

Report on the Testing of the

Orolia Limited

Z423 FastFind 220 Personal Locating Beacon

In accordance with RTCM 11010.2

Prepared for: Orolia Limited
Silver Point
Airport Service Road
Hilsea
Portsmouth
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United Kingdom



Product Service

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Document Number: 75942209-07 | Issue: 02

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Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with the limited clauses tested to RTCM 11010.2



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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	19 December 2018
2	Update to section 2.8	21 December 2018

Table 1

1.2 Introduction

Applicant	Orolia Limited
Manufacturer	Orolia Limited
Model Number(s)	Z423 FastFind 220
Manufacturer Declared Variant*	Z424 FastFind Ranger and Safelink Solo Personal Locating Beacon
Serial Number(s)	#07 #08 #10 #12
Hardware Version(s)	1001488 Issue A
Software Version(s)	1001767 Issue A
Number of Samples Tested	3
Test Specification/Issue/Date	RTCM 11010.2, including amendments 1 – 5
Order Number	20805
Date	20-March-2018
Date of Receipt of EUT	22-March-2018
Start of Test	21-June-2018
Finish of Test	18-December-2018
Name of Engineer(s)	Mehadi Choudhury Bidhan Bhandari Martin Hardy Colin Hedley Michael Mawby

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



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with RTCM 11010.2 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
2.1	A.3	Dry Heat	Satisfactory	
2.2	A.4	Damp Heat	Satisfactory	
2.3	A.5	Low Temperature	Satisfactory	
-	A.6	Vibration	-	Not tested
-	A.7	Bump	-	Not tested
-	A.9	Drop	-	Not tested
2.4	A.10	Thermal Shock	Satisfactory	
-	A.11	Immersion	-	Not tested
-	A.12	Spurious Emissions	-	Not tested
2.5	A.13	Operational Life and Self Test	Pass	
-	A.14	Cospas-Sarsat Type Approval	-	See TUV SUD document 75942209 Report 01
-	A.15	Buoyancy Test	-	Not tested
2.6	A.16	121.5 MHz Auxiliary Radio-Locating Device Transmitter Test	Pass	
-	A.17	Solar Radiation	-	Not tested
-	A.18	Oil Resistance	-	Not tested
-	A.8	Corrosion	-	Not tested
2.7	A.19	Compass Safe Distance	-	See section 2.7
2.8	A.20	Miscellaneous	-	See section 2.8
2.9	A.20.8	Altitude	Satisfactory	
2.9	Annex G	GPS Scenarios	Pass	

Table 2



1.4 Application Form

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-Z423
INDUSTRY CANADA ID (if applicable)	6319A-Z423PL
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: 04/12/2018



1.5 Product Information

1.5.1 Technical Description

The Orolia Type Z423 is a Personal Locator Beacon (PLB) device with built-in 406 Cospas-Sarsat transmitter and 121.5 MHz Homer. It is used to assist in the locating and recovery of people that are in imminent danger.

1.6 Deviations from the Standard

The dry heat test was carried out in accordance with ETSI EN 302 152-1, Clause 6.2.2.

The low temperature test was carried out in accordance with ETSI EN 302 152-1, Clause 6.2.3.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Test samples #07, #08, #10			
0	As supplied by the customer	Not Applicable	Not Applicable
1	Firmware update regarding : User Location test protocol 121 homing transmitter Firmware update regarding PIE	Orolia	26 July 2018
Test sample #12			
0	As supplied by the customer – 121.5 MHz on frequency	Not Applicable	Not Applicable

Table 3



1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Battery Powered - 121.5 MHz Homer		
Dry Heat	Colin Hedley Martin Hardy	UKAS
Damp Heat	Colin Hedley Martin Hardy	UKAS
Low Temperature	Colin Hedley Martin Hardy	UKAS
Thermal Shock	Colin Hedley Martin Hardy	UKAS
Operational Life and Self Test	Martin Hardy	UKAS
Carrier Frequency	Mehadi Choudhury	UKAS
Modulation Characteristics	Mehadi Choudhury Martin Hardy	UKAS
Spurious Emissions	Mehadi Choudhury	UKAS
Compass Safe Distance	Michael Mawby	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

TÜV SÜD Product Service conducted the following tests at EMC Hursley by a TÜV SÜD Product Service Engineer.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Battery Powered - 121.5 MHz Homer		
Peak Equivalent Isotropic Radiated Power	Bidhan Bhandari Nic Forsyth	Not UKAS Accredited

Table 5

Office Address:

Trafalgar House
Trafalgar Cl
Chandler's Ford
Eastleigh
SO53 4BW
United Kingdom

2 Test Details

2.1 Dry Heat

2.1.1 Specification Reference

Note: Tested in accordance with ETSI EN 302 152-1, Clause 6.2.2

2.1.2 Equipment Under Test and Modification State

Z423 FastFind 220, S/N: #07 - Modification State 0

Z423 FastFind 220, S/N: #08 - Modification State 0

2.1.3 Date of Test

28 May 2018 – 29 May 2018

2.1.4 Test Method

The EUT's (powered off) were placed in a climatic chamber where the temperature was increased from laboratory ambient temperature to +70°C. After 16 hours (see temperature plot below), the temperature was reduced to +55°C where it remained for 2 hours. The EUTs were powered on and subjected to a performance check during the functional period at +55°C. After the performance check, the chamber conditions were returned to laboratory ambient.

Test Setup

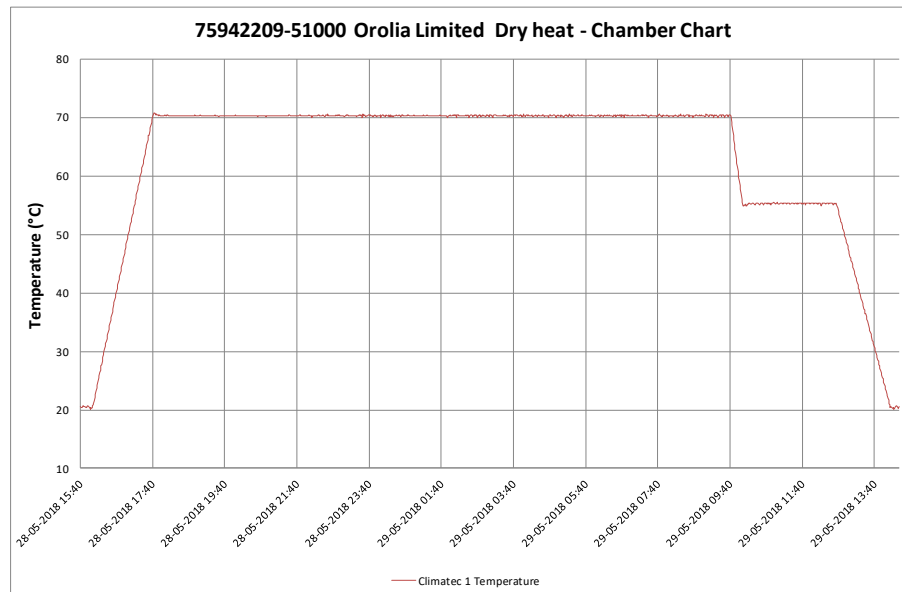


2.1.5 Environmental Conditions

Ambient Temperature 22.0 - 26.6 °C
Relative Humidity 54.9 – 59.8 %

2.1.6 Test Results

Temperature Plot



Performance Check

Z423 FastFind 220 S/N: #07 (TUV Ref TSR003)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFE08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E02BC44E379C8051C4*
406 MHz Frequency	406.030969
121 MHz Presence	P

Table 6 – Performance Check Test Data (#07 dry heat)

* During the Performance Check the EUT detected navigation data and encoded the position N 50° 52' 8", W 1° 14' 40" into the transmitted message. This is acceptable and within the 500m accuracy stated in Cospas Sarsat T.007.



Z423 FastFind 220 S/N: #08 (TUV Ref TSR004)

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E02BC44E379C8044FD*
406 MHz Frequency	406.031046
121 MHz Presence	P

Table 7 – Performance Check Test Data (#08 dry heat)

* During the Performance Check the EUT detected navigation data and encoded the position N 50° 52' 8", W 1° 14' 44" into the transmitted message. This is acceptable and within the 500m accuracy stated in Cospas Sarsat T.007.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Climatec	Climatec 1	2124	12	22-Dec-2018
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	07-Nov-2018
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	28-Jun-2018
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	18-Dec-2018
Beacon Tester	WS Technologies	BT100S	4790	-	TU

Table 8

TU – Traceability Unscheduled

2.2 Damp Heat

2.2.1 Specification Reference

RTCM 11010.2, Clause A.4

2.2.2 Equipment Under Test and Modification State

Z423 FastFind 220, S/N: #07 - Modification State 0

Z423 FastFind 220, S/N: #08 - Modification State 0

2.2.3 Date of Test

30 May 2018 – 31 May 2018

2.2.4 Test Method

The EUT's (powered off) were placed in a climatic chamber where the conditions were increased from laboratory ambient temperature to +40°C and 93% relative humidity. After 10.5 hours (see temperature plot below), the EUTs were powered on and kept operation for a further 2 hour period, during this time they were subjected to a performance check. After the performance check, the chamber conditions were returned to laboratory ambient.

Test Setup

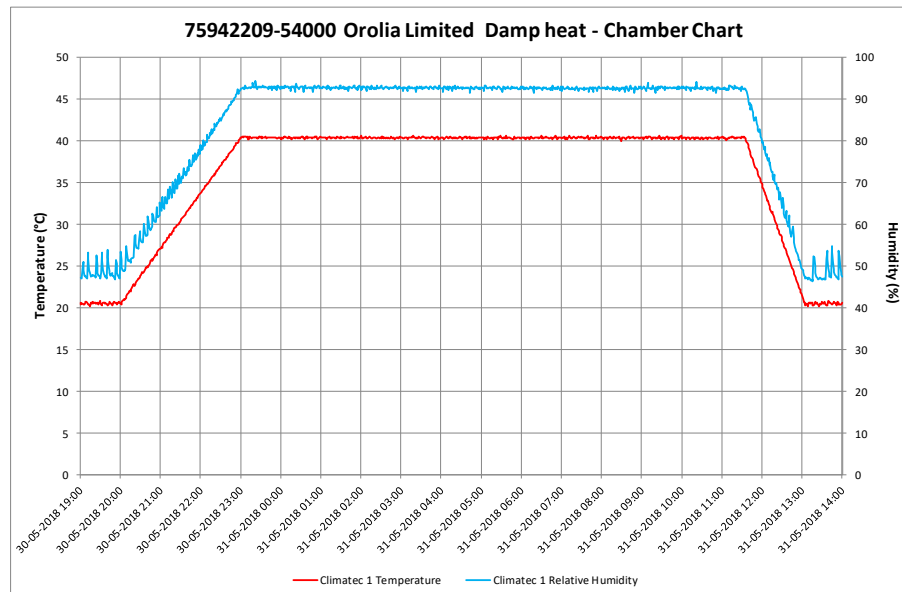


2.2.5 Environmental Conditions

Ambient Temperature 20.5 – 22.2 °C
Relative Humidity 60.8 – 62.3 %

2.2.6 Test Results

Temperature Plot



Performance Check

Z423 FastFind 220 S/N: #07 (TUV Ref TSR003)

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FF FE2F8C9EF9C06332E02BC44E379C8044FD
406 MHz Frequency	406.030985
121 MHz Presence	P

Table 9 – Performance Check Test Data (#07 damp heat)

* During the Performance Check the EUT detected navigation data and encoded the position N 50° 52' 8", W 1° 14' 44" into the transmitted message. This is acceptable and within the 500m accuracy stated in Cospas Sarsat T.007.



Z423 FastFind 220 S/N: #08 (TUV Ref TSR004)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFE08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E02BC44E379C8044FD
406 MHz Frequency	406.031050
121 MHz Presence	P

Table 10 – Performance Check Test Data (#08 damp heat)

* During the Performance Check the EUT detected navigation data and encoded the position N 50° 52' 8", W 1° 14' 44" into the transmitted message. This is acceptable and within the 500m accuracy stated in Cospas Sarsat T.007.

2.2.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Climatec	Climatec 1	2124	12	22-Dec-2018
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	07-Nov-2018
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	28-Jun-2018
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	18-Dec-2018
Beacon Tester	WS Technologies	BT100S	4790	-	TU

Table 11

TU – Traceability Unscheduled

2.3 Low Temperature

2.3.1 Specification Reference

Note: Tested in accordance with ETSI EN 302 152-1, Clause 6.2.3

2.3.2 Equipment Under Test and Modification State

Z423 FastFind 220, S/N: #07 – Modification State 0

Z423 FastFind 220, S/N: #08 – Modification State 0

2.3.3 Date of Test

31 May 2018 – 01 June 2018

2.3.4 Test Method

The EUT's (powered off) were placed in a climatic chamber where the temperature was decreased from laboratory ambient temperature to -30°C. After 16 hours (see temperature plot below), the temperature was increased to -20°C where it remained for 2 hours. The EUTs were subjected to a performance check during the functional period at -20°C. After the performance check, the chamber conditions were returned to laboratory ambient.

Test Setup



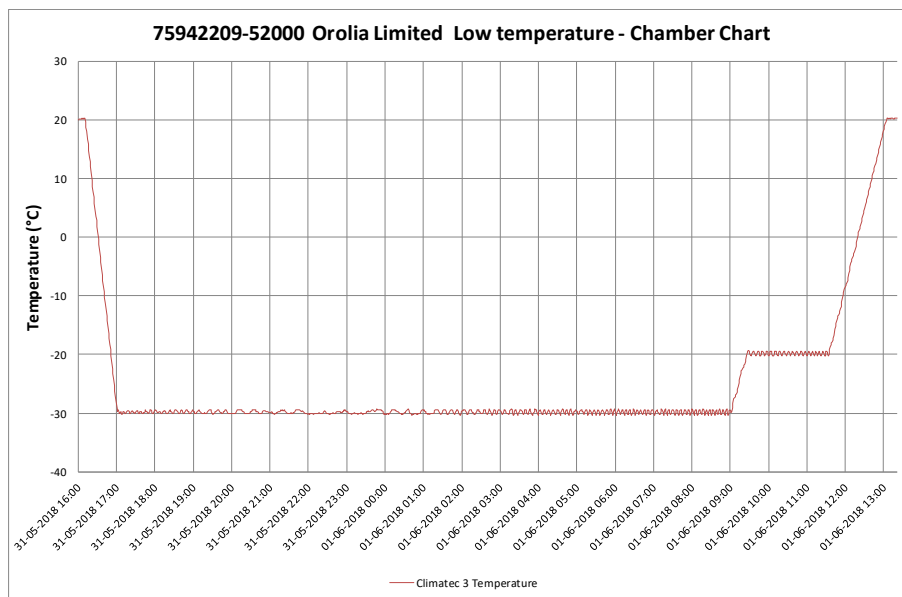


2.3.5 Environmental Conditions

Ambient Temperature 22.7 – 24.7 °C
Relative Humidity 56.2 – 58.9 %

2.3.6 Test Results

Temperature Plot



Performance Check

Z423 FastFind 220 S/N: #07 (TUV Ref TSR003)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFE08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031103
121 MHz Presence	P

Table 12 – Performance Check Test Data (#07 low temperature)



Z423 FastFind 220 S/N: #08 (TUV Ref TSR004)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFE08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031123
121 MHz Presence	P

Table 13 – Performance Check Test Data (#08 low temperature)

2.3.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Climatec	CLIMATEC 3	2846	12	17-Jul-2018
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	07-Nov-2018
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	28-Jun-2018
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	18-Dec-2018
Beacon Tester	WS Technologies	BT100S	4790	-	TU

