



NVLAP LAB CODE 200707-0



# FCC PART 15.225

## EMI MEASUREMENT AND TEST REPORT

For

### Advanced Card Systems Limited

Units 2010-2013, 20<sup>th</sup> Floor, Cheavalier Commercial Centre, 8 Wang Hoi Road,  
Kowloon Bay, Hong Kong.

**Model: V5MACR122S**

<b>Report Type:</b> Original Report	<b>Product Type:</b> PC Link Contactless Reader
<b>Test Engineer:</b> Phoenix Liu	<i>Phoenix Liu</i>
<b>Report Number:</b> RSZ08122406	
<b>Report Date:</b> 2009-04-07	
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**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP\*, NIST, or any agency of the Federal Government.

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

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## GENERAL INFORMATION

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

The *Advanced Card Systems Limited's* product, model number: *ACR122S* or the "EUT" as referred to in this report is a *PC Link Contactless Reader*. The EUT is measured approximately 11.0 cm L x 7.0 cm W x 1.8 cm H. rated input voltage: DC 5V(from PC).

*\* All measurement and test data in this report was gathered from production sample serial number: 0812070 (Assigned by BACL). The EUT was received on 2008-12-24.*

### Objective

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

The objective is to determine compliance with FCC rules, sec 15.203, 15.205, 15.207, 15.209 and 15.225.

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

No Related Submittals.

### 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 radiated and conducted emissions measurement was performed at Bay Area Compliance Lab 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/Standards/scopes/2007070.htm>

## SYSTEM TEST CONFIGURATION

### Justification

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

### Equipment Modifications

Bay Area Compliance Lab Corp. (Shenzhen) has not done any modification on the EUT.

### Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
DELL	Motherboard	OWC297	CN-OWC297-70821-566-02BR	DoC
DELL	Power	NPS-250KB D	CN-0H2678-17972-56E8NBM	DoC
Seagate	Hard Disk	ST340014A	5JXK3NAD	DoC
DELL	3.5' Floppy	N/A	CN-0N8893-69802-54Q-02OZ	DoC
Lite-ON	CD-Rom	LTN-489S	N/A	DoC
Intel	CPU	Celeron D-2533	N/A	N/A
ProMOS	Memory	V826632K24SATG-C0	0525-K1933700	N/A
Intel	Ethernet	PRO 10/100 VE	N/A	DoC

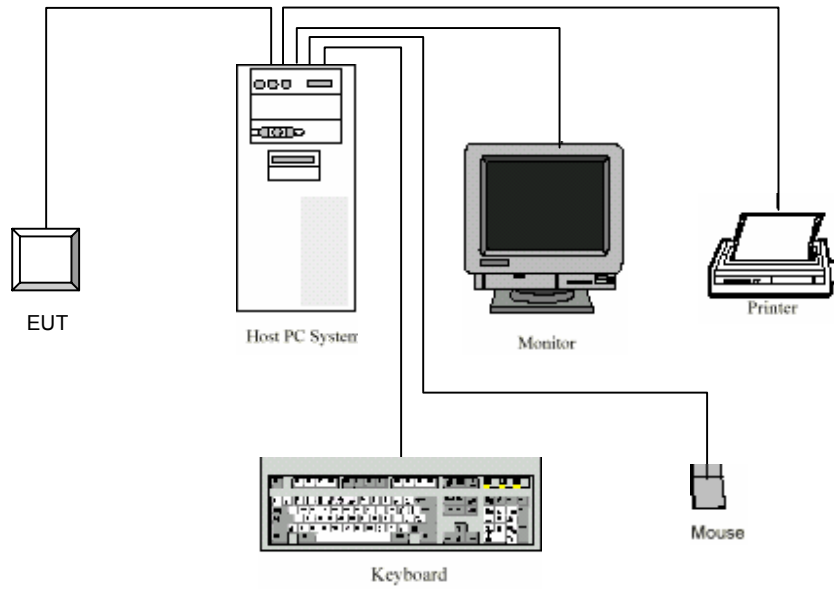
### Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
DELL	PC	DELL 170L	CN-0TC670-70821-560-F4WQ	DoC
DELL	Keyboard	SK-8110	CN07N244-71616-56I-1100	DoC
DELL	Mouse	M071KC	519046820	DoC
DELL	LCD Monitor	1505FP	Y4287-7168-574-GBSH	DoC
HP	Laser Jet5L	C3941A	JPTVOB2337	DoC
ECOM	Modem	EM-56DEV	6588D51200013	DoC

