NVLAP LAB CODE 200707-0

FCC PART 15.225

EMI MEASUREMENT AND TEST REPORT

For

Advanced Card Systems Limited

Units 2010-2013, 20th Floor, Cheavalier Commercial Centre, 8 Wang Hoi Road,

Kowloon Bay, Hong Kong

FCC ID: V5MACR128U

Report Type:	**Product Type:**
Original Report	Contact and Contactless Smart Card Reader and Writer

Test Engineer:	Sula Huang
Report Number:	RSZ09091402
Report Date:	2009-10-10
Reviewed By:	Merry Zhao EMC Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Advanced Card Systems Limited*'s product, model number: *ACR128U(FCC ID:V5MACR128U)* or the "EUT" as referred to in this report is a *Contact and Contactless Smart Card Reader and Writer*. The EUT is measured approximately 12.0 cm L x 7.0 cm W x 2.0 cm H. rated input voltage: DC 5V(from PC).

** All measurement and test data in this report was gathered from production sample serial number: 0909020 (Assigned by BACL, Shenzhen). The EUT was received on 2009-09-14.*

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 21, 2007. 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).

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
Intel	Motherboard	D865GKD	11S19R1949ZJ1WCB46J1K8	DoC
IBM	Power	HIPRO-A2307F3T	11S49P2191ZJ1TAR472225	DoC
Maxtor	Hard Disk	6Y080L0	Y23QNXTE	DoC
ALPS	3.5' Floppy	06P5226	11S06P5226ZJ1W25373957	DoC
Lite-ON	CD-Rom	LTN-489S	11S71P7366ZJ1SYC130015	DoC
ProMOS	Memory	V826616J24SATG-C0	D61A2605H	N/A
Intel	CPU	Pentium4 2800MHz	N/A	N/A
Intel	Ethernet	PRO 10/100 VE	N/A	DoC

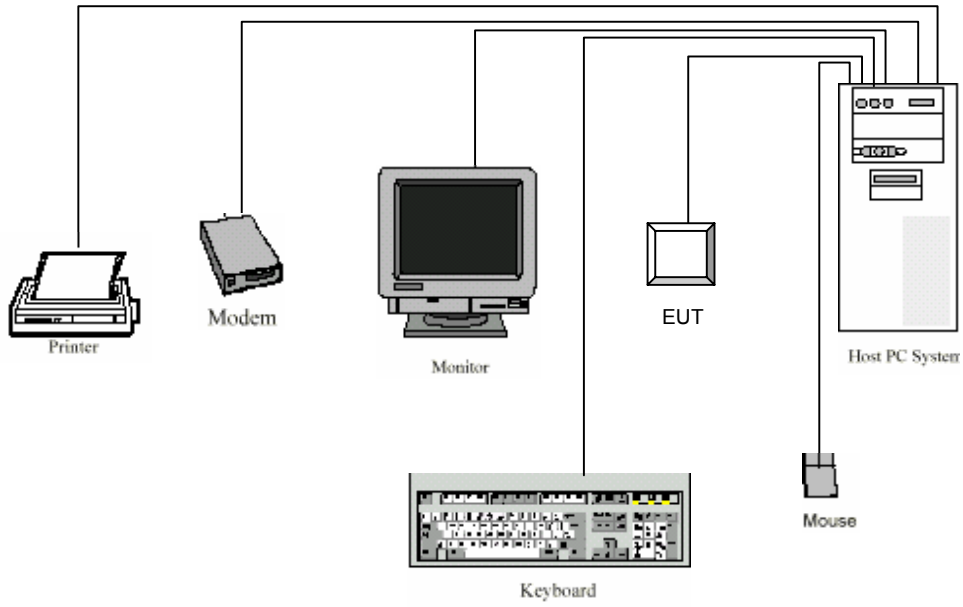
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
IBM	PC	ThinkCentre A50	99Y5469	DoC
DELL	Keyboard	L100	CNORH656658907BL05DC	DoC
DELL	Mouse	MOC5UO	G1900NKD	DoC
DELL	LCD Monitor	1505FP	CN-OY4287-71618-574-GBSH	DoC
HP	Laser Jet5L	C3941A	JPTVOB2337	DoC
SAST	Modem	AEM-2100	0293	DoC
N/A	Card	N/A	N/A	N/A

