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TEST REPORT

TRU-TEST XRS-2 Portable Low Frequency ID (EID) Reader

tested to

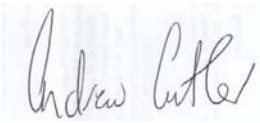
47 Code of Federal Regulations

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

Table of Contents

1. STATEMENT OF COMPLIANCE

The **TRU TEST XRS-2 Portable 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 is integral to the device.
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 14.5 dB margin at 0.198 MHz (Average).
15.209	Radiated emission limits - Fundamental	Complies with a 4.7 dB margin (average) at 134.2 kHz.
15.209	Radiated emission limits - Spurious emissions <30 MHz	Complies.
15.209	Radiated emission limits – Spurious emissions >30 MHz	Complies with a 9.6 dB margin at 250.000 MHz (Horizontal).

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.

This report replace report number 110803.1a to address a number of issues raised by the TCB during the certification process

4. CLIENT INFORMATION

Company Name	Tru-Test Ltd
Address	PO Box 51078 Pakuranga
City	Auckland 2140
Country	New Zealand
Contact	Mr Tim Otley

5. DESCRIPTION OF TEST SYSTEM

Brand Name	Tru-Test
Product Description	Portable (Handheld) Low Frequency Electronic ID (EID) Reader
Manufacturer	Tru Test Ltd
Country of Origin	New Zealand
Model Number	XRS-2
Accessories	Franmar International Inc Model FRA030E-S15-I AC Power Supply
Serial number	500000
FCC ID	XOQXRS-2
BT Module FCC ID	POOWML-C40

This system is a portable (handheld) low frequency electronic ID (EID) device this is used to read animal identification tags.

The system operates on 134.2 kHz and comprises of an EID reader that is battery powered.

An AC adaptor can be used to re-charge the internal battery but it is not possible to operate the device from the external power source without the battery pack installed.

Data from the reader is either down loaded to a PC using the supplied 2 metre long serial cable or by establishing a Bluetooth link.

An FCC approved Bluetooth module has been used.

The module that has been used is a Mistsumi WML-C40# Bluetooth Module which has the following 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

The antenna for this device is integral.

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 device tested transmits as follows:

- On 134.2 kHz which falls between the restricted bands of 90 –110 kHz and 495 – 505 kHz.

Result: Complies.

Section 15.107: Conducted limits

Testing was carried out when the device was charging a flat battery using the supplied AC mains charger at 120 Vac.

Testing was also carried out when the 120 Vac charger was attached when the battery was fully charged.

In both cases testing was carried out when the reader was continuously reading two tags with a Bluetooth link established to a remote laptop computer.

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

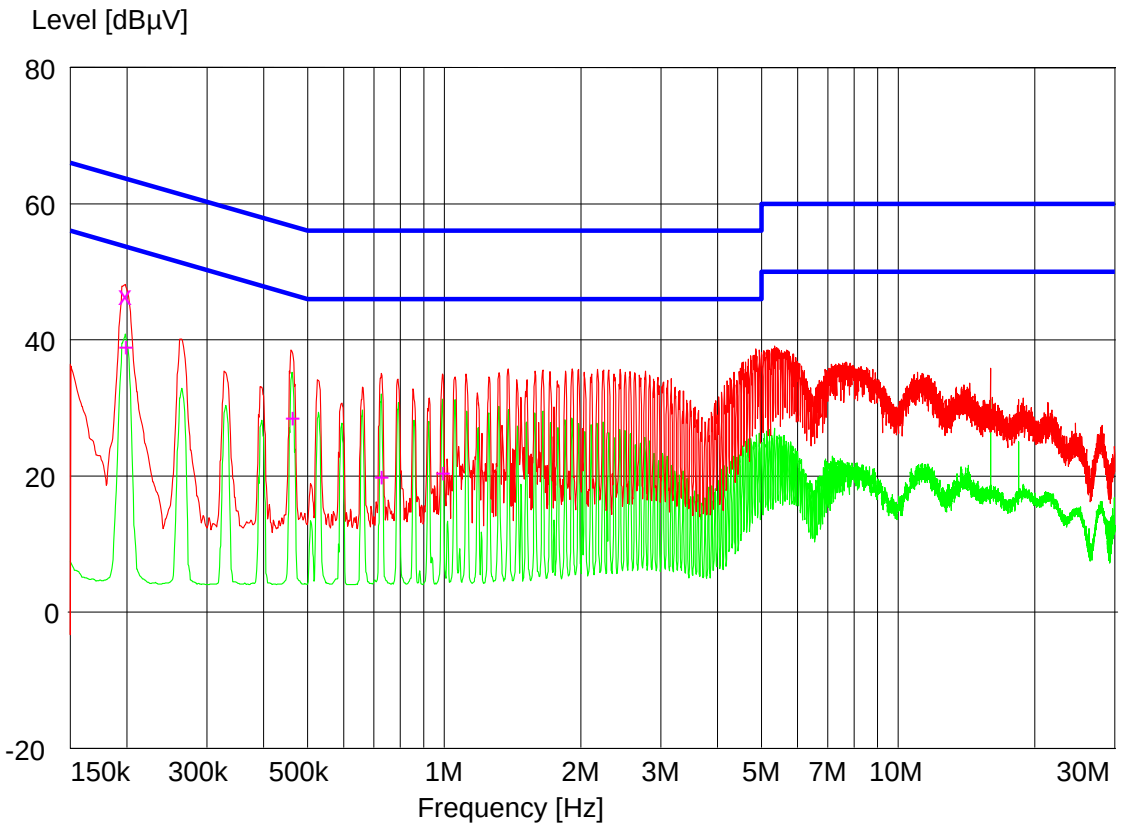
Result: Complies
Measurement uncertainty with a confidence interval of 95% is:

