



NVLAP LAB CODE 200707-0



# FCC PART 15.247


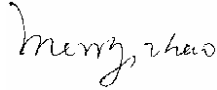
## MEASUREMENT AND TEST REPORT

For

### IOGEAR, Inc.

23 Hubble, Irvine, CA 92618, USA

**FCC ID: QLEGBU421X**  
**Model: GBU421**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Bluetooth 2.1 USB Micro Adapter
<b>Test Engineer:</b> King Tang	
<b>Report No.:</b> RSZ09042312	
<b>Report Date:</b> 2009-09-02	
<b>Reviewed By:</b> EMC Engineer	
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**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 NVLAP\*, NIST, or any agency of the Federal Government.

\* This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk "\*" (Rev.2)

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## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The IOGEAR, Inc.'s product, model number: GBU421 (FCC ID: QLEGBU421X) or the "EUT" as referred to in this report is a *Bluetooth 2.1 USB Micro Adapter*, which measures approximately: 1.2 cm L x 0.4 cm W x 1.9 cm H, rated input voltage: 5 VDC from PC.

*\* All measurement and test data in this report was gathered from production sample serial number: 0806065 (Assigned by BAEL, Shenzhen). The EUT was received on 2008-06-24.*

### Objective

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

The tests were performed in order to determine Compliant with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.247 rules.

### Related Submittal(s)/Grant(s)

No related submittal(s).

### Test Methodology

All measurements contained in this report were conducted 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.

All emissions measurement was performed and Bay Area Compliant Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## Test Facility

The Test site used by Bay Area Compliant Laboratories Corp. (Shenzhen) to collect test data is located in the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliant Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in Compliant with the requirements of Section 2.948 of the FCC Rules on November 21, 2007. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0).



The current scope of accreditations can be found at <http://ts.nist.gov/Standards/scopes/2007070.htm>

## SYSTEM TEST CONFIGURATION

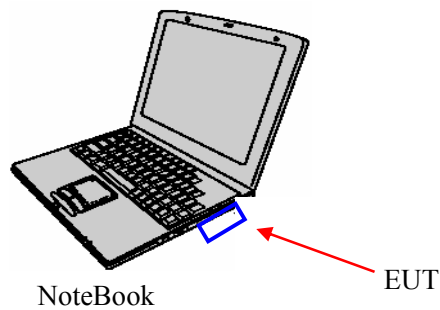
### Description of Test Configuration

The system was configured for testing in a typical fashion (as normally used by a typical user).

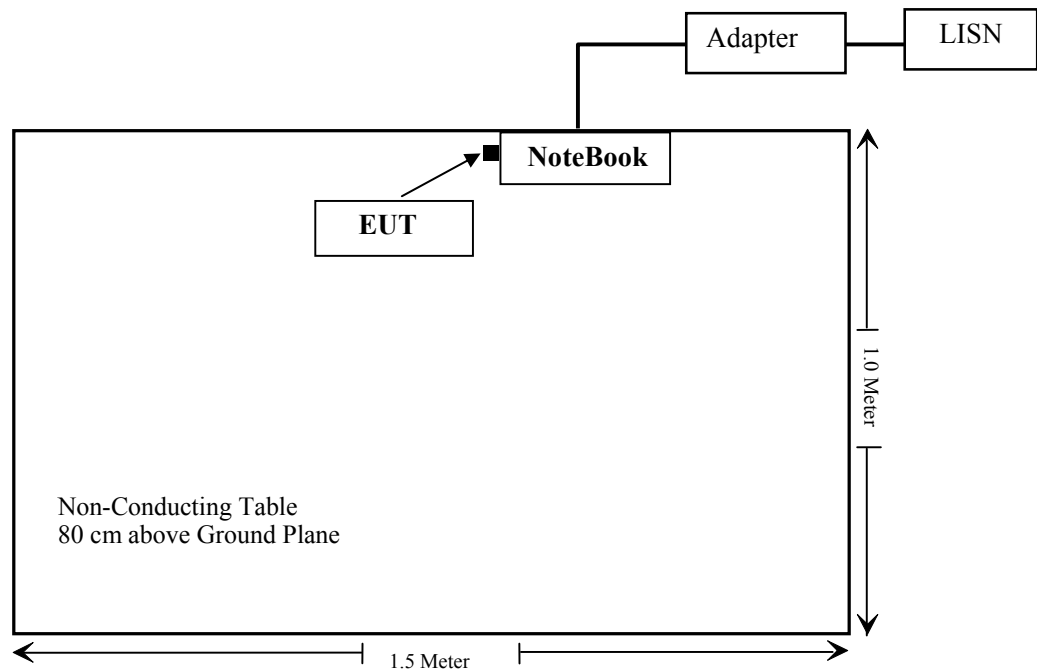
### Equipment Modifications

No modifications were made to the unit tested.

### Configuration of Test Setup



### Block Diagram of Test Setup



## **SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
§15.247 (i) & §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Radiated Emissions	Compliant*
§15.247 (a)(1)	20 dB Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant
§15.247(a)(1)(iii)	Time of occupancy (Dwell Time)	Compliant
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
§15.247(b)(1)	Peak Output Power Measurement	Compliant
§15.247(d)	Band edges	Compliant

*\*Within Measurement Uncertainty*

## **FCC §15.247 (i) & §2.1093 - RF EXPOSURE**

### **Standard Applicable**

According to §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

#### Limits for General Population/Uncontrolled Exposure

According to FCC Exclusion list, In the following table,  $f_{\text{GHz}}$  is mid-band frequency in GHz, and  $d$  is the distance to a person's body, excluding hands, wrists, feet, and ankles.

Exposure category	<u>low threshold</u>	<u>high threshold</u>
general population	$(60/f_{\text{GHz}})$ mW, $d < 2.5$ cm $(120/f_{\text{GHz}})$ mW, $d \geq 2.5$ cm	$(900/f_{\text{GHz}})$ mW, $d < 20$ cm
occupational	$(375/f_{\text{GHz}})$ mW, $d < 2.5$ cm $(900/f_{\text{GHz}})$ mW, $d \geq 2.5$ cm	$(2250/f_{\text{GHz}})$ mW, $d < 20$ cm

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evaluation is not required, portable transmitters with output power greater than the applicable low threshold require SAR evaluation to qualify for TCB approval.

### **Measurement Result:**

This is a portable device and the Max peak output power is  $0.678 \text{ mW} < 24.58 \text{ mW} = (60/2.441 \text{ GHz}) \text{ mW}$   
The SAR measurement is exempt.



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**FCC §15.203 - ANTENNA REQUIREMENT**

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**Standard Applicable**

According to CFR47 § 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.

**Antenna Connector Construction**

The EUT has a printed antenna on PCB. The maximum gain is -2 dBi; please refer to the internal photos.

