



## Test Report

Prepared for: Blackboard, Inc.

Model: PS4101

Description: Contactless Card Reader

To

FCC Part 15.225

Date of Issue: October 29, 2012

On the behalf of the applicant:

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Attention of:

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Project Test Engineer

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### Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	10/29/12	John Erhard	Original Document
2.0	12/14/12	John Erhard	Add additional AC Conducted Emissions test data



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The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



**FCC OATS Reg, #933597**

**IC Reg. #2044A-1**

**Non-accredited tests contained in this report:**

**N/A**



**The applicant has been cautioned as to the following:**

15.21 Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator the responsible part may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.



**Standard Test Conditions Engineering Practices**

Except as noted herein, the following conditions and procedures were observed during the testing.

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (° C)	Humidity (%)	Pressure (mbar)
25.30	28.70	974.300

**EUT Description**

**Model:** PS4101

**Description:** Contactless Card Reader

**Firmware:** N/A

**Software:** N/A

**Additional Information:**

The EUT is a USB powered RFID card reader

**EUT Operation during Tests**

The EUT was operating in a test mode whereby the transmitter was in a continuous operating state.

**Accessories: AC / DC Power Adapter**

Qty	Type	Make, Model	S/N
1	AC to USB	PHIHONG – PSM03A-050Q3	

**Cables: None**

**Modifications: None**



### Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.225(a)	Fundamental Field Strength	Pass	
15.225(b)(c)(d)	Out of Band Spurious Emissions	Pass	
15.225(e)	Frequency Stability	Pass	
12.209	Radiated Emissions	Pass	
12.207	Conducted Powerline Emissions	Pass	
RSS-210	99% Occupied Bandwidth	Pass	

#### 15.203: Antenna Requirement:

- The antenna is permanently attached to the EUT
- The antenna uses a unique coupling
- The EUT must be professionally installed
- The antenna requirement does not apply



**Field Strength**

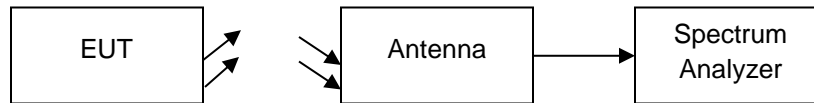
**Name of Test:** Field Strength  
**Specification:** 15.225(a)(b)(c)

**Engineer:** John Erhard  
**Test Date:** 10/29/2012

**Test Procedure**

The EUT was tested at a distance of 1 meter from the receiving loop antenna and characterized to the 30 meter limit. A spectrum analyzer was used to verify that the EUT met the requirements for Fundamental Field Strength. The antenna correction and distance correction factors were summed with the quasi-peak measurement to ensure accurate readings were obtained. The following table indicates the highest emission in each of the indicated bands.

**Test Setup**



**Field Strength**

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBuV/m)	Distance CF (dB)	Antenna CF (dB)	Corrected Measurement (dBuV/m)	Limit (dBuV/m)	Result
13.110_13.410	13.404	57.08	59.1	17.8	-19.82	40.51	Pass
13.410_13.553	13.553	68.01	59.1	17.8	-8.89	50.47	Pass
13.553_13.567	13.55958	79.94	59.1	17.8	3.04	84.00	Pass
13.567_13.710	13.567	66.78	59.1	17.8	-10.12	50.47	Pass
13.710_14.010	13.7715	56.7	59.1	17.8	-20.2	40.51	Pass

Note: Cable correction factors are not included in this measurement as the low loss of the high quality TWINAX cable at low frequencies is practically non-existent.