Table 14

TU – Traceability Unscheduled

2.4 Thermal Shock

2.4.1 Specification Reference

RTCM 11010.2, Clause A.10

2.4.2 Equipment Under Test and Modification State

Z423 FastFind 220, S/N: #08 - Modification State 0

2.4.3 Date of Test

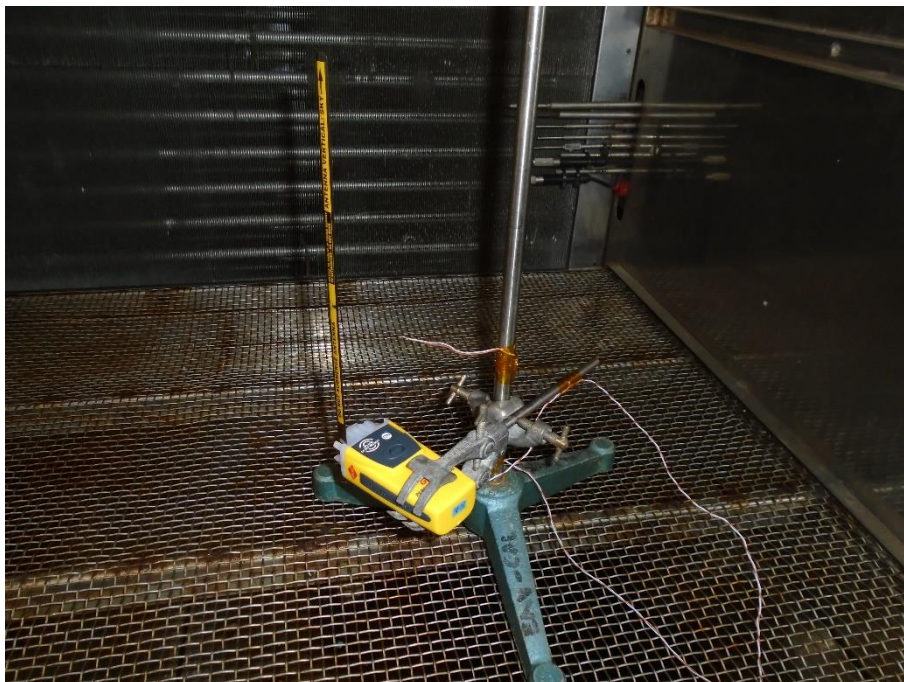
04 June 2018 – 06 June 2018

2.4.4 Test Method

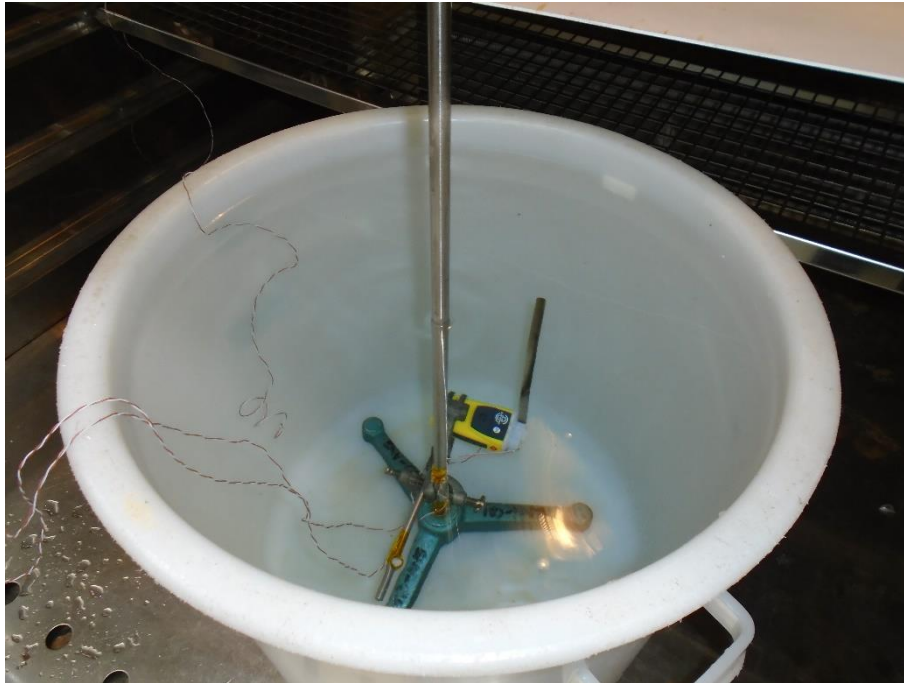
The EUT was placed in the pre-conditioning climatic chamber at a temperature of +70°C for 1 hour.

The EUT was then immersed in a water vessel (preconditioned for greater than 24 hours) at 20°C, at a level of 100mm below the surface of the water (measured to the highest point of the EUT). The EUT remained immersed for 48 hours. After this period of immersion, the EUT was inspected for signs of water ingress and subjected to a performance check.

Test Setup – EUT preconditioning



Test Setup – EUT immersed

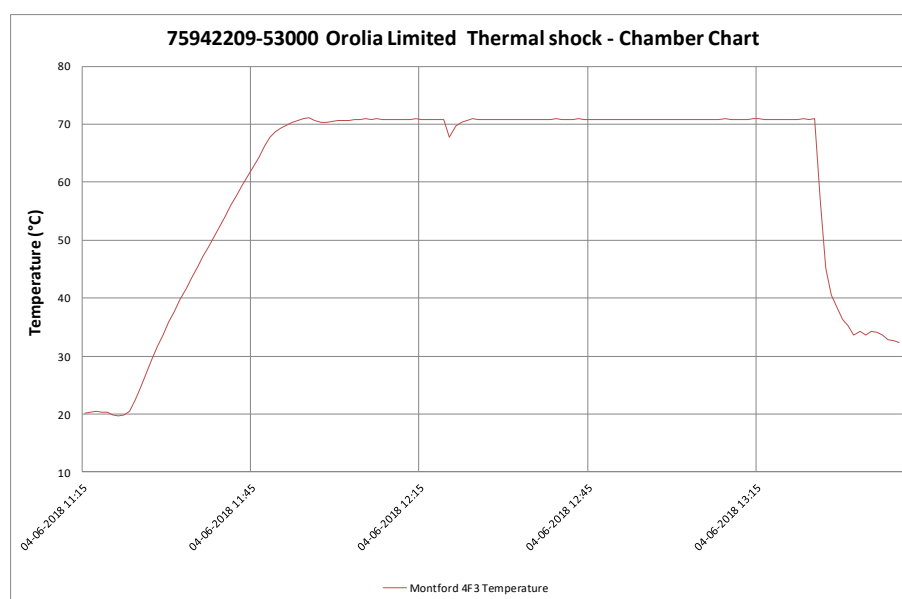


2.4.5 Environmental Conditions

Ambient Temperature 23.0 – 23.2°C
Relative Humidity 40.3 - 57.4 %

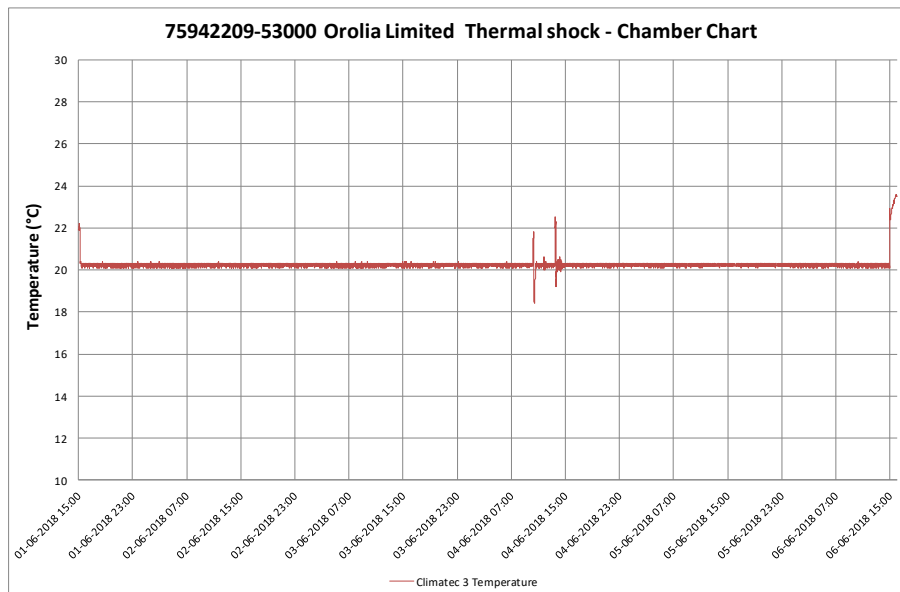
2.4.6 Test Results

Temperature Plot (Pre-conditioning)





Temperature Plot (Water)



The EUT was weighed before and after the water test:

Pre immersion weight: 138.90 g

Post immersion weight: 139.25 g

The difference between the pre and post test weight can be attributed to water trapped within the recesses and external areas inaccessible to surface drying using a lint free cloth.

Performance Check

Z423 FastFind 220 S/N: #08 (TUV Ref TSR004)

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031039
121 MHz Presence	P

Table 15 – Performance Check Test Data (#07 thermal shock)



2.4.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Montford F43	Montford	4FT CUBED	2126	12	12-Jan-2019
5m Tape Measure	Stanley	Fatmax 5m	4024	-	TU
Thermocouple Datalogger	Pico Technology Ltd	TC-08	4429	12	26-Oct-2018
Bench Scales	Kern-Sohn	CKE16K0.05	4647	12	28-Mar-2019
Type T PFA Insulated Thermocouple	TC Limited	Type-T	4739	12	20-Jul-2018
Climatic Chamber	Climatec	CLIMATEC 3	2846	12	17-Jul-2018
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	07-Nov-2018
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	28-Jun-2018
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	18-Dec-2018
Beacon Tester	WS Technologies	BT100S	4790	-	TU

Table 16

TU – Traceability Unscheduled



2.5 Operational Life and Self Test

2.5.1 Specification Reference

RTCM 11010.2, Clause A.13

2.5.2 Equipment Under Test and Modification State

Z423 FastFind 220, S/N: #10 - Modification State 1

2.5.3 Date of Test

04 September 2018 – 05 September 2018

2.5.4 Test Method

The test was carried out in accordance with the above clause.