**Result:** Compliant.

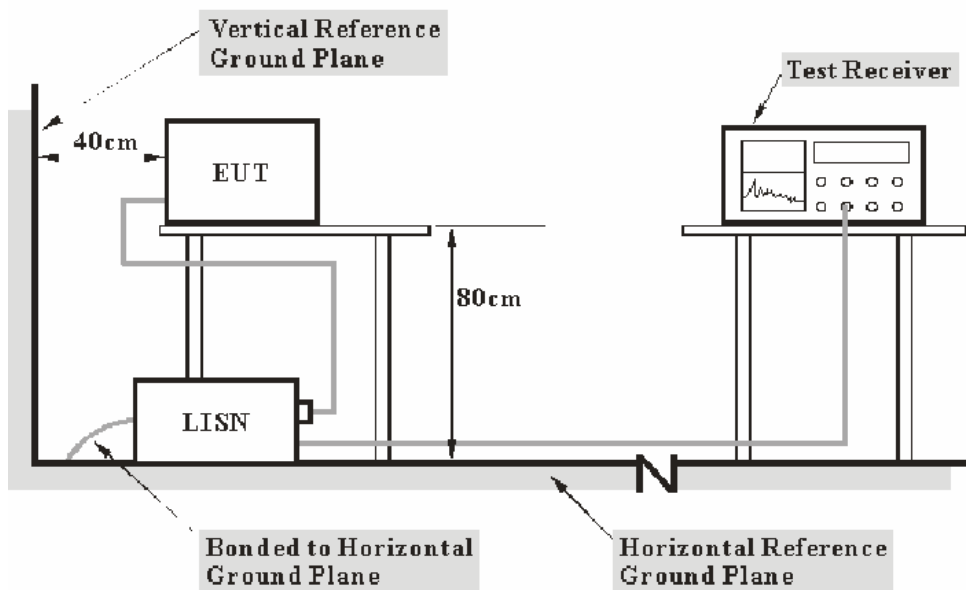
## FCC §15.207 (a) - CONDUCTED EMISSIONS

### Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at Bay Area Compliant Laboratories Corp. (Shenzhen) is  $\pm 2.4$  dB.

### EUT Setup



- Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 VAC/60 Hz power source.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

<i>Frequency Range</i>	<i>IF B/W</i>
150 kHz – 30 MHz	9 kHz

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	DE25330	2008-04-28	2009-04-28
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2008-04-28	2009-04-28

\* **Statement of Traceability:** Bay Area Compliant Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

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

All data was recorded in the Quasi-peak and average detection mode.

### Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, with the worst margin reading of:

**15.23 dB at 0.155 MHz** in the **Neutral** conductor mode

**Test Data****Environmental Conditions**

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.0 kPa

*The testing was performed by King Tang on 2008-07-03*

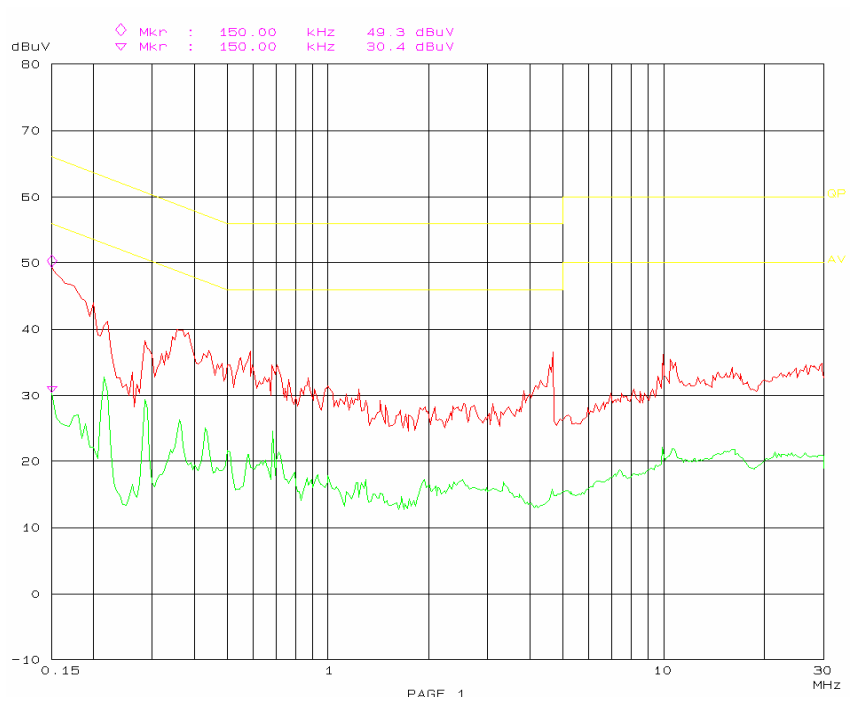
*Test Mode: Transmitting*

Line Conducted Emissions				FCC Part 15.207	
Frequency (MHz)	Amplitude (dBμV)	Detector (QP/AV)	Conductor (Line/Neutral)	Limit (dBμV)	Margin (dB)
0.155	50.50	QP	Neutral	65.73	15.23
0.395	41.40	QP	Neutral	57.96	16.56
0.150	49.30	QP	Line	66.00	16.70
0.155	38.70	AV	Neutral	55.73	17.03
0.200	45.10	QP	Neutral	63.61	18.51
0.360	40.00	QP	Line	58.73	18.73
0.395	29.10	AV	Neutral	47.96	18.86
0.345	40.00	QP	Neutral	59.08	19.08
4.665	36.50	QP	Line	56.00	19.50
0.240	41.30	QP	Neutral	62.10	20.80
0.285	29.40	AV	Line	50.67	21.27
0.240	30.50	AV	Neutral	52.10	21.60
0.220	41.20	QP	Line	62.82	21.62
0.360	26.40	AV	Line	48.73	22.33
0.285	38.30	QP	Line	60.67	22.37
0.220	30.40	AV	Line	52.82	22.42
8.850	37.40	QP	Neutral	60.00	22.60
9.960	36.10	QP	Line	60.00	23.90
0.150	30.40	AV	Line	56.00	25.60
0.345	22.50	AV	Neutral	49.08	26.58
9.905	22.20	AV	Line	50.00	27.80
4.655	15.90	AV	Line	46.00	30.10
0.200	21.60	AV	Neutral	53.61	32.01
8.835	17.50	AV	Neutral	50.00	32.50

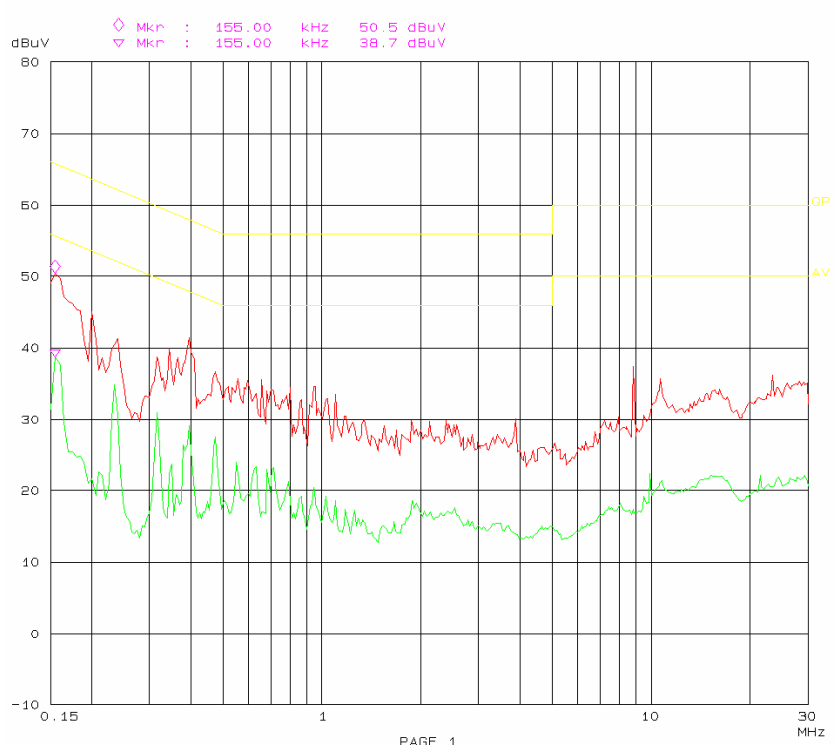
**Plot(s) of Test Data**

Plot(s) of Test Data is presented hereinafter as reference.

**Line:**



**Neutral:**



## FCC §15.205, §15.209 & §15.247 - RADIATED EMISSIONS

### Applicable Standard

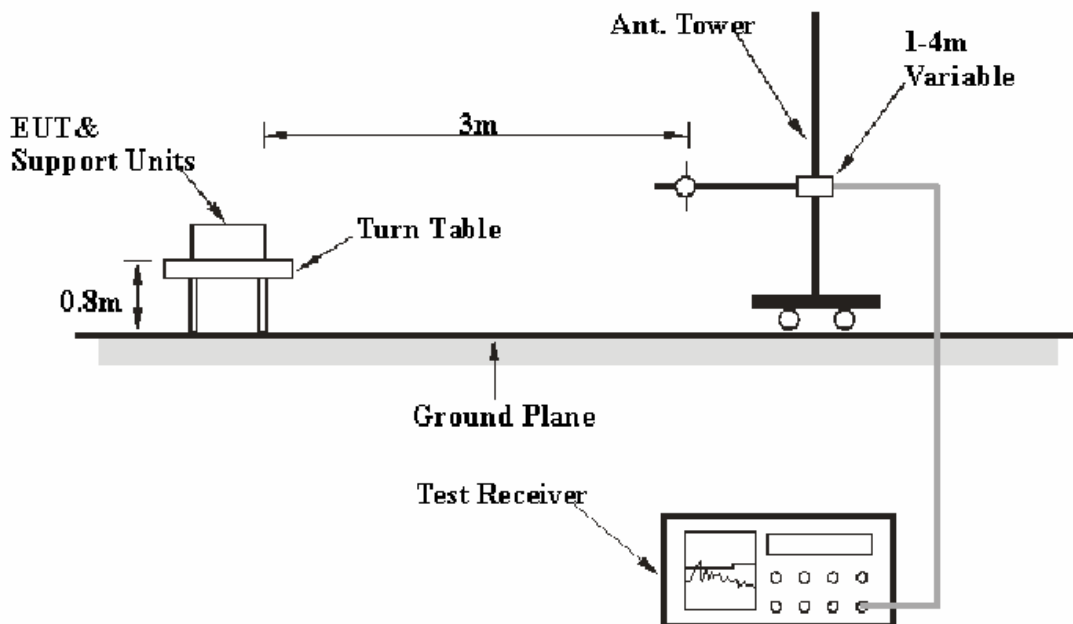
CFR47 §15.205; §15.209; §15.247 (d).

### Measurement Uncertainty

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

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Bay Area Compliant Laboratories Corp. (Shenzhen) is  $\pm 4.0$  dB.

### EUT Setup



The radiated emission tests were performed in the 3 meters chamber B test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.109, FCC 15.209 and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
30 MHz – 1000 MHz	100 kHz	300 kHz
1000 MHz – 25 GHz	1 MHz	3 MHz

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447D	2944A09795	2007-11-15	2008-11-15
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2008-03-11	2009-03-11
HP	Amplifier	8449B	3008A00277	2007-09-29	2008-09-29
Sunol Sciences	Horn Antenna	DRH-118	A052604	2007-09-25	2008-09-25
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2008-05-09	2009-05-09

\* **Statement of Traceability:** Bay Area Compliant Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Test Procedure

For the radiated emissions test, the adapter 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.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1GHz and peak and Average detection modes for frequencies above 1GHz.

## Corrected Amplitude & Margin Calculation

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

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of Compliant with the applicable limit. For example, a margin of 7 dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

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

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.109, 15.205, 15.209, and 15.247, with the worst margin reading of:

### Transmitting mode (Below 1 GHz):

**2.4 dB** at **799.997475 MHz** in the **Horizontal** polarization

### Transmitting mode (Above 1 GHz):

**5.79 dB** at **4804 MHz** in the **Vertical** polarization (**Low Channel**)  
**6.20 dB** at **4882 MHz** in the **Vertical** polarization (**Middle Channel**)  
**7.03 dB** at **4960 MHz** in the **Vertical** polarization (**High Channel**)

## Test Data

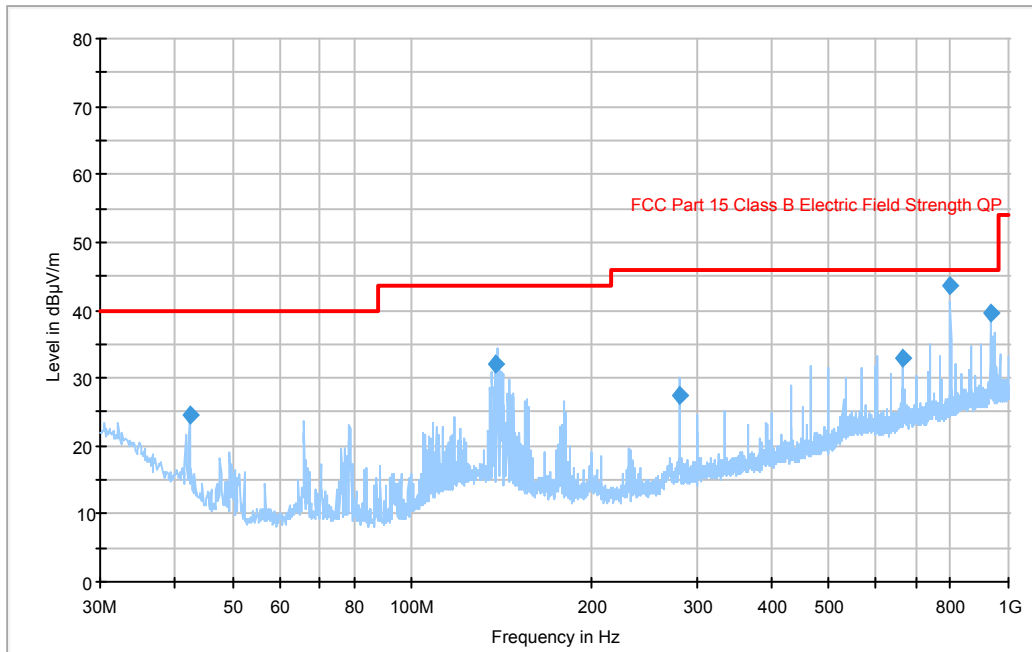
### Environmental Conditions

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.0 kPa

*The testing was performed by King Tang on 2008-07-04.*



Test Mode: Transmitting (Below 1GHz) for GFSK Mode



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
799.997475	43.6	102.0	H	183.0	-0.3	46.0	2.4*
933.352000	39.6	101.0	V	0.0	1.7	46.0	6.4
138.082200	32.1	130.0	V	3.0	-10.8	43.5	11.4
666.653450	33.0	163.0	V	339.0	-2.3	46.0	13.0
42.367500	24.5	239.0	V	0.0	-11.0	40.0	15.5
280.866250	27.3	349.0	V	355.0	-10.9	46.0	18.7

\*Within Measurement Uncertainty

Test Mode: Transmitting (Above 1 GHz) for GFSK Mode

Freq. (MHz)	Meter Reading (dBμV)	Detector PK/QP/AV	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Corr. Amp. (dBuV/m)	FCC Part 15.247/209		
				Height (m)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)	Remarks
Frequency in Low Channel												
4804	45.67	AV	320	1.2	V	31.3	4.64	33.4	48.21	54	5.79	harmonic
4804	44.18	AV	60	1.4	H	31.3	4.64	33.4	46.72	54	7.28	harmonic
1924	41.73	AV	120	1.4	V	27.4	3.12	34.2	38.05	54	15.95	spurious
1924	40.37	AV	180	1.4	H	27.4	3.12	34.2	36.69	54	17.31	spurious
4804	54.01	PK	90	1.1	V	31.3	4.64	33.4	56.55	74	17.45	harmonic
4804	53.12	PK	120	1.3	H	31.3	4.64	33.4	55.66	74	18.34	harmonic
1924	50.19	PK	360	1.3	V	27.4	3.12	34.2	46.51	74	27.49	spurious
1924	48.26	PK	45	1.3	H	27.4	3.12	34.2	44.58	74	29.42	spurious
Frequency in Middle Channel												
4882	45.26	AV	360	1.1	V	31.3	4.64	33.4	47.80	54	6.20	harmonic
4882	42.58	AV	120	1.2	H	31.3	4.64	33.4	45.12	54	8.88	harmonic
1447	43.18	AV	160	1.3	V	25.4	2.73	34.5	36.81	54	17.19	spurious
4882	54.17	PK	200	1.3	V	31.3	4.64	33.4	56.71	74	17.29	harmonic
1447	41.03	AV	45	1.4	H	25.4	2.73	34.5	34.66	54	19.34	spurious
4882	51.26	PK	0	1.4	H	31.3	4.64	33.4	53.80	74	20.20	harmonic
1447	52.32	PK	320	1.2	V	25.4	2.73	34.5	45.95	74	28.05	spurious
1447	49.22	PK	90	1.5	H	25.4	2.73	34.5	42.85	74	31.15	spurious
Frequency in High Channel												
4960	44.52	AV	45	1.5	V	31.3	4.55	33.4	46.97	54	7.03	harmonic
2305	46.73	AV	160	1.3	V	27.4	3.52	33.9	43.75	54	10.25	spurious
4960	40.25	AV	0	1.4	H	31.3	4.55	33.4	42.70	54	11.30	harmonic
2305	42.18	AV	180	1.3	H	27.4	3.52	33.9	39.20	54	14.80	spurious
4960	51.96	PK	160	1.4	V	31.3	4.55	33.4	54.41	74	19.59	harmonic
2305	54.18	PK	360	1.2	V	27.4	3.52	33.9	51.20	74	22.80	spurious
4960	48.26	PK	90	1.2	H	31.3	4.55	33.4	50.71	74	23.29	harmonic
2305	50.26	PK	200	1.4	H	27.4	3.52	33.9	47.28	74	26.72	spurious

## FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

### Applicable Standard

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16

\* **Statement of Traceability:** Bay Area Compliant Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 100 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another truce
3. Measure the channel separation.

### Test Data

#### Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56 %
ATM Pressure:	100.8 kPa

*The testing was performed by King Tang on 2008-07-03.*

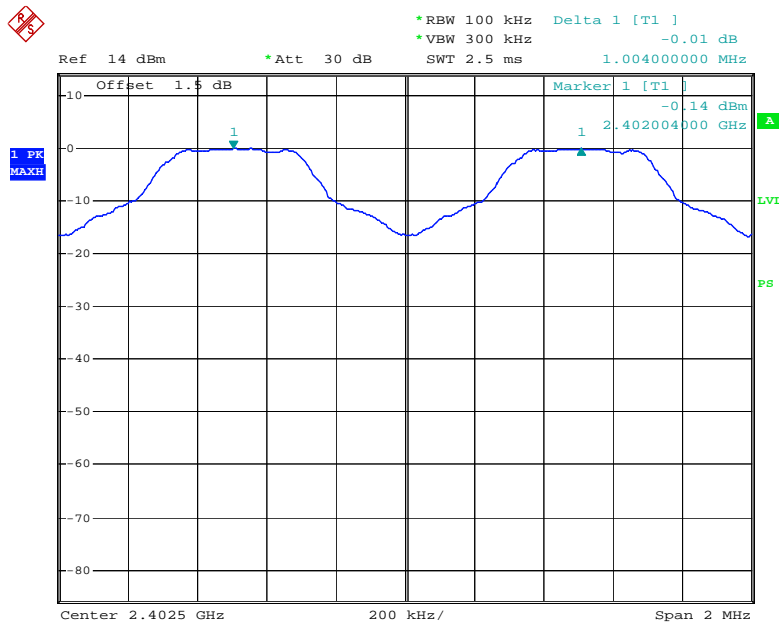
Test Mode: Transmitting

Channel	Channel Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low Channel	2402	1.004	0.592	Pass
Adjacent Channel	2403			
Mid Channel	2441	1.008	0.597	Pass
Adjacent Channel	2442			
High Channel	2480	1.012	0.595	Pass
Adjacent Channel	2479			

**Test Result:** Compliant.

Please refer to following plots

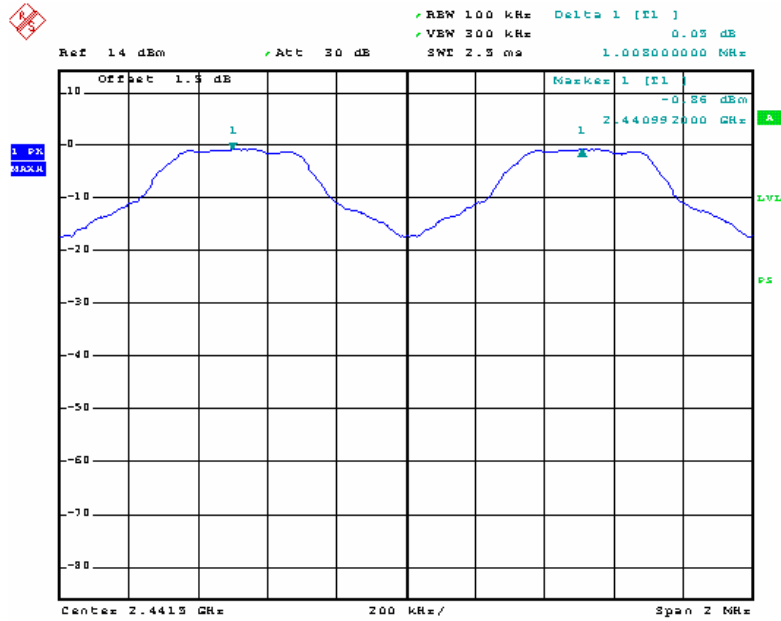
**Low Channel**



channel separation low channel

Date: 3.JUL.2008 19:18:52

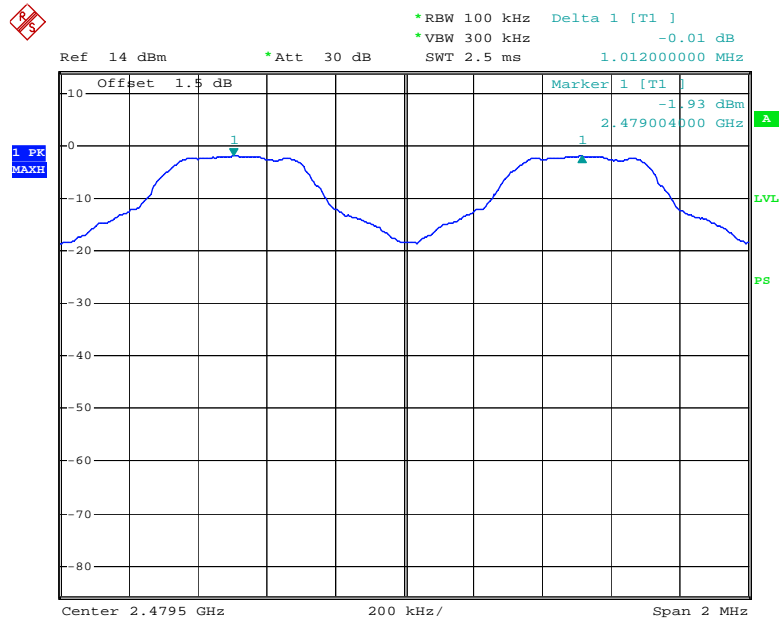
### Middle Channel



channel separation middle channel

Date: 3.JUL.2008 19:27:59

### High Channel



channel separation high channel

Date: 3.JUL.2008 19:29:31

## FCC §15.247(a) (1) – 20dB BANDWIDTH TESTING

### Applicable Standard

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16

\* **Statement of Traceability:** Bay Area Compliant Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Test 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 emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### Test Data

#### Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.8 kPa

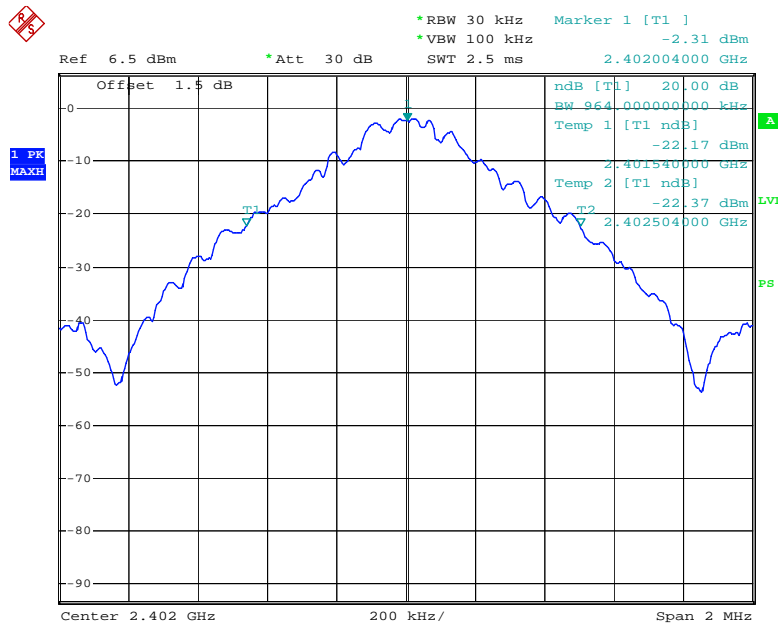
*The testing was performed by King Tang on 2008-07-03.*

Test Mode: Transmitting

Channel	Channel Frequency (MHz)	20 dB Occupied Bandwidth (kHz)
Low	2402	964
Middle	2441	960
High	2480	960

Test Result: Please refer to following plots

### Low Channel



20DB bandwidth low channel  
 Date: 3.JUL.2008 19:12:05





## **FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST**

### **Applicable Standard**

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### **Test Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16

\* **Statement of Traceability:** Bay Area Compliant Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### **Test Procedure**

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in transmitting mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.8 kPa

*The testing was performed by King Tang on 2008-07-03.*

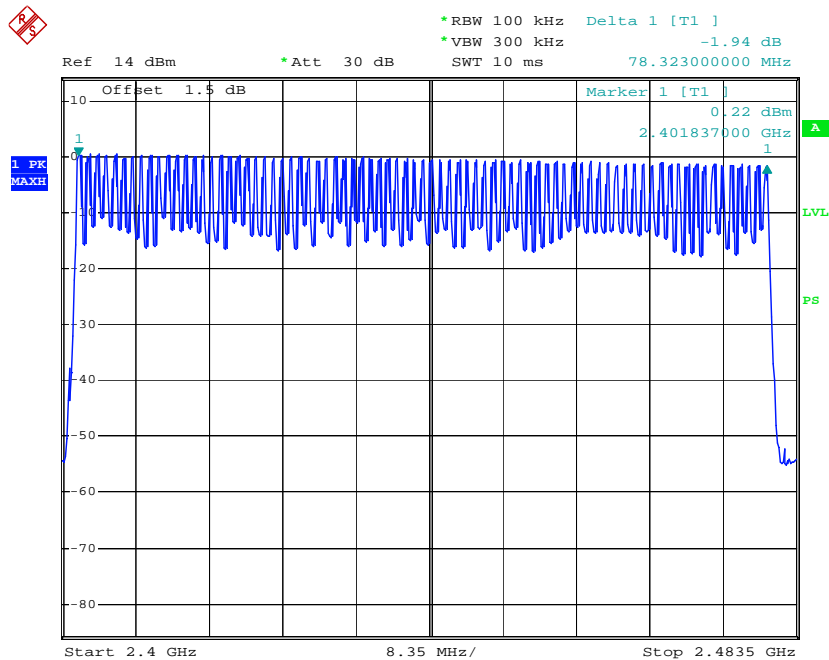
*Test Mode: Transmitting*

**Test Result:** Compliant.

Please refer to following plot

Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
2402-2480	79	> 15

**Number of Hopping Channels**



hopping channel

Date: 3.JUL.2008 20:06:24

## **FCC §15.247(a) (1) (iii) -TIME OF OCCUPANCY (DWELL TIME)**

### **Applicable Standard**

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### **Test Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16

\* **Statement of Traceability:** Bay Area Compliant Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### **Test Procedure**

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 X channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Dwell Time= time slot length \* hope rate/ number of hopping channels \* 31.6s  
Hop rate=1600/s

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.8 kPa

*The testing was performed by King Tang on 2008-07-03.*

**Test Result:** Compliant.

Please refer to following tables and plots

*Test Mode: Transmitting*

**DH 1:** Dwell time=Pulse width (ms)  $\times$  (1600  $\div$  2  $\div$  79)  $\times$  31.6 Second

Channel	Pulse width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Result
Low	0.495	0.1584	0.4	Pass
Middle	0.495	0.1584	0.4	Pass
High	0.495	0.1584	0.4	Pass

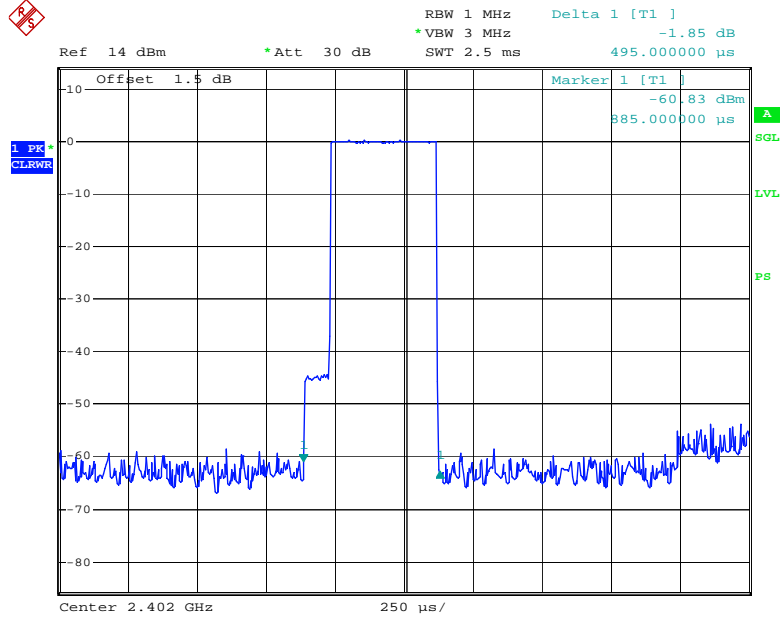
**DH 3:** Dwell time=Pulse width (ms)  $\times$  (1600  $\div$  4  $\div$  79)  $\times$  31.6 Second

Channel	Pulse width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Result
Low	1.792	0.287	0.4	Pass
Middle	1.776	0.284	0.4	Pass
High	1.776	0.284	0.4	Pass

**DH 5:** Dwell time=Pulse width (ms)  $\times$  (1600  $\div$  6  $\div$  79)  $\times$  31.6 Second

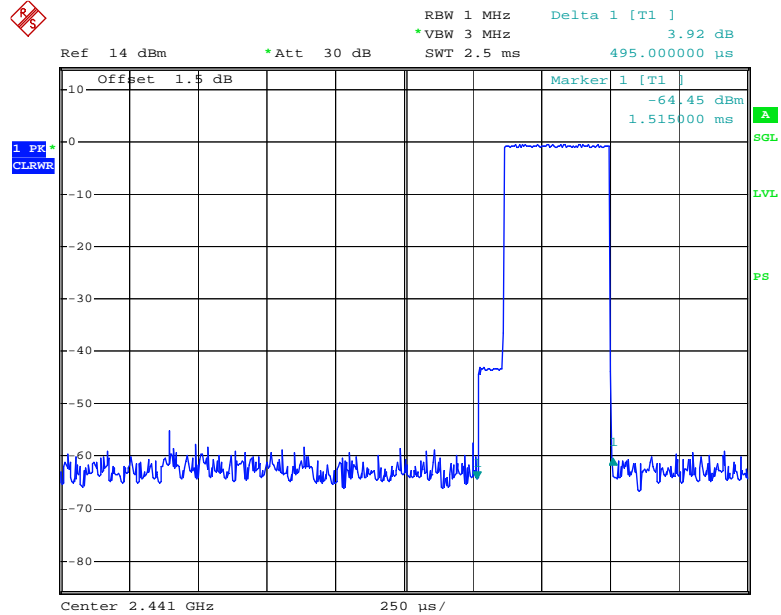
Channel	Pulse width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Result
Low	3.04	0.324	0.4	Pass
Middle	3.04	0.324	0.4	Pass
High	3.04	0.324	0.4	Pass

### Low Channel for DH1



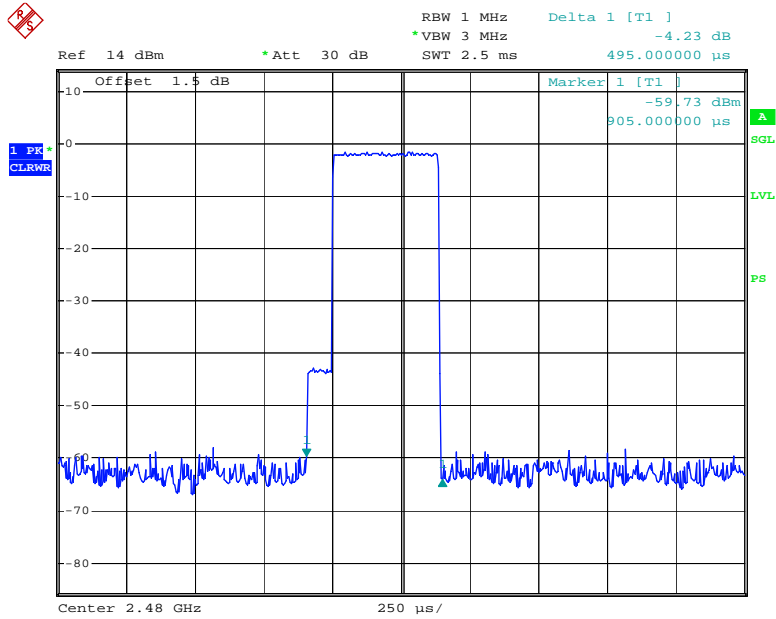
dell time low channel (DH1)  
Date: 3.JUL.2008 20:11:04

### Middle Channel for DH1



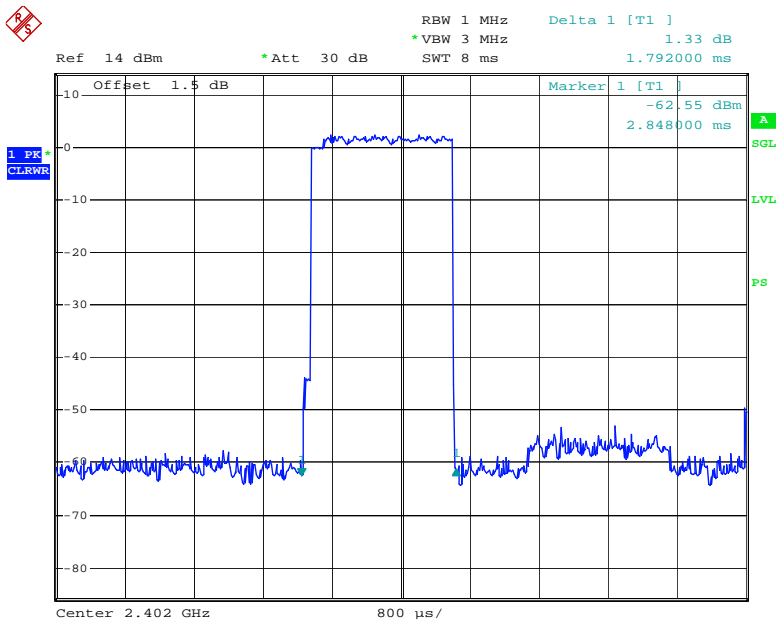
dell time middle channel (DH1)  
Date: 3.JUL.2008 20:12:55

### High Channel for DH1



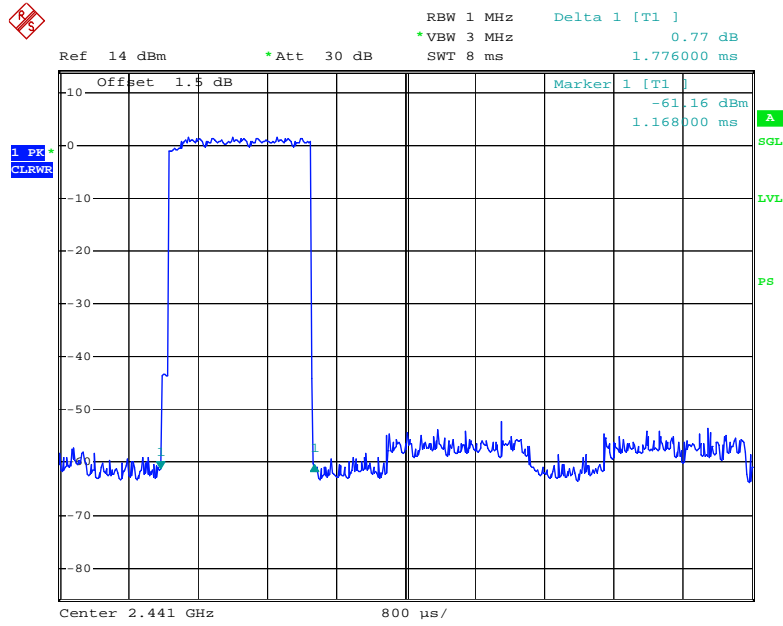
dell time high channel (DH1)  
Date: 3.JUL.2008 20:15:06

### Low Channel for DH3



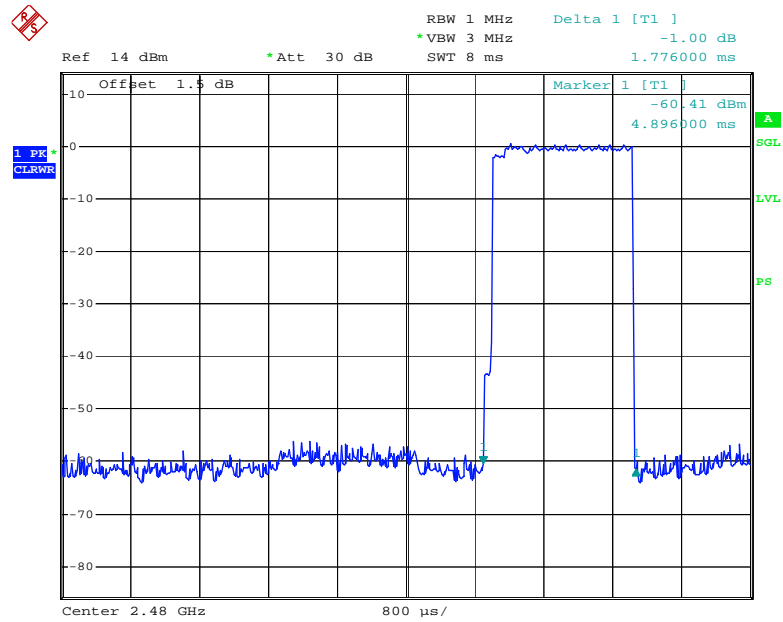
dell time low channel (DH3)  
Date: 3.JUL.2008 20:17:51

### Middle Channel for DH3



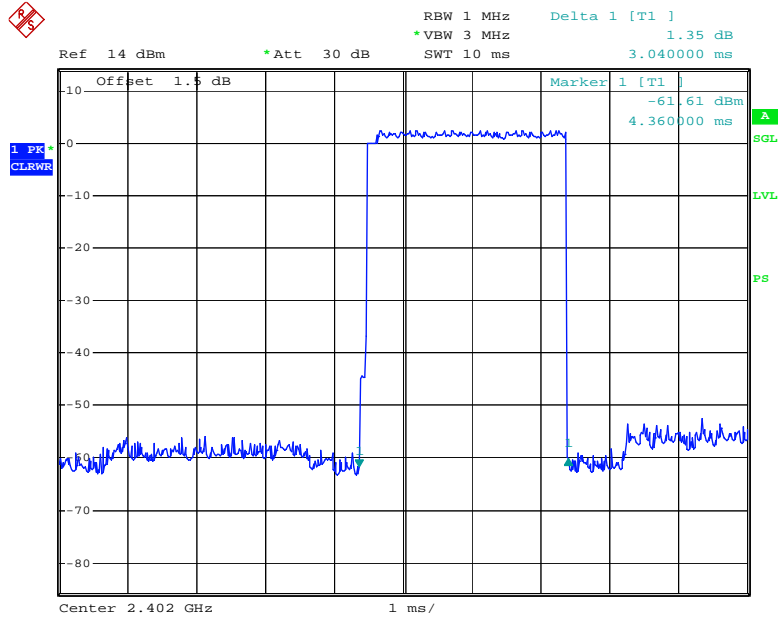
dell time middle channel (DH3)  
Date: 3.JUL.2008 20:20:46

### High Channel for DH3



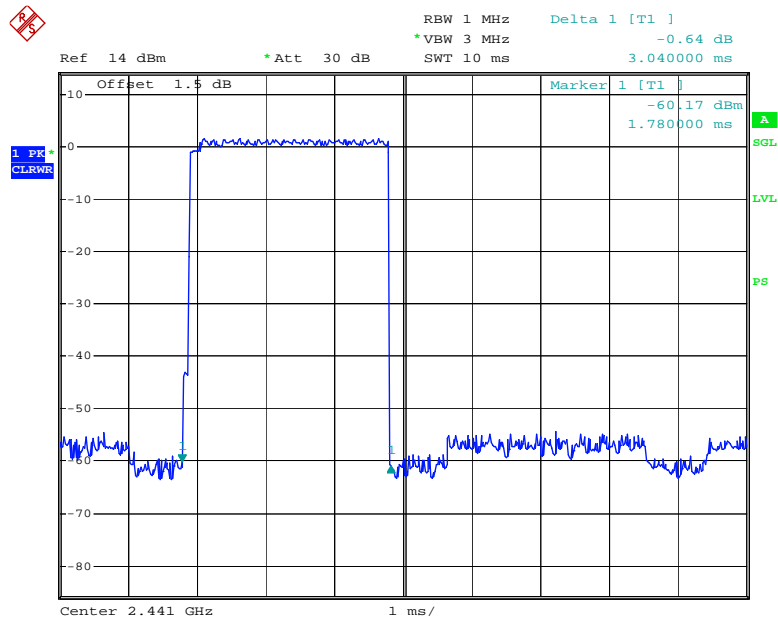
dell time high channel (DH3)  
Date: 3.JUL.2008 20:22:08

### Low Channel for DH5



dell time low channel (DH5)  
Date: 3.JUL.2008 20:24:07

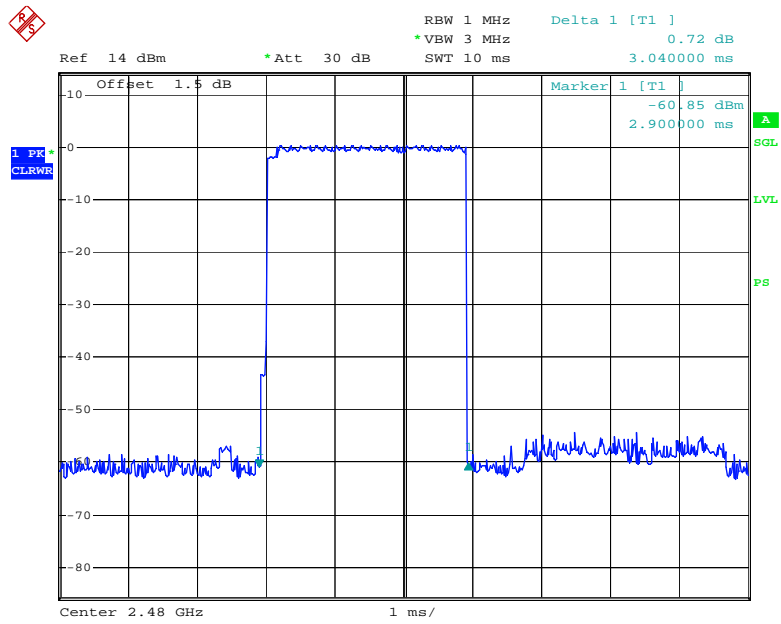
### Middle Channel for DH5



dell time middle channel (DH5)  
Date: 3.JUL.2008 20:25:04



### High Channel for DH5



dell time high channel (DH5)

Date: 3.JUL.2008 20:26:05

## **FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT**

### **Applicable Standard**

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

### **Test Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
HP	Amplifier	HP8447D	2944A09795	2007-11-15	2008-11-15
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16
HP	Amplifier	8449B	3008A00277	2007-09-29	2008-09-29
Sunol Sciences	Horn Antenna	DRH-118	A052604	2007-09-25	2008-09-25
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2008-05-09	2009-05-09

\* **Statement of Traceability:** Bay Area Compliant Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### **Test Procedure**

For the radiated emissions test, the adapter 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.

Data was recorded in peak detection modes.

### **Corrected Amplitude & Margin Calculation**

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

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

**Test Data****Environmental Conditions**

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.8 kPa

The testing was performed by King Tang on 2008-07-03.

Test Mode: Transmitting

**Test Result:** Compliant.

Please refer to following tables and plots

Freq. (MHz)	Receiver Reading (dB $\mu$ V)	Detector PK/AV	Table Direction Degree	Test Antenna		Cable Loss (dB)	Pre- Amp. (dB)	Cord. Amp. (dB $\mu$ V/m)	Tran. Factor (dB)	EIRP		FCC 15.247 Limit (W)
				Height (m)	Factor (dB)					(dBm)	(mW)	
Low Channel												
2402	94.37	PK	90	1.2	30.6	3.61	35	93.58	95.27	-1.69	0.678	1
Middle Channel												
2441	93.86	PK	0	1.4	30.6	3.61	35	93.07	95.27	-2.2	0.603	1
High Channel												
2480	92.12	PK	360	1.3	30.6	3.61	35	91.33	95.27	-3.94	0.404	1

**Note:** P (dBm) = E (dB $\mu$ V/m) – 95.27

## **FCC §15.247(d) - BAND EDGES TESTING**

### **Applicable Standard**

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 Compliant 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)).

### **Test Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16

\* **Statement of Traceability:** Bay Area Compliant Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### **Test 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. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz.
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.

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.8 kPa

The testing was performed by King Tang on 2008-07-03.

Test Mode: Transmitting

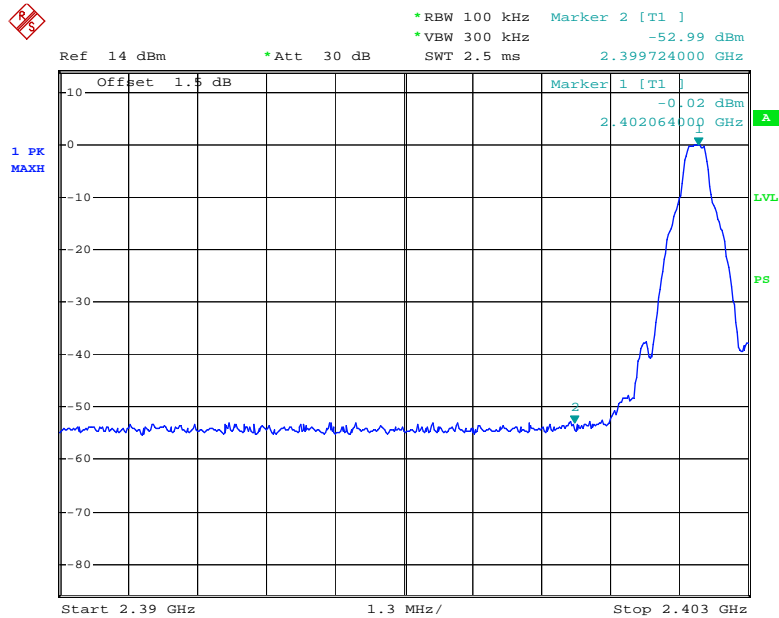
Frequency (MHz)	Attenuation (dBc)	Limit (dBc)
2399.7240	52.97	20
2484.2500	52.70	20

Note: Attenuation = Peaklevel – Emission Level

**Test Result:** Compliant.

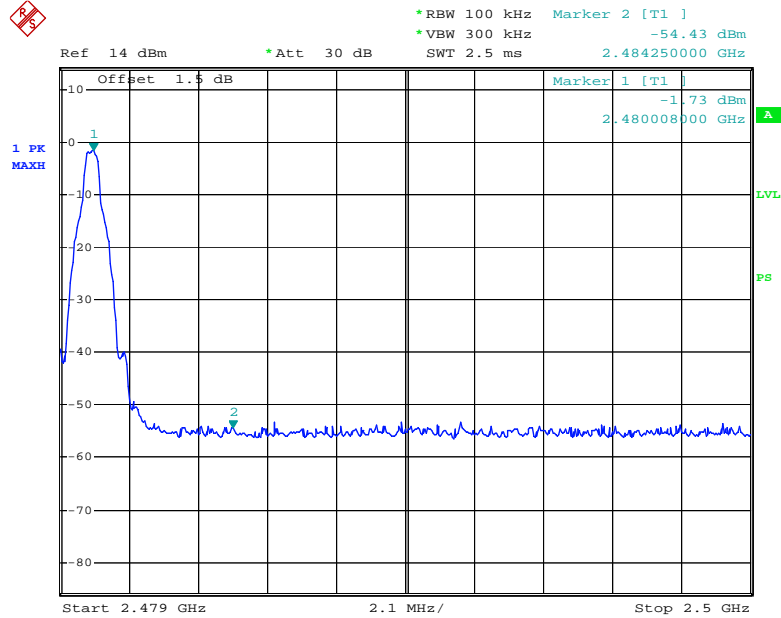
Please refer to following plot.

**Band Edge Left Side**



band edge left  
 Date: 3.JUL.2008 19:38:24

### Band Edge Right Side



band edge right  
Date: 3.JUL.2008 19:40:34

\*\*\*\*\* END OF REPORT \*\*\*\*\*