



NVLAP LAB CODE 200707-0



# FCC PART 15.247

## MEASUREMENT AND TEST REPORT

For

### Weifang GoerTek Electronics Co., Ltd

Dongfang North Road Hi-tech Industry Development District,  
Weifang, Shandong, China

**FCC ID: SZG-GBDU99**

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report (Rev.1)		<b>Equipment Type:</b> BT Bluetooth Dongle	
<b>Test Engineer:</b>	Andy Yan	<i>Andy Yan</i>	
<b>Report No.:</b>	RBJ07082251-a		
<b>Test Date:</b>	2008-01-10 to 2008-01-15		
<b>Report Date:</b>	2008-01-17		
<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 *Weifang GoerTek Electronics Co.,Ltd* 's product, model number: *GBDU99* or the "EUT" as referred to in this report is a *BT Bluetooth Dongle*, which measures approximately: 5.1 cm L x 1.8 cm W x 0.7 cm H, rated input voltage: PC 5.0V.

*\* All measurement and test data in this report was gathered from production sample serial number: 0708023 (Assigned by BAACL, Shenzhen). The EUT was received on 2007-08-22.*

### Objective

This Type approval report is prepared on behalf of *Weifang GoerTek Electronics Co.,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). 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).

### EUT Exercise Software

N/A.

### Special Accessories

No special accessories were required during testing.

### Equipment Modifications

No modification was made to the unit tested.

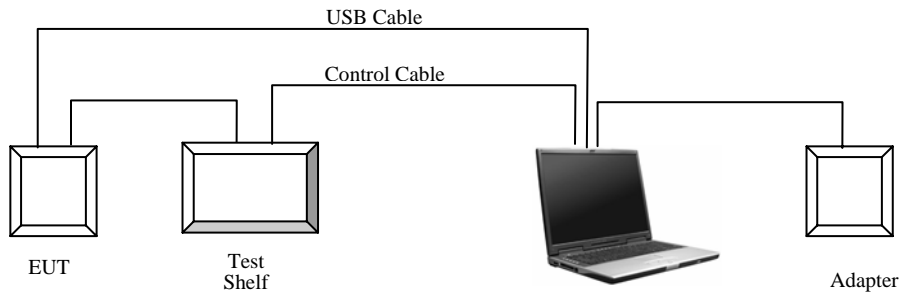
### Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
IBM	Notebook	2373	32P4414	DoC

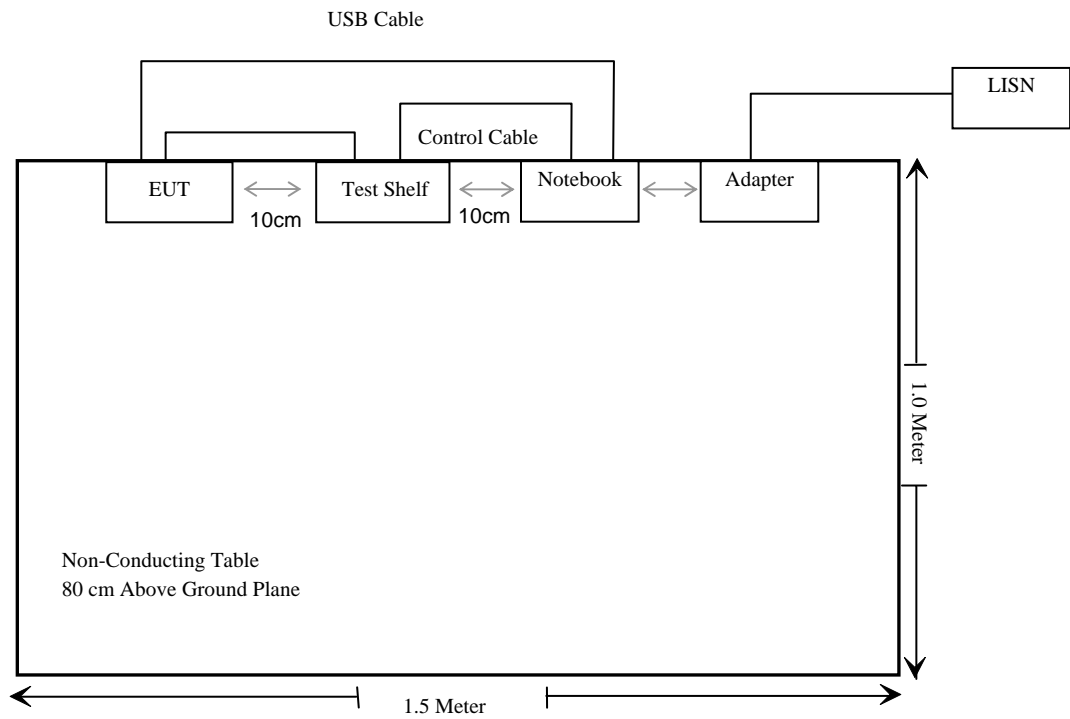
### External I/O Cable

Cable Description	Length (m)	From Port	To
Unshielded Detachable LPT Cable	1.5	PC(Notebook)	EUT
Shielded Detachable USB Cable	0.8	PC(Notebook)	EUT

### 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>
CFR47 §15.247 (i), §1.1307 (b)(1)	RF exposure	Compliant
CFR47 §15.203	Antenna Requirement	Compliant
CFR47 §15.207 (a)	Conducted Emissions	Compliant
CFR47 §15.205	Restricted Band	Compliant
CFR47 §15.205, §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

## CFR47 §15.247 (i) and §1.1310 §2.1093 - RF EXPOSURE

### Standard Applicable

According to CFR47 § 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, fGHz 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  $6.01\text{mW} < 24.58\text{mW} = (60/2.441\text{GHz}) \text{ mW}$

**The SAR measurement is not necessary.**



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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 printed antenna on PCB. The maximum gain is 2.93 dBi.

**Result:** Compliance.

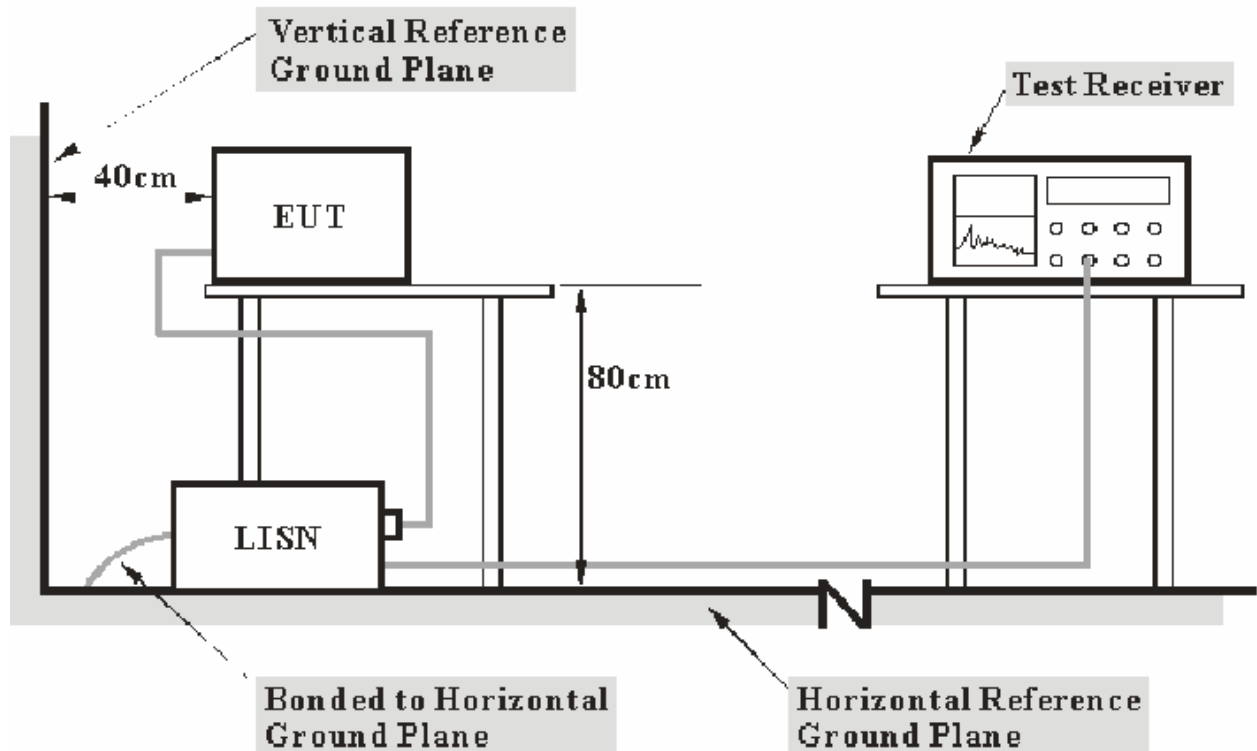
## CFR47 §15.207 (a) - CONDUCTED EMISSIONS

### 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 subpart C 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 Notebook 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	ESCI	100035	2007-10-16	2008-10-16
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2007-03-26	2008-03-26

\* 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 host PC 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:

**4.30 dB at 18.270 MHz** in the **Neutral** 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 Andy Yan on 2008-01-15.*

*Test Mode: Operating*

Line Conducted Emissions				FCC PART 15.207	
Frequency (MHz)	Amplitude (dB $\mu$ V)	Detector QP/AV	Conductor Hot/Neutral	Limit (dB $\mu$ V)	Margin (dB)
18.270	55.70	QP	Neutral	60.00	4.30
0.235	42.10	AV	Hot	52.27	10.17
0.235	40.00	AV	Neutral	52.27	12.27
19.525	44.10	QP	Hot	60.00	15.90
1.415	29.20	AV	Hot	46.00	16.80
0.235	44.30	QP	Hot	62.27	17.97
0.355	30.80	AV	Neutral	48.84	18.04
0.355	30.20	AV	Hot	48.84	18.64
1.420	27.20	AV	Neutral	46.00	18.80
1.535	26.90	AV	Neutral	46.00	19.10
0.235	42.70	QP	Neutral	62.27	19.57
1.530	25.90	AV	Hot	46.00	20.10
5.670	28.90	AV	Neutral	50.00	21.10
1.535	34.30	QP	Neutral	56.00	21.70
5.775	28.00	AV	Hot	50.00	22.00
1.415	33.90	QP	Hot	56.00	22.10
5.775	37.50	QP	Hot	60.00	22.50
0.355	35.60	QP	Hot	58.84	23.24
1.420	32.70	QP	Neutral	56.00	23.30
0.355	35.50	QP	Neutral	58.84	23.34
5.670	36.60	QP	Neutral	60.00	23.40
1.530	32.40	QP	Hot	56.00	23.60
18.365	22.50	AV	Neutral	50.00	27.50
19.710	18.30	AV	Hot	50.00	31.70

