



Electromagnetic Compatibility Test Report

Tests Performed on an RF Ideas, Inc.

Smart Card Reader, Model 1356I

Radiometrics Document RP-5046



Product Detail:

FCC ID: **M9MRFID1356I100**

Equipment type: Low Power Transmitter 13.56 MHz

Test Standards:

US CFR Title 47, Chapter I, FCC Part 15 Subpart C

FCC Part 15 CFR Title 47: 2002

Industry Canada RSS-210, Issue 5 as required for Category I Equipment

This report concerns: Original Grant for Certification

FCC Part 15 Subpart C

Tests Performed For:

RF Ideas, Inc.

714 Bridle Ln.

Cary, IL 60013

Phone: (847) 516-0945

Test Facility:

Radiometrics Midwest Corporation

12 East Devonwood

Romeoville, IL 60446

Phone: (815) 293-0772

e-mail: info@radiomet.com

Test Date(s): (Month-Day-Year)

May 13, 2003

Document RP-5046 Revisions:

Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
0	June 11, 2003			
1	July 7, 2003	1, 3 and 12	Jeff Tomes	

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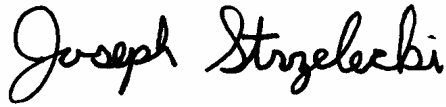
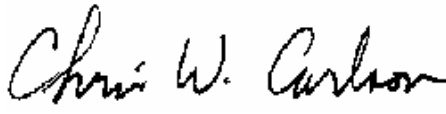
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1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A RF Ideas, Inc., Smart Card Reader Model: 1356I Serial Number: none This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> May 13, 2003	<i>Test Date(s): (Month-Day-Year)</i> May 13, 2003
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> The tests were not witnessed by RF Ideas, Inc.
<i>Radiometrics' Personnel Responsible for Test:</i>  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	<i>Test Report Approved By</i>  Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Smart Card Reader, Model 1356I, manufactured by RF Ideas, Inc. 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	30-1000 MHz	RSS-210 & FCC Part 15	Pass
RF Radiated Emissions H-Field	0.009 – 30 MHz	RSS-210 & FCC Part 15	Pass
Bandwidth	13.56 MHz	RSS-210 & FCC Part 15	Pass

2.1 RF Exposure Compliance Requirements

Since the effective radiated power output is less than 1 mW, The EUT meets the FCC requirement for RF exposure. It is exempt from RSS-102. There are no power level adjustments and the antenna is permanently attached.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Smart Card Reader, Model 1356I, manufactured by RF Ideas, Inc. The EUT was in good working condition during the tests, with no known defects.

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There are two versions of the EUT; a serial and a USB. They both use the same RF section. The serial version gets its power from the keyboard connector. The USB version is self-powered from the USB port.

3.1.1 FCC Section 15.203 Antenna Requirements

The antenna is internal to the device. It is a trace on the circuit board, so it cannot be readily changed by the end user.

3.2 Related Submittals

RF Ideas, Inc. 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.

The serial EUT was connected to the Host computer's serial port and keyboard connector with pass-through connector.

The USB EUT was connected to the Host computer's USB port.

Power was supplied at 115 VAC, 60 Hz single-phase to the host computer. The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Serial Smart Card Reader	E	RF Ideas, Inc.	1356I	none
2	USB Smart Card Reader	E	RF Ideas, Inc.	1356I	none
3	Desktop Computer	H	Paragon Development Sys	P5/90	N/A
4	Key Board	P	Acer	6511-HW	K6569131108P
5	Printer	P	Star	NX-1001	510010542390
6	Mouse	P	Logitech	CC-93-9F	LU119008761
7	VGA Monitor	P	Arche	514AS	5N00815

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

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List of System Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.7	DB9 Serial Cable	#1 and #3	Yes
1	0.3	Keyboard Jumper Cable	#1 and #3	Yes
1	1.8	USB Cable	#1 and #3	Yes
1	1.9	AC Power Cord	#3	No
1	1.8	Printer Cable	#3 and #5	Yes
1	2.0	Mouse Cable	#3 and #6	Yes
1	1.6	Video Data Cable	#3 and #7	Yes

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	2002	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-1992	1992	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 5	2001	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)
IC RSS-212 Issue 1	1998	Test Methods For Radio Equipment

The test procedures used are in accordance with the Industry Canada RSS-212 and ANSI document C63.4-1992, (July 17, 1992) "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 has been 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 "basic standards" 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.a2la.org).

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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/NCSS 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.

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9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	11/29/02
AMP-12	MITEQ	Pre-amplifier	AM-1431	530935	0.01-1000MHz	12 Mo.	12/28/02
ANT-03	Tensor	Biconical Antenna	4104	2231	20-200MHz	24 Mo.	08/07/01
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 mo	08/07/01
ANT-12	RMC	Dipole Antennas	HW1010	202	25-1000MHz	12 Mo.	07/12/02
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	09/30/02
ANT-28	Empire	Loop Antenna	LG-105	102	10-150kHz	24 Mo.	05/01/03
ANT-29	Empire	Loop Antenna	LP-105	656	0.15-30MHz	24 Mo.	05/01/03
LSN-01	Electrometrics	LISN	FCC/VDE 50/2	1001	0.01-30MHz	12 Mo.	1/10/03
LSN-03	Farnell	LISN	1EXLSN30B	000314	0.01-30MHz	12 Mo.	04/08/03
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	06/07/02
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	10/11/02
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	12 Mo.	12/31/02

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. From 30 to 1000 MHz, 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 450 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. 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 9 kHz 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.

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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.

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

Assume a receiver reading of 49.5 dBuV is obtained. The Antenna Factor of 8.1 and a Cable Factor of 1.7 is added. The Amplifier Gain of 23.3 dB is subtracted, giving a field strength of 36 dBuV/m. The 36 dBuV/m can be mathematically converted to its corresponding level in uV/m.

$$FS = 49.5 + 8.1 + 1.7 - 23.3 = 36.0 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(36 \text{ dBuV/m})/20] = 63.1 \text{ uV/m}$$

10.1.2 Radiated Emissions Test Results

Manufacturer	RF Ideas, Inc.	Specification	FCC Part 15.209 Subpart C & RSS-210
Model	1356I	Test Date	5/13/2003
Serial Number	None	Test Distance	3 Meters
Notes	Correction factors = cable loss - preamp gain		
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		

Configuration		USB Version					
Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
119.7	45.4 P#	12.2	H/BC	-24.6	33.0	43.5	10.5
122.8	43.9 P#	12.0	H/BC	-24.6	31.3	43.5	12.2
126.0	42.3 P#	11.9	H/BC	-24.5	29.7	43.5	13.8
135.4	42.8 P#	11.8	H/BC	-24.5	30.1	43.5	13.4
148.0	44.0 P#	12.9	H/BC	-24.3	32.6	43.5	10.9
154.4	44.1 P#	13.6	H/BC	-24.1	33.6	43.5	9.9
163.8	43.1 P#	15.0	H/BC	-24.0	34.1	43.5	9.4
255.8	38.3 P#	12.9	H/LP	-22.4	28.8	46.0	17.2

Emission is from host Computer.

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Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
261.4	46.0 Q#	13.1	H/LP	-22.3	36.8	46.0	9.2
261.9	47.5 P#	13.1	H/LP	-22.3	38.3	46.0	7.7
271.2	42.7 P#	13.5	H/LP	-22.1	34.1	46.0	11.9
277.7	39.5 P#	13.8	H/LP	-21.9	31.4	46.0	14.6
283.8	39.3 P#	14.1	H/LP	-21.8	31.7	46.0	14.3
306.2	36.0 P#	15.6	H/LP	-21.2	30.3	46.0	15.7
332.8	39.7 P#	15.1	H/LP	-20.5	34.3	46.0	11.7
385.4	36.7 P#	15.8	H/LP	-19.9	32.5	46.0	13.5
425.0	39.1 P#	16.2	H/LP	-20.1	35.2	46.0	10.8
46.4	45.6 P#	10.7	V/BC	-25.8	30.5	40.0	9.5
63.0	44.1 P#	7.9	V/BC	-25.5	26.5	40.0	13.5
69.3	47.5 P#	6.4	V/BC	-25.4	28.5	40.0	11.5
78.7	48.5 P#	7.5	V/BC	-25.3	30.8	40.0	9.2
119.6	43.6 P#	12.9	V/BC	-24.6	31.9	43.5	11.6
220.7	41.7 P#	16.0	V/BC	-23.1	34.6	46.0	11.4
261.9	40.4 P#	13.1	V/LP	-22.3	31.2	46.0	14.8
271.6	40.5 P#	13.5	V/LP	-22.1	31.9	46.0	14.1
283.8	38.8 P#	14.1	V/LP	-21.8	31.2	46.0	14.8
302.2	42.5 P#	15.2	V/LP	-21.3	36.4	46.0	9.6
332.8	38.0 P#	15.1	V/LP	-20.5	32.6	46.0	13.4
362.3	38.2 P#	15.4	V/LP	-20.0	33.7	46.0	12.3
385.4	41.6 P#	15.8	V/LP	-19.9	37.5	46.0	8.5
396.9	41.9 P#	16.2	V/LP	-20.0	38.1	46.0	7.9
425.0	41.6 P#	16.2	V/LP	-20.1	37.7	46.0	8.3
Notes: Serial Version							
40.7	44.3 P	12.2	H/BC	-25.9	30.6	40.0	9.4
44.3	44.6 P	12.2	H/BC	-25.8	31.0	40.0	9.0
54.3	44.2 P	10.9	H/BC	-25.7	29.4	40.0	10.6
67.8	48.2 P	6.8	H/BC	-25.4	29.6	40.0	10.4
94.9	44.3 P	10.4	H/BC	-24.9	29.8	43.5	13.7
203.4	40.5 P	16.4	H/BC	-23.4	33.5	43.5	10.0
216.9	35.6 P	15.6	H/BC	-23.2	28.0	46.0	18.0
217.0	38.9 P	15.6	H/BC	-23.2	31.3	46.0	14.7
244.1	35.3 P	17.3	H/BC	-22.6	29.9	46.0	16.1
40.7	41.0 P	10.7	V/BC	-25.9	25.8	40.0	14.2
46.3	42.9 P	10.7	V/BC	-25.8	27.8	40.0	12.2
54.3	39.1 P	10.3	V/BC	-25.7	23.7	40.0	16.3
67.8	39.3 P	6.6	V/BC	-25.4	20.5	40.0	19.5
81.3	46.7 P	8.2	V/BC	-25.2	29.7	40.0	10.3
94.9	45.5 P	11.2	V/BC	-24.9	31.7	43.5	11.8
108.4	36.8 P	12.2	V/BC	-24.7	24.3	43.5	19.2

Emission is from host Computer.

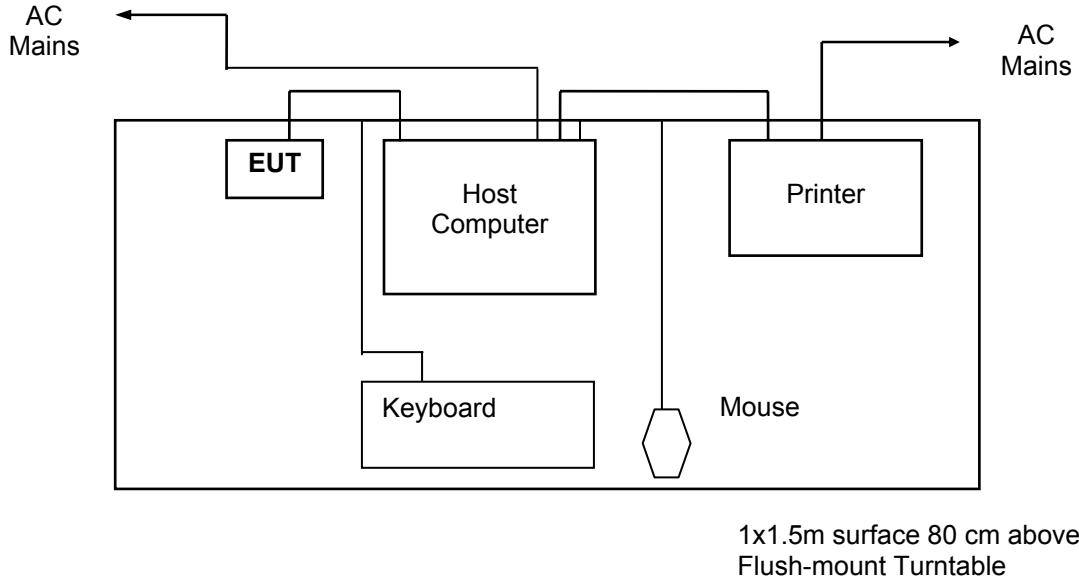
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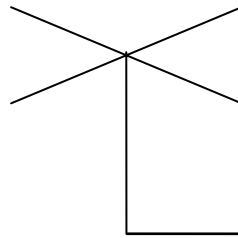
Notes: USB Version							
Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
40.7	44.1 P	12.2	H/BC	-25.9	30.4	40.0	9.6
54.2	44.4 P	10.9	H/BC	-25.7	29.6	40.0	10.4
54.3	46.0 P	10.9	H/BC	-25.7	31.2	40.0	8.8
67.8	43.3 P	6.8	H/BC	-25.4	24.7	40.0	15.3
81.4	42.6 P	6.8	H/BC	-25.2	24.2	40.0	15.8
94.9	48.9 P	10.4	H/BC	-24.9	34.3	43.5	9.2
108.5	46.1 P	11.9	H/BC	-24.7	33.3	43.5	10.2
108.5	40.3 Q	11.9	H/BC	-24.7	27.5	43.5	16.0
149.2	34.0 P	13.0	H/BC	-24.3	22.7	43.5	20.8
189.8	34.9 P	17.1	H/BC	-23.6	28.4	43.5	15.1
203.4	42.3 P	16.4	H/BC	-23.4	35.3	43.5	8.2
203.4	38.1 Q	16.4	H/BC	-23.4	31.1	43.5	12.4
217.0	38.6 P	15.6	H/BC	-23.2	31.0	46.0	15.0
244.1	33.5 P	17.3	H/BC	-22.6	28.2	46.0	17.8
40.7	43.9 P	10.7	V/BC	-25.9	28.7	40.0	11.3
81.4	42.6 P	8.2	V/BC	-25.2	25.6	40.0	14.4
94.9	45.7 P	11.2	V/BC	-24.9	31.9	43.5	11.6
108.5	34.6 P	12.2	V/BC	-24.7	22.0	43.5	21.5
122.0	37.5 P	12.9	V/BC	-24.6	25.8	43.5	17.7
149.2	36.0 P	13.3	V/BC	-24.3	25.1	43.5	18.4
162.7	33.4 P	15.9	V/BC	-24.0	25.3	43.5	18.2
203.4	34.6 P	16.4	V/BC	-23.4	27.6	43.5	15.9
216.9	35.9 P	16.2	V/BC	-23.2	28.9	46.0	17.1
230.4	35.9 P	16.4	V/BC	-22.9	29.5	46.0	16.5
271.0	41.0 P	13.4	V/LP	-22.1	32.3	46.0	13.7

Judgment: Passed by 8.2 dB

Figure 1. Configuration of Tested System



Loop Antenna
For H-field
Emissions



Antenna
For Radiated
Emissions

Preamp

Spectrum
Analyzer

Radiated Emissions:

- LISN's not used
- AC outlet with low-pass filter at the base of the turntable
- No vertical conductive wall
- Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters

Notes:

- Not to Scale

Conducted Emissions:

- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled
- Test platform is not rotated

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report		
<i>Equipment Tested (Company, Model, Product Name):</i> RF Ideas, Inc., 1356I, Smart Card Reader	<i>Document No.:</i> RP-5046 Rev. 1	<i>Page:</i> 12 of 13

10.2 Magnetic Field Measurements and Decay Factor Calculations

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

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

$$\text{Distance factor (dB)} = 40 * \text{Log}(\text{TD}/30)$$

TD is the actual test distance in meters.

Frequencies of 0.009 to 0.490 MHz (300 meters is the specification distance).

Distance correction factor at 3 meters is -80 dB.

Frequencies of 0.500 to 30.0 MHz (30 meters is the specification distance).

Distance correction factor at 3 meters is -40 dB.

10.2.1 Magnetic Field Radiated Emissions Results (0.009 to 30 MHz)

Manufacturer	RFIDeas, Inc.	Specification	FCC 15.209 & RSS-210
Model	1356I	Test Date	5/13/2003
Serial Number	none	Test Distance	3 Meters
Notes	Corr. Factors = cable loss - preamp gain - distance factor. Decay Exponent = 2 Shielded Loop Antennas were used for this test.		
Abbreviations	P = peak; Q = QP		

EUT Version	Freq. MHz	Meter Reading dBuV	Antenna Factor dB	Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
					EUT	Limit	
Serial	13.56	60.2	38.9	-76.5	22.6	29.5	6.9
Serial	27.12	33.1	33.0	-76.3	-10.2	29.5	39.7
USB	13.56	60.5	38.9	-76.5	22.9	29.5	6.6
USB	27.12	33.5	33.0	-76.3	-9.8	29.5	39.3

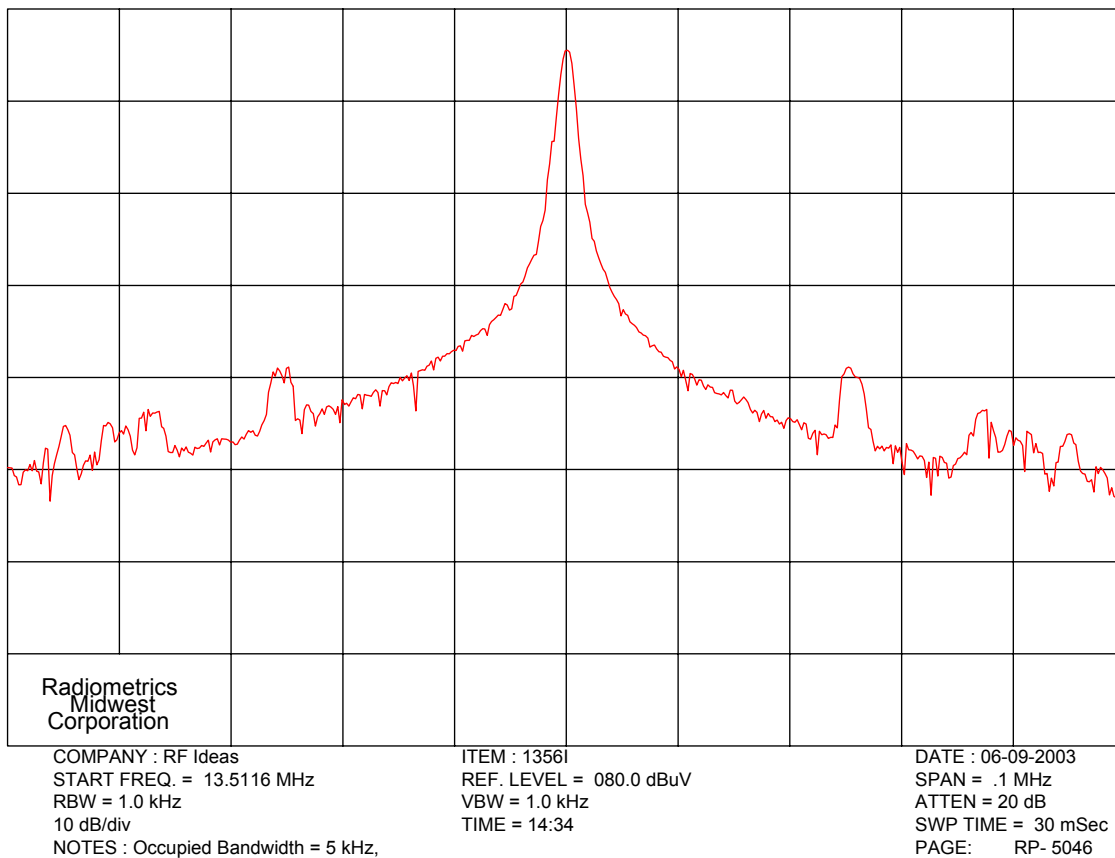
Judgement: Passed by 6.6 dB.

10.3 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. The plot of the occupied bandwidth for the EUT is supplied on the following page.

Figure 2. Occupied Bandwidth Plot



The Occupied Bandwidth is 5 kHz.