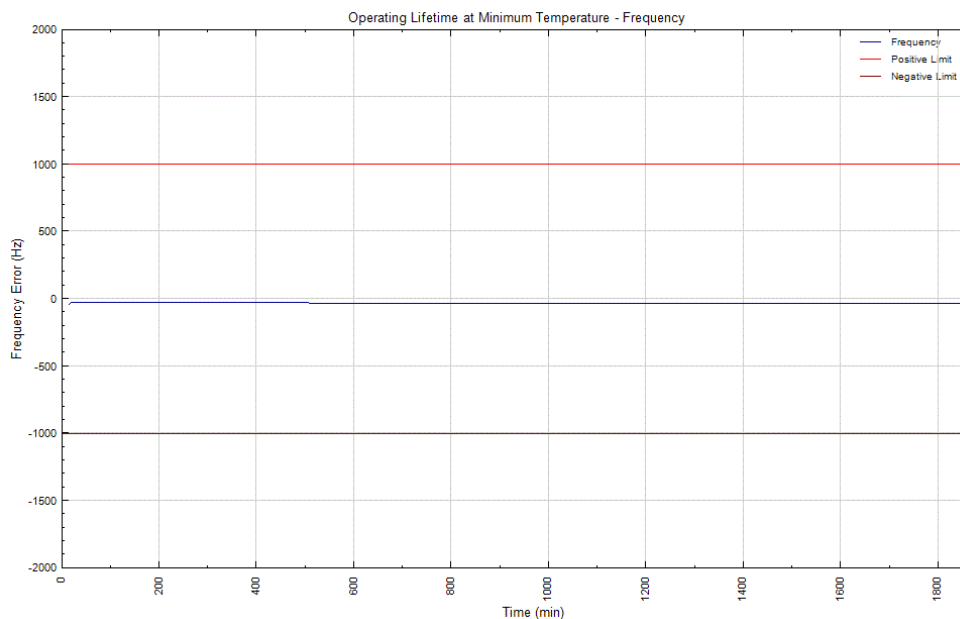
2.5.5 Environmental Conditions

Ambient Temperature 22.9°C

Relative Humidity 45.8%

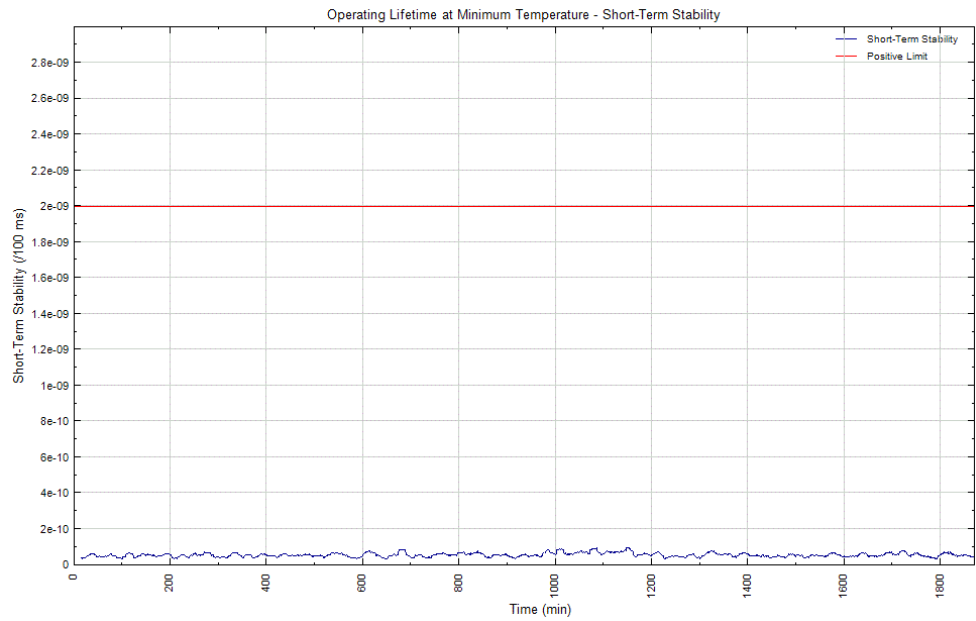
2.5.6 Test Results

Nominal Frequency

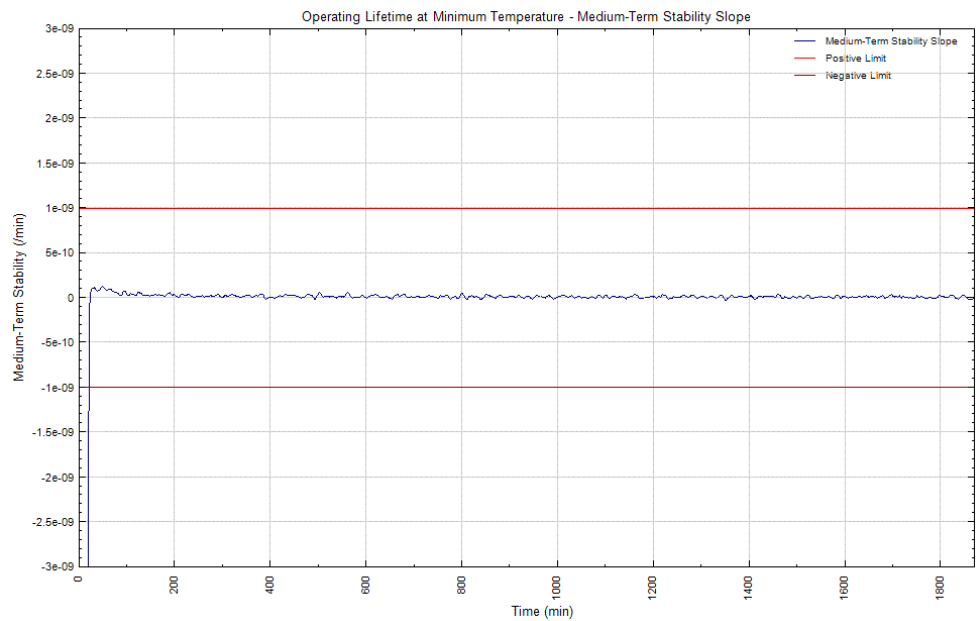




Short Term Stability

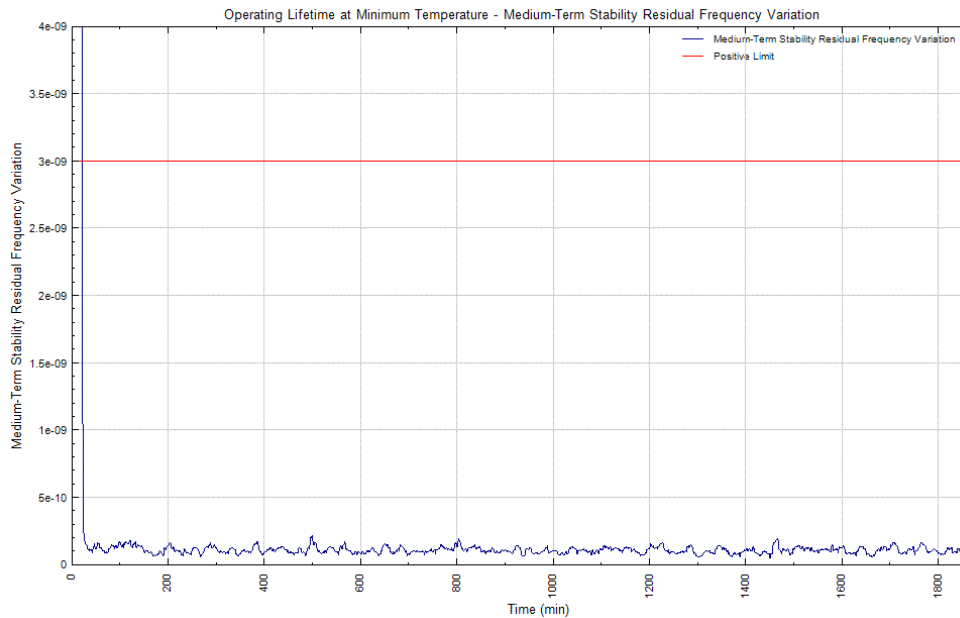


Medium term Stability – Slope





Medium Term Stability – Residual



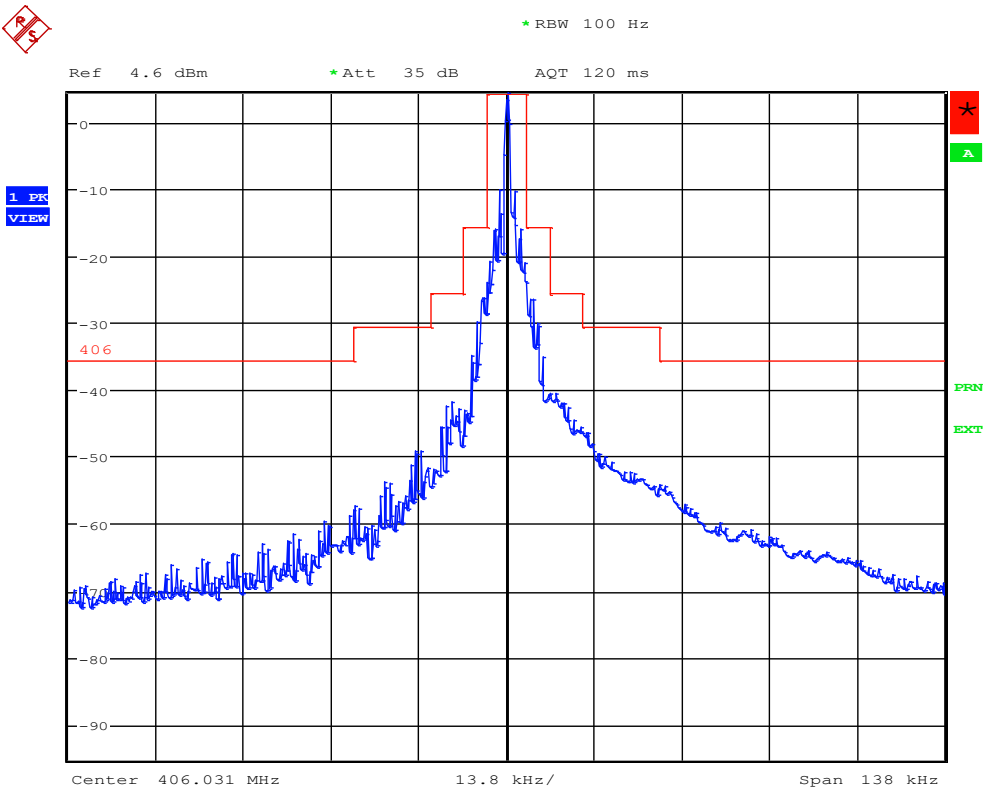
Digital Message

Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C		
Hex ID	193DF380C6FFBFF		
Position	None - Default Values		
Parameter	Bit	Data Bits	Decoded Value
Bit synchronization	1-15	111111111111111	111111111111111
Frame synchronization	16-24	000101111	000101111
Format Flag	25	1	1
Protocol Flag	26	0	0
Country Code	27-36	0011001001	Albania (Republic of)
Protocol Code	37-40	1110	Standard Test Location Protocol
Undefined	41-64	111110011100000001100011	111110011100000001100011
N/S	65	0	Default
Latitude Degrees	66-72	1111111	Default
Latitude Minutes	73-74	11	Default
E/W	75	0	Default
Longitude Degrees	76-83	11111111	Default
Longitude Minutes	84-85	11	Default
BCH Code (21 Bit)	86-106	000001111010001010110	000001111010001010110
Calculated BCH Code (21 Bit)	-	000001111010001010110	000001111010001010110
Supplementary Data Fixed	107-110	1101	1101
Encoded Position Data Source	111	1	Internal
121.5 MHz Homing	112	1	Yes
Delta Latitude +/-	113	1	Default
Delta Latitude Minutes	114-118	00000	Default
Delta Latitude Seconds	119-122	1111	Default
Delta Longitude +/-	123	1	Default
Delta Longitude Minutes	124-128	00000	Default
Delta Longitude Seconds	129-132	1111	Default
BCH Code (12 Bit)	133-144	011001101100	011001101100
Calculated BCH Code (12 Bit)	-	011001101100	011001101100



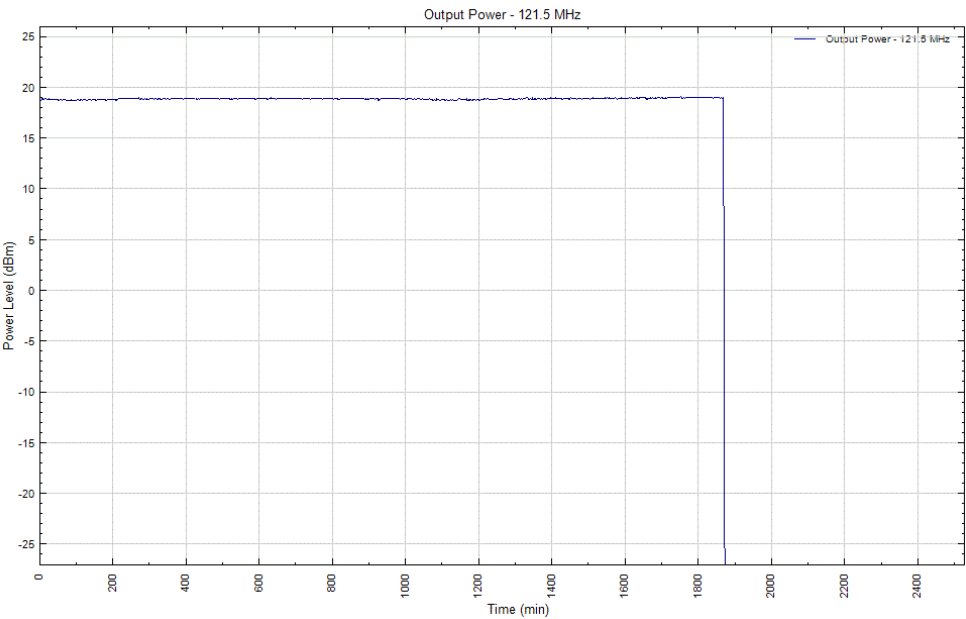
Product Service

406MHz Spurious



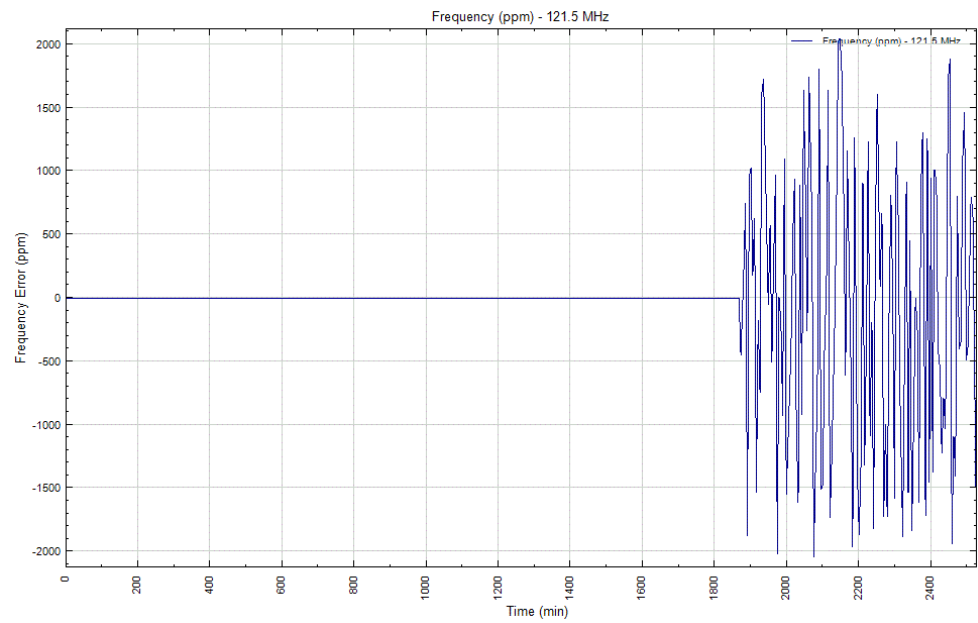
Date: 7.JAN.2000 17:26:30

121MHz Homing Transmitter – Output Power





121MHz Homing Transmitter – Nominal Frequency





Battery Current Measurements

System Configuration →	A, No Ancillaries
Operational Mode ↓	
1, Standby	A1
2, ON at EUT switch (GPS search)	A2
3, ON at EUT (GPS Sleep)	A3
4, On at EUT switch (A2 +A3)	A4
5, Self-test	A5
6, GNSS Self-test (Timeout)	A6
7, GNSS Self-test (Burst)	A7
8, Strobe Morse Code	A8

Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement interval, sec	Average Current, mA	Peak Current, mA
A, No Ancillaries - 1, Standby	A	599.9	0.00001455	0.00001785
A, No Ancillaries - 2, ON at EUT switch (GPS search)	M	1798	57.19	1336
A, No Ancillaries - 3, ON at EUT (GPS Sleep)	M	297.4	47.69	1324
A, No Ancillaries - 4, On at EUT switch (A2 +A3)	M	2096	55.84	1336
A, No Ancillaries - 5, Self-test	M	20.31	50.97	1309
A, No Ancillaries - 6, GNSS Self-test (Timeout)*	M	311.1	18.17	21.63
A, No Ancillaries - 7, GNSS Self-test (Burst)*	M	51.43	27.84	1307
A, No Ancillaries - 8, Strobe Morse Code	M	12.71	43.93	51.67

* Note: 'Timeout' refers to a GNSS ST where no navigation data is detected. The test terminates when a Timeout counter is reached without transmitting a 406MHz message. 'Burst' refers to a GNSS ST where navigation data is present. The test terminates at some point before the timeout timer is reached after navigation data is detected causing a 406MHz transmission to occur. For the pre-discharge calculation, the worst case is an addition of these two measurements.



Operating Lifetime Battery Pre-discharge Calculation

Characteristic	Designation	Units	Value	Comments
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	T_{CS} or TCS	Years	2	max shelf life
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	T_{BR} or TBR	Years	12	useful life
Battery pack electrical configuration	-	-		
Cell model and cell chemistry	-	-	Lithium Manganese Dioxide	
Nominal cell capacity	-	Ah	1.5	
Nominal battery pack capacity	C_{BN}	Ah	1.5	
Annual battery cell capacity loss (self-discharge) due to aging, as specified by cell manufacturer at ambient temperature	L_{SDC}	%	1	
Calculated battery pack capacity loss due to self-discharge: $L_{CBN} = C_{BN} - [C_{BN} * (1 - L_{SDC} / 100)^{TBR + TCS}]$	L_{CBN}	Ah	0.1969	
Number of self-tests per year	N_{ST}	-	10	Declared Value
Average battery current during a self-test	I_{ST}	mA	50.97	
Maximum duration of a self-test	T_{ST}	s	20.3	Measured Value
Calculated battery pack capacity loss due to self-tests during battery replacement period: $L_{ST} = I_{ST} * T_{ST} * T_{BR} * (N_{ST} / 3600)$	L_{ST}	mAh	34.49	
Maximum Number of GNSS self-tests between battery replacements	N_{GST}	-	10	Declared Value
Average battery current during a GNSS self-test of maximum duration	I_{GST}	mA	19.53	Calculated value (Burst + Timeout)
Maximum duration of a GNSS self-test	T_{GST}	s	362.4	Calculated value (Burst + Timeout)
Calculated battery pack capacity loss due to GNSS self-tests during battery replacement period: $L_{GST} = I_{GST} * T_{GST} * (N_{GST} / 3600)$	L_{GST}	mAh	19.6602	
Average stand-by battery pack current	I_{SB}	mA	0.00001455	Measured Value
Other Capacity Losses	L_{OTH}	mAh	1.29	See Comment below
Battery pack capacity loss due to constant operation of circuitry prior to beacon activation: $L_{ISB} = I_{SB} * T_{BR} * 8760$	L_{ISB}	mAh	1.5295	
Calculated value of the battery pack pre-test discharge $L_{CDC} = L_{CBN} + ((L_{ST} + L_{GST} + L_{ISB}) / 1000) + (L_{OTH} / 1000)$	L_{CDC}	Ah	0.2539	



Comment: Once activated, the user may press the 'On' button to activate a 'Morse Code SOS' strobe light indicator. After activation, each time the 'On' button is pressed the strobe will flash a 'SOS' sequence four times in succession, before returning to the normal activation flash rate. This function can be used a maximum of 30 times to save battery capacity. Measurements indicate that each activation of the 'SOS' strobe function consumes an additional 0.043mAh. Therefore, 30 activations would consume 1.29mAh.

Summary

Worst Case (lowest) Operating Current	47.69	mA
Actual Discharge	0	Ah
Further discharge required	0.2539	Ah
Reduce lifetime by:	5.32	Hours (0.2539 / 0.0469)
Result from Life test	29.75	hours
Effective Life	24.43	Hours (29.75 – 5.32)



2.5.7 Test Location and Test Equipment Used

This test was carried out in Radio Lab 3.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Meter & T/C	R.S Components	Meter 615-8206 & Type K T/C	3612	12	12-Sep-2018
Power Meter	Hewlett Packard	436A	83	12	26-Sep-2018
Beacon RF Unit	TUV SUD Product Service	N/A	97	-	TU
Attenuator 10dB 10W	Weinschel	47-10-34	398	12	18-Jul-2019
Attenuator (10dB, 75W)	Bird	8308-100	469	12	19-Dec-2018
3dB/10W Attenuator	Texscan	HFP-50N	475	12	13-Apr-2019
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	23-Apr-2019
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	19-Feb-2019
Hygrometer	Rotronic	I-1000	2829	12	29-Nov-2018
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	20-Dec-2018
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	08-Jan-2019
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	16-Nov-2018
ScopeCorder	Yokogawa	DL750 701210	3254	12	10-Nov-2018
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	20-Sep-2018
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3411	12	13-Sep-2018
Rubidium Frequency Standard	Symmetricon	8040C	3490	12	11-May-2019
2 metre N-Type Cable	Florida Labs	NMS-235SP-78.8-NMS	4508	12	10-Jul-2019
Bandpass Filter (1MHz)	KR Electronics	3219-SMA	4600	12	03-Sep-2019
Cable (18GHz)	Rosenberger	LU7-036-1000	5026	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5028	-	O/P Mon

Table 17

TU – Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment



2.6 121.5 MHz Auxiliary Radio-Locating Device Transmitter Test

2.6.1 Specification Reference

RTCM 11010.2, Clause A.16

2.6.2 Equipment Under Test and Modification State

Z423 FastFind 220, S/N: #07 - Modification State 0

Z423 FastFind 220, S/N: #07 - Modification State 1 (Modulation Duty Cycle)

Z423 FastFind 220, S/N: #08 - Modification State 1 (Radiated sample)

2.6.3 Date of Test

22 June 2018 – 18 December 2018

2.6.4 Test Method

This test was performed in accordance with the requirements of RTCM 11010.2 clause A.16.

2.6.5 Environmental Conditions

Ambient Temperature 22.8 – 30.0°C

Relative Humidity 41.2 - 71.8 %

2.6.6 Test Results

Battery Powered - 121.5 MHz Homer

Carrier Frequency (A.16.1)

Temperature	Measured Frequency (MHz)	Frequency Error (ppm)
+23.5 °C	121.650000458	0.004
-20.0 °C	121.650009278	0.076
+55.0 °C	121.649988000	-0.099

Table 18 - Homer Device, Frequency Error Results

Limit Clause A.16.1

The carrier frequency shall be 121.5 MHz $\pm$ 50 ppm.

The EUT was intentionally offset to 121.65 MHz.



Modulation Characteristics – Transmitter Duty Cycle (A.16.2 a)

It was confirmed that the carrier is not interrupted (except for two seconds encompassing the transmission of the 406 MHz pulse plus the additional time required for the Morse "P" transmission).

Limit Clause A.16.2 (Table 2)

Continuous (100%) except that it shall be interrupted for up to a maximum of 2 seconds.

encompassing the 406 MHz burst transmission is not interrupted (except for up to two seconds encompassing the transmission of the 406 MHz pulse plus the additional time required for the Morse "P" transmission).

Modulation Characteristics – Modulation Frequency and Sweep Repetition Rate (A.16.2.b)

Requirement	Result			Unit
	+21.4 °C	-20.0 °C	+55.0 °C	
Lower Audio Frequency	764.119	761.272	763.785	Hz
Upper Audio Frequency	1500.63	1500.130	1500.327	Hz
Range of Audio Frequency	736.517	738.858	736.542	Hz
Sweep Repetition Rate	2.67	2.67	2.67	Hz

Table 19 - Modulation Characteristics

Limit Clause A.16.2.b (Table 2)

An audio signal swept upward or downward by not less than 700 Hz within the range 300 to 1600 Hz except that during the dot and dash intervals of the Morse "P" the signal shall be modulated at 1000 ± 50 Hz

Modulation Characteristics – Modulation Duty Cycle (A.16.2.c)

Temperature	Duty Cycle (%)
+21.4 °C	34.7 – 35.1%
-20.0 °C	33.7 – 34.8%
+55.0 °C	35.6 – 35.8%

Table 20 – Modulation Duty Cycle

Limit Clause A.16.2.c (Table 2)

The modulation duty cycle shall be between 33% and 55%.



Modulation Characteristics – Modulation Factor (A.16.2.d)

Requirement	Result			Unit
	+21.4 °C	-20.0 °C	+55.0 °C	
Modulation Factor	92.683	90.393	95.039	%

Table 21 - Homer Device, Modulation Factor

Limit Clause A.16.2.d (Table 2)

The modulation factor shall be between 0.85 and 1.0.

Modulation Characteristics – Frequency Coherence (A.16.2.e)

Parameter	Result			Unit
	+21.4 °C	-20.0 °C	+55.0 °C	
Total (Wideband) Power	16.10	15.16	17.09	dBm
Power within the resolution bandwidth	11.74	10.53	12.90	dBm
Difference	4.36	4.63	4.19	dB

Table 22 - Spectrum Characteristics

Remarks

The frequency error was recorded in table 19 and did not exceed an error of 30 Hz.

Limit Clause A.16.2.e (Table 2)

Measurements must be made to show that at least 30% of the total power emitted during any transmission cycle with or without modulation shall be contained within ± 30 Hz of the carrier frequency. Additionally, if the emission is interrupted by the transmission of the 406 MHz burst, the carrier frequency must not shift more than ± 30 Hz.

Modulation Characteristics – Morse Letter P (A.16.2.f)

Requirement	Result			Unit
	+21.4 °C	-20.0 °C	+55.0 °C	
Morse Code P - Dot Length	114.43	114.79	114.53	ms
Morse Code P - Dash Length	345.88	346.15	346.81	ms
Morse Code P - Gap Length	115.91	115.92	115.53	ms
Morse Code P - Modulating Frequency	1.0004938	1.0000150	1.0004556	kHz

Table 23 – Morse Letter P

Limit Clause A.16.2.f

Observe the transmitted signal and confirm that it conforms with Figure 1 of RTCM 11010.2 (see below). Measure the Dot Lengths which shall be $115 \text{ ms} \pm 5\%$, measure the gaps between Dots and Dashes which shall be $115 \text{ ms} \pm 5\%$ and measure the Dash Lengths which shall be $345 \text{ ms} \pm 5\%$, finally measure the Modulation Frequency during the Dots and Dashes which shall be $1000 \text{ Hz} \pm 50 \text{ Hz}$.

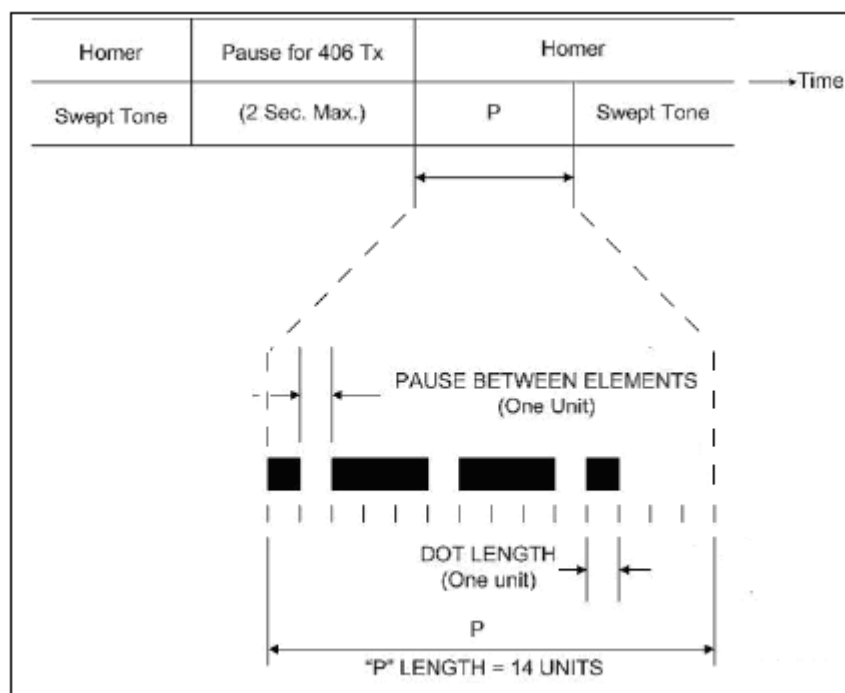


Figure 1 – Format of Morse Code "P" In 121.5 MHz homing signal

Emission Mask for 121.5 MHz Signal (4.2.4)

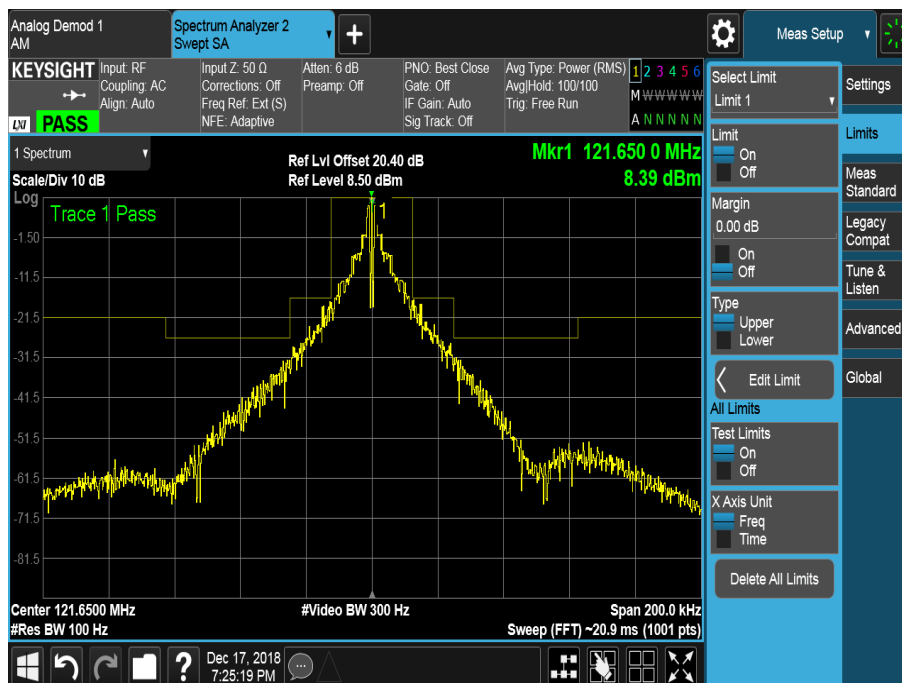


Figure 1 – Emission Mask (Fig4) – Ambient Temperature

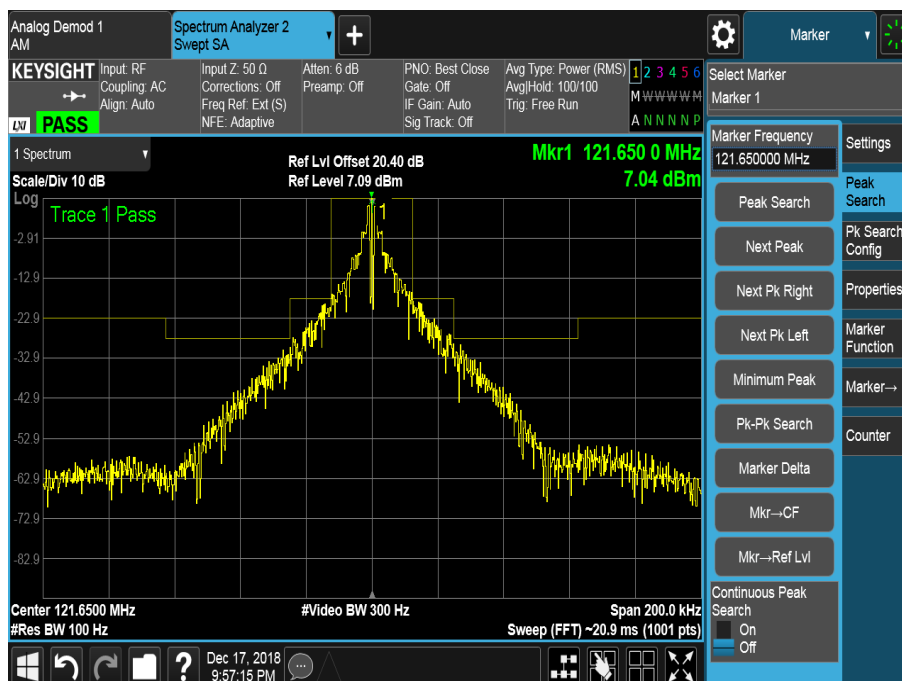


Figure 2 – Emission Mask (Fig4) – Low Temperature

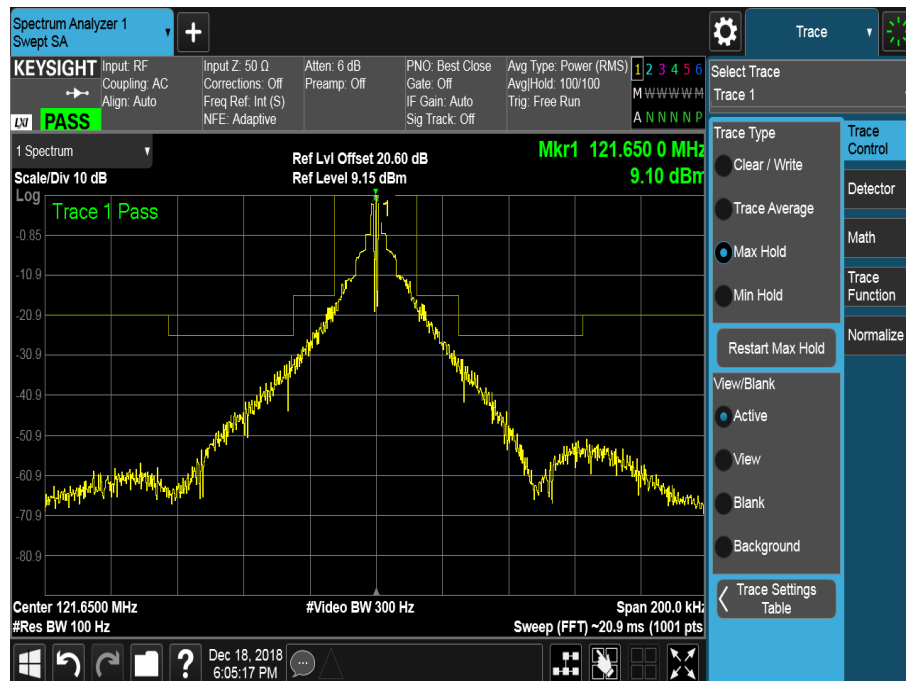


Figure 3 – Emission Mask (Fig4) – High Temperature

Limit Clause 4.2.4

The transmitter power output spectrum shall remain within the limits of the emission mask shown in Figure 4 of the specification.