- Conducted emissions tests (0.15 - 30 MHz) ± 2.2 dB

Conducted Emissions – 120 Vac Input Power Port

Setup:	Device tested operating while continuously reading 2 tags with a Bluetooth link established when powered from a flat battery that was being charged by the 120 Vac charger.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.198000	46.80	63.7	16.9	N	

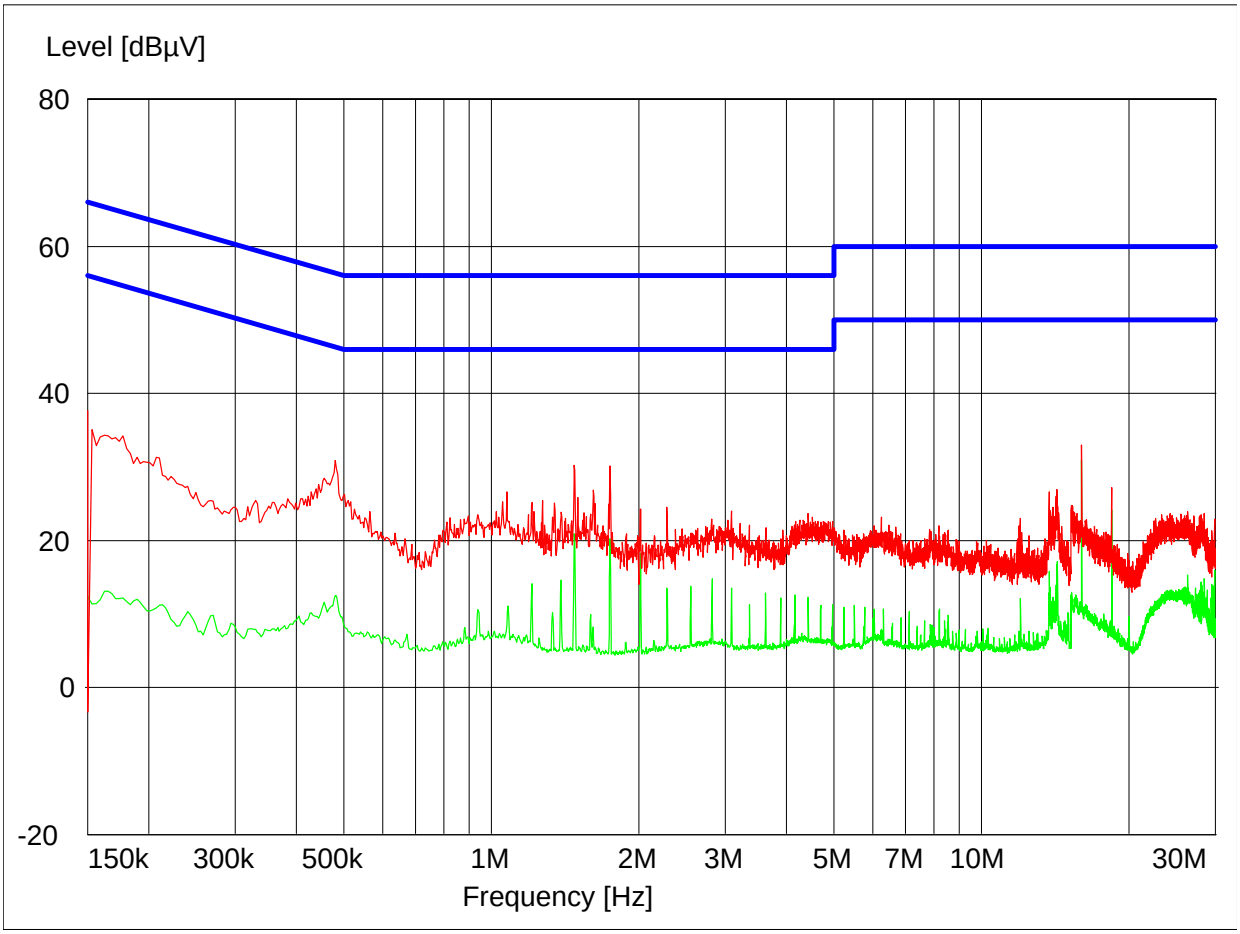
Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.198000	39.20	53.7	14.5	N	
0.462000	28.70	46.7	18.0	N	
0.726000	20.00	46.0	26.0	N	
0.990000	20.60	46.0	25.4	N	

Conducted Emissions – 120 Vac Input Power Port

Setup:	Device tested operating while continuously reading 2 tags with a Bluetooth link established when powered by a battery with full charge with the 120 Vac charger attached.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
No final results obtained within 12dB of limit					

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
No final results obtained within 12dB of limit					

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.

Three modes of operation were tested:

- powered at 120 Vac using the supplied AC mains charger with a Bluetooth link established to a laptop computer that was approximately 5 metres from the device under test.

- powered using the internal battery with a serial cable link established to a laptop computer that was attached to this cable

- powered using the internal battery with a Bluetooth link established to a distant laptop computer

Investigations in the X, Y and Z orientations were carried out to determine the worst case.

The worst case was determined to be with the LCD display and LED's facing upwards towards the test enclosure roof with the device placed longways on top of the test table as per the attached photographs.

Low frequency measurements below 30 MHz were made using a magnetic loop antenna the centre of which was 1 metre above the test site ground.

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) + Coax Loss (dB)

Section 15.209; Fundamental emission at 134.2 kHz:

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

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).

This gives a 10 metres average limit at 134.2 kHz of 85 dBuV/m and 105 dBuV/m in peak.

Frequency kHz	Detector	Distance metres	Level dBuV/m	Limit (dBuV/m)	Margin (dB)
134.200	Average	10	80.3	85.0	4.7
134.200	Peak	10	85.1	105.0	19.9

Testing was carried out at 134.200 kHz to determine 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

The following results were recorded using an average detector.

Voltage (Vac)	Level (dBuV/m)
120.0	80.3
138.0	80.3
102.0	80.3

No variation in level was expected as the device is portable and powered using the internal battery.

It is not possible to operate this device using an external power without the internal battery being installed.

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)

Frequency kHz	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
268.400	< 43	79.0	-	Average	Nil observed
268.400	< 54	99.0	-	Peak	Nil observed
402.600	< 46	75.5	-	Average	Nil observed
402.600	< 58	95.5	-	Peak	Nil observed
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 at 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 limits between 110 – 490 kHz were increased by 20 dB when the peak detector was used.

The spurious emissions observed do not exceed the level of the fundamental 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.

Three modes of operation were tested:

- powered at 120 Vac using the supplied AC mains charger with a Bluetooth link established to a distant laptop computer
- powered using the internal battery with a Bluetooth link established to a distant laptop computer
- powered using the internal battery with a serial cable link established to a laptop computer that was attached to this cable

Investigations in the X, Y and Z orientations were carried out to determine the worst case.

The worst case was determined to be with the LCD display and LED's facing the test antenna with the device placed longways on top of the test table as per the attached photographs.

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

Frequency (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)
30.0 – 88.0	100.0	40.0
88.0 – 216.0	150.0	43.5
216.0 – 960.0	200.0	46.0
Above 960.0	500.0	54.0

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

Tested when powered using an internal battery with a serial cable link established to a laptop computer

Frequency MHz	Vertical dBuV/m	Horizontal dBuV/m	Limit dBuV/m	Margin dB	Antenna
76.000	18.0		40.0	22.0	Vertical
103.066	25.0		40.0	15.0	Vertical
137.420		25.1	43.5	18.4	Horizontal
166.600	28.0	28.3	43.5	15.2	Horizontal
171.775		28.7	43.5	14.8	Horizontal
188.953		28.7	43.5	14.8	Horizontal
223.308		27.4	46.0	18.6	Horizontal
233.000	26.4	30.4	46.0	15.6	Horizontal
240.485		25.5	46.0	20.5	Horizontal
250.000	27.4	33.9	46.0	12.1	Horizontal
446.615	22.5	29.7	46.0	16.3	Horizontal
500.000	28.5		46.0	17.5	Vertical
566.000	27.4		46.0	18.6	Vertical

Tested when powered at 120 Vac using the supplied mains charger with a Bluetooth link established to a distant laptop computer

Frequency MHz	Vertical dBuV/m	Horizontal dBuV/m	Limit dBuV/m	Margin dB	Antenna
76.000	18.0		40.0	22.0	Vertical
103.066	25.0		40.0	15.0	Vertical
137.420		25.1	43.5	18.4	Horizontal
171.775		28.7	40.0	11.3	Horizontal
188.953		28.7	43.5	14.8	Horizontal
223.308		27.4	43.5	16.1	Horizontal
240.485		25.5	46.0	20.5	Horizontal
250.000	27.4	33.9	46.0	12.1	Horizontal
446.615	22.5	29.7	46.0	16.3	Horizontal

When operated without the AC charger attached the above results were identical.

There was no variation in results between all three modes of operation except for the emissions that were being generated by the laptop computer

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
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	Not applicable
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applicable
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3613	30/01/2014
Receiver	R & S	ESIB 40	-	E1595	10/06/2012
Receiver	R & S	ESHS 10	828404/005	RFS 3728	29/10/2011
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	30/01/2014
Loop Antenna	EMCO	6502	9003-2485	3798	12/06/2012
Mains Network	R & S	ESH2-Z5	881362/034	3628	29/07/2012
Variac	General Radio	1592	-	RFS 3690	Not applicable
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applicable
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3613	30/01/2014

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 on 15 February, 2011.

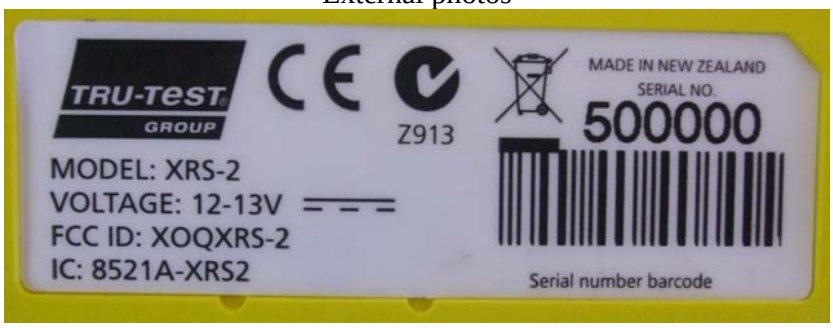
All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005.

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.

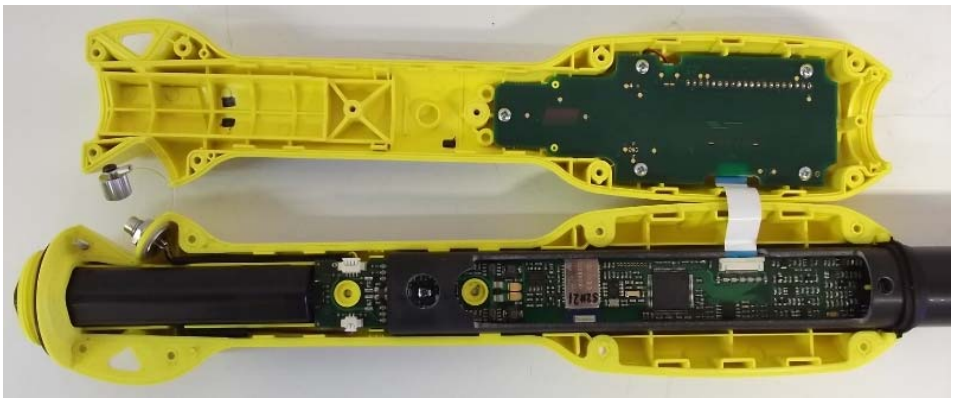
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied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

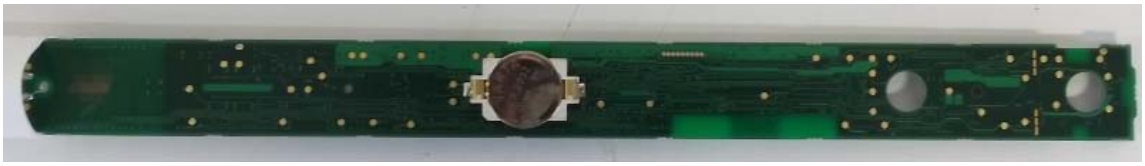
9. PHOTOGRAPHS

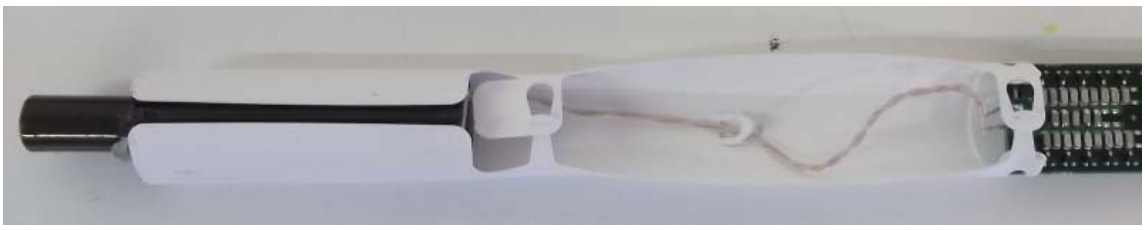
External photos

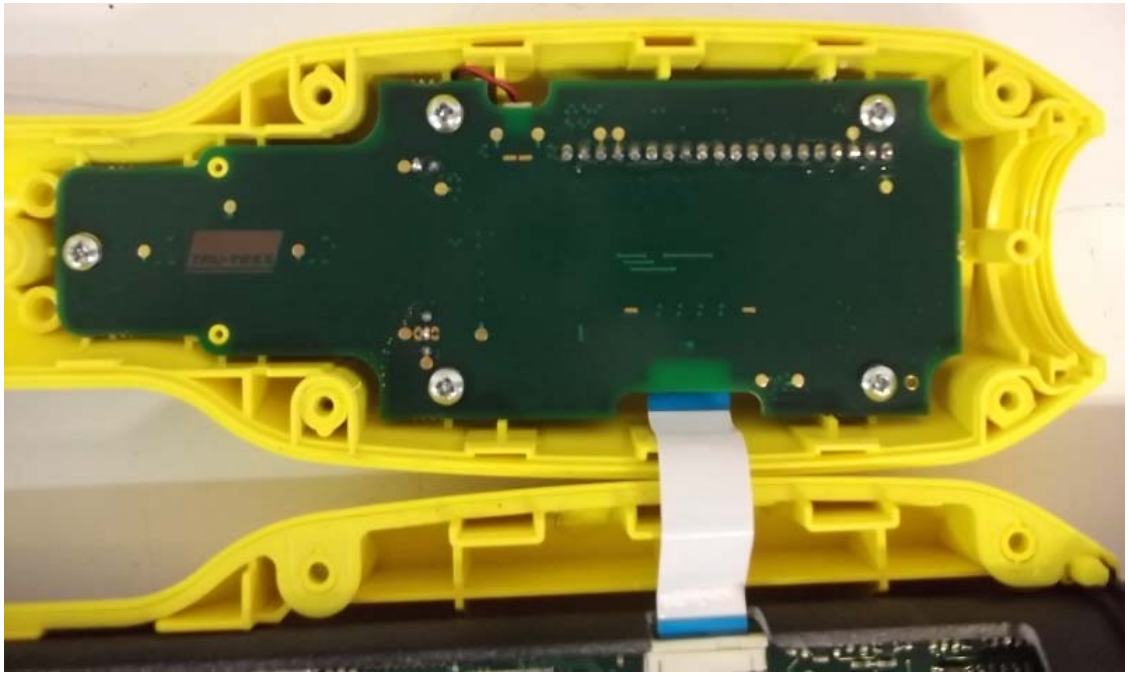


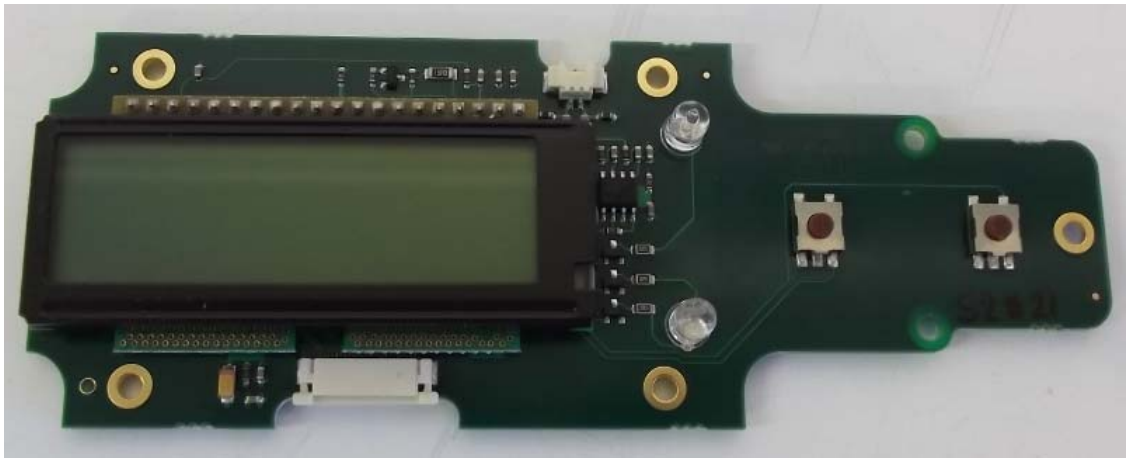
Internal Photos

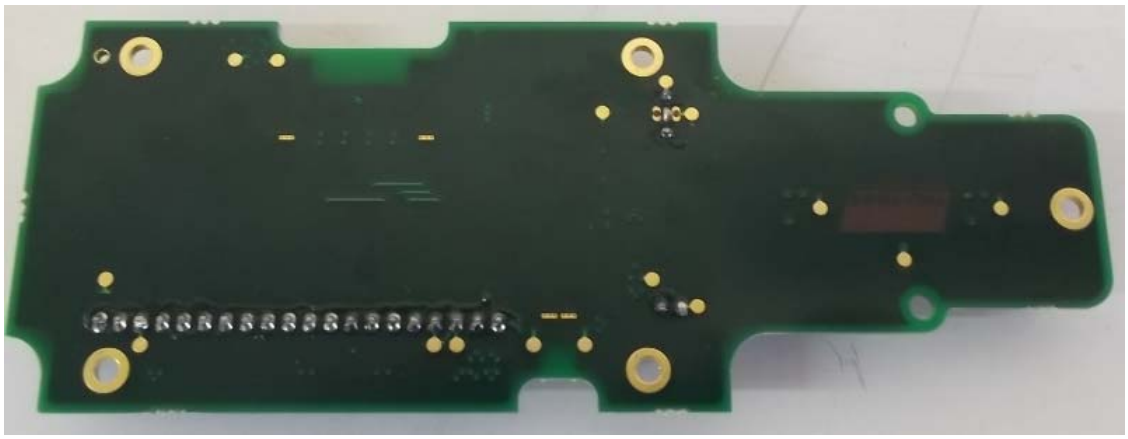




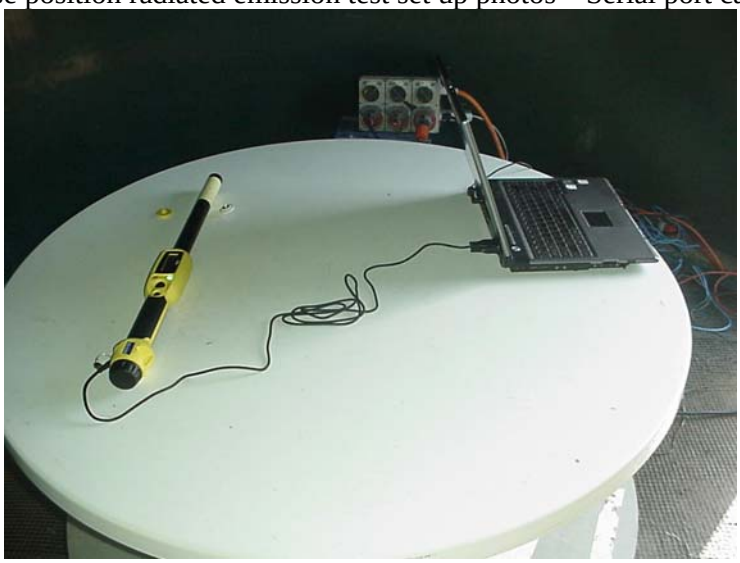








Worst case position radiated emission test set up photos – Serial port cable mode



Bluetooth mode with internal batteries test set up

Bluetooth mode with external AC charger attached

Ancillary test equipment set up – Remote laptop with Bluetooth link

Conducted emissions test set up photos