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Report On

Emergency Beacons Testing of the
Breitling SA EMERGENCY with
Prollion LI-ION Rechargeable Battery Pack
In accordance with Cospas-Sarsat IP (LIRB) Rev.2

Document 75924041 Report 02 Issue 4 February 2014

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REPORT ON

Emergency Beacons Testing of the
Breitling SA EMERGENCY with
Prollion LI-ION Rechargeable Battery Pack

Document 75924041 Report 02 Issue 4

February 2014

PREPARED FOR

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DATED 13 February 2014

UKAS TESTING 0141

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SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
Breitling SA EMERGENCY with
Prollion LI-ION Rechargeable Battery Pack

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the Breitling SA EMERGENCY with Prollion LI-ION Rechargeable Battery Pack to the requirements of Cospas-Sarsat IP (LIRB) Rev.2

Objective	To perform Emergency Beacon Testing (LIRB) to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Prollion
Model Number(s)	1INP6/34/38
Serial Number(s)	S/N#330 (TUV ref: TSR006) S/N#327 (TUV ref: TSR007) S/N#326 (TUV ref: TSR008) S/N#325 (TUV ref: TSR009) S/N#334 (TUV ref: TSR010)
Number of Samples Tested	5
Test Specification/Issue/Date	Cospas-Sarsat IP (LIRB) Rev.2
Date of Receipt of Test Samples	03 June 2013
Order Number Date	QAF (Quote139094) 13 May 2013
Start of Test	12 June 2013
Finish of Test	09 October 2013
Name of Engineer(s)	M Hardy

1.2 LIRB APPLICATION FORM

Beacon Characteristics (for rechargeable batteries) – BREITLING EMERGENCY

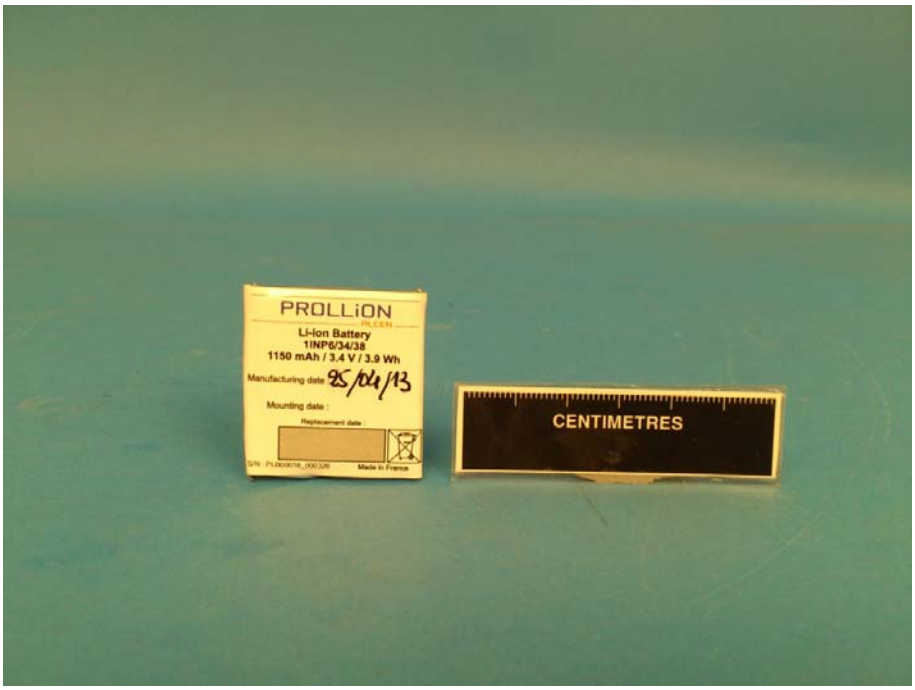
Characteristic	**Specification**
Operating temperature range	Tmin = -20°C Tmax=55°C
Operating lifetime	18 Hours
Battery chemistry	Li-Ion NMC / Si
Battery cell model name, size and number of cells	1INP63438 Size 34x37x5,9mm / 1 cell
Battery cell manufacturer	PROLLION, GRENOBLE, FR
Battery pack manufacturer and part number	PROLLION, GRENOBLE, FR S/N=PLB-00018
Initial capacity of new battery after first charge	*1150 mAh*
Required capacity to meet the operating life time at minimum temperature	*860mAh*
Battery replacement life time	*24 Months = 2 Years*
Charge indication	☒ *Visual /* ☐ *Audio* ☒ *In Normal Mode /* ☒ *Not in Normal mode* ☒ *Charge Ongoing* ☒ *Charge Complete* *Type : External charger with LED (see description in the user manual)*
Time Between Recommended Charges at ambient temperature (TBRC)	*2 Months*
$T_{wake\text{-}up}$ *(wake-up period to check battery)*	*0.25Days (6 Hours)*
$R_{discharge}$ *(resistor for discharge process)*	*21 Ω*
Reversible losses between TBRC: $C_{reversible\_losses}$	*1.7 %*
Voltage drop after TBRC: $V_{partial\_discharge\_mean}$	*0.12 V*
Irreversible losses during TBRC: $C_{irreversible\_losses\_between\_TBRC}$	*2.0 %*
Activation Energy Ea	*36 341* J.mol^{-1}
Test temperature (if applicable) for measurement of irreversible capacity loss during storage	*34 °C -*
Worst Case Life Time (WCLT)	*4 Months*
Irreversible losses in ***two-year storage****:* $C_{irreversible\_loss\_in\_storage}$	*3.5 % This is the* ***value for one-year storage****, as the maximum storage duration is one year.*
Test temperature (if applicable) for measurement of irreversible capacity loss in standby mode	*50 °C*
Irreversible losses in standby mode over replacement life time: $C_{irreversible\_loss\_in\_standby\_mode}$	*7 %*
Measured operating life time in Worst Case Life Time configuration	*>18 Hours*
Battery Charger	
$I_{charge\_initial}$	*200 mA*
I_{charge_final}	*20 mA*
$V_{charge\_initial}$	*2.5 V*
V_{charge_final}	*4.2 V*
Charge time : t_{end_charge}	*Up to 360 Min (6 Hours)*
Charge capacity	*1150 mAh*
Oscillator type (e.g. OCXO, MCXO, TCXO) …	TCXO