### Frequency Stability

**Name of Test:** Frequency Stability

**Engineer:** John Erhard

**Specification:** 15.225(e)

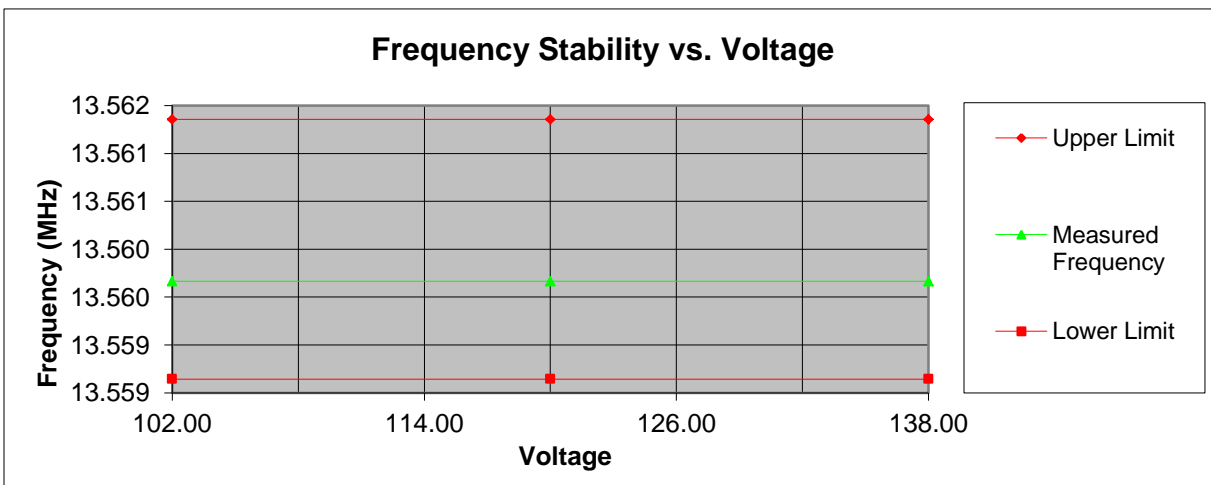
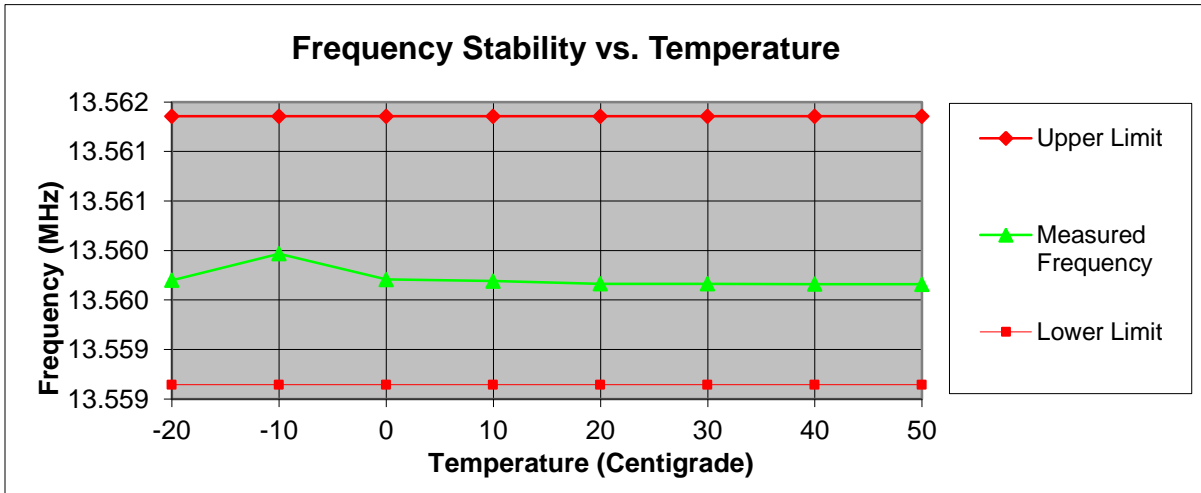
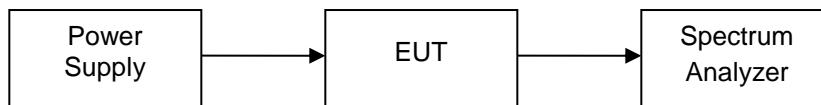
**Test Date:** 10/29/2012

### Test Procedure

The EUT was placed in an environmental test chamber and a spectrum analyzer was utilized to verify that the frequency stability met the requirement for frequency stability across the temperature range from -20°C to +50°C. A variable power supply was used to vary the voltage from 85% to 115% of the rated voltage.

