



FCC PART 15.225


## TEST REPORT

For

### Advanced Card Systems Limited

Units 4107 - 4110, 41st Floor, Manhattan Place, 23 Wang Tai Road, Kowloon Bay, Hong Kong

**FCC ID: V5MACR900**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Banking POS Terminal
<b>Report Number:</b> RSZ170512001-00B	
<b>Report Date:</b> 2017-07-24	
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**Note:** This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

## **TABLE OF CONTENTS**

<b>GENERAL INFORMATION.....</b>	<b>3</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	3
OBJECTIVE .....	3
RELATED SUBMITTAL(S)/GRANT(S).....	3
TEST METHODOLOGY .....	3
MEASUREMENT UNCERTAINTY .....	4
TEST FACILITY .....	4
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>5</b>
JUSTIFICATION .....	5
EUT EXERCISE SOFTWARE .....	5
EQUIPMENT MODIFICATIONS .....	5
LOCAL SUPPORT EQUIPMENT.....	5
EXTERNAL I/O CABLE.....	5
BLOCK DIAGRAM OF TEST SETUP .....	5
<b>SUMMARY OF TEST RESULTS.....</b>	<b>6</b>
<b>TEST EQUIPMENT LIST .....</b>	<b>7</b>
<b>FCC§15.203 - ANTENNA REQUIREMENT.....</b>	<b>8</b>
APPLICABLE STANDARD .....	8
ANTENNA CONNECTED CONSTRUCTION .....	8
<b>FCC §15.207 – AC LINE CONDUCTED EMISSION .....</b>	<b>9</b>
APPLICABLE STANDARD .....	9
EUT SETUP .....	9
EMI TEST RECEIVER SETUP.....	9
TEST PROCEDURE .....	10
CORRECTED FACTOR & MARGIN CALCULATION .....	10
TEST RESULTS SUMMARY .....	10
TEST DATA .....	10
<b>FCC§15.225, §15.205 &amp; §15.209 - RADIATED EMISSIONS TEST .....</b>	<b>13</b>
APPLICABLE STANDARD .....	13
EUT SETUP .....	13
EMI TEST RECEIVER SETUP.....	14
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	14
TEST RESULTS SUMMARY .....	14
TEST DATA .....	15
<b>FCC§15.225(E) - FREQUENCY STABILITY.....</b>	<b>17</b>
APPLICABLE STANDARD .....	17
TEST PROCEDURE .....	17
TEST DATA .....	17
<b>FCC§15.215(C) - 20DB EMISSION BANDWIDTH .....</b>	<b>19</b>
REQUIREMENT .....	19
TEST PROCEDURE .....	19
TEST DATA .....	19

## GENERAL INFORMATION

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

The *Advanced Card Systems Limited's* product, model number: *ACR900 (FCC ID: V5MACR900)* or the "EUT" in this report was a *Banking POS Terminal*, which was measured approximately: 192mm (L) x 83mm (W) x 68mm (H), rated with input voltage: DC 7.4V rechargeable Li-ion battery or DC 9.0V from adapter.

#### Adapter Information:

Model: YJS11-0903000U

Input: AC100-240V, 50/60Hz, 1000 mA

Output: DC9.0V, 3000 mA

*\*All measurement and test data in this report was gathered from production sample serial number: 1700962 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2017-05-12.*

### 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 and C of the Federal Communication Commissions rules.

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

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

Part 22H & 24E PCB and Part 15.247 DTS submissions with FCC ID: V5MACR900.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

**Measurement Uncertainty**

Item		Uncertainty
AC Power Lines Conducted Emissions		$\pm 3.26$ dB
RF conducted test with spectrum		$\pm 0.9$ dB
RF Output Power with Power meter		$\pm 0.5$ dB
Radiated emission	9 kHz~30 MHz	$\pm 6.1$ dB
	30MHz~1GHz	$\pm 5.91$ dB
Occupied Bandwidth		$\pm 0.5$ kHz
Temperature		$\pm 1.0$ °C
Humidity		$\pm 6\%$

**Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China

Bay Area Compliance Laboratories Corp. (Kunshan) has been accredited to ISO/IEC 17025 by CNAS(Lab code: L9963). And accredited to ISO/IEC 17025 by A2LA(Lab code: 4323.01), the FCC Designation No. CN1185 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Kunshan) was registered with ISED Canada under ISED Canada Registration Number 3062E.

