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# Report On

Environmental Approval Testing of the
SRT Marine Limited
AtoN
In accordance with IEC 60945

Document 75917597 Report 01 Issue 2 February 2013

Product Service

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**REPORT ON**

Limited Environmental Approval Testing of the
SRT Marine Limited
AtoN
in accordance with IEC 60945

Document 75917597 Report 01 Issue 2

February 2013

**PREPARED FOR**

SRT Marine Limited
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**PREPARED BY**

**M Hardy**
Test Engineer

**APPROVED BY**

**M Jenkins**
Authorised Signatory

**DATED** 28 February 2013

**This report has been up-issued to Issue 2 to include additional results (extreme voltage checks and excessive voltage).**

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**CONTENTS**

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**SECTION 1**

**REPORT SUMMARY**

Limited Environmental Approval Testing of the
SRT Marine Limited AtoN
in accordance with IEC 60945

## 1.1 INTRODUCTION

AtoN:

The information contained in this report is intended to show limited verification of the Approval Testing of the SRT Marine Limited AtoN to the requirements of IEC 60945.

| | |
|---|---|
| Objective | To perform Type Approval Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out. |
| Manufacturer | SRT Marine Limited |
| Model Number(s) | AtoN |
| Serial Number(s) | P216FTU020 TUV REF: 75917597-TSR0001<br>P216FTU021 TUV REF: 75917597-TSR0021<br>P216FTU030 TUV REF: 75917597-TSR0023<br>P216FTU034 TUV REF: 75917597-TSR0027<br>P216FTU021 TUV REF: 75917597-TSR0033 |
| Number of Samples Tested | Five |
| Test Specification/Issue/Date | IEC 60945: 2002 |
| Order Number<br>Date | POR003047<br>22 March 2012 |
| Start of Test | 09 July 2012 |
| Finish of Test | 09 February 2013 |
| Name of Engineer(s) | C Foster<br>C Bowles<br>R Hampton<br>S Mooney<br>M Hardy<br>A Guy |

## 1.2 BRIEF SUMMARY OF RESULTS

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

| Section | Spec Clause | Test Description | Result | Comments |
|---|---|---|---|---|
| 2.1 | 8.2 | Dry Heat (Storage) | Satisfactory | - |
| 2.2 | 8.2 | Dry Heat (Functional) | Satisfactory | - |
| 2.3 | 8.3 | Damp Heat | Satisfactory | - |
| 2.4 | 8.4 | Low Temperature (Functional) | Satisfactory | - |
| 2.5 | 8.8 | Rain and Spray | Satisfactory | - |
| 2.6 | 8.12 | Corrosion | Satisfactory | - |
| 2.7 | 5.2.3 | Excessive Condition | Satisfactory | - |

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## 1.3 DECLARATION OF BUILD STATUS

| | |
|---|---|
| **Manufacturer** | SRT Marine Ltd |
| **Country of origin** | United Kingdom |
| **UK Agent** | SRT Marine Ltd |
| **Technical Description** | AtoN (Aids to Navigation) |
| **Model No** | TRS & TR |
| **Part No** | 418-0003 & 418-0001 |
| **Serial No** | Sample 1- P216-FTU-20,<br>Sample 2- P216-FTU-21,<br>Sample 3- P216-FTU-30. |
| **Drawing Number** | 418-0003 & 418-0001 |
| **Build Status** | Mod 11 (supplied) |
| **Software Issue** | 080200.00.09.11 |
| **IC ID** | 7075A-4180003 |
| **FCC ID** | UYW-418-0003 |

**Signature**

Richard McMahon

**Date** 12th October 2012

Note: This document has been prepared to enable manufacturers with no mechanism for producing their own Declaration of Build Status, to declare the build state of the equipment submitted for test.

No responsibility will be accepted by TÜV Product Service as to the accuracy of the information declared in this document by the manufacturer.

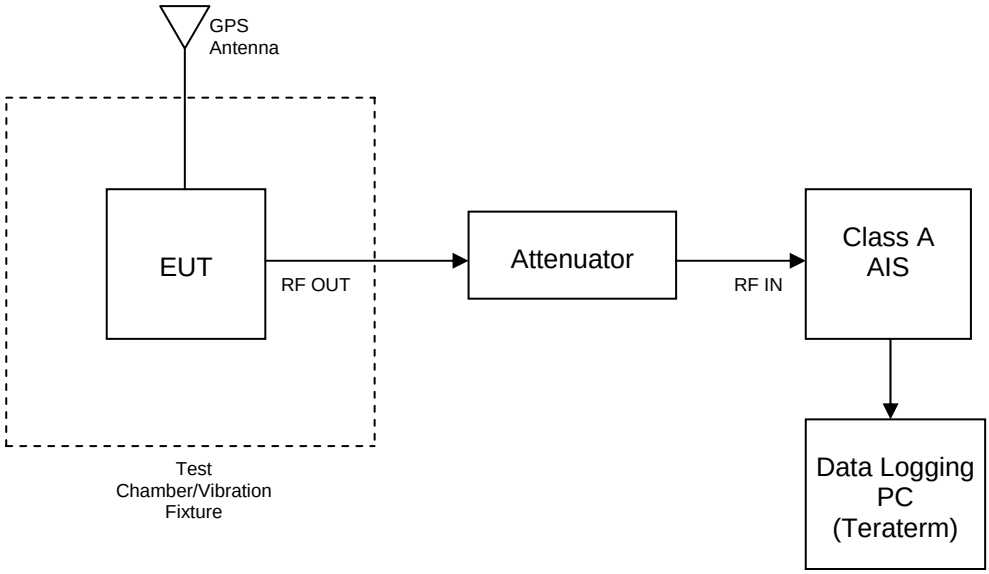
## 1.4 PRODUCT INFORMATION

### 1.4.1 Technical Description

The Equipment Under Test (EUT) was a SRT Marine Limited AtoN as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.


