



FCC PART 15.225

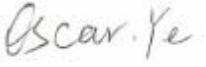
TEST REPORT

For

ROAM Data Inc.

101 Federal Street, Suite 700, Boston, Massachusetts, United States

FCC ID: 2ABY6-RP450BT

Report Type: Original Report	Product Type: RP457 Mobile Payment Terminal
Report Number:	<u>RXM170112050-00C</u>
Report Date:	<u>2017-03-21</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.

TABLE OF CONTENTS

GENERAL INFORMATION	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
MEASUREMENT UNCERTAINTY	5
TEST FACILITY	5
SYSTEM TEST CONFIGURATION	6
JUSTIFICATION	6
EUT EXERCISE SOFTWARE	6
EQUIPMENT MODIFICATIONS	6
LOCAL SUPPORT EQUIPMENT	6
EXTERNAL I/O CABLE	6
BLOCK DIAGRAM OF TEST SETUP	7
SUMMARY OF TEST RESULTS	8
TEST EQUIPMENT LIST	9
FCC§15.203 - ANTENNA REQUIREMENT	10
APPLICABLE STANDARD	10
ANTENNA CONNECTED CONSTRUCTION	10
FCC §15.207 – AC LINE CONDUCTED EMISSION	11
APPLICABLE STANDARD	11
EUT SETUP	11
EMI TEST RECEIVER SETUP.....	11
TEST PROCEDURE	12
CORRECTED FACTOR & MARGIN CALCULATION	12
TEST RESULTS SUMMARY	12
TEST DATA	12
FCC§15.225, §15.205 & §15.209 - RADIATED EMISSIONS TEST	15
APPLICABLE STANDARD	15
EUT SETUP	15
EMI TEST RECEIVER SETUP.....	16
CORRECTED AMPLITUDE & MARGIN CALCULATION	16
TEST RESULTS SUMMARY	16
TEST DATA	17
FCC§15.225(A) (B) (C) – FIELD STRENGTH OF RADIATED EMISSIONS	18
APPLICABLE STANDARD	18
EUT SETUP	18
TEST DATA	18
FCC§15.225(E) - FREQUENCY STABILITY	19
APPLICABLE STANDARD	19
TEST PROCEDURE	19
TEST DATA	19

FCC§15.215(C) - 20DB EMISSION BANDWIDTH	21
REQUIREMENT	21
TEST PROCEDURE	21
TEST DATA	21

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *ROAM Data Inc.*’s product, model number: *RP457 (FCC ID: 2ABY6-RP450BT)* in this report is an *RP457 Mobile Payment Terminal*, which was measured approximately: 6.5 cm (L) *6.5 cm (W) *2.0 cm (H), rated with input voltage: DC3.7V rechargeable Li-ion battery.

** All measurement and test data in this report was gathered from production sample serial number: 170112050 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2017-01-12.*

Objective

This Type approval report is prepared on behalf of *ROAM Data Inc.* 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)

Part 15.247 DTS and DSS submissions with FCC ID: 2ABY6-RP450BT.

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	9 kHz~30 MHz	±6.1dB
	30MHz~1GHz	±5.91dB
	Above 1GHz	±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 No.248 Chenghu Road, Kunshan, Jiangsu province, 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 C63.10-2013.

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

Justification

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

EUT Exercise Software

Software "FactoryTool V2.28 2" was used.

Equipment Modifications

No modification on the EUT.

