Engineering and Testing for EMC and Safety Compliance

Certification Application Report
FCC Part 15.225 & Industry Canada RSS-210

Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. 360 Herndon Parkway Suite 1400 Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com	Phone: 703-689-0368 Fax: 703-689-2056 Web: www.rheintech.com	Sirit Technologies Inc. 1321 Valwood Parkway Suite 620 Carrollton, TX 75006 Web: www.sirit.com	Phone: 972-243-7208 Fax: 972-243-8034 Contact: Michael Koch E-Mail: mkoch@sirit.com

FCC ID/ IC:	M4ZPNPSDIO/ 3637B-PNPSDIO	**Test Report Date:**	August 11, 2006
Platform:	N/A	**RTL Work Order #:**	2006113
Model Name/Model #:	PnP SDIO RFID Reader/ PnP SDIO	**RTL Quote #:**	QRTL06-316

American National Standard Institute:	ANSI C63.4-2003: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
FCC Classification:	DXX – Part 15 Low Power Communication Device Transmitter
FCC Rule Part(s):	FCC Rules Part 15.225 (10-01-05): Operation within the band 13.110-14.010 MHz
Industry Canada:	RSS-210: Low Power License-Exempt Communications Devices
Digital Interface Information	Digital Interface was found to be compliant

Frequency Range (MHz)	Output Power (W)	Frequency Stability (%)	Emission Designator
13.56	0.000000613*	0.001	14K0F1D

* power reported is peak EIRP

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, ANSI C63.4, and Industry Canada RSS-210.

Signature: _____ Date: August 11, 2006

Typed/Printed Name: Desmond A. Fraser Position: President

Table of Contents

Figure Index

Table Index

Plot Index

Appendix Index

Photograph Index

1 General Information

1.1 Scope

Applicable Standards:

- FCC Rules Part 15.225; Operation within the band 13.110-14.010 MHz
- Industry Canada RSS-210: Low Power License-Exempt Communications Devices

1.2 Description of EUT

Equipment Under Test	
Model Name/#	PnP SDIO RFID Reader/PnP SDIO
Power Supply	Powered by 3.3 VDC from SD I/O connector
Modulation Type	FSK, FM
Frequency	13.56 MHz
Antenna Connector Type	Internally hardwired
Antenna Types	Magnetic Loop

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.4 Related Submittal(s)/Grant(s)

This is an original application for certification for Sirit Technologies Inc. Model #: PnP SDIO, FCC ID: M4ZPNPSDIO, IC: 3637B-PNPSDIO.

1.5 Modifications

No modifications were required to achieve compliance.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m) the following frequency was tested:

Table 2-1: Channels Tested

Frequency (MHz)
13.56

2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to transmit continuously during testing. The carrier was also checked to verify that information was being transmitted. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.225)

Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.225(a)	Maximum Peak Power Output	Pass
FCC 15.225(e)	Frequency Stability	Pass

2.4 Test System Details

The test sample was received on August 7, 2006. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables.

Table 2-3: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
RFID SD	Sirit Technologies Inc.	PnP SDIO RFID Reader	N/A	M4ZPNPSDIO	N/A	17424
RFID SD	Sirit Technologies Inc.	PnP SDIO RFID Reader	N/A	M4ZPNPSDIO	N/A	17426
A/C Adapter	Delta Electronics, Inc.	EADP-10BB	592A4029SO0FN	N/A	1.9 m unshielded power	17423
Pocket PC	Hewlett Packard	iPAQ hx4700 series	TWC5150984	NMBROADSTER	N/A	17428
Cradle	Hewlett Packard	HSTNH-F02X	CT:E8760AZDR203H	N/A	1.2 m shielded USB	17427

