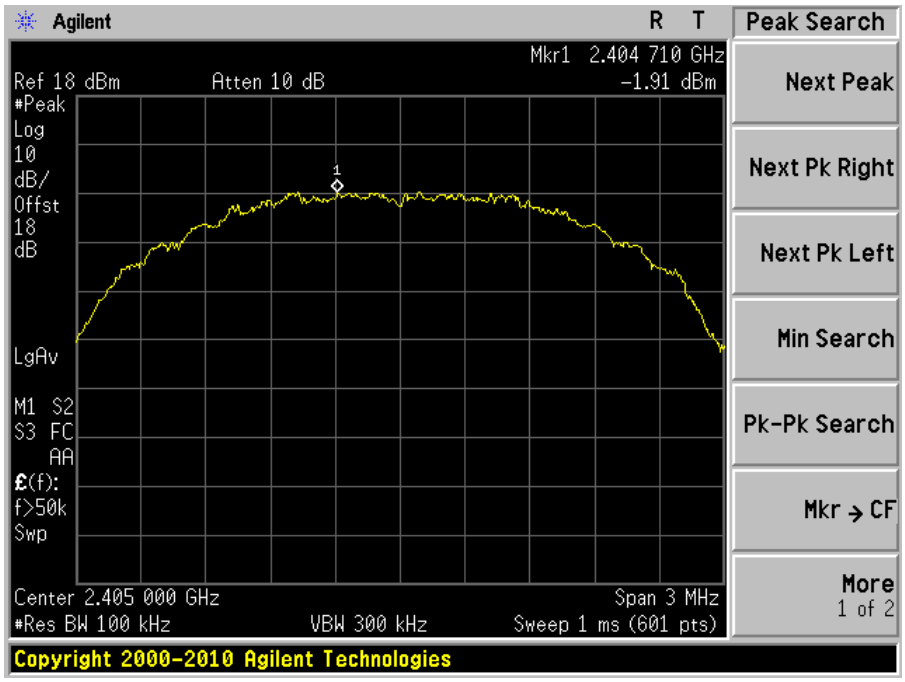
11.5 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Corrected PSD (dBm)	Limit (dBm)	Result
Low	2405	-1.91	-17.11	8	Pass
Mid	2440	-0.76	-15.96	8	Pass
High	2480	-1.55	-16.72	8	Pass

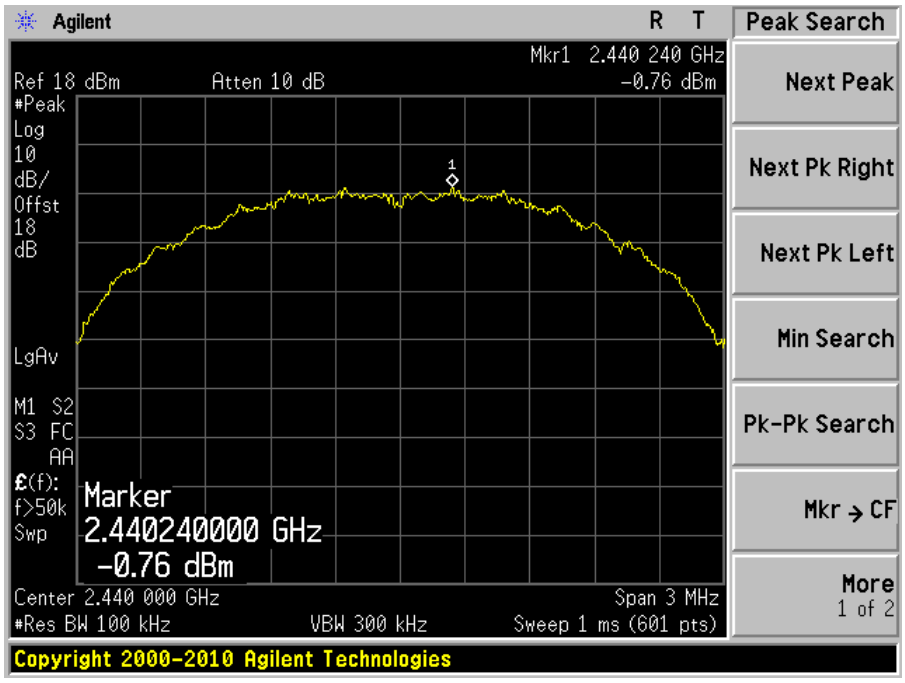
*BWCF (Bandwidth Correction Factor) =10*log (3 kHz/100kHz) = -15.2 dB*

Please refer to the following plots:

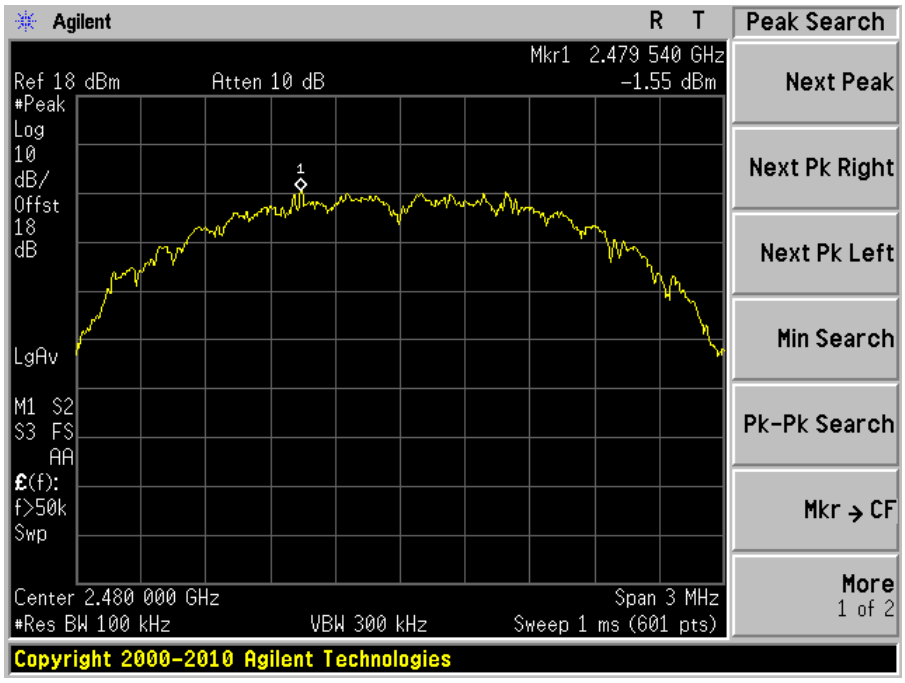
Low Channel, 2405 MHz



Middle Channel, 2440 MHz



High Channel, 2480 MHz



12 FCC §15.247(d) - 100 kHz Bandwidth of Band Edges

12.1 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).

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 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.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10

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

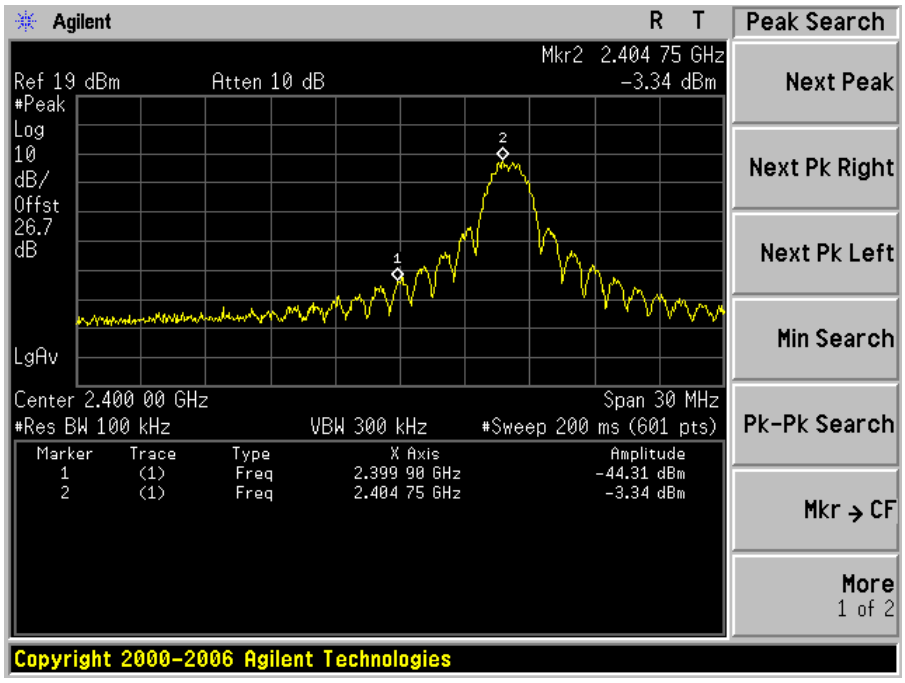
Temperature:	20-21 °C
Relative Humidity:	38-40 %
ATM Pressure:	101.2 kPa

The testing was performed by Lionel Lara on 01-18-2012 to 01-20-2012 in RF site.

12.5 Test Results

Please refer to following pages for plots.

Low Band Edge



High Band Edge