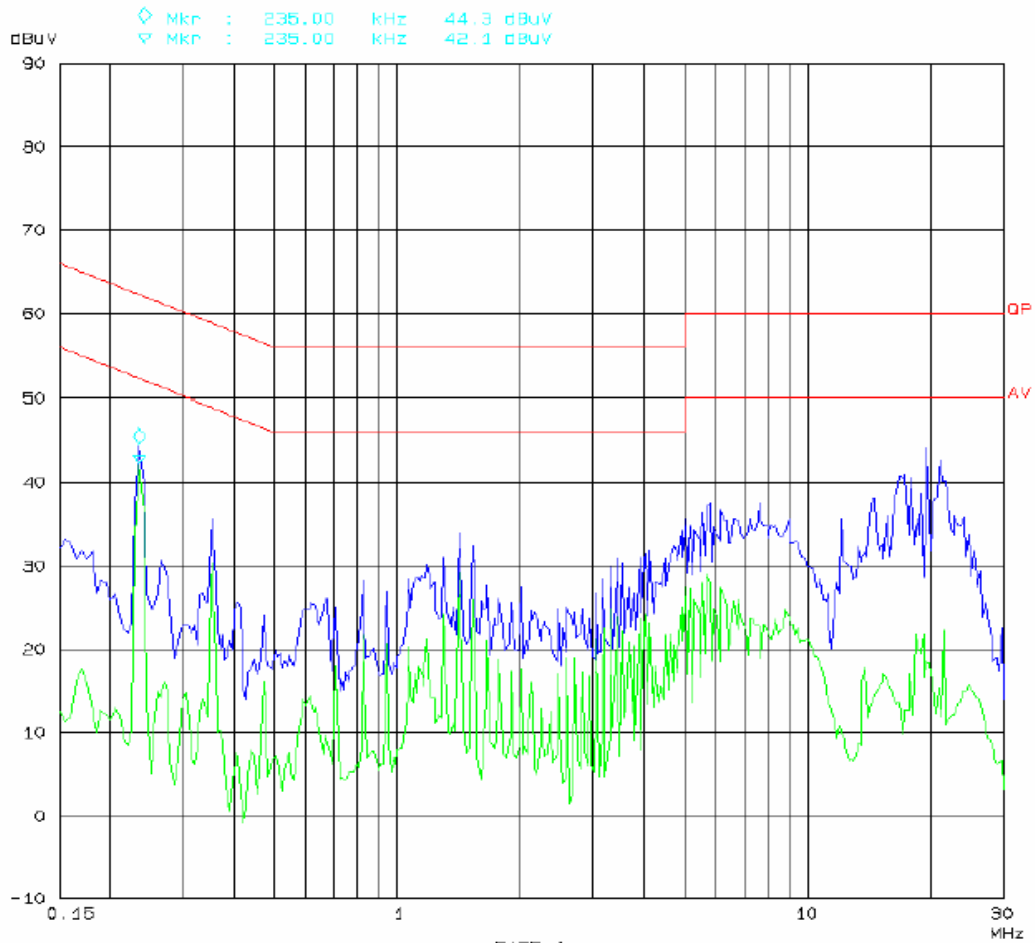
**Plot(s) of Test Data**

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

CONDUCTED EMISSION TEST  
FCC 15

15. Jan 08 09:05

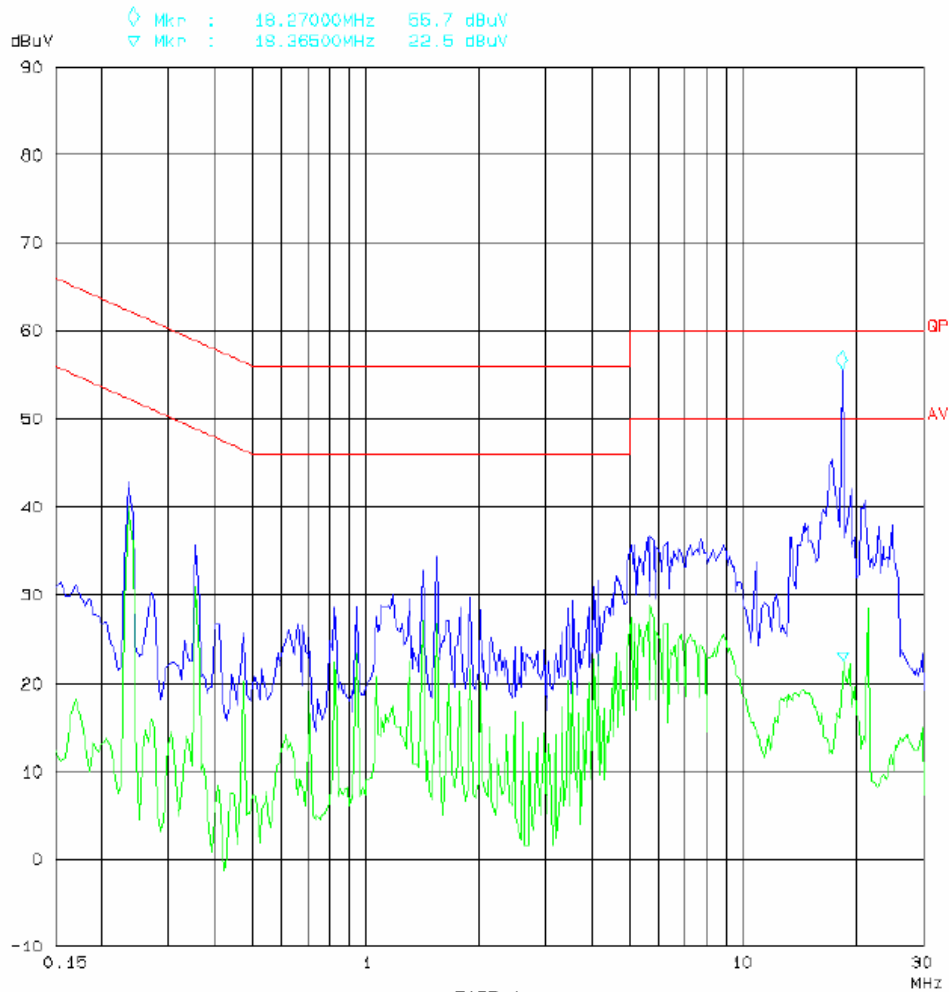
EUT: BT Bluetooth dongle M/K GBDU99  
Manuf: GDERTEK  
Op Cond: Operating  
Operator: Andy  
Test Spec: AC 120/60Hz H  
Comment: Temp: 24%Hum: 50%



CONDUCTED EMISSION TEST  
FCC 15

15. Jan 08 08:38

EUT: BT Bluetooth dongle M/N: GBDU99  
Manuf: GOERTEK  
Op Cond: Operating  
Operator: Andy  
Test Spec: AC 120/60Hz N  
Comment: Temp: 24%Hum: 50%



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

### Applicable Standard

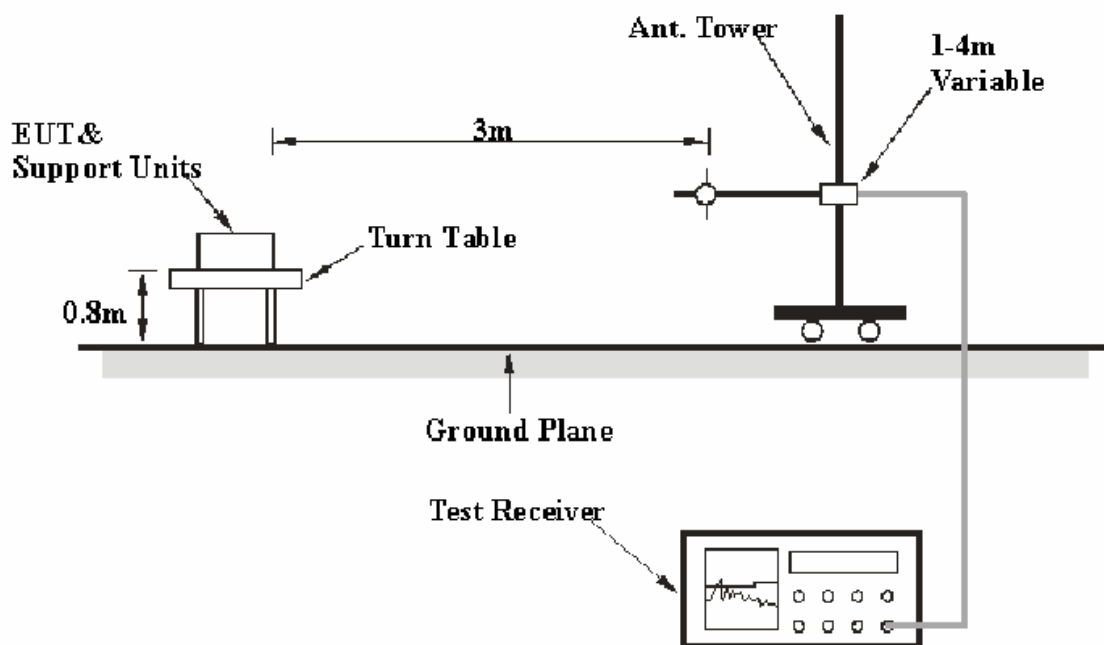
CFR47 §15.205; §15.209; §15.247 (d).

