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TEST REPORT

Vesper Marine VAB1252
Virtual AIS Beacon

tested to the specification

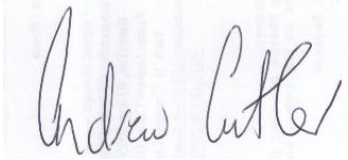
EN 60945: 2002

Maritime navigation and radio communication equipment and systems –

General requirements –
Methods of testing and required test results

for

Vesper Marine 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 **Vesper Marine VAB1252 Virtual AIS Beacon** complies with EN 60945: 2002.

2. RESULTS SUMMARY

The results of testing that was carried out in February 2015 are summarised below.

Electromagnetic emission tests:

Clause	Application	Result
9.2	Conducted emissions 10 kHz – 30 MHz	Complies with a 9.8 dB margin at 0.525 MHz (Quasi-Peak).
9.3	Radiated emissions 150 kHz – 30 MHz	Complies with a 7.4 dB margin at 0.534 MHz (Quasi-Peak).
9.3	Radiated emissions 30 MHz – 2000 MHz	Complies with a 2.4 dB margin at 161.699 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 tested.
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.

This report replaces report number 141122.1 with the Model Equivalence Attestation on page 5 and the radiated emission measurements on page 12 and 13 being revised and clarified.

4. CLIENT INFORMATION

Company Name	Vesper Marine Ltd
Address	45 Sale St, Freemans Bay,
City	Auckland 1011
Country	New Zealand
Contact	David Kearney.

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Vesper Marine
Model Number	VAB 1252
Product	Virtual AIS Beacon
Manufacturer	Vesper Marine Ltd
Country of Origin	New Zealand
Serial Number	Not serialised

Model equivalence attestation:

29/06/15

RE: Virtual AIS Beacon - IEC60945 EMC Certification

To Whom It May Concern,

This is to verify that the Virtual AIS Beacon manufactured by Vesper Marine Ltd and submitted for EMC certification to IEC60945 (chapters 9 & 10) in February 2015 has two model numbers associated with it, both of which are electrically similar.

These model numbers are VAB1250 and VAB1252.

The VAB1252 and VAB1250 are functionally equivalent except for the following differences:

- VAB1250 does not include the Ethernet connectivity option.

Regards,

Carl Omundsen
Director / Chief Engineer
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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) or 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.

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 support software which allowed visualisation of the internal state of the device.

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.

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.

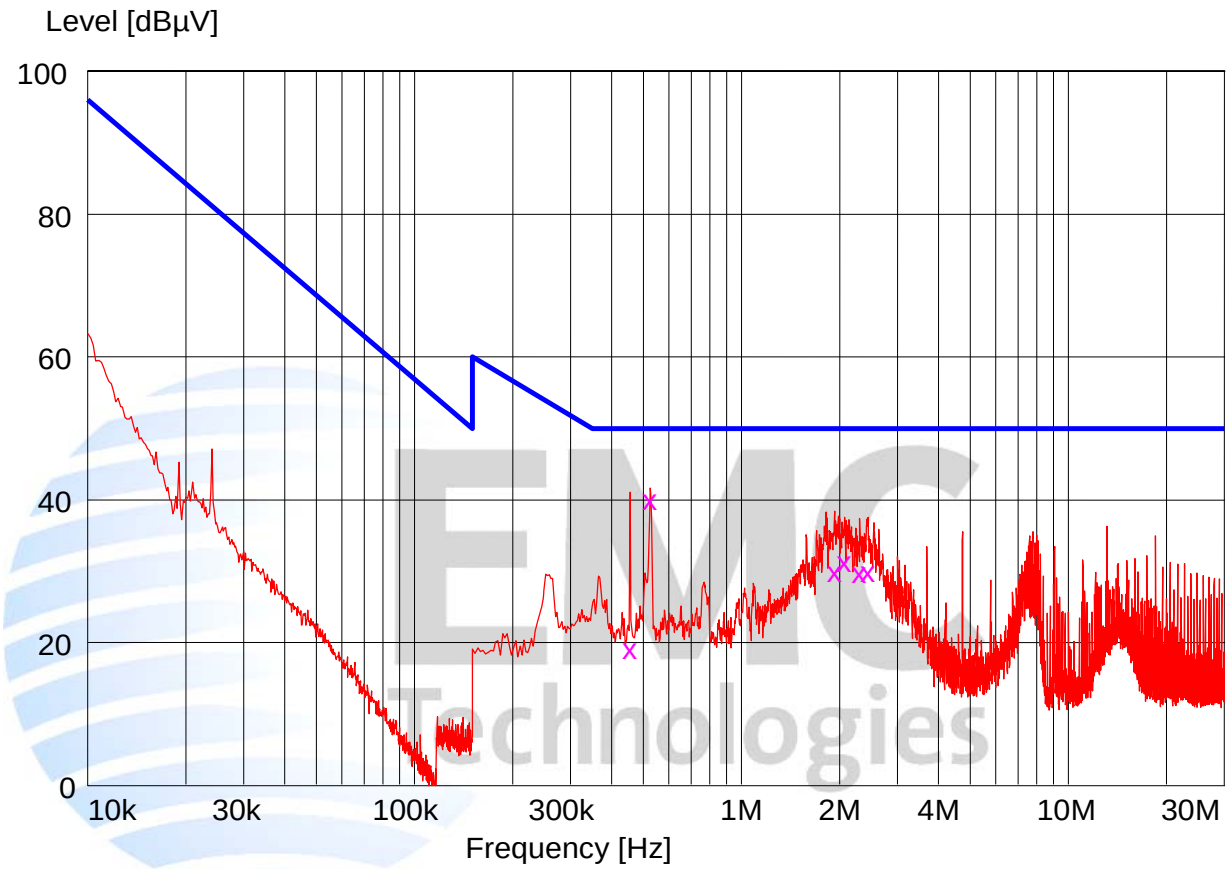
The ancillary equipment was powered from an external 13.8 Vdc lead acid battery.

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 13.2 volts DC lead acid battery. Attached to unit was a GPS and a VHF antenna. All other cables were unterminated.

Peak ---	Average ---	Quasi Peak X



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Rechecks (dBµV)
0.456000	19.50	50.0	30.5	
0.525000	40.20	50.0	9.8	*40.3*
1.932000	30.20	50.0	19.8	*30.1*
2.067500	31.60	50.0	18.4	
2.301500	30.10	50.0	19.9	
2.441000	30.20	50.0	19.8	

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 between 30 - 2000 MHz were made using a Quasi Peak Detector with a 120 kHz bandwidth with the antenna located at a 3 m horizontal distance from the boundary of the devices under test.

Additionally measurements were made between 156.0 – 165.0 MHz with a Quasi Peak Detector with a 9 kHz bandwidth where a limit of 24 dBμV/m was 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:

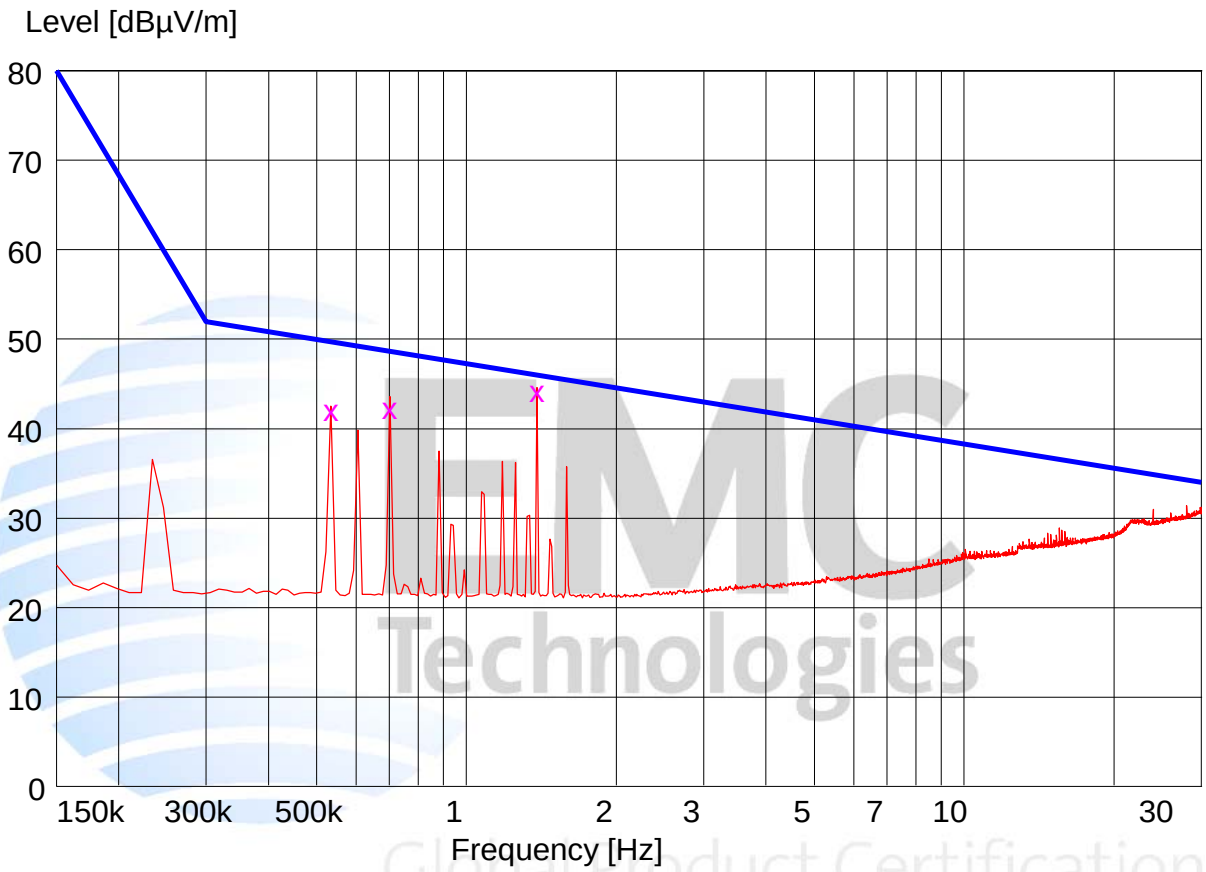
Level (dBμV/m) = Receiver Reading (dBμV) + Antenna Factor (dB/m) + Coax Loss (dB).

Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (0.15 - 2000 MHz) ± 4.5 dB

Radiated emissions 150 kHz – 30 MHz

Setup:	The device was powered from a 13.2 volts DC lead acid battery. Attached to unit was a GPS and a VHF antenna. All other cables were unterminated.

Peak ---	Average ---	Quasi Peak X



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Rechecks (dBµV/m)
0.534000	42.40	49.7	7.4	*42.6*
0.702000	42.60	48.7	6.1	*Ambient – AM Radio*
1.386000	44.50	46.0	1.5	*Ambient – AM Radio*

Radiated Emissions Test Set up (30 – 2000 MHz)

The device was powered from a single 12 Vdc lead acid battery that was placed on top of the ground plane.

The device was placed in the centre of the test table with the display facing vertically and the cable outlets facing to the rear.

A Marine VHF (vertically polarised) and a GPS antennae were attached to the device.

An unpowered laptop computer was attached to the serial port.

Attached to the GPIO port was an unterminated cable supplied by the client.

The ancillary equipment consisted of an AIS receiver operating in close range mode.

The AIS receiver was powered from an AC adapter that was placed on the test pad behind the device.

Connected to the AIS receiver were a Marine VHF antenna and a GPS antenna.

Radiated Emissions Results (30 – 2000 MHz)

Quasi Peak Detector with a 120 kHz bandwidth

Freq (MHz)	Vert (dBµV/m)	Hort (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result	Antenna
31.160	22.5		54.0	31.5	Pass	Vertical
50.800	21.0		54.0	33.0	Pass	Vertical
75.330	18.5		54.0	35.5	Pass	Vertical
107.640	29.0		54.0	25.0	Pass	Vertical
117.000	36.5	34.4	54.0	17.5	Pass	Vertical
129.060	26.5		54.0	27.5	Pass	Vertical
143.403	36.5		54.0	17.5	Pass	Vertical
154.645	24.7		54.0	29.3	Pass	Vertical
163.311	28.5		54.0	25.5	Pass	Vertical
181.680		28.7	54.0	25.3	Pass	Horizontal
323.942	41.7	47.8	54.0	6.2	Pass	Horizontal
363.126	38.5	41.2	54.0	12.8	Pass	Horizontal
583.377	29.1	37.3	54.0	16.7	Pass	Horizontal
666.683	36.3	40.5	54.0	13.5	Pass	Horizontal
749.989	38.5	38.3	54.0	15.5	Pass	Vertical
833.336	37.9	38.3	54.0	15.7	Pass	Horizontal
916.601	33.5	32.8	54.0	20.5	Pass	Vertical
999.907	28.3	28.6	54.0	25.4	Pass	Horizontal
446.432		40.2	54.0	13.8	Pass	Horizontal
1166.655	40.1	39.1	54.0	13.9	Pass	Vertical
1250.000	38.3	39.9	54.0	14.1	Pass	Horizontal
1295.800	41.1	41.6	54.0	12.4	Pass	Horizontal
1333.342	43.5	41.8	54.0	10.5	Pass	Vertical
1456.914		40.9	54.0	13.1	Pass	Horizontal

Radiated Emissions Results (156.0 - 165.0 MHz)

Quasi Peak Detector with a 9 kHz bandwidth

Freq (MHz)	Vert (dBµV/m)	Hort (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result	Antenna
157.406		20.8	24.0	3.2	Pass	Horizontal
159.000		17.5	24.0	6.5	Pass	Horizontal
160.112	19.3		24.0	4.7	Pass	Vertical
160.635	19.0		24.0	5.0	Pass	Vertical
161.158	19.5		24.0	4.5	Pass	Vertical
161.699	21.6		24.0	2.4	Pass	Vertical
164.783		20.5	24.0	3.5	Pass	Horizontal

All other emissions observed had a margin to the limit that exceeded 20 dB when observations were made using vertical and horizontal polarisations.

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 ± 2 kV, ± 4 kV,± 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 (rear)	No effects observed.	Pass
VCP (Ports)	No effects observed.	Pass
VCP (Front)	No effects observed.	Pass
VCP (LHS)	No effects observed.	Pass
VCP (RHS)	No effects observed.	Pass
GPS Connector	No effects observed.	Pass
VHF Connector	No effects observed.	Pass
Casing Screws (x4)	No effects observed.	Pass

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

Point of Contact	Observation	Result
Casing Seam	No discharges occurred	Pass
GPIO Cable	No discharges occurred	Pass
Power Cable	No discharges occurred	Pass
COM Cable	No discharges occurred	Pass
Front Face (LEDs)	No discharges occurred	Pass

Result: Complies.

The device did not display susceptibility to Electrostatic Discharges during the test.

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.

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 front, base (ports) and right hand faces of the device.

Observations:

No effects were observed.

Result: Complies.

The device did not display susceptibility to Radiated RF Electromagnetic Fields during the testing.

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 $3V_{rms}$ in 1% steps with a 3 second dwell time using a 400 Hz tone 80% AM modulated carrier.

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 ± 1.42 dB

The following ports were tested:

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

Result: Complies.

The device did not display susceptibility to Conducted RF Electromagnetic Fields during the test.

The device continued to operate normally after the test.

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 Upeak	3.0 %
-Rise Time tr	2.5 %
-Pulse Width tw	2.0 %
-Burst Frequency fb	1.0 %
-Burst Duration tb	1.0 %
-Burst Period trep	1.0 %

The following ports were tested:

Port Tested	Method	Observation	Result
GPIO Cable	Clamp	No effects observed.	Pass
COM Cable	Clamp	No effects observed.	Pass

Result: Complies.

The device did not display susceptibility to Electrical Fast Transient/Burst (EFT/B) during the test.

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

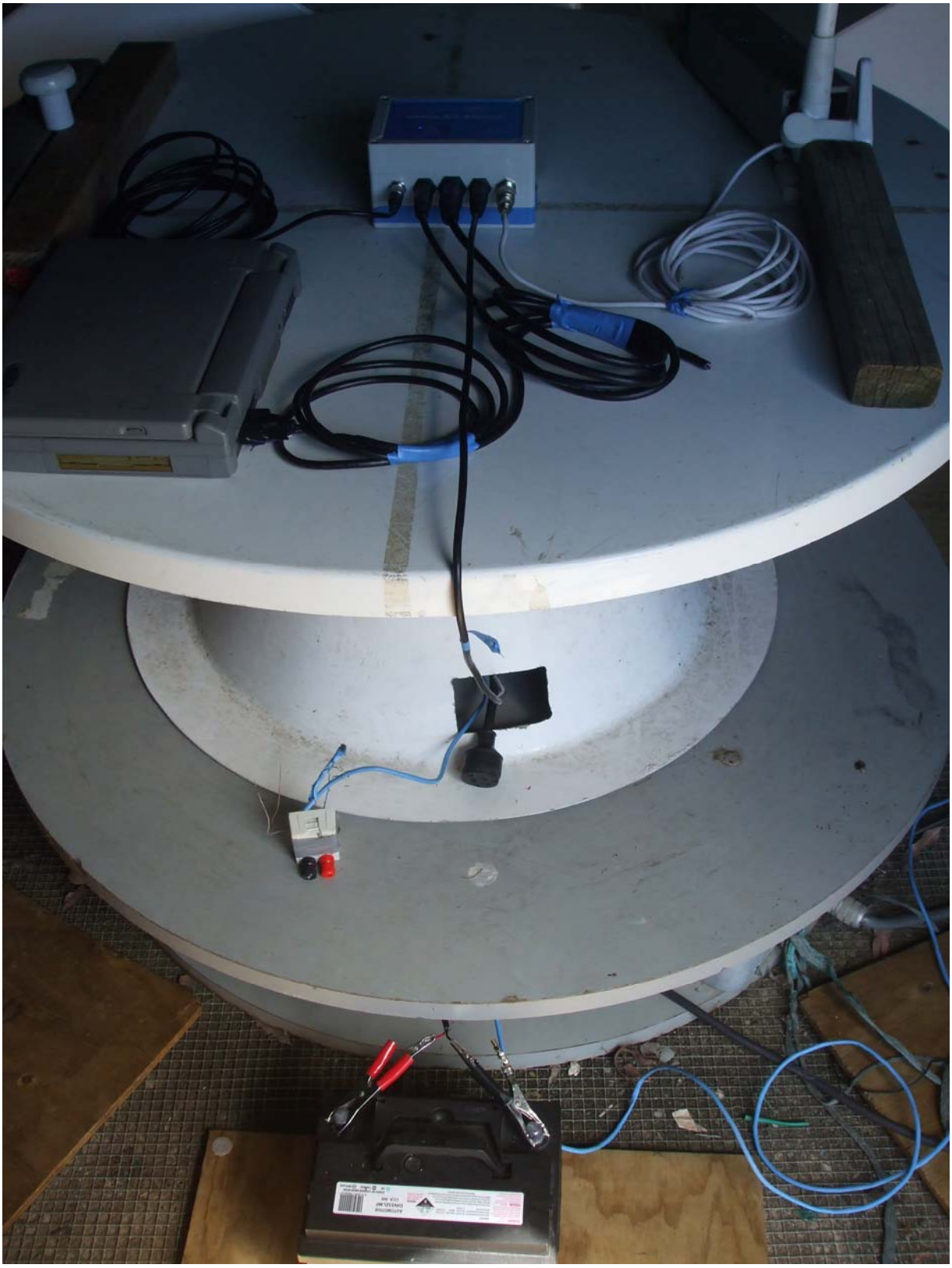
The tests were carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/IEC/ ISO 17025.

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

Radiated Emissions Test Setup



Ancillary Equipment Test Setup