Electromagnetic Compatibility Test Report

Tests Performed on a Locknetics Security Engineering

iClass Reader Series, Card Reader

Radiometrics Document RP-5404

ACCREDITED
Certification # 1495.01

Product Detail: FCC ID: P2G-RDR-ICL Equipment type: DSR; Security/remote Control Transceiver
Test Standards: US CFR Title 47, Chapter I, FCC Part 15 Subpart C FCC Part 15 CFR Title 47: 2004 This report concerns: Original Grant for Certification FCC Part 15.225

Tests Performed For:	*Test Facility:*
Locknetics Security Engineering 575 Birch St. Forestville, CT 06011-9337	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446 Phone: (815) 293-0772 e-mail: info@radiomet.com

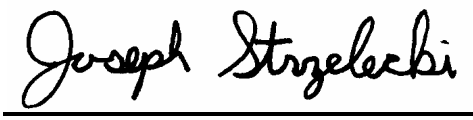
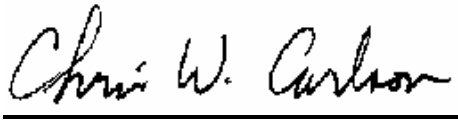
Test Date(s): (Month-Day-Year)
10/26 & 11/5/04

Document RP-5404 Revisions:

Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
0	November 8, 2004			
1	November 10, 2004	1, 6 & 9	Joseph Strzelecki	Joseph Strzelecki

Table of Contents

1 ADMINISTRATIVE DATA

Equipment Under Test: A Locknetics Security Engineering, iClass Card Reader Model: RDR-ICL Serial Number: None This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) 10/26/04	*Test Date(s): (Month-Day-Year)* 10/26 & 11/5/04
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* The tests were not witnessed by Locknetics Security Engineering Locknetics Security Engineering
Radiometrics' Personnel Responsible for Test:  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	*Test Report Approved By*  Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is an iClass Card Reader, Model iClass Reader Series, manufactured by Locknetics Security Engineering. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions E-Field	30-1000 MHz	FCC Part 15	Pass
Occupied Bandwidth Test	Fundamental Freq.	FCC Part 15	Pass
RF Radiated Emissions H-Field	0.15 – 30 MHz	FCC Part 15	Pass
Frequency Stability	Fundamental Freq.	FCC Part 15	Pass

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is an iClass proximity smart Card Reader, Model iClass Reader Series, manufactured by Locknetics Security Engineering. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 Antenna Requirements

The antenna is permanently installed inside the EUT and will not be changed by the end user.

3.2 Related Submittals

Locknetics Security Engineering is not submitting any other products simultaneously for equipment authorization related to the EUT.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations.

Since the EUT is door-mounted, it was placed in an upright configuration during the tests. The EUT was tested as a stand-alone device. Power was supplied with a new battery.

No external cables can be connected to the EUT.

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	iClass Card Reader	E	Locknetics Security Engineering	IClass Reader Series	None

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2004	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2001	2001	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

The test procedures used are in accordance with the ANSI document C63.4-2001, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 1999 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.net).

The following is a list of shielded enclosures located in Romeoville, Illinois:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles in the located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 24' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber C: Is a shielded enclosure that measures 20' L X 10' W X 8' H. Lindgren RF Enclosures Inc. of Addison, Illinois manufactured the enclosure.

Chamber D: Is a fully anechoic chamber that measures 22' L X 10' W X 10' H. The walls, ceiling and floor are fully lined with ferrite absorber tiles. Braden Shielding Systems of Tulsa, Oklahoma manufactured the chamber.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number 31040/SIT 1300F2. The FCC test site Registration Number is 90897. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	11/25/03
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 mo	11/17/03
ANT-42	EMCO	Bicon Antenna	3104C	9512-4713	25-300MHz	12 Mo.	12/02/03
ANT-29	Empire	Loop Antenna	LP-105	656	0.15-30MHz	24 Mo.	10/20/04
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	08/17/04
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	12/29/03
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	24 Mo.	01/28/04
TCH-01	REVCO	Temp. Chamber	REV-50-20	TCH-01	N/A	12 Mo.	10/22/04

Note: All calibrated equipment is subject to periodic checks.
NCR – No Calibration Required. Device monitored by calibrated equipment. N/A: Not Applicable.

10 TEST SECTIONS

10.1 Radiated RF Emissions

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun.

The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 1000 MHz an Anritsu Spectrum analyzer and a MITEQ AM-1431 amplifier with a 10 dB attenuator connected to the input. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

Preliminary radiated emission tests were performed inside of an anechoic enclosure. The frequency range from 30 to 1000 MHz was scanned and plotted using the peak detector function. The test antennas were positioned 3 meters from the EUT. The results of the preliminary scans were only used to identify the frequencies being emitted from the EUT and were not used to determine compliance with the test specification. Radiated emission measurements are performed with linearly polarized broadband antennas.

