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TEST REPORT

TRU-TEST XRP-1S Synchronisable EID Reader

tested to

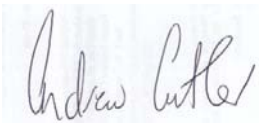
47 Code of Federal Regulations

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 XRP-1S Synchronisable 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 cattle and sheep antenna were tested with this 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 4.9 dB margin at 3.944 MHz (Average).
15.209	Radiated emission limits - Fundamental	Complies with a 3.5 dB margin (average) at 134.2 kHz when the Cattle Antenna is used.
15.209	Radiated emission limits - Spurious emissions <30 MHz	Complies with a 24.3 dB margin at 402.600 kHz (average) when the Cattle Antenna is used.
15.209	Radiated emission limits – Spurious emissions >30 MHz	Complies with a 7.4 dB margin at 154.598 MHz (Vertical) when the Sheep 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.

NB: This report replaces report number 110120.1a to show the FCC ID number and 110120.1b to show additional model information.

4. CLIENT INFORMATION

Company Name	Tru-Test Ltd
Address	PO Box 51078 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 (RFID) Reader System
Model Number	XRP-1S Synchronisable EID Reader
Serial Number	300102
Antenna 1	Cattle EID Antenna
Serial Number	100101
Antenna 2	Sheep EID Antenna
Serial Number	100102
Manufacturer	Tru-Test Ltd
Country of Origin	New Zealand
Power Supply	Cincon Electronics Co Ltd Model TRG36A12 21E11
Serial Number	36120-0010712
FCC ID	XOQXRP-1

The XRP Synchronisable EID Reader is an AC mains and battery operated RFID Reader that operates on 134.2 kHz.

The system comes with two antennas that are suitable for operating with sheep (small antenna) and with cattle (large antenna).

When a tag is successfully read a green LED is illuminated on the EID reader along with an audible beep.

The tag details are then output to a PC using a serial port link using Hyperterminal.

Model variant: TRU-TEST XRP-1 Standard EID Reader

This report can also be used to show compliance with the TRU-TEST XRP-1 Standard EID Reader which is a scaled down version of the XRP-1S which has been tested.

The XRP-1 version has no external SYNC connectors and the internal wire loom to the PCB is not connected.

In all other respects the samples are electrically identical.

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:

- Cattle EID Antenna (large antenna). Serial number 100101

- Sheep EID Antenna (small antenna). Serial Number 100102

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 transmitter transmits on 134.2 kHz.

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

Result: Complies.

Section 15.107: Conducted limits

Conducted emission testing has been carried out when the device was powered at 120 Vac 60 Hz 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

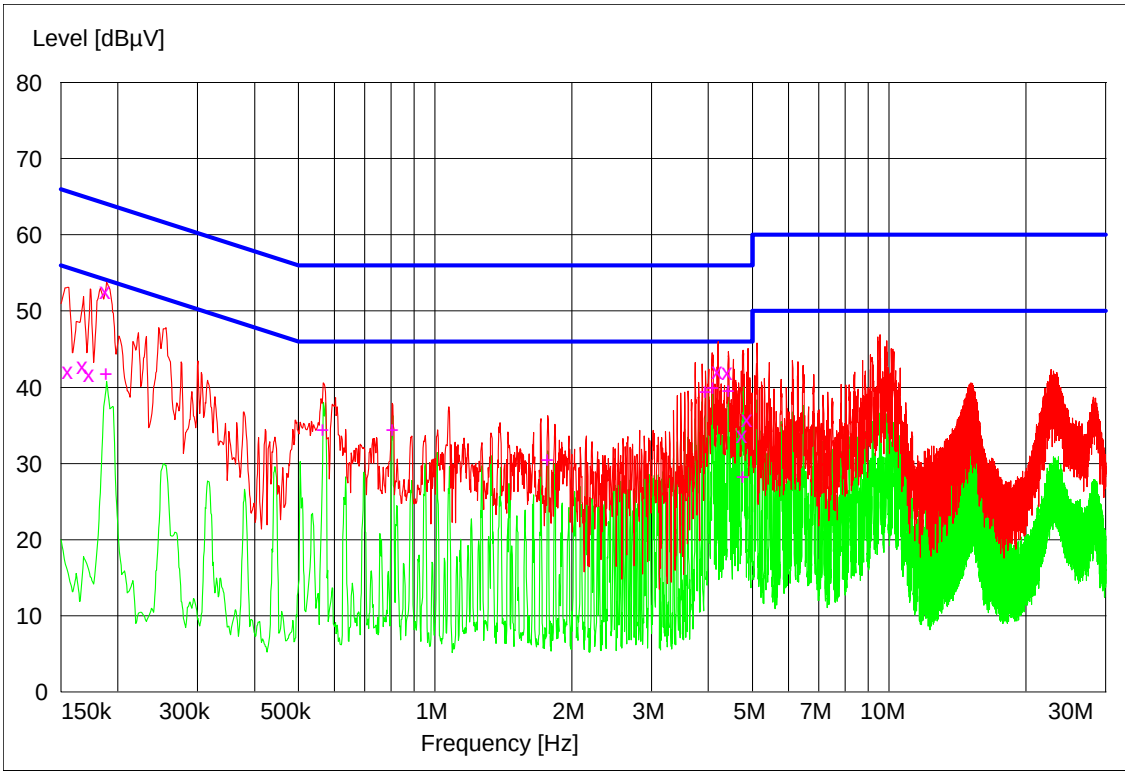
Result: Complies
Measurement uncertainty with a confidence interval of 95% is:

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

Conducted Emissions – AC Input Power Port

Setup:	Device tested when transmitting continuously while interrogating two ear tags when powered at 120 Vac 60 Hz with the small antenna attached.

