FCC PART 15.225

IC RSS-210, ISSUE 8, DECEMBER 2010

TEST AND MEASUREMENT REPORT

For

Transact Technologies Incorporated

2319 Whitney Ave., Suite 3B,

Hamden, CT 06518, USA

FCC ID: RBP-920DLRM
IC: 4705A-920DLRM

Report Type:	**Product Type:**
Original Report	Printer

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Report Number:	R1209289-225
Report Date:	2013-01-22
Reviewed By:	Victor Zhang EMC/RF Lead

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1209289-225	Original Report	2013-01-22

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report has been prepared on behalf of Transact Technologies Incorporated and their product model: 920DL RM Chassis with FCC ID: RBP-920DLRM and IC: 4705A-920DLRM which will henceforth be referred to as the EUT. The EUT is a Printrex 920 printer with 13.56 MHz RFID built in.

1.2 Mechanical Description of EUT

The "EUT" measures approximately *510 mm (L) x 480 mm (W) x 130 mm (H)*, and weighs approximately *10k*g.

The test data gathered are from typical production sample, serial number: JV004917463 assigned by Transact Technologies Incorporated.

1.3 Objective

This report is prepared on behalf of *Transact Technologies Incorporated* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commissions rules and IC RSS-210 Issue 8, Dec 2010.

The objective is to determine compliance with FCC Part 15.225 and IC RSS-210 rules for Radiated Spurious Emission, Conducted Emission, Frequency Stability and Receiver Spurious Emission.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009, 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.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the 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 CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB 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 Corp.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

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 site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). 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 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 System Test Configuration

2.1 Justification

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

2.2 EUT Exercise Software

N/A

2.3 BACL EMI Measurement Software

The software used was EMISoft-Vasona 5.0068 for EMI testing.

2.4 Special Equipment

N/A

2.5 Equipment Modifications

No modifications were made to the EUT.

2.6 Local Support Equipment

N/A

2.7 EUT Internal Configuration Details

Manufacturer	Description	Model No.	Serial No.
TDK-Lambda	Power Supply	CCB024C	-
Transact Technologies, Inc.	Display Board	PWB ART SRT	81-11546L A3
Transact Technologies, Inc.	RFID Sensor	81-115318LB2	-
Transact Technologies, Inc.	Controller Board	81-11293-03	ETI-E2,94V-0,3312

2.8 Interface Ports and Cabling

Cable Descriptions	Length (m)	From	To
USB Cable	0.5	EUT	Termination
RJ 45 Cable	0.5	EUT	Termination

2.9 Power Supply List and Details

N/A

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §15.207(a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	Compliant
FCC §15.209, §15.225 IC RSS-210 §A8.5	Radiated Spurious Emissions	Compliant
FCC §15.225 (e) IC RSS-210 §A2.6	Frequency Stability	Compliant
IC RSS-Gen §4.10, §6	Receiver Spurious Emission	Compliant

4 FCC §15.207 & IC RSS-Gen §7.2.4 – AC Line Conducted Emissions

4.1 Applicable Standard

As per FCC §15.207 & IC RSS-Gen §7.2.4 Conducted limits:

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 (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 1
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

4.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2009 measurement procedure. The specification used was FCC Part15.207 limits and IC RSS-Gen §7.2.4 limits.

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

The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

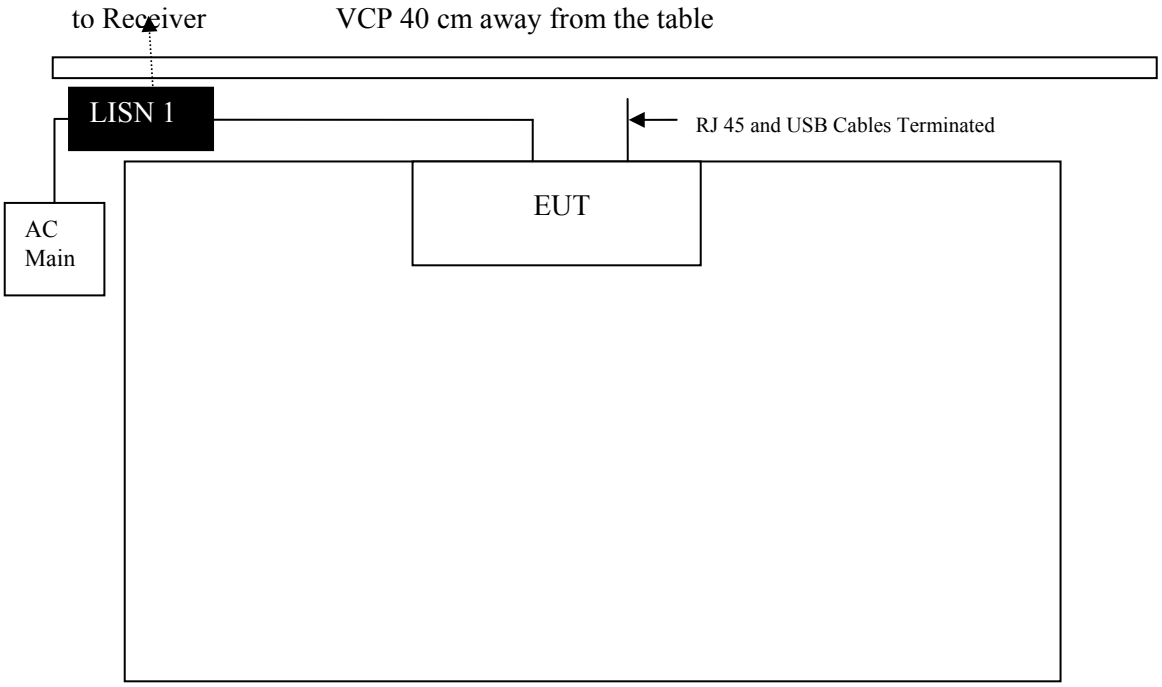
4.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-2.

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”.

4.4 Test Setup Block Diagram



4.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL) plus the High Pass Filter/Attenuator value (HA) and subtracting the Amplifier Gain (Ga) to the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + CL + HA – Ga

For example, a corrected amplitude (CA) of 36 dBuV = Indicated Amplitude reading (Ai) of 50.0 dBuV + Cable Loss (CL) 1.0 dB + High Pass Filter/Attenuator (IA) 5 dB - Amplifier Gain (Ga) 20 dB

The "**Margin**" column of the following data tables indicates the degree of compliance within 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 (dB) = Corrected Amplitude (dBuV) - Limit (dBuV)

4.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2012-04-18	1 year
Solar Electronics	LISN	9252-50-R-24-N	511213	2012-06-25	1 year
TTE	Filter, High Pass	H962-150K-50-21378	K7133	2012-05-30	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

4.7 Test Environmental Conditions

Temperature:	24°C
Relative Humidity:	52%
ATM Pressure:	101.99kPa

The testing was performed by Wei Sun on 2012-10-18 at 5 meter chamber #3.

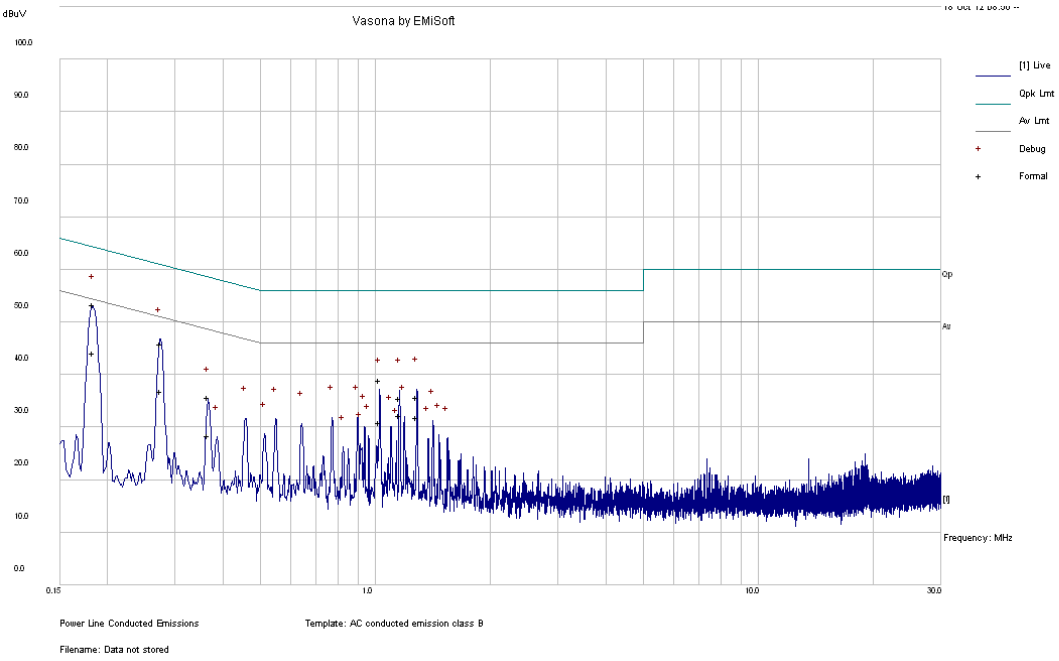
4.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC & IC standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-10.05	0.182499	Neutral	0.15-30