Local Support Equipment

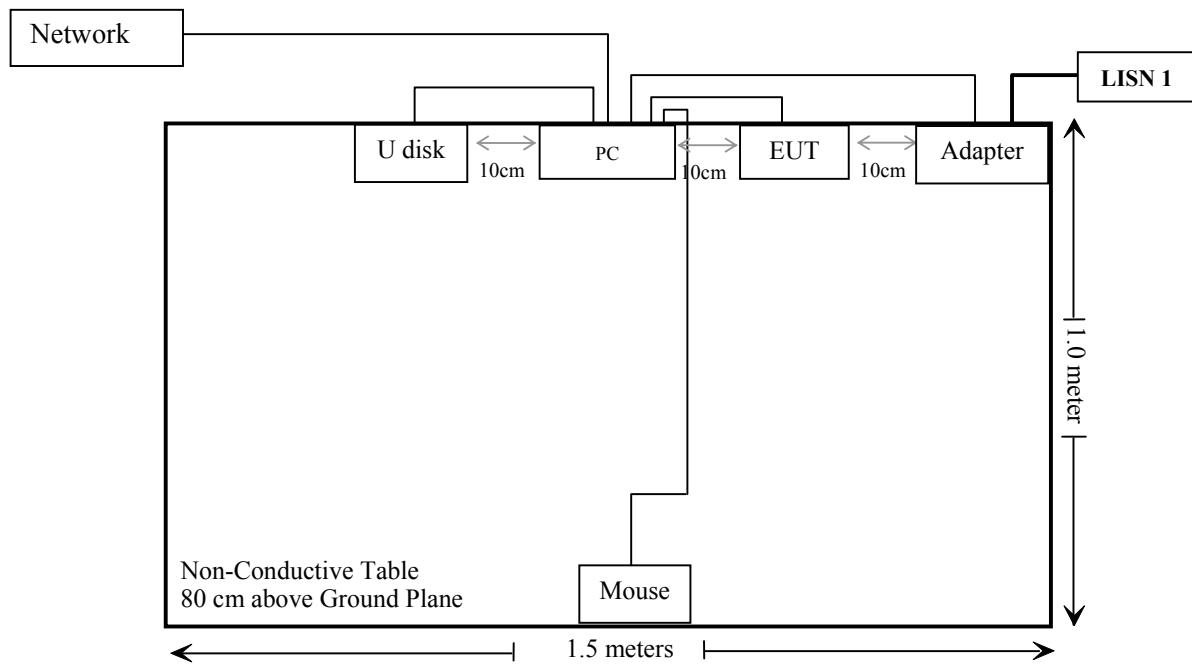
Manufacturer	Description	Model	Serial Number
Lenovo	PC	T400	R8-LXAXE 09/12
DELL	Mouse	MOC5UO	G1900NKG
DELL	Adapter	LA90PM130	CN-06C3W2-72438-6BT-194A-A03

External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-Shielding Detachable USB Cable	1.5	PC	U disk
Un-Shielding Detachable USB Cable	1.5	PC	Mouse
Un-shielding Detachable USB Cable	1.0	EUT	PC
Un-shielding Detachable AC Cable	0.9	Adapter	LISN 1
Un-shielding Un-detachable DC Cable	0.9	Adapter	PC
Un-shielding Detachable RJ45 Cable	3.0	PC	Network

Block Diagram of Test Setup

For conducted emission:



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
AC Line Conducted test					
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	2016-06-18	2017-06-17
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
Radiation test					
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
Yishite	DC Power Supply	MCH-303D-II	14070562	2016-12-29	2017-12-29

*** 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).

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

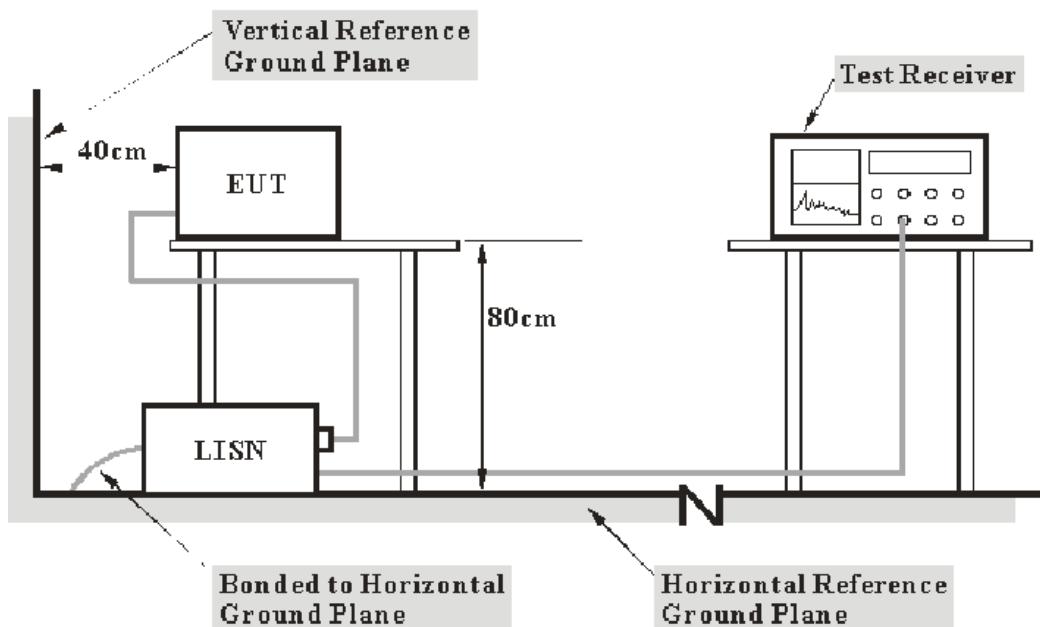
The EUT has a FPC antenna, fulfill the requirement of this section. Please see EUT photo for details.

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 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

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

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

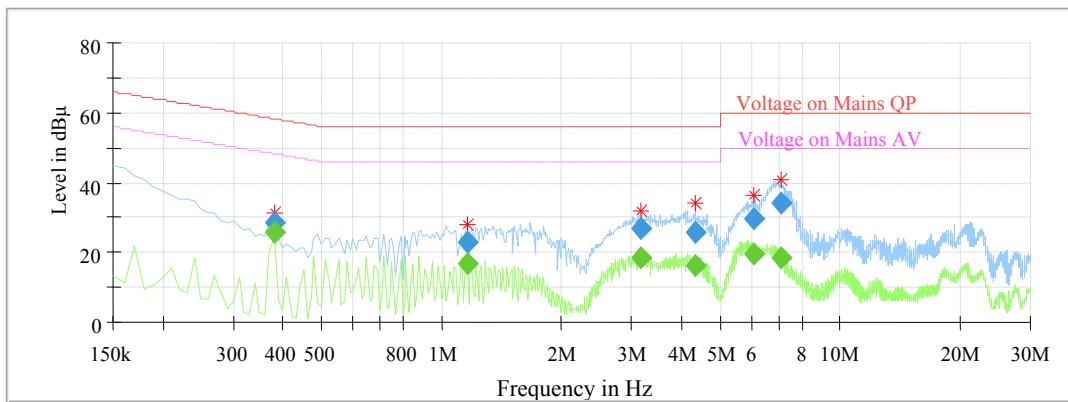
Temperature:	24 °C
Relative Humidity:	49 %
ATM Pressure:	101.0 kPa

The testing was performed by Layne Li on 2017-02-15.

EUT operation mode: Reading Card

AC 120 V/60 Hz, Line:

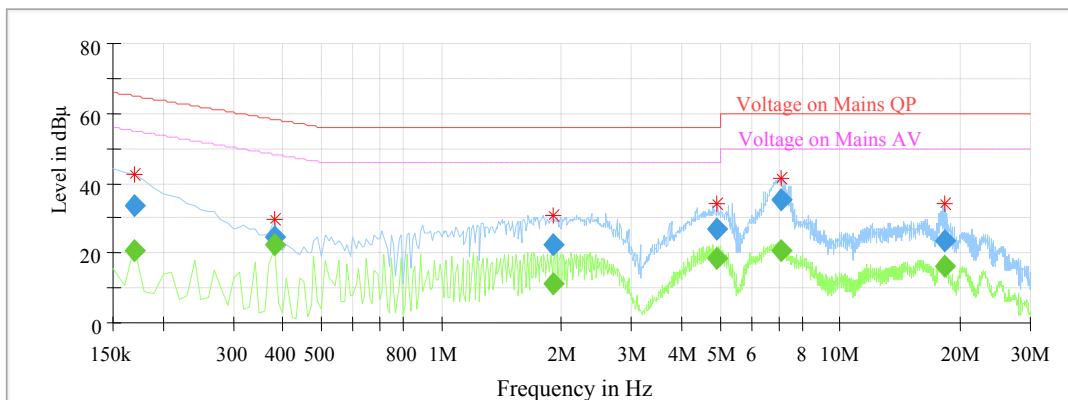
Full Spectrum



Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.380000	---	25.47	9.000	L1	10.1	22.81	48.28	Compliance
0.380000	28.34	---	9.000	L1	10.1	29.94	58.28	Compliance
1.160000	---	16.97	9.000	L1	9.8	29.03	46.00	Compliance
1.160000	22.72	---	9.000	L1	9.8	33.28	56.00	Compliance
3.180000	---	18.56	9.000	L1	9.9	27.44	46.00	Compliance
3.180000	26.62	---	9.000	L1	9.9	29.38	56.00	Compliance
4.340000	---	16.07	9.000	L1	9.9	29.93	46.00	Compliance
4.340000	25.46	---	9.000	L1	9.9	30.54	56.00	Compliance
6.100000	---	19.67	9.000	L1	9.9	30.33	50.00	Compliance
6.100000	29.60	---	9.000	L1	9.9	30.40	60.00	Compliance
7.100000	---	18.55	9.000	L1	10.0	31.45	50.00	Compliance
7.100000	33.98	---	9.000	L1	10.0	26.02	60.00	Compliance

AC 120V/60 Hz, Neutral:

Full Spectrum



Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.170000	---	20.79	9.000	N	10.2	34.17	54.96	Compliance
0.170000	33.72	---	9.000	N	10.2	31.24	64.96	Compliance
0.380000	---	22.38	9.000	N	10.1	25.90	48.28	Compliance
0.380000	24.86	---	9.000	N	10.1	33.42	58.28	Compliance
1.900000	---	11.12	9.000	N	9.9	34.88	46.00	Compliance
1.900000	22.56	---	9.000	N	9.9	33.44	56.00	Compliance
4.930000	---	18.67	9.000	N	9.9	27.33	46.00	Compliance
4.930000	27.02	---	9.000	N	9.9	28.98	56.00	Compliance
7.140000	---	20.55	9.000	N	9.9	29.45	50.00	Compliance
7.140000	35.50	---	9.000	N	9.9	24.50	60.00	Compliance
18.270000	---	16.02	9.000	N	10.1	33.98	50.00	Compliance
18.270000	23.26	---	9.000	N	10.1	36.74	60.00	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

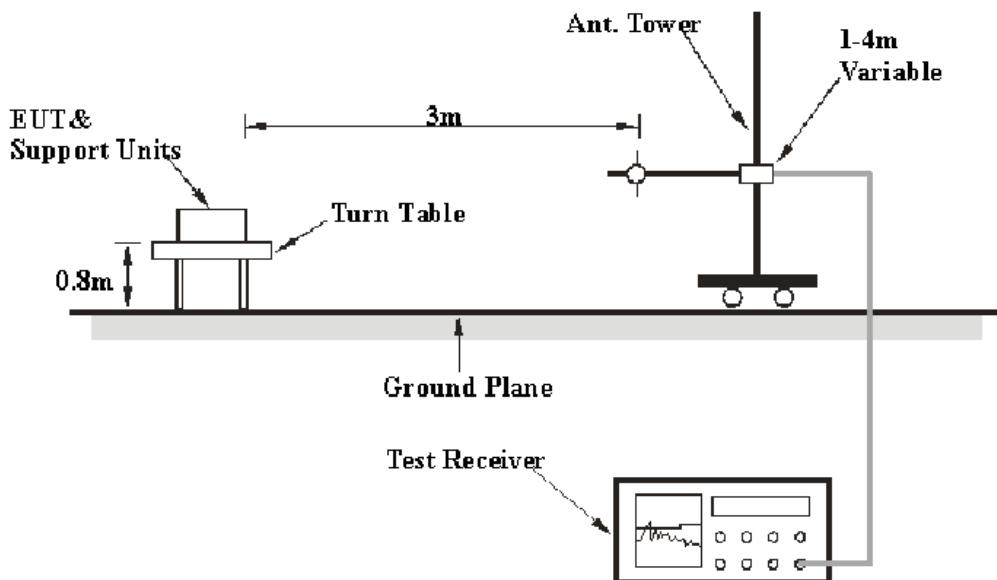
(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(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	200Hz	QP
150 kHz –30 MHz	10 kHz	30 kHz	9kHz	QP
30 MHz – 1000 MHz	100 kHz	300 kHz	120 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:

Corrected Factor = Antenna Factor + Cable Loss- Amplifier Gain

Corrected Amplitude = Meter Reading + 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:

Margin = Limit – 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

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

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

Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	49 %
ATM Pressure:	101.0 kPa

The testing was performed by Layne Li on 2017-02-15.

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 (dB μ V/m) @3m	FCC Part 15.225	
Frequency (MHz)	Maximum Reading (dB μ V) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dB μ V/m) @3m	Result
0.128	0.49	0	1.2	PK	66.4	0.10	0	66.99	105.46	Pass
24.02	8.06	0	1.2	QP	34.7	0.20	0	42.96	69.54	Pass

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

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Detector PK/QP/Ave.	Antenna Height (m)	Antenna Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dB μ V/m)	Margin (dB)
67.80	36.80	QP	3.1	H	200.0	-16.89	40.00	3.20
166.54	33.70	QP	2.3	H	64.0	-12.31	43.50	9.80
176.29	40.26	QP	1.1	V	85.0	-12.19	43.50	3.24
284.77	39.11	QP	1.3	H	323.0	-11.01	46.00	6.89
816.63	30.22	QP	2.1	H	145.0	-1.59	46.00	15.78
849.71	33.72	QP	3.3	H	153.0	-1.59	46.00	12.28

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

Temperature:	23.6 °C
Relative Humidity:	49.5 %
ATM Pressure:	101.0 kPa

The testing was performed by Ada Yu on 2017-02-16.

Test Mode: Transmitting

Test Result: Pass

Indicated			Table Angle Degree	Antenna Height (m)	Detector PK/QP/Ave.	Correction Factor			Corrected Amplitude (dB μ V/m) @3m	FCC Part 15.225	
Frequency Range (MHz)	Mark point (MHz)	Maximum Reading (dB μ V) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dB μ V/m) @3m	Result
13.110-13.410	13.349	11.22	0	1.4	QP	35.2	0.2	0	46.62	80.5	Pass
13.410-13.553	13.489	14.54	0	1.5	QP	35.2	0.2	0	49.94	90.5	Pass
13.553-13.567	13.561	30.05	0	1.5	QP	35.2	0.2	0	65.45	124	Pass
13.567-13.710	13.631	15.12	0	1.4	QP	35.2	0.2	0	50.52	90.5	Pass
13.710-14.010	13.771	11.47	0	1.3	QP	35.2	0.2	0	46.87	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 DC power source, then an 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.

Test Data

Environmental Conditions

Temperature:	23.6 °C
Relative Humidity:	49.5 %
ATM Pressure:	101.0 kPa

The testing was performed by Ada Yu on 2017-02-16.

Test Mode: Transmitting

Test Result: Pass

operating frequency is 13.56 MHz				
Power Supply (V _{DC})	Temperature (°C)	Measured Frequency (MHz)	Frequency Error (%)	Part 15.225 Limit
3.7V	-20	13.56072	0.00531	±0.01%
	-10	13.56077	0.00568	±0.01%
	0	13.56081	0.00597	±0.01%
	10	13.56084	0.00620	±0.01%
	20	13.56088	0.00649	±0.01%
	30	13.56085	0.00627	±0.01%
	40	13.56082	0.00605	±0.01%
	50	13.56084	0.00620	±0.01%

operating frequency is 13.56 MHz				
Temperature (°C)	Power Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (%)	Part 15.225 Limit
25	V min.= 3.5	13.56081	0.00597	±0.01%
25	V max.= 4.2	13.56082	0.00605	±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

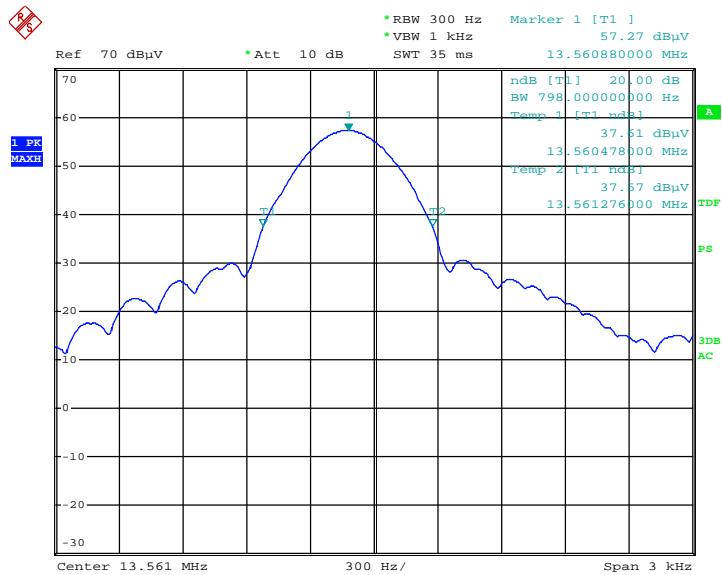
Temperature:	23.6 °C
Relative Humidity:	49.5 %
ATM Pressure:	101.0 kPa

The testing was performed by Ada Yu on 2017-02-16.

Test Mode: Transmitting

Test Result: Pass

20 dB Emission Bandwidth



EUT

Date: 16.FEB.2017 20:45:27

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