

FCC PART 15.225

TEST REPORT

For

Advanced Card Systems Limited

Units 4108 - 4110, 41st Floor, Manhattan Place, 23 Wang Tai Road, Kowloon Bay, Hong Kong

FCC ID: V5MACR1251T

Report Type: Original Report	Product Type: USB Token NFC Reader
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Rocky Kang	
Reviewed By: RF Engineer	<i>Rocky Kang</i>
Prepared By: Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn	

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Advanced Card Systems Limited's* product, model number: *ACR1251T (FCC ID: V5MACR1251T)* or the "EUT" in this report was a *USB Token NFC Reader*, which was measured approximately: 7.5 cm (L) * 3.0 cm (W) * 1.3 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: 1800489 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-04-10.*

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, section 15.203, 15.205, 15.207, 15.209 and 15.225.

Related Submittal(s)/Grant(s)

No Related Submittal(s).

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. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter	uncertainty
Occupied Channel Bandwidth	±5%
RF Output Power with Power meter	±0.5dB
RF conducted test with spectrum	±1.5dB
AC Power Lines Conducted Emissions	±1.95dB
All emissions, radiated	±4.88dB
Temperature	±3°C
Humidity	±6%
Supply voltages	±0.4%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

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 was used.

Equipment Modifications

No modification on the EUT.

Local Support Equipment

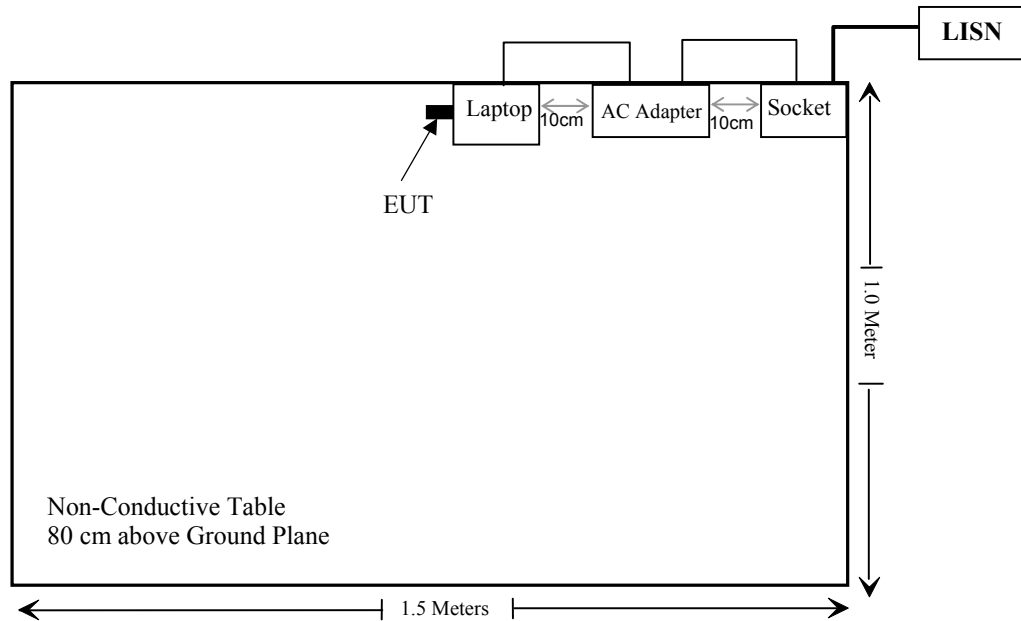
Manufacturer	Description	Model	Serial Number
HP	Laptop	TPN-105	2010DJ3827
DELL	Laptop AC Adapter	LA65NS2-01	N/A

External I/O Cable

Cable Description	Length (m)	From/Port	To
Unshielded Detachable AC cable	1.2	Laptop AC Adapter	Socket
Unshielded Detachable DC cable	1.5	Laptop AC Adapter	Laptop

Block Diagram of Test Setup

For conducted emissions:



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
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2017-08-04	2018-08-04
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2017-12-21	2018-12-21
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2017-11-19	2018-05-17
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
N/A	Conducted Emission Cable	N/A	UF A210B-1-0720-504504	2017-11-12	2018-05-12
Radiated Emission Test					
HP	Amplifier	HP8447E	1937A01046	2017-11-19	2018-05-21
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3003K03-101746-zn	2017-08-19	2018-08-19
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
ETS	Passive Loop Antenna	6512	00029604	2018-03-07	2021-03-06
Sonoma instrument	Amplifier	310N	186238	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	104PEA	218124002	2017-11-19	2018-05-21
Fluke	Digital Multimeter	287	19000011	2018-04-09	2019-04-09
instek	DC Power Supply	GPS-3030DD	EM832096	NCR	NCR
ESPEC	Temperature & Humidity Chamber	EL-10KA	9107726	2017-12-21	2018-12-21
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2017-12-24	2018-12-24
Ducommun technologies	RF Cable	RG-214	3	2017-11-22	2018-05-22

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

FCC§15.203 - ANTENNA REQUIREMENT

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

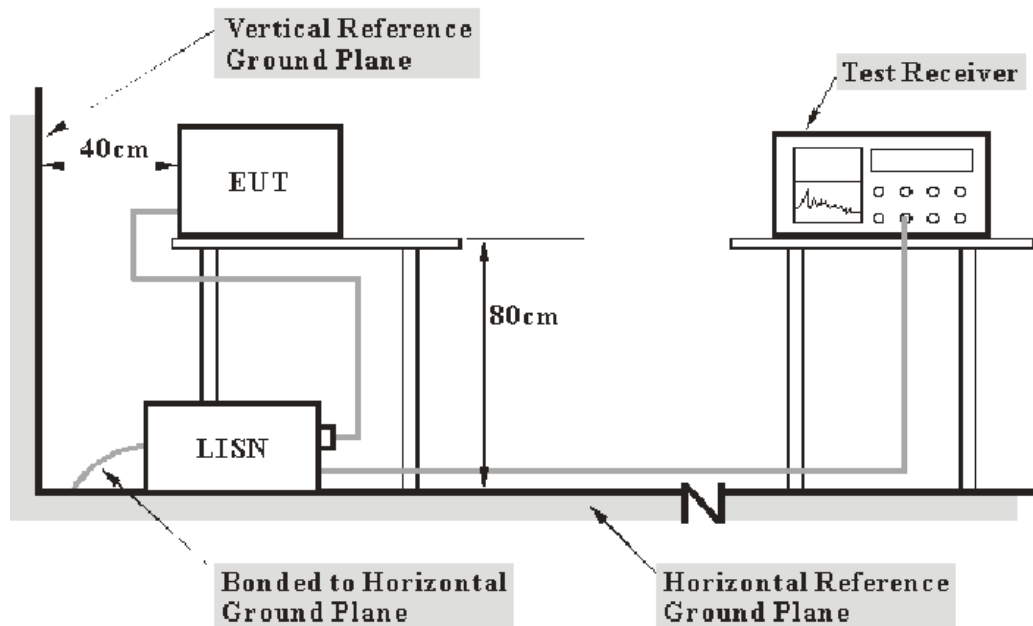
The EUT has an internal antenna arrangement, which was permanently attached, the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to EUT photos for details.

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 adapter of Laptop 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_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data

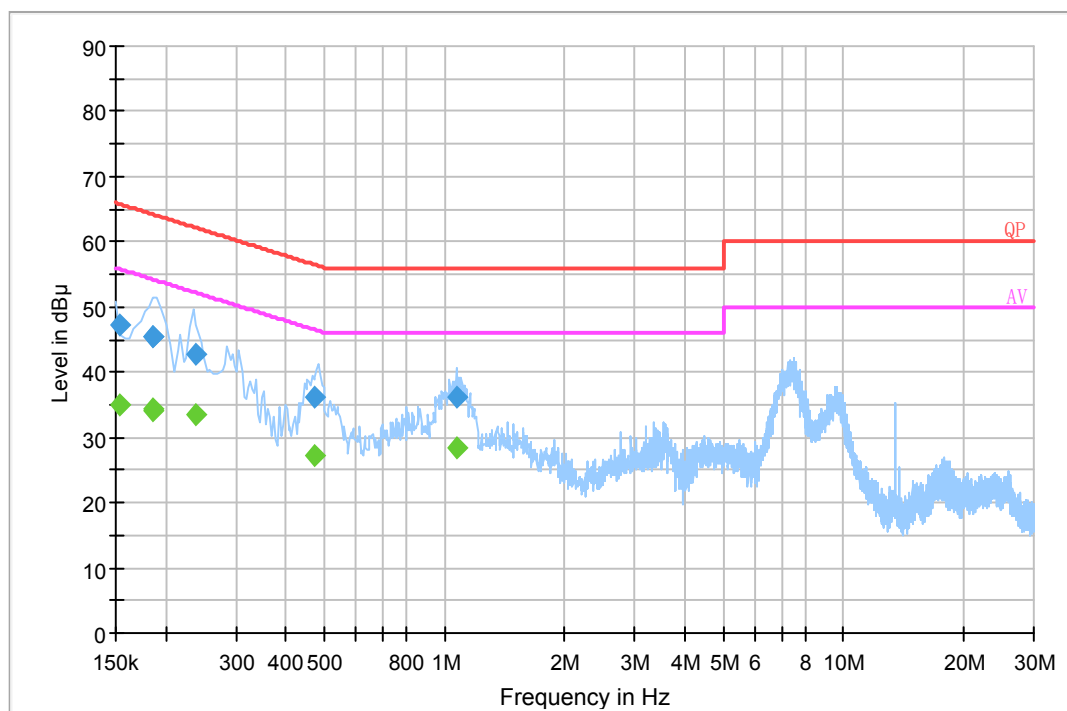
Environmental Conditions

Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

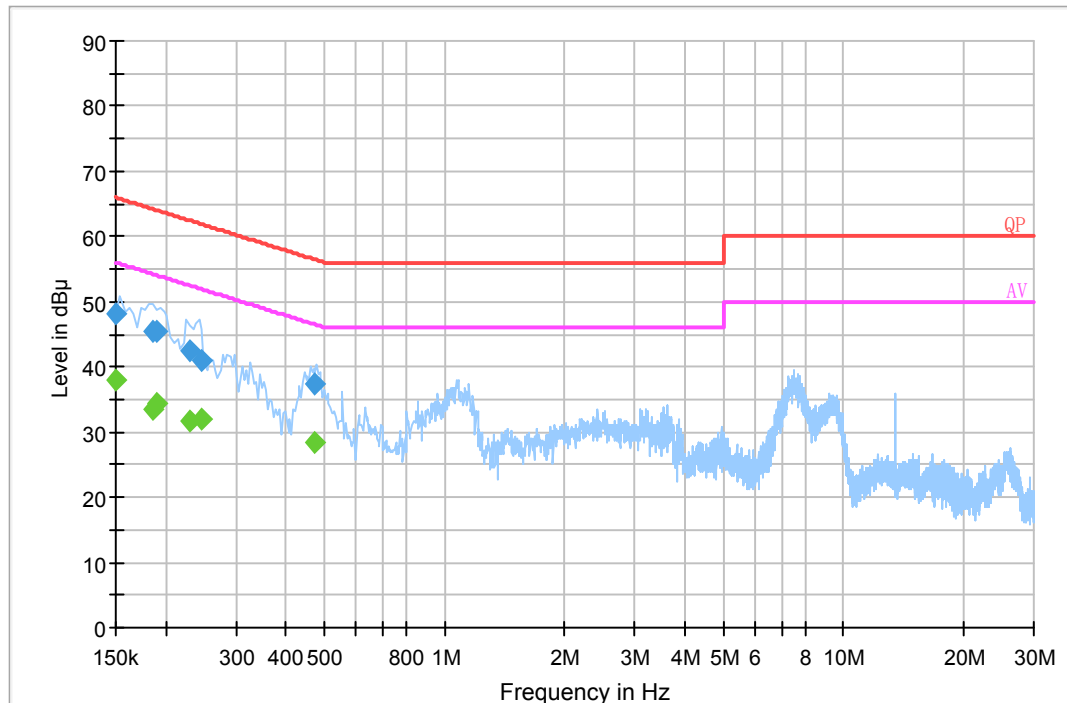
The testing was performed by Xiangguang Kong on 2018-04-23.

EUT operation mode: Transmitting

AC 120 V/60 Hz, Line:



Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.154000	47.3	20.1	65.8	18.5	QP
0.185500	45.4	20.1	64.2	18.8	QP
0.186500	45.5	20.1	64.2	18.7	QP
0.237500	42.8	20.1	62.2	19.4	QP
0.474770	36.2	20.1	56.4	20.2	QP
1.073950	36.2	20.0	56.0	19.8	QP
0.154000	34.9	20.1	55.8	20.9	Ave.
0.185500	34.1	20.1	54.2	20.1	Ave.
0.186500	34.4	20.1	54.2	19.8	Ave.
0.237500	33.4	20.1	52.2	18.8	Ave.
0.474770	27.2	20.1	46.4	19.2	Ave.
1.073950	28.5	20.0	46.0	17.5	Ave.

AC 120V/60 Hz, Neutral:

Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.150000	48.0	20.1	66.0	18	QP
0.185500	45.4	20.1	64.2	18.8	QP
0.190501	45.3	20.1	64.0	18.7	QP
0.229500	42.5	20.1	62.5	20	QP
0.246500	40.9	20.1	61.9	21	QP
0.474830	37.4	20.1	56.4	19	QP
0.150000	38.0	20.1	56.0	18	Ave.
0.185500	33.6	20.1	54.2	20.6	Ave.
0.190501	34.5	20.1	54.0	19.5	Ave.
0.229500	31.7	20.1	52.5	20.8	Ave.
0.246500	31.9	20.1	51.9	20	Ave.
0.474830	28.3	20.1	46.4	18.1	Ave.

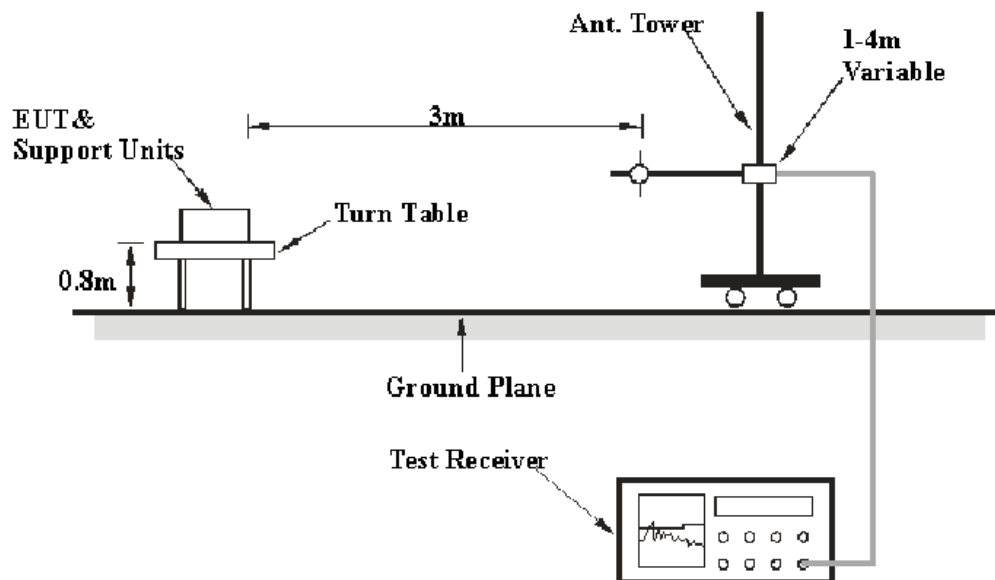
Note:

- 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

Note: Antenna is set up at 1m during test for below 30MHz.

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.

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

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

In BACL, $U_{(L_m)}$ 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

Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Xiangguang Kong on 2018-04-23.

Test mode: Transmitting

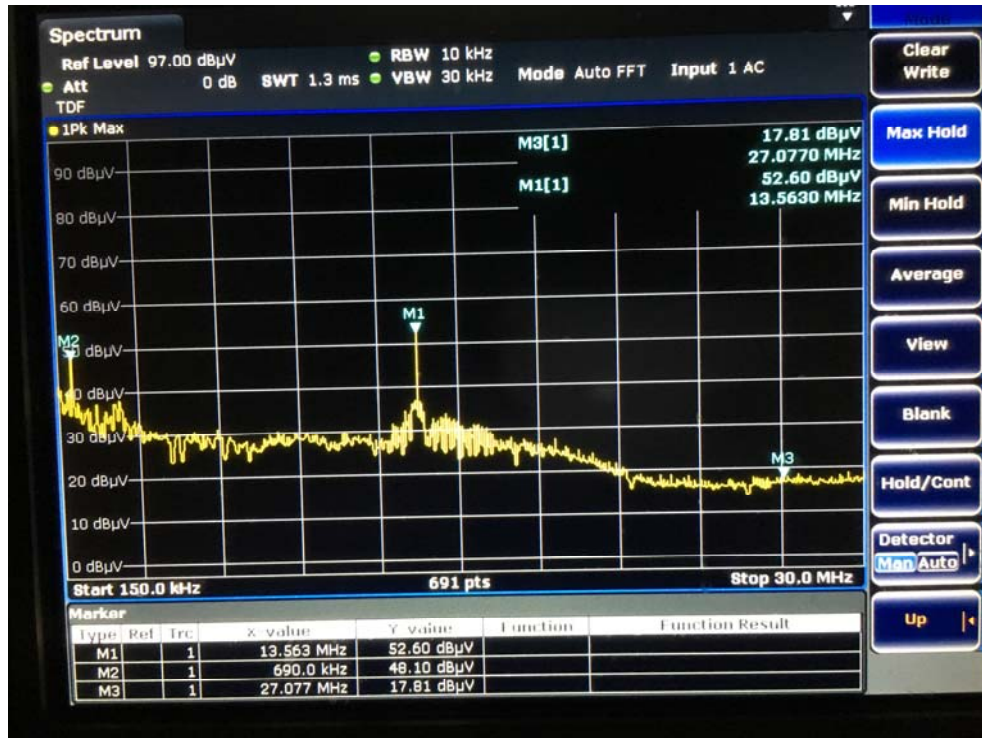
1) Spurious Emissions (9 kHz~30 MHz):

Indicated		Table Angle Degree	Antenna Height (m)	Detector	Correction Factor			Corrected Amplitude (dBμV/m) @3m	FCC part 15.225	
Freq. (MHz)	Corrected Amplitude (dBμV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBμV/m) @3m	Result
0.050	2.42	59	1.0	QP	73.1	0.1	30	45.62	113.62	Pass
0.690	27.8	132	1.0	QP	50.2	0.1	30	48.1	70.83	Pass
27.12	16.61	89	1.0	QP	31.0	0.2	30	17.81	69.54	Pass

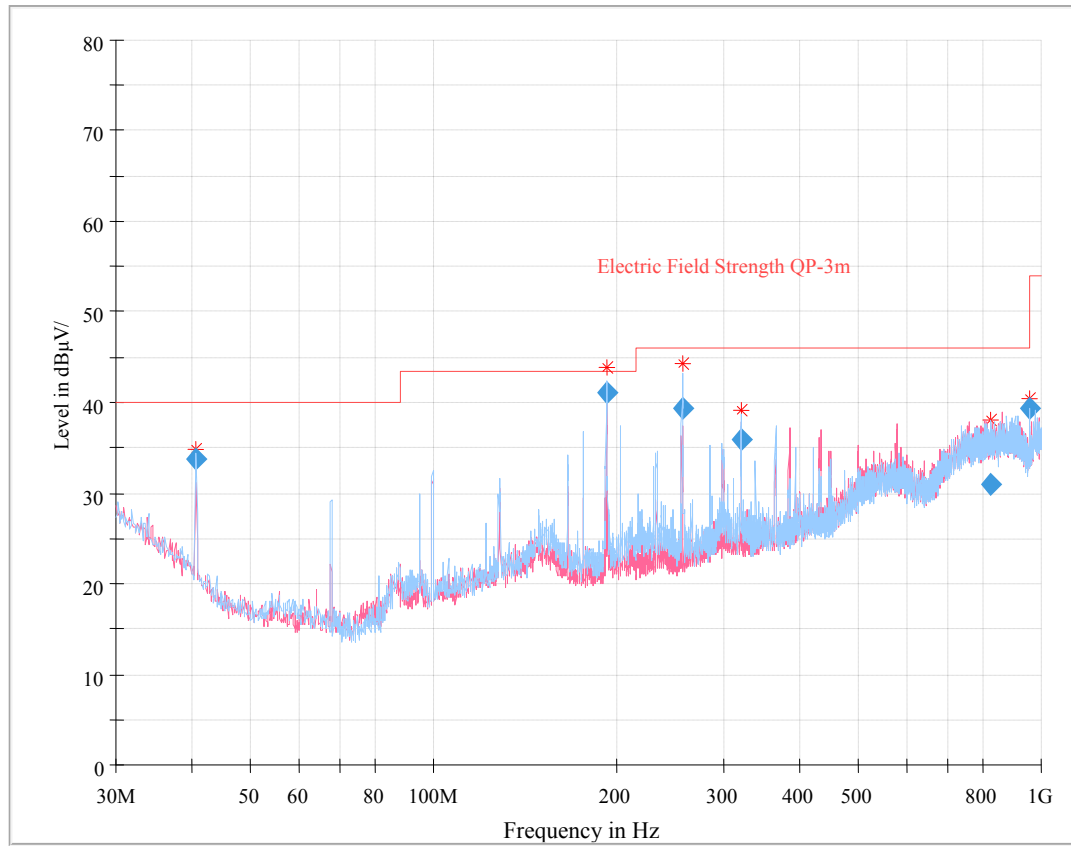
9 kHz~150 kHz



150 kHz~30 MHz



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



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
40.680250	33.72	214.0	H	277.0	-6.1	40.00	6.28
192.210625	41.02	157.0	H	101.0	-5.1	43.50	2.48
256.909875	39.33	114.0	H	301.0	-3.4	46.00	6.67
320.633500	35.82	104.0	H	288.0	-2.0	46.00	10.18
828.402625	31.06	290.0	H	0.0	9.4	46.00	14.94
953.772625	39.30	132.0	H	339.0	8.4	46.00	6.70

Note:

- 1) Correction Factor = Antenna factor(Rx) + Cable Loss – Amplifier factor
- 2) Corrected Amplitude = Reading + Correction Factor
- 3) Margin = Limit – Corrected Amplitude

3) Inband:

Indicated			Table Angle Degree	Antenna Height (m)	Detector	Correction Factor			Corrected Amplitude (dBμV/m) @3m	FCC part 15.225	
Frequency Range (MHz)	Mark Point (MHz)	Corrected Amplitude (dBμV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBμV/m) @3m	Result
13.110~13.410	13.397	28.76	91	1.0	QP	32.3	0.2	30	31.26	80.5	Pass
13.410~13.553	13.551	32.66	91	1.0	QP	32.3	0.2	30	35.16	90.5	Pass
13.553-13.567	13.559	50.10	91	1.0	QP	32.3	0.2	30	52.60	124	Pass
13.567-13.710	13.573	31.89	91	1.0	QP	32.3	0.2	30	34.39	90.5	Pass
13.710-14.010	13.802	27.95	91	1.0	QP	32.3	0.2	30	30.45	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, 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: 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:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Xiangguang Kong on 2018-04-20.

Test Mode: Transmitting

Test Result: Pass

Voltage Supply (V _{DC})	Temperature (°C)	Measured Frequency (MHz)	Frequency Error (%)	Part 15.225 Limit
5	-30	13.559787	-0.00157	$\pm 0.01\%$
	-20	13.559798	-0.00149	$\pm 0.01\%$
	-10	13.559751	-0.00184	$\pm 0.01\%$
	0	13.559806	-0.00143	$\pm 0.01\%$
	10	13.559773	-0.00167	$\pm 0.01\%$
	20	13.559798	-0.00149	$\pm 0.01\%$
	30	13.559764	-0.00174	$\pm 0.01\%$
	40	13.559781	-0.00162	$\pm 0.01\%$
	50	13.559759	-0.00178	$\pm 0.01\%$

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 on the table of the chamber, Turn on the EUT. 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**

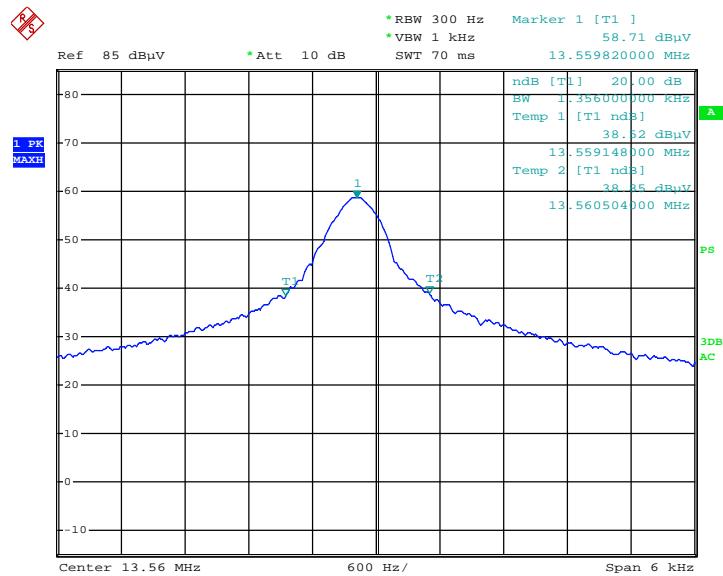
Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Xiangguang Kong on 2018-04-19.

Test Mode: Transmitting

Test Result: Pass

20 dB Emission Bandwidth



EUT
Date: 19.APR.2018 19:42:38

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