2.5 Configuration of Tested System

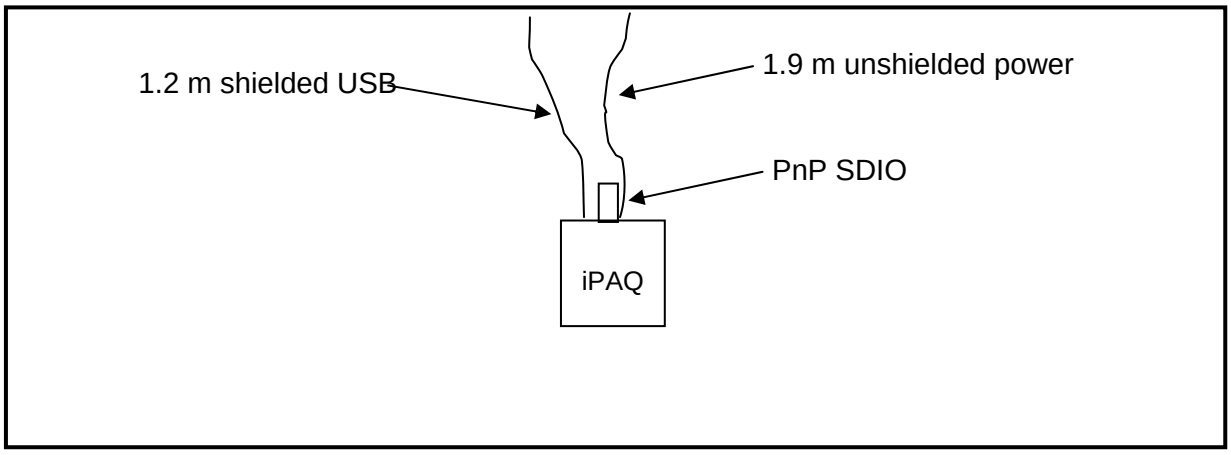


Figure 2-1: Configuration of System Under Test

3 Peak Output Power - §15.225(a); RSS-210 §A2.6

3.1 Power Output Test Procedure

A radiated power measurement of the EUT was taken using a loop antenna and Agilent spectrum analyzer at 3 m. The device was rotated 360° and the antenna polarized in three orthogonal positions. The power was converted from a 30 m distance to a 3 m distance using the inverse square method, or 40log(30/3) = 40 dB, was added to the limit of 15,848 uV/m or 84 dBuV/m which is 124 dBuV/m; a 20 dB offset was used as the site factor at this frequency (reference OBW plot).

Table 3-1: Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer	US44020346	11/2/06
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	8/25/06

3.2 Power Output Test Data

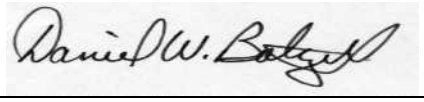
Table 3-2: Power Output Test Data

Frequency (MHz)	Peak EIRP (dBuV/m)	Peak EIRP (uW)
13.56	63.1	0.613

§15.225 Operation within the band 13.110–14.010 MHz.

(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.

Test Personnel:



Daniel W. Baltzell		August 7, 2006
EMC Test Engineer	Signature	Date Of Test

4 Frequency Stability – FCC §15.225(e); IC RSS-210 §A2.6, §2.1

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20° to +50° 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° C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.1 Test Procedure

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -20°C to +50°C.

The temperature was initially set to -20°C and a 1-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10°C through the range. A ½ hour period was observed to stabilize the EUT at each measurement step, and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal input voltage.

The worst-case test data are shown below in Table 4-1 and Table 4-2.

Table 4-1: Temperature Frequency Stability

Temperature (°C)	Relative to 20°C	% difference	Limit (+/- 0.01%)	Margin (%)
-20	13.55987932	-0.00089	0.01	-0.01
-10	13.56009129	0.00067	0.01	-0.01
0	13.56005263	0.00039	0.01	-0.01
10	13.56002363	0.00017	0.01	-0.01
20	13.56000000	0.00000	0.01	-0.01
30	13.56000077	0.00001	0.01	-0.01
40	13.55999596	-0.00003	0.01	-0.01
50	13.55999561	-0.00003	0.01	-0.01

Plot 4-1: Temperature Stability

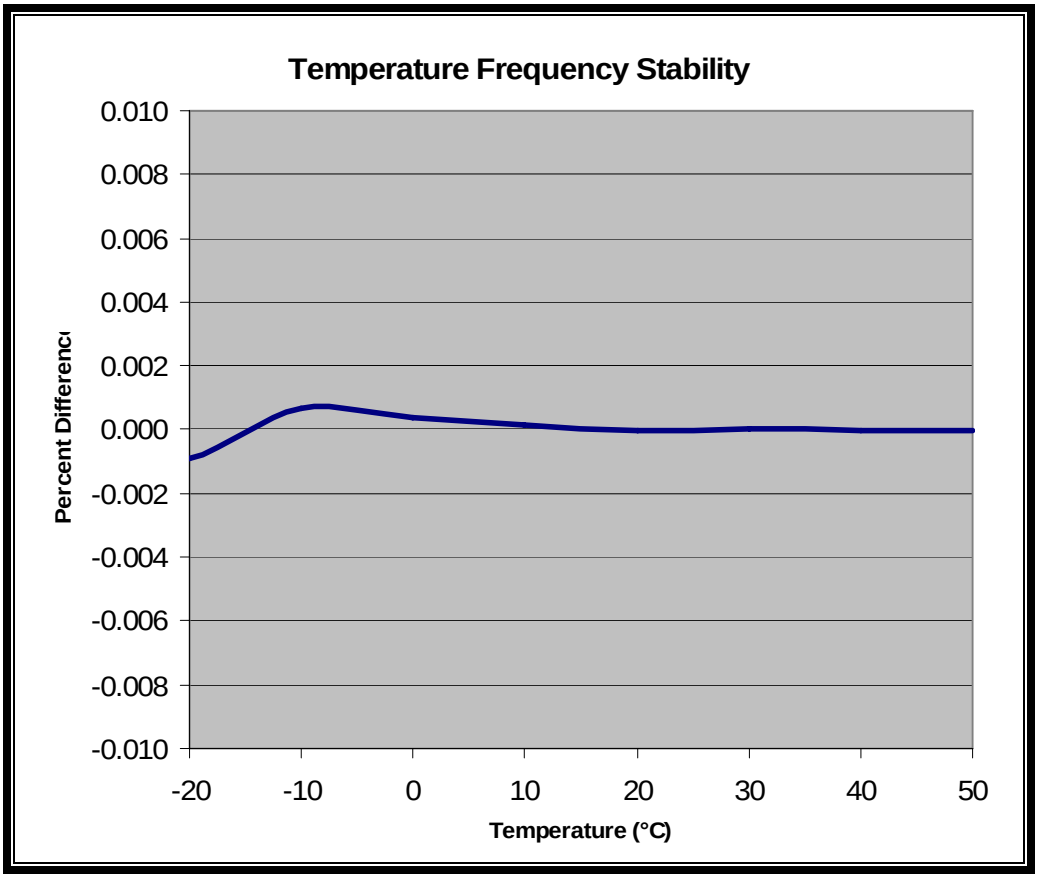


Table 4-2: Test Equipment for Testing Frequency Stability

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	1/20/07
901300	Agilent	53131A (225 MHz)	Universal Frequency Counter	MY40001345	11/23/06
N/A	Hewelett Packard	6024A	Power Supply	N/A	N/A
901247	Wavetek	DM25XT	Multimeter	40804098	12/7/06

Test Personnel:

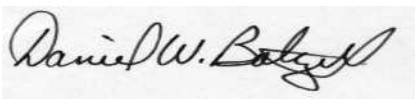
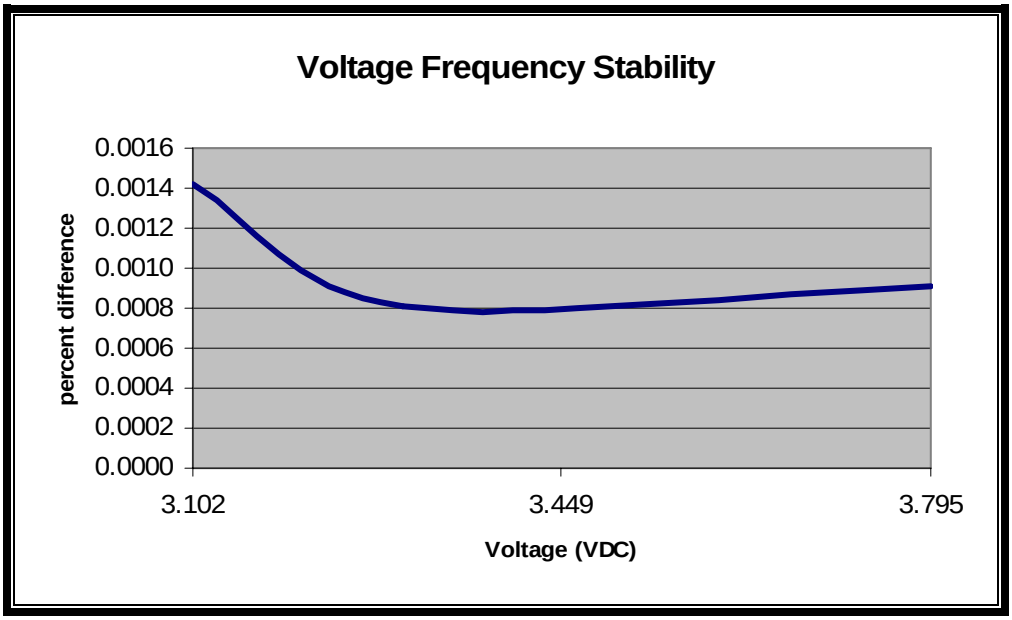
Daniel W. Baltzell		August 10, 2006
Test Engineer	Signature	Dates Of Test

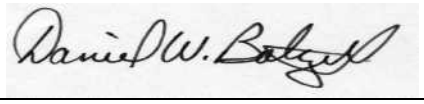
Table 4-3: Voltage Frequency Stability

Voltage (VDC)	Frequency Measured (MHz)	% Error	Limit (%)	Margin (%)
3.102	13.56019198	0.0014	0.01	-0.0086
3.300	13.56010988	0.0008	0.01	-0.0092
3.795	13.56012360	0.0009	0.01	-0.0091

Plot 4-2: Voltage Stability



Test Personnel:

Daniel W. Baltzell		August 11, 2006
Test Engineer	Signature	Dates Of Test

5 20 dB Bandwidth – IC RSS-210 §A2.6; RSS-Gen

5.1 20 dB Bandwidth Test Procedure

The minimum 20 dB bandwidths were measured using a 50-ohm spectrum analyzer. The carrier was adjusted on the analyzer so that it was displayed entirely on the spectrum analyzer. The sweep time was set to auto with the max hold function used in peak detector mode. The resolution bandwidth was set to 9 kHz, and the video bandwidth set at 30 kHz

Table 5-1: 20 dB Bandwidth Test Equipment

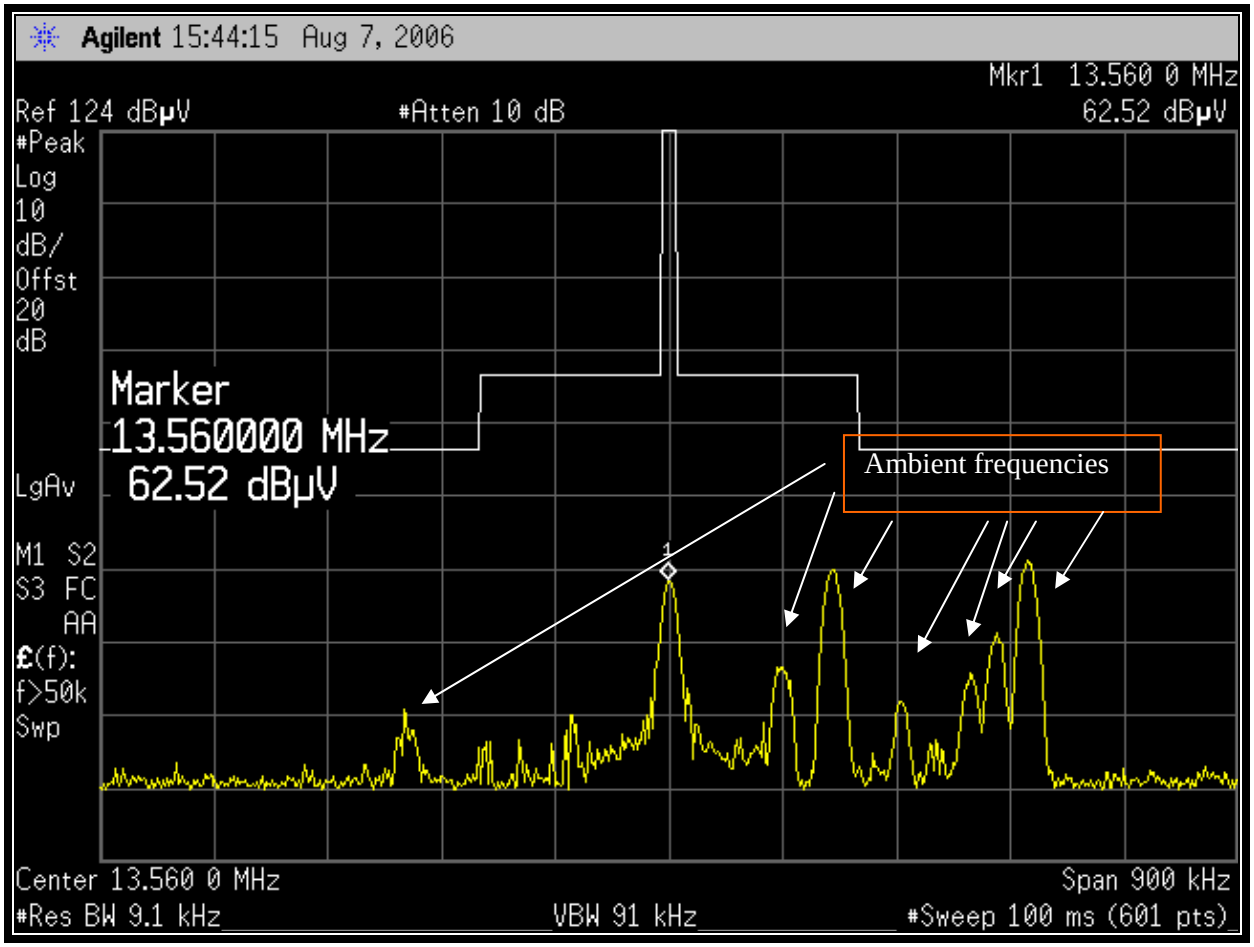
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer	US44020346	11/2/06
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	8/25/06

5.2 20 dB Modulated Bandwidth Test Data

Table 5-2: 20 db Bandwidth Test Data

Frequency (MHz)	20 dB Bandwidth (kHz)
13.56	14

Plot 5-1: Occupied Bandwidth



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	August 7, 2006
EMC Test Engineer	Signature	Date Of Test

6 Conducted Limits - §15.207; RSS-GEN

6.1 Test Methodology for Conducted Line Emissions Measurements

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 micro Henry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 150 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech Quality Manual, Section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

6.2 Conducted Line Emissions Test

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range in peak mode. If the conducted emissions exceed the average limits, the instrument set to the quasi-peak mode, then measurements are made in the average mode and these compared to the appropriate limits to determine a pass/fail criteria, the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and PHASE SIDE.

Table 6-1: Conducted Line Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	8/3/07
901084	AFJ international	LS16	16A LISN	16010020082	1/23/07

6.3 Conducted Line Emission Test Data

Table 6-2: Conducted Emissions (Neutral Side) Transmitting

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.152	Pk	50.8	0.2	51.0	65.9	-14.9	55.9	-4.9	Pass
0.175	Pk	46.8	0.2	47.0	65.3	-18.3	55.3	-8.3	Pass
0.301	Pk	38.2	0.3	38.5	61.7	-23.2	51.7	-13.2	Pass
0.351	Pk	36.6	0.2	36.8	60.3	-23.5	50.3	-13.5	Pass
0.375	Pk	35.9	0.3	36.2	59.6	-23.4	49.6	-13.4	Pass
1.745	Pk	32.6	0.6	33.2	56.0	-22.8	46.0	-12.8	Pass
13.560	Pk	44.5	2.0	46.5	60.0	-13.5	50.0	-3.5	Pass

Pk = Peak; Qp = quasi-peak; Av = Average

Table 6-3: Conducted Emissions (Phase Side) Transmitting

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.151	Pk	50.5	0.2	50.7	66.0	-15.3	56.0	-5.3	Pass
0.177	Pk	46.6	0.2	46.8	65.2	-18.4	55.2	-8.4	Pass
0.302	Pk	37.0	0.3	37.3	61.7	-24.4	51.7	-14.4	Pass
0.354	Pk	34.7	0.2	34.9	60.2	-25.3	50.2	-15.3	Pass
0.875	Pk	28.3	0.3	28.6	56.0	-27.4	46.0	-17.4	Pass
13.560	Pk	45.9	2.0	47.9	60.0	-12.1	50.0	-2.1	Pass

Pk = Peak; Qp = quasi-peak; Av = Average

7 Radiated Emissions - §15.209; RSS-210 §A2.6 and RSS-Gen

7.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1,000 MHz, the field strength limits are based on average detector, however the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB, under any circumstances of modulation.

7.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10^{th} harmonic of the highest fundamental transmitter frequency.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 7-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	8/25/06
901365	Miteq	JS4-00102600-41-5P	Amplifier, 15 V, 0.1-26 GHz, 28 dB gain, power 5 dB	1094152	3/24/07
900905	Rhein Tech Labs	PR-1040	OATS 1 Preamplifier 40 dB (30 MHz – 2 GHz)	1006	3/15/07
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901232	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	9/1/06
901235	IW Microwave Products	KPS-1503-360-KPS	High frequency RF cables	36"	9/1/06
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	8/3/07
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	8/3/07
900889	Hewlett Packard	85685A	RF Preselector (20 Hz - 2 GHz)	3146A01309	4/12/07
901413	Agilent	E4448A	Spectrum Analyzer	US44020346	11/2/06