Tuned Frequency = 13.56 MHz  
Limit = 0.01%  
Upper Limit = 13.5613560 MHz  
Lower Limit = 13.5586440 MHz

### Test Setup





**Radiated Emissions**

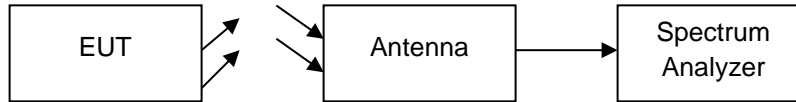
**Name of Test:** Radiated Emissions  
**Specification:** 15.209

**Engineer:** John Erhard  
**Test Date:** 10/30/2012

**Test Procedure**

The EUT was tested on an Open Area Test Site (OATS) at a distance of 3 meters from the receiving antenna. A spectrum analyzer was used to verify that the UUT met the requirements for Radiated Emissions. The spectrum for each tuned frequency was examined beyond the 10<sup>th</sup> harmonic.

**Test Setup**



**Radiated Emissions**

Emission Freq (MHz)	Measured Value (dBuV/m)	Correction Factor (dB)	Corrected Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarity (V/H)	Antenna Height (cm)	Turntable Position (degrees)
69.500	23.130	7.096	30.226	40.000	-9.774	V	102	13
188.900	13.430	10.734	24.164	43.500	-19.336	V	102	13
304.500	20.330	15.374	35.704	46.000	-10.296	V	102	13
450.250	5.250	19.093	24.343	46.000	-21.657	V	102	13
674.100	6.160	22.727	28.887	46.000	-17.113	V	102	13
906.400	5.310	26.048	31.358	46.000	-14.642	V	102	13

Note: There were no detectable emissions. All measurements are system noise floor.



### Powerline Conducted Emissions

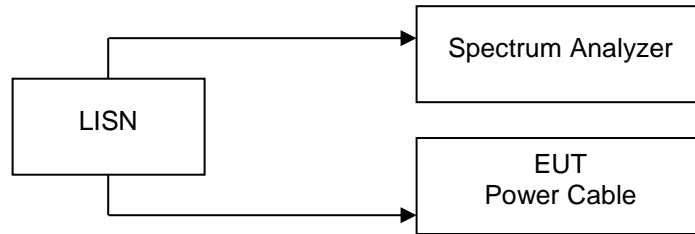
**Name of Test:** Powerline Conducted Emissions  
**Specification:** 15.207

**Engineer:** John Erhard  
**Test Date:** 10/30/2012

#### Test Procedure

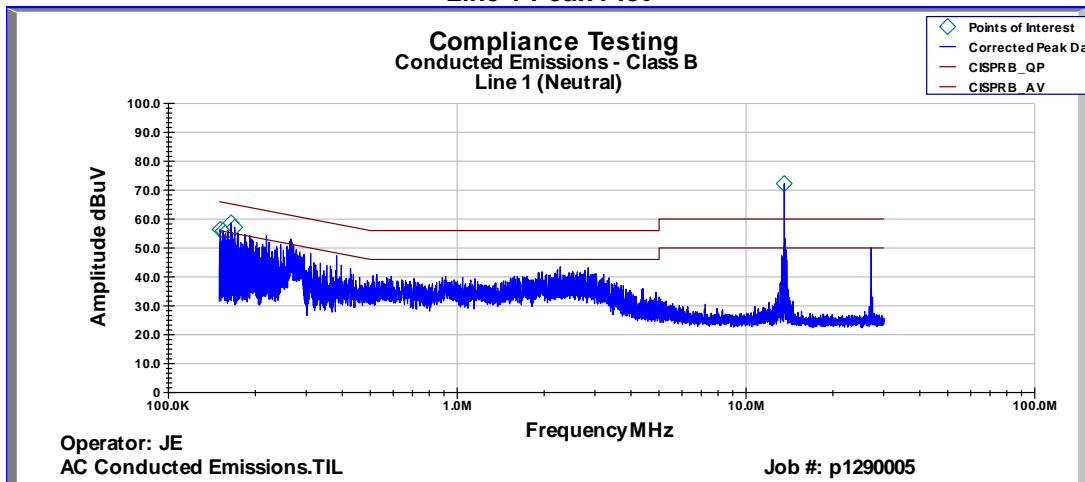
The EUT power cable connected to a LISN and the monitored output of the LISN was connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were monitored and compared to the specification limits. The average measurements were the worst case and are recorded in the tables below.

#### Test Setup

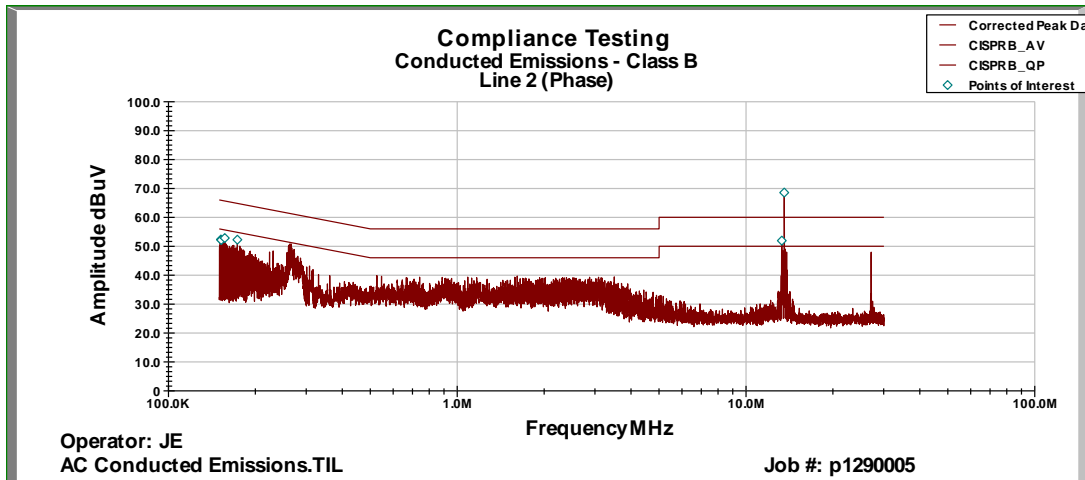


#### Test Data with antenna attached

##### Line 1 Peak Plot



##### Line 2 Peak Plot





**Line 1 Neutral AVG Detector**

Frequency	Measured Value (dBuV)	LISN Corr. Fact (dB)	Cable Loss (dB)	Attenuator (dB)	Final Data (dBuV)	Limit (dBuV)	Margin (dB)
13.56 MHz	61.12	0.00	0.180	10.200	71.504	50.000	21.504
168.67 KHz	27.14	0.20	0.020	10.113	37.471	55.467	-17.995
154.18 KHz	27.95	0.26	0.020	10.200	38.427	55.881	-17.453
152.52 KHz	28.25	0.27	0.020	10.200	38.749	55.928	-17.179
151.37 KHz	28.35	0.29	0.020	10.200	38.857	55.961	-17.104
150.49 KHz	28.65	0.30	0.020	10.200	39.161	55.986	-16.826

**Line 2 Phase AVG Detector**

Frequency	Measured Value (dBuV)	LISN Corr. Fact (dB)	Cable Loss (dB)	Attenuator (dB)	Final Data (dBuV)	Limit (dBuV)	Margin (dB)
13.56 MHz	63.25	0.00	0.180	10.200	73.627	50.000	23.627
13.296 MHz	25.31	0.00	0.180	10.200	35.690	50.000	-14.310
156.24 KHz	27.01	0.24	0.020	10.200	37.465	55.822	-18.357
155.91 KHz	27.41	0.24	0.020	10.200	37.871	55.831	-17.961
154.24 KHz	27.68	0.26	0.020	10.200	38.162	55.879	-17.717
150.4 KHz	27.94	0.30	0.020	10.200	38.454	55.989	-17.535

**Line 1 Neutral QP Detector**

Frequency	Measured Value (dBuV)	LISN Corr. Fact (dB)	Cable Loss (dB)	Attenuator (dB)	Final Data (dBuV)	Limit (dBuV)	Margin (dB)
13.56 MHz	61.084	0.000	0.180	10.200	71.464	60.000	11.464
168.67 KHz	34.987	0.200	0.020	10.113	45.320	65.467	-20.147
154.18 KHz	36.216	0.258	0.020	10.200	46.694	65.881	-19.187
152.52 KHz	36.477	0.275	0.020	10.200	46.972	65.928	-18.957
151.37 KHz	36.207	0.286	0.020	10.200	46.713	65.961	-19.248
150.49 KHz	36.997	0.295	0.020	10.200	47.512	65.986	-18.474

**Line 2 Phase 2 QP Detector**

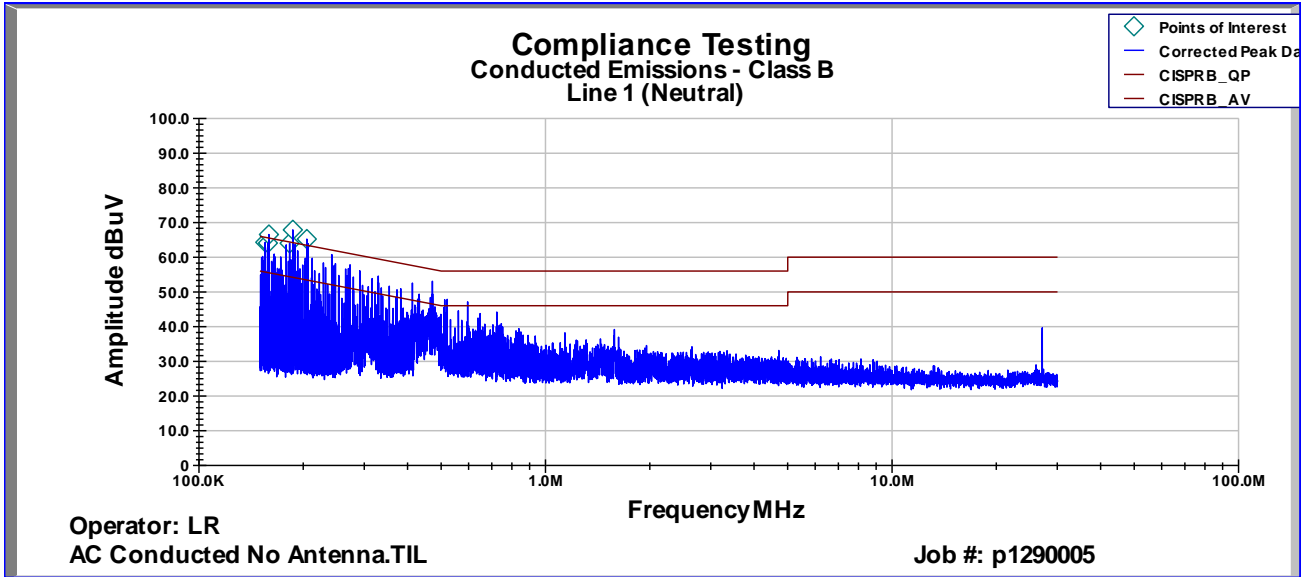
Frequency	Measured Value (dBuV)	LISN Corr. Fact (dB)	Cable Loss (dB)	Attenuator (dB)	Final Data (dBuV)	Limit (dBuV)	Margin (dB)
13.56 MHz	68.39	0.00	0.180	10.200	78.767	60.000	18.767
13.296 MHz	36.75	0.00	0.180	10.200	47.133	60.000	-12.867
156.24 KHz	35.77	0.24	0.020	10.200	46.231	65.822	-19.590
155.91 KHz	35.95	0.24	0.020	10.200	46.412	65.831	-19.420
154.24 KHz	36.21	0.26	0.020	10.200	46.687	65.879	-19.192
150.4 KHz	35.85	0.30	0.020	10.200	46.362	65.989	-19.627

