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TEST REPORT

Vega AIS VAIS3E Aid to Navigation

tested to the specification

EN 60945: 2002

Maritime navigation and radio communication
equipment and systems –
General requirements –
Methods of testing and required test results

for Global Product Certification
Vesper Marine 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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Global Product Certification

1. STATEMENT OF COMPLIANCE

The Vega AIS VAIS3E Aid to Navigation complies with EN 60945: 2002.

2. RESULTS SUMMARY

The results of testing that was carried out in July 2014 are summarised below.

Electromagnetic emission tests:

Clause	Application	Result
9.2	Conducted emissions 9 kHz – 30 MHz	Complies with a 26.7 dB margin at 11.981 MHz (Quasi-Peak).
9.3	Radiated emissions 150 kHz – 30 MHz	Complies.
9.3	Radiated emissions 30 MHz – 2000 MHz	Complies with a 10.4 dB margin at 162.660 (Horizontal) & 163.340 MHz (Vertical).

Electromagnetic immunity tests:

Clause	Application	Result
10.3	Conducted RF disturbance	Complies.
10.4	Radiated disturbance	Complies.
10.5	Fast transients (bursts)	Complies.
10.6	Slow transients (surges)	Not applicable. Device is DC powered
10.7	Power supply short term Variations	Not applicable. Device is DC powered.
10.8	Power supply failure	Not applicable. Device is DC powered using an external battery.
10.9	Electrostatic discharge	Complies.

3. INTRODUCTION

This report describes the tests and measurements for the purpose of determining compliance with the specification under the following conditions:

The test sample was selected by the client.

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 Vesper Marine Ltd
Address 103 Westhaven Drive, St Marys Bay,
City Auckland 1010
Country New Zealand
Contact David Kearney.

5. DESCRIPTION OF TEST SAMPLE

Brand Name Vega AIS
Model Number VAIS3E
Product Aid to Navigation
Manufacturer Vega Industries Ltd
Country of Origin New Zealand
Serial Number 21000010

This report can also be applied to the following model numbers VAIS1S, VAIS1E and VAIS3S.

The client advises that the model tested is a Type 3 device.

The label on the device indicates that the device is a Type 1 device however this label is incorrect and should indicate that it is a Type 3 device with operating receivers and as is evident from the General Test Setup.

The Type 3 VAIS3E model was used since it is the model with the most complexity and is otherwise electrically equivalent to the AIS1S, VAIS1E and VAIS3S models.

6. SETUPS AND PROCEDURES

Standard

The sample was tested in accordance with EN 60945: 2002.

Electromagnetic emissions:

Method	Protected	Limit
Conducted emissions	10 kHz – 150 kHz 150 kHz – 350 kHz 350 kHz – 30 MHz	96 dBuV- 50 dBuV 60 dBuV- 50 dBuV 50 dBuV
Radiated emissions	150 kHz – 300 kHz 300 kHz – 30 MHz 30 MHz – 2 GHz 156 MHz – 165 MHz	80 dBuV/m – 52 dBuV/m 52 dBuV/m – 34 dBuV/m 54 dBuV/m (120 kHz Bw) 24 dBuV/m Quasi-peak (9 kHz Bw) 30 dBuV/m Peak (9 kHz Bw)

Electromagnetic immunity:

Method	Standard	Criteria
Conducted disturbances 3V r.m.s. 150 kHz – 80 MHz, 10V r.m.s. spot frequencies	EN 61000-4-6	A
Radiated disturbances 10V/m 80 MHz – 2 GHz	EN 61000-4-3	A
Fast Transients (bursts) -±1kV common mode signal/ control ports -±2kV AC power ports	EN 61000-4-4	B
Slow transients (surges) -±1 kV line/earth -±0.5 kV line/line	EN 61000-4-5	B
Power supply short term variations -± 20% voltage for 1.5s, AC power ports -± 10% frequency for 5s, AC power ports	EN 61000-4-11	C
Power supply failure 60s interruption, AC and DC power ports	EN 61000-4-11	C
Electrostatic discharge -±8 kV air -±6 kV contact discharges	EN 61000-4-2	B

Performance Criteria

Performance Criterion A:

The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specifications published by the manufacturer;

Performance Criterion B:

The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specifications published by the manufacturer. During the test, degradation or loss of function or performance which is self-recoverable is however, allowed, but no change of actual operating state or stored data is allowed

Performance Criterion C:

Temporary degradation or loss of function or performance is allowed during the test, provided the function is self-recoverable, or can be restored at the end of the test by the operation of the controls, as defined in the relevant equipment standard and in the technical specifications published by the manufacturer.

General Test Set Up :

The device was mounted upright and powered from an external 13.8 V lead acid battery.

The unit was tested with the GPS and VHF antennae attached.

The sense circuit was loaded with a 12 V battery and a 10 ohm load.

A remote ancillary AIS unit was set up which allowed monitoring of the device under test.

The AIS system displayed the current GPS position and would update every 3 minutes through a VHF transmission.

The device was connected via a serial cable to a remote laptop running HyperTerminal which allowed visualisation of the internal state of the device.

Immediately prior to the transmission of the position the on-screen code would update which indicated that the unit was correctly operating and that any missed transmission was due to interruption of the ancillary equipment.

The operation of the device was monitored visually for loss of AIS targeting on the ancillary equipment as well as disruption/corruption of the serial data on the remote laptop.

The manufacturer's minimum level of performance was that the device transmitted its AIS data every 3 minutes.

7. TEST RESULTS

Conducted emissions

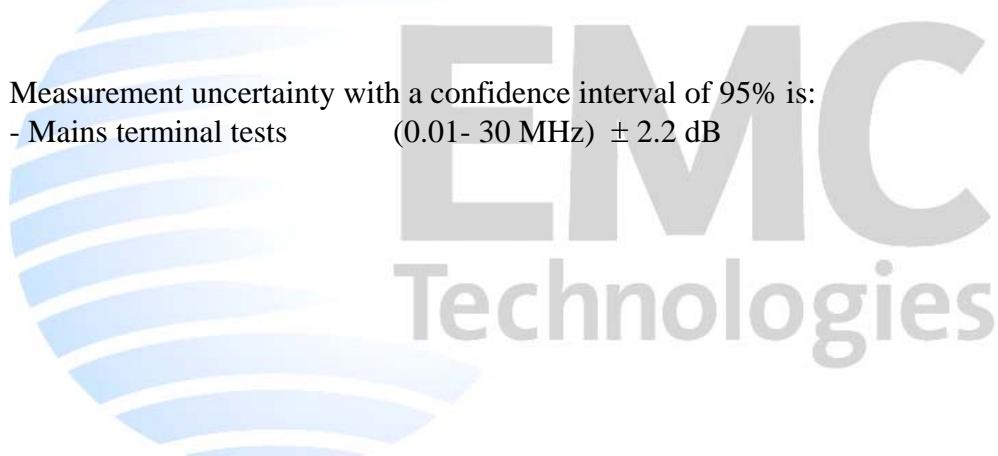
A conducted emission testing was carried out over the frequency range of 10 kHz to 30 MHz.

Testing for conducted emissions was carried out at the laboratory's MacKelvie Street premises in a screened room.

The device was mounted directly to the vertical earth reference plane and located 0.8 m away from the closest edge of the artificial mains terminal network, which is also bonded to the vertical coupling plane.

The ancillary equipment was positioned 0.8m above the ground reference plane on a wooden table 0.8m square.

The ancillary equipment was powered from an external 13.8 Vdc lead acid battery.



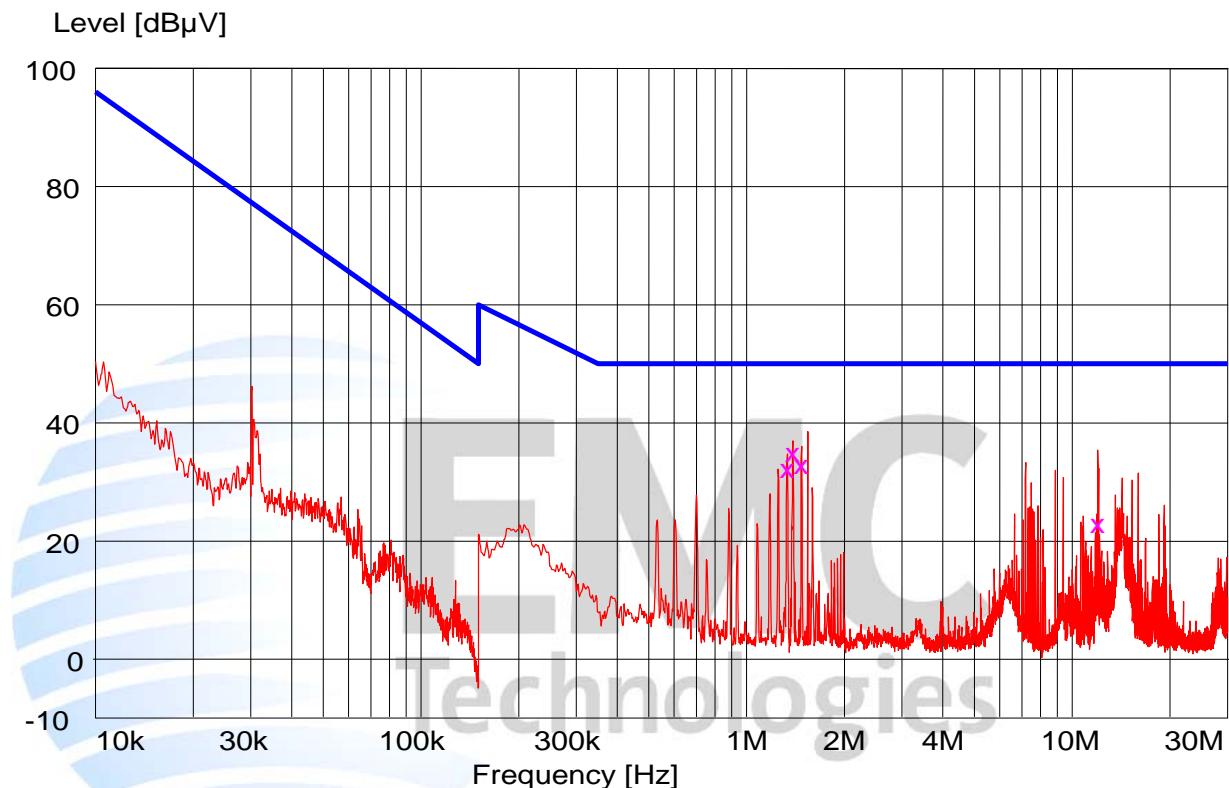
Measurement uncertainty with a confidence interval of 95% is:

- Mains terminal tests (0.01- 30 MHz) ± 2.2 dB

Conducted Emissions – DC Input Power Port

Setup: The device was powered from a linear supply at 13.2 volts DC. Attached to unit was a GPS and a VHF antenna. The signal control line was connected to a 12 volt battery and a 10 ohm load.

Peak --- Average --- Quasi Peak



Final Quasi-Peak Measurements

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Rechecks dB μ V
1.332000	32.70	50	17.3	Ambient
1.386000	35.30	50	14.7	Ambient
1.476000	33.20	50	16.8	Ambient
11.981000	23.30	50	26.7	26.2

Radiated emissions (0.150 MHz to 2000 MHz)

Radiated emissions testing were carried out over the frequency range of 0.15 to 2000 MHz at the laboratory's open area test site - located at 670 Kawakawa-Orere Road, RD5, Papakura, New Zealand.

Before testing was carried out, a receiver Self Test and Long calibration routine was undertaken. Additionally, a check of all connecting cables and programmed antenna factors was carried out.

The device was placed on the test tabletop, which was a total of 0.8 m above the test site ground plane.

Measurements of the radiated field were made with the antenna located at a 3 m horizontal distance from the boundary of the devices under test.

In addition measurements were made between 156.0 – 165.0 MHz with a peak limit of 30 dB μ V/m being applied.

Testing was carried out in the various modes in which the device operated. Any external cables were placed directly behind the Turntable running directly away from the antenna.

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 with an automated antenna tower.

The emission is measured in both vertical and horizontal antenna polarisations above 30 MHz.

Between 0.15 – 30 MHz a loop antenna was used the centre of which was 1.5 metres above the test site ground plane.

During the test, a number of ambient emissions are identified (list of which can be provided upon request).

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

Level (dB μ V/m) = Receiver Reading (dB μ V) + Antenna Factor (dB/m) + Coax Loss (dB).

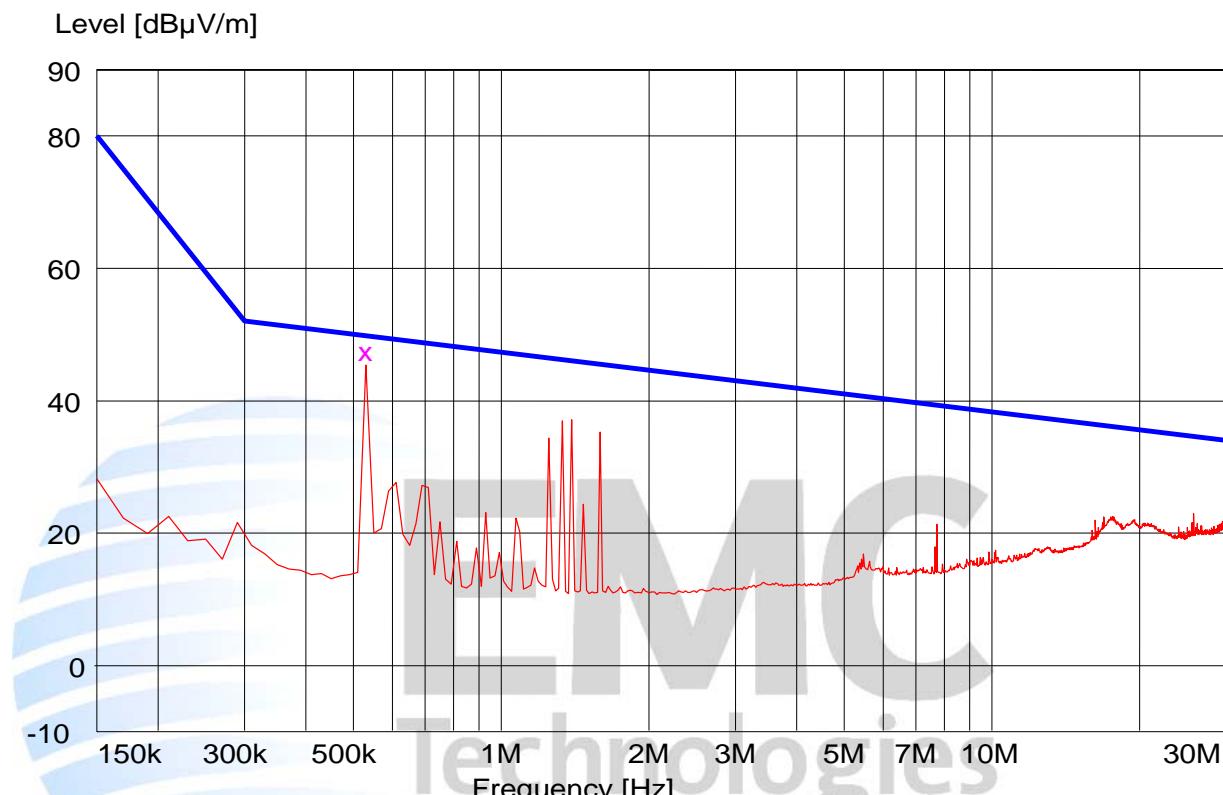
Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (0.15 - 2000 MHz) \pm 4.5 dB

Radiated emissions 150 kHz – 30 MHz

Setup:	The device was powered from a linear supply at 13.2 volts DC. Attached to unit was a GPS and a VHF antenna. The signal control line was connected to a 12 volt battery and a 10 ohm load.
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Peak --- Average --- Quasi Peak **X**



Final Quasi-Peak Measurements

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Rechecks dB μ V/m
0.530000	47.70	49.8	2.1	Ambient

Radiated Emissions (30 – 2000 MHz)

The device was powered from a single 12 V lead acid battery.

A VHF and a GPS antennae were attached.

The signal control line was connected to a 12 volt battery and a 10 ohm load.

A remote AIS unit was configured to indicate the device was operating.

Freq MHz	Vert dB μ V/m	Horiz dB μ V/m	Limit dB μ V/m	Margin dB	Result	Antenna
33.240	19.5		54.0	34.5	Pass	Vertical
43.080	16.7		54.0	37.3	Pass	Vertical
44.520	18.3		54.0	35.7	Pass	Vertical
53.840	17.2		54.0	36.8	Pass	Vertical
55.640	20.4		54.0	33.6	Pass	Vertical
64.880	22.6		54.0	31.4	Pass	Vertical
75.600		14.7	54.0	39.3	Pass	Horizontal
77.000		18.4	54.0	35.6	Pass	Horizontal
77.560		19.1	54.0	34.9	Pass	Horizontal
137.220	19.7	18.3	54.0	34.3	Pass	Vertical
152.640	22.4		54.0	31.6	Pass	Vertical
162.660		19.6	30.0	10.4	Pass	Horizontal
163.340	19.6		30.0	10.4	Pass	Vertical
164.330	18.7		30.0	11.3	Pass	Vertical
185.820	18.7		54.0	35.3	Pass	Vertical
192.000		17.4	54.0	36.6	Pass	Horizontal
249.060		19.1	54.0	34.9	Pass	Horizontal
269.760		18.4	54.0	35.6	Pass	Horizontal
324.100		23.2	54.0	30.8	Pass	Horizontal
326.400	30.3		54.0	23.7	Pass	Vertical
345.600	34.7	28.6	54.0	19.3	Pass	Vertical
364.800	31.3		54.0	22.7	Pass	Vertical
384.000	35.8	32.3	54.0	18.2	Pass	Vertical
403.200		32.5	54.0	21.5	Pass	Horizontal
422.400		30.0	54.0	24.0	Pass	Horizontal
439.900	28.4		54.0	25.6	Pass	Vertical
460.800	32.2		54.0	21.8	Pass	Vertical
480.000	33.5		54.0	20.5	Pass	Vertical
537.600		28.3	54.0	25.7	Pass	Horizontal
604.300		27.4	54.0	26.6	Pass	Horizontal
947.600	29.9	31.4	54.0	22.6	Pass	Horizontal

No further emissions were observed within 15 dB of the specified limit.

Electrostatic Discharge (ESD)

ESD testing was required to be carried out as detailed below.

The device was required to meet performance criteria B.

The calibration uncertainties for Electrostatic Discharge to IEC 61000-4-2 are:

- DC Voltage	0.04%
- Peak Current	4%
- Rise Time	2.5%
- Curve decay points at 30 and 60 nS	5%

10 x \pm 2 kV, \pm 4 kV, \pm 6 kV, Contact discharges were applied at one second intervals as follows:

Point of Contact	Observation	Result
HCP	No effects observed.	Pass
VCP (top)	No effects observed.	Pass
VCP (base)	No effects observed.	Pass
VCP (GPS & Beacon ports)	No effects observed.	Pass
VCP (VHF Port)	No effects observed.	Pass
VCP (Sensor Port)	No effects observed.	Pass
Metal Orientation Tubes (x6)	No effects observed.	Pass
GPS Connector	No effects observed.	Pass
VHF Connector	No effects observed.	Pass
Casing Screws (x4)	No effects observed.	Pass
HCP	No effects observed.	Pass

10 x \pm 2 kV, \pm 4 kV, \pm 8 kV Air discharges were applied at one second intervals as follows:

Point of Contact	Observation	Result
Casing Seam	No discharges occurred	Pass
Sensor Cable	No discharges occurred	Pass
Beacon Cable	No discharges occurred	Pass
Weather Cable Port	No effects observed.	Pass
Digital Port	No effects observed.	Pass
Analog Port	No effects observed.	Pass

Result: Complies.

The device did not display susceptibility to Electrostatic Discharges during the test and complied with the prescribed performance criteria.

The device operated normally at the conclusion of the test.

Radio Frequency Electromagnetic Field

RF Electromagnetic Field testing was required to be carried out at 10 V/m, between 80 - 2000 MHz, in 1% steps with a 3 second dwell time using a 400 Hz 80% AM modulated carrier.

The test was repeated at 10 V/m, between 80 - 2000 MHz, in 10% steps with a 180 second dwell time using a 400 Hz 80% AM modulated carrier.

Testing was carried out using a bilog antenna in both vertical and horizontal polarisations.

The device was required to meet performance criteria A.

The calibration uncertainties for Radiated Susceptibility to EN 61000-4-3 are:

80 - 2000 MHz ± 1.1 V/m

The Radiated RF was injected into the top, base GPS/Beacon ports, Sensor / Digital / Analog / Weather ports and the VHF port faces of the device.

Observations:

No effects observed.

Result:

Complies.

The device did not display susceptibility to Radiated RF Electromagnetic Fields during testing and complied with the prescribed performance criteria.

The device continued to operate normally after the test.

Conducted RF Susceptibility

Conducted RF susceptibility testing was carried out between 150 kHz and 80 MHz at 3V_{rms} with a 400 Hz tone 80% AM modulated.

Additional spot checks were carried out at 10 V_{rms} at 2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz.

Testing was carried out in 1% steps with a dwell time of 3 seconds.

The device is required to meet performance criteria A.

Described below are the calibration uncertainties for Radio frequency continuous conducted susceptibility to EN 61000-4-6 : 0.15 – 80.0 MHz \pm 1.42 dB

The following ports were tested:

Port Tested	Method	Observation	Result
DC Power Port	DC M2 CDN	No effects observed.	Pass
Serial Cable	FCC Clamp	No effects observed.	Pass
Sensor Cable	FCC Clamp	No effects observed.	Pass

Result: Complies.

The device did not display susceptibility to Conducted RF Electromagnetic Fields during the test and complied with the prescribed performance criteria.

The device continued to operate normally after the test.

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Electrical Fast Transients / Burst (EFT/B)

± 1.0 kV (5/50 ns, 5 kHz) transients were injected on to the signal / control port using a capacitive clamp.

Testing was carried out for 3 minutes while the device was being operated.

The device was required to meet performance criteria B.

Described below are the calibration uncertainties for Electrically Fast Transient Bursts to IEC 61000-4-4:

-Peak Output Voltage U _{peak}	3.0 %
-Rise Time t _r	2.5 %
-Pulse Width t _w	2.0 %
-Burst Frequency f _b	1.0 %
-Burst Duration t _b	1.0 %
-Burst Period t _{rep}	1.0 %

The following ports were tested:

Port Tested	Method	Observation	Result
Sensor Cable	Clamp	The 3 minute AIS transmission was not received by the ancillary equipment. The next transmission (at the 6 minute mark) was received.	Pass
Serial Cable	Clamp	The 3 minute AIS transmission was not received by the ancillary equipment. The next transmission (at the 6 minute mark) was received.	Pass

Result: Complies.

The device did display susceptibility to Electrical Fast Transient/Burst (EFT/B) during testing but the device complied with the prescribed performance criteria B.

The device continued to operate normally after the test.

8. EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Asset Ref
2m Triple Antenna	Rohde & Schwarz	HM020	843885/004	-
Aerial Controller	EMCO	1090	9112-1062	RFS 3710
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708
Anechoic Material	Rantec	ERP24 Cones	-	-
Anechoic Material	Rantec	Ferrite Tiles	-	-
Artificial Mains Network	Rohde & Schwarz	ESH 2-Z5	881362/032	3628
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612
Bilog Antenna	EMCO	3141	9707-1071	E1596
Coupling Clamp	Schaffner	CDN 125	606	-
Coupling Network	CIM	CDN-DC2-16A	-	E3792
Current Clamp	FCC	-	42	E3790
ESD Gun	Schaffner	NSG 435	1261	E1426
Interference Test System	Keytek	EMC Pro Plus	S012233	E3788
Isotropic Field Probe	Holaday	-	51528	EMC4027
Log Periodic Antenna	Schwarzbeck	VUSLP 9111	9111-228	3785
Loop Antenna	EMCO	6502	9003-2485	
Measurement Receiver	Rohde & Schwarz	ESCS 30	847124/020	E1595
Measurement Receiver	Rohde & Schwarz	ESHS 10	838693/002	3800
Microwave Amplifier	Ophir	5162FE	1029	E3786
Power Amplifier	Amplifier Research	30W1000B	-	EMC4022
Power Amplifier	IFI	M75	B373-1098	RFS 3773
Signal Generator	Rohde & Schwarz	SML 02	-	EMC4013
Signal Generator	Rohde & Schwarz	SMP04	1035 5005.04	E1560
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709

All Test Equipment was within calibration at the time of testing.

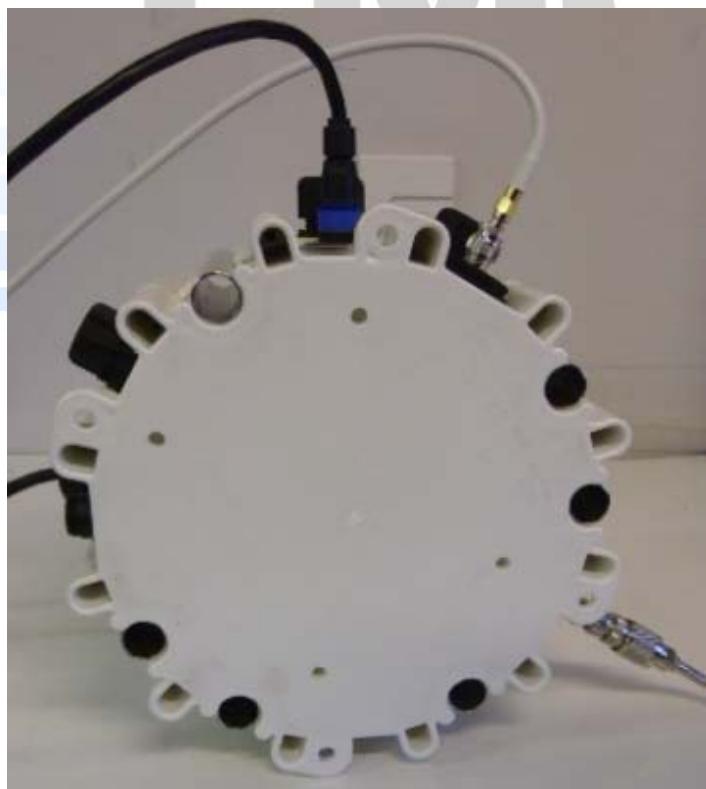
9. ACCREDITATIONS

The tests were carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/IEC/ ISO 17025.

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

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

10. PHOTOGRAPHS





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