EMC Test Report

ACR Electronics
EPIRB RLB-44 (GlobalFix V5)

In accordance with IEC 61097-2: 2021

Prepared for: Ocean Signal Limited
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Document 75953445-03 Issue 01

SIGNATURE			
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NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Andrew Lawson	Chief Engineer, EMC	Authorised Signatory	26 September 2022

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 IEC 61097-2: Edition 4.0 2021-06 for the tests detailed in section 1.3.

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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	26 September 2022

Table 1

1.2 Introduction

Applicant	Ocean Signal Limited
Manufacturer	Ocean Signal Limited / ACR Electronics Inc
Model Number(s)	RLB-44 (GlobalFix V5)
Serial Number(s)	TA000016
Hardware Version(s)	Issue 01.00
Software Version(s)	N/A
Firmware Version(s)	500S-03885 Issue 00.03.00
Number of Samples Tested	1
Test Specification/Issue/Date	IEC 61097-2: Edition 4.0 2021-06
Test Plan/Issue/Date	Not applicable
Order Number Date	13429 16-September-2021
Date of Receipt of EUT	30-March-2022
Start of Test	06-May-2022
Finish of Test	12-May-2022
Name of Engineer(s)	Matthew Dawkins and Michael Mawby
Related Document(s)	IEC 61000-4-3: 1995 IEC 61000-4-2: 1995 IEC 60945: 2002 ISO 694: 2000

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with IEC 61097-2 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: RLB-44 (GlobalFix V5) in float free housing – EPIRB idle / RFiD active				
2.1	5.18 - IEC 60945 10.4	Immunity to Radiated Radio Frequencies	Pass	EN 61000-4-3: 1996
2.2	5.18 - IEC 60945 10.9	Immunity To Electrostatic Discharge	Pass	EN 61000-4-2: 2009
2.3	5.20 - IEC 60945 11.2	Compass Safe Distance	Pass	ISO 694: 2000
Configuration and Mode: RLB-44 (GlobalFix V5) standalone - EPIRB idle, RFID active				
2.2	5.18 - IEC 60945 10.9	Immunity To Electrostatic Discharge	Pass	EN 61000-4-2: 2009
Configuration and Mode: RLB-44 (GlobalFix V5) standalone - EPIRB active, RFID idle				
2.2	5.18 - IEC 60945 10.9	Immunity To Electrostatic Discharge	Pass	EN 61000-4-2: 2009

Table 2

1.4 Declaration of Build Status

MAIN EUT	
MANUFACTURING DESCRIPTION	Emergency Position Indicating Radio Beacon
MANUFACTURER	Ocean Signal Ltd, ACR Electronics Inc.
MODEL	RLB-44 (GlobalFix V5)
PART NUMBER	900S-03858
HARDWARE VERSION	Issue 01.00
SOFTWARE VERSION	Not Applicable
FIRMWARE VERSION	500S-03885 Issue 00.03.00
PSU VOLTAGE/FREQUENCY/CURRENT	9V
HIGHEST INTERNALLY GENERATED FREQUENCY	406.031 MHz
FCC ID (if applicable)	B66ACR-RLB-44
INDUSTRY CANADA ID (if applicable)	1322A-ACRRLB44E1E2
TECHNICAL DESCRIPTION (a brief technical description of the intended use and operation)	Emergency Position Indicating Radio Beacon incorporating 162 MHz AIS Man Overboard positioning, 406MHz Cospas Sarsat Satellite rescue and 121.5MHz homing capabilities.
COUNTRY OF ORIGIN	UK and USA
RF CHARACTERISTICS (if applicable)	
TRANSMITTER FREQUENCY OPERATING RANGE (MHz)	121.5MHz, 161.975MHz, 162.025 MHz & 406.031MHz
RECEIVER FREQUENCY OPERATING RANGE (MHz)	N/A
INTERMEDIATE FREQUENCIES	N/A
EMISSION DESIGNATOR(S): https://fccid.io/Emissions-Designator/	3K20A3X, 16K0GXW, 16K0G1D
MODULATION TYPES: (i.e. GMSK, QPSK)	Swept tone AM, GMSK, BPSK
OUTPUT POWER (W or dBm)	16 ±2dBm (121.5MHz), 31.5 ±0.5 dBm (AIS), 37dBm (406MHz)

I hereby declare that the information supplied is correct and complete.

Name: Mark Newton
Position held: Approvals Manager
Date: 15-June-2022

1.5 Product Information

1.5.1 Technical Description

The Equipment under test (EUT) was an ACR Electronics, EPIRB RLB-44 (GlobalFix V5)

The EUT was a 406 MHz emergency locating beacon with a 121.5 MHz homing transmitter and AIS signal locating function. The EUT is designed to be used to alert emergency services to aide rescue in grave and imminent danger. The device also contains an RFiD transmitter which can be used when the beacon is not active.

Figure 1 - Front View

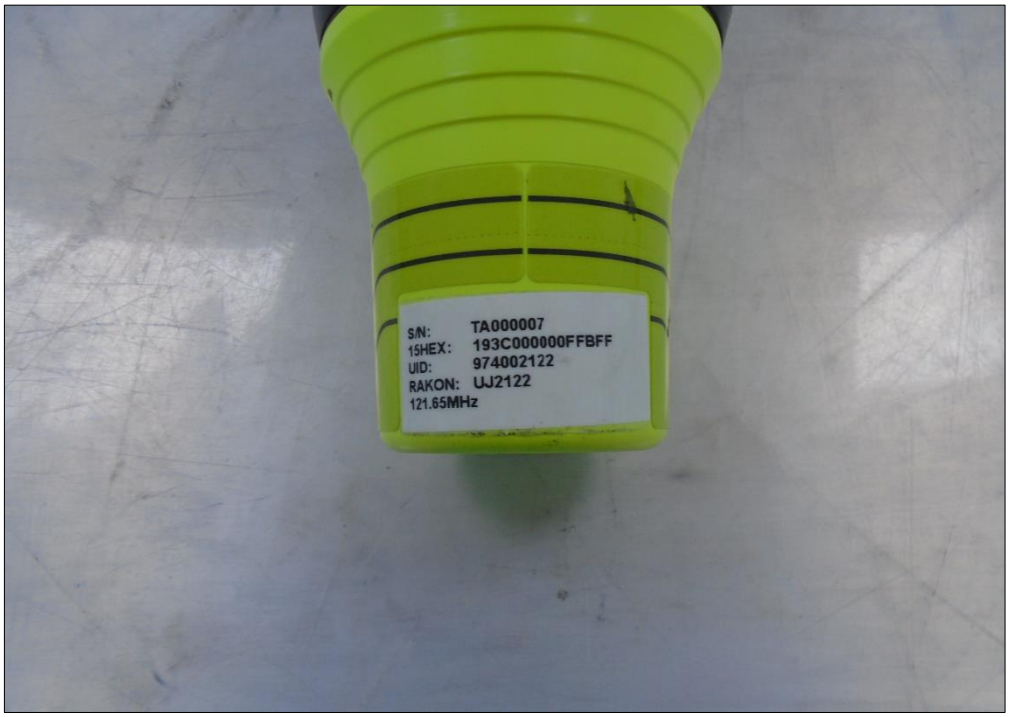

Figure 2 - Rating Plate

1.5.2 Test Configuration

Configuration	Description
RLB-44 (GlobalFix V5) in float free housing	The EUT was installed in its float free housing.
RLB-44 (GlobalFix V5) standalone	The EUT was outside of its float free housing.

Table 3

1.5.3 Modes of Operation

Mode	Description
EPIRB idle, RFiD active	The EUT was switched off with the RFiD active.
EPIRB active, RFiD idle	The EUT was switched on with the RFID idle.

Table 4

1.5.4 Monitoring of Performance

Mode	Description
EPIRB idle, RFiD active	A spectrum analyser was connected to an antenna inside the chamber to monitor for unintentional transmissions from the EUT. An RFID tag was scanned pre and post-test to ensure the EUT's RFiD capabilities were not affected by the testing.
EPIRB active, RFiD idle	A beacon tester was used to monitor the EUT's 406 MHz transmissions including a check of GPS position. A spectrum analyser was connector to an antenna inside the chamber to confirm the presence of the 121 MHz homing transmitter and the 162 MHz AIS locating signal. An RFID tag was scanned pre and post-test to ensure the EUT's RFiD capabilities were not affected by the testing.

Table 5

1.5.5 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:

EPIRB active, RFiD idle - The EUT shall operate as intended by constantly transmitting a 121.5 MHz signal and every 50 seconds transmit a 406 MHz signal.

EPIRB idle, RFiD active - The EUT shall not unintentionally power on or transmit throughout the duration of the test.

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:

EPIRB active, RFiD idle - The EUT shall operate as intended by constantly transmitting a 121.5 MHz signal and every 50 seconds transmit a 406 MHz signal.

EPIRB idle, RFiD active - The EUT shall not unintentionally power on or transmit throughout the duration of the test.

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: RLB-44 (GlobalFix V5), Serial Number: TA000016			
0	As supplied	As supplied	As supplied
1	Update to fix GNSS timings	Ocean Signal Ltd	22/02/2022
2*	AIS True Heading parameter change	Ocean Signal Ltd	07 April 2022

Table 6

*All testing associated with this report was carried out in modification state 2.

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: RLB-44 (GlobalFix V5) in float free housing - EPIRB idle / RFiD active		
Immunity to Radiated Radio Frequencies	Matthew Dawkins	UKAS
Immunity To Electrostatic Discharge	Matthew Dawkins	UKAS
Compass Safe Distance	Matthew Dawkins	UKAS
Configuration and Mode: RLB-44 (GlobalFix V5) standalone - EPIRB idle, RFID active		
Immunity To Electrostatic Discharge	Matthew Dawkins	UKAS
Configuration and Mode: RLB-44 (GlobalFix V5) standalone - EPIRB active, RFID idle		
Immunity To Electrostatic Discharge	Michael Mawby	UKAS

Table 7

Office Address:

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Immunity to Radiated Radio Frequencies

2.1.1 Specification Reference

IEC 61097-2, Clause 5.18
IEC 60945 10.4

2.1.2 Equipment Under Test and Modification State

RLB-44 (GlobalFix V5), S/N: TA000016 - Modification State 2

2.1.3 Date of Test

06-May-2022 to 09-May-2022

2.1.4 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.

2.1.5 Environmental Conditions

Ambient Temperature	21.6 - 22.5 °C
Relative Humidity	52.1 - 54.8 %

2.1.6 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 8

2.1.7 Test Results

Results for Configuration and Mode: RLB-44 (GlobalFix V5) in float free housing - EPIRB idle, RFiD active.

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	9 s			
Modulation	400Hz Sine 80% AM			
Frequency Range	Test Face	Antenna Polarisation	Test Level	Result
80 MHz to 1 GHz	X, Y and Z	Horizontal and Vertical	12.6 V/m (10 + MU)	Pass
1 GHz to 2 GHz	X, Y and Z	Horizontal and Vertical	12.6 V/m (10 + MU)	Pass