4.9 Conducted Emissions Test Plots and Data

120 V, 60 Hz – Line



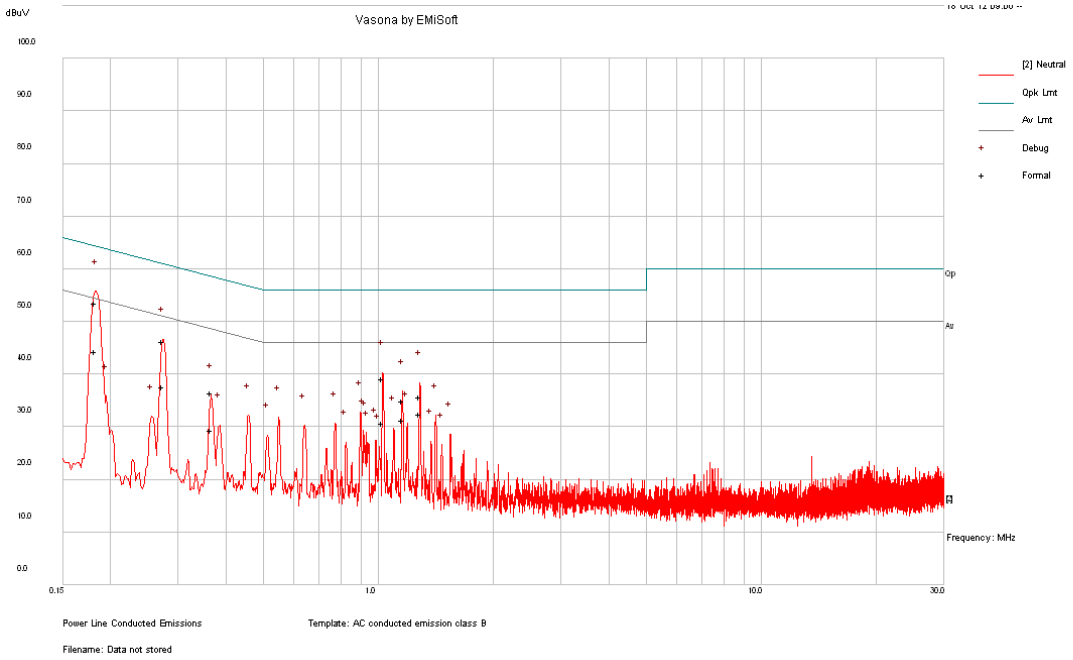
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.184065	53.42	Line	64.3	-10.88
0.274815	45.9	Line	60.97	-15.08
1.281902	35.66	Line	56	-20.34
1.026738	39.01	Line	56	-16.99
1.1562	35.45	Line	56	-20.55
0.365444	35.8	Line	58.6	-22.80

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.184065	44.16	Line	54.3	-10.14
0.274815	36.88	Line	50.97	-14.09
1.281902	31.92	Line	46	-14.08
1.026738	30.87	Line	46	-15.13
1.1562	32.29	Line	46	-13.71
0.365444	28.49	Line	48.6	-20.12

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.182499	53.61	Neutral	64.37	-10.76
0.274437	46.34	Neutral	60.98	-14.64
1.026983	39.15	Neutral	56	-16.85
1.282406	35.72	Neutral	56	-20.28
1.155811	34.93	Neutral	56	-21.07
0.366146	36.45	Neutral	58.59	-22.14

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.182499	44.32	Neutral	54.37	-10.05
0.274437	37.67	Neutral	50.98	-13.31
1.026983	30.66	Neutral	46	-15.34
1.282406	32.51	Neutral	46	-13.49
1.155811	31.41	Neutral	46	-14.59
0.366146	29.38	Neutral	48.59	-19.21

5 FCC §15.225 (e) & IC RSS-210 §A2.6 – Frequency Stability

5.1 Applicable Standard

For FCC §15.225(e) and IC RSS-210 §A2.6

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.