Characteristic	Specification	
Self-Test Mode Characteristics:	Self-Test Mode	Optional GNSS Self-Test Mode
[…]		
- Maximum number of GNSS Self-Tests (beacons with internal navigation devices only)	N/A	N/A
- *Self-test automatically activated after each charge process (for beacon using rechargeable batteries)*	YES	N/A

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Prollion LI-ION Rechargeable Battery Pack as shown in the photograph below as installed in the Breitling SA EMERGENCY. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test

1.3.2 Physical Test Configuration

The Equipment Under Test (EUT) was fitted to a manufacturer supplied charging fixture (see photographs, Section 4), for the Verification of Reversible and Irreversible Capacity Losses test.

For the Charger Test Procedure for CCCV Charge Process test, the EUT was fitted inside a Breitling Emergency PLB.

1.3.3 Modes of Operation

Modes of operation of the EUT during testing were as follows:

Verification of Reversible and Irreversible Capacity Losses

Charging
- EUT fitted inside manufacturer supplied charging fixture
- Charging fixture connected to DC Power Supply at 4.2Vdc/200mA

Discharging
- EUT fitted inside manufacturer supplied charging fixture
- Measurement setup as shown in test results section 2.1.6

Charger Test Procedure for CCCV Charge Process
- EUT fitted inside Breitling Emergency PLB
- Breitling Emergency PLB fitted to manufacturer supplied charging unit (See Photographs, Section 4).

All measurements were made using an ADC-16 Data Logger with 'Windows PicoLog' software, Release 5.21.9.

1.4 MODIFICATIONS

No modifications made to the EUT during the test programme.

1.5 REPORT MODIFICATION RECORD

Issue 1 – First Issue
Issue 2 – Test results table and conclusions amended.
Issue 3 – Manufacturer battery data updated. Summary table and observations updated. Battery data sheet added to annex A.
Issue 4 – Manufacturer battery data updated.

Product Service

SECTION 2

TEST DETAILS

Emergency Beacons Testing of the
Breitling SA EMERGENCY with
Prollion LI-ION Rechargeable Battery Pack

TEST RESULTS TABLE

Parameters to be Measured	Range of Specification		Units	Test Results	Comments
1. Verification of Reversible and Irreversible Capacity Losses					See Observations below
1INP63438, S/Nos: 330, 327, 326, 325, 334 TUV Ref: TSR6, TSR7, TSR8, TSR9, TSR10, Modification State 0					
Reversible Loss between charges	Manufacturer declaration	1.7	%	1.11	
Irreversible Loss between charges	Manufacturer declaration	2.0	%	1.78	
2. Charger Test Procedure for CCCV Charge Process					See Observations below
1INP63438, S/N: 334 TUV Ref:TSR10, Modification State 0					
$I_{charge\_initial}$	Manufacturer declaration	200	mA	205.5	
I_{charge_final}	Manufacturer declaration	20	mA	21.8	
$V_{charge\_initial}$	Manufacturer declaration	2500	mV	3285.8	
V_{charge_final}	Manufacturer declaration	4200	mV	4199.67	
Applied Charge	Manufacturer declaration	>1150	mAh	1260.1	Must be ≥ Manufacturer declared charge capacity of 1150 mAh

Observations

Based on the results found in sections 2.1 and 2.2 of this report, the following conclusions can be made for the batch of 5 batteries supplied for testing:

- The Reversible loss results are within the Manufacturer declaration figure of 1.7 %
- The Irreversible loss figures are within the Manufacturer declaration of 2.0 %
- The $I_{charge\_initial}$ figure exceeds the Manufacturer declaration of 200mA by 2.75 %
- The I_{charge_final} figure exceeds the Manufacturer declaration of 20mA by 9 %
- The $V_{charge\_initial}$ figure exceeds the Manufacturer declaration of 2.5 V by 31.4 %
- The V_{charge_final} figure is lower than the Manufacturer declaration of 4.2 V by 0.008 %
- The Applied Charge is greater than the Manufacturer declared charge capacity

2.1 VERIFICATION OF REVERSIBLE AND IRREVERSIBLE CAPACITY LOSSES

2.1.1 Specification

Cospas-Sarsat IP (LIRB) Rev.2

2.1.2 Equipment Under Test and Modification State

1INP63438, S/Nos: 330, 327, 326, 325, 334 TUV Ref: TSR6, TSR7, TSR8, TSR9, TSR10, Modification State 0

2.1.3 Date of Test

12 June 2013 to 11 September 2013

2.1.4 Test Equipment Used

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

2.1.5 Environmental Conditions

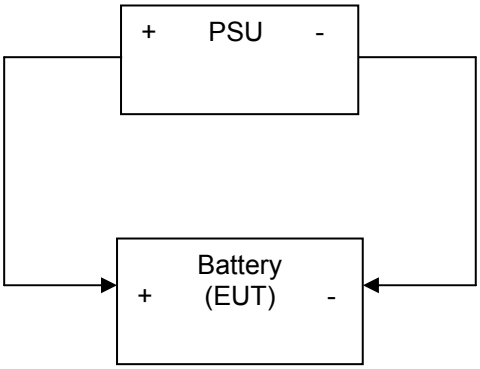
Ambient Temperature 21.5 °C - 22.0 °C
Relative Humidity 41.7 % - 66.2 %

2.1.6 Test Results

Test Setup

Note: The procedure below was carried out on 5 samples of the EUT.