Table 9

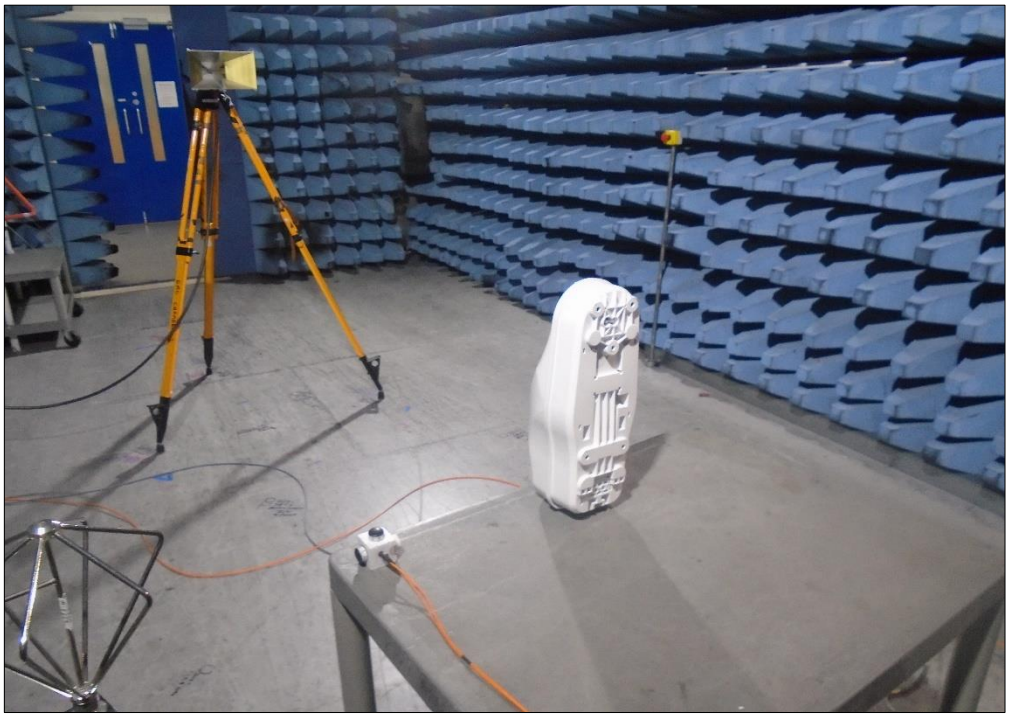

Figure 3 - Test Setup - Above 1 GHz

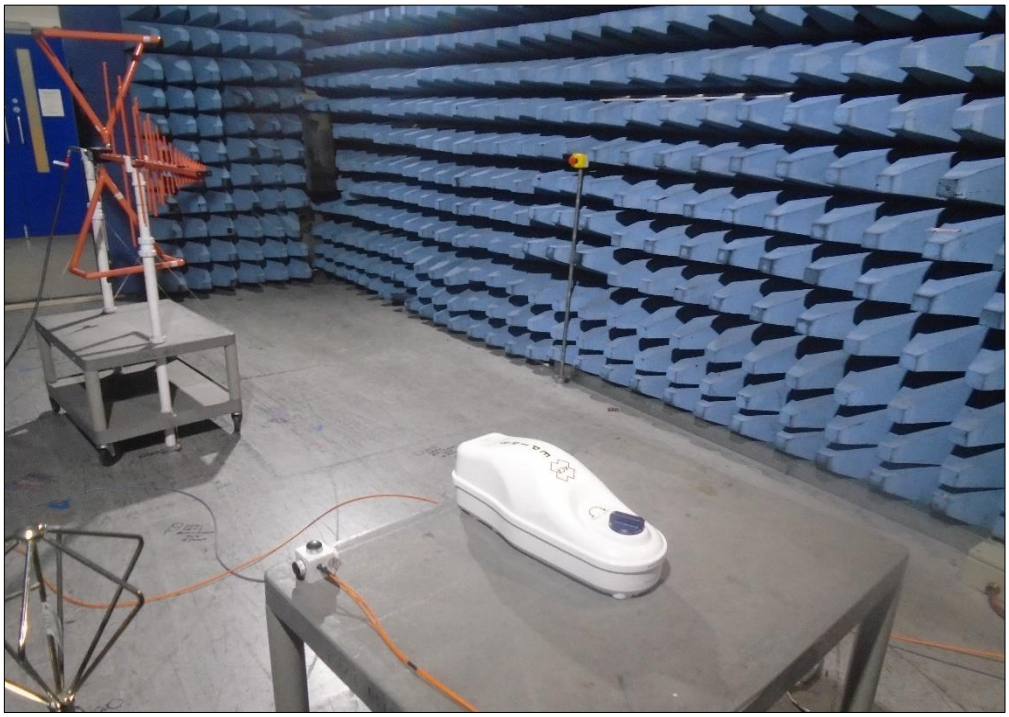

Figure 4 - Test Setup - Below 1 GHz

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 Expires
Screened Room (2)	Rainford	Rainford	1542	12	23-Mar-2023
Radiated Immunity Test Software	Amp Research	EMCWare V4.0.7	4899	-	Software
Signal Generator (9 kHz to 6 GHz)	Rohde & Schwarz	SMB 100A	3500	12	25-Apr-2023
Amplifier (80 MHz to 1 GHz)	Amp Research	250W1000A	3029	-	TU
Amplifier (1 GHz to 2.5 GHz)	Thorn	PTC6341	2069	-	TU
Amplifier (2.5 GHz to 8 GHz)	Thorn	PTC6343	2068	-	TU
Directional Coupler	Amp Research	DC6180	283	-	TU
Power Sensor (100 kHz to 6 GHz)	Rohde & Schwarz	NRV-Z4	3815	-	TU
Power Meter	Rohde & Schwarz	NRVD	747	-	TU
Antenna (Bilog, 30 MHz to 1 GHz)	Schaffner	CBL6143	322	-	TU
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	-	TU
Laser Powered Electric Field Sensor	Dare Development	RadiSense VI - CTR1001A	3209	-	TU

Table 10

TU - Traceability Unscheduled

2.2 Immunity To Electrostatic Discharge

2.2.1 Specification Reference

IEC 61097-2, Clause 5.18
IEC 60945 10.9

2.2.2 Equipment Under Test and Modification State

RLB-44 (GlobalFix V5), S/N: TA000016 - Modification State 2

2.2.3 Date of Test

10-May-2022

2.2.4 Test Method

The equipment under test including associated cabling was configured on a horizontal coupling plane fitted with a 0.5mm 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.

2.2.5 Environmental Conditions

Ambient Temperature	19.4 °C
Relative Humidity	60.0 %

2.2.6 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 11

2.2.7 Test Results

Results for Configuration and Mode: RLB-44 (GlobalFix V5) in float free housing - EPIRB idle, RFID active.

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 12

Results for Configuration and Mode: RLB-44 (GlobalFix V5) standalone - EPIRB idle, RFID active.

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 13

Results for Configuration and Mode: RLB-44 (GlobalFix V5) standalone - EPIRB active, RFID idle.

