Lab Code: 200167-0

FCC PART 15.225

Bay Area Compliance Labs. Corp.

TEST AND MEASUREMENT REPORT

For

Coulomb Technologies, Inc.

1692 Dell Avenue, Campbell, CA 95008, USA

FCC ID: W38CT1H00

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

Test Engineer:	Victor Zhang
Report No.:	R0901165-225
Report Date:	2009-02-09
Reviewed By:	Boni Baniqued Senior RF Engineer
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R0901165-225	Original	2009-02-09

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *Coulomb Technologies, Inc.'s* product FCC ID: *W38CT1H00* is an Electric Vehicle Charging Station with remote monitoring and control via ZigBee / CDMA backhaul. It contains an internal RFID reader. Integrated RFID reader recognizes and identifies subscriber key fobs and smart cards. The EUT is a transceiver.

1.2 Mechanical Description

The EUT measures approximately 230 mm (L) x 210 mm (W) x 510 mm (H). Weight: 23 kg.

** The test data gathered is from production samples, serial number: 090100000023, provided by the manufacturer.*

1.3 EUT Photo

Please see additional photos in Exhibit C

1.4 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.

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.

1.5 Related Submittal(s)/Grant(s)

No Related Submittals.

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

1.7 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.

1.8 Test Facility

The test site used by BACL Corp. to collect 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/ts/htdocs/210/214/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 Justification

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

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 Interface Ports and Cabling

Cable Description	Length (m)	From	To
Power Cable	<3m	EUT	AC line Power Source

3 SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§15.203	Antenna Requirement	Compliant
§ 15.35, § 15.205 § 15.209, § 15.225	Radiated Emission	Compliant
§ 15.207	Conducted Emission	Compliant
§15.225(e)	Frequency Stability	Compliant

4 § 15.203 – ANTENNA REQUIREMENT

4.1 Applicable Standard

According to § 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.

Refer to statement below for compliance.

“The antenna for this device is an integral antenna that the end user cannot access. Furthermore the device is for indoor/outdoor use as detailed in the Users Manual and Operational Description”.

Result: Compliant.

5 § 15.35, § 15.205, § 15.209, § 15.225 - RADIATED EMISSION TEST

5.1 Applicable Standard

As per 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.

(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

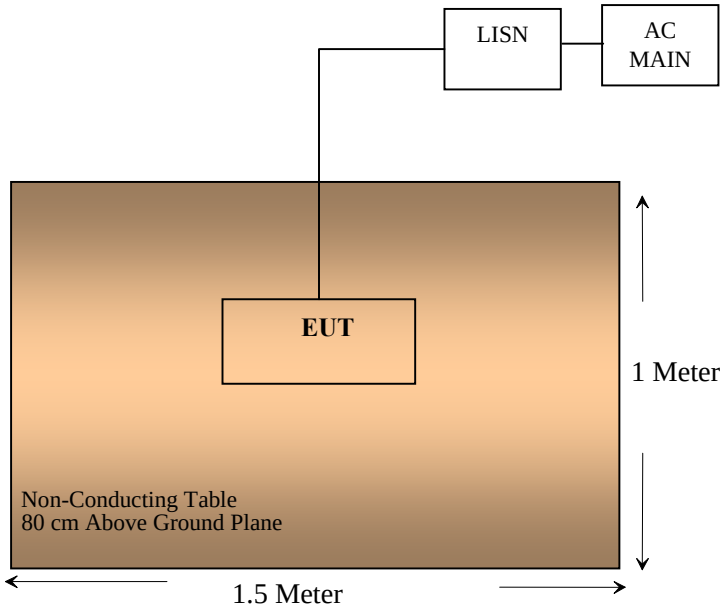
The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

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 center of the back edge on the test table.