### 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 15.209 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 Notebook 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	2007-08-14	2008-08-14
HP	Amplifier	8449B	3008A00277	2007-09-29	2008-09-29
Sunol Sciences	Horn Antenna	DRH-118	A052604	2007-09-25	2008-09-25
Agilent	Spectrum Analyzer	8564E	3943A01781	2007-11-22	2008-11-22

\* **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 C, sections 15.205, 15.209, and 15.247, with the worst margin reading of:

- 15.20 dB at 71.086200 MHz in the Vertical polarization, for below 1GHz (Low Channel)**
- 15.20 dB at 71.117400 MHz in the Vertical polarization, for below 1GHz (Middle Channel)**
- 16.70 dB at 71.112675 MHz in the Vertical polarization, for below 1GHz (High Channel)**
- 2.15dB at 4804 MHz in the Horizontal polarization, for above 1GHz (Low Channel)**
- 1.85 dB at 4882 MHz in the Horizontal polarization, for above 1GHz (Middle Channel)**
- 1.94dB at 4960 MHz in the Horizontal polarization, for above 1GHz (High Channel)**

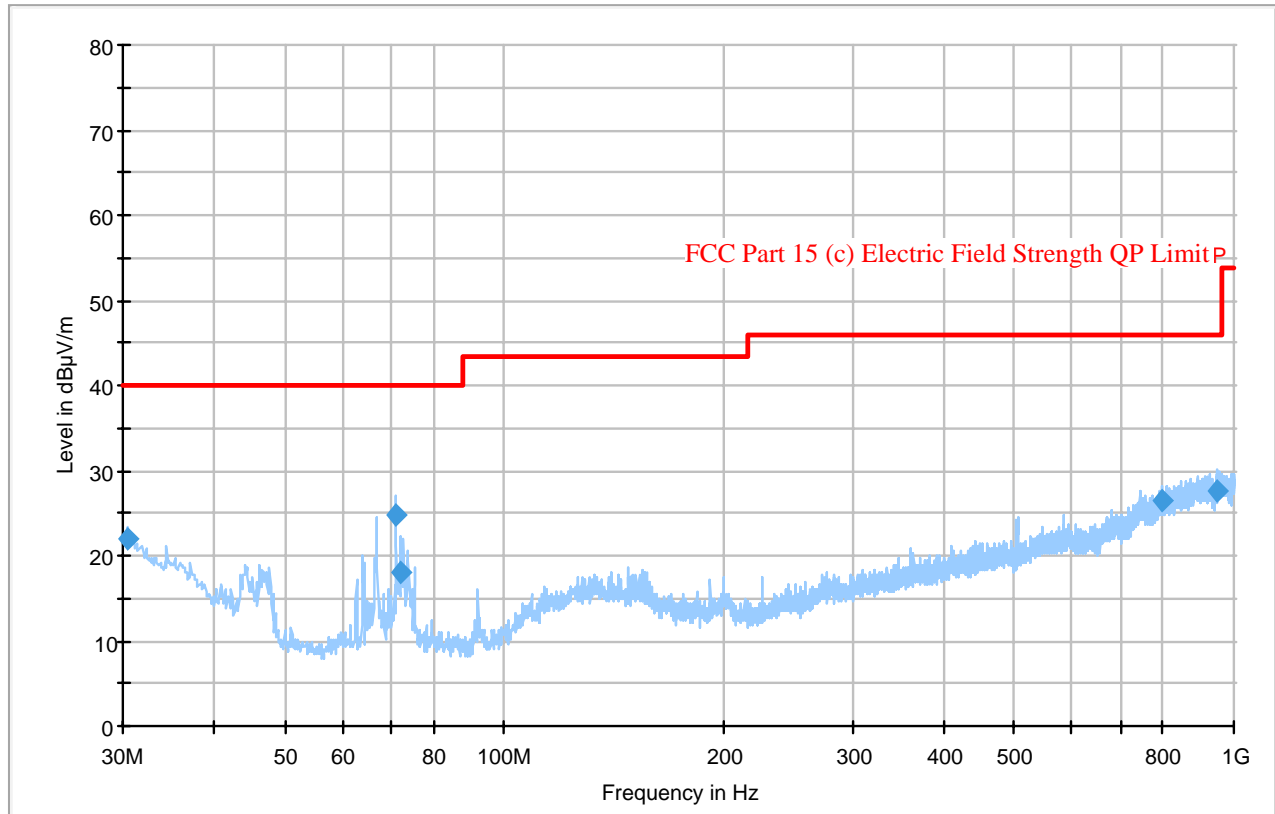
## Test Data

### Environmental Conditions

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	52%
<b>ATM Pressure:</b>	100.9kPa

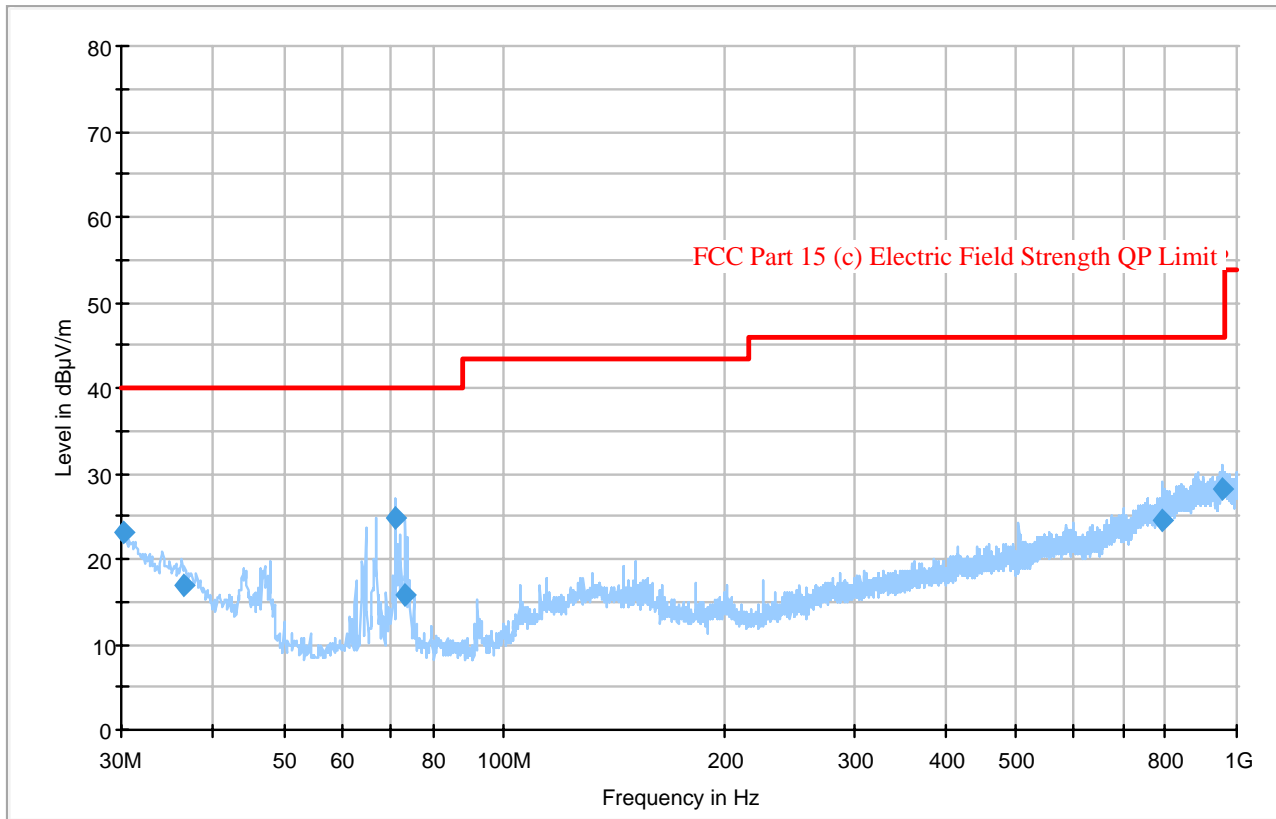
*The testing was performed by Andy Yan on 2007-07-26*

Test Mode: Transmitting (Low Channel)



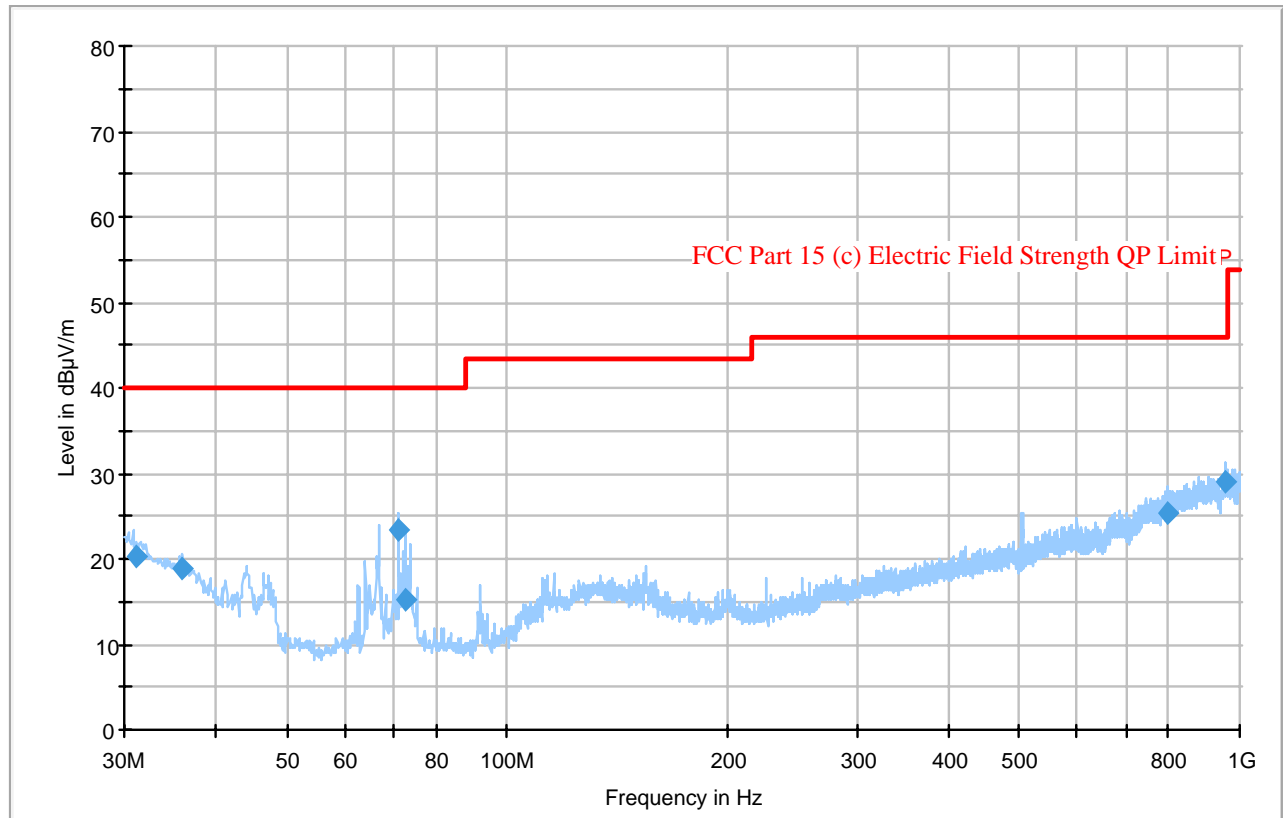
Frequency (MHz)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
71.086200	24.8	142.0	V	75.0	-16.9	40.0	15.2
30.417050	22.1	146.0	H	191.0	-4.5	40.0	17.9
951.942100	27.7	306.0	V	282.0	4.8	46.0	18.3
794.857525	26.4	156.0	V	64.0	2.2	46.0	19.6
72.183525	18.0	102.0	V	324.0	-16.9	40.0	22.0

Test Mode: Transmitting (Middle Channel)



