



FCC PART 15 SUBPART C

TEST AND MEASUREMENT REPORT

For

Fanhattan LLC

489 S El Camino Real,
San Mateo, CA 94402, USA

FCC ID: S2E-L0815

Report Type: Original Report	Product Type: Bluetooth Remote Control
Prepared By: <u>Jeffrey Wu</u> 	
Report Number: <u>R1302203-247 RMC</u>	
Report Date: <u>2013-04-10</u>	
Reviewed By: <u>Quinn Jiang</u>	
Test Engineer Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164	

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government. * This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*" (Rev.3)

TABLE OF CONTENTS

1 General Description.....	5
1.1 Product Description for Equipment Under Test (EUT)	5
1.2 Mechanical Description of EUT	5
1.3 Objective.....	5
1.4 Related Submittal(s)/Grant(s)	5
1.5 Test Methodology	5
1.6 Measurement Uncertainty	5
1.7 Test Facility	6
2 System Test Configuration.....	7
2.1 Justification.....	7
2.2 EUT Exercise Software.....	7
2.3 Special Equipment	7
2.4 Equipment Modifications.....	7
2.5 Local Support Equipment	7
2.6 EUT Internal Configuration Details.....	7
2.7 Interface Ports and Cabling.....	7
2.8 External I/O Cabling List and AC Cord.....	8
2.9 Power Supply List and Details.....	8
3 Summary of Test Results	9
4 FCC §15.247 (i) & §2.1093 – RF Exposure.....	10
4.1 Applicable Standard.....	10
4.2 SAR Evaluation Result	10
5 FCC §15.203 – Antenna Requirements.....	11
5.1 Applicable Standard.....	11
5.2 Antenna List.....	11
5.3 Result	11
6 FCC §2.1051 & §15.247(d) – Spurious Emissions at Antenna Terminals	12
6.1 Applicable Standard.....	12
6.2 Measurement Procedure.....	12
6.3 Test Equipment List and Details.....	12
6.4 Test Environmental Conditions	12
6.5 Test Results.....	12
7 FCC §15.205, §15.209 & §15.247(d) – Spurious Radiated Emissions	16
7.1 Applicable Standard.....	16
7.2 Test Setup	17
7.3 Test Procedure	17
7.4 Corrected Amplitude & Margin Calculation.....	18
7.5 Test Equipment List and Details.....	18
7.6 Test Environmental Conditions	18
7.7 Summary of Test Results	19
7.8 Radiated Emissions Test Data and Plots.....	20
8 FCC§15.247(a) (2) – 6 dB & 99% Emission Bandwidth	23
8.1 Applicable Standard.....	23
8.2 Measurement Procedure.....	23
8.3 Test Equipment List and Details.....	23
8.4 Test Environmental Conditions	23
8.5 Test Results.....	24
9 FCC §15.247(b) – Peak Output Power Measurement	26
9.1 Applicable Standard.....	26

9.2	Measurement Procedure.....	26
9.3	Test Equipment List and Details.....	26
9.4	Test Environmental Conditions	26
9.5	Test Results.....	27
10	FCC §15.247(d) – 100 kHz Bandwidth of Band Edges.....	29
10.1	Applicable Standard.....	29
10.2	Measurement Procedure.....	29
10.3	Test Equipment List and Details.....	29
10.4	Test Environmental Conditions	29
10.5	Test Results.....	29
11	FCC §15.247(e) – Power Spectral Density.....	31
11.1	Applicable Standard.....	31
11.2	Measurement Procedure.....	31
11.3	Test Equipment List and Details.....	31
11.4	Test Environmental Conditions	31
11.5	Test Results.....	32
12	Exhibit A – FCC Equipment Labeling Requirements.....	34
12.1	FCC ID Label Requirements	34
12.2	FCC ID Label Contents and Location on EUT	34
13	Exhibit B – Test Setup Photographs	35
13.1	Radiated Emission Front View at 3 Meter	35
13.2	Radiated Emission below 1 GHz Rear View at 3 Meter.....	35
13.3	Radiated Emission above 1 GHz Rear View at 3 Meter	36
14	Exhibit C – EUT Photographs.....	37
14.1	EUT – Front View	37
14.2	EUT – Rear View	37
14.3	EUT – Top View.....	38
14.4	EUT – Bottom View	38
14.5	EUT – Side View (1)	39
14.6	EUT – Side View (2)	39
14.7	EUT – Main Board Top View	40
14.8	EUT – Main Board Bottom View	40

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1302203-247 RMC	Original Report	2013-04-10

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Fanhattan LLC*, and their product FCC ID: S2E-L0815, model: F1201 or the “EUT” as referred on this report is Bluetooth (low energy) Remote Control for Fanhattan Digital Media Streamer.

1.2 Mechanical Description of EUT

The “EUT” measures approximately 7.3 cm (L) x 6.3 cm (W) x 1.9 cm (H), and weighs approximately 42.0g.

The test data gathered are from typical production sample, serial number: F2EVT100052 for conducted, and F2EVT100061 for radiated, provided by the manufacturer.

1.3 Objective

This report is prepared on behalf of *Fanhattan 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 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)

N/A

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 CISPR16-4-2:2007, The Treatment of Uncertainty in EMC Measurements, the values ranging from ± 2.0 dB for Conducted Emissions tests and ± 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.

2.2 EUT Exercise Software

The test utility used was Realterm (uart) was provided by Fanhattan and was verified Jeffrey Wu to comply with the standard requirements being tested against.

Radio Mode	Frequency (MHz)		
	Low CH	Mid CH	High CH
Bluetooth 4.0	2402	2442	2480

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

Manufacturer	Description	Model	Serial Number
Apple	15 inch Macbook Pro	-	-

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
Fanhattan	Main Board	R1201	12108303-00067

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	<1m	Debug Console	Laptop
USB to mini Serial Cable	<1m	EUT	Debug Console

2.8 External I/O Cabling List and AC Cord

N/A

2.9 Power Supply List and Details

N/A

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
FCC §15.247(i), §2.1093	RF Exposure	Compliant
FCC §15.203	Antenna Requirement	Compliant
FCC §15.207(a)	AC Line Conducted Emissions	Note ¹
§15.247 (d)	Spurious Emissions at Antenna Port	Compliant
FCC §15.205	Restricted Bands	Compliant
FCC §15.209, §15.247 (d)	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2)	6 dB Emission Bandwidth	Compliant
FCC §15.247(b)(3)	Maximum Peak Output Power	Compliant
FCC §15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e)	Power Spectral Density	Compliant

Note¹: EUT is a battery support product

4 FCC §15.247 (i) & §2.1093 – RF Exposure

4.1 Applicable Standard

FCC §2.1093, §15.247(i) and IC RSS-102

According to FCC KDB 447498 D01, Appendix A:

SAR Test Exclusion Thresholds for 100 MHz-6 GHz and ≤ 50 mm

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distance are illustrated in the following Table:

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

4.2 SAR Evaluation Result

The maximum conducted output power of this device is 9.01 dBm (7.96mW), which is less than the SAR threshold of 10 mw (FCC KDB 447498 D01 Appendix A); therefore, SAR evaluation is not required.