Final radiated emissions measurements were performed in the open area test site at a test distance of 3 meters. Measurements were performed using the peak or quasi-peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. All other tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 1000 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high in the preliminary emission scan. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

10.1.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

The peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is 20 * Log(Duty cycle/100).

10.1.2 Radiated Emissions Test Results

Test Date	11/5/04
Test Distance	3 Meters
Specification	FCC Part 15 Subpart C
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-3); LP = Log-Periodic (ANT-6); HN = Horn (ANT-13) P = peak; Q = QP

Tx Freq MHz	Ant Pol.	Emission Freq. MHz	Detector Function	dBuV/m	Limit	Margin under limit
13.56	Horz.	40.7	Peak	24.8	40.0	15.2
13.56	Horz.	50.2	Peak	21.0	40.0	19.0
13.56	Horz.	54.2	Peak	20.5	40.0	19.5
13.56	Horz.	68.1	Peak	16.8	40.0	23.2
13.56	Horz.	81.3	Peak	22.1	40.0	17.9
13.56	Horz.	94.9	Peak	20.2	43.5	23.3
13.56	Horz.	119.8	Peak	17.3	43.5	26.2
13.56	Horz.	162.9	Peak	17.2	43.5	26.3
13.56	Horz.	176.4	Peak	17.7	43.5	25.8
13.56	Horz.	190.0	Peak	18.1	43.5	25.4
13.56	Horz.	203.4	Peak	28.2	43.5	15.3
13.56	Horz.	216.8	Peak	24.0	46.0	22.0
13.56	Horz.	244.4	Peak	21.3	46.0	24.7
13.56	Horz.	258.0	Peak	16.8	46.0	29.2
13.56	Vert.	41.0	Peak	28.0	40.0	12.0
13.56	Vert.	50.2	Peak	20.9	40.0	19.1
13.56	Vert.	54.6	Peak	25.3	40.0	14.7
13.56	Vert.	68.1	Peak	21.1	40.0	18.9

Tx Freq MHz	Ant Pol.	Emission Freq. MHz	Detector Function	dBuV/m	Limit	Margin under limit
13.56	Vert.	81.3	Peak	26.8	40.0	13.2
13.56	Vert.	81.5	Peak	25.9	40.0	14.1
13.56	Vert.	135.4	Peak	19.1	43.5	24.4
13.56	Vert.	162.9	Peak	20.1	43.5	23.4
13.56	Vert.	176.4	Peak	23.4	43.5	20.1
13.56	Vert.	189.8	Peak	27.9	43.5	15.6
13.56	Vert.	190.0	Peak	27.3	43.5	16.2
13.56	Vert.	203.4	Peak	26.8	43.5	16.7
13.56	Vert.	216.8	Peak	28.3	46.0	17.7
13.56	Vert.	230.3	Peak	23.2	46.0	22.8

Judgment: Passed by 14.1 dB
No Emissions were detected from 260 to 1000 MHz within 15 dB of the limits.

10.2 Magnetic Field Measurements and Decay Factor Calculations

Radiated emission measurements are performed with shielded loop antennas. An Empire LP-105 antenna was used. The antenna was rotated in order to find the maximize readings.

The decay exponent used is 2. The distance correction factor is calculated as follows:

Distance factor (dB) = 40*Log(TD/30)

TD is the actual test distance in meters. 30 meters is the specification distance. The actual distance correction factor at 3 meters is -40 dB.

10.2.1 Magnetic Field Radiated Emissions Results (0.15 to 30 MHz)

Test Date	11/5/04
Test Distance	3 Meters
Specification	FCC 15.225

Transmitting at 13.56 MHz

Freq (kHz)	Meter reading dBuV	Detector	Loop Ant Factor	Dist (m)	Decay exp	Cable Loss dB	Dist factor dB	Amp Gain dB	Field Strength dBuV/m	15.209 Limit dBuV/m
13560.0	57.1	Peak	38.9	3.0	2.0	0.5	-40.0	29.0	28.5	80.0
27120.0	22.0	Peak	33.0	3.0	2.0	0.5	-40.0	28.0	-12.5	29.5

