

# EMC Test Report

ACR Electronics Inc.  
AIS SART, Model: Pathfinder AIS  
Brand Variant: Ocean Signal Ltd.  
AIS SART, Model: S200



In accordance with IEC 60945

Prepared for: Ocean Signal Ltd.  
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Margate  
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United Kingdom

## COMMERCIAL-IN-CONFIDENCE

Document 75959389-01 Issue 02

### SIGNATURE

| NAME          | JOB TITLE           | RESPONSIBLE FOR      | ISSUE DATE        |
|---------------|---------------------|----------------------|-------------------|
| Andrew Lawson | Chief Engineer, EMC | Authorised Signatory | 08 September 2025 |

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 60945: 2002 C1: 2008 for the tests detailed in section 1.3.



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## Contents

|          |                                             |           |
|----------|---------------------------------------------|-----------|
| <b>1</b> | <b>Report Summary .....</b>                 | <b>2</b>  |
| 1.1      | Report Modification Record.....             | 2         |
| 1.2      | Introduction.....                           | 2         |
| 1.3      | Brief Summary of Results .....              | 3         |
| 1.4      | Declaration of Build Status .....           | 4         |
| 1.5      | Product Information .....                   | 5         |
| 1.6      | Deviations from the Standard.....           | 8         |
| 1.7      | EUT Modification Record .....               | 8         |
| 1.8      | Test Location .....                         | 9         |
| <b>2</b> | <b>Test Details .....</b>                   | <b>10</b> |
| 2.1      | Radiated Emissions.....                     | 10        |
| 2.2      | Immunity to Radiated Radio Frequencies..... | 20        |
| 2.3      | Immunity To Electrostatic Discharge.....    | 24        |
| 2.4      | Compass Safe Distance.....                  | 30        |
| <b>3</b> | <b>Test Equipment Information .....</b>     | <b>34</b> |
| 3.1      | General Test Equipment Used .....           | 34        |
| <b>4</b> | <b>Incident Reports .....</b>               | <b>35</b> |
| <b>5</b> | <b>Measurement Uncertainty .....</b>        | <b>36</b> |



## 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                                                 | 30-July-2025  |
| 2     | Correction to correlation of Brand Variant to Model number. | 08-Sept-2025  |

**Table 1**

### 1.2 Introduction

|                                  |                                                                                   |
|----------------------------------|-----------------------------------------------------------------------------------|
| Applicant                        | Ocean Signal Ltd.                                                                 |
| Manufacturer                     | ACR Electronics Inc / Ocean Signal Ltd.                                           |
| Model Number Tested              | Pathfinder AIS                                                                    |
| Manufacturer Declared Variant(s) | S200*                                                                             |
| Serial Number(s)                 | TA000016 (TUV Ref: TSR0004) (Pathfinder AIS: Radiated Unit)                       |
| Hardware Version(s)              | 01.00 / 01.00                                                                     |
| Software Version(s)              | 01.00 / 01.00                                                                     |
| Number of Samples Tested         | 1                                                                                 |
| Test Specification/Issue/Date    | IEC 60945: 2002 C1: 2008                                                          |
| Order Number                     | P8980 - QAF                                                                       |
| Date                             | 14-September-2023                                                                 |
| Date of Receipt of EUT           | 01-February-2024                                                                  |
| Start of Test                    | 28-February-2024                                                                  |
| Finish of Test                   | 20-March-2024                                                                     |
| Name of Engineer(s)              | Callum Pennells, Muhammad Enam and Connor Lee                                     |
| Related Document(s)              | CISPR 16-1-4: 2007<br>IEC 61000-4-3: 2006<br>IEC 61000-4-2: 2001<br>ISO 694: 2000 |

\*Manufacturer declared variants: Refer to documents "Variant Relation Declaration - AIS SART Model Variants.pdf" and "921S-06454 Issue 01.00 AIS SART Variant Comparison.pdf".



### 1.3 Brief Summary of Results

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

| Section                                             | Specification Clause | Test Description                       | Result | Comments/Base Standard |
|-----------------------------------------------------|----------------------|----------------------------------------|--------|------------------------|
| Configuration and Mode: Battery Powered - Idle      |                      |                                        |        |                        |
| 2.1                                                 | 9.3                  | Radiated Emissions                     | Pass   | CISPR 16-1-4: 2007     |
| Configuration and Mode: Battery Powered - Operating |                      |                                        |        |                        |
| 2.2                                                 | 10.4                 | Immunity to Radiated Radio Frequencies | Pass   | IEC 61000-4-3: 2006    |
| 2.3                                                 | 10.9                 | Immunity To Electrostatic Discharge    | Pass   | IEC 61000-4-2: 2001    |
| 2.4                                                 | 11.2                 | Compass Safe Distance                  | Pass   | ISO 694: 2000          |

**Table 2**



#### 1.4 Declaration of Build Status

| MAIN EUT                                                                                                               |                                                                    |  |  |
|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|--|--|
| MANUFACTURING DESCRIPTION                                                                                              | AIS SART                                                           |  |  |
| MANUFACTURER                                                                                                           | Ocean Signal Ltd. / ACR Electronics Inc.                           |  |  |
| MODEL                                                                                                                  | S200 / Pathfinder AIS                                              |  |  |
| PART NUMBER                                                                                                            | 900S-04810 / 900S-05232                                            |  |  |
| HARDWARE VERSION                                                                                                       | 01.00 / 01.00                                                      |  |  |
| SOFTWARE VERSION                                                                                                       | 01.00 / 01.00                                                      |  |  |
| PSU VOLTAGE/FREQUENCY/CURRENT                                                                                          | 8V                                                                 |  |  |
| HIGHEST INTERNALLY GENERATED FREQUENCY                                                                                 | 162.025 MHz                                                        |  |  |
| FCC ID (if applicable)                                                                                                 | XYES200                                                            |  |  |
| INDUSTRY CANADA ID (if applicable)                                                                                     | 9296A-S200                                                         |  |  |
| TECHNICAL DESCRIPTION<br>(a brief technical description of the intended use and operation)                             | Search And Rescue Transponder operating in the AIS frequency band. |  |  |
| COUNTRY OF ORIGIN                                                                                                      | United Kingdom                                                     |  |  |
| RF CHARACTERISTICS (if applicable)                                                                                     |                                                                    |  |  |
| TRANSMITTER FREQUENCY OPERATING RANGE (MHz)                                                                            | 161.975MHz - 162.025 MHz                                           |  |  |
| RECEIVER FREQUENCY OPERATING RANGE (MHz)                                                                               | N/A                                                                |  |  |
| INTERMEDIATE FREQUENCIES                                                                                               | N/A                                                                |  |  |
| EMISSION DESIGNATOR(S):<br><a href="https://fccid.io/Emissions-Designator/">https://fccid.io/Emissions-Designator/</a> | 16K0GXW                                                            |  |  |
| MODULATION TYPES: (i.e. GMSK, QPSK)                                                                                    | GMSK                                                               |  |  |
| OUTPUT POWER (W or dBm)                                                                                                | 30+-3dBm                                                           |  |  |
| SEPARATE BATTERY/POWER SUPPLY (if applicable)                                                                          |                                                                    |  |  |
| MANUFACTURING DESCRIPTION                                                                                              | Battery Module Assy LB3S: SART / Battery Module Assy: ACR SART     |  |  |
| MANUFACTURER                                                                                                           | Ocean Signal Ltd. / ACR Electronics Inc.                           |  |  |
| TYPE                                                                                                                   | Lithium/Iron Disulfide (Li/FeS2)                                   |  |  |
| PART NUMBER                                                                                                            | 901S-00325 / 901S-02016                                            |  |  |
| PSU VOLTAGE/FREQUENCY/CURRENT                                                                                          | 8V                                                                 |  |  |
| COUNTRY OF ORIGIN                                                                                                      | United Kingdom                                                     |  |  |
| MODULES (if applicable)                                                                                                |                                                                    |  |  |
| MANUFACTURING DESCRIPTION                                                                                              |                                                                    |  |  |
| MANUFACTURER                                                                                                           |                                                                    |  |  |
| TYPE                                                                                                                   |                                                                    |  |  |
| POWER                                                                                                                  |                                                                    |  |  |
| FCC ID                                                                                                                 |                                                                    |  |  |
| INDUSTRY CANADA ID                                                                                                     |                                                                    |  |  |
| EMISSION DESIGNATOR                                                                                                    |                                                                    |  |  |
| DHSS/FHSS/COMBINED OR OTHER                                                                                            |                                                                    |  |  |
| COUNTRY OF ORIGIN                                                                                                      |                                                                    |  |  |
| ANCILLARIES (if applicable)                                                                                            |                                                                    |  |  |
| MANUFACTURING DESCRIPTION                                                                                              | SART Optional 1m Mounting Pole                                     |  |  |
| MANUFACTURER                                                                                                           | Ocean Signal Ltd                                                   |  |  |
| TYPE                                                                                                                   | -                                                                  |  |  |
| PART NUMBER                                                                                                            | 711S-01802                                                         |  |  |
| SERIAL NUMBER                                                                                                          | -                                                                  |  |  |
| COUNTRY OF ORIGIN                                                                                                      | China                                                              |  |  |

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

*Stefan Kennedy*

Name: Stefan Kennedy  
Position held: R&D Director  
Date: 30-06-2025

## 1.5 Product Information

### 1.5.1 Technical Description

The Equipment under test (EUT) was an ACR Electronics Pathfinder AIS (Automatic Identification System) SART (Search and Rescue Transponder).

The primary function of the EUT is to provide location data in emergencies.



**Figure 1 - Front Face\***

\*The EUT is electrically identical to the Ocean Signal S200 AIS SART. See Section 1.4.



Figure 2 - Rear Face



Figure 3 - Right Face



Figure 4 - Left Face

1.5.2 Test Configuration

| Configuration   | Description                                           |
|-----------------|-------------------------------------------------------|
| Battery Powered | The EUT was powered from its own internal 6 V battery |

Table 3

1.5.3 Modes of Operation

| Mode      | Description                                                     |
|-----------|-----------------------------------------------------------------|
| Operating | The EUT was powered and transmitting at 161.975 and 162.025 MHz |
| Idle      | The EUT's intentional transmitters were turned off.             |

Table 4

1.5.4 Monitoring of Performance

| Mode      | Description                                                                                                                                                                                           |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating | An AIS receiver was setup to log NMEA sentences. These were then checked post-test.<br>A spectrum analyser and antenna were used to confirm that the EUT was transmitting at 161.975 and 162.025 MHz. |
| Idle      | The EUT was monitored for unintentional transmissions using an antenna and spectrum analyser.                                                                                                         |

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:**

| Mode      | Description                                                                                                |
|-----------|------------------------------------------------------------------------------------------------------------|
| Operating | The EUT will transmit 8 times a minute at regular intervals uninterrupted.                                 |
| Idle      | The EUT should not unintentionally transmit or change operating state throughout the duration of the test. |

**Table 6**

### 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:**

| Mode      | Description                                                                                                                                               |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating | The EUT will transmit 8 times a minute at regular intervals. The EUT can stop transmitting, providing it self-recovers on completion of test application. |
| Idle      | The EUT should not unintentionally transmit or change operating state throughout the duration of the test.                                                |

**Table 7**

## 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: Pathfinder AIS, Serial Number: TA000016 (Radiated Unit) |                                                 |                        |                          |
| 0                                                              | As supplied by the customer                     | Not Applicable         | Not Applicable           |

**Table 8**



## 1.8 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

| Test Name                                           | Name of Engineer(s)               | Accreditation |
|-----------------------------------------------------|-----------------------------------|---------------|
| Configuration and Mode: Battery Powered - Operating |                                   |               |
| Radiated Emissions                                  | Callum Pennells and Muhammad Enam | UKAS          |
| Immunity to Radiated Radio Frequencies              | Callum Pennells                   | UKAS          |
| Immunity To Electrostatic Discharge                 | Callum Pennells                   | UKAS          |
| Compass Safe Distance                               | Connor Lee                        | UKAS          |

**Table 9**

Office Address:

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

## 2 Test Details

### 2.1 Radiated Emissions

#### 2.1.1 Specification Reference

IEC 60945, Clause 9.3

#### 2.1.2 Equipment Under Test and Modification State

Model: Pathfinder AIS, S/N: TA000016 - Modification State 0

#### 2.1.3 Date of Test

28-February-2024 to 29-February-2024

#### 2.1.4 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 3 m 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.

#### 2.1.5 Environmental Conditions

Ambient Temperature 19.5 - 20.4 °C  
Relative Humidity 42.1 - 44.3 %  
Atmospheric Pressure 994.0 - 998.0 mbar

#### 2.1.6 Specification Limits

| Required Specification Limits – 3 m Measuring Distance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------|
| Frequency Range (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Quasi-peak (dBµV/m) | Peak (dBµV/m)     |
| 0.15 to 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 80 – 52             | N/A               |
| 0.3 to 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 52 – 34             | N/A               |
| 30 to 2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 54                  | N/A               |
| 156 to 165 <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 24                  | 30 <sup>(3)</sup> |
| <b>Supplementary Information:</b><br>Note 1. 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.<br>Note 2. 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.<br>Note 3. Alternatively, for the frequency band 156 MHz to 165 MHz, a peak receiver or a frequency analyser may be used, in accordance with the agreement between the manufacturer and the test house. |                     |                   |

Table 10

## 2.1.7 Test Results

### Results for Configuration and Mode: Battery Powered - Idle

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

Detailed results are shown below.

Applied Supply Voltage: 6 V DC

Frequency Range of Test: 0.15 MHz to 30 MHz

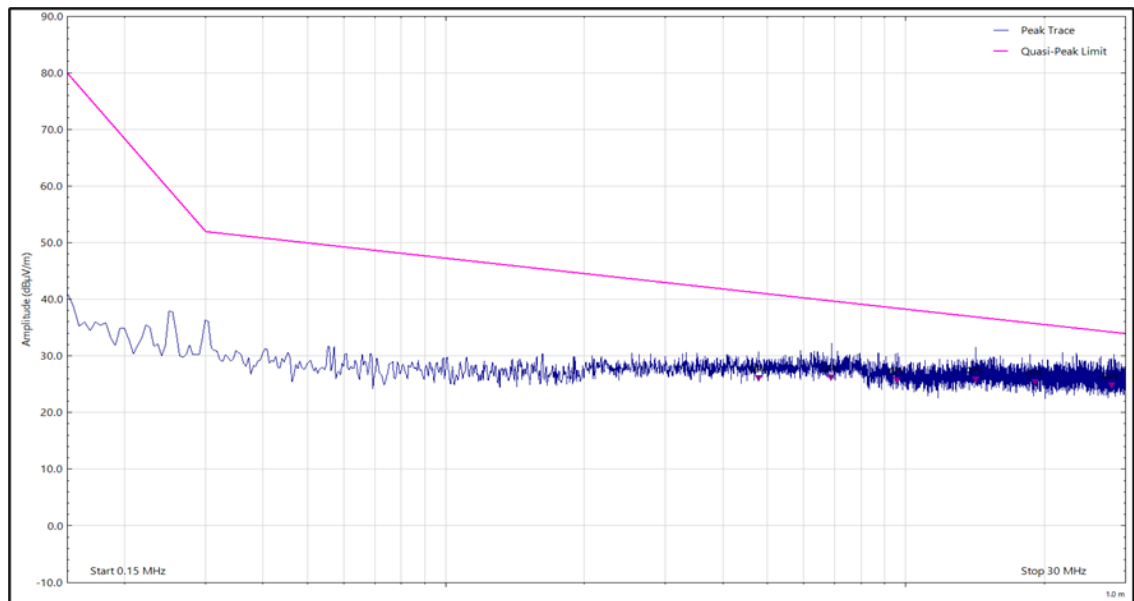
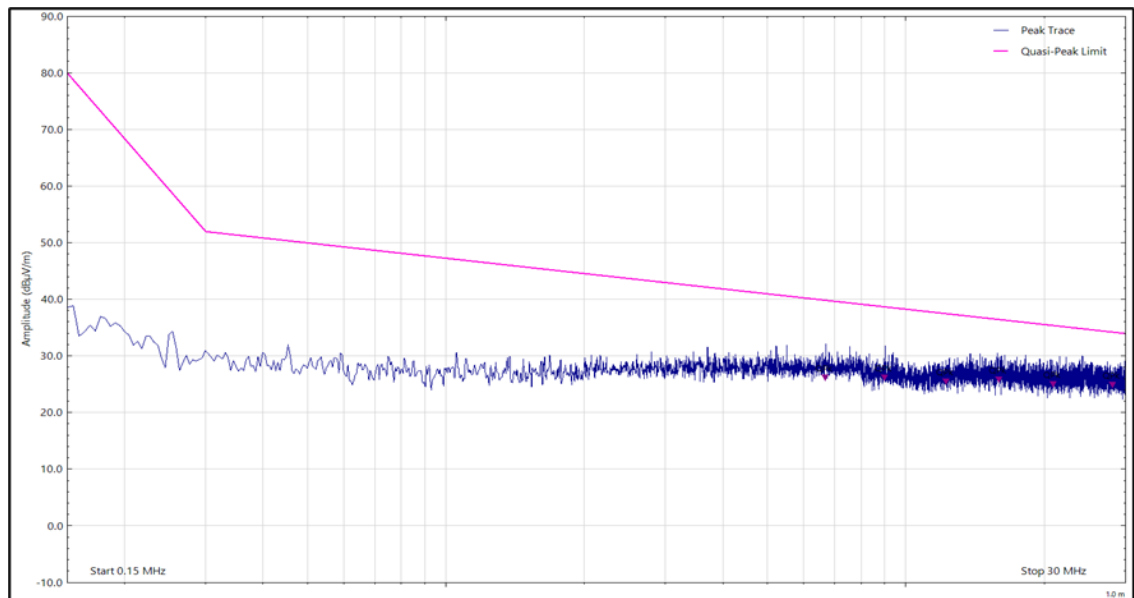


Figure 5 - Graphical Results - Face On Polarisation

| Frequency (MHz) | Level (dBμA/m) | Limit (dBμA/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation |
|-----------------|----------------|----------------|-------------|----------|-----------|-------------|--------------|
| 4.781           | 25.20          | 41.20          | -16.00      | Q-Peak   | 101       | 100         | Horizontal   |
| 6.880           | 25.36          | 39.80          | -14.44      | Q-Peak   | 344       | 100         | Horizontal   |
| 9.557           | 24.95          | 38.50          | -13.55      | Q-Peak   | 337       | 153         | Horizontal   |
| 14.184          | 25.00          | 36.90          | -11.90      | Q-Peak   | 360       | 100         | Horizontal   |
| 19.122          | 24.53          | 35.80          | -11.27      | Q-Peak   | 246       | 100         | Horizontal   |
| 28.005          | 23.99          | 34.30          | -10.31      | Q-Peak   | 238       | 377         | Horizontal   |

Table 11

Frequency Range of Test: 0.15 MHz to 30 MHz



**Figure 6 - Graphical Results - Side On Polarisation**

| Frequency (MHz) | Level (dBμA/m) | Limit (dBμA/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation |
|-----------------|----------------|----------------|-------------|----------|-----------|-------------|--------------|
| 6.689           | 25.36          | 39.90          | -14.54      | Q-Peak   | 179       | 130         | Vertical     |
| 8.997           | 25.39          | 38.70          | -13.31      | Q-Peak   | 360       | 100         | Vertical     |
| 12.249          | 24.62          | 37.50          | -12.88      | Q-Peak   | 284       | 100         | Vertical     |
| 15.947          | 25.03          | 36.50          | -11.47      | Q-Peak   | 286       | 100         | Vertical     |
| 20.900          | 24.20          | 35.40          | -11.20      | Q-Peak   | 322       | 346         | Vertical     |
| 28.150          | 24.14          | 34.20          | -10.06      | Q-Peak   | 21        | 215         | Vertical     |

**Table 12**



Frequency Range of Test: 30 MHz to 1 GHz

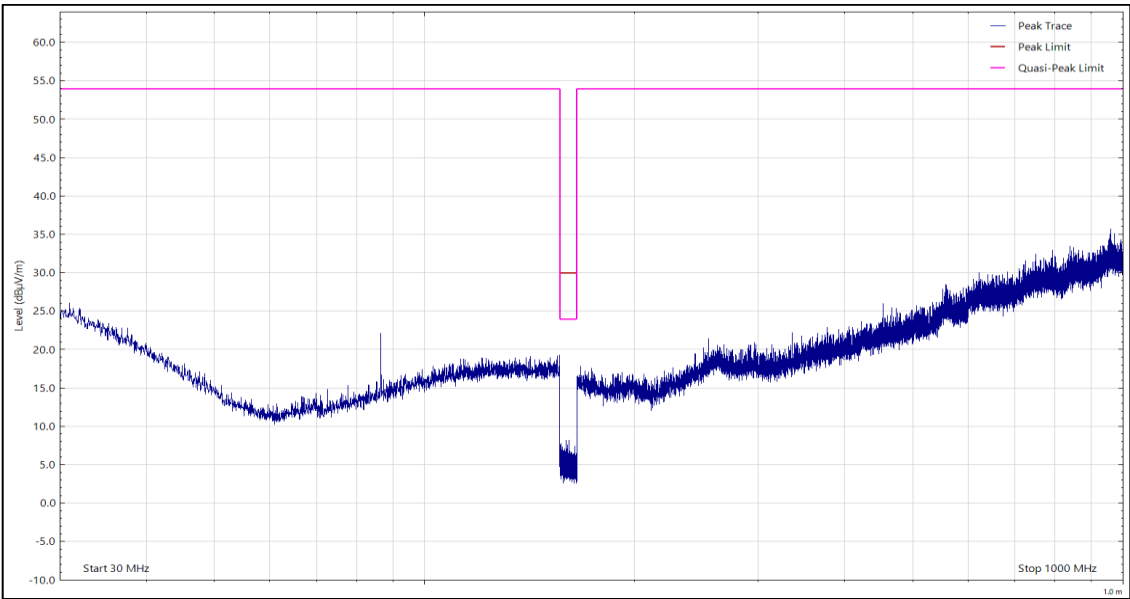


Figure 7 - Graphical Results - Horizontal Polarisation

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

Table 13

\*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.



Frequency Range of Test: 30 MHz to 1 GHz

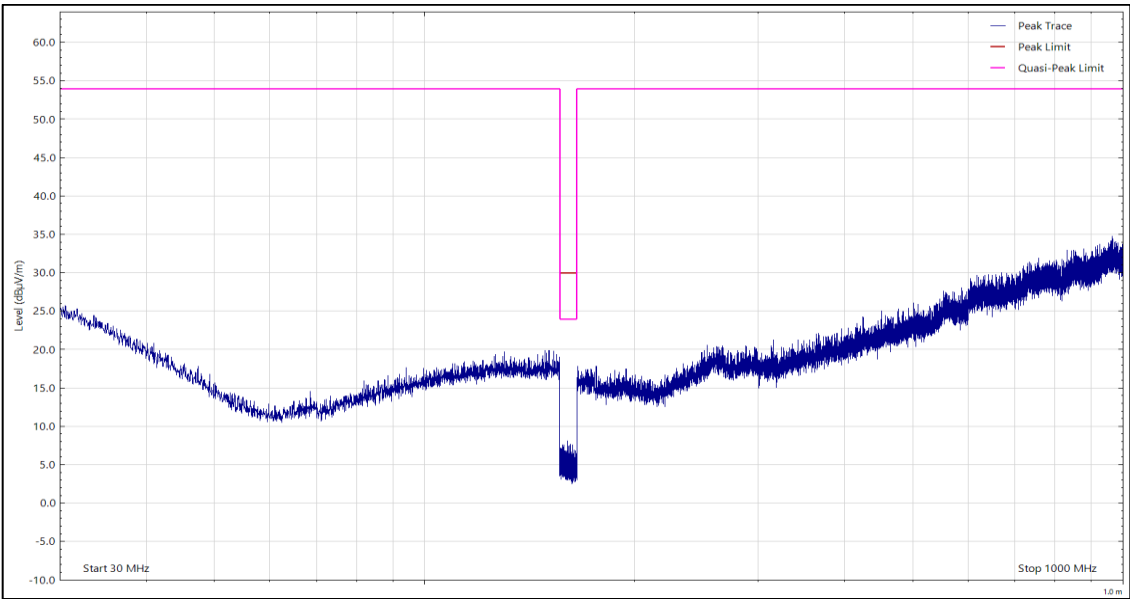


Figure 8 - Graphical Results - Vertical Polarisation

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

Table 14

\*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.



Frequency Range of Test: 1 GHz to 2 GHz

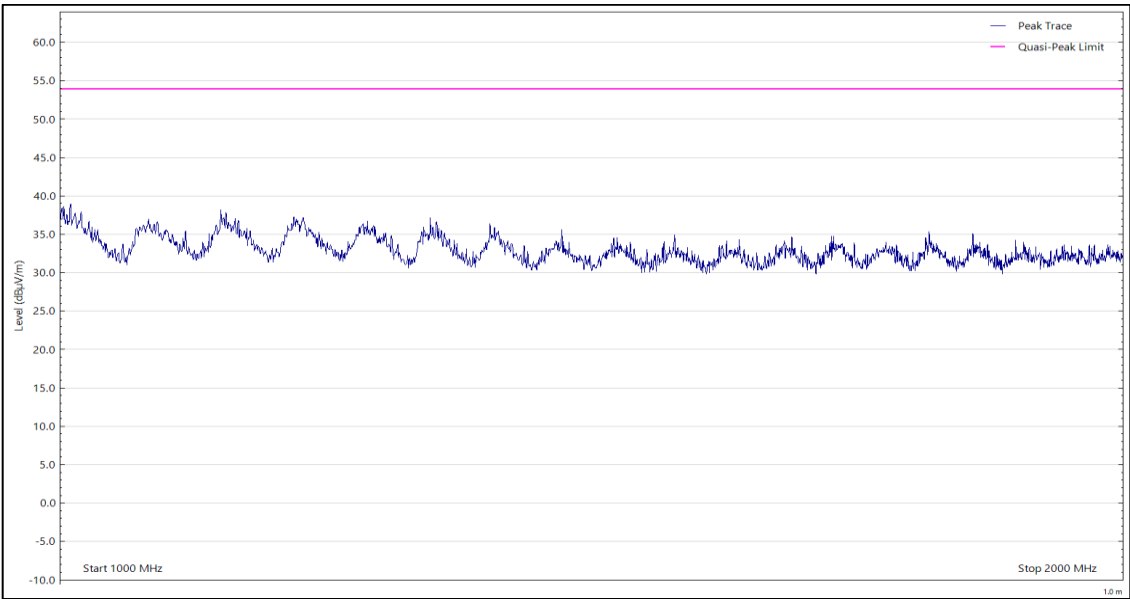


Figure 9 - Graphical Results - Horizontal Polarisation

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

Table 15

\*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.



Frequency Range of Test: 1 GHz to 2 GHz

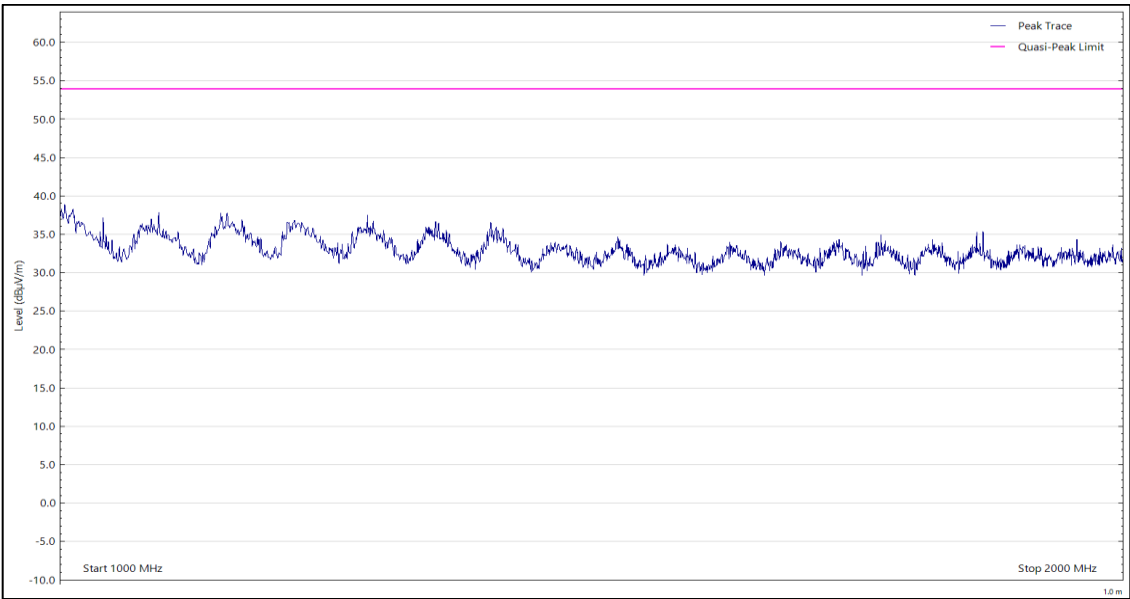


Figure 10 - Graphical Results - Vertical Polarisation

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

Table 16

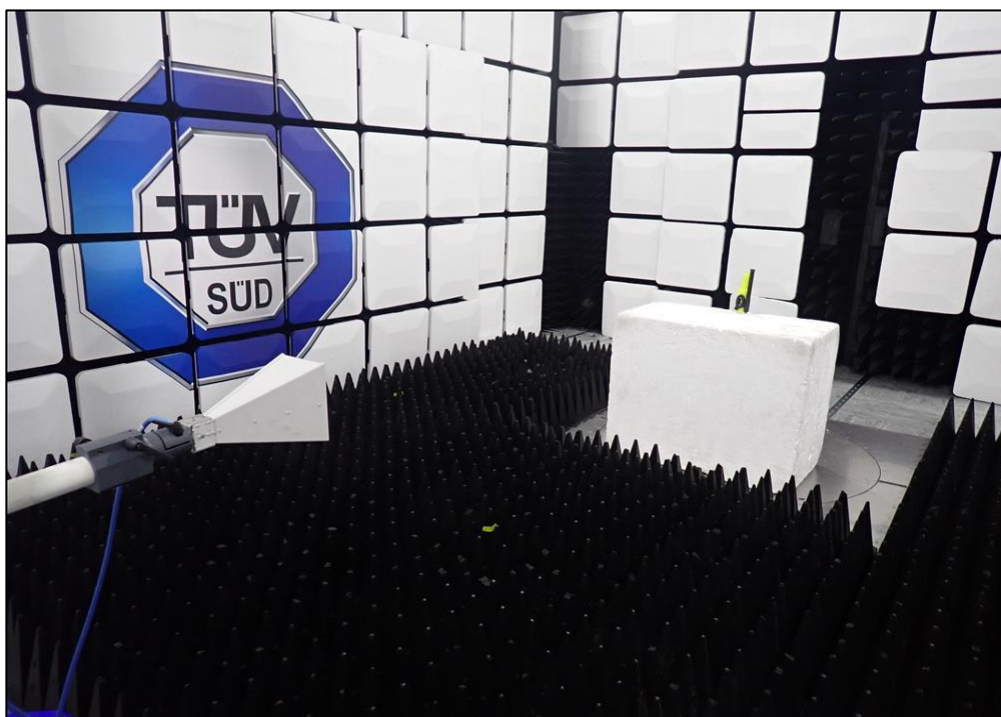
\*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.



Figure 11-Test Setup - 0.15 MHz to 30 MHz



Figure 12-Test Setup - 30 MHz to 1 GHz



**Figure 13-Test Setup - Above 1 GHz**



## 2.1.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

| Instrument                        | Manufacturer    | Type No              | TE No | Calibration Period (months) | Calibration Expires |
|-----------------------------------|-----------------|----------------------|-------|-----------------------------|---------------------|
| 3m Semi-Anechoic Chamber          | MVG             | EMC Chamber 12       | 5621  | 36                          | 07-Aug-2026         |
| Emissions Software                | TUV SUD         | EmX V3.2.0           | 5125  | -                           | Software            |
| EMC Test Receiver                 | Rohde & Schwarz | ESW44                | 6334  | 12                          | 20-Apr-2024         |
| Turntable & Mast Controller       | Maturo Gmbh     | NCD/498/2799.01      | 5612  | -                           | TU                  |
| Tilt Antenna Mast                 | Maturo Gmbh     | TAM 4.0-P            | 5613  | -                           | TU                  |
| Cable (K Type 2m)                 | Junkosha        | MWX241-02000KMS      | 5421  | 12                          | 08-Mar-2024         |
| Cable (2.92 mm(f)-N(m), 2 m)      | Junkosha        | MWX241-02000KFSNMS/B | 5443  | 12                          | 09-Mar-2024         |
| Cable (N-Type to N-Type, 8 m)     | Junkosha        | MWX221-08000NMSNMS/B | 6321  | 12                          | 04-Feb-2025         |
| Pre-Amplifier (1 GHz to 18 GHz)   | Schwarzbeck     | BBV 9718 C           | 5350  | 12                          | 01-Dec-2024         |
| Antenna (DRG, 1 GHz to 10.5 GHz)  | Schwarzbeck     | BBHA9120B            | 5611  | 12                          | 15-Oct-2024         |
| Antenna (Bi-Log, 30 MHz to 1 GHz) | Teseq           | CBL6111D             | 5615  | 24                          | 15-Mar-2025         |
| Antenna (Loop, 9 kHz to 30 MHz)   | Teseq           | HLA                  | 5616  | 24                          | 27-Jul-2024         |
| Power Injector                    | Teseq           | PI 6121              | 5620  | 24                          | 27-Jul-2024         |

**Table 17**

TU - Traceability Unscheduled



## 2.2 Immunity to Radiated Radio Frequencies

### 2.2.1 Specification Reference

IEC 60945, Clause 10.4

### 2.2.2 Equipment Under Test and Modification State

Model: Pathfinder AIS, S/N: TA000016 - Modification State 0

### 2.2.3 Date of Test

04-March-2024

### 2.2.4 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.

### 2.2.5 Environmental Conditions

Ambient Temperature 22.3 °C  
Relative Humidity 39.1 %  
Atmospheric Pressure 1004.0 mbar

### 2.2.6 Specification Limits

| Required Test Levels                                                                                                                                                                                   |                  |                             |               |                  | Performance Criteria |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------------|---------------|------------------|----------------------|
| Frequency Range (MHz)                                                                                                                                                                                  | Test Level (V/m) | Modulation                  | Step Size (%) | Dwell (s)        |                      |
| 80 to 1000                                                                                                                                                                                             | 10               | AM (80 %,400 Hz, sine wave) | 1             | 3 <sup>(1)</sup> | A                    |
| 1000 to 2000                                                                                                                                                                                           | 10               | AM (80 %,400 Hz, sine wave) | 1             | 9 <sup>(1)</sup> | A                    |
| <b>Supplementary information:</b><br>Note 1. Dwell times can be reduced for frequencies below and above 1 GHz when testing samples with a fast cycle time that show an instantaneous failure response. |                  |                             |               |                  |                      |

Table 18

## 2.2.7 Test Results

### Results for Configuration and Mode: Battery Powered - Operating.

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

Detailed results are shown below.

| Tabulated Results for RF Electromagnetic Field |                             |                                                            |                    |        |
|------------------------------------------------|-----------------------------|------------------------------------------------------------|--------------------|--------|
| Step Size                                      |                             | 1 % Log Spaced                                             |                    |        |
| Dwell Time < 1 GHz                             |                             | 3 s                                                        |                    |        |
| Dwell Time > 1 GHz                             |                             | 9 s                                                        |                    |        |
| Dwell Time Justification                       |                             | Dwell times used were suggested specification dwell times. |                    |        |
| Modulation                                     |                             | 400 Hz Sine 80 % AM                                        |                    |        |
| Frequency Range                                | Test Face                   | Antenna Polarisation                                       | Test Level         | Result |
| 80 MHz to 2 GHz                                | Front, Right, Left and Rear | Horizontal and Vertical                                    | 12.6 V/m (10 + MU) | Pass   |

Table 19



Figure 14- Test Setup - Below 1 GHz

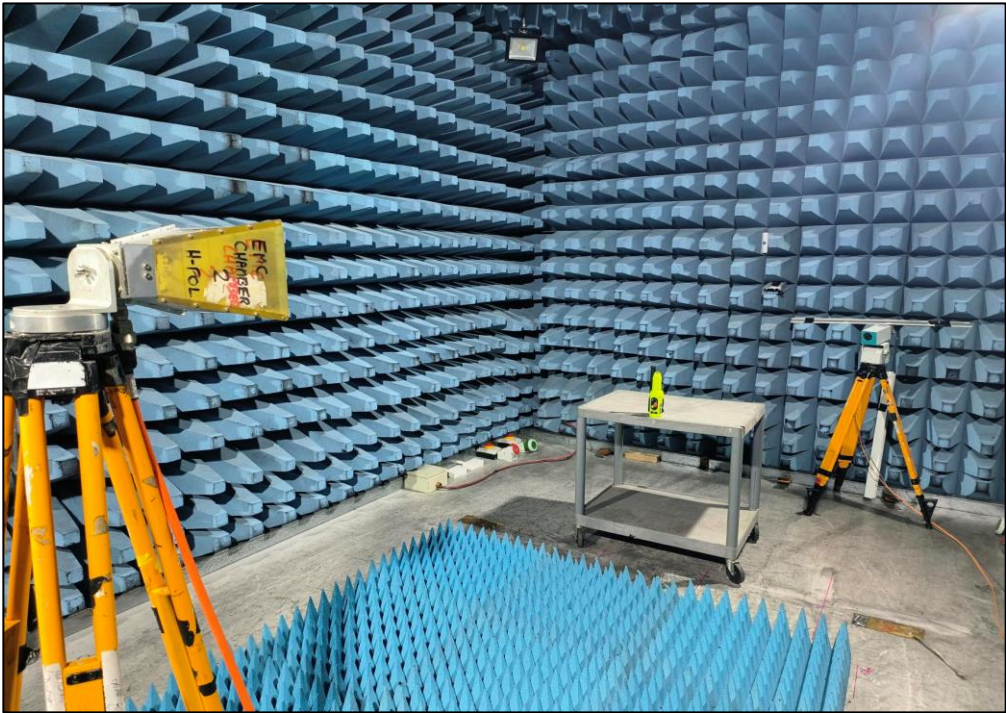


Figure 15- Test Setup - Above 1 GHz



## 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                          | 26-Mar-2024         |
| Radiated Immunity Test Software   | Amp Research          | EMCWare V6.0  | 4899  |                             | Software            |
| Switch Control Platform           | Amp Research          | SCP20000M2    | 6459  |                             | TU                  |
| Signal Generator (9 kHz to 6 GHz) | Keysight Technologies | N5171B        | 6467  | 36                          | 02-Oct-2025         |
| Signal Generator (9 kHz to 6 GHz) | Keysight Technologies | N5171B        | 6468  | 36                          | 04-Oct-2025         |
| Signal Generator (9 kHz to 6 GHz) | Keysight Technologies | N5171B        | 6469  | 36                          | 04-Oct-2025         |
| Signal Generator (9 kHz to 6 GHz) | Keysight Technologies | N5171B        | 6471  | 36                          | 09-Oct-2025         |
| Amplifier (80 MHz to 1 GHz)       | Amp Research          | 1000W1000GM33 | 6472  | -                           | TU                  |
| Amplifier (1 GHz to 6 GHz)        | Amp Research          | 250S1G6CM9    | 6473  | -                           | TU                  |
| Cable (7/16 to 7/16, 5 m)         | Amp Research          | CC41313050    | 6462  | -                           | TU                  |
| Cable (7/16 to 7/16, 5 m)         | Amp Research          | CC41313050    | 6463  | -                           | TU                  |
| Cable (7/16 to 7/16, 2 m)         | Amp Research          | CC41313020    | 6464  |                             | TU                  |
| Cable (7/16 to 7/16, 2 m)         | Amp Research          | CC41313020    | 6465  |                             | TU                  |
| Spectrum Analyser                 | Keysight Technologies | N9322C        | 6466  | -                           | TU                  |
| Directional Coupler               | Amp Research          | DC680AM1      | 6475  |                             | TU                  |
| Directional Coupler               | Amp Research          | DC7210A       | 6476  |                             | TU                  |
| Antenna (Log-P, 80 MHz to 1 GHz)  | Amp Research          | ALT80M1GM1    | 6477  | -                           | TU                  |
| Antenna (DRG, 1 GHz to 18 GHz)    | EMCO                  | 3115          | 234   | -                           | TU                  |
| Field Monitor System              | Amp Research          | MP09000       | 6474  | 12                          | 15-Feb-2025         |

**Table 20**

TU - Traceability Unscheduled

## 2.3 Immunity To Electrostatic Discharge

### 2.3.1 Specification Reference

IEC 60945, Clause 10.9

### 2.3.2 Equipment Under Test and Modification State

Model: Pathfinder AIS, S/N: TA000016 - Modification State 0

### 2.3.3 Date of Test

04-March-2024

### 2.3.4 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 0.8 m non-conductive table for table-top equipment or on a 0.1 m 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.

### 2.3.5 Environmental Conditions

Ambient Temperature 20.9 °C  
Relative Humidity 48.9 %  
Atmospheric Pressure 999.0 mbar

### 2.3.6 Specification Limits

| Required Test Levels               |                             |                                                   | Performance Criteria |
|------------------------------------|-----------------------------|---------------------------------------------------|----------------------|
| Discharge type                     | Discharge Level ( $\pm$ kV) | Number of discharges per location (each polarity) |                      |
| Air – Direct                       | 2, 4 and 8                  | 10                                                | B                    |
| Contact – Direct                   | 6                           | 10                                                | B                    |
| Contact – Indirect                 | 6                           | 10                                                | B                    |
| Supplementary information:<br>None |                             |                                                   |                      |

Table 21



### 2.3.7 Test Results

#### Results for Configuration and Mode: Battery Powered - Operating.

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

Detailed results are shown below.

| 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 | N/A   | N/A |
| Air Discharges            | Air       | ✓*      | ✓*  | ✓*   | ✓*  | N/A  | N/A | ✓*   | ✓*  | N/A   | N/A |

