

# EMI MEASUREMENT AND TEST REPORT

For

## Advanced Card Systems Ltd.

Units 2010-2013, 20th Floor, Chevalier Commercial Centre,  
8 Wang Hoi Road, Kowloon Bay, Hong Kong

**Model: V5MACR1222LD1**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Contactless Smart Card Reader and Writer
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<b>Report Number:</b> RSZ10121602	
<b>Report Date:</b> 2011-01-20	
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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 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 *Advanced Card Systems Ltd.*'s product, model number: *ACR1222L-D1* (FCC ID: *V5MACR1222LD1*) or the "EUT" as referred to in this report is a *Contactless Smart Card Reader and Writer*. The EUT is measured approximately 13.5 cm (L) x 9.0 cm (W) x 2.0 cm (H). Rated input voltage: DC 5 V USB.

*\* All measurement and test data in this report was gathered from production sample serial number: 1012067 (Assigned by BACL, Shenzhen). The EUT was received on 2010-12-16.*

### Objective

This Type approval report is prepared on behalf of *Advanced Card Systems Ltd.* 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 C63.4-2009, 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 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 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 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

### Justification

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

### EUT Exercise Software

APDU.exe. The software was provided by the manufacture.

### 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

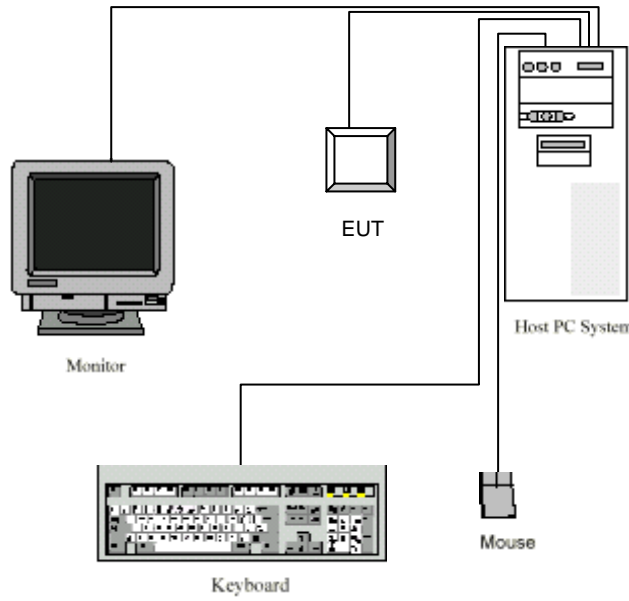
### Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
DELL	PC	DELL 170L	CN-0TC670-70821-560-F4WQ	DoC
DELL	Keyboard	SK-8110	CN07N244-71616-56I-1I0O	DoC
DELL	Mouse	M071KC	519046820	DoC
DELL	LCD Monitor	1505FP	Y4287-7168-574-GBSH	DoC
N/A	Card	N/A	N/A	N/A