Judgement: Passed by at least 40 dB.
No other emission

10.3 Frequency Stability Tests

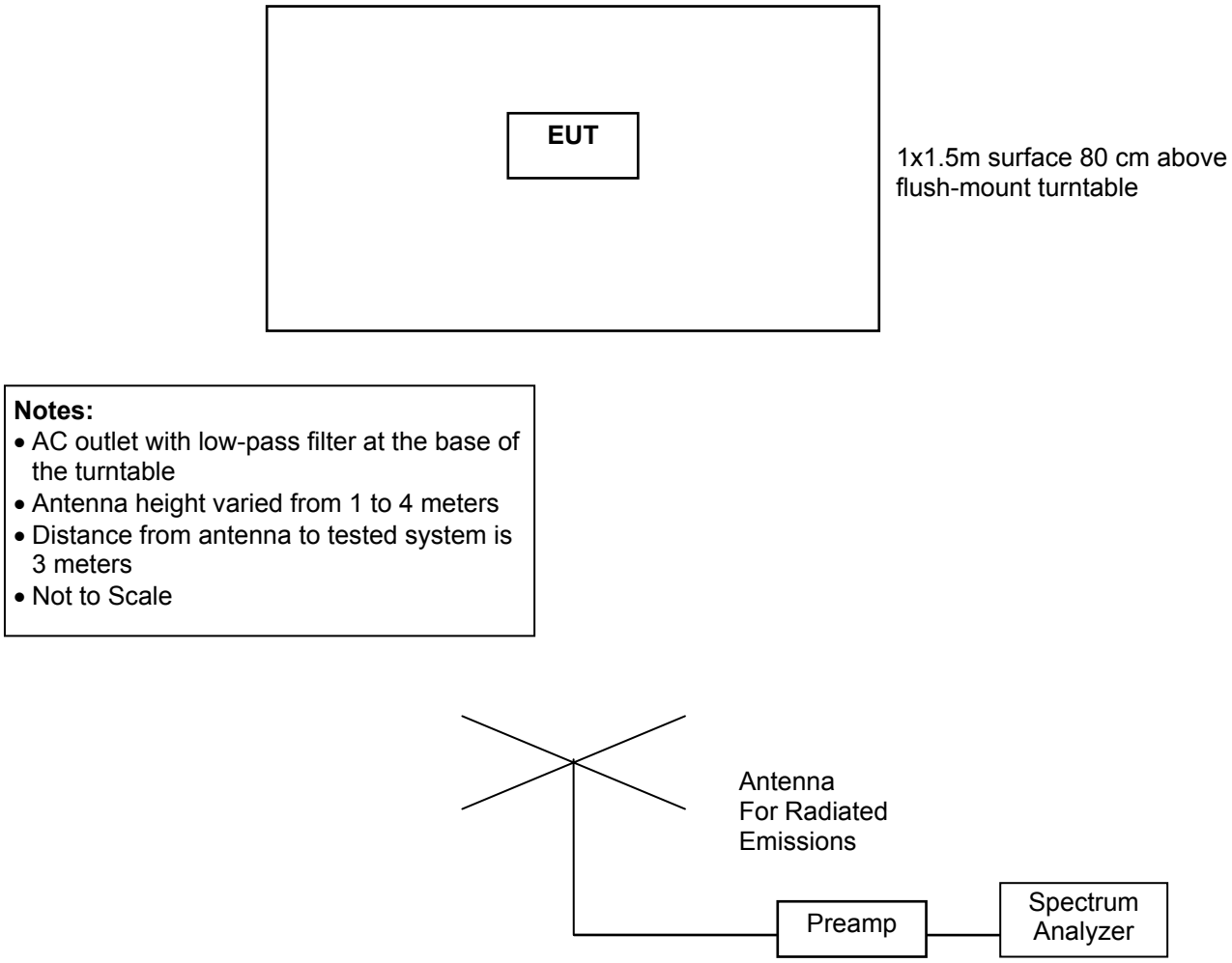
The EUT was placed in a temperature chamber. The EUT temperature was allowed to stabilize at each temperature prior to measuring the frequency. This was performed at 10 degree Celsius increments from –20 to +50 degrees C. The reading at 20 degrees C is nominal frequency.

The transmitter was powered by an adjustable DC power supply. The transmitter frequency was measured at 1.0 Volt increments from 6 to 14 Volts. 12 VDC is the nominal voltage.

Temp.	Freq (MHz)	% Change	Limit %
50	13.5603	0.0037	0.01
40	13.5603	0.0037	0.01
30	13.5596	-0.0015	0.01
20	13.5598	0.0000	0.01
10	13.5600	0.0015	0.01
0	13.5603	0.0037	0.01
-10	13.5602	0.0029	0.01
-20	13.5603	0.0037	0.01
Voltage			
14	13.5599	0.0000	0.01
13	13.5599	0.0000	0.01
12	13.5599	0.0000	0.01
11	13.5599	0.0000	0.01
10	13.5599	0.0000	0.01
9	13.5599	0.0000	0.01
8	13.5599	0.0000	0.01
7	13.5599	0.0000	0.01
6	13.5599	0.0000	0.01

Judgement: Pass

Figure 1. Drawing of Radiated Emissions Setup



10.4 Occupied Bandwidth Data

The occupied bandwidth of the RF output was measured using a spectrum analyzer. The bandwidth was measured using the peak detector function and a narrow resolution bandwidth.

A broadband antenna was used to receive the modulated signal. The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The spectrum analyzer display was digitized and plotted. A limit was drawn on the plots based on the level of the modulated carrier. The plots of the occupied bandwidth for the EUT are supplied on the following page.

Figure 2. Occupied Bandwidth Plot