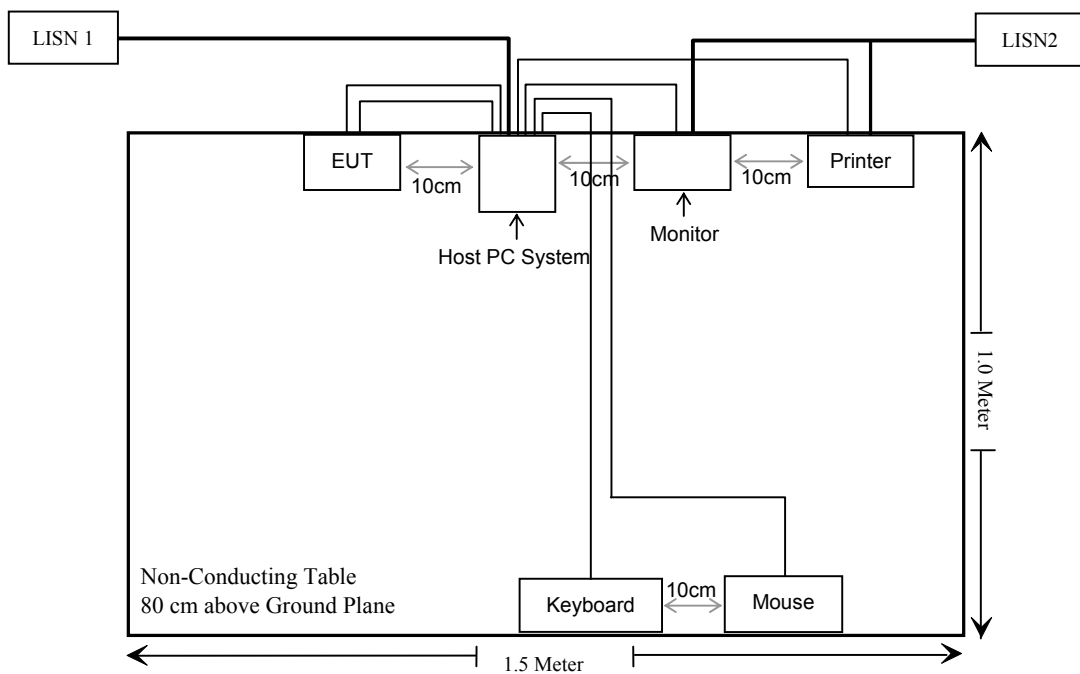
### External I/O Cable

Cable Description	Length (M)	From/Port	To
Shielded Detachable K/B Cable	1.5	K/B Port	K/B
Shielded Detachable Mouse Cable	1.5	Mouse Port	Mouse
Shielded Detachable VGA Cable	1.5	VGA Port	Monitor
Shielded Detachable Printer Line	1.2	Parallel Port	Printer

### Configuration of Test Setup



### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of operation	Compliant
§15.207	Conducted Emission	Compliant
§15.209	Radiated Emission Limit	Compliant
§15.225(a) (b) (c)	Field Strength of Radiated Emissions	Compliant
§15.225(d)	Out of Band Emission	Compliant
§15.225(e)	Frequency Stability	Compliant



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## **§15.203 - ANTENNA REQUIREMENT**

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### **Standard Applicable**

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.

### **Antenna Connected Construction**

The EUT was a PCB antenna which complies with the Part 15.203. Please see EUT photo for details.

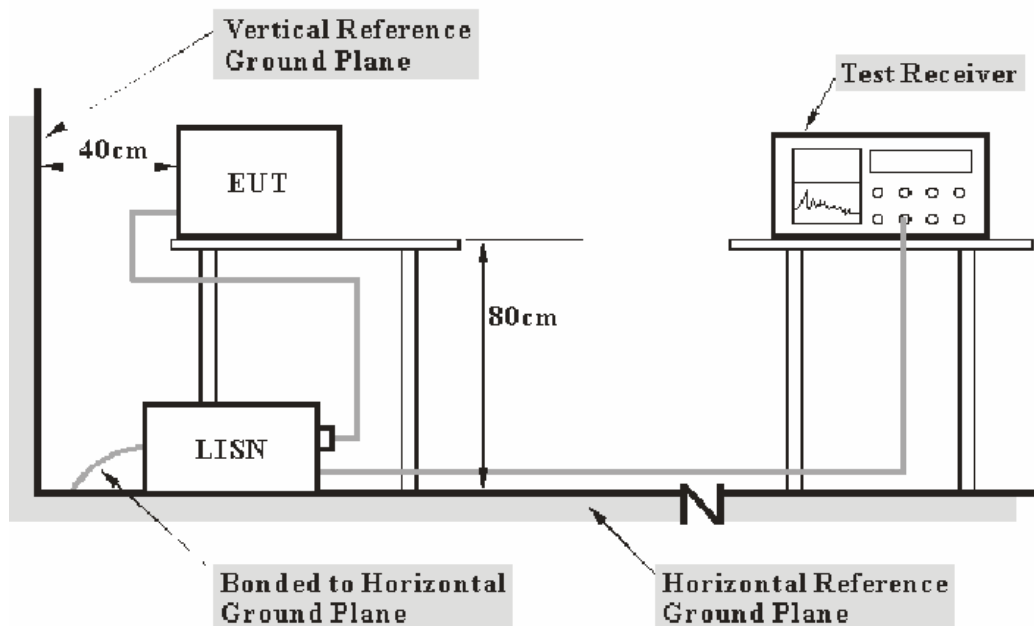
## §15.207 - CONDUCTED EMISSION

### 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 Lab Corp. (ShenZhen) is  $\pm 2.4$  dB.

### EUT Setup



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

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

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 Setup

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

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

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

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	100035	2008-11-07	2009-11-06
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2009-03-25	2010-03-25

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

\* **Statement of Traceability:** Bay Area Compliance Lab 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 first LISN, and all other support equipment power cords were connected to the outlet of the second LISN.

Maximizing procedure were 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:

**3.90 dB at 13.5600 MHz in the Line conductor mode**

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

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

The testing was performed by Phoenix Liu on 2009-03-27.

Test Mode: Running

Line Conducted Emissions				FCC Part 15.207	
Frequency (MHz)	Amplitude (dB $\mu$ V)	Detector (QP/AV)	Conductor (Line/Neutral)	Limit (dB $\mu$ V)	Margin (dB)
13.5600	46.10	AV	Line	50.00	3.90
13.5600	45.20	AV	Neutral	50.00	4.80
13.5600	47.70	QP	Line	60.00	12.30
13.5600	46.30	QP	Neutral	60.00	13.70
4.5600	30.30	AV	Line	46.00	15.70
8.7050	33.10	AV	Line	50.00	16.90
6.9650	32.50	AV	Neutral	50.00	17.50
8.7050	31.80	AV	Neutral	50.00	18.20
1.4400	27.40	AV	Neutral	46.00	18.60
7.2650	31.30	AV	Line	50.00	18.70
4.5600	37.20	QP	Line	56.00	18.80
4.2050	27.00	AV	Neutral	46.00	19.00
6.0050	30.10	AV	Line	50.00	19.90
4.2050	35.90	QP	Neutral	56.00	20.10
8.7050	39.50	QP	Line	60.00	20.50
6.9650	39.10	QP	Neutral	60.00	20.90
7.2650	39.10	QP	Line	60.00	20.90
8.7050	38.70	QP	Neutral	60.00	21.30
1.4400	34.20	QP	Neutral	56.00	21.80
5.0450	28.00	AV	Neutral	50.00	22.00
6.0050	37.90	QP	Line	60.00	22.10
5.0450	37.60	QP	Neutral	60.00	22.40
2.2800	22.90	AV	Line	46.00	23.10
2.2800	32.20	QP	Line	56.00	23.80

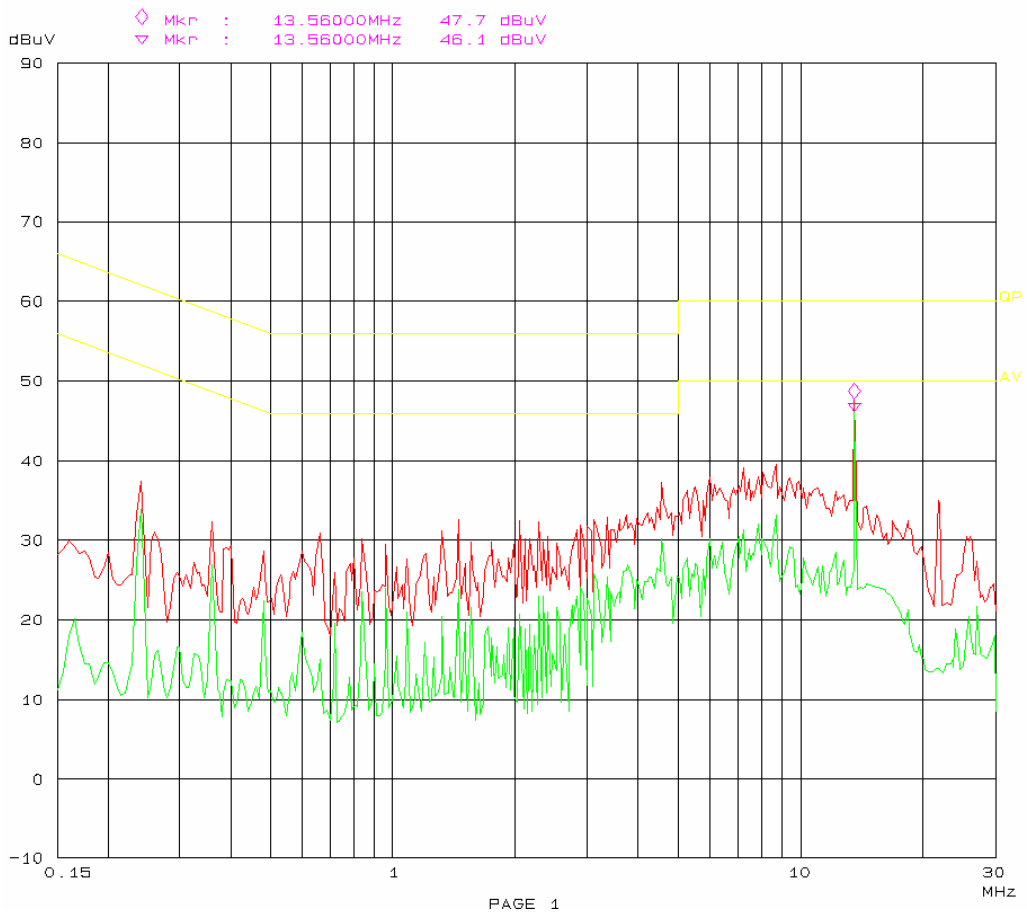
**Plot(s) of Test Data**

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

Conducted emission  
FCC 15

27. Mar 09 15:57

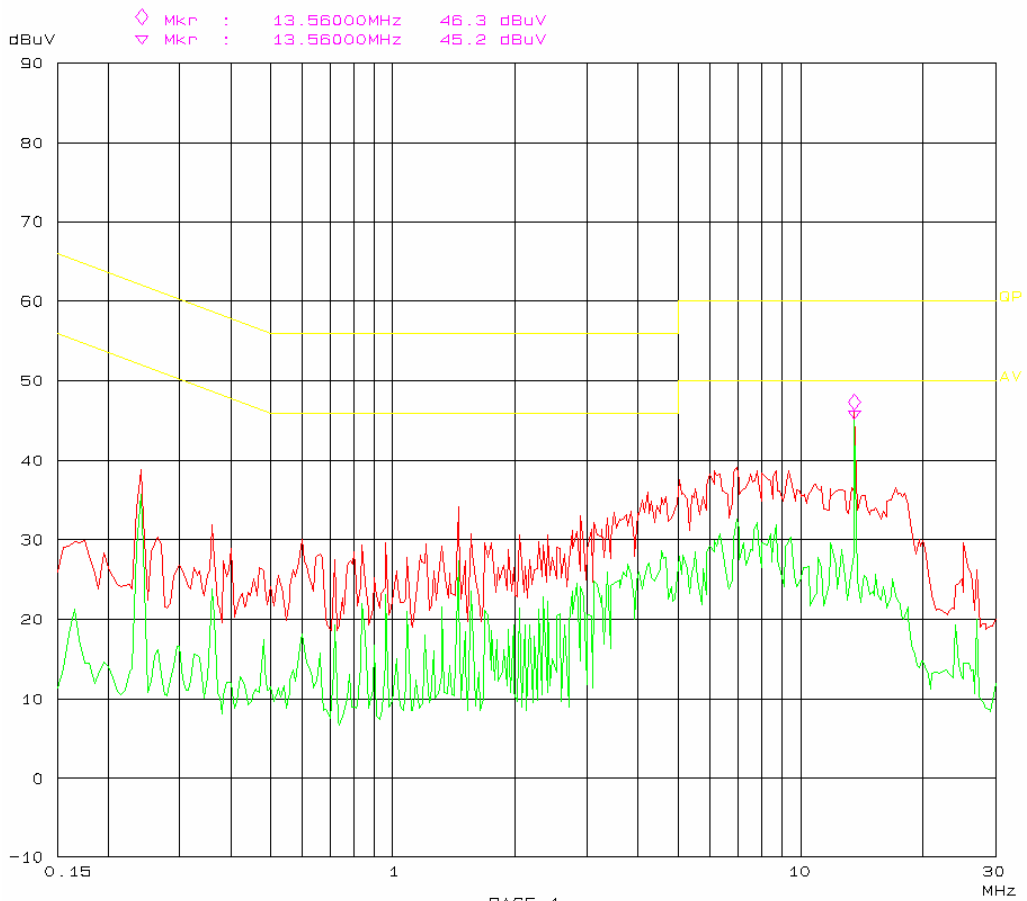
EUT: PC Link Contactless Reader M/N: ACR122S  
Manuf: Advanced Card  
Op Cond: Running  
Operator: Winner  
Test Spec: AC 120V 60HZ L  
Comment: Temp: 23 Hum: 55%  
BADL



Conducted emission  
FCC 15

27. Mar 09 15:20

EUT: PC Link Contactless Reader M/N: ACR122S  
Manuf: Advanced Card  
Op Cond: Running  
Operator: Winner  
Test Spec: AC 120V 60HZ N  
Comment: Temp: 23 Hum: 55%  
BACL



## §15.205 & §15.209 - RADIATED EMISSIONS TEST

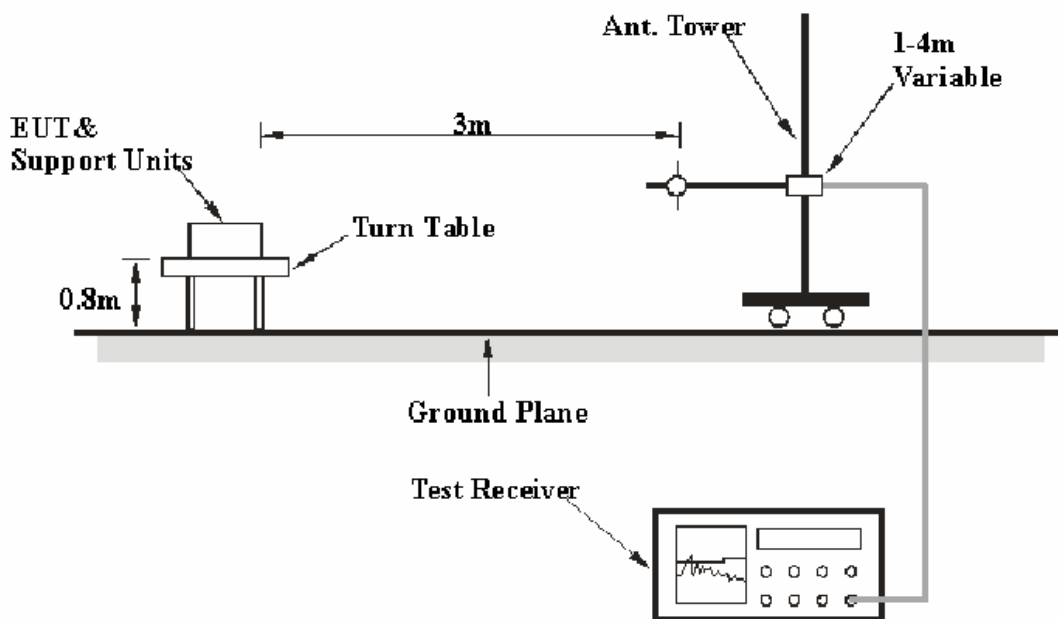
### Measurement Uncertainty

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 Lab Corp. (ShenZhen) is  $\pm 4.0$  dB.

The fundamental data was recorded in average detection mode: set the VBW AVE on, then record the data.

### EUT Setup



The radiated emission tests were performed in the 3-meter chamber A test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC Part Subpart C limits.

The spacing between the peripherals was 10 cm.

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

## EMI Test Receiver Setup

According to FCC Rules, 47 CFR 15.33, the EUT emissions were investigated up to 1000 MHz.

During the radiated emission test, the EMI test Receiver was set with the following configurations:

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

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447D	2944A09795	2008-11-15	2009-11-15
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2008-10-16	2009-10-16
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2009-03-11	2010-03-11
HP	Amplifier	8449B	3008A00277	2008-09-29	2009-09-29
Sunol Sciences	Horn Antenna	DRH-118	A052604	2008-09-25	2009-09-25
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2008-05-09	2009-05-09

\* **Statement of Traceability:** Bay Area Compliance Lab Corp. (ShenZhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

## Corrected Amplitude & Margin Calculation

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

$$\text{Corr. Ampl.} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corr. Ampl.}$$

## Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209 with the worst margin reading of:

**6.2 dB at 949.240775 MHz in the Horizontal polarization**



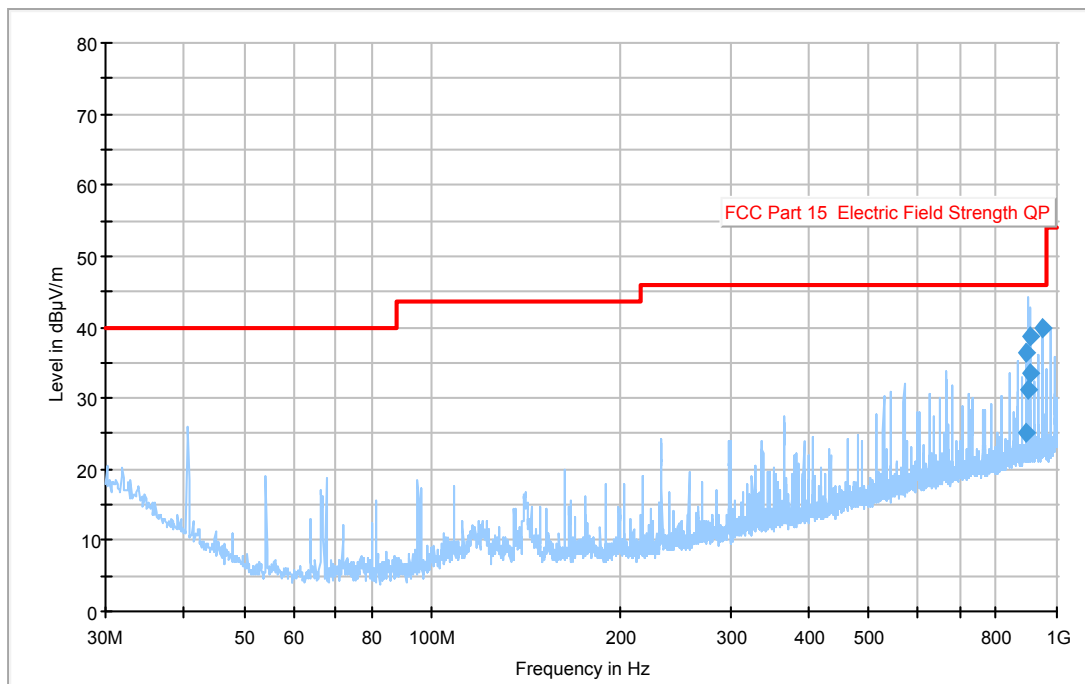
**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	27 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.9 kPa

The testing was performed by Phoenix Liu on 2009-04-03.

Test mode: Transmitting



Frequency (MHz)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
949.240775	39.8	105.0	H	126.0	-3.1	46.0	6.2
908.548550	38.8	104.0	H	149.0	-3.5	46.0	7.2
895.014750	36.5	104.0	H	234.0	-3.9	46.0	9.5
906.946800	33.4	215.0	V	284.0	-3.6	46.0	12.6
897.203325	31.2	179.0	V	336.0	-3.9	46.0	14.8
890.261200	25.0	400.0	H	313.0	-3.9	46.0	21.0

## **§15.225(a) (b) (c) – FIELD STRENGTH OF RADIATED EMISSIONS**

### **Applicable Standard**

As per FCC Part 15.225

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

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

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
HP	Amplifier	8447E	1937A01046	2008-08-02	2009-08-02
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2008-11-07	2009-11-06
ETS	Passive Loop Antenna	6512	00029604	2009-03-04	2010-03-04

\* **Statement of Traceability:** Bay Area Compliance Lab Corp. (ShenZhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

### **EUT Setup**

The field strength of radiated emissions tests were performed in the 3-meter chamber A test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC Part Subpart C limits.

### **Test Data**

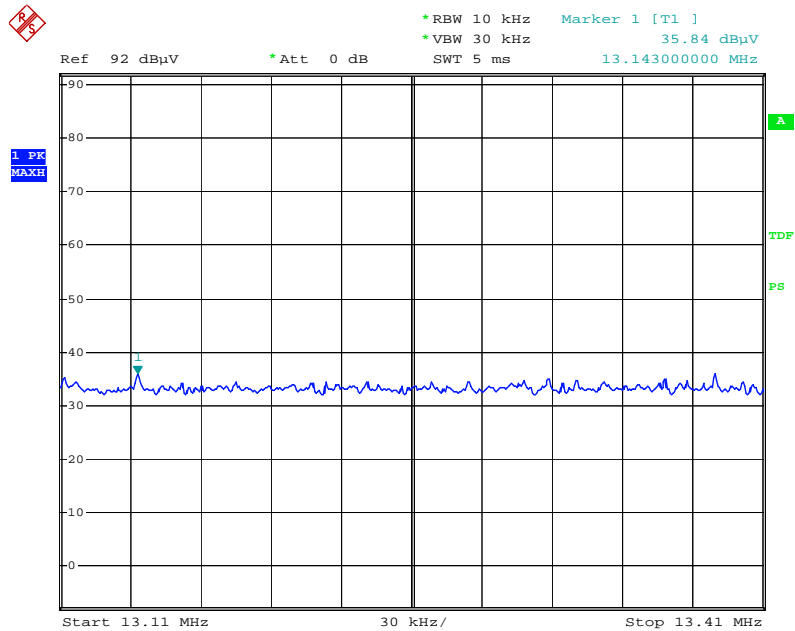
#### **Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Phoenix Liu on 2009-04-02.*

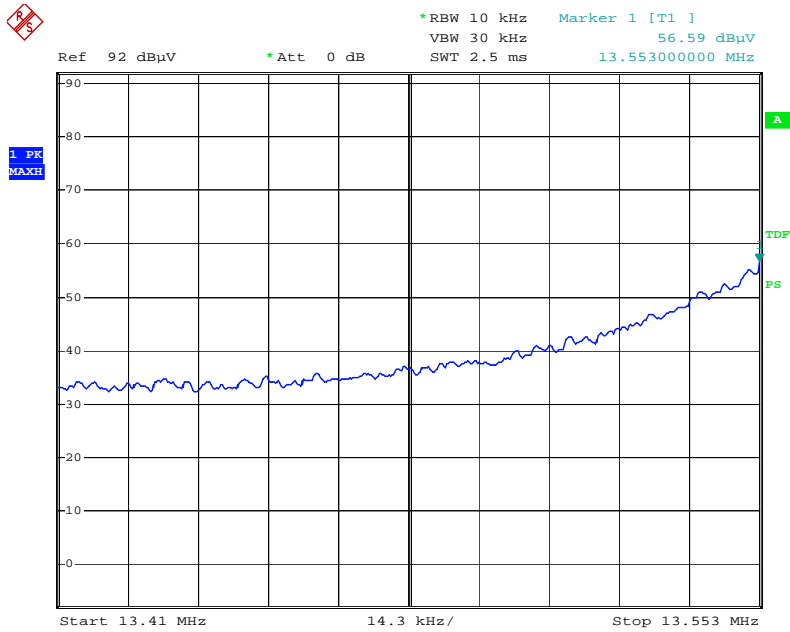
The result has been complied with the 15.225(a), (b), (c) see the following plot:

Frequency (MHz)		Emission (dBµV@3m)	Limit (dBµV@3m)	Result
Range (MHz)	Mark Frequency (MHz)			
13.110-13.410	13.143	35.84	80.5	Pass
13.410-13.553	13.553	56.59	90.5	Pass
13.553-13.567	13.560	76.82	124	Pass
13.567-13.710	13.599	34.51	90.5	Pass
13.710-14.010	13.785	35.94	80.5	Pass



