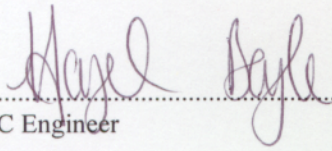


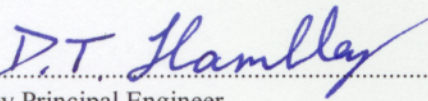


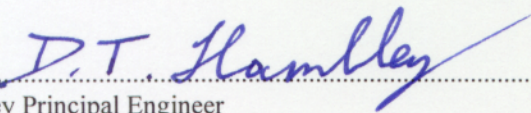
**Electromagnetic  
Compatibility  
Test Report (copy 1 of 3)  
on  
RFID Readers  
for  
PAC International Ltd**

Document number 1926TR3

Project number 7188

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| Issue | Description | Issue by | Date       |
|-------|-------------|----------|------------|
| 3     | Third Issue | HB       | 24/02/2006 |

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The results contained in this report are only applicable to the apparatus tested.



A DTI appointed Competent Body

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## Test Report Change History

| Issue | Modification Details                                                                                                                                                           |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Original issue of test report                                                                                                                                                  |
| 2     | Complete revision of report in light of TCB comments. Addition of Fundamental supply voltage stability test. Assessment of results against both CFR47Part 15 subparts B and C. |
| 3     | Addition of Conducted Emission AC Mains Test (110V)                                                                                                                            |
| 4     |                                                                                                                                                                                |
| 5     |                                                                                                                                                                                |
| 6     |                                                                                                                                                                                |
| 7     |                                                                                                                                                                                |
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## SECTION 1

### Introduction

#### 1.1 General

This report contains the results of EMC tests performed on various RFID Readers (herein called the equipment under test [EUT]) received at the EMC Test Centre 27<sup>th</sup> September 2004 and tested in the period 18<sup>TH</sup> November 2004 to the 29<sup>th</sup> November 2004. Re received 14<sup>th</sup> February 2006 and tested in the period 14<sup>th</sup> February 2006 to the 15<sup>th</sup> February 2006. The tests were carried out in the EMC Test Centre, York EMC Services Ltd Donibristle, Dunfermline. This report was revised in light of Telecommunications Conformity Body (TCB) comments. Then subsequently revised for the Conducted Emission AC mains test.

This report is written assuming the reader is familiar with the terms used in the field of EMC.

The Equipment shall be labelled and identified according to the FCC rules.

#### 1.2 Client

The tests were performed for:

|                      |                       |
|----------------------|-----------------------|
| <b>Company Name:</b> | PAC International Ltd |
| <b>Address:</b>      | 1 Park Gate Close     |
|                      | Bredbury Parkway      |
|                      | Stockport             |
|                      | Cheshire, SK6 2SZ     |
| <b>Contact name:</b> | Mr P. Lucas           |

#### 1.3 Equipment Under Test (EUT)

##### RFID Reader:

A micro controller generates a fixed frequency of 133.3 KHz (derived from its crystal clock of 16 MHz), which is then fed to a series LC resonant circuit via a driver/buffer circuit. The resonant circuit is tuned during manufacture by selecting components on test.

The 'L' of the resonant circuit is the coil, which is the inductive link with a passive identification tag. The passive ID tag (or card) is a very low power device, which is powered by the carrier field from the coil, and which modulates a tuned circuit with its unique ID code. The demodulator detects the code picked up by the inductive link. This is then amplified and band-pass filtered before being converted to a digital signal by a Schmidt trigger.

The micro controller takes the digital signal that has been detected from the passive ID device, and uses it to generate a 4800 Baud serial code via the output Sig A. The device is used in access control applications.

The micro controller also monitors the input 'LED-IN'. This input is pulled up to 5V with a resistor. If the 'LED-IN' input is pulled low by a peripheral device, then the micro controller will change the LED colour from red to green.

The EUT produces a constant carrier and so no duty cycle correction factor was applied to emissions measurements.

#### 1.4 Related Submittal(s)/Grant(s)

None.

