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Report On

Radio Approval Testing of the
McMurdo Limited
SmartFind S5 AIS SART
In accordance with IEC 61097-14 and IEC 60945

Document 75907213 Report 02 Issue 3 May 2010

Product Service

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Document 75907213 Report 02 Issue 3

May 2010

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DATED 21 May 2010

75907213 Report 02 has been up-issued to include additional environmental information.

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

Radio Approval Testing of the
McMurdo Limited
SmartFind S5 AIS SART
in accordance with IEC 61097-14 and IEC 60945

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Radio Approval Testing of the McMurdo Limited SmartFind S5 AIS SART to the requirements of IEC 61097-14 and IEC 60945.

Objective	To perform Radio Approval Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	McMurdo Limited
Model Number(s)	S5
Serial Number(s)	75907213-TSR0001 75907213-TSR0007 75907213-TSR0014
Number of Samples Tested	Three
Test Specification/Issue/Date	IEC 61097-14 FDIS: AIS WG 2009-10-08[1] IEC 60945: 2002
Order Number Date	PC0003713 22 July 2009
Start of Test	26 October 2009
Finish of Test	28 January 2010
Name of Engineer(s)	B Airs R Bennett R Hampton C Bowles S Mooney S Dennison

1 Publication due to be issued 28 February 2010.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with IEC 61097-14 is shown below.

Section	Spec Clause(s)	Test Description	Result	Mod State	Comments
2	Operational				
2.1	6.1	Operational Tests (a-d, i, l-q)	✓	0 and 1	See section 2.1
2.2	6.1 E	Drop into Water	Pass	0	
2.3	6.1 F	Water Immersion	Pass	0	
2.4	6.1 G	Thermal Shock	Pass	0	
2.5	6.1 H	Floatation	Pass	0	
2.6	6.1 J	Corrosion and Oil Resistance	-	N/A	Waiver provided
2.7	6.1 K	Solar Radiation	-	N/A	Waiver provided
2.8	6.2 – 6.11	Miscellaneous Performance tests	✓	0 and 1	See section 2.8

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

Section	Spec Clause	Test Description	Result	Mod State	Comments
3	Environmental Condition Requirements of IEC 60945 (Equipment Category Portable)				
3.1	8.2.1	Dry Heat – Storage	Pass	0	
3.2	8.2.2	Dry Heat – Functional	✓	0	See notes within section 3.2
3.3	8.3	Damp Heat	Pass	0	
3.4	8.4	Low Temperature	✓	0	See notes within section 3.4
3.5	8.6	Drop onto Hard Surface	Pass	1	EUT at MOD state 0 failed the drop test. EUT at MOD state 1 (see section 1.6) passed the drop test.
3.6	8.7	Vibration	Pass	0	
3.7	11.2	Compass Safe Distance	✓	0	

A brief summary of the tests carried out in accordance with IEC 61097-14 is shown below.

Section	Spec Clause	Test Description	Result	Mod State	Comments
4	Physical Radio Tests				
4.1	6.2	Battery Capacity Test	✓	0	
4.2	6.2	Battery Capacity Test – alternate battery	✓	1	
4.3	7.2	Frequency Error	Pass	0	
4.4	7.3	Conducted Power	Pass	0	
4.5	7.4	Radiated Power	Pass	0	
4.6	7.5	Modulation Spectrum Slotted Transmission	Pass	0	
4.7	7.6	Transmitter Test Sequence and Modulation Accuracy	✓	0	See also annex B
4.8	7.7	Transmitter Output Power Versus Time Function	Pass	0	
4.9	7.8	Spurious Emissions from the Transmitter	Pass	0	

1.3 APPLICATION FORM

APPLICANT'S DETAILS
COMPANY NAME:…McMurdo ADDRESS: Silver Point, Airport Service Road Hilsea, Portsmouth, PO3 5PB NAME FOR CONTACT PURPOSES: Neil Jordan TELEPHONE NO: 02392 62393 FAX NO:02392 623997 E-MAIL:neiljordan@mcmurdo.co.uk

EQUIPMENT INFORMATION

Equipment designator:
Model name/number SmartFind S5 AIS SART Identification number

Supply Voltage:

[ ]	AC mains	State AC voltage	and AC frequency
[ ]	DC (external)	State DC voltage	and DC current 7mA average
[X]	DC (internal)	State DC voltage 6.0 V	and Battery type LiMnO2

Frequency characteristics:
Frequency range 161.975. MHz to 162.025 MHz Channel spacing N/A.
Designated test frequencies:
Bottom: 161.975 MHz Middle: Top: 162.025 MHz

Power characteristics:
Maximum transmitter power 1.8 W Minimum transmitter power (if variable)

[ ]	Continuous transmission	
[X]	Intermittent transmission	State duty cycle 0.32%

If intermittent, can transmitter be set to continuous transmit test mode? No

Antenna characteristics:

[ ]	Antenna connector	State impedance …… ohm
[ ]	Temporary antenna connector	State impedance …… ohm
[X]	Integral antenna	State gain 0 dBi

Modulation characteristics:

[ ]	Amplitude	[X] Other
[ ]	Frequency	Details: GMSK
[ ]	Phase	

Can the transmitter operate un-modulated? Yes
ITU Class of emission: 16K0GXW

Extreme conditions: McMurdo has assumed this with the AIS SART running. The stowage temperature for the device is -30C to +70C

Maximum temperature +55 ºC Minimum temperature -20ºC
Maximum supply voltage 6.0 V Minimum supply voltage 5.5V

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature:	Held on file at TÜV Product Service Ltd
Name:	Neil Jordon
Position held:	Engineering Manager
Date:	01 October 2009

TÜV Product Service Ltd formally certifies that the manufacturer's declaration as typed out in this report is a true and accurate record of the original received from the applicant.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a McMurdo Limited SmartFind S5 AIS SART as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test

1.5 DEVIATIONS FROM THE STANDARD

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

1.6 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
0	As supplied by the customer	Not Applicable	Not Applicable
1	**Relating to sample 75907213-TSR0014:** Pole retaining cap (bung) modified such that the cut-outs were orientated horizontally. The moulding of the retaining cap was also modified such that the protruding ribs were removed to allow the foam pad to sit flat against the moulding.	McMurdo Limited	02 December 2009

1.7 PHYSICAL RADIO TESTS – EXTREME TEST CONDITIONS

IEC 61097-14 calls for certain tests to be carried out under extreme test conditions. Extreme test conditions are defined as:

- Low temperature with a battery near end of useful life (92 hours), and
- High temperature with a full capacity battery.

The battery voltage usage was accelerated to obtain a battery with an equivalent 92 hours of usage.

McMurdo Limited declared that in order to achieve a battery in a state nearing the end of its useful life (old battery), a resistive load of 130 ohms could be placed across the battery terminals for 16 hours and that this condition would equate to 92 hours of battery use. This method was used for all of the tests that indicate an old battery was used.

SECTION 2

OPERATIONAL TESTS

Radio Approval Testing of the
McMurdo Limited SmartFind S5 AIS SART
in accordance with IEC 61097-14

2.1 OPERATIONAL TESTS

2.1.1 Specification Reference

IEC 61097-14 Clause 6.1

2.1.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0001, 75907213-TSR0007, 75907213-TSR0014

2.1.3 Date of Test and Modification State

15 December 2009 - Modification State 0 (75907213-TSR0001 and 75907213-TSR0007)
15 December 2009 - Modification State 1 (75907213-TSR0014)

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

2.1.5 Operational Clauses

Spec Clause	Test Description	Result	Comments
6.1	The AIS-SART shall:		
A	Be capable of being easily activated by unskilled personnel.	✓	By inspection.
B	Be fitted with means to prevent inadvertent activation.	✓	By inspection.
C	Be equipped with a means which is either visual or audible, or both visual and audible, to indicate correct operation.	✓	By inspection.
D	Be capable of manual activation and deactivation, provision for automatic activation may be included.	✓	By inspection.
E	Be capable of withstanding without damage drops from a height of 20 m into water.	✓	Confirmed by IEC 60945 Drop into Water. See section 2.2
F	Be watertight at a depth of 10 m for at least 5 min.	✓	Confirmed by IEC 60945 Water Immersion Test (portable equipment). See section 2.3
G	Maintain water tightness when subjected to a thermal shock of 45°C under specified conditions of immersion.	✓	Confirmed by IEC 60945 Thermal Shock Test (portable equipment). See section 2.4
H	If the device is not designed specifically to be an integral part of a survival craft, it shall be placed in fresh water for 5 min, as a check that it is capable of floating. The device complete with its one metre mounting system shall float.	✓	See section 2.5
I	Be equipped with a buoyant lanyard, suitable for use as a tether, if it is capable of floating. The buoyant lanyard shall have a length not less than 10m.	✓	By inspection.
L	Be of a highly visible yellow/orange colour on all surfaces where this will assist detection.	✓	By inspection.
M	Have a smooth external construction to avoid damaging the survival craft.	✓	By inspection.
N	Be provided with an arrangement to bring the AIS-SART antenna to a level of at least 1 metre above sea level, together with illustrated instructions. The manufacturer shall provide a visible means of indicating the base of the antenna. The height of 1 metre shall be measured to the declared 1 metre mark from sea level. The instructions shall illustrate the minimum requirement of 1 metre above sea level during use along with the installation method.	✓	By inspection.
O	Be capable of transmitting with a reporting interval of 1 minute or less.	-	Not tested at TUV
P	Be equipped with an internal position source and be capable of transmitting its current position in each message.	-	Not tested at TUV
Q	Be capable of being tested for all functionalities using specific test information.	-	Not tested at TUV

2.1.6 Test Results

Procedure and Observations

The EUT was physically inspected for the various clauses and photographic evidence, where appropriate was recorded and included below.

Observation Outcome

6.1 A: The AIS-SART shall be capable of being easily activated by unskilled personnel.
6.1 B: The AIS-SART shall be fitted with means to prevent inadvertent activation.

The SmartFind S5 AIS SART is equipped with a blue label which indicates the position of the ON button: this switch is set behind the tamperproof device which provides a means to prevent inadvertent activation. There are additional diagram labels which are located on the lower section of the AIS-SART which depict the removal of the tamper proof device and the pressing of the ON button. Additional diagrams are provided for the installation of the mounting pole; along with installation instructions printed on the inside of the carry bag. Additional instructions are provided in the operator's manual supplied with the product.

SmartFind S5 AIS SART labels depicting activation and installation

6.1 C: The AIS-SART shall be equipped with a means which is either visual or audible, or both visual and audible, to indicate correct operation.

The SmartFind S5 AIS SART contains a red LED which indicates the operation of the unit: the red LED will start to flash every few seconds. 1 flash every 3.5 seconds indicates that the SmartFind S5 AIS SART is ON. Furthermore, a good GPS fix is indicated by the red LED signalling a long flash every minute. Once deactivated the LED on the SmartFind S5 AIS SART will go out.

6.1 D: The AIS-SART shall be capable of manual activation and deactivation; provision for automatic activation may be included.

For manual activation the user is required to break off the tamper proof device and press the activation button beneath. In order to deactivate the SmartFind S5 AIS SART the TEST button must be pressed and held. There is no provision for automatic activation.

6.1 E: The AIS-SART shall be capable of withstanding without damage drops from a height of 20m into water.

The EUT was subject to the 20m drop into water test as per IEC 60945 Clause 8.6.
See section 2.2.

6.1 F: The AIS-SART shall be watertight at a depth of 10 m for at least 5 min.

The EUT was subject to the immersion test as per IEC 60945 Clause 8.9.
See section 2.3.

6.1 G: The AIS-SART shall maintain water tightness when subjected to a thermal shock of 45°C under specified conditions of immersion.

The EUT was subject to the thermal shock test as per IEC 60945 Clause 8.5.
See section 2.4.

6.1 H: If the device is not designed specifically to be an integral part of a survival craft, it shall be placed in fresh water for 5 min, as a check that it is capable of floating. The device complete with its one metre mounting system shall float.

McMurdo Limited have declared that the SmartFind S5 AIS SART is not designed specifically to be an integral part of a survival craft. Therefore the SmartFind S5 AIS SART, complete with its one metre mounting system was placed in fresh water for 5 min. The EUT complete with its mounting system floated for the 5 minute period. See Section 2.5

6.1 I: The AIS SART shall be equipped with a buoyant lanyard, suitable for use as a tether, if it is capable of floating. The buoyant lanyard shall have a length not less than 10m.

The measured length of the EUT's lanyard was 10.02 metres. Section 2.5 demonstrates that the lanyard is capable of floating.

6.1 L: The AIS SART shall be of a highly visible yellow/orange colour on all surfaces where this will assist detection.

The EUT surface areas were approximately measured using a rule, as was the total approximate non orange surface area of the EUT. The EUT surface area is approximately 85% orange.

6.1 M: The AIS SART shall have a smooth external construction to avoid damaging the survival craft.

The EUT was inspected for rough edges with the Sharp Edge Tester, consisting of a 'repeatable-force arm' and a padded 'finger' covered with tape, was run along all edges of the SmartFind S5 AIS SART.

Upon inspection of the tape covering the 'finger' no cuts were found, merely creases.

6.1 N: The AIS SART shall be provided with an arrangement to bring the AIS-SART antenna to a level of at least 1 metre above sea level, together with illustrated instructions.

The EUT is fitted with a mounting pole which requires installation prior to operation. The mounting pole, when fully extended, measures 1.24 metres and fixes to the base of the SmartFind S5 AIS SART, thus raising it at least 1 metre above sea level when installed in a life raft. Labels on the EUT depict the actions required to install the mounting pole and how to raise the antenna. There are additional mounting instructions on the inside of the storage bag.

The manufacturer shall provide a visible means of indicating the base of the antenna. The height of 1 metre shall be measured to the declared 1 metre mark from sea level. The instructions shall illustrate the minimum requirement of 1 metre above sea level during use along with the installation method.

The position of the base of the antenna is identified on the mounting pole and labels on the EUT indicate that this point needs to be 1 metre above sea level. There are additional mounting instructions on the inside of the storage bag.

2.2 DROP INTO WATER

2.2.1 Specification Reference

IEC 61097-14 Clause 6.1 E
IEC 60945 Clause 8.6.2

2.2.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0007

2.2.3 Date of Test and Modification State

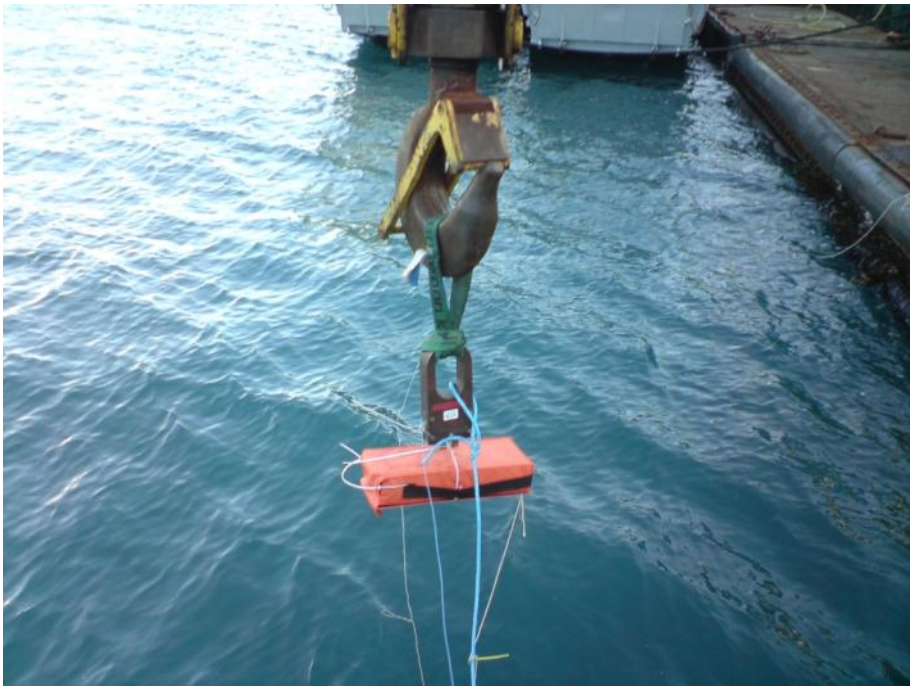
05 November 2009 - Modification State 0

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

2.2.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. This test was performed with the EUT enclosed in the storage bag as supplied by the manufacturer.



Test Set-up

2.2.6 Test Results

Procedure

The EUT was dropped three times 20m ±1m above the water level: once in each of the three orthogonal planes as described in the standard.

Test Observations

The EUT was subject to a mechanical inspection after the third drop: no signs of deterioration or of water ingress were noted.

The EUT was not subjected to the internal examination on completion of the drop into water test as there were no external signs of unwanted ingress of water; the internal examination which involved the disturbance of seals was carried out on completion of the environmental tests as prescribed in IEC 60945. No water ingress was found.

Performance Check

The performance check was completed after the third drop; the self test function of the EUT operated correctly and message 1 and 14 were received by an AIS receiver.

2.3 WATER IMMERSION

2.3.1 Specification Reference

IEC 61097-14 Clause 6.1 F
IEC 60945 Clause 8.9.2

2.3.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0014

2.3.3 Date of Test and Modification State

05 November 2009 - Modification State 0

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

2.3.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. The EUT was tested stand alone i.e. not enclosed in the storage bag as supplied by the manufacturer.

Test Set-up – Water Immersion

2.3.6 Test Results

Procedure

The EUT was submerged just below the surface of the water in the pressure vessel. The water temperature was 22.2°C.

With the EUT in the idle state the pressure of the vessel was raised to 1.0 bar (g); this condition was maintained for 5 minutes, after which the pressure vessel was returned to laboratory ambient.

Test Observations

The EUT was subject to a visual inspection: no signs of water ingress were noted.

The EUT was weighed prior to and after the test. There was a difference in weight of 0.001kg: this can be attributed to water being trapped in the mounting pole, seals and joins of the EUT.

The EUT was not subjected to the internal examination on completion of the water immersion test as there were no external signs of unwanted ingress of water; the internal examination which involved the disturbance of seals was carried out on completion of the environmental tests as prescribed in IEC 60945. No water ingress was found.

Performance Check

The performance check was completed on 09 November 2009; the self test function of the EUT operated correctly and message 1 and 14 were received by an AIS receiver.

2.4 THERMAL SHOCK

2.4.1 Specification Reference

IEC 61097-14 Clause 6.1 G
IEC 60945 Clause 8.5

2.4.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0014

2.4.3 Date of Test and Modification State

02 November 2009 - Modification State 0

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

2.4.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. The EUT was tested stand alone i.e. not enclosed in the storage bag as supplied by the manufacturer.

Test Set-up

2.4.6 Test Results

Procedure

The EUT was placed inside a chamber and the temperature was raised to +70°C.

The chamber conditions were maintained for 1 hour after which time the EUT was immersed in water at 24.9°C to a depth of 100mm from the highest point of the EUT to the surface of the water.

The EUT remained in the water for a period of 1 hour after which time the EUT was removed from the water.

Test Observations

Due to the heat of the EUT and stands placed inside of the tank the water temperature rose to 25.5°C when the EUT was immersed.

The EUT was subject to a visual inspection: no signs of water ingress were noted.

The EUT was not subjected to the internal examination on completion of the thermal shock test as there were no external signs of unwanted ingress of water; the internal examination which involved the disturbance of seals was carried out on completion of the environmental tests as prescribed in IEC 60945. No water ingress was found.

Performance Check

The performance check was completed after the thermal shock test; the self test function of the EUT operated correctly and message 1 and 14 were received by an AIS receiver.

2.5 FLOATATION

2.5.1 Specification Reference

IEC 61097-14 Clause 6.1 H

2.5.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0014

2.5.3 Date of Test and Modification State

27 November 2009 - Modification State 0

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

2.5.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. The EUT was tested with the mounting pole attached but not installed. The EUT was not enclosed in the storage bag as supplied by the manufacturer.

Test Set-up

2.5.6 Test Results

Procedure

The EUT was placed in the immersion tank for a period of 5mins.

Test Observations

The EUT complete with its collapsed 1 metre mounting pole attached (i.e. not installed) and its lanyard floated in fresh water for 5 minutes.

Performance Check

Not required.

2.6 CORROSION AND OIL RESISTANCE

2.6.1 Specification Reference

IEC 61097-14 Clause 6.1 J
IEC 60945 Clauses 8.11 and 8.12

2.6.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: Not applicable

2.6.3 Date of Test and Modification State

Not applicable

2.6.4 Test Equipment Used

Not applicable

2.6.5 Test Results

Corrosion and Oil Resistance tests were waivered in accordance with the following specification references:

IEC 60945: 2002, Clause 8.11.1 Waiver:
"*The oil test shall be waived where the manufacturer is able to produce evidence that the components, material and finishes employed in the equipment would satisfy the test.*"

IEC 60945: 2002, Clause 8.12.1 Waiver:
"The corrosion test shall be waived where the manufacturer is able to produce evidence that the components, material and finishes employed in the equipment would satisfy the test."

2.6.6 Justification

Customer supplied information (see Annex A) is provided with the intension to show that the waivers are justified.

2.7 SOLAR RADIATION

2.7.1 Specification Reference

IEC 61097-14 Clause 6.1 K
IEC 60945 Clause 8.10

2.7.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: Not applicable

2.7.3 Date of Test and Modification State

Not applicable

2.7.4 Test Equipment Used

Not applicable

2.7.5 Test Results

Solar radiation test was waivered in accordance with the following specification references:

IEC 60945: 2002, Clause 8.10.1 Waiver:
"*The solar radiation test shall be waived where the manufacturer is able to produce evidence that the components, material and finishes employed in the equipment would satisfy the test.*"

2.7.6 Justification

Customer supplied information (see Annex A) is provided with the intension to show that the waivers are justified.

2.8 MISCELLANEOUS PERFORMANCE TESTS

2.8.1 Specification Reference

IEC 61097-14 Clause 6.2 – 6.11

2.8.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0001, 75907213-TSR0007, 75907213-TSR0014

2.8.3 Date of Test and Modification State

20 January 2010 - Modification State 0 (75907213-TSR0001 and 75907213-TSR0007)
20 January 2010 - Modification State 1 (75907213-TSR0014)

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

2.8.5 Miscellaneous Performance Test Clauses

IEC 61097-14 Clause	Test Description	Result	Comments
6.2.2	Expiry date indication: the AIS-SART shall be clearly and durably marked with the battery expiry date	✓	See also Manufacturer evidence in support of battery life calculations. By inspection.
6.2.3	Reverse polarity protection	✓	By inspection.
6.3	Unique Identifier	–	Not tested at TUV.
6.4	Environment	✓	See Section 3.
6.5	Range	Pass	See Section 4.5
6.6	Transmission Performance	–	Not tested at TUV.
6.7	Labelling	✓	By inspection.
6.8	Manuals	✓	By inspection.
6.9	Electronic Position Fixing System	–	See report 75908379 Report 01.
6.10	Activator	✓	By inspection.
6.11	Indicator	✓	By inspection.

2.8.6 Test Results

Procedure and Observations

The EUT was physically inspected for the various clauses and photographic evidence, where appropriate was recorded and included below.

Observation Outcome

Clause 6.2.2: Expiry date indication - the AIS SART shall be clearly and durably marked with the battery expiry date.

The expiry date for the primary battery used is displayed on the body of the EUT.

Clause 6.2.3: Reverse polarity protection – it shall not be possible to connect the battery with the polarity reversed.

The battery connector within the EUT is polarised.

Clause 6.3: Unique identifier (User ID).

Not tested at TUV Product Service.

Clause 6.4: Environment – the AIS SART shall meet the environmental condition requirements of IEC 60945 for equipment category Portable.

Confirmed by the tests in IEC 60945 (see section 3).

Clause 6.5: Range performance – The nominal radiated power (EIRP) of the AIS SART shall be 1W

Confirmed by Physical Radio Tests (see section 4.5)

Clause 6.6: Transmission performance

Not tested at TUV Product Service.

Clause 6.7: Labelling

Brief operating and test instruction (in English) are provided on the body of the EUT. Labels were provided which are to be positioned on the AIS SART; the AIS SART label contains fields for the serial number (unique ID), battery expiry date and batch number.

In addition, IEC 60945 calls for the identification of the manufacturer, equipment type number or model identification under which it was type tested, serial number and the requirements for the compass safe distance to be displayed on the AIS SART: these were all identified on the main body of the EUT.

Additional labelling can be found on the storage bag.

Clause 6.8: Manuals

The SmartFind S5 AIS SART manual includes details for periodic testing and maintenance for the AIS SART.

In addition IEC 60945 calls for adequate information that would enable the equipment to be properly operated and maintained by suitable qualified members of a ship's crew, instructions to be written in English, identify the relevant equipment category (portable) and installation instructions: this information was identified in the SmartFind S5 AIS SART user manual.

McMurdo Limited have declared that the SmartFind S5 AIS SART is not designed in a manner that would allow fault diagnosis and repair down to component level; therefore full circuit diagram, component layouts and a components parts list are not provided.

McMurdo Limited have also declared that the SmartFind S5 AIS SART does not contain complex modules in which fault diagnosis and repair down to component level would be possible; therefore full circuit diagram, component layouts and a components parts list are not provided.

Clause 6.9: Electronic position fixing system

See TUV Product Service report 75908379 Report 01.

Clause 6.10: Activator

The EUT requires two independent actions in order to activate the unit. A red tamper cover is fitted which is a onetime only operation; once this has been removed the operator is required to press the ON button. The breaking of the tamper cover indicates that the AIS SART may have been previously activated.

A separate TEST button is provided so that the unit can be tested periodically. The tamper cover is not affected by this action.

The EUT can be deactivated by pressing and holding the TEST button; this procedure is indicated on the body of the unit.

Clause 6.11: Indicator

The SmartFind S5 AIS SART user manual depicts the red LED indication pattern that can be seen on the unit to indicate that the AIS SART is on (activated) i.e. 1 flash every 3.5 seconds. An additional pattern indicates a GPS position fix i.e. 1 long flash every minute. The label on the main body of EUT indicates the flashing sequence for undergoing test and when the test passes. Further details are provided in the user manual.

SECTION 3

ADDITIONAL IEC 60945 TESTS

Radio Approval Testing of the
McMurdo Limited SmartFind S5 AIS SART
in accordance with IEC 60945

3.1 DRY HEAT - STORAGE

3.1.1 Specification Reference

IEC 60945 Clause 8.2.1

3.1.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0014

3.1.3 Date of Test and Modification State

21 November 2009 - Modification State 0

3.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

3.1.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. The EUT was tested stand alone i.e. not enclosed in the storage bag as supplied by the manufacturer.

Test Set-up – Dry Heat

3.1.6 Test Results

Procedure

The EUT was placed in the environmental chamber at laboratory ambient conditions. The temperature was then raised and maintained at +70°C for a period of approximately 13.5 hours after which time a performance check was carried out. The temperature of the chamber was then returned to laboratory ambient conditions after which time another performance check was carried out.

Performance Check

Performance tests were conducted both during and after the dry heat test. The self test function of the EUT operated correctly and message 1 and 14 were received by an AIS receiver.

3.2 DRY HEAT - FUNCTIONAL

3.2.1 Specification Reference

IEC 60945 Clause 8.2.2

3.2.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR001

3.2.3 Date of Test and Modification State

15 December 2009 - Modification State 0

3.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

3.2.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. The EUT was tested stand alone i.e. not enclosed in the storage bag as supplied by the manufacturer.

3.2.6 Test Results

Procedure

The EUT was placed in the environmental chamber at laboratory ambient conditions and the EUT then switched on. The temperature was then raised and maintained at +55°C for a period of approximately 15 hours after which time the performance test was carried out whilst at +55°C. The environmental conditions were maintained throughout the duration of the performance test. Once the performance test was complete the chamber conditions were returned to laboratory ambient.

Test Observations / Performance Check

The self test function of the EUT operated correctly and message 1 and 14 were received by an AIS receiver (performance check).

Performance Test

The performance test as required by IEC 60945 refers to the relevant equipment standard, which, in this case relates to IEC 61097-14. The table that follows lists the parameters that require checking for the Performance Test.

61097-14 Performance Test (Clause 5.2.3, 8.3.2.2)	Comments / Data	Result
A: AIS-SART starts transmission after valid GNSS data is available.	64 seconds after the EUT was switched into Test mode the EUT confirmed a successful self test. Messages 1 and 14 were also received by and AIS receiver.	Pass
B: A single burst of 8 messages in the correct order and correctly populated as per 3.7.2.	8 messages received and the actual decoded messages were compared against the required decoded message. See Confirmation Test Data below.	Pass
C: User ID as configured in the AIS-SART.	Received User ID:970000001 Actual User ID: 970000001	Pass
D: Navigational status = 15 (not defined).	Navigational status of all message 1 messages is equal to 15. See Confirmation Test Data below.	Pass
E: SOG = actual SOG from GNSS receiver.	The SOG value received was equal to 0.1 knots. See Decoded Test Data Table below. See also Note 1 (page 35)	-
F: Position accuracy = according to the RAIM result if provided, otherwise 0.	Position accuracy was equal to 0. See Decoded Test Data Table below.	Pass
G: Position = actual position from internal GNSS receiver.	The applied position was equal to the received position. See Decoded Test Data Table below (applied position was N 51° 22' 35" W 1° 49' 50")	Pass
H: COG = actual COG from internal GNSS receiver	See Decoded Test Data Table below. See also Note 1 (page 35)	-
I: Time stamp = actual UTC second (0...59).	See Note 2 (page 35)	-
J: The communication state time-out always = 0 with sub message = 0.	See Confirmation Test Data below.	Pass
K: The transmission of Messages 1 and 14 stops after one burst of 8 messages.	From 14:00 hours the AIS receiver did not receive any further messages hence confirming that only a single burst of 8 messages was received.	Pass
L: The text message in Message 14 is “SART TEST”.	Text message of message 14 was decoded as “SART TEST”. See Confirmation Test Data below.	Pass
M: Verify correct indication as per manufacturer’s documentation.	The label on the front of the AIS SART indicates that 3 long flashes occur on successful completion of the self test function; 3 long flashes were recorded.	Pass

Confirmation Test Data - a single burst of 8 messages as per B, D, J and L above:

Message 1: !AIVDM,1,1,,A,>>M46PM<59B1@E=@,0*4F
Required Decode: AIS 1, Message 14 “SART TEST”
Actual Decode: AIS 1, Message 14 “SART TEST”

Message 2: !AIVDM,1,1,,B,1>M46POP01OoWe`MIMEDigv:1P00,0*32
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 3: !AIVDM,1,1,,A,1>M46POP01OoWe`MIMEDigv:1P00,0*31
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 4: !AIVDM,1,1,,B,1>M46POP01OoWe`MIMEDigv:1P00,0*32
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 5: !AIVDM,1,1,,A,1>M46POP01OoWe`MIMEDigv:1P00,0*31
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 6: !AIVDM,1,1,,B,1>M46POP01OoWe`MIMEDigv:1P00,0*32
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 7: !AIVDM,1,1,,A,1>M46POP01OoWe`MIMEDigv:1P00,0*31
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 8: !AIVDM,1,1,,B,>>M46PM<59B1@E=@,0*4C
Required Decode: AIS 2, Message 14 “SART TEST”
Actual Decode: AIS 2, Message 14 "SART TEST"

Decoded Test Data Table as per E – M above:

	Message	Safety Related Text	User ID	SOG*	Pos'n acc'cy	Latitude	Longitude	COG*	Time stamp
1	14	SART TEST	970000001	N/A	N/A	N/A	N/A	- N/A -	- N/A -
2	1	N/A	970000001	0.1	0	N 51° 22' 35"	W 1° 49' 50"	122.2	NOTE 2
3	1	N/A	970000001	0.1	0	N 51° 22' 35"	W 1° 49' 50"	122.2	NOTE 2
4	1	N/A	970000001	0.1	0	N 51° 22' 35"	W 1° 49' 50"	122.2	NOTE 2
5	1	N/A	970000001	0.1	0	N 51° 22' 35"	W 1° 49' 50"	122.2	NOTE 2
6	1	N/A	970000001	0.1	0	N 51° 22' 35"	W 1° 49' 50"	122.2	NOTE 2
7	1	N/A	970000001	0.1	0	N 51° 22' 35"	W 1° 49' 50"	122.2	NOTE 2
8	14	SART TEST	970000001	N/A	N/A	N/A	N/A	- N/A -	- N/A -

Note 1: Applied position had no COG or SOG, however, given the SOG is the smallest value possible to encode apart from zero, this was disregarded, that being the case, the COG also becomes invalid. It is likely that the SOG/COG came from the acquired position changing as accuracy improved in the initial few seconds of position validity. NB: 0.1kts = 0.051ms-1

Note 2: It is not possible to encode the UTC into the AIS VDM sentence when the time-out = 0 and the sub-message = 0.

3.3 DAMP HEAT

3.3.1 Specification Reference

IEC 60945 Clause 8.3

3.3.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0014

3.3.3 Date of Test and Modification State

09 November 2009 - Modification State 0

3.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

3.3.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. The EUT was tested stand alone i.e. not enclosed in the storage bag as supplied by the manufacturer.

Test Set-up – Damp Heat

3.3.6 Test Results

Procedure

The EUT 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 15 hours after which time the AIS SART was switched on and remained operational for 2 hours. During the 2 hours of operation the AIS SART was subject to a performance check. The environmental conditions of the climatic chamber were then returned to room temperature within 1 hour. A performance check was also carried out after the test.

Performance Check

Performance tests were carried out both during and after the damp heat test. The self test function of the EUT operated correctly and message 1 and 14 were received by an AIS receiver (performance check).

3.4 LOW TEMPERATURE STORAGE AND FUNCTIONAL

3.4.1 Specification Reference

IEC 60945 Clause 8.4

3.4.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0014

3.4.3 Date of Test and Modification State

10 November 2009 - Modification State 0

3.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

3.4.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. The EUT was tested stand alone i.e. not enclosed in the storage bag as supplied by the manufacturer.

Test Set-up – Low Temperature

3.4.6 Test Results

Procedure

The EUT was placed in the environmental chamber at laboratory ambient conditions. The temperature was then lowered to -30°C for 15.5 hours. The temperature was raised to -20°C and the AIS SART was switch on and remained operational for 2 hours; a performance test and check were carried out during this time. Once the performance test and check were complete the conditions of the environmental chamber were returned to laboratory ambient.

Test Observations / Performance Check

The performance test was carried out after the storage test at -30 whilst at an operational temperature of -20°C; the self test function of the EUT operated correctly and message 1 and 14 were received by an AIS receiver.

Performance Test

The performance test as required by IEC 60945 refers to the relevant equipment standard, which, in this case relates to IEC 61097-14. The table that follows lists the parameters that require checking for the Performance Test.

61097-14 Performance Test (Clause 5.2.3, 8.3.2.2)	Comments / Data	Result
A: AIS-SART starts transmission after valid GNSS data is available.	60 seconds after the EUT was switched into Test mode the EUT confirmed a successful self test. Messages 1 and 14 were also received by and AIS receiver.	Pass
B: A single burst of 8 messages in the correct order and correctly populated as per 3.7.2.	8 messages received and the actual decoded messages were compared against the required decoded message. See Confirmation Test Data below.	Pass
C: User ID as configured in the AIS-SART.	Received User ID:970000001 Actual User ID: 970000001	Pass
D: Navigational status = 15 (not defined).	Navigational status of all message 1 messages is equal to 15. See Confirmation Test Data below.	Pass
E: SOG = actual SOG from GNSS receiver.	The SOG value received was equal to 0.1 knots*. See Decoded Test Data Table below. See also Note 3 (page 41).	-
F: Position accuracy = according to the RAIM result if provided, otherwise 0.	Position accuracy was equal to 0. See Decoded Test Data Table below.	Pass
G: Position = actual position from internal GNSS receiver.	The applied position was equal to the received position. See Decoded Test Data Table below (applied position was N 50° 51’ 59”, E 1° 15’ 48”).	Pass
H: COG = actual COG from internal GNSS receiver	See Decoded Test Data Table below. See also Note 3 (page 41).	-
I: Time stamp = actual UTC second (0...59).	See Note 4 (page 41).	-
J: The communication state time-out always = 0 with sub message = 0.	See Confirmation Test Data below.	Pass
K: The transmission of Messages 1 and 14 stops after one burst of 8 messages.	The EUT was monitored for 78 minutes: during this time the AIS receiver did not receive any further messages hence confirming that only a single burst of 8 messages was received.	Pass
L: The text message in Message 14 is “SART TEST”.	Text message of message 14 was decoded as “SART TEST”. See Decoded Test Data below.	Pass
M: Verify correct indication as per manufacturer’s documentation.	The label on the front of the AIS SART indicates that 3 long flashes occur on successful completion of the self test function; 3 long flashes were recorded.	Pass

Confirmation Test Data - a single burst of 8 messages as per B, D, J and L above:

Message 1: !AIVDM,1,1,,A,>>M46PM<59B1@E=@,0*4F
Required Decode: AIS 1, Message 14 “SART TEST”
Actual Decode: AIS 1, Message 14 “SART TEST”

Message 2: !AIVDM,1,1,,B,1>M46POP0005j7DM6j3Qvww41P00,0*65
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 3: !AIVDM,1,1,,A,1>M46POP0005j7DM6j3Qvww41P00,0*65
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 4: !AIVDM,1,1,,B,1>M46POP0005j7DM6j3Qvww41P00,0*65
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 5: !AIVDM,1,1,,A,1>M46POP0005j7DM6j3Qvww41P00,0*65
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 6: !AIVDM,1,1,,B,1>M46POP0005j7DM6j3Qvww41P00,0*65
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 7: !AIVDM,1,1,,A,1>M46POP0005j7DM6j3Qvww41P00,0*65
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 8: !AIVDM,1,1,,B,>>M46PM<59B1@E=@,0*4C
Required Decode: AIS 2, Message 14 “SART TEST”
Actual Decode: AIS 2, Message 14 "SART TEST"

Decoded Test Data Table as per E – M above:

	Message	Safety Related Text	User ID	SOG*	Pos'n acc'cy	Latitude	Longitude	COG*	Time stamp
1	14	SART TEST	970000001	- N/A -	- N/A -	- N/A -	- N/A -	- N/A -	- N/A -
2	1	- N/A -	970000001	0	0	N 50° 51' 59"	E 1° 15' 48"	50.7	NOTE 4
3	1	- N/A -	970000001	0	0	N 50° 51' 59"	E 1° 15' 48"	50.7	0
4	1	- N/A -	970000001	0	0	N 50° 51' 59"	E 1° 15' 48"	50.7	0
5	1	- N/A -	970000001	0	0	N 50° 51' 59"	E 1° 15' 48"	50.7	0
6	1	- N/A -	970000001	0	0	N 50° 51' 59"	E 1° 15' 48"	50.7	0
7	1	- N/A -	970000001	0	0	N 50° 51' 59"	E 1° 15' 48"	50.7	0
8	14	SART TEST	970000001	- N/A -	- N/A -	- N/A -	- N/A -	- N/A -	- N/A -

Note 3: Applied position had no COG or SOG, however, given the SOG is the smallest value possible to encode apart from zero, this was disregarded, that being the case, the COG also becomes invalid. It is likely that the SOG/COG came from the acquired position changing as accuracy improved in the initial few seconds of position validity. NB: 0.1kts = 0.051ms-1

Note 4: It is not possible to encode the UTC into the AIS VDM sentence when the time-out = 0 and the sub-message = 0.

3.5 DROP ONTO HARD SURFACE

3.5.1 Specification Reference

IEC 60945 Clause 8.6

3.5.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0014

3.5.3 Date of Test and Modification State

02 December 2009 - Modification State 1

3.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

3.5.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. The EUT was tested stand alone i.e. not enclosed in the storage bag as supplied by the manufacturer. The mounting pole was attached to the AIS SART but not installed. A bung was fitted in the end of the mounting pole and the AIS SART was held together with the mounting pole with two rubber bands as supplied by the manufacturer.

Test Set-up - Drop Test

3.5.6 Test Results

Procedure

The EUT was subject to a series of 6 drops from a height of 1 metre, one on each face of the EUT. The EUT was dropped onto a piece of solid hard wood in accordance with the specification. After the 6 drops the EUT was inspected for external signs of damage and subject to the performance check.

Test Observations

The test was carried out twice as some damage occurred. The AIS SART was modified and the EUT retested. No further damage occurred. The modification details are recorded in section 1.6.

Following the second drop test (i.e. after the modification) there were no visible external indications of damage that could affect the functionality of the EUT.

Performance Check

The performance check was carried out after the drop test; the self test function of the EUT operated correctly and message 1 and 14 were received by an AIS receiver.

3.6 VIBRATION

3.6.1 Specification Reference

IEC 60945 Clause 8.7

3.6.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0007

3.6.3 Date of Test and Modification State

11 November 2009 - Modification State 0

3.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

3.6.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle. The EUT was tested in the storage bag as supplied by the manufacturer.

Test Set-up – Vibration

3.6.6 Test Results

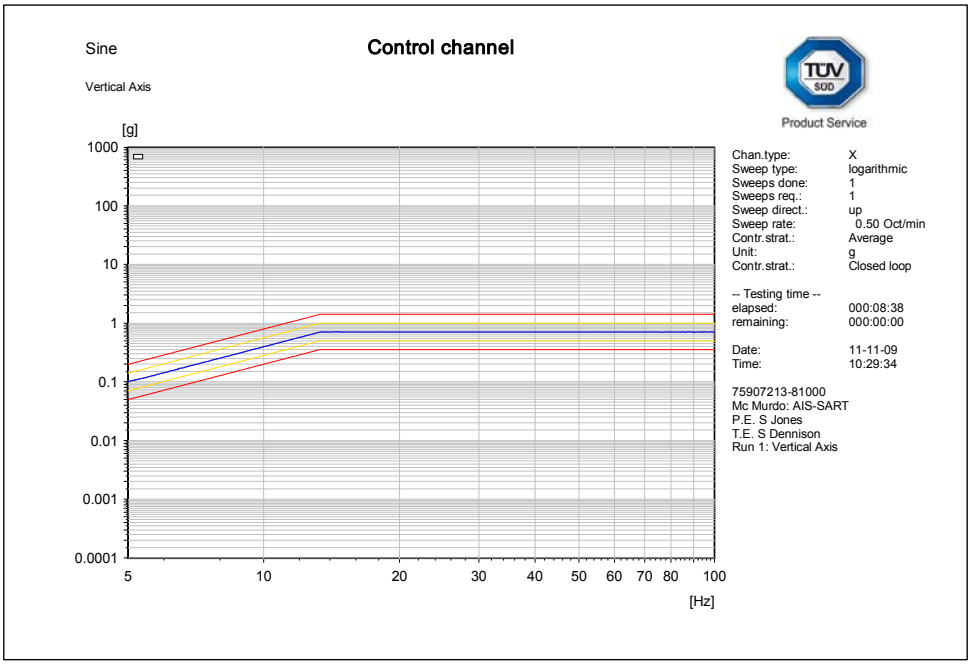
Procedure

The EUT, in the storage bag, was clamped to the vibration table and was subject to the following vibration profile:

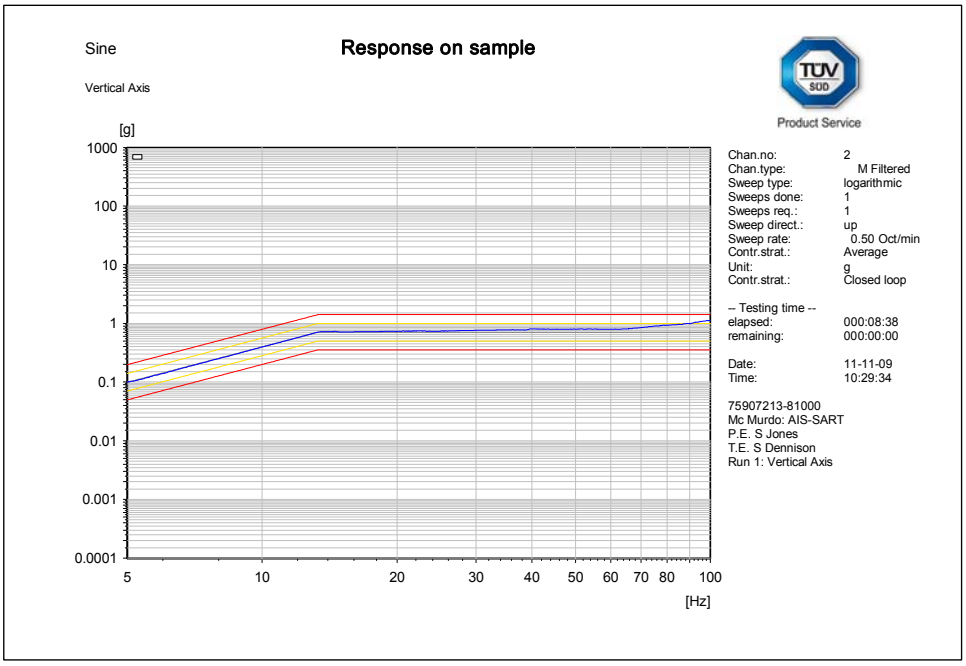
5 Hz and up to 13,2 Hz with an excursion of ±1 mm ± 10 % (7 m/s^2 maximum acceleration at 13,2 Hz);
– above 13,2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s^2.

For each axis a resonance search was conducted, see Control Channel (input) and Response Channel (output/EUT response) plots. If no resonance was found the endurance run was performed at 30Hz for a period of 2 hours, see following Control Channel and Response Channel plots.

Lateral Axis – Resonance Search



C:\VcpNT\Daten\m+p\McMurdo\75907213\RS_007.rsn



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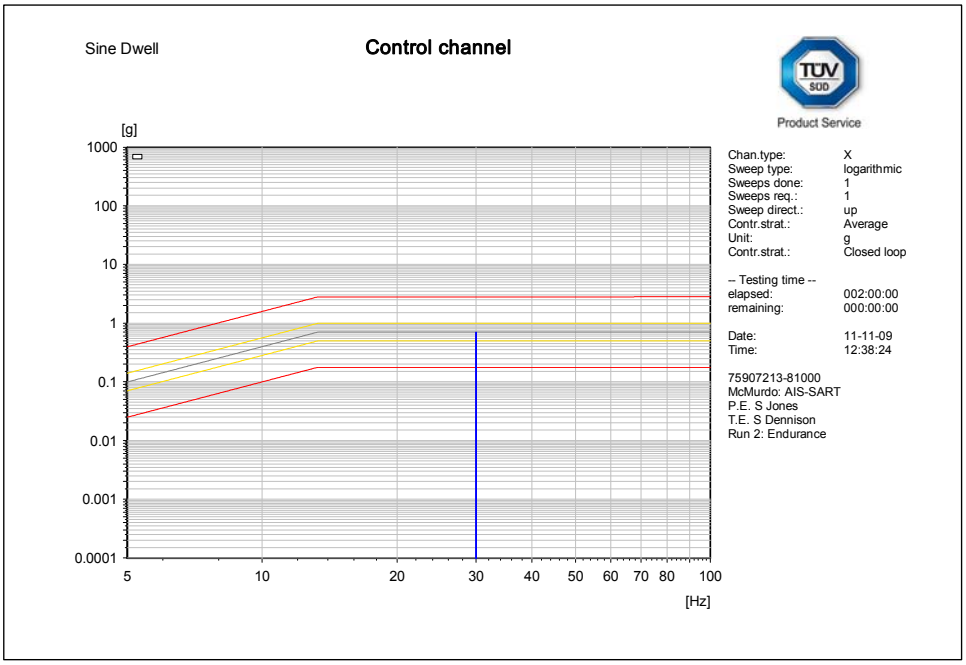
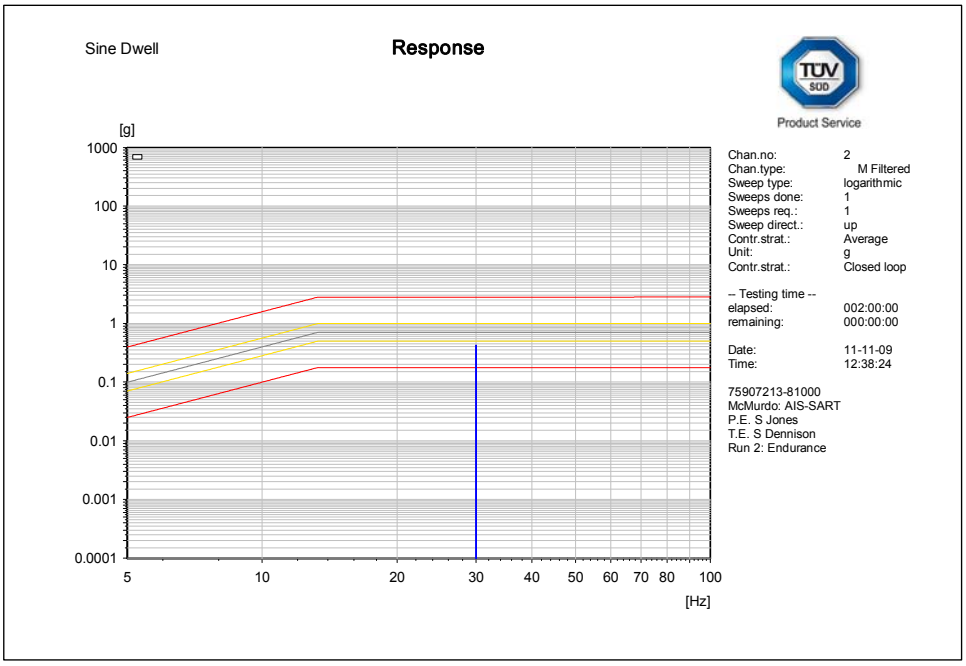
Lateral Axis – Endurance Run

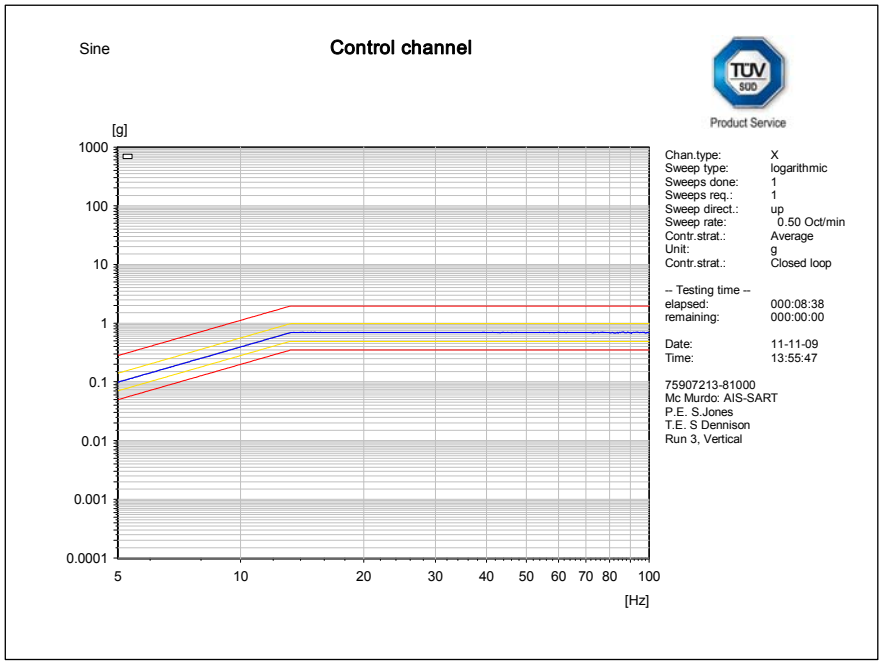


C:\VcpNT\Daten\m+p\McMurdo\75907213\Vertical Endurance 002.rsd

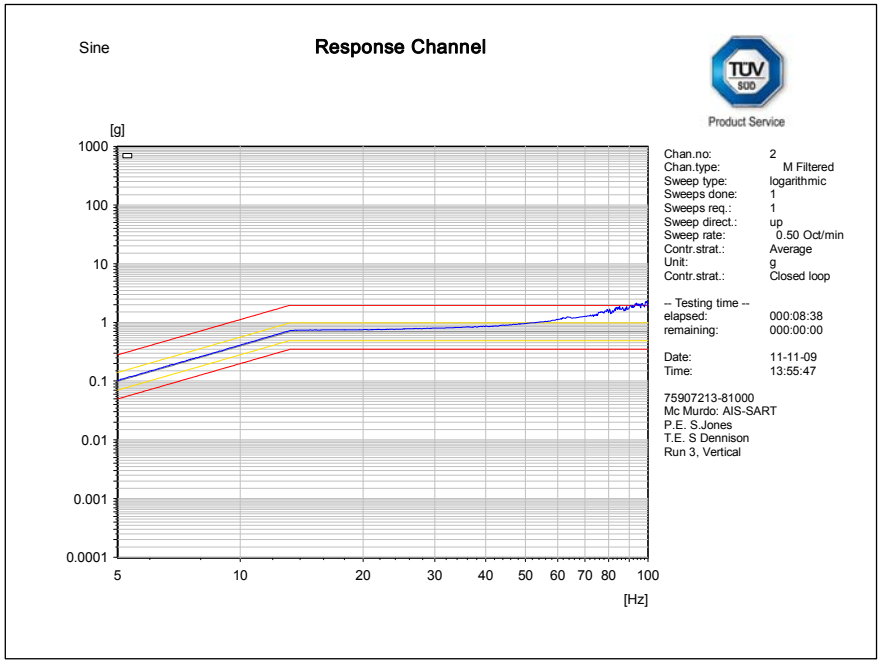


C:\VcpNT\Daten\m+p\McMurdo\75907213\Vertical Endurance 002.rsd

Vertical Axis – Resonance Search

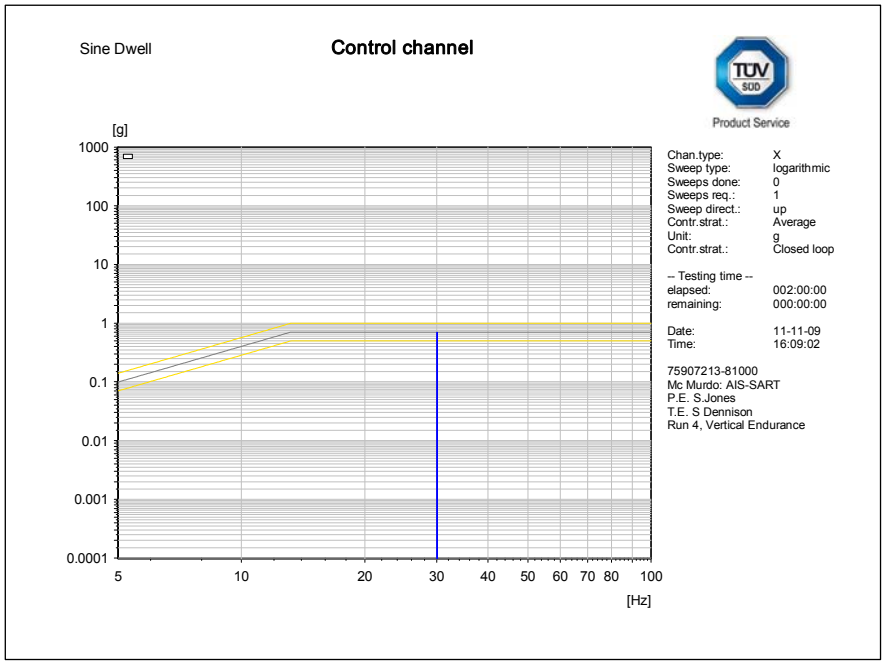


C:\VcpNT\Daten\m+p\Mcmurdo\75907213\Sine Sweep Vibration Test 003.rsn



C:\VcpNT\Daten\m+p\Mcmurdo\75907213\Sine Sweep Vibration Test 003.rsn

Vertical Axis – Endurance Run



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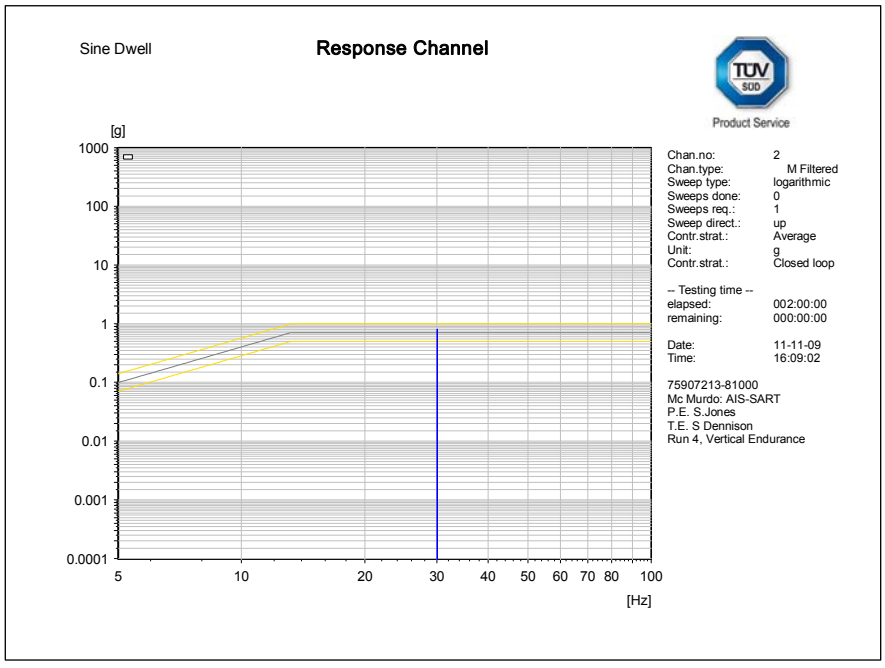

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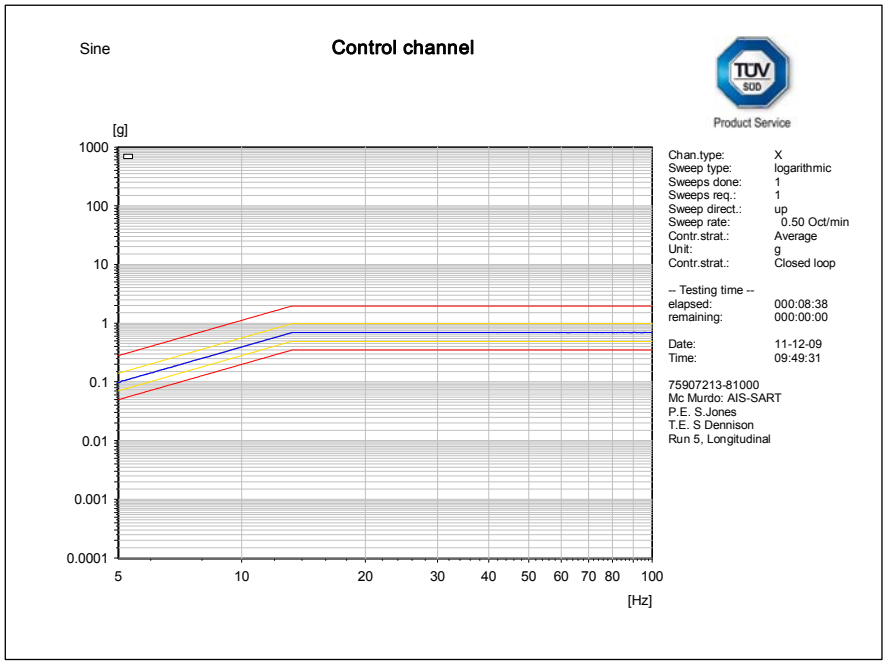
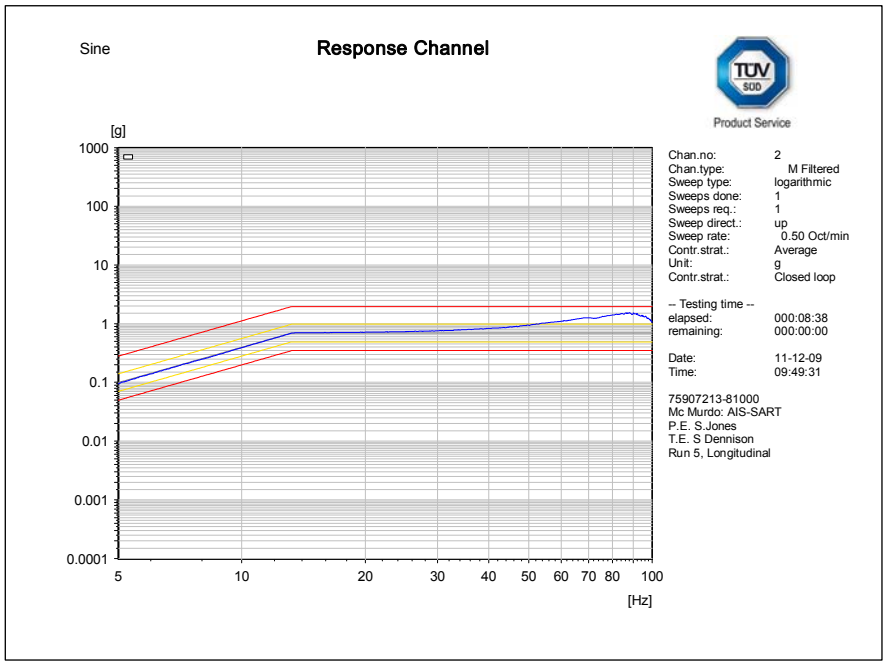
Longitudinal Axis – Resonance Search



C:\VcpNT\Daten\m+p\Mcmurdo\75907213\Sine Sweep Vibration Test 005.rsn



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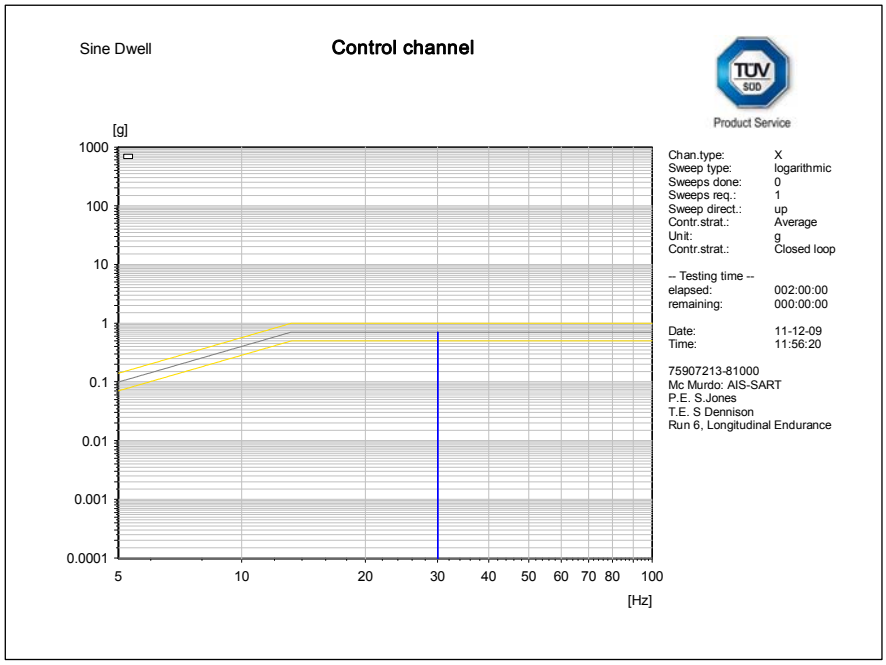
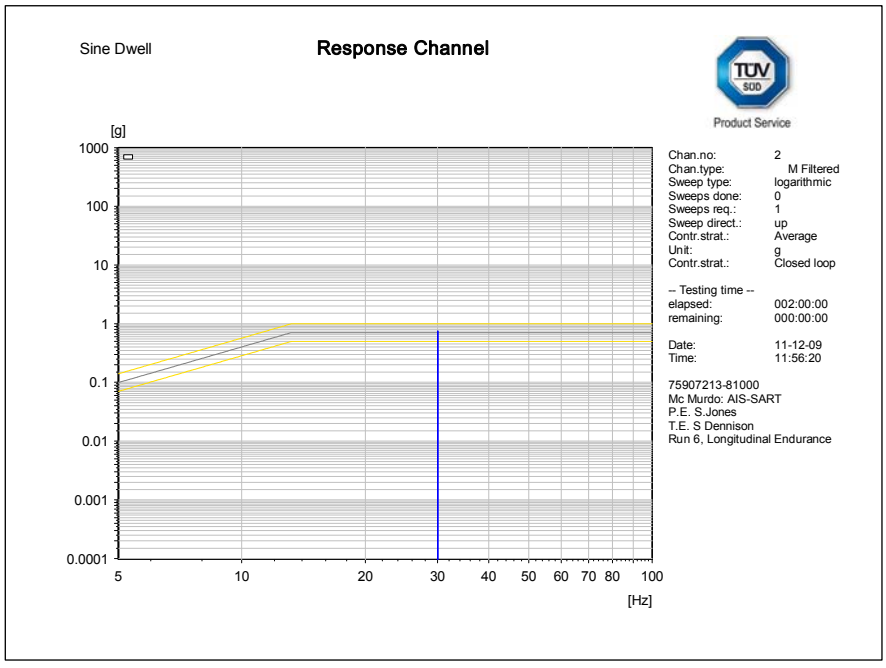
Longitudinal Axis – Endurance Run



C:\VcpNT\Daten\m+p\Mcmurdo\75907213\SineDwell_004.rsd



C:\VcpNT\Daten\m+p\Mcmurdo\75907213\SineDwell_004.rsd

Test Observations

No resonance frequencies were detected and hence the EUT was subject to the 2 hour endurance run at a frequency of 30 Hz for each axis.

Performance Check

The performance check was completed after the vibration test; the self test function of the EUT operated correctly and messages 1 and 14 were received by an AIS receiver.

3.7 COMPASS SAFE DISTANCE

3.7.1 Specification Reference

IEC 60945 Clause 11.2

3.7.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0007

3.7.3 Date of Test and Modification State

02 November 2009 - Modification State 0

3.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

3.7.5 Test Set-up and Operating Modes

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

Test Set-up – Compass Safe Distance

3.7.6 Test Results

Procedure

The test was applied in accordance with the test method requirements of IEC 60945.

For the period of test the EUT met the requirements of IEC 60945: 2002-08 for Compass Safe Distance (Enclosure Port).

Test Observations

Orientation of the EUT	Un-powered State		Normalised	
	Distance From Compass (cm) at 0.27° deflection	Distance From Compass (cm) at 0.9° deflection	Distance From Compass (cm) at 0.27° deflection	Distance From Compass (cm) at 0.9° deflection
Front	17 No deflection	17 No deflection	17 No deflection	17 No deflection
Top	17 No deflection	17 No deflection	17 No deflection	17 No deflection
Left Hand Side	17 No deflection	17 No deflection	17 No deflection	17 No deflection
Right Hand Side	17	17 0.27°	17	17 0.27°
Underside	17 No deflection	17 No deflection	17 No deflection	17 No deflection
Rear	17 No deflection	17 No deflection	17 No deflection	17 No deflection

Standard Compass safe distance	200mm
Emergency Compass safe distance	200mm

Performance Check / Test

Not required.

SECTION 4

PHYSICAL RADIO TESTS

Radio Approval Testing of the
McMurdo Limited SmartFind S5 AIS SART
in accordance with IEC 61097-14

4.1 BATTERY CAPACITY TEST

4.1.1 Specification Reference

IEC 61097-14 Clause 6.2 (3.3.1)

4.1.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0001

4.1.3 Date of Test and Modification State

Start: 21 November 2009 - Modification State 0
End: 28 January 2010 - Modification State 0 (post test performance test only)

4.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

4.1.5 Test Set-up and Operating Modes

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

The test was performed using the Panasonic battery pack.

The EUT was modified to provide a 50Ω conducted output.

4.1.6 Test Results

Procedure

The battery was pre-discharged for 0.222 amp hours prior to the test. The battery was discharged by constant current discharge via a connection to a resistive load.

The EUT was connected to a spectrum analyser which was automated to take power and frequency measurements at regular intervals. This confirmed that the EUT continued to operate throughout the 96-hour period.

Test Observations

The test ran for a period of greater than 96hrs. No noticeable drop in output power was noted at 120 hours, at which point the test was terminated.

Performance Test

The table that follows lists the parameters that require checking for the Performance Test.

61097-14 Performance Test (Clause 5.2.3, 8.3.2.2)	Comments / Data	Result
A: AIS-SART starts transmission after valid GNSS data is available.	59 seconds after the EUT was switched into Test mode the EUT confirmed a successful self test. Messages 1 and 14 were also received by and AIS receiver.	Pass
B: A single burst of 8 messages in the correct order and correctly populated as per 3.7.2.	8 messages received and the actual decoded messages were compared against the required decoded message. See Confirmation Test Data below.	Pass
C: User ID as configured in the AIS-SART.	Received User ID:970000000 Actual User ID: 970000000	Pass
D: Navigational status = 15 (not defined).	Navigational status of all message 1 messages is equal to 15. See Confirmation Test Data below.	Pass
E: SOG = actual SOG from GNSS receiver.	The SOG value received was equal to 0.1 knots. See Decoded Test Data Table below. See also Note 1 (page 35).	-
F: Position accuracy = according to the RAIM result if provided, otherwise 0.	Position accuracy was equal to 0. See Decoded Test Data Table below.	Pass
G: Position = actual position from internal GNSS receiver.	The applied position was equal to the received position. See Decoded Test Data Table below (applied position was N 50° 52' 9" W 1° 14' 41")	Pass
H: COG = actual COG from internal GNSS receiver	See Decoded Test Data Table below. See also Note 1 (page 35).	-
I: Time stamp = actual UTC second (0...59).	See Note 2 (page 35).	-
J: The communication state time-out always = 0 with sub message = 0.	See Confirmation Test Data below.	Pass
K: The transmission of Messages 1 and 14 stops after one burst of 8 messages.	After 15 mins the AIS receiver did not receive any further messages hence confirming that only a single burst of 8 messages was received.	Pass
L: The text message in Message 14 is “SART TEST”.	Text message of message 14 was decoded as “SART TEST”. See Confirmation Test Data below.	Pass
M: Verify correct indication as per manufacturer’s documentation.	The label on the front of the AIS SART indicates that 3 long flashes occur on successful completion of the self test function; 3 long flashes were recorded.	Pass

Confirmation Test Data - a single burst of 8 messages as per B, D, J and L above:

Message 1: !AIVDM,1,1,,A,>>M46P=<59B1@E=@,0*3F
Required Decode: AIS 1, Message 14 “SART TEST”
Actual Decode: AIS 1, Message 14 “SART TEST”

Message 2: !AIVDM,1,1,,B,1>M46P?P01OrCDpM6pVC7?w41P00,0*25
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 3: !AIVDM,1,1,,A,1>M46P?P01OrCDpM6pVC7?w41P00,0*26
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 4: !AIVDM,1,1,,B,1>M46P?P01OrCDpM6pVC7?w41P00,0*25
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 5: !AIVDM,1,1,,A,1>M46P?P01OrCDpM6pVC7?w41P00,0*26
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 6: !AIVDM,1,1,,B,1>M46P?P01OrCDpM6pVC7?w41P00,0*25
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 7: !AIVDM,1,1,,A,1>M46P?P01OrCDpM6pVC7?w41P00,0*26
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 8: !AIVDM,1,1,,B,>>M46P=<59B1@E=@,0*3C
Required Decode: AIS 2, Message 14 “SART TEST”
Actual Decode: AIS 2, Message 14 "SART TEST"

Decoded Test Data Table as per E – M above:

	Message	Safety Related Text	User ID	SOG*	Pos'n acc'cy	Latitude	Longitude	COG*	Time stamp
1	14	SART TEST	970000000	N/A	N/A	- N/A -	- N/A -	- N/A -	- N/A -
2	1	N/A	970000000	0.1	0	N 50° 52' 9"	W 1° 14' 41"	79.6	NOTE 2
3	1	N/A	970000000	0.1	0	N 50° 52' 9"	W 1° 14' 41"	79.6	NOTE 2
4	1	N/A	970000000	0.1	0	N 50° 52' 9"	W 1° 14' 41"	79.6	NOTE 2
5	1	N/A	970000000	0.1	0	N 50° 52' 9"	W 1° 14' 41"	79.6	NOTE 2
6	1	N/A	970000000	0.1	0	N 50° 52' 9"	W 1° 14' 41"	79.6	NOTE 2
7	1	N/A	970000000	0.1	0	N 50° 52' 9"	W 1° 14' 41"	79.6	NOTE 2
8	14	SART TEST	970000000	N/A	N/A	- N/A -	- N/A -	- N/A -	- N/A -

Note 1: Applied position had no COG or SOG, however, given the SOG is the smallest value possible to encode apart from zero, this was disregarded, that being the case, the COG also becomes invalid. It is likely that the SOG/COG came from the acquired position changing as accuracy improved in the initial few seconds of position validity. NB: 0.1kts = 0.051ms-1

Note 2: It is not possible to encode the UTC into the AIS VDM sentence when the time-out = 0 and the sub-message = 0.

4.2 BATTERY CAPACITY TEST – ALTERNATE BATTERY

4.2.1 Specification Reference

IEC 61097-14 Clause 6.2 (3.3.1)

4.2.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0014

4.2.3 Date of Test and Modification State

Start: 14 January 2010 - Modification State 1
End: 28 January 2010 - Modification State 1 (post test performance test only)

4.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

4.2.5 Test Set-up and Operating Modes

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

The test was performed using the alternate Varta battery pack.

The EUT was modified to provide a 50Ω conducted output.

4.2.6 Test Results

Procedure

The battery was pre-discharged for 0.222 amp hours prior to the test. The battery was discharged by constant current discharge via a connection to a resistive load.

The EUT was connected to a spectrum analyser which was automated to take power and frequency measurements at regular intervals. This confirmed that the EUT continued to operate throughout the 96-hour period.

Test Observations

The test ran for a period of greater than 96hrs. No noticeable drop in output power was noted at 120 hours, at which point the test was terminated.

Performance Test

The table that follows lists the parameters that require checking for the Performance Test.

61097-14 Performance Test (Clause 5.2.3, 8.3.2.2)	Comments / Data	Result
A: AIS-SART starts transmission after valid GNSS data is available.	90 seconds after the EUT was switched into Test mode the EUT confirmed a successful self test. Messages 1 and 14 were also received by and AIS receiver.	Pass
B: A single burst of 8 messages in the correct order and correctly populated as per 3.7.2.	8 messages received and the actual decoded messages were compared against the required decoded message. See Confirmation Test Data below.	Pass
C: User ID as configured in the AIS-SART.	Received User ID:970000001 Actual User ID: 970000001	Pass
D: Navigational status = 15 (not defined).	Navigational status of all message 1 messages is equal to 15. See Confirmation Test Data below.	Pass
E: SOG = actual SOG from GNSS receiver.	The SOG value received was equal to 0 knots. See Decoded Test Data Table below. See also Note 1 (page 35).	-
F: Position accuracy = according to the RAIM result if provided, otherwise 0.	Position accuracy was equal to 0. See Decoded Test Data Table below.	Pass
G: Position = actual position from internal GNSS receiver.	The applied position was equal to the received position. See Decoded Test Data Table below (applied position was N 50° 52' 9" W 1° 14' 41")	Pass
H: COG = actual COG from internal GNSS receiver	See Decoded Test Data Table below. See also Note 1 (page 35).	-
I: Time stamp = actual UTC second (0...59).	See Note 2 (page 35).	-
J: The communication state time-out always = 0 with sub message = 0.	See Confirmation Test Data below.	Pass
K: The transmission of Messages 1 and 14 stops after one burst of 8 messages.	After 15 mins the AIS receiver did not receive any further messages hence confirming that only a single burst of 8 messages was received.	Pass
L: The text message in Message 14 is “SART TEST”.	Text message of message 14 was decoded as “SART TEST”. See Confirmation Test Data below.	Pass
M: Verify correct indication as per manufacturer’s documentation.	The label on the front of the AIS SART indicates that 3 long flashes occur on successful completion of the self test function; 3 long flashes were recorded.	Pass

Confirmation Test Data - a single burst of 8 messages as per B, D, J and L above:

Message 1: !AIVDM,1,1,,A,>>M46PM<59B1@E=@,0*4F
Required Decode: AIS 1, Message 14 “SART TEST”
Actual Decode: AIS 1, Message 14 “SART TEST”

Message 2: !AIVDM,1,1,,B,1>M46POP00OrCERM6pPN4?v:1P00,0*70
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 3: !AIVDM,1,1,,A,1>M46POP00OrCERM6pPN4?v:1P00,0*73
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 4: !AIVDM,1,1,,B,1>M46POP00OrCERM6pPN4?v:1P00,0*70
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 5: !AIVDM,1,1,,A,1>M46POP00OrCERM6pPN4?v:1P00,0*73
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 6: !AIVDM,1,1,,B,1>M46POP00OrCERM6pPN4?v:1P00,0*70
Required Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 7: !AIVDM,1,1,,A,1>M46POP00OrCERM6pPN4?v:1P00,0*73
Required Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
Actual Decode: AIS 1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)

Message 8: !AIVDM,1,1,,B,>>M46PM<59B1@E=@,0*4C
Required Decode: AIS 2, Message 14 “SART TEST”
Actual Decode: AIS 2, Message 14 "SART TEST"

Decoded Test Data Table as per E – M above:

	Message	Safety Related Text	User ID	SOG*	Pos'n acc'cy	Latitude	Longitude	COG*	Time stamp
1	14	SART TEST	970000001	N/A	N/A	- N/A -	- N/A -	- N/A -	- N/A -
2	1	N/A	970000001	0	0	N 50° 52' 9"	W 1° 14' 41"	360	NOTE 2
3	1	N/A	970000001	0	0	N 50° 52' 9"	W 1° 14' 41"	360	NOTE 2
4	1	N/A	970000001	0	0	N 50° 52' 9"	W 1° 14' 41"	360	NOTE 2
5	1	N/A	970000001	0	0	N 50° 52' 9"	W 1° 14' 41"	360	NOTE 2
6	1	N/A	970000001	0	0	N 50° 52' 9"	W 1° 14' 41"	360	NOTE 2
7	1	N/A	970000001	0	0	N 50° 52' 9"	W 1° 14' 41"	360	NOTE 2
8	14	SART TEST	970000001	N/A	N/A	- N/A -	- N/A -	- N/A -	- N/A -

Note 1: Applied position had no COG or SOG, however, given the SOG is the smallest value possible to encode apart from zero, this was disregarded, that being the case, the COG also becomes invalid. It is likely that the SOG/COG came from the acquired position changing as accuracy improved in the initial few seconds of position validity. NB: 0.1kts = 0.051ms-1

Note 2: It is not possible to encode the UTC into the AIS VDM sentence when the time-out = 0 and the sub-message = 0.

4.3 FREQUENCY ERROR

4.3.1 Specification Reference

IEC 61097-14 Clause 7.2

4.3.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR001

4.3.3 Date of Test and Modification State

28 October 2009 - Modification State 0

4.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

4.3.5 Environmental Conditions

	28 October 2009
Ambient Temperature	25°C
Relative Humidity	51%

4.3.6 Test Results

Transmitter Unmodulated

Test Conditions		Frequency Error (kHz)	
		AIS 1	AIS 2
		161.975	162.025
Normal Test Conditions		-0.405	-0.263
T_{min}(-20ºC)	Old battery	-0.061	+0.036
T_{max}(+55ºC)	Fresh battery	-0.163	0.203
Measurement uncertainty		± 36 Hz	

Limit Clause 7.2.3

The frequency error shall not exceed ±0.5 kHz under normal test conditions and ±1 kHz under extreme test conditions.

4.4 CONDUCTED POWER

4.4.1 Specification Reference

IEC 61097-14 Clause 7.3

4.4.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR001

4.4.3 Date of Test and Modification State

29 October 2009 - Modification State 0

4.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

4.4.5 Environmental Conditions

	29 October 2009
Ambient Temperature	25°C
Relative Humidity	51%

4.4.6 Test Results

Test Conditions		Conducted Power (dBm)	
		AIS 1 OR AIS 2	
		AIS1	AIS2
		161.975	162.025
Normal Test Conditions		33.03	32.97
T_{min}(-20ºC)	Old battery	31.75	31.58
T_{max}(+55ºC)	Fresh battery	33.54	33.34
Measurement uncertainty		± 0.5 dB	

Limit Clause Table 6

	Result	Minimum Limit
P_R (minimum) [dBm]	*	27
P_{20} [dBm]	32.97	-
Calculated Gain ($G = P_R - P_{20} - P_d$ [a]) [dB]	*	-
P_{-20} – G [dBm]	*	27
P_{55} + G [dBm]	*	27
[a] – See clause 5.5 of the specification.		

* See section 4.5.

4.5 RADIATED POWER

4.5.1 Specification Reference

IEC 61097-14 Clause 7.4

4.5.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR0001

4.5.3 Date of Test and Modification State

12 November 2009 - Modification State 0

4.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

4.5.5 Environmental Conditions

	12 November 2009
Ambient Temperature	19.1°C
Relative Humidity	58%

4.5.6 Test Results

The battery was pre-discharged prior to the test in accordance with the specification. The manufacturer declared that by attaching a 130 ohm resistive load to a fresh battery for 16 hours would equate to 92 hours of pre-discharge.

Measurements were made (in dBm) and converted into PEIRP (using pre-calibrated site transducer factors) at an arbitrarily chosen azimuth angle across a range of elevation angles. Upon finding the maximum, the elevation was fixed and 4 measurements made at 90° azimuth increments. These results (from the vertically polarised dipole) were then converted to PEIRP in mW. See the following table:

Elevation (°)	Azimuth (°)			
	0	90	180	270
5	1825.7	1784.1	1743.5	1911.7
10	834.5	-	-	-
15	345.3	-	-	-
20	102.8	-	-	-
25	196.6	-	-	-
30	277.4	-	-	-

Elevation providing maximum PEIRP was 5°, the minimum result at this elevation was calculated to be 1743.5 mW, which is greater than 500mW and therefore a pass.

1743.5 mW = 32.41dBm, this value is used to complete Table 6 below.

Measurement uncertainty	± 2.12 dB

Limit Clause Table 6

	Result	Minimum Limit
P_R (minimum) [dBm]	32.41	27
P_{20} [dBm]	32.97[2]	-
Calculated Gain ($G = P_R - P_{20} - P_d$[3]) [dB]	32.41 - 32.97 - 0 = -0.56	-
P_{-20} – G [dBm]	31.02	27
P_{55} + G [dBm]	32.78	27

[2] From Conducted Test Results, above
[3] Same unit was used for both tests, hence P_d=0dB

4.6 MODULATION SPECTRUM SLOTTED TRANSMISSION

4.6.1 Specification Reference

IEC 61097-14 Clause 7.5

4.6.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR001

4.6.3 Date of Test and Modification State

26 October 2009 - Modification State 0

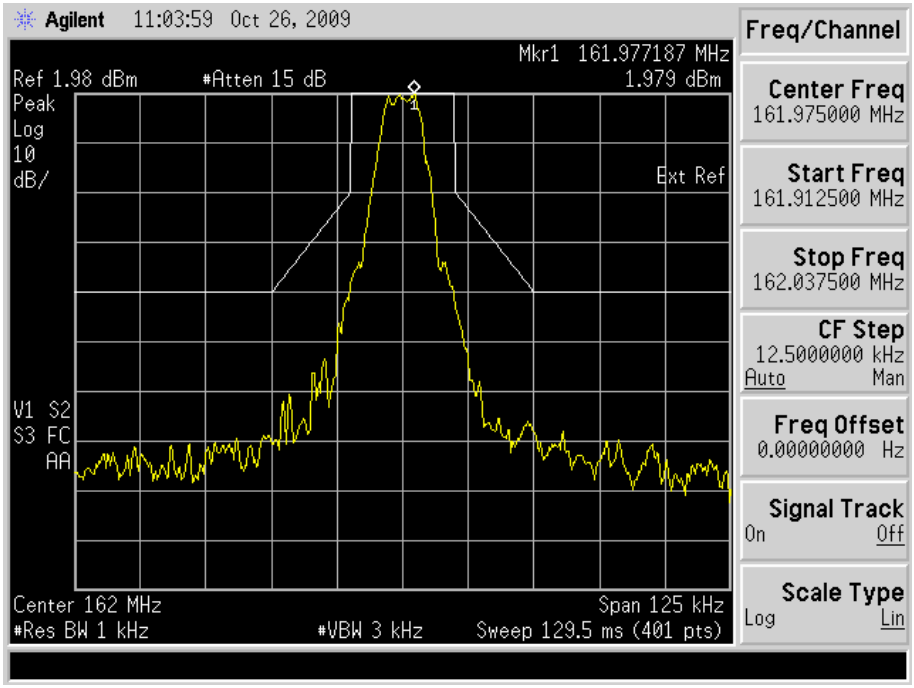
4.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

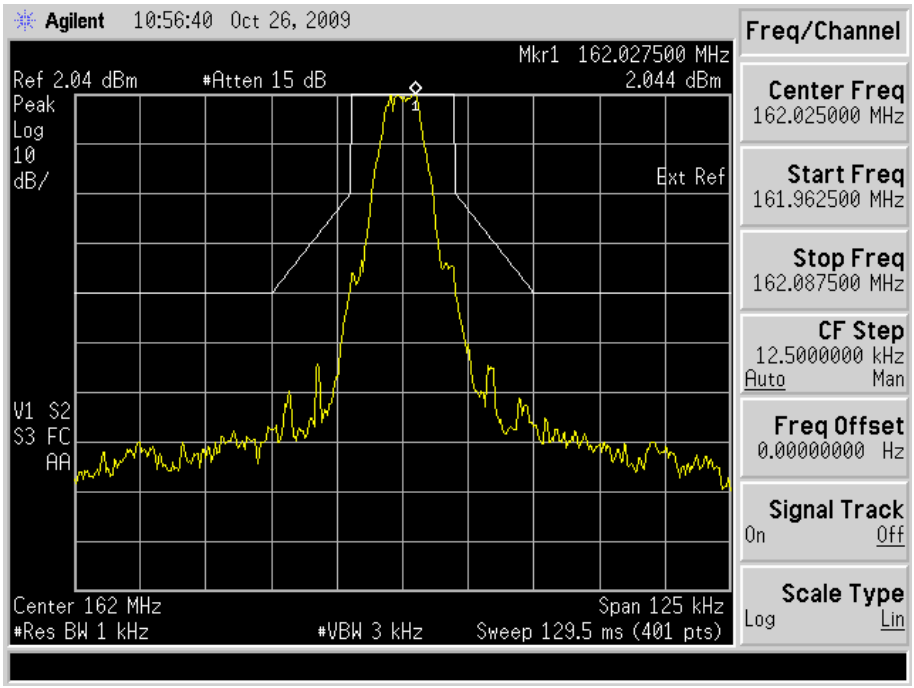
4.6.5 Environmental Conditions

	26 October 2009
Ambient Temperature	23°C
Relative Humidity	46%

4.6.6 Test Results



AIS 1 Bottom Channel



AIS 2 Top Channel

Limit Clause 7.5.3 and figure 4

In the region between the carrier and ±10 kHz removed from the carrier, the modulation and transient sidebands shall be below 0dBc

At 10 kHz removed from the carrier, the modulation and transient sidebands shall be below –20dBc

At 25 kHz to ±62.5kHz removed from the carrier, the modulation and transient sidebands shall be below the lower value of –40dBc

In the region between ±10kHz and ±25kHz removed from the carrier, the modulation and transient sidebands shall be below a line specified between these two points.

The reference level for the measurement shall be the carrier power (conducted) recorded for the appropriate test frequency in 7.3.

Also, please refer to the mask shown in figure 4 of the specification.

Measurement uncertainty	± 1.74 dB / 1.12 kHz

4.7 TRANSMITTER TEST SEQUENCE AND MODULATION ACCURACY

4.7.1 Specification Reference

IEC 61097-14 Clause 7.6

4.7.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR001

4.7.3 Date of Test and Modification State

17 January 2010 - Modification State 0

4.7.4 Test Equipment Used

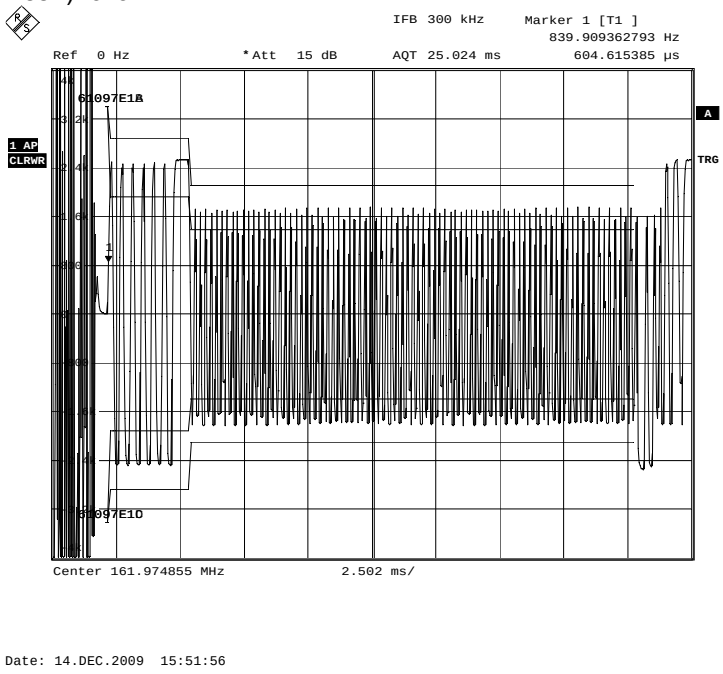
The major items of test equipment used for the above tests are identified in Section 5.1.

4.7.5 Environmental Conditions

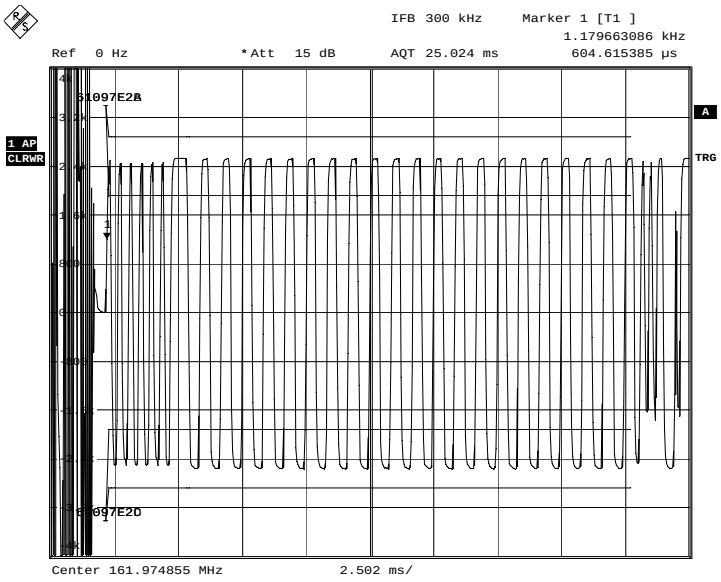
	17 January 2010
Ambient Temperature	21°C
Relative Humidity	24%

4.7.6 Test Results

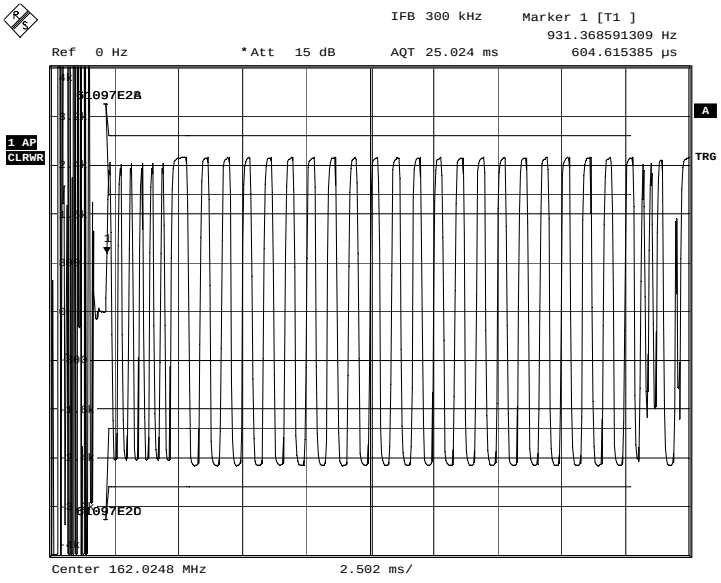
Plots for AIS 1 and AIS 2, for both signals 1 and 2 follow at varying temperatures and battery states (old or fresh) follow.



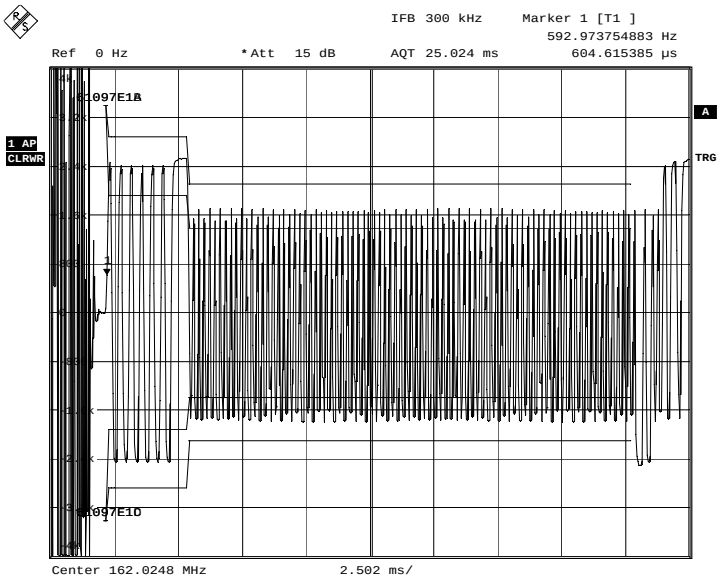
AIS1, Signal 1 – High Temperature and Fresh Battery



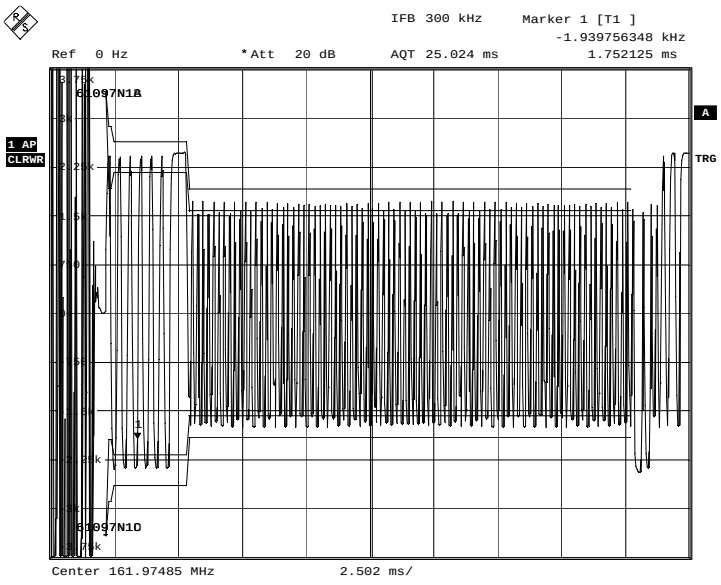
AIS1, Signal 2 – High Temperature and Fresh Battery



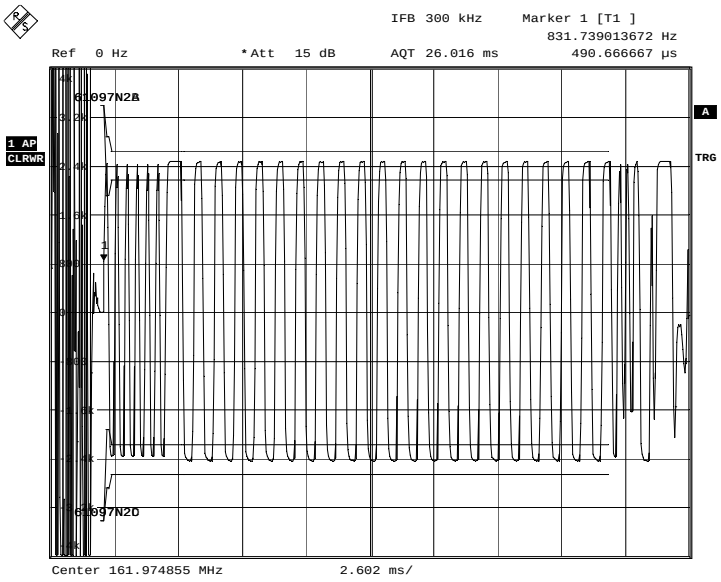
AIS2, Signal 1 – High Temperature and Fresh Battery



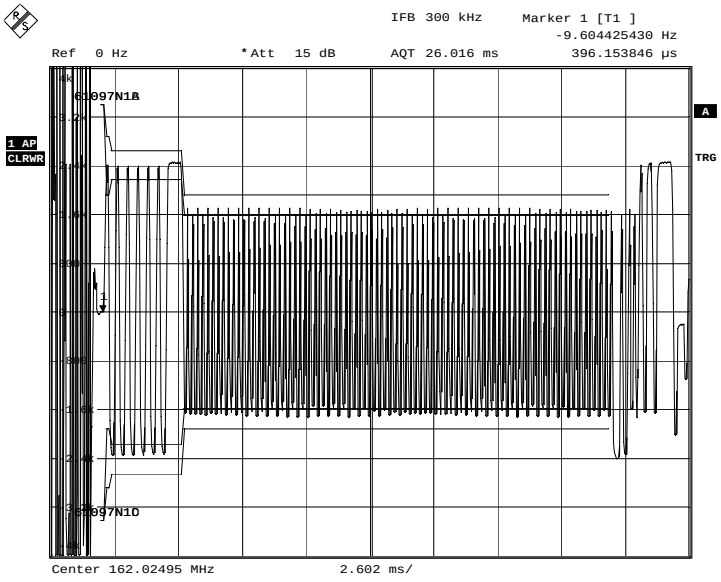
AIS2, Signal 2 – High Temperature and Fresh Battery



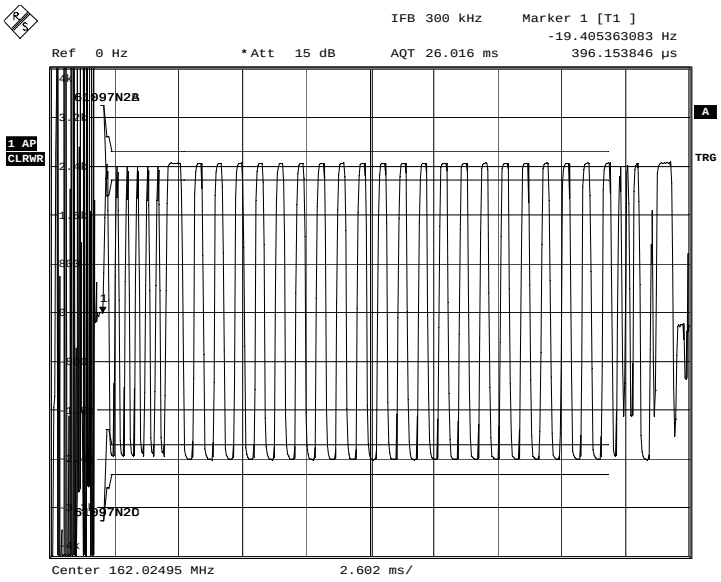
AIS1, Signal 1 – Normal Test Conditions



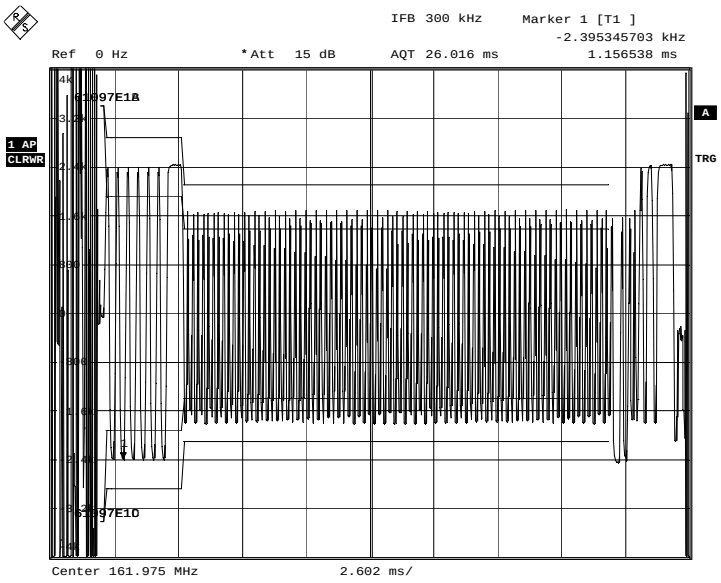
AIS1, Signal 2 – Normal Test Conditions



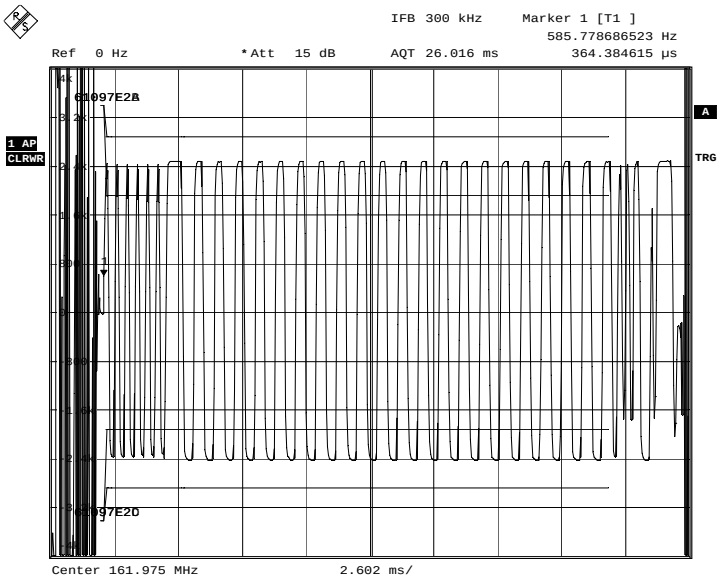
AIS2, Signal 1 – Normal Test Conditions



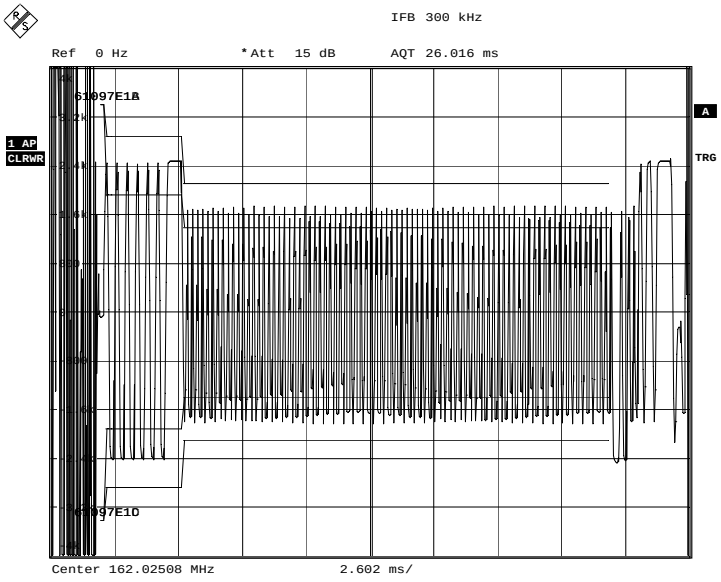
AIS2, Signal 2 – Normal Test Conditions



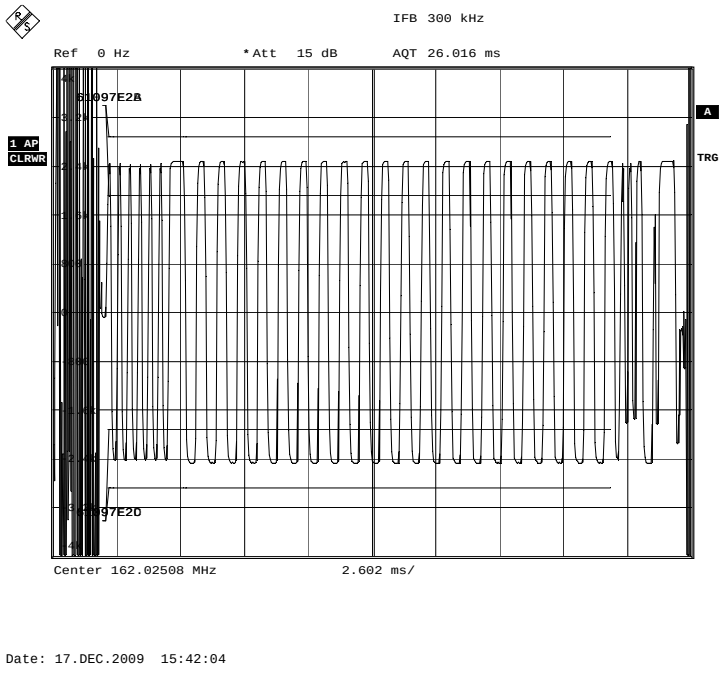
AIS1, Signal 1 – Low Temperature and Old Battery



AIS1, Signal 2 – Low Temperature and Old Battery



AIS2, Signal 1 – Low Temperature and Old Battery



AIS2, Signal 2 – Low Temperature and Old Battery

See Annex B for Customer supplied information relating to the confirmation of the training sequence begins with a '0'.

Limit Clause 7.5.3

Measurement period from centre to centre of each bit	Test Signal 1		Test Signal 2	
	Normal	Extreme	Normal	Extreme
Bit 0 to bit 1	< 3400 Hz			
Bit 2 to bit 3	2400 Hz ± 480 Hz			
Bit 4 to bit 31	2400 Hz ± 240 Hz	2400 Hz ±480 Hz	2400 Hz ±240 Hz	2400 Hz ±480 Hz
Bit 32 to bit 199	1740 Hz ± 175 Hz	1740 Hz ±350 Hz	2400 Hz ±240 Hz	2400 Hz ±480 Hz
Measurement uncertainty	± 60Hz			

4.8 TRANSMITTER OUTPUT POWER VERSUS TIME FUNCTION

4.8.1 Specification Reference

IEC 61097-14 Clause 7.7

4.8.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR001

4.8.3 Date of Test and Modification State

26 October 2009 - Modification State 0

4.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

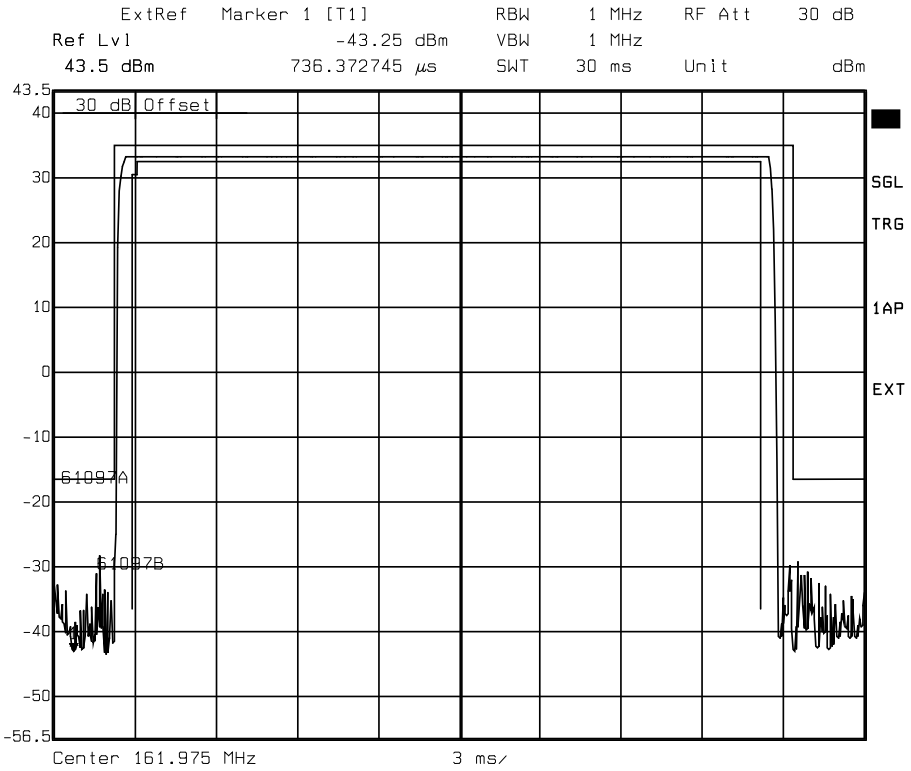
4.8.5 Environmental Conditions

	26 October 2009
Ambient Temperature	24°C
Relative Humidity	44%

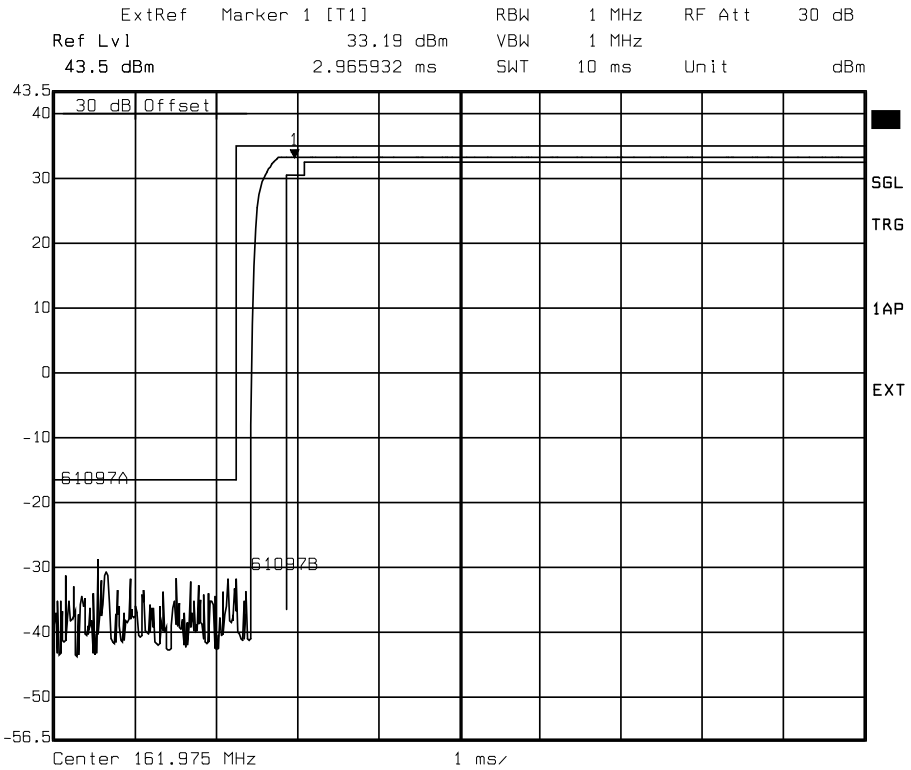
4.8.6 Test Results

Test Signal Number 1

Test Conditions	Output Power versus Time Function (ms)					
	AIS 1					
	T_0	T_A	T_{B1}	T_{B2}	T_{B2} to T_E	T_F
Normal Test Conditions	0	0.005	0.1725	0.270	24.225	24.225
Measurement uncertainty	± 4.6%					

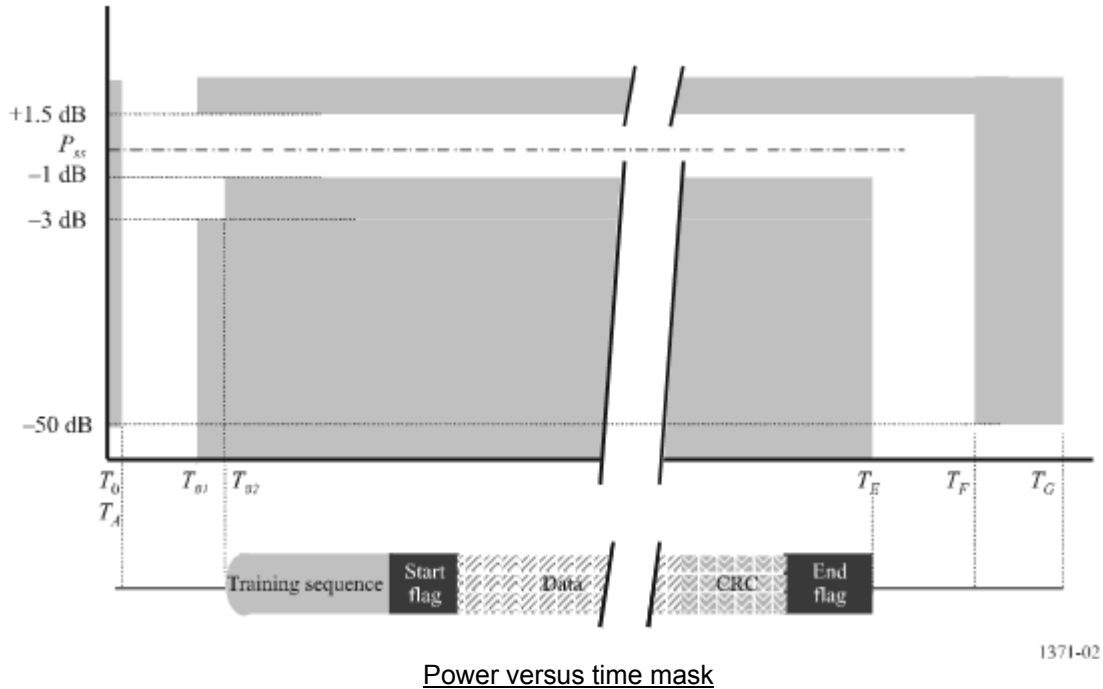


Power verses time function mask: AIS 1



Power verses time function mask: AIS 1 – expanded plot

Limit Clause 7.7.3



Power versus time mask

The transmitter power shall remain within the mask shown above and associated timings given in the table below (as per the specification).

Reference		Bits	Time (ms)	Definition
T_0		0	0	Start of transmission slot. Power shall NOT exceed –50 dB of P_{SS} before T_0
T_A		0 to 6	0 to 0,625	Power exceeds –50 dB of P_{SS}
T_B	T_{B1}	6	0,625	Power shall be within +1.5 or –3 dB of P_{SS}
	T_{B2}	8	0,833	Power shall be within +1.5 or –1 dB of P_{SS} (start of Training sequence)
T_E (includes 1 stuffing bit)		233	24,271	Power shall remain within +1.5 or –1 dB of P_{SS} during the period T_{B2} to T_E
T_F (includes 1 stuffing bit)		241	25,104	Power shall be –50 dB of P_{SS} and stay below this
T_G		256	26,667	Start of next transmission time period

4.9 SPURIOUS EMISSIONS FROM THE TRANSMITTER

4.9.1 Specification Reference

IEC 61097-14 Clause 7.8

4.9.2 Equipment Under Test

SmartFind S5 AIS SART, S/N: 75907213-TSR001

4.9.3 Date of Test and Modification State

27 October 2009 - Modification State 0

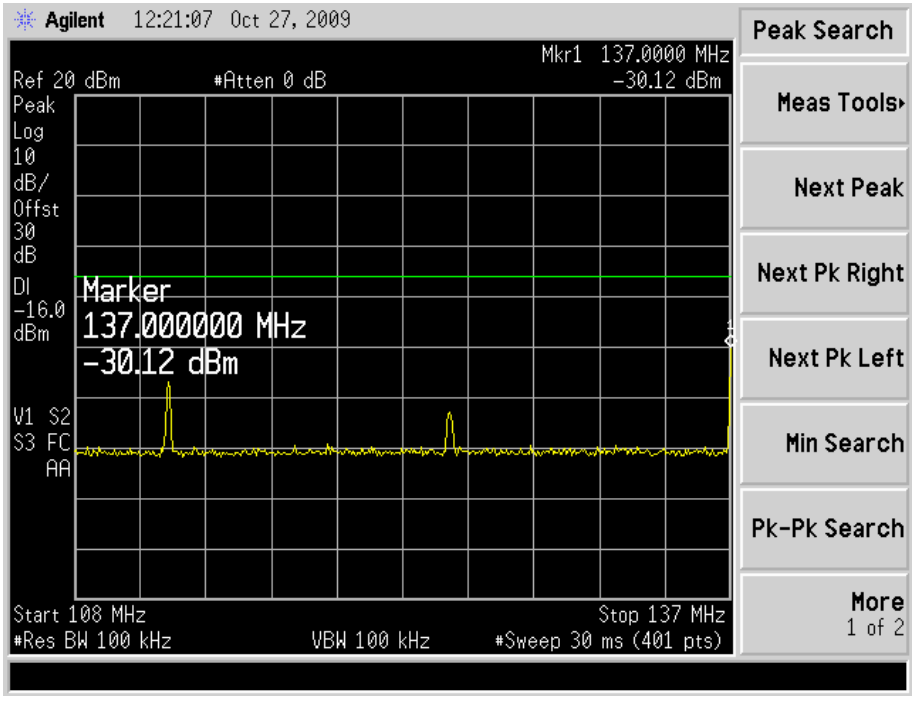
4.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 5.1.

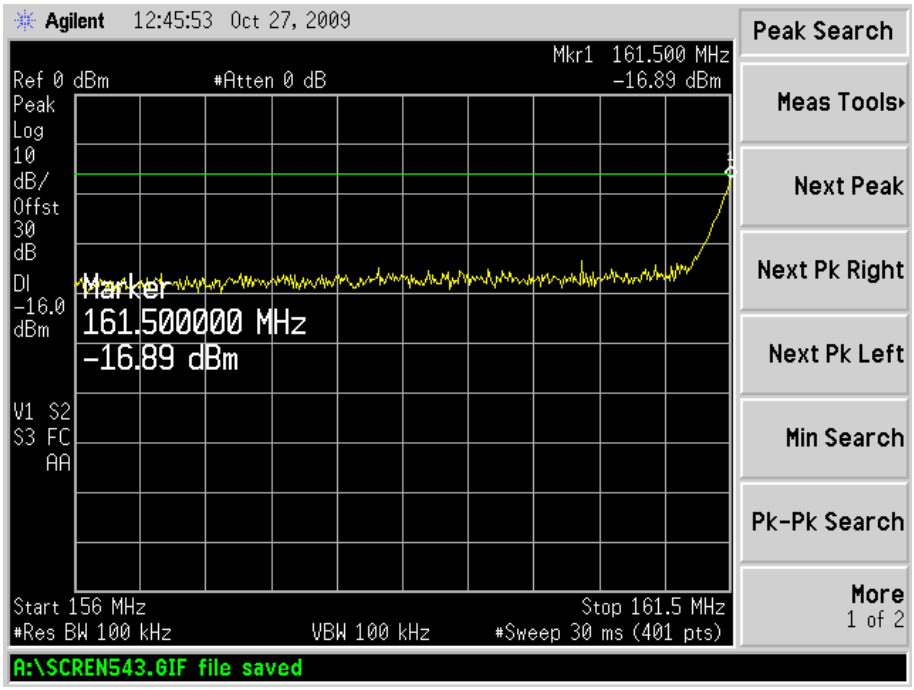
4.9.5 Environmental Conditions

	27 October 2009
Ambient Temperature	25°C
Relative Humidity	49%

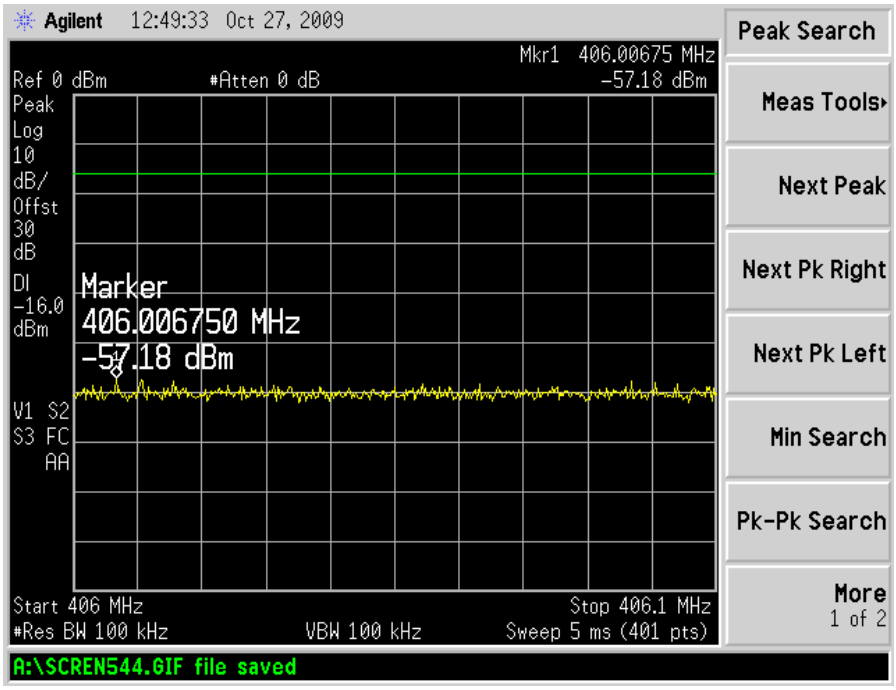
4.9.6 Test Results



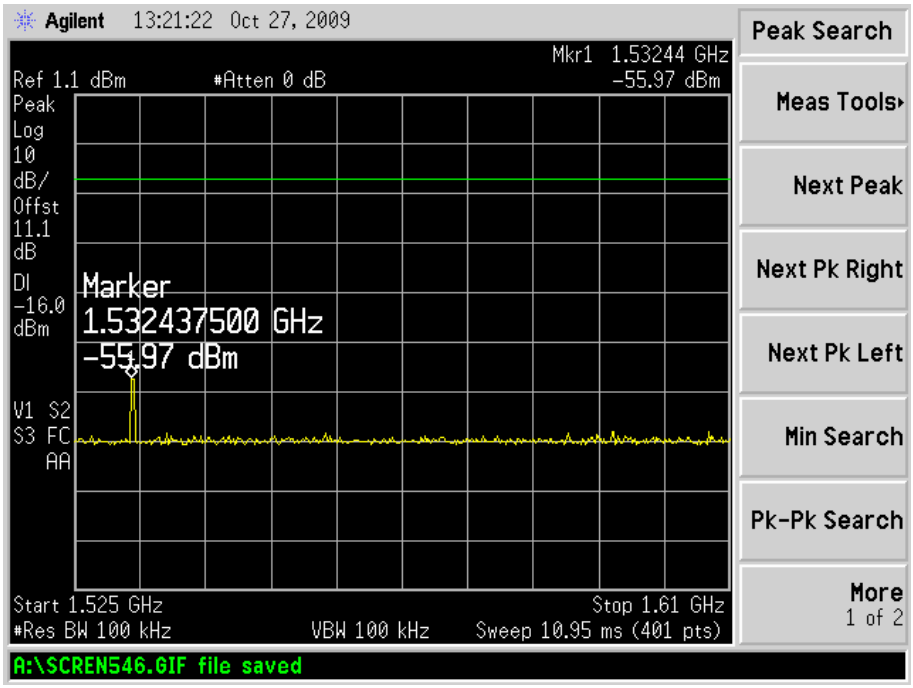
108.0 MHz to 137.0 MHz



156.0 MHz to 161.5 MHz



406.0 MHz to 406.1 MHz



1525.0 MHz to 1610.0 MHz

Limit Clause 7.8.3

No signal level within these bands shall exceed 25 µW (-16 dBm).

