EMC Test Report

for the

SRT Marine Systems PLC

VMS-100S Transceiver
Model: VMS-100S

Project Engineer: C. Rice

Approval Signatory

Approved signatories: J. A. Jones ☐ D. Tiroke ☐ A. R. Coombes ☑

The above named are authorised Eurofins Hursley signatories.

Eurofins Hursley
Trafalgar House
Trafalgar Close
Chandlers Ford, Eastleigh
Hampshire. UK. SO53 4BW

Tel. +44 (0) 23 8027 1111
e mail. adminhursley@eurofins.com
www.eurofins.co.uk/hursley

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1.0 OVERVIEW

1.1 Introduction

The Equipment Under Test (EUT), as described within this document, was submitted for EMC testing as agreed with the customer.

1.2 Objective

The purpose of the test was to measure and report the EUT against limits and methods of the emissions and immunity standards, as requested for and listed in section **2.0 Test Summary**.

1.3 Product Modifications

To meet the electrostatic discharge immunity test requirements, the EUT's software was updated.

1.4 Conclusion

The EUT, as modified, met the emission limits and immunity requirements of the tests defined in section **2.0 Test Summary**.

This report relates to the sample tested and may not represent the entire population. It is valid only for the product identified, either in part or in full, to the relevant electromagnetic requirements necessary for compliance with the EMC Directive 2014/30/EU.

2.0 TEST SUMMARY

2.1 Summary

The EUT was tested to EN 60945:2002 / IEC 60945 test standard for maritime instrumentation equipment.

The EUT was tested to the EN 60945 (Parts 9 and 10) test standard for maritime navigation and radio communication equipment.

The EUT, as modified, met the **emission** test requirements of the following standards:

Description	General Standard	Referenced Standard
Radiated emissions	EN 60945:2002, (Fourth edition – 2002) ETSI EN 301 489-1:V2.2.0, ETSI EN 301 843-1:V2.2.1† & ETSI EN 301 489-17:V3.2.0	CISPR 16-1:1999
Radiated H-Field		CISPR 16-1:1999
Conducted emissions, AC port		CISPR 16-1:1999

The EUT, as modified, met the **immunity** test requirements of the following standards:

Description	General Standard	Referenced Standard
Electrostatic discharge	EN 60945:2002, (Fourth edition – 2002) ETSI EN 301 489-1:V2.2.0, ETSI EN 301 843-1: V2.2.1†, ETSI EN 301 489-17:V3.2.0 & DNVGL-CG-0339:2015	EN 61000-4-2:2009 IEC 61000-4-2:2008
Radiated RF immunity		EN / IEC 61000-4-3:2006 inc A1: 2008 & A2:2010
Fast transient bursts		EN 61000-4-4:2012 IEC 61000-4-4:2013
Conducted immunity		EN 61000-4-6:2014 / IEC 61000-4-6:2013
Power line disturbance		EN / IEC 61000-4-11:2004 inc A1:2017

Compass Safe Distance:
EN 60945:2002 / IEC 60945 Section 11.2 - 0.3 Deg of deflection = 300mm (powered)

†This test standard is not currently included in the UKAS Accreditation Schedule for Eurofins Hursley.

2.2 Test Deviations

None.

2.3 EMC Test Lab Reference

Eurofins Hursley file: 1356.

3.0 EQUIPMENT & TEST DETAILS

3.1 General

EUT:	VMS-100S Transceiver Model: VMS-100S Serial number: EP2-14
EUT powered by:	12V DC via a bench power supply
EUT manufacturer:	SRT Marine Systems PLC
EUT build level:	Production sample
Customer:	SRT Marine Systems PLC Wireless House Westfield Industrial Estate Midsomer Norton Bath BA3 4BS United Kingdom Tel: +44 (0) 1761 409 500
Test commissioned by:	Mr Tom Philips
Date EUT received:	16th July 2019
Test date(s):	16th to the 30th July 2019
EMC measurement site:	Eurofins Hursley Trafalgar House, Trafalgar Close, Chandlers Ford, Hampshire

3.2 EUT Description

The VMS-100 is a Class B AIS transceiver, used to supply real-time information on local vessels, land based stations or aids to navigation that are equipped with either Class A or Class B AIS transceivers.

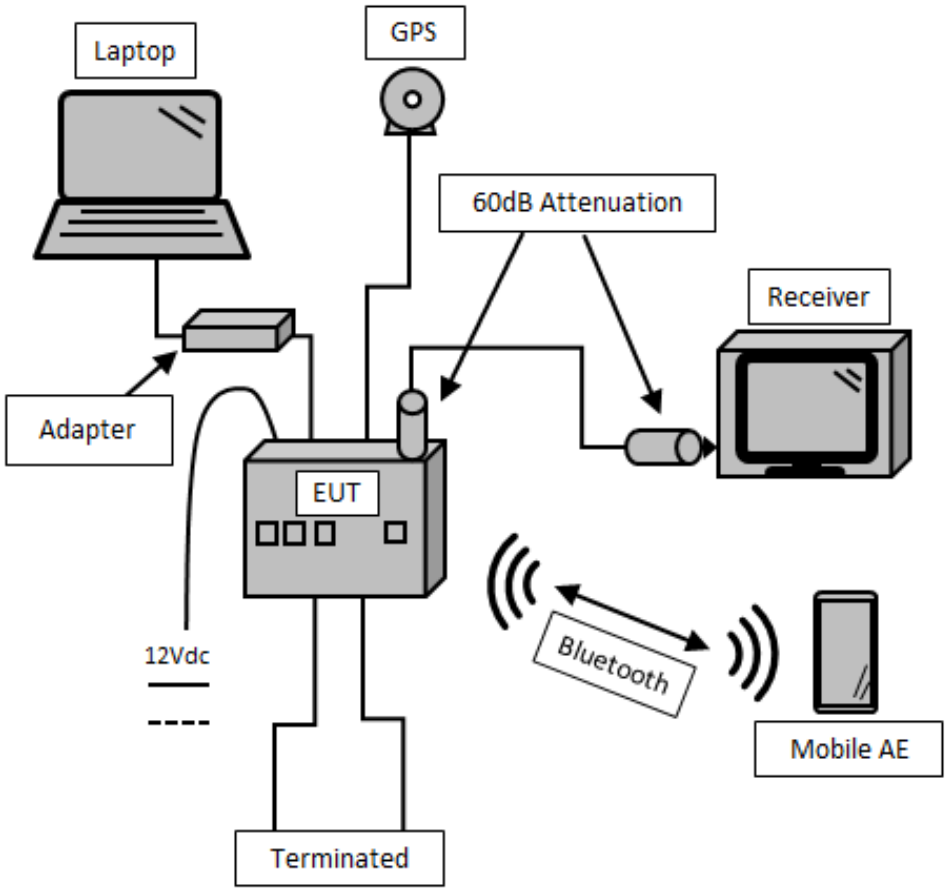
3.3 EUT Support Equipment

- HP Probook 4580s Laptop, model BOW89ES#ABU, s/n CNU2162TZ1
- SRT Marine Apollo Class A, Navigation System, s/n 42500021660006

3.4 EUT Test Exerciser

The unit was exercised by communication between laptop and EUT via serial adapater and communication between mobile phone and EUT via Bluetooth. The EUT also transmitted to a receiver via a coaxial cable.

3.5 EUT Test Configuration



3.6 Environmental Test Conditions

Temperature	21.6 to 25.1° Celsius
Relative Humidity	46 to 59%
Atmospheric Pressure	1012.4 to 1023.3 millibars

3.7 EMC Test Equipment

#ID	CP	Manufacturer	Type	Serial Nø	Description	Calibration due date
030a	2	KeyTek	MZ-15/EC	0406216	ESD Minizap	14/03/2021
033	1	HP	8593EM	3726U00203	Spectrum analyser (9kHz-26.5GHz)	04/12/2019
050	2	HP	8447D	1937A02341	Pre-amplifier (30-1000MHz)	06/10/2019
121	2	EM	CWS500A	0898-02	Conducted immunity simulator	23/07/2021
121a	2	0	6dB pad	001	6dB pad for 121 generator	23/07/2021
147	1	Rohde & Schwarz	ESH3 Z5	846695/011	Single phase (LISN / AMN)	17/09/2019
187	2	Fischer	F-203I-23	379	EM injection clamp (10k-1GHz)	26/08/2019
207	1	Fischer	801-M2-16	08003	CDN 2xwire	Internal
235	1	MEB	M3	13-214	CDN 3W 16A	Internal
250	1	HP	8449B	3008A01077	Pre-amplifier (1.0-26.5GHz)	18/09/2019
252	1	Rohde & Schwarz	ESH 3 Z2	08970	10dB pulse limiter	25/08/2019
252	1	Rohde & Schwarz	ESH 3 Z2	08970	10dB pulse limiter	25/05/2019
285	1	Huber+Suhner	BNC Cable	0	Cable	Internal
289	1	Rohde & Schwarz	ESCI 7	100765	CISPR 7GHz Receiver	10/09/2019
403	1	Fischer	CDN M2	9925	CDN M2	Internal
421	2	Schaffner	CDN126	446	Coupling Clamp	01/03/2021
466	3	Schwarzbeck	BBHA 9120 571	571	1-10GHz Horn	28/02/2022
531	1	IntelliConnect	Cable	I0796	N Tpye Cable 4M yellow	21/08/2019
534	1	IntelliConnect	Cable	I0797	N Type Cable 10M yellow	21/08/2019
668	1	EMC Partner	IMU 4000	0	IMU 4000+E698+A698:G698	02/11/2019
668	1	EMC Partner	IMU 4000	0	IMU 4000+E698+A698:G698	02/11/2019
679	2	Gauss	TDEIM30M	1510003	30MHz TD Receiver	10/04/2021
762a	3	Schwarzbeck	DGA 9552N	0	6dB attenuator for #762	07/04/2020

CP = Interval period [year] prescribed for external calibrations

Note: 'Calibration due date' means that the instrument is certified with a UKAS or traceable calibration certificate. 'Internal' means internally calibrated using HEMCS procedures

4.0 EMISSION RESULTS

Radiated emissions pre-scan profile measurements were taken at a distance of three metres on eight azimuths of the EUT in both horizontal and vertical antenna polarities in a semi-anechoic chamber.

Using the pre-scan results as a guide, each emission from the EUT was maximised. Measurements were carried out a distance of three metres in a CISPR 16-1-4 compliant semi-anechoic chamber. Cable positions were then finally adjusted to produce the maximum emission levels. The worst-case CISPR quasi-peak results are recorded below.

4.1.1 Data

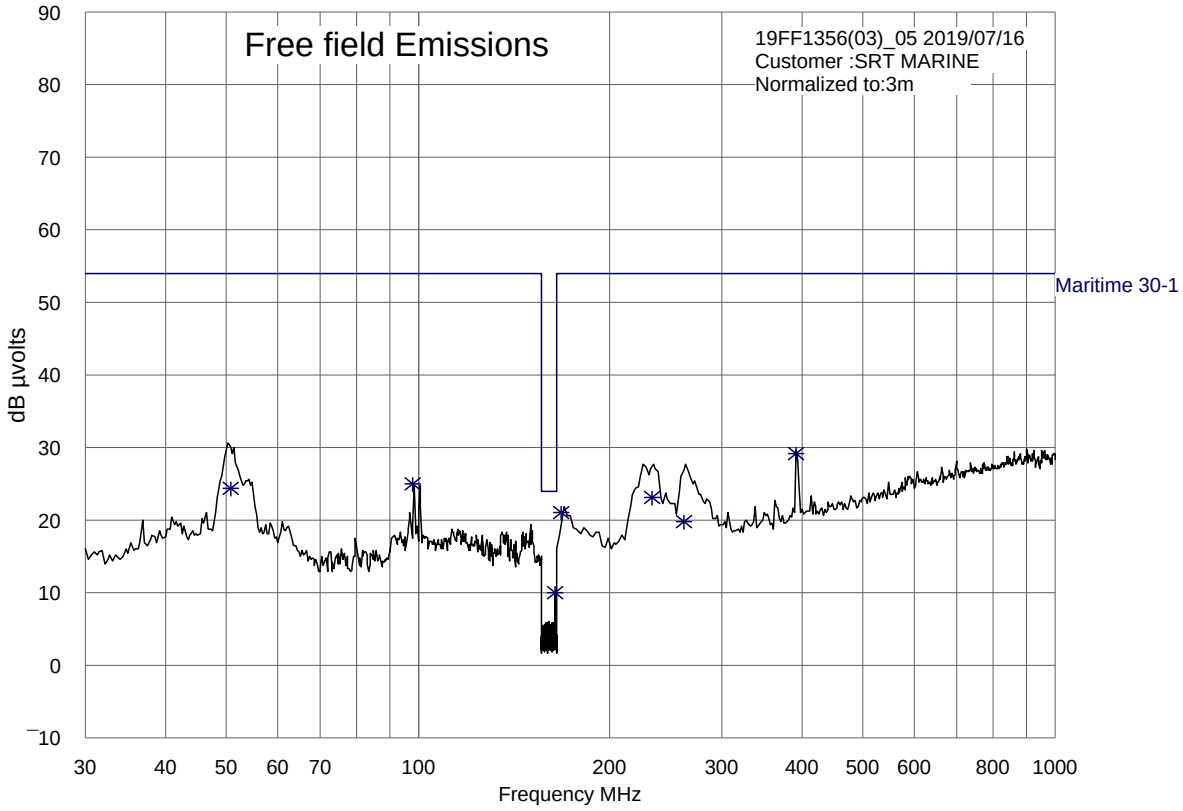
	Quasi-peak value (dBµV)			
Frequency (MHz)	**Measured**	**Measured quasi-peak value including uncertainty budget**	**Limit**	**Status**
50.634	24.47	28.21	54.0	PASS
98.210	24.95	28.69	54.0	PASS
164.222	10.07	13.81	24.0	PASS
167.600	20.96	24.88	54.0	PASS
233.440	23.08	26.86	54.0	PASS
261.000	19.73	23.51	54.0	PASS
391.188	29.22	34.28	54.0	PASS

The measurements reported are the highest emissions relative to the CISPR 11 Class B limits and take into account the antenna and cable loss factors. Measurements made according to the CISPR 11 test standard and Eurofins Hursley test procedure RAD-01.

TEST ENGINEER: Callum Rice

4.1.2 Profile

Maximum peak hold trace with quasi-peak values (✳)



4.2 Radiated Emissions; 1.0 to 2.0 GHz

Radiated emissions pre-scan profile measurements were taken at a distance of three metres with the EUT turned through 360°, with both horizontal and vertical antennae polarities and from one metre to four metres in height in an anechoic chamber. This pre-scan profile was made from 1.0 GHz to 2.0 GHz and evaluated against the CISPR Class B limit.

Using the pre-scan results as a guide, each emission from the EUT was maximised. Measurements were carried out a distance of three metres in a CISPR 16-1-4 compliant semi-anechoic chamber. Cable positions were then finally adjusted to produce the maximum emission levels. There were no frequencies found within the laboratory's ±12dB criterion and so no further measurements were necessary.

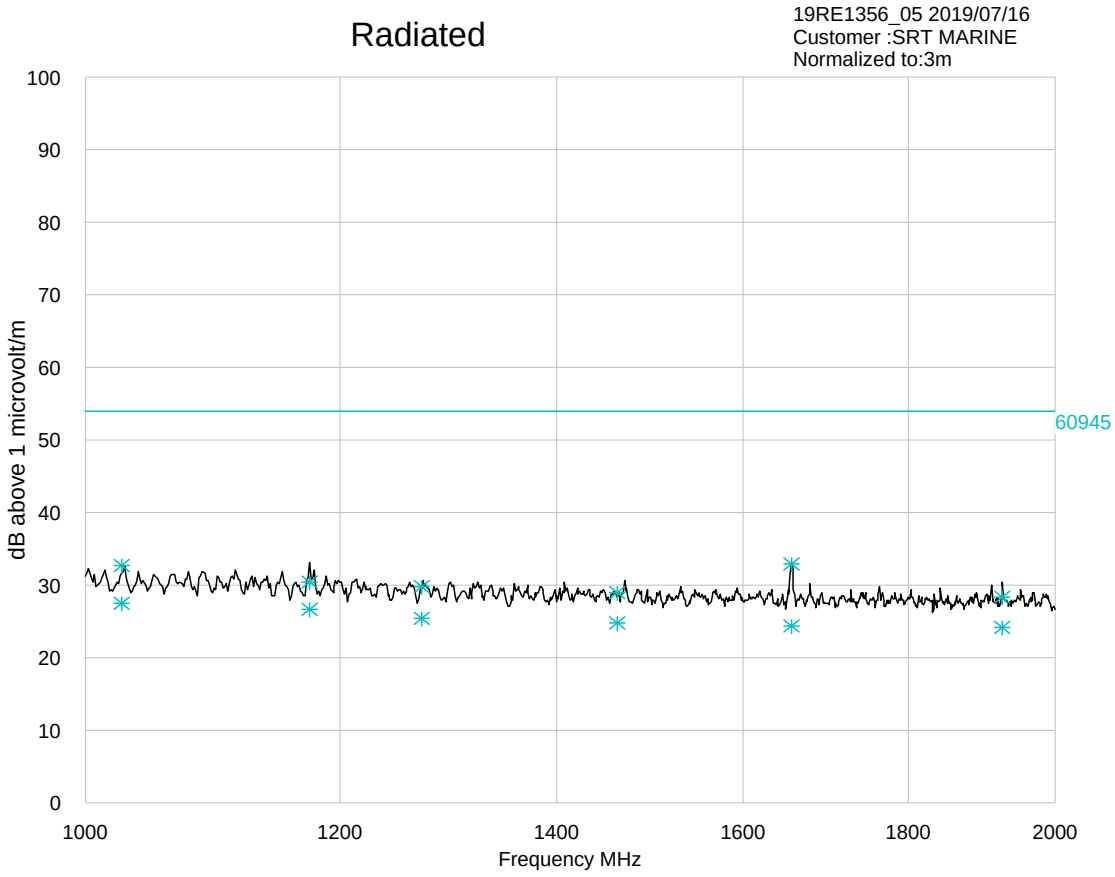
4.2.1 Data

	Quasi-peak value (dBµV)			
Frequency (GHz)	**Measured**	**Measured quasi-peak value including uncertainty budget**	**Limit**	**Status**
No significant peaks found within the specified limit.				Pass

TEST ENGINEER: Callum Rice

4.2.2 Profiles

Maximum peak hold trace



4.3 Radiated H-Field, 150 kHz to 30 MHz

A profile scan was taken at a distance of three metres with a 360° azimuth scan of the EUT in a semi-anechoic chamber. The tests were repeated for three orientations of the loop antenna.

The worst-case quasi-peak results, from testing the EUT with a 12V supply are recorded below.

4.3.1 Data; Antenna 90 degrees to EUT

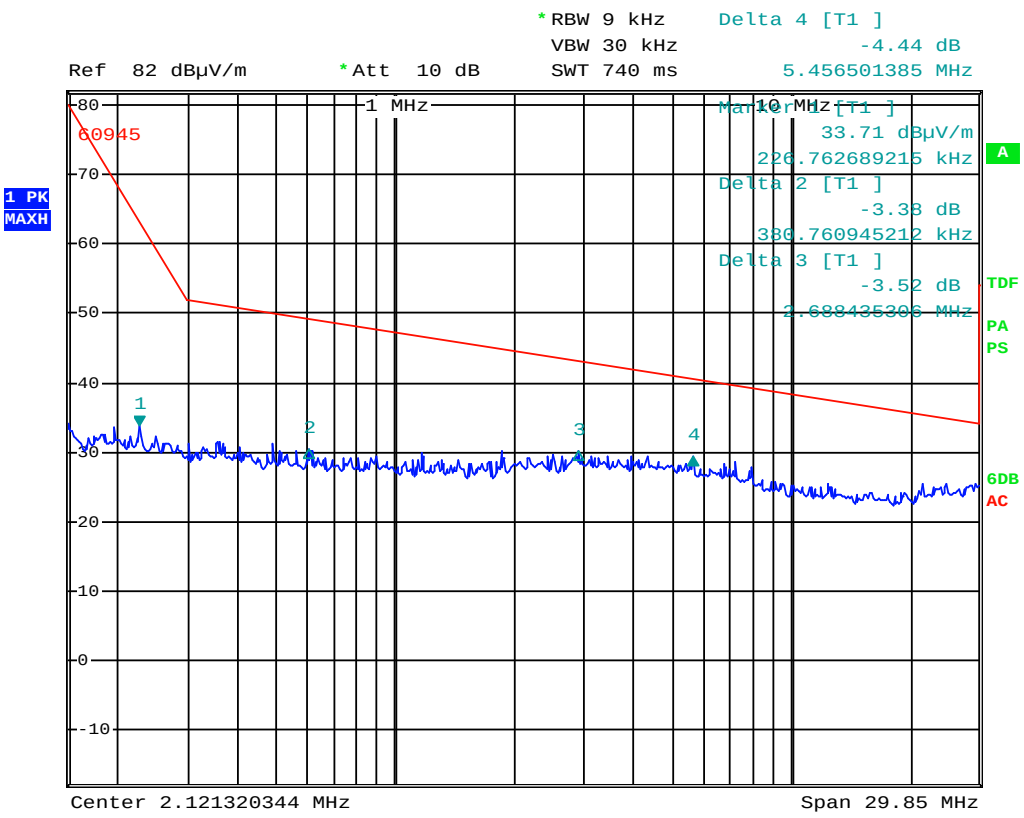
	Quasi-peak value (dBµV)			
Frequency (MHz)	**Measured**	**Measured quasi-peak value including uncertainty budget**	**Limit**	**Status**
No significant peaks found within the specified limit.				Pass

The measurements reported are the highest emissions relative to the EN 60945 limit and take into account the antenna, cable loss factors and uncertainty budget. Measurements made according to the EN 60945 test standard and Eurofins Hursley test procedure MAR-01.

TEST ENGINEER: Callum Rice

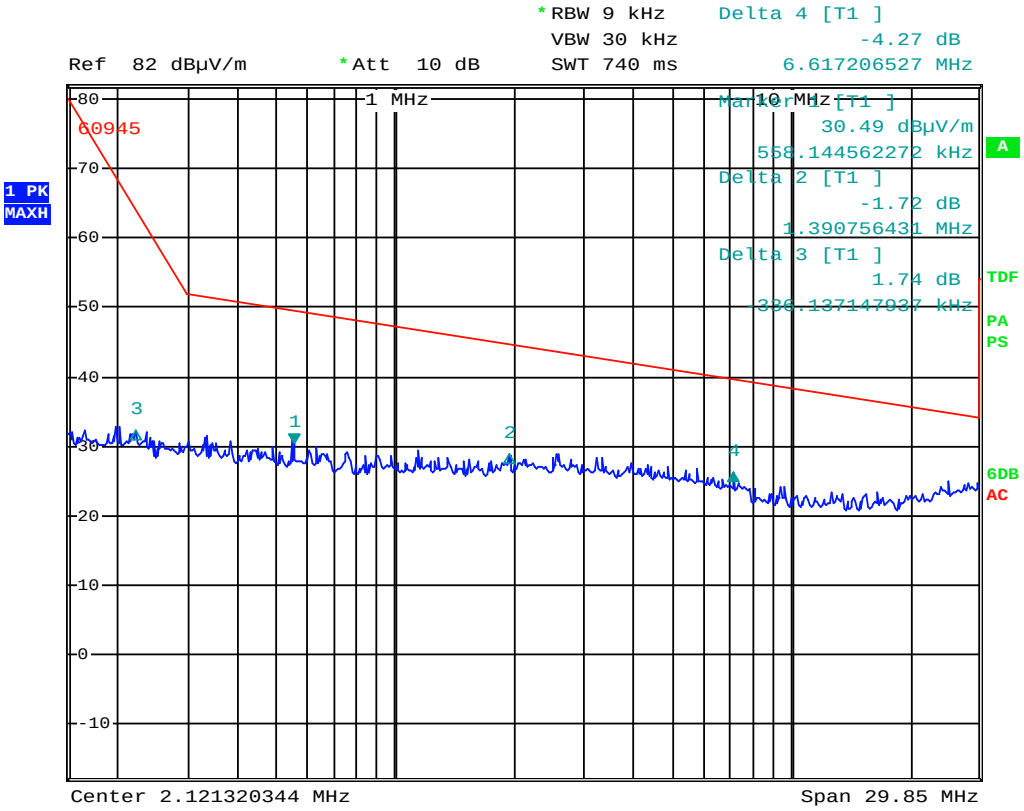
4.3.2 Profiles

Antenna 0 degrees to EUT



Profiles (continued)

Antenna 90 degrees to EUT



4.4 Conducted Emissions

A filtered mains supply was fed to the EUT via a 50Ω/50µH Artificial Mains Network (AMN). The AMN was bonded to a conductive ground plane. Line and neutral phases were measured separately.

A spectrum analyser was set to scan between 10 kHz and 30 MHz to record the peak emission profiles. The worst-case peaks were then measured using a quasi-peak receiver and compared to the EN 60945 limit. Measurements made according the EN 60945 test standard and Eurofins Hursley test procedure CON-02. The worst-case results are shown here.

4.4.1 Data

0V

	Quasi-peak value (dBµV)			
Frequency	**Measured**	**Measured quasi-peak value including uncertainty budget**	**Limit**	**Status**
22.352 kHz	43.99	47.27	82.41	Pass
44.604 kHz	29.10	32.38	70.64	Pass
66.459 kHz	37.58	40.86	63.83	Pass
102.917 kHz	23.59	26.87	56.88	Pass
122.587 kHz	22.74	26.02	53.58	Pass
149.409 kHz	20.44	23.72	50.77	Pass
283.718 kHz	33.99	37.26	52.48	Pass
9.410 MHz	27.49	30.76	50.00	Pass
12.920 MHz	27.79	31.06	50.00	Pass
18.985 MHz	27.81	31.08	50.00	Pass
24.998 MHz	28.60	31.87	50.00	Pass
29.490 MHz	28.86	32.13	50.00	Pass

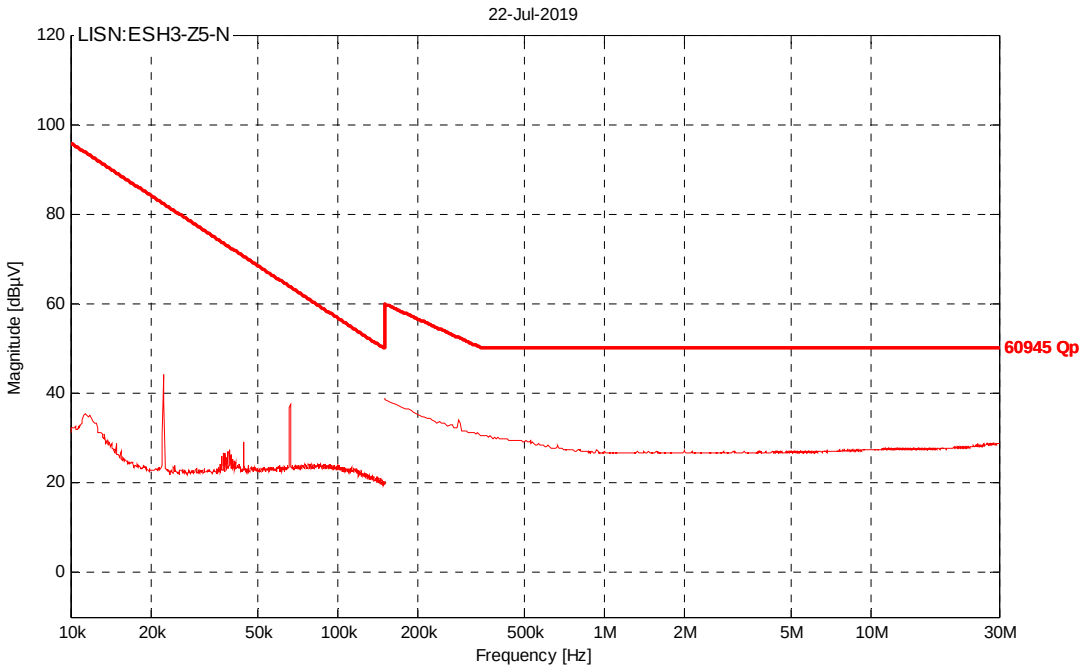
Conducted emissions (continued)

12V

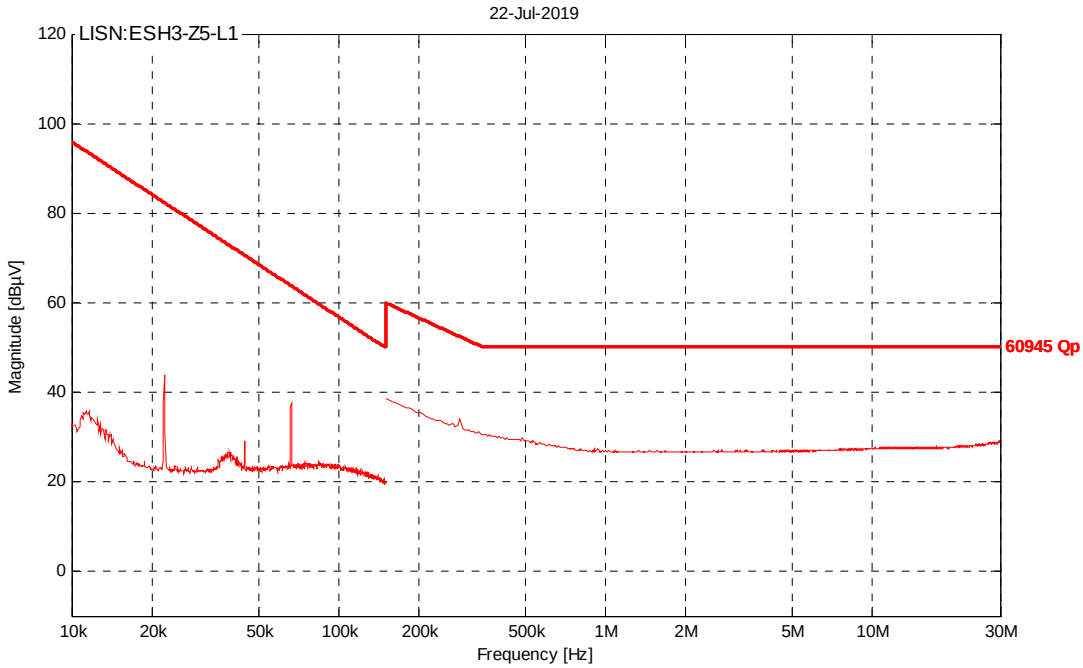
	Quasi-peak value (dBµV)			
Frequency	**Measured**	**Measured quasi-peak value including uncertainty budget**	**Limit**	**Status**
22.252 kHz	43.88	47.16	82.41	Pass
44.505 kHz	28.95	32.23	70.64	Pass
66.459 kHz	37.34	40.62	63.83	Pass
100.036 kHz	23.86	27.14	56.88	Pass
121.494 kHz	22.60	25.88	53.58	Pass
143.349 kHz	21.06	24.34	50.77	Pass
283.718 kHz	33.84	37.11	52.48	Pass
9.911 MHz	27.53	30.80	50.00	Pass
14.460 MHz	27.76	31.03	50.00	Pass
17.431 MHz	27.85	31.12	50.00	Pass
25.003 MHz	28.54	31.81	50.00	Pass
29.972 MHz	28.93	32.20	50.00	Pass

TEST ENGINEER: Callum Rice

4.4.2 Profile; 0V



4.4.3 Profile; 12V



5.0 IMMUNITY RESULTS

5.1 Performance Criteria

General performance criteria for immunity testing are defined below:-

Criterion A:	The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. If the performance level or the permissible level is not specified by the manufacturer then either of these may be derived from the EUT description and documentation and what the user may reasonably expect from the apparatus if used as intended. Wi-Fi: No unintended transmissions, no loss of communication.
Criterion B:	The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible level is not specified by the manufacturer then either of these may be derived from the EUT description and documentation and what the user may reasonably expect from the apparatus if used as intended. Wi-Fi: No unintended transmissions, any loss of communication shall automatically recover.
Criterion C:	Temporary loss of function is allowed provided the loss of function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.

Note: All immunity tests were applied above the specification level to include the uncertainty attributed to each test.

5.2 Electrostatic Discharge

TEST METHOD	IEC 61000-4-2 REFERENCING PROCEDURE: ESD-03

TEST DETAILS

Test severity, <u>contact discharge</u>	± 6.0 kV, 50 strikes per point. Total of 200 strikes (minimum).
Test severity, <u>air discharge</u>	± 8.0 kV, 10 strikes for each selected point
Exerciser program during test	Referencing section 3.4
Specified test criterion	Criterion 'B'
EUT performance criterion	Criterion 'A'

RESULTS

Contact, Indirect

SPECIFIED VOLTS	REFERENCE PLANE @ 10cm	STATUS
± 4.0 kV	Horizontal and vertical; front, rear and sides	PASS
± 6.0 kV	Horizontal and vertical; front, rear and sides	PASS

Contact, Direct To EUT

SPECIFIED VOLTS	TEST POINTS	STATUS
± 2.0 kV	See illustration on next page	PASS
± 4.0 kV		PASS
± 6.0 kV		PASS

Air Discharge (Insulating, Slots & Apertures)

SPECIFIED VOLTS	TEST POINTS	STATUS
± 2.0 kV	See illustration on next page	PASS
± 4.0 kV		PASS
± 8.0 kV		PASS

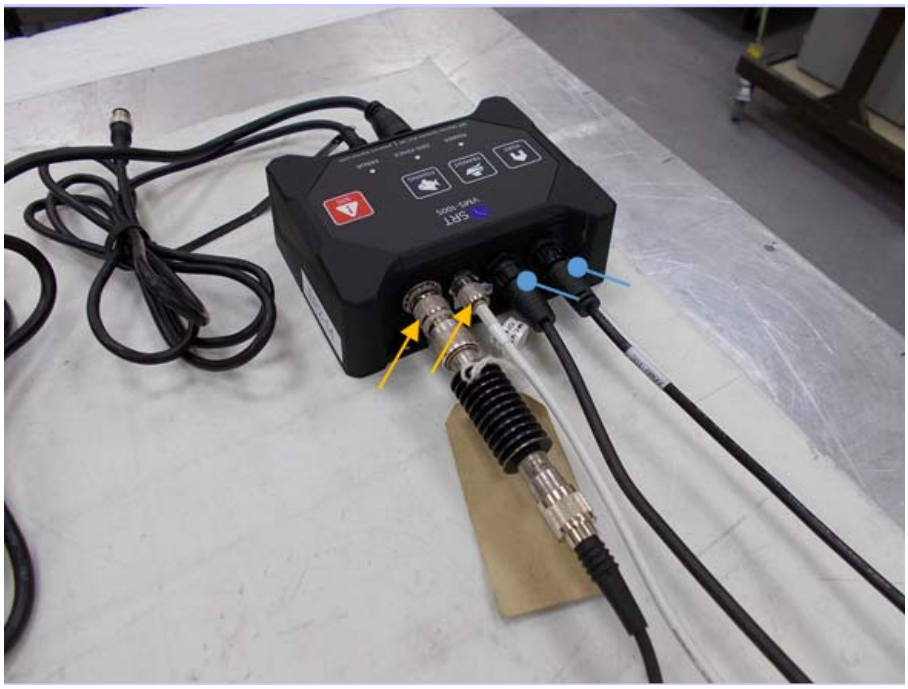
UNCERTAINTY: Specified as less than 5%. The level applied was 5% higher than the upper levels stated above to take into account the uncertainty for this test.

COMMENT: The EUT, as modified (see section 1.3), met the specified test criterion.

TEST ENGINEER: Callum Rice

5.2.1 Electrostatic Discharge Test Points

Yellow arrow indicates Contact Discharge
Blue arrow indicates Air discharge



5.3 Radiated RF Immunity

TEST METHOD	IEC 61000-4-3 REFERENCING PROCEDURE: RES-02

TEST DETAILS

Test severity levels,	• **12.0 V/m; 80 to 1000 MHz swept frequency** • **12.0 V/m; 1.0 to 2.0 GHz swept frequency** • **3.0 V/m; 2.0 to 6.0 GHz swept frequency** • **80% amplitude modulation 400 Hz** • **1% increment, 3 seconds dwell time and 9 seconds dwell time from 1.0 GHz**
Exerciser program during test	**Referencing section 3.4**
Specified test criterion	**Criterion 'A'**
EUT performance criterion	**Criterion 'A'**

RESULTS

TEST POINTS	ANTENNA POLARITIES	FIELD LEVEL SWEPT FREQUENCY	STATUS
Front	**Horizontal & vertical**	**As detailed above**	**PASS**
Side, left	**Horizontal & vertical**		**PASS**
Side, right	**Horizontal & vertical**		**PASS**
Rear	**Horizontal & vertical**		**PASS**

UNCERTAINTY: Estimated uncertainty is 20%. The field level has been applied at level higher of 12 V/m to take into account uncertainties.

COMMENT: The EUT met the specified test criterion.

TEST ENGINEER: Callum Rice

5.4 Fast Transient Bursts

TEST METHOD	IEC 61000-4-4 REFERENCING PROCEDURE: FTB-01

TEST DETAILS

Test severity	• **± 1.0 kV All Ports** **5/50ns Tr/Td 5kHz Repetition Rate**
Exerciser program during test	**Referencing section 3.4**
Specified test criterion	**Criterion 'B'**
EUT performance criterion	**Criterion 'B'**

RESULTS

Direct Injection

PORT	TEST VOLTAGE	STATUS
DC Power Port	**± 1.0kV**	**PASS**

Injection Via Clamp

PORT	TEST VOLTAGE	STATUS
GPS	**± 1.0kV**	**PASS**
USB	**± 1.0kV**	**PASS**
VHF coaxial cable	**± 1.0kV**	**PASS**

UNCERTAINTY: Specified as less than 10% but estimated as less than 5%. The level applied was 5% higher than the levels stated above to take into account the uncertainty for this test.

COMMENT: The EUT met the specified test criterion

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TEST ENGINEER: Callum Rice

5.5 Conducted Immunity

TEST METHOD	IEC 61000-4-6 REFERENCING PROCEDURE: CES-02

TEST DETAILS

Test severity level	• **3.0V rms, 80% amplitude modulation 400 Hz 0.15 to 80 MHz** • **10V rms spot frequencies at: 2, 3, 4, 6.2, 8.2, 12.2, 12.6, 16.5, 18.8, 22, 25 MHz, the dwell at each frequency was 60 seconds.**
Exerciser program during test	**Referencing section 3.4**
Specified test criterion	**Criterion 'A'**
EUT performance criterion	**Criterion 'A'**

RESULTS

TEST VOLTAGE	TEST POINTS	COUPLING METHOD	STATUS
3.0V & 10.0V	**DC Input**	**CDN**	**PASS**

RESULTS – Signal Port

TEST VOLTAGE	TEST POINTS	COUPLING METHOD	STATUS
3.0V & 10.0V	**GPS**	**150-50 ohm Adapter**	**PASS**
3.0V & 10.0V	**USB**	**150-50 ohm Adapter**	**PASS**
3.0V & 10.0V	**VHF coaxial cable**	**150-50 ohm Adapter**	**PASS**

UNCERTAINTY: Estimated uncertainty is < 5%. The applied voltage has been applied at higher level of 4 or 12V to take into account uncertainties.

COMMENT: The EUT met the performance criterion.

TEST ENGINEER: Callum Rice

5.6 Power Line Disturbance

TEST METHOD	IEC 61000-4-11 REFERENCING PROCEDURE: PLD-01

TEST DETAILS	Specified test types & levels (voltage shift @ zero phase crossing)	Specified criteria
	Interrupt: 100% reduction for 60s	C
Exerciser program during test	Referencing section 3.4	

RESULTS

Applied test types & levels	Test point	Nominal operation frequency / voltage	Performed criteria	Status
-100% x 60s	DC Input	12V DC	C	PASS

UNCERTAINTY: Specification level is 5% but estimated as less than 1%.

COMMENT: The EUT met the performance criteria.

TEST ENGINEER: Callum Rice

6.0 COMPASS SAFE DISTANCE (SECTION 11.2)

TEST METHOD EN60945: 2002	REFERENCING PROCEDURE: CSD-01A

TEST DETAILS

TEST LIMIT	STANDARD COMPASS
MAX COMPASS DEFLECTION	$\left(\frac{5.4}{H}\right)^{\circ}$
MAX DEVIATION (µT)	0.33°(0.09 µT)
MODE OF OPERATION	EUT UNPOWERED EUT POWERED EUT NORMALISED
EUT	VMS-100S
EUT COMPASS SAFE DISTANCE	300MM
DATE OF TEST	22ND JULY 2019
TEMPERATURE 23°C	50% RH

RESULTS

EUT MODE	FRONT	REAR	LEFT	RIGHT	TOP	BOTTOM
OFF	200MM	250MM	100MM	100MM	150MM	250MM
ON	250MM	300MM	100MM	100MM	150MM	300MM
NORMALISED	200MM	250MM	100MM	100MM	150MM	250MM

Notes

All distances rounded up to the nearest 5cm or 10cm.

TEST ENGINEER: Callum Rice

7.0 PHOTO LOG (TYPICAL)

Emissions:

Radiated emissions

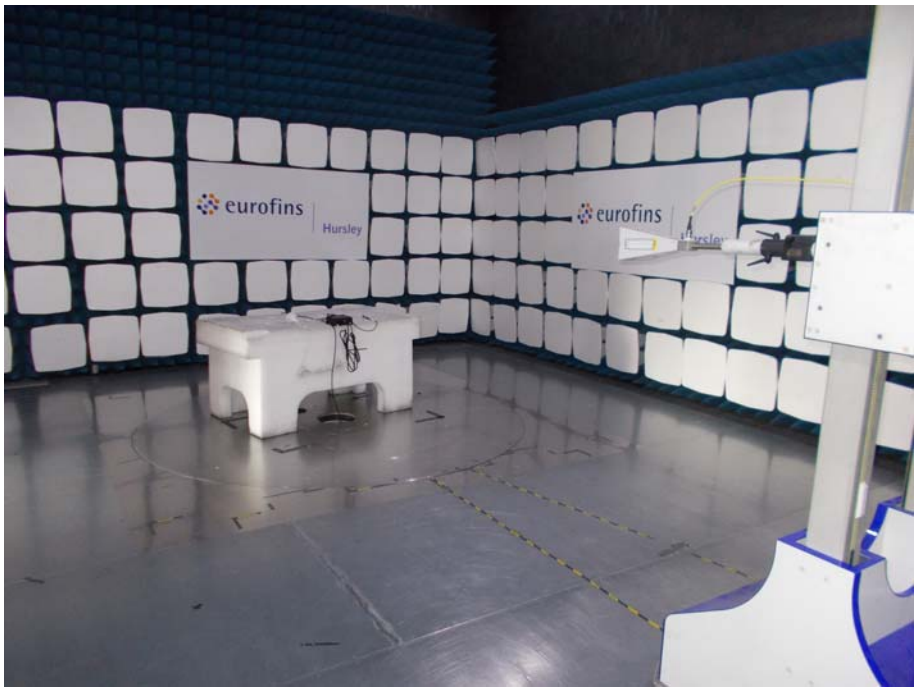


Photo Log (continued)

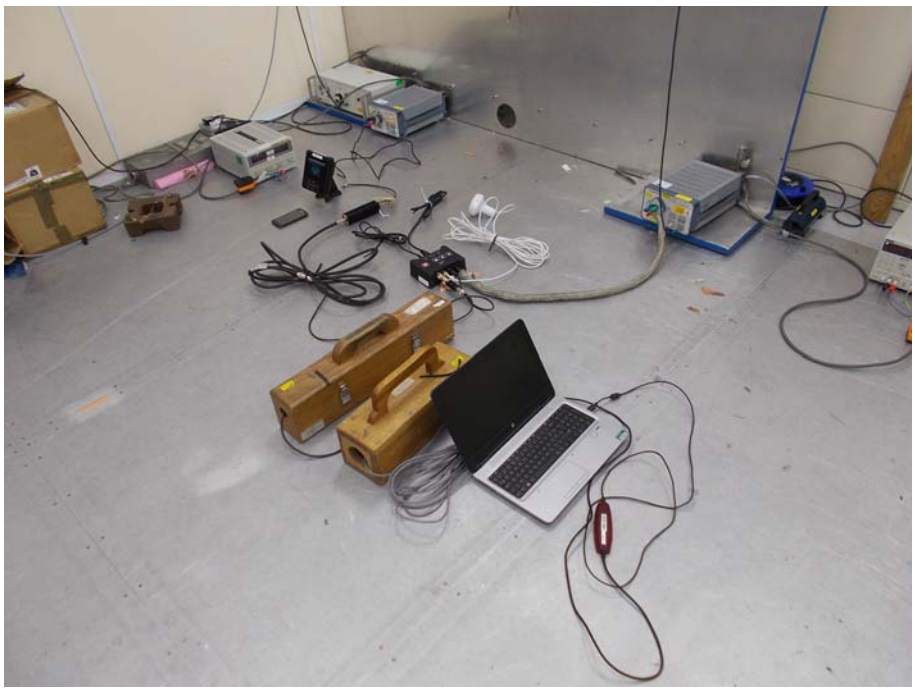
Emissions:

Radiated H-Field

Photo Log (continued)

Emissions:

Conducted emissions



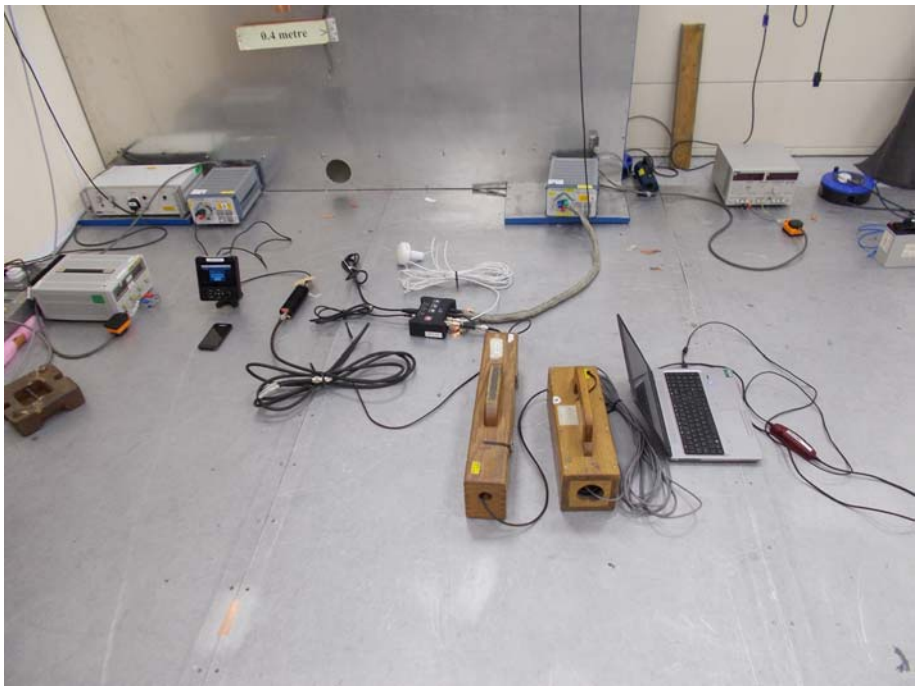


Photo Log (continued)

Immunity:

Electrostatic discharge (set-up)

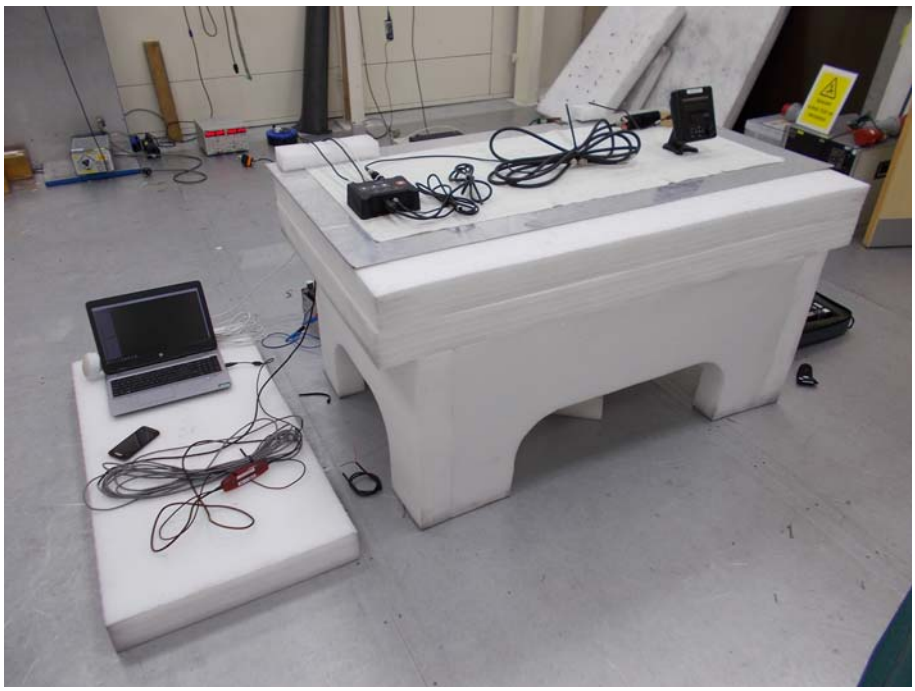


Photo Log (continued)

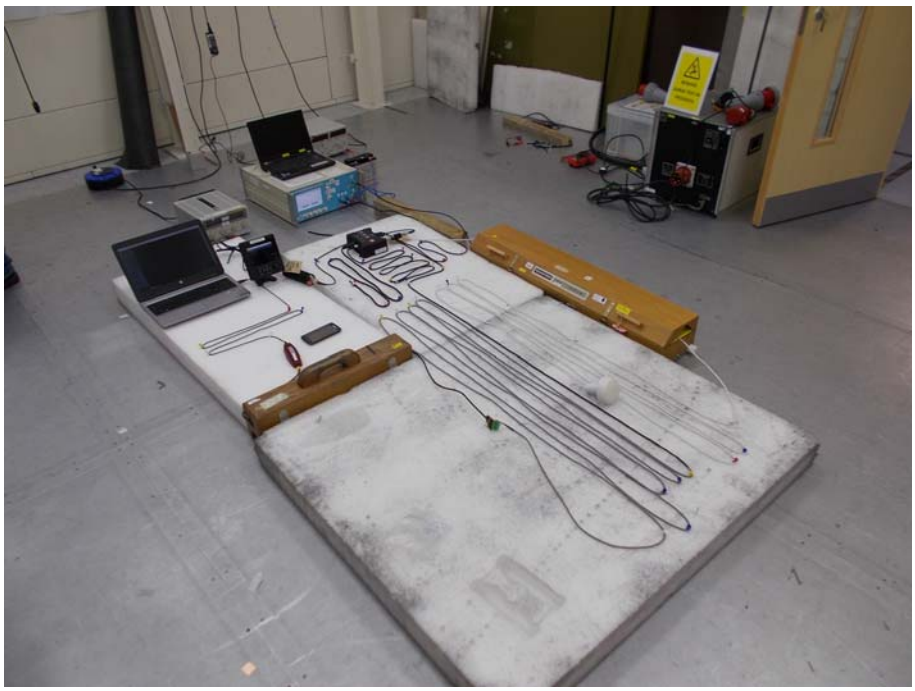
Immunity:

Radiated RF immunity

Photo Log (continued)

Immunity:

Fast burst transients



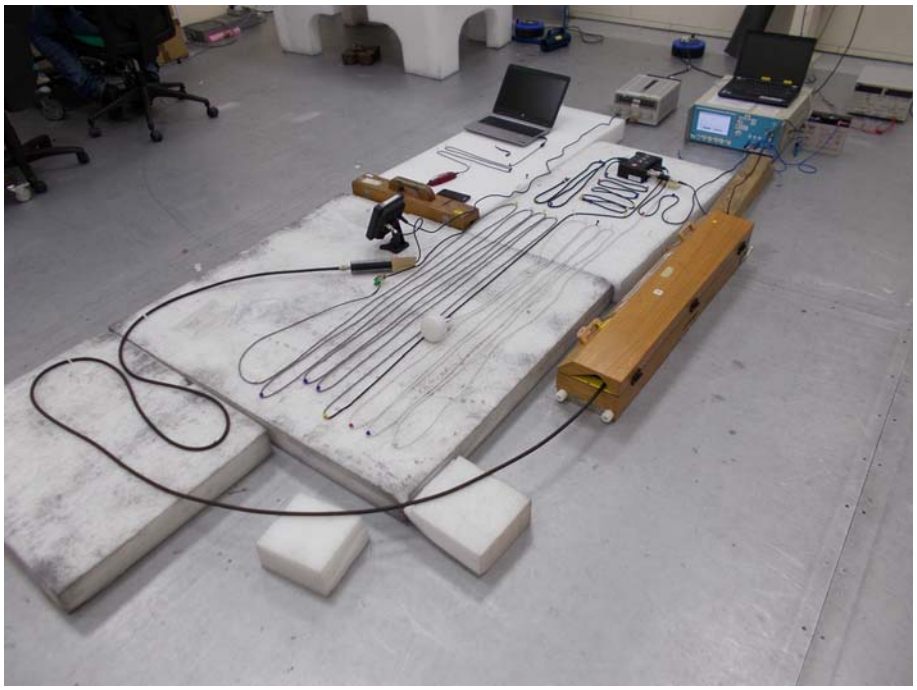
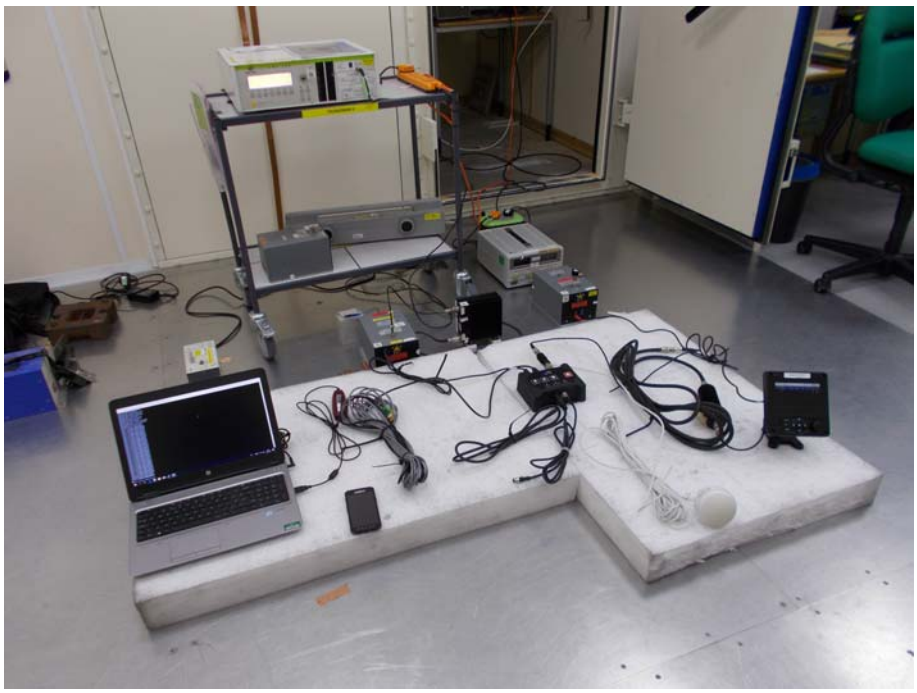


Photo Log (continued)

Immunity:

Conducted immunity



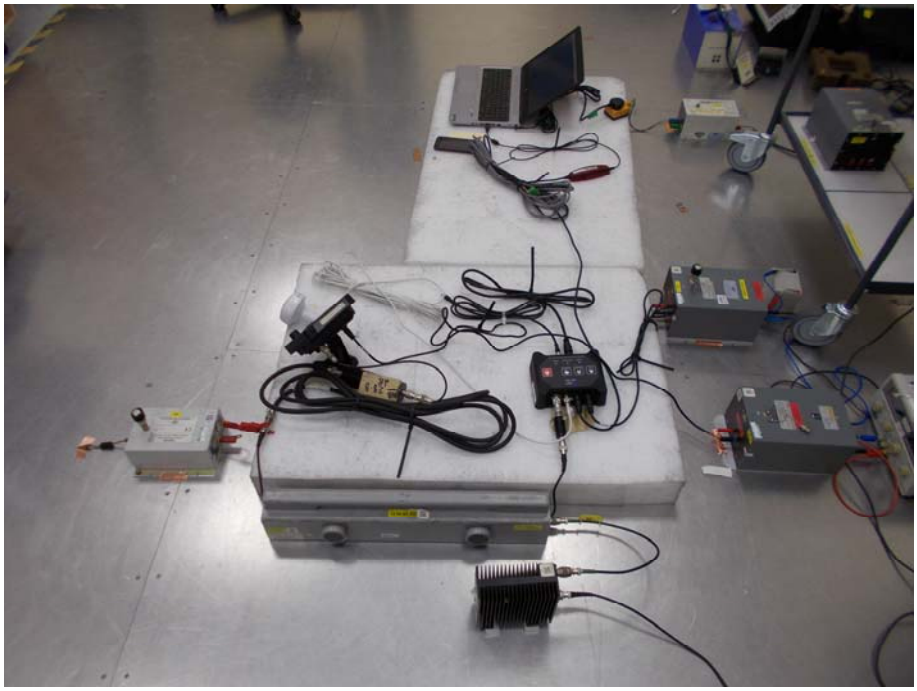
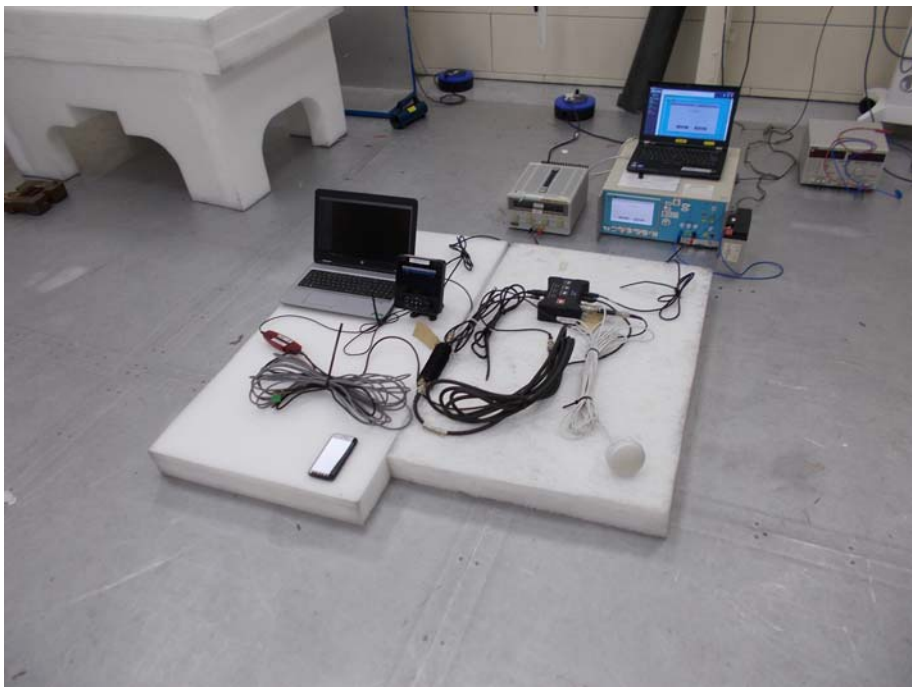


Photo Log (continued)

Immunity:

PLD



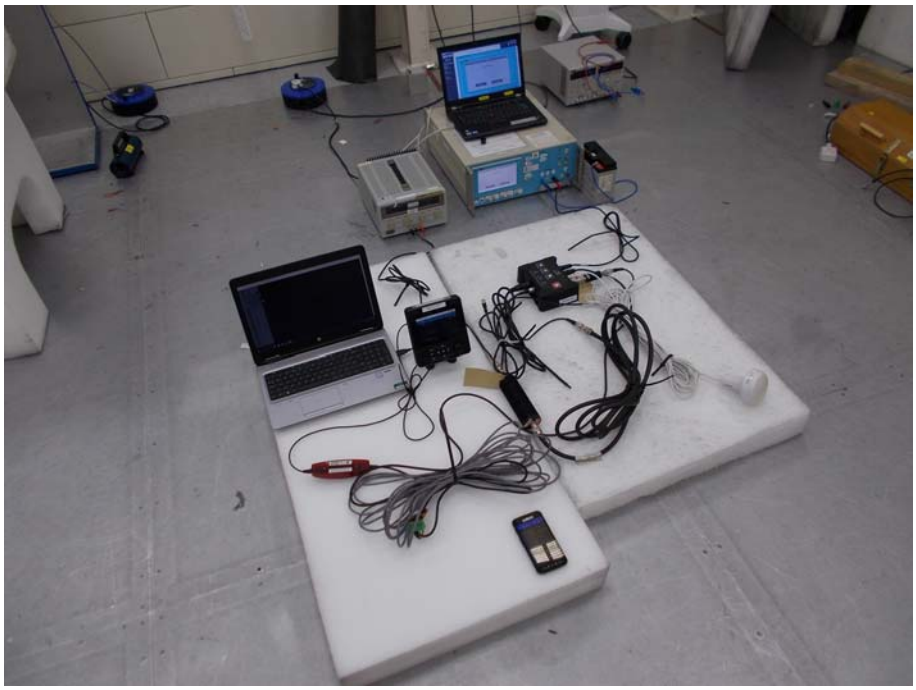
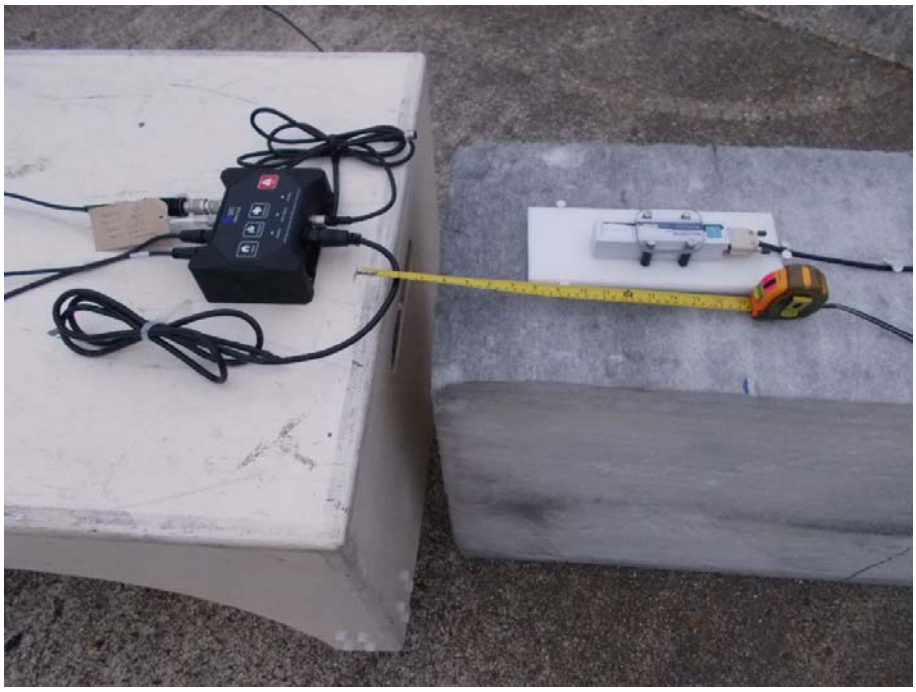


Photo Log (continued)

EN 60945 Compass Safe Distance set-ups

Bottom Face at 300mm



Top Face at 150mm

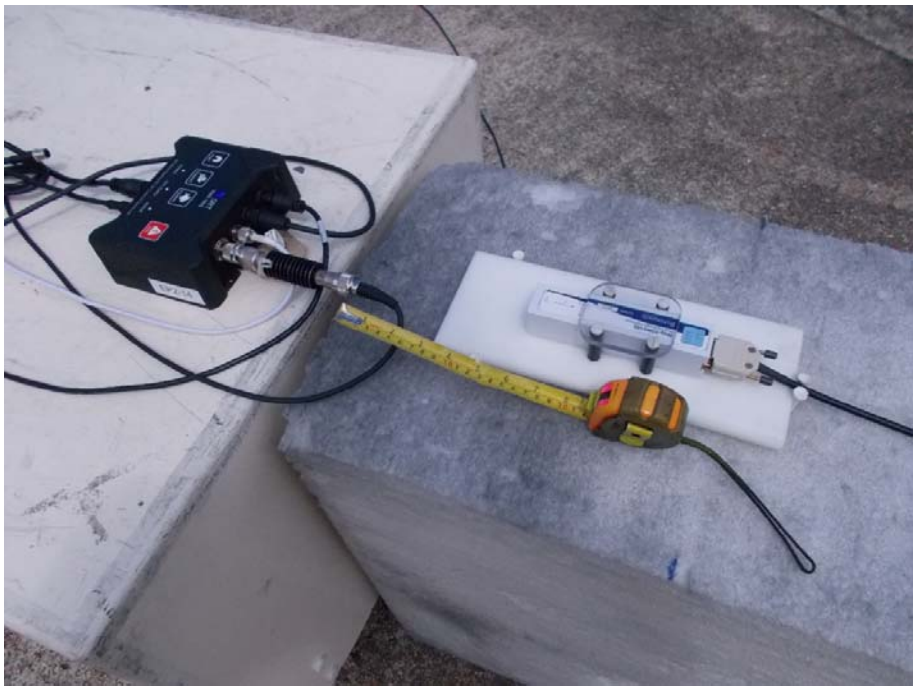


Photo Log (continued)

EN 60945 Compass Safe Distance set-ups

Right Hand Face at 100mm

Left Hand Face at 100mm

Photo Log (continued)

EN 60945 Compass Safe Distance set-ups

Front Face at 250mm

Rear Face at 300mm

Photo Log (continued)

EN 60945 Compass Safe Distance set-ups

Normalised

8.0 MEASUREMENT UNCERTAINTIES

Emissions tests

For all emissions tests, measurement uncertainties have been calculated in line with the requirements of CISPR 16-4-2 to give a confidence level of greater than 95%. In all cases the laboratories calculated uncertainty values (known as Ulab) are equal to or are less than the expected uncertainty values contained in CISPR 16-4-2 (known as Ucispr). Below is a list of the laboratories calculated measurement uncertainties:

Conducted emissions:

Via AMN/LISN:	±3.27 dB (9 kHz – 150 kHz), ±3.28 dB (150 kHz – 30 MHz)
Via AAN/ISN:	±4.99 dB (150 kHz – 30 MHz)
Via CVP:	±3.47 dB (150 kHz – 30 MHz)
Via CP:	±2.69 dB (150 kHz – 30 MHz)
Via 100 Ω:	±2.69 dB (150 kHz – 30 MHz)
Clicks:	±3.34 dB (150 kHz – 30 MHz)
Harmonics:	±5.82 % (100 Hz – 2 kHz)
Flicker:	±3.78 % (worst case for all parameters)

Radiated emissions:

H-Field:	±2.73 dB (9 kHz – 3 MHz), ±2.88 dB (3 MHz – 30 MHz)
D = 3.0 m (Horizontal):	±3.92 dB (30 MHz – 200 MHz), ±3.78 dB (200 MHz – 1 GHz)
D = 3.0 m (Vertical):	±3.74 dB (30 MHz – 200 MHz), ±5.06 dB (200 MHz – 1 GHz)
D = 3.0 m:	±4.50 dB (1 GHz – 6 GHz), ±4.04 dB (6 GHz – 18 GHz), ±4.27 dB (18 GHz – 40 GHz)
D = 10.0 m (Horizontal):	±4.53 dB (30 MHz – 200 MHz), ±4.61 dB (200 MHz – 1 GHz)
D = 10.0 m (Vertical):	±4.41 dB (30 MHz – 200 MHz), ±4.77 dB (200 MHz – 1 GHz)

Immunity tests

For IEC 61000-4-2, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-8, IEC 61000-4-9, IEC 61000-4-11 tests, the following applies:

Measurement uncertainty has been calculated or calibrated for the various required parameters to provide a confidence level of 95% (k=2). These parameters have been compared to the basic standard tolerance requirements for each of the various parameters.
In all cases the calculated or calibrated uncertainty meets the basic standard requirements.

For IEC 61000-4-3, IEC 61000-4-6 tests, the following applies:

Measurement uncertainty has been calculated to provide a confidence level of 95%, or k=2, but this has not been applied to the applied test level, therefore the applied test level has an uncertainty of ±50%. This is in accordance with Cenelec and other international guidance.

In the case of Maritime equipment tested to IEC 60945, there is a specific requirement that the applied test level be increased by the calculated measurement uncertainty. This is done by applying a coverage factor of k = 1.64, which provides a 95% confidence that the applied test level has been achieved.

End of document