

# FCC PART 15.247

## MEASUREMENT AND TEST REPORT

For

**Iqua Ltd.**

Kivenlahdentie7 02360, Espoo, Finland

**FCC ID: TUFBHS-802R1**

<b>This Report Concerns:</b>		<b>Equipment Type:</b>	
<input checked="" type="checkbox"/> Original Report		Bluetooth Wireless Headset	
<b>Test Engineer:</b>	Phoenix Liu	<i>Phoenix Liu</i>	
<b>Report No.:</b>	RSZ08051601		
<b>Test Date:</b>	2008-05-26 to 2008-06-12		
<b>Report Date:</b>	2008-06-12		
<b>Reviewed By:</b>	EMC Manager: Green Xu	<i>Green Xu</i>	
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## GENERAL INFORMATION

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

The *Iqua Ltd.* 's product, model number: *BHS-802* or the "EUT" as referred to in this report is a *Bluetooth wireless headset* , which measures approximately: 5.9 cm L x 1.1 cm W x 2.80 cm H, rated input voltage: 3.7 V battery.

Adapter I: Power Supply (Made in China by SPEEDY TECH)

Model: 7501SD-5018A-UL, Input: 100-240 V~50/60 Hz 50 mA, Output: 5.0 V --- 180 mA

Adapter II: SIL switching adapter (Made in China)

Model: SSA-5W-05 US 050012N, Input: 100-240V 50/60Hz 0.2A, Output: 5.0V --- 120mA

*\* All measurement and test data in this report was gathered from production sample serial number: 0805024 (Assigned by BAACL, Shenzhen). The EUT was received on 2008-05-16.*

### Objective

This Type approval report is prepared on behalf of *Iqua Ltd.* 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 compliance 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 Compliance 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 Compliance 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 Compliance 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 compliance with the requirements of Section 2.948 of the FCC Rules on November 04, 2004. 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).



NVLAP LAB CODE 200707-0

The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/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).

### EUT Exercise Software

N/A.

### Special Accessories

The special accessories were provided by Bay Area Compliance Laboratories Corp. (Shenzhen).

### Equipment Modifications

No modification was made to the unit tested.

### Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
DELL	PC	DELL 170L	CN-0TC670-70821-560-F4Q6	DoC
DELL	Keyboard	SK-8110	CN07N244-71616-56A-1B1E	DoC
DELL	Mouse	M071KC	520027907	DoC
DELL	LCD Monitor	1505FP	Y4287-7168-571-GBSH	DoC
ProMOS	Memory	V826632K24SATG-C0	0525-K1933700	DoC
Intel	CPU	Celeron D-2533	N/A	DoC

### Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
DELL	Motherboard	OWC297	CN-OWC297-70821-564-00NI	DoC
DELL	Power	NPS-250KB D	CN-0H2678-17972-56E-80BM	DoC
Seagate	Hard Disk	ST340014A	5JXK3GXE	DoC
DELL	3.5' Floppy	N/A	CN-0N8893-69802-54Q-02P0	DoC
Lite-ON	CD-Rom	LTN-489S	N/A	DoC
Intel	Ethernet	PRO 10/100 VE	N/A	DoC
CS	Smart Card	ACOS2	N/A	DoC

## External I/O Cable

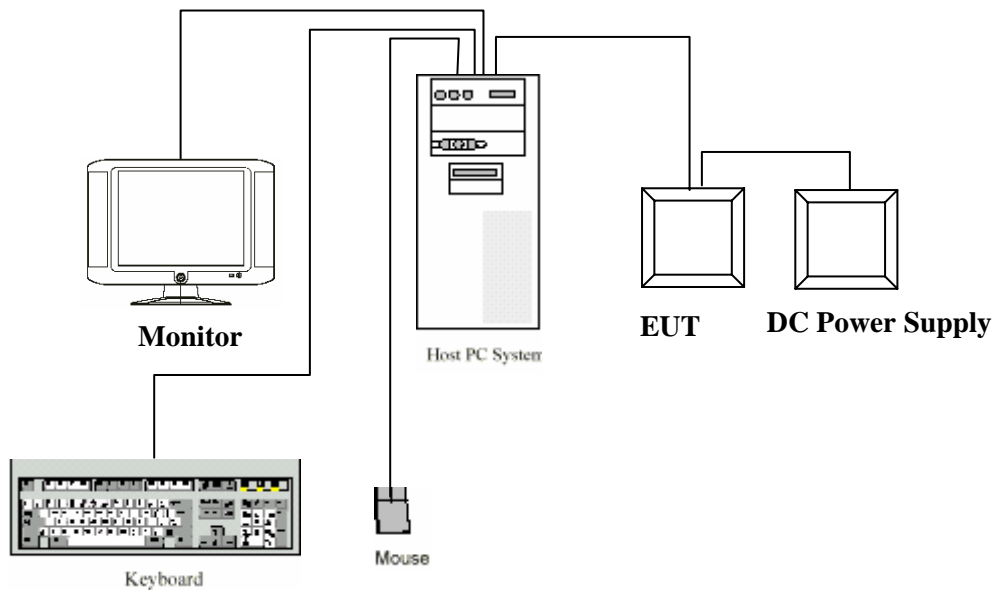
Cable Description	Length (m)	From Port	To
Shielded Detachable K/B Cable	1.5	K/B Port /Host	K/B
Shielded Detachable Mouse Cable	1.5	Mouse Port /Host	Mouse
Unshielded Detachable DC Power Cable	1.4	DC Power Supply	EUT
Unshielded Detachable I/O Cable	1.0	Host PC	EUT

## Configuration of Test Setup

### Charging mode:

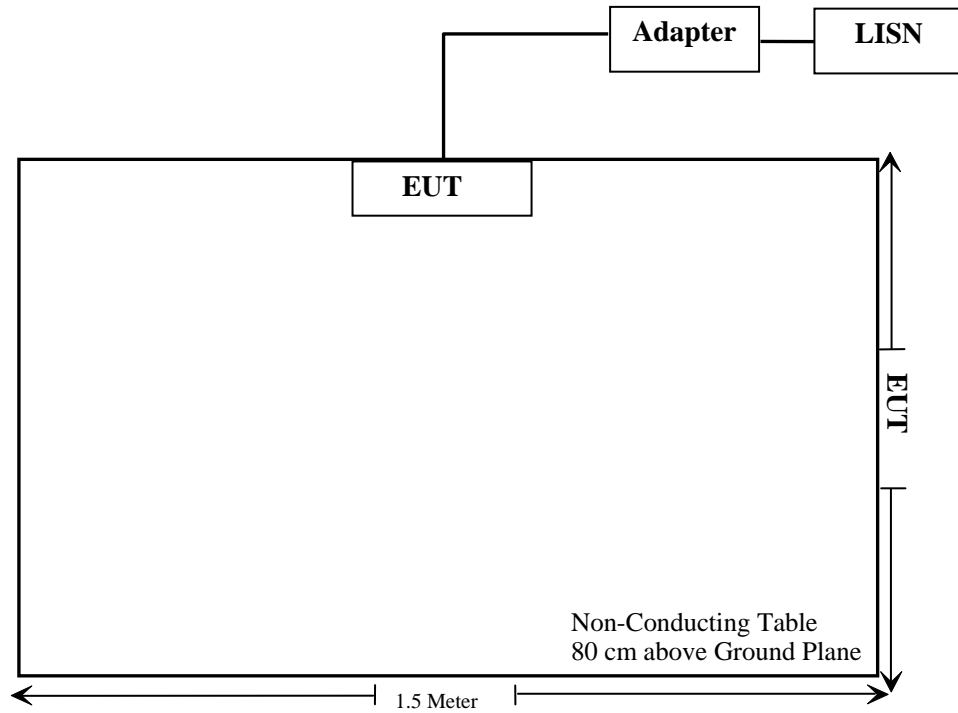


### Transmitting mode:

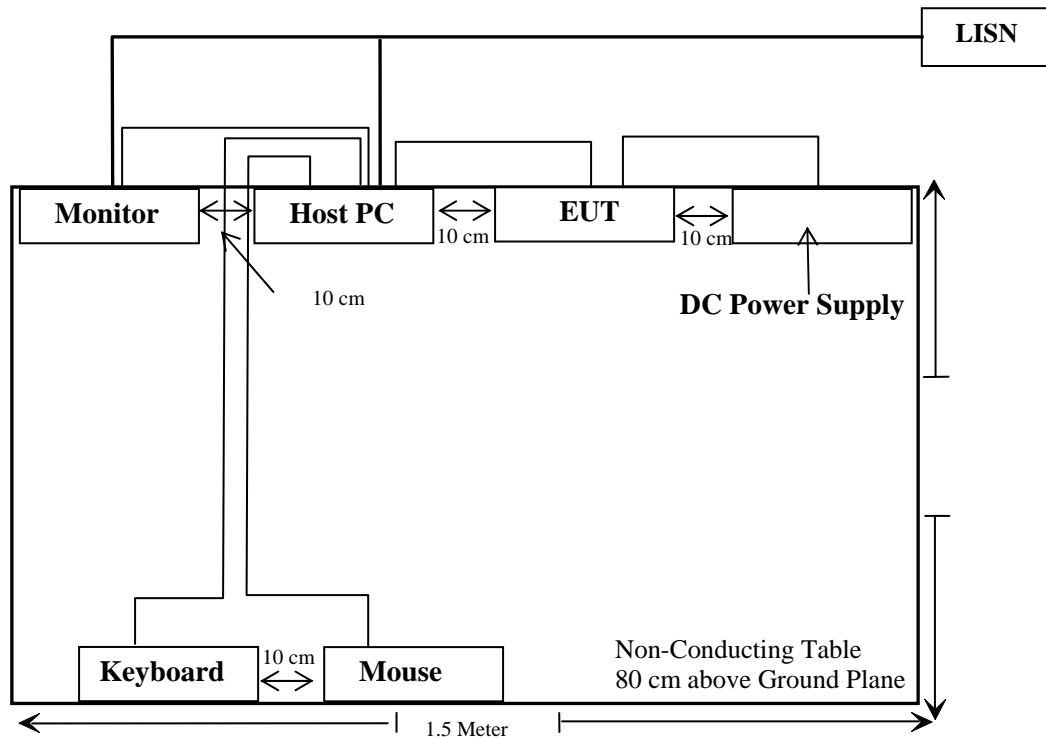


### Block Diagram of Test Setup

Charging mode:



Transmitting mode:





**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
§15.247 (i) & §2.1093	RF exposure	Compliant
CFR47 §15.203	Antenna Requirement	Compliant
CFR47§15.107, §15.207 (a)	Conducted Emissions	Compliant
CFR47 §15.205	Restricted Band	Compliant
CFR47 §15.205, §15.109, §15.209, §15.247(d)	Radiated Emission	Compliant
CFR47 §15.247 (a)(1)	20 dB Bandwidth	Compliant
CFR47 §15.247(a)(1)	Channel Separation Test	Compliant
CFR47 §15.247(a)(1)(iii)	Time of occupancy (Dwell Time)	Compliant
CFR47 §15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
CFR47 §15.247(b)(1)	Peak Output Power Measurement	Compliant
CFR47 §15.247(d)	Band edges	Compliant

## §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.

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  $2.44 \text{ mW} < 24.58 \text{ mW} = (60/2.441 \text{ GHz}) \text{ mW}$

SAR measurement is not required.

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## **CFR47 §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 component antenna, which, in accordance to the above sections, is considered sufficient to comply with the provisions of these sections. Please see EUT photo for details.

**Result:** Compliance.

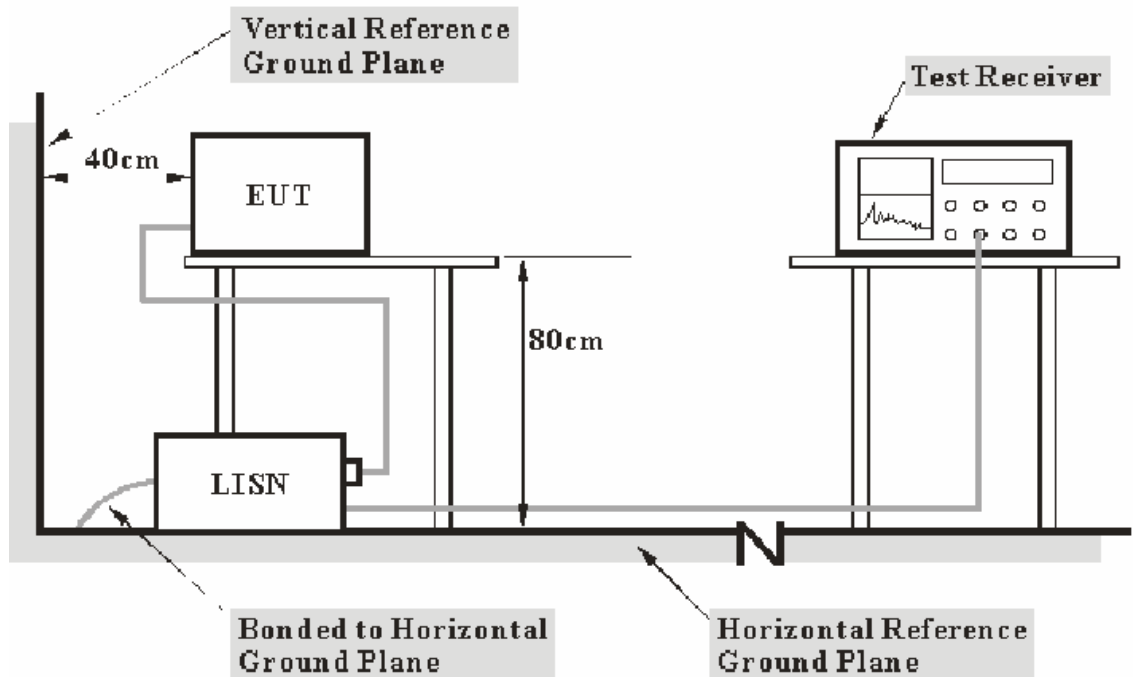
## §15.207 (a) - CONDUCTED EMISSIONS

### 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 Compliance 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 Class B 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
Com-Power	L.I.S.N.	LI-200	12005	N/A	N/A
Com-Power	L.I.S.N.	LI-200	12008	N/A	N/A
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2008-03-25	2009-03-25

\* Com-Power's LISN were used as the supporting equipment.

\* **Statement of Traceability:** Bay Area Compliance 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 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 15.107 and FCC Part 15.207, with the worst margin reading of:

**7.20 dB at 28.745 MHz** in the **Hot** conductor mode

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

<b>Temperature:</b>	22 °C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	100.0 kPa

*The testing was performed by Phoenix Liu on 2008-05-26.*

*Test Mode: Charging and Transmitting*

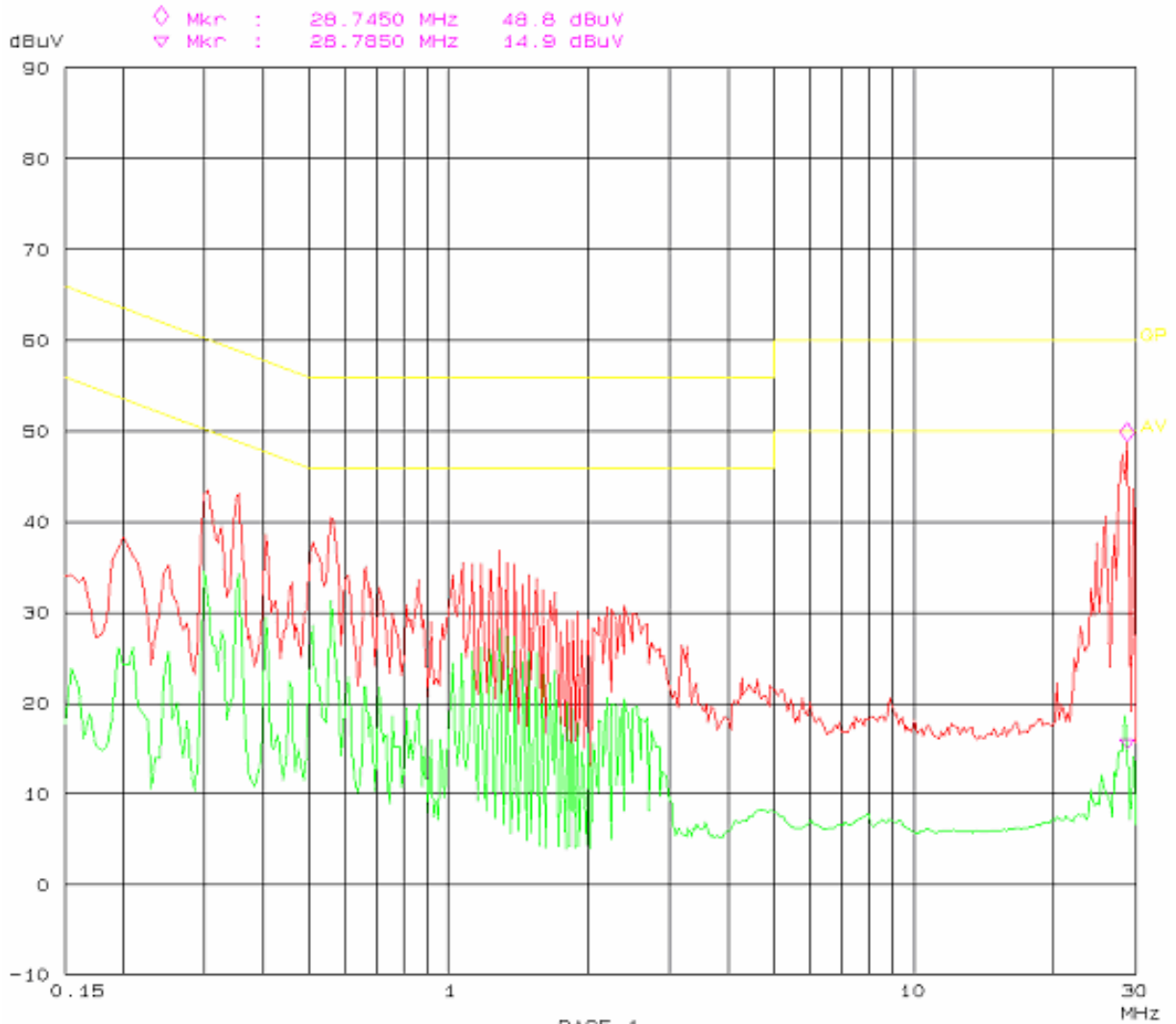
Line Conducted Emissions				FCC PART 15.207	
Frequency (MHz)	Amplitude (dB $\mu$ V)	Detector (QP/AV)	Phase (Hot/Neutral)	Limit (dB $\mu$ V)	Margin (dB)
28.745	48.80	QP	Hot	56.00	7.20
0.350	49.00	QP	Neutral	58.96	9.96
0.490	45.70	QP	Neutral	56.17	10.47
0.665	31.80	AV	Hot	46.00	14.20
0.560	31.20	AV	Hot	46.00	14.80
0.985	40.70	QP	Neutral	56.00	15.30
0.560	40.50	QP	Hot	56.00	15.50
0.305	43.60	QP	Hot	60.11	16.51
0.305	31.50	AV	Hot	50.11	18.61
0.350	29.70	AV	Neutral	48.96	19.26
0.665	35.00	QP	Hot	56.00	21.00
0.490	24.70	AV	Neutral	46.17	21.47
1.030	33.40	QP	Neutral	56.00	22.60
24.720	36.20	QP	Neutral	60.00	23.80
1.550	31.10	QP	Neutral	56.00	24.90
2.390	30.80	QP	Hot	56.00	25.20
2.195	30.60	QP	Hot	56.00	25.40
2.195	20.60	AV	Hot	46.00	25.40
2.395	20.50	AV	Hot	46.00	25.50
0.995	20.20	AV	Neutral	46.00	25.80
1.025	16.90	AV	Neutral	46.00	29.10
0.545	11.60	AV	Neutral	46.00	34.40
28.785	14.90	AV	Hot	50.00	35.10
24.835	10.70	AV	Neutral	50.00	39.30

**Plot(s) of Test Data**

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

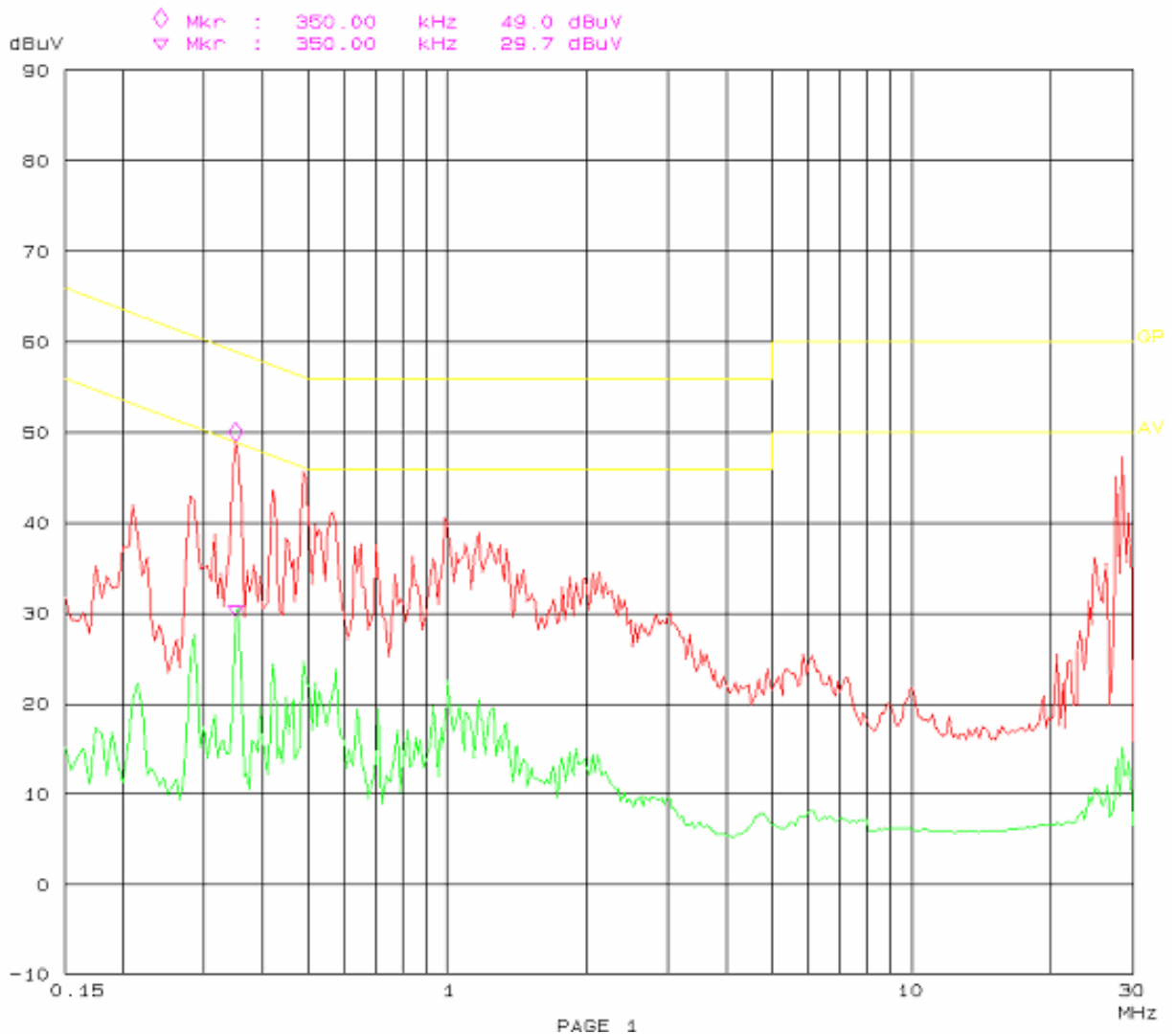
conducted emission test  
FCC Part15

EUT: Bluetooth wireless headset M/N: BHS-802  
Manuf: Iqua  
Op Cond: CHARGING  
Operator:  
Test Spec: AC 120/60HZ H  
Comment: Temp: 25 Humi 56%



# Conducted Emission Test FCC Part15

EUT: Bluetooth wireless headset M/N: BHS-802  
Manuf: Iuga  
Op Cond: CHARGING  
Operator:  
Test Spec: AC 120/60HZ N  
Comment: Temp: 25 Hum: 58%





## CFR47 §15.205, §15.209, §15.247 - RADIATED EMISSIONS

### Applicable Standard

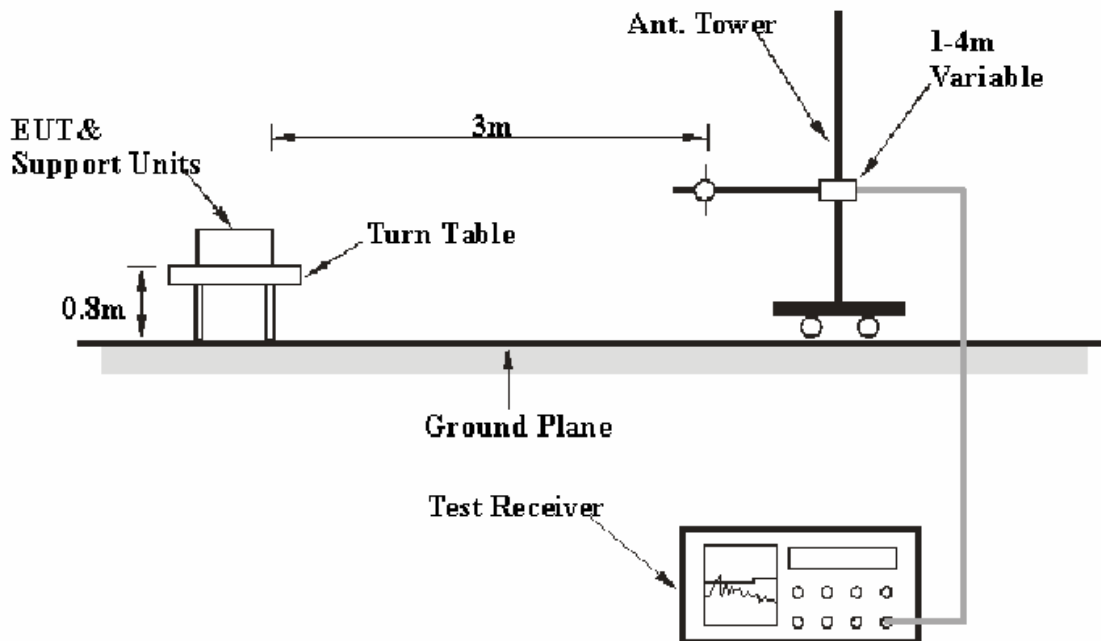
CFR47 §15.205; §15.209; §15.247 (d).

### 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 Compliance 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.

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

## 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>
30MHz – 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 Compliance 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 host PC 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 compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum 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 B, section 15.109, Subpart C, 15.205, 15.209, and 15.247, with the worst margin reading of:

### Transmitting mode:

**7.7 dB at 78.551425 MHz in the Vertical polarization, for below 1GHz**  
**4.54 dB at 4804.00 MHz in the Horizontal polarization, for above 1GHz (Low Channel)**  
**3.64 dB at 4882.00 MHz in the Horizontal polarization, for above 1GHz (Middle Channel)**  
**4.67dB at 4960.00 MHz in the Vertical polarization, for above 1GHz (High Channel)**

### Charging mode:

**18.2dB at 30.216275 MHz in the Horizontal polarization**

## Test Data

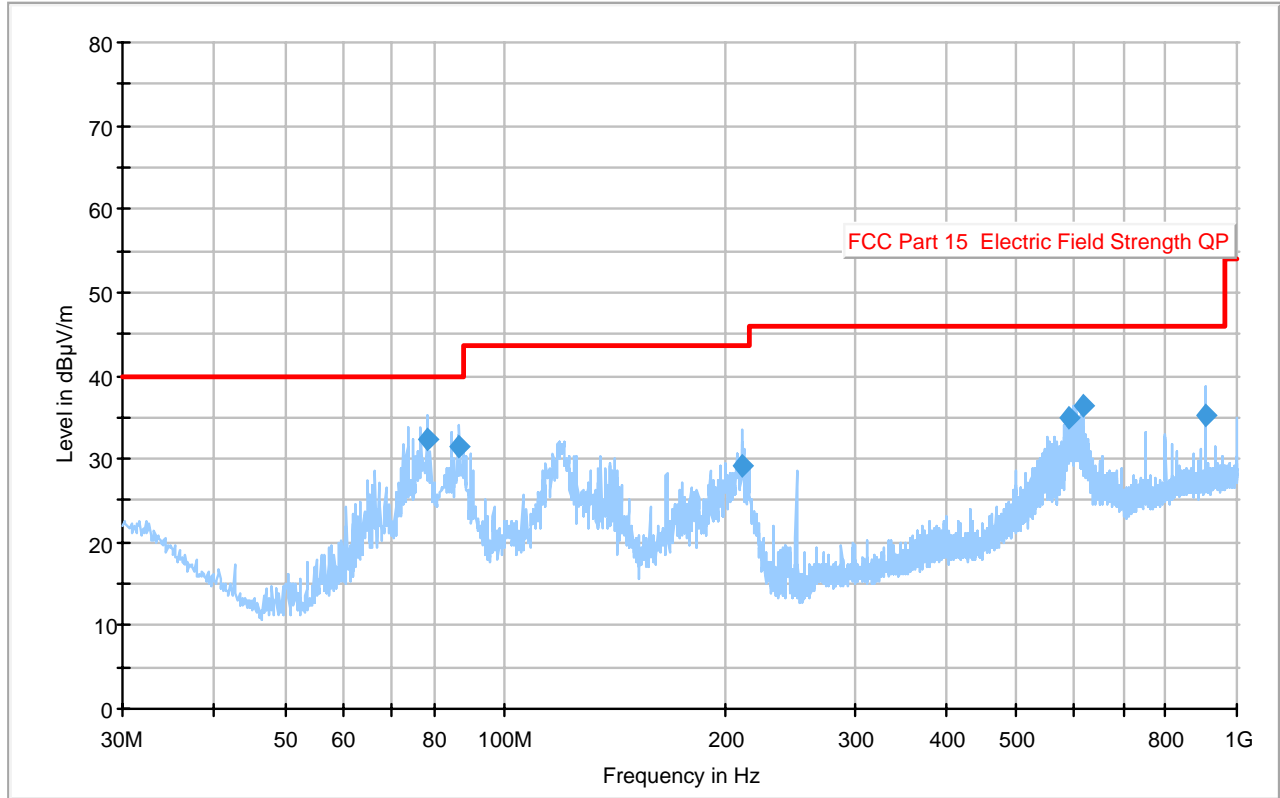
### Environmental Conditions

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

*The testing was performed by Phoenix Liu on 2008-05-26.*

**Below 1 GHz**

Test Mode: Transmitting



Frequency (MHz)	Corrected Amp. (dBµV/m)	Ant. Height (cm)	Ant. Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
78.551425	32.3	260.0	V	234.0	-16.9	40.0	7.7
86.661450	31.4	346.0	V	82.0	-17.5	40.0	8.6
617.491225	36.5	158.0	H	76.0	-3.7	46.0	9.5
906.971450	35.3	128.0	V	205.0	1.2	46.0	10.7
588.739425	35.1	163.0	H	70.0	-3.5	46.0	10.9
210.994075	29.2	256.0	V	110.0	-12.9	43.5	14.3

**Above 1 GHz**

Test Mode: Transmitting

Freq. (MHz)	Meter Reading (dBµV)	Detector PK/QP/AV	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Corr. Amp. (dBµV/m)	FCC Part 15.247/209		
				Height (m)	Polar (H/V)	Factor (dB)				Limit (dBµV/m)	Margin (dB)	Remarks
<b>Low Channel (2402 MHz)</b>												
4804.00	43.52	AV	90	1.0	H	34.7	4.64	33.4	49.46	54	4.54	Harmonic
4804.00	41.99	AV	90	1.0	V	34.6	4.64	33.4	47.83	54	6.17	Harmonic
1627.20	39.42	AV	0	1.0	V	28.5	3.03	34.8	36.15	54	17.85	Spurious
4804.00	50.23	PK	180	1.2	H	34.6	4.64	33.4	56.07	74	17.93	Harmonic
1593.60	38.85	AV	45	1.0	H	28.0	2.98	34.8	35.03	54	18.97	Spurious
4804.00	48.70	PK	180	1.2	V	34.7	4.64	33.4	54.64	74	19.36	Harmonic
1095.20	40.56	AV	180	1.2	V	26.5	2.22	35.0	34.28	54	19.72	Spurious
1264.40	39.04	AV	180	1.2	H	27.1	2.87	35.0	34.01	54	19.99	Spurious
1627.20	46.13	PK	180	1.2	V	28.5	3.03	34.8	42.86	74	31.14	Spurious
1593.60	45.56	PK	0	1.2	H	28.0	2.98	34.8	41.74	74	32.26	Spurious
1095.20	47.27	PK	45	1.2	V	26.5	2.22	35.0	40.99	74	33.01	Spurious
1264.40	45.75	PK	45	1.2	H	27.1	2.87	35.0	40.72	74	33.28	Spurious