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



Final Quasi-Peak Measurements

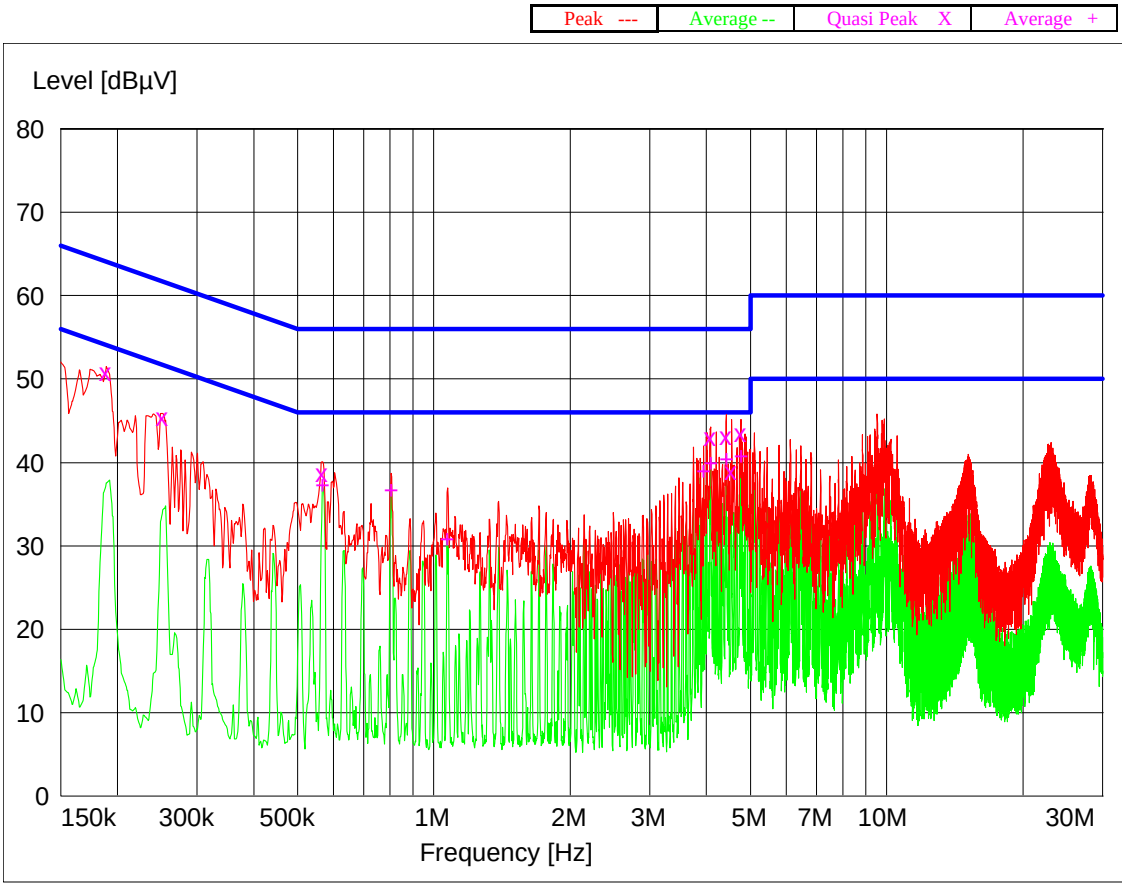
Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.156000	42.10	65.7	23.6	N	
0.168000	42.80	65.0	22.2	L1	
0.174000	41.70	64.8	23.1	N	
0.189000	52.70	64.1	11.4	L1	
4.205000	42.10	56.0	13.9	N	
4.434500	42.00	56.0	14.0	L1	
4.763000	33.70	56.0	22.3	N	
4.893500	35.80	56.0	20.2	N	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.189000	41.70	54.1	12.4	L1	
0.567000	34.40	46.0	11.6	N	
0.807000	34.50	46.0	11.5	L1	
1.773000	30.50	46.0	15.5	L1	
3.939500	39.40	46.0	6.6	N	
4.097000	40.00	46.0	6.0	L1	40.5
4.439000	39.50	46.0	6.5	L1	
4.767500	28.30	46.0	17.7	N	

Conducted Emissions – AC Input Power Port

Setup:	Device tested in standby mode transmitting continuously when powered at 120 Vac 60 Hz with the small antenna attached with no ear tags in the field



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.189000	50.90	64.1	13.2	N	
0.252000	45.40	61.7	16.3	N	
0.567000	38.70	56.0	17.4	N	
4.088000	43.10	56.0	12.9	N	
4.425500	43.20	56.0	12.8	N	
4.547000	39.00	56.0	17.0	L1	
4.767500	43.50	56.0	12.5	L1	