Equipment Under Test

Test Setup Diagram




The Class A AIS device was used to receive transmissions from the EUT. The PC was used with Teraterm data logging software to monitor messages transmitted by the EUT.

## 1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

## 1.6 MODIFICATION RECORD

No modifications were made to the EUT during testing.

| Modification State | Description of Modification still fitted to EUT | Modification Fitted By | Date Modification Fitted |
|---|---|---|---|
| **P216FTU020 TUV REF: 75917597-TSR0001** | | | |
| 0 | As supplied (Mod level 11) | - | - |
| 1 | Modification following failure at temperature (mod level 27) | SRT Marine Ltd | 21 September 2012 |
| **P216FTU021 TUV REF: 75917597-TSR0021** | | | |
| 0 | As supplied (Mod level 11) | - | - |
| 1 | Modification following failure at temperature (mod level 27) | SRT Marine Ltd | 21 September 2012 |
| **P216FTU030 TUV REF: 75917597-TSR0023** | | | |
| 0 | As supplied (Mod level 11) | - | - |
| 1 | Modification following failure at temperature (mod level 27) | SRT Marine Ltd | 21 September 2012 |
| **P216FTU034 TUV REF: 75917597-TSR0027** | | | |
| 0 | As supplied (T3 model) used for excessive conditions checks | - | - |
| **P216FTU034 TUV REF: 75917597-TSR0033** | | | |
| 0 | As supplied (T3 model) used for extreme power supply checks | - | - |

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**SECTION 2**

**TEST RESULTS**

Limited Environmental Approval Testing of the
SRT Marine Limited AtoN
in accordance with IEC 60945

## 2.1 DRY HEAT (STORAGE)

### 2.1.1 Specification Reference

IEC 60945: 2002 Clause 8.2.1

### 2.1.2 Equipment Under Test

AtoN: P216FTU021 TUV REF: 75917597-TSR0021

### 2.1.3 Date of Test and Modification State

21 to 22 September 2012 – Modification State 1

### 2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.1.5 Environmental Conditions

Ambient Temperature 24.8 - 24.9°C
Relative Humidity 45.9 - 46.7%

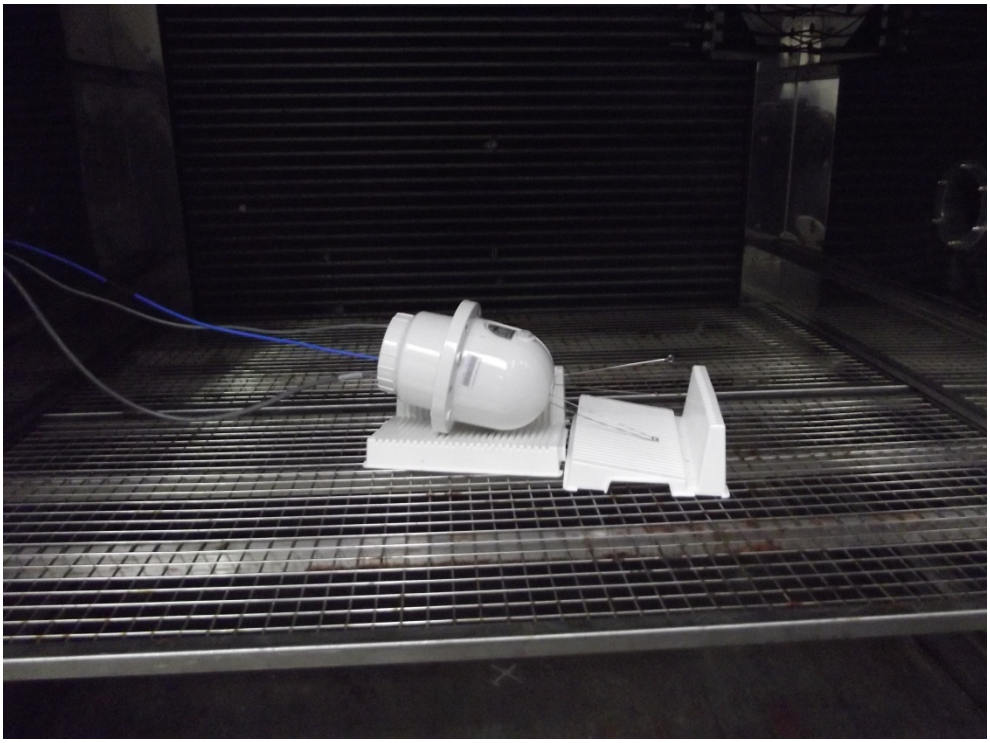
### 2.1.6 Test Procedure

The EUT was placed in the environmental chamber at laboratory ambient conditions. The temperature of the chamber was then raised to +70 °C for a period of 14 hours. The temperature of the chamber was then returned to laboratory ambient and a performance check was carried out.

### 2.1.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle.

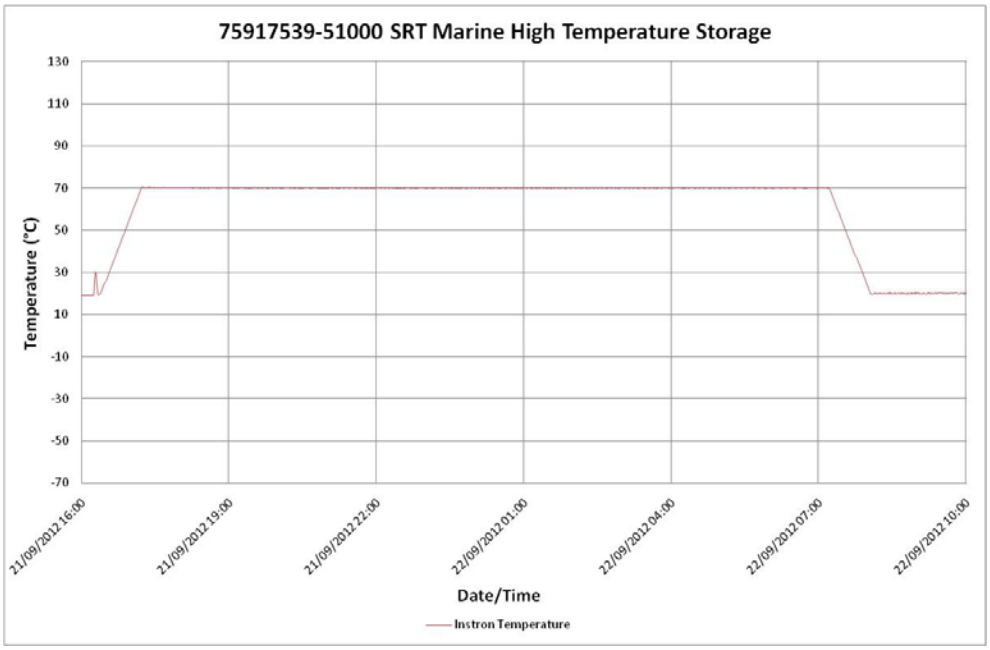
Test Setup



### 2.1.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Temperature Plot




Performance Check

The Manufacturer declared that the performance check carried out by TUV after the test was satisfactory.

## 2.2 DRY HEAT (FUNCTIONAL)

### 2.2.1 Specification Reference

IEC 60945: 2002 Clause 8.2.2

### 2.2.2 Equipment Under Test

AtoN: P216FTU021 TUV REF: 75917597-TSR0021
AtoN: P216FTU021 TUV REF: 75917597-TSR0033

### 2.2.3 Date of Test and Modification State

24 to 25 September 2012 – Modification State 1 (TSR0021)
31 January 2013 – Modification State 0 (TSR033)

### 2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.2.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 24.4°C – 25.2°C |
| Relative Humidity | 30.2% – 59.3% |

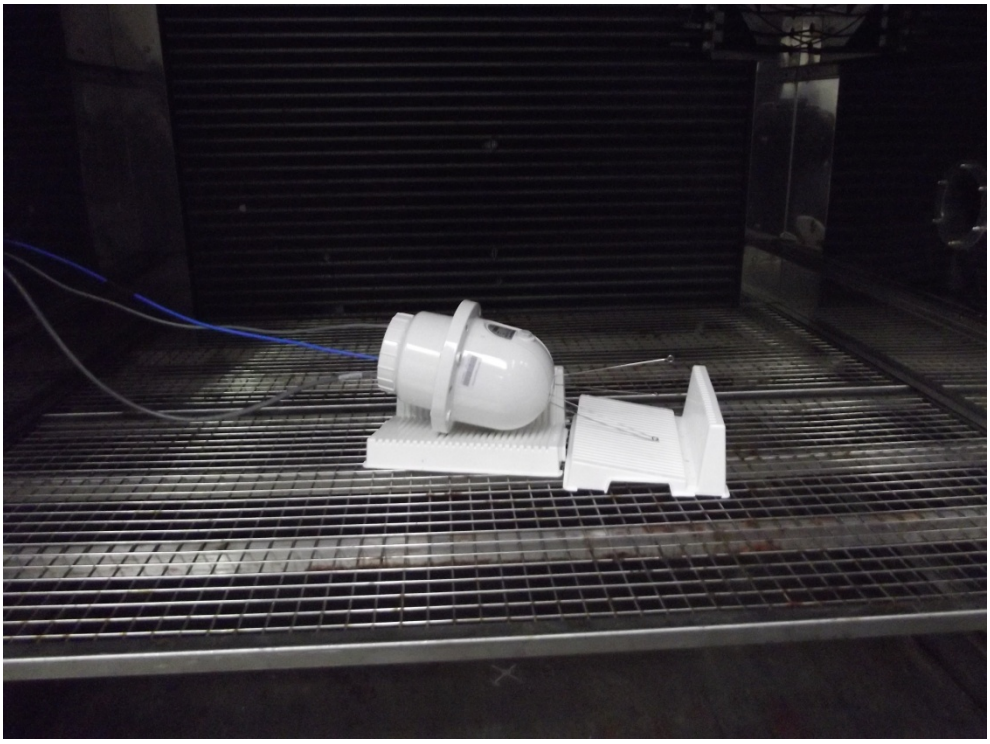
### 2.2.6 Test Procedure

The EUT was placed in the environmental chamber at laboratory ambient conditions and powered on. The temperature of the chamber was then raised to +55 °C for a period of 14 hours. The temperature of the chamber was then returned to laboratory ambient. A performance check was carried out during the complete test period.

### 2.2.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Operating.

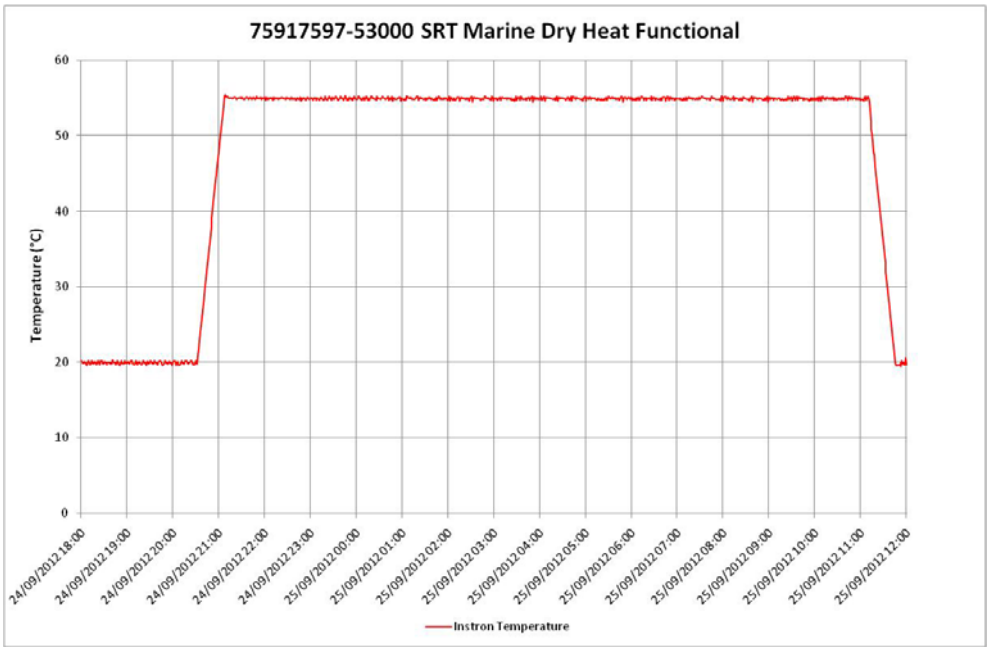
Test Setup



### 2.2.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Temperature Plot




Performance Check

The Manufacturer declared that the performance check carried out by TUV during the test was satisfactory.

An additional performance check was carried out with extreme power supply conditions in accordance with clause 7.1. An upper voltage of 31.2V was applied whilst at +55 °C. The performance check results were satisfactory.

Once the EUT had returned to ambient conditions a further performance check was carried out with extreme power supply conditions in accordance with clause 7.1. An upper voltage of 31.2V was applied whilst at lab ambient and a performance check made. This was repeated with a lower extreme voltage of 10.2V. The performance check results were satisfactory in both the upper and lower extreme voltage conditions.

## 2.3 DAMP HEAT

### 2.3.1 Specification Reference

IEC 60945: 2002 Clause 8.3

### 2.3.2 Equipment Under Test

AtoN: P216FTU021 TUV REF: 75917597-TSR0021

### 2.3.3 Date of Test and Modification State

25 to 26 September 2012 - Modification State 1

### 2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.3.5 Environmental Conditions

Ambient Temperature 23.9°C
Relative Humidity 45.8%

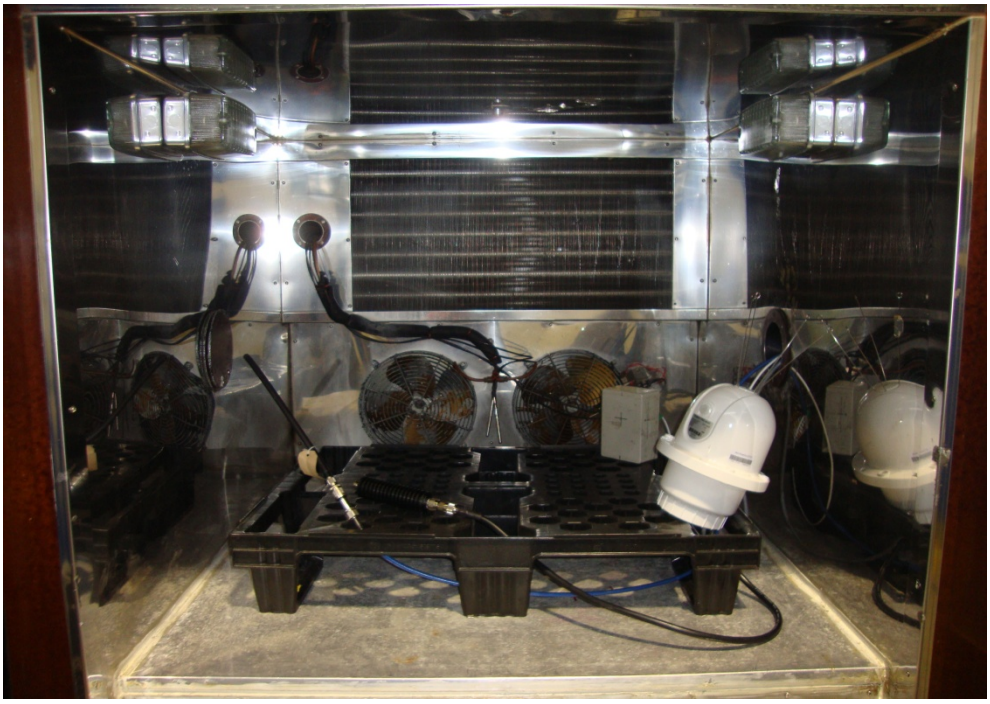
### 2.3.6 Test Procedure

The EUT (powered off) was placed in the environmental chamber at laboratory ambient conditions. The temperature of the chamber was then raised to +40 °C and the relative humidity raised to 93% over a period of 3 hours. The conditions were maintained for a period of 15 hours during which time the performance check was carried out. The EUT continued to operate for at least 2 hours. Once the performance check was complete the chamber conditions were returned to laboratory ambient.

### 2.3.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle and Operating.

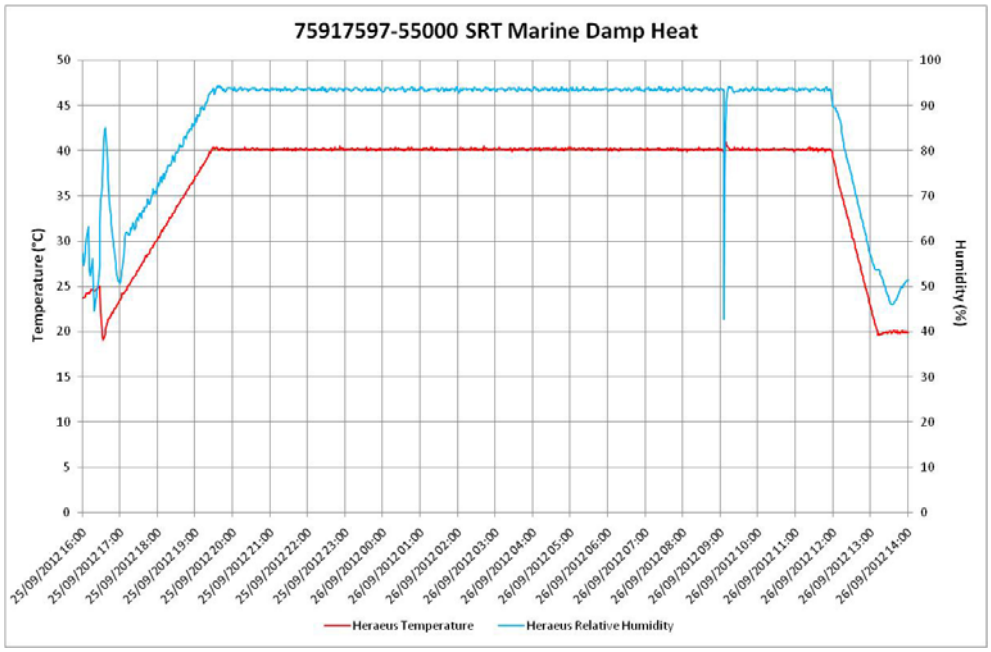
Test Set Up



### 2.3.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Temperature Plot




Performance Check

The Manufacturer declared that the performance check carried out by TUV during the test was satisfactory.

## 2.4 LOW TEMPERATURE (FUNCTIONAL)

### 2.4.1 Specification Reference

IEC 60945: 2002 Clause 8.4.2

### 2.4.2 Equipment Under Test

AtoN: P216FTU021 TUV REF: 75917597-TSR0021
AtoN: P216FTU021 TUV REF: 75917597-TSR0033

### 2.4.3 Date of Test and Modification State

25 to 26 September 2012 - Modification State 1 (TSR0021)
26 January 2013 - Modification State 0 (TSR033)

### 2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.4.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.4°C – 24.7°C |
| Relative Humidity | 28.2% – 37.6% |

### 2.4.6 Test Procedure

The EUT was placed in the environmental chamber at laboratory ambient conditions and the temperature of the chamber was then lowered to -25 °C. The conditions were maintained for a period of 15 hours during which time the performance check was carried out and the EUT continued to operate for at least 2 hours. Once the performance check was complete the chamber conditions were returned to laboratory ambient. Following completion of the performance check the chamber conditions were returned to laboratory ambient.

### 2.4.7 Test Set-up and Operating Modes

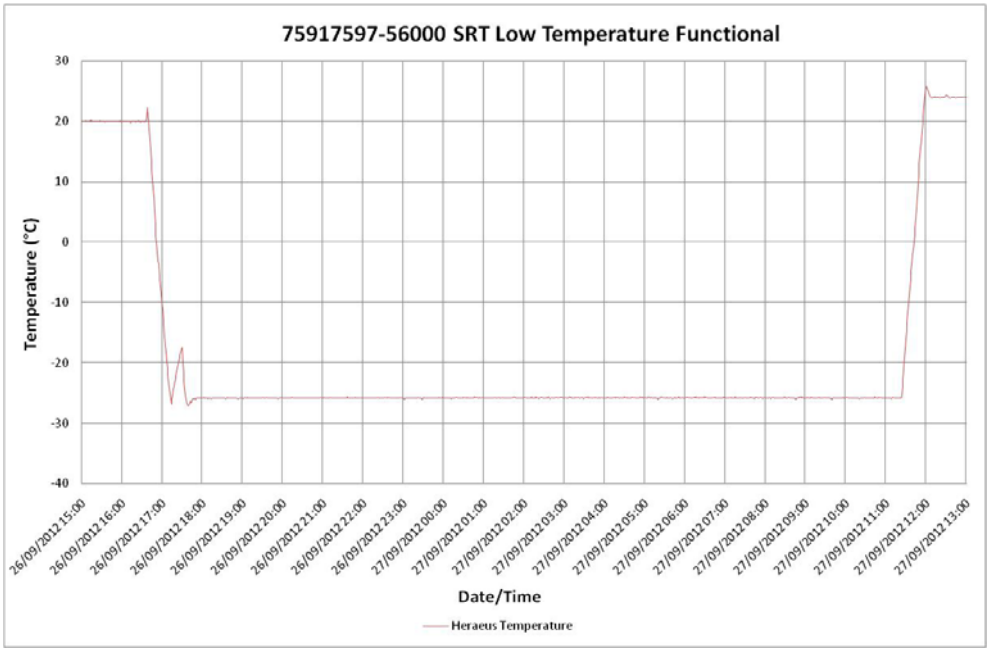
The test was performed with the EUT in the following mode(s): Idle and Operating.

Setup Photo

### 2.4.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Temperature Plot




Performance Check

The Manufacturer declared that the performance check carried out by TUV during the test was satisfactory.

An additional performance check was carried out with extreme power supply conditions in accordance with clause 7.1. An lower voltage of 10.8V was applied whilst at -25 °C. The performance check results were satisfactory.

## 2.5 RAIN AND SPRAY

### 2.5.1 Specification Reference

IEC 60945: 2002 Clause 8.8

### 2.5.2 Equipment Under Test

AtoN: P216FTU030 TUV REF: 75917597-TSR0023

### 2.5.3 Date of Test and Modification State

5 February 2013 - Modification State 1

### 2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.5.5 Environmental Conditions

Ambient Temperature 17.3°C
Relative Humidity 57.8%

### 2.5.6 Test Procedure

The EUT was sprayed with water in accordance with the following requirements. Operation of the EUT was monitored throughout the test.

– internal diameter of nozzle: 12,5 mm;
– delivery rate: 100 l/min ± 5 % ;
– water pressure: to be adjusted to achieve the specified delivery rate;
– core of substantial stream: circle of approximately 120 mm diameter at distance 2,5 m from nozzle;
– test duration: approximately 30 min;
– distance from nozzle to the equipment surface: approximately 3 m.

The EUT was tested in four azimuths separated by 90°, for 7.5 minutes at each azimuth.

At the conclusion of the test, the EUT was subjected an inspection and performance check.

### 2.5.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Operating.

Test Setup Photo

### 2.5.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Performance Check

The Manufacturer declared that the performance check carried out by TUV after the test was satisfactory.

## 2.6 CORROSION

### 2.6.1 Specification Reference

IEC 60945: 2002 Clause 8.12

### 2.6.2 Equipment Under Test

AtoN: P216FTU020 TUV REF: 75917597-TSR0001

### 2.6.3 Date of Test and Modification State

02 to 30 July - Modification State 0

### 2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.6.5 Test Procedure

The EUT was placed in a chamber and sprayed with a salt solution for 2 h at normal temperature. The salt solution was prepared by dissolving (5 ± 1) parts by weight of sodium chloride (NaCl) in 95 parts by weight of distilled or demineralized water.

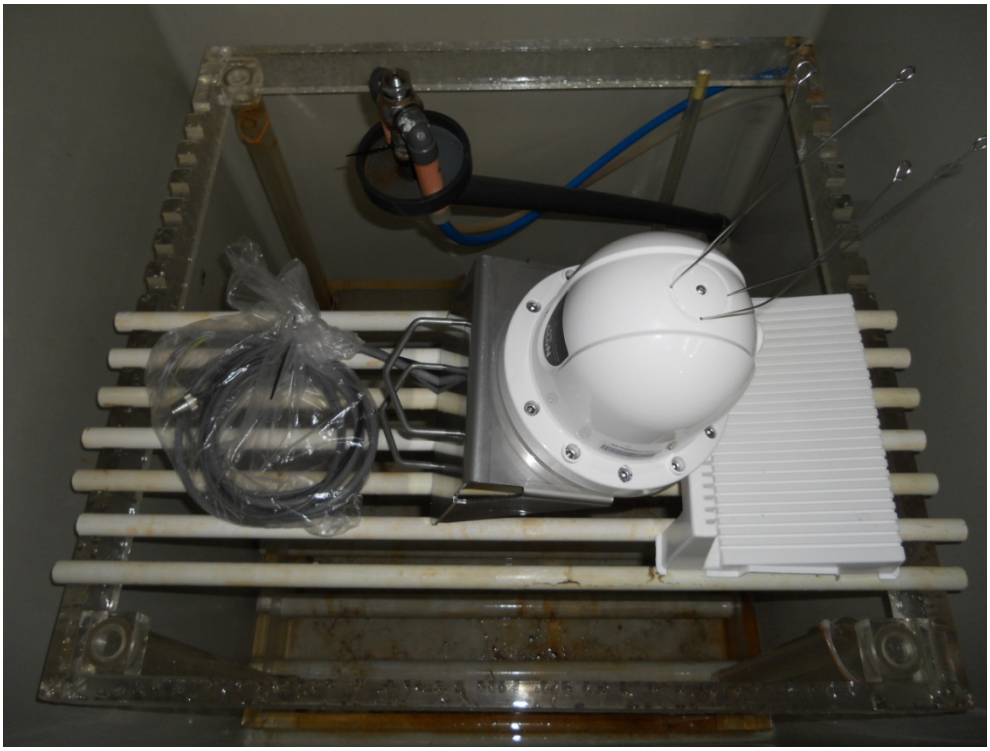
At the end of the spraying period, the EUT was placed in a chamber which was maintained at a temperature of 40 °C ± 2 °C, and a relative humidity between 90 % and 95 % for a period of seven days.

The EUT was subjected to a test comprising four spraying periods, each of duration 2 h, with a storage period of seven days after each. At the conclusion of the test the EUT was inspected with the naked eye without magnification. The EUT was then subjected to a performance check.

### 2.6.6 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle.

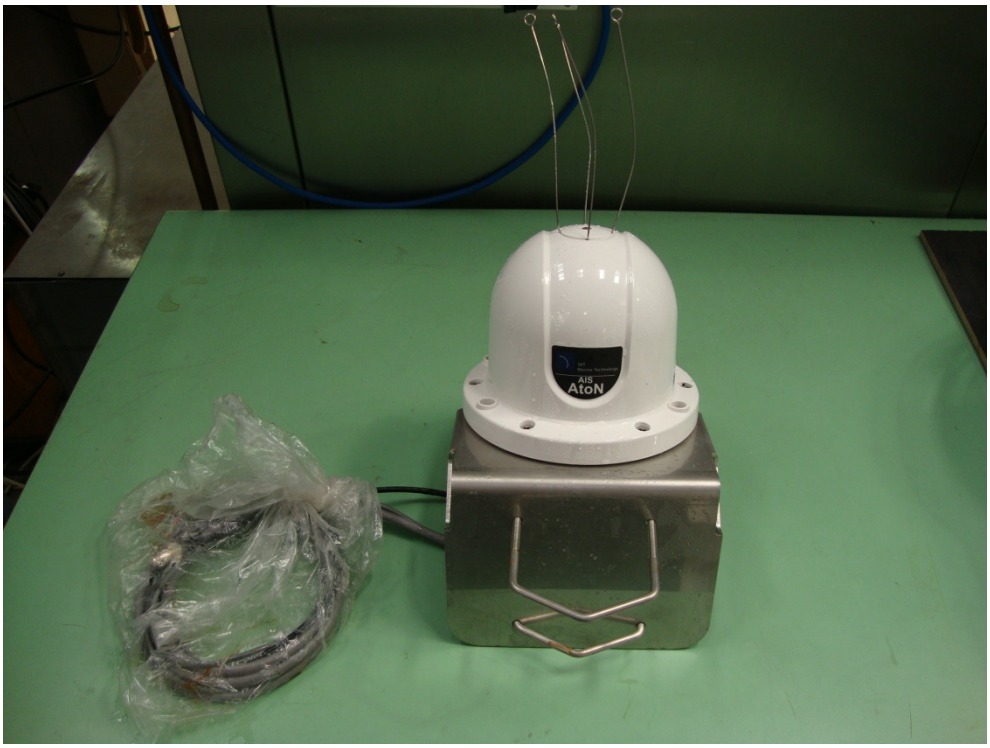
Test Setup Photo

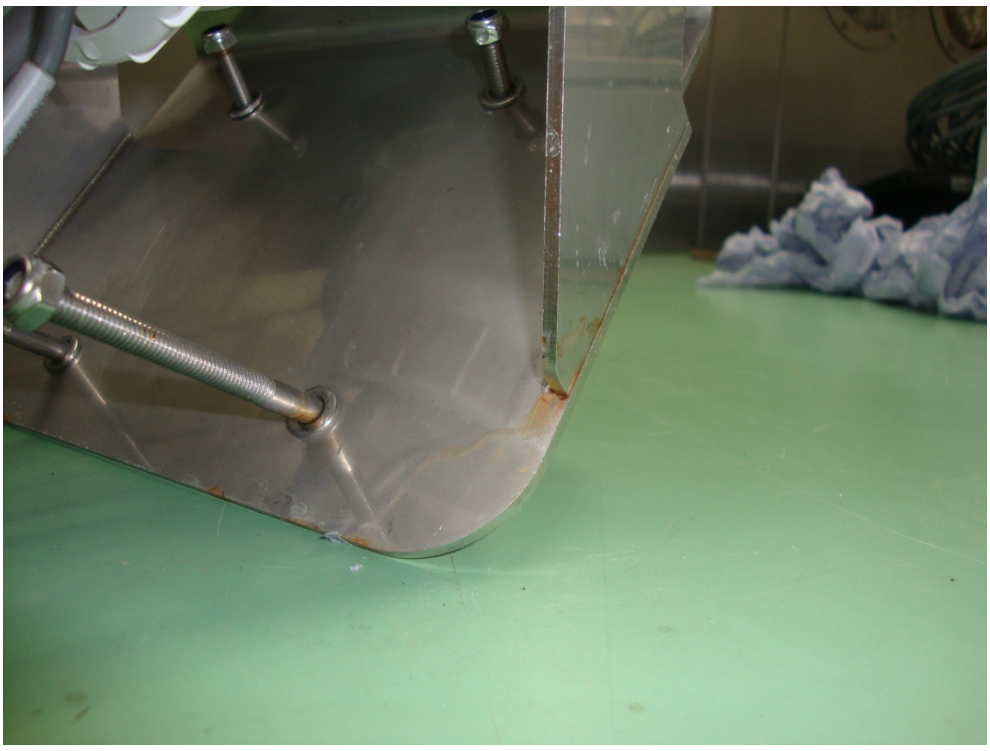


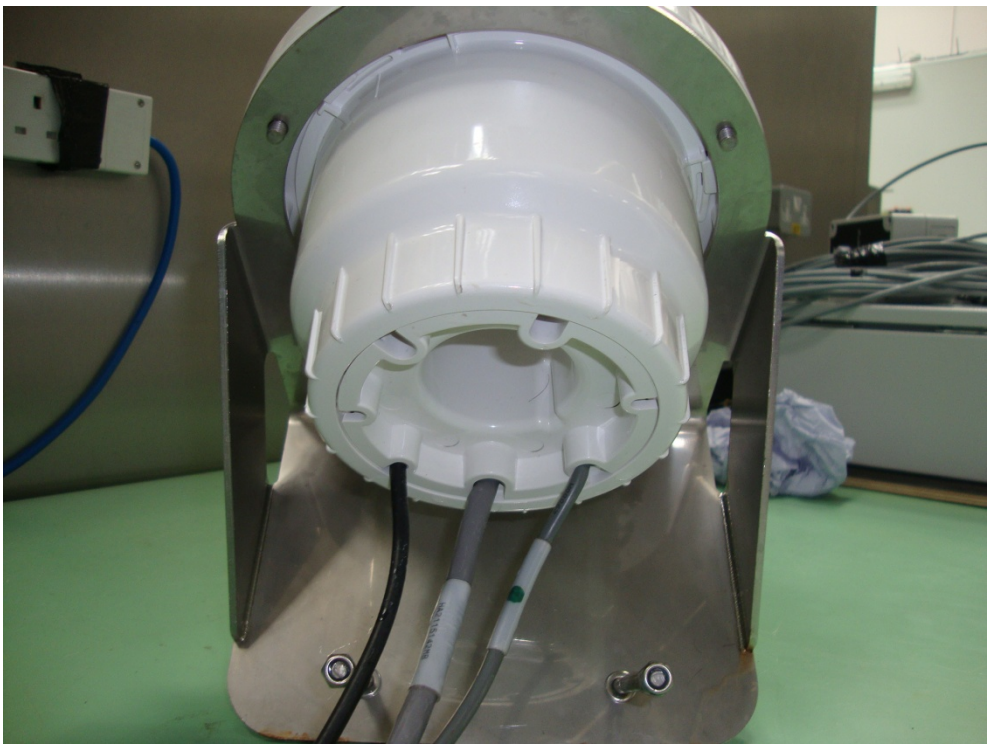
### 2.6.7 Test Results

The Test was completed in accordance with the described Test Procedure.

Post Test Photos





The post test photographs show that no damage or corrosion appeared to be present on the EUT - however slight surface corrosion occurred on the mounting bracket.

Performance Check

The Manufacturer declared that the performance check carried out by TUV after the test was satisfactory.

## 2.7 EXCESSIVE CONDITIONS

### 2.7.1 Specification Reference

IEC 60945: 2002 Clause 7.2 (5.2.3)

### 2.7.2 Equipment Under Test

AtoN: P216FTU034 TUV REF: 75917597-TSR0027
AtoN: P216FTU021 TUV REF: 75917597-TSR0033

### 2.7.3 Date of Test and Modification State

09 February 2013 - Modification State 0

### 2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.7.5 Environmental Conditions

Ambient Temperature 21.5°C
Relative Humidity 28%

### 2.7.6 Test Procedure

Excessive Voltage

The EUT (TSR0027) was set up and operated correctly at the high extreme voltage level of 31.2V dc as declared by the manufacturer.

The voltage applied to the EUT was increased until the EUT turned off or became unservicable.

Power supply misconnections

The EUT (TSR0033) was set up and operated correctly at the upper nominal voltage of 24V dc, as declared by the manufacturer, prior to the reversed polarity test. The power was turned off and the polarity of the supply connections was reversed. Power was then re-applied for a period of 5 minutes.

The test was repeated at the lower nominal voltage of 12V dc.

### 2.7.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode: Operating.

Test Set Up

The EUT was setup in accordance with the manufacturer's instructions. It was electrically connected to a Class A transponder via a USB cable for monitoring purposes. The output of the EUT was confirmed prior to the start of each test.

### 2.7.8 Test Results

Excessive Voltage Condition

The applied voltage was raised to 40V dc at which point the EUT ceased transmitting (observed as no messages where received on the Class A to which is was connected). The EUT's nominal power supply was restored however the EUT remained inoperative.

The EUT was returned to the manufacturer for evaluation.

After inspection of the EUT the Manufacturer declared the following:

*We have looked at the AtoN unit you have returned and the problem is that the TVS diode is short circuit. This is consistent with having had a fast rise time overvoltage of around 40V+ applied. This is the behaviour we would expect and we had planned for. Replacing the TVS diode allows the unit to operate normally. The circuit has done its job of protecting the TRX and SEN PCAs. In this case by sacrificing itself like a very fast fuse.*

Power supply misconnections

The test was carried out satisfactorily. No damage or degradation was observed.

Note: for both the power supply misconnection testn at 12V dc and 24V dc, after removal of the misconnection a waiting time of 15 minutes was required prior to the EUT being able to recieve power.

Performance Check

Excessive Voltage Condition

*IEC 60945* states that *the excessive voltage is greater than that specified in 5.2.2. Protection shall be provided against such excesses at an appropriate level chosen by the manufacturer and, when activated, may require the EUT to be reset, for example by fuse replacement. The power supply shall be adjusted to cause activation of the protection and after EUT rese".*

The Manufacturer has accordingly declared that the EUT operated correctly in the excessive voltage condition: *We have checked functionality of the AtoN and conclude that once the TVS diode was replaced the unit performed normally.*

The Manufacturer declared that the operation of the EUT was intended after replacement of the protection device.

Power Supply Misconnections

The performance check carried out by TUV during the test was satisfactory.

**SECTION 3**

**TEST EQUIPMENT USED**

## 3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

| Instrument | Manufacturer | Type No. | TE No. | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| **Section 2.1 Climatic – Dry Heat (Storage)** | | | | | |
| Climatic Chamber | Climatec | Climatec 1 | 2124 | 12 | 22-Nov-2012 |
| **Section 2.2 Climatic – Dry Heat (Functional)** | | | | | |
| Temperature Chamber | Instron | 906 | 2128 | 12 | 17-Oct-2012 |
| **Section 2.3 Climatic – Damp Heat** | | | | | |
| Chamber | Heraeus | HC 4033 | 2174 | 12 | 16-Mar-2013 |
| **Section 2.4 Climatic - Low Temperature (Functional)** | | | | | |
| Chamber | Heraeus | HC 4033 | 2174 | 12 | 16-Mar-2013 |
| **Section 2.5 Climatic - Wet Tests** | | | | | |
| Temperature Chamber | Instron | 906 | 2128 | 12 | 17-Oct-2012 |
| Chamber | Heraeus | HC 4033 | 2174 | 12 | 16-Mar-2013 |
| Water Jet Nozzle | Unknown | 12.5mm DIA | 2453 | 36 | 19-Jul-2014 |
| Stop Watch | Radio Spares | Model 694 (974) | 4026 | | 6-Aug-2013 |
| 50 Litre Container | TUV SUD Product Service | n/a | 4028 | - | TU |
| 10 meter Tape Measure | Stanley | Fatmax 10m/33' | 4071 | - | TU |
| **Section 2.6 Climatic - Corrosion** | | | | | |
| Weiss Technik (T) | Weiss Technik | Salt Mist | 2121 | 12 | 1-Feb-2013 |
| Climatic Chamber | Climatec | Climatec 2 | 2845 | 12 | 5-Jan-2013 |
| **Section 2.7 Excessive Condition** | | | | | |
| Meter | Fluke | 79 Series III | 411 | 12 | 25-Jul-2013 |

## SECTION 4

## PHOTOGRAPHS

## 4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)


Equipment under test

## SECTION 5

## ACCREDITATION, DISCLAIMERS AND COPYRIGHT

## 5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).