Frequency (MHz)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
71.117400	24.8	121.0	V	23.0	-16.9	40.0	15.2
30.190485	23.1	137.0	H	169.0	-4.4	40.0	17.0
956.547275	28.1	373.0	V	42.0	4.9	46.0	17.9
791.359450	24.5	143.0	V	259.0	2.1	46.0	21.5
36.555050	16.9	298.0	H	65.0	-8.7	40.0	23.1
73.390475	15.7	117.0	V	47.0	-16.9	40.0	24.3

Test Mode: Transmitting (High Channel)



Frequency (MHz)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
71.112675	23.3	132.0	V	64.0	-16.9	40.0	16.7
956.539475	29.2	119.0	H	96.0	4.9	46.0	16.8
31.115600	20.3	400.0	H	65.0	-5.0	40.0	19.7
797.002150	25.3	155.0	H	287.0	2.3	46.0	20.7
36.002200	18.8	188.0	V	57.0	-8.2	40.0	21.2
72.623525	15.3	119.0	V	313.0	-16.9	40.0	24.7

Test Mode: Transmitting (Above 1GHz)

Freq. (MHz)	Meter Reading (dBuV)	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/m)				Limit (dBuV/m)	Margin (dB)	Remarks
<b>Low Channel</b>												
2402	99.82	PK	90	1.0	H	30.6	3.61	35.0	99.03			Fund.
2402	67.96	AV	45	1.0	H	30.6	3.61	35.0	67.17			Fund.
2402	103.68	PK	90	1.0	V	30.6	3.61	35.0	102.89			Fund.
2402	68.82	AV	45	1.0	V	30.6	3.61	35.0	68.03			Fund.
4804	44.01	AV	90	1.0	H	36.6	4.64	33.4	51.85	54	2.15*	Harmonic
4804	45.11	AV	90	1.0	V	35.4	4.64	33.4	51.75	54	2.25*	Harmonic
4804	60.54	PK	180	1.2	V	35.4	4.64	33.4	67.18	74	6.82	Harmonic
4804	59.20	PK	180	1.2	H	36.6	4.64	33.4	67.04	74	6.96	Harmonic
1601	42.54	AV	180	1.2	V	26.0	2.77	35.0	36.31	54	17.69	Spurious
1601	40.19	AV	180	1.2	H	26.5	2.77	35.0	34.46	54	19.54	Spurious
1601	56.72	PK	45	1.2	V	26.0	2.77	35.0	50.49	74	23.51	Spurious
1601	52.21	PK	45	1.2	H	26.5	2.77	35.0	46.48	74	27.52	Spurious
<b>Middle Channel</b>												
2441	100.24	PK	60	1.4	V	30.6	3.61	35	99.45			Fund.
2441	66.56	AV	152	1.3	V	30.6	3.61	35	65.77			Fund.
2441	103.85	PK	128	1.5	H	30.6	3.61	35	103.06			Fund.
2441	67.96	AV	156	1.2	H	30.6	3.61	35	67.17			Fund.
4882	44.31	AV	243	1.4	H	36.6	4.64	33.4	52.15	54	1.85*	Harmonic
4882	45.41	AV	142	1.6	V	35.4	4.64	33.4	52.05	54	1.95*	Harmonic
4882	63.09	PK	234	1.8	V	35.4	4.64	33.4	69.73	74	4.27	Harmonic
4882	60.12	PK	153	1.5	H	36.6	4.64	33.4	67.96	74	6.04	Harmonic
1627.8	41.92	AV	135	1.3	V	26.0	2.77	35.0	35.69	54	18.31	Spurious
1627.8	40.28	AV	85	1.5	H	26.5	2.77	36.0	33.55	54	20.45	Spurious
1627.8	54.83	PK	156	1.4	V	26.0	2.77	35.0	48.6	74	25.4	Spurious
1627.8	53.16	PK	265	1.4	H	26.5	2.77	36.0	46.43	74	27.57	Spurious
<b>High Channel</b>												
2480	99.93	PK	89	1.5	H	30.6	3.61	35	99.14			Fund.
2480	66.83	AV	65	1.5	H	30.6	3.61	35	66.04			Fund.
2480	101.72	PK	65	1.4	V	30.6	3.61	35	100.93			Fund.
2480	66.90	AV	65	1.6	V	30.6	3.61	35	66.11			Fund.
4960	44.31	AV	256	1.8	H	36.6	4.55	33.4	52.06	54	1.94*	Harmonic
4960	44.71	AV	142	1.5	V	35.4	4.55	33.4	51.26	54	2.74*	Harmonic
4960	60.57	PK	145	1.4	H	36.6	4.55	33.4	68.32	74	5.68	Harmonic
4960	58.61	PK	142	1.4	V	35.4	4.55	33.4	65.16	74	8.84	Harmonic
1653.9	42.54	AV	156	1.2	H	26.5	2.77	35.0	36.81	54	17.19	Spurious
1653.9	41.07	AV	210	1.2	V	26.0	2.77	35.0	34.84	54	19.16	Spurious
1653.9	56.43	PK	128	1.5	H	26.5	2.77	35.0	50.7	74	23.3	Spurious
1653.9	55.72	PK	240	1.4	V	26.0	2.77	35.0	49.49	74	24.51	Spurious

\* Within measurement uncertainty.

**Radiated Emissions in restricted band**

Spurious emission in restricted band: (RBW=1MHz, VBW=3MHz)

Freq. (MHz)	Reading (dBuV/m)	Detector PK/QP/AV	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBuV/m)	FCC 15.209	
				Height (m)	Polar (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)
<b>(2310 – 2390 MHz)</b>											
2387.9	37.96	AV	156	1.4	V	30.6	3.61	35	37.17	54	16.83
2336.4	37.65	AV	90	1.1	H	30.6	3.61	35	36.86	54	17.14
2367.5	37.25	AV	90	1	V	30.6	3.61	35	36.46	54	17.54
2387.2	50.03	PK	45	1.2	V	30.6	3.61	35	49.24	74	24.76
2336.8	49.87	PK	180	1.2	H	30.6	3.61	35	49.08	74	24.92
2367.6	49.66	PK	180	1.2	V	30.6	3.61	35	48.87	74	25.13
<b>(2483.5 – 2500 MHz)</b>											
2484.7	38.01	AV	90	1.1	H	30.6	3.61	35	37.22	54	16.78
2491.2	36.66	AV	45	1.2	H	30.6	3.61	35	35.87	54	18.13
2496.7	36.42	AV	156	1.4	V	30.6	3.61	35	35.63	54	18.37
2484.6	50.06	PK	153	1.5	H	30.6	3.61	35	49.27	74	24.73
2491.4	49.94	PK	243	1.4	H	30.6	3.61	35	49.15	74	24.85
2496.3	48.28	PK	234	1.8	V	30.6	3.61	35	47.49	74	26.51

## 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>	50 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Andy Yan on 2008-01-10.*

*Test Mode: Transmitting*

Channel	Channel Frequency (MHz)	Channel Separation (kHz)	Limit (kHz)	Result
Low Channel	2402	1004	509.3	Pass
Adjacency Channel	2403			
Middle Channel	2441	1004	514.7	Pass
Adjacency Channel	2442			
High Channel	2480	1004	506.7	Pass
Adjacency Channel	2479			

**Test Result:** Compliance.

Please refer to following plots



### Low Channel

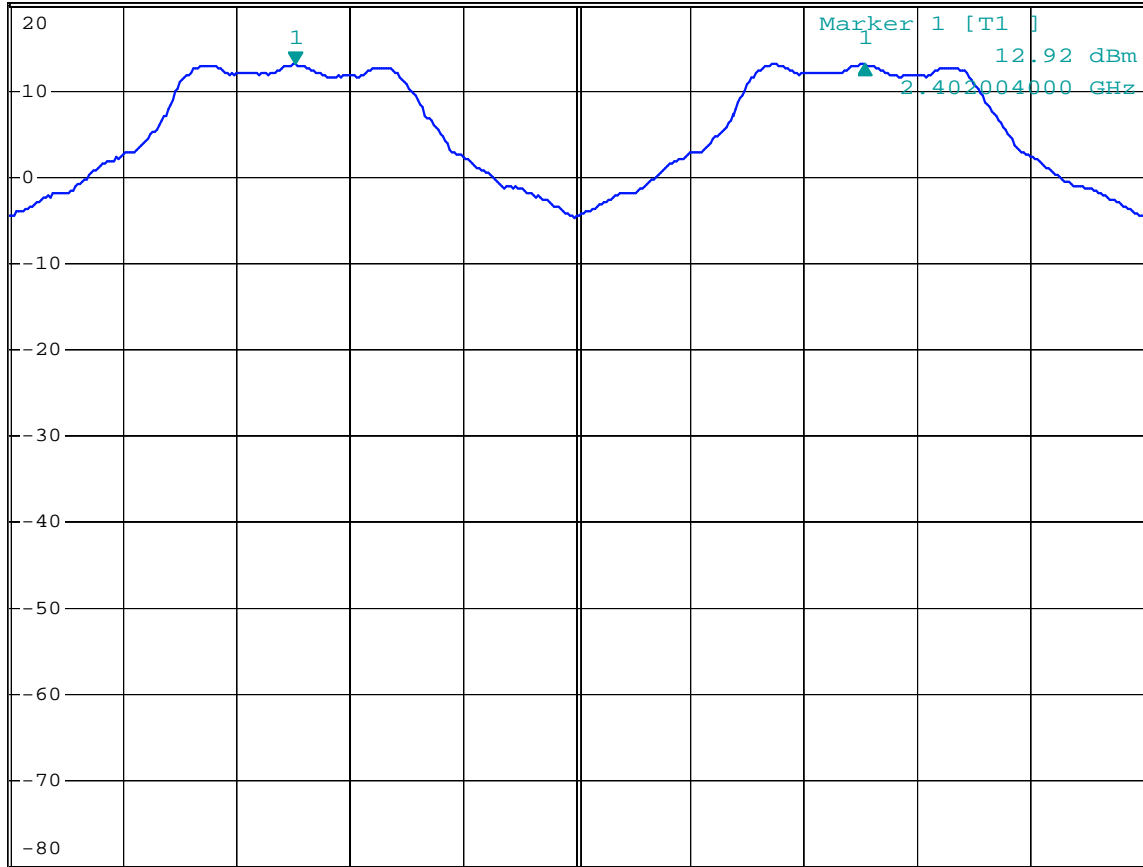


\*RBW 100 kHz Delta 1 [T1 ]  
\*VBW 300 kHz 0.03 dB  
SWT 2.5 ms 1.004000000 MHz

Ref 20 dBm

\*Att 35 dB

1 PK  
MAXH



A

PS

Center 2.4025 GHz

200 kHz/

Span 2 MHz

channel separation low channel

Date: 10.JAN.2008 23:01:54

### Middle Channel

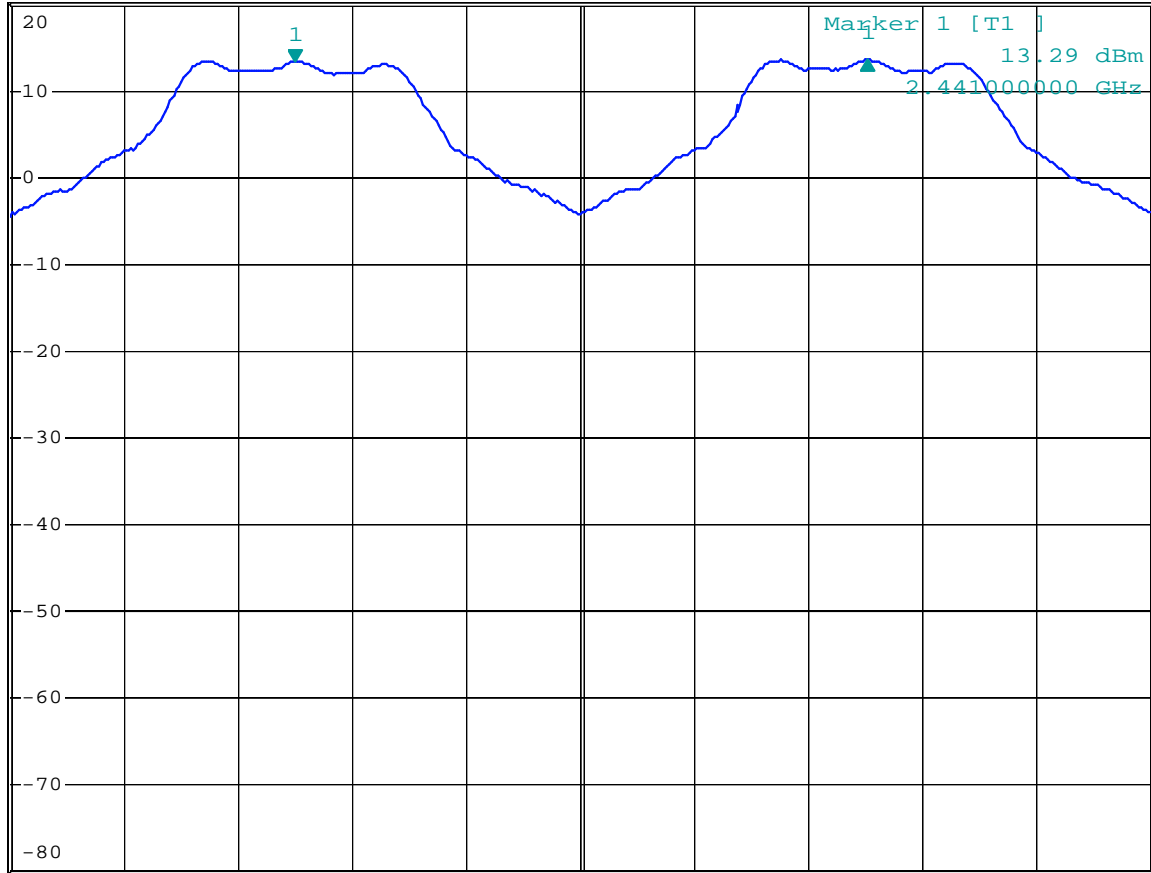


\*RBW 100 kHz    Delta 1 [T1 ]  
\*VBW 300 kHz    0.18 dB  
SWT 2.5 ms    1.004000000 MHz

Ref 20 dBm

\*Att 35 dB

1 PK  
MAXH



Center 2.4415 GHz

200 kHz/

Span 2 MHz

channel separation middle channel

Date: 10.JAN.2008 23:00:18

### High Channel

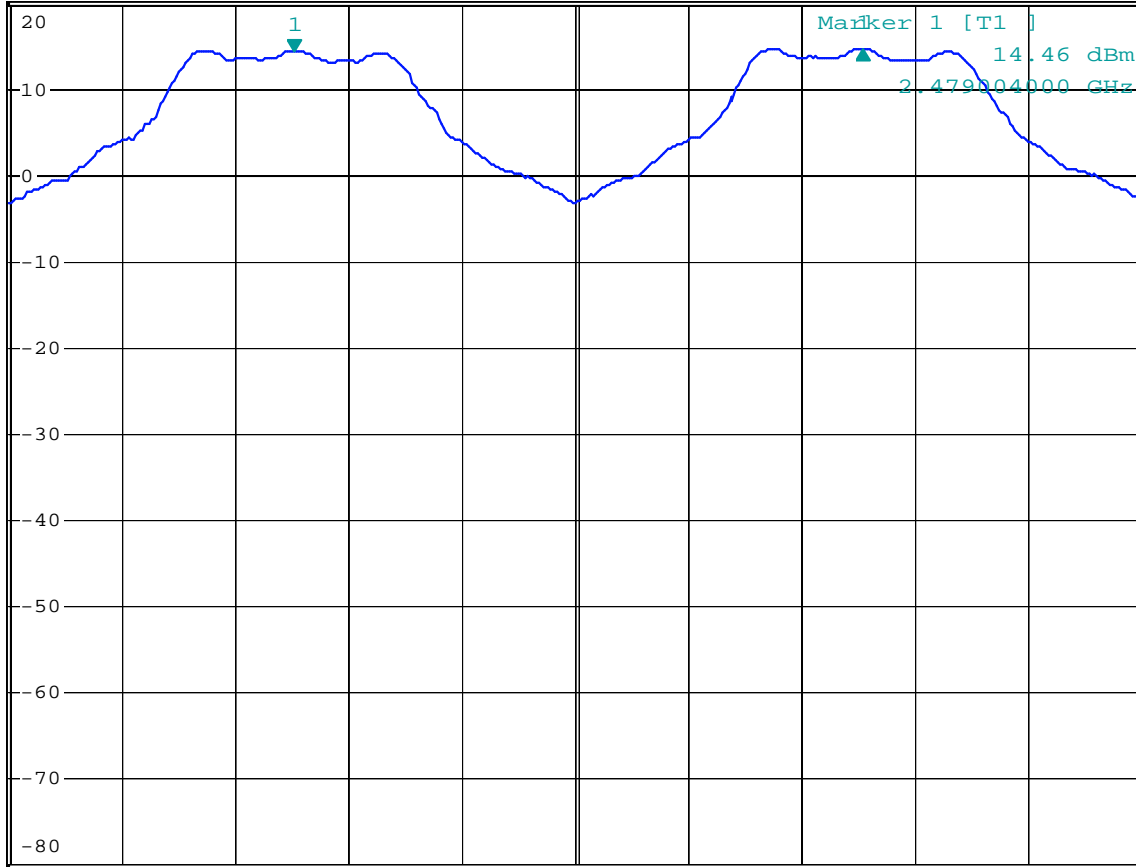


\*RBW 100 kHz    Delta 1 [T1 ]  
\*VBW 300 kHz    0.19 dB  
SWT 2.5 ms      1.004000000 MHz

Ref 20 dBm

\*Att 35 dB

1 PK  
MAXH



Center 2.4795 GHz

200 kHz/

Span 2 MHz

channel separation high channel

Date: 10.JAN.2008 23:02:57

## 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>	50 %
<b>ATM Pressure:</b>	100.9 kPa

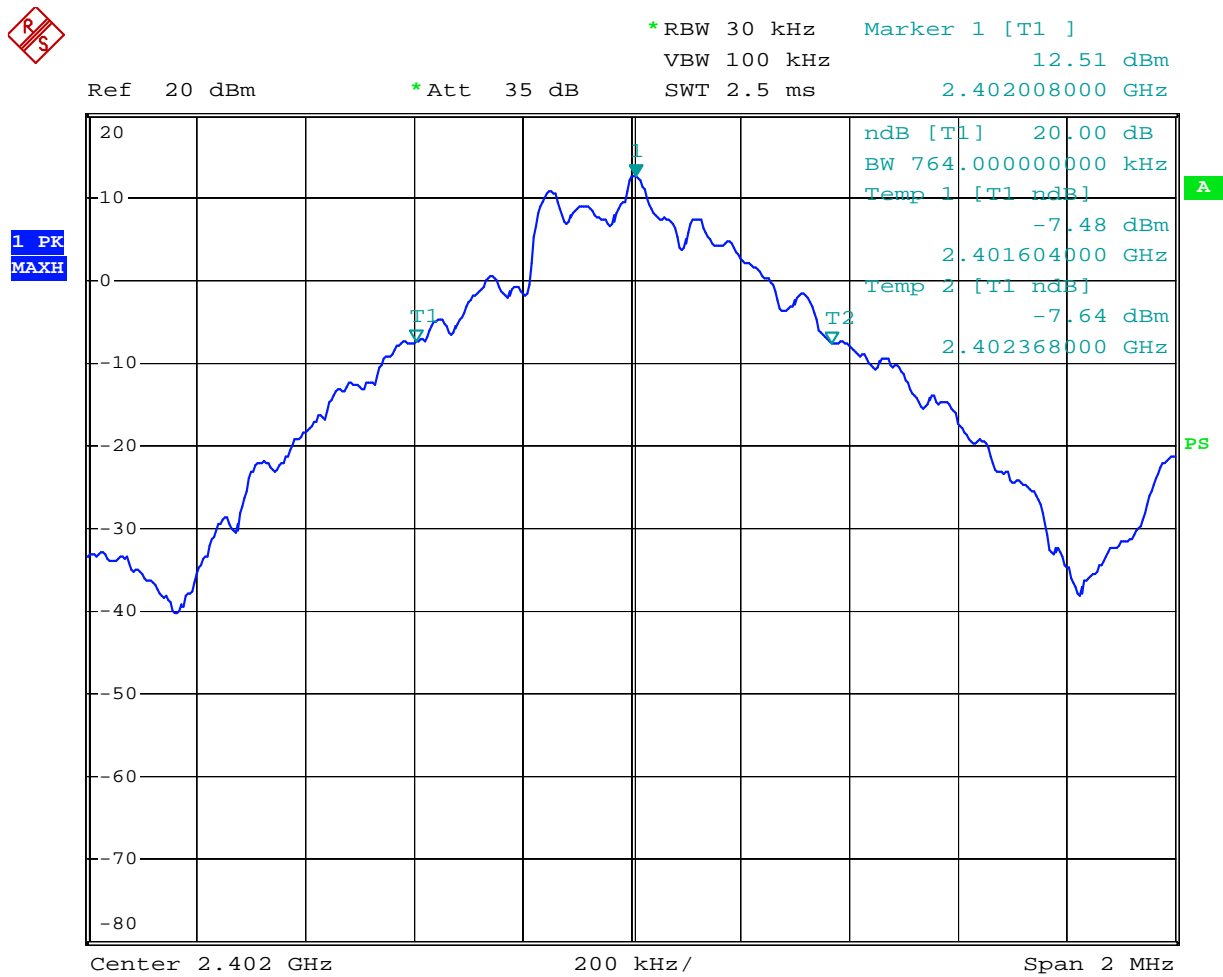
*The testing was performed by Andy Yan on 2008-01-13.*

