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TEST REPORT

Tru-Test SRS2-1 Handheld 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

IANZ ACCREDITED LABORATORY

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 SRS2-1 Handheld Low Frequency Electronic ID (EID) Reader** complies with FCC Part 15 Subpart C as an Intentional Radiator when the methods as described in ANSI C63.10 - 2013 are applied.

2. RESULTS SUMMARY

The results from testing during May and June 2016 are summarised in the following table:

Clause	Parameter	Result
15.201	Equipment authorisation requirement	Certification required for the 134.2 kHz transmitter.
15.203	Antenna requirement	Complies. Antenna is internal to the device and is permanently attached
15.204	External PA and antenna modifications	Noted.
15.205	Restricted bands of operation	Complies. Device transmits on 134.2 kHz and contains a Bluetooth 2.4 GHz module transmitter.
15.207	Conducted limits	Complies.
15.209	Radiated emission limits - Fundamental	Complies.
15.209	Radiated emission limits - Spurious emissions <30 MHz	Complies.
15.209	Radiated emission limits – Spurious emissions >30 MHz	Complies.

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.

All compliance statements have been made with respect of the specification limit with no reference to the measurement uncertainty.

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	Handheld Low Frequency Electronic ID (EID) Reader
Model Number	SRS2-1
Serial Number	500000
Manufacturer	Tru-Test Ltd
Country of Origin	New Zealand
FCC ID	XOQSRS21
Supply Voltage	5V
Modulation	AM (FDX tag), FSK (HDX tag)
Bandwidth	10 kHz (Receiver bandwidth)
Frequencies	Processor 17.1776 MHz Transmitter 134.2 kHz Bluetooth 2402 - 2480 MHz
Duty Cycle	50 ms on, 4 ms off
Ports	USB

The Tru-Test SRS2-1 Handheld Low Frequency Electronic ID (EID) Reader is a dual mode FDX (AM) / HDX (FSK) tag reading device 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 0.5 m.

The Reader System identifies and reads electronic tags on individual animals.

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

The FCC ID of this module is FCC ID: QOQWT11IA

The device has a USB port which can be used to power the device and to also charge the internal battery.

Data can be retrieved from the device using either the Bluetooth connection or the USB port.

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 C63.10 - 2013 were used.

Section 15.201: Equipment authorisation requirement

Certification as detailed in Subpart J of Part 2 is required for the 134.2 kHz EID transmitter.

The Bluetooth transmitter has modular approval.

Section 15.203: Antenna requirement

This device operates using a permanently attached internal 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 band.

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 with a Bluetooth link established to a remote laptop computer.

Testing was also carried out when the supplied charger was charging the internal battery that was flat and when the device was turned on and was operating in standby mode not reading any tags and with the Bluetooth link not established.

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.

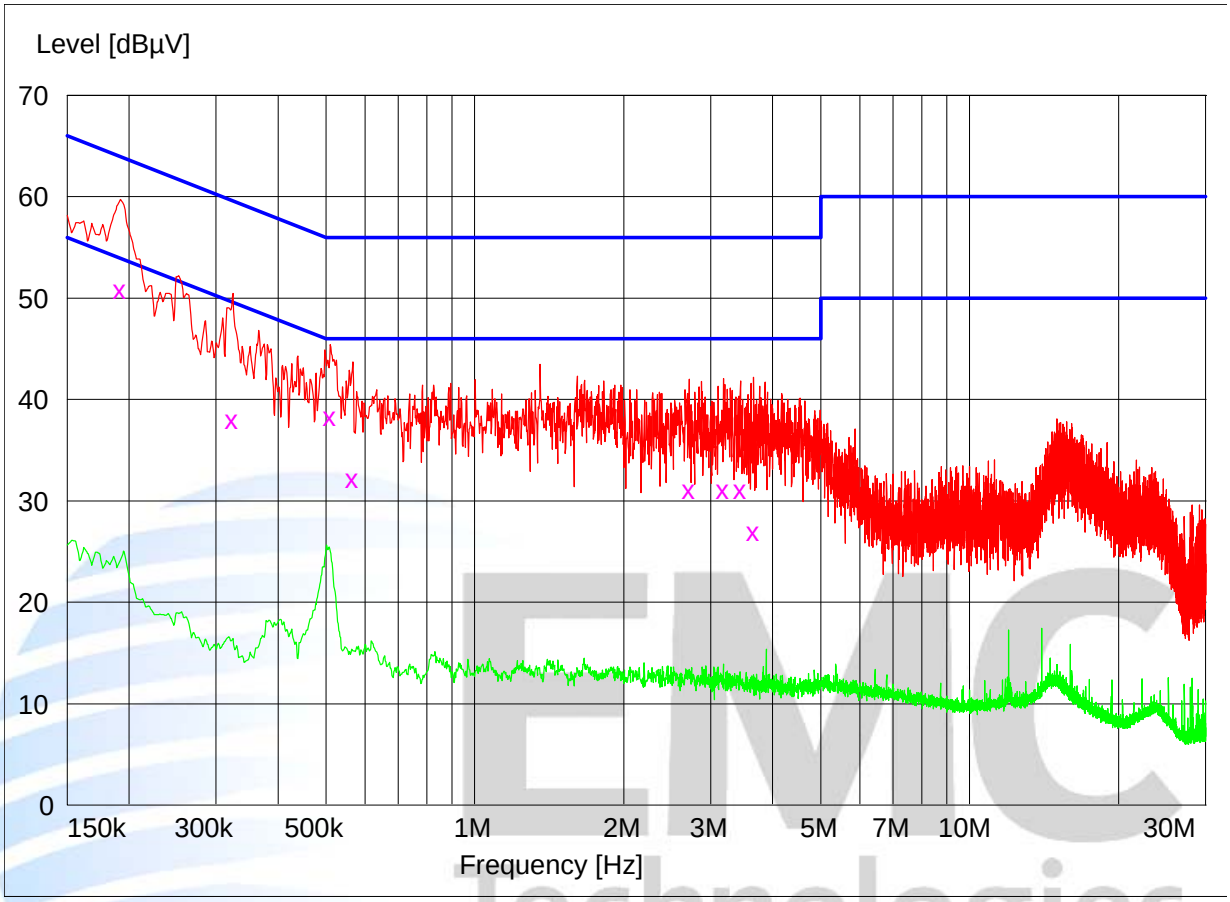
The Class B conducted limits have been applied

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 being charged using a external power supply at 120 Vac 60 Hz.

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



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.192000	50.80	64.1	13.1	N	
0.324000	38.00	59.6	21.6	N	
0.510000	38.40	56.0	17.6	N	
0.567000	32.20	56.0	23.8	N	
2.711000	31.10	56.0	24.9	L1	
3.179000	31.10	56.0	24.9	L1	
3.444500	31.10	56.0	24.9	L1	
3.660500	27.00	56.0	29.0	N	

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Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
	No emissions detected within 15 dB of the limit				

Conducted Emissions – AC Input Power Port

Setup:	Device tested in standby using an external DC supply that was powered at 120 Vac 60 Hz.

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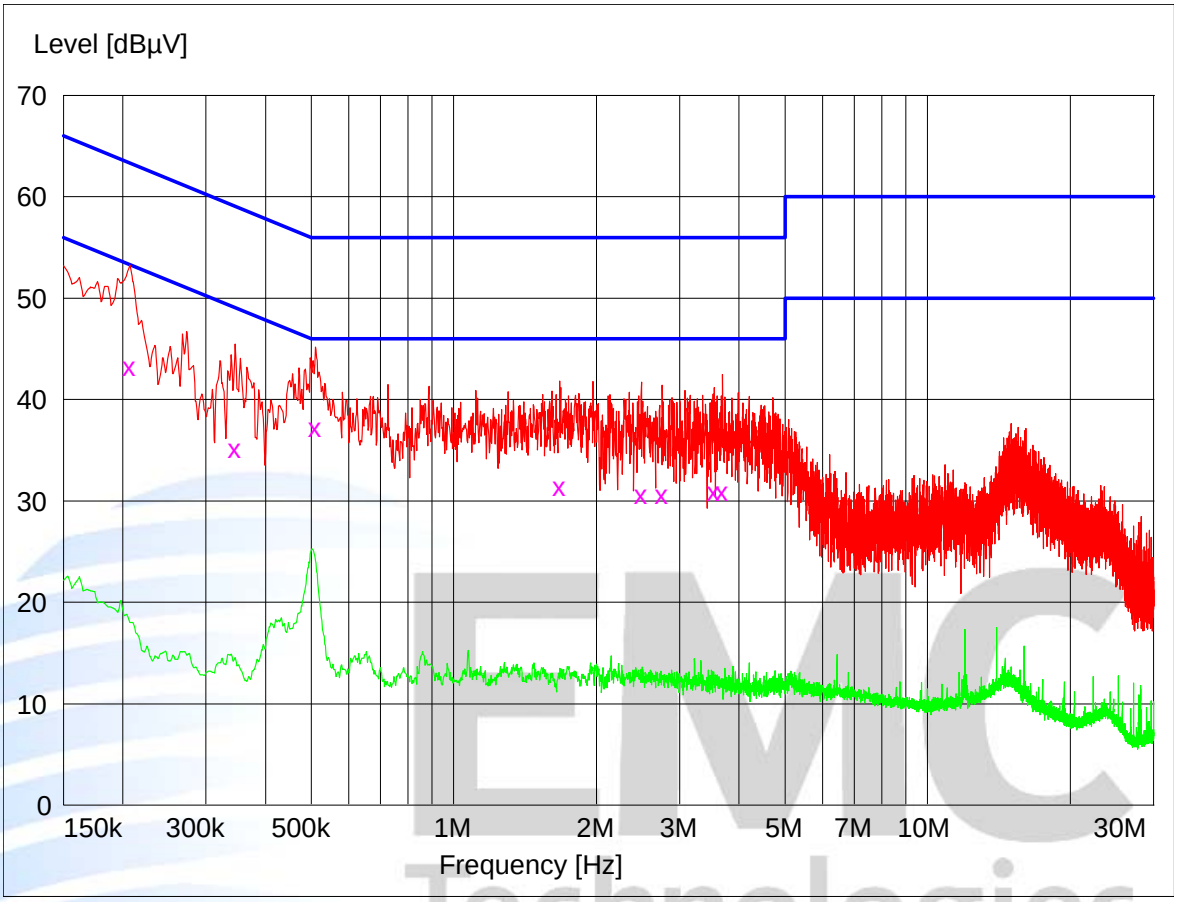

Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.207000	43.00	63.3	20.3	N	
0.345000	35.20	59.1	23.9	N	
0.510000	37.20	56.0	18.8	L1	
1.674000	31.40	56.0	24.6	L1	
2.490500	30.60	56.0	25.4	L1	
2.756000	30.70	56.0	25.3	L1	
3.548000	30.90	56.0	25.1	L1	
3.692000	30.90	56.0	25.1	L1	

Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
	No emissions detected within 15 dB of the limit				

Conducted Emissions – AC Input Power Port

Setup:	Device tested when operating reading two animal tags with a Bluetooth link established when the device was powered using a external power supply at 120 Vac 60 Hz.

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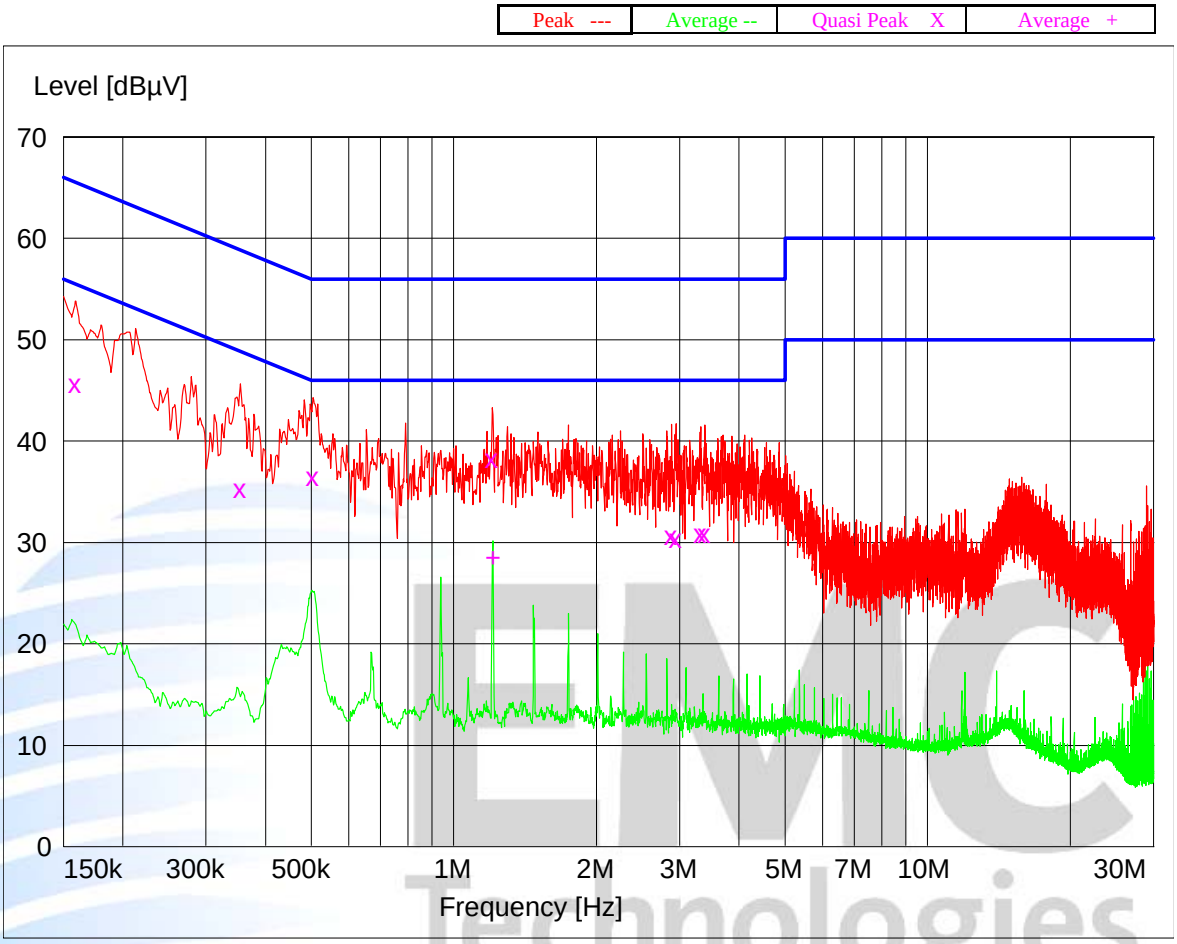


Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.159000	45.70	65.5	19.8	L1	
0.354000	35.40	58.9	23.5	N	
0.504000	36.50	56.0	19.5	N	
1.206000	38.30	56.0	17.7	L1	
2.882000	30.70	56.0	25.3	L1	
2.945000	30.40	56.0	25.6	L1	
3.318500	30.90	56.0	25.1	L1	
3.390500	30.90	56.0	25.1	L1	

Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
1.209000	28.50	46.0	27.5	L1	

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.

An enclosure containing absorber material, Panashield HYB-NF-12, has been placed between the turntable and the measurement antenna for when measurements are made above 1 GHz.

This material has no absorbing affect below 1 GHz with site verification measurements confirming this.

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 two RFID tags with the green LED flashing, an audible warning tone(s) being activated, the blue Bluetooth link LED continuously illuminated and the tag id's output to a laptop computer using a Bluetooth link.

The device was placed in the centre of the test table with the device being placed in the X, Y and Z planes as the device is hand held.

X plane: Laying flat with the LCD display facing up
Y plane: Laying flat with the LCD display facing the test antenna
Z plane: Device standing up with the LCD display facing the test antenna

Below 30 MHz the centre of this loop antenna was placed 1 metre above the ground at a distance of 10 metres from the device under test with the loop antenna being placed in two orientations.

Above 30 MHz testing was carried out at the test site 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)

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 – 1000 MHz) ± 4.1 dB
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

Section 15.209: 134.2 kHz 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

Frequency (kHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Distance (metres)
134.200	84.1	84.1	0.0	Average	10
134.200	85.8	104.1	18.3	Peak	10

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).

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

= 25.0 dBuV/m + 40 dB/decade * (log (300) - log (10))
= 25.0 dBuV/m + 40 dB/decade * (2.477-1.000)
= 25.0 dBuV/m + 40 dB/decade * 1.477
= 25.0 dBuV/m + 59.08
= 84.1 dBuV/m

This gives a limit at 10 m at 134.2 kHz of 84.1 dBuV/m and 104.1 dBuV/m in peak

Testing was also carried out to determine whether a +/- 15% variation in the 120 Vac supply, when the battery was almost flat (the battery could not be easily removed to carry out this test), would cause a significant change in the peak field strength.

Voltage (Vdc)	Average Field Strength (dBuV/m)
102.0	84.1
120.0	84.1
138.0	84.1

No variation was observed.

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	41.1	79.0	37.9	Average	Noise floor
268.400	52.0	99.0	47.0	Peak	Noise floor
402.600	37.0	75.5	38.5	Average	Noise floor
402.600	51.0	95.5	44.5	Peak	Noise floor
536.800	< 49	53.0	-	Quasi Peak	Ambient
671.000	39.0	51.1	12.1	Quasi Peak	Noise floor
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	31.0	46.0	15.0	Quasi Peak	Noise floor
1342.000	31.0	45.0	14.0	Quasi Peak	Noise floor
1476.200	< 40	44.2	-	Quasi Peak	Ambient
1610.400	27.0	43.5	16.5	Quasi Peak	Noise floor

No emissions were 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.

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.

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 USB port which was attached to the AC/DC power supply

- a Bluetooth link was established with a remote laptop computer which continuously displayed the ID of the tags that were being read

Measurements were attempted with the device orientated in the X, Y and Z axis with the worst case levels being recorded.

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

30 - 1000 MHz results

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result	Antenna
52.665	36.5		40.0	3.5	Pass	Vertical
54.000	37.3		40.0	2.7	Pass	Vertical
55.000	37.2		40.0	2.8	Pass	Vertical
56.152	36.8		40.0	3.2	Pass	Vertical
56.850	35.8		40.0	4.2	Pass	Vertical
76.600	24.1		40.0	15.9	Pass	Vertical
184.659	31.3	33.8	43.5	9.7	Pass	Horizontal
186.864	31.6	33.3	43.5	10.2	Pass	Horizontal
251.000		26.6	46.0	19.4	Pass	Horizontal
308.120		32.1	46.0	13.9	Pass	Horizontal
314.260	21.1		46.0	24.9	Pass	Vertical
328.060		26.5	46.0	19.5	Pass	Horizontal
342.480	30.1		46.0	15.9	Pass	Vertical
361.000		26.1	46.0	19.9	Pass	Horizontal

All other emissions detected had a margin to limit that exceeded 25 dB when measurements were attempted up to 1 GHz using both vertical and horizontal polarisations.

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 1000 MHz) ± 4.1 dB

7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Asset Ref	Period	Cal Due
AC Supply	APT	7008	4170003	-	-	Not applicable
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	-	Not applicable
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	-	Not applicable
Biconical	Schwarzbeck	BBA 9106	-	RFS 3612	3 years	5 Feb 2017
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	3 years	5 Feb 2017
Loop Antenna	EMCO	6502	9003-2485	3798	3 years	7 Jul 2017
Mains Network	R & S	ESH2-Z5	881362/032	3628	2 years	2 Oct 2016
Receiver	R & S	ESHS 10	828404/005	3728	1 year	27 June 2017
Receiver	R & S	ESIB-40	100171	R-27-1	1 year	15 Feb 2017
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	-	Not applicable
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	3 years	5 Feb 2017

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, 2014.

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.

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.

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.

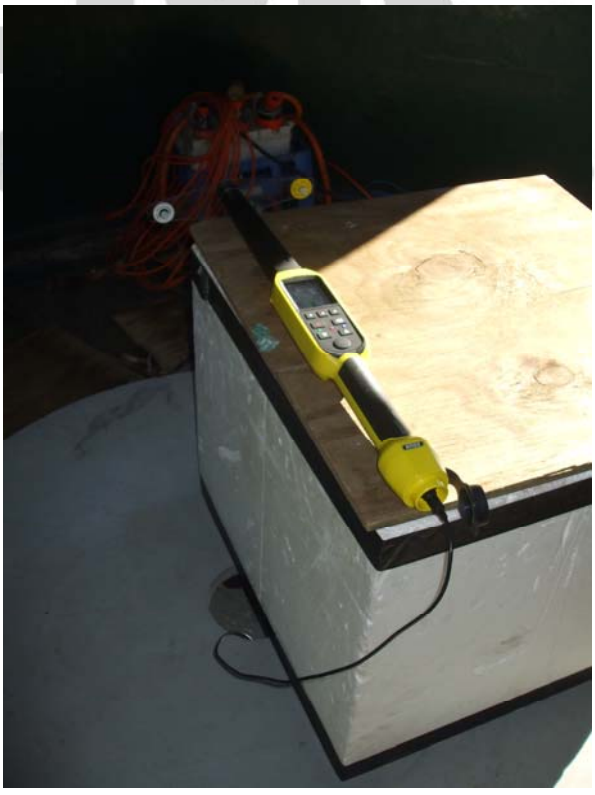
9. PHOTOGRAPHS

External Photos

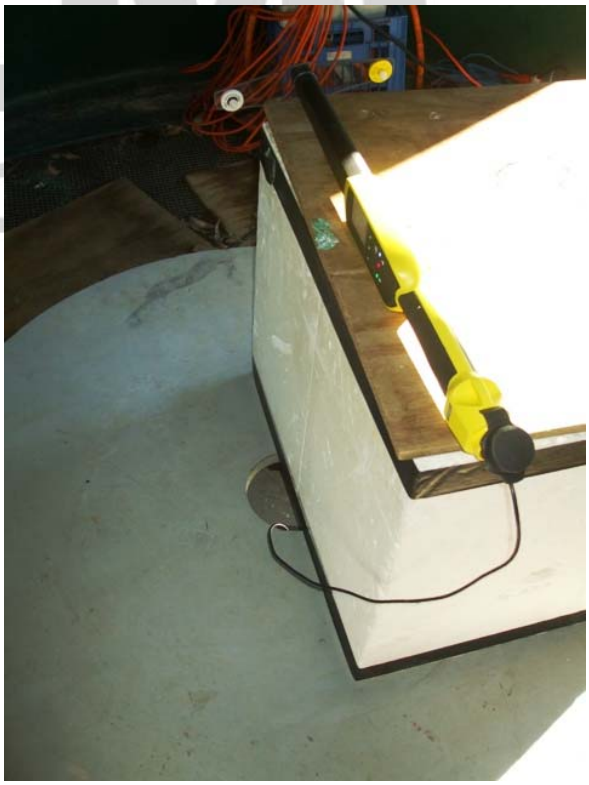
Power Supply

Radiated emissions test set up photos

Device in the X plane



Device in the Y plane



Device in the Z plane

Conducted emissions test set up