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

Antenna Model/Part Number	Antenna Gain (dBi)
47948-0001	3.6

5.3 Result

The EUT has a surface mount device antenna with maximum gain of 3.6 dBi antenna, which in accordance to sections FCC §15.203, is considered sufficient to comply with the provisions of these sections. Please refer to the EUT photos.

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

6.1 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.

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	E4446A	US44300386	2012-09-29	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:	21 °C
Relative Humidity:	47 %
ATM Pressure:	101.3kPa

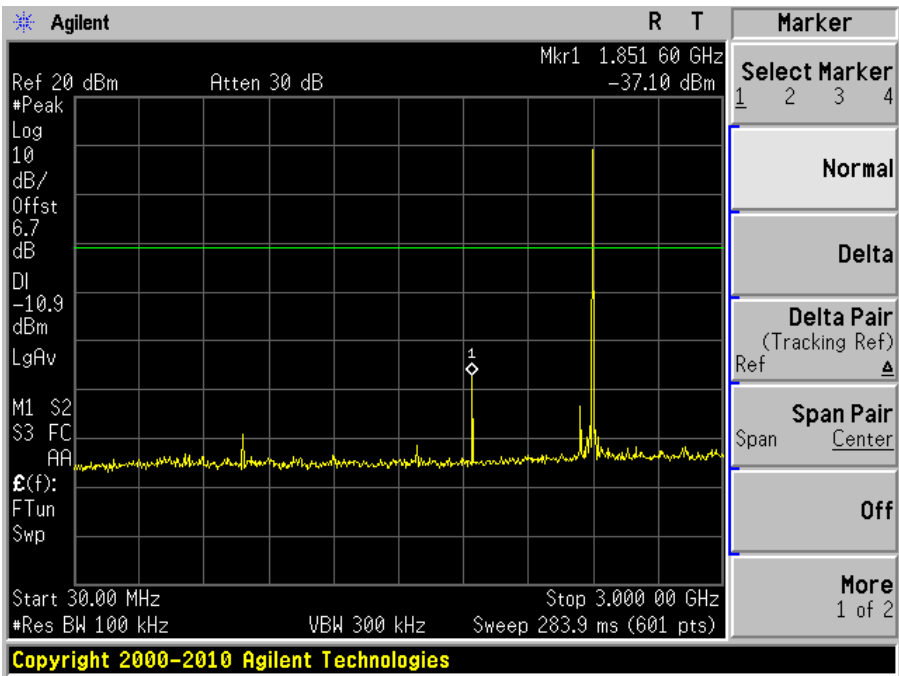
The testing was performed by Jeffrey Wu on 2013-03-15 at RF Site

6.5 Test Results

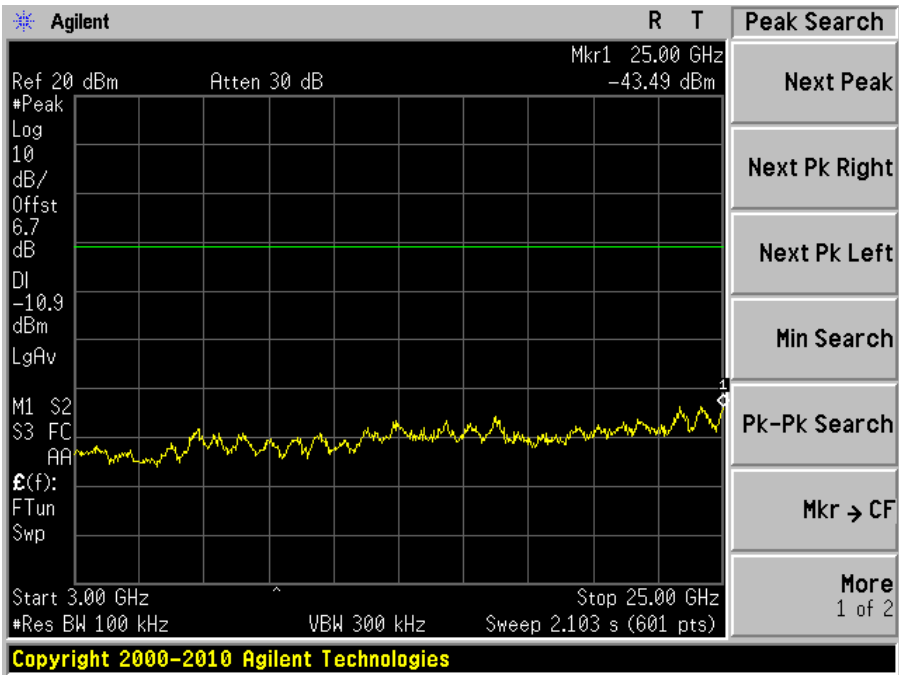
Please refer to following plots of spurious emissions.

