FCC PART 15 SUBPART C

TEST AND MEASUREMENT REPORT

For

iMPak Health, LLC

1350 Campus Parkway, Neptune, NJ 07753, USA

FCC ID: 2ABEF-KMB121

Report Type:	Product Type:
Original Report	Bluetooth Low Energy Device

Prepared By: Cipher Chu

Report Number: R1310226-247

Report Date: 2013-12-12

Reviewed By: Shakti Kosta, Engineering Manager

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732-9164

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1310226-247	Original Report	2013-12-12

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of i*MPak Health LLC* and their product FCC ID: 2ABEF-KMB121 which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is a Bluetooth Low Energy Device operates in 2.4 GHz.

1.2 Mechanical Description of EUT

The EUT measures approximately 7.7 cm (L) x 10.8 cm (W) x 1.3 cm (H) and weighs 0.2(kg).

The test data gathered are from typical production sample, serial number: 4657300, provided by the BACL.

1.3 Objective

This report is prepared on behalf of *iMPak Health LLC* 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 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)

N/A

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 and ANSI C63.10-2009, American National Standard for Testing Unlicensed Wireless Devices.

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.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

N/A.

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

Manufacturer	Description	Model	Serial Number
iMPak Health LLC	PCB Board	Daypak BLE	-
Texas Instruments	-	CC2541F256	-
NDK	-	NX2520SA-32.000000MHz	-
Abracon	-	ABS07-32.768KHZ-T	-

2.7 Interface Ports and Cables

Cable Description	Length (m)	To	From
RF Cable	< 1.0	PSA	EUT

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	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	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

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):	-2.02
Maximum peak output power at antenna input terminal (mW):	0.628058
Prediction distance (cm):	20
Prediction frequency (MHz):	2402
Maximum Antenna Gain, typical (dBi):	-1.7
Maximum Antenna Gain (numeric):	0.676083
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0000845
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 0.0000845 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 List

Frequency Range (MHz)	External/Internal/Integral	Antenna Type/Pattern	Antenna Gain (dBi)
2400-2500	Integral	PCB	-1.7

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

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

6.1 Applicable Standard

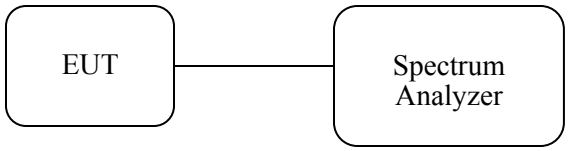
For FCC §15.247(d) in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band 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.

Requirements: CFR 47, §2.1051.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1057.

6.2 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.



6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2013-03-05	1 year

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

6.4 Test Environmental Conditions

Temperature:	23°C
Relative Humidity:	42%
ATM Pressure:	102kPa

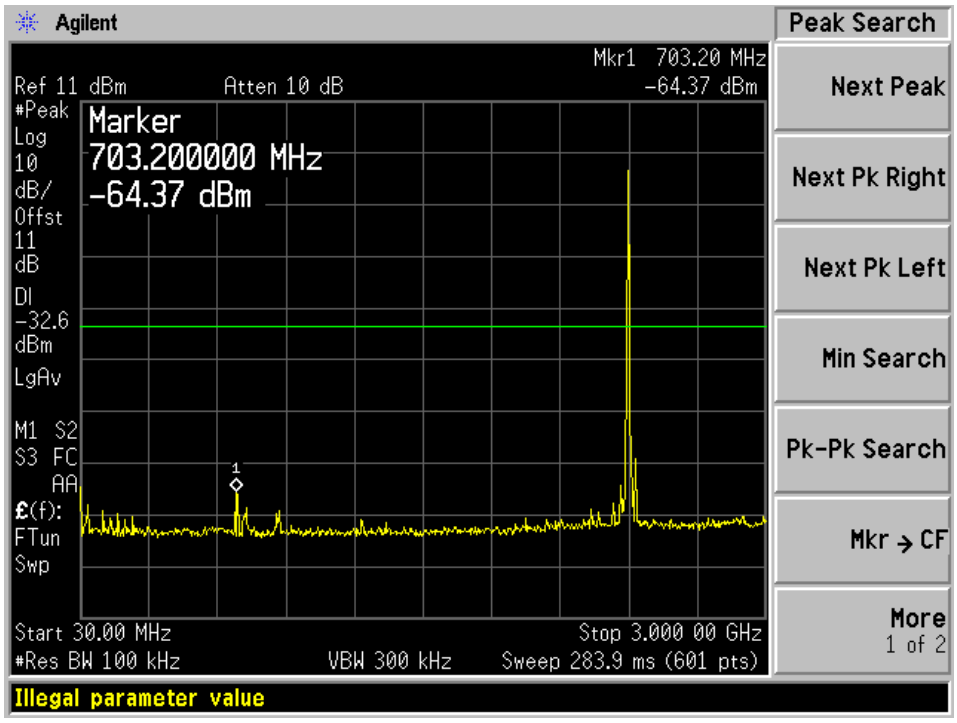
The testing was performed by Cipher Chu on 2013-10-28 at RF site.

6.5 Test Results

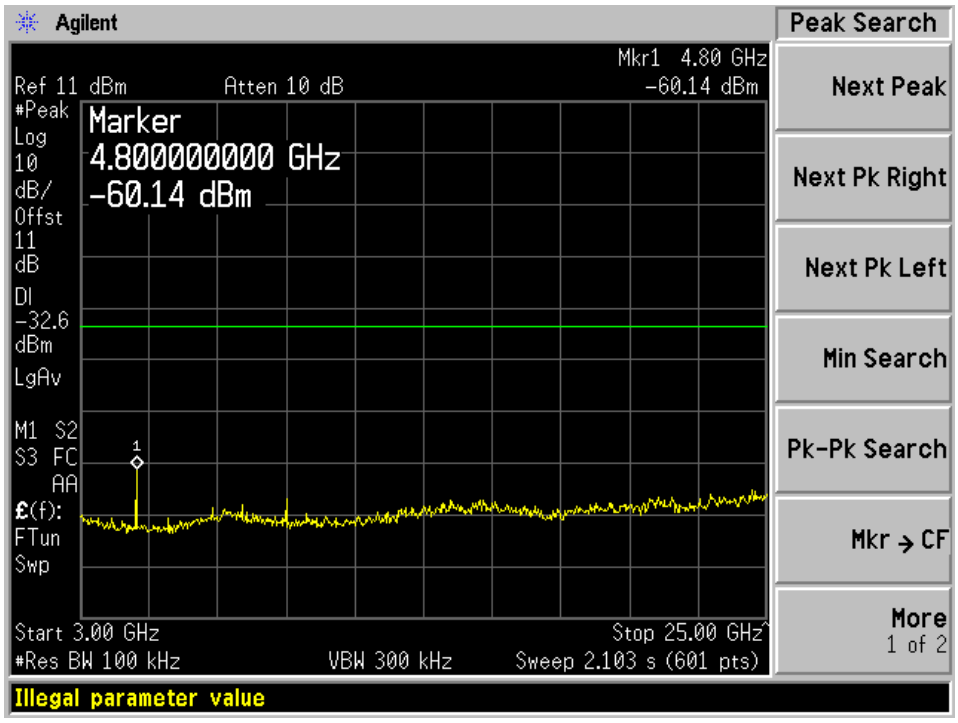
Please refer to following plots of spurious emissions.

Low Channel, 2402 MHz

30 MHz – 3 GHz

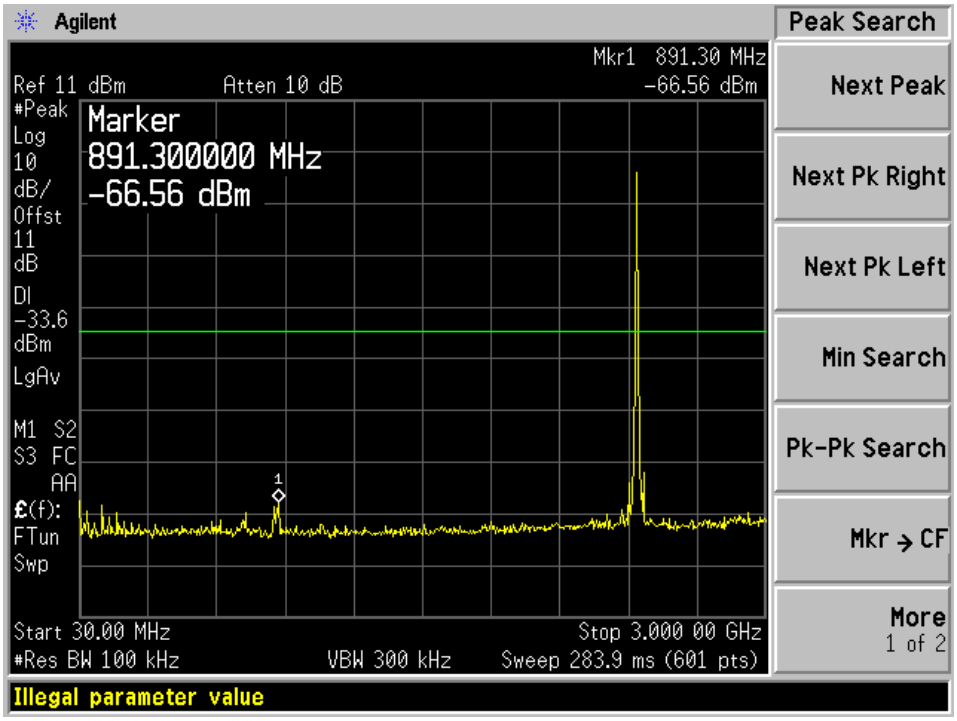


3 GHz – 25 GHz

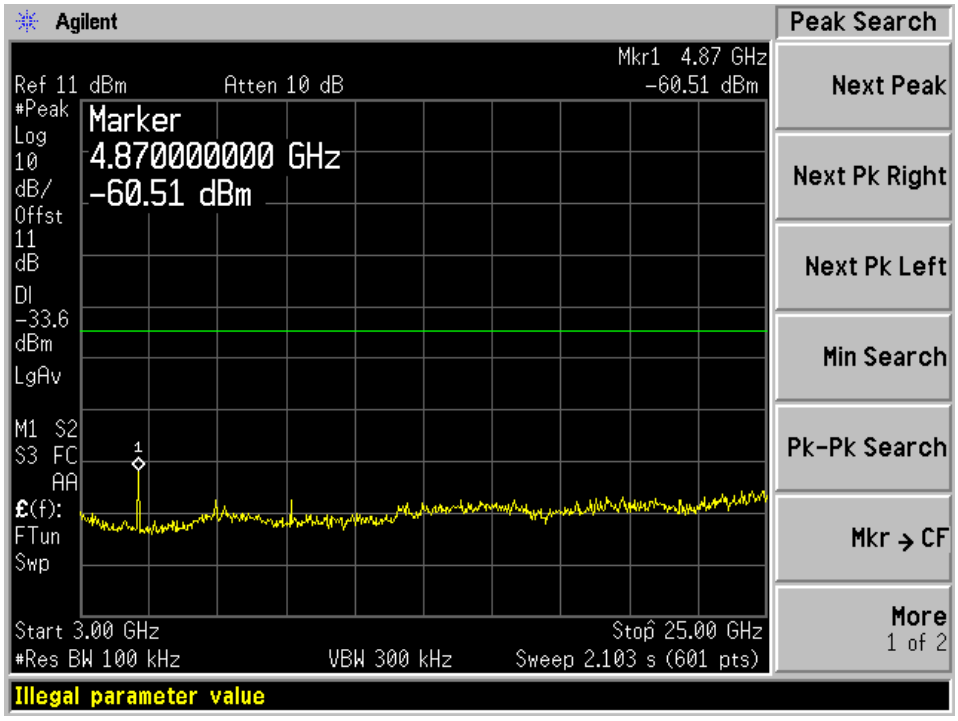


Middle Channel, 2440 MHz

30 MHz – 3 GHz

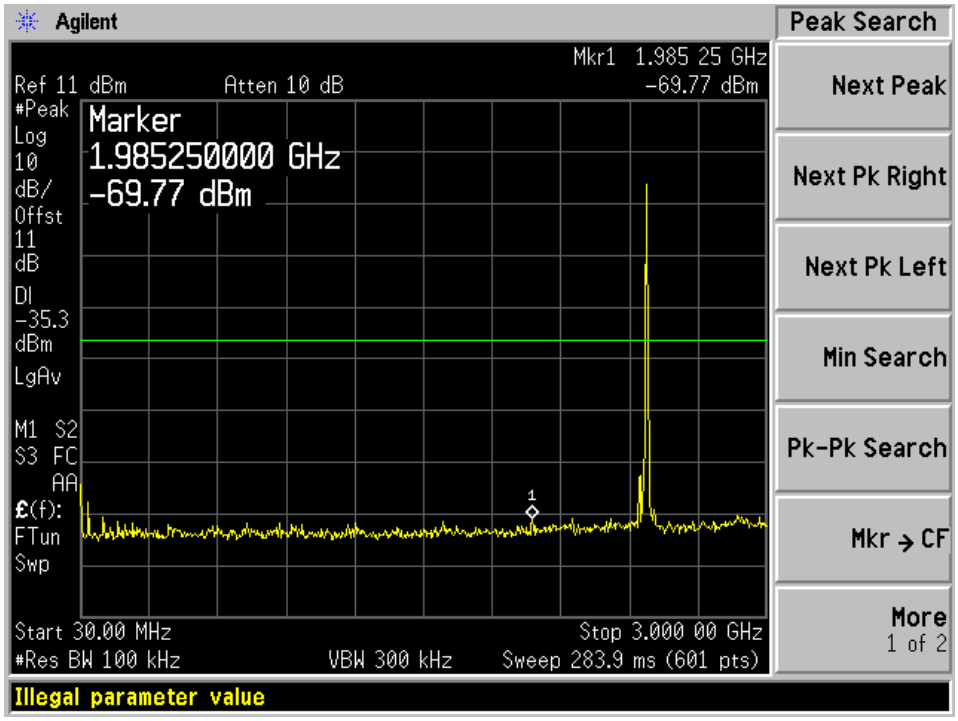


3 GHz – 25 GHz

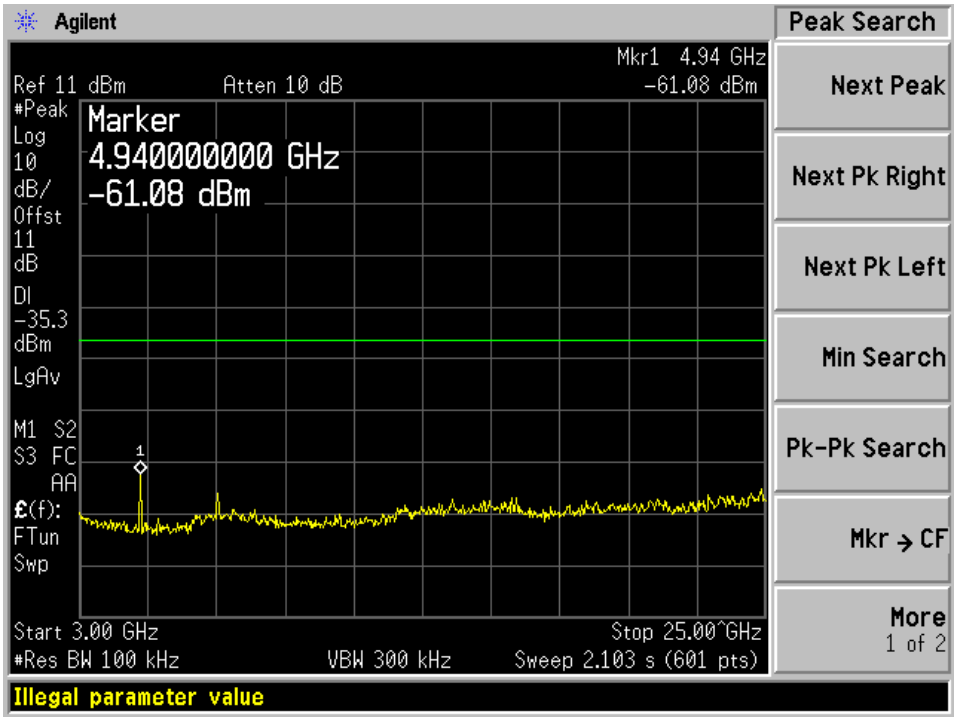


High Channel, 2480 MHz

30 MHz – 3 GHz



3 GHz – 25 GHz



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

7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

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

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

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

MHz	MHz	MHz	GHz
0.090 – 0.110	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	156.52480 – 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).

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

7.3 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

7.4 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

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 year
Agilent	Spectrum Analyzer	E4440A	US42221851	2013-03-05	1 year
EMCO	Horn Antenna	3315	9511-4627	2012-10-17	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2013-01-08	1 year

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

7.6 Test Environmental Conditions

Temperature:	22-23 °C
Relative Humidity:	43 %
ATM Pressure:	102 kPa

The testing was performed by Cipher Chu on 2013-11-8 at 5M chamber 3.

7.7 Summary of Test Results

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

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel**
-19.85	30	Horizontal	Middle Channel

1-25 GHz:

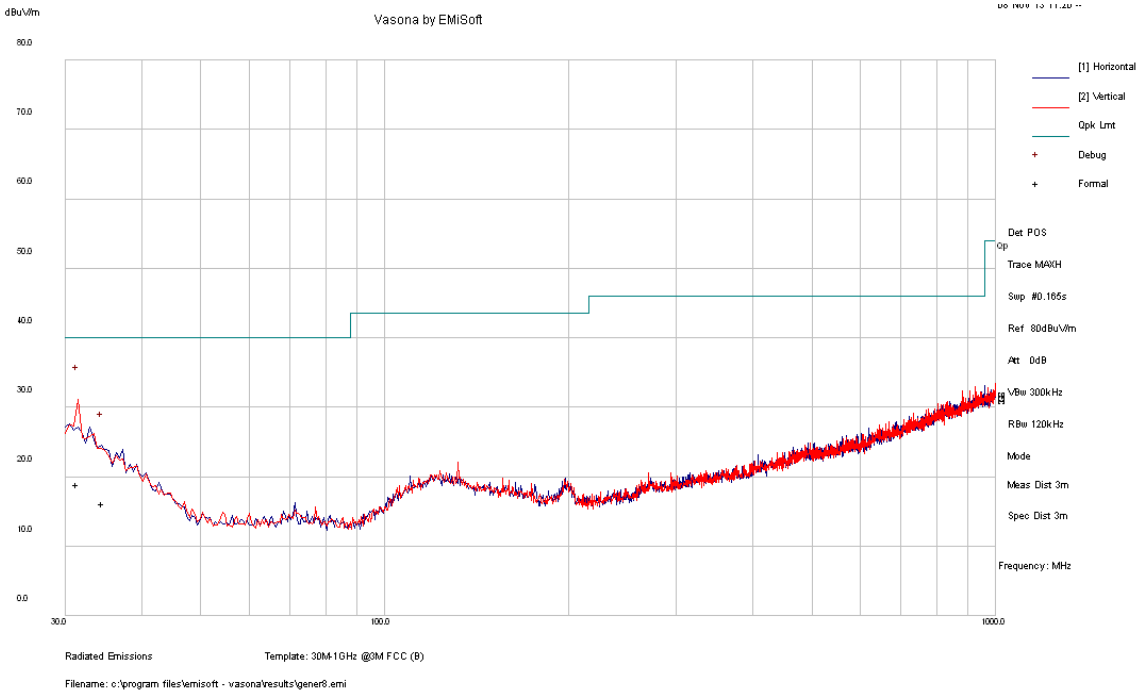
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel**
-1.263	4960	Vertical	High Channel

Please refer to the following table for specific test result details

7.8 Radiated Emissions Test Data and Plots

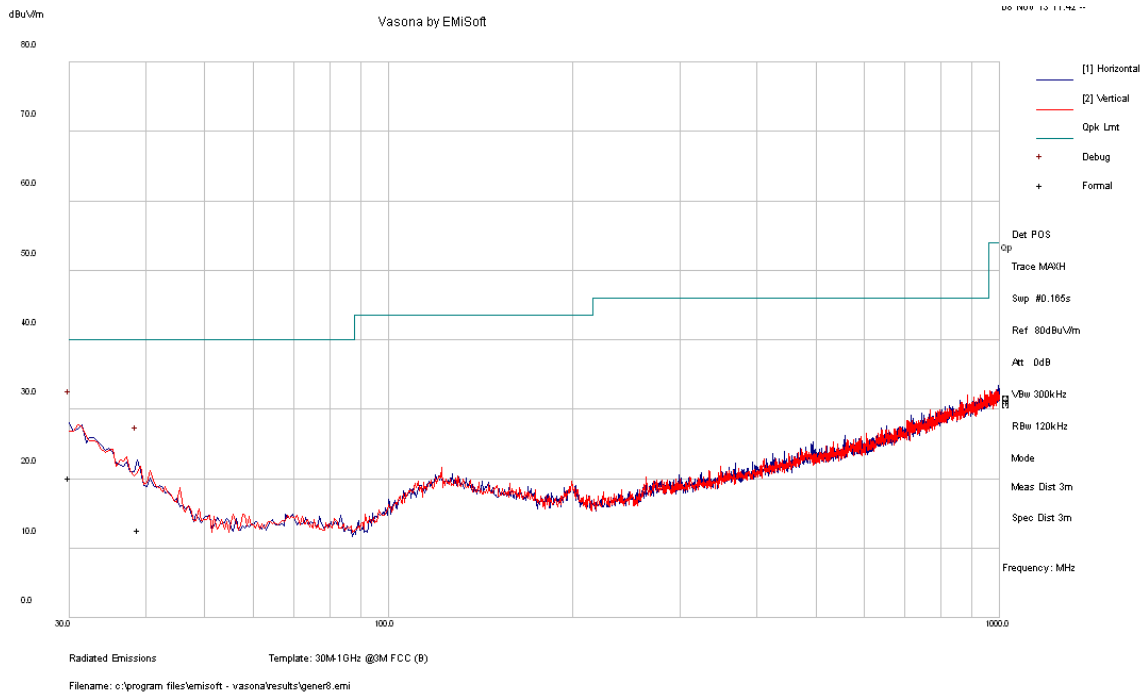
1) 30-1000 MHz, measured at 3m distance

Low Channel: 2402 MHz



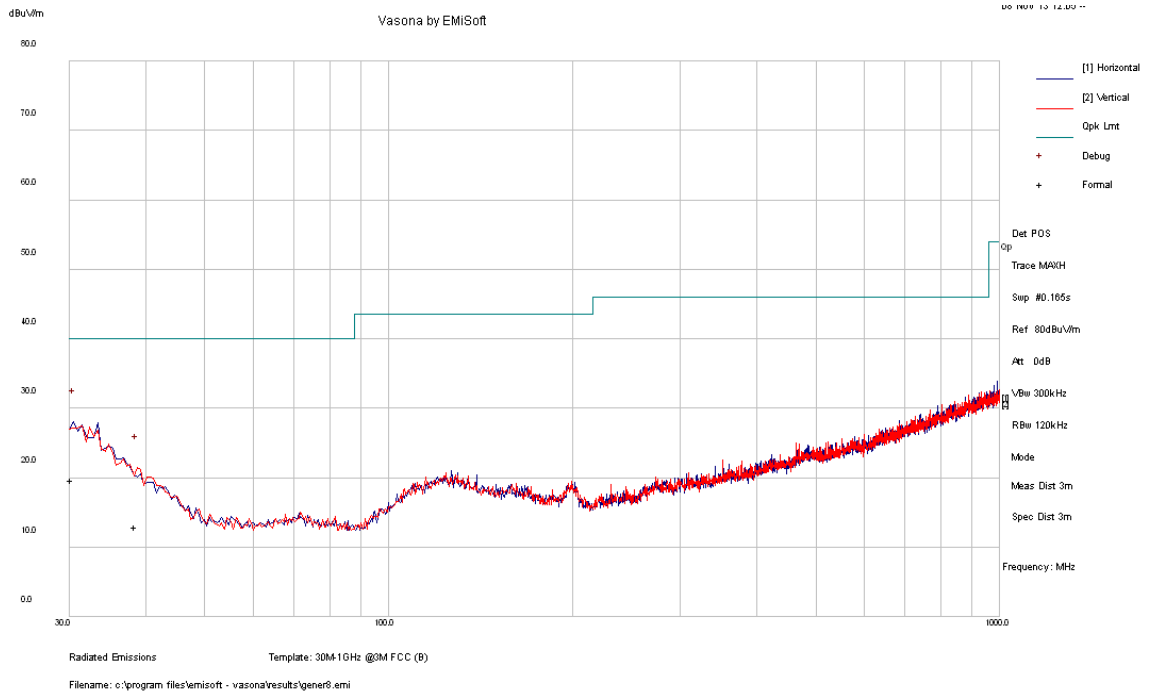
Frequency (MHz)	Corrected Amplitude (dBuV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBuV/m)	Margin (dB)	Detector (PK/QP/Ave)
31.425	8.66	156	V	116	40	-20.99	QP
34.538	8.18	263	H	294	40	-23.83	QP

Middle Channel: 2440 MHz



Frequency (MHz)	Corrected Amplitude (dBuV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBuV/m)	Margin (dB)	Detector (PK/QP/Ave)
30	8.61	374	H	325	40	30	QP
38.9255	8.1	111	H	330	40	38.9255	QP

High Channel: 2480 MHz



Frequency (MHz)	Corrected Amplitude (dBuV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBuV/m)	Margin (dB)	Detector (PK/QP/Ave)
30.29575	8.5	306	H	193	40	-20.23	QP
38.53975	8.05	314	V	114	40	-27.08	QP

2) Above 1 GHz, measured at 3m distance

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel, 2402 MHz											
2402	52.38	171	100	V	28.956	3.12	0	84.456	-	-	Peak
2402	59.94	230	100	H	28.956	3.12	0	92.016	-	-	Peak
2402	51.02	171	100	V	28.956	3.12	0	83.096	-	-	Ave
2402	58.86	230	100	H	28.956	3.12	0	90.936	-	-	Ave
2354	27.18	0	100	V	28.192	3.12	0	58.492	74	-15.508	Peak
2354	27.02	0	100	H	28.192	3.12	0	58.332	74	-15.668	Peak
2354	12.34	0	100	V	28.192	3.12	0	43.652	54	-10.348	Ave
2354	12.31	0	100	H	28.192	3.12	0	43.622	54	-10.378	Ave
4804	45.78	321	100	V	33.097	4.56	27.7	55.737	74	-18.263	Peak
4804	45.1	288	100	H	33.097	4.56	27.7	55.057	74	-18.943	Peak
4804	41.59	321	100	V	33.097	4.56	27.7	51.547	54	-2.453	Ave
4804	40.36	288	100	H	33.097	4.56	27.7	50.317	54	-3.683	Ave
7206	37.56	312	100	V	35.928	5.49	27.58	51.398	64.456	-13.058	Peak
7206	36.06	274	100	H	35.928	5.49	27.58	49.898	72.016	-22.118	Peak
7206	29.48	312	100	V	35.928	5.49	27.58	43.318	63.096	-19.778	Ave
7206	23.97	274	100	H	35.928	5.49	27.58	37.808	70.936	-33.128	Ave
9608	33.44	0	100	V	37.954	6.54	27.06	50.874	64.456	-13.582	Peak
9608	32.75	0	100	H	37.954	6.54	27.06	50.184	72.016	-21.832	Peak
9608	19.24	0	100	V	37.954	6.54	27.06	36.674	63.096	-26.422	Ave
9608	19.26	0	100	H	37.954	6.54	27.06	36.694	70.936	-34.242	Ave
Middle Channel, 2440 MHz											
2440	52.34	140	100	V	28.956	3.12	0	84.416	-	-	Peak
2440	58.96	235	100	H	28.956	3.12	0	91.036	-	-	Peak
2440	46.59	140	100	V	28.956	3.12	0	78.666	-	-	Ave
2440	58.05	235	100	H	28.956	3.12	0	90.126	-	-	Ave
4880	43.41	319	100	V	33.327	4.54	27.76	53.517	74	-20.483	Peak
4880	42.5	250	100	H	33.327	4.54	27.76	52.607	74	-21.393	Peak
4880	38.69	319	100	V	33.327	4.54	27.76	48.797	54	-5.203	Ave
4880	36.93	250	100	H	33.327	4.54	27.76	47.037	54	-6.963	Ave
7320	36.24	321	100	V	36.369	5.57	27.51	50.669	74	-23.331	Peak
7320	34.55	274	100	H	36.369	5.57	27.51	48.979	74	-25.021	Peak
7320	29.84	321	100	V	36.369	5.57	27.51	44.269	54	-9.731	Ave
7320	25.57	274	100	H	36.369	5.57	27.51	39.999	54	-14.001	Ave
9760	33.35	0	100	V	38.287	6.62	26.98	51.277	64.416	-13.139	Peak
9760	32.22	0	100	H	38.287	6.62	26.98	50.147	71.036	-20.889	Peak
9760	18.4	0	100	V	38.287	6.62	26.98	36.327	58.666	-22.339	Ave
9760	18.45	0	100	H	38.287	6.62	26.98	36.377	70.126	-33.749	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel, 2480 MHz											
2480	51.19	227	100	V	29.155	3.25	0	83.595	-	-	Peak
2480	59.75	307	100	H	29.155	3.25	0	92.155	-	-	Peak
2480	49.99	227	100	V	29.155	3.25	0	82.395	-	-	Ave
2480	58.64	307	100	H	29.155	3.25	0	91.045	-	-	Ave
2483.5	27.82	0	100	V	29.155	3.25	0	60.225	74	-13.775	Peak
2483.5	28.74	0	100	H	29.155	3.25	0	61.145	74	-12.855	Peak
2483.5	13.33	0	100	V	29.155	3.25	0	45.735	54	-8.265	Ave
2483.5	12.87	0	100	H	29.155	3.25	0	45.275	54	-8.725	Ave
4960	46.52	95	100	V	33.327	4.52	27.75	56.617	74	-17.383	Peak
4960	40.67	71	100	H	33.327	4.52	27.75	50.767	74	-23.233	Peak
4960	42.64	95	100	V	33.327	4.52	27.75	52.737	54	-1.263	Ave
4960	35.2	71	100	H	33.327	4.52	27.75	45.297	54	-8.703	Ave
7440	37.17	120	100	V	36.565	5.62	27.51	51.845	74	-22.155	Peak
7440	35.3	54	100	H	36.565	5.62	27.51	49.975	74	-24.025	Peak
7440	31.67	120	100	V	36.565	5.62	27.51	46.345	54	-7.655	Ave
7440	27.03	54	100	H	36.565	5.62	27.51	41.705	54	-12.295	Ave
9920	31.85	0	100	V	38.287	6.55	26.98	49.707	63.595	-13.888	Peak
9920	30.89	0	100	H	38.287	6.55	26.98	48.747	72.155	-23.408	Peak
9920	17.11	0	100	V	38.287	6.55	26.98	34.967	62.395	-27.428	Ave
9920	17.08	0	100	H	38.287	6.55	26.98	34.937	71.045	-36.108	Ave