Note: There is an FCC exclusion band for 13.56 MHz active transmitters. KDB 174176 and ANSI C63.10 allow substitution of the Radiating antenna with a Dummy Load for performing AC Conducted emissions in the fundamental frequency band.

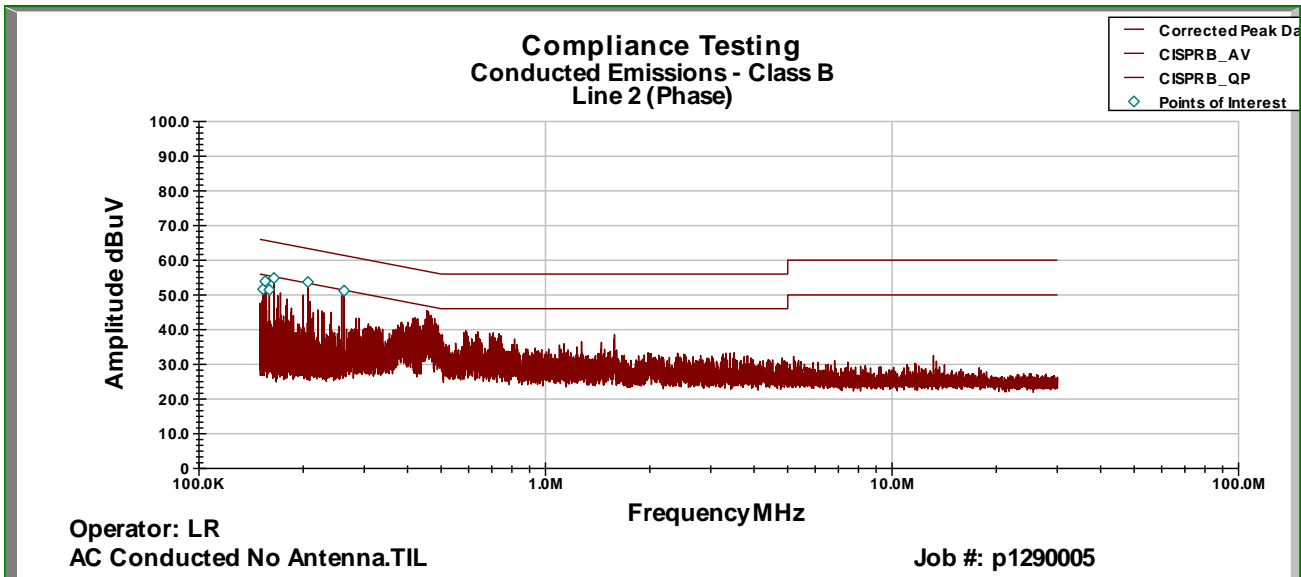


Test Data with antenna replaced by a dummy load

Line 1 Peak Plot



Line 2 Peak Plot





**Line 1 Neutral AVG Detector**

Frequency (KHz)	Measured Value (dBuV)	LISN Corr. Fact (dB)	Cable Loss (dB)	Attenuator (dB)	Final Data (dBuV)	Limit (dBuV)	Margin (dB)
203.29	21.36	0.20	0.020	10.100	31.680	54.477	-22.797
197.88	21.84	0.20	0.020	10.100	32.156	54.632	-22.476
183.99	23.48	0.20	0.020	10.100	33.803	55.029	-21.226
169.06	27.45	0.20	0.020	10.109	37.778	55.455	-17.678
163.42	24.27	0.20	0.020	10.166	34.653	55.617	-20.964
155.99	24.92	0.24	0.020	10.200	35.375	55.829	-20.453

**Line 2 Phase AVG Detector**

Frequency (KHz)	Measured Value (dBuV)	LISN Corr. Fact (dB)	Cable Loss (dB)	Attenuator (dB)	Final Data (dBuV)	Limit (dBuV)	Margin (dB)
272.53	21.53	0.16	0.024	10.100	31.814	52.499	-20.685
195.3	21.51	0.20	0.020	10.100	31.830	54.706	-22.875
171.82	22.71	0.20	0.020	10.100	33.032	55.377	-22.345
165.16	22.91	0.20	0.020	10.148	33.282	55.567	-22.285
155.54	22.54	0.24	0.020	10.200	33.003	55.842	-22.839
