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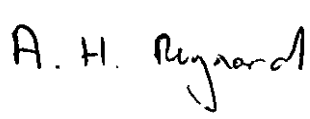
Electromagnetic Compatibility
Test Report

Test of:	RF ID Card Entry Reader
Model Number:	20447
Applicant:	PAC International LTD
Test Type:	Compliance
Test Specification:	FCC CFR47, parts 15.109 for unintentional radiators, parts 15.207 and 15.209 for Intentional Radiators.
SGS Serial Number:	DUR 21558
Date of Receipt:	9th September 1999
Date of Test(s):	15th to 24th September 1999
Date of Issue:	27th September 1999
Issue Number:	1



Test Engineer ***Authorised Signatory***

L. Steel A. H. Reynard

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1. Client Information

Company Name:	PAC International LTD.
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2. Details Of Test Laboratory

Company Name:	SGS EMC Services LTD.
UKAS Accreditation Number:	1116
Address:	Unit 10, Bowburn South Industrial Estate, Bowburn, County Durham, DH6 5AD, United Kingdom.
Contact Persons:	Mr Alan Reynard / Mr Fred Huggins
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3. Equipment Under Test (EUT)

3.1 Identification Of EUT

Model Number:	20447
Unique Identifier:	Unique Identifier Not Supplied
Description of EUT:	The EUT is an R.F. card entry reader, designed to prevent access to restricted areas by unauthorised persons.
Fundamental (Carrier) Frequency	125 kHz Single Channel
Internal Clock Frequencies:	8 MHz
Supply Voltage:	18V DC (Via central controller)
Classification:	Intentional radiator, incorporating digital device.
Environment Class:	Commercial / Class A
Ports present:	One port comprising six wires. Refer to configuration/peripherals section of this report for details.
Accessories Supplied:	Central Controller (refer to section 6 for full details)

4. Test Specification, Methods and Procedures

4.1 Test Specification(s)

Specification(s)	Title
FCC CFR 47 : October 1998 Parts 15.109, 15.207 and 15.209	Code Of Federal Regulations
ANSI C63.4 : 1992	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.

4.2 Purpose Of Test

To perform the relevant tests and assess the product for compliance with the above specification (s), so that the manufacturer (PAC International Limited) can verify compliance with the specified limits.

4.3 Methods and Procedures

The standards listed on the previous page refer to the following tests:

CFR 47 Clause	Test
15.109	Radiated Emissions (Unintentional Radiator)
15.207	AC Power line Conducted Emissions
15.209	Radiated Emissions (Intentional Radiator)

5. Deviations or Exclusions from the Test Specifications

There were no deviations from the test specifications.

The scope of the inspection is limited to what is specified in the clients instructions and does not include any other checks or tests such as the electrical (electronic) control systems ability to cope with the implications of the dates falling on, before or after “January 2000”.

6. Support Equipment

The EUT was tested whilst interfaced with a central controller.

Controller Manufacturer:	PAC International Ltd
Model No.:	2100
Serial No.:	Unique identifier not supplied.

The controller consists of the following input/output ports:

AC Mains Port
Front Panel RF ID Reader Port
DC Battery Backup Port (Internal 12V Lead Acid Battery)
Channel 1 Port (For connecting RF ID reader)
Channel 2 Port (For connecting RF ID reader)
Channel 3 Port (For connecting RF ID reader)
Channel 4 Port (For connecting RF ID reader)
2xRelay ports
RS232 Port
Six Wire Bus Port
Tamper Port
Spare Port (similar to RS 232 Port)

The controller ports were terminated as follows:

Front Panel RF Reader

The front panel was mechanically / physically left in the controller, but was not electrically connected for radiated emissions of the intentional radiator (sec 15.209). (The EUT is also a reader, hence it would be difficult to distinguish between front panel emissions and actual EUT emissions).

The front panel was connected physically and electrically for radiated emissions of the unintentional radiator(sec 15.109) and conducted emissions (sec 15.207).

Front Panel Manufacturer:	PAC International Ltd
Model No.:	21397
Serial No.:	Unique identifier not supplied.

Channel 1 port :

A 1m lead was connected to this port (ten core, unscreened). 150Ω resistors were connected to each conductor, with respect to the GND terminal, except for:

LED terminal, terminated with 10kΩ, with respect to ground
Signal terminal, terminated with 100Ω, with respect to ground
Lock output, terminated with 22Ω, between L+ and L- terminals.

Channel 2 port :

A 1m lead was connected to this port (ten core, unscreened). 150Ω resistors were connected to each conductor, with respect to the GND terminal, except for:

LED terminal, terminated with 10kΩ, with respect to ground
Signal terminal, terminated with 100Ω, with respect to ground
Lock output, terminated with 22Ω, between L+ and L- terminals.

Channel 3 port :

A 1m lead was connected to this port (ten core, unscreened). 150Ω resistors were connected to each conductor, with respect to the GND terminal, except for:

LED terminal, terminated with 10kΩ, with respect to ground
Signal terminal, terminated with 100Ω, with respect to ground
Lock output, terminated with 22Ω, between L+ and L- terminals.

Channel 4 port :

The EUT was connected to this port via a 1m lead. (The +V supply terminal, ground terminal, signal terminal and VCA terminal were used. All other terminals were terminated via 1m leads (6 core, unscreened) with 150Ω resistors, with respect to ground, except for the lock output which was terminated with a 22Ω resistor between L+ and L- terminals).

Six Wire Bus Port

A 1m lead was connected to this port (six core, unscreened). 150Ω resistors were connected to each conductor, with respect to the -V terminal, with the exception of the +V conductor, which was terminated with a 330Ω resistor, as declared by the client.

Tamper Port

A 1m lead was connected to this port (six core, unscreened). 150Ω resistors were connected to each conductor, with respect to the GND terminal, as declared by the client.

Printer / RS 232 Port

A 1m lead was connected to this port (six core, unscreened). 150Ω resistors were connected to each conductor, with respect to the GND terminal, as declared by the client.

Relay Port #1

A 1m lead was connected to this port (six core, unscreened). 150Ω resistors were connected to each conductor, with respect to the GND terminal, as declared by the client.

Relay Port#2

A 1m lead was connected to this port (six core, unscreened). 150Ω resistors were connected to each conductor, with respect to the GND terminal, as declared by the client.

7. Operation of the EUT During Testing / Configuration and Peripherals

7.1 Operation of EUT during testing.

Refer to individual test results sections for details of EUT operation during testing.

7.2 Configuration and Peripherals

The EUT was tested whilst interfaced with a central controller. (refer to section 6 of this report for controller details).

The EUT consists of one port, comprising the following terminals, terminated as indicated:

Terminal Details	Description of termination
+V terminal	Controller
Ground terminal	Controller
Signal terminal	Controller
VCA terminal,	Controller

Two further terminals are provided on the reader. These terminals were terminated with 150Ω resistors.

Note: The client states that this is the usual configuration when a PAC card reader is interfaced with a PAC controller. The terminals terminated with 150Ω resistors can be used when a non-PAC controller is used.

Terminations applied at the end of 1m lead (six core, unscreened).

8. Test Results

8.1 General Comments

The test methods used are referred to in the individual test results sections of this test report.

8.2 Modifications Made to the EUT

No modifications were made to the EUT during the testing process.

8.3 Summary of Test Results

CFR 47 Clause	Test	Result
15.109	Radiated Emissions (Unintentional)	Complied
15.207	AC Power line Conducted Emissions	Complied
15.209	Radiated Emissions (Intentional)	Complied

Result

In the configuration tested, the EUT complies with the requirements of Clauses 15.109, 15.207 and 15.209 of CFR 47 : October 1998.

Full details of all tests can be found in the test results section of this report.

8.4 Radiated Emissions Test Results- Unintentional Radiator

CFR Clause	15.109
Limits	Class A
Frequency Range	30 – 1000 MHz

Operating Mode

The compliance test was performed with an authorised RF ID tag on the reader (door open condition).

Test Results

Worst Case Emissions

Frequency (MHz)	Quasi Peak Measurement (dBμV)	Quasi Peak Limit (dBμV)	Antenna Polarity (H/V)
79.863	27.4	39.0	V
116.743	27.5	43.5	V
190.481	31.2	43.5	V
208.916	27.0	43.5	V
239.636	28.2	46.4	V
301.093	29.8	46.4	V

Test Method

As per ANSI C63.4 : 1992

Measurements performed at a test distance of 10m.

Frequency Range tested = 30 to 1000MHz (as per sec 15.33 (a)(1)).

Measurement Detector Details: Quasi-Peak, 120 kHz bandwidth.

Note: Initial pre-testing was performed to obtain worst case operating mode for the compliance test (Authorised RF ID card on and off the reader).

Radiated Emissions Test Configuration

EUT Configuration

Radiated Emissions Environmental Conditions

Power Supply (to controller)	120V, 60Hz
Temperature	16 °C
Relative Humidity	81 %
Barometric Pressure	997 mb

Radiated Emissions Measurement Uncertainties

Frequency	± 200kHz
Amplitude	± 4.6dB

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Test Equipment Used

Equipment Type	Model Number	Last Calibration Date	Calibration Interval
Biconical Antenna	EMCO 3109	2/6/98	2 Years
Log Periodic Antenna	EMCO 3146	2/6/98	2 Years
Hewlett Packard Receiver System	HP8573B	12/5/99	1 Year

8.5 AC Power Line Conducted Emissions Test Results

CFR 47 Clause:	15.207
Frequency Range	0.45 – 30 MHz.

Operating Mode

The compliance test was performed without an authorised RF ID card on the reader (door closed condition).

Test Results

Live Terminal Worst Case Emissions

Frequency (MHz)	Quasi Peak Measurement (dBµV)	Quasi Peak Limit (dBµV)
16.2540	42.6	47.96
16.5060	39.2	47.96
17.0055	40.9	47.96
17.2575	35.8	47.96
17.7570	37.1	47.96
18.4995	40.9	47.96

Neutral Terminal Worst Case Emissions

Frequency (MHz)	Quasi Peak Measurement (dBµV)	Quasi Peak Limit (dBµV)
13.0005	38.3	47.96
16.5015	43.5	47.96
17.0055	39.8	47.96
18.2565	36.7	47.96
18.4995	40.5	47.96
21.0015	39.8	47.96

Note: The figures shown have been corrected automatically by measurement software, to account for cable loss and LISN attenuation.

Test Method

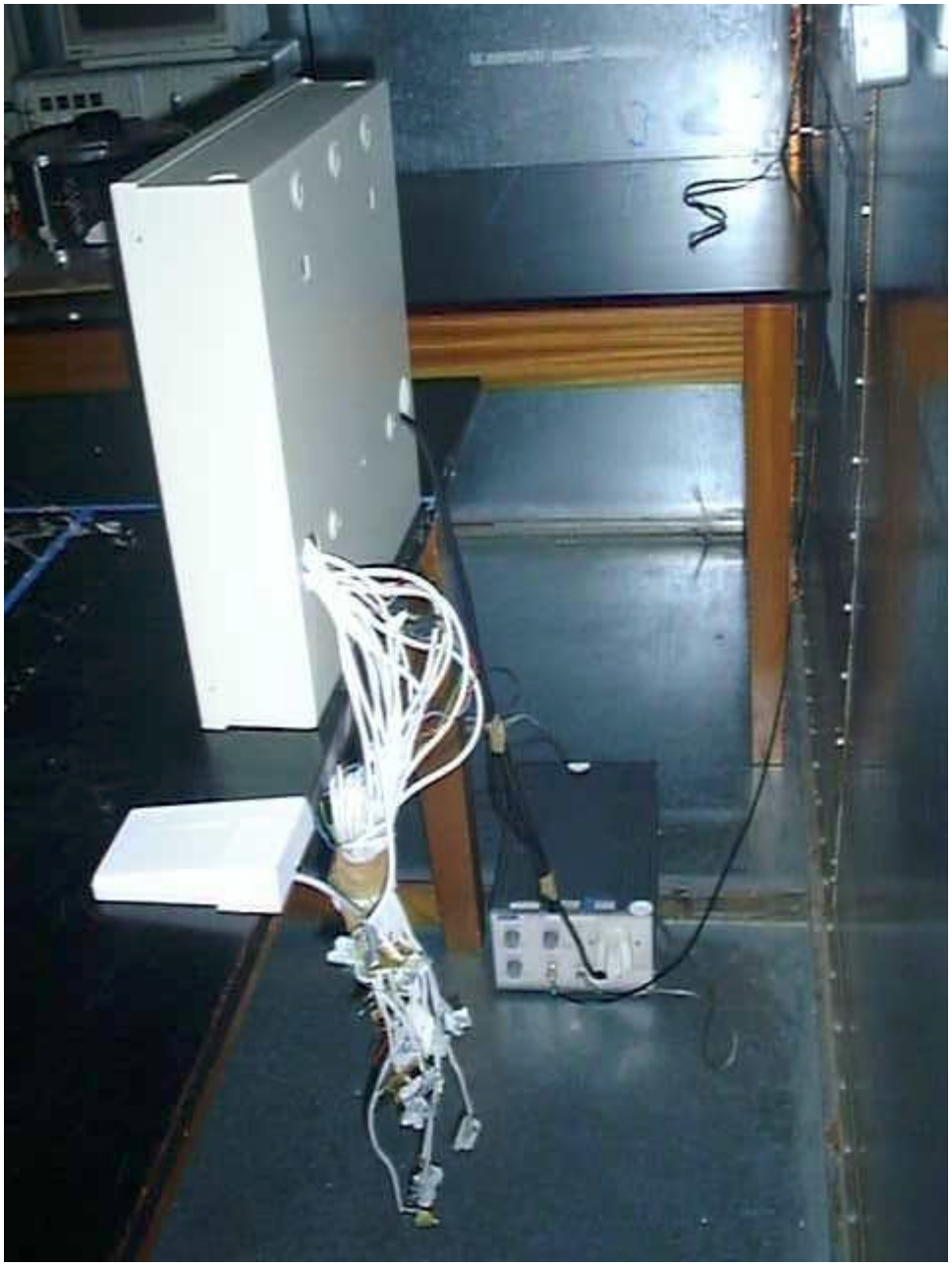
As per ANSI C63.4 : 1992.

Measurement Detector Details: Quasi-Peak, 9 kHz bandwidth.

Note: Initial pre-testing was performed to obtain worst case operating mode for the compliance test (Authorised RF ID card on and off the reader) .

Conducted Emissions Test Configuration

EUT Configuration



Conducted Emissions Environmental Conditions

Power Supply (to controller)	120V, 60Hz
Temperature	23°C
Relative Humidity	47 %
Barometric Pressure	1000 mb

Conducted Emissions Measurement Uncertainties

Frequency	± 200kHz
Amplitude	± 3.0dB

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Test Equipment Used

Equipment Type	Model Number	Last Calibration Date	Calibration Interval
LISN (50Ω)	Thurlby Thandar TTi 1600	21/9/98	1 Year
Chase Receiver	LHR7000	11/2/99	1 Year
Software	Version 6.00b	N/A	N/A
SGS Screened Room	-	N/A	N/A

8.6 Radiated Emissions Test Results- Intentional Radiator

CFR Clause	15.209
Frequency Range	0.125MHz – tenth harmonic frequency

Operating Mode

Fundamental (carrier) emission measurements performed without card on reader (door closed condition). All other measurements performed with card on reader (door open condition).

Test Results

Worst Case Emissions

Frequency (kHz)	Corrected Peak Measurement (dBμV/m)	Limit (dBμV/m)
*125.013	-5.97	25.66
[1]250	<-35.90	25.66
375.03	-25.23	25.66
625.087	-34.83	25.66
875.077	-42.00	25.66
1125.117	-46.33	25.66
1375.16	-48.67	25.66

*Indicates fundamental (carrier) emission at 115% of controller mains supply voltage (138V), card not on reader.

[1]Noise floor figures of test equipment shown at approximate fundamental harmonic frequencies.

Test Method

As per ANSI C63.4 : 1992

Measurements performed at 3m and extrapolated to correct distance (300m below 490kHz, 30m above 490kHz) using factor of 40dB/dec. Hence the correction factor of –80 dB was used. The corrected values are given above.

Frequency Range tested = 0.15MHz to tenth harmonic frequency (as per sec 15.33 (a)(1)).

Measurement Detector Details: Peak, 300Hz bandwidth at frequencies below 150 kHz, 10 kHz at frequencies above 150 kHz.

Note: Initial pre-testing was performed to obtain worst case operating mode for the compliance test (Authorised RF ID card on and off the peripheral readers).

Radiated Emissions Test Configuration

EUT Configuration

Radiated Emissions Environmental Conditions

Power Supply (to controller)	120V, 60Hz
Temperature	17 °C
Relative Humidity	53 %
Barometric Pressure	994 mb

Radiated Emissions Measurement Uncertainties

Frequency	± 200kHz
Amplitude	± 4.6dB

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Test Equipment Used

Equipment Type	Model Number	Last Calibration Date	Calibration Interval
Active loop antenna	EMCO 6502	7/8/98	2 Years
Spectrum Analyser	HP 8563E	12/2/99	1 Year

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