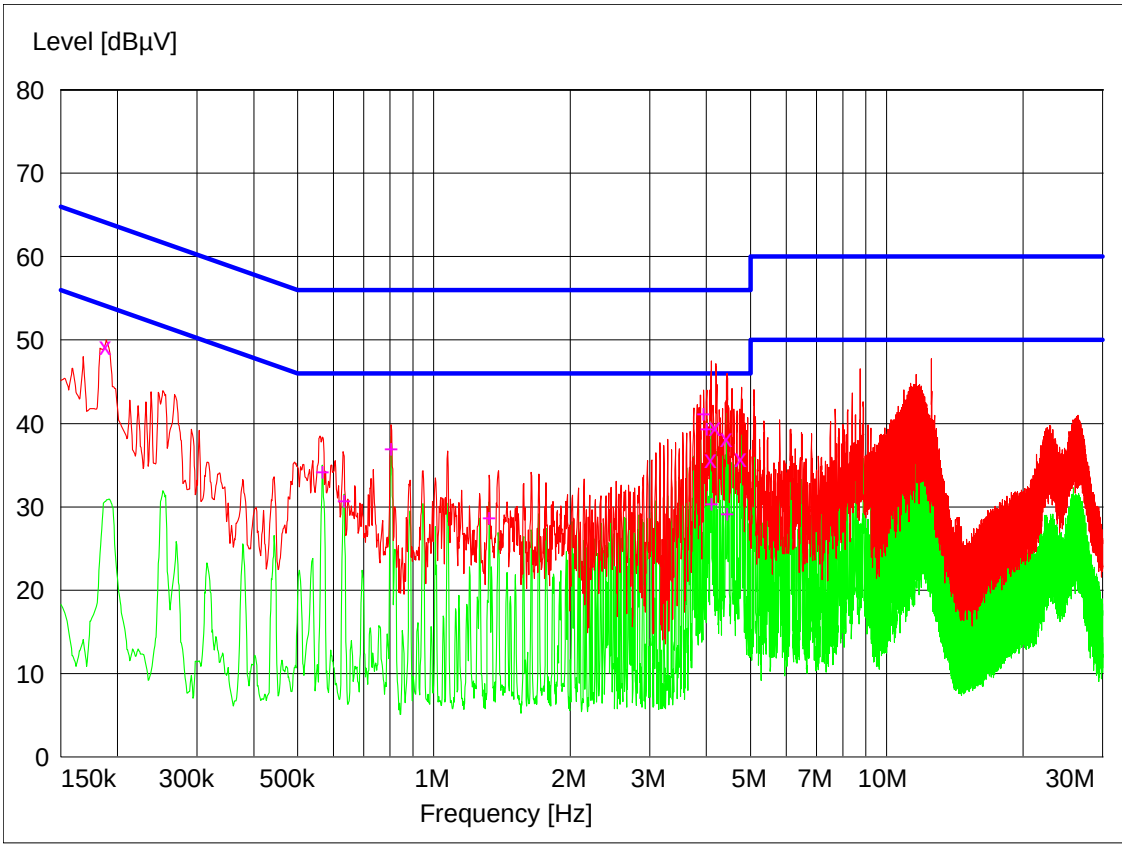
Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.567000	37.30	46.0	8.7	L1	
0.804000	36.70	46.0	9.3	L1	
1.071000	30.80	46.0	15.2	N	
3.939500	39.00	46.0	7.0	N	
4.083500	39.90	46.0	6.1	L1	40.1
4.425500	40.40	46.0	5.6	N	
4.767500	40.80	46.0	5.2	L1	

Conducted Emissions – AC Input Power Port

Setup:	Device tested when transmitting continuously while interrogating two ear tags when powered at 120 Vac 60 Hz with the large antenna attached.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.189000	49.30	64.1	14.8	N	
4.101500	35.70	56.0	20.3	N	
4.196000	39.60	56.0	16.4	L1	
4.439000	38.20	56.0	17.8	N	
4.781000	35.90	56.0	20.1	N	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.567000	34.10	46.0	11.9	L1	
0.633000	30.70	46.0	15.3	L1	
0.804000	36.90	46.0	9.1	N	
1.326000	28.70	46.0	17.3	L1	
3.944000	41.10	46.0	4.9	L1	
4.007000	39.30	46.0	6.8	N	
4.097000	30.40	46.0	15.6	N	
4.439000	29.20	46.0	16.8	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 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 10 and 30 metres using a magnetic loop antenna.

The centre of this loop antenna was placed 1 metre above the test site 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) + 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.

Sheep Antenna – Small Antenna

Frequency kHz	Detector	Distance metres	Level dBuV/m	Limit (dBuV/m)	Margin (dB)
134.200	Average	10	93.4		
	Average	30	69.4		
	Calculated	300	19.0	25.0	6.0
134.200	Peak	10	95.8		
	Peak	30	73.6		
	Calculated	300	27.0	45.0	18.0

Cattle Antenna – Large Antenna

Frequency kHz	Detector	Distance metres	Level dBuV/m	Limit dBuV/m	Margin dB
134.200	Average	10	101.8		
	Average	30	75.9		
	Calculated	300	21.5	25.0	3.5
134.200	Peak	10	104.1		
	Peak	30	79.4		
	Calculated	300	27.5	45.0	17.5

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

The roll off from 10 metres to 30 metres is 0.4771 of a decade (log30 – 1og10).

The roll off from 10 metres to 300 metres is 1.4771 of a decade (log300 – log10)

Therefore the proportion of 10 to 30 metres compared to 10 to 300 metres will be 3.1 (1.4771 / 0.4771)

The field strength roll off over this distance is 24.0 dB (93.4 – 69.4)

Therefore the calculated field strength at 300 metres will be the 10 metre field strength measurement less the distance proportion factor times the roll off attenuation which equals 19.0 dBuV/m (93.4 dBuV/m – (3.1 x 24.0 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)	Sheep Antenna (dBuV/m)	Cattle Antenna (dBuV/m)
12.0	93.4	101.8
18.0	93.4	101.8
24.0	93.4	101.8

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)

Sheep Antenna – Small Antenna

Frequency kHz	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
268.400	43.8	79.0	35.2	Average	
268.400	54.2	99.0	44.8	Peak	
402.600	46.3	75.5	29.2	Average	
402.600	48.4	95.5	47.1	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

Cattle Antenna – Large Antenna

Frequency kHz	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
268.400	45.8	79.0	33.2	Average	
268.400	53.4	99.0	45.6	Peak	
402.600	51.3	75.5	24.2	Average	
402.600	55.2	95.5	40.3	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 sheep and cattle 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
- 1 metre data cable between the two sync ports

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

30.0 – 88.0 MHz	100 uV/m	40 dBuV/m
88.0 – 216.0 MHz	150 uV/m	43.5 dBuV/m
216.9 – 960.0 MHz	200 uV/m	46.0 dBuV/m
Above 960 MHz	500 uV/m	54.0 dBuV

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
30.581	23.5		40.0	16.5	Vertical
30.930		16.6	40.0	23.4	Horizontal
68.710	20.7		40.0	19.3	Vertical
78.700	28.9	25.3	40.0	11.1	Vertical
120.243	26.8	30.8	43.5	12.7	Horizontal
137.421	30.1	31.8	43.5	11.7	Horizontal
154.598	32.1	36.1	43.5	7.4	Horizontal
165.971	32.8	32.6	43.5	10.7	Vertical
171.776	33.3	29.3	43.5	10.2	Vertical
188.953		29.6	43.5	13.9	Horizontal
223.309	23.6	28.4	46.0	17.6	Horizontal
232.985	28.1	31.5	46.0	14.5	Horizontal
235.651	25.7		46.0	20.3	Vertical
240.486	25.8	21.8	46.0	20.2	Vertical
256.212	29.3	28.1	46.0	16.7	Vertical
257.664	27.1	29.5	46.0	16.5	Horizontal
274.842	22.8	24.3	46.0	21.7	Horizontal
275.000	28.1	29.1	46.0	16.9	Horizontal
292.019	25.6	29.5	46.0	16.5	Horizontal
325.000		30.6	46.0	15.4	Horizontal
343.552	23.8	28.7	46.0	17.3	Horizontal
366.000	25.1	29.8	46.0	16.2	Horizontal
375.000		28.4	46.0	17.6	Horizontal
384.000	28.1	28.4	46.0	17.6	Horizontal
400.000		25.1	46.0	20.9	Horizontal
432.000	31.0	28.6	46.0	15.0	Vertical
446.618	24.4	28.4	46.0	17.6	Horizontal
498.150	26.8	30.5	46.0	15.5	Horizontal
564.529	29.3	28.8	46.0	16.7	Vertical
600.000	27.5	29.5	46.0	16.5	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.

Large antenna attached

Frequency MHz	Vertical dBuV/m	Horizontal dBuV/m	Limit dBuV/m	Margin dB	Antenna
68.710	23.0		40.0	17.0	Vertical
72.000		26.1	40.0	13.9	Horizontal
80.793	26.8		40.0	13.2	Vertical
120.243	28.3	32.9	43.5	10.6	Horizontal
137.421	29.5	31.8	43.5	11.7	Horizontal
154.598	33.3	31.4	43.5	10.2	Vertical
166.000	35.5	33.6	43.5	8.0	Vertical
171.776	32.3	29.3	43.5	11.2	Vertical
188.953	25.3	30.6	43.5	12.9	Horizontal
223.309	29.1	28.4	46.0	16.9	Vertical
232.985	28.1	34.1	46.0	11.9	Horizontal
235.651	25.7		46.0	20.3	Vertical
240.486	27.0	21.8	46.0	19.0	Vertical
256.212	33.2	28.1	46.0	12.8	Vertical
257.664	33.8	29.5	46.0	12.2	Vertical
275.000	26.3	29.1	46.0	16.9	Horizontal
292.019	26.1	29.5	46.0	16.5	Horizontal
325.000	29.0	33.2	46.0	12.8	Horizontal
336.087	29.6	28.5	46.0	16.4	Vertical
343.552	23.8	28.8	46.0	17.2	Horizontal
366.000	29.9	30.8	46.0	15.2	Horizontal
375.000	27.5	26.0	46.0	18.5	Vertical
384.000	28.1	28.4	46.0	17.6	Horizontal
400.000	31.1	32.2	46.0	13.8	Horizontal
432.000	34.4	31.5	46.0	11.6	Vertical
446.618	28.6	28.4	46.0	17.4	Vertical
498.150	33.3	30.5	46.0	12.7	Vertical
564.529	33.6	29.8	46.0	12.4	Vertical
566.330	34.0	29.5	46.0	12.0	Vertical
600.000	30.6	28.5	46.0	15.4	Vertical

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	10/06/2011
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.

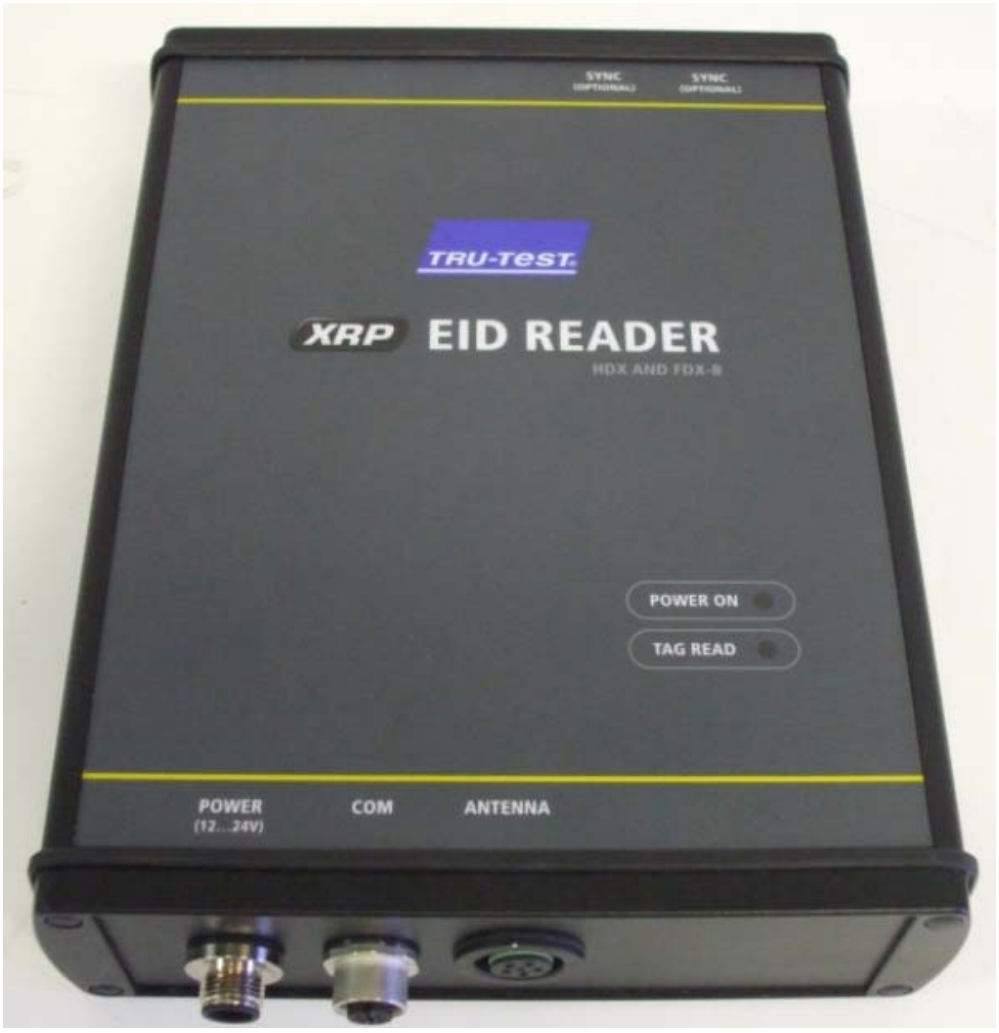
All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005.

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. PHOTOTGRAPHS

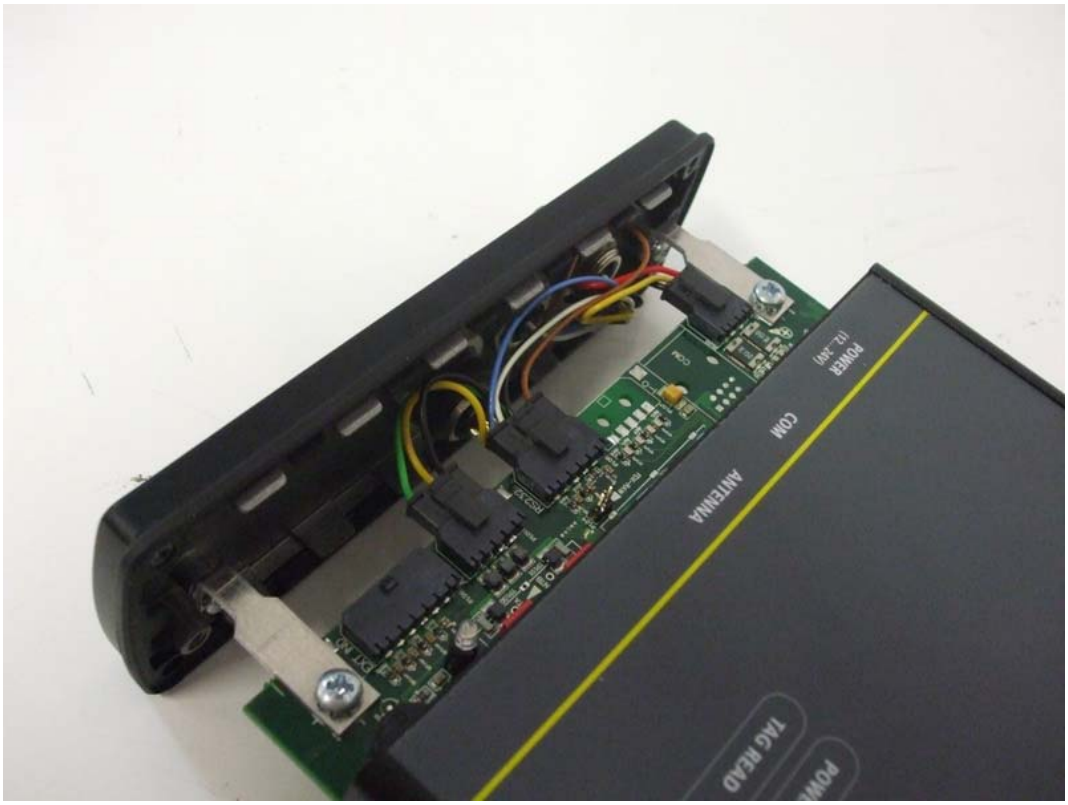
EID Reader

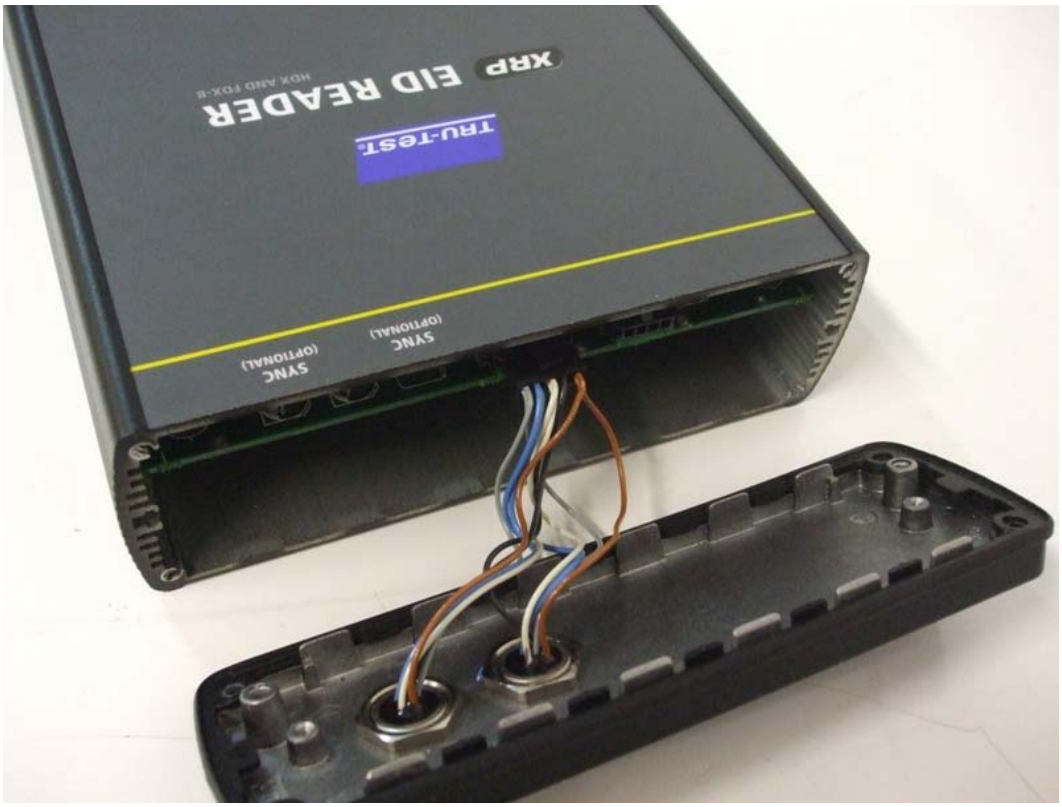


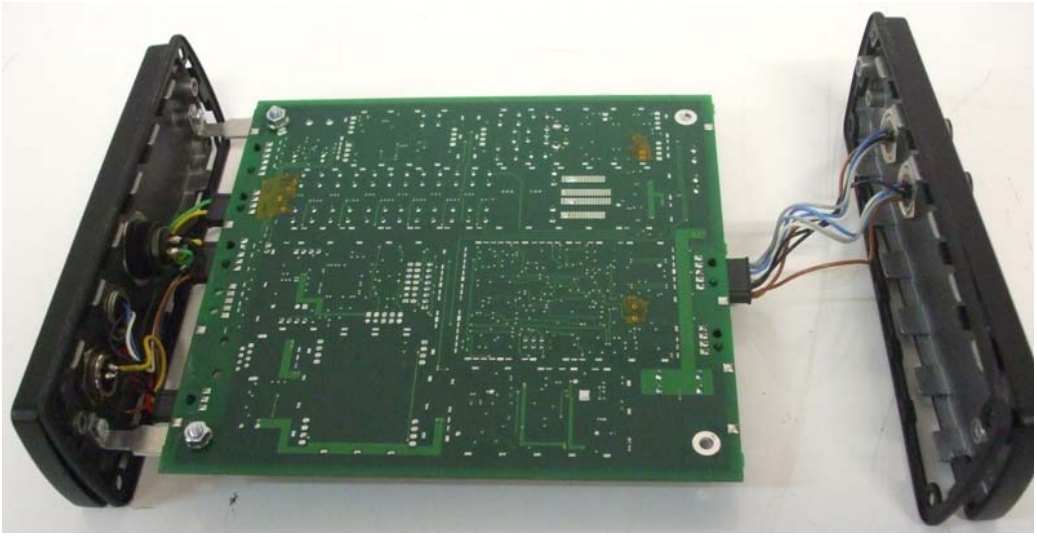
Cattle Antenna – Large Antenna

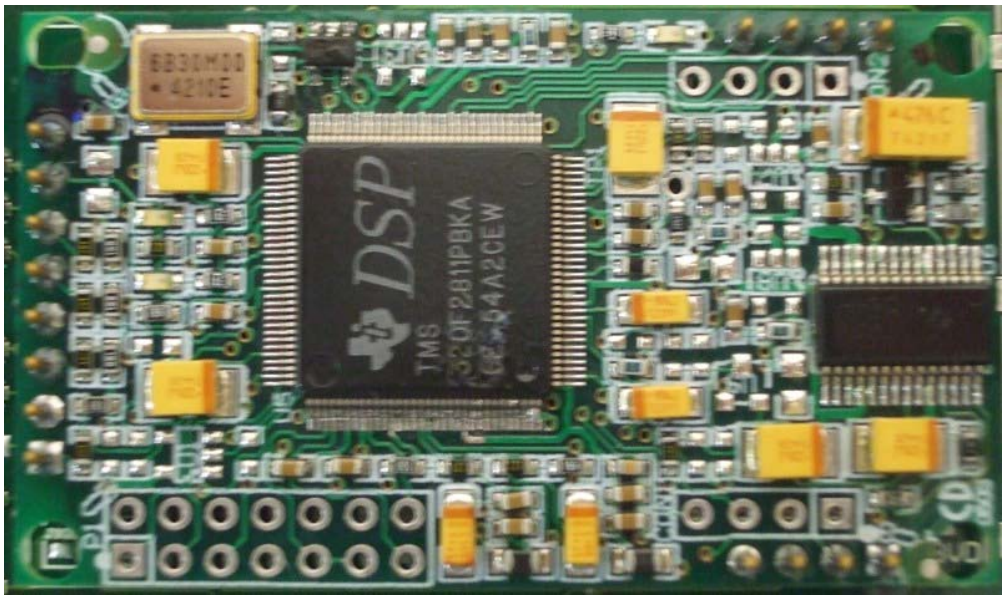
Sheep Antenna – Small Antenna

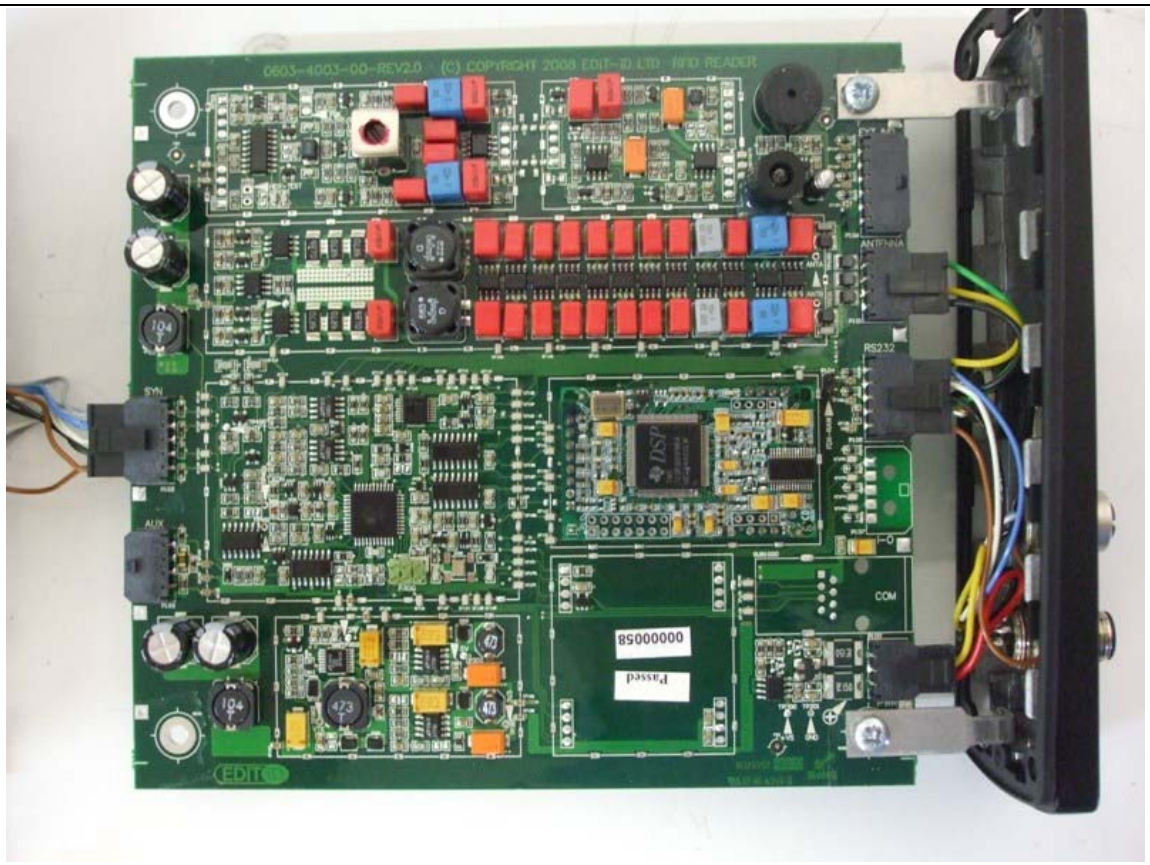
Internal Photos

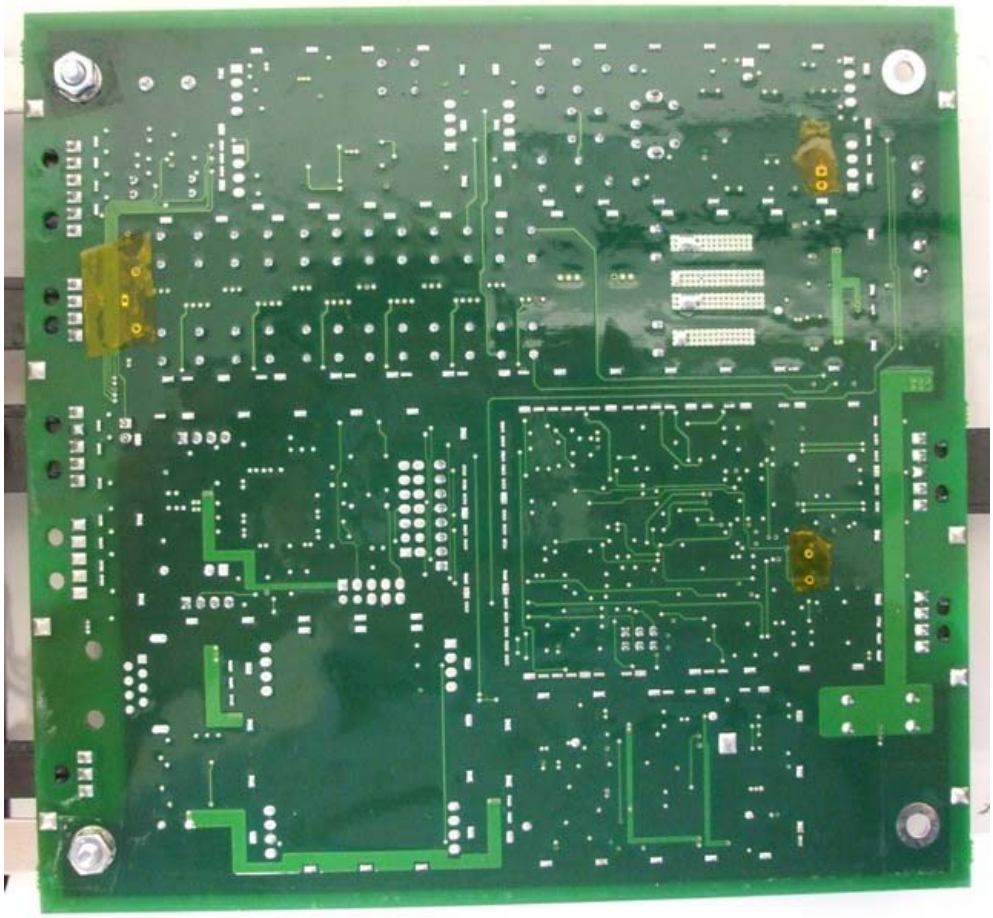


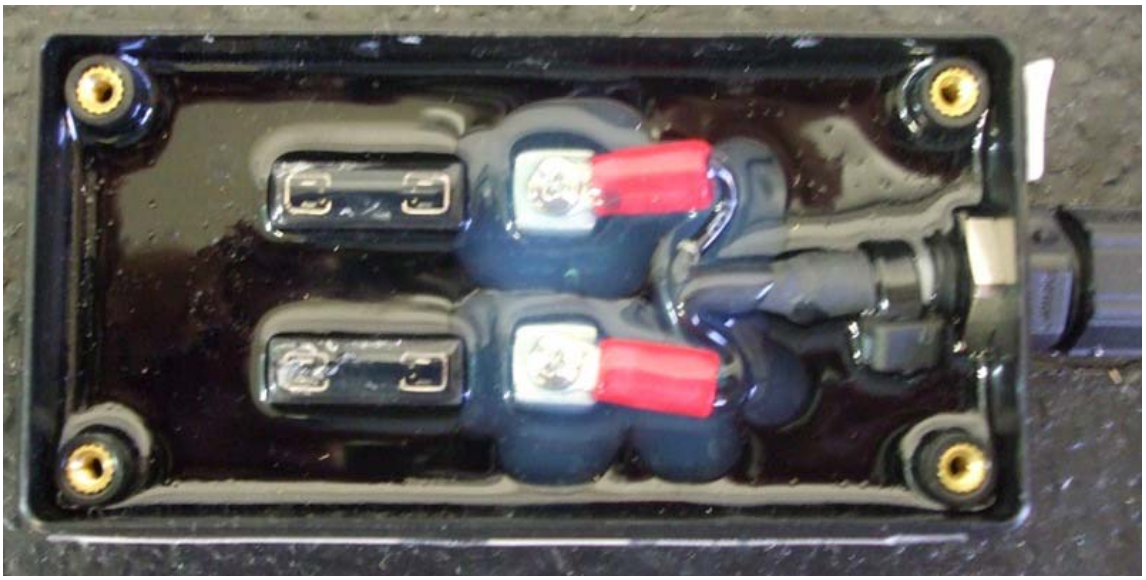








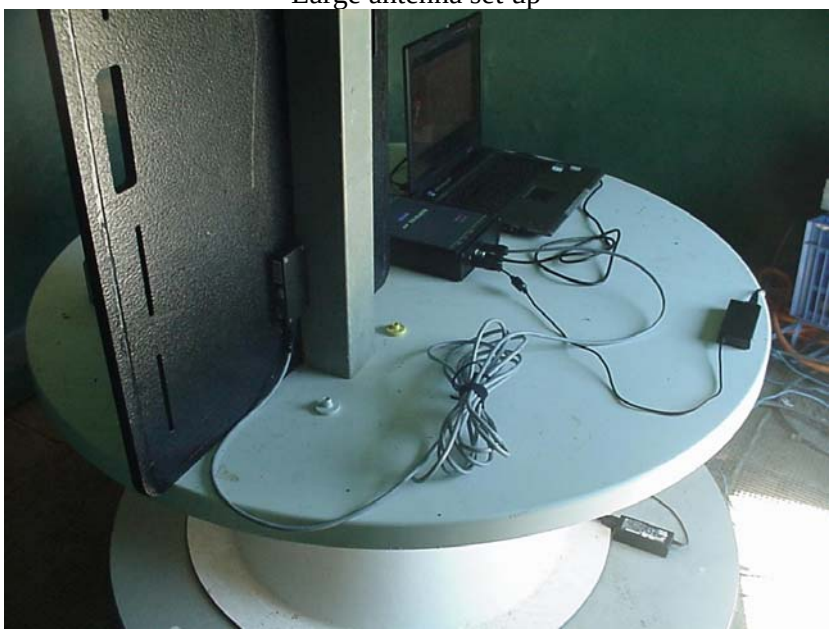


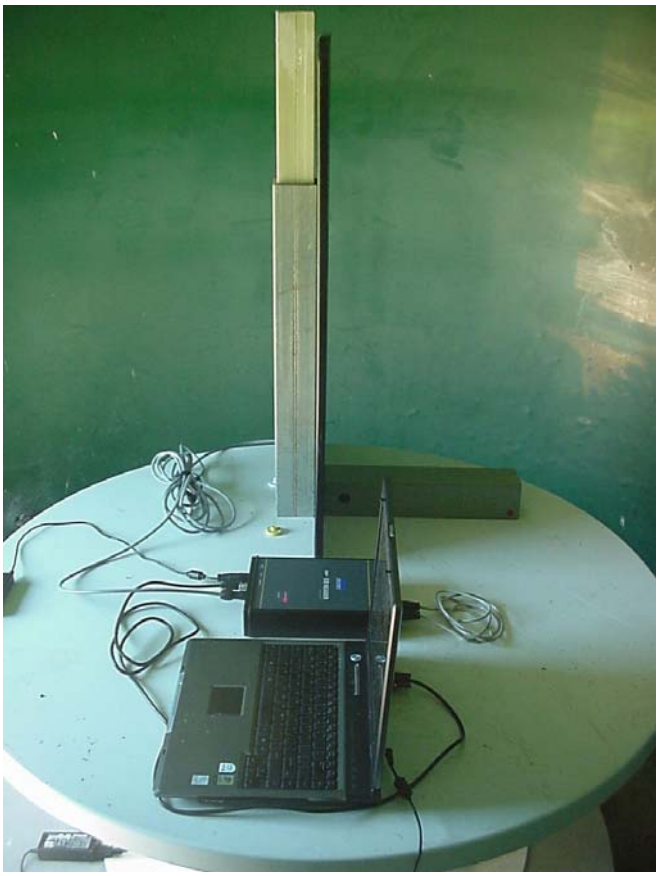


Radiated emissions test set up – Low Frequency test set up

Radiated emissions – Metallic ground plane general set up

Large antenna set up





Small antenna