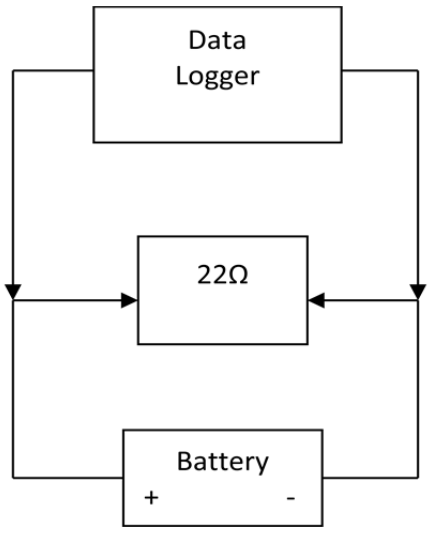
Battery Charge



Initially, the EUT was set up as shown above. The power supply was set to 4.2 Vdc with the current limit set to 200mA. During charging, the EUT drew 200mA, until the voltage reached 4.2V. The EUT was considered fully charged once the current had reduced to I_{charge_final} (as stated in the data supplied by the manufacturer).

The EUT was stored in a climate controlled chamber at 22°C for the period TBRC (62 days).

Battery Discharge (Capacity)



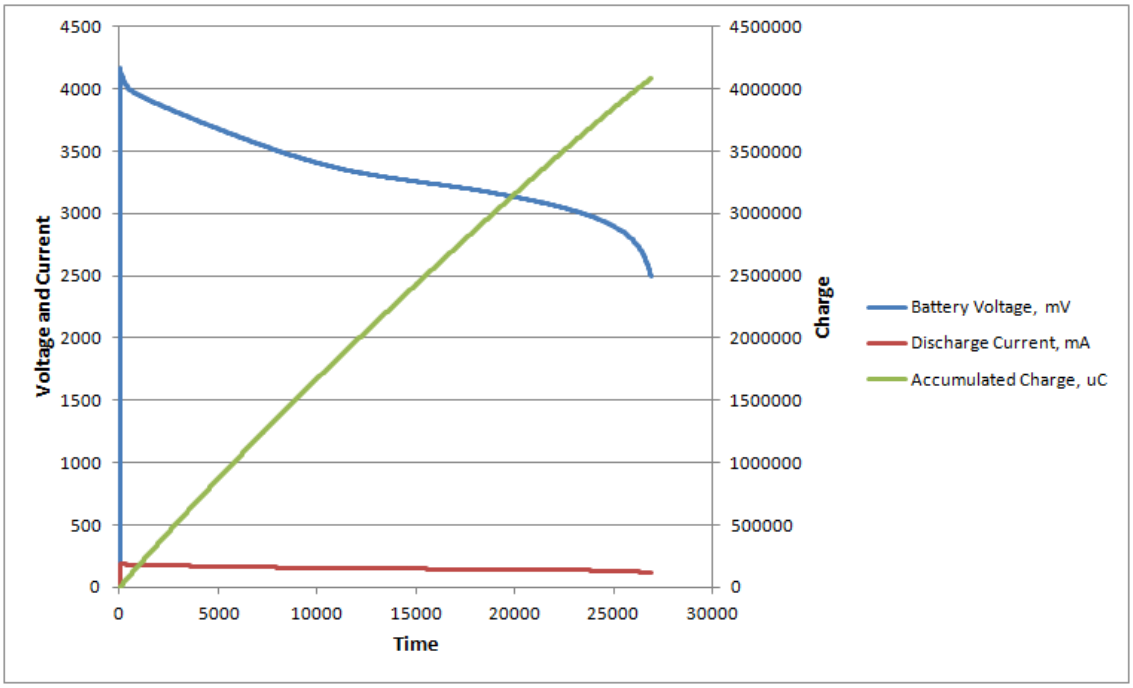
The EUT was configured as shown in the diagram above. The charge capacity of the EUT was measured at the intervals shown in the table below. The EUT was considered 'discharged', once the voltage had dropped to Vmin (as stated by the manufacturer)

Charger (Battery) TSR	Battery S/N	Initial Charge date	Initial Voltage	Discharge date (t0)	Capacity (t0) mAh	Recharge date	Voltage (Vdc)	TBRC (62days) date	Voltage (t0+TBRC)	Capacity (t0+TBRC)	Recharge date	Discharge date (Final Capacity)	Final Capacity mAh
001 (006)	330	12/06/13	4.2 V	13/06/13	1141.75	18/06/13	4.20	19/08/13	4.06	1105.62	22/08/13	23/08/13	1100.81
002 (007)	327	21/06/13	4.2 V	24/06/13	1134.44	25/06/13	4.20	26/08/13	4.04	1093.09	29/08/13	30/08/13	1102.27
003 (008)	326	24/06/13	4.2 V	01/07/13	1141.48	02/07/13	4.20	02/09/13	4.08	1111.00	03/09/13	03/09/13	1136.57
004 (009)	325	01/07/13	4.2 V	02/07/13	1123.98	03/07/13	4.20	03/09/13	4.07	1084.17	04/09/13	05/09/13	1102.18
005 (010)	334	07/07/13	4.2 V	08/07/13	1143.62	09/07/13	4.20	09/09/13	4.07	1127.41	10/09/13	11/09/13	1142.29
Average					1137.05					1104.26			1116.82

