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**SGS United Kingdom Ltd.**

**EMC Services**



TESTING  
No. 1116

## ***Electromagnetic Compatibility Test Report***

|                            |                                                                                                         |
|----------------------------|---------------------------------------------------------------------------------------------------------|
| <b>Test of:</b>            | RF ID Card Entry Reader                                                                                 |
| <b>Model Number:</b>       | 20476                                                                                                   |
| <b>Applicant:</b>          | PAC International LTD                                                                                   |
| <b>Test Type:</b>          | Compliance                                                                                              |
| <b>Test Specification:</b> | FCC CFR47, parts 15.109 for unintentional radiators, parts 15.207 and 15.209 for Intentional Radiators. |
| <b>SGS Serial Number:</b>  | DUR 21561                                                                                               |
| <b>Date of Receipt:</b>    | 9 <sup>th</sup> September 1999                                                                          |
| <b>Date of Test(s):</b>    | 10 <sup>th</sup> to 24 <sup>th</sup> September 1999                                                     |
| <b>Date of Issue:</b>      | 27 <sup>th</sup> September 1999                                                                         |
| <b>Issue Number:</b>       | 1                                                                                                       |

***Test Engineer***

L. Steel

***Authorised Signatory***

A. H. Reynard

| <b>CONTENTS</b>                                                              | <b>Page Number</b> |
|------------------------------------------------------------------------------|--------------------|
| 1. Client Information .....                                                  | 3                  |
| 2. Details Of Test Laboratory .....                                          | 3                  |
| 3. Equipment Under Test (EUT) .....                                          | 4                  |
| 3.1 Identification Of EUT .....                                              | 4                  |
| 4. Test Specification, Methods and Procedures .....                          | 4                  |
| 4.1 Test Specification(s) .....                                              | 4                  |
| 4.2 Purpose Of Test .....                                                    | 4                  |
| 4.3 Methods and Procedures .....                                             | 5                  |
| 5. Deviations or Exclusions from the Test Specifications .....               | 6                  |
| 6. Support Equipment .....                                                   | 7                  |
| 7. Operation of the EUT During Testing / Configuration and Peripherals ..... | 10                 |
| 7.1 Operation of EUT during testing. ....                                    | 10                 |
| 7.2 Configuration and Peripherals .....                                      | 10                 |
| 8. Test Results .....                                                        | 11                 |
| 8.1 General Comments .....                                                   | 11                 |
| 8.2 Modifications Made to the EUT .....                                      | 11                 |
| 8.3 Summary of Test Results .....                                            | 12                 |
| 8.4 Radiated Emissions Test Results- Unintentional Radiator .....            | 13                 |
| 8.5 AC Power Line Conducted Emissions Test Results .....                     | 16                 |
| 8.6 Radiated Emissions Test Results- Intentional Radiator .....              | 19                 |

**1. Client Information**

**Company Name:** PAC International LTD.

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SK6 2SZ,  
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**Contact Person:** Mr Shaun Byrne

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**2. Details Of Test Laboratory**

**Company Name:** SGS EMC Services LTD.

**UKAS Accreditation Number:** 1116

**Address:** Unit 10,  
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### 3. Equipment Under Test (EUT)

#### 3.1 Identification Of EUT

|                                        |                                                                                                               |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Model Number:</b>                   | 20476                                                                                                         |
| <b>Unique Identifier:</b>              | Unique Identifier Not Supplied                                                                                |
| <b>Description of EUT:</b>             | The EUT is an R.F. card entry reader, designed to prevent access to restricted areas by unauthorised persons. |
| <b>Fundamental (Carrier) Frequency</b> | 125 kHz Single Channel                                                                                        |
| <b>Internal Clock Frequencies:</b>     | 8 MHz                                                                                                         |
| <b>Supply Voltage:</b>                 | 18V DC (Via central controller)                                                                               |
| <b>Classification:</b>                 | Intentional radiator, incorporating digital device.                                                           |
| <b>Environment Class:</b>              | Commercial / Class A                                                                                          |
| <b>Ports present:</b>                  | One port comprising eight wires. Refer to configuration/peripherals section of this report for details.       |
| <b>Accessories Supplied:</b>           | Central Controller<br>(refer to section 6 for full details)                                                   |

