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**EMC testing of the Siborg Systems Inc. LCR-Reader MP
in accordance with ICES-003 Issue 6 and FCC Part 15.109**

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Prepared for: Siborg Systems Inc.
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REVISION RECORD

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1.0 INTRODUCTION

1.1 Scope

The purpose of this report is to present the results of compliance testing performed in accordance with ICES-003 Issue 6 and FCC Part 15 § 109, as specified by Siborg Systems Inc. All test procedures, limits, criteria, and results described in this report apply only to the Siborg Systems Inc. LCR-Reader MP test sample, referred to herein as the EUT (Equipment Under Test).

This report does not imply product endorsement by the Electronics Test Centre, SCC, NAVLP, A2LA, nor any Canadian Government agency.

1.2 Applicant

This test report has been prepared for Siborg Systems Inc, located in Waterloo, Ontario, Canada.

1.3 Test Sample Description

As provided to ETC Airdrie by Siborg Systems Inc.:

Product Name:	Model #	Serial #
LCR-Reader MP	LCRR-MP	D23001200
Power:	4.0 VDC, 50 mA	

More detailed information is provided by Siborg Systems Inc. in Appendix A.

1.4 General Test Conditions and Assumptions

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

Where relevant, the EUT was only tested using the monitoring methods and test criteria defined in this report.

The environmental conditions are recorded during each test, and are reported in the relevant sections of this document.

1.5 Scope of Testing

Tests were performed in accordance with ICES-003 Issue 6 and FCC Part 15 § 109, as referenced by Siborg Systems Inc.

1.5.1 Test Methodology

Test methods are specified in the Basic Standard as referenced and/or modified by the Product Standard in the part of Section 2 of this report associated with each particular test case.

1.5.2 Variations in Test Methodology

Any variance in methodology or deviation from the reference Standard is documented in the part of Section 2 of this report associated with each particular Test Case.

1.5.3 Test Sample Verification, Configuration & Modifications

EUT setup, configuration, protocols for operation and monitoring of EUT functions, and any modifications performed in order to meet the requirements, are detailed in each Test Case of Section 2 of this report.

2.0 TEST CONCLUSION

STATEMENT OF COMPLIANCE

The customer equipment referred to in this report was found to comply with the requirements, as summarized below.

The EUT was subjected to the following tests. Compliance status is reported as **Compliant** or **Non-compliant**. If testing was not performed at this time, the appropriate field is marked **n/t**. **N/A** indicates the test was Not Applicable to the EUT.

Note: Maintenance of compliance is the responsibility of the Manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the EUT with respect to the standards detailed in this test report.

The following table summarizes the tests performed in terms of the specification, class or performance criterion applied, and the EUT modification state.

Test Case	Test Type	Specification	Class	Test Sample	Modifications	Config.	Result
§ 2.1	Radiated Emissions	ICES-003 FCC Part 15.109	Class B	LCR-Reader MP	none	see § 2.1	Compliant

Refer to the test data for applicable test conditions.

2.1 Radiated Emissions

Test Lab: Electronics Test Centre, Airdrie	EUT: LCR-Reader MP
Test Personnel: Henry Coockeygam and Imran Akram	Standard: ICES-003 Issue 6 FCC Part 15.109
Date: 2017-08-28 (25.9° C, 31.8% RH, 102.0 kPa)	Basic Standard: ANSI C63.4: 2014 Class: B
EUT status: Compliant	

Specification: Class B

Frequency	ICES-003 Class B Limit (3 m)	FCC Class B Limit (3 m)
30 – 88 MHz	40 dBµV/m (QP)	40 dBµV/m (QP)
88 – 216 MHz	43.5 dBµV/m (QP)	43.52 dBµV/m (QP)
216 – 960 MHz	46 dBµV/m (QP)	46.02 dBµV/m (QP)
960 – 1000 MHz	54 dBµV/m (QP)	53.98 dBµV/m (QP)
Above 1000 MHz	54 dBµV/m (Avg.) 74 dBµV/m (Peak)	53.98 dBµV/m (Avg.)
Criteria: The radiated emissions produced by a device, measured at a distance of 3 meters, shall not exceed the limits as specified.		

2.1.1 Test Guidance:

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz.

The scan is performed at discreet increments of turntable azimuth and antenna height, which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

All frequencies having peak emissions within 10dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 – 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. Up to 1 GHz, measurements are performed with a Quasi-Peak detector. Above 1 GHz, measurements are recorded with Peak and/or Average detectors, as applicable.

2.1.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.1.3 Uncertainty of Measurement:

The factors contributing to uncertainty of measurement are identified and calculated in accordance with UKAS (United Kingdom Accreditation Service) document “Lab 34, The Expression of Uncertainty in EMC Testing, Aug 2002.” as based on the “ISO Guide to the Expression of Uncertainty in Measurement, 1995.”

This uncertainty estimate represents an expanded uncertainty expressed at approximately 95% confidence using a coverage factor of $k = 2$.

Test Method	Frequency	Uncertainty
Radiated Emissions Level	30 MHz – 1 GHz	±4.6 dB

2.1.4 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	
EMI receiver	Agilent	N9038A	6130	2017-06-20	2018-06-20
Biconilog Antenna	ARA	LPB-2520/A	4318	2016-05-18	2018-05-18
Temperature/Humidity Logger	Extech Ins. Corp.	42270	5892	2017-04-06	2018-04-06
Pre- Amplifier	Hp	4387D		Monitored	

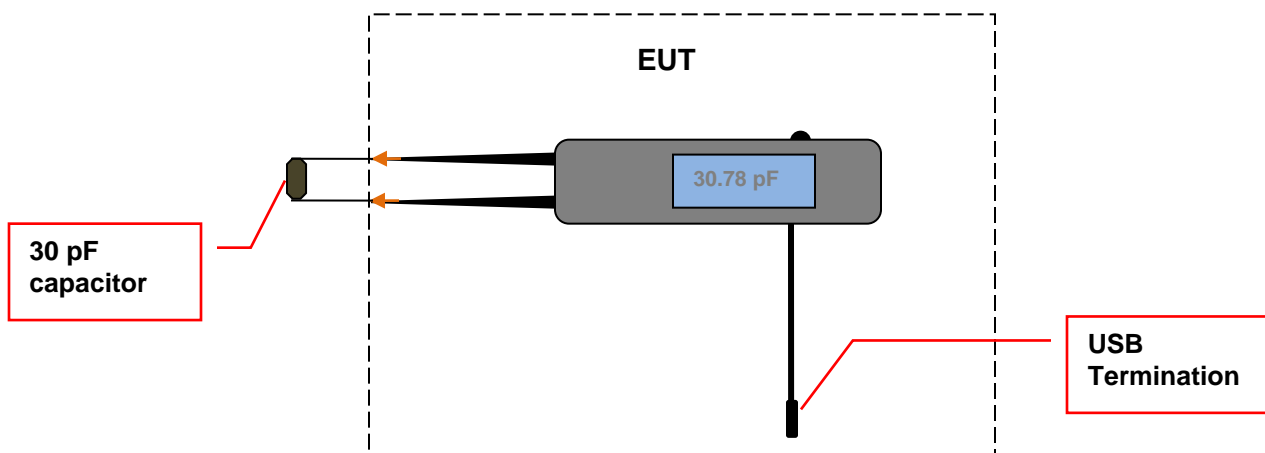
2.1.5 Test Sample Verification, Configuration & Modifications

Pre-Scan was performed at three axes to determine the position of the EUT that produces the worst emission. Compliance testing was performed with the EUT placed in the orientation of the worst emission.

In order to prevent the EUT from turning off during the compliance scan, a 30 pF capacitor was placed between the measuring tips of the EUT to simulate constant measurement. Also, the USB port was terminated by plugging in a USB adapter cable.

The EUT met the requirements without modification.

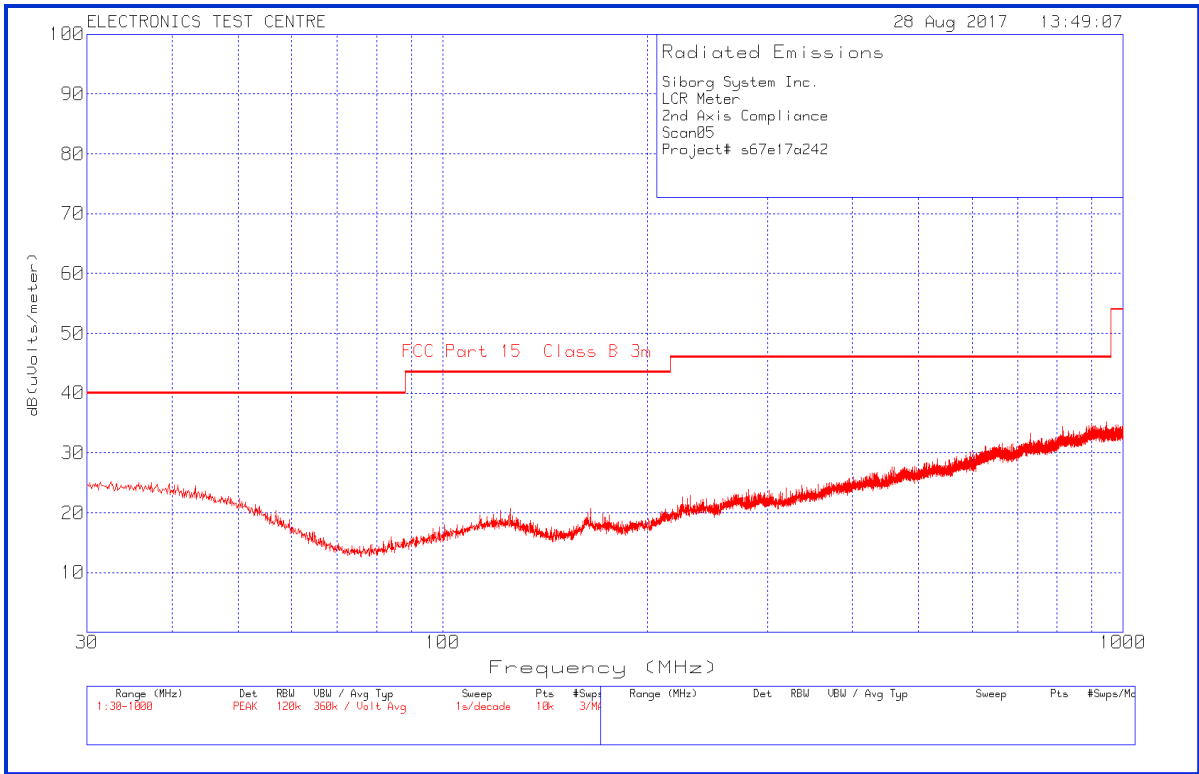
EUT configuration for Radiated Emissions testing:



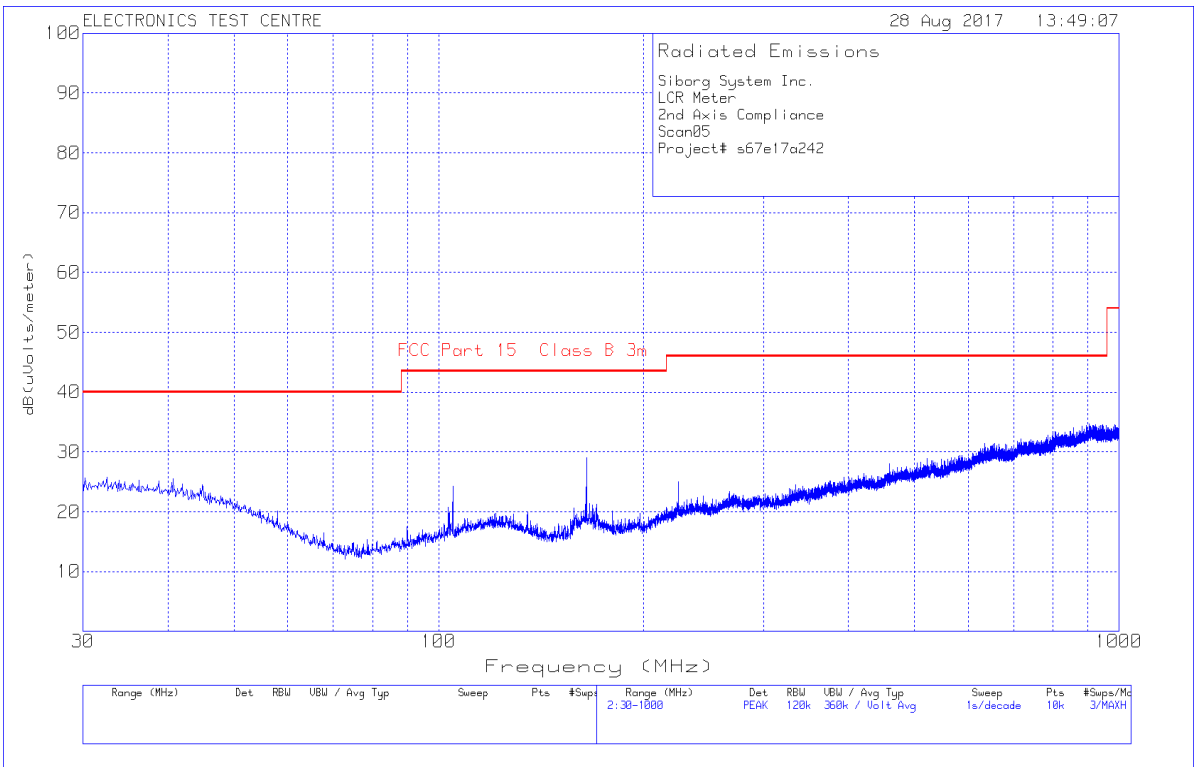
2.1.6 Radiated Emissions Data:

There were no peaks within 10 dB of the specified limits; hence no Quasi-Peak analysis was performed.

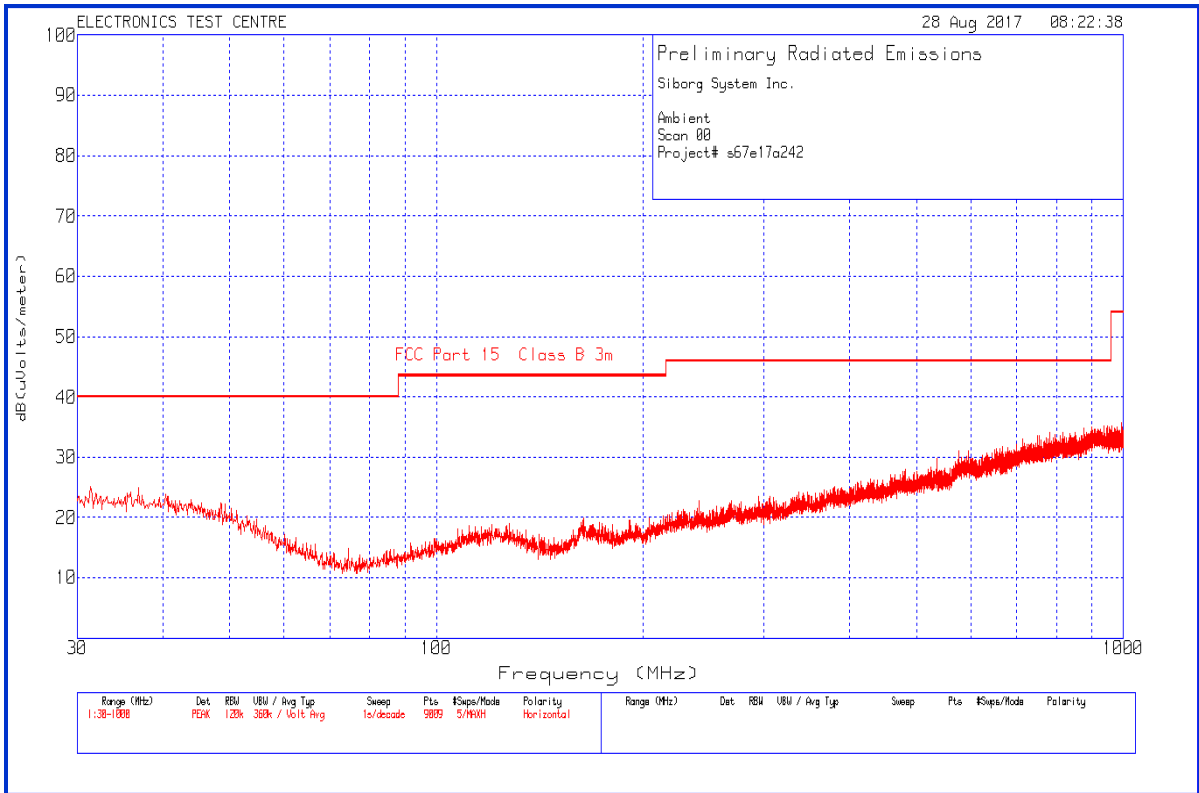
Plot of Radiated Emissions: Horizontal polarization



Plot of Radiated Emissions: Vertical polarization



Plot of Test Chamber Ambient: (measurement noise floor):



Plot of Test Chamber Ambient: (measurement noise floor):

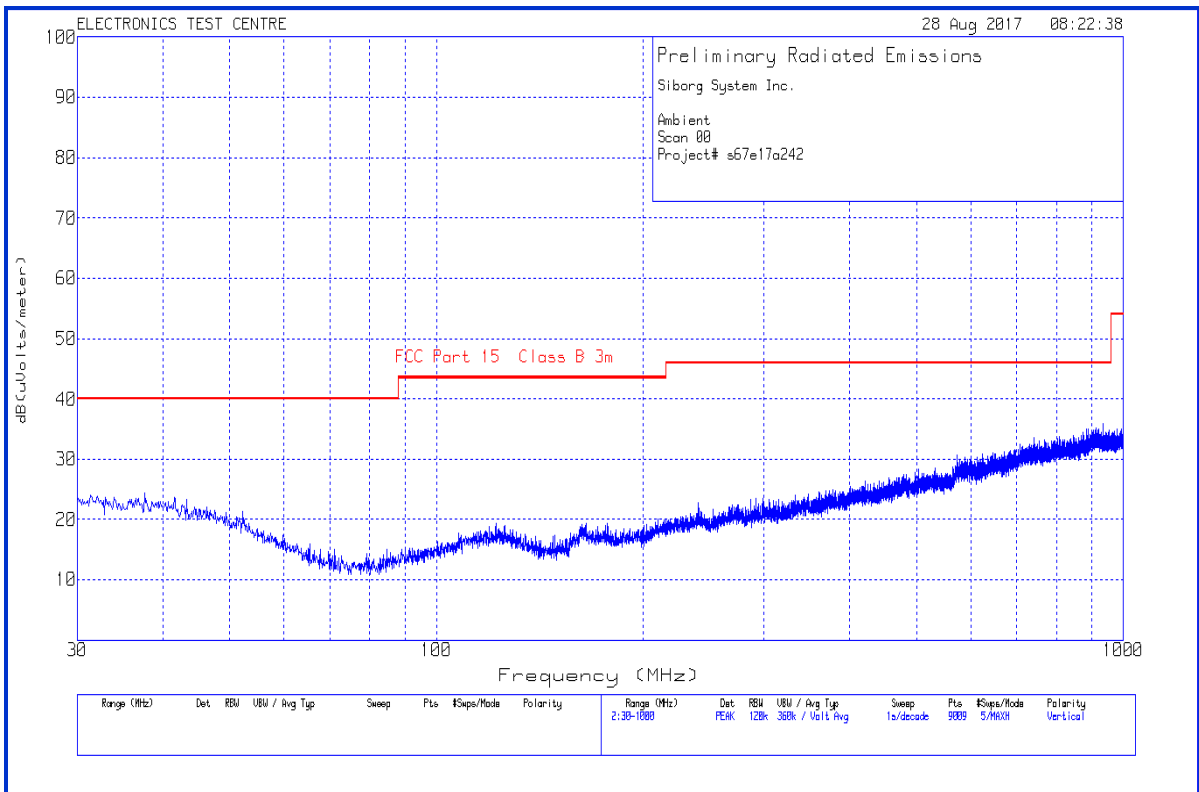
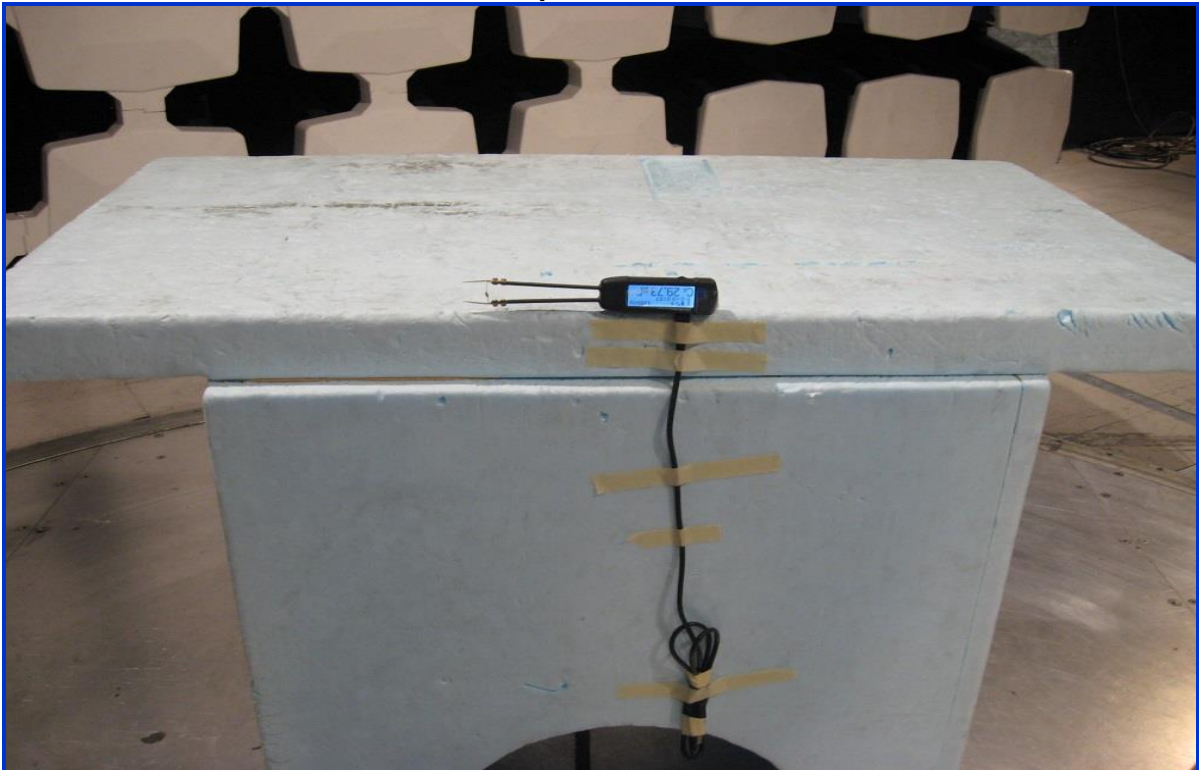