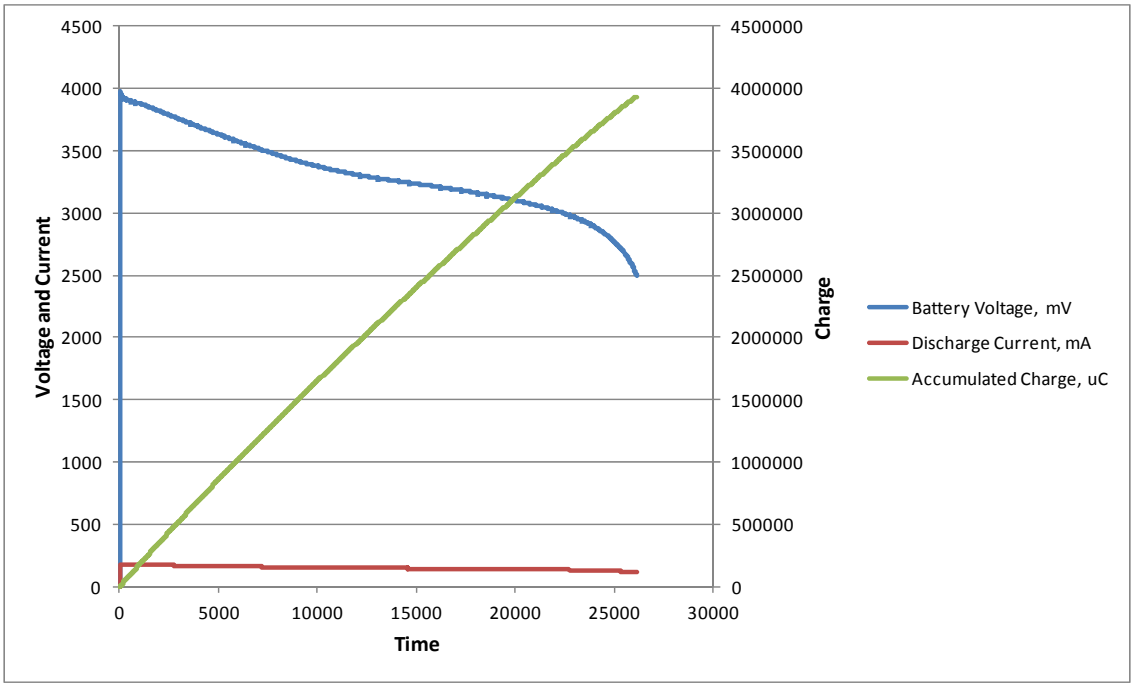
C0_mean_lab	C1_mean_lab	C2_mean_lab	Rev Loss between charges	IRRev Loss between charges
1137.05	1104.26	1116.82	12.56	20.23
			(1.11%)	(1.78%)

Example Capacity Measurement Plots (TSR007)

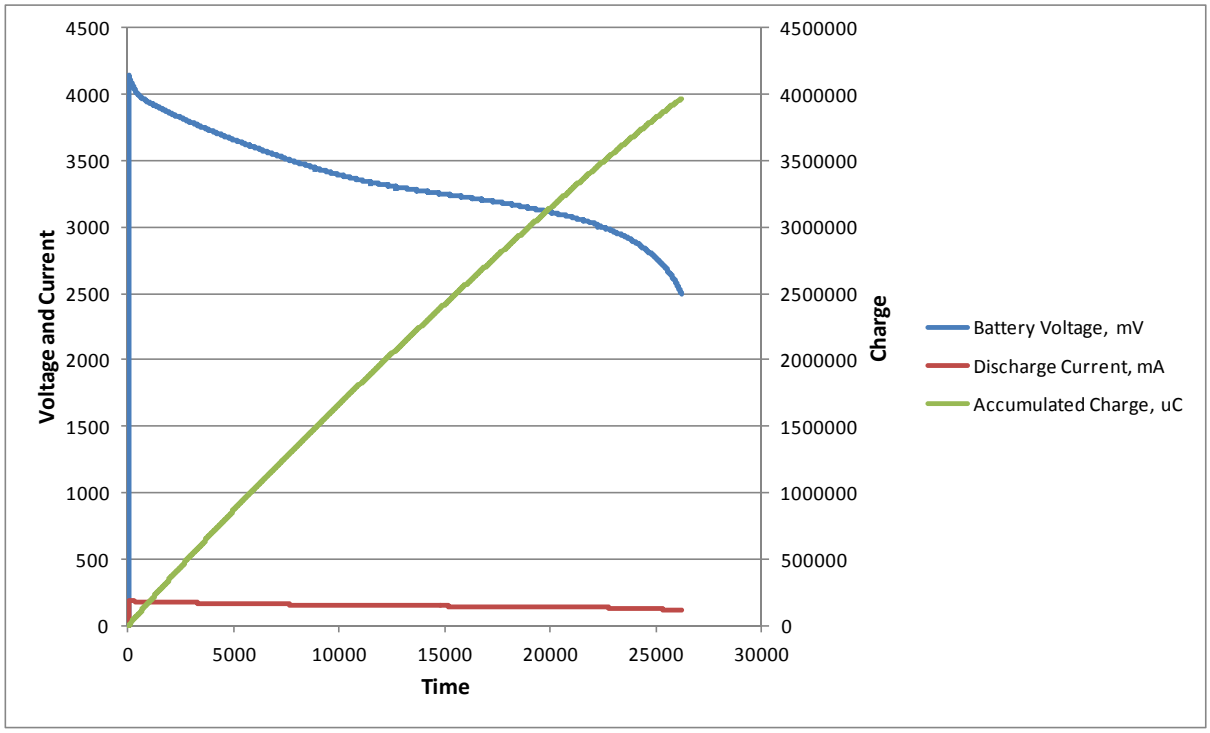
Initial Capacity (t0)