Low Channel, 2402 MHz

Plot: 30 MHz – 3 GHz

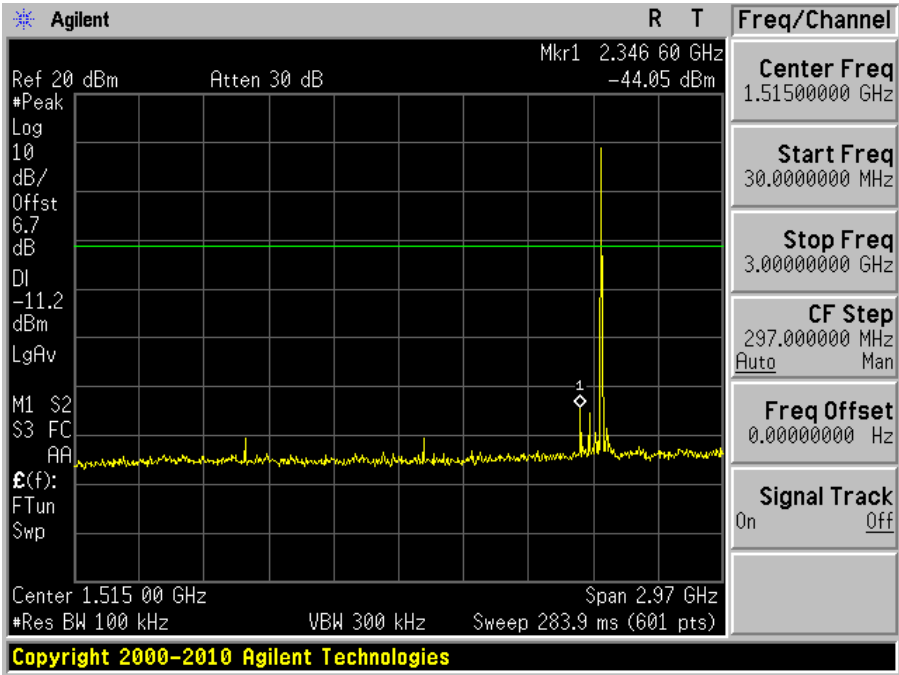


Plot: 3 GHz – 25 GHz

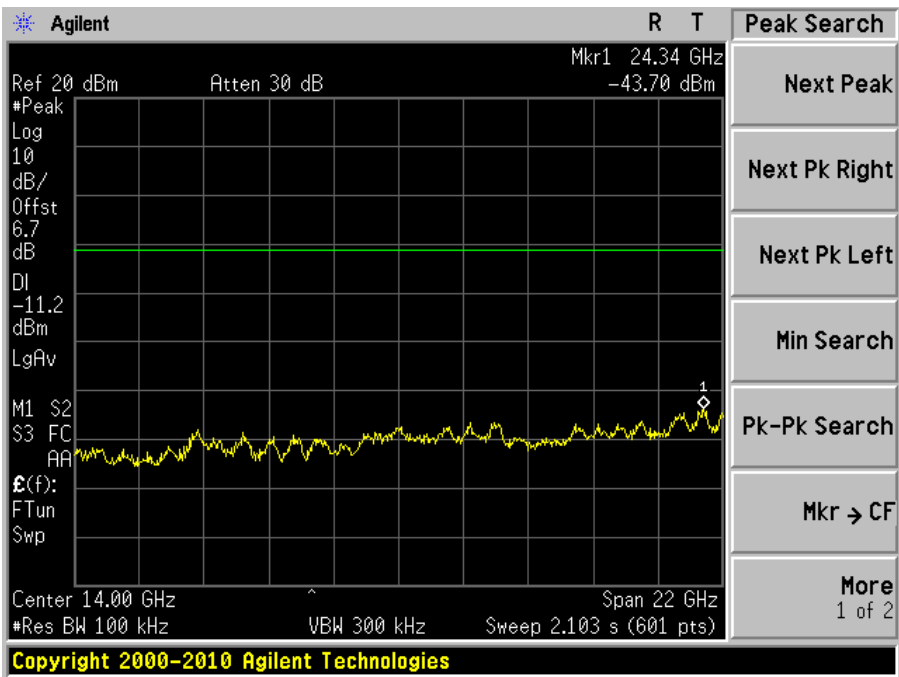


Middle Channel, 2442 MHz

Plot: 30 MHz – 3 GHz

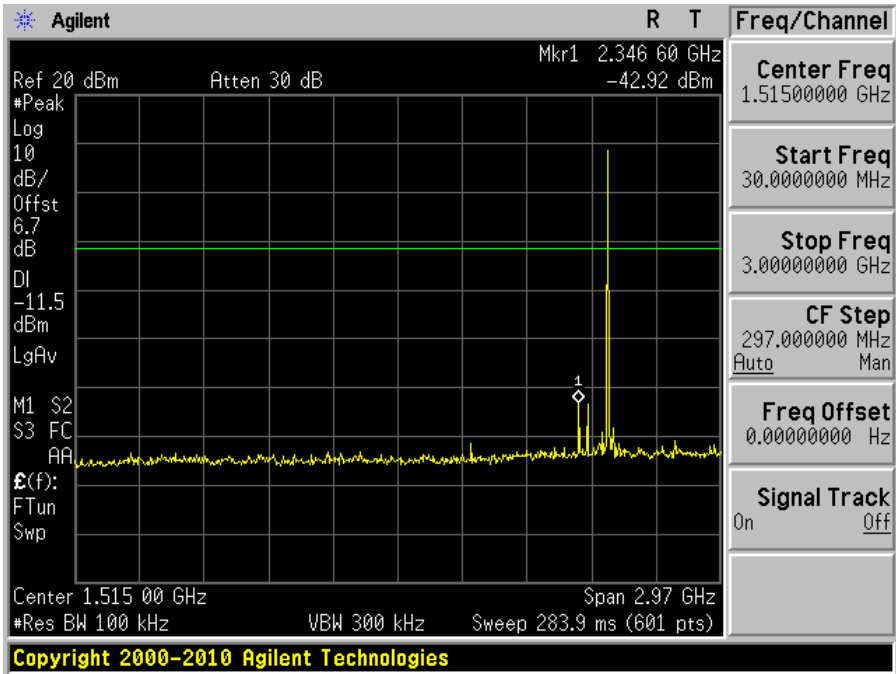


Plot: 3 GHz – 25 GHz

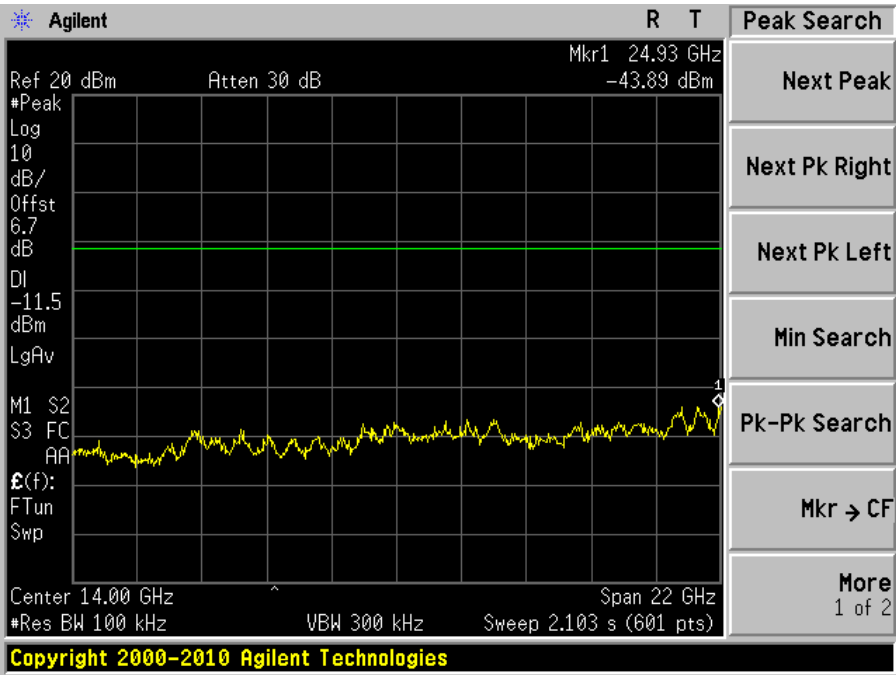


High Channel, 2480 MHz

Plot: 30 MHz – 3 GHz



Plot: 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) 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)).