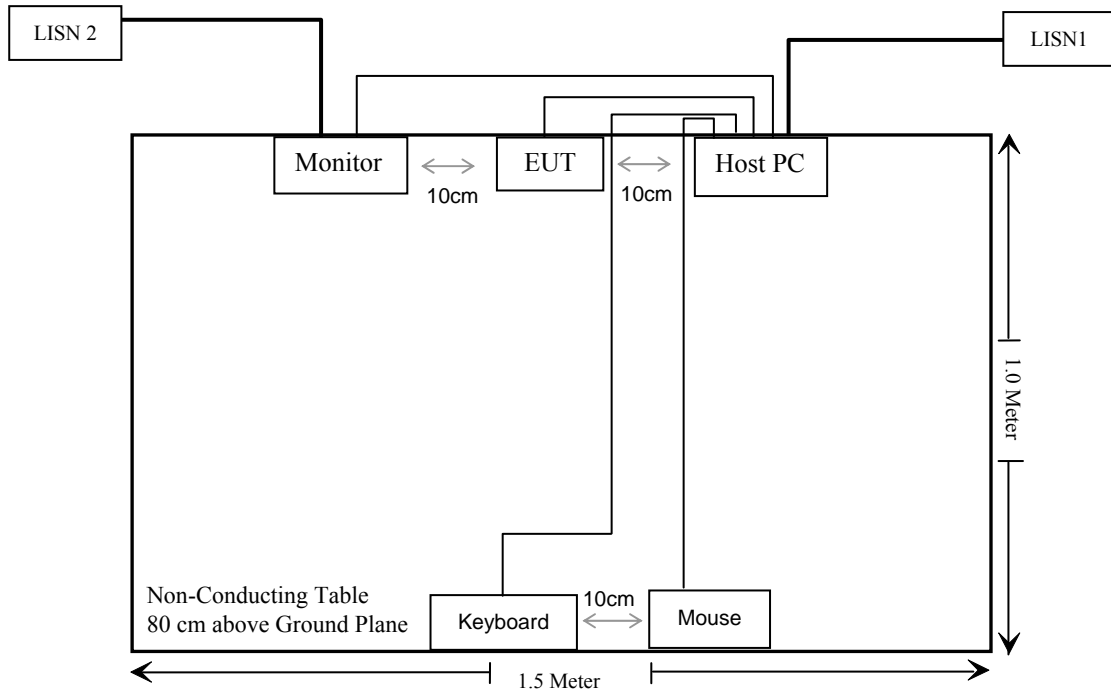
### External I/O Cable

Cable Description	Length (m)	From/Port	To
Unshielded Undetachable USB Cable	1.4	USB Port/Host	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>
§15.203	Antenna Requirement	Compliance
§15.205	Restricted Band of operation	Compliance
§15.207	AC Line Conducted Emission	Compliance
§15.209	Radiated Emissions Test	Compliance
§15.225(a) (b) (c) §15.31(f)	Field Strength of Emissions	Compliance
§15.225(d) §15.209§15.31(f)	Out of Band Emissions	Compliance
§15.225(e)	Frequency Stability	Compliance
§15.215(c)	20 dB Emission Bandwidth	Compliance



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## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

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 has a printed antenna on PCB, which complies with the Part 15.203. Please see EUT photo for details.

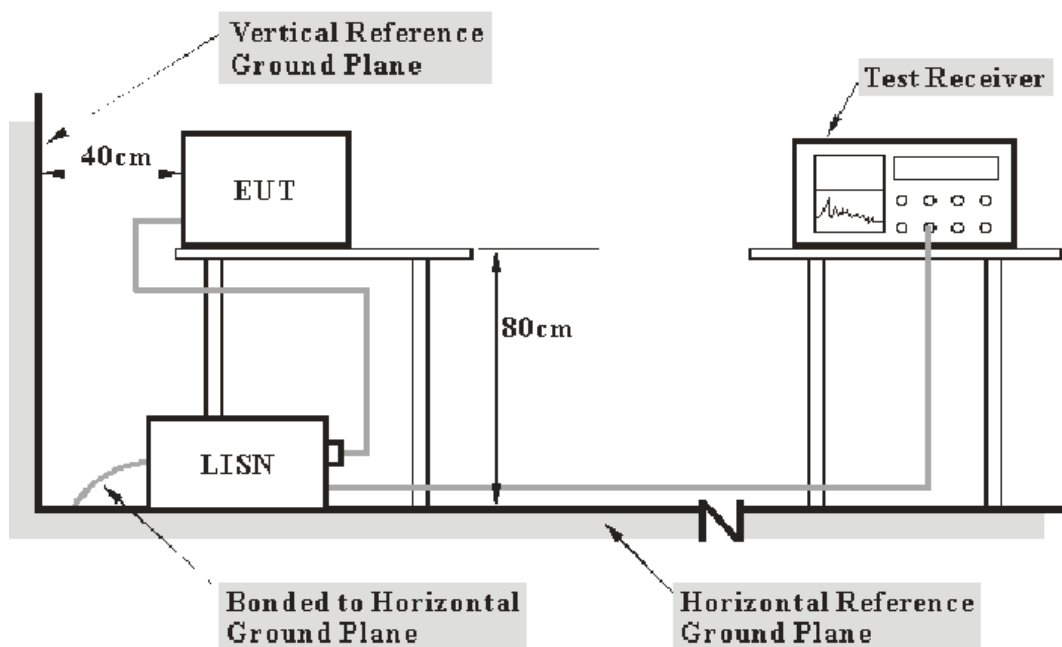
## FCC §15.207 – AC LINE CONDUCTED EMISSIONS

### 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 Lab Corp. (Shenzhen) is  $\pm 2.4$  dB(k=2, 95% level of confidence).

### 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 C63.4-2009 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	2010-03-03	2011-03-02
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2010-03-09	2011-03-08

\* **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 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:

**2.20 dB at 1.645 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 Allan An on 2011-01-12.*

*Test Mode: Transmitting*

**120 V, 60 Hz, Line:**



Frequency (MHz)	Correct Factor (dB)	Cord. Result (dBµV)	Limit (dBµV)	Margin (dB)	Remark (PK/QP/Ave.)
1.645	10.10	53.80	56.00	2.20*	QP
3.340	10.20	42.33	46.00	3.67	Ave.
4.165	10.10	51.32	56.00	4.68	QP
3.340	10.20	51.04	56.00	4.96	QP
0.825	10.20	50.64	56.00	5.36	QP
1.645	10.10	39.92	46.00	6.08	Ave.
4.115	10.10	39.38	46.00	6.62	Ave.
2.615	10.20	48.67	56.00	7.33	QP
2.615	10.20	38.42	46.00	7.58	Ave.
0.825	10.20	36.41	46.00	9.59	Ave.
16.120	10.10	33.77	50.00	16.23	Ave.
16.265	10.10	32.06	60.00	27.94	QP

\* Within measurement uncertainty.

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



Frequency (MHz)	Correct Factor (dB)	Cord. Result (dBµV)	Limit (dBµV)	Margin (dB)	Remark (PK/QP/Ave.)
1.645	10.10	53.50	56.00	2.50	QP
3.340	10.20	42.20	46.00	3.80	Ave.
4.165	10.10	50.39	56.00	5.61	QP
1.645	10.10	40.29	46.00	5.71	Ave.
3.340	10.20	50.27	56.00	5.73	QP
0.825	10.20	50.11	56.00	5.89	QP
2.615	10.20	49.03	56.00	6.97	QP
4.165	10.10	37.90	46.00	8.10	Ave.
2.615	10.20	37.79	46.00	8.21	Ave.
0.820	10.20	35.38	46.00	10.62	Ave.
15.685	10.10	36.73	50.00	13.27	Ave.
15.685	10.10	45.79	60.00	14.21	QP

## FCC §15.205 & §15.209 - RADIATED EMISSIONS TEST

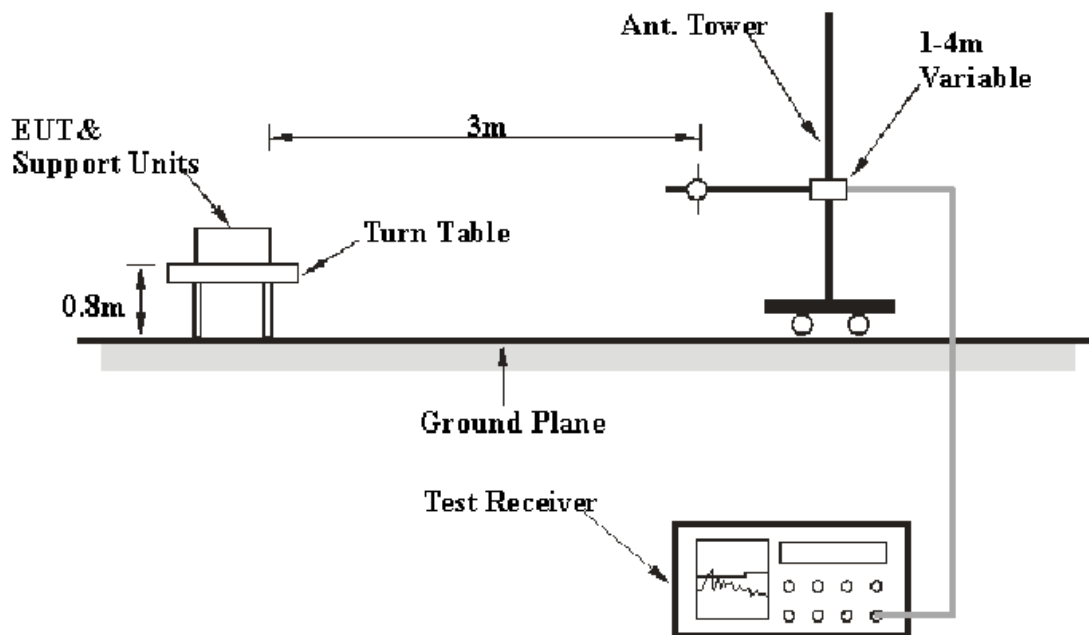
### Measurement Uncertainty

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 ( $k=2$ , 95% level of confidence).