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 14

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 15

Figure 5 - ESD Test Positions

Figure 6 - ESD Test Positions

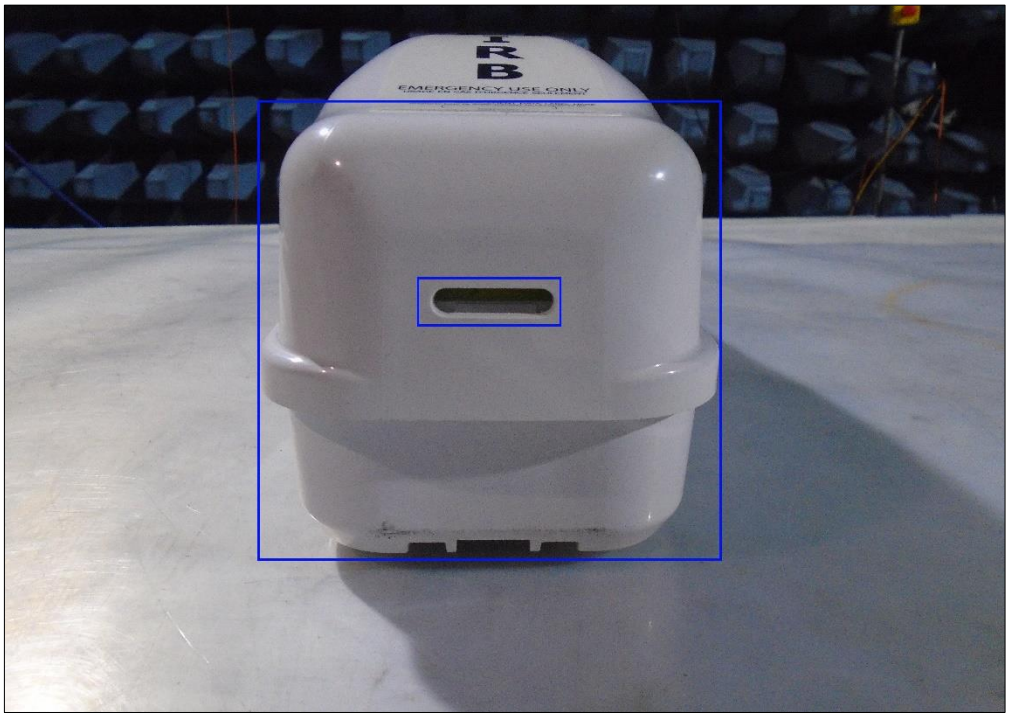

Figure 7 - ESD Test Positions

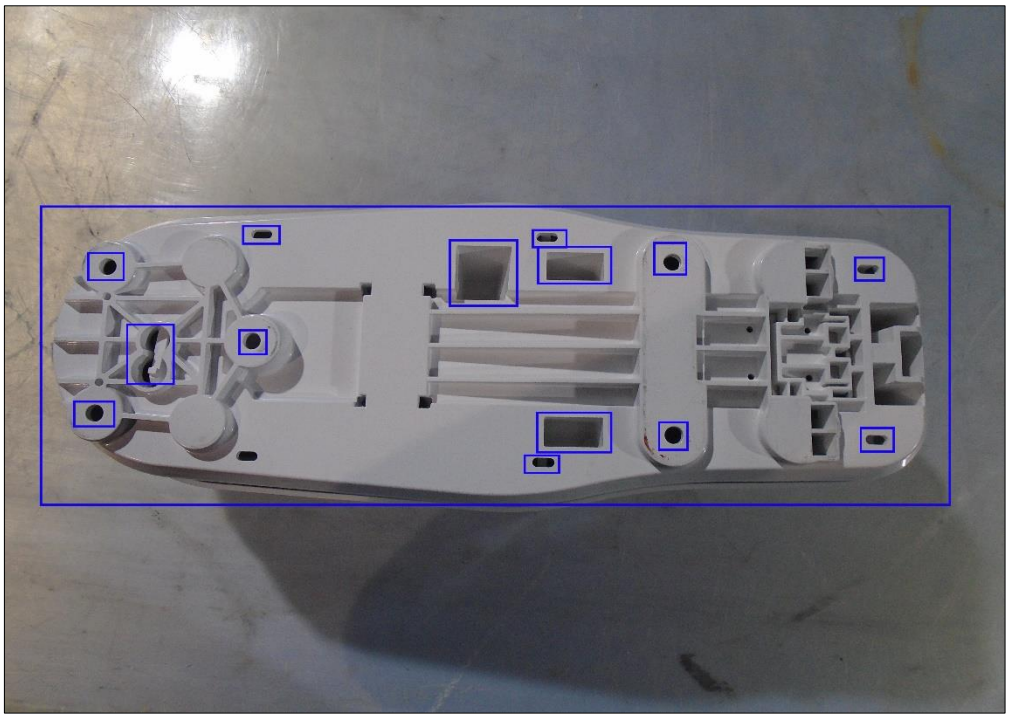

Figure 8 - ESD Test Positions

Figure 9 - ESD Test Positions

Figure 10 - ESD Test Positions

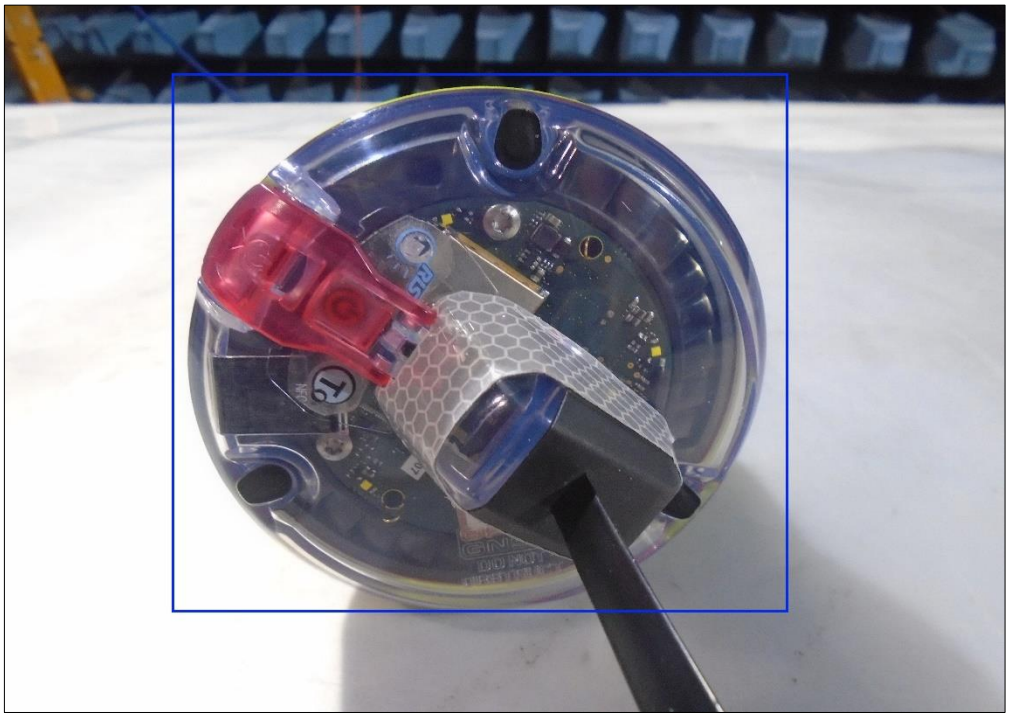

Figure 11 - ESD Test Positions

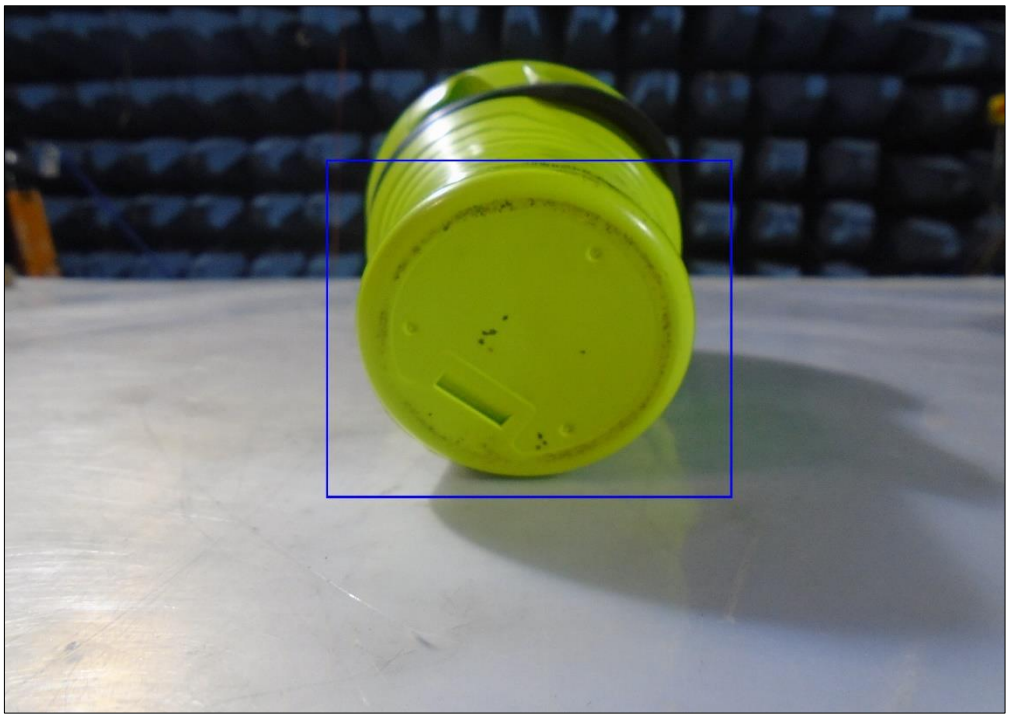

Figure 12 - ESD Test Positions

Figure 13 - ESD Test Positions

Figure 14 - ESD Test Positions

Figure 15 - ESD Test Positions

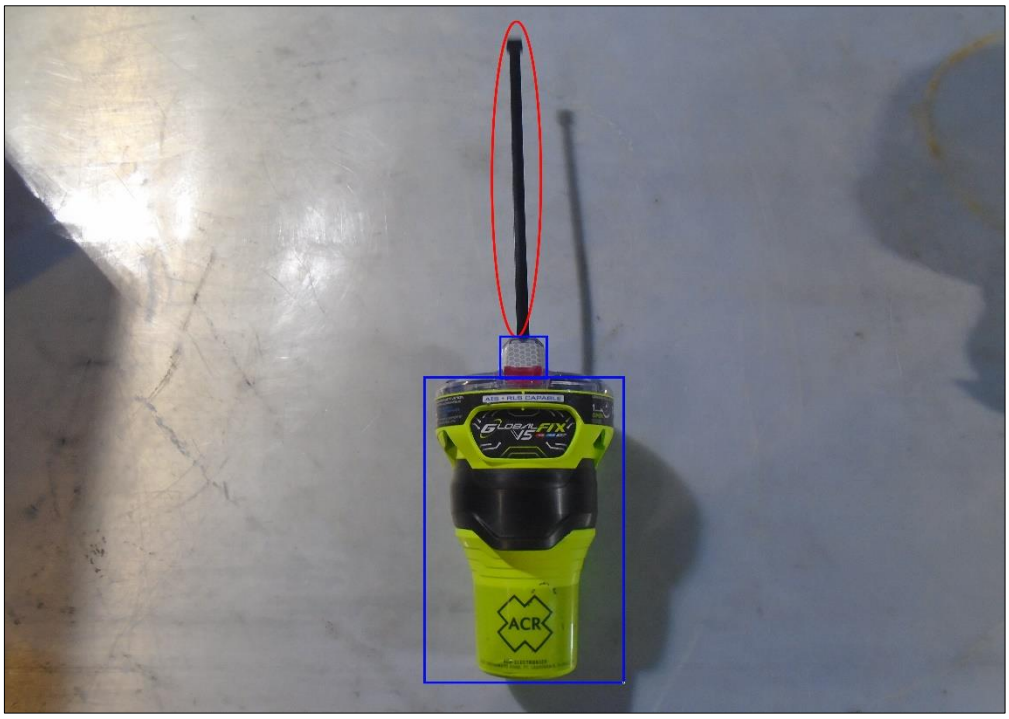

Figure 16 - ESD Test Positions

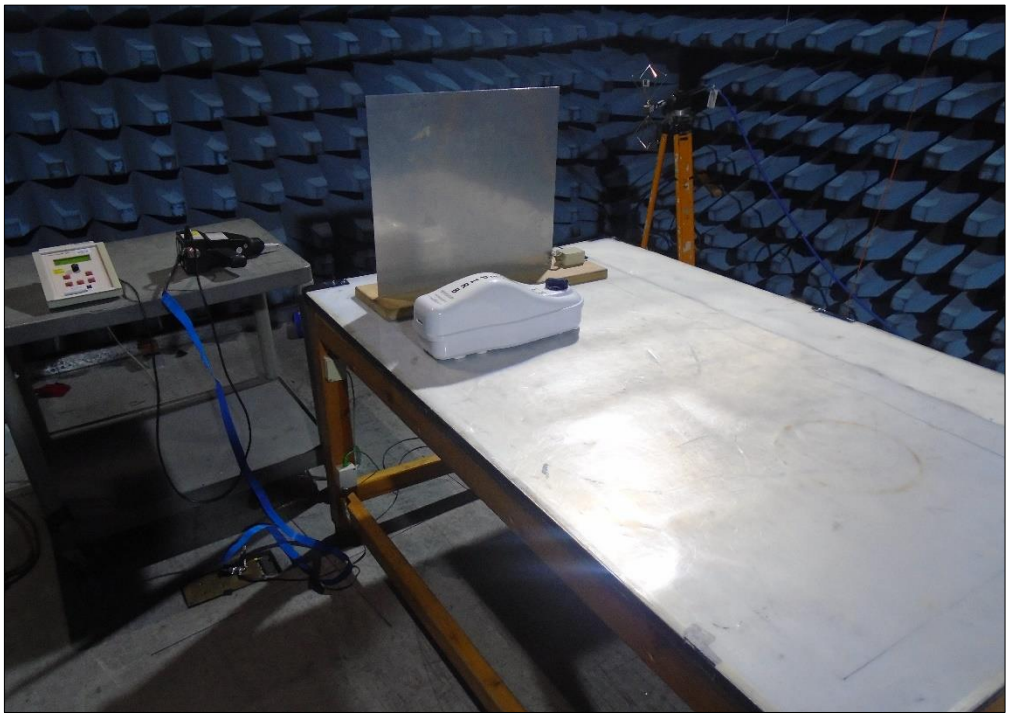

Figure 17 - Test Setup

2.2.8 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 Expires
Screened Room (2)	Rainford	Rainford	1542	12	23-Mar-2023
ESD Gun	Schloder	SESD 30000	4319	12	02-Nov-2022
ESD Generator	Schloder	SESD 30000	4724	12	23-Aug-2022

Table 16

TU - Traceability Unscheduled

2.3 Compass Safe Distance

2.3.1 Specification Reference

IEC 61097-2, Clause 5.20
IEC 60945 11.2

2.3.2 Equipment Under Test and Modification State

RLB-44 (GlobalFix V5), S/N: TA000016 - Modification State 2

2.3.3 Date of Test

12-May-2022

2.3.4 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 50mm or 100mm.

2.3.5 Environmental Conditions

Ambient Temperature	19.4 °C
Relative Humidity	53.9 %

2.3.6 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.

2.3.7 Test Results

Results for Configuration and Mode: RLB-44 (GlobalFix V5) in float free housing - EPIRB idle, RFiD active.

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

Detailed results are shown below.

Deflection Calculation Table:

Horizontal Maximum Flux Density, Magnetic North (H)	Standard Compass Deviation Limit (5.4/H in Degrees)	Emergency Compass Deviation Limit (18/H in Degrees)
19.25	0.3	0.9

Table 17

Test Results

Equipment Under Test	EUT Face Under Test	Un-Powered State		Normalised		Powered State	
		Distance from Compass Centre (mm) at A° deflection	Distance from Compass Centre (mm) at B° deflection	Distance from Compass Centre (mm) at A° deflection	Distance from Compass Centre (mm) at B° deflection	Distance from Compass Centre (mm) at A° deflection	Distance from Compass Centre (mm) at B° deflection
RLB-44 (GlobalFix V5)	Front Face	200	170	180	170	230	170
RLB-44 (GlobalFix V5)	Top Face	770	510	760	460	170	170
RLB-44 (GlobalFix V5)	Left Face	1000	710	940	700	170	170
RLB-44 (GlobalFix V5)	Right Face	1000	650	940	730	310	230
RLB-44 (GlobalFix V5)	Bottom Face	700	450	620	470	230	170
RLB-44 (GlobalFix V5)	Rear Face	250	210	250	230	490	250

Table 18

Final Results

Unit Under Test	Standard Compass Safe Distance (mm)	Emergency Compass Safe Distance (mm)
Saturn 5	1000	750

Table 19

Figure 18 - Test Setup

Figure 19 – RLB-44 (GlobalFix V5) - Front Face

Figure 20 - EUT Normalising

2.3.8 Test Location and Test Equipment Used

This test was carried out in EMC Open Area Test Site.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Sussex Helmholtz Coil	Various	88771	327	-	TU
Magnetometer	Bartington	MAG01	671	36	05-Jul-2024
Power Supply Unit	Farnell	TSV-70	2043	12	O/P Mon
Marine Binnacle Compass with Repeater Display	Cassens & Plath	Compass: Type 11	3834	-	TU

Table 20

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	29-Oct-2022
Antenna (Bicon)	Schwarzbeck	UBAA 9115	1414	24	13-Aug-2023
Multi-GNSS Simulator (GPS)	Spirent	GSS6700	4596	12	20-Aug-2022
2 Meter Cable	Teledyne	PR90-088-2MTR	5196	12	31-Aug-2022
Tester (Beacon)	WS Technologies	BT200-1100Y	5395	-	TU
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5473	12	07-Apr-2023
Cable (N-Type to N-Type, 2 m)	Junkosha	MWX221-02000AMSAMS/B	5726	6	11-Aug-2022

Table 21

TU - Traceability Unscheduled

4 Incident Reports

No incidents reports were raised.

5 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Immunity to Radiated Radio Frequencies	80 MHz to 2 GHz Test Amplitude ±2.0 dB
Immunity To Electrostatic Discharge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2
Compass Safe Distance	± 0.1 °

Table 22

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. (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.