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

8.1 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

8.2 Measurement Procedure

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

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2013-03-05	1 year

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

8.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	42 %
ATM Pressure:	102 kPa

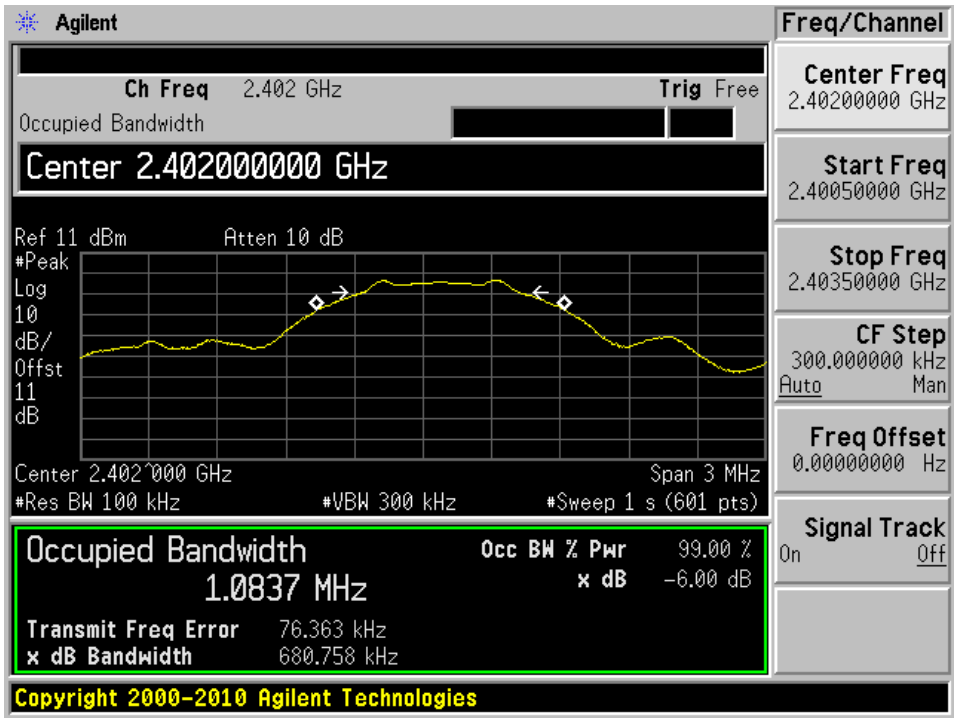
The testing was performed by Cipher Chu on 2013-10-28 at RF site.

8.5 Test Results

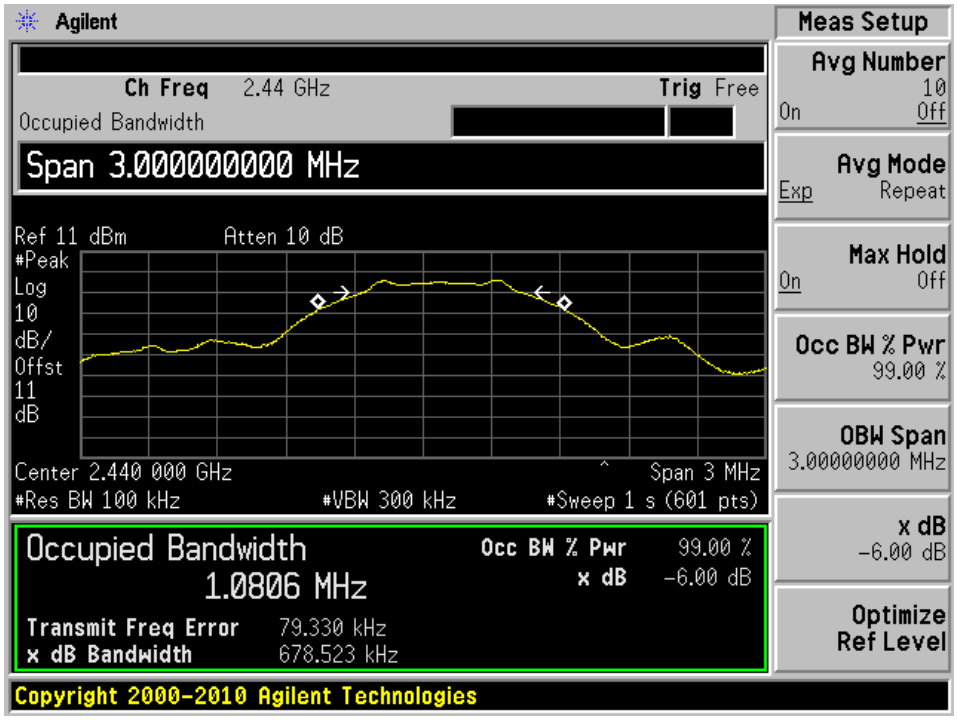
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (kHz)	Limit (MHz)	Results
Low	2402	1.0837	680.758	> 0.5	Compliant
Middle	2440	1.0806	678.523	> 0.5	Compliant
High	2480	1.0805	680.048	> 0.5	Compliant

