



FCC PART 15.225

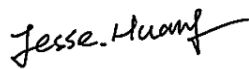
TEST REPORT

For

**Advanced Card Systems Limited**

Units 2010-2013, 20/F, Chevalier Commercial Centre, Kowloon, Hong Kong

**FCC ID: V5MACM1252U-Z2**

<b>Report Type:</b> Original Report	<b>Product Type:</b> USB NFC Reader Module
<b>Report Number:</b> <u>RSZ160914001-00</u>	
<b>Report Date:</b> <u>2016-10-17</u>	
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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.

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## GENERAL INFORMATION

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

The *Advanced Card Systems Limited's* product, model number: *ACM1252U-Z2* (FCC ID: *V5MACM1252U-Z2*) or the "EUT" in this report was an *USB NFC Reader Module*, which was measured approximately: 5.2 cm (L) × 2.0 cm (W) × 0.6 cm (H), rated with input voltage: DC 5V from USB port.

*\*All measurement and test data in this report was gathered from production sample serial number: 1603265 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2016-09-14.*

### Objective

This 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 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)

No Related Submittals.

### 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		±3.26 dB
RF conducted test with spectrum		±0.9dB
RF Output Power with Power meter		±0.5dB
Radiated emission	30MHz~1GHz	±5.91dB
	Above 1G	±4.92dB
Occupied Bandwidth		±0.5kHz
Temperature		±1.0°C
Humidity		±6%

### **Test Facility**

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

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) 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 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4.

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.

## SYSTEM TEST CONFIGURATION

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### Justification

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

### EUT Exercise Software

“APDU.exe” software was used.

### Equipment Modifications

No modification on the EUT.

### Support Equipment List and Details

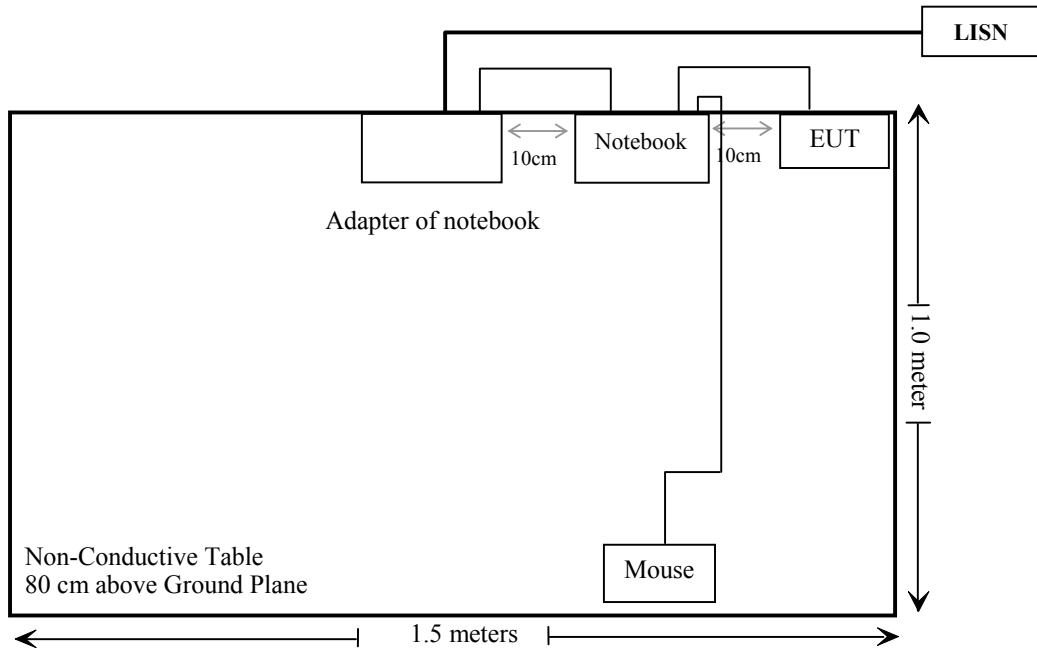
Manufacturer	Description	Model	Serial Number
DELL	Notebook	E6410	GYXJ3A00 JSD2
DELL	Mouse	MOC5UO	G1900NKD
DELL	Adapter	E6410	10912240373