Capacity after TBRC (t0+TBRC)



Final Capacity



2.2 CHARGER TEST PROCEDURE FOR CCCV CHARGE PROCESS

2.2.1 Specification

Cospas-Sarsat IP (LIRB) Rev.2

2.2.2 Equipment Under Test and Modification State

1INP63438, S/N: 334 TUV Ref: TSR10, Modification State 0

2.2.3 Date of Test

08 & 09 October 2013

2.2.4 Test Equipment Used

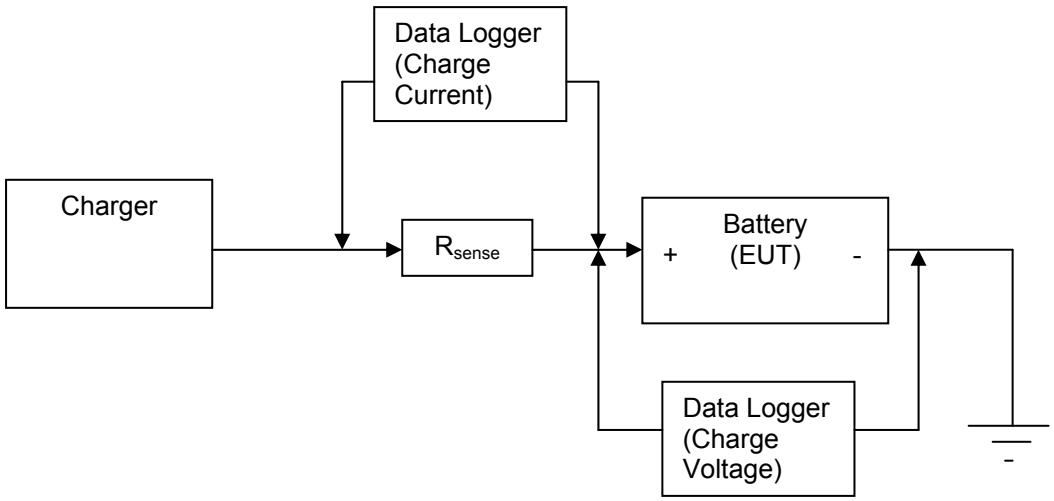
The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Environmental Conditions

Ambient Temperature 19.9 °C - 22.6 °C
Relative Humidity 46.6 % - 60.1 %

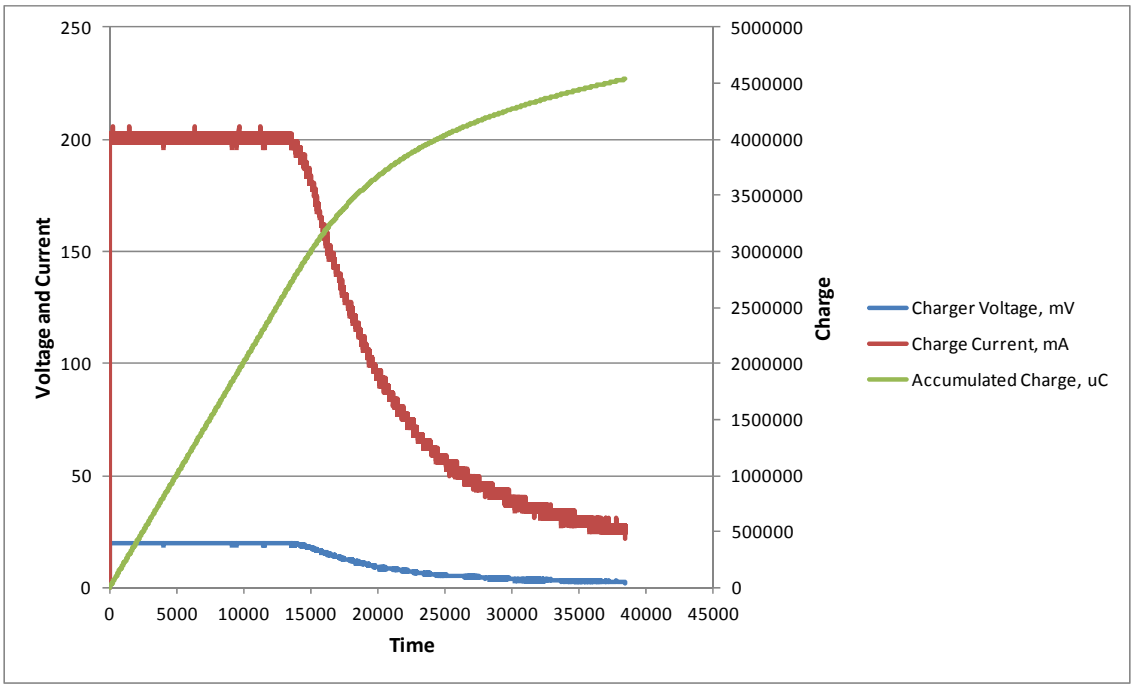
2.2.6 Test Results

Test Set-up



The EUT was configured as shown in the set up above. An EUT that had previously been discharged (as described in section 2.1) was fitted into a Breitling Emergency Watch (PLB), and placed in the charging unit. The charging unit was fitted with a 0.1 Ω resistor (Rsense) to allow charge currents to be monitored throughout the charging process. The results are presented below. Note – the end of the test was considered as when the first instance of Imin occurred.

Charger Current

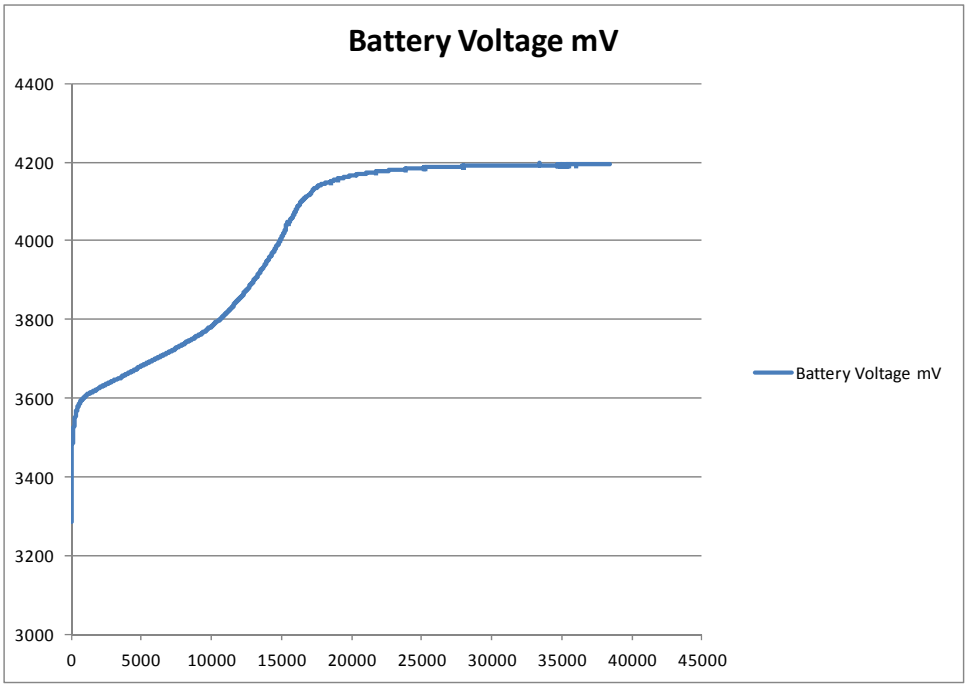


Measurement Data Summary

Duration	38430 10.7	Seconds Hours
Resistor	0.09805	Ω
Average I	118.04	mA
Peak I	205.5	mA
Min I	21.8	mA
Total Q	4536295	uC
Total Q	1.2601	Ah

In all cases, the measurement sampling interval was 5 seconds.

Charger Voltage



Measurement Data Summary

Duration	38430 10.7	Seconds Hours
Average V	118.04	mV
Peak V	4199.67	mV
Min V	3285.87	mV

In all cases, the measurement sampling interval was 5 seconds.

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT

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

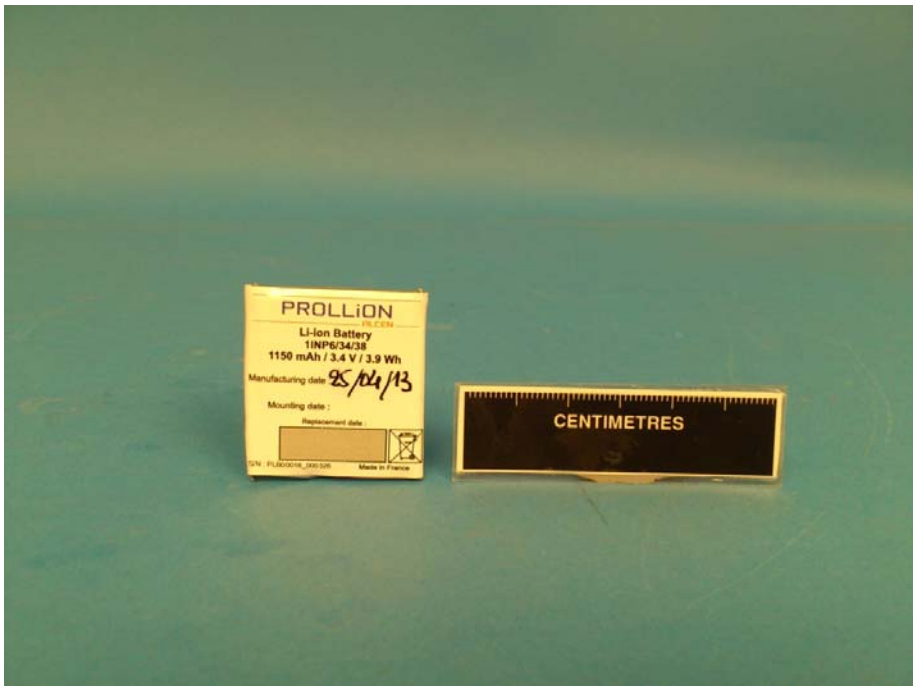
Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Sections 2.1 and 2.2					
Hygrometer	Rotronic	I-1000	1386	12	18-Apr-2014
Multimeter	Iso-tech	IDM101	2424	12	12-Sep-2014*
Power Supply	Iso-tech	IPS 2010	2440	-	O/P Mon
8 Channel Datalogger + Terminal Board	Pico Technology Ltd	ADC-16	3287	12	13-Dec-2013

* The previous calibration date on this test equipment was 12-Sep-2013.
OP MON – Output Monitored with Calibrated Equipment

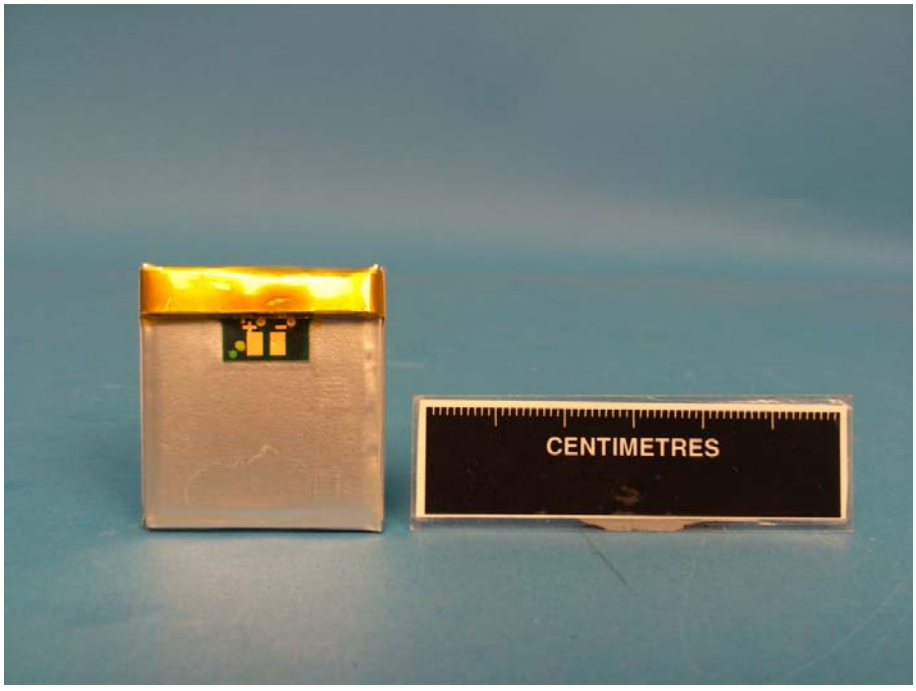
SECTION 4

PHOTOGRAPHS

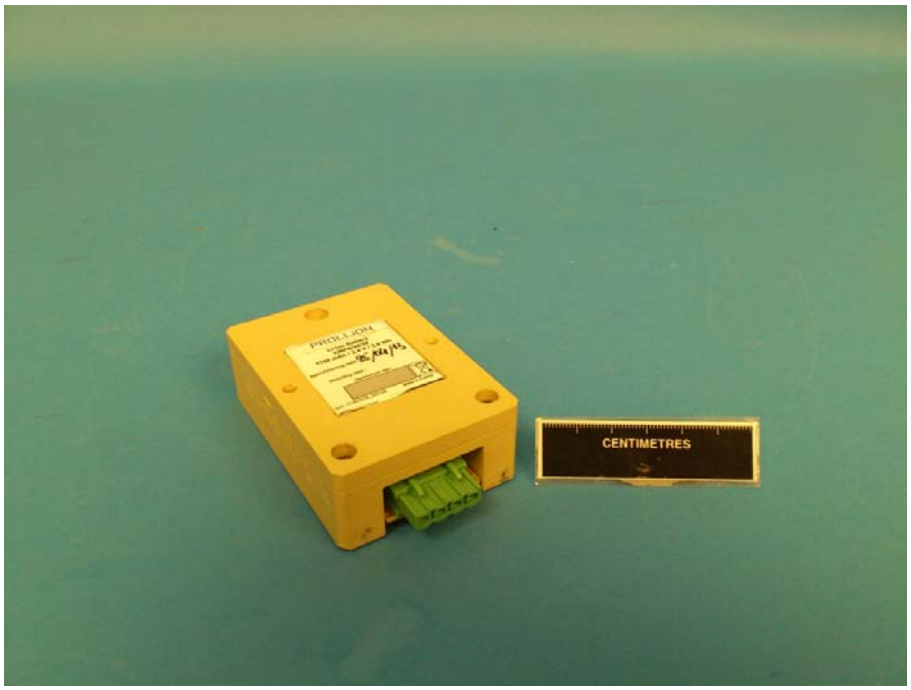
4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