Please refer to the following plots for detailed test results

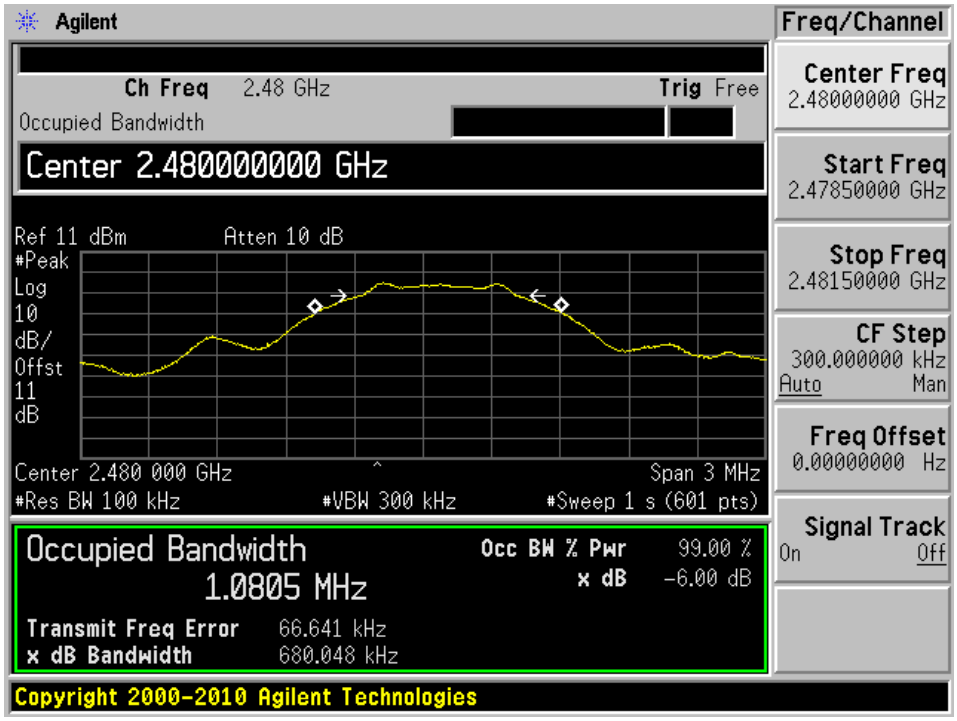
Low Channel: 2402 MHz



Middle Channel: 2440 MHz



High Channel: 2480 MHz



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

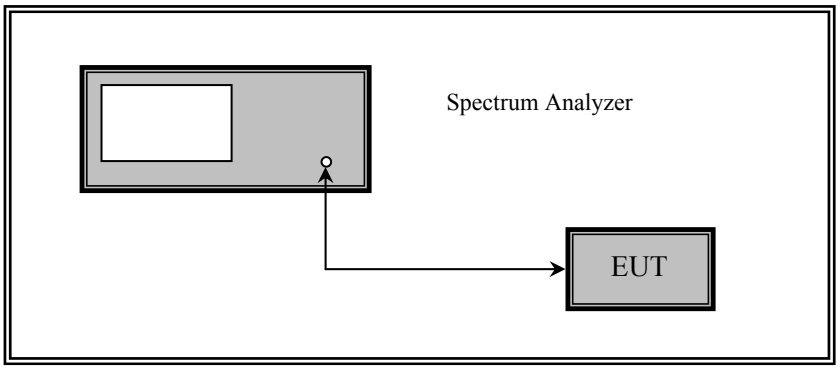
9.1 Applicable Standard

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

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.

9.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.



9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2013-03-05	1 year

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

9.4 Test Environmental Conditions

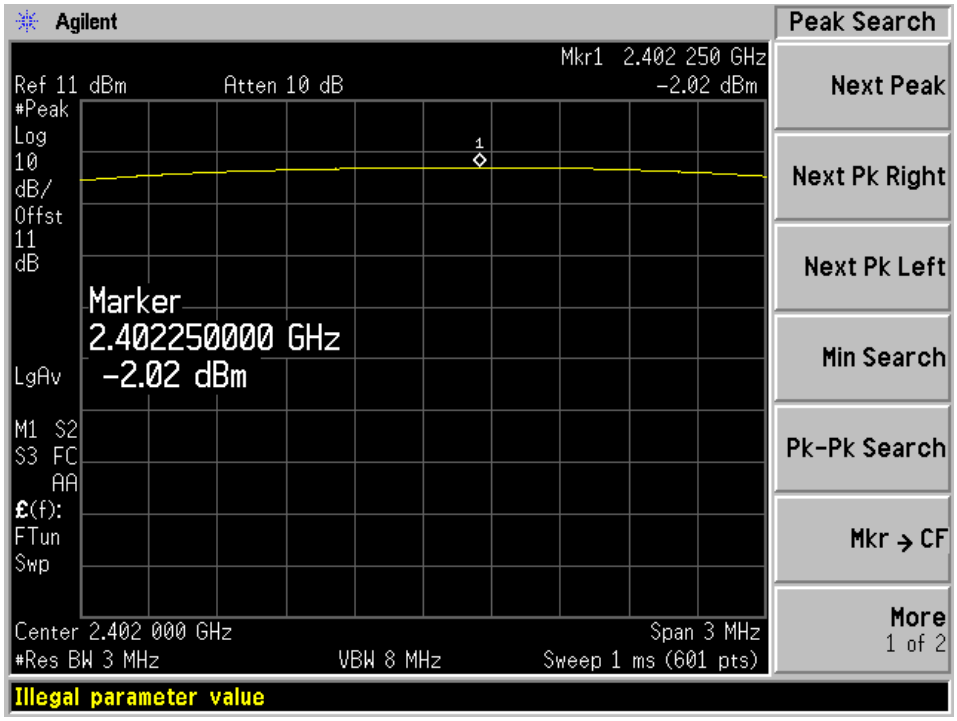
Temperature:	23 °C
Relative Humidity:	42 %
ATM Pressure:	102 kPa

The testing was performed by Cipher Chu on 2013-10-28 at RF site.

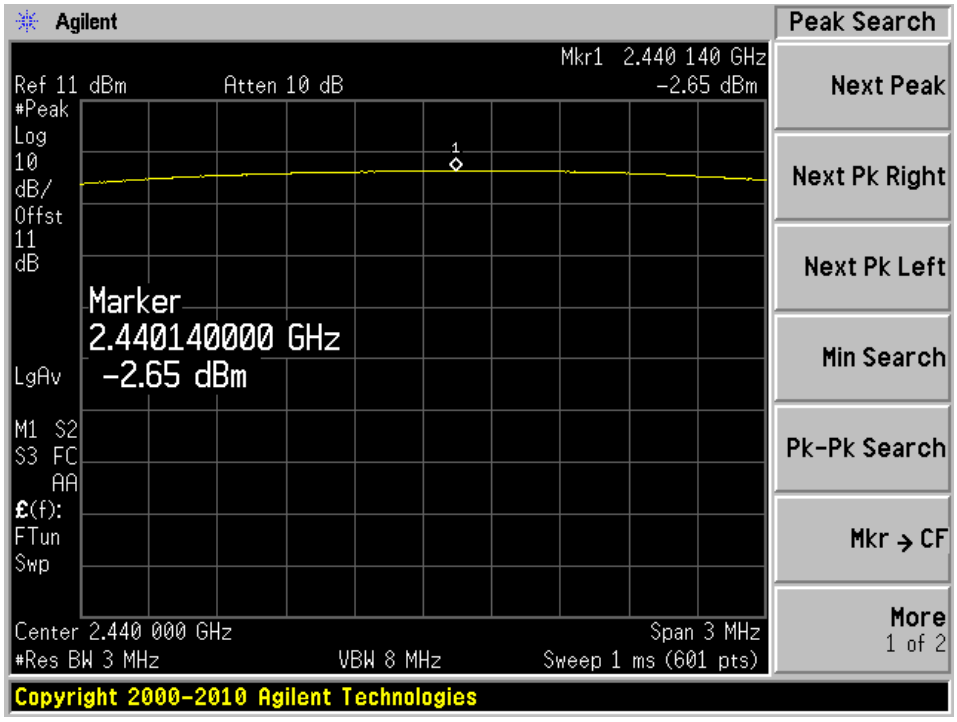
9.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	FCC Limit (dBm)	Margin (dB)
Low	2402	-2.02	30	-32.02
Middle	2440	-2.65	30	-32.65
High	2480	-3.97	30	-33.97