### External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-Shielding Detachable USB Cable	1.5	PC	Mouse
Un-shielding Detachable USB Cable	1.0	EUT	Notebook
Un-shielding Detachable AC Cable	0.9	Adapter	LISN
Un-shielding Un-detachable DC Cable	0.9	Adapter	Notebook

### Block Diagram of Test Setup

For conducted emission:



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
§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	934115/007	2015-11-12	2016-11-11
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2015-11-12	2016-11-11
Rohde & Schwarz	Pulse limiter	ESH3-Z2	879940/0058	2016-06-19	2017-06-18
MICRO-COAX	Coaxial line	UFB-293B-1-0480-50X50	97F0173	2016-09-01	2017-09-01
Rohde & Schwarz	CE Test software	EMC 32	V 09.10.0	NCR	NCR
<b>Radiation test</b>					
Sonoma Instrument	Amplifier	330	171377	2016-09-16	2017-09-16
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2015-11-12	2016-11-11
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2015-11-07	2016-11-06
ETS	Passive Loop Antenna	6512	00108100	2016-01-09	2019-01-08
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-06-16	2016-12-15
BACL	RF cable	KS-LAB-010	KS-LAB-010	2015-12-16	2016-12-15

\* **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**

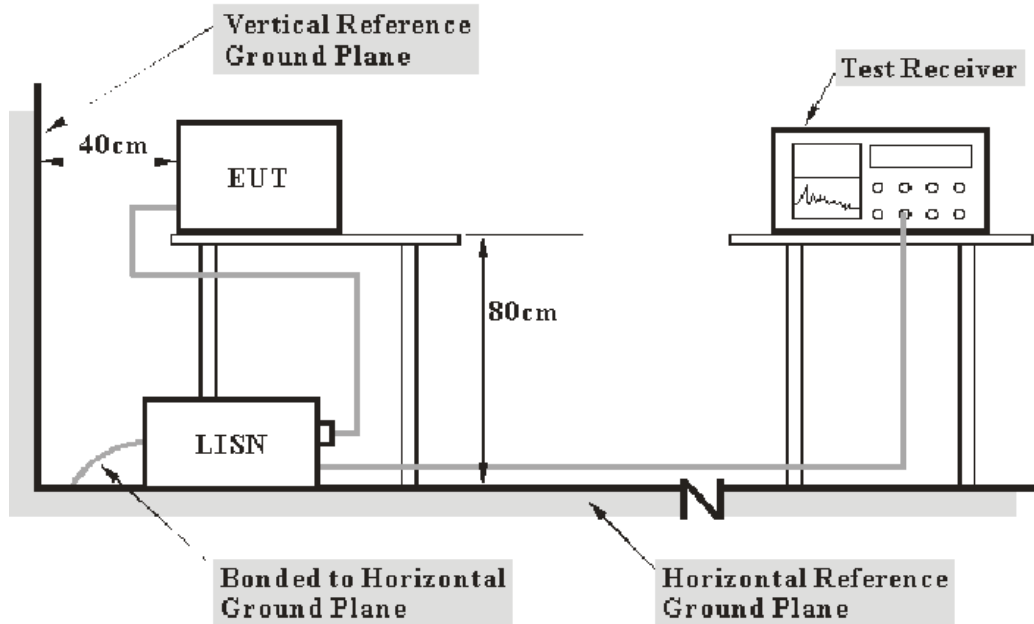
The EUT has a printed antenna on PCB, which was permanently attached, the antenna gain is 0 dBi, fulfill the requirement of this section. Please see EUT photo for details.

## 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

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 7dB 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

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

In BAEL,  $U_{(L_m)}$  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

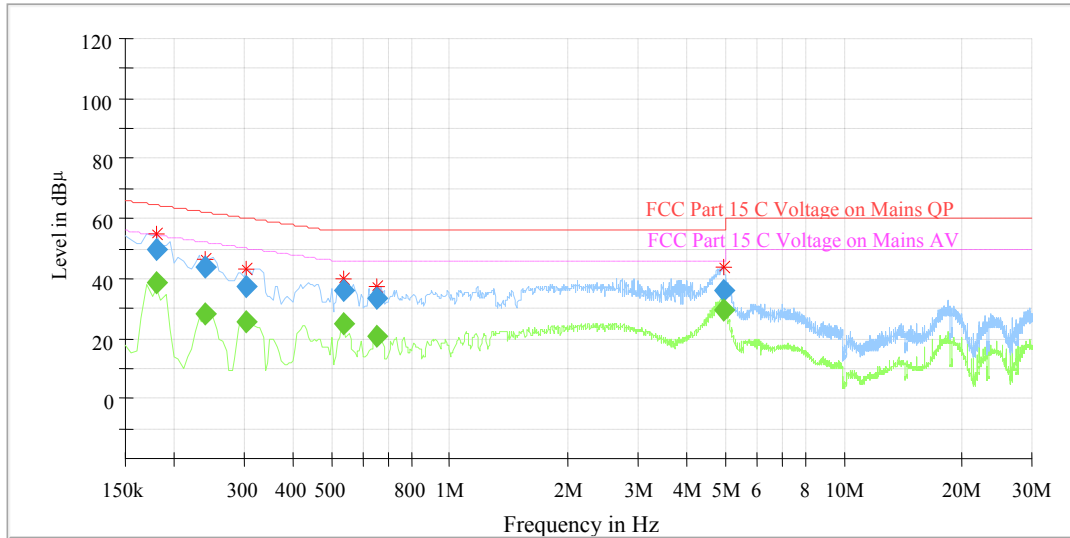
### Environmental Conditions

<b>Temperature:</b>	27 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Chris Wang on 2016-10-14.*