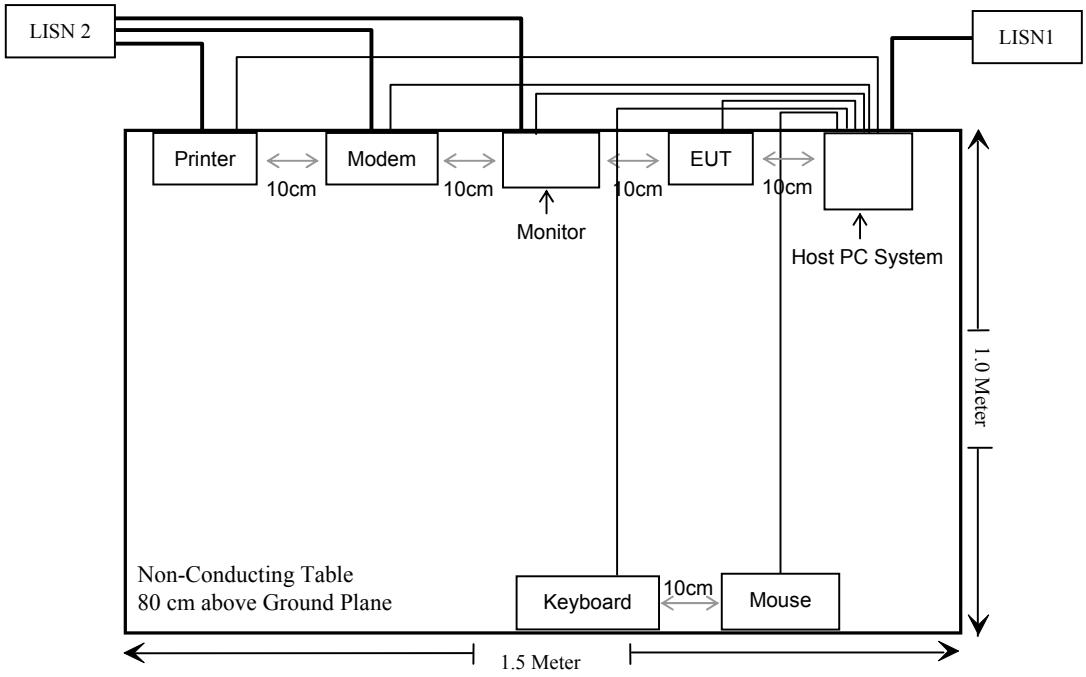
External I/O Cable

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
Shielded Detachable Serial Cable	1.2	Serial Port/Host	Modem
Shielded Undetachable USB Cable With a Core	1.1	EUT	PC

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of operation	Compliant
§15.207	Conducted Emission	Compliant*
§15.209	Radiated Emission Test	Compliant*
§15.225(a) (b) (c) §15.31(f)	Field Strength of Radiated Emissions	Compliant
§15.225(d) §15.209, §15.31(f)	Out of Band Emission	Compliant
§15.225(e)	Frequency Stability	Compliant
§15.215(c)	20 dB Bandwidth Testing	Compliant

Note:* Within measurement uncertainty.

FCC §15.203 - ANTENNA REQUIREMENT

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

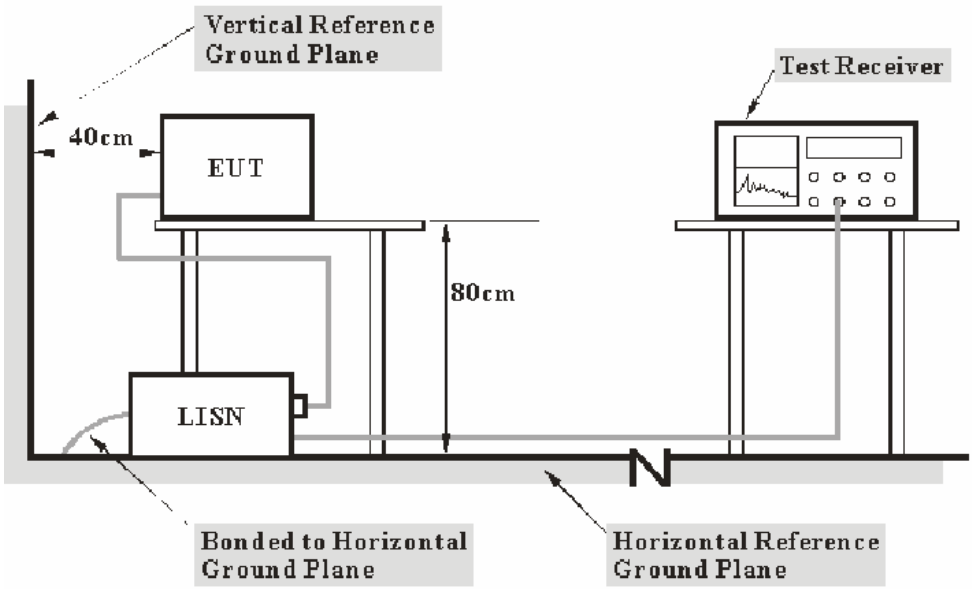
FCC §15.207 - CONDUCTED EMISSION

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 ±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:

Frequency Range	***IF B/W***
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:

8.93 dB at **0.2350 MHz** in the **Line** conductor mode
10.33 dB at **0.2350 MHz** in the **Neutral** conductor mode

Test Data

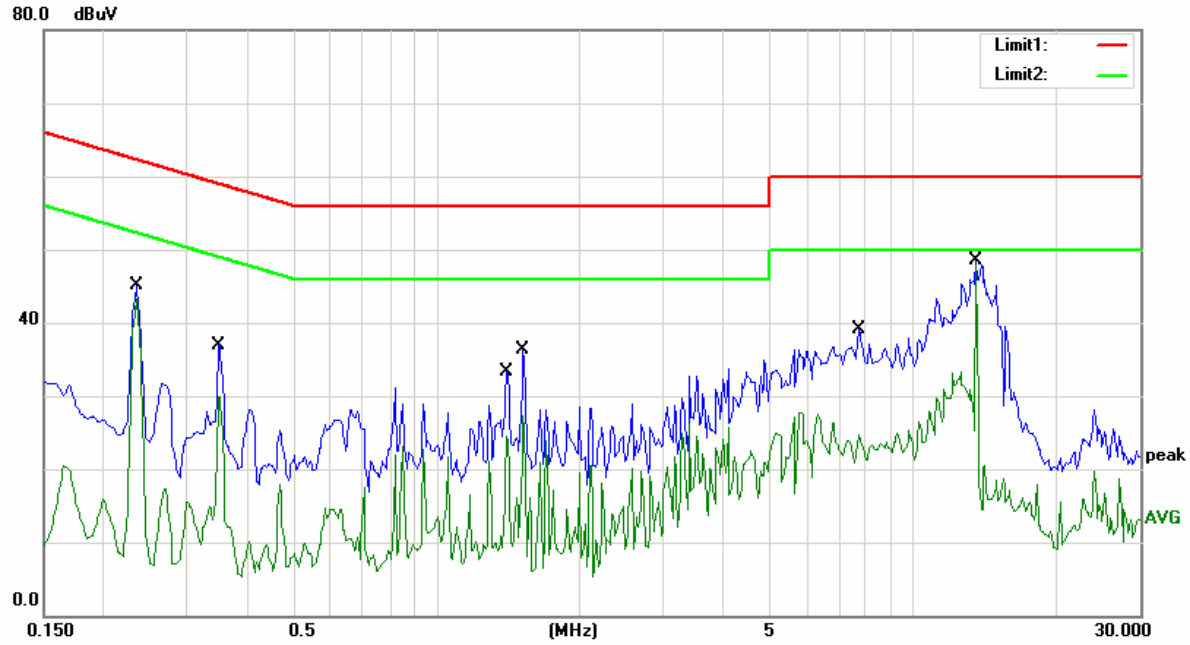
Environmental Conditions

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

The testing was performed by Sula Huang on 2009-09-18.

Test Mode: Transmitting

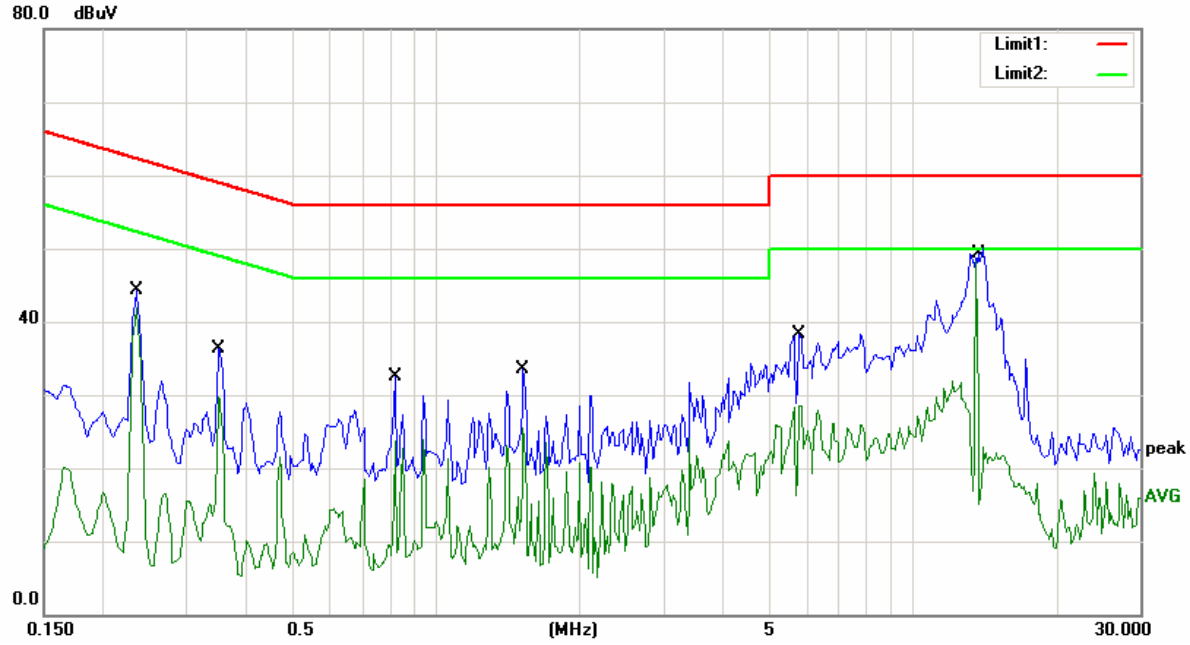
Line:



Conducted Emission				FCC Part 15.207		
Frequency (MHz)	Receiver Reading (dBµV)	Correction Factor (dB)	Cord. Result (dBµV)	Limit (dBµV)	Margin (dB)	Remark
13.5600	37.75	10.20	47.95	-	-	AV *
13.5600	38.66	10.20	48.86	-	-	QP *
0.2350	33.24	10.10	43.34	52.27	8.93	AV
0.2350	33.94	10.10	44.04	62.27	18.23	QP
0.3500	19.87	10.10	29.97	48.96	18.99	AV
1.5250	16.39	10.10	26.49	46.00	19.51	AV
1.4100	13.70	10.10	23.80	46.00	22.20	AV
1.5250	23.19	10.10	33.29	56.00	22.71	QP
0.3500	24.44	10.10	34.54	58.96	24.42	QP
1.4100	19.90	10.10	30.00	56.00	26.00	QP
7.6900	6.99	10.15	17.14	50.00	32.86	AV
7.6900	15.41	10.15	25.56	60.00	34.44	QP

Note: * The 13.56 MHz signal is fundamental.