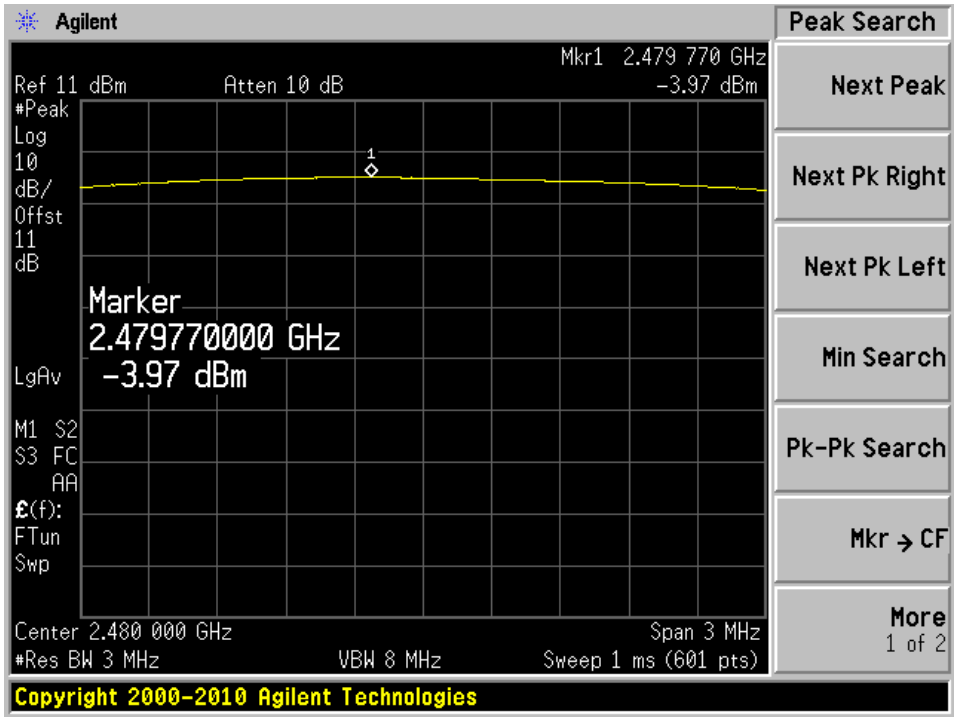
Low Channel: 2402 MHz



Middle Channel: 2440 MHz



High Channel: 2480 MHz



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

10.1 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)).

10.2 Measurement Procedure

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

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2013-03-05	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

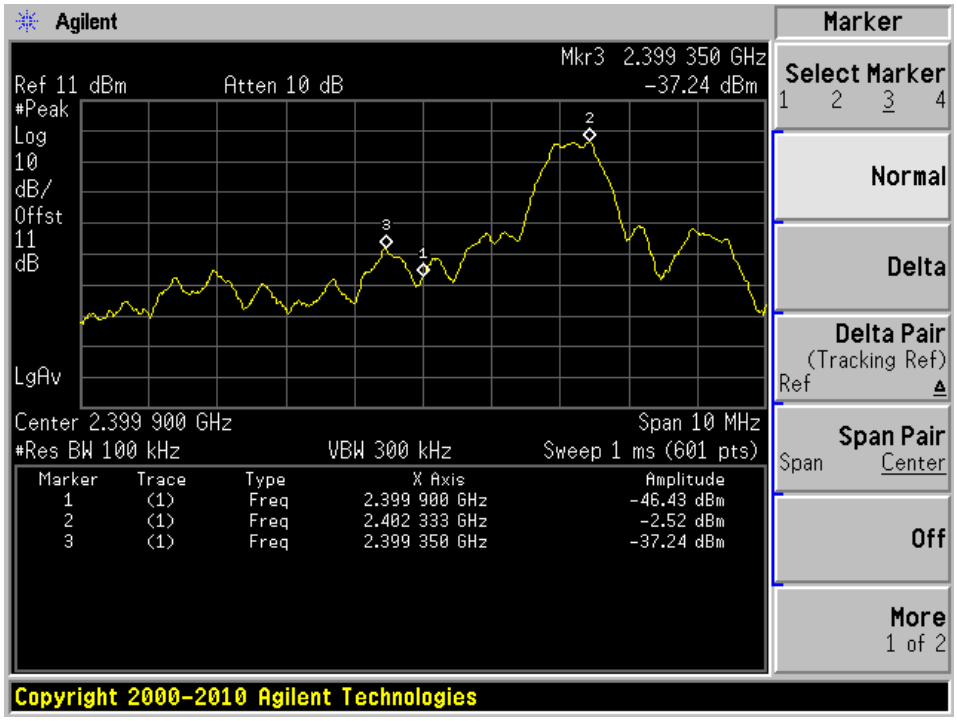
Temperature:	23 °C
Relative Humidity:	42 %
ATM Pressure:	102 kPa

The testing was performed by Cipher Chu on 2013-10-28 at RF site.

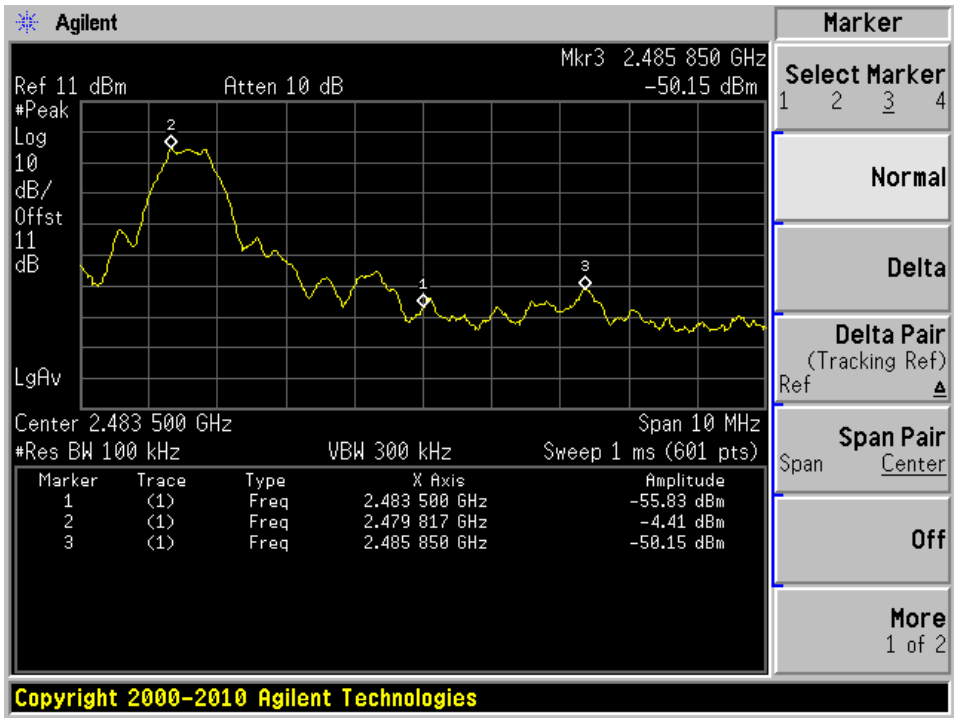
10.5 Test Results

Please refer to following pages for plots of band edge.

Low Band Edge



High Band Edge



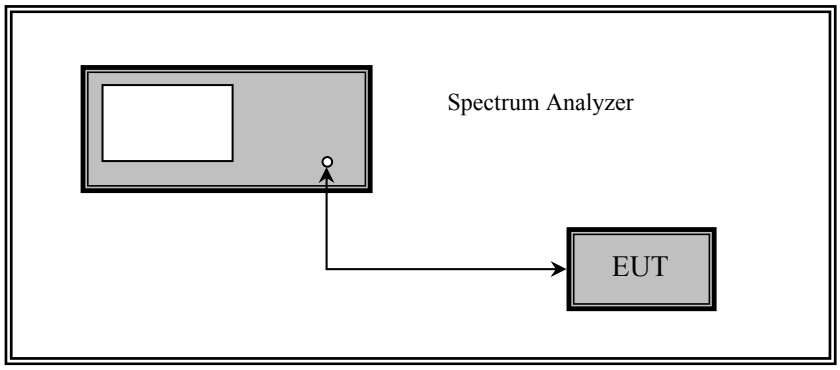
11 FCC §15.247(e) – Power Spectral Density

11.1 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.

11.2 Measurement Procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW ≥ 3 kHz.
4. Set the VBW ≥ 3 x RBW.
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 amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2013-03-05	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:	23°C
Relative Humidity:	42%
ATM Pressure:	102kPa

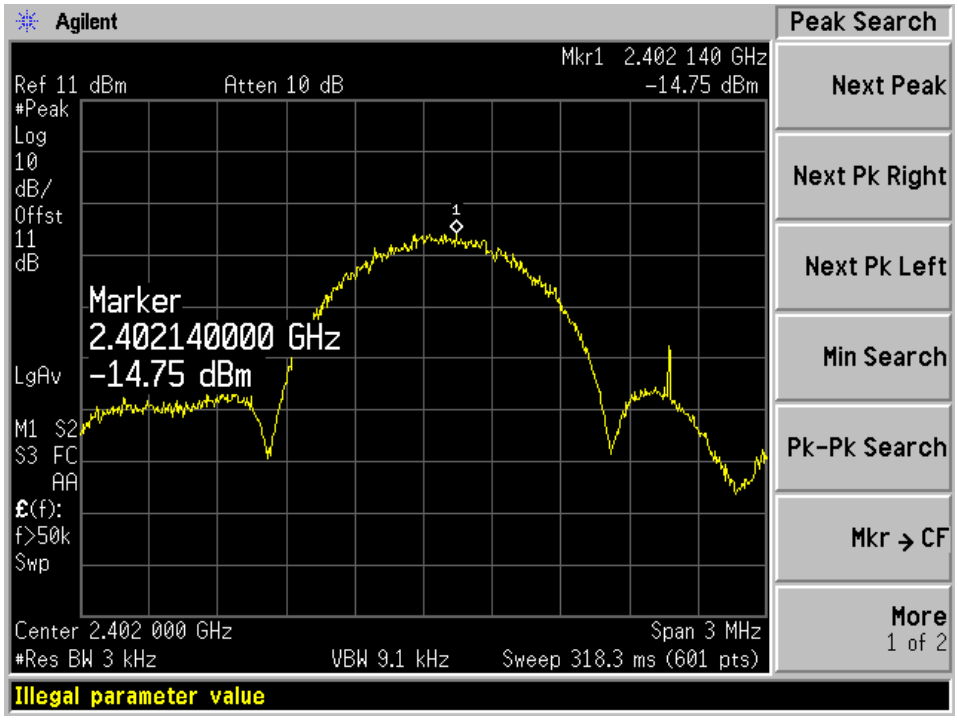
The testing was performed by Cipher Chu on 2013-10-28 at RF site.

11.5 Test Results

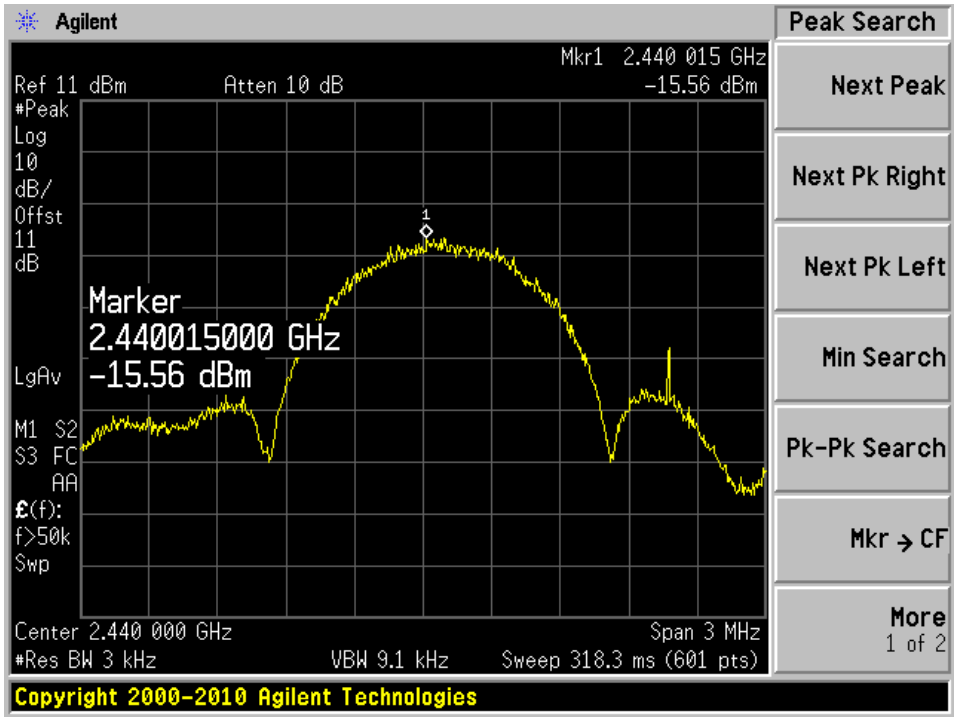
Channel	Frequency (MHz)	PSD (dBm)	FCC Limit (dBm)	Margin (dB)
Low	2402	-14.75	8	-22.75
Middle	2440	-15.56	8	-23.56
High	2480	-16.78	8	-24.78

Please refer to the following plots for detailed test results:

Low Channel: 2402 MHz



Middle Channel: 2440 MHz



High Channel: 2480 MHz