



## FCC PART 15.407



### TEST REPORT

For

### JUPITER TECHNOLOGY (WUXI) CO., LTD

No.13 Minjiang Road, Wuxi State, High & New Technology Industry Development Zone,  
Wuxi, Jiangsu, China

**FCC ID: WIOWS3004**

<b>Report Type:</b> Original Report	<b>Product Type:</b> WHDI 5.8 GHz Mini Displayport Kit
<b>Test Engineer:</b> <u>Felix Li</u> 	
<b>Report Number:</b> <u>RSZ111010001-00B</u>	
<b>Report Date:</b> <u>2011-10-27</u>	
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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\*, or any agency of the Federal Government.

\* This report contains 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 *JUPITER TECHNOLOGY (WUXI) CO., LTD*'s product, model number: *WS3004 (FCC ID: WIOWS3004)* ("EUT") in this report is a transmitter of *WHDI 5.8GHz Mini Displayport Kit*, which was measured approximately: 8.0 cm (L) x 3.0 cm (W) x 1.6 cm (H), rated input voltage: DC 5V from USB port.

*\* All measurement and test data in this report was gathered from production sample serial number: 1110009 (Assigned by Shenzhen BACL). The EUT was received on 2011-10-10.*

### Objective

This Type approval report is prepared on behalf of *JUPITER TECHNOLOGY (WUXI) CO., LTD* in accordance with Part 2, Subpart J and Part 15-Subparts A, B and C of the Federal Communication Commissions rules.

The tests were performed in order to determine the compliance of EUT with FCC Part 15, Subpart E, section 15.203, 15.205, 15.207, 15.209 and 15.407 rules.

This device has the same RF PCB layout/schematics and the antennas as the approved device with FCC ID: WIOWS3001, the RF specification does not change, compared to the original device (FCC ID: WIOOWS3001), the updates made by the manufacture is changed the HDMI interface to Mini display port. The original results can be accurately represented for the new device. Only conducted emissions and radiated spurious emissions have been performed.

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

FCC Part 15.247 DTS submission with FCC ID: WIOWS3004  
FCC Part 15.247 NII filing with FCC ID: WIOWS3001.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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 on 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 December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

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 an ISO/IEC 17025 accredited laboratory, and is accredited by 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 an engineering mode, which is provided by manufacturer.

The operating frequency band is 5150-5250 MHz; the test frequency is 5190 MHz and 5230 MHz.

### EUT Exercise Software

Test software: APPcom&Debug View

### Equipment Modifications

No modification was made to the EUT tested.

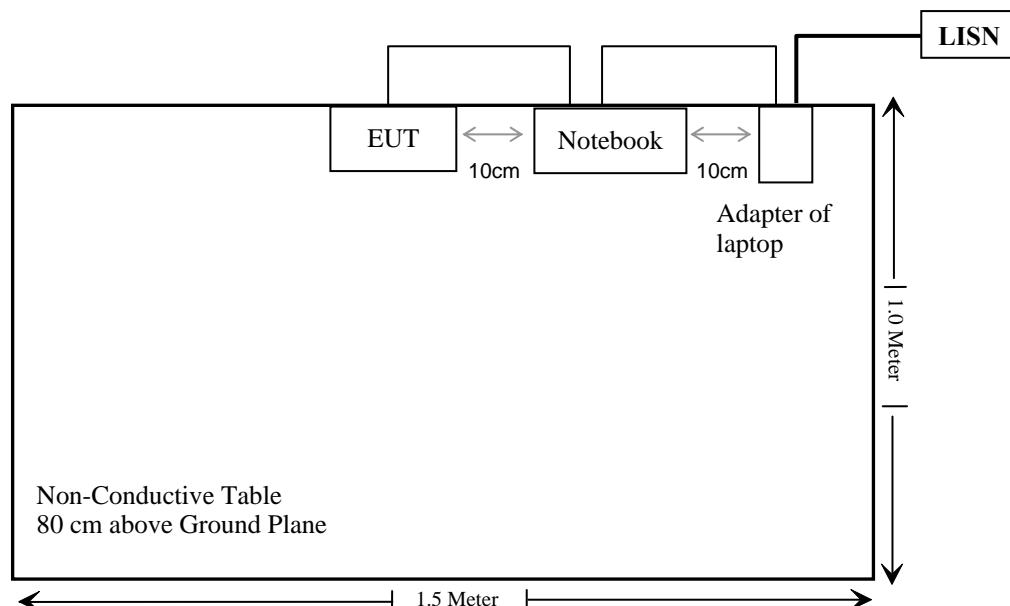
### Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
APPLE	MAC(Laptop)	A1278	C2VG9SBBDRJ7