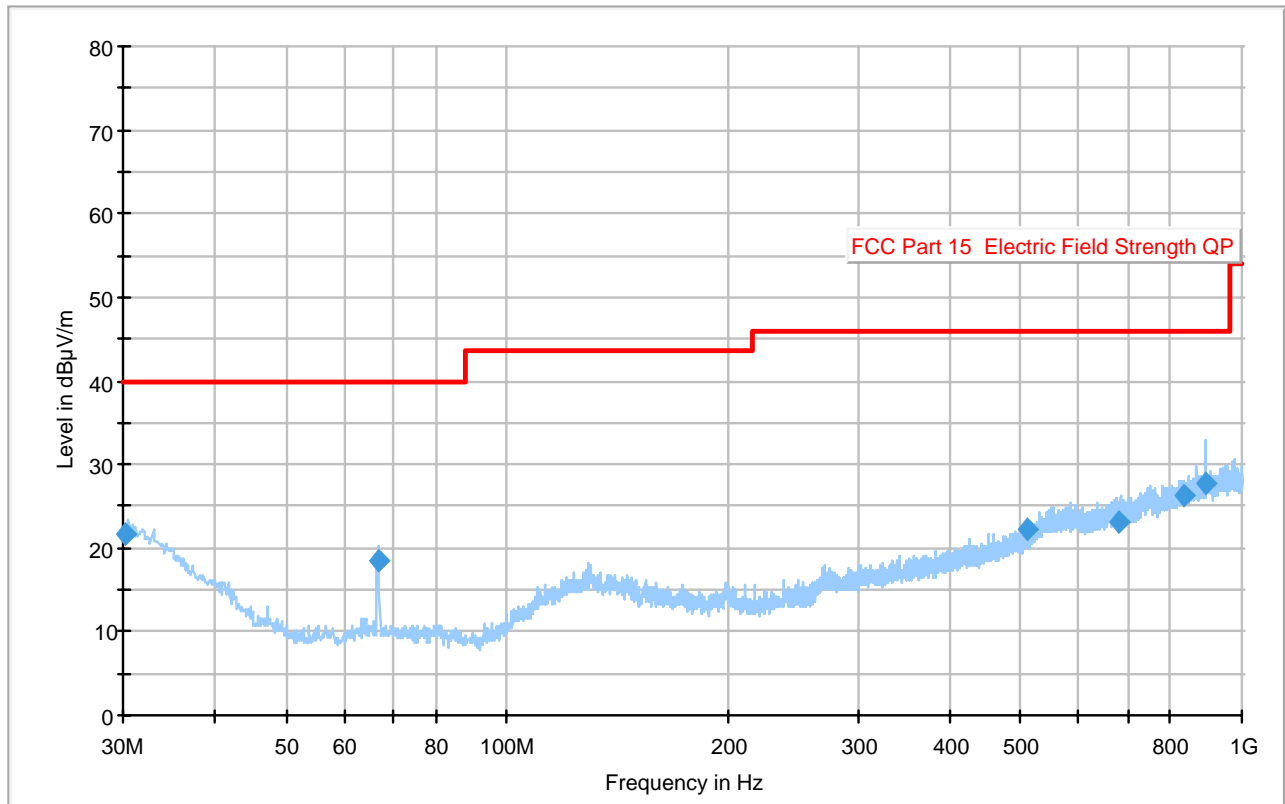
Freq. (MHz)	Meter Reading (dBµV)	Detector PK/QP/AV	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Corr. Amp. (dBµV/m)	FCC Part 15.247/209		
				Height (m)	Polar (H/V)	Factor (dB)				Limit (dBµV/m)	Margin (dB)	Remarks
<b>Middle Channel (2441 MHz)</b>												
4882.00	44.52	AV	243	1.4	H	34.6	4.64	33.4	50.36	54	3.64	Harmonic
4882.00	43.42	AV	142	1.6	V	34.7	4.64	33.4	49.36	54	4.64	Harmonic
1596.00	41.63	AV	153	1.2	V	28.5	3.03	34.8	38.36	54	15.64	Spurious
4882.00	51.23	PK	153	1.5	H	34.6	4.64	33.4	57.07	74	16.93	Harmonic
4882.00	50.13	PK	234	1.8	V	34.7	4.64	33.4	56.07	74	17.93	Harmonic
1062.00	41.91	AV	85	1.5	V	26.5	2.22	35.0	35.63	54	18.37	Spurious
1600.00	38.60	AV	142	1.2	H	28.0	2.98	34.8	34.78	54	19.22	Spurious
1070.00	39.78	AV	135	1.3	H	26.0	2.24	35.0	33.02	54	20.98	Spurious
1596.00	48.34	PK	135	1.2	V	28.5	3.03	34.8	45.07	74	28.93	Spurious
1062.00	48.62	PK	265	1.4	V	26.5	2.22	35.0	42.34	74	31.66	Spurious
1600.00	45.31	PK	234	1.2	H	28.0	2.98	34.8	41.49	74	32.51	Spurious
1070.00	46.49	PK	156	1.4	H	26.0	2.24	35.0	39.73	74	34.27	Spurious

Freq. (MHz)	Meter Reading (dB $\mu$ V)	Detector PK/QP/AV	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Corr. Amp. (dB $\mu$ V/m)	FCC Part 15.247/209		
				Height (m)	Polar (H/V)	Factor (dB)				Limit (dB $\mu$ V/m)	Margin (dB)	Remarks
<b>High Channel (2480 MHz)</b>												
4960.00	43.58	AV	256	1.8	V	34.6	4.55	33.4	49.33	54	4.67	Harmonic
4960.00	43.09	AV	142	1.5	H	34.7	4.55	33.4	48.94	54	5.06	Harmonic
1594.00	39.92	AV	90	1.4	V	28.5	3.03	34.8	36.65	54	17.35	Spurious
1790.00	38.62	AV	120	1.4	H	29.2	3.12	34.3	36.64	54	17.36	Spurious
4960.00	50.29	PK	145	1.4	V	34.6	4.55	33.4	56.04	74	17.96	Harmonic
4960.00	49.80	PK	142	1.4	H	34.7	4.55	33.4	55.65	74	18.35	Harmonic
1260.00	38.55	AV	210	1.2	H	27.1	2.87	35.0	33.52	54	20.48	Spurious
1260.00	38.28	AV	156	1.2	V	27.1	2.87	35.0	33.25	54	20.75	Spurious
1594.00	46.63	PK	150	1.2	V	28.5	3.03	34.8	43.36	74	30.64	Spurious
1790.00	45.33	PK	145	1.2	H	29.2	3.12	34.3	43.35	74	30.65	Spurious
1260.00	45.26	PK	240	1.4	H	27.1	2.87	35.0	40.23	74	33.77	Spurious
1260.00	44.99	PK	128	1.5	V	27.1	2.87	35.0	39.96	74	34.04	Spurious

**Note:** The spurious emission PK below the limit (AV) was not recorded.

\* Within measurement uncertainty.

Test Mode: Charging



Frequency (MHz)	Corrected Amp. (dBµV/m)	Ant. Height (cm)	Ant. Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
30.216275	21.8	257.0	H	221.0	-4.1	40.0	18.2
893.981250	27.7	148.0	H	130.0	1.1	46.0	18.3
831.032525	26.4	380.0	V	54.0	0.2	46.0	19.6
66.869450	18.5	300.0	V	188.0	-16.8	40.0	21.5
682.645300	23.1	266.0	H	224.0	-2.2	46.0	22.9
512.018775	22.1	293.0	H	111.0	-5.7	46.0	23.9

## CFR47 §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 Compliance 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

<b>Temperature:</b>	27 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.0 kPa

*The testing was performed by Phoenix Liu on 2008-05-26.*



*Test Mode: Transmitting*

Channel	Channel Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low Channel	2402	1.004	0.53	Pass
Adjacency Channel	2403			
Middle Channel	2441	1.004	0.53	Pass
Adjacency Channel	2442			
High Channel	2480	1.004	0.53	Pass
Adjacency Channel	2479			