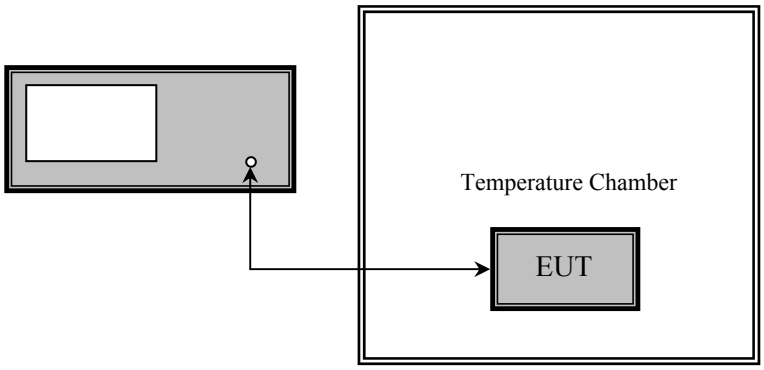
5.2 Measurement Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to the Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable DC power supply Source. The voltage was set to 115% and 85% of the nominal value. The output frequency was recorded for each voltage.

5.3 Test Setup Block Diagram



5.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year
Tenney	Temperature Chamber	Versa Tenn	12.222-193	-	-

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

5.5 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	49%
ATM Pressure:	101.97kPa

The testing was performed by Wei Sun on 2012-10-10 at RF Site.

5.6 Test Results

Test Condition		Frequency (MHz)	Frequency Error (ppm)	Limit (ppm)
Voltage (Vac)	Temperature (^{o}C)			
138	20 ºC	13.56	0	100
102		13.56	0	100
120	40 ºC	13.560003	0.22	100
120	0 ºC	13.56	0	100

Note: EUT can only work at the range of 0 ºC to 40 ºC.

6 FCC §15.205, §15.209, §15.225 & IC RSS-210 §2.2, §A2.6 – Spurious Radiated Emissions

6.1 Applicable Standards

FCC §15.225, §15.205, §15.209 and IC RSS-210 §2.2, §A2.6

6.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15C and IC RSS-210, RSS-Gen limits.

The spacing between the peripherals was 10 centimeters.

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

6.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

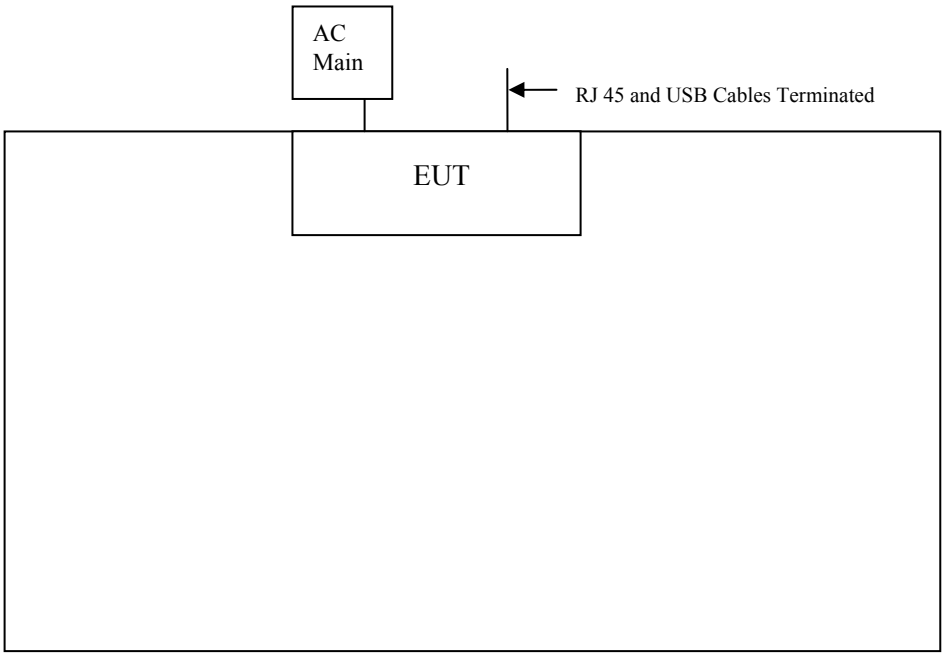
Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, the Corrected Amplitude (CA) of 40.3 dBuV/m = indicated Amplitude reading (Ai) 32.5 dBuV + Antenna Factor (AF) 23.5dB + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 dB - Amplifier Gain (Ga) 29.4 dB

