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# TEST REPORT

Customer Confidential

## *ENVIRONMENTAL TEST REPORT NO. 4857-1*

## *MARINE RESCUE TECHNOLOGIES LTD*
## *MARSHALL HOUSE*
## *ZARYA COURT*
## *GROVEHILL ROAD*
## *BEVERLEY*
## *YORKSHIRE*
## *HU17 0JG*

## *DATE : 18 OCTOBER 2013*

2379



*Product Assessment and Reliability Centre Ltd. performs all of its product testing under a rigorous laboratory management system. We are accredited by UKAS to BS EN ISO/IEC 17025:2005, the "General requirements for the competence of testing and calibration laboratories". Details of our UKAS accredited tests and a copy of our UKAS Schedule of Accreditation are available upon request. Tests marked "non-UKAS" are currently not covered by our UKAS 17025:2005 accreditation. All testing, whether UKAS or non-UKAS, is performed within the same laboratory management system and to the same levels of calibration and traceability.*

*The results contained in this report relate only to the samples submitted.*

parc
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# TEST REPORT

Report Number: 4857-1

Issue Number: 1

Date of Issue: 18/10/13

Reason for Re-issue: N/A

**Customer Confidential**



ilac-MRA UKAS TESTING 2379

| | | | |
|---|---|---|---|
| **Date Samples Arrived** | 09/08/13 | **Requested by:** | Geoff Smith<br>Marine Rescue Technologies Ltd<br>Marshall House<br>Zarya Court<br>Grovehill Road<br>Beverley<br>East Riding<br>HU17 0JG |
| **Date Testing Started** | 19/08/13 | | |
| **Date Testing Completed** | 23/09/13 | | |
| **Customer Purchase Order No:** | 32807 | | |

**Description of equipment under test:**

3 off personal locator beacons, Model No AU10

**Serial/Identity numbers:**

Serial No M16130048/MMSI No 972418545, Serial No M16130049/MMSI No 972418546, Serial No M16130107/MMSI No 972418604

| **Test Performed:** | | | **In accordance with (Test Specification or Standard/Customer supplied test programme)** |
|---|---|---|---|
| Process 1 | Altitude | UKAS | EUROCAE ED-14G Section 4, Category B2. Condition @ 25000ft & ambient temperature for 2 hours. |
| Process 2 | Temperature variation | UKAS | EUROCAE ED-14G Section 5, Category B. 2 cycles of the profile with temperature extremes of +70°C & -45°C. |
| Process 3 | Operational vibration | UKAS | EUROCAE ED-14G Section 8, Category U. Resonance search, 10 minutes of performance levels, 2 hours of endurance, 10 minutes of performance, resonance search. Repeat sequence 3 times in each of the 3 axes. |
| Process 4 | Operational shock & crash safety (Impulse) | UKAS | EUROCAE ED-14G Section 7, Category B. 6g 11 msec TPS, 3 shocks in each sense of each axis followed by 20g 11msec TPS, 1 shock in each sense of each axis. |
| Process 5 | Icing | UKAS | EUROCAE ED-14G Section 24, Category A. 3 cycles of the following - Stabilise samples @ -55°C, transfer to chamber @ +30°C & 95%RH, leave until sample reaches +5°C then transfer back to chamber @ -55°C. |
| Process 6 | Crash safety (Sustained) | UKAS | EUROCAE ED-14G Section 7, sub contracted. Sustained acceleration using a centrifuge to achieve 20g in all directions. |
| Process 7 | Functional Test | Non UKAS | As per test schedule MRT AU9-AIS JARS OP3.110 (CAA AC200908) |

**Report Summary:**

The samples were subjected to the test regime outlined in this report.
During the test processes a sample was monitored for false triggering using an AM radio and no instances of false triggering were noted during any of the test processes.
The samples operated correctly during all of the functional tests conducted during all test processes with the exception of the random vibration test.
Upon completion of the post performance test 2 serial No M16130048 failed to operate correctly, the sample was returned to the customer and was replaced with serial no M16130107 for the remainder of testing.

**Disposal of Sample**

Returned to customer via courier on 24/09/13

**Distribution:**

1. G.Smith
2. PARC Ltd File

Test Engineer — Name: N.Edwards
Signature:

Approved by: Name: R.Tabor
Signature:
Job Title: Sales Manager

## 1. Sample Content

| Description | Serial Numbers |
|---|---|
| 3 off personal locator beacons, Model No AU10 | Serial No M16130048, MMSI No 972418545 |
| | Serial No M16130049, MMSI No 972418546 |
| | Serial No M16130107, MMSI No 972418604 |

## 2. Test Equipment Used

| Test Equipment | PARC Ltd ID number | Calibration Due Date |
|---|---|---|
| Altitude chamber | 385 | 23/11/13 |
| ARS1100 climatic chamber | 687 | 23/05/14 |
| Pico logger | 651 | 09/01/14 |
| Thermocouple | 629 | 11/10/14 |
| Shaker system & amplifier | 178 & 179 | Monitored by calibrated equipment |
| Charge amplifier | 54 & 55 | 29/11/13 |
| Dactron controller | 279 | 25/01/14 |
| Accelerometer | 240 | 05/02/14 |
| Accelerometer | 669 | 25/03/14 |
| Accelerometer | 559 | 22/10/13 |
| ARS1100 climatic chamber | 580 | 23/04/14 |
| Pico logger | 650 | 10/01/14 |
| Thermocouple | 605 | 10/09/13 |
| Thermocouple | 627 | 11/10/13 |
| Thermocouple | 706 | 02/08/14 |

## 3. Initial Inspection (Non UKAS)

The samples were subjected to an initial visual inspection (non UKAS) and no obvious signs of damage were noted. A pre test functional check was also conducted as per test schedule MRT AU9-AIS JARS OP3.110 (CAA AC200908) and customer's instructions. This consisted of arming and then activating the beacons, a check was made to ensure that they emitted audible SOS tones and that a down swept tone was transmitted on 121.65MHz.

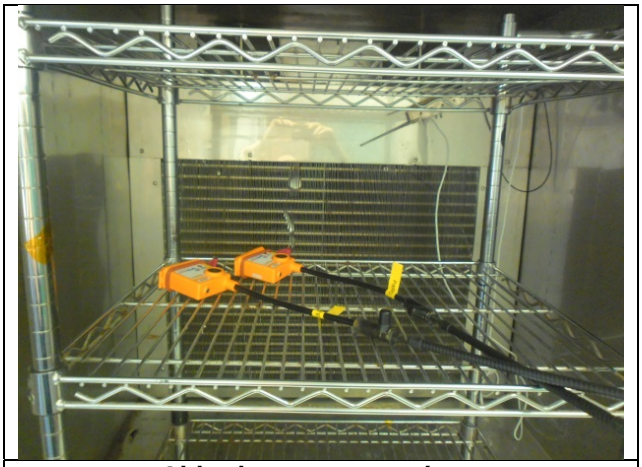
## 4. Test Procedure

4.1 Process 1

Altitude test in accordance with EUROCAE ED-14G Section 4, Category B2 & previous project WIP 2734. Samples numbered Serial No M16130048 & Serial No M16130049 were loaded into the chamber as shown in the photograph in paragraph 4.1.1 and were then subjected to the conditions detailed below

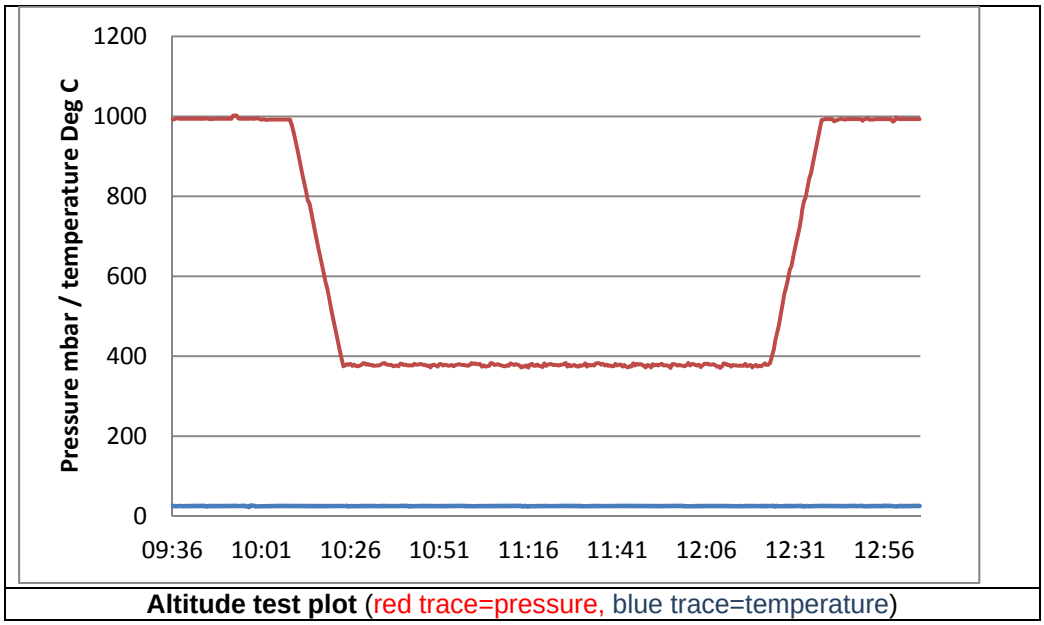
Altitude 25000ft (376 mbar)
Temperature +25°C
Duration 2 hours
Sample state Serial No M16130048 was armed but not transmitting & Serial No M16130049 was unarmed

4.1.1 Test Photos



**Altitude test set up photo**

4.1.2 Test Results/plots




**Altitude test plot** (red trace=pressure, blue trace=temperature)

Note – A correction error of -7 mbar needs to be applied to the above plot to ascertain a more accurate reading.

4.1.3 Function Test (Non UKAS)
An AM radio tuned to 121.65MHz was used to monitor the sample for false triggering; no instances of false triggering were noted.
Upon completion of test a functional check was carried out on both samples as per initial the initial inspection. Both samples operated correctly during these tests.

4.2 Process 2

Temperature variation in accordance with EUROCAE ED-14G Section 5, Category B & previous project WIP 2734. Samples numbered Serial No M16130048 & Serial No M16130049 were loaded into the chamber as shown in the photograph in paragraph 4.2.1 and a thermocouple was attached to monitor stabilisation times. The samples were then subjected to 2 cycles of the conditions detailed overleaf

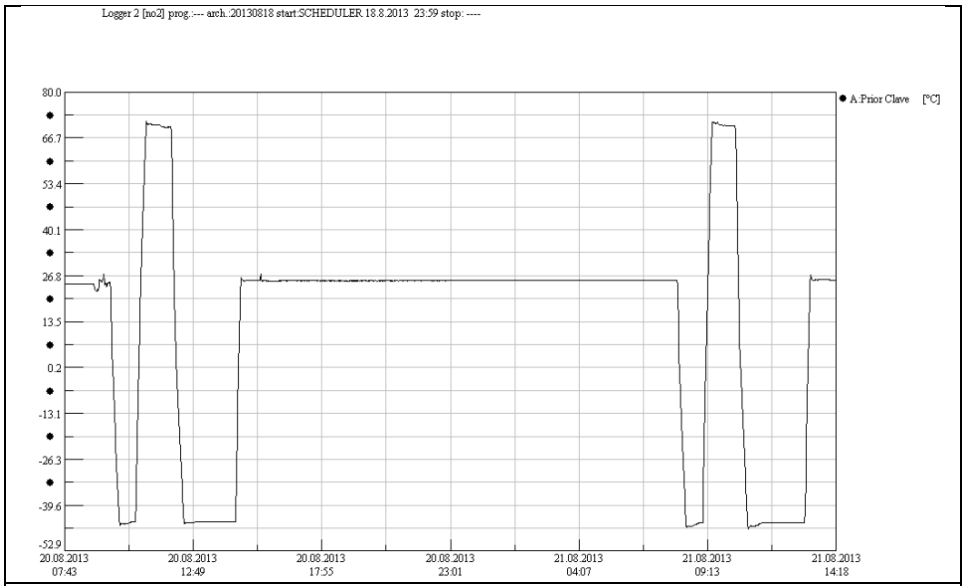
| Chamber conditions | Serial No M16130048 | Serial No M16130049 |
|---|---|---|
| Ramp chamber from +20°C to -45°C | Sample armed | Unarmed |
| Stabilise sample @ -45°C | Sample armed | |
| Ramp to +70°C | Sample function tested | |
| Stabilise sample @ +70°C | Sample armed | |
| Dwell @ +70°C for 2 minutes | Sample switched off | |
| Ramp chamber to -45°C | Sample function tested | |
| Stabilise sample @ -45°C | Sample armed | |
| Dwell @ -45°C for 1 hour | Sample armed | |
| Dwell @ -45°C for 30 minutes | Sample switched off | |
| Ramp chamber to +20°C | Sample switched on | |
| Stabilise sample @ +20°C | Sample function tested | |

4.2.1 Test Photos

**Temperature variation test set up**


**Location of monitoring thermocouple**

4.2.2 Test Results/plots




**Temperature variation test plot**

Note – No correction error needs to be applied to the above plot to ascertain a more accurate reading.

4.2.3 Function Test (Non UKAS)

An AM radio tuned to 121.65MHz was used to monitor the sample for false triggering; no instances of false triggering were noted.
Upon completion of test a functional check was carried out on both samples as per initial the initial inspection. Both samples operated correctly during these tests.

4.3 Process 3

Operational vibration in accordance with EUROCAE ED-14G Section 8, Category U & previous project WIP 2734. Samples numbered Serial No M16130048, M16130049 & M16130107 were loaded onto the shaker system as shown in the photograph in paragraph 4.3.1 and were then subjected to the sequence detailed below in each of the 3 axes

Sample Nos M16130048 & M16130107 were armed during the test processes and M16130049 was unarmed.

1. Resonance search
2. Pre performance 1 (10 minutes duration)
3. Endurance 1 (2 hours duration)
4. Post performance 1 (10 minutes duration)
5. Resonance search
6. Pre performance 2 (10 minutes duration)
7. Endurance 2 (2 hours duration)
8. Post performance 2 (10 minutes duration)
9. Resonance search
10. Pre performance 3 (10 minutes duration)
11. Endurance 3 (2 hours duration)
12. Post performance 3 (10 minutes duration)
13. Resonance search

Note – Due to a sample mal-function serial No M16130048 was replaced with serial No M16130107 before conducting the post test 2/pre test 3 resonance search.

| **Resonance search test details** | |
|---|---|
| Frequency (Hz) | Acceleration (g) |
| 10 | 0.5 |
| 2000 | 0.5 |
| Sweep rate 1 oct/min | |

| **Performance 1** | | | | | |
|---|---|---|---|---|---|
| Frequency (Hz) | Acceleration ($g^2$/Hz) | Sine tone 1 | Sine tone 2 | Sine tone 3 | Sine tone 4 |
| 10 | 0.01 | 11Hz @ 0.44$g_{peak}$ | 19.9Hz @ 0.79$g_{peak}$ | 35.5Hz @ 1.42$g_{peak}$ | 63.9Hz @ 1.6$g_{peak}$ |
| 300 | 0.01 | | | | |
| 2000 | -3.66dB/oct | | | | |

| **Endurance 1** | | | | | |
|---|---|---|---|---|---|
| Frequency (Hz) | Acceleration ($g^2$/Hz) | Sine tone 1 | Sine tone 2 | Sine tone 3 | Sine tone 4 |
| 10 | 0.02 | 11Hz @ 0.7$g_{peak}$ | 19.9Hz @ 2.48$g_{peak}$ | 35.5Hz @ 2.5$g_{peak}$ | 63.9Hz @ 2.5$g_{peak}$ |
| 300 | 0.02 | | | | |
| 2000 | -3.66dB/oct | | | | |

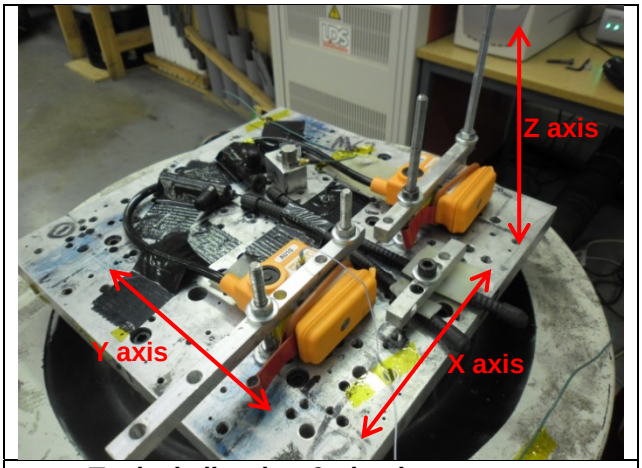
| Performance 2 | | | | | |
|---|---|---|---|---|---|
| Frequency (Hz) | Acceleration ($g^2$/Hz) | Sine tone 1 | Sine tone 2 | Sine tone 3 | Sine tone 4 |
| 10 | 0.01 | 13.4Hz @ 0.536$g_{peak}$ | 24Hz @ 0.96$g_{peak}$ | 43.4Hz @ 1.6$g_{peak}$ | 77.8Hz @ 1.6$g_{peak}$ |
| 300 | 0.01 | | | | |
| 2000 | -3.66dB/oct | | | | |

| Endurance 2 | | | | | |
|---|---|---|---|---|---|
| Frequency (Hz) | Acceleration ($g^2$/Hz) | Sine tone 1 | Sine tone 2 | Sine tone 3 | Sine tone 4 |
| 10 | 0.02 | 13.4Hz @ 1.18$g_{peak}$ | 24Hz @ 2.5$g_{peak}$ | 43.4Hz @ 2.5$g_{peak}$ | 77.8Hz @ 2.5$g_{peak}$ |
| 300 | 0.02 | | | | |
| 2000 | -3.66dB/oct | | | | |

| Performance 3 | | | | | |
|---|---|---|---|---|---|
| Frequency (Hz) | Acceleration ($g^2$/Hz) | Sine tone 1 | Sine tone 2 | Sine tone 3 | Sine tone 4 |
| 10 | 0.01 | 16.3Hz @ 0.652$g_{peak}$ | 29.9Hz @ 1.168$g_{peak}$ | 52.5Hz @ 1.6$g_{peak}$ | 94.9Hz @ 1.6$g_{peak}$ |
| 300 | 0.01 | | | | |
| 2000 | -3.66dB/oct | | | | |

| Endurance 3 | | | | | |
|---|---|---|---|---|---|
| Frequency (Hz) | Acceleration ($g^2$/Hz) | Sine tone 1 | Sine tone 2 | Sine tone 3 | Sine tone 4 |
| 10 | 0.02 | 16.3Hz @ 1.76$g_{peak}$ | 29.9Hz @ 2.5$g_{peak}$ | 52.5Hz @ 2.5$g_{peak}$ | 94.9Hz @ 2.5$g_{peak}$ |
| 300 | 0.02 | | | | |
| 2000 | -3.66dB/oct | | | | |

4.3.1 Test Photos

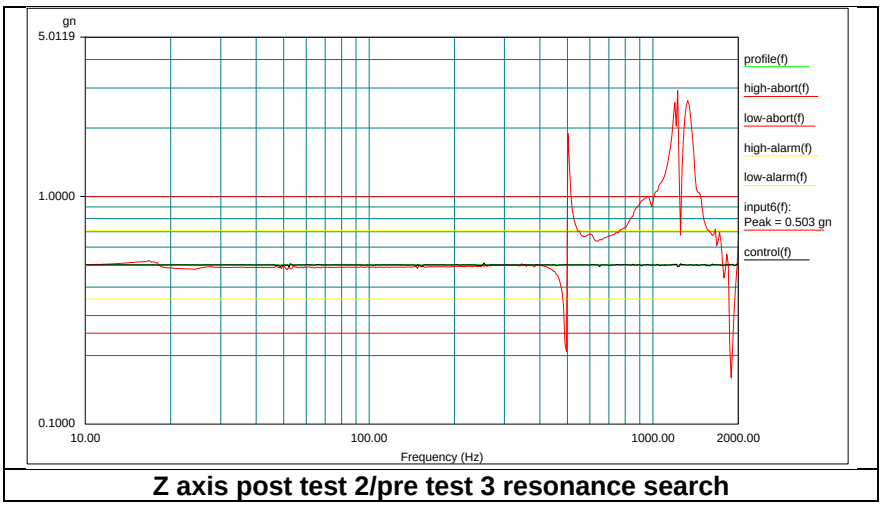



**Typical vibration & shock test set up**

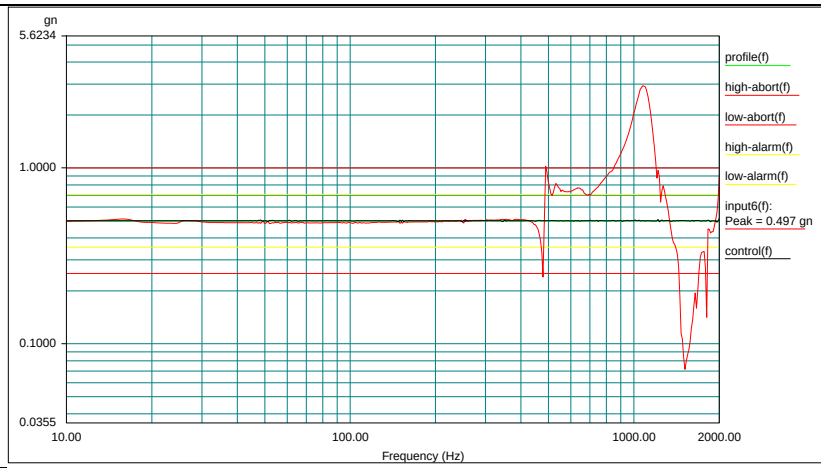
4.3.2 Test Results/plots


**Z axis Initial resonance search plot**

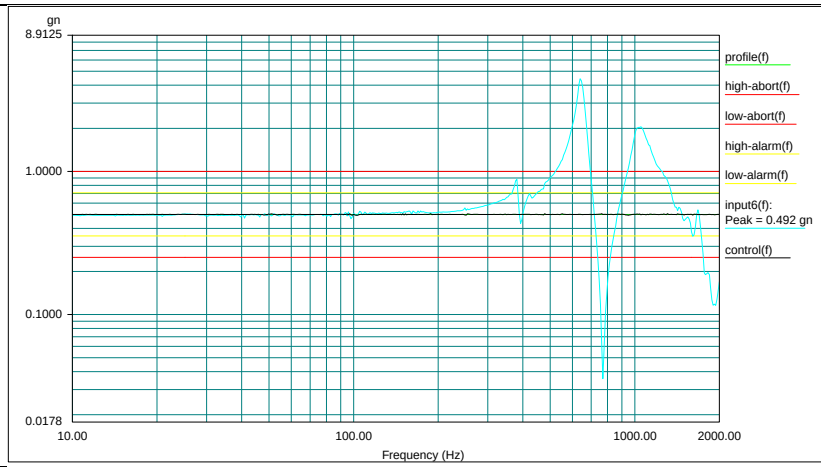

**Z axis post test 1/pre test 2 resonance search**



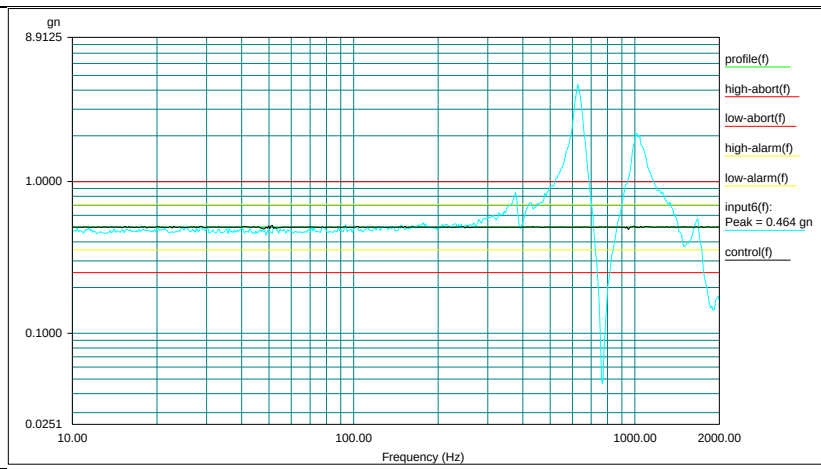

**Z axis post test 2/pre test 3 resonance search**



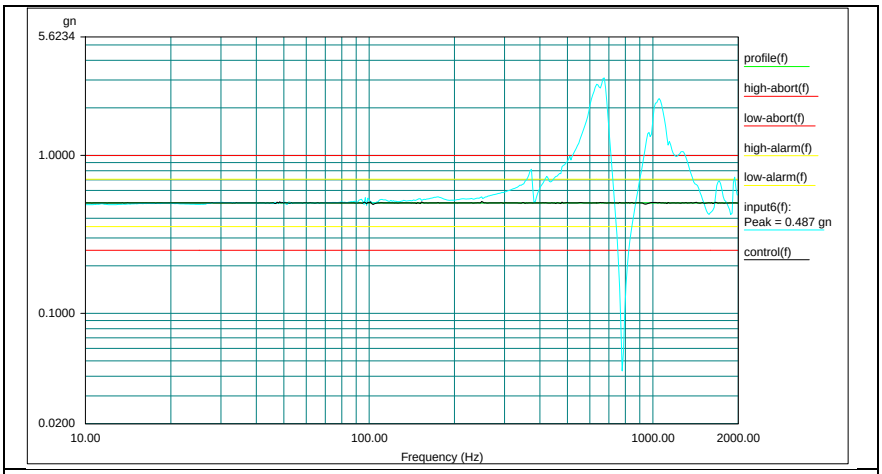

**Z axis post test 3 resonance search**



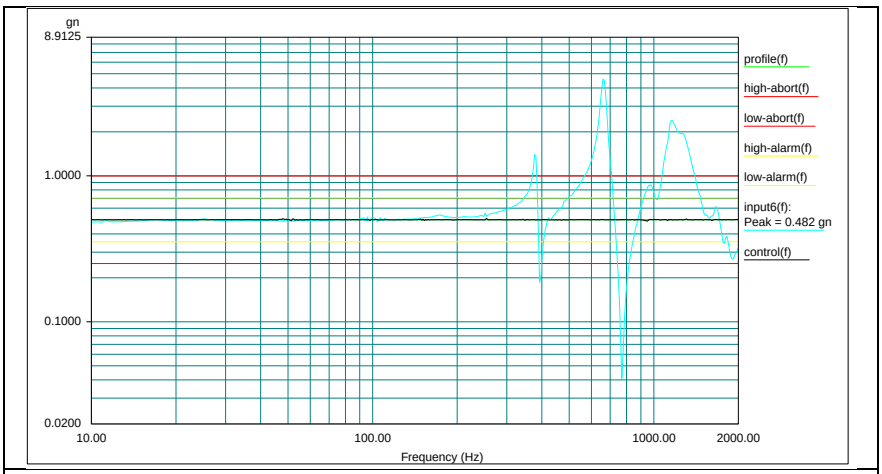

**Y axis Initial resonance search plot**



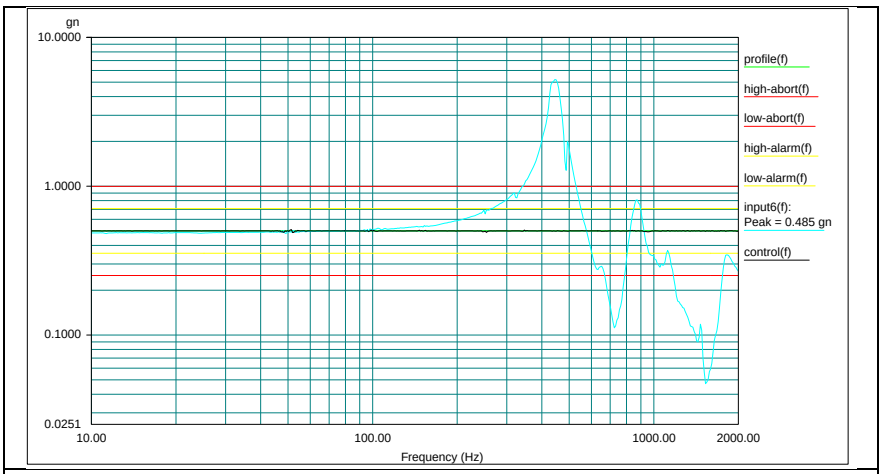

**Y axis post test 1/pre test 2 resonance search**



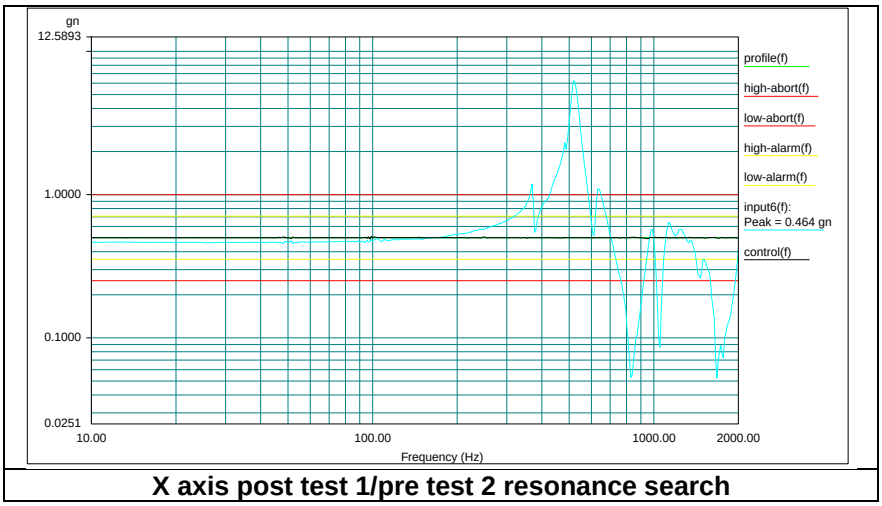

**Y axis post test 2/pre test 3 resonance search**



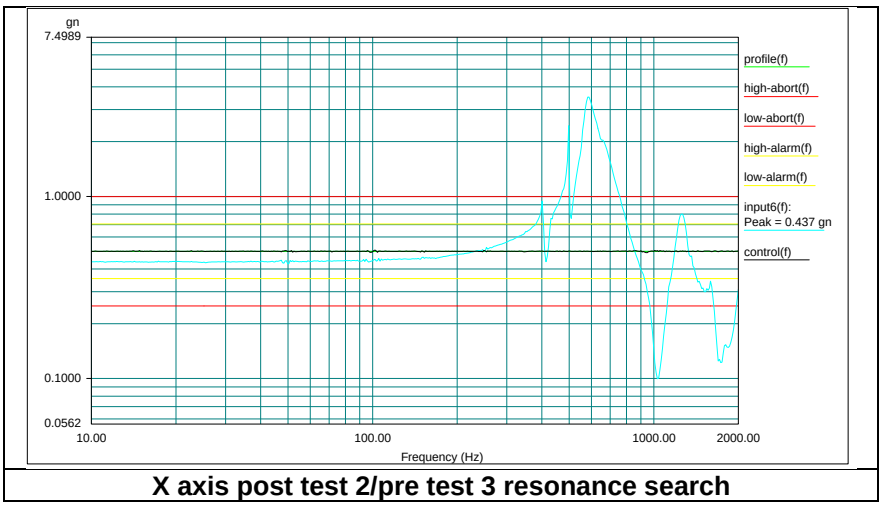

**Y axis post test 3 resonance search**




**X axis Initial resonance search plot**

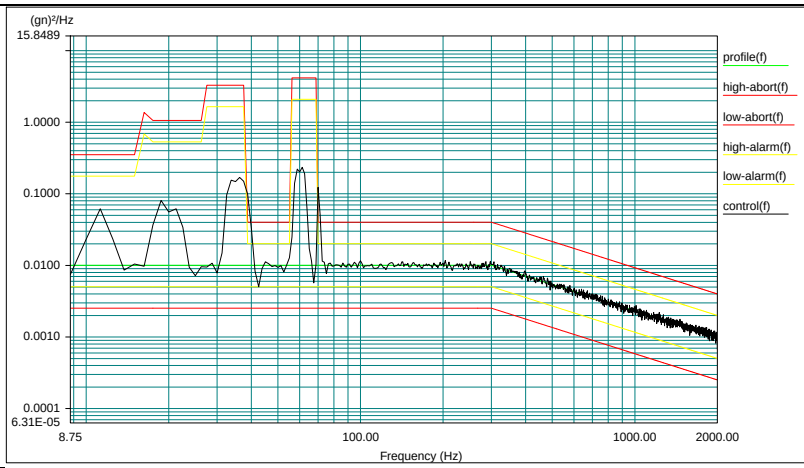



**X axis post test 1/pre test 2 resonance search**

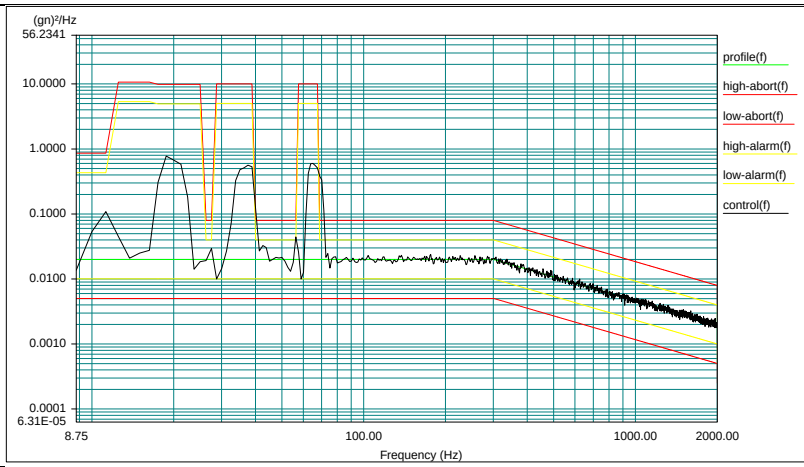



**X axis post test 2/pre test 3 resonance search**

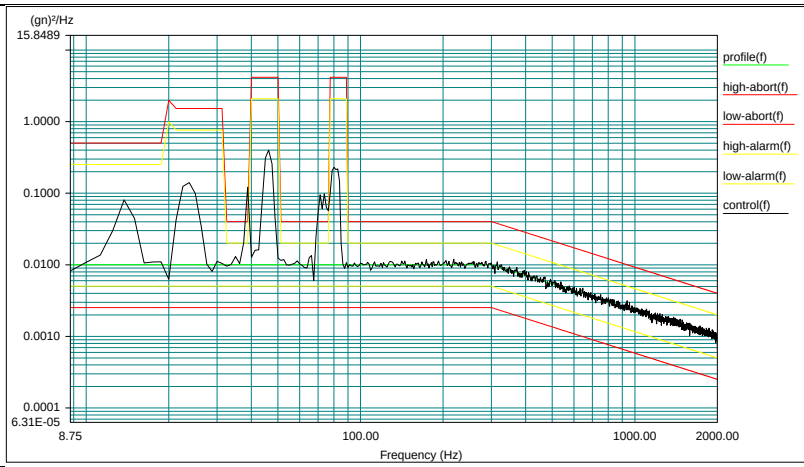

**X axis post test 3 resonance search**



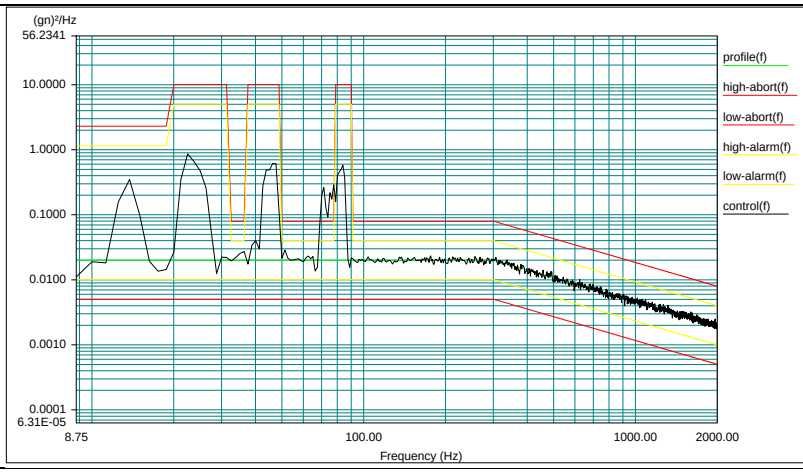

**Typical pre/post performance 1 test plot**



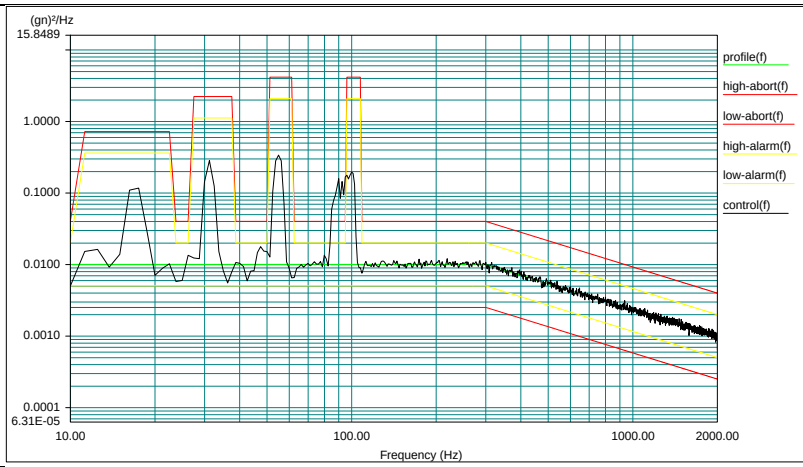

**Typical Endurance 1 test plot**



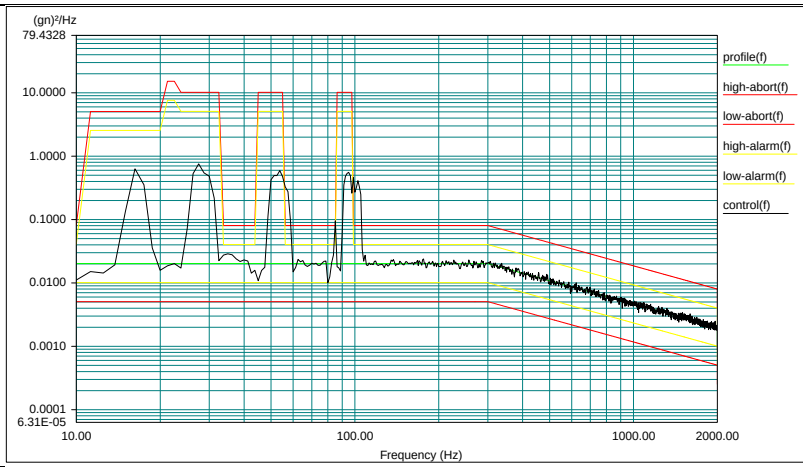

**Typical pre/post performance 2 test plot**




**Typical Endurance 2 test plot**




**Typical pre/post performance 3 test plot**




**Typical Endurance 3 test plot**

4.3.3 Function Test (Non UKAS)

An AM radio tuned to 121.65MHz was used to monitor the sample for false triggering; no instances of false triggering were noted.
Upon completion of the post performance test 2 serial No M16130048 failed to operate correctly, no SOS tones were emitted and the down swept tone transmitted on 121.65MHz could not be heard, instead a random series of tones were heard.
Serial No M16130048 was returned to the customer for investigation and was replaced with serial No M16130107.
During the Z axis of test it was noted that the shaker system was affecting the operation of the samples, the shaker system had to be completely powered off to enable the functional tests to be conducted.
No other problems were noted during any of the functional tests.

4.4 Process 4

Operational shock & crash safety (Impulse) in accordance with EUROCAE ED-14G Section 7, Category B & previous project WIP 2734. Samples numbered Serial No M16130049 & M16130107 were loaded onto the shaker system as shown in the photograph in paragraph 4.3.1 and were then subjected to the sequence detailed below in each of the 3 axes

Acceleration - $6g_{peak}$
Duration - 11 msec
Pulse shape - Terminal peak sawtooth
Number of pulses - 3 in each sense of each axis
Sample state - Serial No M16130107 was armed but not transmitting & Serial No M16130049 was unarmed

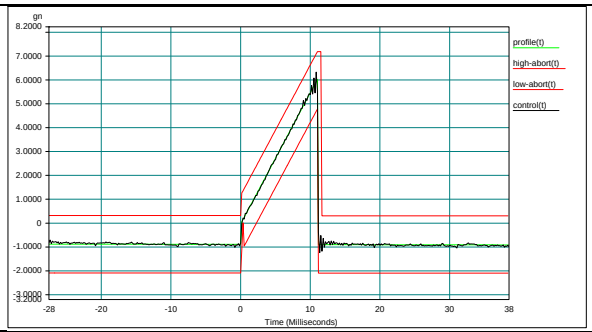
Followed by

Acceleration - $20g_{peak}$
Duration - 11 msec
Pulse shape - Terminal peak sawtooth
Number of pulses - 1 in each sense of each axis
Sample state - Serial No M16130107 was armed but not transmitting & Serial No M16130049 was unarmed

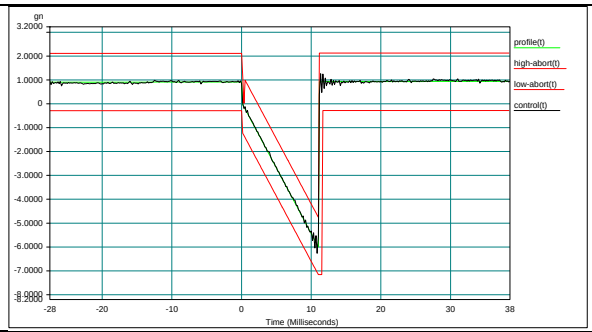
4.4.1 Test Photos

See paragraph 4.3.1 for information

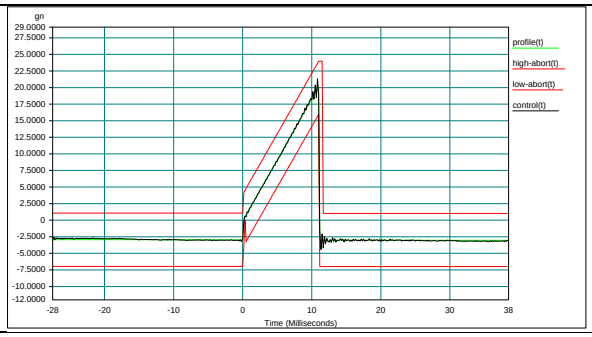
4.4.2 Test Results/plots



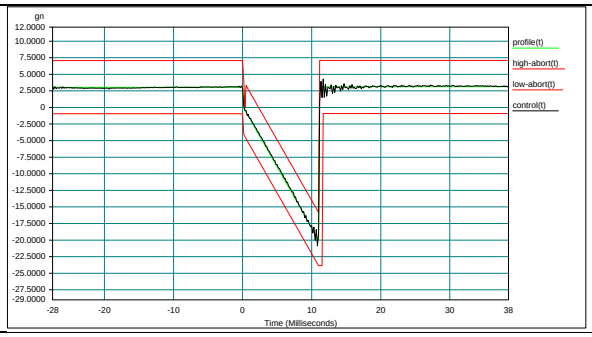

**Typical 6g positive shock pulse**




**Typical 6g negative shock pulse**




**Typical 20g positive shock pulse**




**Typical 20g negative shock pulse**

4.4.3 Function Test (Non UKAS)

An AM radio tuned to 121.65MHz was used to monitor the sample for false triggering; no instances of false triggering were noted.
Upon completion of test a functional check was carried out on both samples as per initial the initial inspection. Both samples operated correctly during these tests.

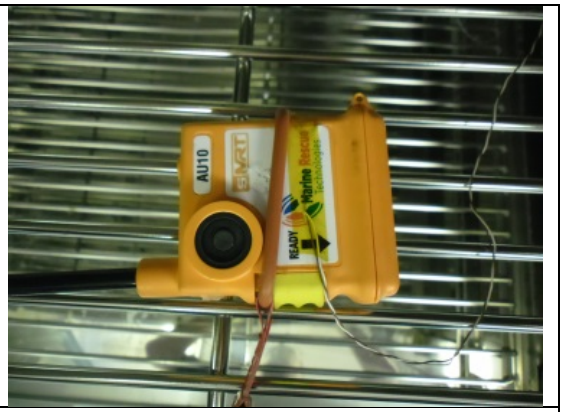
4.5 Process 5

Icing in accordance with EUROCAE ED-14G Section 24, Category A & previous project WIP 2734. Samples numbered Serial No M16130107 & Serial No M16130049 were loaded into the cold chamber as shown in the photograph in paragraph 4.5.1 and a thermocouple was attached to monitor stabilisation times. The samples were then subjected to the conditions detailed below

1. Stabilise samples @ -55°C
2. Transfer to a chamber set to +30°C & 95%RH and leave until sample surface temperature reaches +5°C
3. Transfer back to chamber set to -55°C
4. Repeat steps 1 – 3 for a further 2 cycles
5. On completion of the third cycle raise the chamber temperature to -10°C and leave sample to stabilise.
6. Once stabilised conduct a functional check
7. Ramp chamber back to ambient temperature.

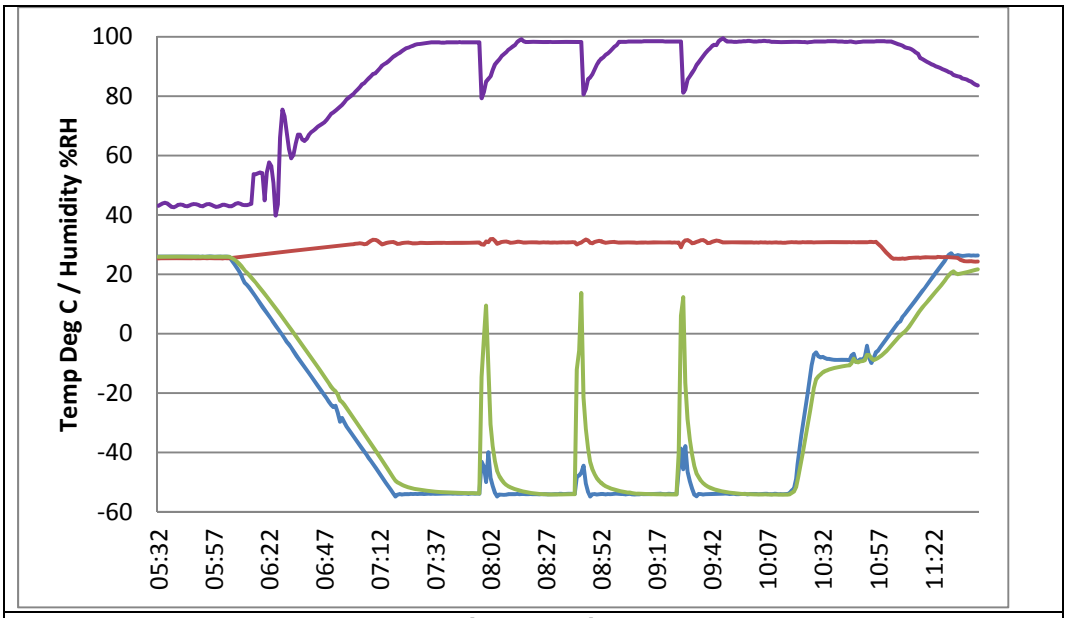
4.5.1 Test Photos

**Typical cold chamber set up photo**




**Location of monitoring thermocouple**

4.5.2 Test Results/Plots




**Icing test plot**
**(-55° chamber, sample, humidity chamber temperature, Humidity chamber %RH)**

4.5.3 Function Test (Non UKAS)

An AM radio tuned to 121.65MHz was used to monitor the sample for false triggering; no instances of false triggering were noted.
Once stabilised @ -10°C and also upon completion of test a functional check was carried out on both samples as per initial the initial inspection. Both samples operated correctly during these tests.

4.6 Process 6

Crash safety (Sustained) in accordance with EUROCAE ED-14G Section 7, sub contracted.
Sustained acceleration using a centrifuge to achieve 20g in all directions.
See appendix 1 for report.

## 5. Report Summary

The samples were subjected to the test regime outlined in this report.

During the test processes a sample was monitored for false triggering using an AM radio and no instances of false triggering were noted during any of the test processes.

The samples operated correctly during all of the functional tests conducted during all test processes with the exception of the random vibration test.
Upon completion of the post performance test 2 serial No M16130048 failed to operate correctly, no SOS tones were emitted and the down swept tone transmitted on 121.65MHz could not be heard, instead a random series of tones were heard. The sample was returned to the customer for evaluation and was replaced with serial No M16130107 for the remainder of testing.

END OF REPORT

## 6. Appendices

Process 6 – Crash Safety (Sustained) sub contract report

BAE SYSTEMS

**Certificate Number: 13267**

**BAE Systems (Operations) Limited**
**The Faraday Test Centre**
Marconi Way
Rochester
Kent ME1 2XX
Telephone: 01634 203541
Facsimile: 01634 203647

UKAS TESTING
0047

# CERTIFICATE OF LABORATORY TEST

**CUSTOMER**

| | |
|---|---|
| **Name:** | Product Assessment and Reliability Centre Ltd |
| **Address:** | Units 10 to 13, Caddsdown Industrial Park, Clovelly Road, Bideford, Devon, EX39 3DX. |

**ITEM(S) TESTED**

| | |
|---|---|
| **Title(s):** | Man Overboard Transmitter – 2 off |
| **Type Number(s):** | 1) MOA-50000 2) MOA-50001 |
| **Serial Number(s):** | 1) M16130049 2) M16130107 |
| **Date(s) Received:** | 12 September 2013 |

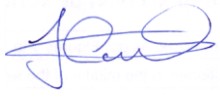
**TEST(s) PERFORMED** Crash Safety Test Procedure 2 (Sustained)

**ACCREDITED SPECIFICATION**

| | | | | | |
|---|---|---|---|---|---|
| **Title:** | Environmental Conditions and Test Procedures for Airborne Equipment | | | | |
| **Reference No:** | EUROCAE ED-14F | | | | |
| **Issue:** | - | **A/L:** | - | **Dated:** | March 2008 |
| **Para. Number(s):** | Section 7, Paragraph 7.3.3 ( **See Remarks Section on Page 2**) | | | | |

| | | | |
|---|---|---|---|
| **DATE STARTED:** | 13 September 2013 | **DATE FINISHED:** | 16 September 2013 |
| **TEST REPORT REF:** | - | **CUSTOMER ORDER No:** | P/13/1521 |

Certified that the calibration status of equipment used for testing was correct and traceable to National Standards. This Certificate applies solely to the Item(s) specified above.

**Signed:** 

**Name:** **J. M. Carley**
**Job Title:** **Principal Qualification Engineer**
**Date:** **16 September 2013**

For and on behalf of BAE SYSTEMS (Operations) Limited

BAE SYSTEMS

Certificate Number: 13267

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# CERTIFICATE OF LABORATORY TEST

**REMARKS:**

The Units were subjected to an acceleration level of 20g for a duration of 3 seconds in each direction of their three mutually perpendicular axes. Mounting of the Units to the centrifuge was achieved via a beam clamp.

Unit S/No. M16130107 was armed and did not activate during the test.

A quick look external visual examination carried out on completion of the test at room ambient temperature revealed no obvious deterioration of the Units.

**DECLARED OR OBSERVED DEVIATIONS OF TEST ITEM PRIOR TO TEST:**

NONE

**FUNCTIONAL TESTS OR EVALUATIONS PERFORMED BUT NOT UKAS ACCREDITED:**

On completion of each direction, the Units were functionally checked satisfactorily in accordance with customers' instructions.

**FUNCTIONAL TESTS OR EVALUATIONS NOT PERFORMED BY THE LABORATORY:**

NONE

**DEVIATIONS FROM SPECIFIED TEST CONDITIONS:**

NONE

**UNCERTAINTY OF MEASUREMENT:**

(To be entered when uncertainty may influence the Pass/Fail decision)

NOT APPLICABLE