154.51	22.06	0.25	0.020	10.200	32.537	55.871	-23.334

**Line 1 Neutral QP Detector**

Frequency (KHz)	Measured Value (dBuV)	LISN Corr. Fact (dB)	Cable Loss (dB)	Attenuator (dB)	Final Data (dBuV)	Limit (dBuV)	Margin (dB)
203.29	26.879	0.198	0.020	10.100	37.197	64.477	-27.280
197.88	28.735	0.200	0.020	10.100	39.055	64.632	-25.577
183.99	28.851	0.200	0.020	10.100	39.171	65.029	-25.858
169.06	36.870	0.200	0.020	10.109	47.199	65.455	-18.256
163.42	34.185	0.200	0.020	10.166	44.571	65.617	-21.046
155.99	33.791	0.240	0.020	10.200	44.251	65.829	-21.578

**Line 2 Phase 2 QP Detector**

Frequency (KHz)	Measured Value (dBuV)	LISN Corr. Fact (dB)	Cable Loss (dB)	Attenuator (dB)	Final Data (dBuV)	Limit (dBuV)	Margin (dB)
272.53	26.35	0.16	0.024	10.100	36.639	62.499	-25.860
195.3	26.14	0.20	0.020	10.100	36.459	64.706	-28.247
171.82	30.31	0.20	0.020	10.100	40.630	65.377	-24.747
165.16	29.17	0.20	0.020	10.148	39.539	65.567	-26.028
155.54	29.99	0.24	0.020	10.200	40.455	65.842	-25.386
154.51	30.18	0.25	0.020	10.200	40.651	65.871	-25.220

Note: There is an FCC exclusion band for 13.56 MHz active transmitters.



### 99% Occupied Bandwidth

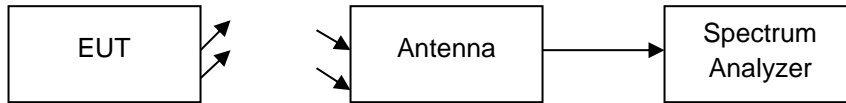
**Name of Test:** 99% Occupied Bandwidth  
**Specification:** RSS 210 Industry Canada Only

**Engineer:** John Erhard  
**Test Date:** 10/30/2012

#### Test Procedure

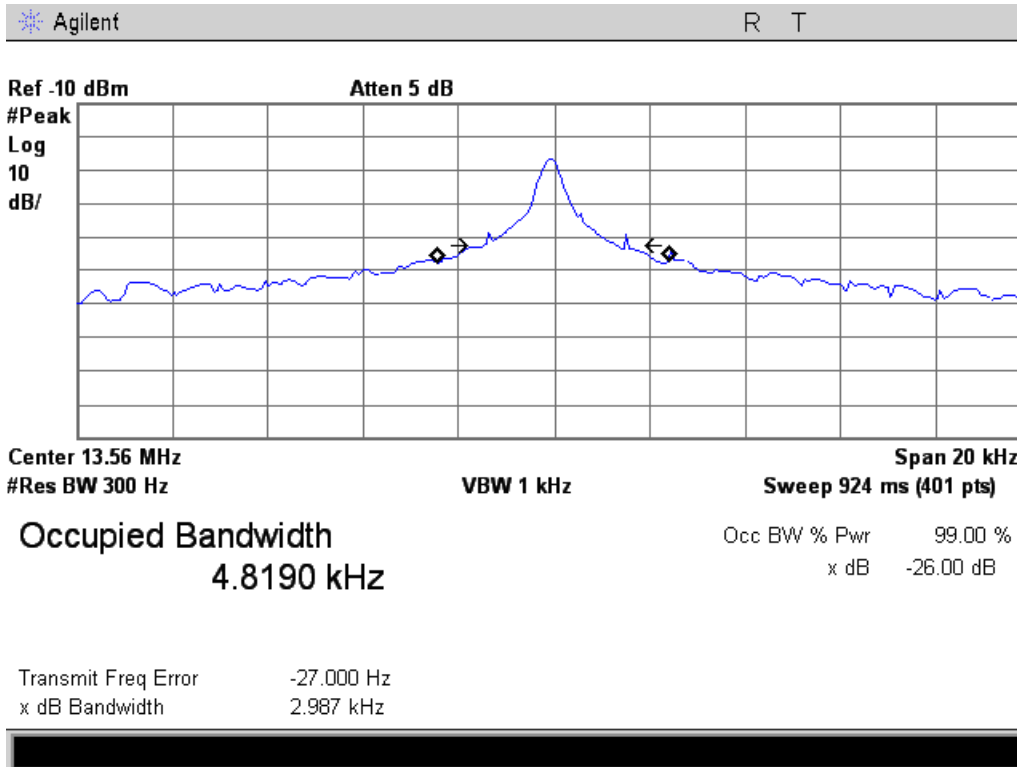
The EUT was tested on an anechoic chamber at a distance of 1 meter from the receiving loop antenna. A spectrum analyzer was used to measure the 99% occupied bandwidth.

#### Test Setup



#### 99% Bandwidth Summary

Frequency (MHz)	Recorded Measurement (kHz)	Result
13.56	4.819	Pass





### Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Temperature Chamber	Tenney	Tenney Jr	i00027	Verified on: 8/31/12	
Bi-Log Antenna	Schaffner	CBL611C	i00267	12/19/11	12/19/13
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	11/5/11	11/5/12
Voltmeter	Fluke	87III	i00319	7/3/12	7/3/13
Spectrum Analyzer	Agilent	E4407B	i00331	4/20/12	4/20/13
Data Logger	Fluke	Hydra Data Bucket	i00343	12/15/11	12/15/12
Humidity / Temp Meter	Control Company	4189CC	i00355	1/11/12	1/11/13
EMI Receiver	HP	8546A	i00033	12/20/11	12/20/12
Transient Limiter	Com-Power	LIT-930	i00123	Verified on:8/30/12	
Bilog Antenna	Schaffner	CBL6111C	i00267	12/19/11	12/19/13
LISN	FCC	FCC-LISN-50-32-2-01	i00270	9/30/10	9/30/12
AC Power Source	Behlman	BL 6000	i00362	Verified on:8/30/12	
Spectrum Analyzer	Agilent	E7405A	i00379	12/14/11	12/14/12
Labview Software	National Instruments	FCC_PART15AB_R2	i00395	Verified on:06/11	
Loop Antenna	Emco	6507	i00326	4/29/11	4/29/13

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT