Engineering and Testing for EMC and Safety Compliance

CERTIFICATION APPLICATION REPORT
FCC PART 15 CERTIFICATION

Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 Web Site: www.rheintech.com Herndon, VA 20170 E-Mail: ATCBINFO@rheintech.com	SARACOM s.a.r.l. 52 Blvd Risso Phone: (33) 6-71-2258-84 06300 Nice, France Fax: (33) 1-5301-4680 Contact: Pourang Mahdavi Email: pmahdavi@saracomsarl.com

FCC ID:	RT5-MXDBR10	**GRANTEE FRN NUMBER:**	0010306389
PLATFORM:	N/A	**RTL WORK ORDER NUMBER:**	2004002
MODEL:	MXDBR10	**RTL QUOTE NUMBER:**	QRTL04-027
DATE OF TEST REPORT:	February 11, 2004		
American National Standard Institute:	ANSI C63.4: 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:	DCD - Part 15 Low Power Transmitter Below 1705 kHz		
FCC Rule Part(s):	Part 15		
Industry Canada Standard:	N/A		
Digital Interface Information	Digital Interface was found to be compliant		
Receiver Information	Receiver was found to be compliant		
Frequency	133.3 kHz		

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 FCC Part 2, FCC Part 15, and ANSI C63.4.

Signature:  Date: February 11, 2004

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

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1 GENERAL INFORMATION

1.1 SCOPE

The EUT, an RFID reader system operating at 133.3 kHz, from SARACOM s.a.r.l., Model: MXDBR10, was tested to the applicable portions of FCC Part 15 as a low-power, low-frequency transmitter.

1.2 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 1992).

Because of the physical area required for the testing of the RFID reader, additional radiated testing was done with the unit placed on the second open site and the receiver antenna placed on the other end of the first range. This set-up allowed the additional radiated testing to be performed 30 meters away from the EUT.

1.3 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application for certification for SARACOM s.a.r.l., Model: MXDBR10, FCC ID: RT5-MXDBR10.

2 TEST INFORMATION

2.1 TEST JUSTIFICATION

The EUT is a low-frequency, low-power RFID reader system operating at 133.3 kHz. Testing of the intentional radiator parameters of the EUT was performed on Rhein Tech's open site to simulate a typical installation and adhere to the FCC's guidelines for this type of EUT.

For the AC conducted test, the unit has been tested in two configurations: 1) ADU and PSU connected to LISN, and 2) DPU connected to LISN.

2.2 EXERCISING THE EUT

The EUT was set to continuously transmit at maximum power during all testing. There were no deviations from the test standards and/or methods.

2.3 TEST RESULT SUMMARY

The EUT passed all applicable requirements.

2.4 MODIFICATIONS

ADU1 and ADU2:

- add 2.2 and 1.2 nF on the antenna lead
- place ferrite 0443806406 from Fair Rite on power line and I/O lines
- Implement ground connection to chassis

Power Module:

- FN 2060-6-06 Schaffner on power line
- Ground connection between the AC/DC grounds on the external AC/DC converter

Cables:

- Power supply cable on ADU1 on both sides 2 turns 044176451(side of the power module) and 1 turn 0443806406 (side of the ADU)
- Power supply cable on ADU2 on both sides 2 turns 043116181 (side of the power module) and 1 turn 0443806406(side of the ADU)
- Antenna lead (ADU side) 044164181
- DPU to power supply module 0431164181(on DPU side) and 0461164181 (on Power module side)

2.5 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system are identified in Table 2-2.

TABLE 2-1: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
Digital Processing Unit (DPU)	SARACOM s.a.r.l.	MXDBR-DPU10	0001	RT5-MXDBR10	16.4 meter power supply	15001
Antenna Driver Unit (ADU	SARACOM s.a.r.l.	MXDBR-ADU10	0001, 0002	RT5-MXDBR10	1.1 meter power supply	15009,15010
Antenna	SARACOM s.a.r.l.	MXDBR-ANT10	0001, 0002, 0003, 0004	N/A	1.5 meter Unshielded	15003
Power Supply Unit (PSU)	SARACOM s.a.r.l.	MXDBR-PSU10	0001	N/A	0.5 meter to AC/DC converter	15004

TABLE 2-2: AUXILIARY EQUIPMENT

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
Photo switches	SICK	WL36-B230	N/A	N/A	3.2 meter shielded	15005
Traffic light	McCain Traffic Supply	N/A	N/A	N/A	12 and 9 meter unshielded	15006
Laptop Computer	Hewlett-Packard	Pavilion N5495	TW14212971	FCC ID: 0.1(B) 6CTTAI-36268-M5-E	serial 2 meter	15007
Temperature sensor	SARACOM s.a.r.l.	MXDBR-TS10	N/A	N/A	8.4 meter shielded	15008

2.6 CONFIGURATION OF TESTED SYSTEM

PHOTOGRAPH 1: TEST CONFIGURATION FOR DIGITAL RADIATED AND POWER LINE CONDUCTED EMISSIONS

3 CONDUCTED LIMITS - §15.207

3.1 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. 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 instrument 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.

3.2 CONDUCTED LINE EMISSION TEST

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and PHASE SIDE.

3.3 CONDUCTED LINE EMISSIONS TEST DATA FOR MAIN UNIT

TABLE 3-1: CONDUCTED EMISSIONS (NEUTRAL SIDE)

Temperature: 65°F Humidity: 54%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)	FCC B AV Limit (dBuV)	FCC B AV Margin (dBuV)	Pass/ Fail
2.266	Av	50.8	1.2	40.1			46.0	-5.9	Pass
2.267	Qp	49.9	1.2	41.3	46.0	-14.7			Pass
7.066	Av	40.7	1.9	42.6			50.0	-7.4	Pass
7.066	Qp	41.3	1.9	43.2	60.0	-16.8			Pass
9.466	Av	51.4	2.1	43.2			50.0	-6.8	Pass
9.466	Qp	51.9	2.1	45.6	60.0	-14.4			Pass
15.067	Av	53.7	2.8	45.3			50.0	-4.7	Pass
15.067	Qp	54.3	2.8	46.1	60.0	-13.9			Pass
15.200	Av	27.8	2.8	30.6			50.0	-19.4	Pass
15.201	Qp	29.4	2.8	32.2	60.0	-27.8			Pass
19.067	Qp	43.3	3.1	46.4	50.0	-13.6			Pass
19.067	Av	43.3	3.1	46.4			50.0	-3.6	Pass

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

TABLE 3-2: CONDUCTED EMISSIONS (PHASE SIDE)

Temperature: 65°F Humidity: 54%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)	FCC B AV Limit (dBuV)	FCC B AV Margin (dBuV)	Pass/ Fail
2.266	Av	48.2	1.2	40.4			46.0	-5.6	Pass
2.267	Qp	48.8	1.2	42.3	56.0	-13.7			Pass
7.067	Qp	42.4	1.9	44.3	60.0	-15.7			Pass
7.067	Av	42.4	1.9	43.3			50.0	-6.7	Pass
11.600	Av	45.1	2.4	46.5			50.0	-3.5	Pass
11.600	Qp	45.7	2.4	45.1	60.0	-14.9			Pass
15.067	Av	54.3	2.7	45.6			50.0	-4.4	Pass
15.067	Qp	54.7	2.7	46.4	60.0	-13.6			Pass
19.334	Av	43.8	3.1	46.9			50.0	-3.1	Pass
19.334	Qp	43.4	3.1	46.5	60.0	-13.5			Pass

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

3.4 CONDUCTED LINE EMISSIONS TEST DATA FOR DPU

TABLE 3-3: CONDUCTED EMISSIONS (NEUTRAL SIDE)

Temperature: 65°F Humidity: 54%									
Emission Frequency (MHz)	**Test Detector**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB)**	**Emission Level (dBuV)**	**FCC B QP Limit (dBuV)**	**FCC B QP Margin (dBuV)**	**FCC B AV Limit (dBuV)**	**FCC B AV Margin (dBuV)**	**Pass/ Fail**
2.266	Av	50.8	1.2	40.1			46.0	-5.9	Pass
2.267	Qp	49.9	1.2	41.3	56.0	-14.7			Pass
7.066	Av	40.7	1.9	42.6			50.0	-7.4	Pass
7.066	Qp	41.3	1.9	43.2	60.0	-16.8			Pass
9.466	Av	51.4	2.1	43.2			50.0	-6.8	Pass
9.466	Qp	51.9	2.1	45.6	60.0	-14.4			Pass
15.067	Av	53.7	2.8	45.3			50.0	-4.7	Pass
15.067	Qp	54.3	2.8	46.1	60.0	-13.9			Pass
15.200	Av	27.8	2.8	30.6			50.0	-19.4	Pass
15.201	Qp	29.4	2.8	32.2	60.0	-27.8			Pass
19.067	Qp	43.3	3.1	46.4	60.0	-13.6			Pass
19.067	Av	43.3	3.1	46.4			50.0	-3.6	Pass

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

TABLE 3-4: CONDUCTED EMISSIONS (PHASE SIDE)

Temperature: 65°F Humidity: 54%									
Emission Frequency (MHz)	**Test Detector**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB)**	**Emission Level (dBuV)**	**FCC B QP Limit (dBuV)**	**FCC B QP Margin (dBuV)**	**FCC B AV Limit (dBuV)**	**FCC B AV Margin (dBuV)**	**Pass/ Fail**
1.998	Qp	39.9	1.2	41.1	56.0	-14.9			Pass
1.999	Av	39.6	1.2	40.8			46.0	-5.2	
6.133	Av	37	1.8	38.8			50.0	-11.2	
6.134	Qp	37.9	1.8	39.7	60.0	-20.3			
11.600	Av	36.7	2.4	39.1			50.0	-10.9	Pass
11.600	Qp	37.1	2.4	39.5	60.0	-20.5			Pass
15.068	Av	34.7	2.7	37.4			50.0	-12.6	Pass
15.068	Qp	36.4	2.7	39.1	60.0	-20.9			Pass
18.400	Av	26.8	3	29.8			50.0	-20.2	Pass
18.401	Qp	28.6	3	31.6	60.0	-28.4			Pass
25.000	Av	43	3.4	46.4			50.0	-3.6	Pass
25.000	Qp	43.5	3.4	46.9	60.0	-13.1			Pass

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

TEST PERSONNEL:

Rachid Sehb		January 18, 2004
EMC Test Engineer	Signature	Date Of Test

4 RADIATED EMISSION LIMITS - §15.209

4.1 DIGITAL DEVICE EMISSIONS TEST DATA

Digital device emissions were investigated from 30 MHz to 1000 MHz. As the transmitter unit of the EUT is always transmitting in typical use, it was transmitting during this testing. The receiver unit of the EUT was simultaneously investigated. The device was tested at 10 and 3 meters, and the limits shown below are 10 meter limits for the DPU and 3 meters for the radio portion ADU and PSU.

TABLE 4-1: DIGITAL DEVICE EMISSIONS TEST DATA AT 10 METERS FOR DPU

Temperature: 42°F Humidity: 59%										
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
52.6700	Qp	H	10	1	54.6	-22.3	32.3	39	-6.7	Pass
65.2030	Qp	H	0	2	60.6	-23.5	37.1	39	-1.9	Pass
65.4640	Qp	H	1	1	45.5	-24.8	20.7	39	-18.3	Pass
70.0000	Qp	H	0	2	58.1	-23.5	34.6	39	-4.4	Pass

TABLE 4-2: DIGITAL DEVICE EMISSIONS TEST DATA AT 3 METERS FOR ADU AND PSU

Temperature: 42°F Humidity: 59%										
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
118.7010	Qp	H	20	1	31.4	-19.9	11.5	43.5	-32	Pass
177.2780	Qp	H	90	2	28.2	-16.2	12	43.5	-31.5	Pass
235.8130	Qp	H	90	1	25.4	-13.7	11.7	46.4	-34.7	Pass
294.3480	Qp	H	90	1	25.5	-11.6	13.9	46.4	-32.5	Pass
352.8840	Qp	H	180	1	24.8	-9.9	14.9	46.4	-31.5	Pass

TEST PERSONNEL:

Rachid Sehb		January 23, 2004
EMC Test Engineer	Signature	Date Of Test

4.2 SPURIOUS AND FUNDAMENTAL EMISSIONS

This location allowed the spurious and fundamental radiated testing to be performed 10 meters away from the EUT with 360' of antenna wire connected to the EUT.

Note: Peak readings, average limits. Measurements were taken with antenna in horizontal polarity, as this was determined to be the worst-case emissions. Measurements were taken at 10 meters and corrected to 300 meters. These measurements were corrected to 300 meters by the following: 40 log (300/10) = 59.1

Sample calculation:
Corrected SA Peak Level to 300m (dBuV/m) = SA reading (dBuv) + SCF(dB/m)
Correction from 10m to 300m (dB)

For example, at 133.0kHz:
Corrected SA Peak Level to 300m (dBuV/m) = 58.9(dBuV) + 19.7(dB/m) – 59.1(dB) = **19.5 dBuV/m**

TABLE 4-3: SPURIOUS AND FUNDAMENTAL EMISSIONS TEST DATA

Frequency (kHz)	Spectrum Analyzer Peak (dBuV)	Site Correction Factor (dB/m)	Corrected Spectrum Analyzer Peak Level to 10m (dBuV/m)	Correction from 10m to 300 meters (dB)	Corrected Spectrum Analyzer Peak Level to 300m (dBuV/m)	Limit (dBuV/m) at 300m	Margin (dB)
0.133	58.9	19.7	78.6	59.1	19.5	25.1	-5.6 [1]
0.267	46.9	19.5	66.4	59.1	7.3	19.1	-11.8
0.400	46.2	19.8	66.0	59.1	6.9	15.6	-8.7
0.533	45.4	19.8	65.2	59.1	6.1	13.1	-7.0
0.667	44.8	19.9	64.7	59.1	5.6	11.1	-5.5
0.800	42.6	19.8	62.4	59.1	3.3	9.5	-6.2
0.933	39.9	20.0	59.9	59.1	0.8	8.2	-7.4
1.070	39.4	20.0	59.4	59.1	0.3	7.0	-6.7
2.000	30.4	19.9	50.3	59.1	-8.8	1.6	-10.4

[1] FUNDAMENTAL

TEST PERSONNEL:

Desmond Fraser		January 22, 2002
EMC Test Engineer	Signature	Date Of Test

4.3 TEST EQUIPMENT

TABLE 4-4: TEST EQUIPMENT USED

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/12/2004
901084	AFJ International	LS16	16A LISN	16010020082	12/4/2004
900901	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	2/7/2004
900889	Hewlett Packard	85685A	RF Preselector for HP 8566B or 8568B (20 Hz-2 GHz)	3146A01309	3/5/2004
900905	Rhein Tech Labs	PR-1040	Amplifier	900905	9/10/2004
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/12/2004
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	5/12/2004
901053	Schaffner Chase	CBL6112B	Bi-Log Antenna (20 MHz - 2 GHz)	2648	9/3/200
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	8/25/2006

5 CONCLUSION

The data in this measurement report shows that the SARACOM s.a.r.l., Model: MXDBR10, FCC ID: RT5-MXDBR10, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations.