



Product Service

---

**Choose certainty.  
Add value.**

# Report On

GNSS testing of the  
Orolia Limited  
Z423 Fastfind 220 Personal Locating Beacon

COMMERCIAL-IN-CONFIDENCE



Product Service

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North,  
Fareham, Hampshire, United Kingdom, PO15 5RL  
Tel: +44 (0) 1489 558100. Website: [www.tuv-sud.co.uk](http://www.tuv-sud.co.uk)

COMMERCIAL-IN-CONFIDENCE

**REPORT ON**

GNSS testing of the  
Orolia Limited  
Z423 Fastfind 220 Personal Locating Beacon

Document 75942209 Report 08 Issue 1

December 2018

**PREPARED FOR**

Orolia Limited  
Silver Point,  
Airport Service Road  
Hilsea  
Portsmouth  
PO3 5PB  
United Kingdom

**PREPARED BY**

---

Sarah Jones  
**Project Manager**

**APPROVED BY**

---

Matthew Russell  
**Authorised Signatory**

**DATED**

---

06 December 2018





## CONTENTS

Section	Page No
<b>1</b>	<b>REPORT SUMMARY ..... 3</b>
1.1	Introduction ..... 4
1.2	Brief Summary of Results ..... 5
1.3	Declaration of Build Status ..... 6
1.4	Product Information ..... 7
1.5	Test Locations ..... 9
1.6	Deviations from the Standard ..... 9
1.7	Modification Record ..... 9
<b>2</b>	<b>TEST DETAILS ..... 10</b>
2.1	Static Accuracy – GPS ..... 11
2.2	Static Accuracy – Angular Movement of the Antenna ..... 13
2.3	Dynamic Accuracy – GPS ..... 15
2.4	Dynamic Accuracy – Differential GPS ..... 19
2.5	Acquisition Condition A - Initialization ..... 20
2.6	Acquisition Condition B – Power Outage ..... 22
2.7	Acquisition Condition C – Interruption of GPS Signal ..... 25
2.8	Acquisition Condition D – Brief Interruption of Power ..... 28
2.9	Short Circuit protection ..... 30
2.10	Sensitivity and Dynamic Range - Acquisition ..... 31
2.11	Sensitivity and Dynamic Range – Tracking ..... 34
2.12	Effects of Interfering Signals ..... 36
2.13	Position Update – Slow Speed Update Rate ..... 37
2.14	Position Update – High Speed Update Rate ..... 40
<b>3</b>	<b>TEST EQUIPMENT USED ..... 43</b>
3.1	Test Equipment Used ..... 44
<b>4</b>	<b>PHOTOGRAPHS ..... 45</b>
4.1	Photographs of Equipment Under Test (EUT) ..... 46
<b>5</b>	<b>ACCREDITATION, DISCLAIMERS AND COPYRIGHT ..... 47</b>
5.1	Accreditation, Disclaimers and Copyright ..... 48
<b>ANNEX A</b>	<b>Manufacturer Supplied Information ..... A.2</b>



Product Service

## **SECTION 1**

### **REPORT SUMMARY**

GNSS testing of the  
Orolia Limited  
Z423 Fastfind 220 Personal Locating Beacon



## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Orolia Limited Z423 Fastfind 220 Personal Locating Beacon (PLB) to limited requirements of IEC 61108-1 as required by RTCM 11010.2 (clause 4.3.1.3.3).

Objective	To perform GPS Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Orolia Limited
Model Number(s)	Z423 Fastfind 220 PLB
Manufacturer Declared Variant*	Z424 Fastfind Ranger and SafeLink Solo Personal Locating Beacon
Serial Number(s)	#09 (TUV ref 75942209 TSR 006)
Number of Samples Tested	1
Test Specification/Issue/Date	IEC 61108-1: 2003
Order Number	20805
Date	20 March 2018
Date of Receipt of EUT	22 March 2018
Start of Test	31 May 2018
End of Test	10 August 2018
Name of Engineer(s)	Bidhan Bhandari
Related Document(s)	GPS SPS Performance Specification - USA DoD - 3rd Edition October 2001 RTMC 11010.2

\*See Annex A for Manufacturer document detailing the declared variant(s).



Product Service

## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with IEC 61108-1 is shown below. These clauses are defined as required by the product specific standard, and are defined in RTCM 11010.2 Clause 4.2.9.1.

Section	Spec Clause	Test Description	Result	Comments
2.1	5.6.4.1.1	Static Accuracy - GPS	Pass	
2.2	5.6.4.2	Static Accuracy - GPS - Angular Movement of the Antenna	Pass	
2.3	5.6.4.3.1	Dynamic Accuracy - GPS	Pass	
2.4	5.6.4.3.2	Dynamic Accuracy – Differential GPS	N/A	Not applicable – EUT does not support differential GPS
2.5	5.6.5.1	Acquisition - Condition A – Initialization	Pass	
2.5	5.6.5.2	Acquisition - Condition B - Power Outage	Pass	
2.6	5.6.5.3	Acquisition - Condition C - Interruption of GPS Signals	Pass	
2.7	5.6.5.4	Acquisition - Condition D – Brief Interruption of Power	Pass	
-	5.6.6	Short Circuit Protection	N/A	GPS antenna is located inside the EUT housing (handheld device)
2.8	5.6.8.1	Sensitivity and Dynamic Range - Acquisition	Pass	
2.9	5.6.8.2	Sensitivity and Dynamic Range - Tracking	Pass	
-	5.6.9	Effects of Interfering Signal	N/T	Refer to BSH report BSH/4542/001/41432 54/18
2.10	5.6.10.1	Slow Speed Update Rate	Pass	
2.11	5.6.10.2	High Speed Update Rate	Pass	

N/A Not Applicable  
N/T Not Tested

### 1.3 DECLARATION OF BUILD STATUS

MAIN EUT			
MANUFACTURING DESCRIPTION	FastFind 220 PLB		
MANUFACTURER	OROLIA LTD		
MODEL NAME/NUMBER	Z423		
PART NUMBER	Z423		
SERIAL NUMBER			
HARDWARE VERSION	1001488 Issue A		
SOFTWARE VERSION	1001767 Issue A		
PSU VOLTAGE/FREQUENCY/CURRENT	Lithium 12 Volts nominal (2 Battery pack in series)		
HIGHEST INTERNALLY GENERATED / USED FREQUENCY	GEN : 406.031 Mhz / USED : 1575.42 MHz (GNSS)		
FCC ID (if applicable)	KLS		
INDUSTRY CANADA ID (if applicable)	6319A		
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	Personal Locator Beacon (PLB) device with built-in 406 Mhz Cospas-Sarsat transmitter and 121.5MHz Homer. It is used to assist in the locating and recovery of people that are in imminent danger.		
COUNTRY OF ORIGIN	N/A		
RF CHARACTERISTICS (if applicable)			
TRANSMITTER FREQUENCY OPERATING RANGE (MHz)	406.031 MHz / 121.5 MHz		
RECEIVER FREQUENCY OPERATING RANGE (MHz)	1575.42 MHz (GNSS)		
INTERMEDIATE FREQUENCIES	N/A		
EMISSION DESIGNATOR(S): (i.e. G1D, GXW)	16K0G1D (406.031 MHz) / 3K20A3X (121.5MHz)		
MODULATION TYPES: (i.e. GMSK, QPSK)	Phase Mod (406.031 MHz) / Swept tone AM (121.5MHz)		
OUTPUT POWER (W or dBm)	37dBm (406.031 MHz) / 19dBm (121.5MHz)		
SEPARATE BATTERY/POWER SUPPLY (if applicable)			
MANUFACTURING DESCRIPTION	Lithium battery Pack		
MANUFACTURER	OROLIA LTD (Made with CR123 GP cells)		
TYPE	Lithium Manganese Dioxide		
PART NUMBER	1001802		
PSU VOLTAGE/FREQUENCY/CURRENT	6V		
COUNTRY OF ORIGIN	N/A		
MODULES (if applicable)			
MANUFACTURING DESCRIPTION			
MANUFACTURER			
TYPE			
POWER			
FCC ID			
INDUSTRY CANADA ID			
EMISSION DESIGNATOR			
DHSS/FHSS/COMBINED OR OTHER			
COUNTRY OF ORIGIN			
ANCILLARIES (if applicable)			
MANUFACTURING DESCRIPTION			
MANUFACTURER			
TYPE			
PART NUMBER			
SERIAL NUMBER			
COUNTRY OF ORIGIN			

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

Name: Erwan THOMAS Position held: Hardware and Certification engineer

Date: 14/08/2018

## 1.4 PRODUCT INFORMATION

### 1.4.1 Technical Description

The Equipment Under Test (EUT) was an Orolia Limited Z423 FastFind PLB, as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test



### 1.4.2 Physical Test Configuration

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Where simulated GNSS signals were applied the tests were carried out with the EUT situated in a shielded enclosure.

The NMEA data was recorded directly from the data cable connected to the device. The EUT was powered by the internal battery pack.

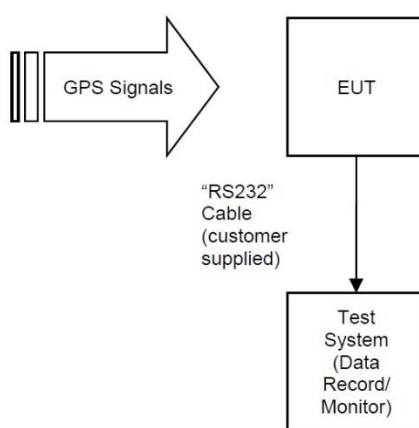


Figure 1. System Configuration A Schematic

Test set up was a laptop running Tera Term; a serial terminal program that records the NMEA output of the EUT and adds a timestamp (with 1 ms resolution) to each sentence.

The GPS signal applied is recorded at the appropriate test section.

Physical set up was defined by the standard for Static Accuracy (the Angular Movement of the antenna) tests. GPS signal input was as per “live” (real world) conditions at the time/location.

The physical configuration for the all the other tests was at most practical at the time. GPS signal input was checked using the reference receiver to provide enough of high (but not maximum\*) signal-to-noise ratios(SNRs) on all Satellite Vehicles (SVs) in view.

\*i.e attenuated down until SNRs began to drop then maintained.

All relevant physical configurations are described or illustrated in the appropriate test section.



Product Service

#### **1.5 TEST LOCATIONS**

TUV SUD Product Service, Octagon House, Fareham.

#### **1.6 DEVIATIONS FROM THE STANDARD**

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

#### **1.7 MODIFICATION RECORD**

No modifications were made to the EUT during testing.



Product Service

## **SECTION 2**

### **TEST DETAILS**

GNSS testing of the  
Orolia Limited  
Z423 Fastfind 220 PLB



## **2.1 STATIC ACCURACY – GPS**

### **2.1.1 Specification Reference**

IEC 61108-1, Clause 5.6.4.1.1

### **2.1.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 0

### **2.1.3 Date of Test**

30 July 2018 – 31 July 2018

### **2.1.4 Test Equipment Used**

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

### **2.1.5 Environmental Conditions**

Ambient Temperature 24.7 – 25.4 °C

Relative Humidity 47.2 – 59.3%

### **2.1.6 Test Methods**

The following testing is required by the specification:

#### Static Test Site Clause 5.5.2

“The antenna shall be mounted according to the manufacturer's instructions at a height of between 1 m and 1,5 m above the electrical ground in an area providing clear line of sight to the satellites from zenith through to an angle of +5° above horizontal. The position of the antenna shall be known, with reference to WGS 84 to an accuracy of better than 0,1 m in (x, y, z). Maximum cable lengths as specified by the manufacturer shall be used during testing.

All static tests shall utilize actual GPS signals.”

#### Test Method Clause 5.6.4.1.1

“Position fix measurements shall be taken over a period of not <24 h. The absolute horizontal position accuracy shall be within 13 m (95 %), having discarded measurements taken in conditions of HDOP ≥ 4 and PDOP ≥ 6.”

#### Performance Standard Clause 4.3.3.1

“(M.112/A3.4) The GPS receiver equipment shall have static accuracy such that the horizontal position of the antenna is determined to within 100 m (95 %) with horizontal dilution of precision (HDOP) ≤ 4 (or PDOP ≤ 6). Since Selective Availability has been set to zero, the static accuracy has been determined to be within 13 m (95 %) as specified by the GPS SPS Performance Standards of October 2001.”

## 2.1.7 Test Set Up



Test Set up Photo

## 2.1.8 Test Results

EUT was placed on static test site with non-conductive platform. It was operated and monitored continuously for the period of measurements as given below.

Test Parameters	Units	Result	Limit
Test Specific			
Non-Conductive Platform Height	m	1.34	1-1.5
General			
Time to Acquire Valid Position	s	33.49	-
Performance Check			
Start Time / Event of Performance Check	-	Position Lock	-
Measurement Duration	hh:mm:ss	24:03:15	>24h
Total Number of Position Solutions	-	86595	-
Number of Solutions with HDOP $\leq$ 4 and PDOP $\leq$ 6	-	86595	-
Measurement of error $\leq$ 13m	%	100	>95



## **2.2 STATIC ACCURACY – ANGULAR MOVEMENT OF THE ANTENNA**

### **2.2.1 Specification Reference**

IEC61108-1, Clause 5.6.4.2

### **2.2.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 0

### **2.2.3 Date of Test**

10 July 2018 to 11 July 2018

### **2.2.4 Test Equipment Used**

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

### **2.2.5 Environmental Conditions**

Ambient Temperature 18.9 – 58.7°C

Relative Humidity 24.6 – 65.6.0%

### **2.2.6 Test Methods**

The following testing is required by the specification:

#### Test Method Clause 5.6.4.2

“The static tests specified in 5.6.4.1.1 and 5.6.4.1.2 shall be repeated with the antenna performing an angular displacement of  $\pm 22.5^\circ$  (simulating roll) in a period of about 8 s (see IEC 60721-3-6) during the duration of the tests.

The results shall be as in 5.6.4.1.1 and 5.6.4.1.2.”

#### Performance Standard Clause 4.3.3.1

“(M.112/A3.4) The GPS receiver equipment shall have static accuracy such that the horizontal position of the antenna is determined to within 100 m (95 %) with horizontal dilution of precision (HDOP)  $\leq 4$  (or PDOP  $\leq 6$ ). Since Selective Availability has been set to zero, the static accuracy has been determined to be within 13 m (95 %) as specified by the GPS SPS Performance Standards of October 2001.”

## 2.2.7 Test Set Up



Test Set Up

## 2.2.8 Test Results

EUT was placed on static test site on a non-conductive platform. It was operated and monitored continuously for the period of measurement as given below.

Test Parameters	Units	Result	Limit
Test Specific			
Non-Conductive Platform Height	m	1.34	1-1.5
General			
Time to Acquire Valid Position	s	36.53	-
Performance Check			
Start Time / Event of Performance Check	-	Position Lock	-
Measurement Duration	hh:mm:ss	24:00:11	>24h
Total Number of Position Solutions	-	86411	-
Number of Solutions with HDOP $\leq$ 4 and PDOP $\leq$ 6	-	86411	-
Measurement of error $\leq$ 13m	%	100	>95



## **2.3 DYNAMIC ACCURACY – GPS**

### **2.3.1 Specification Reference**

IEC 61108-1, Clause 5.6.4.3.1

### **2.3.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 0

### **2.3.3 Date of Test**

31 May 2018

### **2.3.4 Test Equipment Used**

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

### **2.3.5 Environmental Conditions**

Ambient Temperature 23.5°C

Relative Humidity 41.8%

### **2.3.6 Test Method**

The following testing is required by the specification:

IEC-61108:2003 Clause 5.6.4.3.1

“The tests for dynamic accuracy are a practical interpretation of the conditions set out in IEC 60721-3-6, Table V, item e), X – direction (surge) and Y – direction (sway). These are stated as surge 5 m/s<sup>2</sup> and sway 6 m/s<sup>2</sup> for all classes of environment. When using a simulator, the simulator characteristics shall accurately represent the signals required.

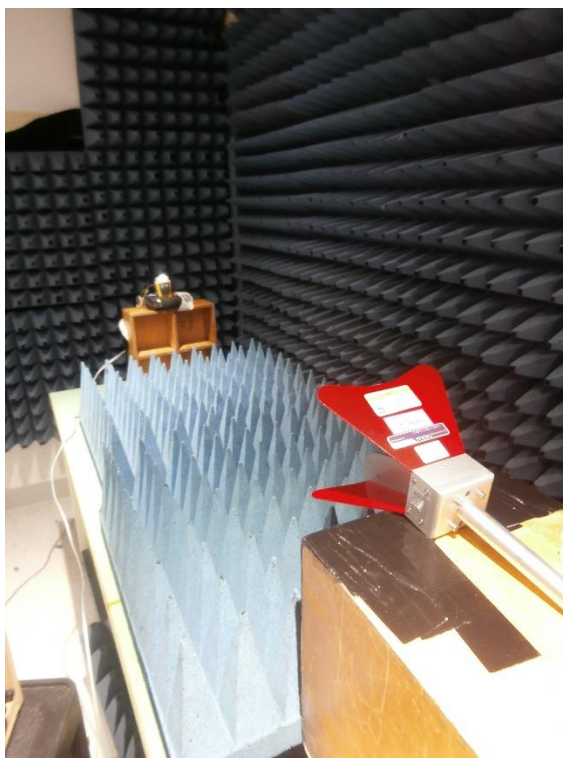
The results of the test performed by simulation facilities shall be identical with those in a) and b) below:

a) a fully locked and settled EUT travelling in a straight line at 48 knots  $\pm$  2 knots for a minimum of 1,2 min which is reduced to 0 knots in the same straight line in 5 s, shall not indicate a positional offset  $>\pm 13$  m from the final position 10 s after coming to rest;

b) a fully locked and settled EUT travelling at least 100 m at 24 knots  $\pm$  1 knot in a straight line then subjected, for at least 2 min, to smooth deviations either side of the straight line of approximately 2 m at a period of 11 s to 12 s shall remain in lock and follow the actual position to within a lane of 30 m wide centred on the mean direction of motion.”



### 2.3.7 Test Set Up



Test Set Up

## 2.3.8 Test Results

### Dynamic Accuracy A

EUT and GPS simulator were started simultaneously. The EUT acquired position lock after the acquisition time stated below; the simulator ran a dynamic position travelling at 48 knots in a straight line for 10 minutes before decelerating to 0 knots in 5 seconds. The position output 10 seconds after coming to rest was determined by NMEA 0183 output.

Test Parameters	Units	Result	Limit
General			
Signal Type	Live / Simulated	Simulated	-
EUT Started Simultaneously	Y/N	Y	-
Time to Acquire Valid position	s	49.12	-
Test Specific			
Position Error 10s after coming to rest	m	2.06	≤13
Performance Specific			
Start Time / Event of performance check	-	10 s After performance comes to rest	-
Total Number of Position solutions	-	601	-
Number of solution with HDOP ≤4 and PDOP ≤6	-	600	-
Measurement Duration	Min	10	-
Measurement of error ≤13m	%	100	-

### Dynamic Accuracy B

EUT and GPS simulator were started simultaneously, the EUT acquired the position lock after the acquisition time stated in the table below. The simulator ran a dynamic position travelling at 24 knots in a straight line for 10 minutes before starting to oscillate smoothly  $\pm 2\text{m}$  either side of the original path for further 20 minutes.

EUT position output error compared to the simulated dynamic position was determined from EUT NMEA output.

A Performance Check was conducted during the 20-minute oscillation period in order to determine that the position error was not outside of the  $\pm 30\text{ m}$  'lane' of tolerance.

Test Parameters	Units	Result	Limit
General			
Signal Type	Live / Simulated	Simulated	-
EUT Started Simultaneously	Y/N	Y	-
Initial Acquisition Time	s	48.87	-
Performance Check	P/F	P	P
Start Time / Event of performance check	-	Start of Oscillation	-
Total Number of Measurement	-	601	-
Number of solution with HDOP $\leq 4$ and PDOP $\leq 6$	-	601	$\geq 100$
Measurement Duration	Min	10	$> 2$
Measurement of error $\leq 15\text{m}$	%	100	100



Product Service

## **2.4 DYNAMIC ACCURACY – DIFFERENTIAL GPS**

### **2.4.1 Specification Reference**

IEC 61108-1, Clause 5.6.4.3.2

Not applicable – EUT does not support differential GPS.



Product Service

## **2.5 ACQUISITION CONDITION A - INITIALIZATION**

### **2.5.1 Specification Reference**

IEC 61108-1, Clause 5.6.5.1

### **2.5.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 0

### **2.5.3 Date of Test**

04 June 2018

### **2.5.4 Test Equipment Used**

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

### **2.5.5 Environmental Conditions**

Ambient Temperature 23.3

Relative Humidity 53.6

### **2.5.6 Test Methods**

The following testing is required by the specification:

#### Test Method Clause 5.6.5.1

"The EUT shall be either:

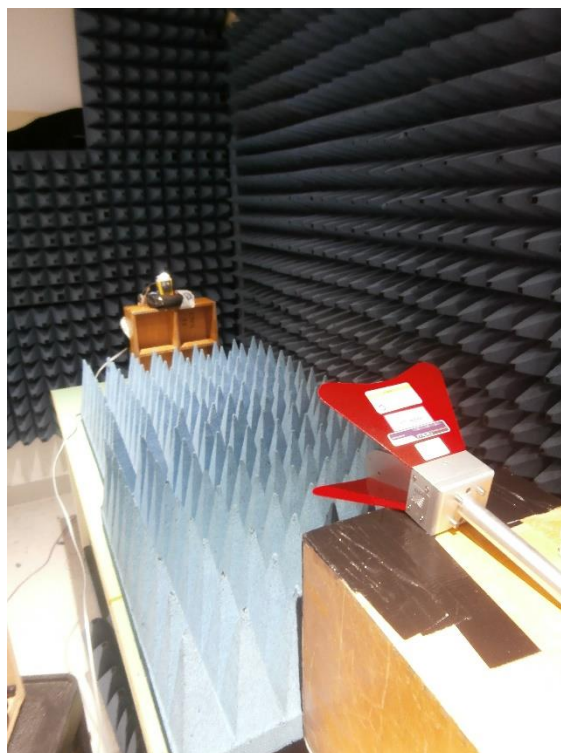
- a) Initialised to a false position at least 1000 km and not greater than 10,000 km from the test position, or alternatively, by deletion of the current almanac; or
- b) Isolated from a power source for >7 days.

A performance check shall be carried out after the time limit contained in Table 1.

#### Performance Standard Clause 4.3.4

"M.112/A3.8) The GPS receiver equipment shall be capable of acquiring position to the required accuracy within 30 min, when there is no valid almanac data."

## 2.5.7 Test Set Up



Test Set Up

## 2.5.8 Test Results

EUT was initialised to a false position as per the table below.

Time to lock was measured and a performance test was started once the position lock was obtained. The simulator ran as static position for a sufficient time for the remaining test to complete.

Test Parameter	Units	Results	Limit
Test Specific			
False position difference from test position	km	1679.28	1000-10000
Time to acquire valid position	s	59.12	<30 min
Performance Check			
Start time / event	-	Position Lock	-
Measurement duration	Min	10	$5 \leq$ and $\geq 10$
Total number of position solutions	-	601	-
Number of solutions with HDOP $\leq 4$ and PDOP $\leq 6$	-	601	$\geq 100$
Measurement with position error $\leq 13$ m	%	100	$\geq 95$



Product Service

## **2.6 ACQUISTION CONDITION B – POWER OUTAGE**

### **2.6.1 Specification Reference**

IEC 61108-1, Clause 5.6.5.2

### **2.6.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 0

### **2.6.3 Date of Test**

14 June 2018 – 15 June 2018

### **2.6.4 Test Equipment Used**

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

### **2.6.5 Environmental Conditions**

Ambient Temperature 24.5 -24.4 °C

Relative Humidity 34.4- 48.5 %

### **2.6.6 Test Methods**

The following testing is required by the specification:

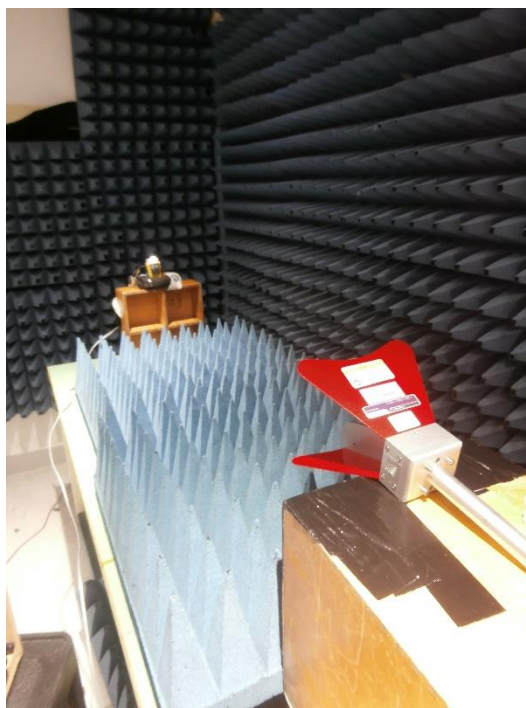
#### Test Method Clause 5.6.5.2

“The EUT shall be isolated from the power source for a period within 24 h to 25 h. At the end of the period, a performance check shall be carried out after the time limit contained in Table 1.”

#### Performance Standard Clause 4.3.4

“M.112/A3.9) The GPS receiver equipment shall be capable of acquiring position to the required accuracy within 5 min, when there is no valid almanac data.”

## 2.6.7 Test Set Up



Test Set Up





## 2.6.8 Test Results

EUT was position locked and stable when the power was removed for the power isolation period as below, then re-applied.

Test Parameter	Units	Results	Limit
Test Specific			
Power isolation period	hh:mm:ss	24:17:48	$\geq 24$ and $\leq 25$
Time to acquire valid position	s	25.69	<5 min
Performance Check			
Start time / event	-	Position Lock	-
Measurement duration	Min	10	$5 \leq$ and $\geq 10$
Total number of position solutions	-	601	-
Number of solutions with HDOP $\leq 4$ and PDOP $\leq 6$	-	601	$\geq 100$
Measurement with position error $\leq 13$ m	%	100	$\geq 95$



Product Service

## **2.7 ACQUISITION CONDITION C – INTERRUPTION OF GPS SIGNAL**

### **2.7.1 Specification Reference**

IEC 61108-1, Clause 5.6.5.3

### **2.7.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 06

### **2.7.3 Date of Test**

11 June 2018 – 12 June 2018

### **2.7.4 Test Equipment Used**

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

### **2.7.5 Environmental Conditions**

Ambient Temperature 24.6 – 23.8 °C

Relative Humidity 44.8 – 46.7%

### **2.7.6 Test Methods**

The following testing is required by the specification:

#### Test Method Clause 5.6.5.3

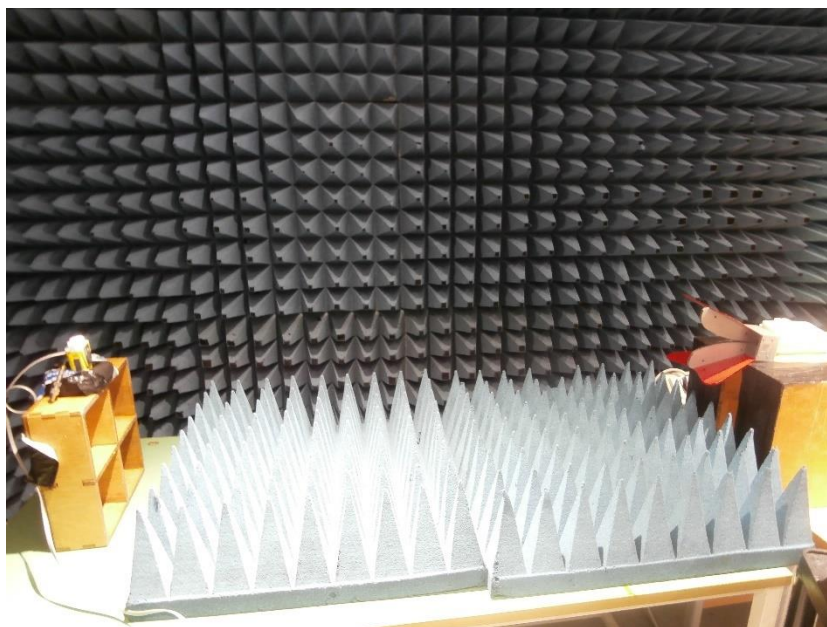
“During normal operation of the EUT, the antenna shall be completely masked for a period between 24 h and 25 h.

At the end of the period, a performance check shall be carried out after the time limit contained in Table 1.”

#### Performance Standard Clause 4.3.4

“M.112/A3.10) The GPS receiver equipment shall be capable of re-acquiring position to the required accuracy within 5 min, when the GPS signals are interrupted for a period of at least 24 h, but there is no loss of power.”

### 2.7.7 Test Set Up



Test Set Up

## 2.7.8 Test Results

EUT was position locked and stable when the GPS signal was removed for an isolation period. Upon application of GPS the re-acquisition time was measured and a performance check was performed.

Test Parameter	Units	Results	Limit
Test Specific			
Power isolation period	hh:mm:ss	24:37:24	$24 \leq$ and $\geq 25$
Time to acquire valid position	s	12s	<5 min
Performance Check			
Start time / event	-	Re-acquisition	-
Measurement duration	Min	10	$5 \leq$ and $\geq 10$
Total number of position solutions	-	601	-
Number of solutions with HDOP $\leq 4$ and PDOP $\leq 6$	-	601	$\geq 100$
Measurement with position error $\leq 13\text{m}$	%	100	$\geq 95$



Product Service

## **2.8 ACQUISITION CONDITION D – BRIEF INTERRUPTION OF POWER**

### **2.8.1 Specification Reference**

IEC 61108-1, Clause 5.6.5.4

### **2.8.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 06

### **2.8.3 Date of Test**

04 June 2018

### **2.8.4 Test Equipment Used**

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

### **2.8.5 Environmental Conditions**

Ambient Temperature 24.3

Relative Humidity 54.5

### **2.8.6 Test Methods**

The following testing is required by the specification:

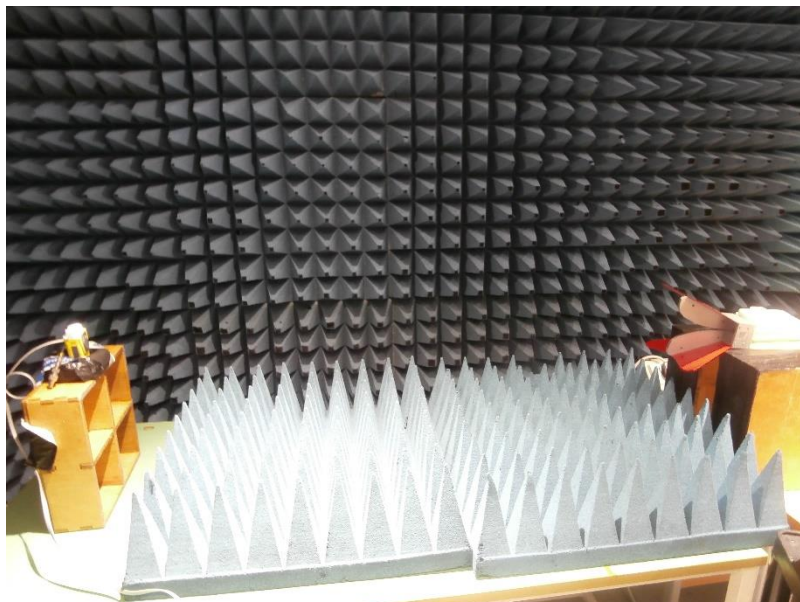
#### Test Method Clause 5.6.5.4

“During normal operation of the EUT, the power shall be removed for a period of 60 s. At the end of this period, the power shall be restored. A performance check shall be carried out after the time limit contained in Table 1.

#### Performance Standard Clause 4.3.4

“M.112/A3.10) The GPS receiver equipment shall be capable of re-acquiring position to the required accuracy within 2 min, when subjected to a power interruption of 60 s.”

## 2.8.7 Test Set Up



Test Set Up

## 2.8.8 Test Results

EUT was position locked and stable when the GPS signal was removed for an isolation period. Upon application of power the re-acquisition time was measured and a performance check was performed.

Test Parameter	Units	Results	Limit
Test Specific			
Power isolation period	s	68	60s
Time to acquire valid position	s	17.5	<2 min
Performance Check			
Start time / event	-	Re-acquisition	-
Measurement duration	Min	10	5 ≤ and ≥ 10
Total number of position solutions	-	601	-
Number of solutions with HDOP≤4 and PDOP≤6	-	601	≥100
Measurement with position error ≤ 13m	%	100	≥95



Product Service

## **2.9 SHORT CIRCUIT PROTECTION**

### **2.9.1 Specification Reference**

IEC 61108-1, Clause 5.6.6

No antenna input is provided (GPS antenna is located inside the EUT housing (handheld device)).



## **2.10 SENSITIVITY AND DYNAMIC RANGE - ACQUISITION**

### **2.10.1 Specification Reference**

IEC 61108-1, Clause 5.6.8.1

### **2.10.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 06

### **2.10.3 Date of Test**

10 August 2018

### **2.10.4 Test Equipment Used**

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

### **2.10.5 Environmental Conditions**

Ambient Temperature 21.1°C

Relative Humidity 45%

### **2.10.6 Test Methods**

The following testing is required by the specification:

#### Test Clause 5.6.8.1

"This is tested by using a simulator

- a) Transmit the simulator signal over a suitable antenna.
- b) Adjust the signal power by use of a calibrated test receiver to  $-125 \text{ dBm} \pm 5 \text{ dBm}$ .
- c) Replace the antenna of the calibrated test receiver by the receiving unit of the EUT.
- d) A performance check shall be carried out."

#### Performance Standard Clause 4.3.7

"M.112/A3.7) The GPS receiver equipment shall be capable of acquiring satellite signals with input signals having carrier levels in the range of  $-130 \text{ dBm}$  to  $-120 \text{ dBm}$  as measured at the output of a 3 dBi linear polarized receiving antenna. Once the satellite signals have been acquired the equipment shall continue to operate satisfactorily with satellite signals having carrier levels down to  $-133 \text{ dBm}$  as measured at the output of a 3 dBi linear polarized receiving antenna."

#### Performance Standard Clause 5.6.8.1

Required result

"The EUT shall meet the requirements of this check, within this signal range."

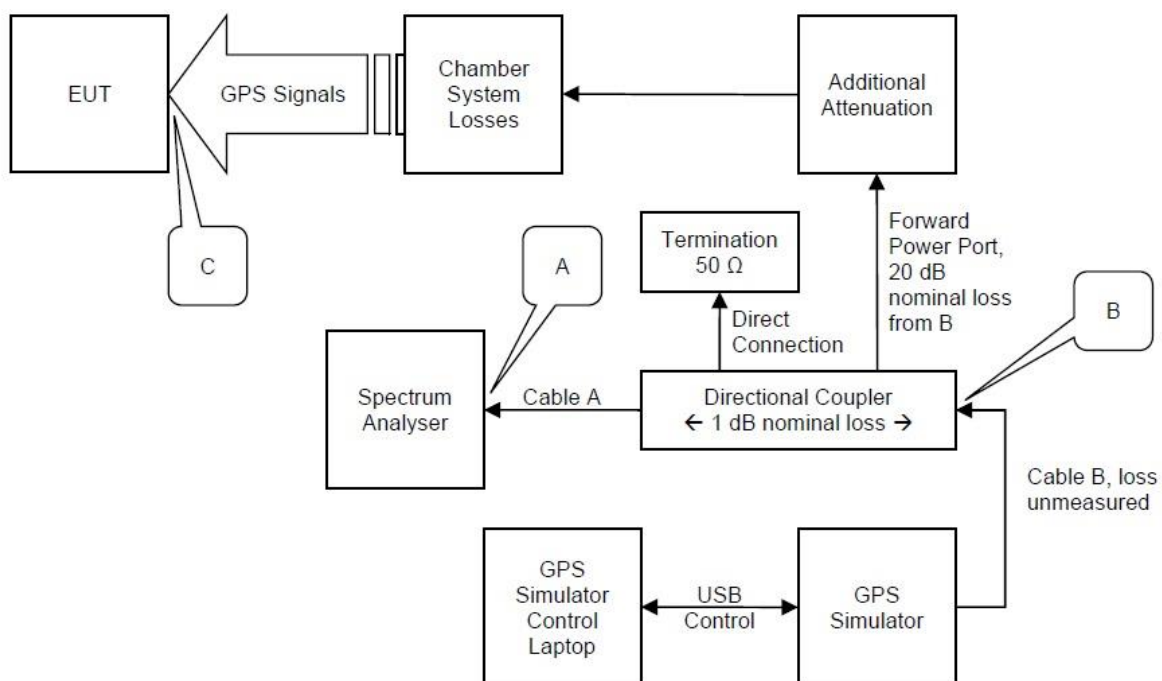


## 2.10.7 Test Set Up



Test Set Up

### Calibrated Field Set Up:



The basic premise of field schematic is that the power at C equals power at B minus loss from B to C. Power at B equals power at A minus loss from B to A.

## 2.10.8 Test Results

EUT was activated in the above test setup, acquisition time was measured and the performance check was carried out.

Test Parameter	Units	Results	Limit
Test Specific			
Received signal strength	dBm	-124.28	-125 ±5
General			
Initial Acquisition time	s	19	-
Performance check			
Start time / event	-	Position lock	-
Measurement duration	Min	10	5 ≤ and ≥ 10
Total Number of measurements	-	601	-
Number of solution with HDOP ≤4 and PDOP ≤6	-	601	≥100
Measurement with position error ≤ 13 m	%	100	≥95



Product Service

## **2.11 SENSITIVITY AND DYNAMIC RANGE – TRACKING**

### **2.11.1 Specification Reference**

IEC 61108-1, Clause 5.6.8.2

### **2.11.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 0

### **2.11.3 Date of Test**

10 August 2018

### **2.11.4 Test Equipment Used**

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

### **2.11.5 Environmental Conditions**

Ambient Temperature 21.1°C

Relative Humidity 45%

### **2.11.6 Test Methods**

The following testing is required by the specification:

#### Test Clause 5.6.8.2

“The received satellite signals shall be monitored by a suitable test receiver. These signals shall be attenuated down to –133 dBm. Under these conditions, the performance requirements shall be met.

This is tested by using a simulator. Method:

- a) Transmit the simulator signal over a suitable antenna.
- b) Adjust the signal power by use of a calibrated test receiver to –125 dBm  $\pm$  5 dBm.
- c) Replace the antenna of the calibrated test receiver by the receiving unit of the EUT.
- d) After the start of transmission and tracking with the nominal transmission level condition,  
gradually reduce transmission level down to –133 dBm.

#### Required Result

“The EUT shall continue tracking at least one satellite.”

### 2.11.7 Test Set Up

The initial test set up is identical to “Sensitivity and Dynamic Range – Acquisition”.

### 2.11.8 Test Results

EUT remained operational after “Sensitivity and Dynamic Range – Acquisition”, locked and settled having just completed the performance check. Signal power was then reduced gradually.

Test Parameter	Units	Results	Limit
Test Specific			
Received signal strength (per SV) - initial	dBm	-124.28	-125 ±5
Received signal strength (per SV) - final	dBm	-134.51	-133
Reduction increment	dB	2	See Note 1
Total duration of reduction and measurement	Min	10	See Note 1
Satellite in Scenario	-	10	-
Required EUT Response			
Satellites Tracked	-	10	≥ 1

NOTE 1: The received signal strength was gradually reduced by 10 dB in no more than 2 dB steps over a period of approximately 10 minutes. A received signal strength less than the requirement in the table above was considered an over-test.



Product Service

## **2.12 EFFECTS OF INTERFERRING SIGNALS**

### **2.12.1 Specification Reference**

IEC 61108-1, Clause 5.6.9

Refer to BSH Report: BSH/4542/001/4143254/18



Product Service

## **2.13 POSITION UPDATE – SLOW SPEED UPDATE RATE**

### **2.13.1 Specification Reference**

IEC 61108-1, Clause 5.6.10.1

### **2.13.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 0

### **2.13.3 Date of Test**

04 June 2018

### **2.13.4 Test Equipment Used**

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

### **2.13.5 Environmental Conditions**

Ambient Temperature 24.4 °C

Relative Humidity 54.5 %

### **2.13.6 Test Methods**

The following testing is required by the specification:

#### Test Method Clause 5.6.10.1

“The EUT shall be placed upon a platform, moving in approximately a straight line, at a speed of 5 knots  $\pm$  1 knot. The position output of the EUT shall be checked at intervals of 10 s, over a period of 10 min. The output position shall be observed to be updated on each occasion.

This test may be carried out by using a simulator.

#### Performance standard clause 5.6.10.2

“[...] received positions at the end of each interval are in compliance with the real or simulated reference position.”

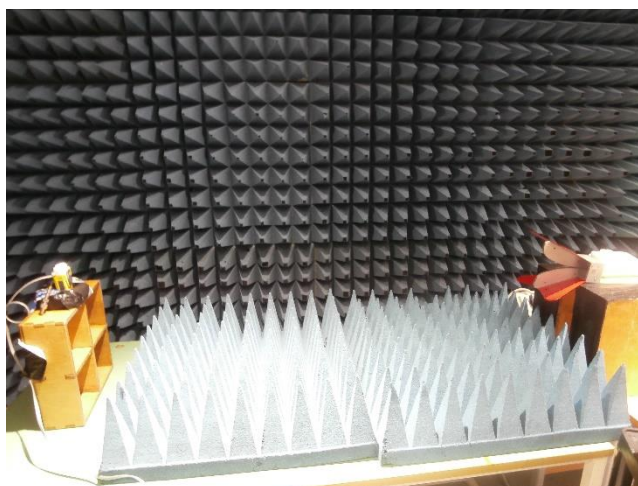
#### Performance Standard Clause 4.3.9

“(M.112/A3.12) The GPS receiver equipment shall generate and output to a display and digital interface a new position solution at least once every 1 s.

NOTE For craft meeting the HSC code, a new position solution at least every 0,5 s is recommended.

(M.112/A3.13) The minimum resolution of position i.e. latitude and longitude shall be 0,001 min.”

#### **2.13.7 Test Set Up**



Test Set Up

## 2.13.8 Test Results

EUT was locked and settled on a static simulated position; the simulated scenario then began a period of motion at the speed given in the table below. During the observation period of ten minutes, the time between position output messages and the time between position updates was checked.

Test Parameters	Units	Result	Limit
General			
Time to Acquire Valid Position	s	45.16	-
Test Specific			
Scenario Velocity	Knots	4.86	-
Minimum Position Change (Min[ dLat+dLon])*	Decimal Degrees	$7 \times 10^{-6}$	>0
Maximum Position Update Interval	s	1.015	≤10
Sample Latitude Field Value	DDMM.X	5051.01811	Resolution must be to 0.001
Sample Longitude Field Value	DDMM.X	00108.61701	Resolution must be to 0.001
Performance Check			
Start Time / Event of Performance Check	-	Start of steady velocity	-
Measurement duration	Min	10	10
Total number of position solutions	-	601	-
Number of Solutions with HDOP ≤4 and PDOP ≤6	-	601	≥100
Measurement of error ≤13m	%	100	≥95

\*Note: If the minimum position change was zero, it would indicate that the position output was not updated; hence any result above zero would indicate that the output was updated.





Product Service

## **2.14 POSITION UPDATE – HIGH SPEED UPDATE RATE**

### **2.14.1 Specification Reference**

IEC 61108-1, Clause 5.6.10.2

### **2.14.2 Equipment Under Test**

Orolia Limited, Z423 PLB, #09, Modification State 0

### **2.14.3 Date of Test**

04 June 2018

### **2.14.4 Test Equipment Used**

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

### **2.14.5 Environmental Conditions**

Ambient Temperature 24.5 °C

Relative Humidity 53.4 %

### **2.14.6 Test Methods**

The following testing is required by the specification:

#### Test Method Clause 5.6.10.2

“The EUT shall be placed upon a platform, moving in approximately a straight line, at a speed of 50 knots  $\pm$  5 knots. The position output of the EUT shall be checked at intervals of 1 s, over a period of 10 min. The output position shall be observed to be updated on each occasion. This test may be carried out by using a simulator with a speed of 70 knots at intervals of 0,5 s.

Record the IEC 61162 output of the EUT during this test and confirm that received positions at the end of each interval are in compliance with the real or simulated reference position.”

#### Performance Standard Clause 4.3.9

“(M.112/A3.12) The GPS receiver equipment shall generate and output to a display and digital interface a new position solution at least once every 1 s.

NOTE For craft meeting the HSC code, a new position solution at least every 0.5 s is recommended.

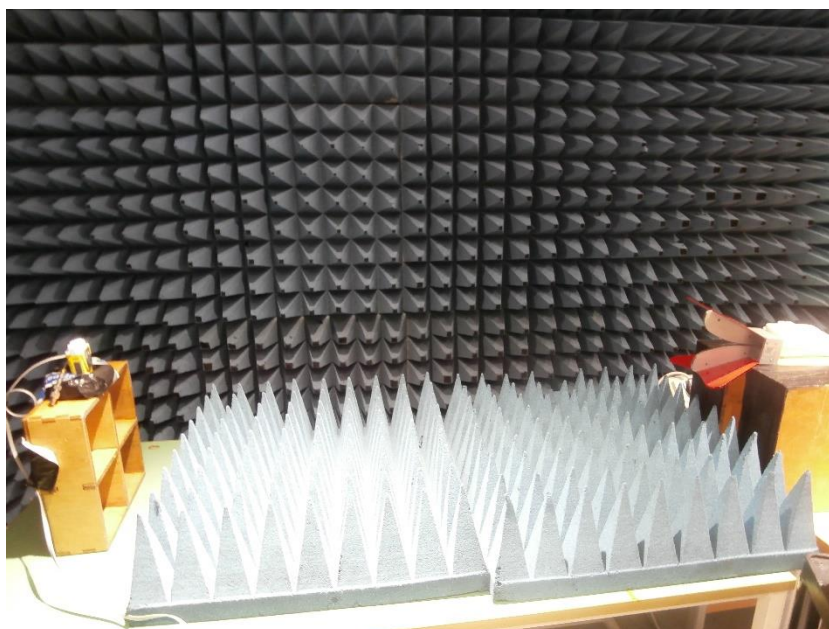
(M.112/A3.13) The minimum resolution of position i.e. latitude and longitude shall be 0,001 min.”

Performance standard clause 5.6.10.1

“The position output of the EUT shall be checked at intervals of 1 s, over a period of 10 min. The output position shall be observed to be updated on each occasion.”

Performance standard clause 5.6.10.2

“[...] received positions at the end of each interval are in compliance with the real or simulated reference position.”

**2.14.7 Test Set Up**

Test Set Up

## 2.14.8 Test Results

EUT was locked and settled on a scenario simulating motion at the speed indicated in the table below. During an observation period of 10 minutes, the time between position output messages and time between position updates was checked.

Test Parameters	Units	Result	Limit
General			
Time to Acquire Valid Position	s	45.225	
Test Specific			
Scenario Velocity	Knots	70	-
Minimum Position Change (Min[ dLat+dLon])	Decimal Degrees	0.000511	>0
Maximum Position Update Interval	s	1.029	≤10
Sample Latitude Field Value	DDMM.X	5052.99751	Resolution must be to 0.001
Sample Longitude Field Value	DDMM.X	00110.65932	Resolution must be to 0.001
Performance Check			
Start Time / Event of Performance Check	-	Start of steady velocity	-
Measurement duration	Min	10	10
Total number of position solutions	-	601	-
Number of Solutions with HDOP ≤4 and PDOP ≤6	-	601	≥100
Measurement of error ≤13m	%	100	≥95



Product Service

## **SECTION 3**

### **TEST EQUIPMENT USED**



### 3.1 TEST EQUIPMENT USED

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

Instrument	Manufacturer	TE No.	Calibration Date	Calibration due
Digital Hygrometer	Radio Spares	4300	30-Aug-2017	30-Aug-2018
Hygrometer	Rotronic	3068	21-Jun-2018	21-Jun-2019
GNSS Simulator	Spirent	4596	11-Aug-2017	11-Aug-2018
Spectrum Analyser	Agilent Technologies	3348	20-Sep-2017	20-Sep-2018
50 Ohm Load	Bird	0472	13-Sep-2017	13-Sep-2018
Antenna	ETS-Lindgren	4738	28-Feb-2018	08-Feb-2019
Antenna	EMCO	0035	08-Dec-2017	08-Feb-2018
Directional Coupler	Narda	0503	-	TU
Attenuator	Weinschel	0400	21-Jun-2017	31-Aug-2018
Cable	Reynolds	2402	19-Sep-2017	19-Sep-2018
Cable	Florida Labs	4509	14-Jun-2017	14-Jun-2018
Network Analyser	Rohde & Schwarz	3348	20-Sep-2017	20-Sep-2018
Load 50 ohm	Weinschel	0285	18-Sep-2017	18-Sep-2018
Stop Watch	RS Components	2674	13-Jul-2017	13-Jul-2018
Attenuator 10dB	Weinschel	0400	21-Jun-2017	21-Jun-2018

TU – Traceability Unscheduled



Product Service

## **SECTION 4**

### **PHOTOGRAPHS**

#### 4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



EUT and GPS Antenna



Product Service

## **SECTION 5**

### **ACCREDITATION, DISCLAIMERS AND COPYRIGHT**





Product Service

## 5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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

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

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

This report must not be reproduced, except in its entirety, without the written permission of  
TÜV SÜD Product Service

© 2018 TÜV SÜD Product Service

**ANNEX A**

**MANUFACTURER SUPPLIED INFORMATION**



Orolia Limited

Silver Point  
Airport Service Road  
Portsmouth  
PO3 5PB  
United Kingdom  
Int + 44 (0)23 9262 3900

## Z423 / Z424 variants description statement

OROLIA develops and sells Personal Locator Beacon (PLB) that uses the dedicated 406MHz frequency to transmit a unique ID and precise GNSS location to the global network of search and rescue satellites. It also integrates a 121.5MHz homing transmission to help local rescue researches.

These PLBs are named FastFind and Safelink. The Fastfind and Safelink PLB has 3 existing variants, where electronics is the same and some minor mechanical parts differs:

- Fastfind 220
- Fastfind Ranger
- Safelink SOLO



The table below summarizes the differences between variants. It can be highlighted that, between variants:

- Firmware is the same.
- Electronics and battery pack are the same.
- Point of attachment of the antenna is the same so the 406MHz, 121.5Mhz performances are equivalent on all the products types.
- The internal volume of the mechanical shapes is the same so thermal aspects are equivalent on all the products types.
- Materials are the same.





Orolia Limited

Silver Point  
Airport Service Road  
Portsmouth  
PO3 5PB  
United Kingdom  
Int + 44 (0)23 9262 3900

## VARIANTS ELECTRICAL AND MECHANICAL PARTS

Z423 (FF220) 91-100-xxxB	Z424 (SOLO – RANGER) 91-103-xxxB
PCB and components	Identical
Battery	Identical
Programming software	Identical
Beacon firmware	Identical
Antenna	Identical
Antenna connection to PCB	Identical
Plastic material - Cycoloy	Identical
Weight = 150g	Weight = 165g
Dimensions LxWxD in mm = 107x48x34	Dimensions LxWxD in mm = 112x50x36
cover moulding	Minor change to external shape, dimensions see figure 1 below
Silicon keypad	Minor change to external shape see figure 1 above
Base plastic moulding	Minor change to external shape, dimensions see figure 1 above
Silicon side grips	None on FF220 see figure 1 below
Lever moulding	identical
Top moulding	identical
Sealing gasket	identical
Dome switch assembly	identical

## VARIANTS MATERIALS

⇒ Mechanical parts material

The materials used on the different variants is listed below.

Part	Material	Comment
Base plastic moulding	Cycoloy 1200	Identical on all beacon variants
Cover moulding	Cycoloy 1200	Identical on all beacon variants
Top moulding	Polycarbonate – calibre 303-15	Identical on all beacon variants
Lever moulding	Polypropylene PPH9081	Identical on all beacon variants
Sealing gasket	White silicone sponge	Identical on all beacon variants
Silicon keypad	Silicon rubber 55 shore	Identical on all beacon variants
Silicon side grips	Silicon rubber 55 shore	Identical on all beacon variants
Antenna	SUS-301 S/S	Identical on all beacon variants
Antenna Bolt	Stainless steel SUS-316	Identical on all beacon variants
Antenna o-ring	BS005 N70 Silicon o-ring	Identical on all beacon variants
Label set	Clear polypropylene	Identical on all beacon variants
M2.5 Nyloc nut	Stainless steel	Identical on all beacon variants
M3x12mm pan head pozi stainless steel screw	Stainless steel	Identical on all beacon variants
M2.5x5mm screw	Stainless steel	Identical on all beacon variants





Orolia Limited

Silver Point  
Airport Service Road  
Portsmouth  
PO3 5PB  
United Kingdom  
Int + 44 (0)23 9262 3900

All variants use the same materials.

⇒ **Label parts material**

The materials used on the different variants is listed below.

Part	Material	Comment
Label set	Clear polypropylene	Identical on all beacon variants
Labels	MADICO 03-770	Identical on all beacon variants
Adhesive	P110 Acrylic	Identical on all beacon variants
Liner	LR09 90 gsm white polycoated glissine	Identical on all beacon variants

All variants use the same labels materials, only few rear text statements differs.

With this statement, it can be concluded that performance results on Z424 SOLO and RANGER beacons regarding ETSI EN 302 152 and ETSI EN 303 413 will be covered by the Z423 FASTFIND 220 beacon test results.

Erwan THOMAS  
Certification and Hardware Engineer  
[erwan.thomas@orolia.com](mailto:erwan.thomas@orolia.com)

