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# TEST REPORT

## Tru-Test XRP2-1 Low Frequency Electronic ID (EID) Reader

*tested to*

## 47 Code of Federal Regulations

## Part 15 - Radio Frequency Devices

## Subpart C – Intentional Radiators

*for*

## Tru-Test Ltd

This Test Report is issued with the authority of: _____
**Andrew Cutler - General Manager**

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

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# 1. STATEMENT OF COMPLIANCE

The **Tru-Test XRP2-1 Low Frequency Electronic ID (EID) Reader** complies with FCC Part 15 Subpart C as an Intentional Radiator when the methods as described in ANSI C63.4 - 2003 are applied.

# 2. RESULTS SUMMARY

| Clause | Parameter | Result |
|---|---|---|
| 15.201 | Equipment authorisation requirement | Certification required. |
| 15.203 | Antenna requirement | Complies. Antenna connects externally to the device and has a unique non standard fitting. A Large and Small antenna were tested with this device.<br>Large EID Antenna (87 x 60 cm).<br>Small EID Antenna (43 x 40 cm). |
| 15.204 | External PA and antenna modifications | Noted. |
| 15.205 | Restricted bands of operation | Complies. Device transmits on 134.2 kHz. |
| 15.207 | Conducted limits | Complies with a 4.3 dB margin at 513.0 kHz (Average) when either the Large or Small EID antenna is attached. |
| 15.209 | Radiated emission limits - Fundamental | Complies with a 3.1 dB margin at 134.2 kHz (Average and Peak) when the Small EID antenna is used. |
| 15.209 | Radiated emission limits - Spurious emissions <30 MHz | Complies with a 20.2 dB margin at 268.4 kHz (Average) when the Large EID antenna is used. |
| 15.209 | Radiated emission limits – Spurious emissions >30 MHz | Complies with a 10.8 dB margin at 33.603 MHz (Vertical) when the Large EID antenna is used. |

# 3. INTRODUCTION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification.

**The client selected the test sample.**

**This report relates only to the sample tested.**

**This report contains no corrections or erasures.**

Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both Class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

# 4. CLIENT INFORMATION

| | |
|---|---|
| **Company Name** | Tru-Test Ltd |
| **Address** | PO Box 51078<br>Pakuranga |
| **City** | Auckland 2140 |
| **Country** | New Zealand |
| **Contact** | Mr Jason Crozier |

# 5. DESCRIPTION OF TEST SYSTEM

| | |
|---|---|
| **Brand Name** | Tru-Test |
| **Product** | Low Frequency Electronic ID (EID) Reader System |
| **Model Number** | XRP2-1 |
| **Serial Number** | 700012 |
| **Antenna 1** | Large EID Antenna |
| **Serial Number** | 150002 |
| **Antenna 2** | Small EID Antenna |
| **Serial Number** | 150001 |
| **Manufacturer** | Tru-Test Ltd |
| **Country of Origin** | New Zealand |
| **Power Supply** | TDC Power SA3A-120-1250 |
| **Serial Number** | Power supply not serialised |
| **FCC ID** | XOQXRP2-1 |

The Tru Test XRP2-1 EID Reader is a dual mode FDX-B / HDX low frequency EID reader that is optimized for high performance with animal tags that comply with ISO 11784/11785.

The Reader operates on 134.2 kHz and is designed to operate with read distances of up to 1 m.

The Reader System identifies and reads electronic tags on individual animals when either the Large Antenna or the Small Antenna is attached.

The device also contains a Bluetooth module transmitter that has modular approval.

The FCC ID of this module is FCC ID: POOWML-C40.

# 6. RESULTS

**Standard**

The sample was tested in accordance with 47 CFR Part 15 Subpart C.

**Methods and Procedures**

The measurement methods and procedures as described in ANSI C63.4 - 2003 were used.

**Section 15.201: Equipment authorisation requirement**

Certification as detailed in Subpart J of Part 2 is required for this device.

**Section 15.203: Antenna requirement**

This device operates with an external antenna using a unique custom connector that can be seen in the photographs at the rear of this report.

Two antennas were supplied and tested with this device.

The antennas are as follows:

- Large EID Antenna

- Small EID Antenna

**Result:** Complies.

**Section 15.204: External radio frequency power amplifiers and antenna modifications**

It is not possible to attach an external power amplifier to this transmitter.

**Result:** Complies.

**Section 15.205: Restricted bands of operation**

The EID transmitter transmits on 134.2 kHz.

This falls between the restricted bands of 90 –110 kHz and 495 – 505 kHz.

The Bluetooth transmitter module operates in the 2400.0 – 2483.5 MHz

**Result:** Complies.

**Section 15.107: Conducted limits**

Conducted emission testing has been carried out when the device was powered at 120 Vac using a supplied power supply.

The device was operated transmitting continuously while continuously reading two tags.

Conducted emissions testing was carried out over the frequency range of 150 kHz to 30 MHz at the Laboratory's MacKelvie Street premises in a 2.4 m x 2.4 m x 2.4 m screened room.

Testing was carried out in accordance with section 15.207(a) using a measuring receiver and a 50 uH / 50 ohm artificial mains network which is also known as a line impedance stabilisation network (LISN).

Measurements on both the phase and neutral lines were made using either a Quasi Peak or an Average detector with a 9 kHz bandwidth.

The supplied conducted emission plot is a combined plot showing the worst case of the Peak, Quasi Peak and Average levels for both phase and neutral.