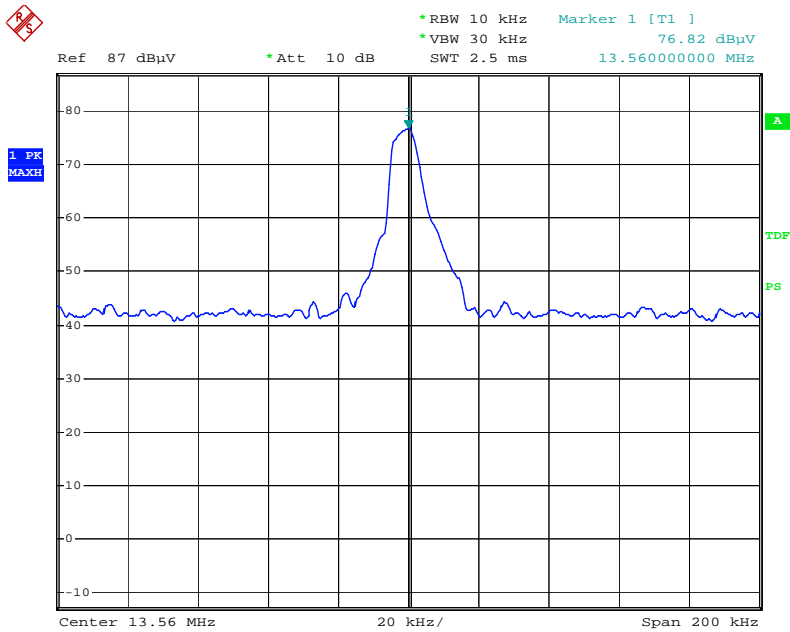
13.11MHz-13.41MHz

Date: 2.APR.2009 02:23:05



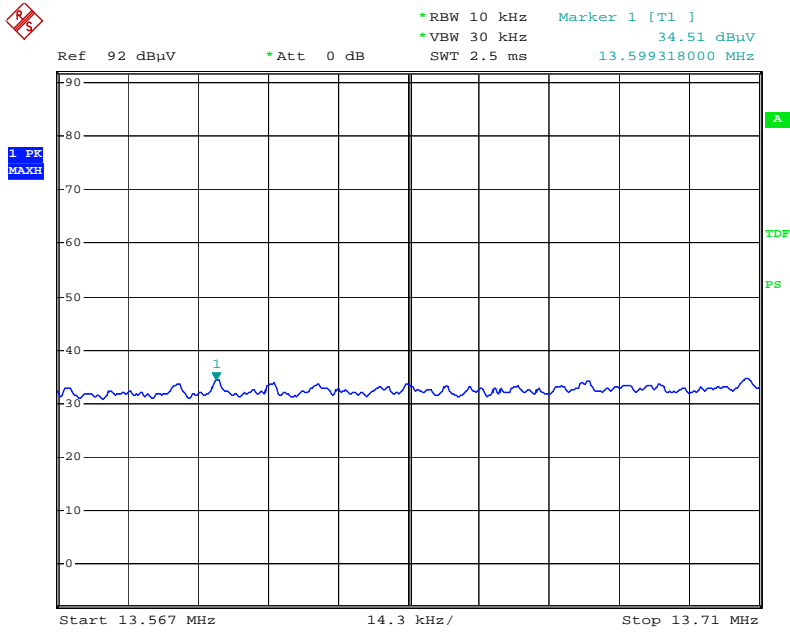
13.41MHz-13.553MHz

Date: 2.APR.2009 02:31:04



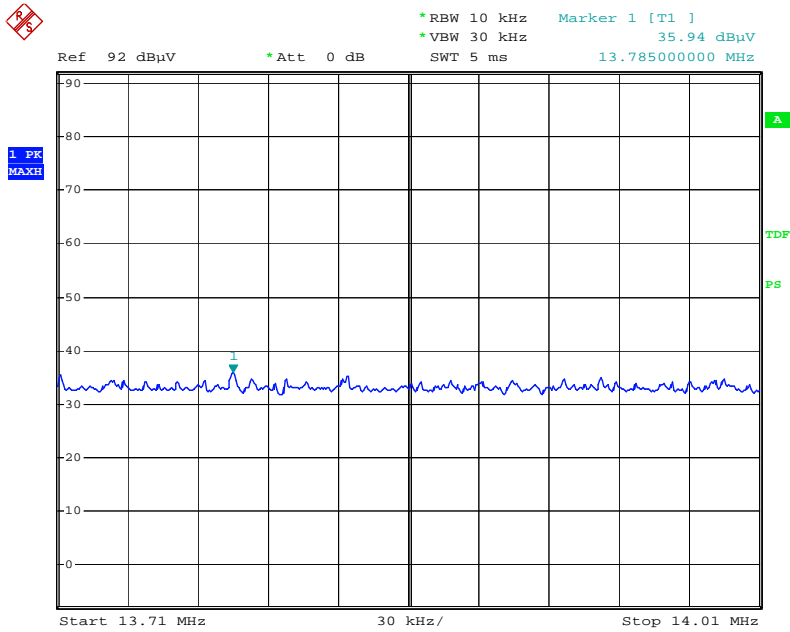
Radiated H-Field

Date: 3.APR.2009 15:32:31



13.567MHz-13.710MHz

Date: 2.APR.2009 02:47:41



13.710MHz-14.010MHz

Date: 2.APR.2009 02:46:27

## §15.225(d) - OUT OF BAND EMISSION

### Applicable Standard

As per FCC Part 15.225(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	8447E	1937A01046	2008-08-02	2009-08-02
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2008-11-07	2009-11-06
ETS	Passive Loop Antenna	6512	00029604	2009-03-04	2010-03-04

\* **Statement of Traceability:** Bay Area Compliance Lab Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

### EUT Setup

The out of band emission tests were performed in the 3-meter chamber A test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC Part Subpart C limits.

### Test Data

#### Environmental Conditions

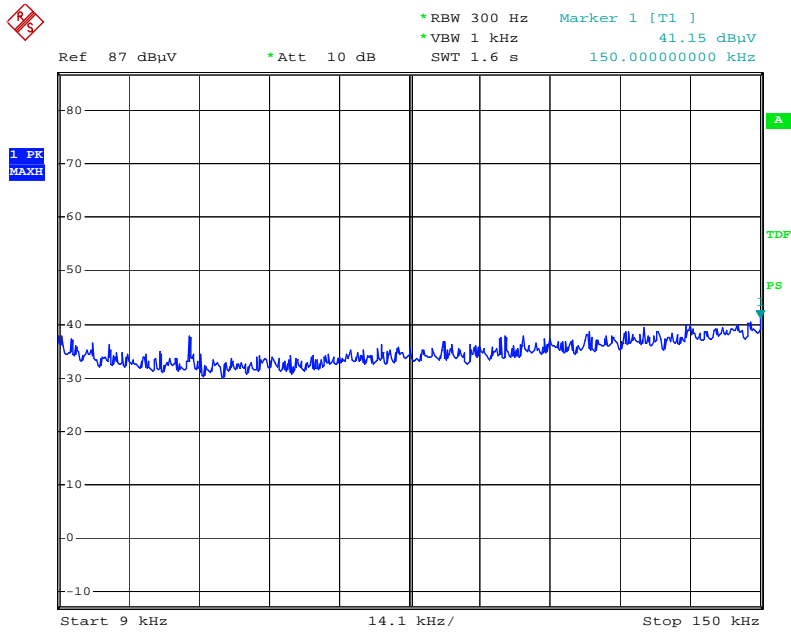
<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Phoenix Liu on 2009-04-01 to 2009-04-03.*

The result has been complied with the 15.225(d), see the following plot:

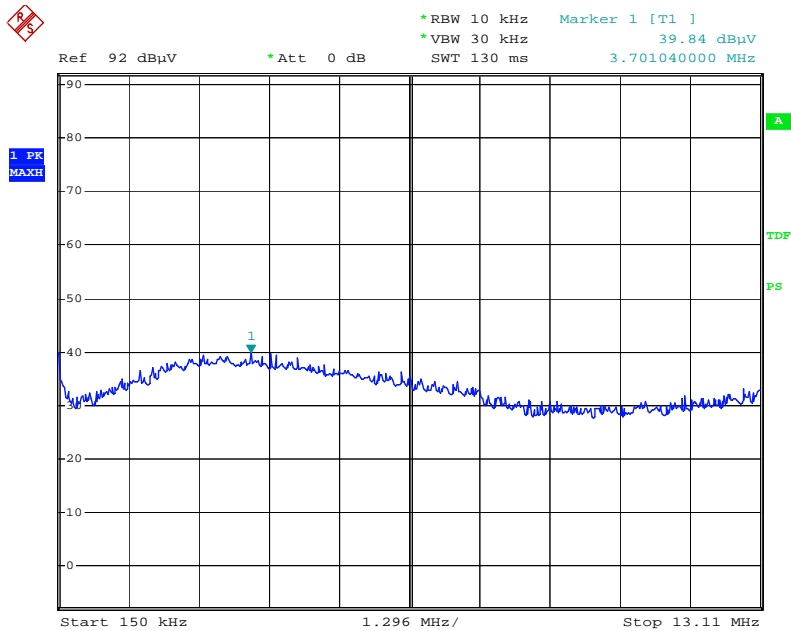
Frequency (MHz)	Emission (dB $\mu$ V@3m)	Limit (dB $\mu$ V@3m)	Result
0.150000	41.15	104	Pass
3.701040	39.84	69.5	Pass
14.117820	34.37	69.5	Pass
27.120000	33.17	69.5	Pass

Test Result: Pass



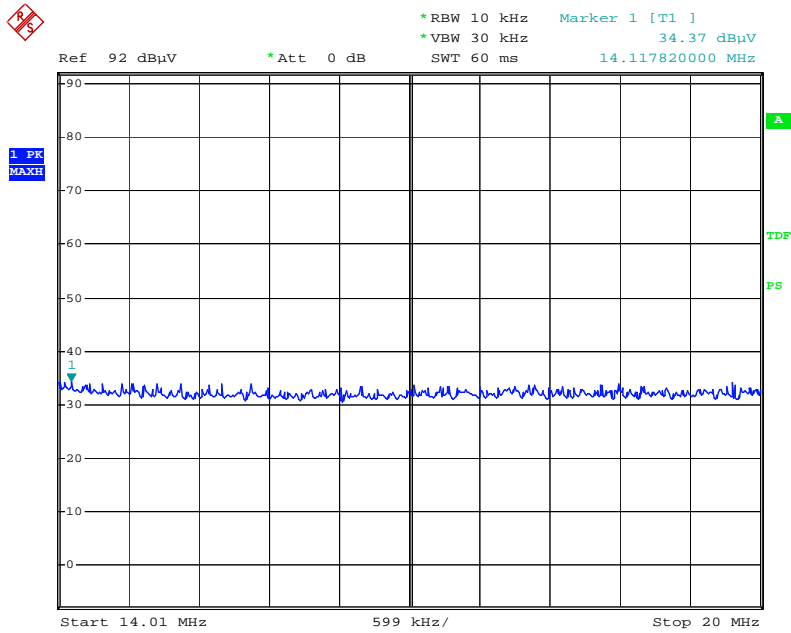
9KHz-150KHz

Date: 3.APR.2009 15:30:03

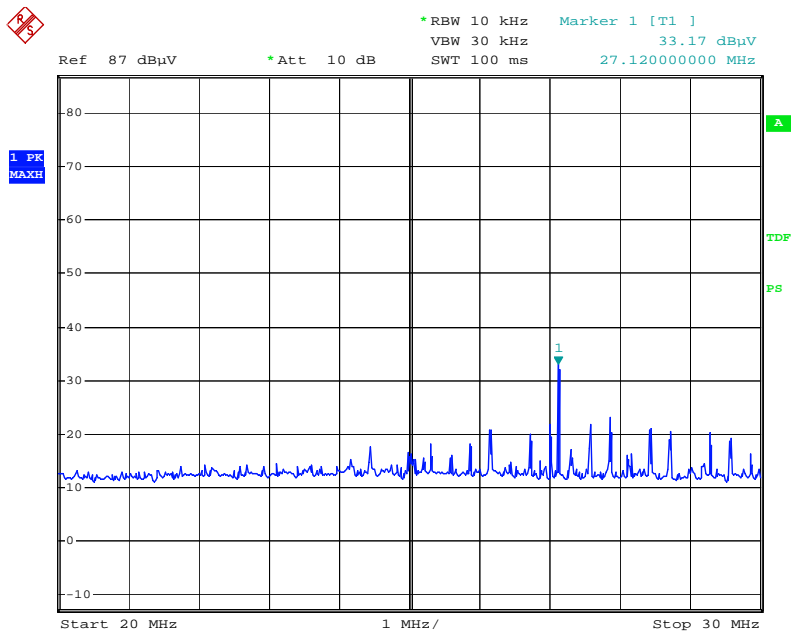


150kHz-13.11MHz

Date: 2.APR.2009 02:13:14



14.01MHz~20MHz  
Date: 2.APR.2009 02:17:22



20MHz~30MHz  
Date: 1.APR.2009 22:58:43



## §15.225(e) - FREQUENCY STABILITY

### Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $+50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2008-11-07	2009-11-06
WUHUAN	Temperature & Humidity Chamber	HTP205	20021115	2008-05-09	2009-05-09

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

### Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to PC, than to an external AC power supply and loop antenna was connected to a f Spectrum Analyzer. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable AC power supply Source. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the end point. The output frequency was recorded for each voltage.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Phoenix Liu on 2009-04-03.*

Test Result: Pass

*Test Mode: Reading Card*

Power Supply	Temperature (°C)	Measured Frequency (MHz)	Frequency Error	Part 15.225 Limit
AC 120V	0	13.55976	-0.00177%	± 0.01%
	10	13.55996	-0.00029%	± 0.01%
	20	13.55980	-0.00147%	± 0.01%
	30	13.56004	0.00029%	± 0.01%
	40	13.55976	-0.00177%	± 0.01%
	50	13.55944	-0.00413%	± 0.01%
Max. = AC 138V	20	13.55996	-0.00029%	± 0.01%
Min. = AC 102V	20	13.55972	-0.00206%	± 0.01%

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