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

*Test Mode: Transmitting*

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)
Low	2402	764
Middle	2441	772
High	2480	760

**Low Channel**



20dB bandwidth low channel

Date: 13.JAN.2008 05:23:26

### Middle Channel

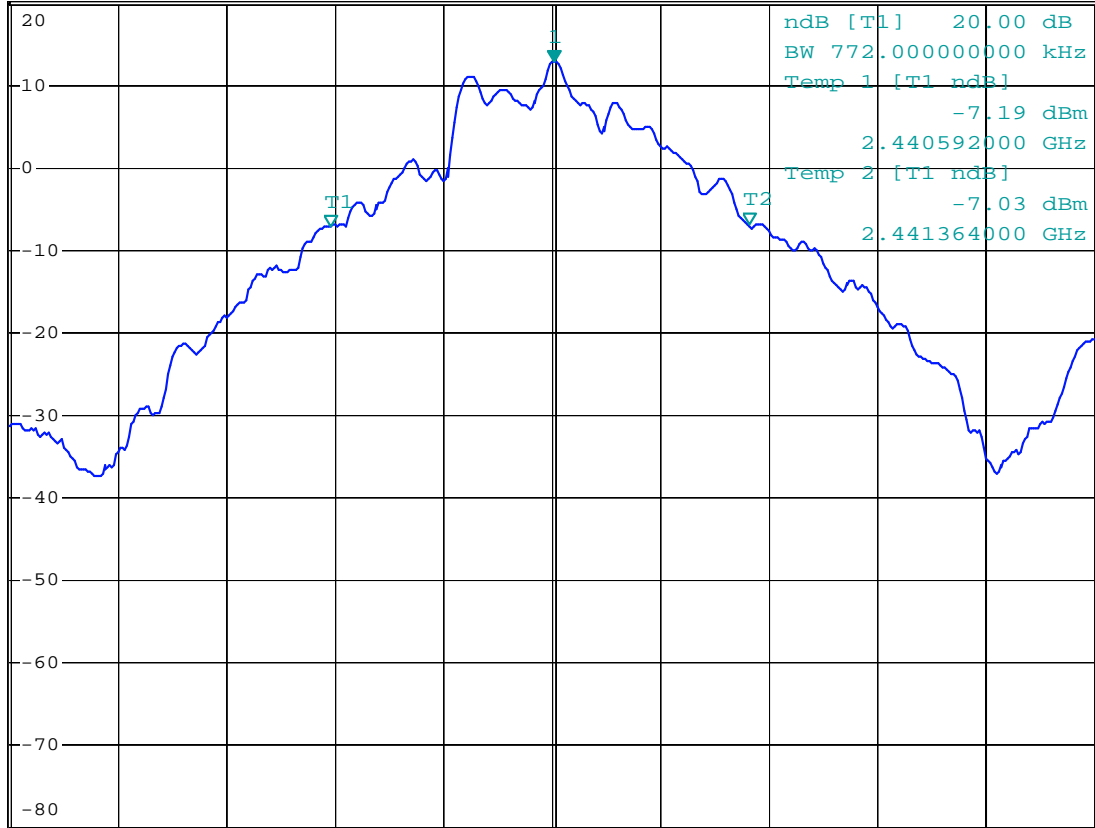


\*RBW 30 kHz    Marker 1 [T1 ]  
VBW 100 kHz                    12.82 dBm  
SWT 2.5 ms                    2.441004000 GHz

Ref 20 dBm

\*Att 35 dB

1 PK  
MAXH



Center 2.441 GHz

200 kHz/

Span 2 MHz

20dB bandwidth midle channel

Date: 13.JAN.2008 05:22:19

### High Channel

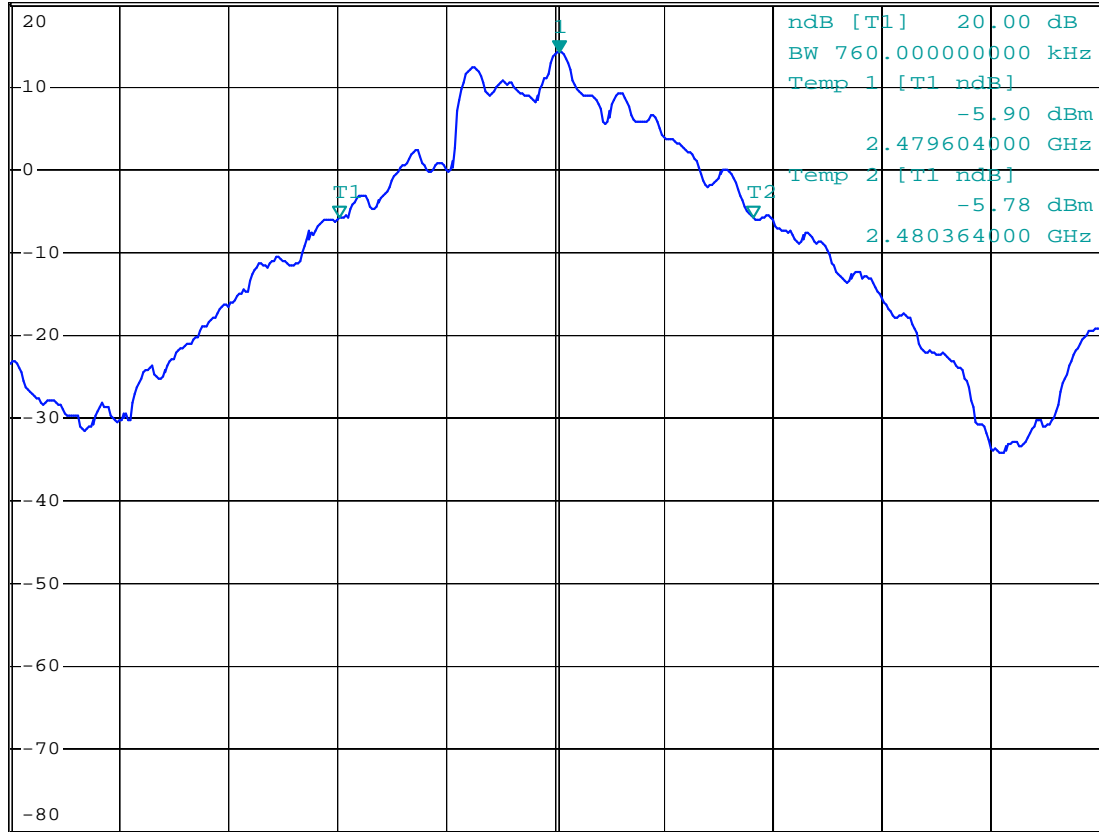


\*RBW 30 kHz    Marker 1 [T1 ]  
VBW 100 kHz    14.07 dBm  
SWT 2.5 ms    2.48008000 GHz

Ref 20 dBm

\*Att 35 dB

1 PK  
MAXH



Center 2.48 GHz    200 kHz/    Span 2 MHz

20dB bandwidth high channel

Date: 13.JAN.2008 05:21:22

## 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>	50 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Andy Yan on 2008-01-10.*

*Test Mode: Transmitting*

**Test Result:** Compliance.

Please refer to following plot.

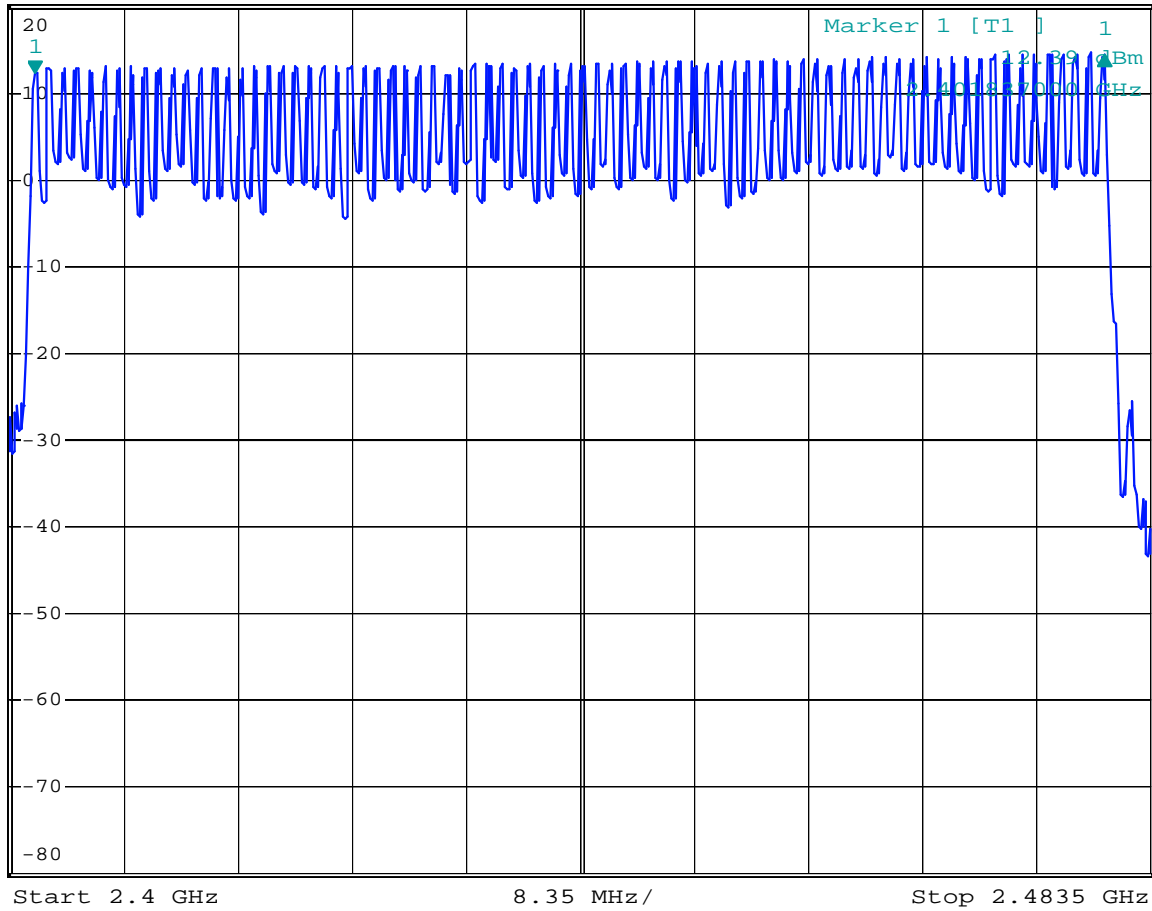


### Number of Hopping Channels



\*RBW 100 kHz Delta 1 [T1 ]  
\*VBW 300 kHz 2.05 dB  
Ref 20 dBm \*Att 35 dB SWT 10 ms 78.32300000 MHz

1 PK  
MAXH



number of hopping channels

Date: 10.JAN.2008 21:47:41

**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**

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**

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>	50 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Andy Yan on 2008-01-10.*

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots

Channel	Pulse width (msec)	Dwell time (sec)	Limit (sec)	Result
Low	0.625	0.200	0.4	Pass
Middle	0.625	0.200	0.4	Pass
High	0.625	0.200	0.4	Pass

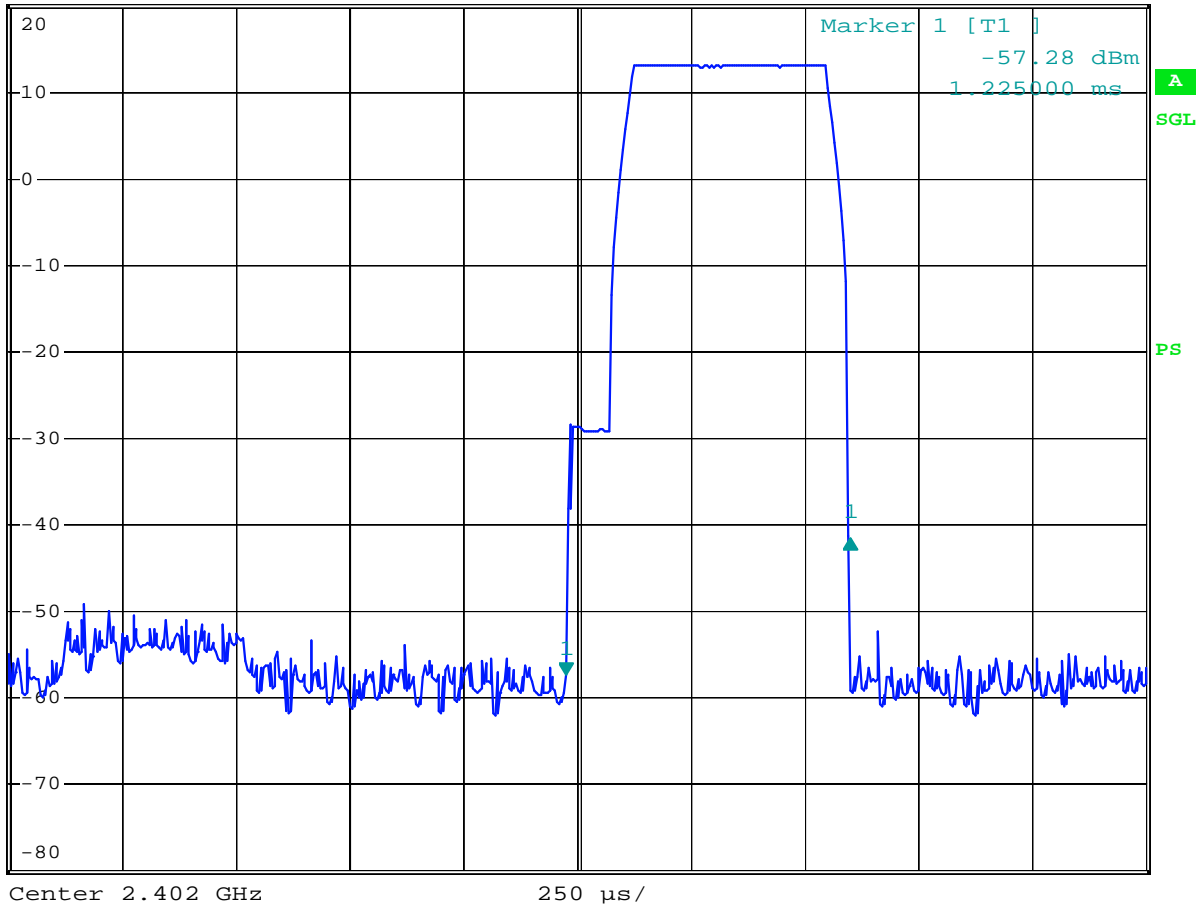
**NOTE:** Dwell time=Pulse width (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second

### Low Channel



RBW 1 MHz      Delta 1 [T1 ]  
\*VBW 3 MHz      15.66 dB  
Ref 20 dBm      \*Att 35 dB      SWT 2.5 ms      625.000000  $\mu$ s

1 PK  
MAXH



dwll time low channel

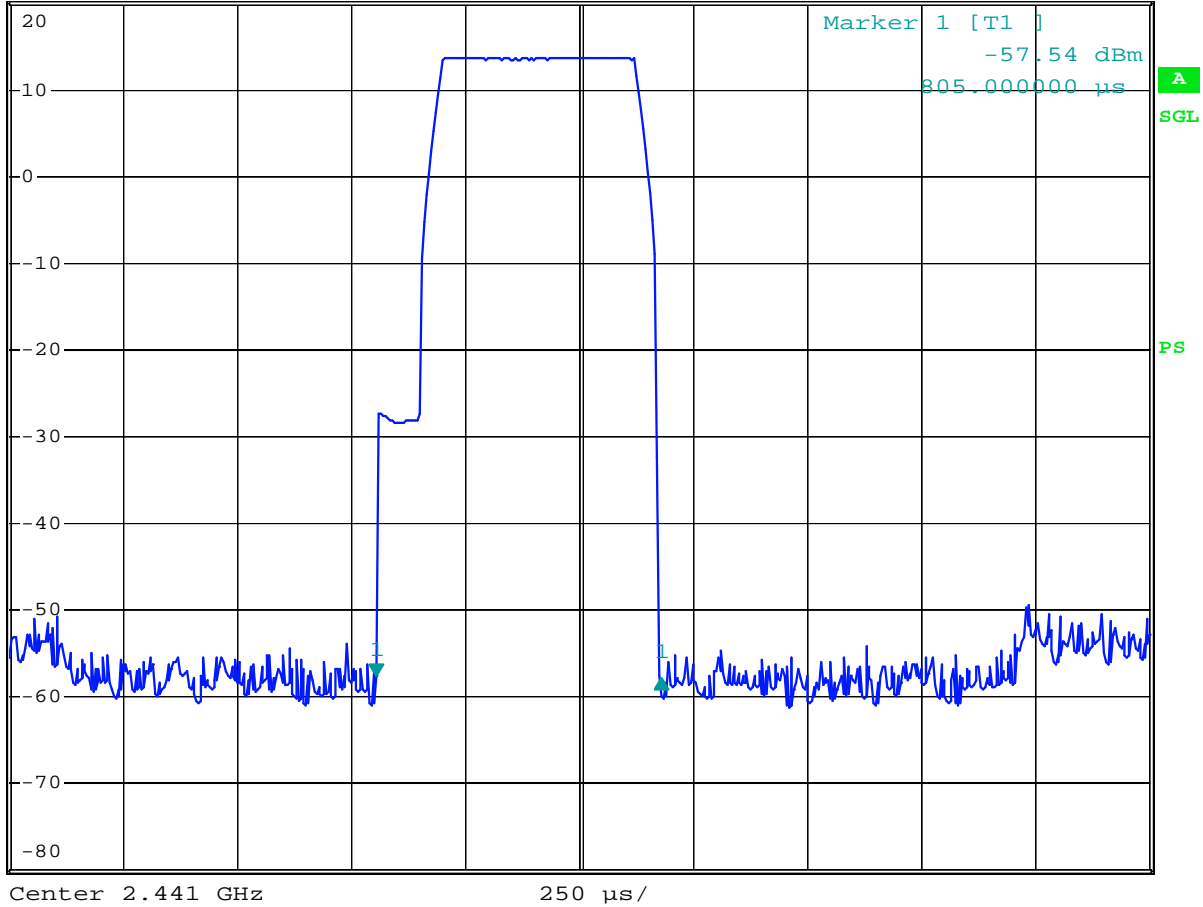
Date: 10.JAN.2008 21:13:44

### Middle Channel



RBW 1 MHz      Delta 1 [T1 ]  
\*VBW 3 MHz      -0.23 dB  
Ref 20 dBm      \*Att 35 dB      SWT 2.5 ms      625.000000  $\mu$ s

1 PK  
MAXH



dwel time middle channel

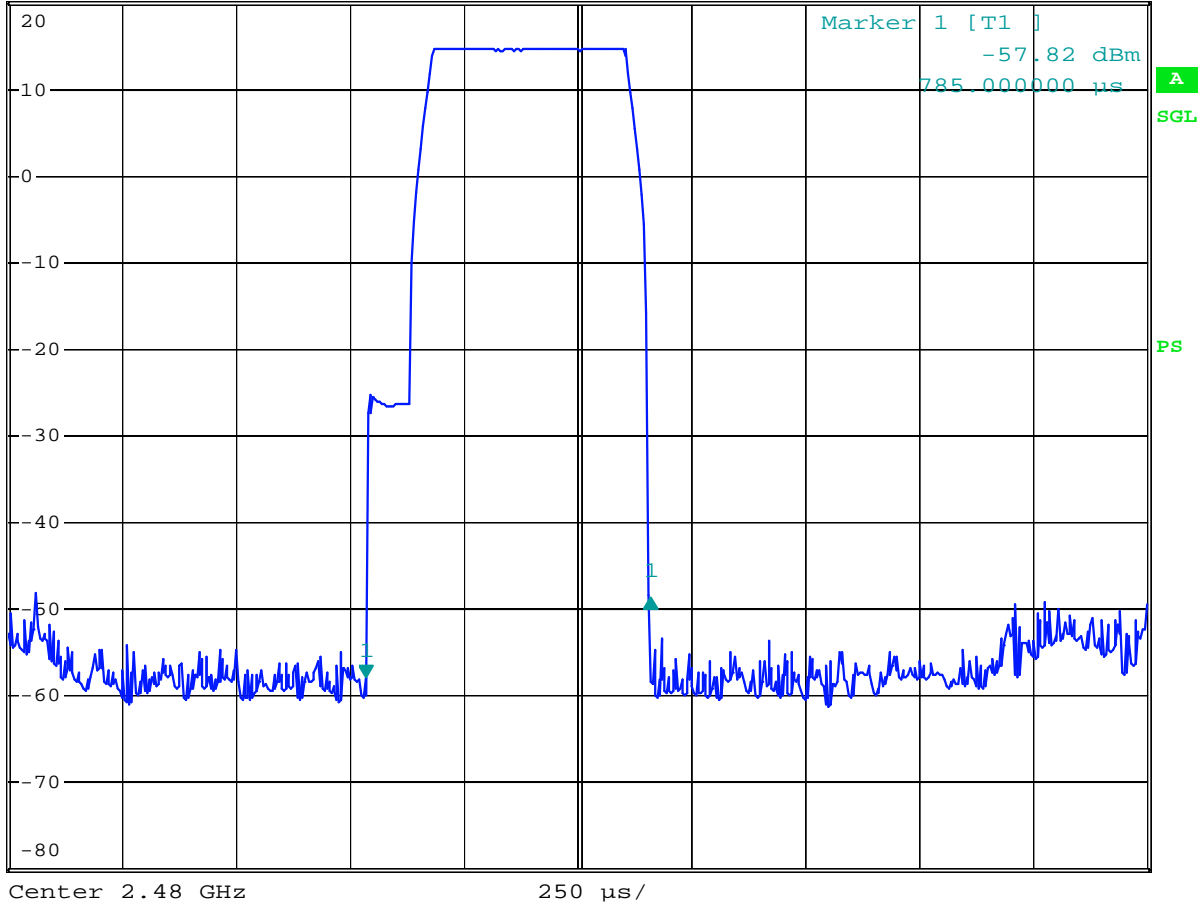
Date: 10.JAN.2008 21:11:40

### High Channel



Ref 20 dBm      \* Att 35 dB      RBW 1 MHz      Delta 1 [T1 ]      9.10 dB  
\* VBW 3 MHz      SWT 2.5 ms      625.000000 μs

1 PK  
MAXH



dwel time high channel

Date: 10.JAN.2008 21:10:39

## 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	2007-05-09	2008-05-09

\* **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 Notebook 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:

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

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

<b>Temperature:</b>	27 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	100.9 kPa

The testing was performed by Andy Yan on 2008-01-10.

Test Mode: Transmitting

Freq. (MHz)	Receiver Reading (dBuV/m)	Detector PK/AV	Table Direction Degree	Antenna		Cable Loss (dB)	Pre- Amp. (dB)	Cord. Amp. (dBuV/m)	Transducer Factor (dB)	EIRP (dBm)	Part15C Limit (W)
				Height (m)	Factor (dB/m)						
<b>Low Channel</b>											
2402	103.68	PK	90	1.0	30.6	3.61	35	102.89	95.27	7.62	1
<b>Middle Channel</b>											
2441	103.85	PK	128	1.5	30.6	3.61	35	103.06	95.27	7.79	1
<b>High Channel</b>											
2480	101.72	PK	65	1.4	30.6	3.61	35	100.93	95.27	5.66	1

**Note:** P (dBm) = E (dB $\mu$ V/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>	50 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Andy Yan on 2008-01-10.*

*Test Mode: Transmitting*

<b>Frequency (MHz)</b>	<b>Delta Peak to band emission (dBc)</b>	<b>Limit (dBc)</b>
2395.590	37.82	20
2496.052	50.48	20

**Test Result:** Pass

Please refer to the following plots.

### Low Band Edge

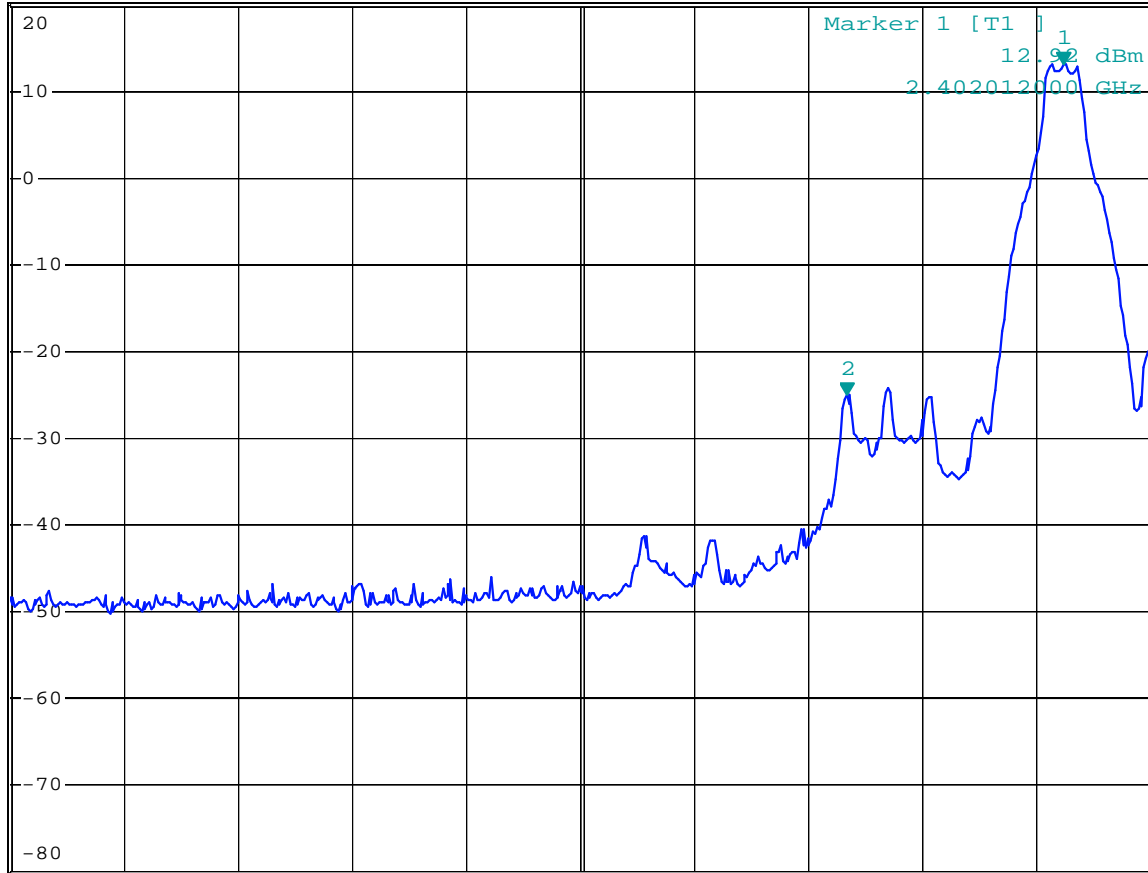


\*RBW 100 kHz    Marker 2 [T1 ]  
\*VBW 300 kHz                    -24.90 dBm  
SWT 2.5 ms                        2.399542000 GHz

Ref 20 dBm

\*Att 35 dB

1 PK  
MAXH



Start 2.39 GHz

1.3 MHz/

Stop 2.403 GHz

out of bandwidth left

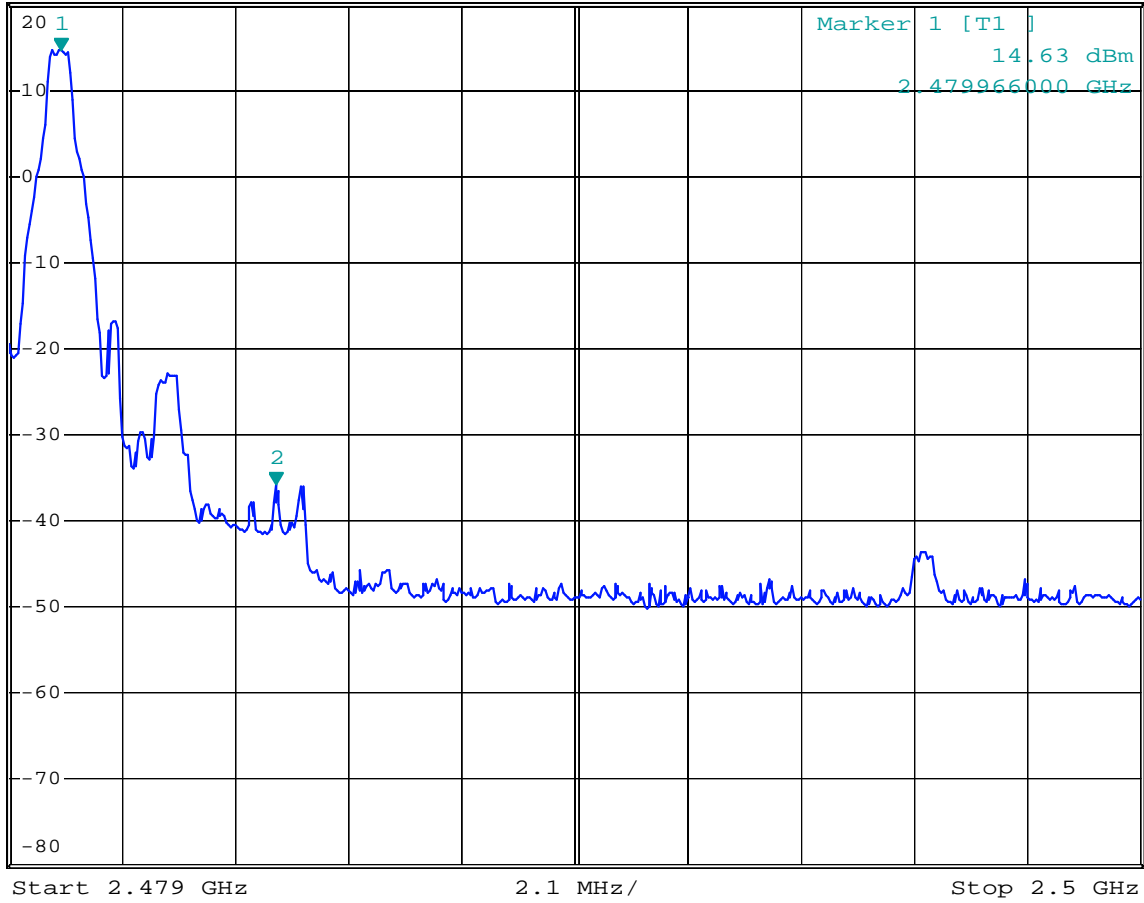
Date: 10.JAN.2008 23:11:26

### High Band Edge



\*RBW 100 kHz    Marker 2 [T1 ]  
 \*VBW 300 kHz                    -35.85 dBm  
 Ref 20 dBm                    \*Att 35 dB                    SWT 2.5 ms                    2.483956000 GHz

1 PK  
MAXH



out of bandwidth right

Date: 10.JAN.2008 23:13:50

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