The "**Margin**" column of the following data tables indicates the degree of compliance within 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 (dB) = Corrected Amplitude (dBuV/m) - Limit (dBuV/m)

6.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Hewlett Packard	Pre-amplifier	8447D	2944A07030	2012-04-08	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2012-04-18	1 year
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2012-06-18	1 year
HP	Pre-amplifier	8449B	3147A00400	2012-02-03	1 year
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year
EMCO	Passive Rod Antenna	3303	2849	2012-01-14	1 year
EMCO	Passive Loop Antenna	6512	24167	2012-04-10	2 years

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

6.7 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52%
ATM Pressure:	101.99kPa

The testing was performed by Wei Sun on 2012-10-12 at 5 meter chamber #3.

6.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15C and IC RSS-210 standard's radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-8.38	244.13	Horizontal	9kHz – 1GHz

Please refer to the following table for specific test result details

6.9 Radiated Emissions Test Result Data

Radiated Emission at 3 meters, 9 kHz – 1 GHz

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Transmitting Mode, measured at 3 meters											
13.563	34.64	21	100	NA[1]	11.5	0.02	0	46.16	124	-77.84	Peak
13.563	54.1	21	100	NA[1]	11.5	0.02	25.5	40.12	124	-63.88	Ave
244.12	49.1	265	121	H	11.5	1.34	24.32	37.62	46	-8.38	QP
244.12	47.22	113	137	V	11.5	1.34	24.32	35.74	46	-10.26	QP
18.77	54.08	11	100	NA[1]	11.2	0.02	25.5	39.8	70	-30.2	QP

Note: [1]Loop antenna was used during the test.

7 FCC §15.215 & IC RSS-Gen §4.6 – Emission Bandwidth

7.1 Applicable Standards

FCC §15.215 and IC RSS-Gen §4

7.2 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

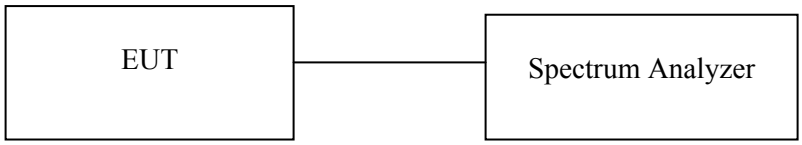
Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

7.3 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	49%
ATM Pressure:	101.97kPa

The testing was performed by Wei Sun on 2012-10-10 at RF Site.

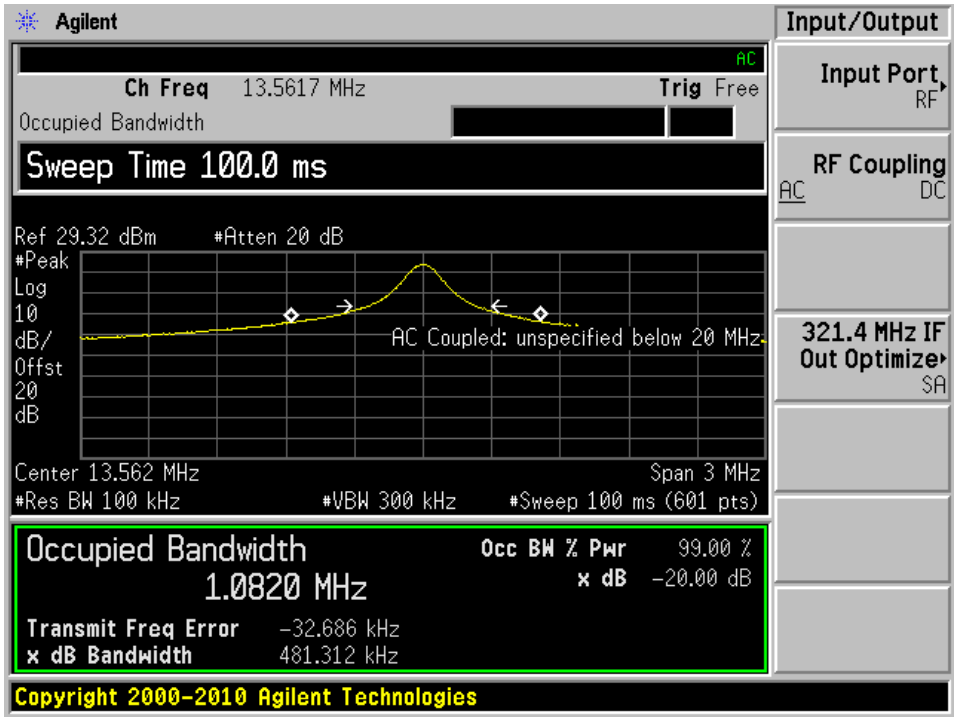
7.4 Test Setup Block Diagram



7.5 Test Result Data ad Plot

Frequency (MHz)	20 dB OBW (kHz)	99% OBW (kHz)
13.56	481.312	1080.2

Emission Bandwidth



8 RSS-Gen §4.10 & §6.1 – Receiver Spurious Radiated Emissions

8.1 Applicable Standard

As per IC RSS-Gen §4.10

The receiver shall be operated in the normal receive mode near the mid-point of the band in which the receiver is designed to operate.

Radiated emission measurements are to be performed on a test site registered with Industry Canada. As an alternative, the conducted measurement method may be used when the antenna is detachable. In such a case, the receiver spurious signal may be measured at the antenna port.

If the receiver is super-regenerative, stabilize it by coupling to it an unmodulated carrier on the receiver frequency (antenna conducted measurement) or by transmitting an unmodulated carrier on the receiver frequency from an antenna in the proximity of the receiver (radiated measurement). Taking care not to overload the receiver, vary the amplitude and frequency of the stabilizing signal to obtain the highest level of the spurious emissions from the receiver.

For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least 3 times the highest tuneable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.

For emissions below 1000 MHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.

Above 1000 MHz, measurements shall be performed using an average detector with a minimum resolution bandwidth of 1 MHz.

As per IC RSS-Gen §6.1

Spurious emissions from receivers shall not exceed the radiated limits shown in the table below:

Radiated Limits of Receiver Spurious Emissions

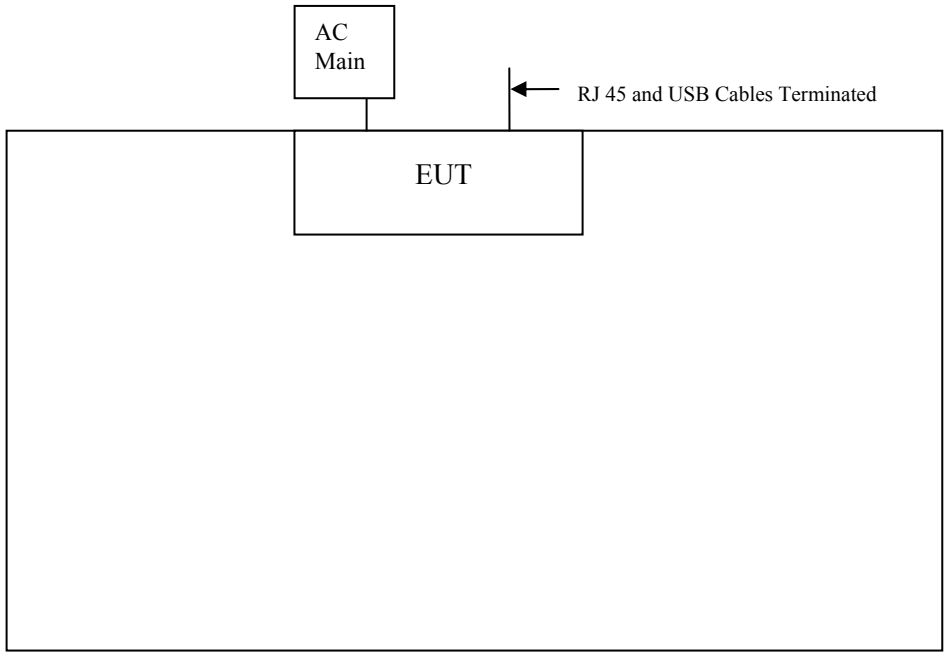
Frequency (MHz)	**Field Strength (microvolts/m at 3 metres)***
30-88	100
88-216	150
216-960	200
Above 960	500

8.2 Measurement Procedure

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

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

8.3 Test Setup Block Diagram



8.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Hewlett Packard	Pre-amplifier	8447D	2944A07030	2012-04-08	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2012-04-18	1 year
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
HP	Pre-amplifier	8449B	3147A00400	2012-02-03	1 year
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

8.5 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52%
ATM Pressure:	101.99kPa

The testing was performed by Wei Sun on 2012-10-19 in 5 meters chamber 3.

8.6 Summary of Test Results

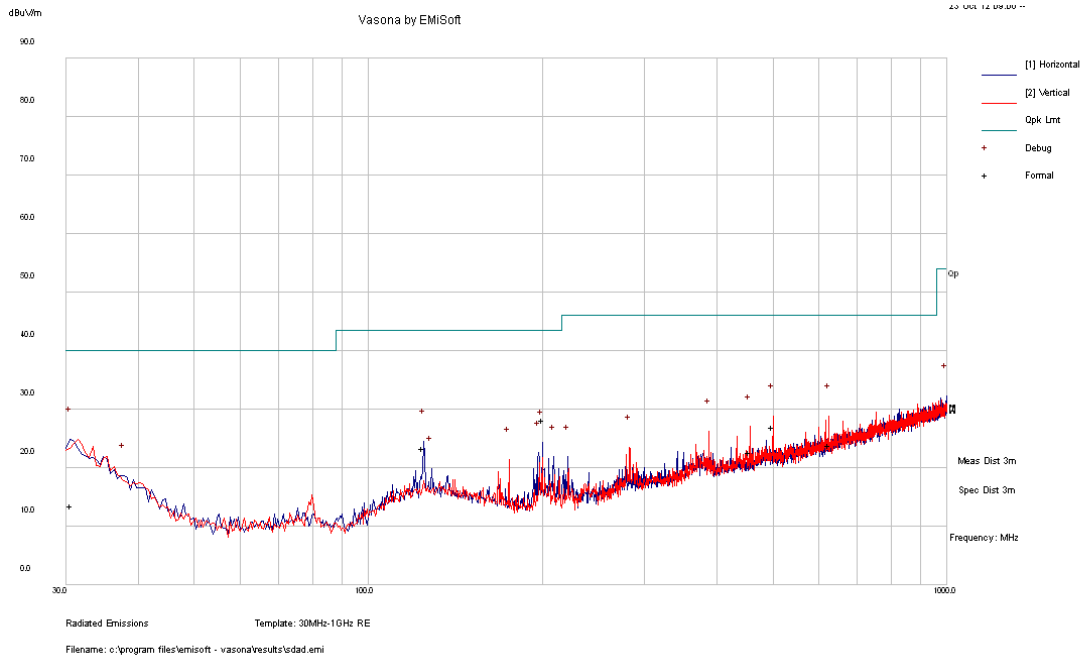
According to the test data, the EUT complied with IC RSS-210/RSS-Gen, with the closest margins from the limit listed below:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-15.23	199.982	Horizontal	30 to 1GHz

8.7 Test Data and Plots

30 -1000 MHz, Measured at 3 meters

Receiving Mode



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
30.6995	13.59	173	H	74	40	-26.41
499.9848	27.04	99	V	0	46	-18.96
625.015	23.9	108	V	333	46	-22.10
124.4728	23.39	235	H	360	43.5	-20.11
456.028	22.64	109	V	360	46	-23.36
199.982	28.27	155	H	254	43.5	-15.23