## SYSTEM TEST CONFIGURATION

### Justification

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

### EUT Exercise Software

No Exercise Software.

### Equipment Modifications

No modification on the EUT.

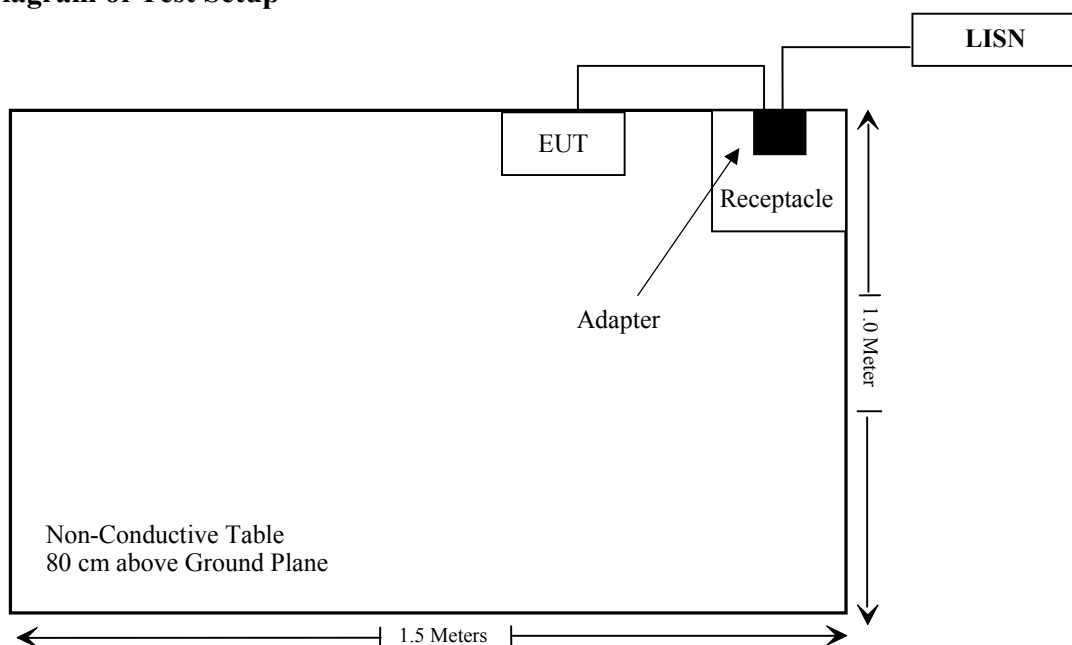
### Local Support Equipment

Manufacturer	Description	Model	Serial Number
N/A	N/A	N/A	N/A

### External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-shielding Detachable USB Cable	1.5	EUT	Adapter

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207	AC Line Conducted Emission	Compliance
§15.225 §15.209 §15.205	Radiated Emission Test	Compliance
§15.225(e)	Frequency Stability	Compliance
§15.215(c)	20dB Emission Bandwidth	Compliance

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>AC Line Conducted test</b>					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2016-11-25	2017-11-25
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2016-10-10	2017-10-10
Rohde & Schwarz	Pulse limiter	ESH3-Z2	879940/0058	2017-06-18	2018-06-17
MICRO-COAX	Coaxial line	UFB-293B-1-0480-50X50	97F0173	2016-09-08	2017-09-08
Rohde & Schwarz	CE Test software	EMC 32	V 09.10.0	NCR	NCR
<b>Radiation test</b>					
Sonoma Instrunent	Amplifier	330	171377	2016-12-12	2017-12-12
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
ETS-LINDGREN	PASSIVE LOOP	6512	108100	2016-01-09	2019-01-08
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-12

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

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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 internal antenna on PCB, which was permanently attached, fulfill the requirement of this section. Please see EUT photo for details.

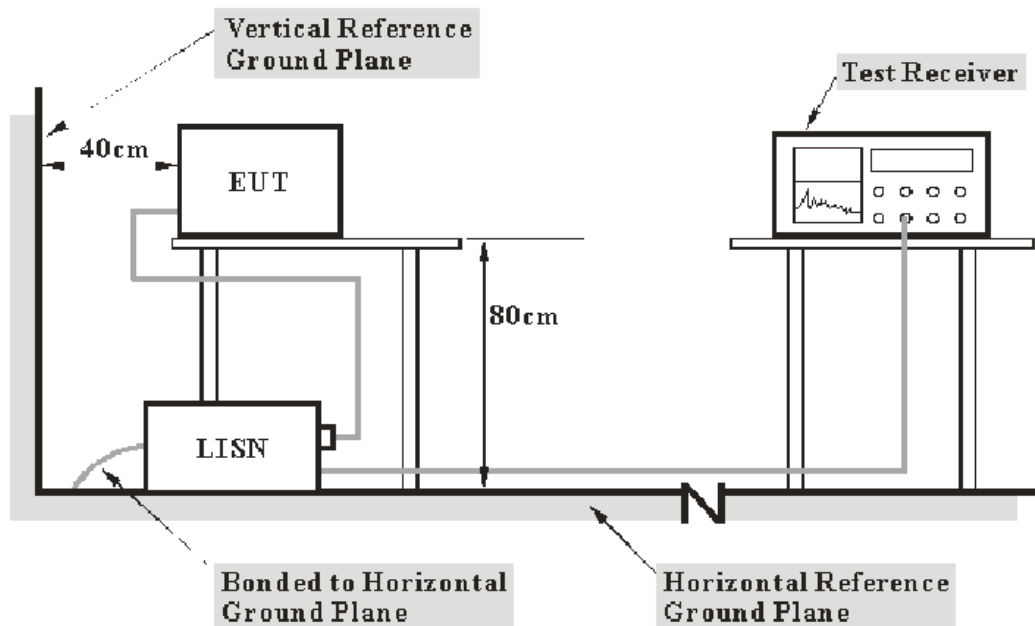


## FCC §15.207 – AC LINE CONDUCTED EMISSION

### Applicable Standard

FCC§15.207

### 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 C63.10-2013 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.

### 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 Procedure

During the conducted emission test, the adaptor was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

## Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

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 limit. The equation for margin calculation is as follows:

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

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{\text{lim}} + U_{\text{cispr}}$$

In BACL,  $U_{(Lm)}$  is less than  $U_{\text{cispr}}$ , if  $L_m$  is less than  $L_{\text{lim}}$ , it implies that the EUT complies with the limit.

## Test Data

### Environmental Conditions

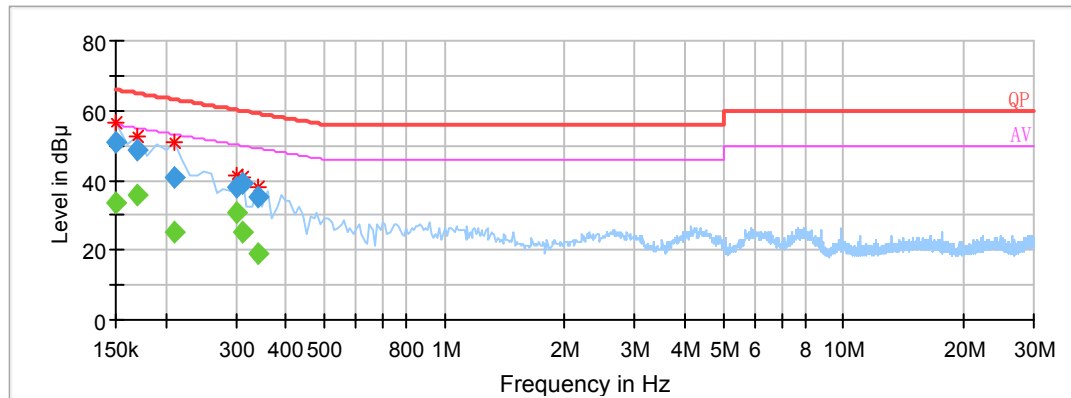
Temperature:	24 °C
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

*The testing was performed by Layne Li on 2017-07-18.*

EUT operation mode: Reading Card

AC 120 V/60 Hz, Line:

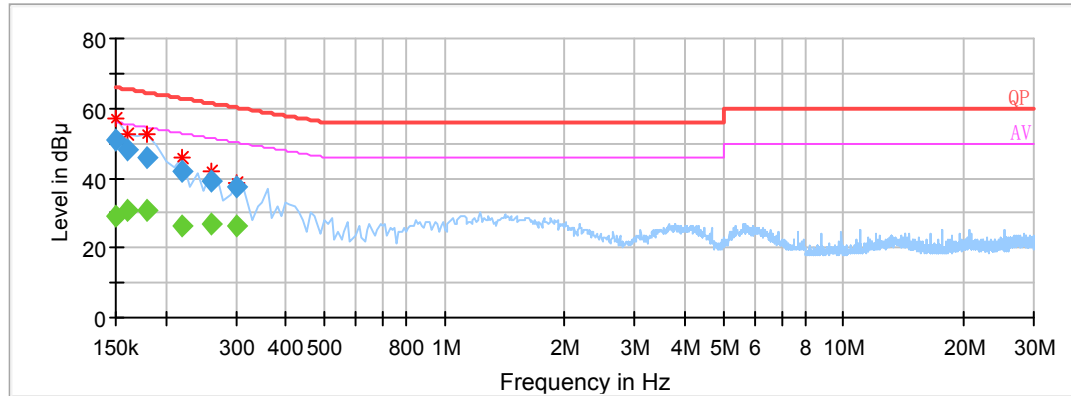
Full Spectrum



Frequency (MHz)	QuasiPeak (dBμV)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	---	33.37	9.000	L1	10.1	22.63	56.00	Compliance
0.150000	50.77	---	9.000	L1	10.1	15.23	66.00	Compliance
0.170000	---	35.59	9.000	L1	10.1	19.37	54.96	Compliance
0.170000	48.87	---	9.000	L1	10.1	16.09	64.96	Compliance
0.210000	---	25.31	9.000	L1	10.2	27.90	53.21	Compliance
0.210000	40.70	---	9.000	L1	10.2	22.51	63.21	Compliance
0.300000	---	30.58	9.000	L1	10.1	19.66	50.24	Compliance
0.300000	38.28	---	9.000	L1	10.1	21.96	60.24	Compliance
0.310000	---	25.11	9.000	L1	10.1	24.86	49.97	Compliance
0.310000	39.02	---	9.000	L1	10.1	20.95	59.97	Compliance
0.340000	---	19.18	9.000	L1	10.1	30.02	49.20	Compliance
0.340000	35.17	---	9.000	L1	10.1	24.03	59.20	Compliance

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

Full Spectrum



Frequency (MHz)	QuasiPeak (dBμV)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	---	28.88	9.000	N	10.1	27.12	56.00	Compliance
0.150000	50.89	---	9.000	N	10.1	15.11	66.00	Compliance
0.160000	---	30.98	9.000	N	10.1	24.48	55.46	Compliance
0.160000	48.01	---	9.000	N	10.1	17.45	65.46	Compliance
0.180000	---	30.67	9.000	N	10.1	23.82	54.49	Compliance
0.180000	45.85	---	9.000	N	10.1	18.64	64.49	Compliance
0.220000	---	26.08	9.000	N	10.1	26.74	52.82	Compliance
0.220000	41.70	---	9.000	N	10.1	21.12	62.82	Compliance
0.260000	---	27.00	9.000	N	10.1	24.43	51.43	Compliance
0.260000	39.28	---	9.000	N	10.1	22.15	61.43	Compliance
0.300000	---	26.26	9.000	N	10.1	23.98	50.24	Compliance
0.300000	37.29	---	9.000	N	10.1	22.95	60.24	Compliance

**Note:**

- 1) Correction Factor = LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
- 2) Corrected Amplitude = Reading + Correction Factor
- 3) Margin = Limit – Corrected Amplitude

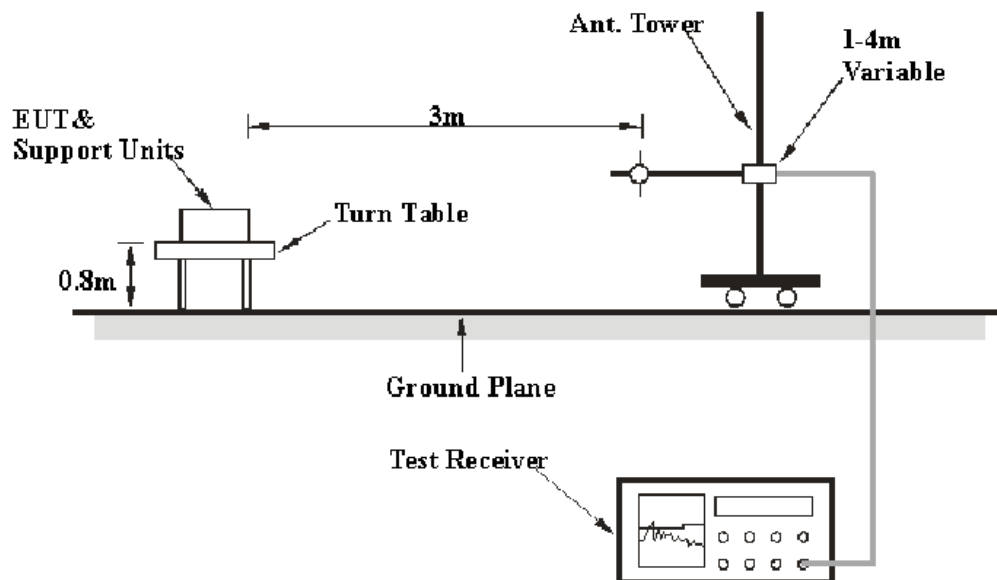
## **FCC§15.225, §15.205 & §15.209 - RADIATED EMISSIONS TEST**

### **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.
- (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.

### **EUT Setup**



The radiated emission tests were performed in the 3-meter chamber a test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part Subpart C limits.

The spacing between the peripherals was 10 cm.

## 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	IF B/W	Detector
9 kHz – 150 kHz	300 Hz	1 kHz	/	QP
150 kHz – 30 MHz	10 kHz	30 kHz	/	QP
30 MHz – 1000 MHz	100 kHz	300 kHz	/	QP

## 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:

$$\text{Corrected Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Corrected Factor}$$

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 limit. The equation for margin calculation is as follows:

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

## Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.209.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL,  $U_{(Lm)}$  is less than  $U_{cispr}$ , if  $L_m$  is less than  $L_{lim}$ , it implies that the EUT complies with the limit.

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

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	58 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Layne Li on 2017-07-10.*

*Test mode: Transmitting*

## 1) Spurious Emissions (9 kHz~30 MHz):

Indicated		Table Angle Degree	Antenna Height (m)	Detector PK/QP/Ave.	Correction Factor			Corrected Amplitude (dBμV/m) @3m	FCC Part 15.225	
Frequency (MHz)	Maximum Reading (dBμV) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBμV/m) @3m	Result
0.183	-0.66	115	1.1	QP	66.4	0.11	0	65.85	102.36	Pass
27.02	11.90	168	1.1	QP	34.7	0.23	0	46.83	69.54	Pass