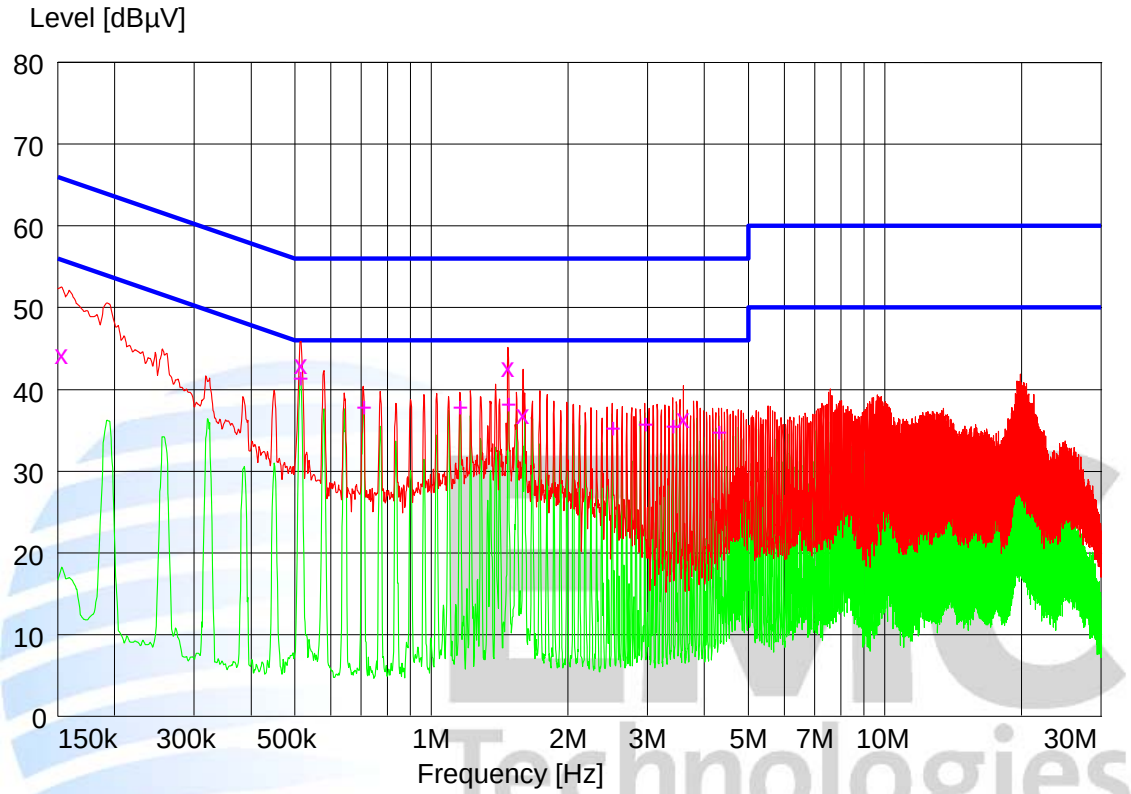
The Class B conducted limits have been applied

**Result:** Complies
Measurement uncertainty with a confidence interval of 95% is:
- Conducted emissions tests (0.15 - 30 MHz) ± 2.2 dB

## Conducted Emissions – AC Input Power Port

| | |
|---|---|
| **Setup:** | Device powered at 110 volts AC 60 Hz running continuously when attached to a laptop reading RS232 data, and when connected to a second EID Reader unit located remotely. The large antenna was which attached and the Reader was reading 2 tags. |

| Peak --- | Average -- | Quasi Peak X | Average + |
|---|---|---|---|




Final Quasi-Peak Measurements

| Frequency MHz | Level dBµV | Limit dBµV | Margin dB | Phase | Rechecks dBµV |
|---|---|---|---|---|---|
| 0.153000 | 44.60 | 65.8 | 21.2 | N | |
| 0.516000 | 43.40 | 56.0 | 12.6 | N | |
| 1.476000 | 42.90 | 56.0 | 13.1 | N | |
| 1.593000 | 37.20 | 56.0 | 18.8 | L1 | |
| 3.597500 | 36.70 | 56.0 | 19.3 | N | |

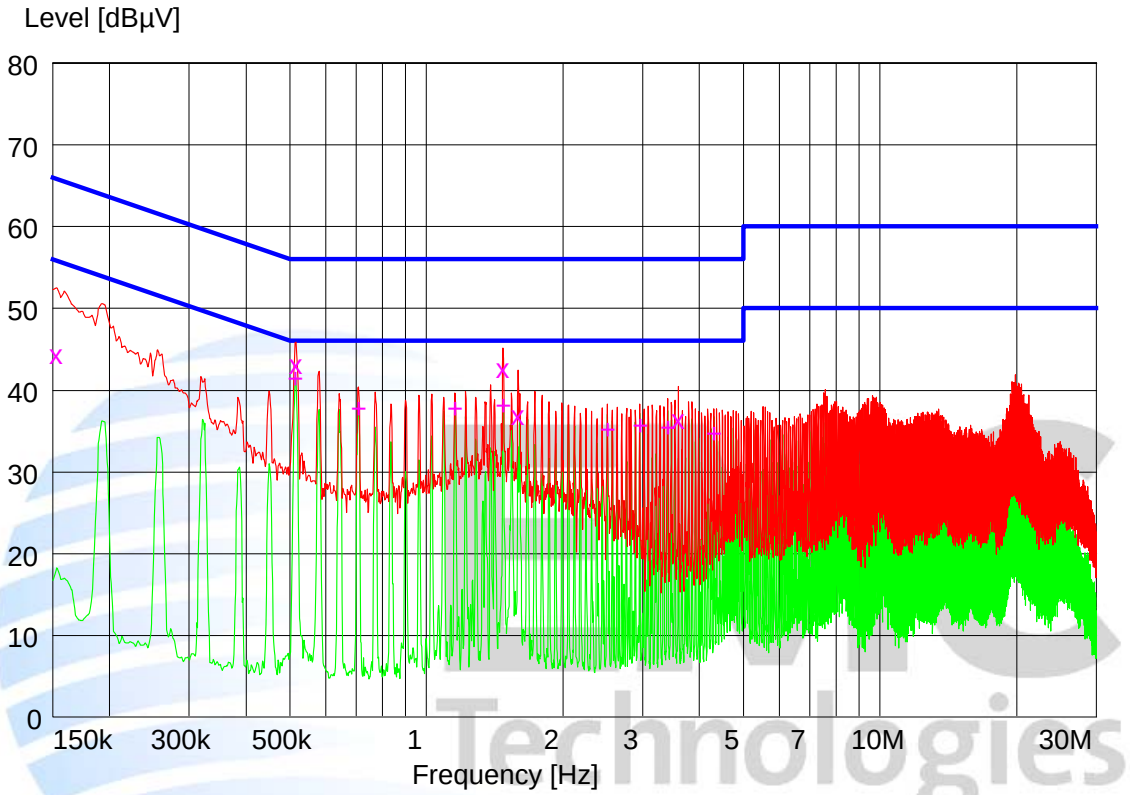
Final Average Measurements

| **Frequency MHz** | **Level dBµV** | **Limit dBµV** | **Margin dB** | **Phase** | **Rechecks dBµV** |
|---|---|---|---|---|---|
| 0.513000 | 41.70 | 46.0 | 4.3 | N | |
| 0.708000 | 38.10 | 46.0 | 7.9 | L1 | |
| 1.155000 | 38.10 | 46.0 | 7.9 | N | |
| 1.476000 | 38.40 | 46.0 | 7.6 | N | |
| 2.504000 | 35.50 | 46.0 | 10.5 | N | |
| 2.954000 | 36.00 | 46.0 | 10.0 | N | |
| 3.404000 | 35.80 | 46.0 | 10.2 | N | |
| 4.304000 | 35.00 | 46.0 | 11.0 | N | |

## Conducted Emissions – AC Input Power Port

| | |
|---|---|
| **Setup:** | Device powered at 110 volts AC 60 Hz running continuously when attached to a laptop reading RS232 data, and when connected to a second EID Reader unit located remotely. The Small antenna which was attached and the Reader was reading 2 tags. |

| Peak --- | Average -- | Quasi Peak X | Average + |
|---|---|---|---|




Final Quasi-Peak Measurements

| Frequency MHz | Level dBµV | Limit dBµV | Margin dB | Phase | Rechecks dBµV |
|---|---|---|---|---|---|
| 0.153000 | 44.60 | 65.8 | 21.2 | N | |
| 0.516000 | 43.40 | 56.0 | 12.6 | N | |
| 1.476000 | 42.90 | 56.0 | 13.1 | N | |
| 1.593000 | 37.20 | 56.0 | 18.8 | L1 | |
| 3.597500 | 36.70 | 56.0 | 19.3 | N | |

Final Average Measurements

| Frequency MHz | Level dBµV | Limit dBµV | Margin dB | Phase | Rechecks dBµV |
|---|---|---|---|---|---|
| 0.513000 | 41.70 | 46.0 | 4.3 | N | *41.5* |
| 0.708000 | 38.10 | 46.0 | 7.9 | L1 | |
| 1.155000 | 38.10 | 46.0 | 7.9 | N | |
| 1.476000 | 38.40 | 46.0 | 7.6 | N | *38.2* |
| 2.504000 | 35.50 | 46.0 | 10.5 | N | |
| 2.954000 | 36.00 | 46.0 | 10.0 | N | |
| 3.404000 | 35.80 | 46.0 | 10.2 | N | |
| 4.304000 | 35.00 | 46.0 | 11.0 | N | |

**Section 15.209: Radiated emission limits, general requirements**

Radiated emissions testing was carried out over the frequency range of 100 kHz to 1000 MHz.

Testing was carried out at the laboratory's open area test site - located at Driving Creek, Orere Point, Auckland, New Zealand.

This site conforms to the requirements of CISPR 16 and ANSI C63.4 - 2003.

Testing was carried out when the device was powered at 120 Vac 60 Hz using the supplied AC power supply.

Testing was carried out when the reader was continuously reading between two RFID tags with the green LED flashing, the audible tone could be heard and the tag id's output to a laptop computer, that was running Hyper terminal, using the serial port.

The device was placed in the centre of the test table, laying flat, face up with the antenna standing upright facing the test antenna and to the right of the device under test and with the laptop computer placed to the left of the device under test.

Low frequency measurements below 30 MHz were not made on the metallic ground plane but on a grass test site at distances of 30 and 60 metres using a magnetic loop antenna.

The centre of this loop antenna was placed 1 metre above the ground.

Testing was carried out in this position as can be seen from the photographs.

Above 30 MHz testing was carried out at the test site using a metallic ground plane where emissions were measured in both vertical and horizontal antenna polarisations.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height, where appropriate, with an automated antenna tower.

The emission level was determined in field strength by taking the following into consideration:

Level (dBμV/m) = Receiver Reading (dBμV) + Antenna Factor (dB/m) + Coax Loss (dB)

**Fundamental emission:**

Measurements were made using a magnetic loop antenna and a receiver with an average detector and a peak detector both using a 9 kHz bandwidth

Initial measurements were made at a distance of 10 metres with the limit being determined by using the extrapolation factor of 40 dB per decade limit, as detailed in section 15.31 f (2) however this showed that the device would exceed the average limit.

Measurements were then made at two points along the highest field strength radial and the level at 300 metres was then calculated using this roll off factor

The average limit at 300 m at 134.2 kHz is 17.8 uV/m or 25 dBuV/m and 45 dBuV/m in peak.

Small Antenna

| Frequency kHz | Detector | Distance metres | Level dBuV/m | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|
| 134.200 | Average | 30 | 72.1 | | |
| | Average | 60 | 57.0 | | |
| | Calculated | 300 | 21.9 | 25.0 | 3.1 |
| | | | | | |
| 134.200 | Peak | 30 | 76.4 | | |
| | Peak | 60 | 66.0 | | |
| | Calculated | 300 | 41.9 | 45.0 | 3.1 |

Large Antenna

| Frequency kHz | Detector | Distance metres | Level dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|
| 134.200 | Average | 30 | 81.2 | | |
| | Average | 60 | 61.5 | | |
| | Calculated | 300 | 15.8 | 25.0 | 9.2 |
| | | | | | |
| 134.200 | Peak | 30 | 84.8 | | |
| | Peak | 60 | 63.8 | | |
| | Calculated | 300 | 15.0 | 45.0 | 30.0 |

The 300 metre field strength has been calculated as follows using the Small antenna average measurements as an example.

The roll off from 30 metres to 60 metres is 0.3010 of a decade (log 60 – 1og 30).

The roll off from 30 metres to 300 metres is 1.000 of a decade (log 300 – log 30)

Therefore the proportion of 30 to 60 metres compared to 30 to 300 metres will be 3.322 (1 / 0.3010)

The field strength roll off from 30 m to 60 m is 15.1 dB (72.1 – 57.0)

Therefore the calculated field strength at 300 metres will be the 30 metre field strength measurement less the distance proportion factor times the roll off attenuation which equals 21.9 dBuV/m (72.1 dBuV/m – (3.322 x 15.1 dB))

Testing was carried out at 134.200 kHz to determine the whether a variation in the supply voltage caused any changes in field strength.

The 120 Vac mains voltage was varied by +/- 10% however the field strength did not vary

As a further check the DC supply voltage to the device was varied over the range declared by the manufacturer from 12 Vdc to 24 Vdc.

The following results were recorded using an average detector.

| Voltage (Vdc) | Small Antenna (dBuV/m) | Large Antenna (dBuV/m) |
|---|---|---|
| 12.0 | 72.1 | 81.2 |
| 18.0 | 72.1 | 81.2 |
| 24.0 | 72.1 | 81.2 |

**Result:** Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

**Section 15.209: Spurious Emissions (below 30 MHz)**

Small Antenna

| Frequency kHz | Level dBuV/m | Limit dBuV/m | Margin dB | Detector | Comment |
|---|---|---|---|---|---|
| 268.400 | 46.0 | 79.0 | 33.0 | Average | - |
| 268.400 | 57.0 | 99.0 | 42.0 | Peak | - |
| 402.600 | 42.0 | 75.5 | 33.5 | Average | - |
| 402.600 | 53.0 | 95.5 | 42.5 | Peak | - |
| 536.800 | < 49 | 53.0 | - | Quasi Peak | Ambient |
| 671.000 | < 36 | 51.1 | - | Quasi Peak | Nil observed |
| 805.200 | < 44 | 49.5 | - | Quasi Peak | Ambient |
| 939.400 | < 42 | 48.1 | - | Quasi Peak | Ambient |
| 1073.600 | < 43 | 47.0 | - | Quasi Peak | Ambient |
| 1207.800 | < 31 | 46.0 | - | Quasi Peak | Nil observed |
| 1342.000 | < 31 | 45.0 | - | Quasi Peak | Nil observed |
| 1476.200 | < 40 | 44.2 | - | Quasi Peak | Ambient |
| 1610.400 | < 27 | 43.5 | - | Quasi Peak | Nil observed |

Large Antenna

| Frequency kHz | Level dBuV/m | Limit dBuV/m | Margin dB | Detector | Comment |
|---|---|---|---|---|---|
| 268.400 | 58.8 | 79.0 | 20.2 | Average | - |
| 268.400 | 63.8 | 99.0 | 35.2 | Peak | - |
| 402.600 | 57.3 | 75.5 | 18.2 | Average | - |
| 402.600 | 61.9 | 95.5 | 33.6 | Peak | - |
| 536.800 | < 49 | 53.0 | - | Quasi Peak | Ambient |
| 671.000 | < 36 | 51.1 | - | Quasi Peak | Nil observed |
| 805.200 | < 44 | 49.5 | - | Quasi Peak | Ambient |
| 939.400 | < 42 | 48.1 | - | Quasi Peak | Ambient |
| 1073.600 | < 43 | 47.0 | - | Quasi Peak | Ambient |
| 1207.800 | < 31 | 46.0 | - | Quasi Peak | Nil observed |
| 1342.000 | < 31 | 45.0 | - | Quasi Peak | Nil observed |
| 1476.200 | < 40 | 44.2 | - | Quasi Peak | Ambient |
| 1610.400 | < 27 | 43.5 | - | Quasi Peak | Nil observed |

Magnetic loop measurements were made a distance of 10 metres.

At each frequency the measurement antenna was further adjusted to give the highest field strength.

A receiver with an average detector and a peak detector using a 9 kHz bandwidth was used between 110 – 490 kHz and a quasi peak detector with a 9 kHz bandwidth was used between 490 kHz – 30.0 MHz.

The 300 metre limit between 125 – 490 kHz has been scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2). The 30 metre limit between 490 – 1705 kHz has been scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2).

The limit between 110 – 490 kHz was increased by 20 dB when the peak detector was used.

The spurious emissions observed do not exceed the level of the fundament emission.

**Result:** Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

**Section 15.209: Spurious Emissions (above 30 MHz)**

Measurements between 30 –1000 MHz have been made at a distance of 3 metres.

A receiver with a quasi peak detector with a 120 kHz bandwidth was used between 30 – 1000 MHz.

Measurements were carried out as the device contains a digital device that operates on 17.1776 MHz.

The device was tested transmitting continuously on 134.2 kHz while continuously reading 2 animal tags with the Small and Large antennas being attached in turn.

The device was tested when powered at 120 Vac using the supplied AC/DC power supply and was configured as follows;

- a data cable attached to the com port which was attached to a laptop computer that was running hyper terminal
- Small or Large antenna attached to the antenna port
- AC adaptor attached to the power port
- 5 metre data cable from the sync port to a second Reader that was remotely located

The limits as described in Section 15.209 have been applied as follows:

| Frequency (MHz) | Limit (uV/m) | Limit (dBuV/m) |
|---|---|---|
| 30.0 – 88.0 | 100 | 40.0 |
| 88.0 – 216.0 | 150 | 43.5 |
| 216.9 – 960.0 | 200 | 46.0 |
| Above 960 | 500 | 54.0 |

**Result:** Complies
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 – 1000 MHz) ± 4.1 dB

Small antenna attached

| Frequency MHz | Vertical dBuV/m | Horizontal dBuV/m | Limit dBuV/m | Margin dB | Antenna |
|---|---|---|---|---|---|
| 32.092 | 28.1 | | 40.0 | 11.9 | Vertical |
| 74.168 | 20.3 | | 40.0 | 19.7 | Vertical |
| 112.717 | 23.1 | | 40.0 | 16.9 | Vertical |
| 123.000 | 26.3 | | 40.0 | 13.7 | Vertical |
| 126.440 | 27.8 | | 40.0 | 12.2 | Vertical |

Large antenna attached

| Frequency MHz | Vertical dBuV/m | Horizontal dBuV/m | Limit dBuV/m | Margin dB | Antenna |
|---|---|---|---|---|---|
| 33.603 | 29.2 | | 40.0 | 10.8 | Vertical |
| 70.440 | 21.8 | | 40.0 | 18.2 | Vertical |
| 78.460 | 21.0 | | 40.0 | 19.0 | Vertical |
| 79.166 | | 21.1 | 40.0 | 18.9 | Horizontal |
| 117.619 | 24.7 | | 40.0 | 15.3 | Vertical |
| 119.540 | | 25.2 | 40.0 | 14.8 | Horizontal |

All other emissions detected had a margin to limit that exceeded 15 dB when measurements were attempted up to 1 GHz using both vertical and horizontal polarisations.

# 7. TEST EQUIPMENT USED

| Instrument | Manufacturer | Model | Serial No | Asset Ref | Cal Due | Interval |
|---|---|---|---|---|---|---|
| Aerial Controller | EMCO | 1090 | 9112-1062 | RFS 3710 | N/a | N/a |
| Aerial Mast | EMCO | 1070-1 | 9203-1661 | RFS 3708 | N/a | N/a |
| Biconical Antenna | Schwarzbeck | BBA 9106 | - | RFS 3613 | 30 Jan 2015 | 3 years |
| Receiver | R & S | ESIB-40 | 100171 | R-27-1 | 20 Apr 2014 | 1 year |
| Receiver | R & S | ESHS 10 | 828404/005 | RFS 3728 | 22 Aug 2014 | 1 year |
| Spectrum Analyser | Hewlett Packard | E7405A | US39150142 | 3776 | 26 Feb 2015 | 1 year |
| Loop Antenna | EMCO | 6502 | 9003-2485 | 3798 | 15 May 2014 | 3 years |
| Log Periodic | Schwarzbeck | VUSLP 9111 | 9111-228 | 3785 | 30 Jan 2015 | 3 years |
| Mains Network | R & S | ESH2-Z5 | 881362/034 | 3628 | 29 Jul 2014 | 3 years |
| Variac | General Radio | 1592 | - | RFS 3690 | N/a | N/a |
| Turntable | EMCO | 1080-1-2.1 | 9109-1578 | RFS 3709 | N/a | N/a |
| VHF Balun | Schwarzbeck | VHA 9103 | - | RFS 3613 | 30 Jan 2015 | 3 years |

# 8. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies Ltd registration with the Federal Communications Commission as a listed facility, registration number: 90838, which was updated in July, 2013.

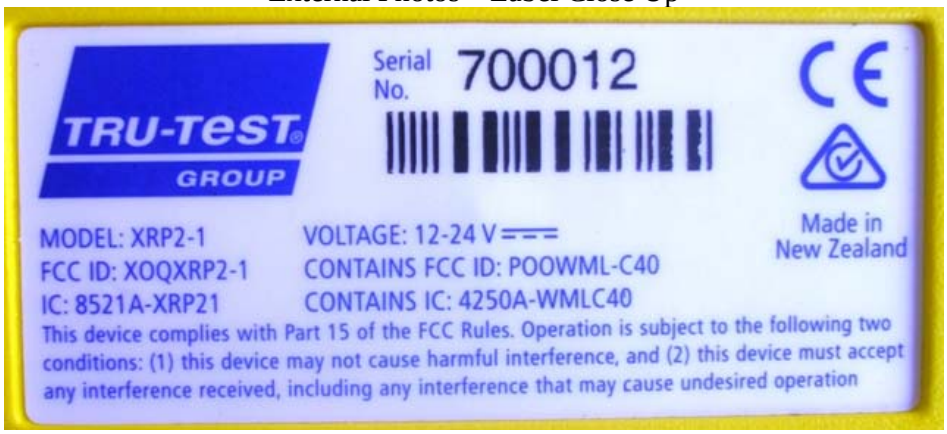
All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005.

All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005.

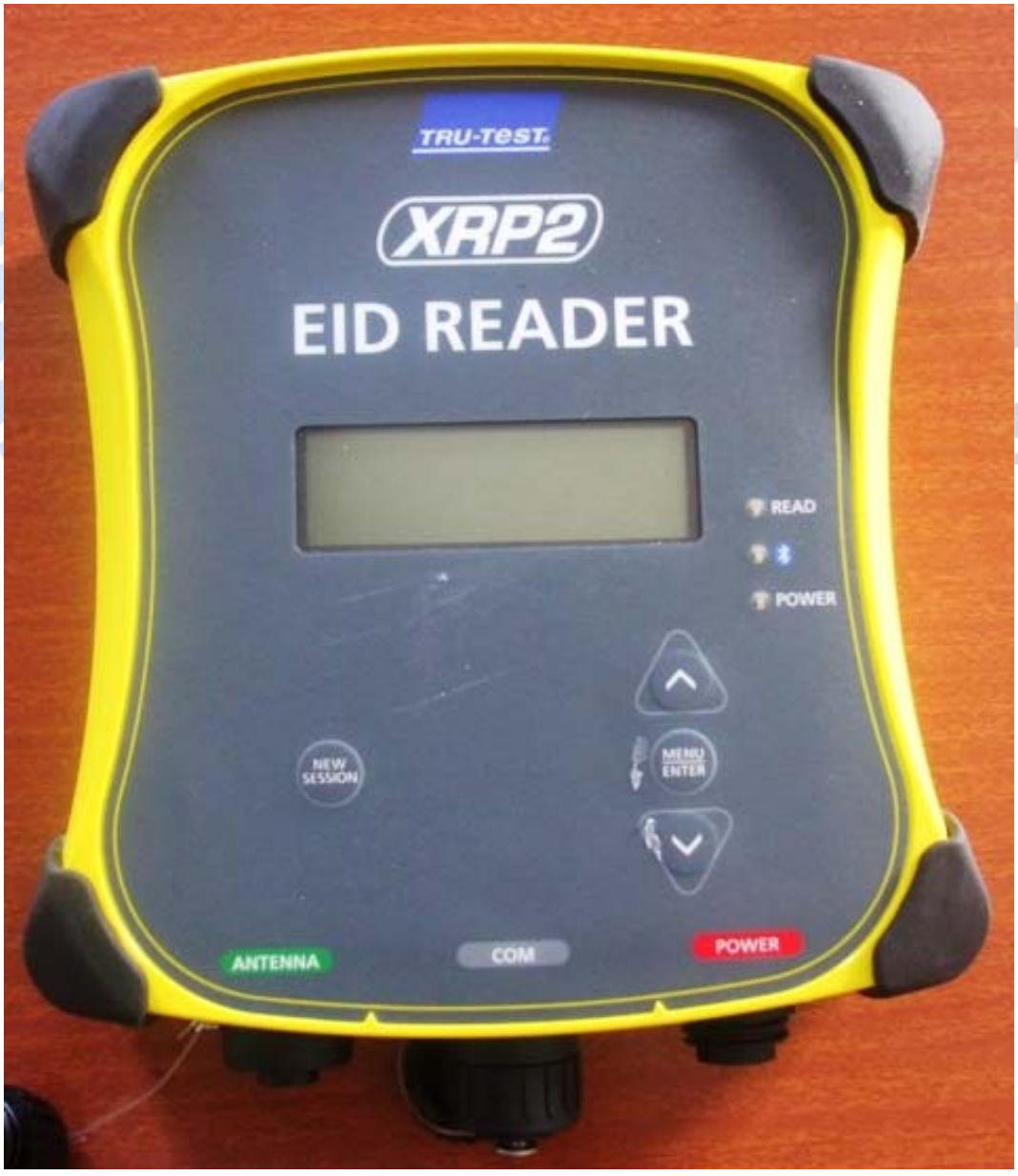
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

# 9. PHOTOGRAPHS

External Photos – Label Close Up

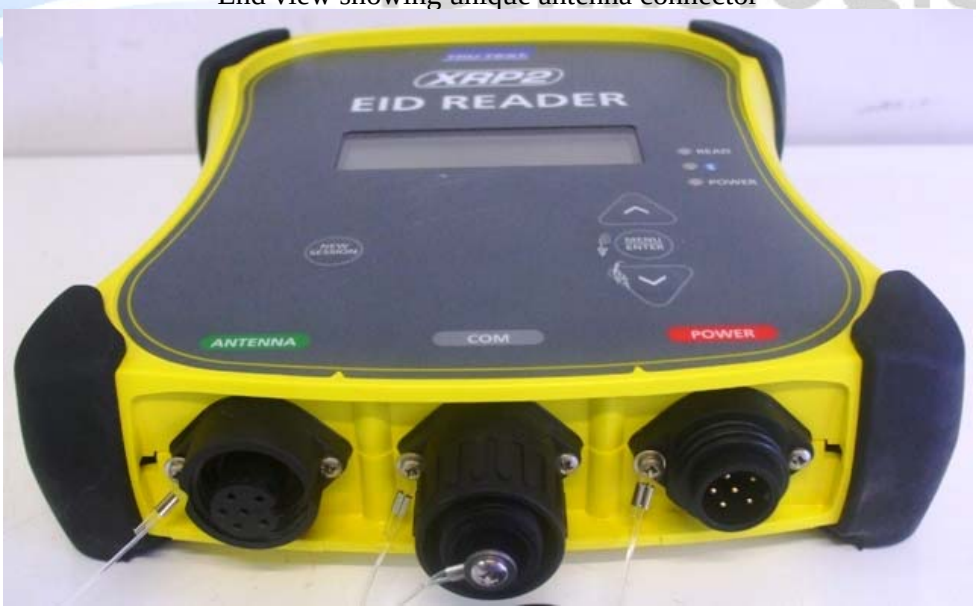



Front View



Rear face including label on product


End view showing unique antenna connector



Power Supply



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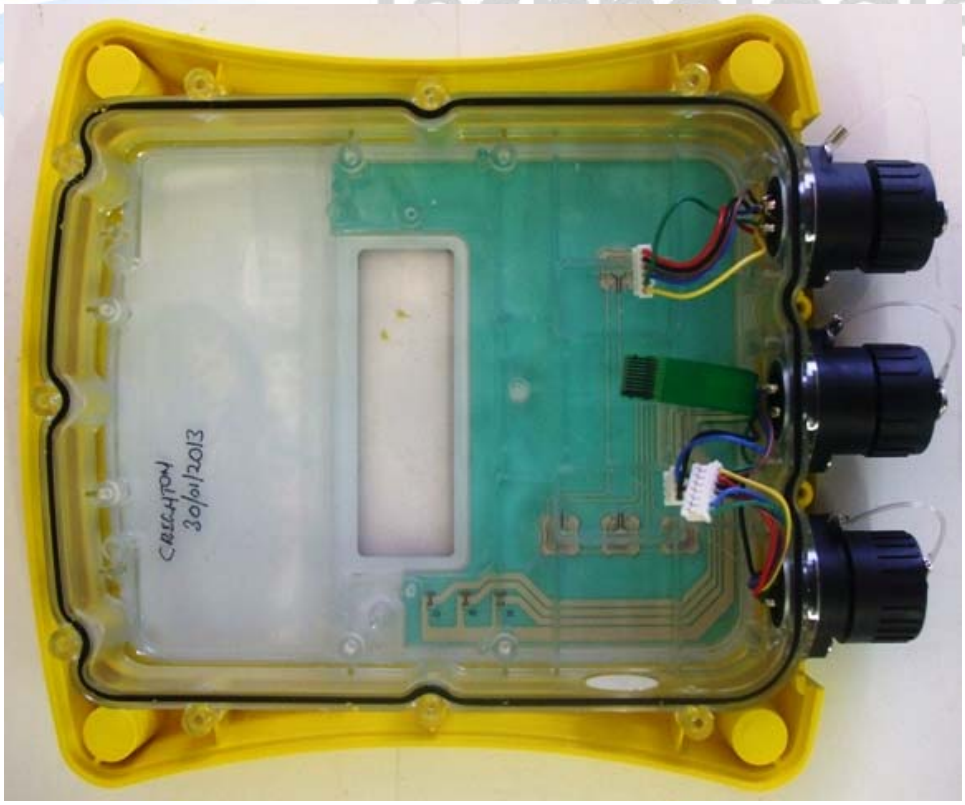
Large Antenna

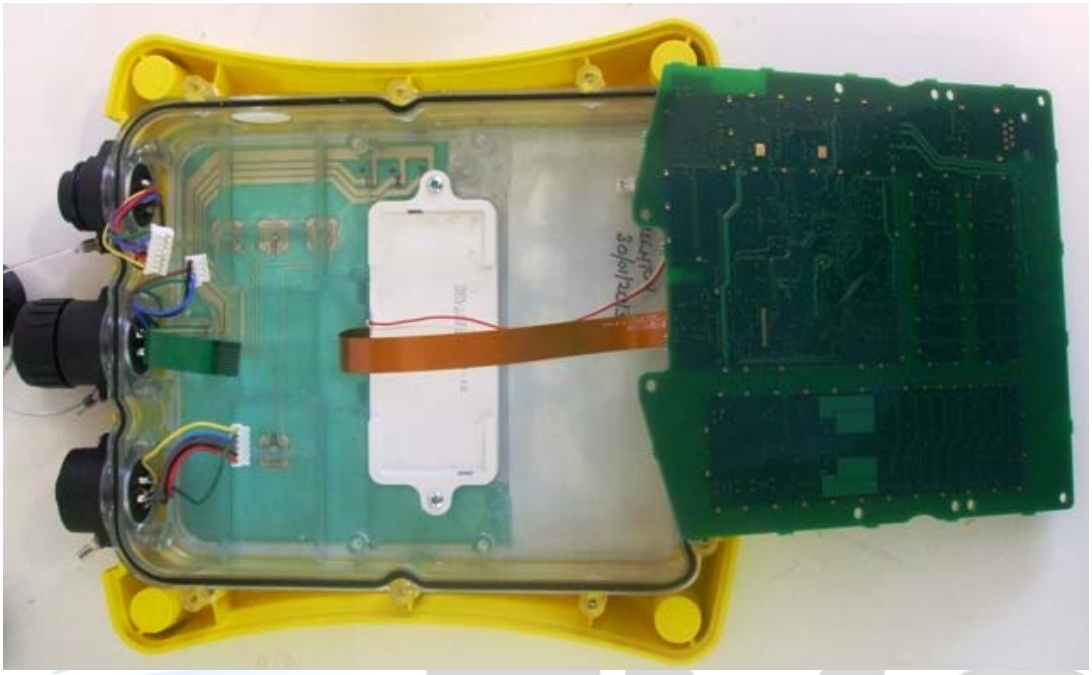


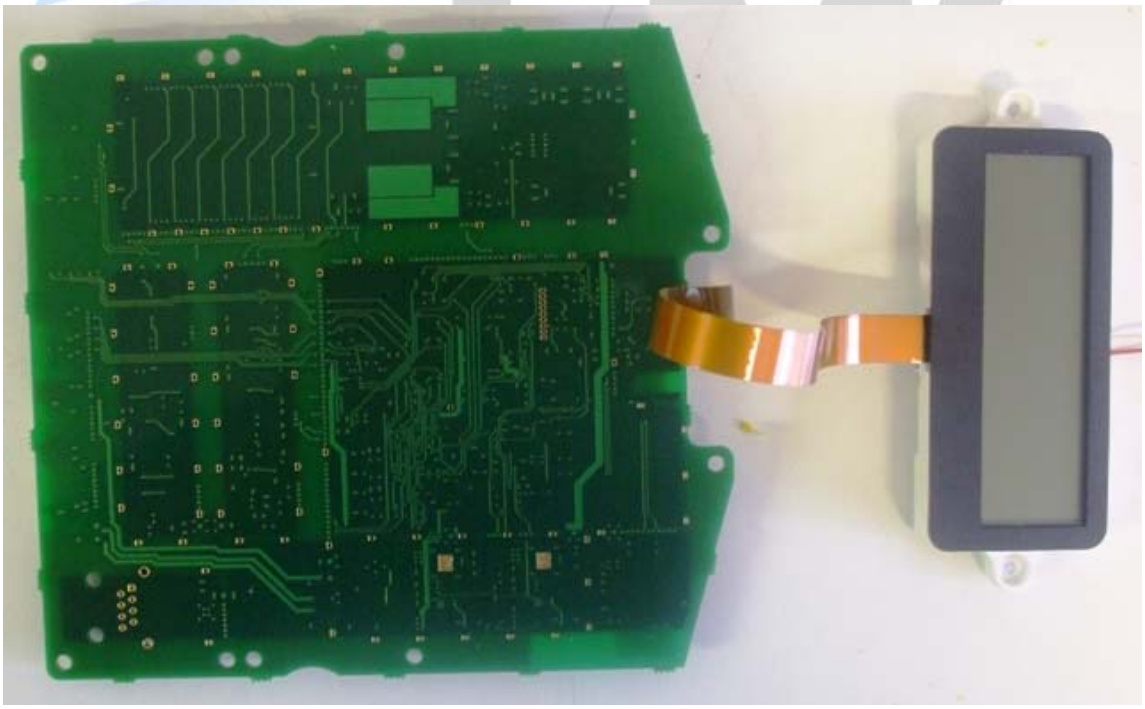
Small Antenna

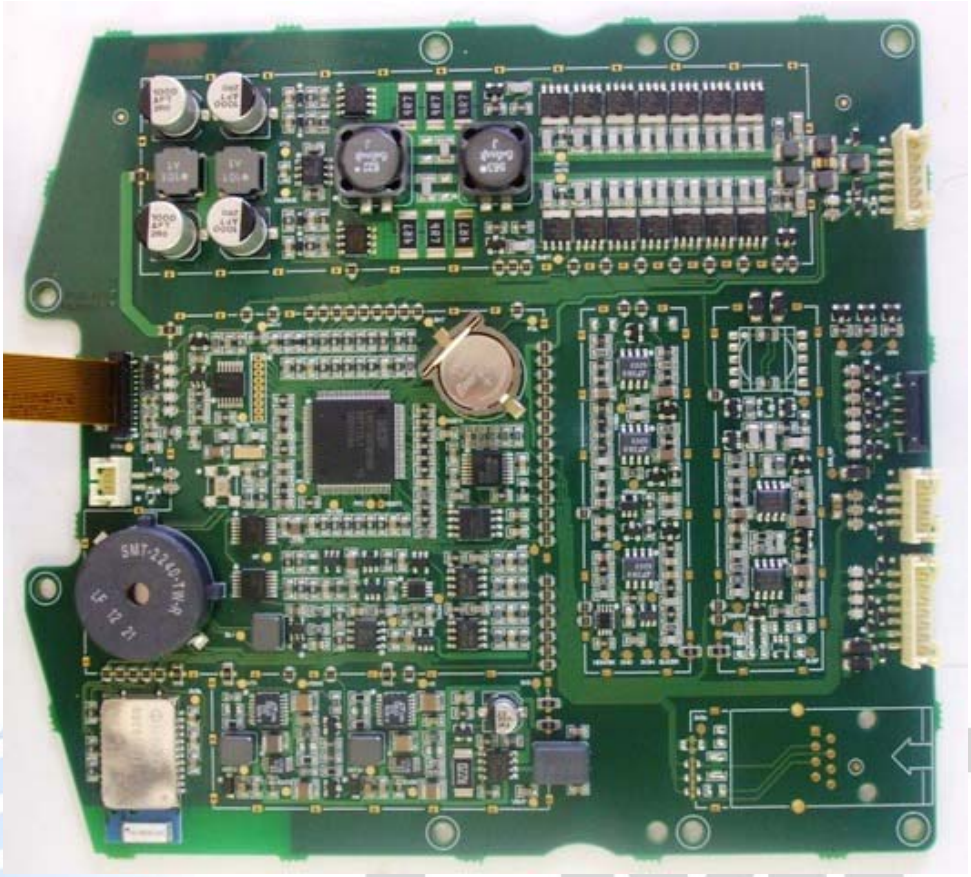


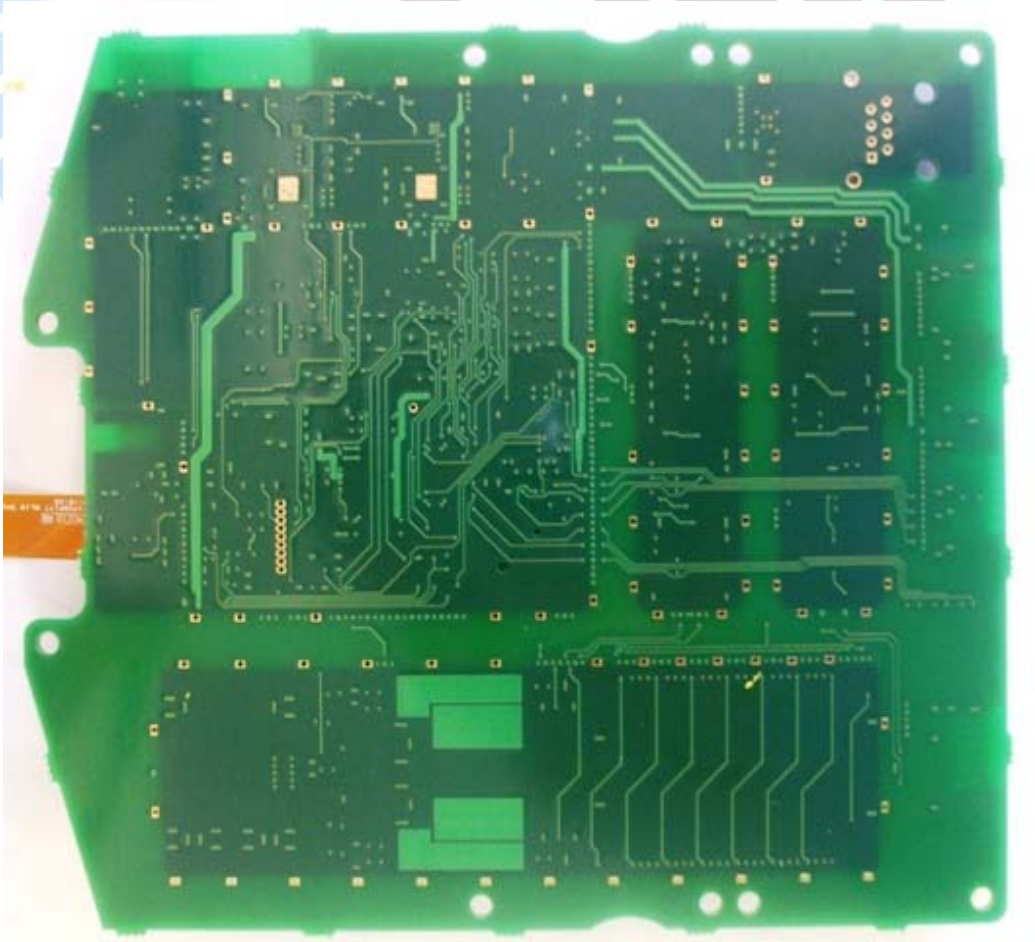
Internal Photos









Radiated Emission Test Set Up - Below 30 MHz

Large Antenna at 60 metres

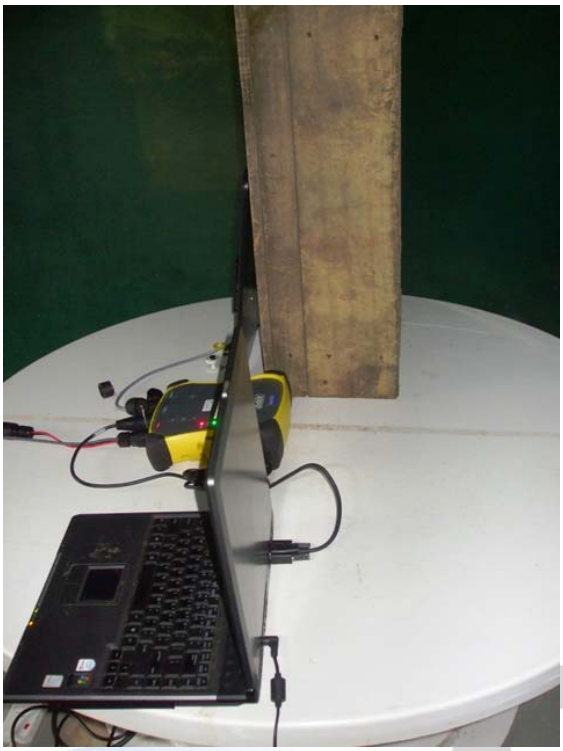
Large antenna at 30 metres

Small antenna set up that was moved to 30 metres to be tested

Small Antenna at 30 metres (White line is the tape measure)

Small antenna at 60 metres – A stick was needed to keep the antenna upright.

Above 30 MHz – Small Antenna



Above 30 MHz – Large Antenna