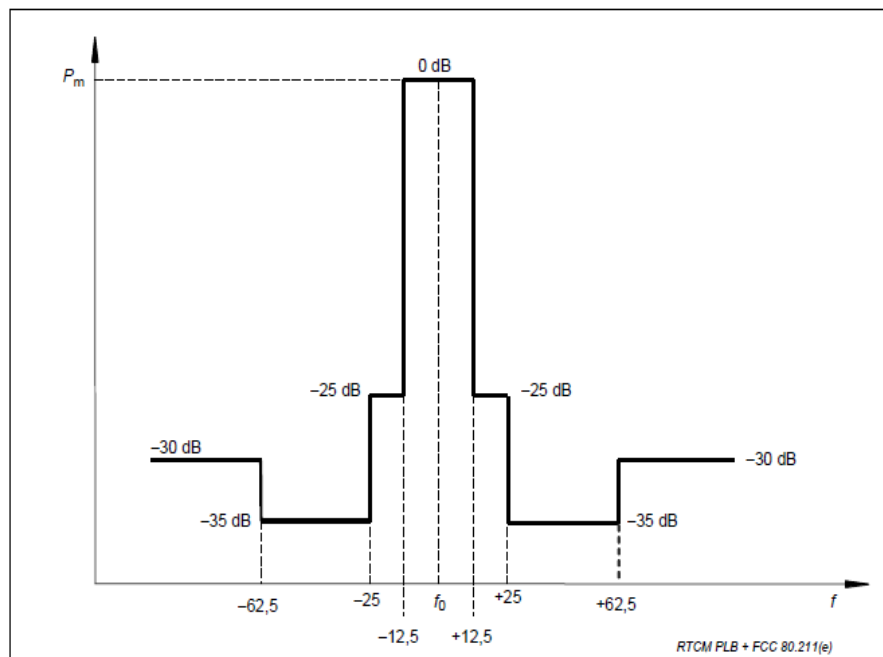


Figure 4 – Emission Mask Limit for 121.5 MHz Signal



Peak Equivalent Isotropic Radiated Power (A.16.3)

Azimuth (°)	PEIRP (mW)
	Elevation with highest antenna gain = 6.9 °
0	26.32
30	25.96
60	25.37
90	25.25
120	24.74
150	24.12
180	23.46
210	23.46
240	24.01
270	25.14
300	25.72
330	25.78
Median PEIRP (mW)	25.20
Maximum to Minimum Ratio (dB)	0.5

Table 24 - On Ground Plane, Peak EIRP

Limit Clause A.16.3

The median value of PEIRP shall be between 25 and 100 mw; the ratio of maximum to minimum of the 11 highest values of PEIRP shall not exceed 4 to 1 (6 dB).

Off Ground Plant Radiated Power Test A.16.4

Azimuth (°)	PEIRP (mW)
	Elevation with highest antenna gain = 5 °
0	16.92
90	16.46
180	14.30
270	15.18
Minimum PEIRP (mW)	14.30

Table 25 - Above Ground Plane, Peak EIRP

Limit Clause A.16.4

The minimum value of PEIRP measured at each of the 4 azimuth angle increments shall be at least 2mW.



2.6.7 Test Location and Test Equipment Used

This EIRP test was carried out in OATS (EMC Hursley). All other tests were carried out in Radio Lab 3

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	24-Oct-2019
Antenna, (Tuned Dipole Set)*	Roberts Antenna	A-100	569	-	TU
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	20-Oct-2018
Digital Temperature Indicator	Fluke	51	1385	12	02-Jan-2019
Power Sensor	Hewlett Packard	8481A	1338	12	31-Oct-2018
Digital Temperature Indicator	Fluke	51	1385	12	02-Jan-2019
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	23-Aug-2018
Digital Temperature Indicator	Fluke	51	2267	12	05-Jul-2018
Climatic Chamber	TAS	Micro 225	2892	-	O/P Mon
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	31-Aug-2018
Power Splitter	Weinschel	1870A	3204	12	12-Apr-2019
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3700	12	31-Jan-2019
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	29-Jun-2018
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	19-Jul-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	20-Oct-2018
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	13-Feb-2019
Climatic Chamber	Aralab	FitoTerm 300E45	4823	-	O/P Mon
EXA	Keysight Technologies	N9010B	4968	12	21-Dec-2018
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018
Cable (18GHz)	Rosenberger	LU7-036-1000	5031	-	O/P Mon

Table 26

TU – Traceability Unscheduled

O/P Mon – Output Monitored Using Calibrated Test Equipment.



2.7 Compass Safe Distance

2.7.1 Specification Reference

IEC 60945, Clause 11.2

2.7.2 Equipment Under Test and Modification State

Z423 FastFind 220, S/N: #08 - Modification State 0

2.7.3 Date of Test

18 May 2018

2.7.4 Environmental Conditions

Ambient Temperature	21°C
Relative Humidity	64%

2.7.5 Test Method

A wooden table aligned E-W was used with a compass set in the centre, aligned to read zero. The table was marked to give a graduated scale of distance. The EUT was moved towards the compass until a standard deviation of 0.3° was obtained.

Each orientation of the EUT was tested in this manner with the measurement distance between the compass centre and the EUT being noted.

The test was repeated with readings taken when the compass gave a steering deviation of 0.9°.

The local area Magnetic Flux density (H) at the site of testing was 20.6 uT.

The above testing was performed three times with the EUT as follows:

- a. Unpowered.
- b. Normalised.
- c. Power applied.

Prior to performing the tests in accordance with part b above, the EUT was normalised by placing it into Helmholtz Coil Assembly and subjecting it to a magnetic field of 79A/m.

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

Test Setup



2.7.6 Test Results

Standard Compass safe distance (mm)	300
Emergency Compass safe distance (mm)	230

Horizontal maximum flux density, Magnetic North (H)	H	20.6
Standard compass deviation limit (degrees)	$5.4/H = A$	$A = 0.3$
Emergency compass deviation limit (degrees)	$18/H = B$	$B = 0.9$

Orientation of the EUT(server)	Un-powered State		Normalised		Powered Up	
	Distance from Compass Centre (mm) at A° deflection	Distance from Compass Centre (mm) at B° deflection	Distance from Compass Centre (mm) at A° deflection	Distance from Compass Centre (mm) at B° deflection	Distance from Compass Centre (mm) at A° deflection	Distance from Compass Centre (mm) at B° deflection
Front	170	170	200	170	300	170
Top	280	170	200	170	300	170
Left Hand Side	180	170	200	170	220	170
Right Hand Side	220	170	200	170	220	170
Underside	290	230	230	230	270	200
Rear	280	170	210	170	260	170



2.7.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Compass	Cassens & Plath	Type 11	3331	-	TU
Magnetometer	Bartington	MAG01	671	36	05-Jun-2021
Compass Verification Unit	TUV SUD	CVU	3579	-	TU

Table 27

TU – Traceability Unscheduled



Product Service

2.8 Miscellaneous Test

2.8.1 Specification Reference

RTCM 11010.2, Clause A.20

2.8.2 Equipment Under Test and Modification State

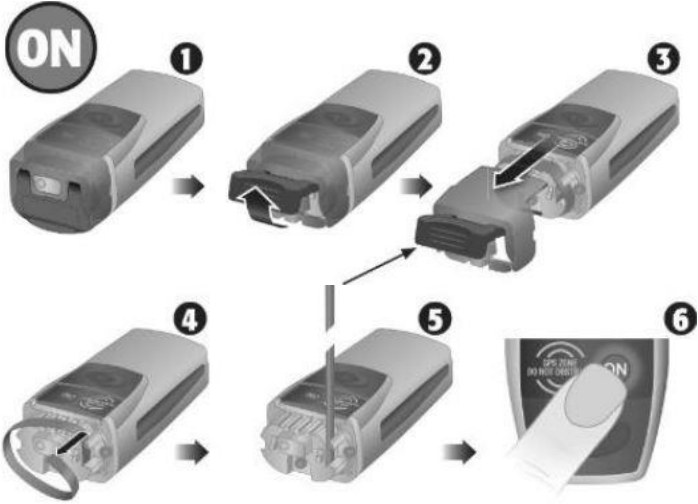
Z423 FastFind 220, S/N: #08 - Modification State 0

2.8.3 Date of Test

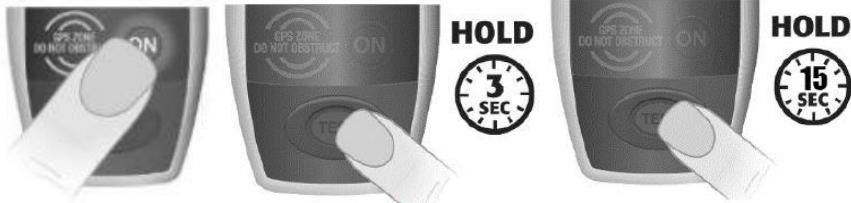
04 June 2018



2.8.4 Test Results

A.20 Miscellaneous		
Sub clause	Statement	Comment
A.20.1 Controls and Indicators		
	The PLB shall be inspected to ensure that all the requirements of paragraph 4.4.1 are met. All controls shall be operated by a person wearing gloves or mittens from an IMO SOLAS compliant immersion suit. The inspection shall ensure that if there is a tamper proof seal it is not counted as one of the two independent actions required to activate the PLB. The means to indicate that the PLB may have been previously activated shall be checked either visually or by operation of the device in accordance with the manufacturer's instructions, a clear means of visible or audible indication shall be apparent.	The EUT was operated by a TUV SUD engineer wearing an immersion suit glove. The EUT is activated by firstly pulling the plastic anti-tamper seal covering the on button. Uncoil the antenna and then press the ON button to activate the beacon. 



4.4.1	Controls and Indicators	
4.4.1	All controls shall be clearly and durably marked. They shall be designed to prevent inadvertent activation and shall require the use of not less than two simple, independent mechanical actions for manual activation of the [the PLB]. Activation of the [the PLB] shall not require the use of two hands. The [PLB] shall be provided with a means to indicate that it has been activated. The controls should be few in number and the function of each control shall be kept simple to permit ease of operation of the [PLB]. All controls shall be so designed that they can be used by personnel wearing gloves or mittens. [The PLB] shall have, as a minimum, integral manual controls to operate the device in the following modes: OFF In the OFF mode, the [the PLB] is deactivated. ON In the ON mode, the [the PLB] is activated. TEST The various modes of the PLB shall be readily apparent by visual observation. A positive visual and/or audible indication that the PLB is activated shall be provided.	The EUT has two physical buttons: ON button and a combined SELF-TEST / GNSS SELF TEST and OFF button labelled both TEST and OFF. When used as an OFF button after beacon activation, depress the TEST/OFF button for 3 seconds to deactivate the beacon. When used as a SELF-TEST button the button should be depressed for 3 seconds or 15 seconds for a GNSS SIGNAL ACQUISITION TEST.  The two independent actions for activation are:  When activated the beacon indicator light emits TWO flashes every second until GPS acquisition has been achieved at which point the beacon indicator light will emit ONE flash every three seconds. Once the beacon has transmitted a distress signal with a GNSS position the beacon indicator light will emit a LONG flash followed by THREE rapid flashed every 50 Seconds. It is possible to activate the EUT with one hand. The physical controls relating to the 406 MHz feature of the device are few in number (as per above). The EUT was operated by a TUV SUD engineer wearing an immersion suit glove.



A.20.2 Self-test and GNSS Self Test Function	
The self-test mode of the PLB shall be activated. The automatic reset of the test facility and the indication of the self-test mode shall be checked by inspection. The manufacturer's declaration as to the functioning of the self-test mode shall be checked for compliance with paragraph 4.4.2. a), b) and c). If applicable the GNSS Self Test function as defined in paragraph 4.4.2 shall be checked by inspection to ensure that it is operated by a Distinct Operation, prevents Inadvertent Operation, is provided with Distinct Pass and Fail indicators. Also if applicable the manufacturer's declaration as to the functioning of the GNSS Self Test mode shall be checked for compliance with paragraph 4.4.2. c), d), e) and f).	The EUT includes a combined 406 MHz / 121.5 MHz Self- test mode. To perform a SELF-TEST depress the TEST button for 3 seconds and then release, the beacon indicator light will then emit one flash. After a few seconds the beacon indicator light will emit ONE SHORT flash indicating the transmission of the 121.5 MHz HOMING signal followed by ONE long flash to indicate the transmission of the 406 MHz signal. At the end of the SELF-TEST the beacon indicator light will emit between ONE and THREE flashes to indicate the condition of the battery and conclusion of the SELF-TEST. The beacon will then self deactivate. To perform a GNSS SELF-TEST depress the TEST button for 15 seconds and release, the beacon indicator light will then flash slowly denoting that it is searching for a GNSS signal. Once a GNSS fix is obtained the beacon will emit a series of LONG flashes denoting the number of remaining GNSS test. The beacon will then self deactivate. If the beacon cannot acquire a GNSS fix within 5 minutes, the test will end and the beacon will stop flashing denoting that the GNSS SELF-TEST has failed. The beacon will then self deactivate. If the number of GNSS SELF-TEST have been exceeded the beacon will emit ONE LONG flash and will self deactivate without performing a GNSS SELF-TEST



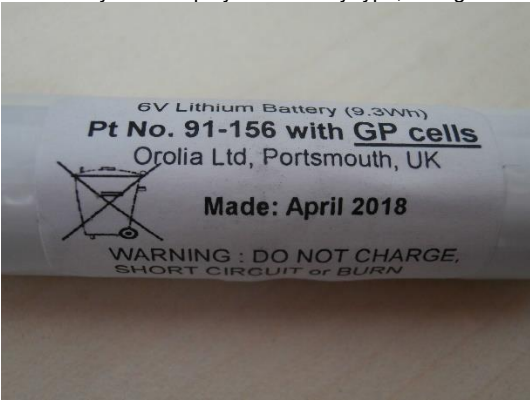
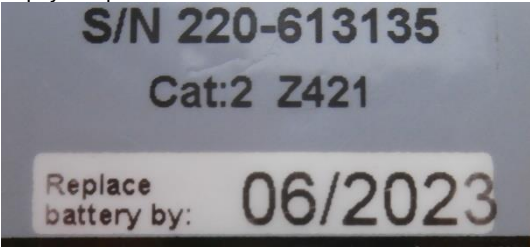
Product Service

A.20.3 Battery		
	The manufacturer shall provide evidence that the primary battery used to power the PLB is not hazardous to personnel as required by paragraph 4.4.3. The manufacturer shall provide evidence that the design of the PLB includes measures to protect the batteries from reversal of polarity, shorting, self heating, cell-to-cell charging and forced discharging. The manufacturer shall declare the useful life of the battery and its expiration date and provide evidence to support these as required by paragraph 4.4.3. The battery shall be inspected to ensure that all the labelling requirements of paragraph 4.5.2.1 are met. The manufacturer shall provide evidence that the battery and the cells making up the battery are either exempt from testing or have been tested to the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, Fourth Revised Edition, PART III, Section 38.3 (ST/SG/AC.10/11/Rev.4) as amended.	The Manufacturer provided document D002360_01 Z423 Z424 BATTERY PACK 6V 1.5AH.PDF in support of this clause. See also report 75942209 Report 6 (UN 38.3).



4.4.3	Battery	
4.4.3	The PLB shall have its own primary (non-rechargeable) battery and shall not depend upon any external source of power for its operation when activated. The battery shall be an integral part of the equipment. Replacement of the battery, if user-replaceable, should be possible with relative ease, and any interface connections required shall be such as to prevent reversed polarity or incorrect installation. Provision shall be made to ensure watertight integrity upon replacement of the battery. The PLB shall not be hazardous to personnel handling it, operating it, or performing manufacturer-approved servicing of it nor shall it release toxic or corrosive products outside the PLB case during or subsequent to storage at temperatures between -55 and +75 C and: a) During a full or partial discharge at any rate up to and including an external short circuit. b) During a charge or forced discharge of a cell or cells by another cell or cells within the battery. c) After a full or partial discharge. All PLBs shall include measures to protect the batteries from reversal of polarity, shorting, and the effects of self-heating, cell-to-cell charging, and forced discharging. The PLB manufacturer shall establish a useful life and an expiration date for batteries. The useful life is defined as the period of time after the date of battery manufacture that the battery will continue to meet the input power requirements of the PLB. The following losses must be included (at a temperature of +20C ±5C): a) Testing, as recommended by the manufacturer, including GNSS Self Tests if applicable, or as required by the regulatory authority, whichever is the more demanding. b) Self-discharge of the battery pack. c) Standby loads. The battery expiration date shall be the date of battery cell manufacture plus no more than 1/2 of the useful life of the battery. The battery cells shall be no older than 2 years when first fitted in the PLB.	The device has its own primary non-rechargeable battery source. The battery pack is an integral part of the EUT. The battery pack is not user replaceable. The batteries connectors are keyed and as such can only be connected to the EUT in the correct orientation. The Manufacturer provided document D002360_01 Z423 Z424 BATTERY PACK 6V 1.5AH.PDF with respect to battery chemistry / handling etc. See also TUV SUD document 071-75942209-000TRF_CE_E (Safety assessment in accordance with IEC 60950-1 See also Manufacturer statement (Annex A): RTCM 11010.2 battery statement



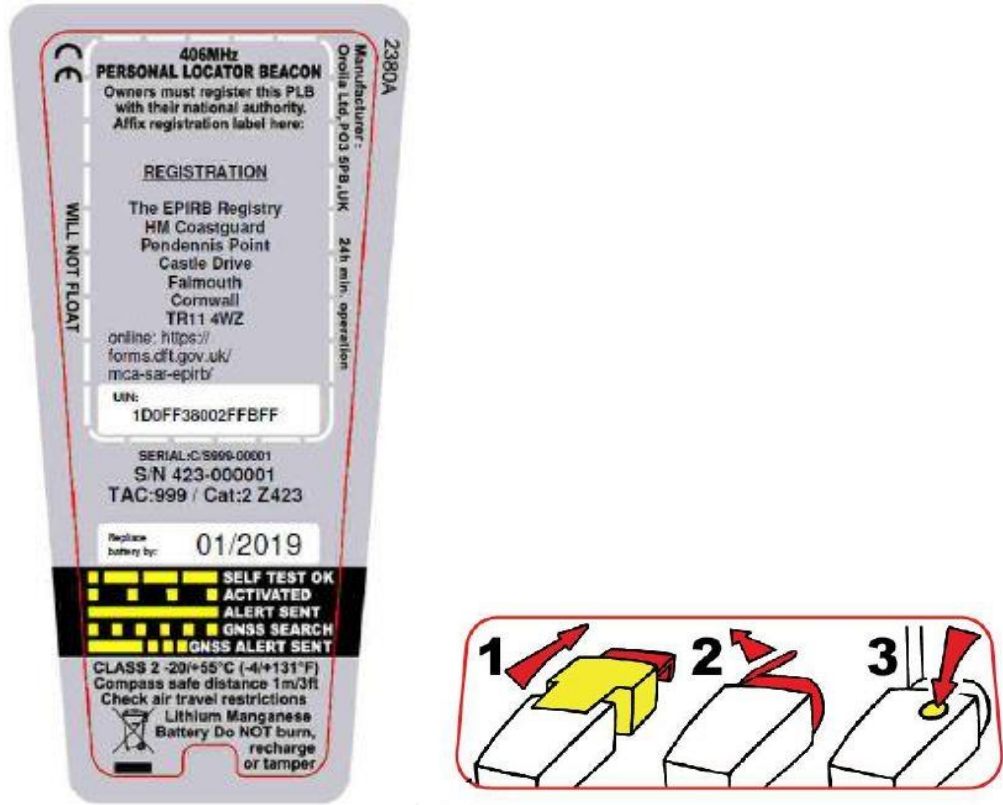
4.5.2.1	Battery Labelling	
4.5.2.1	The battery shall be marked indelibly and legibly with the battery type (chemical composition), voltage, expiration date (month and year) and as appropriate, precautions associated with its use, handling and disposal.	The battery is not user accessible. The battery label displays the battery type, voltage and 'Made' date:  Expiry / Replacement Date is on the PLB label: 



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4.5.2.1	The battery shall be marked indelibly and legibly with the battery type (chemical composition), voltage, expiration date (month and year) and as appropriate, precautions associated with its use, handling and disposal.	The Manufacturer provided a copy of an additional production label: 6V Lithium Metal Battery Pack [LiMnO₂] Capacity: 1500 mAh - 9 Wh P/N: 1001802 Amdt: X S/N: Barcode below Pack Made: MM-YYYY Expiry Date: MM-YYYY WARNING: DO NOT charge, puncture, short-circuit or burn. CAUTION: Regulated lifesaving device. Unauthorized battery replacement may lead to failure. Contact Manufacturer for detail. Manufacturer: Orolia Ltd PO3 5PB, UK.  2383B
A.20.4 General Construction		
	The PLB shall be inspected to ensure that it has no sharp edges or points, likely to cause injury to persons or damage to inflatables or similar survival equipment.	The EUT was inspected with a Sharp Edge tester. The result indicated that there were no sharp edges present.
A.20.5 Exterior Finish		
	The PLB shall be inspected to ensure that the exterior finish complies with the requirements of paragraph 4.5.1.	See below.
4.5.1	Exterior Finish	
4.5.1	The PLB case shall be predominantly a highly-visible yellow/orange color.	The PLB is Yellow in colour.



A.20.6 Labelling	The labelling of the exterior of the PLB and any labelling permanently attached to the PLB shall be inspected to ensure that they comply with the requirements of paragraphs 4.5.2.2 to 4.5.2.2.4. All labelling on the exterior of the PLB shall be tested for abrasion resistance by the manufacturer who shall present evidence of the suitability of the labelling to last for at least the stated battery shelf life of the beacon, ideally this should be in the form of test results obtained using a recognized abrasion test method. Instructions for operating the PLB and any pictographs not already commonly in use shall be tested for comprehension in accordance with an appropriate internationally recognized testing procedure (i.e.: ISO, ANSI, ASTM) or a manufacturer may demonstrate the comprehensibility of the instruction or pictograph by the success of at least 4 out of a set of 5 randomly selected naive test subjects demonstrating compliance with or understanding of, as appropriate, the instructions.	See Annex B for Manufacturer Supplied Abrasion Test declaration. The following operating instructions and pictographs are provided (via adhesive labels) on the EUT: 
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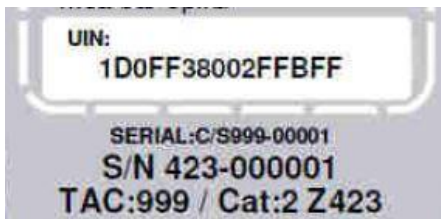


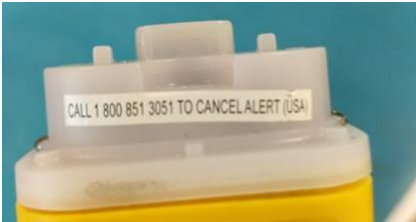
4.5.2.2	PLB Labelling
4.5.2.2	All labelling on the exterior of the PLB shall be resistant to deterioration by prolonged exposure to sunlight, not unduly affected by seawater or oil, and abrasion resistant. All labelling essential to the safe and effective operation of the PLB shall be in high contrast to the background of the text or pictograph. Labelling and Pictograph instructions essential to the safe and effective operation of the PLB shall be sized such that they are readable by persons having 20/20 normal vision at a minimum viewing distance of 150 mm with illumination no greater than 0.3 Lux. Items a) through h) in 4.5.2.2.1 below and any other information required for the safe and effective operation of the PLB shall be visible on the PLB, or their location identified and accessible by a single simple action on the part of the operator (e.g. lifting or removing a protective cover over the control panel). Such information shall not be hidden by any permanent or semi-permanent accessory or ancillary devices normally attached to or installed on or around the body of the PLB. (A separate storage case from which the PLB can be easily removed with one hand for activation is not included in this requirement.) Solar Radiation: not tested. Corrosion: not tested. Oil Resistance: not tested. The operating instructions for the PLB provide a basic pictorial description on a label attached to the anti-tamper seal that is located on the top of the PLB.  The GPS antenna location label is located on the front rubber section of the PLB: 



4.5.2.2	PLB Labelling	
4.5.2.2	All labelling essential to the safe and effective operation of the PLB shall be in high contrast to the background of the text or pictograph. Labelling and Pictograph instructions essential to the safe and effective operation of the PLB shall be sized such that they are readable by persons having 20/20 normal vision at a minimum viewing distance of 150 mm with illumination no greater than 0.3 Lux.	See Annex A for Manufacturer RTCM 10010.2 PLB Labelling statement.
4.5.2.2.1	The outside of the PLB shall be marked indelibly and legibly with the following: a) Concise, unambiguous instructions for operating and testing of the PLB that shall be understandable by untrained personnel. b) The warning, or equivalent: WARNING USE ONLY IN SITUATIONS OF GRAVE AND IMMINENT DANGER	The following label items / instructions were identified on the EUT (Exhibit 5h Rev01 Label Drawings Fastfind) was provided to identify the label placement: a) Basic operating instructions for emergency mode activation.  b) The warning: WARNING: USE ONLY IN SITUATIONS OF GRAVE AND IMMINENT DANGER can be found underneath the red cover. 



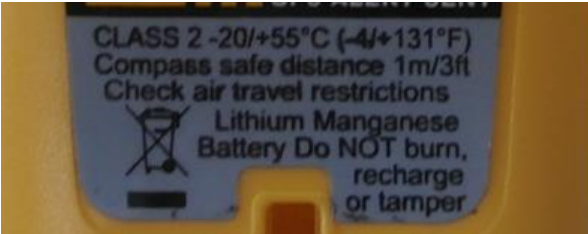
4.5.2.2.1	Labelling on the PLB	
4.5.2.2.1	c) The warning, or equivalent: NOTICE TO THE PUBLIC DO NOT MOVE IF FOUND REPORT POSITION TO AUTHORITIES d) Space for 15 characters shall be provided on a label with text identifying this as the "Beacon Identification Code." This is the hexadecimal representation of bits 26 through 85 of the digital message. This unique identifier number, the 15 Hex ID, shall be inserted on the label when the PLB is programmed. e) The serial number of the PLB.	c) The warning, or equivalent: NOTICE TO THE PUBLIC: IF FOUND DO NOT MOVE. REPORT POSITION TO AUTHORITIES is printed on the antenna of the PLB.  d) The unique identification label shown below can be found on the back of the EUT:  e) The serial number of the device: the serial number label of the EUT can be found on the back of the EUT, (see above).

4.5.2.2.1	Labelling on the PLB	
4.5.2.2.1	f) Instructions to register the PLB with the appropriate authority and the contact details of the authority.	f) Instructions to register the device with the appropriate authority is present on the rear label. A telephone number is provided on a label underneath the red cover. Contact details can also be found in the user manual (Exhibit 5e Rev00 FF220 User Manual).
	g) Space for any required registration sticker.	
	h) The battery expiration date determined in accordance with section 4.4.3.	g) Space for any required registration sticker: The registration label can be found on the back of the PLB:  h) The battery expiration date determined in accordance with section 4.4.3: the battery expiration date label (labelled as "Replace battery by") can be found on the rear label of the EUT: 



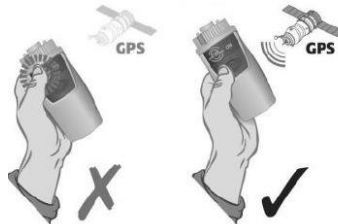
4.5.2.2.2	Attached labelling	
4.5.2.2.2	The following instructions shall be marked indelibly and legibly on the outside of the PLB or permanently attached to the PLB. If permanently attached, the placard including the instructions(s) shall be conspicuously marked adjacent to the attachment point: "DO NOT REMOVE" a) The identification of the manufacturer.	a) The manufacturers identification is moulded into the rubber grips on both sides of the PLB  A photograph of a yellow and black McMurdo 406 PLB (Personal Locator Beacon) device. The device is cylindrical with a yellow body and black rubber grips at each end. A red diamond-shaped label with the number '406' is visible on the yellow body. The brand name 'mcmurdo' is embossed on the black rubber grip.



4.5.2.2.2	Attached labelling	
4.5.2.2.2	b) The PLB type number or model identification under which it was type tested. c) The temperature operating range in degrees Celsius and Fahrenheit of the PLB. d) An appropriate Dangerous Goods transportation statement together with the applicable date	b) The name Fast Find 220 PLB can be identified on the anti-tamper seal on the front of the PLB:  c) The operating and storage temperatures can be found on the back of the EUT in both degrees Celsius and Fahrenheit.  d) Checking of air travel restrictions is advised (see above) however <u>no applicable</u> date could be seen.

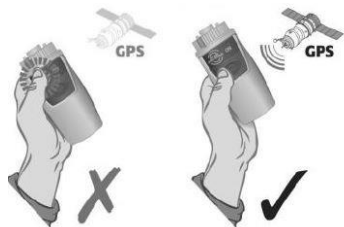


4.5.2.2.2	Attached labelling	
4.5.2.2.2	e) If there exists a condition or operating circumstance which has been identified by the manufacturer or regulating authorities that could substantially affect the alerting or self locating performance of the PLB, then information appropriate to prevent this occurring shall appear in a conspicuous location appropriate to the prevention or remediation by the operator of said condition or operating circumstance (e.g. the necessity to orient the antenna vertically upward if orientation of the antenna is adjustable).	e) A GPS antenna label can be found on the top of the EUT, indicating that the area must have <i>clear view to sky</i>:  The antenna must be vertical to the sky:  The label on the back of the EUT indicates that the device does not float:  f) The phone number(s) to be used to report inadvertent activation negating the need for the distress alert. f) The telephone number can be found underneath the red cover – see 4.5.2.2.1 f above.

4.5.2.2.2	Attached labelling	a) A printed GPS label can be found on the front top rubber section of the EUT, "GPS ZONE DO NOT OBSTRUCT": 
	b) A positive visual and/or audible indication that the GNSS receiver has acquired a location. c) Instructions on or permanently attached to the PLB shall guide the operator towards maximizing self-locating performance. If permanently attached, the placard including the instructions(s) shall be conspicuously marked adjacent to the attachment point: "DO NOT REMOVE"	b) A label can be found on the rear bottom of the PLB indicating the LED flashes for the PLB at various stages including the successful acquisition and sending of a GNSS signal / location. This is denoted by one long flash and three short flashes  c) The beacon markings indicates "GPS ZONE DO NOT OBSTRUCT", further guidance is provided on the antenna:  Further information is provided in the user manual:  Ensure that the area marked "GPS Zone" is not obstructed or covered in any way and always has a clear view of the sky.



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4.5.2.2.2	Attached labelling	
4.5.2.2.3	For Category 2 PLBs The outside of the PLB shall be marked indelibly and legibly with a warning label that states "WILL NOT FLOAT."	A label on the back of the PLB includes the wording "Will Not Float" notice (see above).
4.5.2.2.4	c) Instructions on or permanently attached to the PLB shall guide the operator towards maximizing self-locating performance. If permanently attached, the placard including the instructions(s) shall be conspicuously marked adjacent to the attachment point: "DO NOT REMOVE"	c) The beacon markings indicates "GPS ZONE DO NOT OBSTRUCT", further guidance is provided on the antenna:  Further information is provided in the user manual:  Ensure that the area marked "GPS Zone" is not obstructed or covered in any way and always has a clear view of the sky.



A.20.7 Documentation		
	The manufacturer shall supply a copy of the operation manual and this shall be inspected to ensure that it complies with the requirements of paragraph 4.5.3. The manufacturer shall supply a copy of the end user (consumer) packaging (or the labelling for the packaging) and this shall be inspected to ensure that it complies with the requirements of paragraph 4.5.4.	The following documents / labels were briefly reviewed with respect to clause A.20.7 (note: the inspection was provided to confirm the presence of the required information. The accuracy of the instructions was not checked):
4.5.3	Documentation	
4.5.3	The manufacturer shall provide an operation manual which includes the following: a) Complete instructions for operating the PLB. b) Cautions and recommendations to prevent false alerts. c) A warning paragraph with, at a minimum, the information in 4.5.2.2 and the fact that misuse of a PLB is subject to a fine.	The User Manual was briefly inspected as per clause 4.5.3 and the following was noted with respect to the applicable sub clauses (note: the inspection was provided to confirm the presence of the required information. The accuracy of the instructions was not checked): a) A pictograph activation description and further detailed 'Emergency Activation' operating instructions are provided (Exhibit 5e Rev00 FF220 User Manual). b) Cautions or recommendations to prevent false alerts are provided (Exhibit 5e Rev00 FF220 User Manual). c) The following conditions of 4.5.2.2 (and the following sub clauses) where met in the User Manual (Exhibit 5e Rev00 FF220 User Manual): - Operating instructions - Warnings (see below) - Registration information - Identification of the Manufacturer - Device model name and name under which it was tested - Operating temperature range in degrees Celsius and Fahrenheit - Dangerous goods transportation information (no applicable date) - Antenna optimization information (clear view to sky, not to hold the device via the antenna, positioning of the device etc) - Phone number to report inadvertent activation - The warning: the unit will not float without the buoyancy pouch and that the unit is not designed to float - Location of the GPS antenna. The user manual also includes a warning to only use in "SITUATIONS OF GRAVE AND IMMINENT DANGER", and that "Deliberate misuse of the device could result a penalty (Exhibit 5e Rev00 FF220 User Manual). There is a note on the EUT antenna, warning the public not to move if found.



4.5.3	Documentation	e) The following (in addition to above) information for the safe transportation or shipping of the EUT is provided: (Exhibit 5e Rev00 FF220 User Manual). 10 TRANSPORTATION • The product contains a lithium metal battery with a lithium content exceeding 2 g and a total net quantity of 0.068 kg. It is classified as dangerous goods for transportation purposes: Class 9, UN3091, Lithium metal Batteries Contained in Equipment. • Transport by air: the product cannot be carried on a passenger aircraft either as carry-on or checked in baggage. For transport by air, the product must be packaged and shipped as cargo via a qualified dangerous goods shipper. Packing instruction P970 Section 1 applies. • Transport by sea: It may be possible to carry the product in a private vehicle or as carry-on baggage – this must be checked with the ferry company/shipping line prior to travel. If this is not allowed, the product must be packaged and shipped as cargo via a qualified dangerous goods shipper. Packing instruction P903 applies. • Transport by road: The transport of dangerous goods regulations do not apply to items carried in a private vehicle for personal use. Product being transported by courier/road haulier must be packaged and shipped as cargo via a qualified dangerous goods shipper. Packing instruction P903 applies.
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4.5.3	Documentation	d) Basic battery information (for the 406 MHz feature) is provided: (Exhibit 5e Rev00 FF220 User Manual). 2 SAFETY NOTICES It is recommended that the Self Test is performed once a month - unnecessary testing reduces battery life in the event of an emergency. Return the unit to a service center for battery replacement if battery level is low (single flash in Self Test mode). Confirm that the battery expiry date shown is in date for the duration of intended use. 12 END OF LIFE STATEMENT - At the end of its life, the product must be disposed of according to local laws and regulations and it must be disposed of separately from household waste. - The battery should also be removed to prevent false alerts. - Do not incinerate, but take it to a recycling facility.   Battery life (storage) 6 years Battery replacement Service center Battery Use Logged by microprocessor - Contains lithium batteries. Do not incinerate, puncture, deform, short-circuit or recharge. - Product and battery pack contain no user-serviceable parts. Do not dismantle.
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4.5.3	Documentation	
4.5.3	f) Information regarding the need to replace the battery after activation of the PLB and how to determine if the PLB has been activated or the battery needs to be replaced. g) Information related to the requirements of preventive maintenance.	f) There is a note indicating that the 406 MHz lithium battery should be replaced after activation.: (Exhibit 5e Rev00 FF220 User Manual). The top cap is fitted with an anti-tamper seal which is broken on activation of the unit and must then be replaced. A new cap should then be fitted and the battery has to be replaced following any operation other than a Self-test or a GNSS Test. g) Instructions relating to preventative maintenance are provided in the CAUTIONS section: (Exhibit 5e Rev00 FF220 User Manual).
4.5.3	h) Minimum operating lifetime and operating and stowage temperature ranges.	h) The following specification details are provided: (Exhibit 5e Rev00 FF220 User Manual). Transmit duration> 24 hours @ -20 °C (-4 °F) Battery life (storage) 6 years Operating temperature-20 to +55 °C (-4 to + 131 °F) Storage temperature-30 to +70 °C (-22 to +158 °F)



4.5.3	Documentation	
4.5.3	i) Information explaining the requirement and procedure for licensing and registering PLBs, as appropriate, and encouragement to do so promptly. j) Instructions on actions to be taken in the case of false alerts, including toll and toll – free phone numbers for contacts and including instructions that in the case of accidental activation of the PLB, the user should de-activate the PLB and notify the appropriate search and rescue authorities at the earliest possible time. k) For Category 2 PLB, a warning that states "THIS PLB WILL NOT FLOAT" and, if applicable, the information that when used around water it must be installed in a provided auxiliary flotation device, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and that the PLB is not designed to float and transmit a distress signal and that the PLB may not be substituted for a required EPIRB on a vessel. l) For Category 1 PLB, information that the PLB is appropriate for use in or around water and, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and as appropriate, either: The PLB is buoyant (but is not designed to float in an upright position and transmit a distress signal) and that the PLB may not be substituted for a required EPIRB on a vessel. Or the PLB will float without support in an upright position and transmit a distress signal and that the PLB may not be substituted for a required EPIRB on a vessel.	i) A 406 MHz <i>Registration</i> section is provided within the "ANNEX: LOCAL AUTHORITY INFORMATION "for multiple countries: (Exhibit 5e Rev00 FF220 User Manual). j) Instructions or actions to be taken in the case of false alert are provided within the "ANNEX: LOCAL AUTHORITY INFORMATION "for multiple countries: (Exhibit 5e Rev00 FF220 User Manual). k) The User Manual notes the following (Exhibit 5e Rev00 FF220 User Manual): • The unit will not float without the buoyancy pouch. • The unit is not designed to float in an upright position or transmit a distress alert when floating in water. Once activated it must always be kept above water, as direct contact with the sea will severely reduce the transmission range.  Buoyancy Category 2, will not float (keep in buoyancy pouch provided) l) This sub clause is only applicable to Category 1 PLBs.



4.5.3	Documentation	
4.5.3	m) Information to guide the operator towards maximizing self-locating performance including a warning not to obstruct the GNSS antenna's view of the sky and to ensure the GNSS antenna is not submersed in water.	m) A brief note indicating the GPS Receiver Location is provided: (Exhibit 5e Rev00 FF220 User Manual). • For optimum transmission, the antenna must be pointing vertically upwards at all times. • Do not hold the antenna. • Fit the lanyard through the eye hole in the base of the unit and fasten securely to your clothing. • The unit will not float without the buoyancy pouch. • The unit is not designed to float in an upright position or transmit a distress alert when floating in water. Once activated it must always be kept above water, as direct contact with the sea will severely reduce the transmission range. • Ensure that the area marked "GPS Zone" is not obstructed or covered in any way and always has a clear view of the sky. • In strong winds, turn the unit so the indicator light faces into the wind.



4.5.3	Documentation	
4.5.3	n) If the 121.5 MHz signal is transmitted during the Self-test, information noting that the Self test shall be performed only within the first 5 minutes of any hour. o) An overview and explanation of how the Cospas-Sarsat system operates. p) Beacon registration materials and information q) For PLBs with the capability to be connected to an external GNSS receiver the manufacturer shall provide instructions for connecting and setting up the external GNSS receiver in the equipment manual. This information shall include: 1) A list of all the GNSS receivers that have been tested with the PLB to ensure correct operation of the interface; 2) Details of the electrical and/or data connections to the PLB; 3) The specification of the interface (e.g. IEC 61162-1); 4) Details of the communications protocol to be used (e.g. Baud Rate, Data Bits, Parity Bits etc); 5) A list of the NMEA messages that the PLB can handle (e.g. GGA, GLL, RMC etc) and; 6) Instructions on the key settings and parameters of the GNSS Receiver (e.g. Map Datum (WGS84/GTRF), I/O Formats, Mode of Operation etc).	n) The following specification details are provided: (Exhibit 5e Rev00 FF220 User Manual).. WARNING: ONLY SELF TEST IN THE FIRST FIVE MINUTES OF THE HOUR. o) An overview and explanation of the how the Cospas Sarsat system works is provided in the INTRODUCTION section of the user manual. p) The user manual does not contain any beacon registration documents, however a link to the beacon registration website is provided. q) The EUT is not capable of being connected to an external GNSS receiver.



4.5.4	Packaging Labelling	
4.5.4	End user (consumer) packaging shall include the following information in a conspicuous location, readily readable and visible to the purchaser without opening the packaging: a) The Category of the PLB: If Category 2, the additional information that the PLB will not float and is not recommended for use on or in the water and that THIS PLB IS NOT AN ELT or an EPIRB and does not meet the regulatory requirements for an ELT or an EPIRB or if applicable, the additional information that the PLB will not float and is not recommended for use on or in the water unless it is fitted with the provided auxiliary flotation device, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and that THIS PLB IS NOT AN ELT or an EPIRB and does not meet the regulatory requirements for an ELT or an EPIRB. This PLB is buoyant when fitted with the provided auxiliary flotation device, but will not float in an upright position. Or, if applicable, the additional information that the PLB will not float and is not recommended for use on or in the water unless it is installed into the provided auxiliary flotation device, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and that THIS PLB IS NOT AN ELT or an EPIRB and does not meet the regulatory requirements for an ELT or an EPIRB. This PLB will float in an upright position when installed into the provided auxiliary flotation device and transmit a distress signal once manually activated.	The following documents were briefly reviewed with respect to clause 4.5.4 (note: the inspection was provided to confirm the presence of the required information. The accuracy of the instructions was not checked): 91-309-003N-Issue -2: Display Sleeve, Fast Find The following items were included with respect to each sub clause: A) The product packaging does <u>NOT</u> state that the PLB will not float but it does show a pictorial indicator showing that the device will float with a pouch.  The packaging does show the words "THIS DEVICE IS NOT AN ELT OR AN EPIRB" The packaging does <u>NOT</u> show, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) or does not meet the regulatory requirements for an ELT or an EPIRB. 



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4.5.4	Packaging Labelling																	
4.5.4	b) The temperature operating range in degrees Celsius and Fahrenheit of the PLB. c) The expiration date of the battery. d) The Country that is coded into the 15 Hex ID e) If the Country Code or unique national characteristics cannot be readily changed in the field at nominal cost to another Country Code due to the configuration of the PLB, a warning to that effect.	The Manufacturer advises that the following label is applied to the packaging: <table><tr><td colspan="2">Fast Find 220</td><td>GPS</td><td>Category 2 : Floats in pouch Class 2 : -20°C to +55°C -4°F to +131°F</td></tr><tr><td colspan="2">Part No.: 91-001-220A-C</td><td colspan="2"></td></tr><tr><td>Serial No.: 423-00000012</td><td> 0000 0123</td><td colspan="2">Battery Expiry : 01/2019</td></tr><tr><td> 5 035963 007358</td><td>Country : FRANCE 1C44000080FFBFF CE</td><td colspan="2"> 6 58185 00144 4</td></tr></table> Use of this equipment may require a user licence. It may be operated in: AT, BG, CY, CZ, DE, DK, EL, ES, FI, FR, HR, HU, IS, IT, LI, LU, LV, MT, NL, NO, PL, PT, RO, SI, SK, UK	Fast Find 220		GPS	Category 2 : Floats in pouch Class 2 : -20°C to +55°C -4°F to +131°F	Part No.: 91-001-220A-C				Serial No.: 423-00000012	 0000 0123	Battery Expiry : 01/2019		 5 035963 007358	Country : FRANCE 1C44000080FFBFF CE	 6 58185 00144 4	
Fast Find 220		GPS	Category 2 : Floats in pouch Class 2 : -20°C to +55°C -4°F to +131°F															
Part No.: 91-001-220A-C																		
Serial No.: 423-00000012	 0000 0123	Battery Expiry : 01/2019																
 5 035963 007358	Country : FRANCE 1C44000080FFBFF CE	 6 58185 00144 4																



Product Service

A.20.8 Altitude		
	With the PLB test specimen coded using the test user protocol, activation switch in the OFF mode and under normal test conditions, place the test specimen in the altitude test chamber and reduce the chamber pressure to an altitude equivalent of 25,000 feet (7,620 meters), $\pm$ 5%. The rate of pressure change should not exceed 1.5 inches of Hg per minute (5 kPa/min). Hold the chamber at this pressure for a minimum of two hours. Increase pressure in the test chamber at a rate not to exceed 1.5 inches of Hg per minute (5 kPa/min) until the chamber pressure is equal to the ambient pressure. Carry out a self-test and verify that the self-test passes. The test specimen passes if it does not activate during the pressure changes and hold time at altitude and the self -test response is correct on completion of the test.	Refer to section 2.9 of this report.
Annex G	Internal Navigation Device	See section 2.10 of this report.



Product Service

2.8.5 Test Location and Test Equipment Used

This test was carried out in Radio Lab 4.

There is no test equipment recorded for this section: inspection of documentation / labelling etc only.

2.9 Altitude

2.9.1 Specification Reference

RTCM 11010.2, Clause A.20.8

2.9.2 Equipment Under Test and Modification State

Z423 FastFind 220, S/N: #08 - Modification State 1

2.9.3 Date of Test

26 September 2018

2.9.4 Test Method

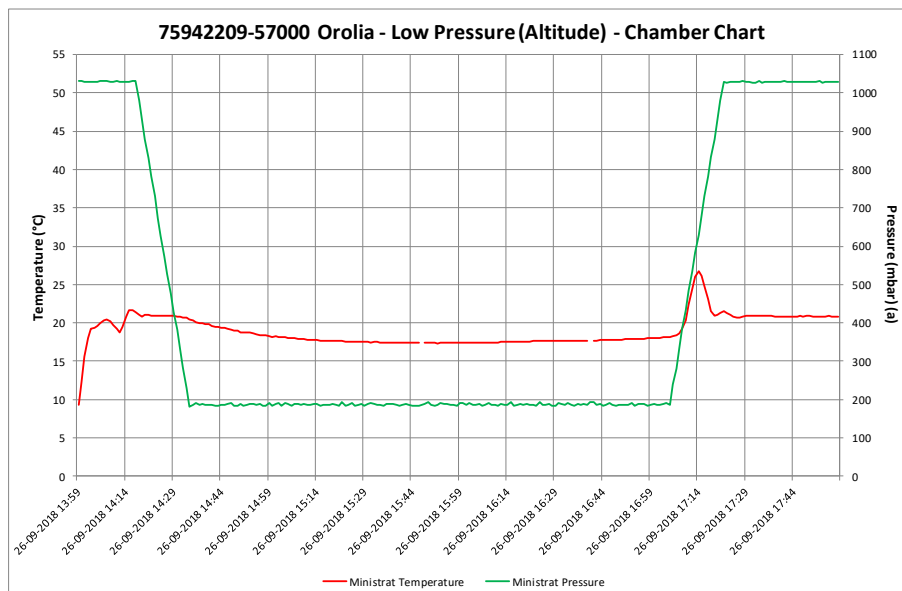
The EUT (powered off) was placed in a climatic chamber where the conditions were increased from laboratory ambient atmospheric pressure to 40,000 ft (187 mbar) at a rate of 50mbar / min. The conditions were maintained for 2 and a half hours. The conditions were then returned to laboratory ambient atmospheric conditions. The EUT was then subject to a performance check.

2.9.5 Environmental Conditions

Ambient Temperature 21.4°C
Relative Humidity 41.7%

2.9.6 Test Results

Temperature Plot



Performance Check

Z423 FastFind 220 S/N: #08 (TSR004)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFE08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031030
121 MHz Presence	P

Table 28 – Performance Check Test Data (#08, TSR004)

2.9.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Unitemp	Ministrat	2129	12	06-Feb-2019
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	25-Sep-2019
Beacon Tester	WS Technologies	BT100S	3263	-	TU

Table 29

TU – Traceability Unscheduled

2.10 Internal Navigation Device (GPS Scenarios)

2.10.1 Specification Reference

RTCM 11010.2, Annex G

2.10.2 Equipment Under Test and Modification State

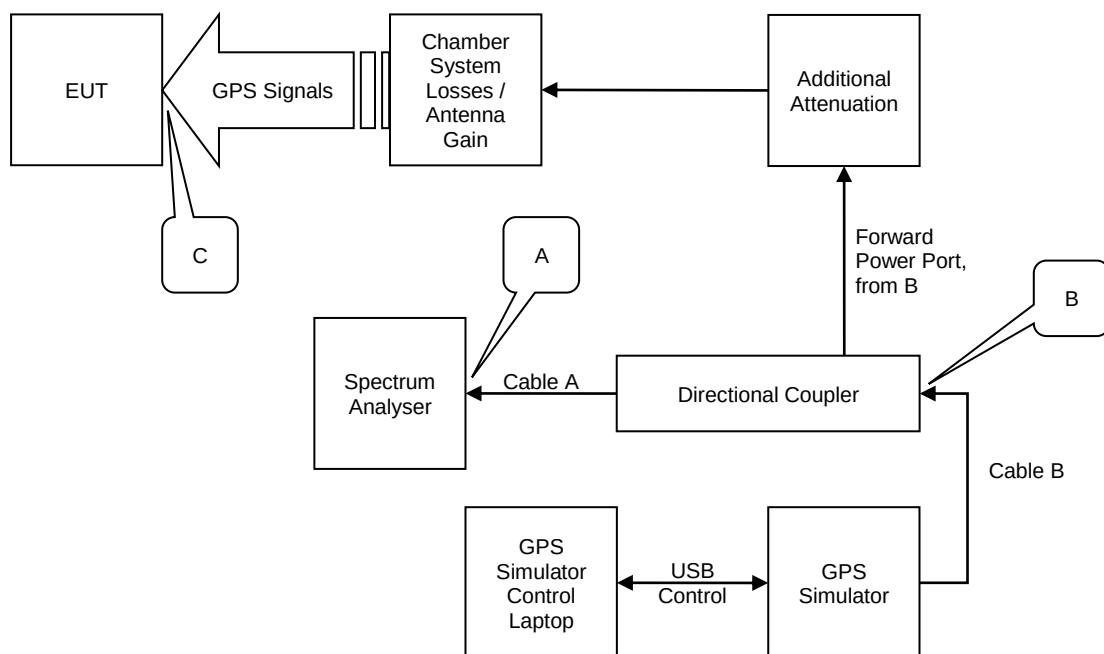
Z423 FastFind 220, S/N: #12 - Modification State 0 (with no 121.5 MHz offset)

2.10.3 Date of Test

10 July 2018 – 11 July 2018

2.10.4 Test Method

Field Calibration



Field Calibration Schematic

The basic premise of the Field Calibration procedure is that Received Signal Strength (P_{RSS}) at C equals P_{RSS} at B minus the loss from B to C (calibrated), where the P_{RSS} at B equals the power measured at A plus the loss B to A.

Resultant P_{RSS} at C is recorded for each scenario at the test results section, below.

2.10.5 Environmental Conditions

Ambient Temperature	23.6°C
Relative Humidity	48.5%

2.10.6 Test Results

Result Summary

Pass / Fail Analysis (Table G.8):

	Pass / Fail
Land TTFF Success Rate $\geq$ 70%	Pass
Land Location Accuracy Pass Rate $\geq$ 70%	Pass
Maritime TTFF Success Rate $\geq$ 70%	Pass
Maritime Location Accuracy Pass Rate $\geq$ 70%	Pass
All four results must be a "Pass" for the EUT to pass, any one or more "Fails" indicates failure	

Table 30

Land Scenarios

Scenario P_{RSS} Summary Table:

Scenario #	Number of SVs	Required RSS [dBm]	Actual RSS [dBm]
1	3	-123	-123.05
2	3	-130	-130.43
3	3	-137	-137.43
4	3	-123	-123.31
5	3	-130	-130.72
7	3	-123	-123.03
8	3	-130	-130.99
13	4	-123	-123.39
14	4	-130	-130.98
15	4	-137	-137.07
16	4	-123	-123.15
17	4	-130	-130.80
19	4	-123	-123.13
20	4	-130	-130.94
25	5	-123	-123.07
26	5	-130	-130.62
27	5	-137	-137.71
28	5	-123	-123.02
29	5	-130	-130.44
31	5	-123	-123.11
32	5	-130	-130.21
34	6	-123	-123.48
35	6	-130	-130.04
36	6	-137	-137.45
37	4	-130	-130.08
38	4	-130	-130.20
39	4	-130	-130.07
40	4	-130	-130.39
41	4	-130	-130.24
42	4	-130	-130.28

Table 31

Land Scenarios Test Results (G.4):

Scenario #	TTF (min : sec)	Simulator Location	Transmitted Location	Location Error (m)
1	Fail	39° 36' N, 119° 35' W	N/A	N/A
2	Fail	39° 36' N, 119° 35' W	N/A	N/A
3	Fail	39° 36' N, 119° 35' W	N/A	N/A
4	Fail	39° 36' N, 119° 35' W	N/A	N/A
5	Fail	39° 36' N, 119° 35' W	N/A	N/A
7	Fail	39° 36' N, 119° 35' W	N/A	N/A
8	Fail	39° 36' N, 119° 35' W	N/A	N/A
13	11:45	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
14	Fail	39° 36' N, 119° 35' W	N/A	N/A
15	11:45	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
16	10:50	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
17	10:54	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
19	10:02	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
20	10:49	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
25	05:51	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
26	05:50	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
27	11:43	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
28	03:21	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
29	03:24	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
31	08:21	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
32	08:23	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
34	01:39	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
35	01:38	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
36	12:37	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
37	11:43	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
38	00:53	23° 42.01668' S 133° 53.83336' E	S 23° 42' 0" E 133° 52' 87"	102.82
39	00:52	71° 37.56666' N 128° 52.06668' E	N 71° 37.56' 0" E 128° 52.06' 0"	15.88
40	01:40	71° 37.56666' N 128° 52.06668' E	S 23° 42' 0" E 133° 52' 87"	10590833.12
41	01:38	71° 37.56666' N 128° 52.06668' E	N 71° 37.56' 0" E 128° 52.06' 0"	15.88
42	00:51	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00

Table 32

Land Scenarios Results Analysis (Table G.6):

Criteria	Limit / Condition	Result
No. of Successful Tests	TTFF $\leq$ 13 minutes	21
Total No. of Land Scenarios	30	N/A
TTFF Percentage Success Rate	(No. Successful Tests / 30) $\times$ 100	72.4
TTFF Pass / Fail Limit	$\geq$ 70%	N/A
No of Locations with Errors	$\leq$ 650 m	21
No of Scenarios with Locations	Enter result	22
Location Accuracy Percentage Pass Rate	(No Locations Errors $\leq$ 30 m / No Scenarios with Location) $\times$ 100	95.5%
Location Accuracy Pass / Fail Limit	$\geq$ 70%	N/A

Table 33

Maritime Scenarios

General Note: The standard contains some contradictions, specifically regarding simulated positions. Testing was carried out in accordance with the Maritime Scenario Tables (G.11) because they are most accurate when compared to the official scenarios downloaded from the Spirent website. Where changes were made to the result templates, original values are stricken out.

Scenario P_{RSS} Summary Table:

Scenario #	Number of SVs	Required RSS [dBm]	Actual RSS [dBm]
1	7	-130	-130.27
2	7	-130	-131.54
7	7	-130	-130.32
8	7	-130	-130.32
9	7	-130	-130.42
12	7	-130	-130.35
13	6	-130	-130.19
14	6	-130	-130.48
16	6	-130	-130.21
18	6	-130	-130.28
20	6	-130	-130.08
22	6	-130	-130.24
26	7	-130	-130.60
30	7	-130	-130.76
32	7	-130	-130.29
34	7	-130	-130.73
36	7	-130	-130.76
37	7	-130	-130.74
38	7	-130	-130.72
39	7	-135	-135.30

Table 34

Maritime Scenarios Test Results G.5:

Scenario #	TTFF (min : sec)	Simulator Location	Transmitted Location	Location Error (m)
1	00:48	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
2	00:48	0° 0' N, 0° 0' E	S 0° 0' 0" E 0° 0' 0"	0.00
6	01:40	80° 0' N, 0° 0' E	N 80° 0' 0" E 0° 0' 0"	0.00
7	01:38	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
8	00:00	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
9	Fail	0° 0' N, 0° 0' E	N/A	N/A
12	02:27	80° 0' N, 0° 0' E	N 80° 0' 0" E 0° 0' 0"	0.00
13	00:55	80° 0' N, 0° 0' E	N 80° 0' 0" E 0° 0' 0"	0.00
14	03:21	80° 0' N, 0° 0' E	N 80° 0' 0" E 0° 0' 0"	0.00
16	01:39	80° 0' N, 0° 0' E	N 80° 0' 0" E 0° 0' 0"	0.00
17	02:28	80° 0' N, 0° 0' E	N 80° 0' 0" W 0° 0' 0"	0.00
18	08:20	80° 0' N, 0° 0' E	N 80° 0' 0" E 0° 0' 0"	0.00
20	00:48	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
22	01:38	0° 0' N, 0° 0' E	S 0° 0' 0" W 0° 0' 0"	0.00
24	01:41	0° 0' N, 0° 0' E	S 0° 0' 0" W 0° 0' 0"	0.00
26	02:28	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
28	01:40	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
30	01:42	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
32	01:37	0° 0' N, 0° 0' E	S 0° 0' 0" W 0° 0' 0"	0.00
33	01:40	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
34	09:10	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
35	01:40	0° 0' N, 0° 0' E	N 0° 0' 0" E 0° 0' 0"	0.00
36	02:30	0° 0' N, 0° 0' E	S 0° 0' 0" W 0° 0' 0"	0.00
37	01:40	44° 0' S, 175° 0' E	S 44° 3' 0" E 174° 9' 0"	0.00
38	00:55	47° 0' N, 8° 0' E	N 47° 21' 0" W 8° 27' 0"	0.00
39	02:32	0° 0' N, 0° 0' E	S 0° 0' 0" E 0° 0' 0"	0.00

Table 35

Maritime Scenarios Results Analysis (G.7):

Criteria	Limit / Condition	Result
No. of Successful Tests	TTFF $\leq$ 13 minutes	25
Total No. of Maritime Scenarios	26	N/A
TTFF Percentage Success Rate	(No. Successful Tests / 26) $\times$ 100	96.2
TTFF Pass / Fail Limit	$\geq$ 70%	N/A
No of Locations with Errors	$\leq$ 650 m	25
No of Scenarios with Locations	Enter result	25
Location Accuracy Percentage Pass Rate	(No Locations Errors $\leq$ 30 m / No Scenarios with Location) $\times$ 100	100
Location Accuracy Pass / Fail Limit	$\geq$ 70%	N/A

Table 36

2.10.7 Test Location and Test Equipment Used

This test was carried out in Chamber 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Directional Coupler	Narda	3022	503	-	O/P Mon
GPS/SBAS Simulator	Spirent	STR4500	3056	0	09-Oct-2018
Cable(3m, SMA(m) - SMA(m))	Reynolds	262-0248-3000	2402	12	19-Sep-2018
Hygrometer	Rotronic	I-1000	2882	12	29-Nov-2018
Beacon Tester	WS Technologies	BT100S	3263	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	20-Sep-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019

Table 37

TU = Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

3 Photographs

3.1 Equipment Under Test (EUT)



4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Frequency Error	± 11 Hz
Modulation Duty cycle	± 5%
Modulation Factor	± 5%
Peak Equivalent Isotropic Radiated Power	± 5.2 dB
Spurious Emissions	± 3.45 dB

Table 38



Product Service

ANNEX A

MANUFACTUER SUPPLIED IFORMATION



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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.



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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 - Cyclopedia	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	Cyclopedia 1200	Identical on all beacon variants
Cover moulding	Cyclopedia 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





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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.

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RTCM 10010.2 PLB Labelling statement

RTCM states that :

All labeling essential to the safe and effective operation of the PLB shall be in high contrast to the background of the text or pictograph. Labeling and Pictograph instructions essential to the safe and effective operation of the PLB shall be sized such that they are readable by persons having 20/20 normal vision at a minimum viewing distance of 150 mm with illumination no greater than 0.3lux.

Essential to safe and effective operation:

- Lever label pictographs
- LED feedback pictograph on product label
- ON button keypad
- Antenna label text

Lux meter was set-up in a screened room and the light level adjusted but leaving the door slightly opened. The beacon was placed on the table next to the light sensor.

Six suitable persons (3 women / 3 men) were selected to perform the test. With a light level at 0.3lux the group found it possible to read all the operation guides listed above at a distance exceeding 150mm and to activate the ON button of the PLB beacon





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RTCM 11010.2 battery statement

RTCM standard requires the PLB manufacturer to establish a useful life and expiration date for batteries.

The battery pack pre-discharge evaluation has been performed with:

- 2 years battery pack of maximum shelf life
- 12 years beacon battery pack replacement period

Operating Lifetime Battery Pre-discharge Calculation

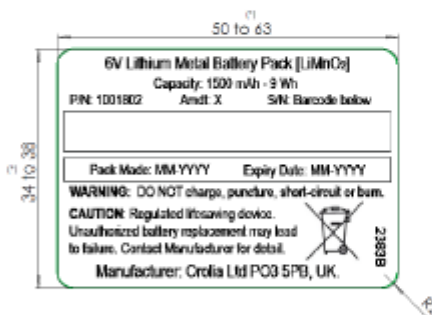
Characteristic	Designation	Units	Value	Comments
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	T _{DS} or TCS	Years	2	max shelf life
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	T _{BP} or TER	Years	12	useful life

RTCM operating life testing has been performed with the values above and complies with the Cospas Sarsat 24 hours of operating lifetime required for PLBs. The test results are presented in the RTCM test report 75942209-07.

PLB label includes battery pack manufacturing date and expiry date.

Battery pack manufacturing instructions includes dates of :

- Battery cell manufacturing
- Battery pack sales limit
- Battery pack expiry date



NOTES:

- Amdt : Amendment reference of part number (see order).
- S/N : Serial number, Chronological number, barcode code 38, height: 5 mm rate: 3.
- Pack Made : Manufacturing date of the battery pack (MM for month YYYY for year).
- Expiry Date : Manufacturing date of cells + 7 years (MM for month YYYY for year).



With tests results and manufacture instruction, we ensure the compliance with RTCM requirement

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