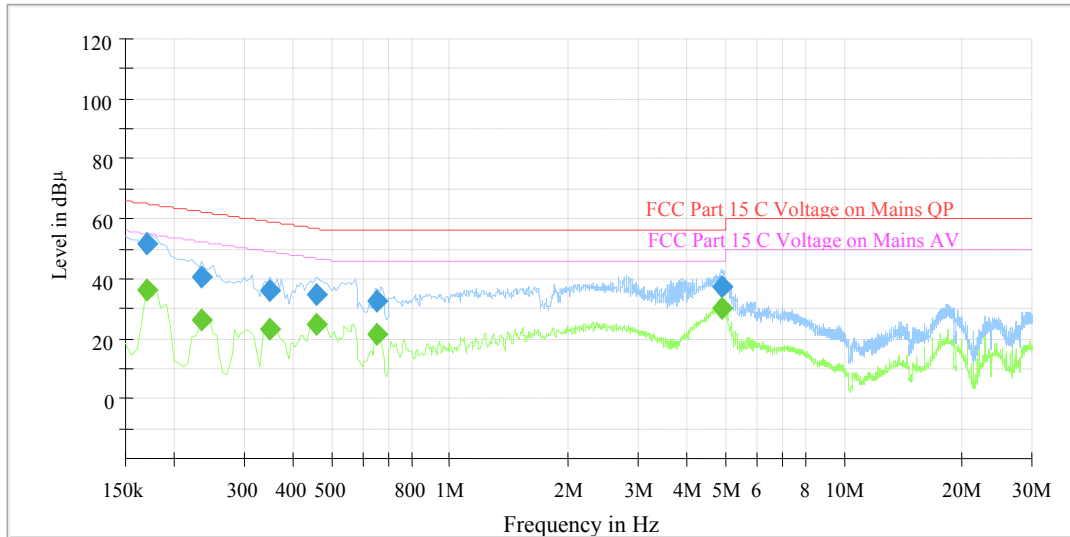
*EUT operation mode: Transmitting*

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



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Limit (dBµV)	Margin (dB)	Comment
0.180000	---	38.67	9.000	L1	10.3	54.49	15.82	Compliance
0.180000	49.98	---	9.000	L1	10.3	64.49	14.51	Compliance
0.240000	---	28.20	9.000	L1	10.3	52.10	23.90	Compliance
0.240000	43.54	---	9.000	L1	10.3	62.10	18.56	Compliance
0.305000	---	25.31	9.000	L1	10.3	50.11	24.80	Compliance
0.305000	37.19	---	9.000	L1	10.3	60.11	22.92	Compliance
0.535000	---	24.69	9.000	L1	10.3	46.00	21.31	Compliance
0.535000	36.30	---	9.000	L1	10.3	56.00	19.70	Compliance
0.650000	---	20.52	9.000	L1	10.3	46.00	25.48	Compliance
0.650000	33.50	---	9.000	L1	10.3	56.00	22.50	Compliance
4.950000	---	29.54	9.000	L1	10.5	46.00	16.46	Compliance
4.950000	36.20	---	9.000	L1	10.5	56.00	19.80	Compliance

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



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Limit (dBµV)	Margin (dB)	Comment
0.170000	---	35.83	9.000	N	10.3	54.96	19.13	Compliance
0.170000	51.39	---	9.000	N	10.3	64.96	13.57	Compliance
0.235000	---	26.11	9.000	N	10.3	52.27	26.16	Compliance
0.235000	40.70	---	9.000	N	10.3	62.27	21.57	Compliance
0.350000	---	23.38	9.000	N	10.3	48.96	25.58	Compliance
0.350000	35.91	---	9.000	N	10.3	58.96	23.05	Compliance
0.460000	---	24.48	9.000	N	10.3	46.69	22.21	Compliance
0.460000	34.70	---	9.000	N	10.3	56.69	21.99	Compliance
0.655000	---	21.79	9.000	N	10.3	46.00	14.21	Compliance
0.655000	32.52	---	9.000	N	10.3	56.00	23.48	Compliance
4.875000	---	29.90	9.000	N	10.6	46.00	16.10	Compliance
4.875000	37.04	---	9.000	N	10.6	56.00	18.96	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

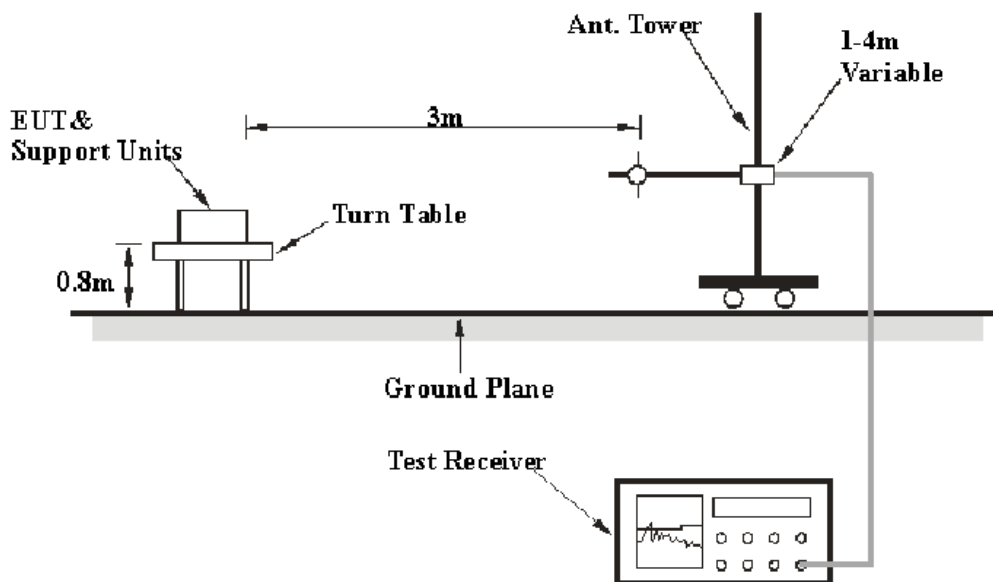
## FCC§15.225, §15.205 & §15.209 - RADIATED EMISSIONS TEST

### 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:

$$\begin{aligned} \text{Corrected Factor} &= \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain} \\ \text{Corrected Amplitude} &= \text{Meter Reading} + \text{Corrected Factor} \end{aligned}$$

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 Part 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 BAEL,  $U_{(Lm)}$  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>	27 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Chris Wang on 2016-10-14.*



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
0.116	1.87	0	1.2	Ave.	66.4	0.11	0	68.38	106.32	Pass
27.01	10.97	0	1.2	QP	34.7	0.23	0	45.90	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)
31.87	31.56	QP	1.0	V	135.0	4.0	40	8.44
176.58	30.98	QP	1.3	H	87.0	-11.97	43.5	12.52

**FCC§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.

**EUT Setup**

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

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	27 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Chris Wang on 2016-10-15.*

*Test Mode: Transmitting*

Test Result: Pass

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	13.389	13.45	0	1.3	QP	35.6	0.21	0	49.26	80.5	Pass
13.410-13.553	13.552	16.98	0	1.5	QP	35.6	0.21	0	52.79	90.5	Pass
13.553-13.567	13.560	32.69	0	1.5	QP	35.6	0.21	0	68.50	124.0	Pass
13.567-13.710	13.568	16.13	0	1.4	QP	35.6	0.21	0	51.94	90.5	Pass
13.710-14.010	13.839	12.57	0	1.5	QP	35.6	0.21	0	48.38	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

<b>Temperature:</b>	27 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Chris Wang on 2016-10-15.*

*Test Mode: Transmitting*

Test Result: Pass

Voltage Supply (V <sub>DC</sub> )	Temperature (°C)	Measured Frequency (MHz)	Frequency Error (%)	Part 15.225 Limit
5V <sub>DC</sub>	-20	13.55972	-0.00206	$\pm 0.01\%$
	-10	13.55984	-0.00118	$\pm 0.01\%$
	0	13.55979	-0.00155	$\pm 0.01\%$
	10	13.55968	-0.00236	$\pm 0.01\%$
	20	13.55971	-0.00214	$\pm 0.01\%$
	30	13.55976	-0.00177	$\pm 0.01\%$
	40	13.55966	-0.00251	$\pm 0.01\%$
	50	13.55979	-0.00155	$\pm 0.01\%$

## **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**

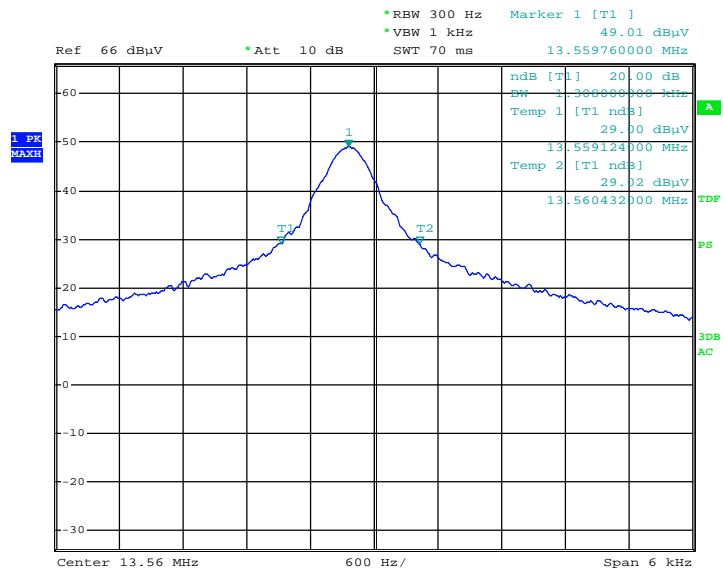
<b>Temperature:</b>	27 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Chris Wang on 2016-09-23.*

*Test Mode: Transmitting*

*Test Result: Pass*

### 20 dB Emission Bandwidth



EUT

Date: 23.SEP.2016 21:47:25

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