### 1.5 Tested System Details

| Model Number | FCC ID       | Description                                  | Cable Description                                         | Length | Ports                                           |
|--------------|--------------|----------------------------------------------|-----------------------------------------------------------|--------|-------------------------------------------------|
| PR003        | OQL – R - CM | Classic Mullion                              | Typically multi core non screened with 7x0.2mm conductors | < 1km  | 8 way screw terminal connector block            |
| PR009        | OQL – R - P  | Panel Standard                               | Typically multi core non screened with 7x0.2mm conductors | < 1km  | 8 way screw terminal connector block            |
| PR006        | OQL-R-V      | Vandal Standard                              | Typically multi core non screened with 7x0.2mm conductors | < 1km  | Hard wired 8-way flying lead of ~25cm in length |
| PR008        | OQL-R-LP     | Low Profile Standard (also known as Desktop) | Typically multi core non screened with 7x0.2mm conductors | < 1km  | Hard wired 8-way flying lead of ~25cm in length |
| PR005        | OQL-R-SP     | Standard Plus                                | Typically multi core non screened with 7x0.2mm conductors | < 1km  | 8 way screw terminal connector block            |
| PR004        | OQL-R-DS     | Designer Standard                            | Typically multi core non screened with 7x0.2mm conductors | < 1km  | 8 way screw terminal connector block            |
| PR007        | OQL-R-US     | Universal Standard (also known as PX50)      | Typically multi core non screened with 7x0.2mm conductors | < 1km  | 8 way screw terminal connector block            |

### 1.6 Test Methodology

Radiated emission testing was performed according to the procedures in ANSI C63.4-2000. Radiated testing was performed at an antenna to EUT distance of 10m.

### 1.7 UKAS Accreditation

Tests marked "Not UKAS Accredited" in this report are not included in the UKAS Accreditation Schedule for our laboratory.

The laboratory is accredited for ETSI standards EN300 339 and ETS 300 683, these being radio specific. All testing performed by the laboratory uses UKAS calibrated instrumentation and the same methods and procedures as for ISO 17025 accredited work.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

### 1.8 Abnormalities/Departures from Standard Conditions

Testing was performed on seven individual RFID readers. However due to time restrictions it was necessary to test the readers in pairs as follows: Designer Standard with Classic Mullion, Low Profile Standard with Vandal Standard, Panel Standard with Standard Plus and the Universal Standard Reader as an individual.

CFR47 Pt 15 Sub Pt C Clause 15.208 (c) states that devices that obtain their power through another device that is connected to the AC power lines shall be tested to demonstrate compliance to the conducted limits. The EUT has no AC power port; it is DC powered via the signal cable and the power source is the responsibility of the user. A typical bench power supply was used as the EUT power source. It was found that the power line conducted emissions from the EUT DC power source were masking the emissions from the EUT. As a result the emissions on the DC lines were measured against 15.107 Class A limits to accurately characterize the emissions from the EUT. The EUT was also powered from a PAC202 door controller and the conducted emissions on the AC power port measured.

CFR47 Pt 15 Sub Pt C Clause 15.209 (a) states that the field strength should be measured in dBuV/m, this implies an E field antenna. ANSCI C63.4 provides a test methodology for H-field measurements below 30MHz but not E field. As a result the actual test was carried out in the H field giving dBuA/m. This result was transposed to E field units as described in Para 6.2.3.

CFR47 Pt 15 Sub Pt A Clause 15.31(e), output power stability under voltage variations requires radiated signal level measurement at 85% and 115% of nominal rated supply voltage. Output power tests at 53%, 100% and 171% of nominal voltage were performed against the requirements of EN300 330-1. These results have been used to demonstrate compliance to 15.31(e).

### 1.9 FCC Registration

The EMC Test Centre, York EMC Services Ltd, is a registered test facility with the Federal Communications Commission (FCC). The appropriate FCC registration number is 90609, dated 13 May 1994 and reconfirmed 21 March 2003.

York EMC Services is also listed as a Conformity Assessment Body (CAB) under the Sectional Annex of the EU-US Mutual Recognition Agreement

## SECTION 2

### Specifications, List of Tests and Test Results Summary

#### 2.1 Specifications and Related Documents

The relevant EMC specifications are;

47CFR: 2002 Part 15, Sub Part C

Intentional Radiators; Conducted and Radiated Emission Limits.

47CFR: 2002 Part 15, Sub Part B

Unintentional Radiators, Conducted and Radiated Emission Limits.

47CFR: 2002 refers to the following specification: -

ANSI C63-4: 2000

Methods of Measurements of Radio Noise Emissions from Low

Voltage Electrical and Electronic Equipment in the Range 9kHz to 40GHz.

#### 2.2 List of Tests

The following is the list of tests, which were required for compliance with the above specifications;

Conducted Emission Test 150kHz to 30MHz, DC power lines

Conducted Emission Test 150kHz to 30MHz, AC power lines

Radiated Emission Test 9kHz to 30MHz

Radiated Emission Test 30MHz to 1000MHz

Fundamental supply voltage stability 85% and 115% of nominal supply voltage.

The sequence of testing is described in Section 6 of this report.

#### 2.3 Summary of Test Results

The following is a brief summary of the test results. Detailed data are contained in Section 6 of this report.

##### 2.3.1 Conducted Emission Test, 0.15kHz to 30MHz (dc Lines)

The Designer standard, Mullion, Universal and their associated DC power cabling complied with the clause 15.207 (a) specification limit as follows

| Line                                   | Frequency<br>MHz | 15.207 (a)<br>dBuV | Margin<br>dB | Comment                                       |
|----------------------------------------|------------------|--------------------|--------------|-----------------------------------------------|
| <b>Designer Standard &amp; Mullion</b> |                  |                    |              |                                               |
| Positive                               | 25.3             | 50                 | -1           | Pass: UNCER LO<br>Peak Trace to Average Limit |
| Negative                               | 23.39            | 50                 | -3.8         | Pass:<br>Peak Trace to Average Limit          |
| <b>UNIVERSAL</b>                       |                  |                    |              |                                               |
| Positive                               | 25.6             | 50                 | -1.4         | Pass: UNCER LO<br>Peak Trace to Average Limit |
| Negative                               | 25.6             | 50                 | -4.4         | Pass:<br>Peak Trace to Average Limit          |

Note: The emissions marked UNCER LO were found to fall within the uncertainty relative to the specification limit. The compliance statements above are therefore made at a lower than 95% confidence level. The measured results, however, indicate that compliance is more probable than non / compliance.

The LPR, Vandal, Panel standard, Standard PLVS and their associated DC power cabling failed to comply with the clause 15.207 (a) specification limit as follows

| Line                                      | Frequency<br>MHz | 15.207 (a)<br>dBuV | Margin<br>dB | Comment                                       |
|-------------------------------------------|------------------|--------------------|--------------|-----------------------------------------------|
| <b>LPR &amp; VANDAL</b>                   |                  |                    |              |                                               |
| Positive                                  | 15.48            | 50                 | 3.6          | Fail:<br>Average Trace to Average Limit       |
| Negative                                  | 15.08            | 50                 | 3.3          | Fail:<br>Peak Trace to Average Limit          |
| <b>Panel Standard &amp; Standard PLVS</b> |                  |                    |              |                                               |
| Positive                                  | 17.95            | 50                 | 2.6          | Fail:<br>Peak Trace to Average Limit          |
| Negative                                  | 17.67            | 50                 | -0.1         | Pass: UNCER LO<br>Peak Trace to Average Limit |

Note: The emissions marked UNCER LO were found to fall within the uncertainty relative to the specification limit. The compliance statements above are therefore made at a lower than 95% confidence level. The measured results, however, indicate that compliance is more probable than non-compliance.

The EUTs and their associated DC power cabling complied with the clause 15.107 (b) specification limit as follows

| Line                                      | Frequency<br>MHz | 15.107 (b)<br>dBmV | Margin<br>dB | Comment                                 |
|-------------------------------------------|------------------|--------------------|--------------|-----------------------------------------|
| <b>Designer Standard &amp; Mullion</b>    |                  |                    |              |                                         |
| Positive                                  | 25.3             | 60                 | -11          | Pass:<br>Peak Trace to Average Limit    |
| Negative                                  | 23.39            | 60                 | -13.8        | Pass:<br>Peak Trace to Average Limit    |
| <b>LPR &amp; VANDAL</b>                   |                  |                    |              |                                         |
| Positive                                  | 15.48            | 60                 | -6.4         | Pass:<br>Average Trace to Average Limit |
| Negative                                  | 15.08            | 60                 | -6.7         | Pass:<br>Peak Trace to Average Limit    |
| <b>Panel Standard &amp; Standard PLVS</b> |                  |                    |              |                                         |
| Positive                                  | 17.95            | 60                 | -7.4         | Pass:<br>Peak Trace to Average Limit    |
| Negative                                  | 17.67            | 60                 | -10.1        | Pass:<br>Peak Trace to Average Limit    |
| <b>UNIVERSAL</b>                          |                  |                    |              |                                         |
| Positive                                  | 25.6             | 60                 | -11.4        | Pass:<br>Peak Trace to Average Limit    |
| Negative                                  | 25.6             | 60                 | -14.4        | Pass:<br>Peak Trace to Average Limit    |

## 2.3.2 Conducted Emission Test, 0.15kHz to 30MHz (ac Lines)

The Designer standard, Mullion, Universal and their associated AC power cabling complied with the clause 15.207 (a) specification limit as follows

| Line    | Frequency<br>MHz | 15.207 (a)<br>dBuV | Margin<br>dB | Comment                                       |
|---------|------------------|--------------------|--------------|-----------------------------------------------|
| Live    | 29.84            | 50                 | -0.4         | Pass: UNCER LO<br>Peak Trace to Average Limit |
| Live    | 24.8             | 50                 | -2.8         | Pass<br>Peak Trace to Average Limit           |
| Neutral | 24.66            | 50                 | -2.9         | Pass<br>Peak Trace to Average Limit           |
| Live    | 25.06            | 50                 | -2.9         | Pass<br>Peak Trace to Average Limit           |
| Live    | 24.53            | 50                 | -3.2         | Pass<br>Peak Trace to Average Limit           |
| Neutral | 24.15            | 50                 | -3.9         | Pass<br>Peak Trace to Average Limit           |

Note: The emissions marked UNCER LO were found to fall within the uncertainty relative to the specification limit. The compliance statements above are therefore made at a lower than 95% confidence level. The measured results, however, indicate that compliance is more probable than non / compliance.

The LPR/Vandal, Panel standard/Standard PLVS and their associated AC power cabling failed to comply with the clause 15.207 (a) specification limit as follows

| Line    | Frequency<br>MHz | 15.207 (a)<br>dBuV | Margin<br>dB | Comment                                          |
|---------|------------------|--------------------|--------------|--------------------------------------------------|
| Live    | 29.84            | 50                 | 5.8          | Fail:<br>Average Trace to Average Limit          |
| Live    | 29.53            | 50                 | 5.2          | Fail:<br>Average Trace to Average Limit          |
| Neutral | 29.68            | 50                 | 4.4          | Fail:<br>Average Trace to Average Limit          |
| Neutral | 29.37            | 50                 | 2.5          | Fail: UNCER HI<br>Average Trace to Average Limit |
| Live    | 24.8             | 50                 | 1            | Fail: UNCER HI<br>Average Trace to Average Limit |
| Neutral | 24.53            | 50                 | 0.2          | Fail: UNCER HI<br>Average Trace to Average Limit |
| Neutral | 24.8             | 50                 | 0            | Pass: UNCER LO<br>Average Trace to Average Limit |
| Live    | 25.06            | 50                 | -0.5         | Pass: UNCER LO<br>Average Trace to Average Limit |
| Neutral | 24.53            | 50                 | -0.8         | Pass: UNCER LO<br>Average Trace to Average Limit |
| Neutral | 25.06            | 50                 | -1.2         | Pass: UNCER LO<br>Average Trace to Average Limit |
| Live    | 24.28            | 50                 | -1.2         | Pass: UNCER LO<br>Average Trace to Average Limit |
| Live    | 28.91            | 50                 | -1.5         | Pass: UNCER LO<br>Average Trace to Average Limit |
| Live    | 24.02            | 50                 | -2.9         | Pass<br>Average Trace to Average Limit           |

|         |       |    |      |                                        |
|---------|-------|----|------|----------------------------------------|
| Live    | 25.33 | 50 | -3.3 | Pass<br>Average Trace to Average Limit |
| Neutral | 25.33 | 50 | -3.9 | Pass<br>Average Trace to Average Limit |

Note: The emissions marked UNCER HI or LO were found to fall within the uncertainty relative to the specification limit. The compliance statements above are therefore made at a lower than 95% confidence level. The measured results, however, indicate that non-compliance is more probable than compliance.

### 2.3.3 Radiated Emission Test, 9kHz to 30MHz (Not UKAS Accredited)

The EUTs and their associated DC power cabling complied with the clause 15.209 (a) and 15.209 (c) specification limit as follows

| Frequency<br>MHz | 15.209 (a)<br>dBmV/m | Margin<br>dB | Comment                                |
|------------------|----------------------|--------------|----------------------------------------|
| 0.133            | 25.13                | -29.38       | Pass:<br>H-Field transposed to E-field |
| 0.4              | 15.56                | -40.76       |                                        |

| Frequency<br>MHz | 15.209 (c)<br>dBμA/m | Margin<br>dB | Comment                                           |
|------------------|----------------------|--------------|---------------------------------------------------|
| 0.133            | 34.4                 | na           | Level of fundamental                              |
| 0.4              | 3.9                  | 30.5         | Pass:<br>Unwanted emissions less than fundamental |
| 0.665            | -2.9                 | 37.3         |                                                   |
| 0.93             | -10.1                | 44.5         |                                                   |
| 1.2              | -13                  | 47.4         |                                                   |
| 1.465            | -15.4                | 49.8         |                                                   |
| 1.73             | -18.58               | 52.98        |                                                   |
| 2                | -19.2                | 53.6         |                                                   |
| 3.07             | -23.2                | 57.6         |                                                   |
| 3.6              | -21.1                | 55.5         |                                                   |
| 4.13             | -21.4                | 55.8         |                                                   |
| 4.665            | -13.3                | 47.7         |                                                   |
| 5.28             | -24.7                | 59.1         |                                                   |
| 6.8              | -19.8                | 54.2         |                                                   |
| 7.865            | -17.6                | 52           |                                                   |
| 8.935            | -21.4                | 55.8         |                                                   |
| 11.065           | -8.7                 | 43.1         |                                                   |
| 11.335           | -5.4                 | 39.8         |                                                   |
| 13.335           | -17.8                | 52.2         |                                                   |
| 18.4             | -12.5                | 46.9         |                                                   |
| 18.67            | -13.3                | 47.7         |                                                   |
| 24.27            | -6.1                 | 40.5         |                                                   |
| 25.605           | -16                  | 50.4         |                                                   |

### 2.3.4 Radiated Emission Test, 30MHz to 1000MHz

The Designer standard, Classic Mullion, Panel Standard, Standard PLVS and their associated DC power cabling complied with the clause 15.209 (a) specification limit as follows

| Frequency<br>MHz                          | 15.209 (a)<br>dBmV/m | Margin<br>dB | Comment        |
|-------------------------------------------|----------------------|--------------|----------------|
| <b>Designer Std &amp; Classic Mullion</b> |                      |              |                |
| 80.0131                                   | 39                   | -2.94        | Pass: UNCER LO |
| 76.676                                    | 39                   | -8.04        | Pass           |
| 72.279                                    | 39                   | -8.84        | Pass           |
| 55.0757                                   | 39                   | -9.34        | Pass           |
| 67.3447                                   | 39                   | -10.74       | Pass           |
| <b>Panel Std &amp; Std Plus</b>           |                      |              |                |
| 56.0082                                   | 39                   | -4.64        | Pass: UNCER LO |
| 55.4747                                   | 39                   | -4.74        | Pass: UNCER LO |
| 67.61                                     | 39                   | -5.44        | Pass           |
| 66.2764                                   | 39                   | -5.64        | Pass           |
| 80.0119                                   | 39                   | -8.54        | Pass           |

Note: The emissions marked UNCER LO were found to fall within the uncertainty relative to the specification limit. The compliance statements above are therefore made at a lower than 95% confidence level. The measured results, however, indicate that compliance is more probable than non-compliance.

The LPR, Vandal, Universal and their associated DC power cabling failed to comply with the clause 15.209 (a) specification limit as follows

| Frequency<br>MHz            | 15.209 (a)<br>dBmV/m | Margin<br>dB | Comment        |
|-----------------------------|----------------------|--------------|----------------|
| <b>LPR &amp; Vandal Std</b> |                      |              |                |
| 73.9469                     | 39                   | 9.80         | Fail:          |
| 80.0138                     | 39                   | 5.69         | Fail:          |
| 76.0133                     | 39                   | 3.99         | Fail: UNCER HI |
| 41.474                      | 39                   | 1.82         | Fail: UNCER HI |
| 63.8781                     | 39                   | -0.99        | Pass: UNCER LO |
| 35.4728                     | 39                   | -1.68        | Pass: UNCER LO |
| <b>UNIVERSAL</b>            |                      |              |                |
| 40.0065                     | 39                   | 0.56         | Fail: UNCER HI |
| 36.8061                     | 39                   | -0.84        | Pass: UNCER LO |
| 35.7393                     | 39                   | -2.44        | Pass: UNCER LO |
| 62.277                      | 39                   | -6.74        | Pass           |
| 59.3431                     | 39                   | -9.04        | Pass           |

Note: The emissions marked UNCER LO or UNCER HI were found to fall within the uncertainty relative to the specification limit. The compliance statements above are therefore made at a lower than 95% confidence level. The measured results, however, indicate that non-compliance is more probable than compliance.

The Designer standard, Classic Mullion, Panel standard, Standard PLVS, Universal and their associated DC power cabling complied with the clause 15.109 (b) specification limit as follows

| Frequency<br>MHz                          | 15.109 (b)<br>dBmV/m | Margin<br>dB | Comment |
|-------------------------------------------|----------------------|--------------|---------|
| <b>Designer Std &amp; Classic Mullion</b> |                      |              |         |
| 80.0131                                   | 39                   | -12.48       | Pass    |
| 76.676                                    | 39                   | -17.58       | Pass    |
| 72.279                                    | 39                   | -18.38       | Pass    |
| 55.0757                                   | 39                   | -18.88       | Pass    |
| 67.3447                                   | 39                   | -20.28       | Pass    |
| <b>Panel Std &amp; Std Plus</b>           |                      |              |         |
| 56.0082                                   | 39                   | -14.18       | Pass    |
| 55.4747                                   | 39                   | -14.28       | Pass    |
| 67.61                                     | 39                   | -14.98       | Pass    |
| 66.2764                                   | 39                   | -15.18       | Pass    |
| 80.0119                                   | 39                   | -18.08       | Pass    |
| <b>UNIVERSAL</b>                          |                      |              |         |
| 40.0065                                   | 39                   | -8.98        | Pass    |
| 36.8061                                   | 39                   | -10.38       | Pass    |
| 35.7393                                   | 39                   | -11.98       | Pass    |
| 62.277                                    | 39                   | -16.28       | Pass    |
| 59.3431                                   | 39                   | -18.58       | Pass    |

The LPR, Vandal and their associated DC power cabling failed to comply with the clause 15.209 (a) specification limit as follows

|                             |    |        |                |
|-----------------------------|----|--------|----------------|
| <b>LPR &amp; Vandal Std</b> |    |        |                |
| 80.0138                     | 39 | -3.85  | Pass: UNCER LO |
| 76.0133                     | 39 | -5.55  | Pass           |
| 41.474                      | 39 | -7.72  | Pass           |
| 73.9469                     | 39 | 0.26   | Fail: UNCER HI |
| 63.8781                     | 39 | -10.53 | Pass           |
| 35.4728                     | 39 | -11.22 | Pass           |

Note: The emissions marked UNCER LO or UNCER HI were found to fall within the uncertainty relative to the specification limit. The compliance statements above are therefore made at a lower than 95% confidence level. The measured results, however, indicate that non-compliance is more probable than compliance.

### 2.3.5 Fundamental supply voltage stability (Not UKAS Accredited)

The fundamental field strength was found to change by 3.2dB over the supply voltage range +71% to -53% of nominal. Clause 15.31 (e) does not specify a tolerance and hence no compliance statement can be made.

### 2.3.6 EUT Submitted

It should be noted that these results apply only to the particular EUT submitted, in the configuration used and in the mode of operation tested.