EMC Test Report

Global Maritime Distress and Safety System, Model: LT-3100S

In accordance with EN 60945

Prepared for: LARS THRANE A/S
Skovlytoften 33
Holte
DK-2840
DENMARK

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Document 75946681-02 Issue 01

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Andy Lawson	Senior Engineer	Authorised Signatory	19 December 2019

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with EN 60945: 2002 C1: 2008 for the tests detailed in section 1.3.

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Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	18 December 2019

Table 1

1.2 Introduction

Applicant	LARS THRANE A/S
Manufacturer	LARS THRANE A/S
Model Number(s)	LT-3100S Comprising of: Control Unit: LT-3110S Interface Unit: LT-3140S Handset: LT-3120 Alarm Panel: LT-3150S Antenna Unit: LT-3130
Serial Number(s)	Control Unit: 00006286 Interface Unit: 00006296 Handset: 00006088 Alarm Panel: 00006300 Antenna Unit: 00006280
Hardware Version(s)	1.00
Software Version(s)	1.00
Number of Samples Tested	One System
Test Specification/Issue/Date	EN 60945: 2002 C1: 2008
Order Number Date	1931-001 29-July-2019
Date of Receipt of EUT	02-October-2019
Start of Test	07-October-2019
Finish of Test	15-October-2019
Name of Engineer(s)	Colin McKean, Matthew Smart and Jack Tuckwell
Related Document(s)	EN 61000-4-6: 1996 EN 61000-4-3: 1996 EN 61000-4-4: 1995 EN 61000-4-11: 1994 EN 61000-4-2: 2009 CISPR 16-1-2: 2006 CISPR 16-1-4: 2007 ISO 694: 2000

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with EN 60945 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: DC Powered - Transmitting				
2.1	9.2	Conducted Emissions	Pass	CISPR 16-1-2: 2006
2.2	9.3	Radiated Emissions	Pass	CISPR 16-1-4: 2007
2.3	10.3	Immunity to Conducted Radio Frequency Disturbance	Pass	EN 61000-4-6: 1996
2.4	10.4	Immunity to Radiated Radio Frequencies	Pass	EN 61000-4-3: 1996
2.5	10.5	Immunity to Fast Transients on A.C. Power, Signal and Control Lines	Pass	EN 61000-4-4: 1995
2.6	10.8	Immunity to Power Supply Failure	Pass	EN 61000-4-11: 1994
2.7	10.9	Immunity to Electrostatic Discharge	Pass	EN 61000-4-2: 2009
2.8	11.2	Compass Safe Distance	Pass	ISO 694: 2000

Table 2

1.4 Declaration of Build Status

Build State Declaration

Manufacture Lars Thrane A/S
Country of Origin Denmark
UK Agent TÜV SÜD Product Service

Product Identification

Product Name:	LT-3100S GMDSS Satellite Communication System	
Unit and Part Numbers:	LT-3110S Control Unit	P/N: 51-101812
	LT-3120 Handset	P/N: 51-100988
	LT-3121 Cradle	P/N: 51-101181
	LT-3130 Antenna Unit	P/N: 51-100989
	LT-3140S Interface Unit	P/N: 51-101814
	LT-3150S Alarm Panel	P/N: 51-101815
	LT-3160S Printer Adapter	P/N: 51-101816

Unit Serial Number Printed on each EUT unit label

SW Identification
Part Number: 71-101828, Version: 1.00R
File name: LT-3100S-v1.00R-0001.lti
Build Number: 0001, Commit ID: f3b383903b
Timestamp: 1569318715 (2019-09-24 09:51:55)
Checksum: 95b2f234c15cfcaeb0f104c3e9972bf9

Highest Frequency generated or used within EUT
Iridium: 1626.50 MHz
BT: 2480 MHz

Released by: Carsten Thomsen, CTO
Date: 02.10.2019

1.5 Product Information

1.5.1 Technical Description

The Equipment Under Test (EUT) was a LARS THRANE A/S, Global Maritime Distress and Safety System, Model: LT-3100S.

The LT-3100S Global Maritime Distress and Safety System is a maritime fixed Iridium satellite phone. The system is designed for the professional marine market e.g. deep sea fishing and other forms of heavy marine use.

The LT-3100 system consists of a Control Unit, Interface Unit, Handset, Alarm Panel, Antenna Unit and Print Adaptor Cable.

Each module connects to the control unit which in turn is connected to the marine vessels internal communications electronic systems. A single cable solution connects the control unit with the antenna unit.

Using a standard coaxial cable, up to 500 meters of separation between the units can be obtained, giving freedom to mount the antenna in the best possible location, with free line of sight to the satellites.

Figure 1 - Front View

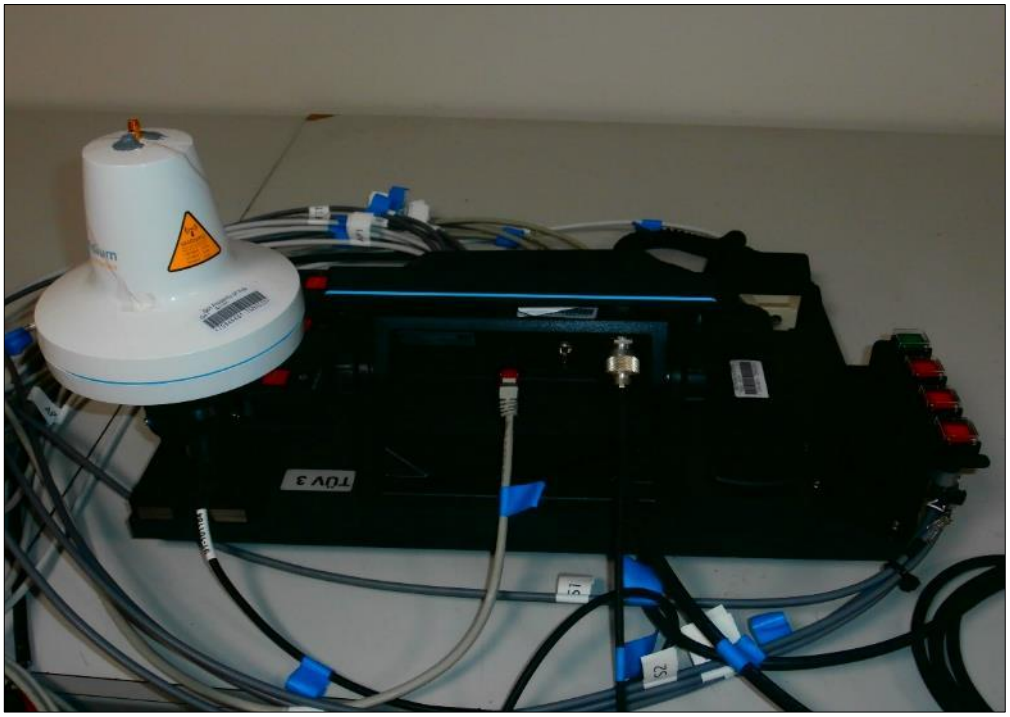

Figure 2 - Rear View

Figure 3 - Product Label – Interface Unit

Figure 4 - Product Label – Control Unit

Figure 5 - Product Label – Antenna Unit

Figure 6 – Handset

Figure 7 – Alarm Panel

Figure 8 Printer Adapter

1.5.2 EUT Port/Cable Identification

Port	Cable length used during test	Usage	Type	Screened
Configuration and Mode: DC Powered - Transmitting				
Interface Unit +12 V DC Live Line	<1 m	Power Supply	2 Core Cable	No
Interface Unit 0 V Return Line	<1 m	Power Supply	2 Core Cable	No
Control Unit +12 V DC Live Line	<1 m	Power Supply	2 Core Cable	No
Control Unit 0 V Return Line	<1 m	Power Supply	2 Core Cable	No
Control Unit Earth	0.3 m	Earth	Earth	No
Interface Unit Earth	0.3 m	Earth	Earth	No
Antenna coax	25 m	RF	Coaxial	Yes
LAN 2	25 m	Data	RJ45	Yes
AP3	25 m	Power and communications	Power and communications	Yes
ST	25 m	Power and communications	Power and communications	Yes
S1	25 m	Power and communications	Power and communications	Yes

Port	Cable length used during test	Usage	Type	Screened
RS1	25 m	Power and communications	Power and communications	Yes
PA	25 m	Power and communications	Power and communications	Yes

Table 3

1.5.3 Test Configuration

Configuration	Description
DC Powered	The EUT was powered from a 12 V DC supply.

Table 4

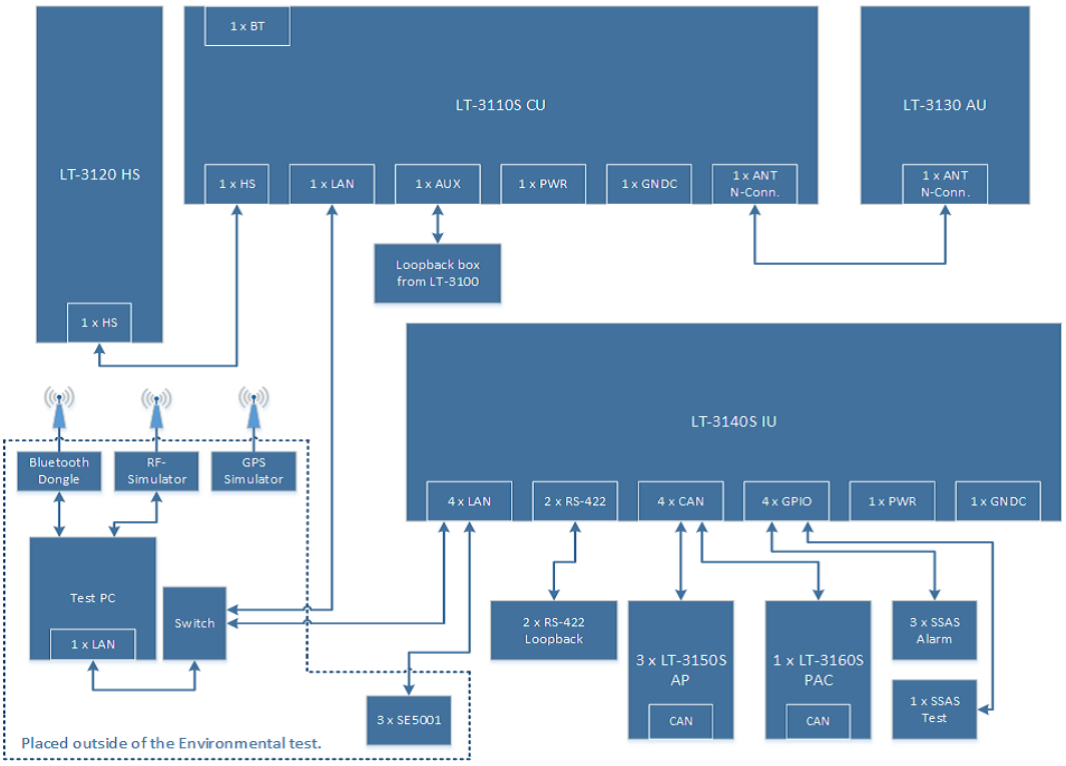

Figure 9 Block diagram of system setup

1.5.4 Modes of Operation

Mode	Description
Transmitting	The test system was running loopback testing on all interfaces. The test program monitors all interfaces for package loss. The Iridium RF interface uses a software define radio with Iridium loopback software. The Bluetooth (BT) interface uses a BT loopback software program. All discrete interfaces use ping test.

Table 5

1.5.5 Monitoring of Performance

The EUT was monitored using a laptop PC running Lars Thrane LT-3140S & LT-3110 Interface Test Suites.

The software monitored various system component operational parameters using a combination of visual indicators and text.

1.5.6 Performance Criteria

Performance Criteria A

The apparatus shall continue to operate as intended during and 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. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

The manufacturers specified performance level is detailed as:

There shall be no loss of functionality or any errors displayed via the monitoring software during the Immunity tests.

Performance Criteria 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. 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 performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

The manufacturers specified performance level is detailed as:

There shall be only minor loss of functionality or errors displayed no longer than one cycle of the monitoring software during the Immunity tests.

Performance Criteria C

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

The manufacturers specified performance level is detailed as:

There shall be only be a temporary loss of functionality or errors displayed via the monitoring software during the Immunity tests.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Model: LT-3100S – Control Unit: Serial Number: 00006284			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 6

1.8 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: DC Powered - Transmitting		
Conducted Emissions	Colin McKean and Matthew Smart	UKAS
Radiated Emissions	Colin McKean and Matthew Smart	UKAS
Immunity to Conducted Radio Frequency Disturbance	Matthew Smart and Jack Tuckwell	UKAS
Immunity to Radiated Radio Frequencies	Matthew Smart	UKAS
Immunity to Fast Transients on A.C. Power, Signal and Control Lines	Matthew Smart	UKAS
Immunity to Power Supply Failure	Matthew Smart	UKAS
Immunity to Electrostatic Discharge	Colin McKean	UKAS
Compass Safe Distance	Matthew Smart	UKAS

Table 7

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Conducted Emissions

2.1.1 Specification Reference

EN 60945, Clause 9.2

2.1.2 Equipment Under Test and Modification State

Global Maritime Distress and Safety System, Model: LT-3100S - Modification State 0

2.1.3 Date of Test

11-October-2019

2.1.4 Test Method

The EUT was powered from an artificial mains network.

Measurements were made with all measuring equipment and the EUT mounted on and bonded to an earth plane. Where provision of an earth plane was not practicable, equivalent arrangements were made using the metallic frame or mass of the EUT as the earth reference.

The power input cables between the power ports of the EUT and the artificial mains network were screened and 0.8 m in length.

If the EUT consisted of more than one unit with individual power ports, power ports of identical nominal supply voltage were connected in parallel to the artificial mains supply network.

2.1.5 Environmental Conditions

Ambient Temperature	20.0 °C
Relative Humidity	44.0 %

2.1.6 Specification Limits

Required Specification Limits		
Line Under Test	Frequency Range (MHz)	Quasi-peak (dBµV)
Power Input	0.01 to 0.15	96 to 50*
	0.15 to 0.35	60 to 50*
	0.35 to 30	50*
Supplementary information: Note 1: The emission shall be measured by means of the quasi-peak measuring receiver only. *As detailed in specification clause 5.3 Test results, the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty.		

Table 8

2.1.7 Test Results

Results for Configuration and Mode: DC Powered - Transmitting.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Line Under Test: Interface Unit - 12 V DC Line

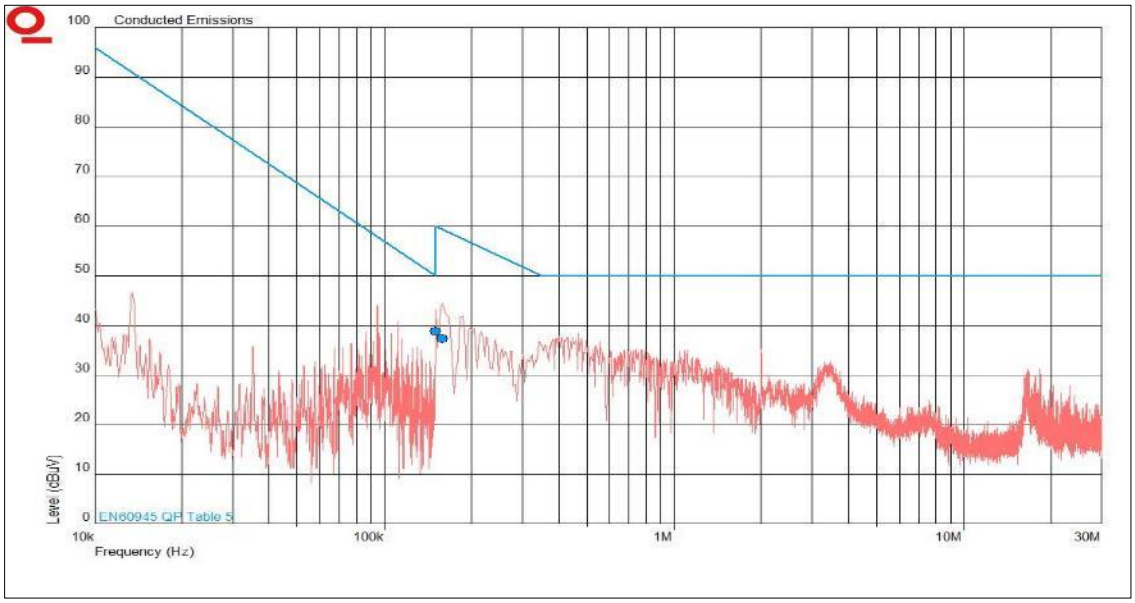

Figure 10 - Graphical Results

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)
0.150	38.8	50.0	-11.2
0.159	37.4	59.3	-21.9

Table 9

No other measurements were made as all other peak emissions seen were greater than 10 dB below the QP test limit.

Line Under Test: Interface Unit - 0 V DC Line

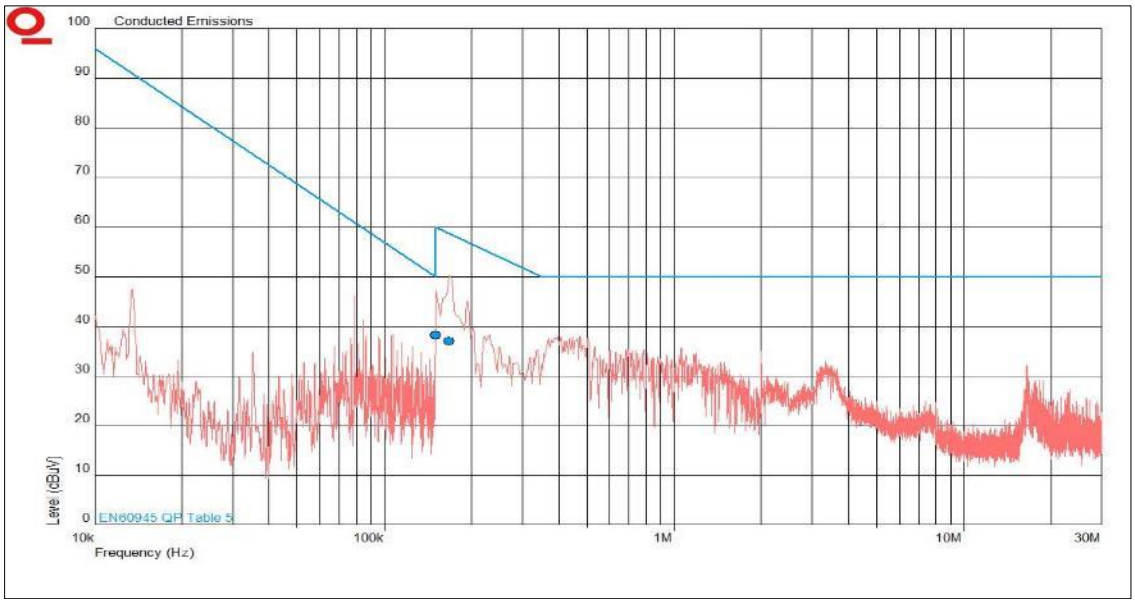

Figure 11 - Graphical Results

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)
0.150	38.3	50.0	-11.7
0.168	37.2	58.7	-21.5

Table 10

No other measurements were made as all other peak emissions seen were greater than 10 dB below the QP test limit.

Line Under Test: Control Unit - 12 V DC Line

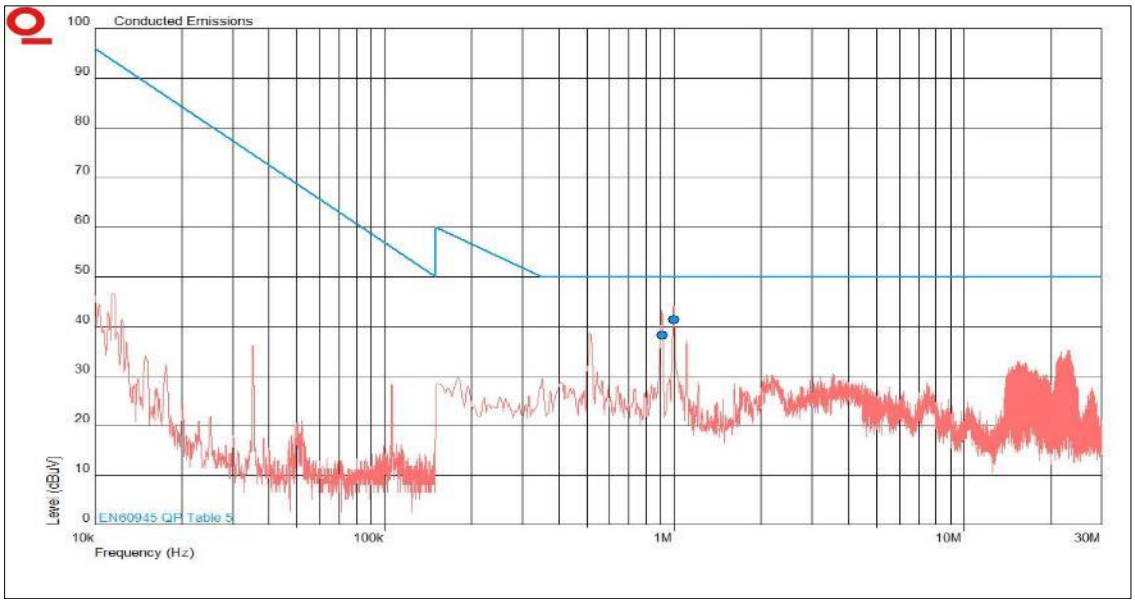

Figure 12 - Graphical Results

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)
0.909	38.2	50.0	-11.8
0.999	41.4	50.0	-8.6

Table 11

No other measurements were made as all other peak emissions seen were greater than 10 dB below the QP test limit.

Line Under Test: Control Unit - 0 V DC Line

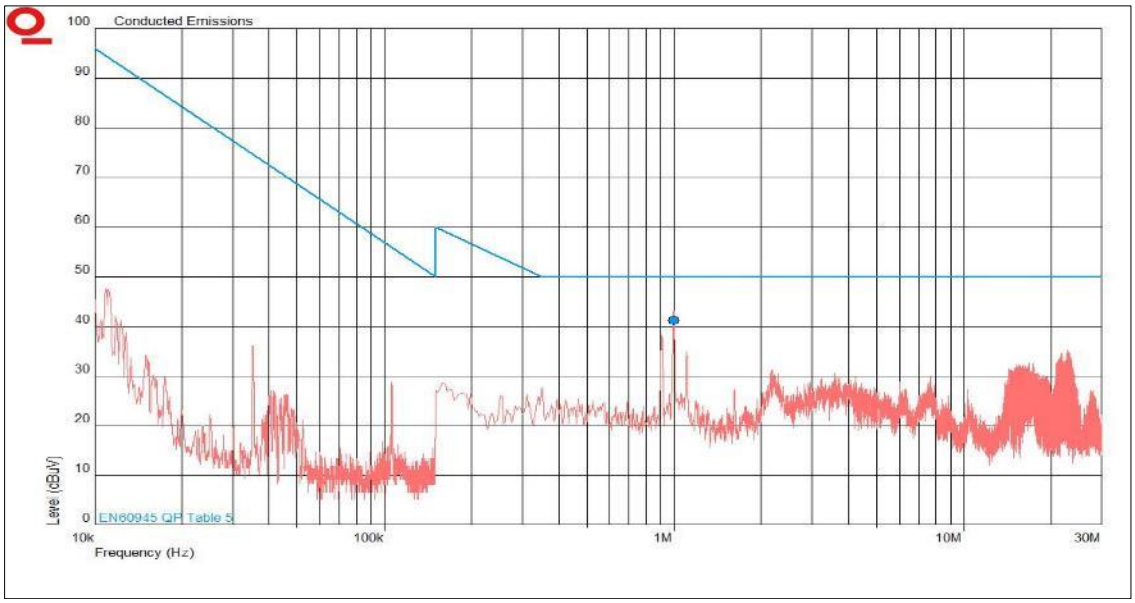

Figure 13 - Graphical Results

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)
1.000	41.3	50.0	-8.7

Table 12

No other measurements were made as all other peak emissions seen were greater than 10 dB below the QP test limit.

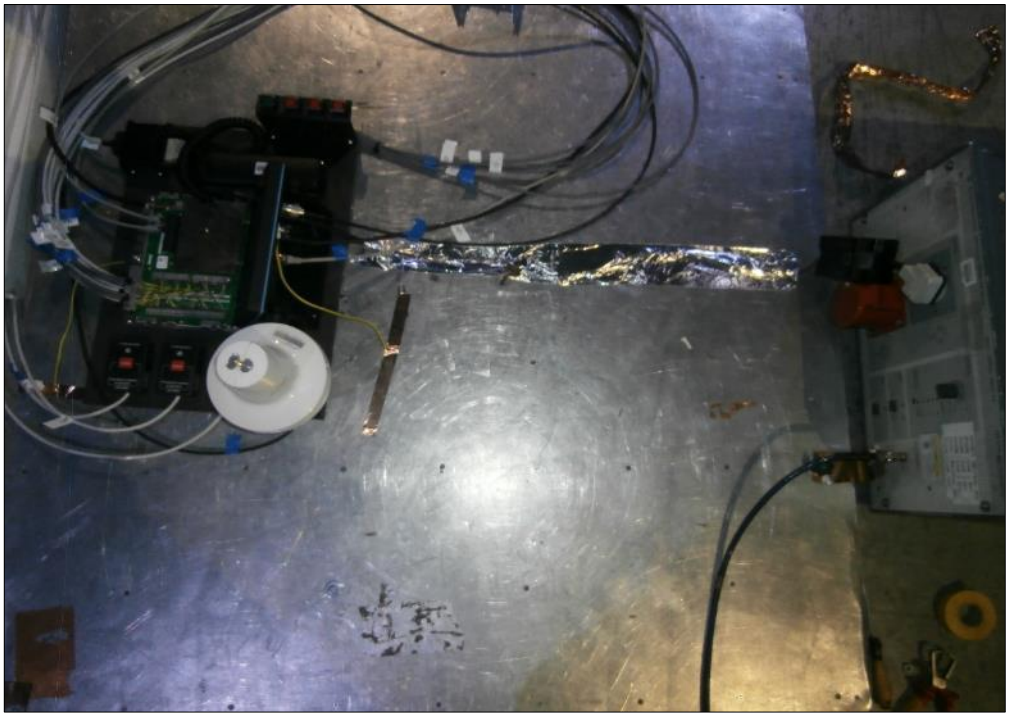

Figure 14 - Test Setup

2.1.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Compliance 5 Emissions	Teseq	V5.26.51	3275	-	Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	17-Dec-2019
Transient Limiter	Hewlett Packard	11947A	2377	12	26-Feb-2020
3 Phase Artificial Mains Network (LISN)	Rohde & Schwarz	ESH2-Z5	16	12	28-Feb-2020
2 Meter Cable	Teledyne	PR90-088-2MTR	5198	12	29-Jul-2020
8 Meter Cable	Teledyne	PR90-088-8MTR	5213	12	30-Aug-2020

Table 13

2.2 Radiated Emissions

2.2.1 Specification Reference

EN 60945, Clause 9.3

2.2.2 Equipment Under Test and Modification State

Global Maritime Distress and Safety System, Model: LT-3100S - Modification State 0

2.2.3 Date of Test

13-October-2019

2.2.4 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable and placed on a non-conductive table 0.8 m above a reference ground plane.

A pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarisation using a peak detector; measurements were taken at a 3m distance. Using the pre-scan list of the highest emissions detected, their bearing and associated antenna polarisation, the EUT was then formally measured using a Quasi-Peak detector.

The readings were maximised by adjusting the antenna height, polarisation and turntable azimuth, in accordance with the specification.

2.2.5 Environmental Conditions

Ambient Temperature	21.0 °C
Relative Humidity	42.0 %

2.2.6 Specification Limits

Required Specification Limits (@ 3m)	
Frequency Range (MHz)	Quasi-peak (dBµV/m)
0.15 to 0.3	80 - 52*
0.3 to 30	52 - 34*
Supplementary Information: The measured test results shall be compared with the corresponding acceptable performance limits, and the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty. *As detailed in specification clause 5.3 Test results, the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty.	

Table 14

Required Specification Limits (@ 3m)		
Frequency Range (MHz)	Quasi-peak (dBµV/m)	Peak (dBµV/m)
30 to 2000(1)	54*	N/A
156 to 165(2)	24*	30*
Supplementary Information: *As detailed in specification clause 5.3 Test results, the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty. (1) In addition, for the frequency band 156 MHz to 165 MHz, the measurement shall be repeated with a receiver bandwidth of 9 kHz, all other conditions hereinbefore remaining unchanged. (2) Alternatively, for the frequency band 156 MHz to165 MHz, a peak receiver or a frequency analyser may be used, in accordance with the agreement between the manufacturer and the test house.		

Table 15

2.2.7 Test Results

Results for Configuration and Mode: DC Powered - Transmitting.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Frequency Range of Test: 156 MHz to 165 MHz

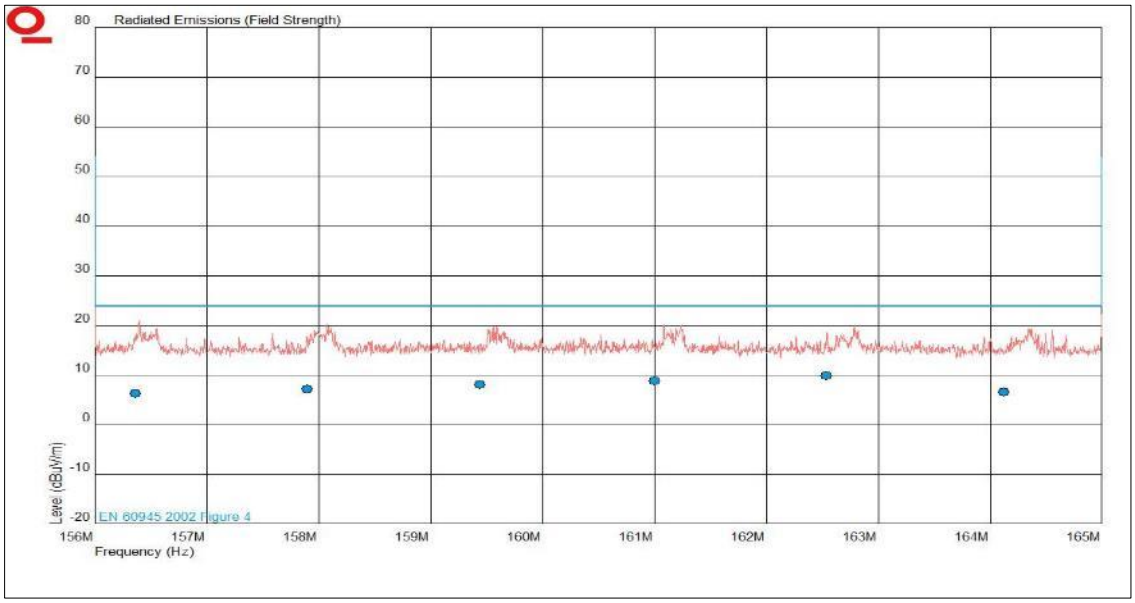

Figure 15 - Graphical Results - Horizontal and Vertical Polarity

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
156.363	6.4	24.0	-17.6	CISPR Average	0	1.00	Horizontal
157.905	7.3	24.0	-16.7	CISPR Average	0	1.00	Vertical
159.444	8.1	24.0	-15.9	CISPR Average	0	1.00	Vertical
161.006	8.9	24.0	-15.1	CISPR Average	0	1.00	Horizontal
162.538	9.9	24.0	-14.1	CISPR Average	0	1.00	Vertical
164.122	6.6	24.0	-17.4	CISPR Average	0	15.43	Vertical

Table 16

Frequency Range of Test: 150 kHz to 30 MHz

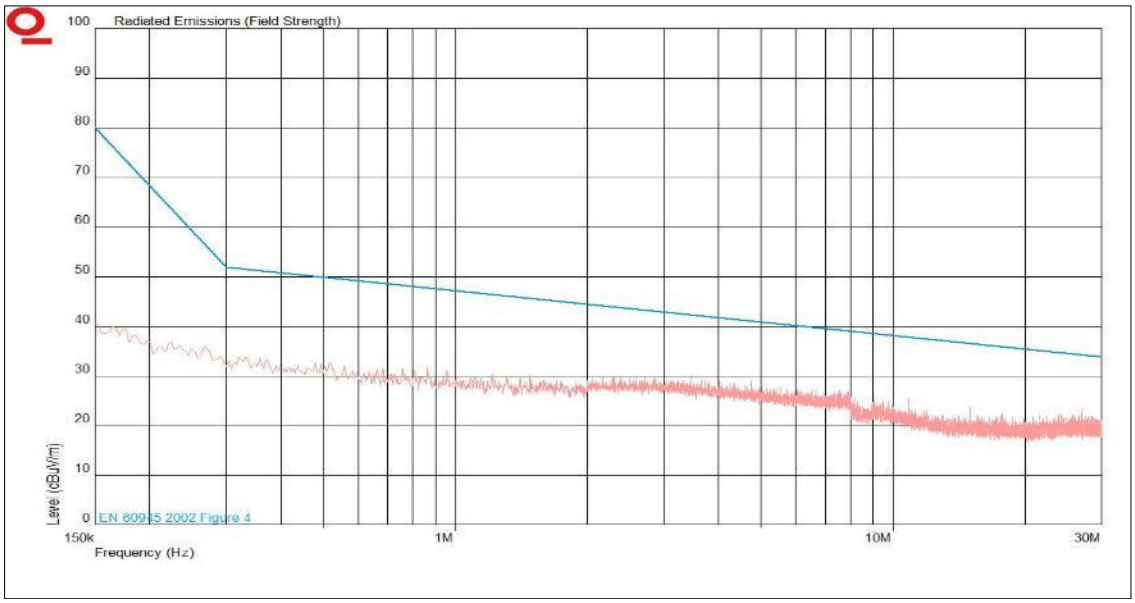

Figure 16 - Graphical Results - Horizontal and Vertical Polarity

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 17

* No emissions were detected within 10 dB of the limit.

Frequency Range of Test: 30 MHz to 2 GHz

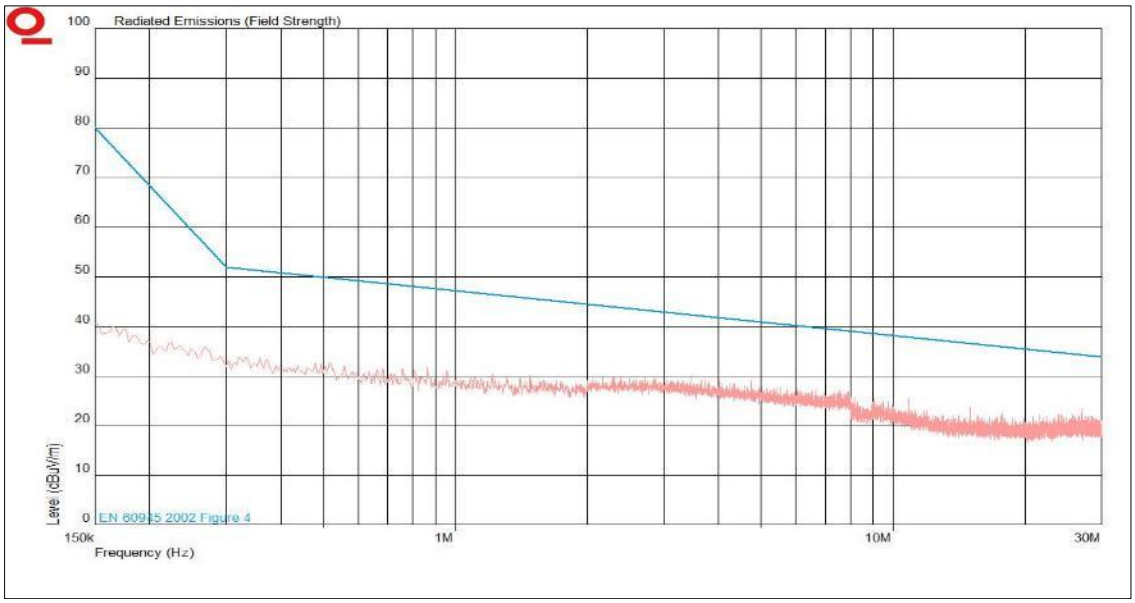

Figure 17 - Graphical Results - Horizontal and Vertical Polarity

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 18

* No emissions were detected within 10 dB of the limit.

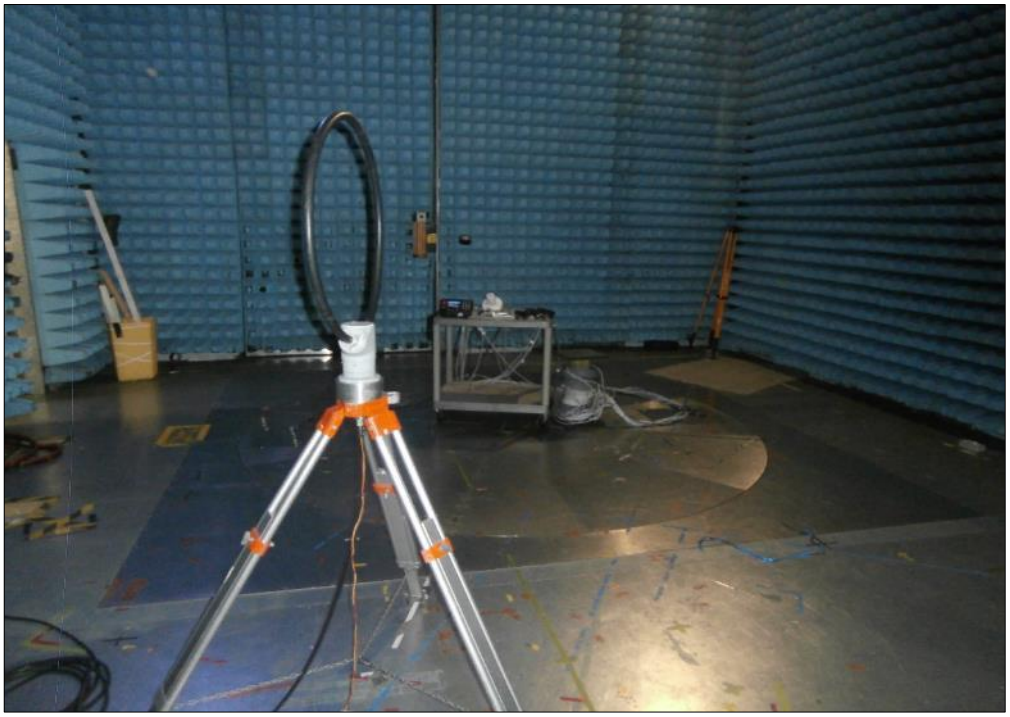

Figure 18 - Test Setup - 150 kHz to 30 MHz

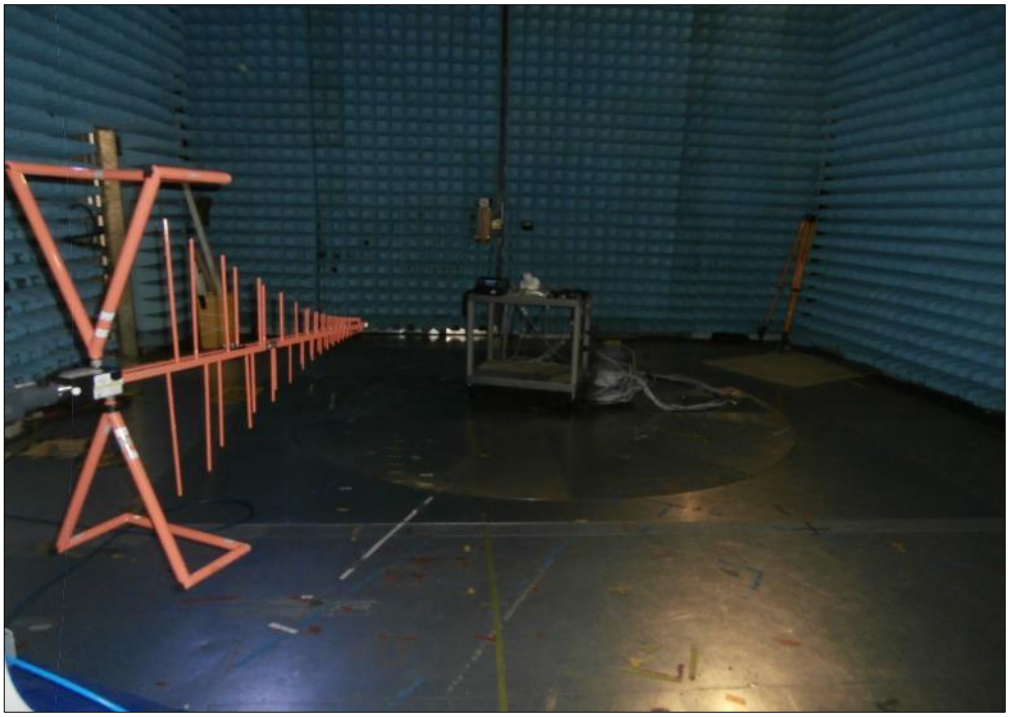

Figure 19 - Test Setup - 30 MHz to 2 GHz

2.2.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 7.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (7)	Siemens	S M	1547	36	21-Jan-2021
Compliance 5 Emissions	Teseq	V5.26.51	3275	-	Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	17-Dec-2019
Turntable Controller	Heinrich Diesel	HD 050	280	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	Maturo Gmbh	NCD	3917	-	TU
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	15-May-2020
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	05-Mar-2020
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	25-Oct-2019
Pre-Amplifier	Phase One	PS04-0086	1533	12	08-Feb-2020
Hygromer	Rotronic	A1	2677	12	20-Feb-2020
Comb Generator	Schaffner	RSG1000	3034	-	TU
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	11-Dec-2019
2 Meter Cable	Teledyne	PR90-088-2MTR	5198	12	29-Jul-2020
8 Meter Cable	Teledyne	PR90-088-8MTR	5213	12	30-Aug-2020
3 GHz High pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	5220	12	15-Feb-2020

Table 19

TU - Traceability Unscheduled

2.3 Immunity to Conducted Radio Frequency Disturbance

2.3.1 Specification Reference

EN 60945, Clause 10.3

2.3.2 Equipment Under Test and Modification State

Global Maritime Distress and Safety System, Model: LT-3100S - Modification State 0

2.3.3 Date of Test

07-October-2019 to 08-October-2019

2.3.4 Test Method

The equipment under test was configured, on but insulated from, using a 0.1 m isolator, a ground reference plane within a test laboratory.

All associated cabling was configured, on but insulated from, using a 50 mm isolator, the same horizontal coupling plane as the equipment under test.

Using CDNs, EM Clamps or current clamps as appropriate, the power ports and applicable signal and control ports were subjected to the required, pre-calibrated RF injected signal strength, modulated as described, swept over the frequency range of test.

During this test, any anomalies in the equipment under tests performance were recorded.

2.3.5 Environmental Conditions

Ambient Temperature	20.0 °C
Relative Humidity	44.0 %

2.3.6 Specification Limits

Required Test Levels						Performance Criteria
Line Under Test	Frequency Range (MHz)	Level (V/m)	Modulation	Step Size (%)	Dwell (s)	
Power Port Signal / Control Port	0.15 to 80	3*	AM (80 %,400 Hz, sine wave)	1	3	A
	Spot Frequencies	10*	AM (80 %,400 Hz, sine wave)	-	3	A
Supplementary information: Note 1. EUT powered at one of the nominal input voltages and frequencies. Spot Frequencies: 2 MHz, 3 MHz, 4 MHz, 6,2 MHz, 8,2 MHz, 12,6 MHz, 16,5 MHz, 18,8 MHz, 22 MHz and 25 MHz. *As detailed in specification clause 5.3 Test results, the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty.						

Table 20

2.3.7 Test Results

Results for Configuration and Mode: DC Powered - Transmitting.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Conducted Radio Frequency Interference					
Modulation = 80 % AM (400 Hz)		Step Size = 1 %		Dwell = 3 s	
Line Under Test	Frequency Range	Test Level (V/m)	Coupling Method	Interference Return Path	Result
Interface Unit +12 V DC Live Line	150kHz to 80MHz	3.6 (3 + MU)	M2 CDN	M1 CDN	Pass
Control Unit DC	150kHz to 80MHz	3.6 (3 + MU)	M2 CDN	M1 CDN	Pass
Control Unit Earth	150kHz to 80MHz	3.6 (3 + MU)	M1 CDN	M2 CDN	Pass
Interface Unit Earth	150kHz to 80MHz	3.6 (3 + MU)	M1 CDN	M2 CDN	Pass
Antenna coax	150kHz to 80MHz	3.6 (3 + MU)	EM Clamp	M1 CDN	Pass
AP3	150kHz to 80MHz	3.6 (3 + MU)	EM Clamp	M1 CDN	Pass
ST	150kHz to 80MHz	3.6 (3 + MU)	EM Clamp	M1 CDN	Pass
S1	150kHz to 80MHz	3.6 (3 + MU)	EM Clamp	M1 CDN	Pass
RS1	150kHz to 80MHz	3.6 (3 + MU)	EM Clamp	M1 CDN	Pass
PA	150kHz to 80MHz	3.6 (3 + MU)	EM Clamp	M1 CDN	Pass
LAN 2	150kHz to 80MHz	3.6 (3 + MU)	EM Clamp	M1 CDN	Pass

Table 21

Tabulated Results for Conducted Radio Frequency Interference (Spot Frequencies)					
Modulation = 80 % AM (400 Hz)			Dwell = 3 s		
Line Under Test	Spot Frequencies	Test Level	Coupling Method	Interference Return Path	Result
Interface Unit +12 V DC Live Line	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	M2 CDN	M1 CDN	Pass
Control Unit DC	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	M2 CDN	M1 CDN	Pass
Control Unit Earth	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	M1 CDN	M2 CDN	Pass
Interface Unit Earth	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	M1 CDN	M2 CDN	Pass
Antenna coax	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	EM CLAMP	M1 CDN	Pass
AP3	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	EM CLAMP	M1 CDN	Pass
ST	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	EM CLAMP	M1 CDN	Pass
S1	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	EM CLAMP	M1 CDN	Pass
RS1	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	EM CLAMP	M1 CDN	Pass
PA	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	EM CLAMP	M1 CDN	Pass
LAN 2	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz	12.6 (10+MU)	EM CLAMP	M1 CDN	Pass

Table 22

Figure 20 - Test Setup - 150 kHz to 80 MHz

2.3.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Conducted Immunity Test Software	Schaffner	WIN2070 V5.00	5251	-	Software
RF Generator + Attenuator	Schaffner	NSG2070-400	222	12	22-Jan-2020
CDN, 16A, switchable M2 or M3	Teseq	CDN M016	3666	12	11-Oct-2020
Load (50ohm, 30W)	JFW	Load	284	12	05-June-2020
Coupling Decoupling Network	Teseq	CDN M116	3978	12	11-Oct-2020
EM Clamp	MEB Messelektronik	KEMZ 801S	3373	-	TU
Calibration Fixture (x2)	MEB Messelektronik	KEMZ 801	229	-	TU
Attenuator	Weinschel	45-10-43	509	12	20-Dec-2019

Table 23

2.4 Immunity to Radiated Radio Frequencies

2.4.1 Specification Reference

EN 60945, Clause 10.4

2.4.2 Equipment Under Test and Modification State

Global Maritime Distress and Safety System, Model: LT-3100S - Modification State 0

2.4.3 Date of Test

14-October-2019

2.4.4 Test Method

The equipment under test including associated cabling was configured, on a 0.8 m non-conductive table for table-top equipment and on a 0.1 m insulated support for floor standing equipment; with a pre-calibrated semi anechoic chamber.

All four sides of the equipment under test were subjected to the required RF field strength, modulated as described, swept over the frequency range of test with the antenna positioned in both horizontal and vertical polarisations.

During this test, any anomalies in the equipment under tests performance were recorded.

2.4.5 Environmental Conditions

Ambient Temperature	20.0 °C
Relative Humidity	46.0 %

2.4.6 Specification Limits

Required Test Levels					Performance Criteria
Frequency Range (MHz)	Level (V/m)	Modulation	Step Size (%)	Dwell (s)	
80 to 1000	10*	AM (80 %,400 Hz, sine wave)	1	3[1]	A
1000 to 2000	10*	AM (80 %,400 Hz, sine wave)	1	9[1]	A

Supplementary information:
Note 1. Dwell times <1GHz can be reduced to 2 s and >1GHz to 5 s for samples with fast cycle times.
Note 2. EUT powered at one of the Nominal input voltages and frequencies.
*As detailed in specification clause 5.3 Test results, the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty.

Table 24

2.4.7 Test Results

Results for Configuration and Mode: DC Powered - Transmitting.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for RF Electromagnetic Field				
Step Size	1 %			
Dwell Time < 1GHz	3 s			
Dwell Time > 1GHz	5 s			
Modulation	400 Hz Sine 80 % AM			
Frequency Range	Test Face	Antenna Polarisation	Test Level	Result
80 MHz to 2 GHz	Front	Vertical	12.6 V/m (10 + MU)	Pass
80 MHz to 2 GHz	Front	Horizontal	12.6 V/m (10 + MU)	Pass
80 MHz to 2 GHz	Left	Horizontal	12.6 V/m (10 + MU)	Pass
80 MHz to 2 GHz	Left	Vertical	12.6 V/m (10 + MU)	Pass
80 MHz to 2 GHz	Right	Vertical	12.6 V/m (10 + MU)	Pass
80 MHz to 2 GHz	Right	Horizontal	12.6 V/m (10 + MU)	Pass
80 MHz to 2 GHz	Rear	Horizontal	12.6 V/m (10 + MU)	Pass
80 MHz to 2 GHz	Rear	Vertical	12.6 V/m (10 + MU)	Pass

Table 25

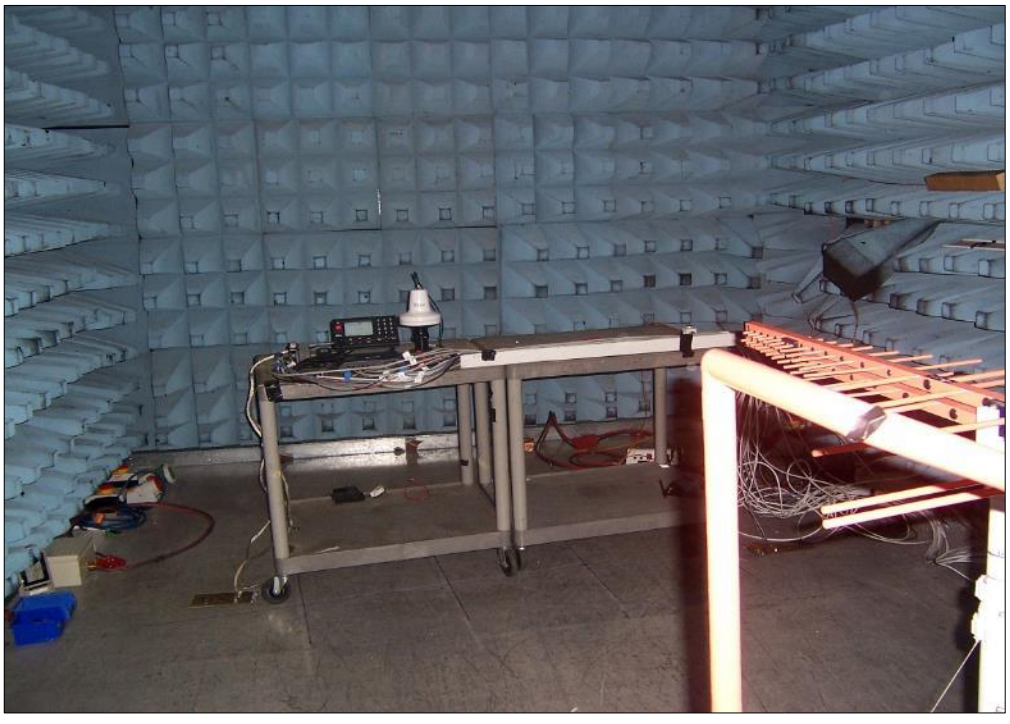

Figure 21 - Test Setup

2.4.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMCWare	Amp Research	V3.8.2	4899	-	Software
Signal Generator, 9kHz to 6GHz	Rohde & Schwarz	SMB 100A	3499	12	11-Jun-2020
Amplifier (250W, 80MHz - 1GHz)	Amp Research	250W1000A	3029	-	TU
Directional Coupler	Amp Research	DC6180	283	-	TU
Power Meter	Rohde & Schwarz	NRVD	1391	-	TU
Power Sensor	Rohde & Schwarz	NRV- Z5	2878	12	12-Jun-2018
Load (50ohm, 30W)	JFW	50T-054	284	12	05-Jun-2020
CW TWT (1-2.5GHz)	Thorn	PTC6341	2069	-	TU
Antenna	Schaffner	CBL6143	322	-	TU
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	-	TU

Table 26

TU - Traceability Unscheduled

2.5 Immunity to Fast Transients on A.C. Power, Signal and Control Lines

2.5.1 Specification Reference

EN 60945, Clause 10.5

2.5.2 Equipment Under Test and Modification State

Global Maritime Distress and Safety System, Model: LT-3100S - Modification State 0

2.5.3 Date of Test

09-October-2019

2.5.4 Test Method

The equipment under test including associated cabling was configured on but insulated from, using a 0.1 m isolator, a horizontal coupling plane fitted to the top of a 0.8 m non-conductive table for table-top equipment; and on a 0.1 m insulated support for floor standing equipment; above a ground reference plane all within a test laboratory.

Using a CDN for power ports, capacitive coupling clamp for signal and control ports and a 33 nF coupling capacitor for earth ports, the required fast transient burst voltage levels in both voltage polarities were applied at the detailed pulse repetition rate and duration of test.

During this test, any anomalies in the equipment under tests performance were recorded.

2.5.5 Environmental Conditions

Ambient Temperature	20.2 - 20.3 °C
Relative Humidity	43.0 %

2.5.6 Specification Limits

Required Test Levels					Performance Criteria
Line Under Test	Level (± kV)	Repetition Rate (kHz)	Test Duration	Coupling Method	
AC Power Port	0.5 and 1.0	5	3 min per polarity	Direct	B
AC Power Port	2.0	2.5	3 min per polarity	Direct	
Signal / Control Port	1.0	5	3 min per polarity	Capacitive Clamp	
Supplementary information: Note 1. EUT powered at one of the nominal input voltages and frequencies					

Table 27

2.5.7 Test Results

Results for Configuration and Mode: DC Powered - Transmitting.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Fast Transient Burst Immunity					
Line under test	Test Level (kV)	Repetition Rate (kHz)	Test Duration (s)	Coupling Method	Result
AP3	+1.0	5	180	Capacitive Clamp	Pass
AP3	- 1.0	5	180	Capacitive Clamp	Pass
ST	+1.0	5	180	Capacitive Clamp	Pass
ST	- 1.0	5	180	Capacitive Clamp	Pass
S1	+1.0	5	180	Capacitive Clamp	Pass
S1	- 1.0	5	180	Capacitive Clamp	Pass
Antenna coax	+1.0	5	180	Capacitive Clamp	Pass
Antenna coax	- 1.0	5	180	Capacitive Clamp	Pass
RS1	+1.0	5	180	Capacitive Clamp	Pass
RS1	- 1.0	5	180	Capacitive Clamp	Pass
PA	+1.0	5	180	Capacitive Clamp	Pass
PA	- 1.0	5	180	Capacitive Clamp	Pass
LAN 2	+1.0	5	180	Capacitive Clamp	Pass
LAN 2	- 1.0	5	180	Capacitive Clamp	Pass

Table 28

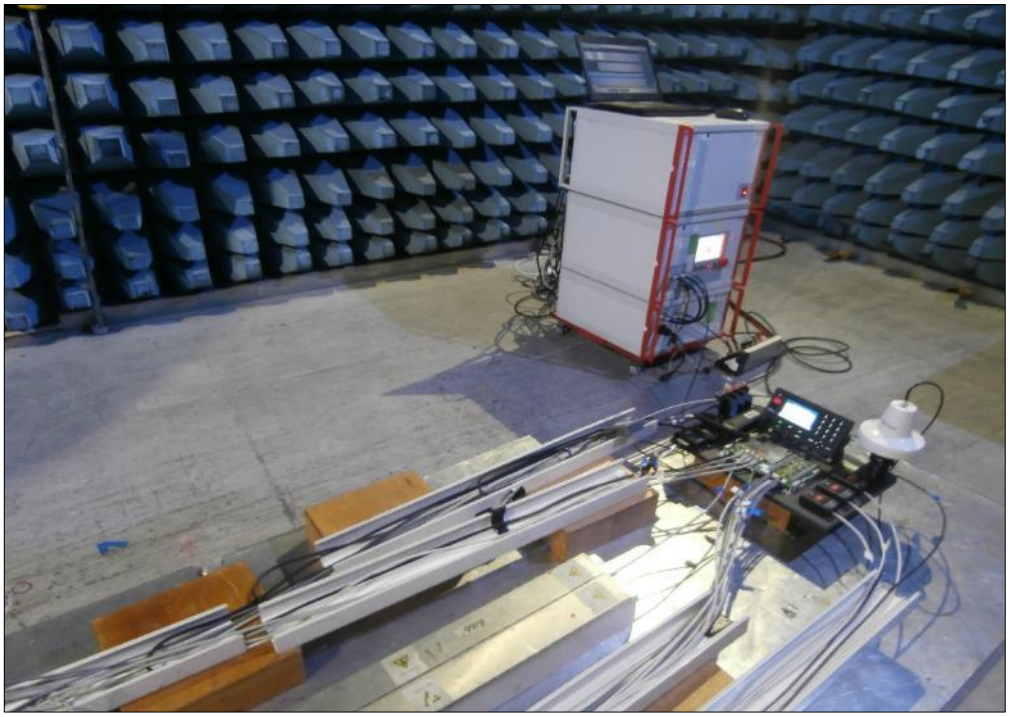

Figure 22 - Test Setup

2.5.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Immunity Test Set	Teseq	NSG3060	4556	12	15-Jul-2020
Coupling/Decoupling Network	Teseq	CDN3061	4555	12	15-Jul-2020
Variable Supply	Teseq	VAR3005	4557	12	15-Jul-2020

Table 29

2.6 Immunity to Power Supply Failure

2.6.1 Specification Reference

EN 60945, Clause 10.8

2.6.2 Equipment Under Test and Modification State

Global Maritime Distress and Safety System, Model: LT-3100S - Modification State 0

2.6.3 Date of Test

11-October-2019

2.6.4 Test Method

The equipment under test including associated cabling was configured, on a 0.8 m non-conductive table for table-top equipment and on a 0.1 m insulated support for floor standing equipment above a ground reference plane all within a test laboratory.

Using a programmable power supply the equipment under test was subjected to the detailed supply voltage interruptions. The required supply phase synchronisation and test repetition rate, detailed, was controlled by the programmable power supply.

During this test, any anomalies in the equipment under tests performance were recorded.

2.6.5 Environmental Conditions

Ambient Temperature	20.0 °C
Relative Humidity	44.0 %

2.6.6 Specification Limits

Required Test Levels			Performance Criteria
Test	Test Level % of nominal Voltage	Duration (s)	
Short Interruption	0	60 repeated 3 times	C
Supplementary information: Note 1. EUT powered at one of the nominal input voltages and frequencies			

Table 30

2.6.7 Test Results

Results for Configuration and Mode: DC Powered - Transmitting.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Power Supply Failure					
Line under test	Operating Frequency	Nominal Voltage (V)	Test Level Voltage (V)	Duration (s)	Result
Interface Unit DC Power	N/A	12	0	60	Pass
Control Unit DC Power	N/A	12	0	60	Pass

Table 31

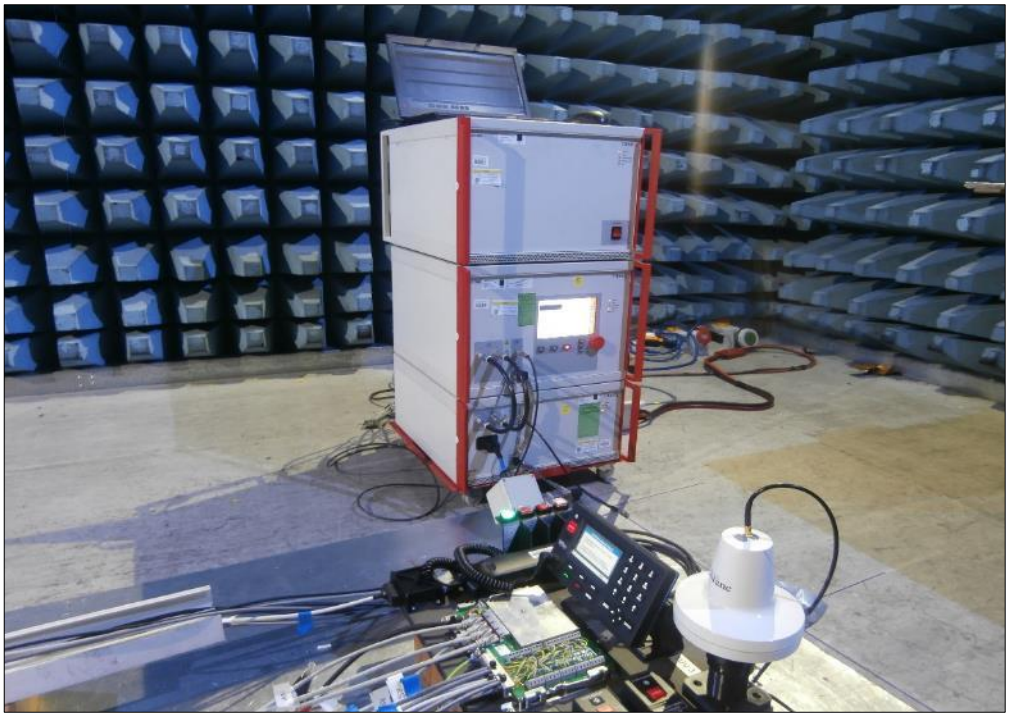

Figure 23 - Test Setup

2.6.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Immunity Test Set	Teseq	NSG3060	4556	12	15-Jul-2020
Coupling/Decoupling Network	Teseq	CDN3061	4555	12	15-Jul-2020
Variable Supply	Teseq	VAR3005	4557	12	15-Jul-2020

Table 32

2.7 Immunity to Electrostatic Discharge

2.7.1 Specification Reference

EN 60945, Clause 10.9

2.7.2 Equipment Under Test and Modification State

Global Maritime Distress and Safety System, Model: LT-3100S - Modification State 0

2.7.3 Date of Test

13-October-2019

2.7.4 Test Method

The equipment under test including associated cabling was configured on a horizontal coupling plane fitted with a 0.5 mm insulated surface attached to the top of a 0.8m non-conductive table for table-top equipment or on a 0.1m insulated support for floor standing equipment, above a ground reference plane within a test laboratory.

Using the air discharge method for non-metallic parts, contact discharge method for metallic parts with both vertical and horizontal couple plane discharge methods for the sides of the equipment under test, The required electrostatic discharge voltage levels in both voltage polarities were applied at the detailed pulse repetition rate.

During this test, any anomalies in the equipment under tests performance were recorded.

2.7.5 Environmental Conditions

Ambient Temperature	20.0 °C
Relative Humidity	42.0 %

2.7.6 Specification Limits

Required Test Levels				Performance Criteria
Discharge type	Discharge Level (kV)		Number of discharges per location (each polarity)	
	Positive	Negative		
Air – Direct	2, 4 and 8	2, 4 and 8	10	B
Contact – Direct	6	6	10	B
Contact – Indirect	6	6	10	B
Supplementary information: None				

Table 33

2.7.7 Test Results

Results for Configuration and Mode: DC Powered - Transmitting.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

◯ Contact ☐ Air

Test Point	Discharge	Results									
		2 kV		4 kV		6 kV		8 kV		15 kV	
		+	-	+	-	+	-	+	-	+	-
Horizontal Coupling Plane	Contact	N/A	N/A	N/A	N/A	✓	✓	N/A	N/A	N/A	N/A
Vertical Coupling Plane	Contact	N/A	N/A	N/A	N/A	✓	✓	N/A	N/A	N/A	N/A
Contact Discharges	Contact	N/A	N/A	N/A	N/A	✓	✓	N/A	N/A	N/A	N/A
Air Discharges	Air	✓*	✓*	✓*	✓*	N/A	N/A	✓*	✓*	N/A	N/A

Table 34

Key to Results	
✓	The EUT's performance was not impaired at this test point when the ESD pulse was applied.
✓*	No discharge occurred at this point when the ESD pulse was applied.
N/A	Not Applicable.

Table 35

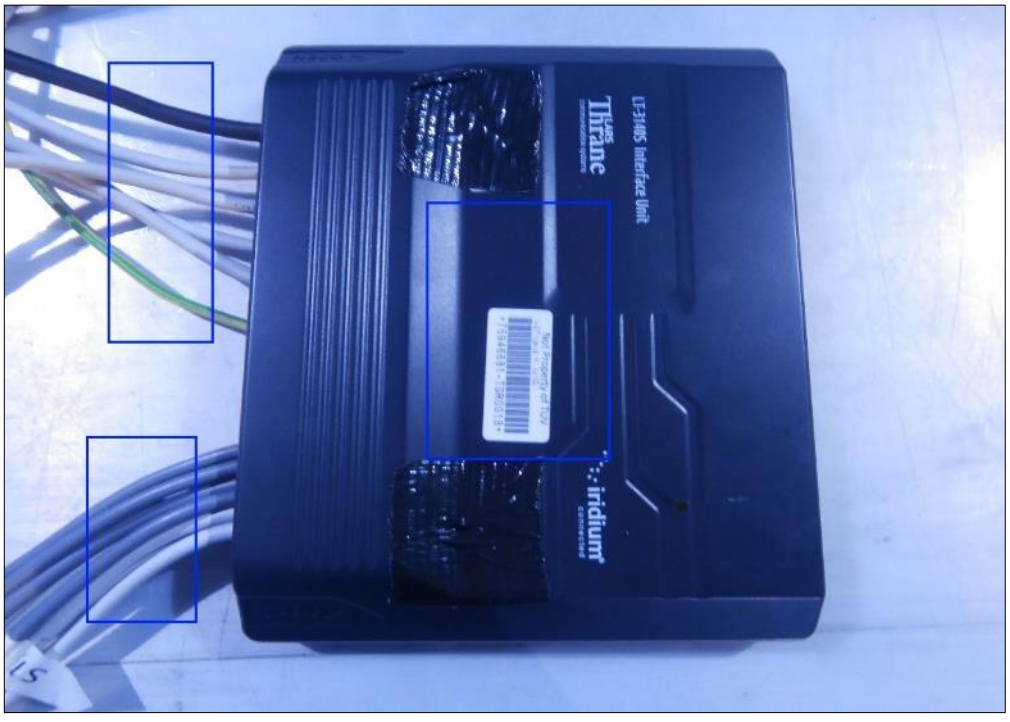

Figure 24 - ESD Test Positions

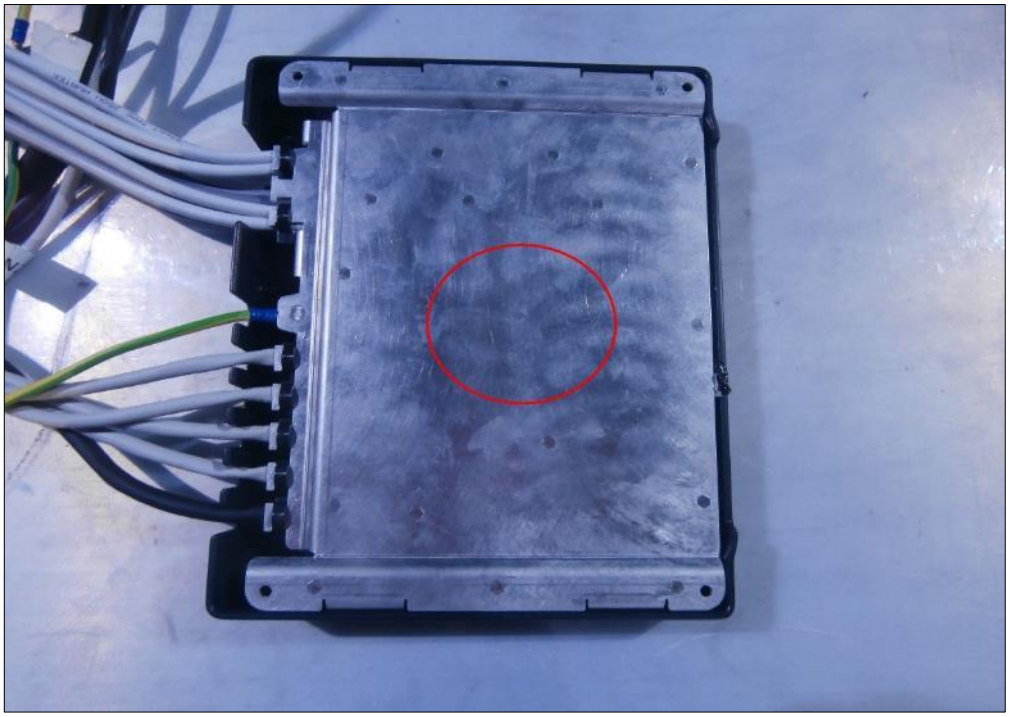

Figure 25 - ESD Test Positions

Figure 26 - ESD Test Positions

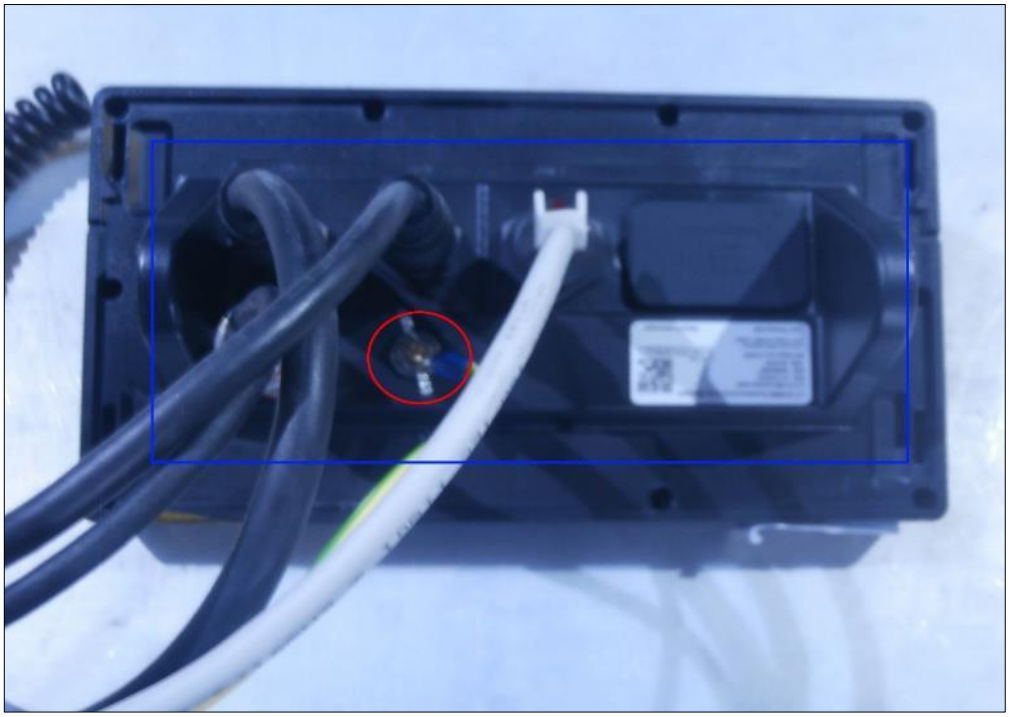

Figure 27 - ESD Test Positions

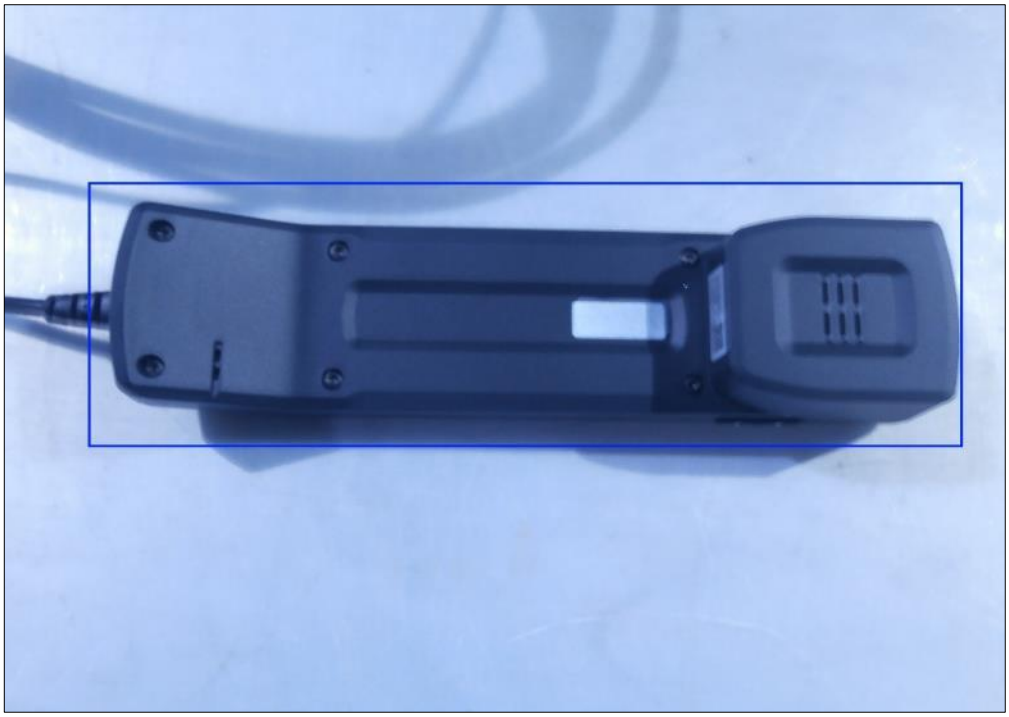

Figure 28 - ESD Test Positions

Figure 29 - ESD Test Positions

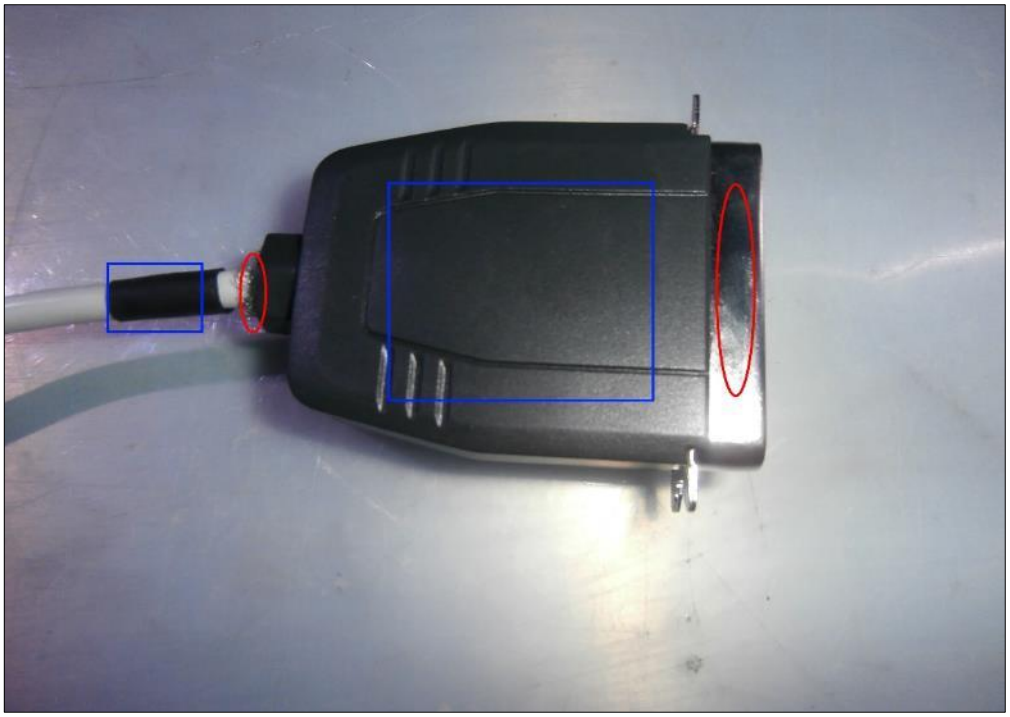

Figure 30 - ESD Test Positions

Figure 31 - ESD Test Positions

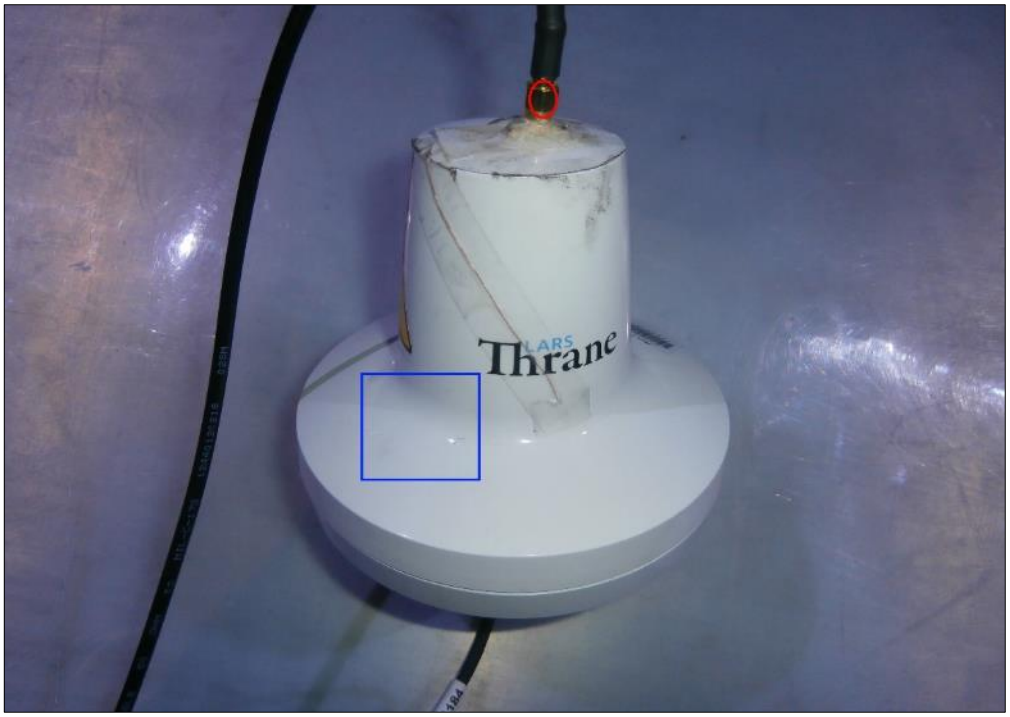

Figure 32 - ESD Test Positions

Figure 33 - ESD Test Positions

Figure 34 - ESD Test Positions

Figure 35 - ESD Test Positions

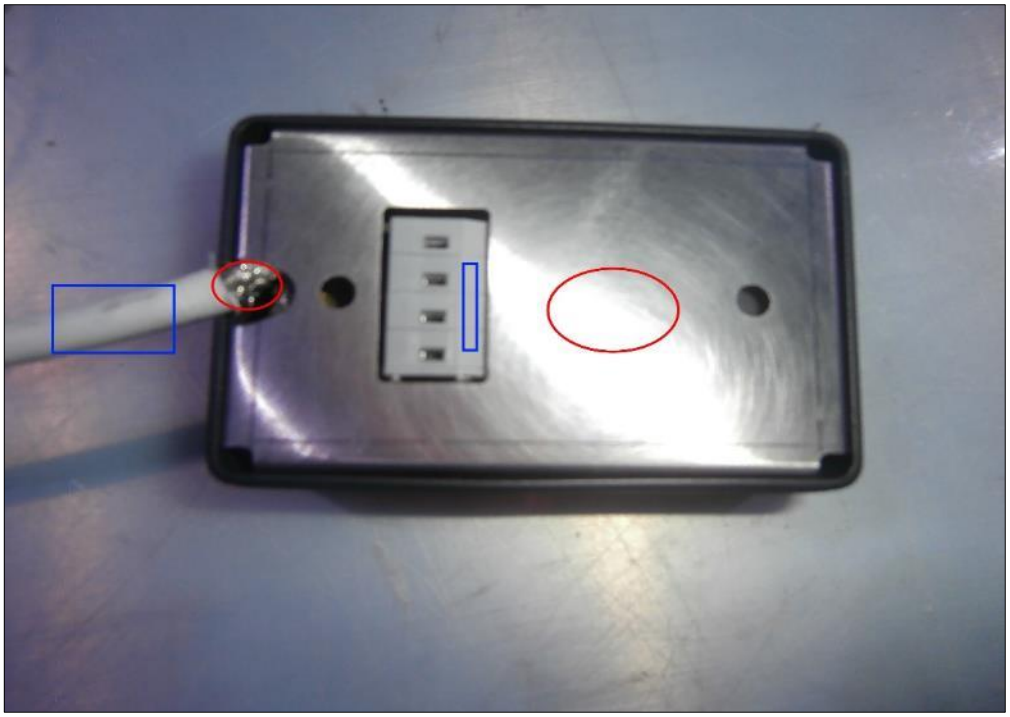

Figure 36 - ESD Test Positions

Figure 37 - Test Setup

2.7.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Digital Multimeter	Iso-tech	IDM-101	2895	12	11-Oct-2020
ESD Generator	Schloder	SESD 30000	4724	12	01-Jul-2020

Table 36

2.8 Compass Safe Distance

2.8.1 Specification Reference

EN 60945, Clause 11.2

2.8.2 Equipment Under Test and Modification State

Global Maritime Distress and Safety System, Model: LT-3100S - Modification State 0

2.8.3 Date of Test

15-October-2019

2.8.4 Test Method

The EUT was setup on an East to West oriented level non-magnetic surface.

A magnetometer was used to take a horizontal magnetic flux density measurement and from this measurement, a standard and an emergency compass deflection was calculated.

A ships magnetic compass was located at the west end of the non-magnetic surface.

The compass was zeroed and the EUT was gradually moved from the east to the west end of the non-magnetic surface towards the compass centre in all 6 of its orthogonal planes and in 3 different states until the calculated compass deflection was achieved, or the EUT had reached the boundary of the ships magnetic compass.

Once all raw readings had been obtained, the worst case reading for each state was rounded up to the nearest 50 mm or 100 mm.

2.8.5 Environmental Conditions

Ambient Temperature	16.0 °C
Relative Humidity	55.0 %

2.8.6 Specification Limits

For the steering compass, the standby steering compass and the emergency compass, the permitted deviation is 18°/H, H being defined as the horizontal component of the magnetic flux density in μT's (micro-tesla's) at the location that testing takes place.

2.8.7 Test Results

Results for Configuration and Mode: DC Powered - Transmitting.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Magnetometer Reading and Calculations

Horizontal Maximum Flux Density, Magnetic North (H)	Standard Compass Deviation Limit (5.4/H in Degrees)	Emergency Compass Deviation Limit (18/H in Degrees)
20.54	0.26	0.846

Table 37

Test Results - EUT In Unpowered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Antenna Unit	Front	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Top	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Left Hand Side	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Right Hand Side	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Underside	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Rear	0.1 at 170 mm	0.1 at 170 mm

Table 38

Test Results - EUT In Normalised State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Antenna Unit	Front	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Top	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Left Hand Side	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Right Hand Side	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Underside	0.1 at 170 mm	0.1 at 170 mm
Antenna Unit	Rear	0.1 at 170 mm	0.1 at 170 mm

Table 39

Test Results - EUT In Powered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Antenna Unit	Front	0.1 at 170 mm	0 at 170 mm
Antenna Unit	Top	0.1 at 170 mm	0 at 170 mm
Antenna Unit	Left Hand Side	0.1 at 170 mm	0 at 170 mm
Antenna Unit	Right Hand Side	0.1 at 170 mm	0 at 170 mm
Antenna Unit	Underside	0.1 at 170 mm	0 at 170 mm
Antenna Unit	Rear	0.1 at 170 mm	0 at 170 mm

Table 40

Final Results

Unit Under Test	Standard Compass Safe Distance (mm)	Emergency Compass Safe Distance (mm)
Antenna Unit	200	200

Table 41

Test Results - EUT In Unpowered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Handset	Front	240	170
Handset	Top	350	160
Handset	Left Hand Side	1000	630
Handset	Right Hand Side	1000	880
Handset	Underside	480	210
Handset	Rear	450	170

Table 42

Test Results - EUT In Normalised State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Handset	Front	240	170
Handset	Top	350	160
Handset	Left Hand Side	1000	630
Handset	Right Hand Side	1000	880
Handset	Underside	480	210
Handset	Rear	450	170

Table 43

Test Results - EUT In Powered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Handset	Front	500	360
Handset	Top	500	300
Handset	Left Hand Side	850	650
Handset	Right Hand Side	850	700
Handset	Underside	700	500
Handset	Rear	700	300

Table 44

Final Results

Unit Under Test	Standard Compass Safe Distance (mm)	Emergency Compass Safe Distance (mm)
Handset	1000	900

Table 45

Test Results - EUT In Unpowered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Switch Unit	Front	0 at 170 mm	0 at 170 mm
Switch Unit	Top	0 at 170 mm	0 at 170 mm
Switch Unit	Left Hand Side	0 at 170 mm	0 at 170 mm
Switch Unit	Right Hand Side	0 at 170 mm	0 at 170 mm
Switch Unit	Underside	0.2 at 170 mm	0 at 170 mm
Switch Unit	Rear	0 at 170 mm	0 at 170 mm

Table 46

Test Results - EUT In Normalised State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Switch Unit	Front	0 at 170 mm	0 at 170 mm
Switch Unit	Top	0 at 170 mm	0 at 170 mm
Switch Unit	Left Hand Side	0 at 170 mm	0 at 170 mm
Switch Unit	Right Hand Side	0 at 170 mm	0 at 170 mm
Switch Unit	Underside	0.2 at 170 mm	0 at 170 mm
Switch Unit	Rear	0 at 170 mm	0 at 170 mm

Table 47

Test Results - EUT In Powered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Switch Unit	Front	0 at 170 mm	0 at 170 mm
Switch Unit	Top	0 at 170 mm	0 at 170 mm
Switch Unit	Left Hand Side	0 at 170 mm	0 at 170 mm
Switch Unit	Right Hand Side	0 at 170 mm	0 at 170 mm
Switch Unit	Underside	0 at 170 mm	0 at 170 mm
Switch Unit	Rear	0 at 170 mm	0 at 170 mm

Table 48

Final Results

Unit Under Test	Standard Compass Safe Distance (mm)	Emergency Compass Safe Distance (mm)
Switch Unit	200	200

Table 49

Test Results - EUT In Unpowered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Alarm Panel	Front	450	320
Alarm Panel	Top	0 at 170 mm	0 at 170 mm
Alarm Panel	Left Hand Side	0.8 at 170 mm	250
Alarm Panel	Right Hand Side	300	250
Alarm Panel	Underside	0 at 170 mm	0 at 170 mm
Alarm Panel	Rear	550	350

Table 50

Test Results - EUT In Normalised State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Alarm Panel	Front	450	320
Alarm Panel	Top	0 at 170 mm	0 at 170 mm
Alarm Panel	Left Hand Side	0.8 at 170 mm	250
Alarm Panel	Right Hand Side	300	250
Alarm Panel	Underside	0 at 170 mm	0 at 170 mm
Alarm Panel	Rear	550	350

Table 51

Test Results - EUT In Powered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Alarm Unit	Front	700	350
Alarm Unit	Top	600	250
Alarm Unit	Left Hand Side	450	250
Alarm Unit	Right Hand Side	500	200
Alarm Unit	Underside	550	300
Alarm Unit	Rear	500	350

Table 52

Final Results

Unit Under Test	Standard Compass Safe Distance (mm)	Emergency Compass Safe Distance (mm)
Alarm Unit	700	350

Table 53

Test Results - EUT In Unpowered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Interface Unit	Front	0.2 at 170 mm	0 at 170 mm
Interface Unit	Top	0.2 at 170 mm	0 at 170 mm
Interface Unit	Left Hand Side	0 at 170 mm	0 at 170 mm
Interface Unit	Right Hand Side	0 at 170 mm	0 at 170 mm
Interface Unit	Underside	0.2 at 170 mm	0 at 170 mm
Interface Unit	Rear	0 at 170 mm	0.1 at 170 mm

Table 54

Test Results - EUT In Normalised State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Interface Unit	Front	0.2 at 170 mm	0 at 170 mm
Interface Unit	Top	0.2 at 170 mm	0 at 170 mm
Interface Unit	Left Hand Side	0 at 170 mm	0 at 170 mm
Interface Unit	Right Hand Side	0 at 170 mm	0 at 170 mm
Interface Unit	Underside	0.2 at 170 mm	0 at 170 mm
Interface Unit	Rear	0 at 170 mm	0.1 at 170 mm

Table 55

Test Results - EUT In Powered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Interface Unit	Front	0.2 at 170 mm	0 at 170 mm
Interface Unit	Top	0 at 170 mm	0 at 170 mm
Interface Unit	Left Hand Side	0 at 170 mm	0.1 at 170 mm
Interface Unit	Right Hand Side	0 at 170 mm	0.1 at 170 mm
Interface Unit	Underside	0.2 at 170 mm	0.2 at 170 mm
Interface Unit	Rear	0 at 170 mm	0.1 at 170 mm

Table 56

Final Results

Unit Under Test	Standard Compass Safe Distance (mm)	Emergency Compass Safe Distance (mm)
Interface Unit	200`	200

Table 57

Test Results - EUT In Unpowered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Control Unit	Front	400	260
Control Unit	Top	480	300
Control Unit	Left Hand Side	400	250
Control Unit	Right Hand Side	350	250
Control Unit	Underside	450	200
Control Unit	Rear	550	250

Table 58

Test Results - EUT In Normalised State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Control Unit	Front	400	260
Control Unit	Top	480	300
Control Unit	Left Hand Side	400	250
Control Unit	Right Hand Side	350	250
Control Unit	Underside	450	200
Control Unit	Rear	550	250

Table 59

Test Results - EUT In Powered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Control Unit	Front	450	250
Control Unit	Top	500	300
Control Unit	Left Hand Side	350	270
Control Unit	Right Hand Side	500	280
Control Unit	Underside	500	280
Control Unit	Rear	500	300

Table 60

Final Results

Unit Under Test	Standard Compass Safe Distance (mm)	Emergency Compass Safe Distance (mm)
Control Unit	550	300

Table 61

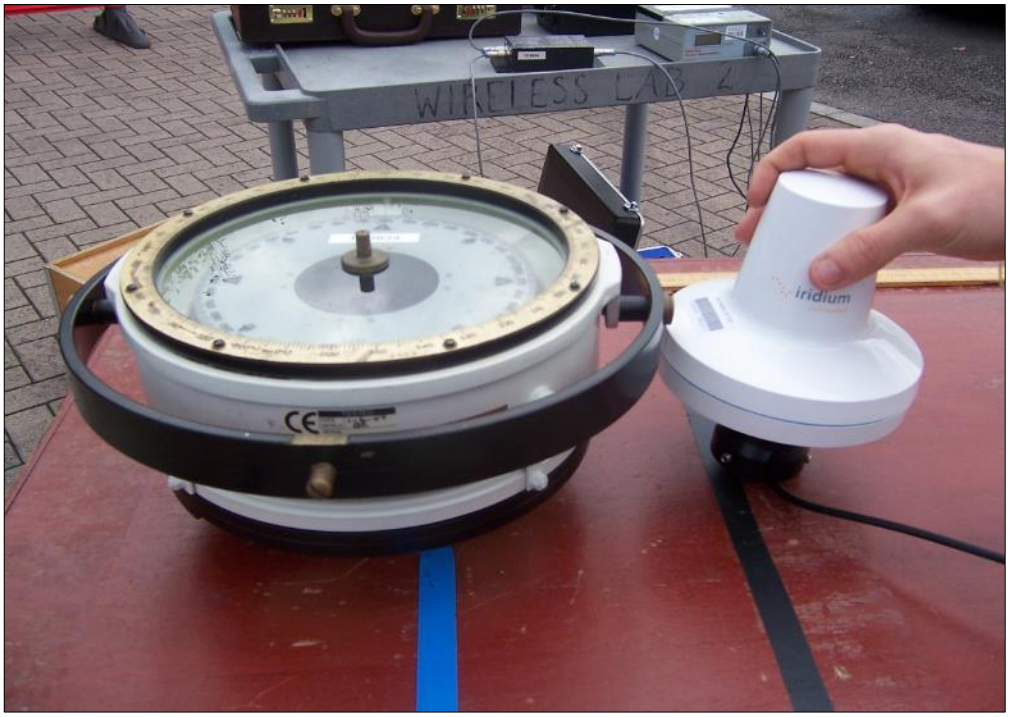

Figure 38 – Antenna Unit

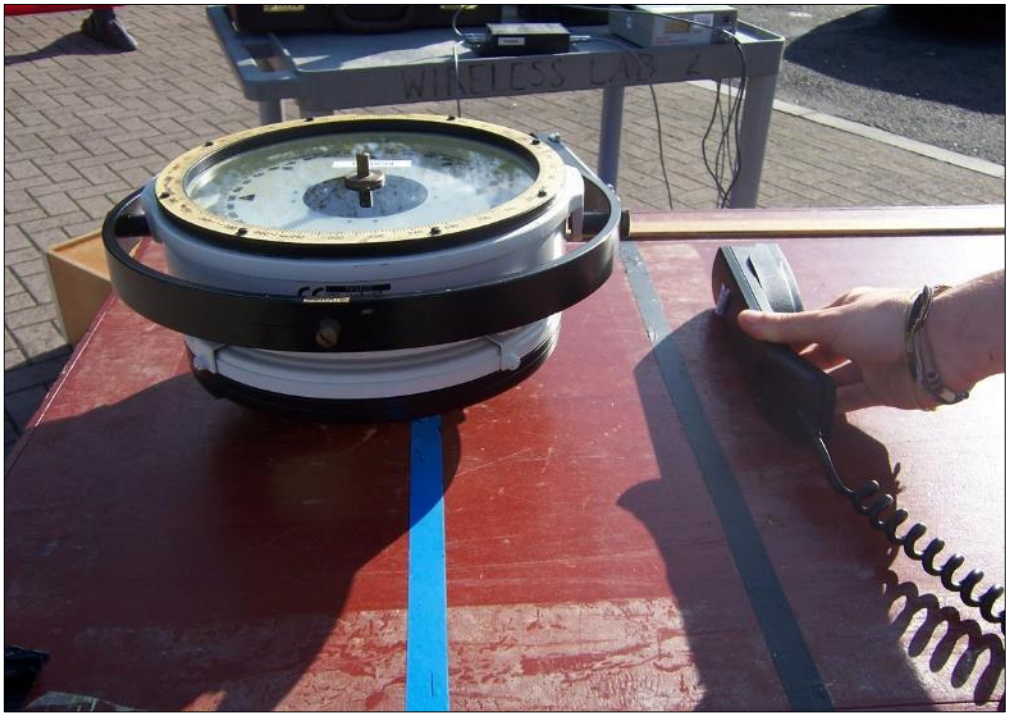

Figure 39 – Handset

Figure 40 - Switch Unit

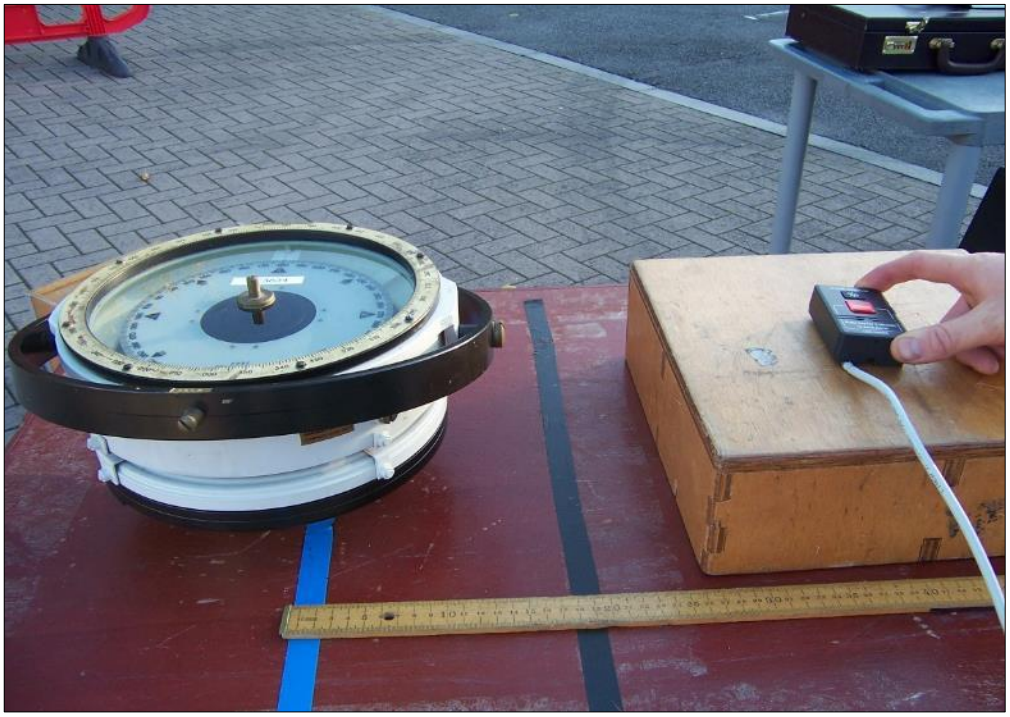

Figure 41 - Alarm Unit

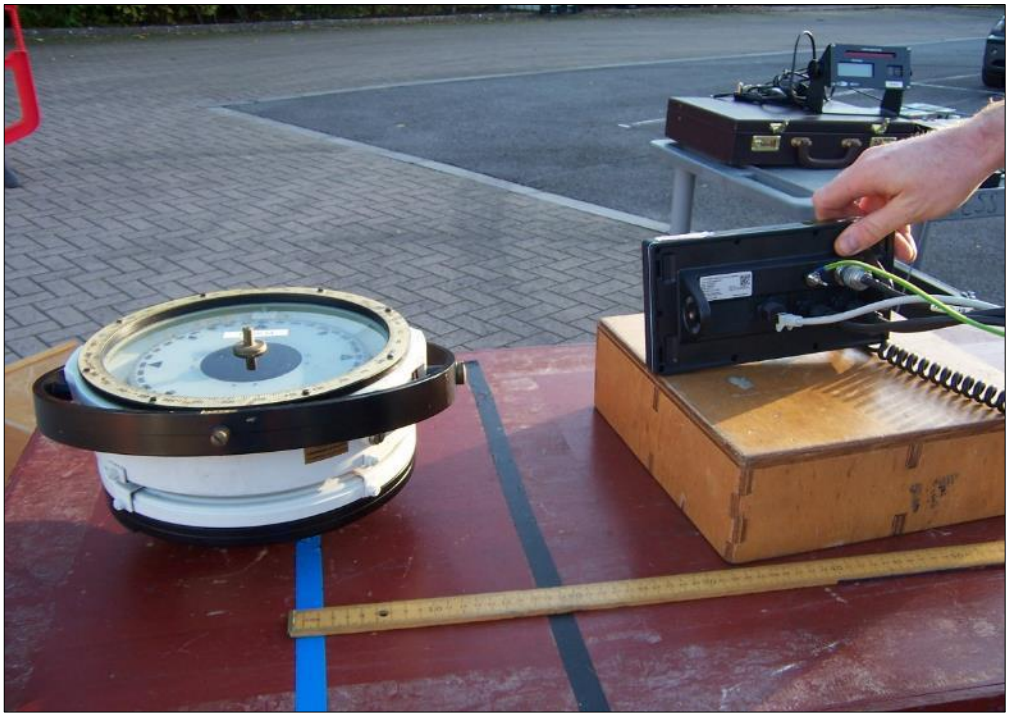

Figure 42 - Interface Unit

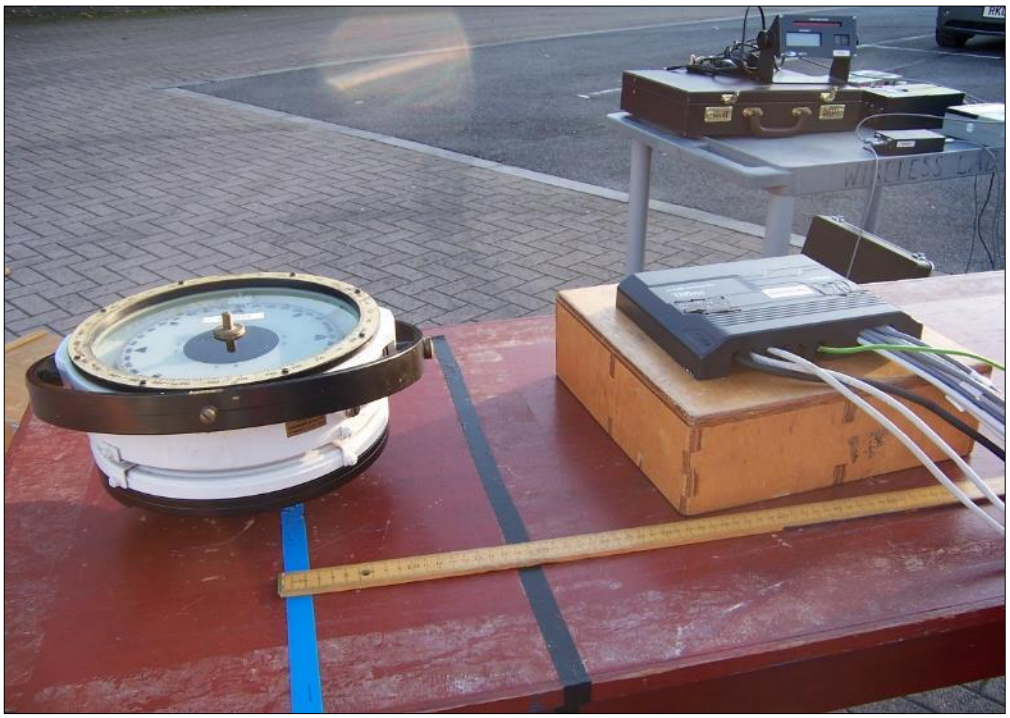

Figure 43 - Control Unit

Figure 44 - Test Setup

2.8.8 Test Location and Test Equipment Used

This test was carried out in the Open Area Facility

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Unit	Thurlby	PL320	288	-	TU
Sussex Helmholtz Coil	Various	88771	327	-	TU
Magnetometer	Bartington	MAG01	671	36	5-Jun-2021
Marine Binnacle Compass with Repeater Display	Cassens & Plath	Compass: Type 11	3834	-	TU

Table 62

TU – Traceability Unscheduled

3 Incident Reports

No incidents reports were raised.

4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Immunity To Electrostatic Discharge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2
Radiated Emissions	9 kHz to 30 MHz, Active Loop Antenna, ±3.4 dB 30 MHz to 2 GHz, Bilog Antenna, ±5.2 dB
Immunity to Power Supply Failure	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-11
Compass Safe Distance	± 0.1 °
Immunity to Fast Transients on A.C. Power, Signal and Control Lines	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-4
Immunity to Radiated Radio Frequencies	80 MHz to 2 GHz Test Amplitude ±2.0 dB
Immunity to Conducted Radio Frequency Disturbance	150 kHz to 80 MHz EM Clamp Method of Test, Amplitude ±3.1 dB CDN Method of Test, Amplitude ±1.2 dB BCI Clamp Method of Test, Amplitude ±1.1 dB Direct Injection Method of Test, Amplitude ±1.2 dB
Conducted Emissions	10 kHz to 30 MHz, LISN, ±3.7 dB

Table 63

Worst case error for both Time and Frequency measurement 12 parts in 10^6.

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2007, clause 4.4.3 and 4.5.1.