Lab Code: 200167-0

FCC PART 15.225

IC RSS-210, ISSUE 7, JUNE 2007

TEST AND MEASUREMENT REPORT

For

Coulomb Technologies, Inc.

1692 Dell Avenue, Campbell, CA 95008, USA

FCC ID: W38-CT500
IC: 8854A-CT500

Report Type:	**Product Type:**
Original Report	Electric Vehicle Charging Station

Test Engineer:	Kevin Li
Report No.:	R1008201-225
Report Date:	2010-10-01
Reviewed By:	Victor Zhang Test Engineer, RF Lead
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1008201-225	Original Report	2010-10-01

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *Coulomb Technologies Inc.'s* product model: CT500, FCC ID: W38-CT500, IC: 8854A-CT500 is an Electric Vehicle Charging Station with remote monitoring and control via ZigBee/CDMA/GPRS backhaul. It contains an internal RFID reader. Integrated RFID reader recognizes and identifies subscriber key fobs and smart cards.

1.2 Mechanical Description of EUT

The EUT measures approximately 420 mm (L) x 90 mm (W) x 300 mm (H). And weight of the EUT is 6.4 kg.

The test data gathered is from production samples, serial number: R1008201-*1, assigned by BACL.*

1.3 Objective

This Type approval report is prepared on behalf of *Coulomb Technologies, Inc.* in accordance with Part 2, Subpart J, and Part 15 Subpart C of the Federal Communication Commissions rules and IC RSS-210 Issue 7, June 2007.

The objective of the manufacturer is to demonstrate compliance with FCC rules, Part 15, sec 15.35, sec 15.203, sec 15.205, sec 15.207, sec 15.209 and sec 15.225, and IC RSS-210, RSS-Gen.

1.4 Related Submittal(s)/Grant(s)

No Related Submittals.

1.5 Test Methodology

All measurements contained in this report were conducted in accordance 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 and ANSI C63.10-2009, American National Standard for Testing Unlicensed Wireless Devices.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratory, Corp.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from $\pm$2.0 for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. 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, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-2463 and R-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2003 & ANSI C63.10-2009.

2.2 EUT Exercise Software

N/A

2.3 Special Accessories

N/A

2.4 Equipment Modifications

No modifications were made to the EUT

2.5 Remote Support Equipment

N/A

2.6 Local Support Equipment

N/A

2.7 Internal Configurations

Cable Description	Manufacture	Model No.	Serial No.
RFID Board	Uniform Industrial Corp	UIC680-RD1SNNNNC4B	00005968
VF Display Board	Coulomb Technologies Inc	CL28-002022-01LFREV :4	CTS2610CL8254
Smartlet Combined Main Board	Coulomb Technologies Inc	CL28-001061-05LF REV : A	CTS2310CL7505
Smartlet Pilot Board	Coulomb Technologies Inc	CL28-001092-07LF REV : 1	CTS3010CL0659
Zigbee Module	CEL	AZLM-301-1	016490
Safety Supervisor Module	Coulomb Technologies Inc	CL28-001152-02LFR REV : 6	CTS2810CL9196

2.8 Interface Ports and Cabling

Cable Description	Length (m)	From	To
J1772	6	EUT	Load

3 SUMMARY OF TEST RESULTS

FCC/IC Rules	Description of Test	Results
FCC §15.203 IC RSS-Gen §7.1.4	Antenna Requirement	Compliant
FCC § 15.35, § 15.205 § 15.209, § 15.225 IC RSS-210 §2.2, §A2.6	Radiated Emissions	Compliant
FCC §15.207 IC RSS-Gen §7.2.2	AC Line Conducted Emissions	Compliant
FCC §15.225(e) IC RSS-210 §A2.66	Frequency Stability	Compliant

4 FCC §15.203 & IC RSS-Gen §7.1.4 – ANTENNA REQUIREMENT

4.1 Applicable Standard

According to FCC §15.203, 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

According to IC RSS-Gen §7.1.4, A transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

Result:

The antenna of RFID is integrated which is not allowed to access by the end-user.

5 FCC §15.205, §15.209, §15.225 & IC RSS-210 §2.2, §A2.6 - RADIATED EMISSIONS

5.1 Applicable Standard

As per FCC §15.225 and IC RSS-210 §A2.6:

(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.

(e) The frequency tolerance of the carrier signal shall be maintained within }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.

(f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.

5.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of test table and bundle when necessary.

The EUT was placed on the turn table

The EUT was connected to a 208 V, 60 Hz 3-Phase AC line power source.
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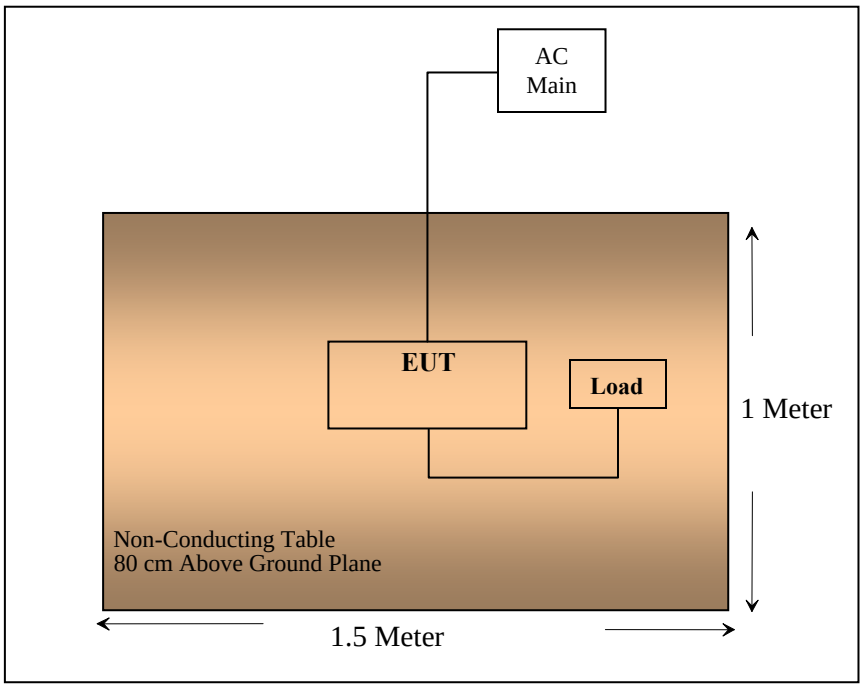
5.3 Test Setup Block Diagram



5.4 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -4 dB of specification limitation), and are distinguished with a "**QP**" in the data table.

The EUT was operating at normal to represent worst case during final qualification test. Therefore, this configuration was used for final test data recorded in the following table of this report.

5.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

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 maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

5.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Hewlett Packard	Pre amplifier	8447D	2944A07030	2010-04-16
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2010-06-24
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB1	A020106-1	2010-05-28
COM-POWER	Loop Antenna	AL-130	17043	2010-06-01
A.R.A Inc	Horn antenna	DRG-1181A	1132	2009-10-27
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09
HP	Pre Amplifier	8449B	3147A00400	2010-02-01

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

5.7 Test Environmental Conditions

Temperature:	22.3 °C
Relative Humidity:	42 %
ATM Pressure:	100.7 kPa

The testing was performed by Kevin Li from 2010-09-08 to 2010-09-09 in 5 meter chamber 3.

5.8 Summary of Test Results

According to the data in the following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.225 and IC RSS-210. The EUT had the worst margin reading of:

-11.5 dB at 87.1MHz Vertical polarization 9 kHz to 1GHz

5.9 Radiated Emissions Test Result

1) 9 kHz to 30 MHz:

Measured at 3 meters distance

Frequency (MHz)	S.A. Reading (dBuV/m)	Turntable Degrees	Test Antenna		Cable Loss (dB)	Distance Factor (dB)	Cord. Amp. (dBuV/m)	FCC 15C/IC RSS-210	
			Height (m)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)
11.28	25.98	49	1.0	11.6	0.1	40	-2.32	29.5	-31.82
13.37	26.57	31	1.0	11.3	0.1	40	-2.03	40.51	-42.54
13.81	30.14	105	1.0	11.3	0.1	40	1.54	40.51	-38.97
13.62	33.62	21	1.0	11.3	0.1	40	5.02	50.5	-45.48
13.47	31.28	18	1.0	11.3	0.1	40	2.68	50.5	-47.82
13.56	50.52	19	1.0	11.3	0.1	40	21.92	84	-62.08

2) 30 to 1000 MHz:

Measured at 3 meters distance

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Test Antenna		Turntable Azimuth (degrees)	FCC/IC Limit (dBµV/m)	Margin (dB)
		Height (cm)	Polarity (H/V)			
58.04200	26.39	375	V	72	40	-13.61
63.41300	20.11	94	V	216	40	-19.89
85.63925	26.98	91	V	194	40	-13.02
87.10000	28.50	159	V	123	40	-11.50
79.77050	15.51	127	V	124	40	-24.49
61.58100	13.81	294	V	307	40	-26.19

6 FCC §15.207 & IC RSS-GEN §7.2.2 – AC LINE CONDUCTED EMISSIONS

6.1 Applicable Standard

As per FCC §15.207 & RSS-Gen §7.2.2 Conducted limits:

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

**Decreases with the logarithm of the frequency*

According to "New Policies for Part 15 Devices" release on May 10-13, 2005:
AC line-conducted emissions measurements conducted emissions measurements of Part 15 transmitters that operate < 30 MHz

Although C63.4 is designed for Part 15 transmitters that operate above 30 MHz with a detachable antenna, we are willing to accept measurements on a 13.56 MHz transmitter done with a dummy load under the following conditions:

1)First, perform the AC line conducted tests with the antenna attached to make sure the device complies with the 15.207 limits outside the transmitter's fundamental emission band.

2) Second, retest with a dummy load to make sure the device complies with the 15.207 limits inside the transmitter's fundamental emission band. Only the fundamental TX emission band needs to be retested.

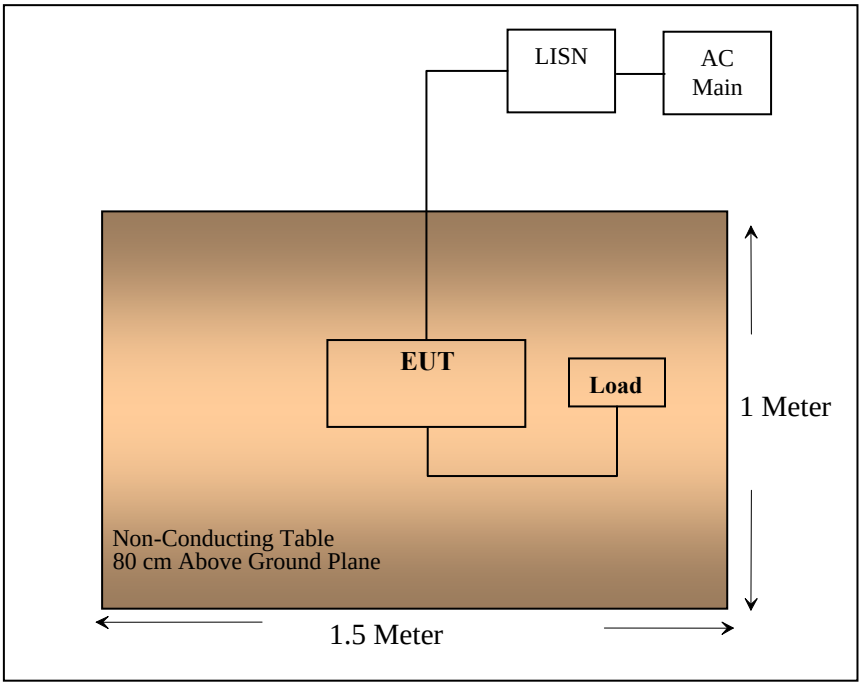
6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected with LISN-1.

6.3 Test Setup Block Diagram



6.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
TTE	Filter, High Pass	H9962-150K-50-21378	K7133	2010-06-10
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2010-06-24
Solar Electronics	LISN	9252-R-24-BNC	511205	2010-06-25

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.*

6.5 Test Procedure

During the conducted emissions test, the power cord of the host was connected to the mains outlet of the LISN-1.

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

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a “QP”. Average readings are distinguished with an “Ave”.

6.6 Test Environmental Conditions

Temperature:	22.3 °C
Relative Humidity:	42 %
ATM Pressure:	100.7 kPa

The testing was performed by Kevin Li on 09-09-2010 in 10 meter chamber 1.

6.7 Summary of Test Results

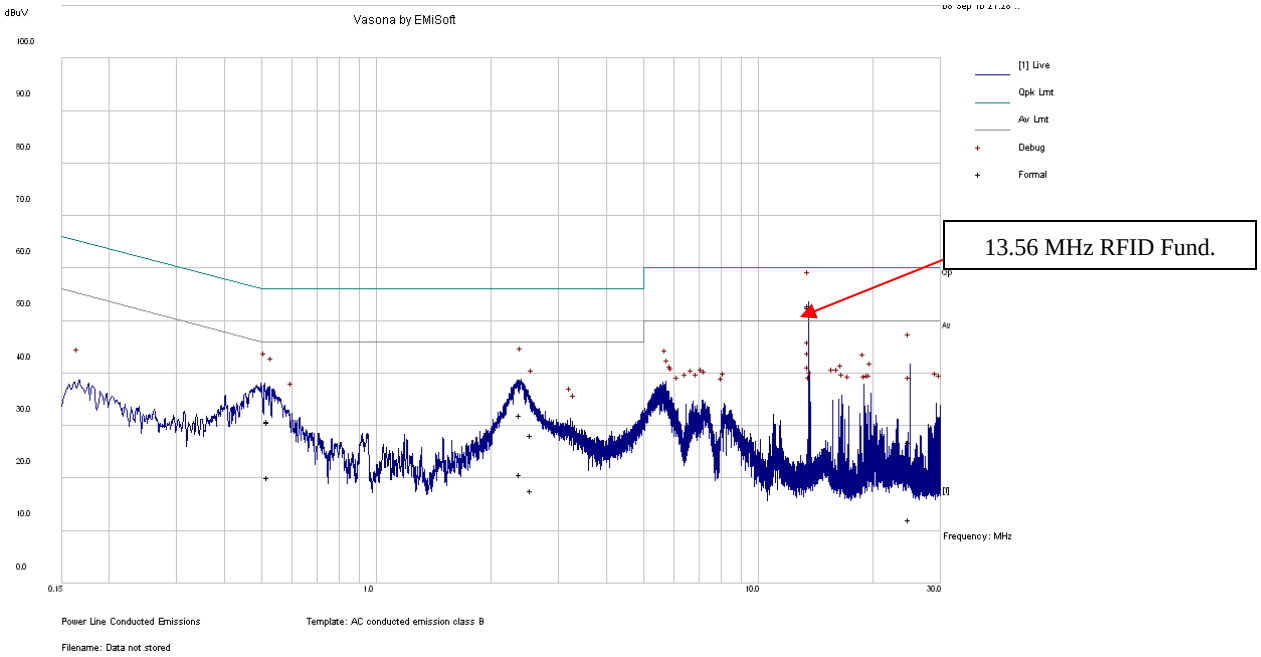
According to the recorded data in following table, the EUT complied with the FCC/IC standard's conducted emissions limits for Class B devices, with the *worst* margin reading of:

-0.54 dB at 13.56081**MHz** in the **Line 1** Conductor mode

Please refer to the following plots and tables for complete test results

13.56 MHz RFID with Antenna Attached:

208 V, 60 Hz-Line 1



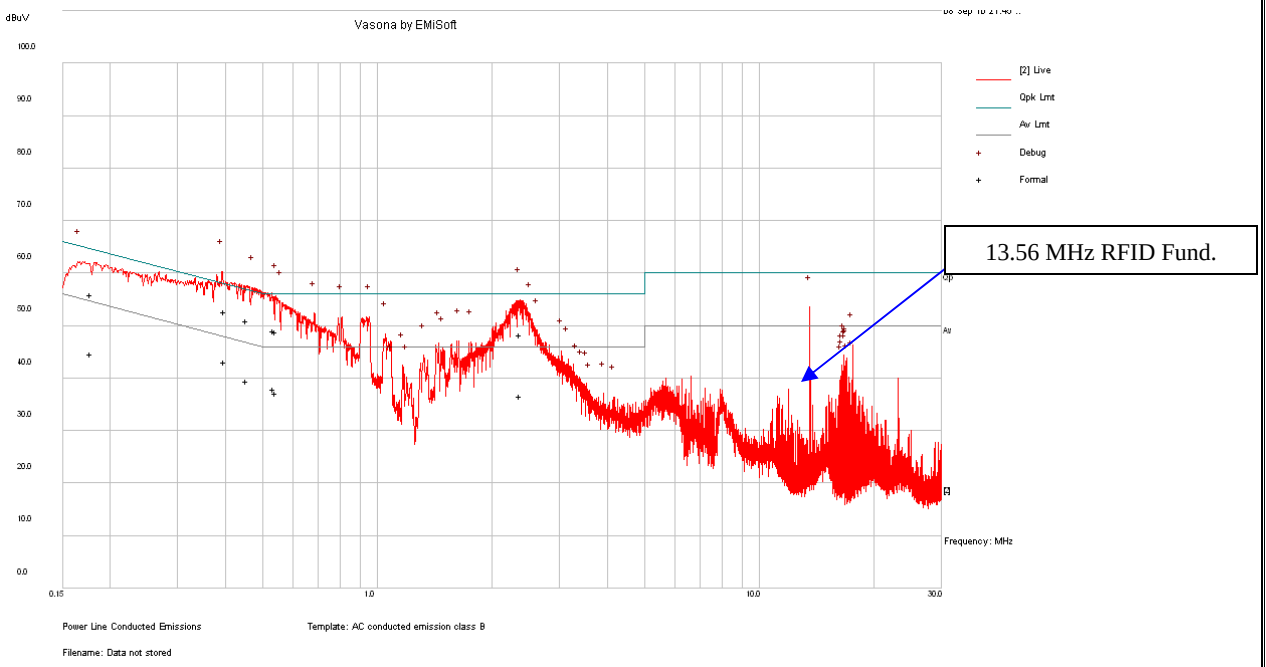
Quasi-Peak Measurement:

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)
13.56081	52.96	Quasi Peak	Line 1	60	-7.04
2.381862	31.98	Quasi Peak	Line 1	56	-24.02
0.520218	30.80	Quasi Peak	Line 1	56	-25.20
24.90819	26.94	Quasi Peak	Line 1	60	-33.06
0.521349	30.72	Quasi Peak	Line 1	56	-25.28
2.544632	28.25	Quasi Peak	Line 1	56	-27.75

Average Measurements:

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)
13.56081	49.46	Average	Line 1	50	-0.54
2.381862	20.82	Average	Line 1	46	-25.18
0.520218	20.09	Average	Line 1	46	-25.91
24.90819	12.18	Average	Line 1	50	-37.82
0.521349	20.15	Average	Line 1	46	-25.85
2.544632	17.75	Average	Line 1	46	-28.25

208 V, 60 Hz-Line 2



Quasi-Peak Measurements:

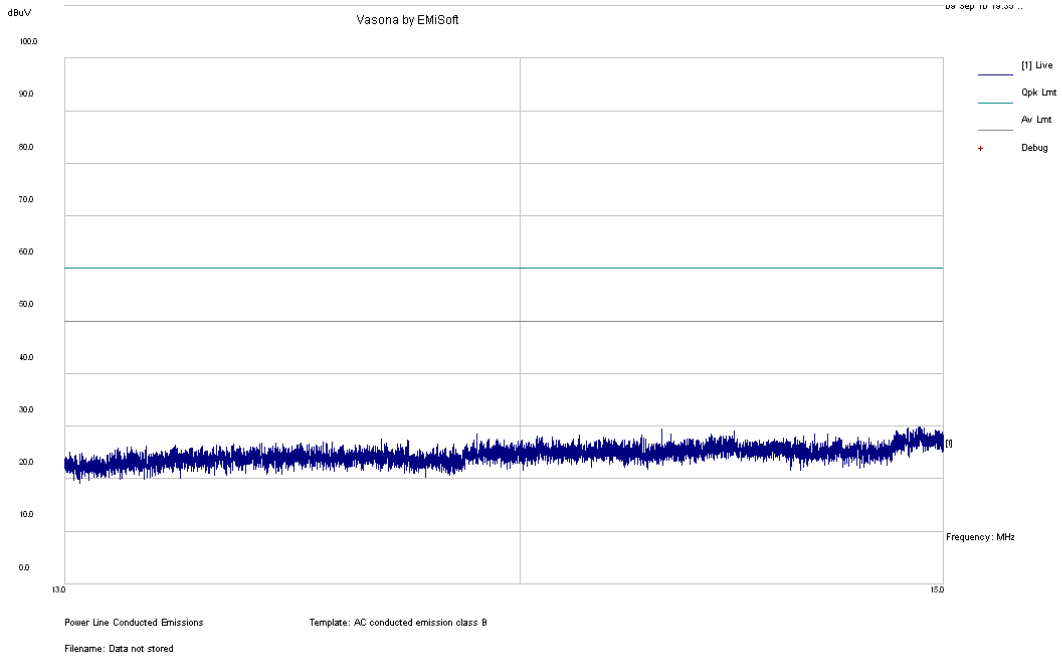
Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)
0.397965	52.59	Quasi Peak	Line 2	57.9	-5.31
0.454818	51.04	Quasi Peak	Line 2	56.79	-5.75
0.536406	49.08	Quasi Peak	Line 2	56	-6.92
2.368657	48.29	Quasi Peak	Line 2	56	-7.71
0.543453	48.77	Quasi Peak	Line 2	56	-7.23
0.178173	55.90	Quasi Peak	Line 2	64.57	-8.67

Average Measurements:

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)
0.397965	43.18	Average	Line 2	47.90	-4.72
0.454818	39.43	Average	Line 2	46.79	-7.36
0.536406	37.89	Average	Line 2	46.00	-8.11
2.368657	36.67	Average	Line 2	46.00	-9.33
0.543453	37.19	Average	Line 2	46.00	-8.81
0.178173	44.64	Average	Line 2	54.57	-9.94

13.56 MHz RFID with Dummy Load TX band:

208 V, 60 Hz – Line 1(13 to 14 MHz)

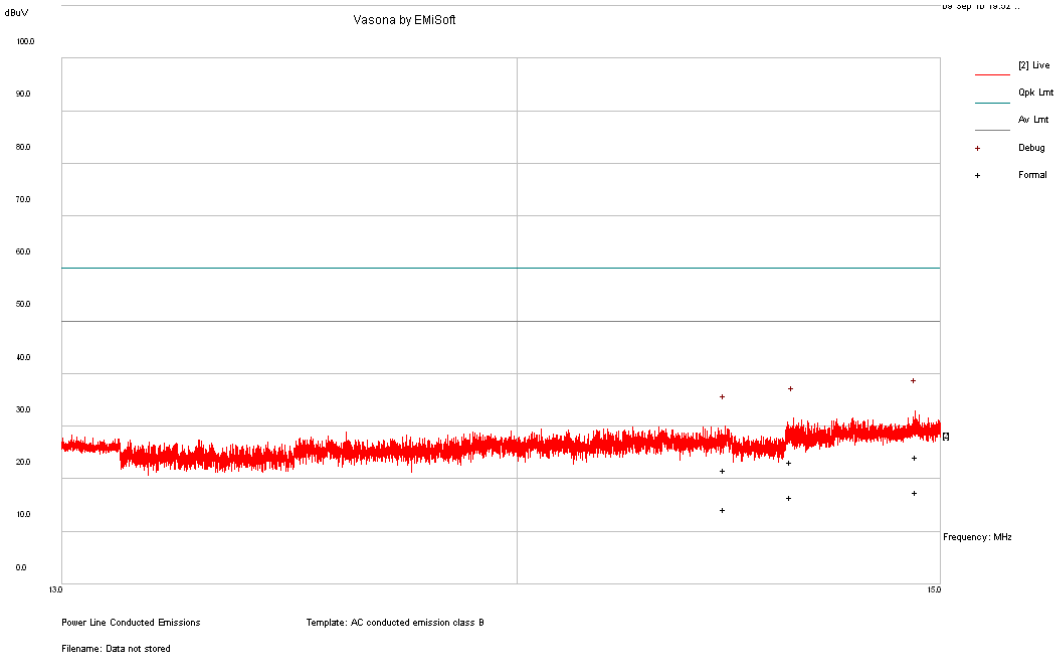


Quasi-Peak Measurements:

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)
-	-	-	Line 1	-	-[1]

[1] all the emissions are 20 dB under the limit or below the noise floor.

208 V, 60 Hz – Line 2(13 to 14 MHz)



Quasi-Peak Measurements:

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)
14.94194	24.24	Quasi Peak	Line 2	60	-35.76
14.63887	23.23	Quasi Peak	Line 2	60	-36.77
14.48225	21.72	Quasi Peak	Line 2	60	-38.28

Average Measurements:

Frequency (MHz)	Corrected Amplitude (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)
14.94194	14.31	Average	Line 2	50	-32.52
14.63887	14.31	Average	Line 2	50	-33.39
14.48225	14.31	Average	Line 2	50	-35.77

7 FCC §15.225(e) & IC RSS-210 §A2.6 - FREQUENCY STABILITY MEASUREMENT

7.1 Standard Applicable

According to FCC §15.225(e), the frequency tolerance of the carrier signal shall be maintained within ± 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.

According to RSS 210 A2.6, Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

7.2 Test Procedures

Frequency stability versus environmental temperature

The equipment under test was connected to an external AC power supply and the RF output was connected to a frequency counter via feed through attenuators. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

Frequency Stability versus Input Voltage

At room temperature (25±5°C), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Series Spectrum Analyzer	E4440A	US45303156	2010-08-09
Espec	Chamber, Temperature	ESL-4CA	18010	2009-12-15

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	22.3 °C
Relative Humidity:	42 %
ATM Pressure:	100.7 kPa

The testing was performed by Kevin Li on 2010-08-27 at RF Site.

7.5 Test Results

Test Environment		Reference Frequency (Hz)	Measured Frequency (Hz)	Frequency Error (Hz)	FCC/IC Limit* (Hz)
Voltage (Vac)	Temperature (^{O}C)				
208	-30	13560000	13559321	- 679	± 1356
208	-20	13560000	13560495	+ 495	± 1356
208	-10	13560000	13560527	+ 527	± 1356
208	0	13560000	13560561	+ 561	± 1356
208	10	13560000	13560672	+ 672	± 1356
208	20	13560000	13560498	+ 498	± 1356
208	30	13560000	13560761	+ 761	± 1356
208	50	13560000	13560692	+ 692	± 1356
177	20	13560000	13560406	+ 406	± 1356
239	20	13560000	13560287	+ 287	± 1356

Note: The limit is ± 0.01% of the operating frequency, the fundamental of EUT is 13.56 MHz.