### 4. Test Specification, Methods and Procedures

#### 4.1 Test Specification(s)

| <b>Specification(s)</b>                                      | <b>Title</b>                                                                                                                                                       |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC CFR 47 : October 1998<br>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<br>(Unintentional Radiator) |
| 15.207        | AC Power line<br>Conducted Emissions           |
| 15.209        | Radiated Emissions<br>(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). 150 $\Omega$  resistors were connected to each conductor, with respect to the GND terminal, except for:

LED terminal, terminated with 10k $\Omega$ , with respect to ground  
Signal terminal, terminated with 100 $\Omega$ , with respect to ground  
Lock output, terminated with 22 $\Omega$ , between L+ and L- terminals.

**Channel 2 port :**

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

LED terminal, terminated with 10k $\Omega$ , with respect to ground

Signal terminal, terminated with 100 $\Omega$ , with respect to ground

Lock output, terminated with 22 $\Omega$ , between L+ and L- terminals.

**Channel 3 port :**

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

LED terminal, terminated with 10k $\Omega$ , with respect to ground

Signal terminal, terminated with 100 $\Omega$ , with respect to ground

Lock output, terminated with 22 $\Omega$ , between L+ and L- terminals.

**Channel 4 port :**

The EUT was connected to this port via a 1m lead. (The 18v supply terminal, ground terminal, signal terminal and LED terminal were used. All other terminals were terminated via 1m leads (6 core, unscreened) with 150 $\Omega$  resistors, with respect to ground, except for the lock output which was terminated with a 22 $\Omega$  resistor between L+ and L- terminals.

**Six Wire Bus Port**

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

**Tamper Port**

A 1m lead was connected to this port (six core, unscreened). 150 $\Omega$  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). 150 $\Omega$  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). 150 $\Omega$  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). 150 $\Omega$  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      |
|----------------------------|---------------------------------|
|                            |                                 |
| 18V supply terminals       | Controller                      |
| Ground terminal            | Controller                      |
| Signal terminal            | Controller                      |
| LED terminal,              | Controller                      |
| Buzzer terminal,           | 150 $\Omega$ resistor to ground |
| Auxiliary signal terminal, | 150 $\Omega$ resistor to ground |
| Tamper terminal            | 150 $\Omega$ resistor to ground |
| 1 spare terminal           | 150 $\Omega$ resistor to ground |

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 150 $\Omega$  resistors can be used when a non-PAC controller is used.

Terminations applied at the end of 1m lead (eight 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<br>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**

|                        |               |
|------------------------|---------------|
| <b>CFR Clause</b>      | 15.109        |
| <b>Limits</b>          | Class A       |
| <b>Frequency Range</b> | 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 (dB $\mu$ V) | Quasi Peak Limit (dB $\mu$ V) | Antenna Polarity (H/V) |
|-----------------|-------------------------------------|-------------------------------|------------------------|
| 264.211         | 31.7                                | 46.4                          | V                      |
| 301.083         | 29.1                                | 46.4                          | V                      |
| 233.493         | 27.4                                | 46.4                          | V                      |
| 190.505         | 27.1                                | 43.5                          | V                      |
| 116.737         | 26.3                                | 43.5                          | V                      |
| 380.975         | 26.0                                | 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**

|                                     |            |
|-------------------------------------|------------|
| <b>Power Supply (to controller)</b> | 120V, 60Hz |
| <b>Temperature</b>                  | 16 °C      |
| <b>Relative Humidity</b>            | 81 %       |
| <b>Barometric Pressure</b>          | 997 mb     |

**Radiated Emissions Measurement Uncertainties**

|                  |          |
|------------------|----------|
| <b>Frequency</b> | ± 200kHz |
| <b>Amplitude</b> | ± 4.6dB  |

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

**Test Equipment Used**

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

## 8.5 AC Power Line Conducted Emissions Test Results

|                        |                |
|------------------------|----------------|
| <b>CFR 47 Clause:</b>  | 15.207         |
| <b>Frequency Range</b> | 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 (dB $\mu$ V) | Quasi Peak Limit (dB $\mu$ V) |
|-----------------|-------------------------------------|-------------------------------|
| 1.8180          | 11.1                                | 47.96                         |
| 2.4525          | 11.1                                | 47.96                         |
| 3.5235          | 11.2                                | 47.96                         |
| 17.1315         | 37.6                                | 47.96                         |
| 21.6315         | 33.6                                | 47.96                         |
| 28.503          | 35.6                                | 47.96                         |

#### *Neutral Terminal Worst Case Emissions*

| Frequency (MHz) | Quasi Peak Measurement (dB $\mu$ V) | Quasi Peak Limit (dB $\mu$ V) |
|-----------------|-------------------------------------|-------------------------------|
| 1.7235          | 19.3                                | 47.96                         |
| 2.1555          | 11.1                                | 47.96                         |
| 2.3670          | 23.2                                | 47.96                         |
| 17.1315         | 37.6                                | 47.96                         |
| 18.1305         | 39.4                                | 47.96                         |
| 28.5075         | 27.2                                | 47.96                         |

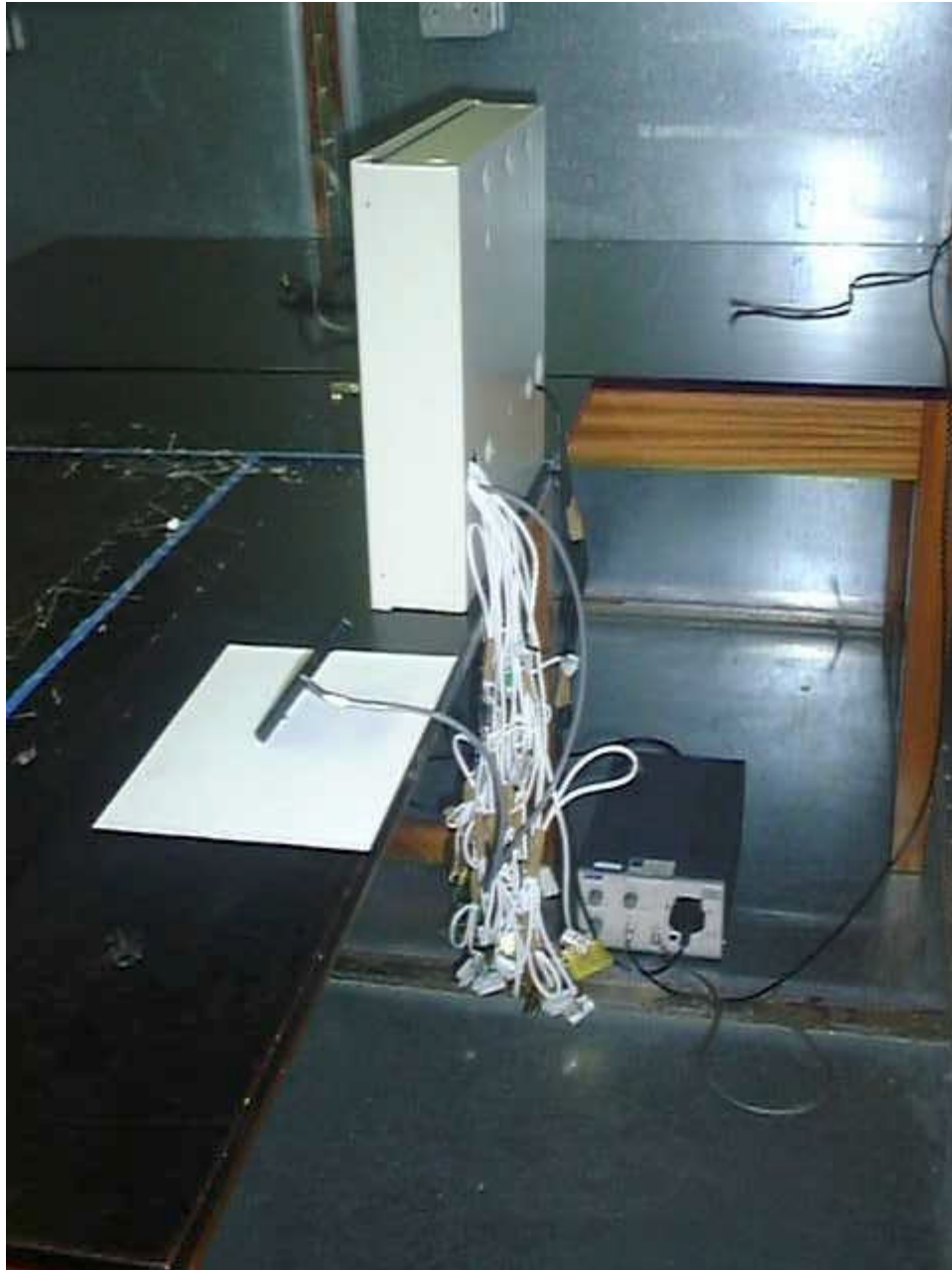
Note: The figures shown have been corrected automatically by measurement software, to account for cable loss and LISN attenuation.

### 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**

|                                     |            |
|-------------------------------------|------------|
| <b>Power Supply (to controller)</b> | 120V, 60Hz |
| <b>Temperature</b>                  | 21.5°C     |
| <b>Relative Humidity</b>            | 44 %       |
| <b>Barometric Pressure</b>          | 1013 mb    |

**Conducted Emissions Measurement Uncertainties**

|                  |                     |
|------------------|---------------------|
| <b>Frequency</b> | $\pm 200\text{kHz}$ |
| <b>Amplitude</b> | $\pm 3.0\text{dB}$  |

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

**Test Equipment Used**

| <b>Equipment Type</b> | <b>Model Number</b>         | <b>Last Calibration Date</b> | <b>Calibration Interval</b> |
|-----------------------|-----------------------------|------------------------------|-----------------------------|
| LISN (50 $\Omega$ )   | Thurlby Thandar<br>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 | 0.15MHz – 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 (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) |
|-----------------|-------------------------------------------|----------------------|
| *125.023        | 17.53                                     | 25.66                |
| **250           | <-34.90                                   | 25.66                |
| 375.03          | -26.90                                    | 25.66                |
| 625.087         | -35.83                                    | 25.66                |
| **750           | <-50.17                                   | 25.66                |
| 875.1           | -41.50                                    | 25.66                |
| 1125.117        | -44.33                                    | 25.66                |

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

\*\*Noise floor figures of test equipment shown at approximate fundamental harmonic frequencies.

### Test Method

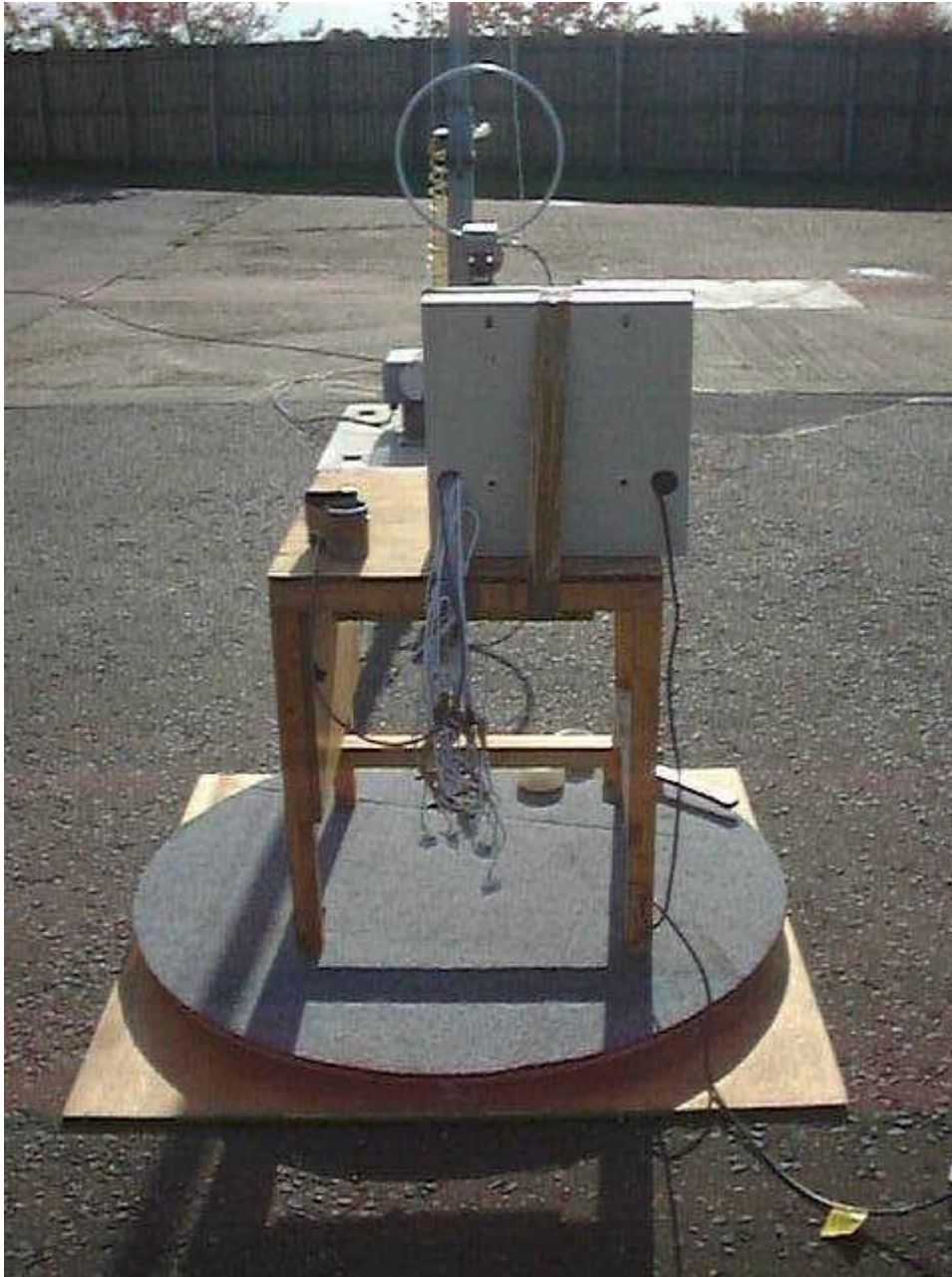
As per ANSI C63.4 : 1992

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**

|                                     |            |
|-------------------------------------|------------|
| <b>Power Supply (to controller)</b> | 120V, 60Hz |
| <b>Temperature</b>                  | 17 °C      |
| <b>Relative Humidity</b>            | 53 %       |
| <b>Barometric Pressure</b>          | 994 mb     |

**Radiated Emissions Measurement Uncertainties**

|                  |          |
|------------------|----------|
| <b>Frequency</b> | ± 200kHz |
| <b>Amplitude</b> | ± 4.6dB  |

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

**Test Equipment Used**

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

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