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 -7dB means the emission is 7dB below the maximum limit for Class B. 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
Antenna Research Association	Horn Antenna	DRG-1181A	1132	2008-07-28
AH Systems	Horn Antenna	SAS200/571	261	2008-07-01
Com-Power	Active Loop Antenna (10 kHz-30 MHz)	AL-130	17043	2008-04-30**
Agilent	Spectrum Analyzer	E4440A	US45303156	2008-05-31
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100044	2008-03-26

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

5.7 Environmental Conditions

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

**The testing was performed by Victor Zhang on 2009-01-29.*

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. The EUT had the worst margin reading of:

-29.63 dB at **11.85 MHz** below 30 MHz

-4.03 dB at **297.234 MHz** in the **Horizontal** polarization 30 to 1000 MHz

Co-location with CDMA Module and 802.15.4 Module:

CDMA 850, RFID and 802.15.4 Radio (30 MHz-25GHz):

-14.7 dB at **30.779 MHz** in the **Horizontal** polarization 30 MHz to 25 GHz

CDMA 1900, RFID and 802.15.4 Radio (30 MHz-25GHz):

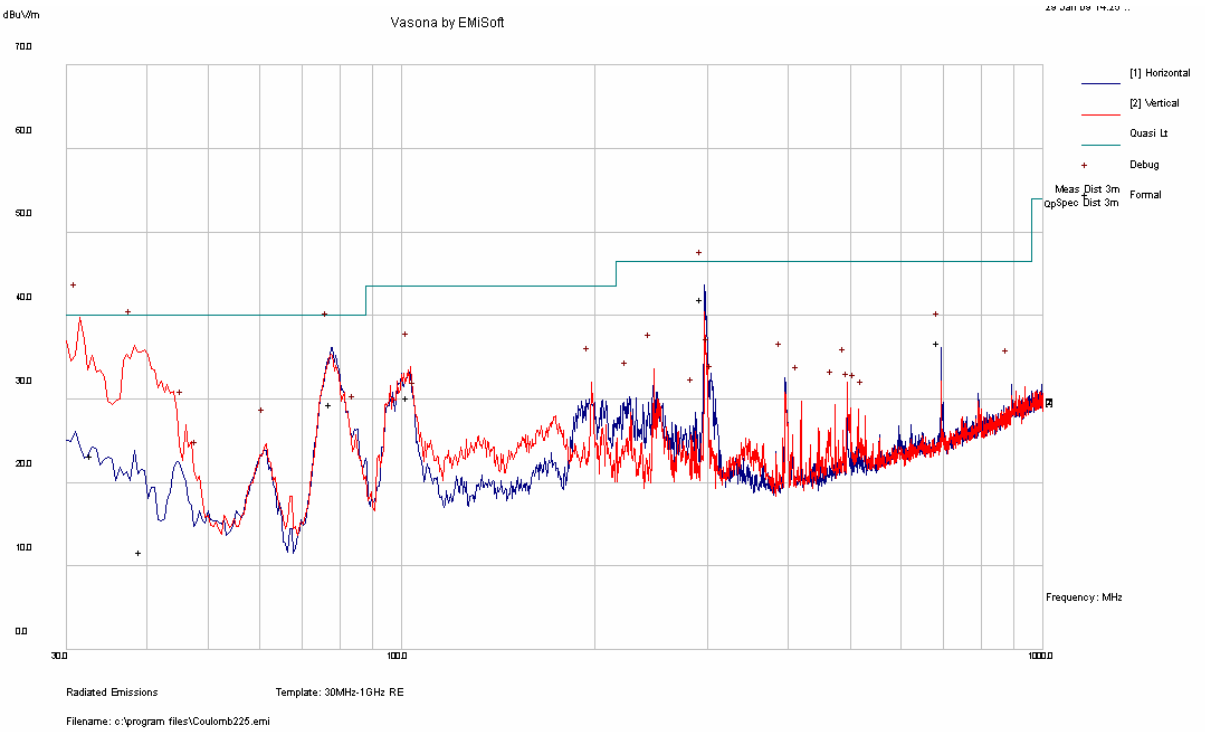
-13.32 dB at **30 MHz** in the **Horizontal** polarization 30 MHz to 25 GHz

Radiated Emissions Test Result Data @ 3meter

9 kHz to 30 MHz

Frequency (MHz)	S.A. Reading (dBuV/m)	Turntable Degrees	Antenna		Cable Loss (dB)	Distance Factor (dB)	Cord. Amp. (dBuV/m)	FCC 15C	
			Height (m)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)
11.8500	28.37	352	1.41	11.4	0.1	40	-0.13	29.50	-29.63
13.4000	29.45	355	1.08	11.2	0.1	40	0.75	40.51	-39.76
13.7169	29.22	8	1.19	11.2	0.1	40	0.52	40.51	-39.99
13.6104	38.26	18	1.07	11.2	0.1	40	9.56	50.50	-40.94
13.5000	38.21	17	1.0	11.2	0.1	40	9.51	50.50	-40.99
13.5581	57.48	14	1.0	11.2	0.1	40	28.78	84.00	-55.22

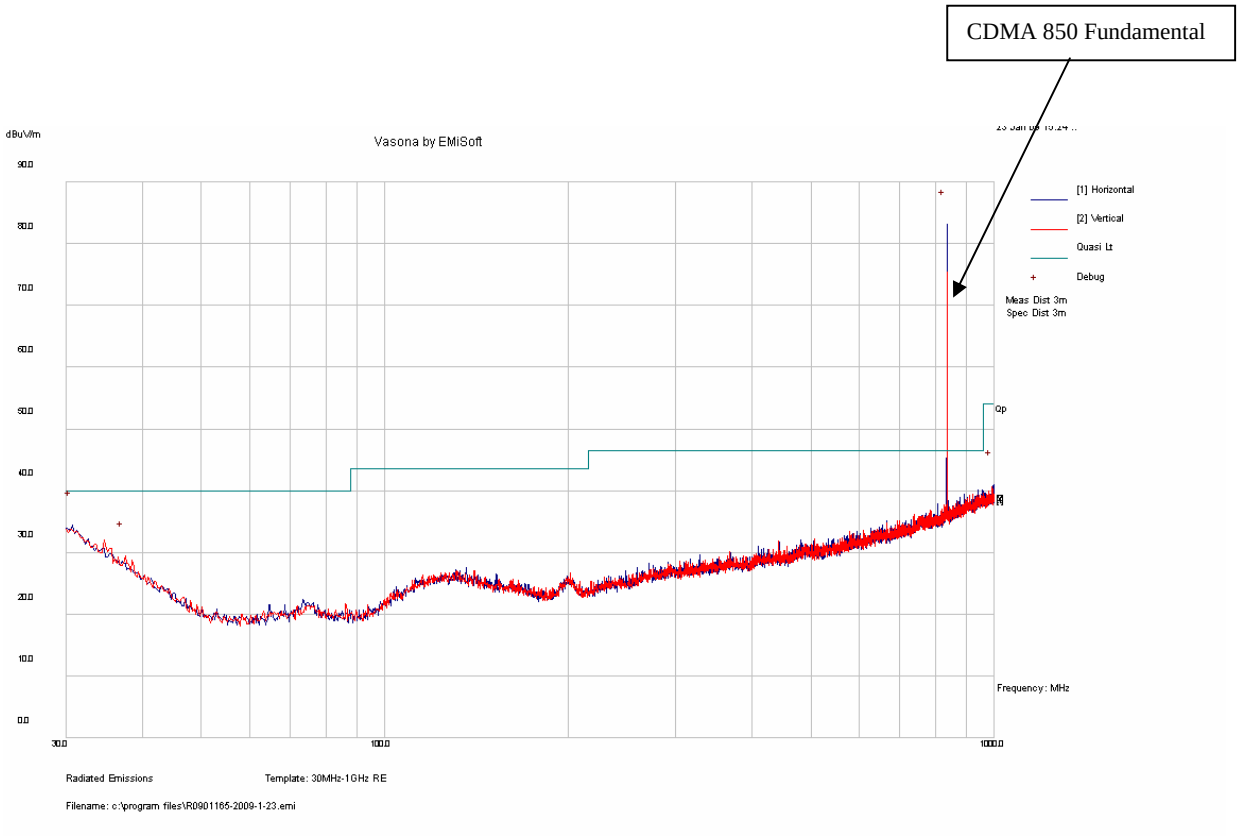
30 to 1000 MHz:



Quasi Peak Measurement

Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Position (deg)	Corrected Factor (dB)	Limit (dBµV/m)	Margin (dB)
297.234	41.93	100	H	248	-4.14	46.0	-4.03
693.861	36.71	152	H	20	2.06	46.0	-9.29
78.501	29.38	314	H	76	-10.85	40.0	-10.62
103.433	30.19	119	V	163	-8.13	43.5	-13.31
33.21	23.25	196	V	335	0.01	40.0	-16.75
39.607	11.67	307	V	315	-4.9	40.0	-28.33

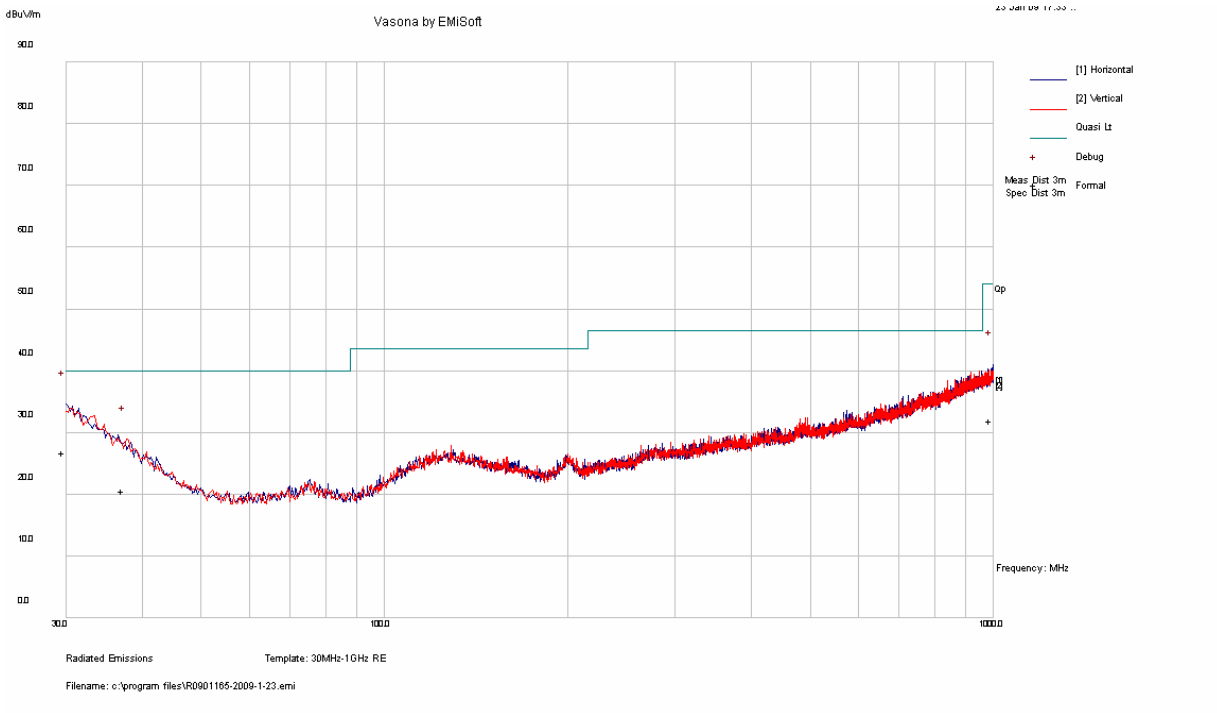
Co-location with CDMA 850, RFID and 802.15.4 Radio:



Frequency (MHz)	Corrected Quasi -Peak (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (deg.)	Corrected Factor (dB)	Limit (dBµV/m)	Margin (dB)
30.779	25.83	291	H	77	11.92	40	-14.17
37.685	20.49	198	V	173	6.59	40	-19.51
996.441	31.89	154	H	105	16.87	54	-22.11

Note: Above 1 GHz, all emission was at noise floor except for 2.4 GHz 802.15.4 fundamental.

Co-location with CDMA 1900, RFID and 802.15.4 Radio:



Frequency (MHz)	Corrected Quasi -Peak (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (deg.)	Corrected Factor (dB)	Limit (dBµV/m)	Margin (dB)
30	26.68	110	H	113	12.54	40	-13.32
37.574	20.63	334	V	96	6.67	40	-19.37
1000	31.92	392	H	196	16.97	54	-22.08

Note: Above 1 GHz, all emission was at noise floor except for CDMA 1900 and 2.4 GHz 802.15.4 fundamental.

6 §15.207 – CONDUCTED EMISSIONS

6.1 Applicable Standard

According to FCC §15.207 (a) 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.

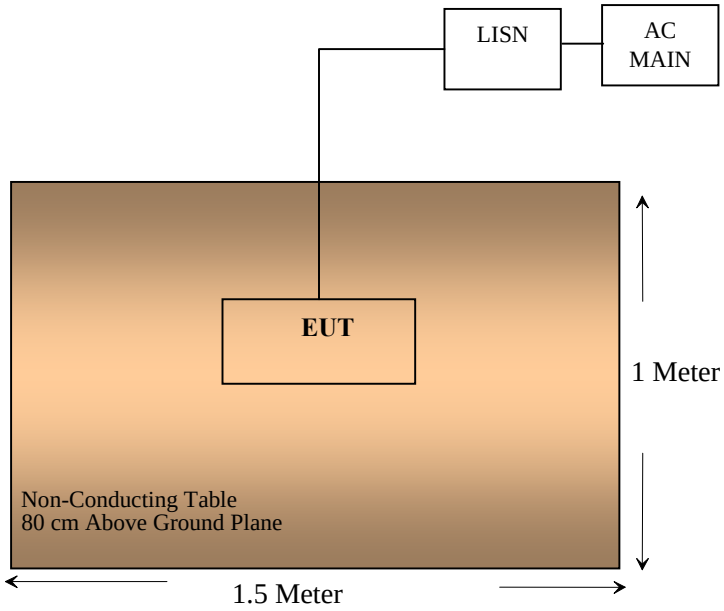
6.2 Test Setup

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 host of 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
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2008-04-21
Solar Electronics	LISN	9252-R-24-BNC	511205	2008-07-31

*** 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 Environmental Conditions

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

**The testing was performed by Victor Zhang from 2009-01-29.*

6.7 Summary of Test Results

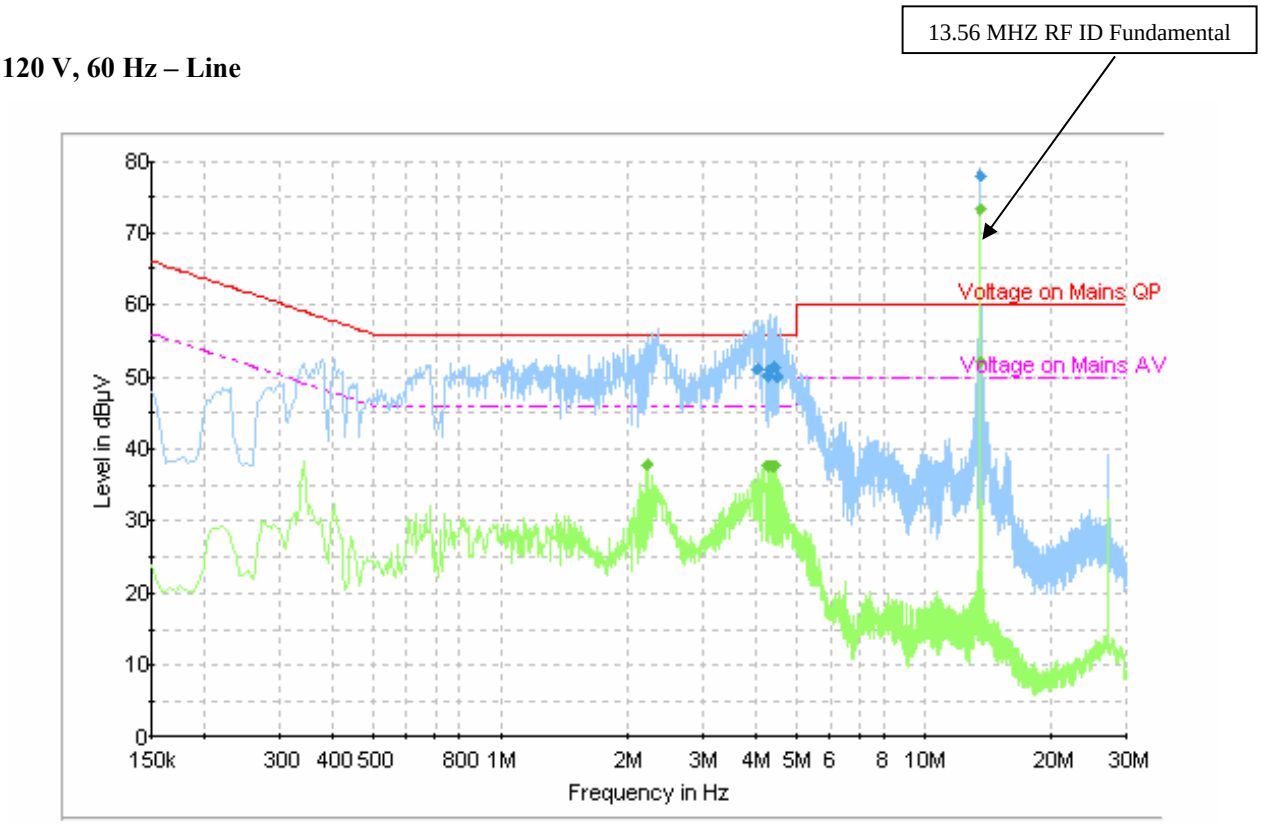
According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits for Class B devices, with the *worst* margin reading of:

-4.7 dB at **4.414 MHz** in the **Line** Conductor mode
-4.2 dB at **4.185 MHz** in the **Neutral** Conductor mode

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

13.56 MHz RFID Antenna Attached:

120 V, 60 Hz – Line



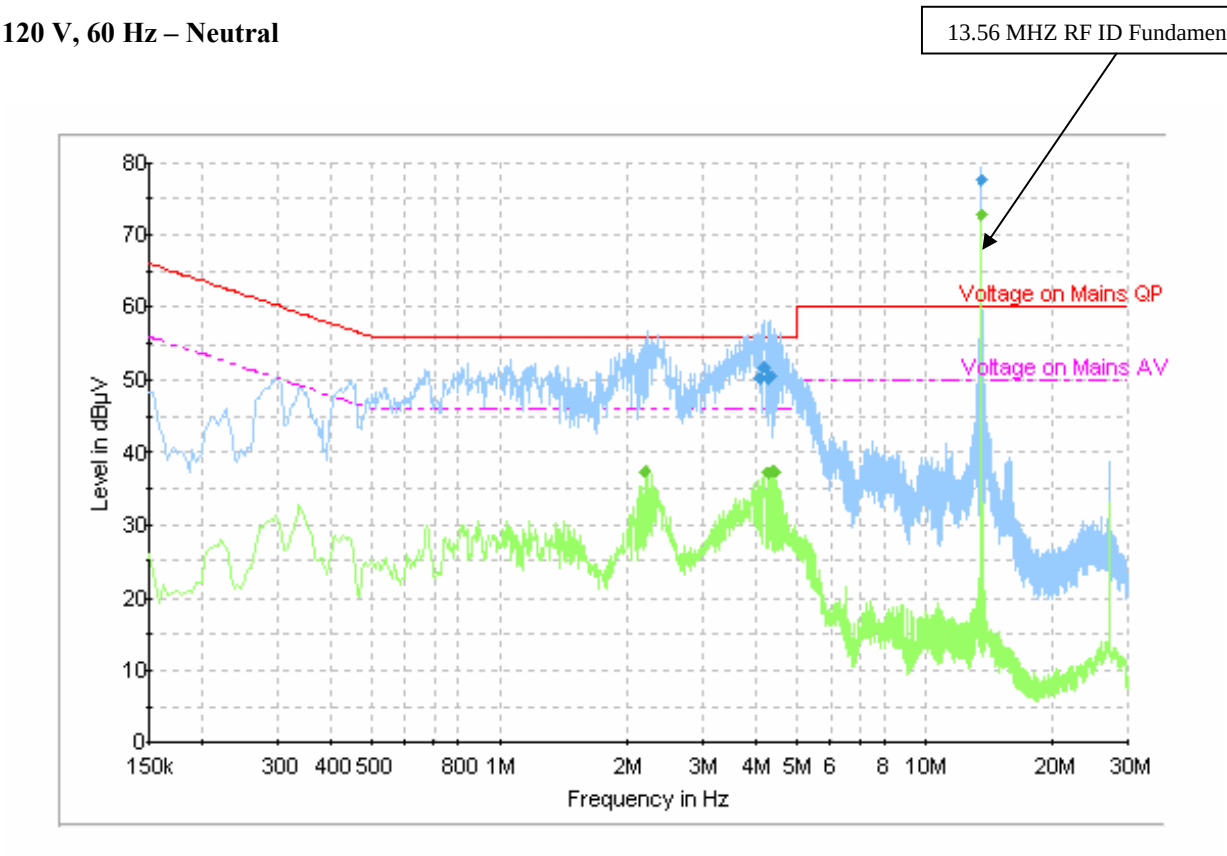
Quasi-Peak Measurement:

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
13.558	78	Line	60	18
4.414	51.3	Line	56	-4.7
4.034	51.1	Line	56	-4.9
4.338	51	Line	56	-5
4.262	50.2	Line	56	-5.8
4.49	49.9	Line	56	-6.1

Average Measurement:

Frequency (MHz)	Average (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
13.558	73.3	Line	50	23.3
13.55	52.1	Line	50	2.1
2.206	37.9	Line	46	-8.1
4.346	37.6	Line	46	-8.4
4.274	37.5	Line	46	-8.5
4.414	37.6	Line	46	-8.5

120 V, 60 Hz – Neutral



Quasi-Peak Measurement:

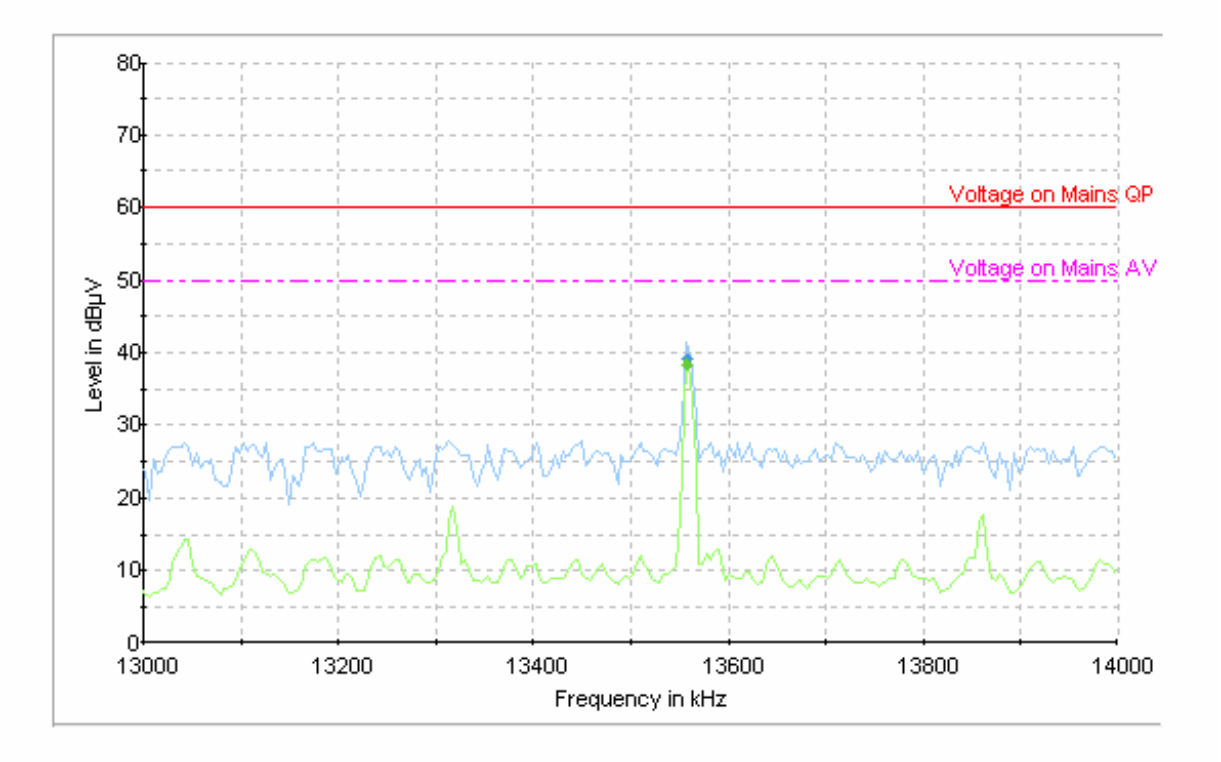
Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
13.557	77.5	Neutral	60	17.5
4.185	51.8	Neutral	56	-4.2
4.337	50.6	Neutral	56	-5.4
4.109	50.1	Neutral	56	-5.9
4.277	50.1	Neutral	56	-5.9
13.557	77.5	Neutral	60	17.5

Average Measurement:

Frequency (MHz)	Average (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
13.557	72.8	Neutral	50	22.8
4.345	37.5	Neutral	46	-8.5
2.205	37.4	Neutral	46	-8.6
4.413	37.4	Neutral	46	-8.6
4.273	37.2	Neutral	46	-8.8
13.557	72.8	Neutral	50	22.8

13.56 MHz RFID with Dummy Load TX band:

120 V, 60 Hz – Line (13 to 14 MHz)



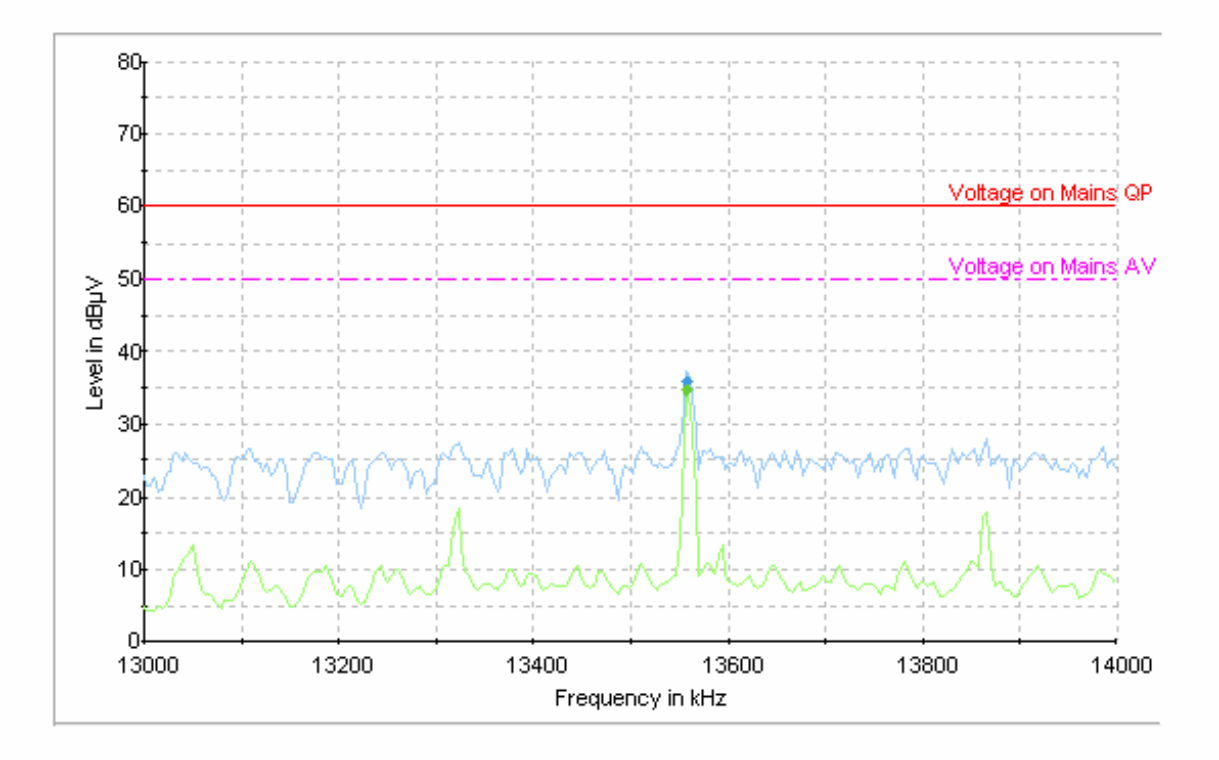
Quasi-Peak Measurement:

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
13.557000	39.0	Line	60.0	-21

Average Measurement:

Frequency (MHz)	Average (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
13.557000	38.4	Line	50.0	-11.6

120 V, 60 Hz – Neutral (13 to 14 MHz)



Quasi-Peak Measurement:

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
13.558000	35.9	Neutral	60.0	-24.2

Average Measurement:

Frequency (MHz)	Average (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
13.558000	34.6	Neutral	50.0	-15.4

7 § 15.225(e) - 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.

7.2 Test Procedure

7.2.1 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.

7.2.2 .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	2008-05-31
Espec	Chamber, Temperature	ESL-4CA	18010	2008-12-10

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

7.4 Environmental Conditions

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

**The testing was performed by Victor Zhang from 2009-01-29.*

7.5 Test Results

Test Environment		Reference Frequency (Hz)	Measured Frequency (Hz)	Frequency Error (Hz)	Limit* (Hz)
Voltage (Vac)	Temperature (^{O}C)				
120	-30	13558000	13558750	750	1356
120	-20	13558000	13558900	900	1356
120	-10	13558000	13558758	758	1356
120	0	13558000	13558850	850	1356
120	10	13558000	13558833	833	1356
120	20	13558000	13558755	755	1356
120	30	13558000	13558783	783	1356
120	50	13558000	13558739	739	1356
102	20	13558000	13558917	917	1356
138	20	13558000	13558650	650	1356

Note: The limit is ± 0.01% of the operating frequency, the fundamental of EUT is 13.558 MHz.