7.2 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 10 centimeters.

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

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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 Year
A.H. System	Horn Antenna	SAS-200/571	261	2013-01-29	1 Year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 Year
Rohde & Schwarz	Test Receiver	ESCI 1166.5950K03	100338	2012-09-19	1 Year
Sunol Sciences	Biconi-Log Antenna	JB3	A020106-2	2012-08-15	1 Year
HP	Pre-amplifier	8447D	2944A06639	2012-06-09	1 Year
Sunol Sciences	System Controller	SC104V	113005-1	N/A	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:	21-22°C
Relative Humidity:	35-48 %
ATM Pressure:	101-102 kPa

The testing was performed by Jeffrey Wu from 2013-03-20 to 2013-03-27 at 5m3.

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)	Range
-24.15	30.97	Vertical	30 MHz-1 GHz

1-25 GHz:

Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-3.821	4960	Vertical	1GHz -25 GHz

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

7.8 Radiated Emissions Test Data and Plots

1) 30 MHz–1 GHz, Measured at 3 meters

Quasi-Peak Measurements

Low Channel, 2402 MHz

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)
30.2945	15.42	360	V	285	40	-24.58
76.596	2.65	315	V	204	40	-37.35
115.5603	8.15	247	V	39	43.5	-35.35
125.373	8.64	139	V	115	43.5	-34.86
315.6493	9.1	199	V	0	46	-36.9
591.3568	13.82	359	V	167	46	-32.18

Middle Channel, 2442 MHz

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)
30.9485	14.78	118	V	273	40	-25.22
39.07625	8.64	353	V	277	40	-31.36
107.4035	7.09	296	V	215	43.5	-36.41
119.5718	8.62	256	V	217	43.5	-34.88

High Channel, 2480 MHz

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)
30.97	15.85	117	H	270	40	-24.15
38.245	8.69	339	V	275	40	-31.31
106.63	7.21	306	V	225	43.5	-36.29
113.42	7.62	296	V	216	43.5	-35.88
115.36	7.54	257	V	214	43.5	-35.96

2) 1–25 GHz, Measured at 3 meters

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, measured at 3 meters											
2402	72.93	283	100	V	28.7	2.94	0	104.542	Fund.	-	Peak
2402	67.61	344	102	H	28.7	2.94	0	99.222	Fund.	-	Peak
2402	48.6	283	100	V	28.7	2.94	0	80.212	Fund.	-	Ave
2402	45.14	344	102	H	28.7	2.94	0	76.752	Fund.	-	Ave
2390	28.97	283	100	V	28.7	2.94	0	60.582	74	-13.418	Peak
2390	26.83	344	102	H	28.7	2.94	0	58.442	74	-15.558	Peak
2390	12.75	283	100	V	28.7	2.94	0	44.362	54	-9.638	Ave
2390	12.56	344	102	H	28.7	2.94	0	44.172	54	-9.828	Ave
4804	46.64	56	142	V	33.5	4.06	27.78	56.384	74	-17.616	Peak
4804	43.2	348	165	H	33.5	4.06	27.78	52.944	74	-21.056	Peak
4804	33.01	56	142	V	33.5	4.06	27.78	42.754	54	-11.246	Ave
4804	30.6	348	165	H	33.5	4.06	27.78	40.344	54	-13.656	Ave
7206	43.26	25	163	V	37.8	4.93	27.59	58.406	84.542	-26.136	Peak
7206	38.31	343	162	H	37.8	4.93	27.59	53.456	79.222	-25.766	Peak
7206	29.21	25	163	V	37.8	4.93	27.59	44.356	60.212	-15.856	Ave
7206	24.22	343	162	H	37.8	4.93	27.59	39.366	56.752	-17.386	Ave
9608	43.41	240	158	V	38.5	5.82	27.05	60.639	84.542	-23.903	Peak
9608	41.82	246	145	H	38.5	5.82	27.05	59.049	79.222	-20.173	Peak
9608	26.97	240	158	V	38.5	5.82	27.05	44.199	60.212	-16.013	Ave
9608	25.81	246	145	H	38.5	5.82	27.05	43.039	56.752	-13.713	Ave
Middle Channel 2442 MHz, measured at 3 meters											
2442	71.96	284	100	V	28.7	2.94	0	103.572	Fund.	-	Peak
2442	65.92	344	106	H	28.7	2.94	0	97.532	Fund.	-	Peak
2442	47.66	284	100	V	28.7	2.94	0	79.272	Fund.	-	Ave
2442	43.74	344	106	H	28.7	2.94	0	75.352	Fund.	-	Ave
4884	49.6	57	137	V	33.8	4.10	27.67	59.802	74	-14.198	Peak
4884	44.73	357	132	H	33.8	4.10	27.67	54.932	74	-19.068	Peak
4884	35.04	57	137	V	33.8	4.10	27.67	45.242	54	-8.758	Ave
4884	31.56	357	132	H	33.8	4.10	27.67	41.762	54	-12.238	Ave
7320	43.95	42	135	V	37.5	4.88	27.50	58.865	74	-15.135	Peak
7320	39.7	340	135	H	37.5	4.88	27.51	54.605	74	-19.395	Peak
7320	30.07	42	135	V	37.5	4.88	27.51	44.975	54	-9.025	Ave
7320	26.13	340	135	H	37.5	4.88	27.51	41.035	54	-12.965	Ave
9760	39.28	253	155	V	38.2	5.77	27.03	56.206	83.572	-27.366	Peak
9760	36.96	118	153	H	38.2	5.77	27.03	53.886	77.532	-23.646	Peak
9760	24.18	253	155	V	38.2	5.77	27.03	41.106	59.272	-18.166	Ave
9760	22.17	118	153	H	38.2	5.77	27.03	39.096	55.352	-16.256	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, measured at 3 meters											
2480	72.86	281	100	V	29.3	3.01	0	105.172	Fund.	-	Peak
2480	66.98	343	105	H	29.3	3.01	0	99.292	Fund.	-	Peak
2480	48.2	281	100	V	29.3	3.01	0	80.512	Fund.	-	Ave
2480	44.41	343	105	H	29.3	3.01	0	76.722	Fund.	-	Ave
2483.5	26.5	281	100	V	29.3	3.01	0	58.812	74	-15.188	Peak
2483.5	26.1	343	105	H	29.3	3.01	0	58.412	74	-15.588	Peak
2483.5	13.34	281	100	V	29.3	3.01	0	45.652	54	-8.348	Ave
2483.5	12.88	343	105	H	29.3	3.01	0	45.192	54	-8.808	Ave
4960	56.99	57	118	V	34.1	4.21	27.70	67.569	74	-6.431	Peak
4960	49.12	44	103	H	34.1	4.21	27.70	59.699	74	-14.301	Peak
4960	39.6	57	118	V	34.1	4.21	27.70	50.179	54	-3.821	Ave
4960	34.36	44	103	H	34.1	4.21	27.70	44.939	54	-9.061	Ave
7440	42.35	82	119	V	37.1	4.89	27.53	56.831	74	-17.169	Peak
7440	38.91	331	123	H	37.1	4.89	27.53	53.391	74	-20.609	Peak
7440	28.53	82	119	V	37.1	4.89	27.53	43.011	54	-10.989	Ave
7440	25.71	331	123	H	37.1	4.89	27.53	40.191	54	-13.809	Ave
9920	35.61	106	126	V	38.1	5.92	27.01	52.576	85.172	-32.596	Peak
9920	34.43	320	124	H	38.1	5.92	27.01	51.396	79.292	-27.896	Peak
9920	21.19	106	126	V	38.1	5.92	27.01	38.156	60.512	-22.356	Ave
9920	19.72	320	124	H	38.1	5.92	27.01	36.686	56.722	-20.036	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	E4446A	US44300386	2012-09-29	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:	21 °C
Relative Humidity:	47 %
ATM Pressure:	101.3kPa

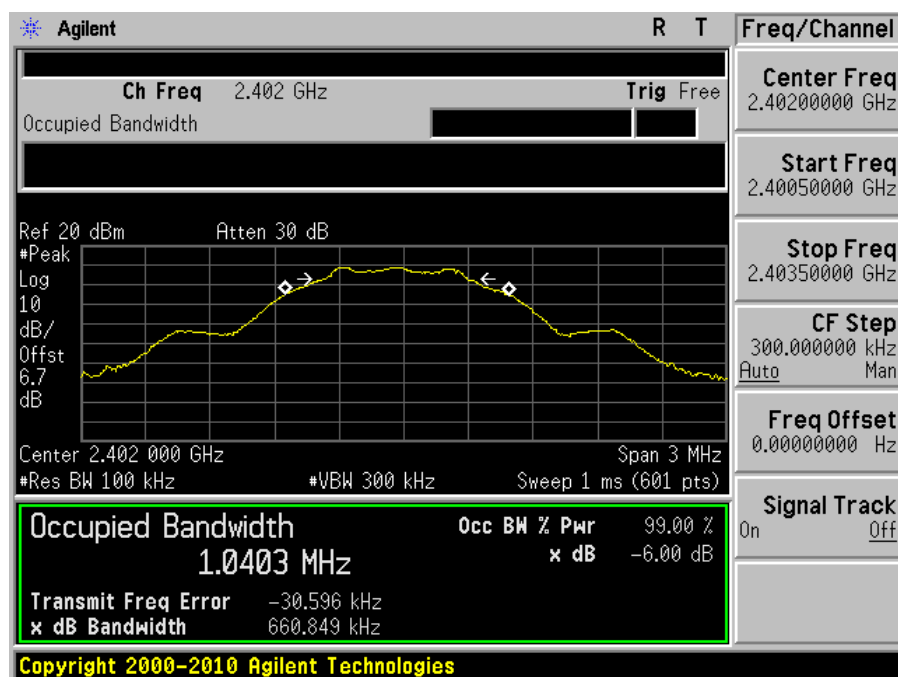
The testing was performed by Jeffrey Wu on 2013-03-15 at RF Site

8.5 Test Results

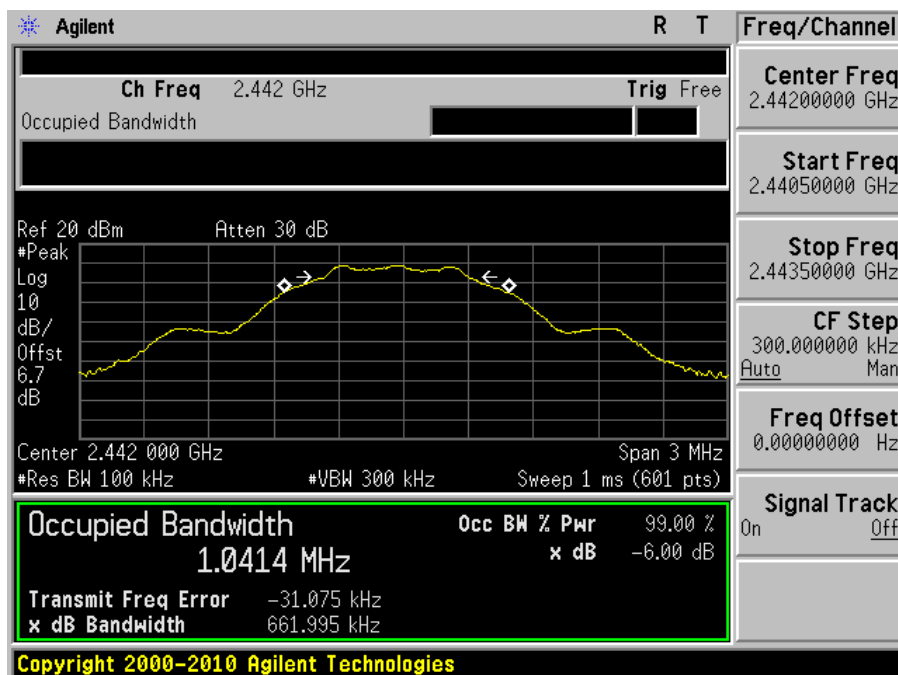
Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	99% Emission Bandwidth (kHz)	6 dB OBW Limit (kHz)	Results
Low	2402	660.849	1040.3	> 500	Pass
Middle	2442	661.995	1041.4	> 500	Pass
High	2480	671.468	1043.9	> 500	Pass

Please refer to the following plots for detailed test results

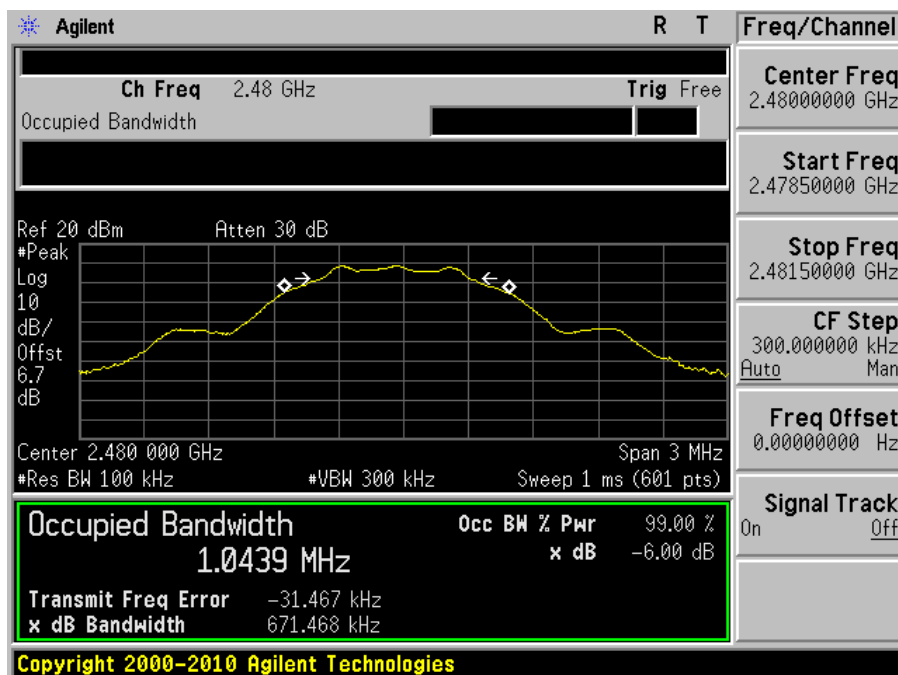
Low channel: 2402 MHz



Middle channel: 2442 MHz



High channel: 2480 MHz



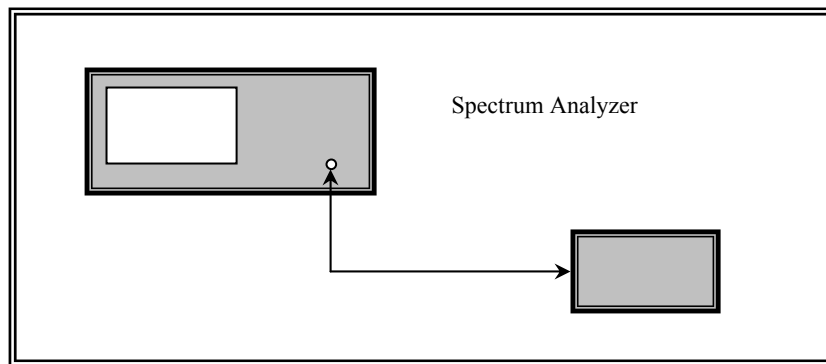
9 FCC §15.247(b) – Peak Output Power Measurement

9.1 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.

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	E4446A	US44300386	2012-09-29	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:	21 °C
Relative Humidity:	47 %
ATM Pressure:	101.3kPa

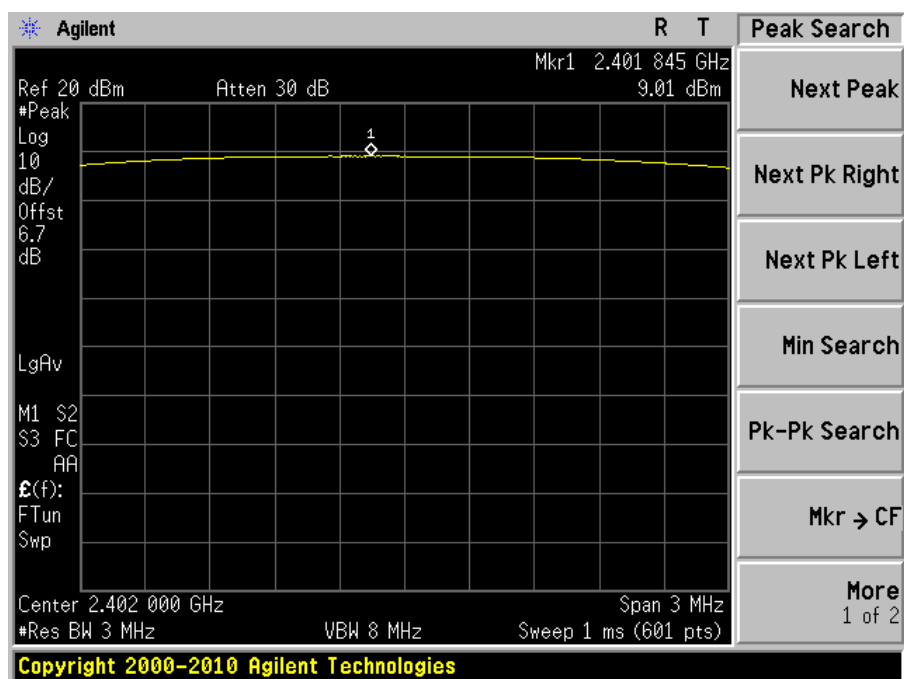
The testing was performed by Jeffrey Wu on 2013-03-15 at RF Site

9.5 Test Results

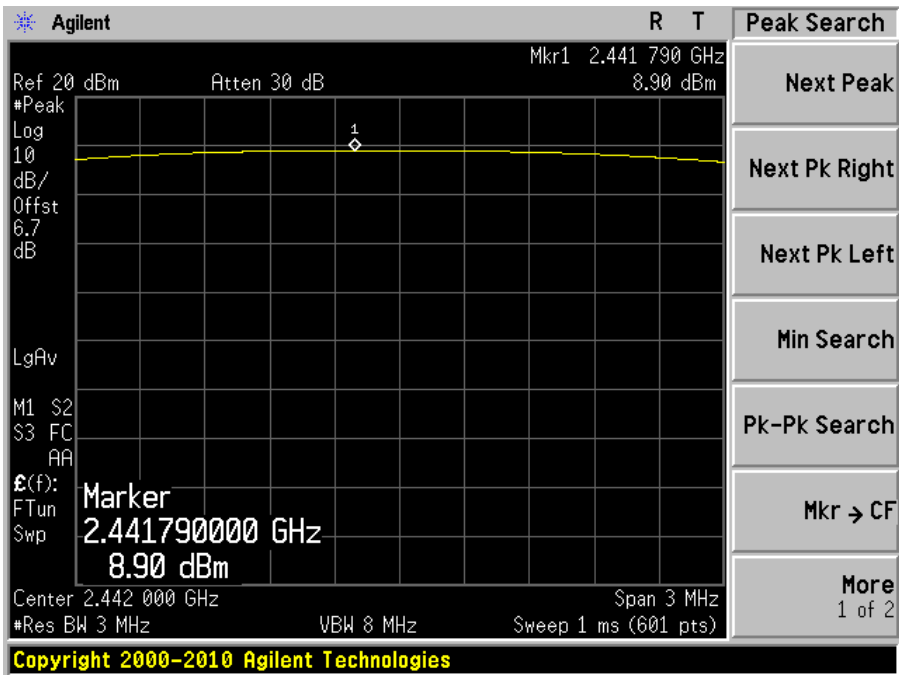
Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)	FCC Limit (dBm)	Margin (dB)
Low	2402	9.01	30	-20.99
Middle	2442	8.90	30	-21.10
High	2480	8.53	30	-21.47

Please refer to the following plots.

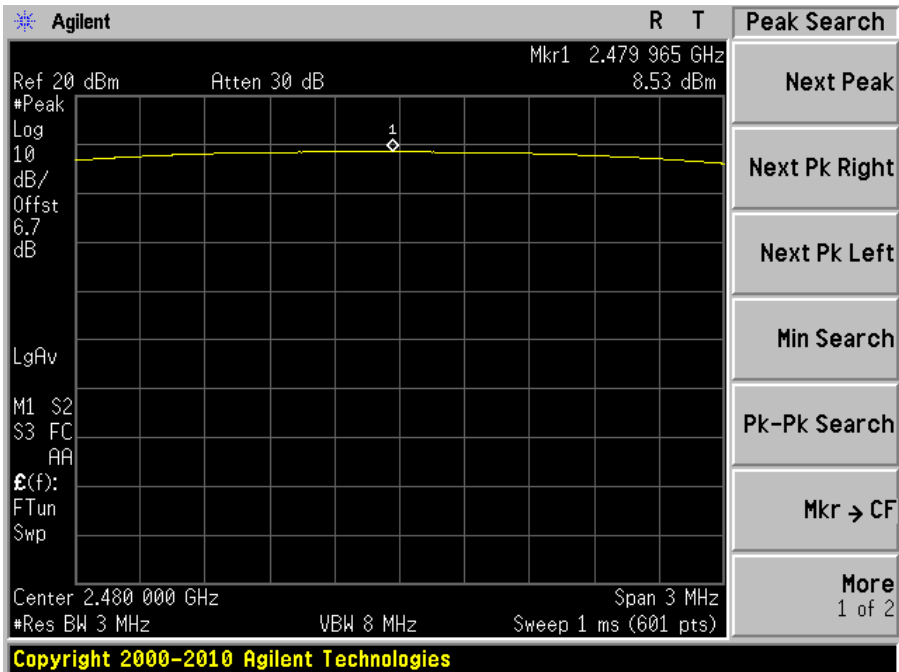
Low channel: 2402 MHz



Middle channel: 2442 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	E4446A	US44300386	2012-09-29	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

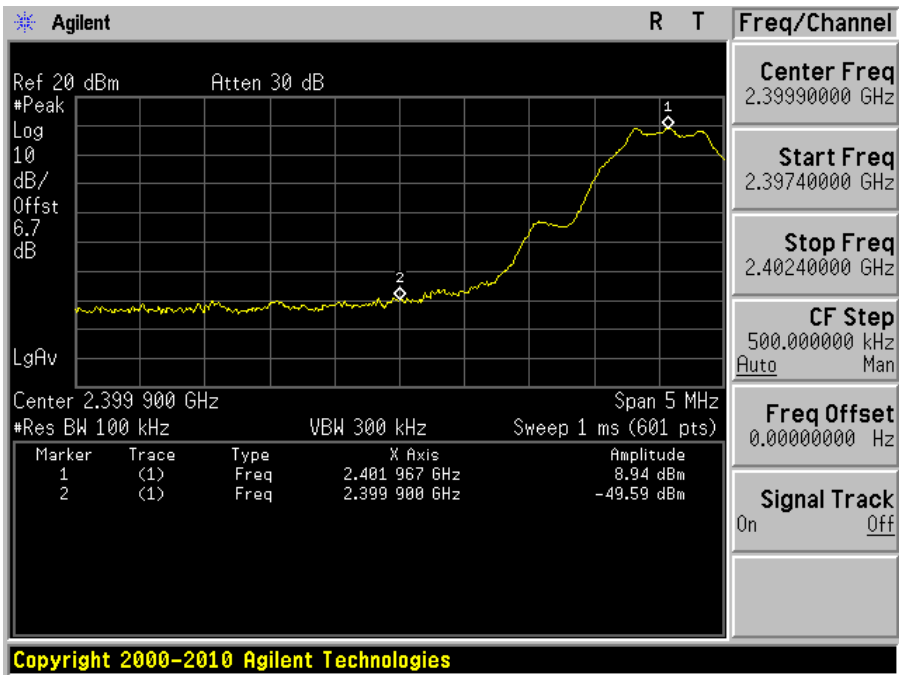
Temperature:	21 °C
Relative Humidity:	47 %
ATM Pressure:	101.3kPa

The testing was performed by Jeffrey Wu on 2013-03-15 at RF Site

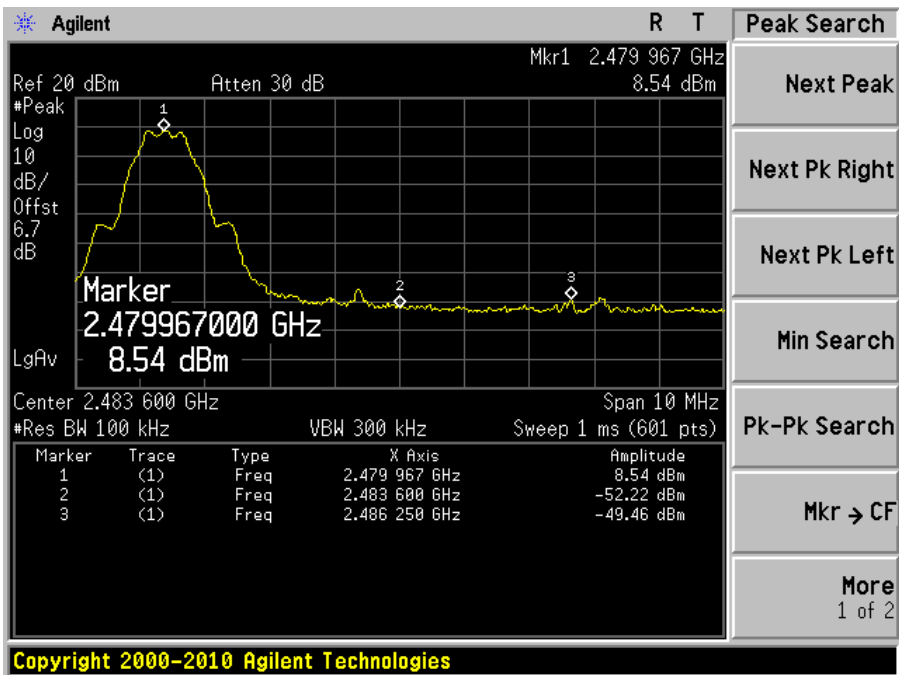
10.5 Test Results

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. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW ≥ 3 kHz.
3. Set the VBW ≥ 3 times of RBW
4. Set the span to 1.5 times the DTS channel bandwidth.
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. The resulting peak PSD level must be ≤ 8 dBm.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	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:	22 °C
Relative Humidity:	35 %
ATM Pressure:	101.3kPa

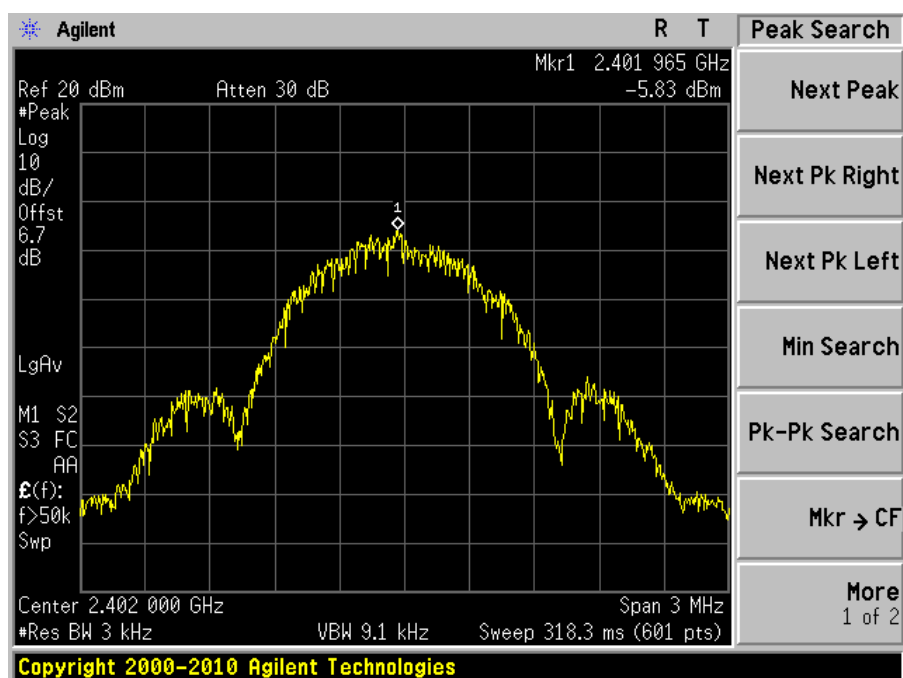
The testing was performed by Jeffrey Wu on 2013-03-21 at the RF Test Site.

11.5 Test Results

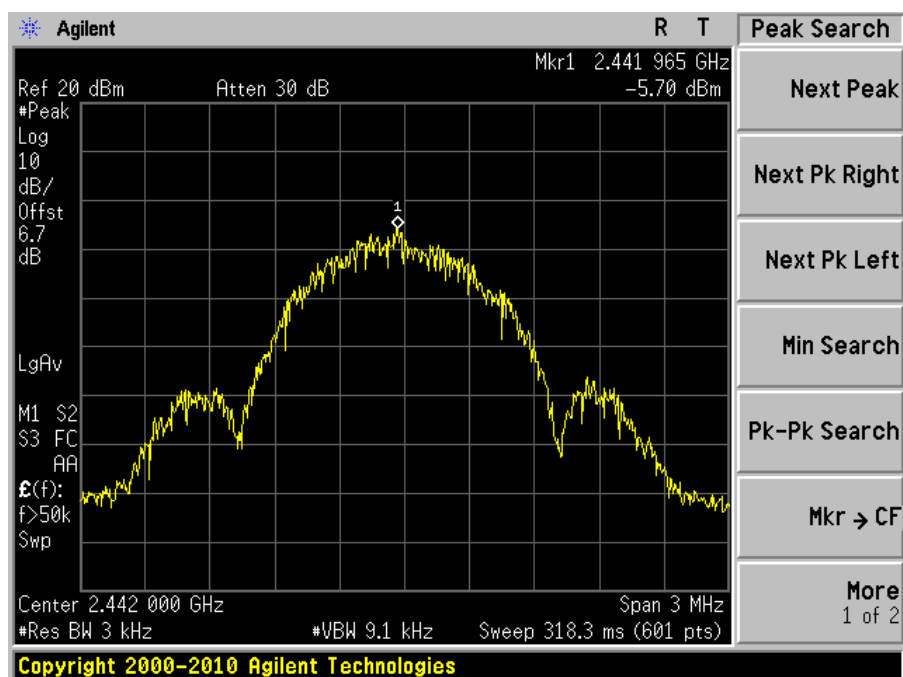
Channel	Frequency (MHz)	Power Spectral Density (dBm)	FCC Limit (dBm)	Results
Low	2402	-5.83	8	Pass
Mid	2442	-5.70	8	Pass
High	2480	-6.57	8	Pass

Please refer to the following plots for detailed test results:

Low channel: 2402 MHz



Middle channel: 2442 MHz



High channel: 2480 MHz