### External I/O Cable

Cable Description	Length(m)	From Port	To
Unshielded Undetachable USB Cable	0.5	Laptop	EUT

### Block Diagram of Test Setup



## SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.407 (f), §2.1091	RF Exposure Evaluation	N/A*
§15.203	Antenna Requirement	Compliance
§15.407(b)(6) & §15.207(a)	Conducted Emissions	Compliance
§15.205& §15.209 & §15.407(b) (1),(6),(7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(a) (1)	26 dB Bandwidth	N/A*
§15.407(a)(1),	Conducted Transmitter Output Power	N/A*
§15.407 (a)(1),(5)	Power Spectral Density	N/A*
§15.407(a)(6)	Peak Excursion Ratio	N/A*
§15.407(g)	Frequency Stability	N/A*

Note: N/A\* please refer to FCC ID: WIOWS3001.

## FCC §15.407 (f) & §2.1091 – RF EXPOSURE EVALUATION

### Applicable Standard

According to FCC §15.407(f) and subpart §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz;

\* = Plane-wave equivalent power density

### MPE Calculation

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

S = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
	(dBi)	(numeric)	(dBm)	(mW)			
5190	2	1.585	7.76	5.97	20	0.002	1.0
5230	2	1.585	7.46	5.57	20	0.002	1.0

**Result:** The device meets FCC MPE at 20 cm distance.

## **FCC §15.203 – ANTENNA REQUIREMENT**

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### **Applicable Standard**

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.407 (a), if the transmitting antennas of directional gain greater than 6dBi are used, the transmit power and power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **Antenna Connector Construction**

The EUT has two ceramic patch antennas on the PCB, which in accordance to section 15.203, the maximum gain is 2.0 dBi; please refer to the internal photos.

**Result:** Compliance.

## FCC §15.407 (b) (6) §15.207 (a) – AC LINE CONDUCTED EMISSIONS

### Applicable Standard

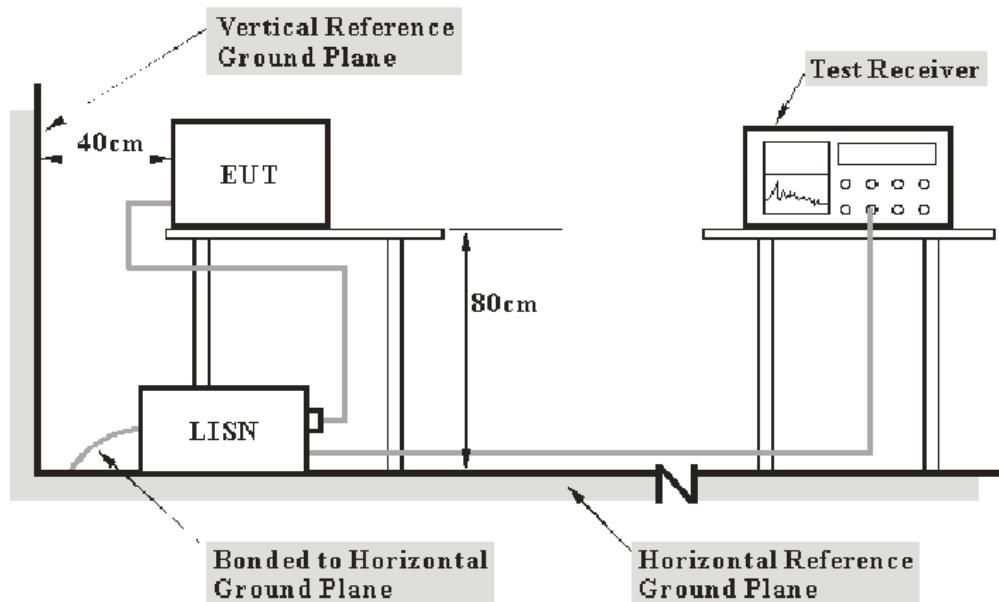
FCC §15.207, §15.407(b) (6)

### 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 Laboratory Corp. (Shenzhen) is  $\pm 2.4$  dB.

### EUT Setup



**Note:** 1. Support units were connected to second LISN.  
2. Both of LISNs (AMIN) 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 C63.4-2009 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter of laptop 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:

<b>Frequency Range</b>	<b>IF B/W</b>
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	830245	2011-03-03	2012-03-02
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2011-03-09	2012-03-08

**\*Statement of Traceability:** Bay Area Compliance Laboratory 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 of laptop was connected to 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:

**17.97 dB at 0.150 MHz in the Neutral conducted mode**

## Test Data

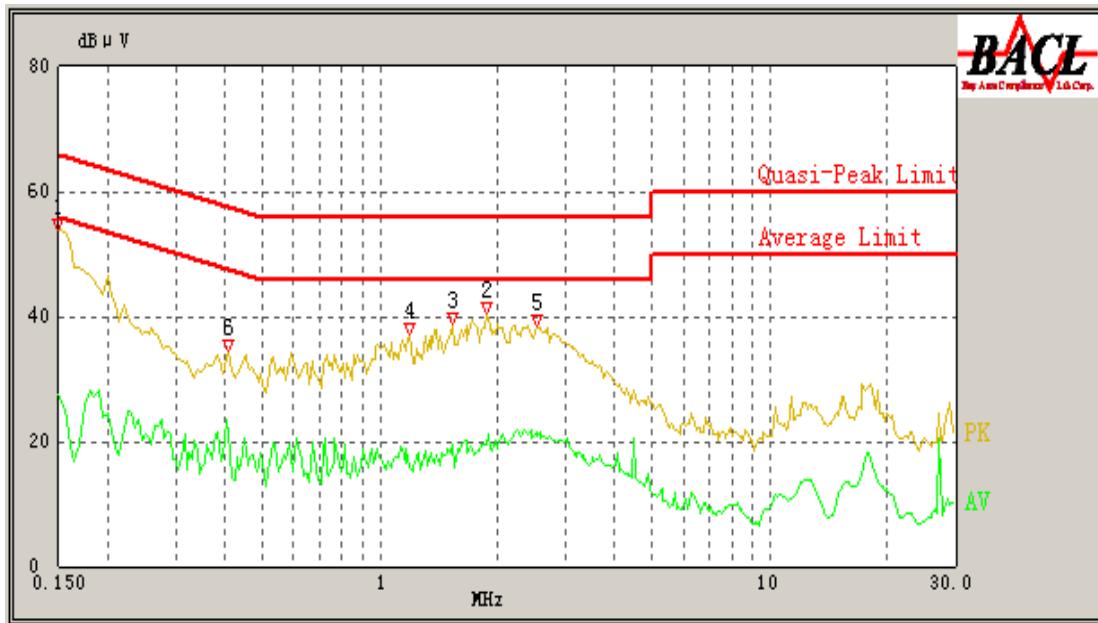
### Environmental Conditions

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

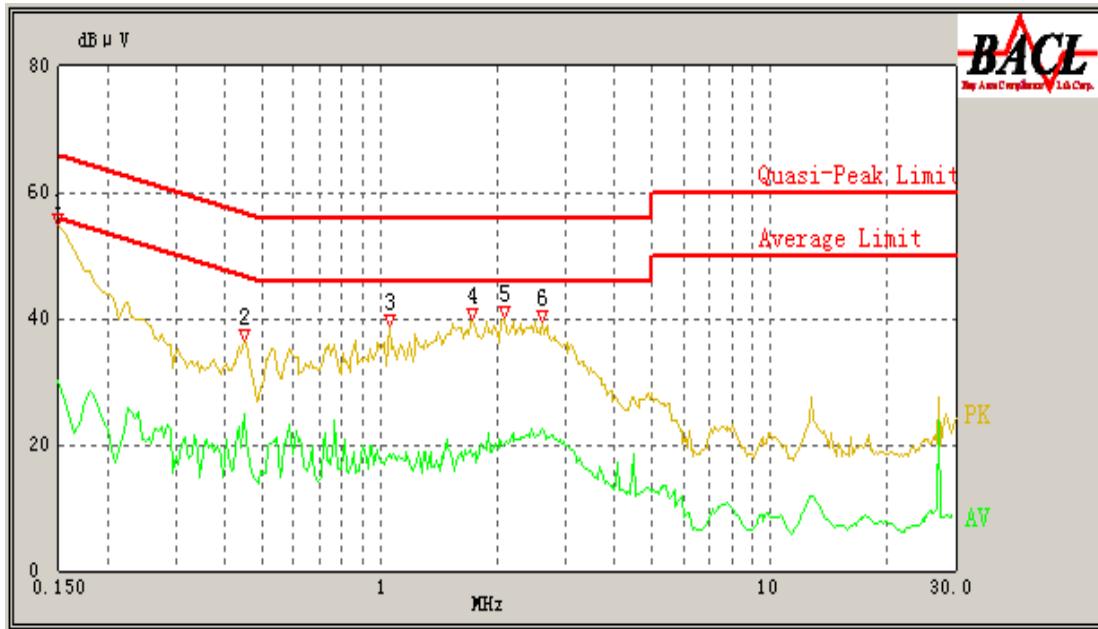
*The testing was performed by Felix Li on 2011-10-20.*

*Test Mode: Transmitting*

## 120 V, 60 Hz, Line:



Frequency (MHz)	Corrected Amplitude (dB $\mu$ V)	Correction Factor (dB)	Limit (dB $\mu$ V)	Margin (dB)	Detector (PK/QP/Ave.)
0.150	45.66	10.10	66.00	20.34	QP
2.515	21.54	10.10	46.00	24.46	Ave.
2.515	30.40	10.10	56.00	25.6	QP
1.870	19.43	10.10	46.00	26.57	Ave.
1.530	19.34	10.10	46.00	26.66	Ave.
0.411	21.35	10.10	48.57	27.22	Ave.
1.870	28.55	10.10	56.00	27.45	QP
0.150	27.42	10.10	56.00	28.58	Ave.
1.535	27.34	10.10	56.00	28.66	QP
0.411	28.73	10.10	58.57	29.84	QP
1.185	26.04	10.10	56.00	29.96	QP
1.190	15.85	10.10	46.00	30.15	Ave.

**120V, 60 Hz, Neutral:**

Frequency (MHz)	Corrected Amplitude (dB $\mu$ V)	Correction Factor (dB)	Limit (dB $\mu$ V)	Margin (dB)	Detector (QP/Ave.)
0.150	48.03	10.10	66.00	17.97	QP
0.450	24.78	10.10	47.43	22.65	Ave.
2.600	22.36	10.10	46.00	23.64	Ave.
0.450	33.64	10.10	57.43	23.79	QP
2.600	30.52	10.10	56.00	25.48	QP
2.085	30.30	10.10	56.00	25.7	QP
0.150	30.05	10.10	56.00	25.95	Ave.
2.070	19.94	10.10	46.00	26.06	Ave.
1.725	29.54	10.10	56.00	26.46	QP
1.060	18.43	10.10	46.00	27.57	Ave.
1.720	18.32	10.10	46.00	27.68	Ave.
1.060	27.52	10.10	56.00	28.48	QP

## FCC §15.209, §15.205 & §15.407(b) (1) (6) (7) – UNDESIRABLE EMISSION & RESTRICTED BANDS

### Applicable Standard

FCC §15.407 (b) (1), (6), (7); §15.209; §15.205;

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

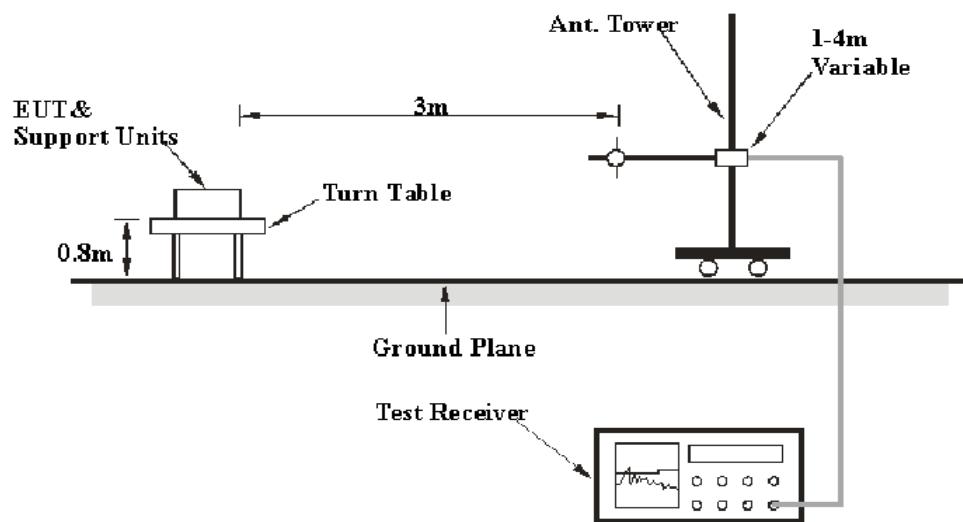
### Measurement Uncertainty

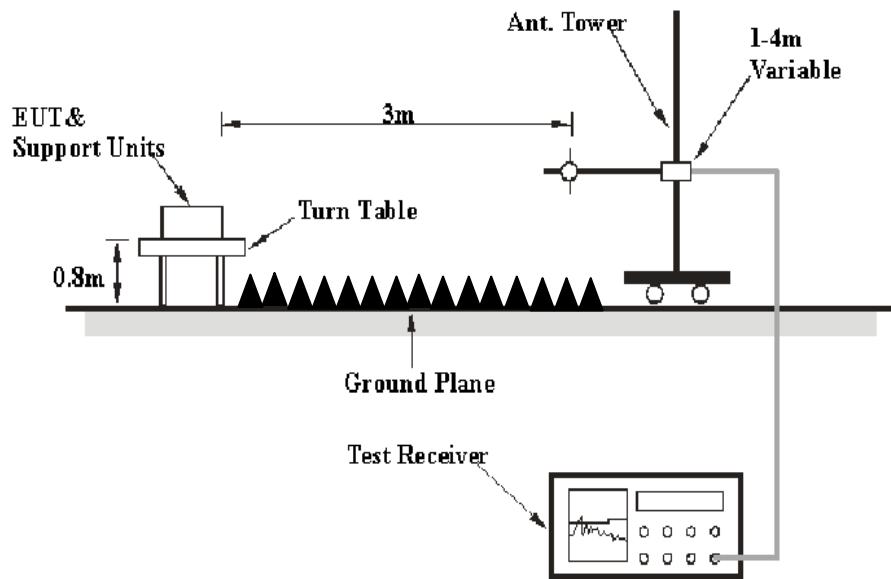
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency 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

#### Below 1 GHz:



**Above 1 GHz:**

The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.4-2009. The specification used was the FCC 15.209, and FCC 15.407 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 of laptop was connected to a 120 VAC/60 Hz power source,

### EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

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

<b>Frequency Range</b>	<b>RBW</b>	<b>Video B/W</b>	<b>Detector</b>
30 MHz – 1000 MHz	100 kHz	300 kHz	QP
1000 MHz – 40 GHz	1 MHz	3 MHz	PK
1000 MHz – 40 GHz	1 MHz	10 Hz	Ave.

### Test Procedure

During the radiated emission test, the adapter of laptop 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.

## 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 limit. The equation for margin calculation is as follows:

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

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447D	2944A09795	2011-08-02	2012-08-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-11	2011-11-10
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2011-07-05	2012-07-04

\* **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 Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Section 15.205, 15.209 and 15.407, with the worst margin reading of:

**3.1 dB at 198.310250 MHz in the Horizontal polarization**

## Test Data

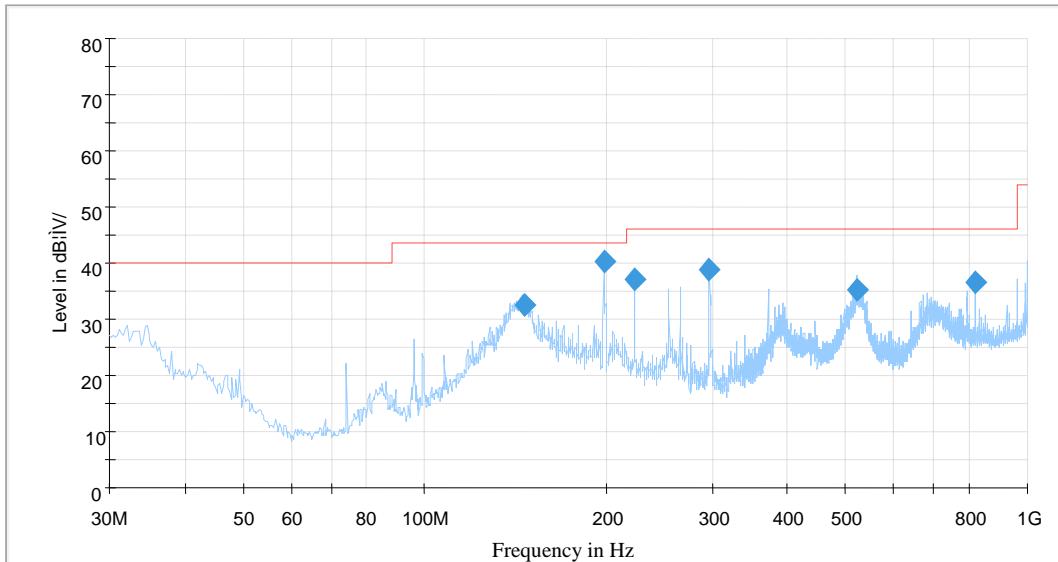
### Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56 %
ATM Pressure:	100.0 kPa

*The testing was performed by Felix Li on 2011-10-20.*

Test Mode: Transmitting

**1) Below 1 GHz:**



Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Ant. Height (cm)	Ant. Polarity (H/V)	Turntable Position (degree)	Correction Factor (dB)	Limit (dB $\mu$ V/m)	Margin (dB)
198.310250	40.4	154.0	H	117.0	-14.4	43.5	3.1*
297.014000	38.5	135.0	H	64.0	-12.5	46.0	7.5
222.753000	37.2	125.0	H	65.0	-14.0	46.0	8.8
816.803500	35.6	353.0	H	25.0	-1.6	46.0	10.4
146.5531000	30.5	235.0	H	206.0	-13.8	43.5	13
519.948250	31.8	221.0	V	243.0	-8.0	46.0	14.2

\*Within measurement uncertainty!

**2) Above 1 GHz:**

The spurious emissions above 1 GHz are consistent with the original results, please refer to the original results of FCC ID: WIOWS3001.

**FCC §15.407(a) (1) – 26 dB OCCUPIED BANDWIDTH****Applicable Standard**

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**Test Data**

Please refer to FCC ID: WIOWS3001.

**FCC §15.407(a) (1) – CONDUCTED TRANSMITTER OUTPUT POWER****Applicable Standard**

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**Test Data**

Please refer to FCC ID: WIOWS3001.

## **FCC §15.407(a) (1) (5) - POWER SPECTRAL DENSITY**

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### **Applicable Standard**

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

### **Test Data**

Please refer to FCC ID: WIOWS3001.

**FCC §15.407(a) (6) – PEAK EXCURSION RATIO****Applicable Standard**

According to §15.407(a) (6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**Test Data**

Please refer to FCC ID: WIOWS3001.

## **FCC §407(g) - FREQUENCY STABILITY**

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### **Applicable Standards**

FCC§407(g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

### **Test Data**

Please refer to FCC ID: WIOWS3001.

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