## 2) Spurious Emissions (30 MHz ~1 GHz):

Frequency (MHz)	Corrected Amplitude (dBμV/m)	Detector PK/QP/Ave.	Antenna Height (m)	Antenna Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBμV/m)	Margin (dB)
36.52	13.15	QP	1.5	V	135	4.34	40.00	26.85
469.52	24.25	QP	1.8	V	158	4.39	46.00	21.75
510.65	21.36	QP	1.6	V	115	5.78	46.00	24.64
632.54	22.36	QP	1.6	V	215	6.08	46.00	23.64
830.25	26.52	QP	1.6	H	103	9.93	46.00	19.48

3) inband:

Indicated			Table Angle Degree	Antenna Height (m)	Detector PK/QP/Ave.	Correction Factor			Corrected Amplitude (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	13.355	15.12	0	1.5	QP	35.6	0.21	0	50.93	80.5	Pass
13.410-13.553	13.521	17.32	0	1.4	QP	35.6	0.21	0	53.13	90.5	Pass
13.553-13.567	13.559	35.24	0	1.4	QP	35.6	0.21	0	71.05	124	Pass
13.567-13.710	13.612	22.54	0	1.4	QP	35.6	0.21	0	58.35	90.5	Pass
13.710-14.010	13.902	16.52	0	1.4	QP	35.6	0.21	0	52.33	80.5	Pass



## FCC§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 Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to PC, then to an external AC power supply and inductive antenna was connected to a 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:	24 °C
Relative Humidity:	54 %
ATM Pressure:	101.0 kPa

*The testing was performed by Alisa Gao on 2017-07-14.*

*Test Mode: Transmitting*

Test Result: Pass

Power Supply (V <sub>DC</sub> )	Temperature (°C)	Measured Frequency (MHz)	Frequency Error (%)	Part 15.225 Limit
7.4	-20	13.56072	0.0053	±0.01%
	-10	13.56045	0.0033	±0.01%
	0	13.56074	0.0055	±0.01%
	10	13.56056	0.0041	±0.01%
	20	13.56023	0.0017	±0.01%
	30	13.56054	0.0040	±0.01%
	40	13.56073	0.0054	±0.01%
	50	13.56099	0.0073	±0.01%
6.3	25	13.56043	0.0032	±0.01%
8.4		13.56056	0.0041	±0.01%

**FCC§15.215(c) - 20dB EMISSION BANDWIDTH****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 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**

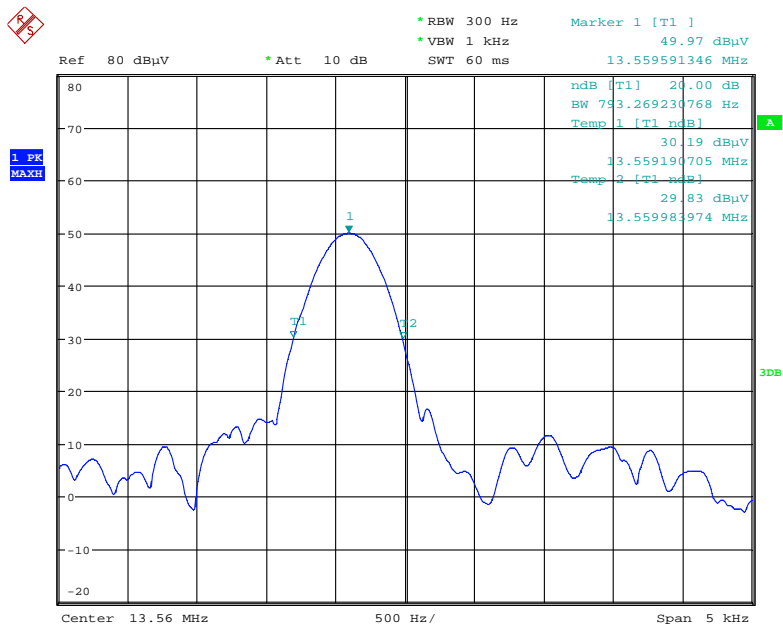
<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Alisa Gao on 2017-07-14.*

*Test Mode: Transmitting*

Test Result: Pass

20 dB Emission Bandwidth



Date: 14.JUL.2017 16:19:19

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