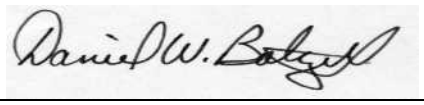
7.3 Radiated Emissions Test Results

7.3.1 Radiated Emissions - Digital

Table 7-2: Digital Radiated Emissions

Temperature: 71°F Humidity: 60%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB/m)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Pass/ Fail**
48.236	Qp	V	270	1.0	57.9	-20.9	37.0	40.0	-3.0	Pass
96.495	Qp	H	90	1.8	53.0	-18.3	34.7	43.5	-8.8	Pass
144.731	Qp	V	0	1.0	49.8	-16.8	33.0	43.5	-10.5	Pass
144.734	Qp	H	180	2.2	48.7	-16.8	31.9	43.5	-11.6	Pass
168.865	Qp	V	180	1.0	51.2	-17.7	33.5	43.5	-10.0	Pass
192.973	Qp	H	180	2.0	51.8	-18.2	33.6	43.5	-9.9	Pass
217.118	Qp	V	180	1.4	54.6	-17.2	37.4	46.0	-8.6	Pass
241.221	Qp	H	0	1.4	50.5	-15.5	35.0	46.0	-11.0	Pass
337.681	Qp	H	0	1.0	45.1	-12.2	32.9	46.0	-13.1	Pass
361.874	Qp	V	0	1.5	49.1	-11.4	37.7	46.0	-8.3	Pass
385.915	Qp	H	180	1.0	47.8	-10.8	37.0	46.0	-9.0	Pass
434.128	Qp	H	30	1.0	42.1	-8.9	33.2	46.0	-12.8	Pass
599.964	Qp	H	180	1.0	46.2	-5.7	40.5	46.0	-5.5	Pass
599.964	Qp	V	180	1.2	40.0	-5.8	34.2	46.0	-11.8	Pass

Test Personnel:



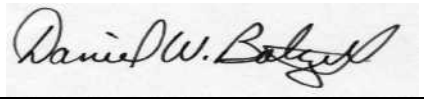
Daniel W. Baltzell		August 9, 2006
EMC Test Engineer	Signature	Date Of Test

7.3.2 Radiated Emissions Harmonics/Spurious

Table 7-3: Radiated Emissions Harmonics/Spurious

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.560	Qp	V	0	1	42.2	20.0	62.2	124.0	-61.8
13.560	Pk	V	0	1	43.1	20.0	63.1	144.0	-80.9
27.120	Qp	V	0	1	24.9	21.7	46.6	69.5	-22.9
27.120	Pk	V	0	1	27.6	21.7	49.3	89.5	-40.2
40.680	Qp	H	275	1.5	33.5	-16.4	17.1	40.0	-22.9
40.680	Pk	H	270	1.5	37.1	-16.4	20.7	60.0	-39.3
54.242	Qp	V	230	1.0	41.9	-22.4	19.5	40.0	-20.5
54.242	Pk	V	230	1.0	41.4	-22.4	19.0	60.0	-41.0
81.362	Qp	V	340	1.0	46.6	-21.3	25.3	40.0	-14.7
81.362	Pk	V	340	1.0	47.0	-21.3	25.7	60.0	-34.3
94.922	Qp	V	30	1.0	46.5	-17.8	28.7	43.5	-14.8
94.922	Pk	V	30	1.0	47.3	-17.8	29.5	63.5	-34.0
108.482	Qp	V	275	1.0	47.1	-16.1	31.0	43.5	-12.5
108.482	Pk	V	275	1.0	47.7	-16.1	31.6	63.5	-31.9
122.042	Qp	V	30	1.0	46.8	-15.5	31.3	43.5	-12.2
122.042	Pk	V	30	1.0	47.2	-15.5	31.7	63.5	-31.8
135.602	Qp	V	280	1.0	48.1	-16.2	31.9	43.5	-11.6
135.602	Pk	V	280	1.0	48.6	-16.2	32.4	63.5	-31.1

Test Personnel:



Daniel W. Baltzell		August 8, 2006
EMC Test Engineer	Signature	Date Of Test

8 Conclusion

The data in this measurement report shows that the EUT as tested, Sirit Technologies Inc. Model PnP SDIO RFID Reader, Model # PnP SDIO, FCC ID: M4ZPNPSDIO, IC: 3637B-PNPSDIO, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations, and Industry Canada RSS-210 & RSS-Gen.