Neutral:



Conducted Emission				FCC Part 15.207		
Frequency (MHz)	Receiver Reading (dBµV)	Correction Factor (dB)	Cord. Result (dBµV)	Limit (dBµV)	Margin (dB)	Remark
13.5600	37.68	10.20	47.88	-	-	AV *
13.5600	38.57	10.20	48.77	-	-	QP *
0.2350	31.84	10.10	41.94	52.27	10.33	AV
0.3500	19.41	10.10	29.51	48.96	19.45	AV
0.2350	32.64	10.10	42.74	62.27	19.53	QP
1.5250	15.88	10.10	25.98	46.00	20.02	AV
5.7450	18.24	10.11	28.35	50.00	21.65	AV
0.8217	13.65	10.10	23.75	46.00	22.25	AV
1.5250	22.51	10.10	32.61	56.00	23.39	QP
0.3500	24.14	10.10	34.24	58.96	24.72	QP
5.7450	24.12	10.11	34.23	60.00	25.77	QP
0.8217	17.99	10.10	28.09	56.00	27.91	QP

Note: * The 13.56 MHz signal is fundamental.

FCC §15.205 & §15.209 - RADIATED EMISSIONS TEST

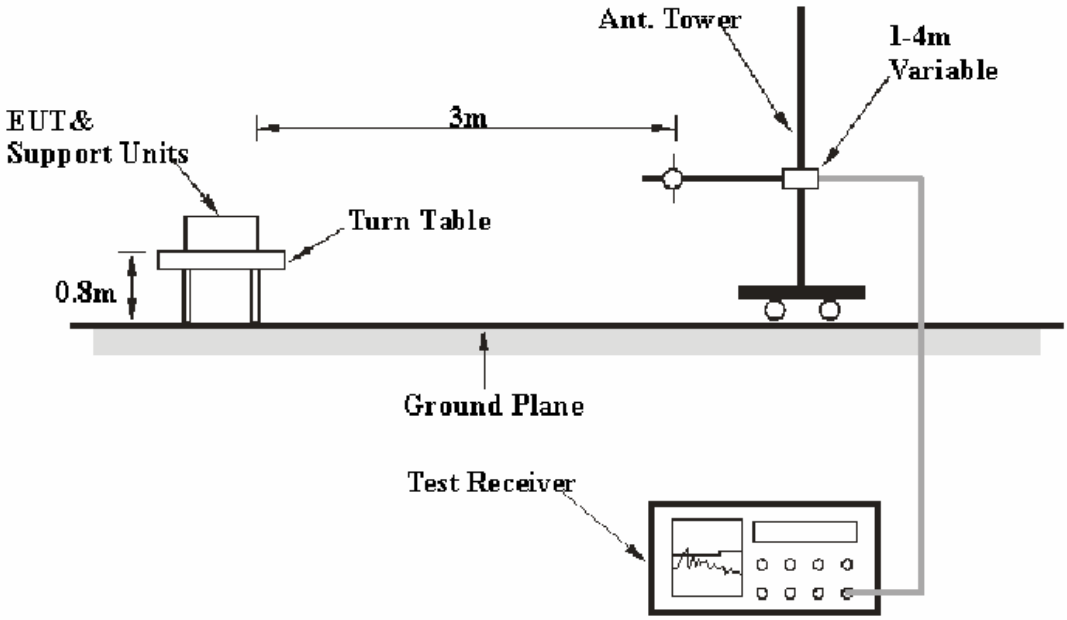
Measurement Uncertainty

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 ±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:

Frequency Range	***RBW***	***Video B/W***
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	2009-05-05	2010-05-04
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2009-07-08	2010-07-07

*** 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:

Cord. Amp. = Meter Reading + Antenna Loss+ Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Limit - Cord. 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:

2.7 dB at **300.160750 MHz** in the **Horizontal** polarization

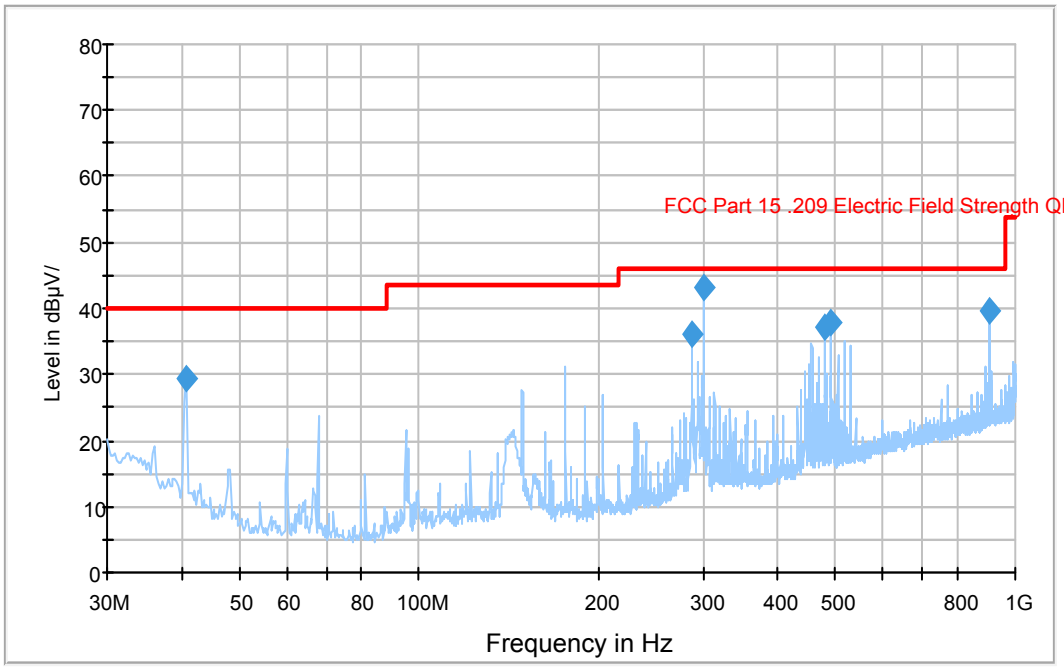
Test Data

Environmental Conditions

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

The testing was performed by Sula Huang on 2009-09-23.

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)
300.160750	43.3	100.0	H	331.0	-14.6	46.0	2.7*
905.596500	39.5	127.0	V	241.0	-3.6	46.0	6.5
286.933750	36.0	100.0	H	314.0	-14.7	46.0	8.0
492.040750	37.7	196.0	H	184.0	-10.7	46.0	8.3
480.004500	37.1	100.0	H	169.0	-10.5	46.0	8.9
40.678750	29.5	114.0	V	29.0	-15.8	40.0	10.5

Note: * Within measurement uncertainty.

FCC §15.225(a) (b) (c) & §15.31(f) – 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

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447E	1937A01046	2009-08-02	2010-08-02
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

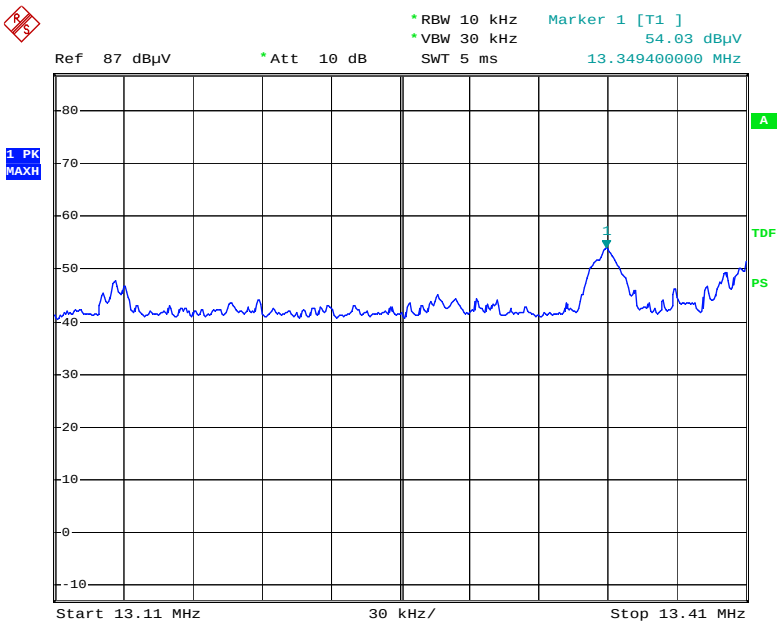
Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Sula Huang on 2009-09-23 to 2009-10-10.

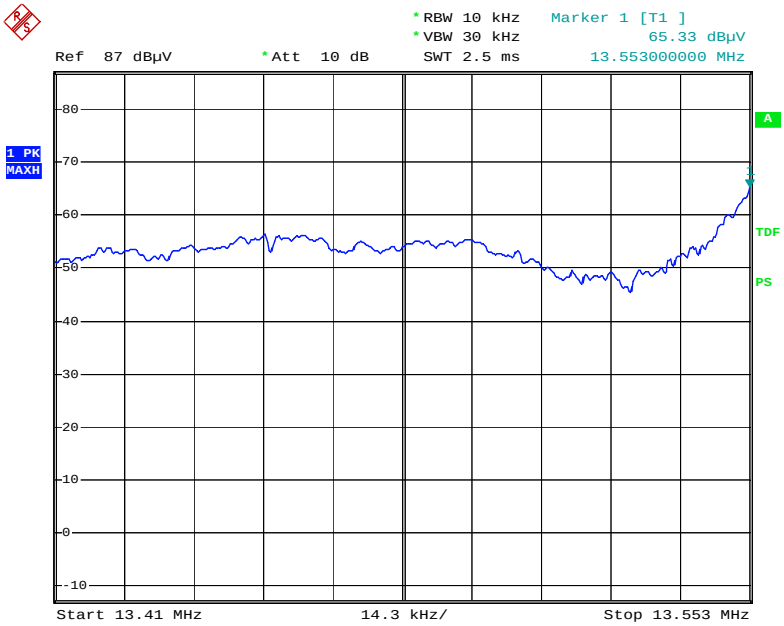
Test Mode: Transmitting

Test Result: Pass

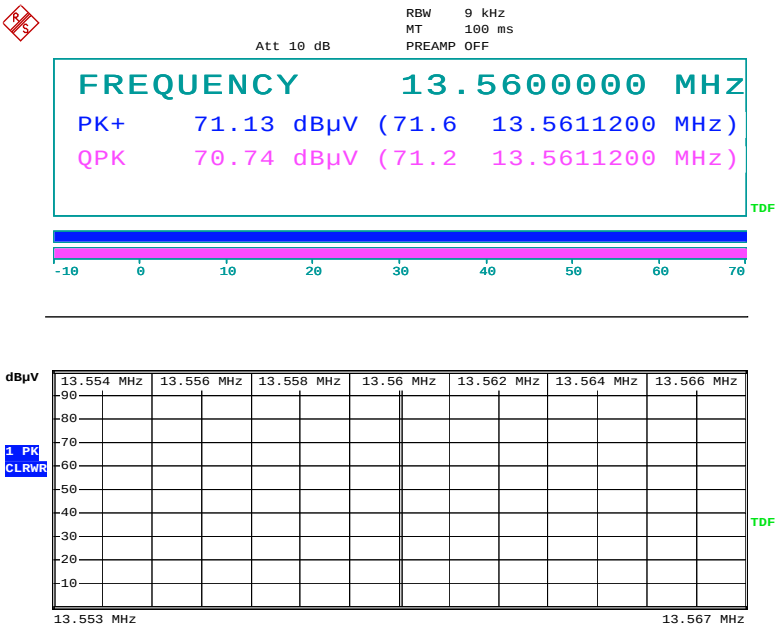
Indicated			Table Angle Degree	Antenna Height (m)	Detector PK/QP/AV	Correction Factor			Cord. Amp. (dBµV/m) @ 3m	FCC Part 15.225	
Frequency Range (MHz)	Mark Point (MHz)	Reading (dBµV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBµV/m) @3m	Result
13.110-13.410	13.349	21.73	0	1.30	PK	32.1	0.20	0.0	54.03	80.5	Pass
13.410-13.553	13.553	33.03	1	1.31	PK	32.1	0.20	0.0	65.33	90.5	Pass
13.553-13.567	13.560	38.90	1	1.31	QP	32.1	0.20	0.0	71.20	124	Pass
13.567-13.710	13.567	35.18	0	1.30	PK	32.1	0.20	0.0	67.48	90.5	Pass
13.710-14.010	13.774	21.71	1	1.31	PK	32.1	0.20	0.0	54.01	80.5	Pass



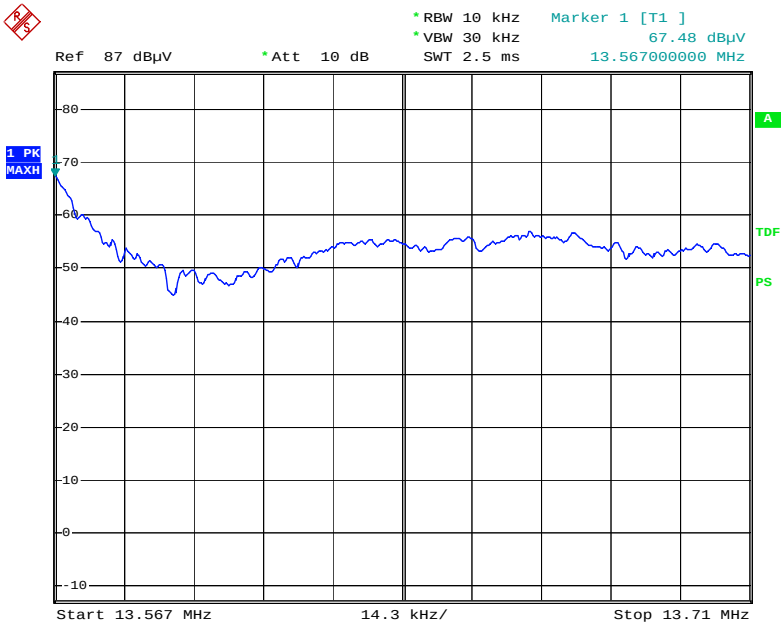
Date: 23.SEP.2009 09:25:38



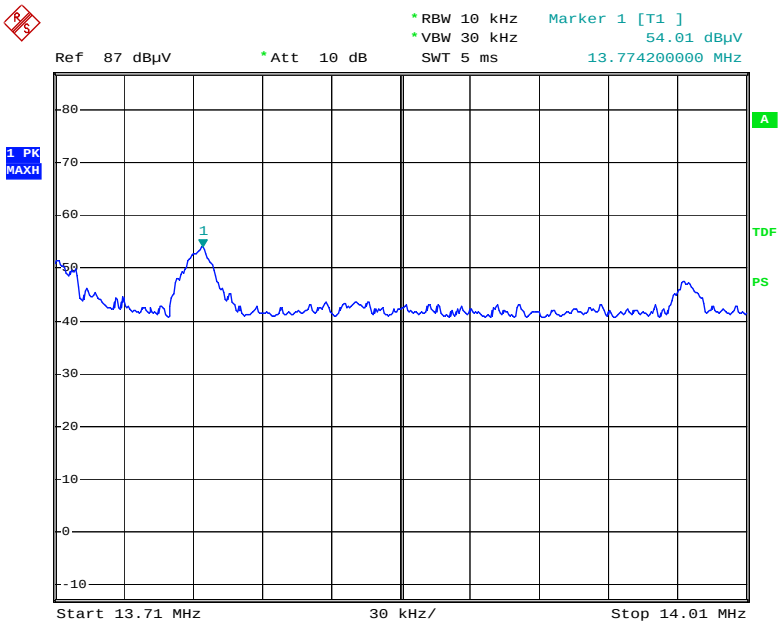
Date: 23.SEP.2009 09:28:09



Date: 10.OCT.2009 10:15:04



Date: 23.SEP.2009 09:31:14



Date: 23.SEP.2009 09:33:29

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

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	HP8447E	1937A01046	2009-08-02	2010-08-02
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

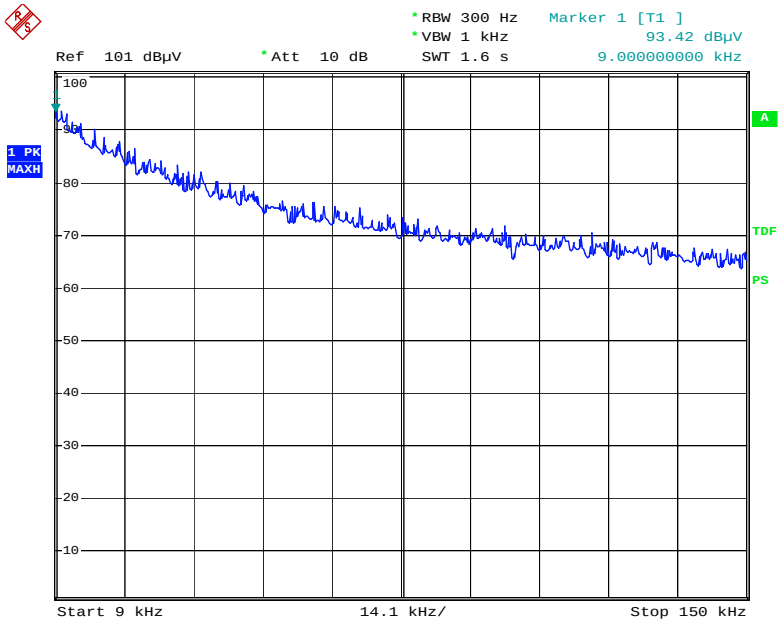
Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Sula Huang on 2009-09-23.

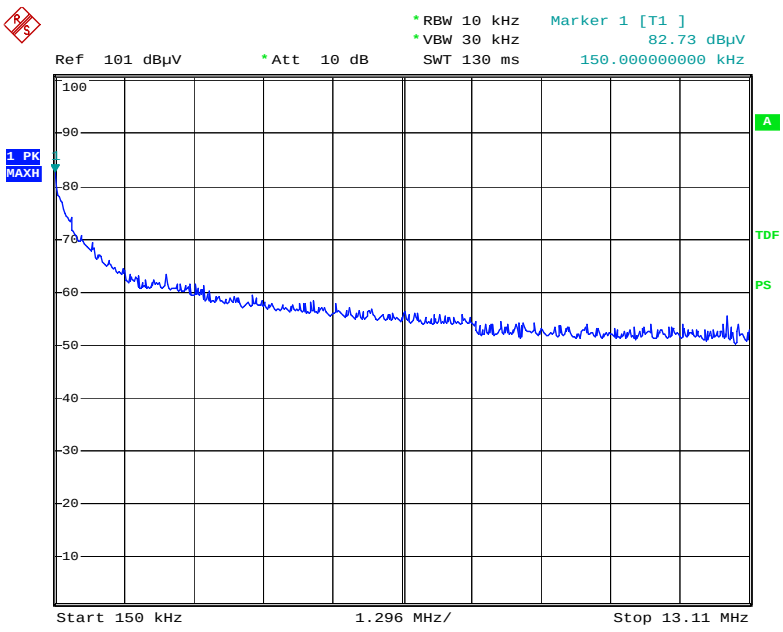
Test Mode: Transmitting

Indicated		Table Angle Degree	Antenna Height (m)	Detector PK/QP/AV	Correction Factor			Cord. Amp. (dBµV/m) @3m	FCC Part 15.225	
Frequency (MHz)	Reading (dBµV/m) @ 3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBµV/m) @3m	Result
0.009	5.57	0	1.30	PK	87.8	0.05	0.0	93.42	128.51	Pass
0.150	19.17	1	1.30	PK	63.5	0.06	0.0	82.73	84.08	Pass
15.866	22.80	3	1.30	PK	31.9	0.20	0.0	54.90	69.5	Pass
24.060	31.48	0	1.30	PK	30.9	0.25	0.0	62.63	69.5	Pass

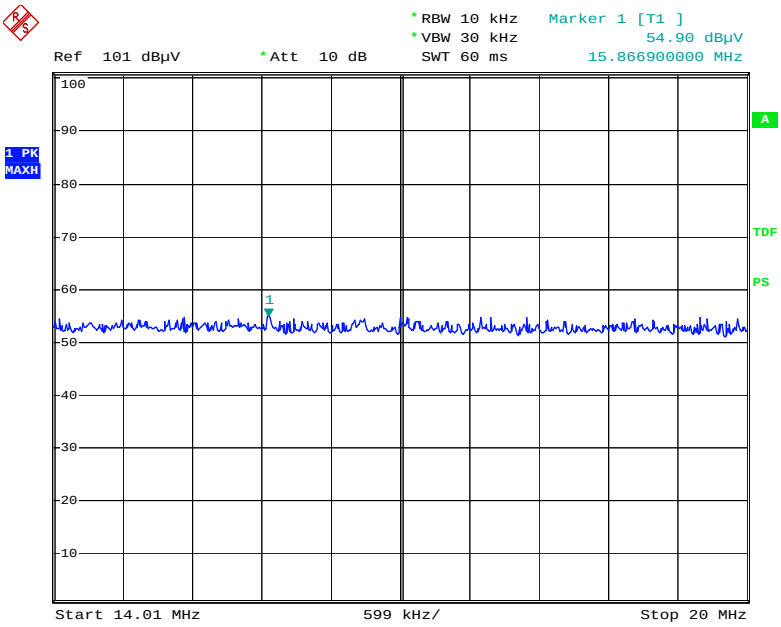
Test Result: Pass



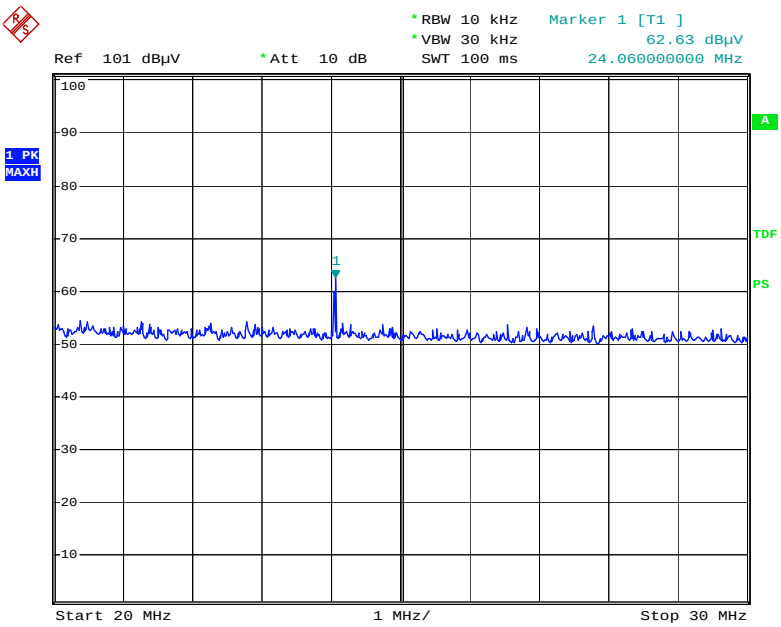
Date: 23.SEP.2009 09:44:33



Date: 23.SEP.2009 09:47:44



Date: 23.SEP.2009 09:49:40



Date: 23.SEP.2009 09:50:34

FCC §15.225(e) - FREQUENCY STABILITY

Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within ±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	2009-05-09	2010-05-09

*** 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

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

The testing was performed by Sula Huang on 2009-09-23.

Test Result: Pass

Test Mode: Transmitting

Test Environment		Measured Frequency (MHz)	Frequency Error	Part 15.225 Limit	Result
Power Supply	Temperature (^{O}C)				
AC 120 V	0	13.56114	0.0084%	±0.01%	Pass
	10	13.56111	0.0082%	±0.01%	Pass
	20	13.56032	0.0024%	±0.01%	Pass
	30	13.56112	0.0083%	±0.01%	Pass
	40	13.56111	0.0082%	±0.01%	Pass
	50	13.56114	0.0084%	±0.01%	Pass
Max. = AC 138 V	20	13.56030	0.0022%	±0.01%	Pass
Min. = AC 102 V	20	13.56031	0.0023%	±0.01%	Pass

* Note: The temperature range is 0~50 ^{O}C, which was declared by manufacturer.

FCC §15.215(c) – 20 dB BANDWIDTH TESTING

Requirement

Per 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	2008-10-16	2009-10-16
HP	Amplifier	8447E	1937A01046	2008-11-15	2009-11-15
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2009-05-05	2010-05-04

*** 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

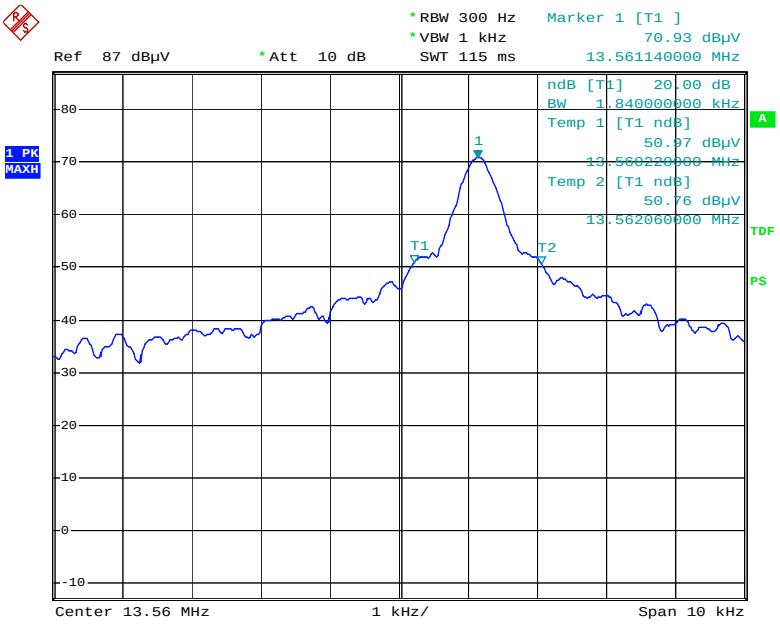
Environmental Conditions

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

The testing was performed by Sula Huang on 2009-09-23.

Test Mode: Transmitting

20 dB Occupied Bandwidth



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