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TEST REPORT

Watchmate WMX850 AIS Device

tested to the specification

EN 301 843-1 v1.2.1 (2004-06)

Electromagnetic compatibility and Radio Spectrum Matters (ERM);

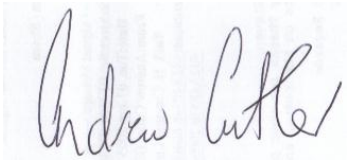
ElectroMagnetic Compatibility (EMC) standard for marine radio equipment and services;

Part 1: Common technical requirements

for

Vesper Marine

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 **Watchmate WMX850 AIS device** complies with EN 301 843-1 v1.2.1 (2004-06).

2. RESULTS SUMMARY

Electromagnetic emission tests:

Clause	Phenomenon	Application	Result
8.2	Radiated emissions (below 30 MHz)	Enclosure of ancillary equipment	Complies
8.2	Radiated emissions (above 30 MHz)	Enclosure of ancillary equipment	Complies
8.3	Conducted emissions	DC power input/ output port	Complies
8.4	Conducted emissions	AC mains power input/ output port	Not applicable

Electromagnetic immunity tests:

Clause	Phenomenon	Application	Result
9.2	RF electromagnetic field (80 MHz to 2000 MHz)	Enclosure	Complies
9.3	Electrostatic discharge	Enclosure	Complies
9.4	Fast transients common mode	Signal and control ports, DC and AC power ports	Complies
9.5	RF common mode (0.15 MHz - 80 MHz)	Signal and control ports, DC and AC power ports	Complies
9.6.1	Short term power supply variations	AC power input ports	Not applicable – DC powered device
9.6.2	Power supply failure	AC power input ports	Not applicable – DC powered device
9.7	Surges, line to line and line to ground	AC power input ports	Not applicable – DC powered device

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.

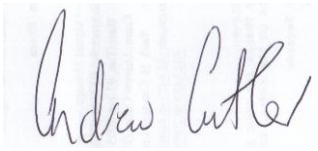
This report relates only to the sample tested.

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.

This EN 301 843 test report replaces report number 100417.1 dated 16 August 2010 with the following changes having been made:

- Fast transient testing was actually carried out over a period of 180 seconds and not 120 seconds as initially reported



Andrew Cutler
General Manger

4. CLIENT INFORMATION

Company Name	Vesper Marine Ltd
Address	103 Westhaven Drive St Marys Bay
City	Auckland
Country	New Zealand
Contact	Carl Omundsen

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Watchmate
Model Number	WMX 850
Product	AIS Device
Manufacturer	Vesper Marine Ltd
Country of Origin	New Zealand
Serial Number	ZZ00001 – Test 1

6. SETUPS AND PROCEDURES

Standard

The sample was tested in accordance with EN 301 843 v1.2.1 (2004-06)

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, 2004	A
Radiated disturbances 10V/m 80 MHz – 2 GHz	EN 61000-4-3, 2003	A
Fast Transients (bursts) -±1kV common mode signal/ control ports -±2kV AC power ports	EN 61000-4-4, 2004	B
Slow transients (surges) -±1 kV line/earth -±0.5 kV line/line	EN 61000-4-5, 2005	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, 2004	C
Power supply failure 60s interruption, AC and DC power ports	EN 61000-4-11,2004	C
Electrostatic discharge -±8 kV air -±6 kV contact discharges	EN 61000-4-2, 2001	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 AIS transceiver under test was powered at 12Vdc using a lead acid battery.

AIS transceivers operate continuously in receive mode with periodic transmissions being made with the transceiver programmed to operate on 161.975 MHz and 162.025 MHz.

Attached to the device was a GPS antenna with GPS lock by supplied using a GPS repeater.

A dummy load was attached to the antenna port.

The AIS status screen was visually monitored throughout the tests for degradation and changes in state.

Modifications

Ferrite chokes were added to each wire of the display ribbon cable to overcome a radiated immunity issue between 400-500 MHz.

Modifications were undertaken by the client to overcome ESD issues.

Modifications were also undertaken by the client to overcome EFTB issues which caused the GPS to fail.

When the device was returned the device complied with the EFTB test but it did not comply with the ESD test at the GPS Port which caused screen distortion and knockout.

Further modifications were undertaken by the client to overcome these issues.

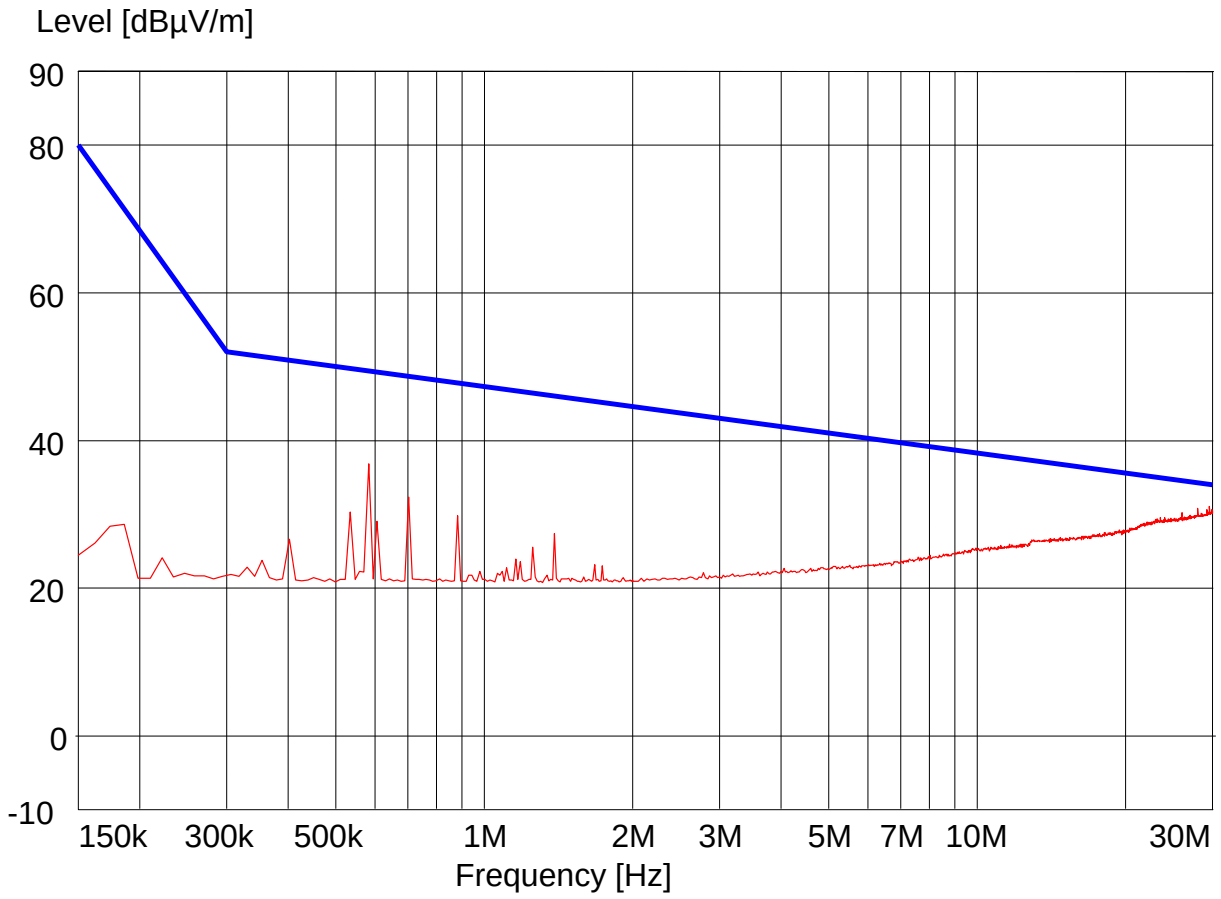
All tests were then repeated as reported in this test report.

7. TEST RESULTS

Radiated emissions

Setup:	DUT was powered from an external linear supply set to 13.8 VDC, device was operating with GPS antenna attached and dummy load on transmitter output. Device's screen displaying status of device. Modification: Board work due to ESD and EFTB issues.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
No final result recorded					

Radiated emissions (above 30 MHz)

Radiated emissions testing were carried out over the frequency range of 30.0 to 2000 MHz at the laboratory's open area test site - located at 670 Kawakawa-Orere Road, Orere Point, Auckland, New Zealand (Note: Site conforms to the requirements of CISPR 16, Part 1, Clause 16, and ANSI C63.4 - 2003).

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 quasi peak limit of 24 dBμV/m being applied (30 dBμV/m in peak).

Testing was carried out in the various modes in which the device operated. Any external cables were orientated for the worst-case emissions level.

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.

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) + Coax Loss (dB)

Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 - 2000 MHz) ± 4.1 dB

Radiated Emissions 30 MHz – 2000 MHz

Device tested when powered at 12 Vdc using an external DC battery
Device was tested with the AIS status menu being displayed
Attached to the device were the following:
-resistive dummy load to the VHF antenna port
- laptop computer to the USB port using a supplied 1 metre length of data cable
- GPS antenna to the GPS port
Device has a clock operating on 19.2 MHz.
161.500 MHz transmitter spurious emissions observed and recorded but below the limit.
140.150 MHz is the receiver local oscillator assuming as it has a 21.4 MHz IF

Frequency MHz	Vertical dBuV/m	Horizontal dBuV/m	Limit dBuV/m	Margin dB	Antenna
44.540	46.2		54.0	7.8	Vertical
49.040	26.2		54.0	27.8	Vertical
71.225	28.0		54.0	26.0	Vertical
72.540		33.5	54.0	20.5	Horizontal
96.000	26.0		54.0	28.0	Vertical
115.200	26.2	34.1	54.0	19.9	Horizontal
134.400	29.2		54.0	24.8	Vertical
140.150	46.0	48.6	54.0	5.4	Horizontal
143.770	34.3		54.0	19.7	Vertical
192.000	30.1		54.0	23.9	Vertical
230.400	29.2	41.8	54.0	12.2	Horizontal
249.598		42.0	54.0	12.0	Horizontal
268.800		44.1	54.0	9.9	Horizontal
287.536		40.6	54.0	13.4	Horizontal
307.214	37.2	48.7	54.0	5.3	Horizontal
323.000	41.5	48.5	54.0	5.5	Horizontal
326.395	40.0	45.4	54.0	8.6	Horizontal
345.597	39.8	48.3	54.0	5.7	Horizontal
364.328	42.4	48.5	54.0	5.5	Horizontal
384.168	46.9	49.7	54.0	4.3	Horizontal
403.407	42.5	50.1	54.0	3.9	Horizontal
422.044	42.4	47.8	54.0	6.2	Horizontal
441.282	42.2	45.2	54.0	8.8	Horizontal
460.521	45.7	47.8	54.0	6.2	Horizontal
479.760	44.4	48.0	54.0	6.0	Horizontal
484.569		45.2	54.0	8.8	Horizontal
498.997	44.3	45.1	54.0	8.9	Horizontal
518.236	42.7	41.9	54.0	11.3	Vertical
537.474	42.6	45.8	54.0	8.2	Horizontal
575.951	45.8	45.8	54.0	8.2	Vertical
614.425	38.6	20.2	54.0	15.4	Vertical
645.691	41.5	42.7	54.0	11.3	Horizontal
652.829	42.4	41.3	54.0	11.6	Vertical
690.581	40.1	41.8	54.0	12.2	Horizontal
768.336	37.9		54.0	16.1	Vertical
806.445	38.3	39.7	54.0	14.3	Horizontal
844.849	38.4		54.0	15.6	Vertical

Conducted emissions

Conducted emissions 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.

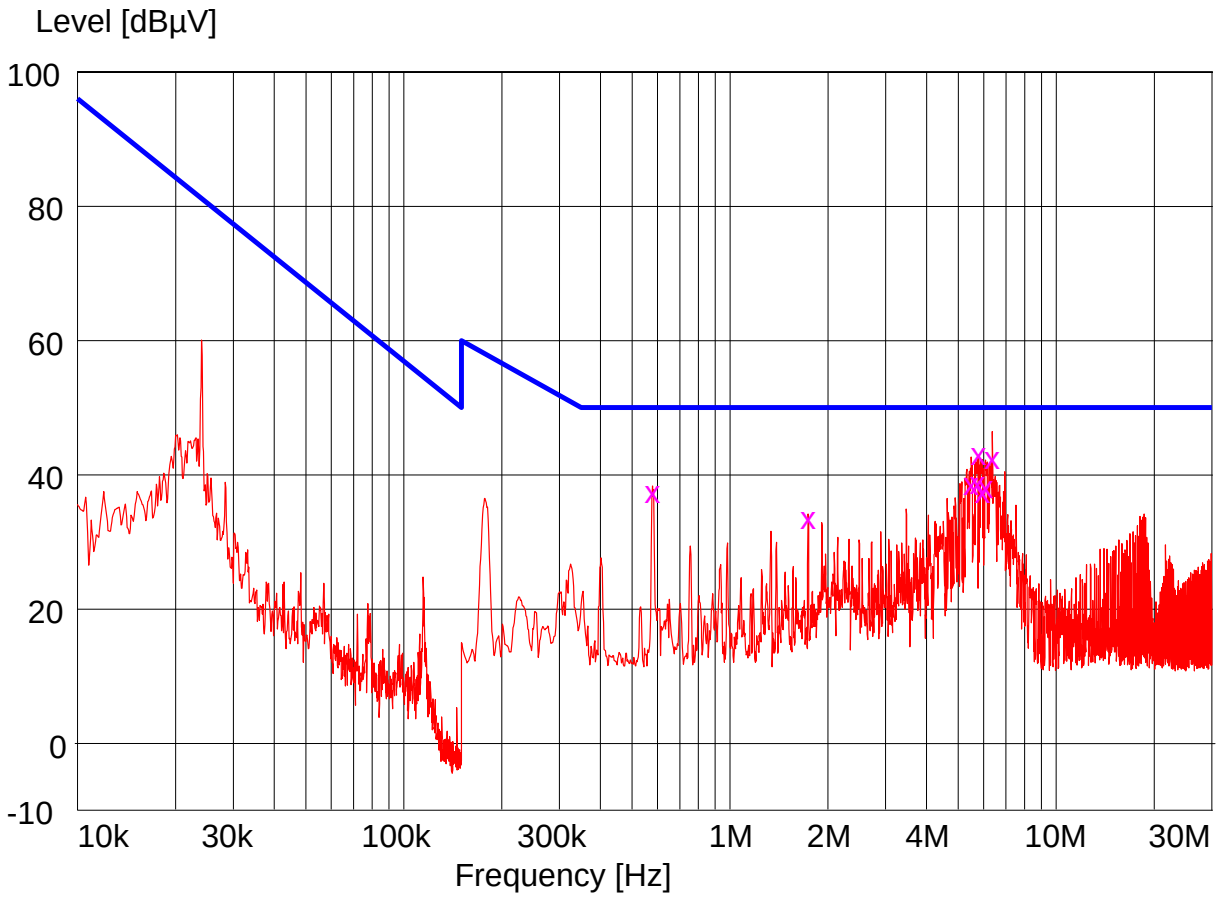
The device was placed 0.8 m away from the closest edge of the artificial mains terminal network on the emissions test table which is 1 m x 1.5 m, and is 0.1 m above the screened room floor which acts as the horizontal ground plane and is 0.6 m away from the screened room wall which acts as the vertical ground plane.

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 an external linear supply set to 13.8 Vdc. Device was operating with the GPS antenna attached and a dummy load on transmitter output. Device's screen displaying status of device. Modification: Board work due to ESD and EFTB issues.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.579000	37.90	50.0	12.1	L1	
1.737000	34.00	50.0	16.0	L1	
5.487500	39.10	50.0	10.9	L1	*38.8*
5.739500	39.20	50.0	10.8	L1	*38.7*
5.789000	43.50	50.0	6.5	L1	*41.5*
5.937500	37.90	50.0	12.1	L1	
6.059000	38.60	50.0	11.4	L1	
6.369500	43.00	50.0	7.0	L1	*43.2*

Radio Frequency Electromagnetic Field Susceptibility

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 with a 400 Hz tone 80% AM modulated.
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

Testing was carried out with a total of 93 dB of attenuation between the transceiver under test and a third party AIS system.

The third party AIS system was controlled using a serial port connection with the NMEA output monitored to observe successful transmission and reception of AIS packets.

When operating in this mode the Radiated RF was injected into the front and rear faces of the device.

Observations:

No detrimental effects were observed throughout testing.

During the testing the AIS status screen on the device indicated a “Position Report Not Sent” warning.

This was due to a carrier sense transmission timeout.

Successful transmission occurred on the next reporting interval once the carrier sense averager had adjusted its threshold value.

This is the intended operation of the device.

Result: Complies.
The device did not display susceptibility to Radiated RF Electromagnetic Fields throughout the test and continued to operate normally after the test.

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%

Testing was carried out with the USB port not terminated as this was determined to be the worst case configuration.

10 x ± 6 kV Contact discharges were applied at one second intervals as follows:

Point of Contact	Result	Observations
HCP	Pass	No permanent degradation of product observed.
VCP	Pass	No permanent degradation of product observed.
GPS Port	Pass	No permanent degradation of product observed.
Antenna Port	Pass	No permanent degradation of product observed.
USB Socket	Pass	No permanent degradation of product observed.
4 x Case Screws	Pass	No permanent degradation of product observed.
6 x Brass Inserts	Pass	No permanent degradation of product observed.

10 ± 8 kV Air discharges were applied at one second intervals as follows:

Point of Contact	Result	Result
No discharges took place	Pass	No effects noted on system

Result: Complies.
The device did not display susceptibility to Electrostatic Discharges throughout the test and continued to operate normally after the test.

Electrical Fast Transient/Burst (EFT/B)

± 1.0 kV transients were injected on to the signal and control cables, as detailed below, using a capacitive clamp for a period of 180 seconds while the device was being operated in transmit mode.

The device was required to meet performance criteria B.

The calibration uncertainties for Electrically Fast Transient Bursts to IEC 61000-4-4 are:

-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 %

Port Tested	Result	Observations
GPS	Pass	No effects noted on system
Antenna	Pass	No effects noted on system
USB	Pass	No effects noted on system

Testing on the DC port was not carried out as the cable to this port will be less than 3 metres in length

Result: Complies.
The device did not display susceptibility to Electrical Fast Transient/Burst (EFT/B) during the test and did not change state or lose stored data. The device operated normally after the test.

Conducted RF Susceptibility

Conducted RF susceptibility testing was carried out between 150 kHz and 80 MHz at 3 V r.m.s. with a 400 Hz tone 80% AM modulated.

Testing was also carried out as detailed above at 10 V rms on the selected spot frequencies of 2.0, 3.0, 4.0, 6.2, 8.2, 12.6, 16.5, 18.8, 22.0 and 25.0 MHz

Testing was carried out in 1% steps with a dwell time of 3 seconds on the ports detailed below.

Testing was carried out with a total of 93 dB of attenuation between the transceiver under test and a third party AIS system.

The third party AIS system was controlled using a serial port connection with the NMEA output monitored to observe successful transmission and reception of AIS packets.

The device is required to meet performance criteria A.

The calibration uncertainties for Radio frequency continuous conducted susceptibility to EN 61000-4-6 are: 0.15 – 80.0 MHz ± 1.42 dB

The following ports were tested:

Port Tested	Method	Result	Observations
DC input power	DC CDN	Pass	No effects observed at 3 or 10 Vrms
USB	FCC Clamp	Pass	No effects observed at 3 or 10 Vrms
GPS	FCC Clamp	Pass	No effects observed at 3 or 10 Vrms
Antenna	FCC Clamp	Pass	No effects observed at 3 or 10 Vrms

Result: Complies.
The device did not display susceptibility to Conducted RF Electromagnetic Fields throughout the test and 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	-	-
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612
Bilog Antenna	EMCO	3141	9707-1071	E1596
Coax Cable	Sucoflex	104PA	2736/4PA	-
Log periodic Antenna	Schwarzbec	VUSLP 9111	9111-2801	3785
Measurement Receiver	Rohde & Schwarz	ESHS 10	838693/002	3800
Measurement Receiver	Rohde & Schwarz	ESCS 30	847124/020	E1595
Microwave RF Amplifier	Ophir	5162FE	1029	E3786
Power Amplifier	IFI	M75	B373-1098	RFS 3773
Power Amplifier	Amplifier Research	10W1000	8329	E1138
Signal Generator	Rohde & Schwarz	SMP04	1035 5005 04	E1560
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709
ESD Gun	Schaffner	NSG 435	1261	E1426
AIS Class B Transponder	True Heading	Carbon-CTRX	1056	-

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 immunity test setup photographs