

FCC PART 15C

TEST REPORT

For

Roam Data Inc.

280 Summer St Boston, Massachusetts

FCC ID: 2ABY6-RP750X

Report Type: Original Report	Product Type: mPOS
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Report Number: R2XM140224050-00A	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Roam Data Inc.*'s product, model number: *RP750x* (FCC ID: *2ABY6-RP750X*) or ("EUT") in this report is a *mPOS*, which was measured approximately: 5.6 cm (L) x 10.1 cm (W) x 2.2 cm (H), rated input voltage: DC 3.7 V from lithium battery.

All measurement and test data in this report was gathered from production sample serial number: 140224050 (Assigned by BACL, Dongguan). The EUT was received on 2014-02-26.

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 Communications Commission's 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)

FCC Part 15C DSS submissions with FCC ID: *2ABY6-RP750X* for Bluetooth BDR mode.
FCC Part 15C DTS submissions with FCC ID: *2ABY6-RP750X* for Bluetooth LE mode.

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 emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications 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 February 02, 2012. 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.: 273710. 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. (Dongguan) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 500069-0).



The current scope of accreditations can be found at <http://ts.nist.gov/standards/scopes/5000690.htm>

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in a test mode

EUT Exercise Software

No software was performed under test.

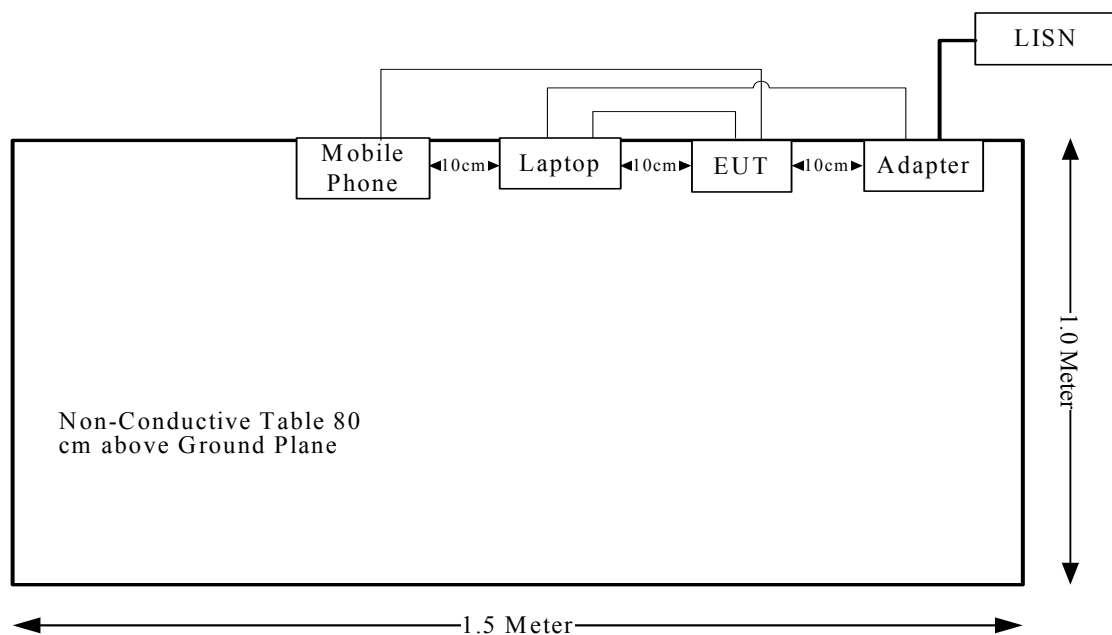
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017
Nokia	Mobile phone	Lumia 520	N/A

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB line	No	No	0.5	EUT	Laptop
Audio line	No	No	0.8	EUT	Mobile phone

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)	20 dB Emission Bandwidth	Compliance

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

This EUT has an internal antenna, and please refers to the internal photos.

Result: Compliance.

FCC §15.207 – AC LINE CONDUCTED EMISSION

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:

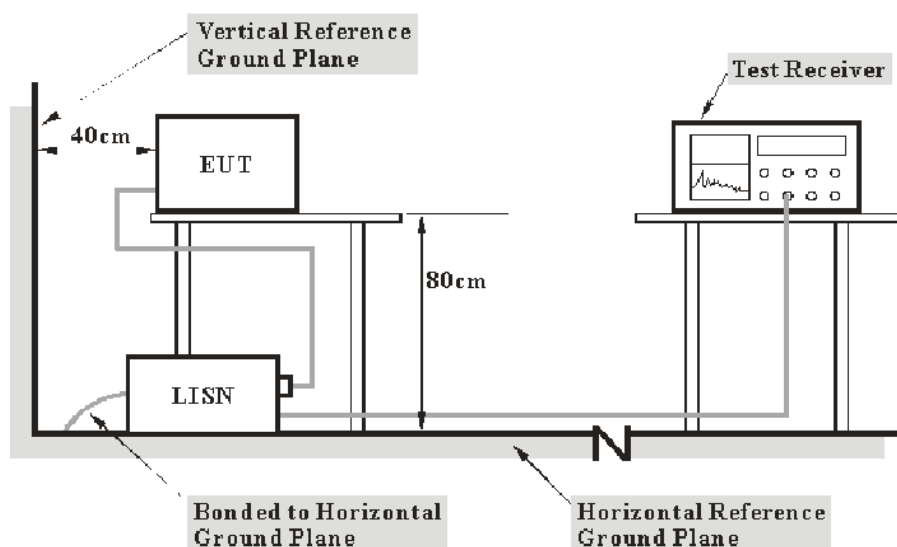
- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Based on CISPR 16-4-2-2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Dongguan) is 3.46 dB (150 kHz to 30 MHz), and conducted disturbance at telecommunication port using AAN is 5.03 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (9 kHz to 150 kHz)	3.8 dB
(150 kHz to 30 MHz)	3.4 dB
Conducted disturbance at mains port using voltage probe (9 kHz to 30 MHz)	2.9 dB
Conducted disturbance at telecommunication port using AAN (150 kHz to 30 MHz)	5.0 dB
Conducted disturbance at telecommunication port using CVP (150 kHz to 30 MHz)	3.9 dB
Conducted disturbance at telecommunication port using CP (150 kHz to 30 MHz)	2.9 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 adapter 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
R&S	EMI Test Receiver	ESCS 30	830245/006	2013-11-20	2014-11-19
R&S	Two-line V-network	ENV216	3560.6550.12	2014-01-22	2015-01-21
R&S	L.I.S.N	ESH3-Z5	100113	N/A	N/A
BACL	Test Software	BACL-EMC	V1.0-2010	N/A	N/A

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

Test Procedure

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

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

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

According FCC publication number 174176, for a device with a permanent antenna operating at or below 30 MHz, the measurements done with a suitable dummy load, in lieu of the permanent antenna under the following conditions: (1) perform the AC line conducted tests with the permanent antenna to determine compliance with the Section 15.207 limits outside the transmitter's fundamental emission band; (2) retest with a dummy load in lieu of the permanent antenna to determine compliance with the Section 15.207 limits within the transmitter's fundamental emission band.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

Herein,

V_C : corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF: voltage division factor of AMN or ISN

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum 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, with the worst margin reading of:

9.88 dB at 0.180 MHz in the **Neutral** conducted mode

Test Data

Environmental Conditions

Temperature:	20.9 °C
Relative Humidity:	56 %
ATM Pressure:	101.2 kPa

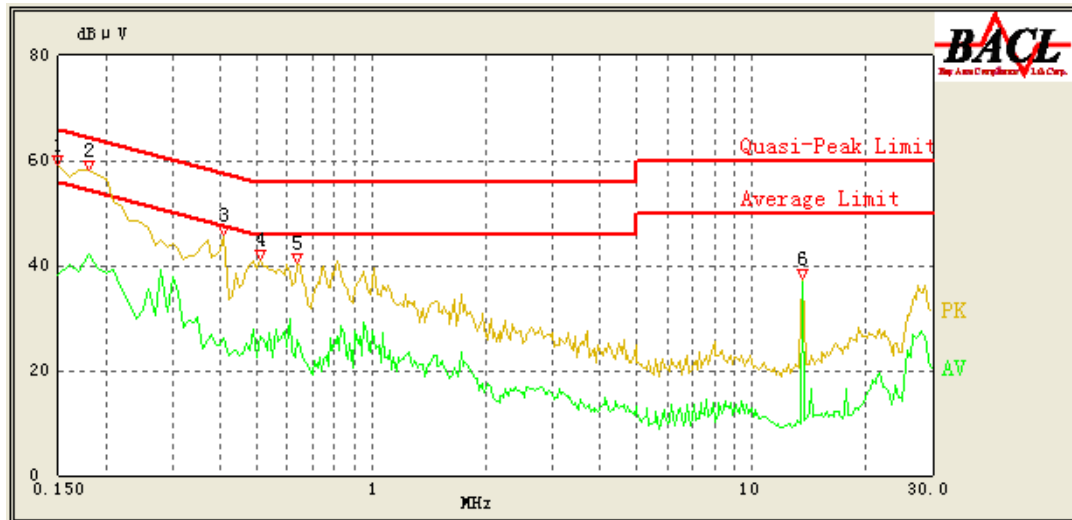
The testing was performed by Leon Chen on 2014-03-07.

Test Mode: Transmitting

AC 120V, 60 Hz, Line:



Frequency (MHz)	Cord. Reading (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
0.150	52.77	9.51	66.00	13.23	QP
0.150	44.87	9.51	56.00	11.13	AV
0.180	48.89	9.92	64.49	15.60	QP
0.180	43.40	9.92	54.49	11.09	AV
0.340	38.69	10.08	59.20	20.51	QP
0.340	31.35	10.08	49.20	17.85	AV
0.420	32.00	10.02	57.45	25.45	QP
0.420	25.96	10.02	47.45	21.49	AV
0.610	37.17	9.88	56.00	18.83	QP
0.610	28.26	9.88	46.00	17.74	AV
0.840	32.19	9.77	56.00	23.81	QP
0.840	26.58	9.77	46.00	19.42	AV

120 V, 60 Hz, Neutral:

Frequency (MHz)	Cord. Reading (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
0.150	55.01	9.71	66.00	10.99	QP
0.150	38.15	9.71	56.00	17.85	AV
0.180	54.61	10.36	64.49	9.88	QP
0.180	42.26	10.36	54.49	12.23	AV
0.410	38.59	10.20	57.65	19.06	QP
0.410	26.18	10.20	47.65	21.47	AV
0.510	35.68	9.94	56.00	20.32	QP
0.510	26.55	9.94	46.00	19.45	AV
0.640	37.95	9.86	56.00	18.05	QP
0.640	25.81	9.86	46.00	20.19	AV
13.560	37.37	9.86	60.00	22.63	QP
13.560	36.78	9.86	50.00	13.22	AV

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.

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cisp} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cisp} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:

30M~200MHz: 5.0 dB

200M~1GHz: 6.2 dB

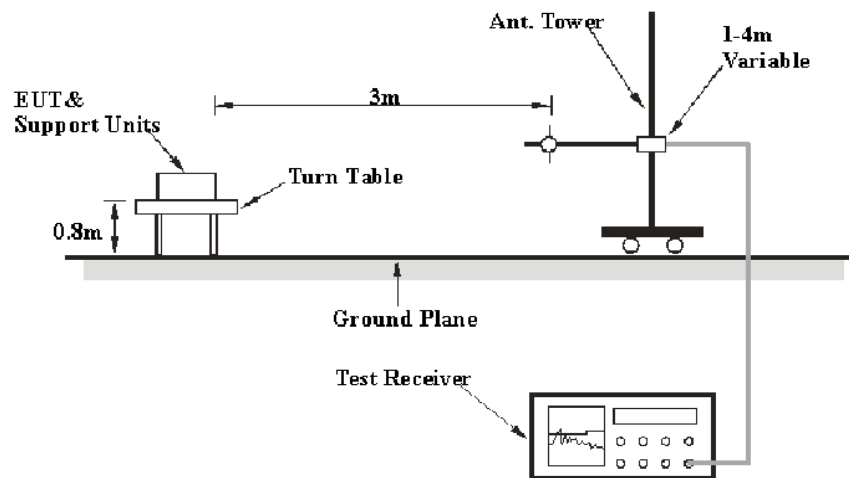
1G~6GHz: 4.45 dB

6G~18GHz: 5.23 dB

Table 1 – Values of U_{cisp}

Measurement	U_{cisp}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

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 adapter for laptop was connected to 120VAC/60Hz 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	Detector
9kHz – 150 kHz	300 Hz	1 kHz	QP
150kHz – 30 MHz	10 kHz	30 kHz	QP
30MHz – 1000 MHz	100 kHz	300 kHz	QP

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:

$$\text{Corr. Ampl.} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

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 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corr. Ampl.}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2013-05-06	2014-05-05
Sunol Sciences	Antenna	JB3	A060611-1	2011-09-06	2014-09-05
HP	Amplifier	8447E	2434A02181	2013-09-06	2014-09-05
The Electro-Mechanics Company	Passive Loop Antenna	6512	9706-1206	2011-11-30	2014-11-29

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

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:

1.22 dB at 976.72 MHz in the Vertical polarization

Test Data**Environmental Conditions**

Temperature:	21.5 °C
Relative Humidity:	70 %
ATM Pressure:	100.8 kPa

* *The testing was performed by Leon Chen on 2014-03-19*

Test mode: Transmitting

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

Frequency	Receiver		Rx Antenna Factor	Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector						
MHz	dBμV	PK/QP/AV	dB(1/m)	dB	dB	dBμV/m	dBμV/m	dB
13.56	47.6	QP	32.08	0.35	21.44	58.59	124.00	65.41
13.477	17.7	QP	32.07	0.35	21.43	28.69	90.50	61.81
13.575	18.5	QP	32.08	0.35	21.44	29.49	90.50	61.01
13.395	19.7	QP	32.07	0.35	21.43	30.69	80.50	49.81
13.77	19	QP	32.09	0.35	21.44	30.00	80.50	50.50
21.92	15.6	QP	31.31	0.41	21.45	25.87	69.50	43.63

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

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector	Polar	Factor					
MHz	dBμV	PK/QP/AV	H/V	dB(1/m)	dB	dB	dBμV/m	dBμV/m	dB
786.6	38.2	QP	H	21.71	3.45	22.34	41.02	46.00	4.98*
814.73	38.3	QP	H	22.07	3.46	22.32	41.51	46.00	4.49*
949.56	37.1	QP	V	23.26	3.73	22.09	42.00	46.00	4.00*
976.72	39.3	QP	V	23.67	3.85	22.04	44.78	46.00	1.22*

*Within measurement uncertainty!

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, than to an external AC power supply and loop 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2013-06-16	2014-06-15
Dongzhixu	High Temperature Test Chamber	DP1000	201105083-3	2013-08-01	2014-07-31
The Electro-Mechanics Company	Passive Loop Antenna	6512	9706-1206	2011-11-30	2014-11-29

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

Test Data**Environmental Conditions**

Temperature:	24.5 °C
Relative Humidity:	59 %
ATM Pressure:	101.7 kPa

* The testing was performed by Leon Chen on 2014-03-21

Test Mode: Transmitting

Test Result: Pass

$f_o = 13.56 \text{ MHz}$				
Temperature	Voltage	Measured frequency	Frequency Error	Limit
°C	V _{DC}	MHz		
-20	3.7	13.560783	0.0058%	±0.01%
-10	3.7	13.560780	0.0058%	±0.01%
0	3.7	13.560780	0.0058%	±0.01%
10	3.7	13.560780	0.0058%	±0.01%
20	3.7	13.560779	0.0057%	±0.01%
30	3.7	13.560778	0.0057%	±0.01%
40	3.7	13.560777	0.0057%	±0.01%
50	3.7	13.560778	0.0057%	±0.01%
20	3.5	13.560778	0.0057%	±0.01%

FCC §15.215(c) – 20 dB EMISSION BANDWIDTH

Applicable Standard

Per FCC §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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2013-06-16	2014-06-15
The Electro-Mechanics Company	Passive Loop Antenna	6512	9706-1206	2011-11-30	2014-11-29

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

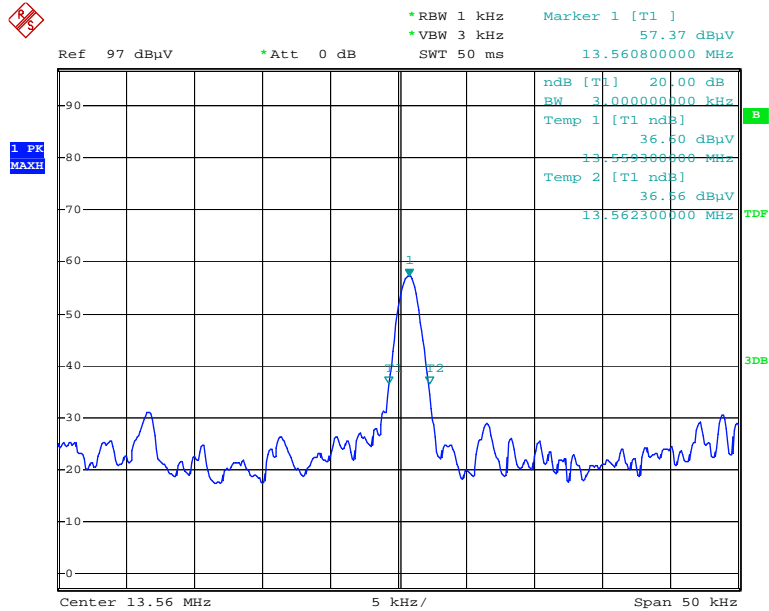
Test Data Environmental Conditions

Temperature:	22.8 °C
Relative Humidity:	61 %
ATM Pressure:	100 kPa

The testing was performed by Leon Chen on 2013-03-12.

Test Mode: Transmitting

20 dB Emission Bandwidth



Date: 12.MAR.2014 20:46:44

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