Photo of Radiated Emissions test setup:



Photo of Radiated Emissions test setup: EUT Orientation



3.0 TEST FACILITY

3.1 Location

The LCR-Reader MP was tested for emissions at the Electronics Test Centre laboratory located in Airdrie, Alberta, Canada. The Radio Frequency Semi Anechoic Chamber (RFSAC), identified as Chamber 1, has a usable working space measuring 10.6 m long x 7.3 m wide x 6.5 m high.

Measurements taken at this site are accepted by Industry Canada as evidence of conformity per registration file number 2046A. This site is also listed with the FCC under Registration Number CA2046.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment located in the Control Room. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in the Control Room, consisting of two shielded vestibules joined together at the side of the main room. Cables are routed through bulkhead panels between the rooms and the test chamber as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

Either floor mounted or table-top equipment can be tested at this facility.

3.2 Grounding Plan

The LCR-Reader MP was placed at the centre of the test chamber turntable on top of an 80-cm high polystyrene foam table. The EUT was not grounded, according to Siborg Systems Inc. specifications.

3.3 Power Supply

All EUT power was supplied by internal rechargeable battery.

3.4 Emissions Profile

Ambient emission profiles were generated throughout the tests and are included in the test data.

Appendix A: Test Sample Description

(Information provided by Siborg Systems Inc.)
LCR-Reader MP:

Quotation Number:		Project Number:	
Company Name : Siborg Susyems Inc		Contact Name : Michael Obrecht/ Brittany Turnbull	
Address : 24 Combermere Crescent, Waterloo, On N2L 5B1		Phone : 519-888-9906	
		Fax : 519-725-9522	
		E-mail : obrecht@siborg.ca	
Product Name:LCR-Reader MP		# of units to be tested : 1	
Part/Model # :LCRR-MP		Serial # (Critical) :	
Product Application		Designated Marketplaces	
Residential <input type="checkbox"/>		Canada <input type="checkbox"/> Other _____	
Industrial <input checked="" type="checkbox"/>		United States of America <input checked="" type="checkbox"/> _____	
Military <input type="checkbox"/>		European Union <input type="checkbox"/> _____	
		Is your product or system considered to be Controlled Good?	
		Yes <input type="checkbox"/>	
		No <input checked="" type="checkbox"/>	
GENERAL INFORMATION REQUIRED FOR ALL PRODUCTS			
Dimensions (L x W x H) 18x3x1.5 cm		Weight: 0.06 kgs.	
		Engineering Evaluation? YES <input type="checkbox"/> NO (compliance test only) <input checked="" type="checkbox"/>	
If compliance testing, to what standards?			
Regulatory Compliance testing:		For: FCC <input checked="" type="checkbox"/> Industry Canada <input type="checkbox"/> Other <input type="checkbox"/> Specify: _____	
Yes: <input checked="" type="checkbox"/> No: <input type="checkbox"/>		ETC to do the submission? YES <input type="checkbox"/> NO <input type="checkbox"/>	
Power Requirements: (A DC powered device that is sold with an AC/DC adaptor is considered to be AC powered for emissions testing purposes.)		AC (incl wall wart) <input type="checkbox"/> Voltage: VAC # of AC phases: ____ Current: ____ Amps Frequency: ____ Hz	
		DC <input checked="" type="checkbox"/> External <input type="checkbox"/> Internal Battery <input checked="" type="checkbox"/> Voltage: 4 VDC Current: 0.005 Amps	
Duration of self-test : 1 sec		Fault Recovery Time: _____ Reaction Time (delay between fault & alarm): _____	
Product Intended Application		LCR-meter, Voltage meter, frequency meter	
Product Deployment Environments			
Operating Modes in the Field		Auto, L-C-R, Diode, Volrage, Frequency meter	
Peripheral and/or Support Equipment to Monitor and Operate the Product (to be supplied by client):			
Description of interconnecting leads & cables (Attach separate sheet, if required)		Cable 1 N/A	
Type: Connectors: Terminations : Shielding: Length:		Cable 2	
		Cable 3	
		Cable 4	
List of internally generated frequencies: Crystal / Oscillator / Switcher / LO		100, 1000, 10000, 100000 Hz	
Typical installation and operating instructions/configuration to expedite EUT set-up (Attach a Separate sheet, if required)		Follow menu instructions, in Auto mode simply connect to the measured component	

Brief Functional description of Product including System Block Diagram (Attach a Separate sheet, if required)	
Any additional information?	

WIRELESS PRODUCT INFORMATION

Type of Radio Device (check all applicable Equipment Configurations)							
Intentional transmitter	<input type="checkbox"/>	Receiver	<input type="checkbox"/>	Transceiver	<input type="checkbox"/>		
Type of Radio Operating License							
Unlicensed Personal Communication	<input type="checkbox"/>	Unlicensed National Information Infrastructure	<input type="checkbox"/>	Ultra-Wideband Operation	<input type="checkbox"/>	Licensed	<input type="checkbox"/>
Type of Modulation of Radio Device							
CDMA	<input type="checkbox"/>	TDMA	<input type="checkbox"/>	Other	<input type="checkbox"/>		
Spread Spectrum Technology	<input type="checkbox"/>	Direct sequencer	<input type="checkbox"/>	Frequency hopper	<input type="checkbox"/>		
Transmitter Power Output :				Emission Designator :			
Information on Radio Frequencies							
Transmitter Operating Frequency(s) & Bandwidth							
Transmitter Channel Frequencies & separations (If required, attach a separate sheet)							
Receiver Operating Frequency(s) & Bandwidth							
Receiver Channel Frequencies & separations (If required, attach a separate sheet)							
Information on Antenna(s)							
Is the antenna removable?	YES <input type="checkbox"/>	NO <input type="checkbox"/>	Antenna Connector Type :			Number of Antennas :	
Gain of Each Antenna (and tolerance)							
Activity and State of Digital Circuitry during ON Time							
Radio Transmission Type							
Continuous	<input type="checkbox"/>	Intermittent	<input type="checkbox"/>	ON Time/ OFF Time :			
Activity and State of Digital Circuitry during OFF Time							

Pre-Approved Radio Systems & Sub-Assemblies		
FCC ID:	Grantee Code:	Approval Agency /TCB:
Software changes to the Pre-Approved Equipment?		
Software additions to the Pre-Approved Equipment		
Hardware changes to the Pre-Approved Equipment?		
Hardware additions to the Pre-Approved Equipment?		
Prepared By:	Title:	Date:

End of Document