**Table 22**

| 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 23**

 Contact       Air



Figure 16 - ESD Test Positions



Figure 17 - ESD Test Positions



 Contact       Air



Figure 18 - ESD Test Positions



Figure 19 - ESD Test Positions

 Contact     Air

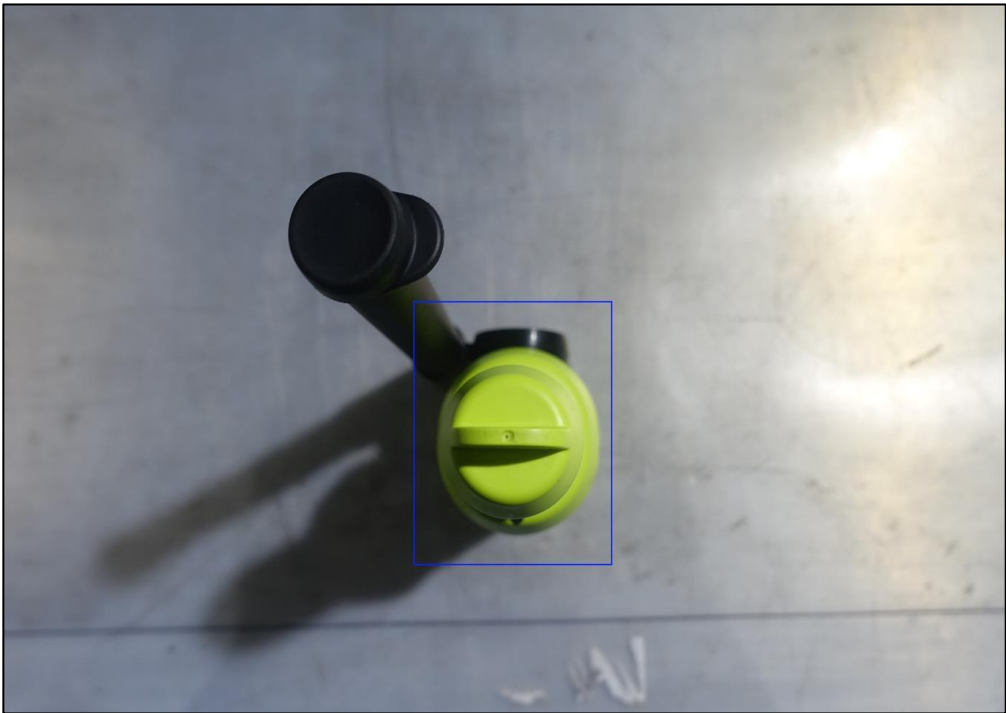


Figure 20 - ESD Test Positions

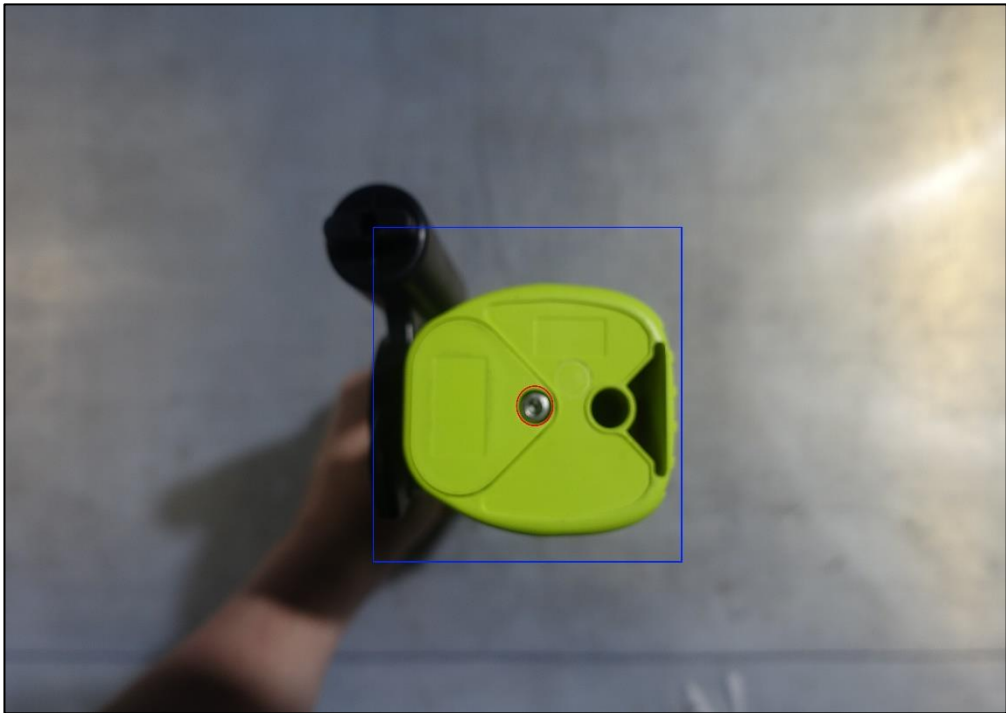


Figure 21 - ESD Test Positions



Figure 22-Test Setup

2.3.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

| Instrument    | Manufacturer | Type No    | TE No | Calibration<br>Period<br>(months) | Calibration<br>Expires |
|---------------|--------------|------------|-------|-----------------------------------|------------------------|
| ESD Generator | Schloder     | SESD 30000 | 4724  | 12                                | 02-Oct-2024            |

Table 24



## **2.4 Compass Safe Distance**

### **2.4.1 Specification Reference**

IEC 60945, Clause 11.2

### **2.4.2 Equipment Under Test and Modification State**

Model: Pathfinder AIS, S/N: TA000016 - Modification State 0

### **2.4.3 Date of Test**

18-March-2024 to 20-March-2024

### **2.4.4 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.

### **2.4.5 Environmental Conditions**

|                      |                      |
|----------------------|----------------------|
| Ambient Temperature  | 13.1 - 15.2 °C       |
| Relative Humidity    | 47.3 - 51.4 %        |
| Atmospheric Pressure | 1003.0 - 1008.0 mbar |

### **2.4.6 Specification Limits**

For the steering compass, the standby steering compass and the emergency compass, the permitted deviation is  $18^\circ/H$ , H being defined as the horizontal component of the magnetic flux density in  $\mu T$ 's (micro-tesla's) at the location that testing takes place.

## 2.4.7 Test Results

### Results for Configuration and Mode: Battery Powered - Operating.

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

Detailed results are shown below.

Deflection Calculation Table:

| Horizontal Maximum Flux Density,<br>Magnetic North (H) | Standard Compass Deviation Limit<br>(5.4/H in Degrees) | Standby Steering Compass /<br>Emergency Compass Deviation Limit<br>(18/H in Degrees) |
|--------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------|
| 19.25                                                  | 0.3                                                    | 0.9                                                                                  |

**Table 25**

Test Results

| Equipment<br>Under Test | EUT Face<br>Under Test | Un-Powered State                                                  |                                                                   | Normalised                                                        |                                                                   | Powered State                                                     |                                                                   |
|-------------------------|------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|
|                         |                        | Distance<br>from<br>Compass<br>Centre<br>(mm) at A°<br>deflection | Distance<br>from<br>Compass<br>Centre<br>(mm) at B°<br>deflection | Distance<br>from<br>Compass<br>Centre<br>(mm) at A°<br>deflection | Distance<br>from<br>Compass<br>Centre<br>(mm) at B°<br>deflection | Distance<br>from<br>Compass<br>Centre<br>(mm) at A°<br>deflection | Distance<br>from<br>Compass<br>Centre<br>(mm) at B°<br>deflection |
| Pathfinder<br>AIS SART  | Front Face             | 224                                                               | 178                                                               | 347                                                               | 174                                                               | 378                                                               | 244                                                               |
| Pathfinder<br>AIS SART  | Top Face               | 170                                                               | 170                                                               | 170                                                               | 170                                                               | 170                                                               | 170                                                               |
| Pathfinder<br>AIS SART  | Left Face              | 318                                                               | 206                                                               | 314                                                               | 209                                                               | 342                                                               | 294                                                               |
| Pathfinder<br>AIS SART  | Right Face             | 336                                                               | 201                                                               | 294                                                               | 203                                                               | 318                                                               | 211                                                               |
| Pathfinder<br>AIS SART  | Bottom<br>Face         | 324                                                               | 254                                                               | 312                                                               | 243                                                               | 337                                                               | 227                                                               |
| Pathfinder<br>AIS SART  | Rear Face              | 338                                                               | 224                                                               | 331                                                               | 222                                                               | 362                                                               | 219                                                               |

**Table 26**

Final Results

| Unit Under Test     | Standard Compass Safe Distance<br>(mm) | Standby Steering Compass /<br>Emergency Compass Safe Distance<br>(mm) |
|---------------------|----------------------------------------|-----------------------------------------------------------------------|
| Pathfinder AIS SART | 400                                    | 300                                                                   |

**Table 27**



Figure 23 - Test Setup



Figure 24 - Pathfinder AIS SART Under Test



#### 2.4.8 Test Location and Test Equipment Used

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

| 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         |
| Marine Binnacle Compass with Repeater Display | Cassens & Plath | Compass: Type 11 | 3834  | -                           | TU                  |
| Clamp Meter True-RMS                          | Fluke           | 325              | 5301  | 12                          | 26-Jul-2024         |

**Table 28**

TU - Traceability Unscheduled



### 3 Test Equipment Information

#### 3.1 General Test Equipment Used

| Instrument             | Manufacturer         | Type No    | TE No | Calibration Period (months) | Calibration Expires |
|------------------------|----------------------|------------|-------|-----------------------------|---------------------|
| Multimeter             | Fluke                | 177        | 3832  | 12                          | 28-Jul-2024         |
| Spectrum Analyser      | Agilent Technologies | E7405A     | 1410  | 12                          | 23-Nov-2024         |
| Antenna (Log Periodic) | Schaffner            | UPA6108    | 3108  | 12                          | 26-Aug-2024         |
| Thermo-Hygro-Barometer | PCE Instruments      | PCE-THB-40 | 5481  | 12                          | 28-Apr-2024         |

Table 29



## **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                                                                            |
|----------------------------------------|----------------------------------------------------------------------------------------------------|
| Radiated Emissions                     | 9 kHz to 30 MHz, Active Loop Antenna, $\pm 3.4$ dB<br>30 MHz to 2 GHz, Bilog Antenna, $\pm 5.2$ dB |
| Immunity to Radiated Radio Frequencies | 80 MHz to 2 GHz Test Amplitude $\pm 2.0$ dB                                                        |
| Immunity To Electrostatic Discharge    | The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2       |
| Compass Safe Distance                  | $\pm 0.1^\circ$                                                                                    |

**Table 30**

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 measured test results being 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 in accordance with IEC 60945: 2002 C1: 2008 Clause 5.3.