**Test Result:** Compliance.

Please refer to following plots

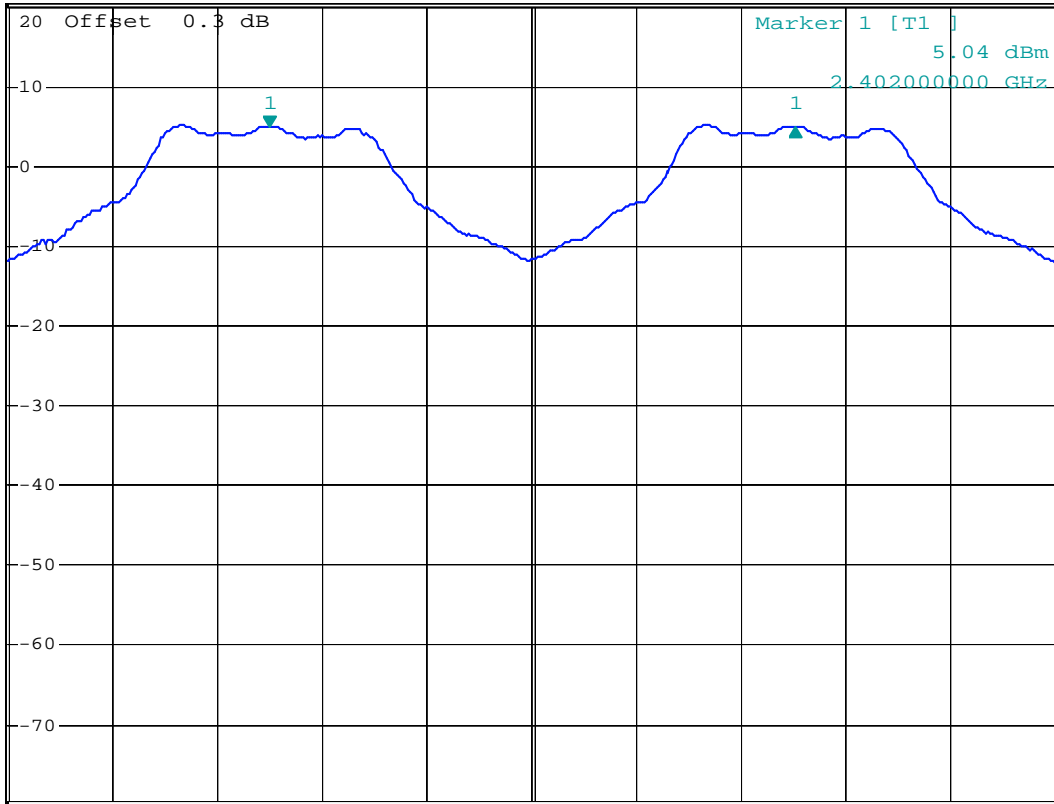
### Low Channel



\*RBW 100 kHz Delta 1 [T1 ]  
VBW 300 kHz -0.01 dB  
SWT 2.5 ms 1.004000000 MHz

Ref 20.3 dBm \*Att 35 dB

1 PK  
MAXH



Center 2.4025 GHz 200 kHz/ Span 2 MHz

Channel separation low channel

Date: 26.MAY.2008 22:26:48

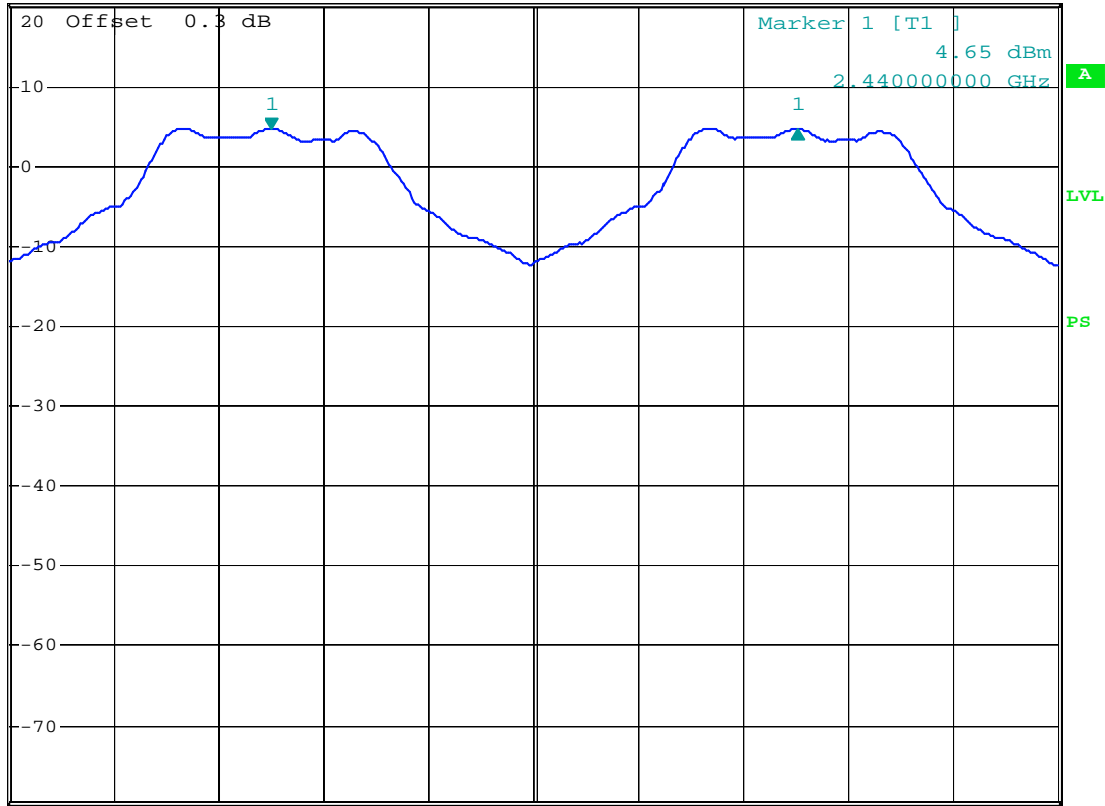
### Middle Channel



\*RBW 100 kHz Delta 1 [T1 ]  
VBW 300 kHz -0.02 dB  
SWT 2.5 ms 1.004000000 MHz

Ref 20.3 dBm \*Att 35 dB

1 PK  
MAXH



Center 2.4405 GHz 200 kHz/ Span 2 MHz

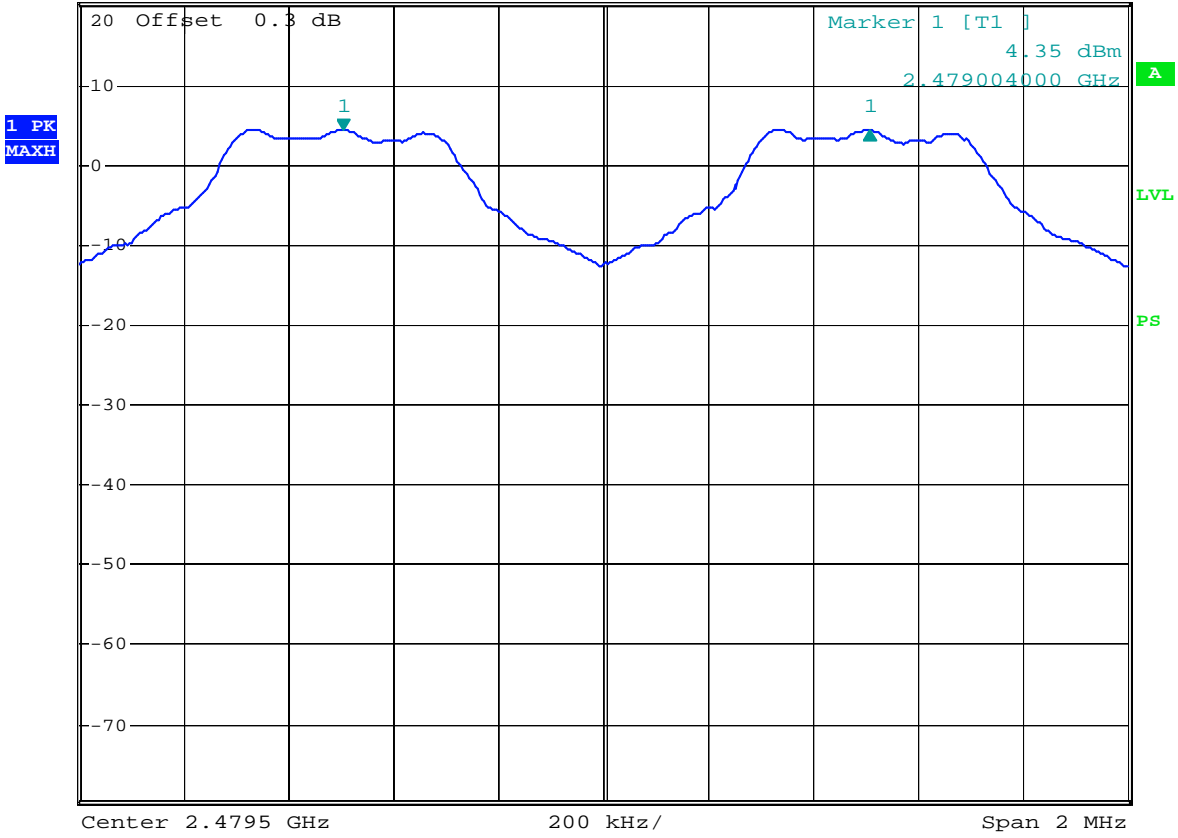
Channel separation middle channel

Date: 26.MAY.2008 22:24:53

### High Channel



Ref 20.3 dBm      \*Att 35 dB      \*RBW 100 kHz      Delta 1 [T1]      -0.01 dB  
SWT 2.5 ms      1.00400000 MHz



Channel separation high channel

Date: 26.MAY.2008 22:23:02

## CFR47 §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 125mW.

### 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 Compliance 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

<b>Temperature:</b>	27 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.0 kPa

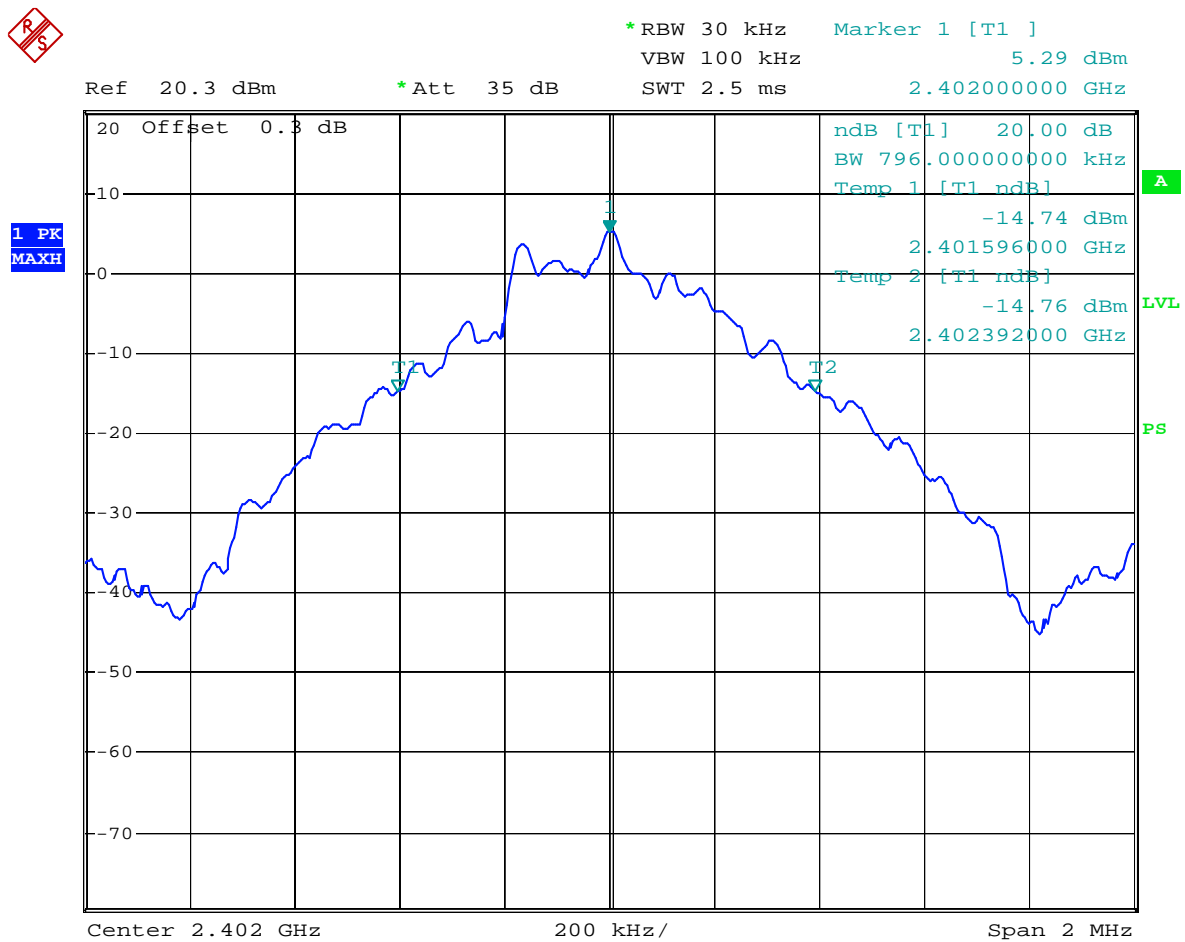
*The testing was performed by Phoenix Liu on 2008-05-26.*

**Test Result:** Please refer to the following table and plots.

*Test Mode: Transmitting*

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)
Low	2402	796
Middle	2441	796
High	2480	800

**Low Channel**



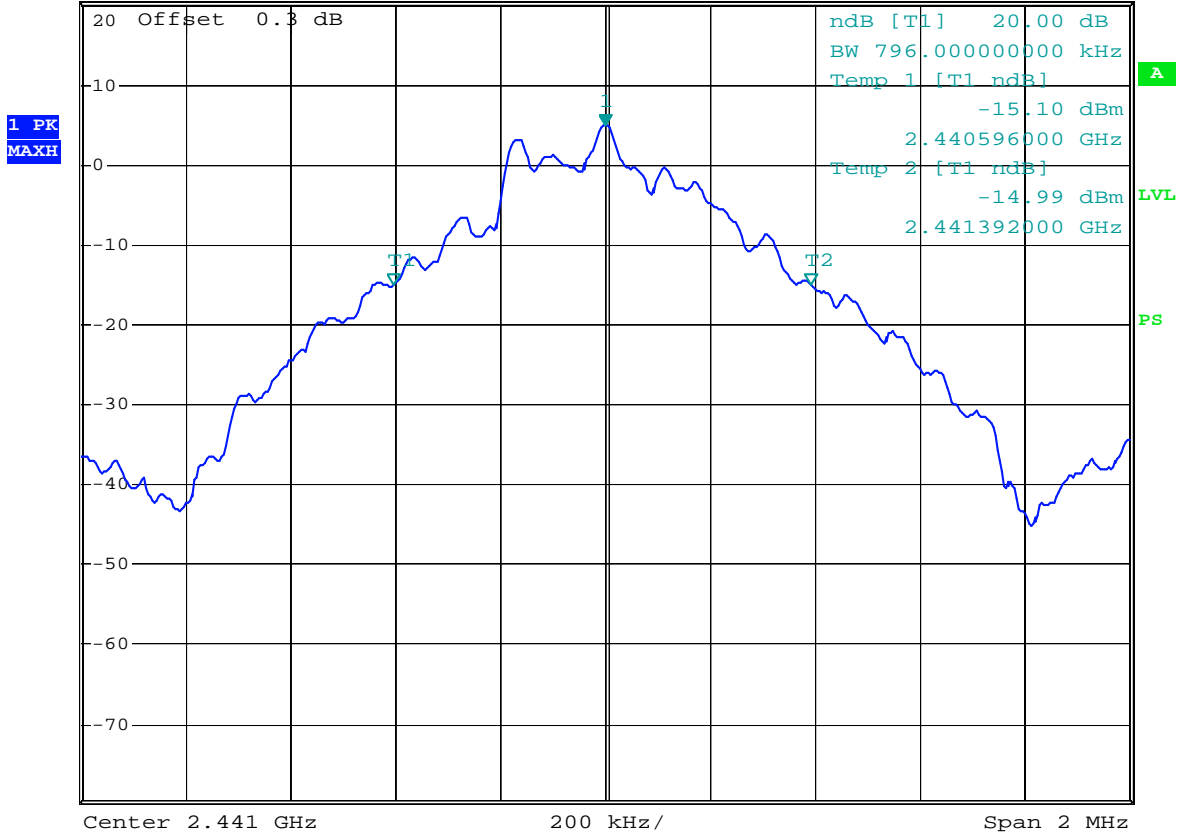
20dB bandwidth low channel

Date: 26.MAY.2008 22:18:28

### Middle Channel



\*RBW 30 kHz    Marker 1 [T1 ]  
 VBW 100 kHz                    4.90 dBm  
 Ref 20.3 dBm            \*Att 35 dB            SWT 2.5 ms            2.441000000 GHz



20dB bandwidth middle channel

Date: 26.MAY.2008 22:17:44





## CFR47 §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

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 Compliance 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>	27 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.0 kPa

*The testing was performed by Phoenix Liu on 2008-05-26.*

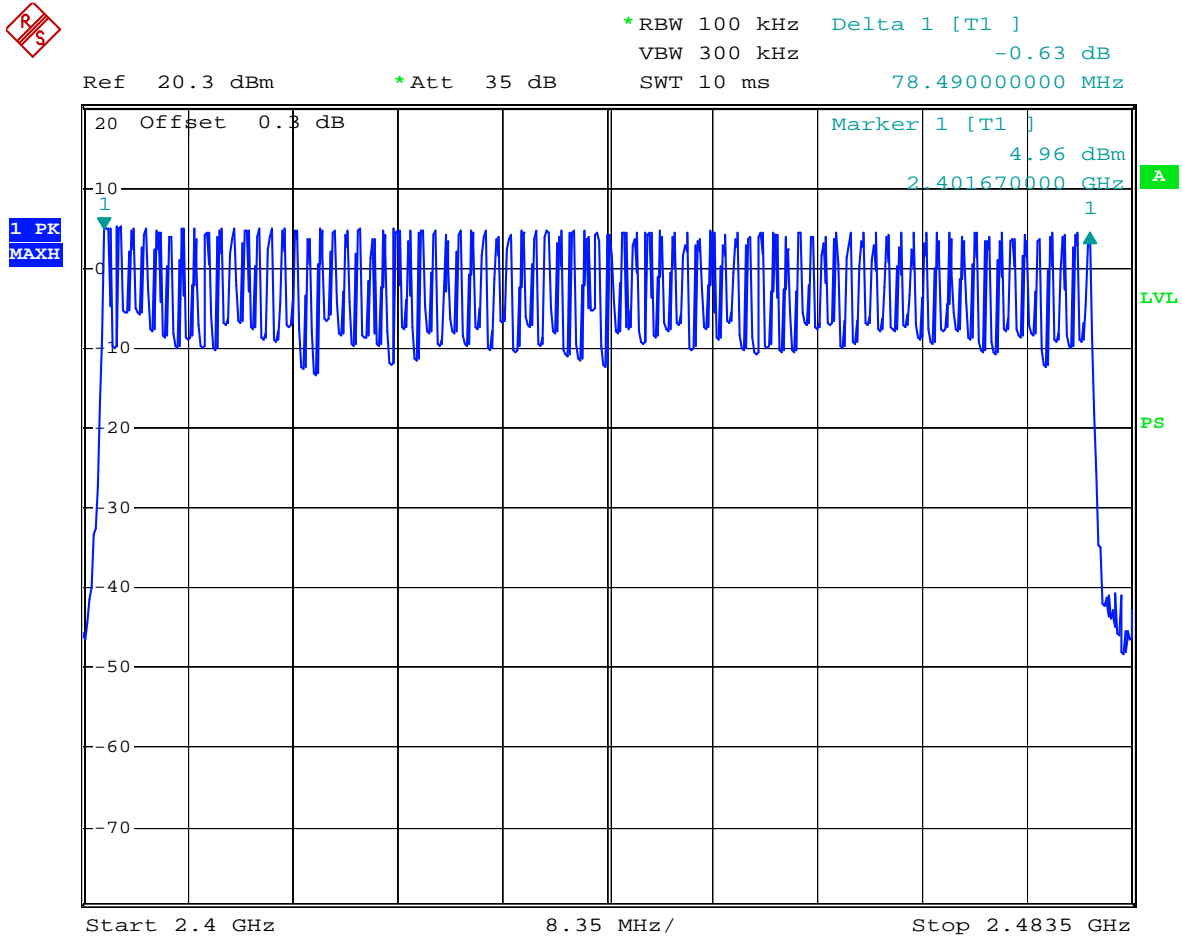
*Test Mode: Transmitting*

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

**Test Result:** Compliance.

Please refer to following plot.

### Number of Hopping Channels



hopping channels

Date: 26.MAY.2008 22:28:54

## **CFR47 §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 Compliance 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>	27 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.0 kPa

*The testing was performed by Phoenix Liu on 2008-06-12.*

*Test Mode: Transmitting*

**Test Result:** Compliance.

Please refer to following tables and plots

**DH1**

Channel	Pulse Width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Result
Low	0.540	0.1728	0.4	Pass
Middle	0.535	0.1712	0.4	Pass
High	0.540	0.1728	0.4	Pass

**DH3**

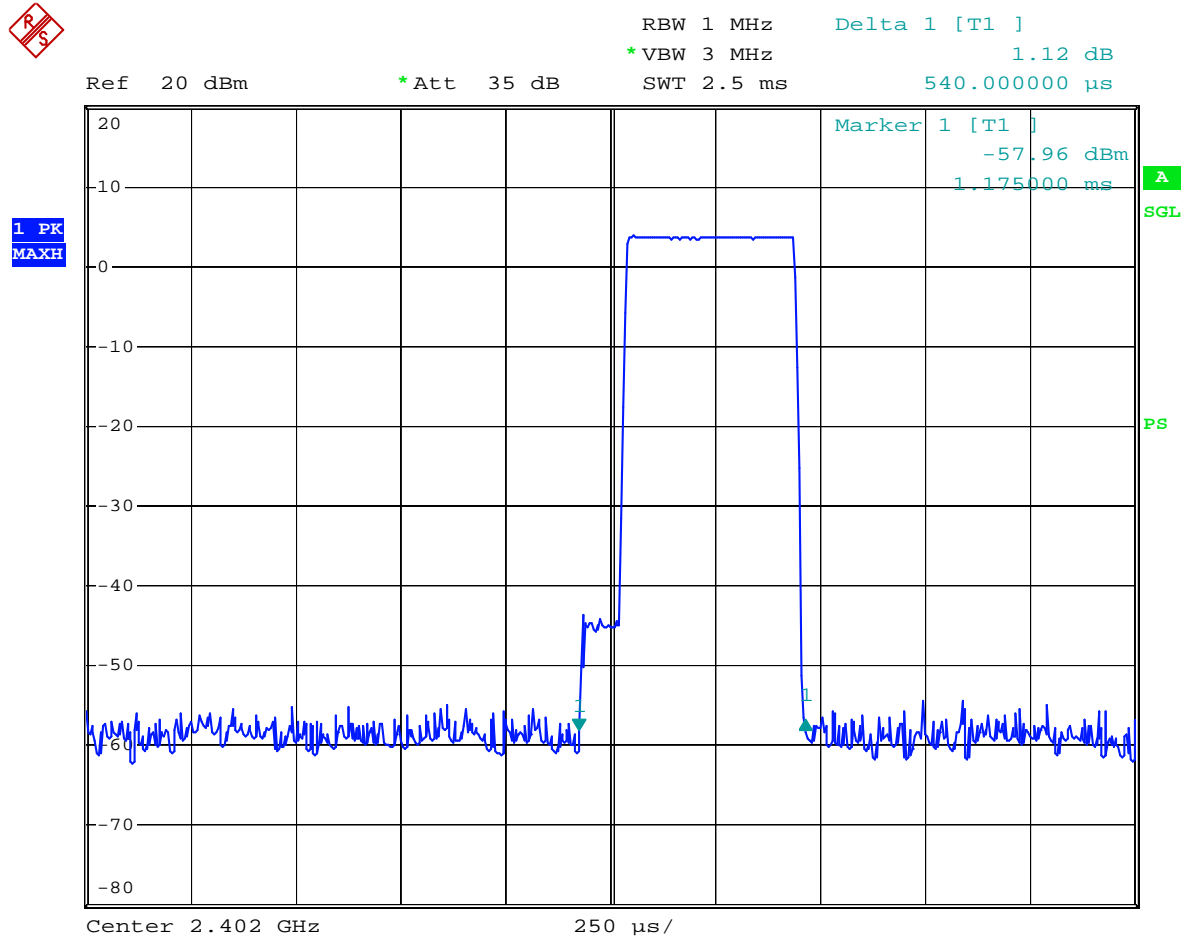
Channel	Pulse Width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Result
Low	1.800	0.2880	0.4	Pass
Middle	1.800	0.2880	0.4	Pass
High	1.800	0.2880	0.4	Pass

**DH5**

Channel	Pulse Width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Result
Low	3.080	0.3285	0.4	Pass
Middle	3.080	0.3285	0.4	Pass
High	3.080	0.3285	0.4	Pass

**Note:** Dwell time = Pulse Width\*(1600/2/79)\*31.6 S

### Low Channel for DH1



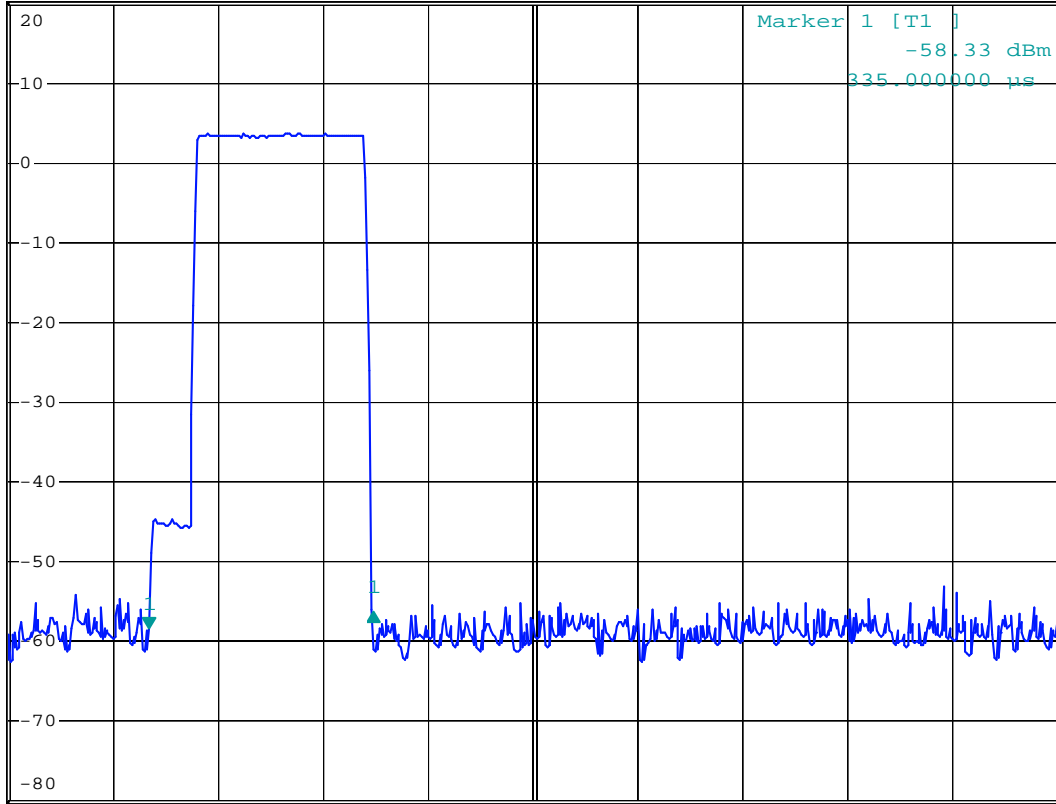
Dwell time DH 1 low channel

### Middle Channel for DH1



Ref 20 dBm      \*Att 35 dB      RBW 1 MHz      Delta 1 [T1 ]  
\*VBW 3 MHz      1.99 dB  
SWT 2.5 ms      535.000000 μs

1 PK  
MAXH



Center 2.441 GHz      250 μs/

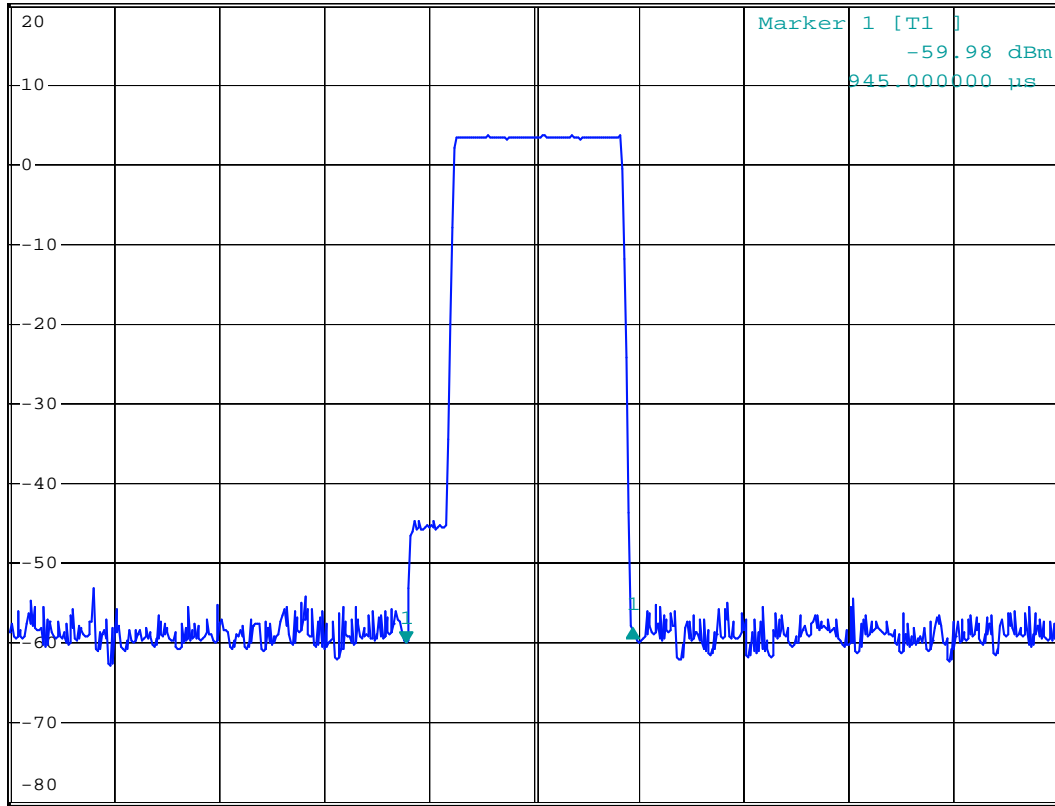
Dwell time DH 1 middle channel

### High Channel for DH1



Ref 20 dBm      \*Att 35 dB      RBW 1 MHz      Delta 1 [T1 ]  
\*VBW 3 MHz      1.92 dB  
SWT 2.5 ms      540.000000 μs

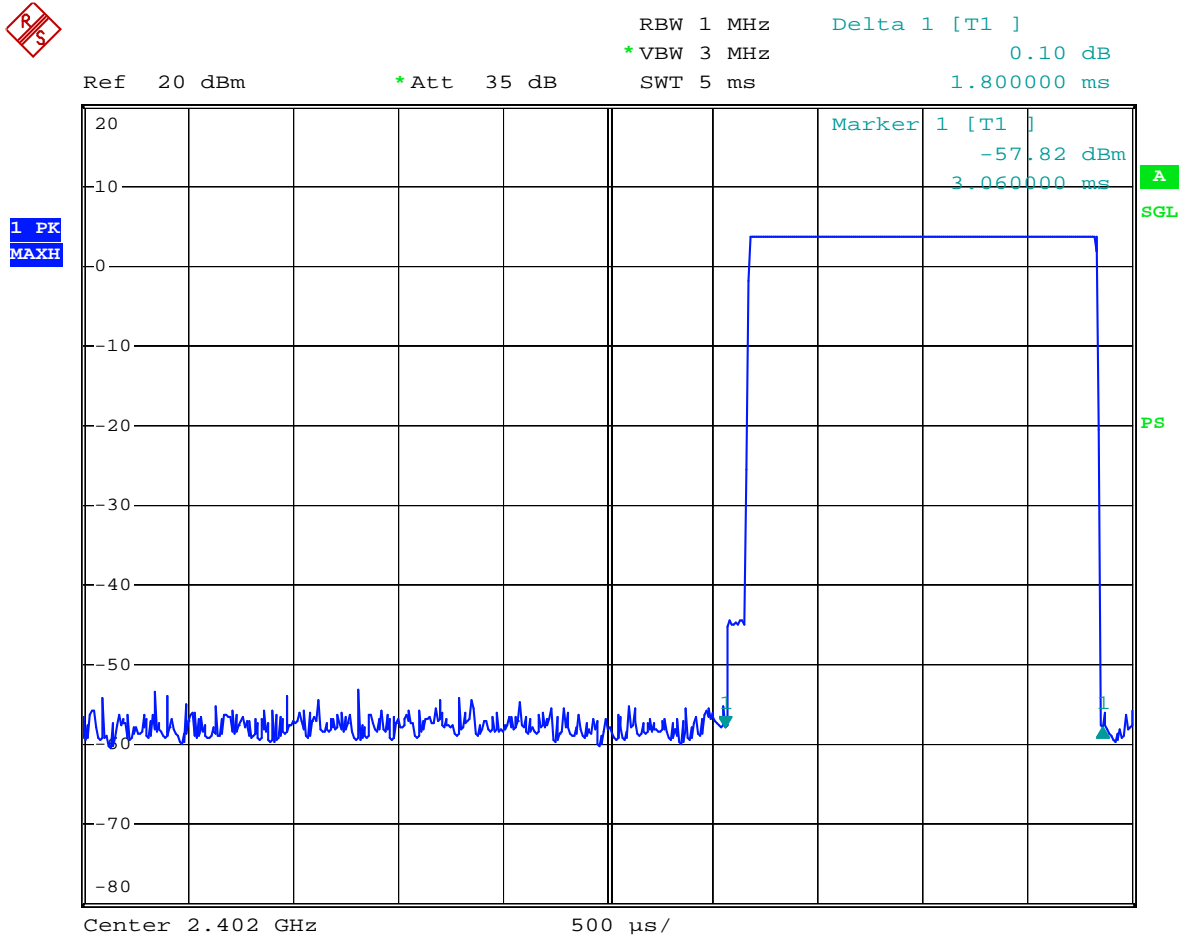
1 PK  
MAXH



Center 2.48 GHz      250 μs/

Dwell time DH 1 high channel

### Low Channel for DH3



Dwell time DH 3 low channel

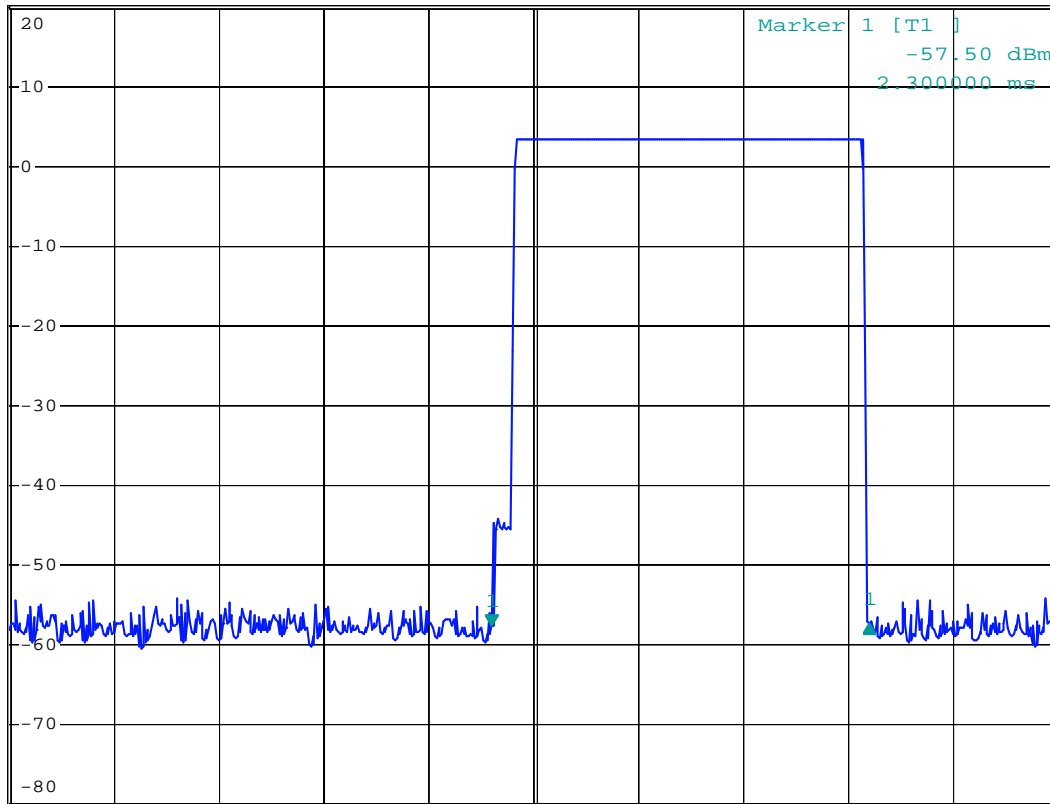


### Middle Channel for DH3



Ref 20 dBm      \*Att 35 dB      RBW 1 MHz      Delta 1 [T1 ]  
\*VBW 3 MHz      0.24 dB  
SWT 5 ms      1.800000 ms

1 PK  
MAXH



A

SGL

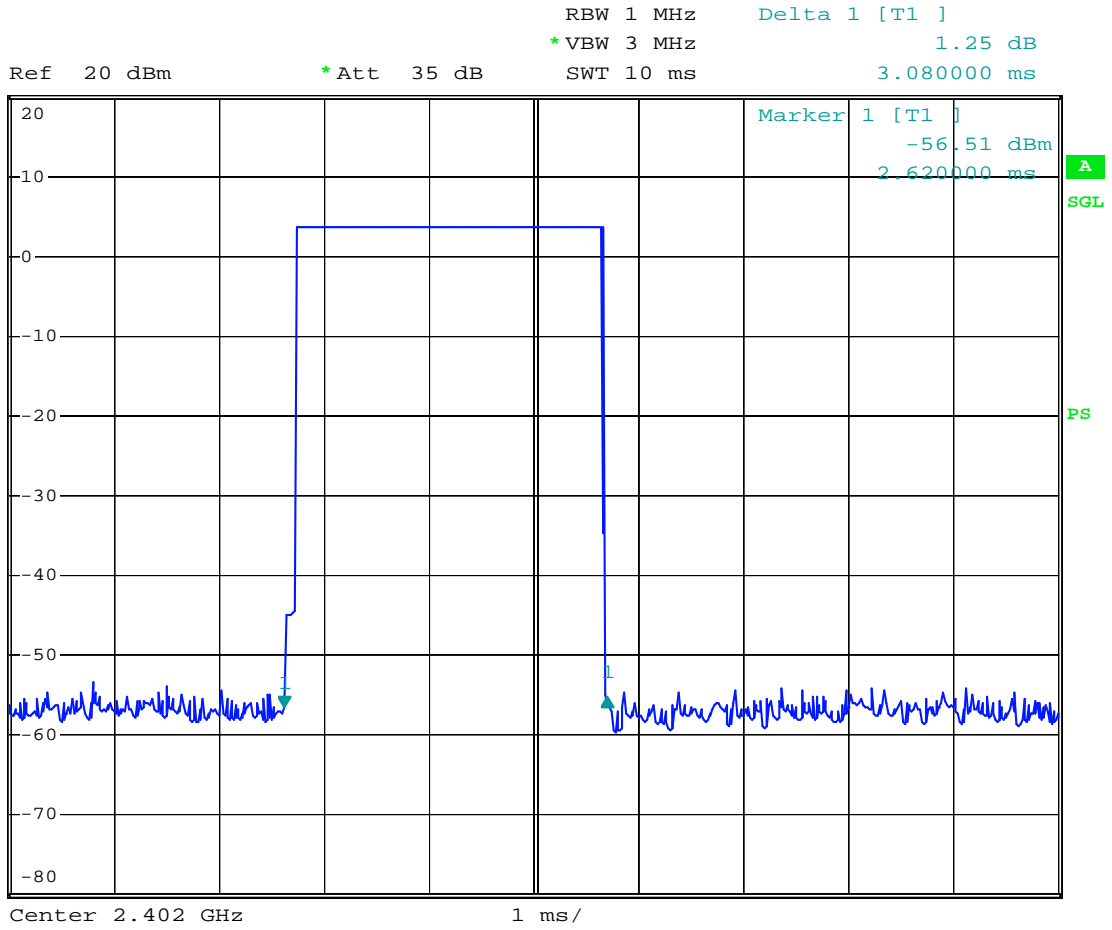
PS

Center 2.441 GHz      500 μs/

Dwell time DH 3 middle channel

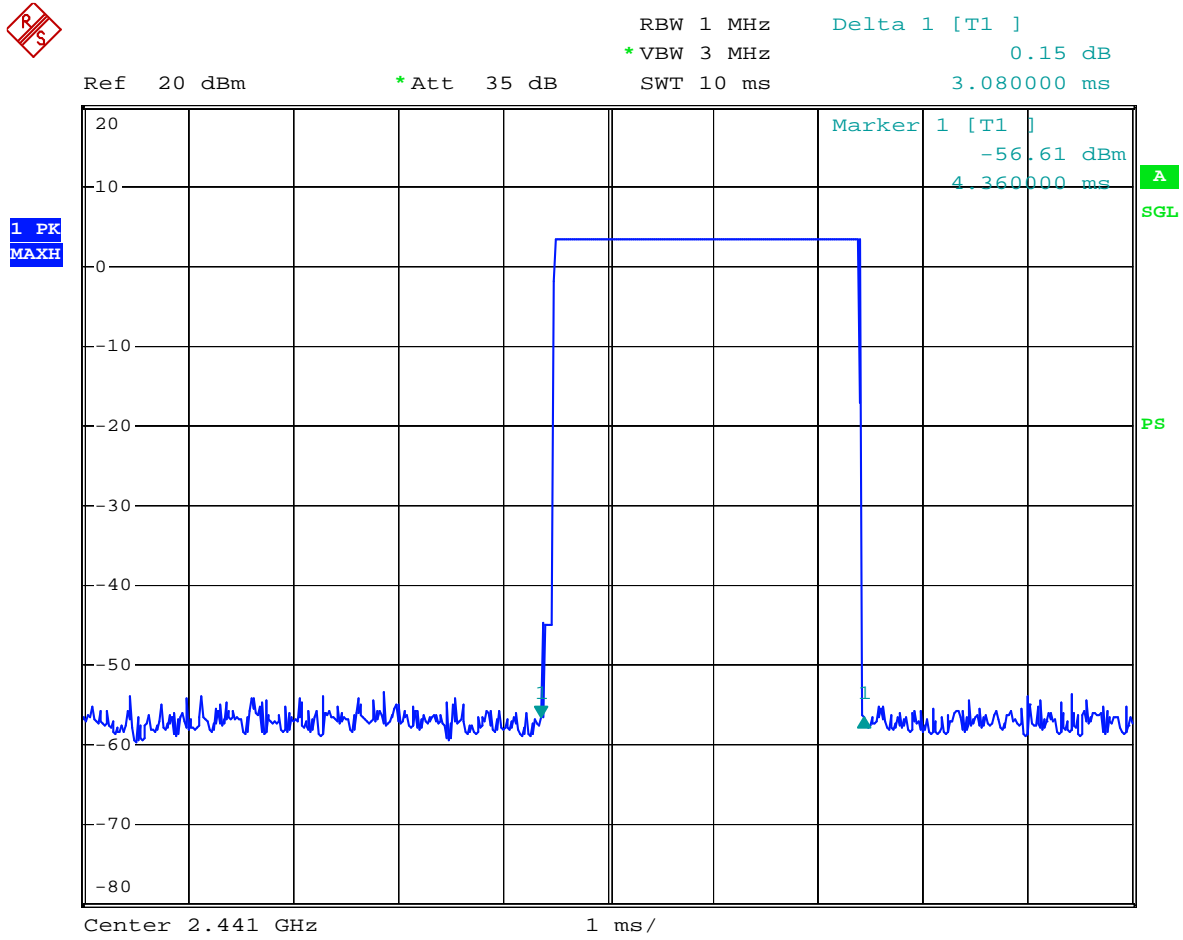


### Low Channel for DH5



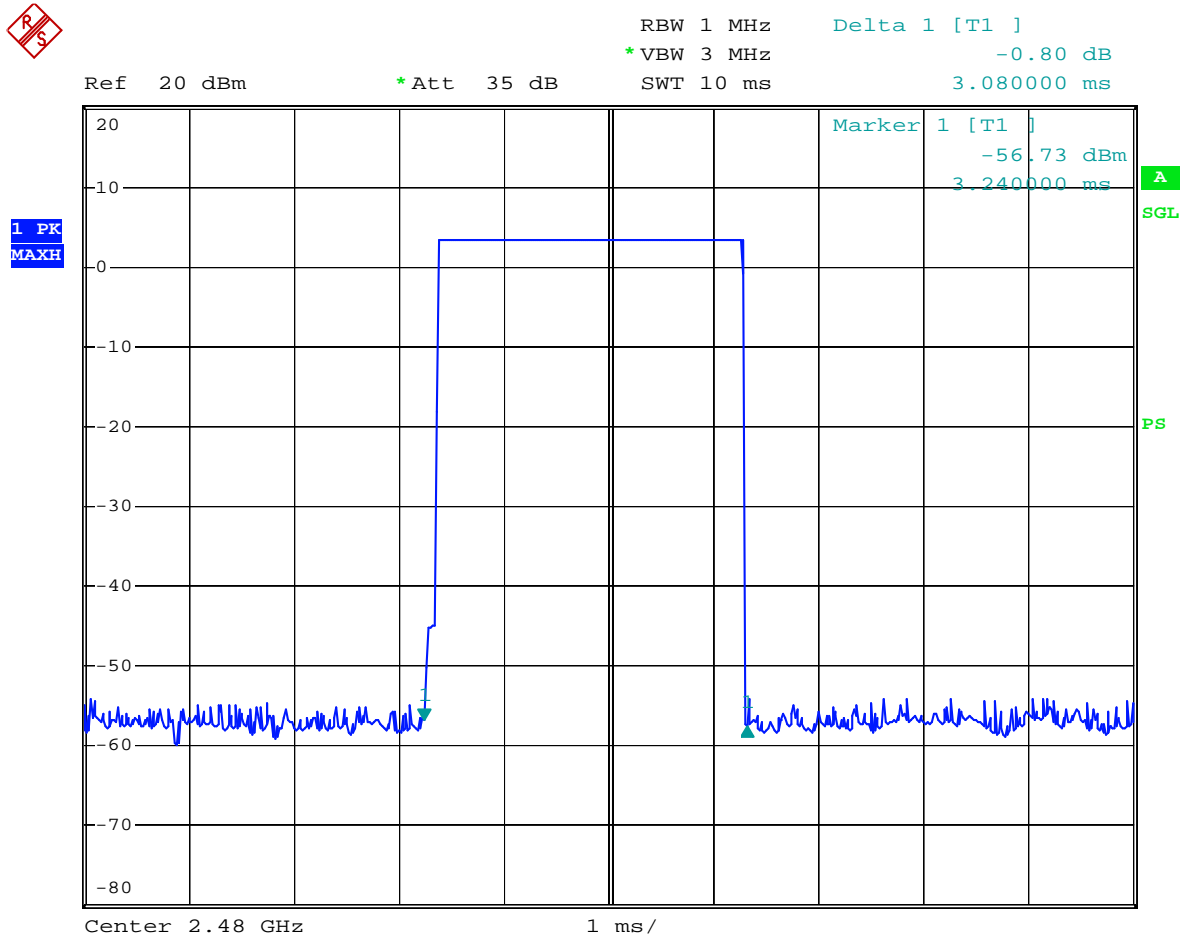
Dwell time DH 5 low channel

### Middle Channel for DH5



Dwell time DH 5 middle channel

### High Channel for DH5



Dwell time DH 5 high channel

## CFR47 §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

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
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 Compliance 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>	27 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.0 kPa

The testing was performed by Phoenix Liu on 2008-05-26.

Test Mode: Transmitting

Freq. (MHz)	Receiver Reading (dBμV)	Detector PK/AV	Table Direction Degree	Antenna		Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBμV/m)	Tran. Factor (dB)	EIRP		Part 15C Limit (mW)
				Height (m)	Factor (dB)					(dBm)	mW	
Low Channel												
2402	90.34	PK	120	1.0	36.75	4.0	35	96.09	95.27	0.82	1.21	1000
Middle Channel												
2441	93.25	PK	0	1.0	36.80	4.1	35	99.15	95.27	3.88	2.44	1000
High Channel												
2480	91.54	PK	180	1.2	37.26	4.2	35	98.00	95.27	2.73	1.87	1000

**Note:** P(dBm) = E (dBμV/m) – 95.27

## CFR47 §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 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)).

### 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 Compliance 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>	27 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.0 kPa

*The testing was performed by Phoenix Liu on 2008-05-26.*

*Test Mode: Transmitting*

<b>Frequency (MHz)</b>	<b>Delta Peak to in Band Emission (dBc)</b>	<b>Limit (dBc)</b>
2310-2390	47.17	>20
2483.5-2500	45.58	>20

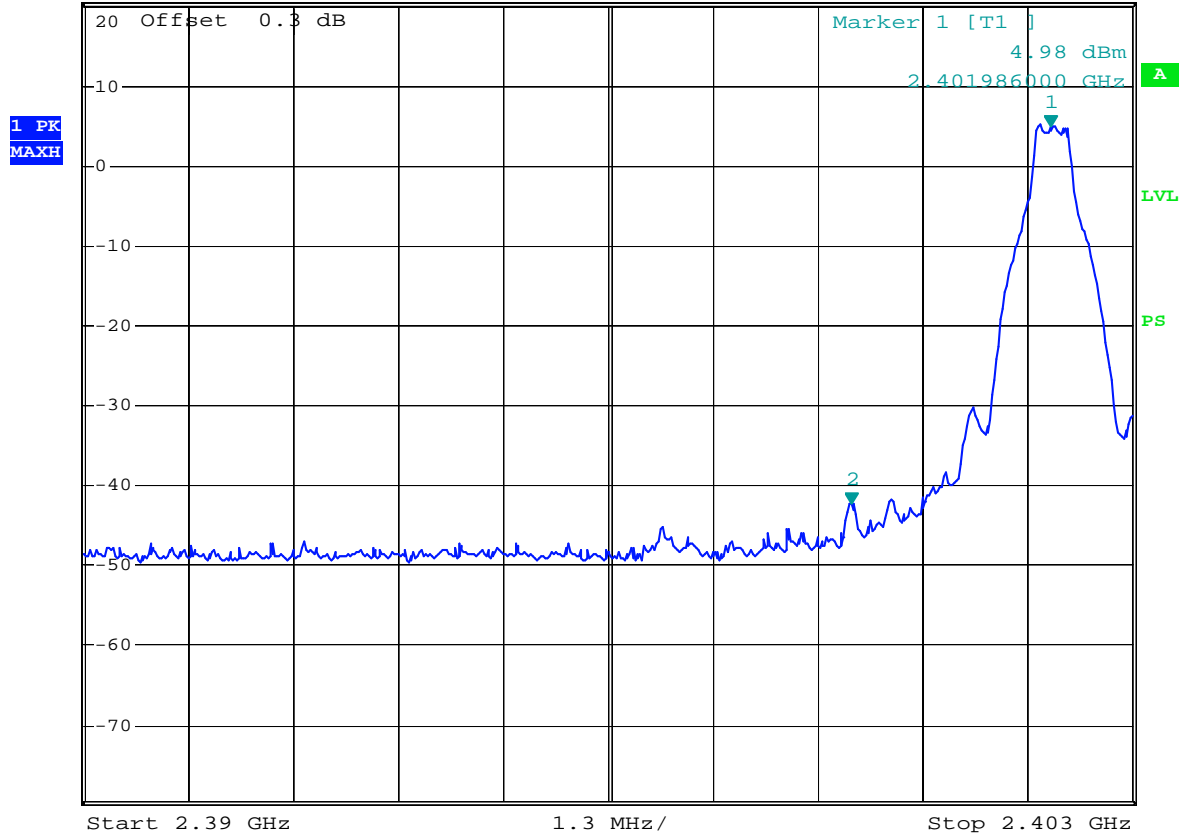
**Test Result:** Pass

Please refer to the following plots.

### Band Edge on Left Side



Ref 20.3 dBm      \*Att 35 dB      \*RBW 100 kHz      Marker 2 [T1 ]  
VBW 300 kHz      -42.19 dBm  
SWT 2.5 ms      2.399516000 GHz



band edge left

Date: 26.MAY.2008 22:40:43