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 C63.4-2009. 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
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-24	2011-11-23
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2010-03-11	2011-03-10

\* **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:

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

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:

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

## 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:

**2.2 dB at 749.613000 MHz in the Horizontal polarization**

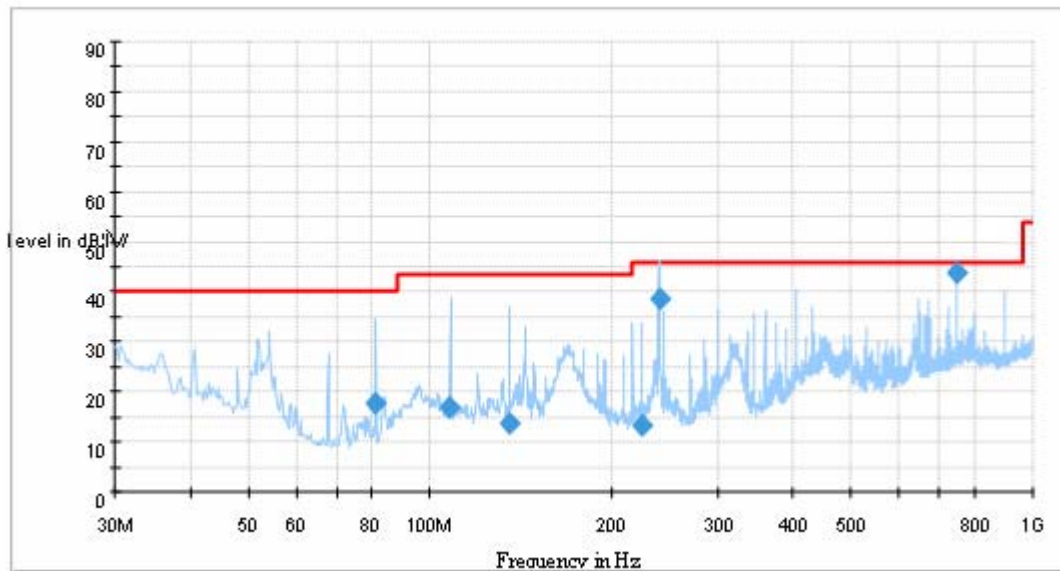
## Test Data

### Environmental Conditions

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

The testing was performed by Allan An on 2011-01-13.

Test mode: Transmitting



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
749.613000	43.8	100.0	V	73.0	-2.4	46.0	2.2*
240.004500	38.7	201.0	H	173.0	-13.7	46.0	7.3
81.259250	17.5	400.0	H	312.0	-18.1	40.0	22.5
107.863750	17.0	286.0	H	283.0	-13.7	43.5	26.5
135.940000	13.5	298.0	H	225.0	-12.9	43.5	30.0
225.411500	13.2	114.0	H	339.0	-13.9	46.0	32.8

\* Within measurement uncertainty.



## **FCC §15.225(a) (b) (c) §15.31(f) – FIELD STRENGTH OF 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	2010-08-02	2011-08-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-24	2011-11-23
ETS	Passive Loop Antenna	6512	00029604	2010-04-27	2011-04-26

\* **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 C63.4-2009. 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 Allan An on 2011-01-12.*

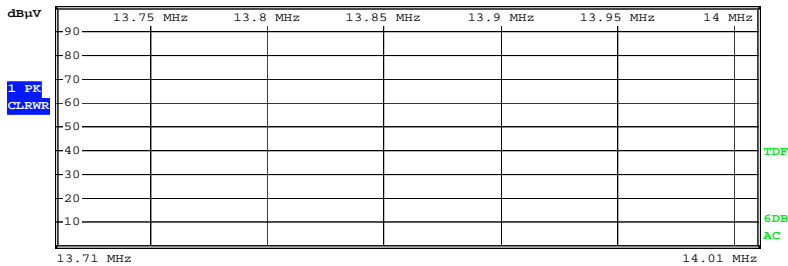
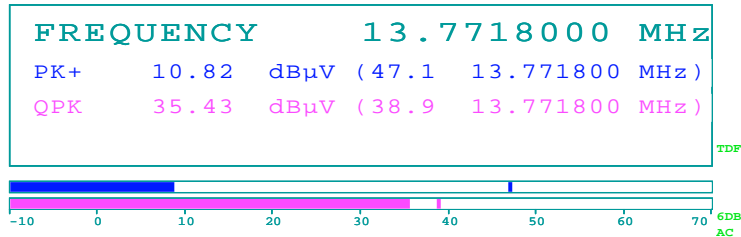
*Test Mode: Transmitting*

Test Result: Pass

Indicated			Table Angle Degree	Antenna Height (m)	Detector PK/QP/AV	Correction Factor			Cord. Amp. (dBµV/m) @3m	FCC Part 15.225	
Frequency Range (MHz)	Mark point (MHz)	Maximum Reading (dBµV) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBµV/m) @3m	Result
13.110-13.410	13.260	-0.3	181	1.2	QP	32.1	0.20	0.0	32.0	80.5	Pass
13.410-13.553	13.553	17	173	1.4	QP	32.1	0.20	0.0	49.3	90.5	Pass
13.553-13.567	13.560	34.4	182	1.3	QP	32.1	0.20	0.0	66.7	124	Pass
13.567-13.710	13.567	16	176	1.3	QP	32.1	0.20	0.0	48.3	90.5	Pass
13.710-14.010	13.771	6.6	173	1.5	QP	32.1	0.20	0.0	38.9	80.5	Pass



Att 10 dB RBW 9 kHz  
MT 10 ms  
PREAMP OFF



Date: 12.JAN.2011 23:08:29





## FCC §15.225(d) §15.209 & §15.31(f) - OUT OF BAND EMISSIONS

### Applicable Standard

As per FCC Part 15.225(d) §15.31(f) 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	2010-08-02	2011-08-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-24	2011-11-23
ETS	Passive Loop Antenna	6512	00029604	2010-04-27	2011-04-26

\* **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

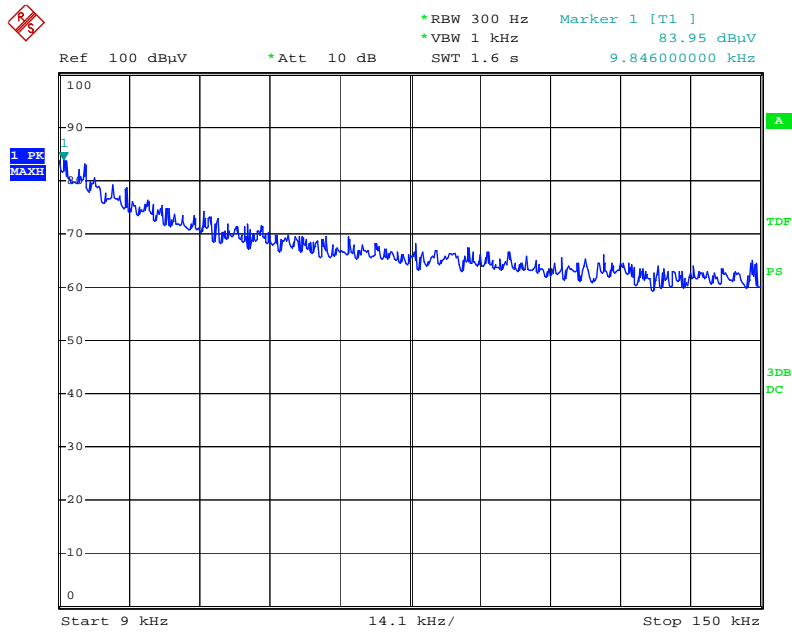
Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Allan An on 2011-01-12.

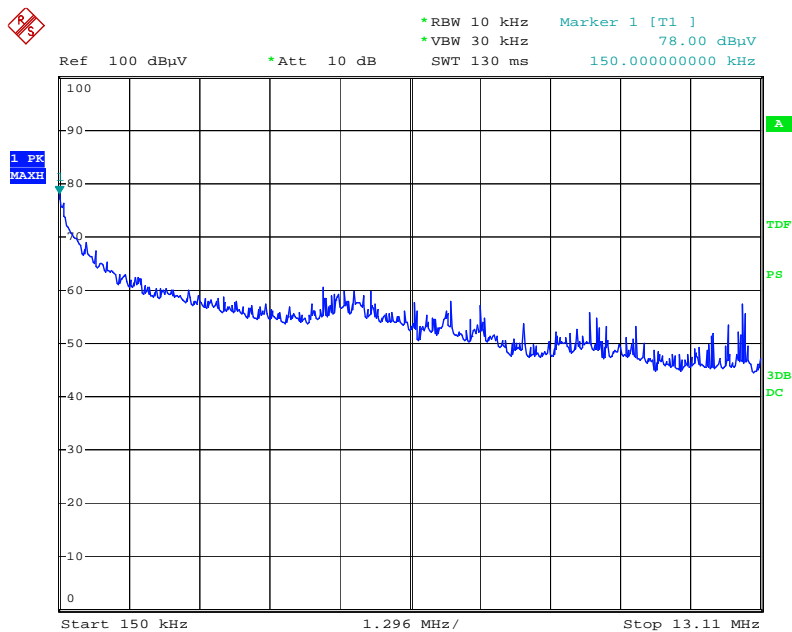
Test Mode: Transmitting

Indicated		Table Angle Degree	Antenna Height (m)	Detector PK/QP/AV	Correction Factor			Cord. Amp. (dB $\mu$ V/m) @3m	FCC Part 15.225	
Frequency (MHz)	Maximum Reading (dB $\mu$ V) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dB $\mu$ V/m) @3m	Result
0.009846	-3.9	162	1.4	PK	87.8	0.05	0.0	83.95	128.52	Pass
0.150000	17.62	178	1.5	PK	60.3	0.08	0.0	78.00	104.00	Pass
9.846000	21.85	187	1.6	PK	32.7	0.11	0.0	54.66	69.5	Pass
27.120000	20.25	184	1.6	PK	30.3	0.27	0.0	50.82	69.5	Pass

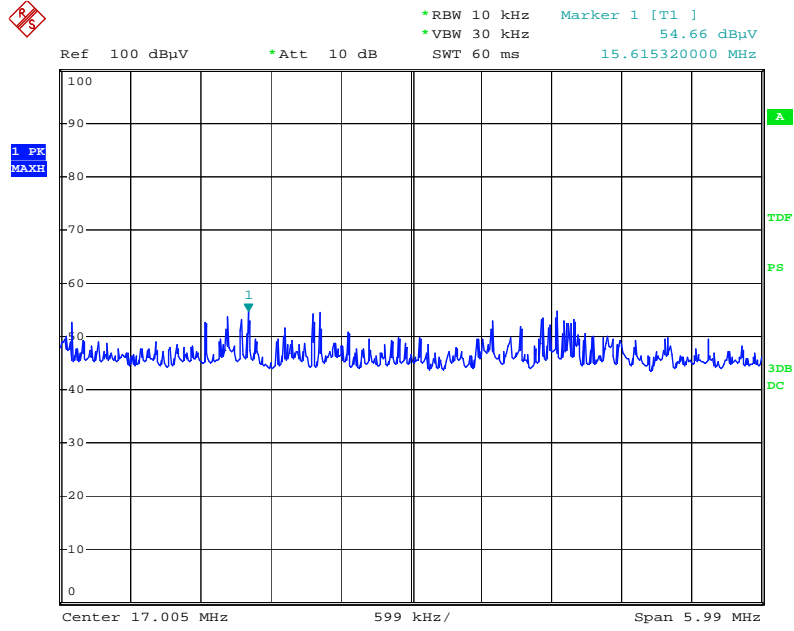
Test Result: Pass



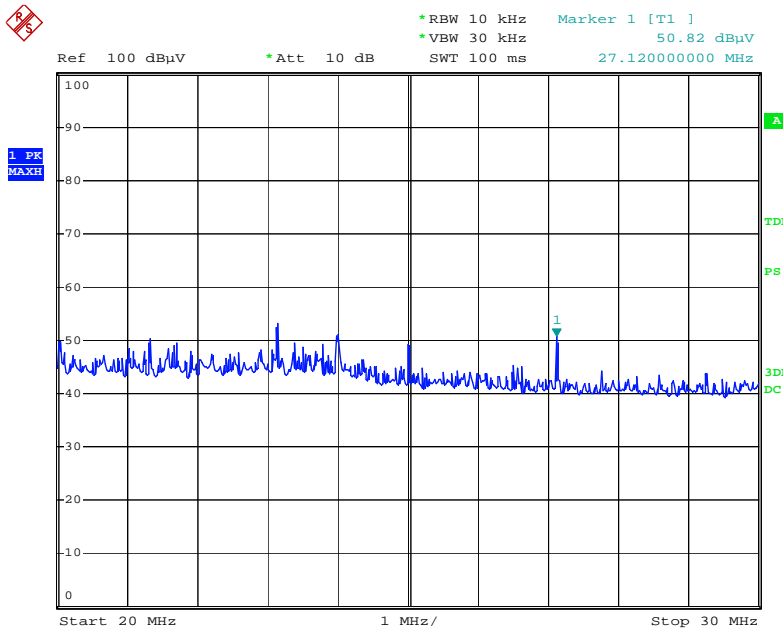
Date: 12.JAN.2011 23:45:57



Date: 12.JAN.2011 23:47:26



Date: 12.JAN.2011 23:50:04



Date: 12.JAN.2011 23:48:13

## FCC §15.225(e) - FREQUENCY STABILITY

### Applicable Standard

According to FCC Part 15.225(e), 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	2010-11-24	2011-11-23
WUHUAN	Temperature & Humidity Chamber	HTP205	20021115	2010-06-04	2011-06-03

\* **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

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Allan An on 2011-01-13.

Test Result: Pass

Test Mode: Transmitting



Power Supply	Temperature (°C)	Measured Frequency (MHz)	Frequency Error (%)	Part 15.225 Limit (%)
AC 120 V	0	13.56074	0.00545723	± 0.01
	10	13.56055	0.00405605	± 0.01
	20	13.56063	0.00464602	± 0.01
	25	13.56087	0.00641593	± 0.01
	30	13.56083	0.00612094	± 0.01
	40	13.56082	0.00604720	± 0.01
	50	13.56088	0.00648968	± 0.01
Max. = AC 138 V	25	13.56086	0.00634218	± 0.01
Min. = AC 102 V	25	13.56104	0.00766962	± 0.01

## FCC §15.215(c) – 20 dB EMISSION BANDWIDTH

### Requirement

As per FCC Part 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-24	2011-11-23
HP	Amplifier	8447E	1937A01046	2010-08-02	2011-08-01
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2010-05-05	2011-05-04

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

### Test Data

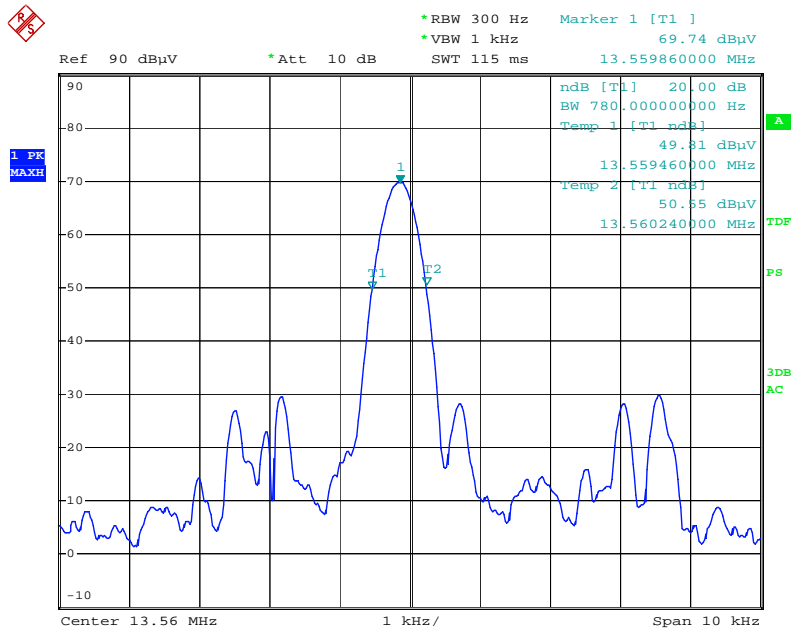
#### Environmental Conditions

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

*The testing was performed by Allan An on 2011-01-13.*

*Test Mode: Transmitting*

### 20 dB Emission Bandwidth



Date: 12.JAN.2011 23:31:00

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