Measurement uncertainty	± 3.5 dB

SECTION 5

TEST EQUIPMENT USED

5.1 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- Operational Tests					
Tape Measure	Stanley	5 metre / 16 ft	3624	-	TU
Section 2.2 – 60945 Drop into Water					
Bomb Release	MOD	1000kg	3667	-	TU
Sections 2.3 and 2.5 Climatic - Wet Tests					
Over Pressure (T)	ASL (TUV)	0 TO 15 PSI	2125	-	TU
Balance	Geniweigher	GM-11K	2334	12	6-Mar-2010
Pressure Indicator	Druck	DPI 700	2458	12	7-Nov-2009
Stopwatch	Farnell	SUPER LAB/SPLIT	2465	12	1-Sep-2010
Digital Thermometer	Digitron	T208	2831	12	24-Jul-2010
Thermocouple	Unknown	Type T	3415	24	18-Feb-2010
5 metre Tape Measure	Stanley	33-719	3550	-	TU
940 litre Tank	Unknown	940 litre	3574	-	TU
Section 2.4 Climatic - Thermal Shock					
Weiss Technik (T)	Weiss Technik	WEISS ALT	2133	12	29-Nov-2009
Stopwatch	Farnell	SUPER LAB/SPLIT	2465	12	1-Sep-2010
Digital Thermometer	Digitron	T208	2831	12	24-Jul-2010
Thermocouple	Unknown	Type T	3415	24	18-Feb-2010
5 metre Tape Measure	Stanley	33-719	3550	-	TU
Section 3.1 Climatic - Dry Heat - Storage					
Climatic Chamber	Climatec	CLIMATEC 2	2845	12	26-Oct-2010
Section 3.2 Climatic – Dry Heat - Functional					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Thermocouple Thermometer	Fluke	51	3173	12	3-Jul-2010
Section 3.3 Climatic - Humidity					
Climatic Chamber	Climatec	CLIMATEC 2	2845	12	26-Oct-2010
Section 3.4 Climatic - Low Temperature					
Climatic Chamber	Climatec	CLIMATEC 2	2845	12	26-Oct-2010
Section 3.5 Mechanical - Free Fall Drop					
Block	Unknown	ELM	2650	-	TU
Tape Measure	Stanley	5 metre / 16 ft	3624	-	TU
Section 3.6 Vibration - Sine					
Vibration Controller	Muller & Partner	NT VX1	2509	12	29-Jun-2010
Vibration Controller	Muller & Partner	VIBCO NT VX1	2510	12	7-Nov-2010
Vibration System	Ling Dynamic Systems	LDS V964	2515	6	2-Apr-2010
Charge Amplifier	Endevco	133	2725	12	24-Aug-2010
Isotron Accelerometer	Endevco	256-10	3113	6	5-Feb-2010
Vibration Table	Ling Dynamic Systems	875	3170	6	7-Jan-2010
Charge Amplifier	Endevco	133	3188	12	22-May-2010
Isotron Accelerometer	Endevco	256-10	3377	6	16-Apr-2010
Isotron Accelerometer	Endevco	256-10	3381	6	5-Feb-2010
Accelerometer	Endevco	256-10	3571	6	5-Feb-2010

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 3.7 EMC - Compass Safe Distance					
Sussex Helmholtz Coil	Various	88771	327	-	TU
Magnetometer	Bartington	MAG01	671	36	3-Sep-2011
Hygrometer	Rotronic	A1	1388	12	6-Jul-2010
Multimeter	Iso-tech	IDM101	2423	12	11-Sep-2010
Marine Binacle Compass with Azimuth Circle	Cassens & Plath	Type 11	3331	24	TU
Compass Verification Unit	TUV	CVU	3579	-	TU
Section 4.1 and 4.2 – Battery Capacity Tests					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Hygrometer	Rotronic	I-1000	3068	12	3-Jul-2010
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	4-Jun-2010
Thermocouple Thermometer	Fluke	51	3173	12	3-Jul-2010
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	22-Apr-2010
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	22-Apr-2010
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	24-Feb-2010
Section 4.3 Radio (Tx) - Frequency Error					
Counter	Hewlett Packard	53181A	159	12	26-May-2010
Attenuator 20dB/2W	Weinschel	Model 2	379	12	25-Nov-2009
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	24-Jun-2010
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	4-Mar-2010
Digital Temperature Indicator	Fluke	51	2267	12	23-Jun-2010
Hygrometer	Rotronic	I-1000	3220	12	17-Apr-2010
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	23-Apr-2010
Section 4.4 Radio (Tx) – Conducted Power					
Counter	Hewlett Packard	53181A	159	12	26-May-2010
Attenuator 20dB/2W	Weinschel	Model 2	379	12	25-Nov-2009
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	24-Jun-2010
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	4-Mar-2010
Digital Temperature Indicator	Fluke	51	2267	12	23-Jun-2010
Hygrometer	Rotronic	I-1000	3220	12	17-Apr-2010
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	23-Apr-2010
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	28-Nov-2009
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	22-Dec-2009
Section 4.5 – Radiated Power					
OATS	TUV	OATS2	1850	36	11/09/2011
Antenna	York Electronics	CBL6111B	1868	24	20/08/2010
Antenna	EMCO	1050	1859	-	TU
Antenna	EMCO	1050	1707	-	TU
Miscellaneous	Various	RH253	1708	-	TU
Miscellaneous	Various	RH-253.6	1855	-	TU

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 4.6 Radio (Tx) – Modulation Spectrum Slotted Transmission					
Attenuator 20dB/2W	Weinschel	Model 2	379	12	25-Nov-2009
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	24-Jun-2010
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	4-Mar-2010
Hygrometer	Rotronic	I-1000	3220	12	17-Apr-2010
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	23-Apr-2010
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	22-Dec-2009
Section 4.7 Radio (Tx) – Transmitter Test Sequence and Modulation Accuracy					
Attenuator 20dB/2W	Weinschel	Model 2	379	12	28-Nov-2010
Temperature Chamber	Montford	2F3	467	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	4-Mar-2010
Digital Temperature Indicator	Fluke	51	2267	12	23-Jun-2010
Hygrometer	Rotronic	I-1000	3220	12	17-Apr-2010
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	13-Oct-2010
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-May-2010
Section 4.8 Radio (Tx) – Transmitter Output Power Versus Time Function					
Spectrum Analyser	Rohde & Schwarz	FSEM	37	12	16-Apr-2010
Attenuator 20dB/2W	Weinschel	Model 2	379	12	25-Nov-2009
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	24-Jun-2010
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	4-Mar-2010
Hygrometer	Rotronic	I-1000	3220	12	17-Apr-2010
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	22-Dec-2009
Section 4.9 Radio (Tx) – Spurious Emissions from the Transmitter					
Attenuator 20dB/2W	Weinschel	Model 2	379	12	25-Nov-2009
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	24-Jun-2010
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	4-Mar-2010
Filter (Hi Pass)	Mini-Circuits	NHP-800	2842	12	29-Oct-2009
Hygrometer	Rotronic	I-1000	3220	12	17-Apr-2010
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	23-Apr-2010
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	22-Dec-2009

TU – Traceability Unscheduled
OP MON – Output Monitored with Calibrated Equipment

SECTION 6

PHOTOGRAPHS

6.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

SmartFind S5 AIS SART

SECTION 7

DISCLAIMERS AND COPYRIGHT

7.1 DISCLAIMERS AND COPYRIGHT

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

ANNEX A

CUSTOMER SUPPLIED INFORMATION – SmartFind S5 AIS SART WAIVER REPORTS

Product Service

COMMERCIAL IN CONFIDENCE

mcmurdo
EMERGENCY LOCATION BEACONS

Smartfind S5 AIS SART Materials Declaration

As required by IEC 61097-14 & IEC 60945; the McMurdo Ltd Smartfind S5 AIS SART product is required to be tested and to meet the specific tests -

- Corrosion (Salt Mist) IEC 60945 8.12 & IEC 61097-14 6.1
- Solar Radiation IEC 60945 8.10 & IEC 61097-14 6.1
- Oil Resistance IEC 60945 8.11 & IEC 61097-14 6.1

IEC 60945 stipulates that where a manufacturer can produce evidence that the components, materials and finishes employed in the equipment would satisfy the tests then the tests shall be waived.

In this instance McMurdo Ltd claim, for the one or more of the reasons listed below that these criteria are met and therefore make application that the tests be waivered.

1. The materials have a proven history of service in a marine environment. Either from use in McMurdo's existing approved marine equipment range, or by implication from a long established history of exposure without effect (e.g. stainless steel).
2. The material manufacturer has conducted equivalent testing and has declared the product as being immune to these effects in the relevant data sheet.
3. McMurdo in-house testing has proven the materials to be immune to the cause of degradation (e.g. oil resistance).

McMurdo Ltd hereby declares that the materials used in the construction of the Smartfind S5 AIS SART product as here-in listed are not affected by the degrading agents listed above.

Signed on behalf of McMurdo Ltd

.... Date .....3-12-2009.....

Neil Jordan
Engineering Manager

mcmurdo
EMERGENCY LOCATION BEACONS

Components and materials listed below are in contact with the marine environment

BATTERY MOULDING	CYCOLOY C1200
TOP MOULDING	CYCOLOY C1200
POLE CONNECTOR	CYCOLOY C1200
POLE LABEL	RAFLATAC PE/ POLYPROPYLENE OVERLAY
BATTERY LABEL	POLYESTER
ANTI-TAMPERMOULDING	SAN PDV 3E
'O'-RING	SILICONE
SWITCH LABEL	175 MICRON HP92W POLYCARBONATE
ANTENNA	SUS-301 S/S
ANTENNA BOLT	STAINLESS STEEL SUS-316
ANTENNA O-RING	BS005 N70 SILICONE O-RING
LABEL SET	CLEAR POLYPROPYLENE
M3X12MM PAN HEAD POZI STAINLESS STEEL SCREW	STAINLESS STEEL
M2.5 NYLOC NUT	STAINLESS STEEL
BULKHEAD BAG	NYLON 420D WITH PVC LAMINATION
BULKHEAD BRACKET	STAINLESS STEEL SUS-316
STORAGE BAG FOAM INSERT	POLYETHYLENE FOAM
1M POLE ASSEMBLY	EPOXY RESIN IMPREGNATED FIBREGLASS 90%/10% WOVEN GLASS, EPOXY RESIN IMPREGNATED

Material Oil Resistance Testing - AIS SART Storage Bag 92-206-XXXD

Introduction

The materials used for the McMurdo Grab Bag (87-300D) were tested for oil resistance, in order to assess their suitability for use in the AIS SART storage bag (92-206-XXXD).

Testing

The test was completed according to specifications laid out in IEC-60945:

8.11 Oil resistance (portable equipment)

8.11.1 Waiver
The oil test shall be waived where the manufacturer is able to produce evidence that the components, materials and finishes employed in the equipment would satisfy the test.

8.11.2 Purpose
To simulate the effects of mineral oil on equipment.

8.11.3 Method of test
The EUT shall be immersed at a temperature of 19 °C ± 5 °C for 3 h in a mineral oil of the following specification:

- aniline point: 120 °C ± 5 °C;
- flashpoint: minimum 240 °C;
- viscosity: (10 – 25) cST at 99 °C.

The following oils may be used:

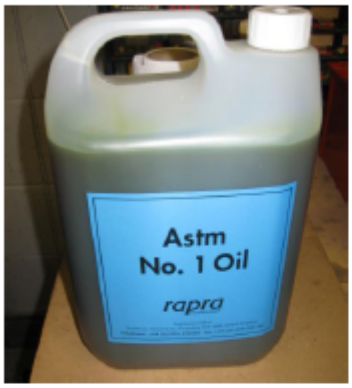
- ASTM oil No. 1;
- ASTM oil No. 5;
- ISO oil No. 1.

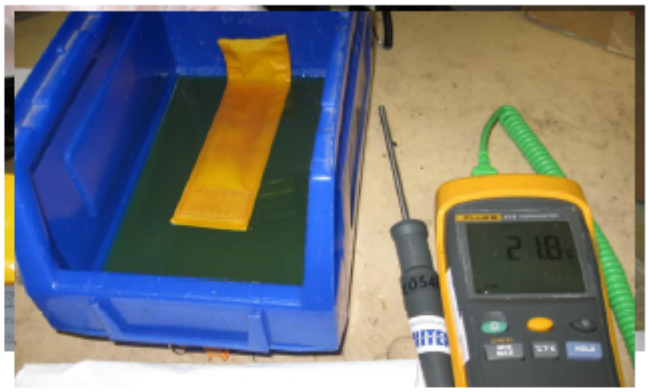
After the test, the EUT shall be cleaned in accordance with the manufacturer's instructions. The EUT shall then be subjected to a performance check and an examination with the naked eye.

8.11.4 Required result
The requirements of the performance check shall be met. The EUT shall show no signs of damage such as shrinking, cracking, swelling, dissolution or change of mechanical characteristics.

Test 1

The McMurdo grab bag is made from Nylon 420D. A sample of this material was cut away from the bag and immersed in a bath of ASTM oil No.1 for 3 hours at 21.8°C.





When removed from the oil, the material showed no signs of degradation.

The Velcro and thread used were still intact and provided a strong join between two layers of material.

Test 2

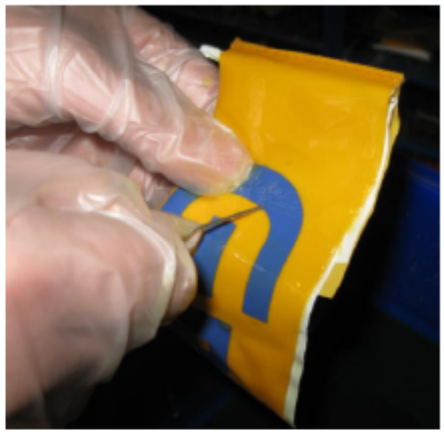
The test was then repeated using samples of the following:

- Nylon with printed text
- Plastic lining material
- Foam which pads the bag walls

This was left submerged in oil for 24 hours at a temperature of 19°C ±5°C.

After 24 hours in the oil, no detrimental effects were noticed on any of the materials tested, and the stitching did not appear to be weakened in any way.
The printed text on the nylon was still undamaged, and was not defaced even when scratched at with a sharp metal tool.





Test 3

The bag contains a foam insert. The proposed material is foamed Polyethylene with a density of either 18kg/m³ or 45kg/m³. These materials needed to be tested for oil resistance.

Four samples of foam were immersed in ASTM No.1 oil for 3 hours at 19°C ±5°C. These were:

Plastazote foams:

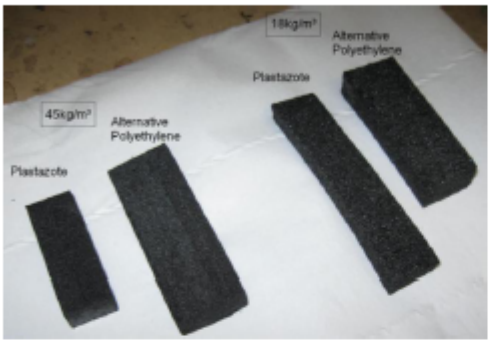
- LD45 (45kg/m³)
- LD18 (18kg/m³)

Alternative unbranded Polyethylene foams:

- PEX45 (45kg/m³)
- PEX18 (18kg/m³)

The foams regularly worked their way to the surface of the oil. These were frequently pushed back under the surface.

After 3 hours, the foams were removed for the oil and inspected. All samples showed no signs of degradation, and still floated above the oil.



Conclusion

The results of the test show that Nylon 420D, the Polyethylene foam and the Velcro are not unduly affected by the specified oil, and so meet with the requirements of IEC-60945. Therefore, these materials can be implemented in the production of the AIS SART Storage Bag – 92-206-XXXD.

The printing has proven itself to be substantial enough to survive the oil test. This is another feature which can be employed in the AIS SART Storage Bag.

Annika Page
03/12/2009

ANNEX B

CUSTOMER SUPPLIED INFORMATION – CONFIRMATION OF TRAINING SEQUENCE

The following information was supplied by McMurdo with reference to clause 7.6 of 61097-14: Transmitter test sequence and modulation accuracy.

Modulation: Trainings sequence and Start flag

Trainings sequence: 010101

Variant 1

1	2	3	4	5	6	7	8	9	0	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0			
1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	1	1	1	1	1	0			

Variant 2

1	2	3	4	5	6	7	8	9	0	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0			
0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	1			

Trainings sequence: 10101010

Variant 1

1	2	3	4	5	6	7	8	9	0	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	1	1	1	1	1	1	0			
0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1	0			

Variant 2

1	2	3	4	5	6	7	8	9	0	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	1	1	1	1	1	1	0			
1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1			

- The first yellow/green 0/1 bit line is the data line.
- The second yellow/green 0/1 bit line shows the NRZI coded data going to the modulator.
- The yellow part is the training sequence, the green part is the start flag.

With reference to the above diagram – an illustration of what the NRZI encoding will look like. Basically, each time you get a 0 in the data the output state toggles. We have Training sequence 010101 etc (first bit 0) So this could mean that the output encoded data looks like either picture 1 or 2, we have chosen variant 1 so the encoded data looks like 11001100 etc (which you can see from our frequency Vs time plots). If the other training sequence 101010 was used then the output would toggle at the 2nd bit (not the 3rd) as per picture 3 & 4, i.e. it would look like 011001100 etc or 100110011 etc) - again you can see from the F Vs T plots you have done this is not the case.

ANNEX C

CUSTOMER SUPPLIED INFORMATION – BATTERY SELF-DISCHARGE STATEMENT

mcmurdo
EMERGENCY LOCATION BEACONS

McMurdo 'S5' AIS-SART

Battery self-discharge statement (IEC61097-14)

This statement examines the self-discharge regime of the 'S5' AIS-SART under the requirements of IEC 61097-14 and determines the exact 'Ah' figure for battery capacity that must be allowed for within the battery capacity test specified in section 6.2.1 of that specification.

Para 3.3.2 requirements
The following battery discharge allowances must be catered for :

a) Self testing annually with GPS signals available
b) Self discharge of the battery
c) Standby loads

McMurdo wishes to quote a 7 year 'rated' shelf life for the battery pack. Therefore a 14 year 'useful' life is required. Calculations follow :

(a) Self test
Self-test is controlled by firmware and typically lasts 60~75 seconds. The GPS datasheet states a typical 33s fix from a cold start anywhere in the world. Evaluation has shown that a realistic maximum figure for this is 50 seconds, given GPS signals are available.
The self test current profile is can be summarised as follows :-

- 10 seconds	@ 6mA (expecting ATE command)	0.06	As
- 50 seconds	@ 30mA (GPS acquiring – cold start)	1.50	As
- 15 seconds	@ 3mA (Quiescent between Tx pulses)	0.045	As
- 8 * 24 ms	@ 0.6A (Tx current)	0.115	As
		1.72	**As = 0.000478 Ah**

Self test is conducted annually. Over the 14 year 'useful' life it consumes 14*0.000478 = 0.00669 Ah.

(b) Self discharge at 20°C
The battery uses Lithium Manganese Dioxide cells connected in series. These cells may be either Varta CR2/3AH cells, or Panasonic CR123A cells. The nominal rated capacity of both types of cell is 1.55Ah. According to battery supplier's datasheets, the self-discharge rate for both types of cell is 1% per year. Over 14 years this equates to a loss of 1.55 x $(1-0.99^{14})$ = 0.203 Ah capacity.

(c) Standby loads
There are no standby loads, the battery is isolated by a PFET until the unit is activated.
Leakage current is : 0.1uA x 14 yrs x 8,760 hrs = 0.0123 Ah.

Total losses to be extracted
Adding the above losses gives a total allowance of 0.222 Ah.

This capacity should be extracted from a fresh battery prior to the start of the life test.
For example by applying a 330R load resistor for 12.6 hrs.

John Norrish
29 October 2009