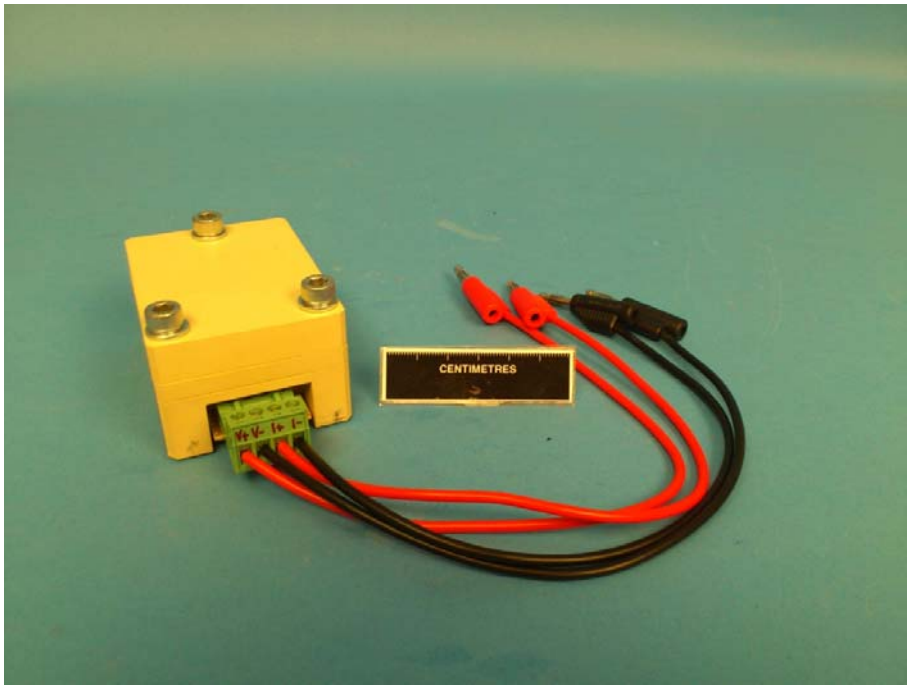
Front View



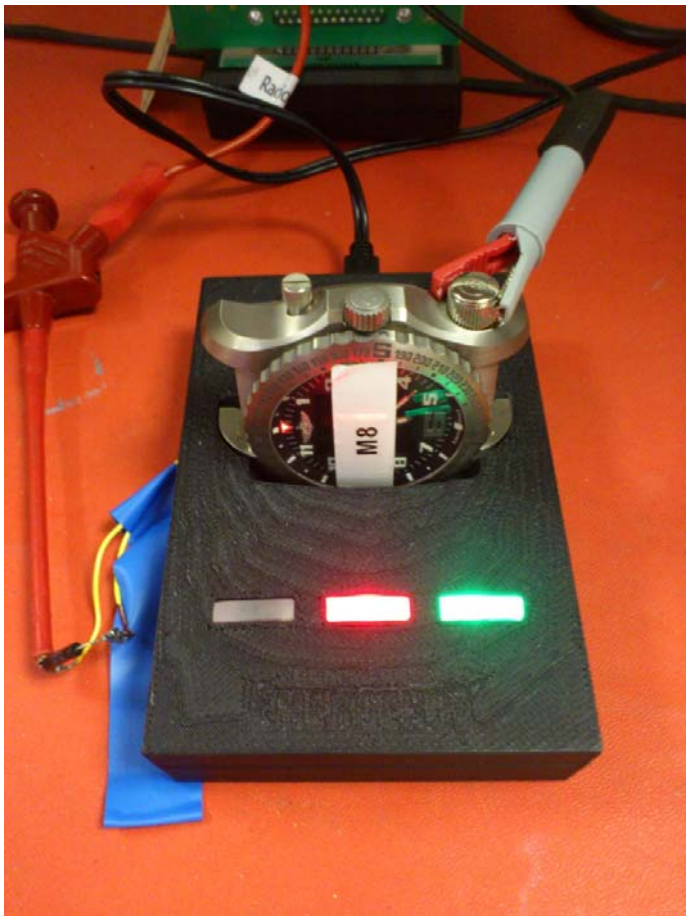
Rear View



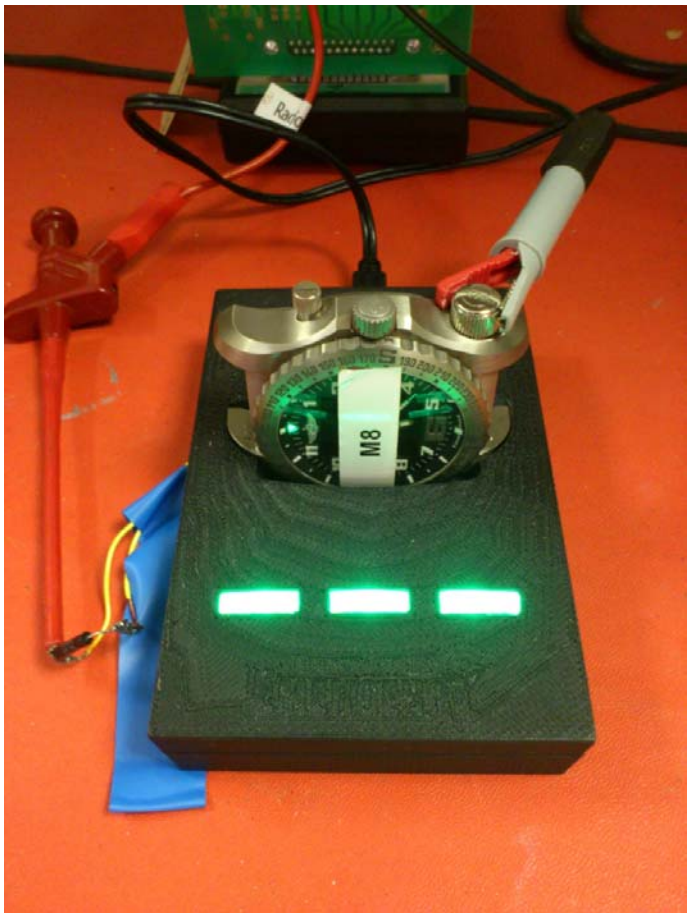
EUT in Charging Fixture



Charging Fixture



Breitling Emergency PLB with Charging Unit
Red LED - Charging



Breitling Emergency PLB with Charging Unit
Green LED – Fully Charged

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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

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

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

ANNEX A

CUSTOMER SUPPLIED INFORMATION

Product Service

APPLICATION FORM

Beacon Manufacturer and Beacon Model

Beacon Manufacturer	BREITLING SA
Beacon Model	EMERGENCY
Other Model Names	

Beacon Type and Operational Configurations

Beacon Type	**Beacon used while:**	**Tick where appropriate**
EPIRB	Floating in water or on deck or in a safety raft	☐
PLB	On ground and above ground	☐
	On ground and above ground and floating in water	☐
ELT Survival	On ground and above ground	☐
	On ground and above ground and floating in water	☐
ELT Auto Fixed	Fixed ELT with aircraft external antenna	☐
ELT Auto Portable	In aircraft with an external antenna	☐
	On ground, above ground, or in a safety raft with an integrated antenna	☐
ELT Auto Deployable	Deployable ELT with attached antenna	☐
Other (specify)	above ground	☒

Beacon Characteristics

Characteristic	**Specification**
Operating frequency	406,040 MHz and 121,500 MHz
Operating temperature range	Tmin = -20 °C Tmax = +55 °C
Operating lifetime	18 Hrs
Beacon power supply type (internal, external, combined, other)	Internal
External power supply parameters (AC/DC and nominal voltages)	N/A
Is external power supply needed to energise the beacon or its ancillary devices in any of operation modes (Y/N or Yes of No)	No
Battery cell chemistry	Li-Ion NMC / Si
Battery cell model name, size and number of cells in a battery pack, and details of the battery pack electrical configuration	1INP63438 Size 34x37x5,9mm / 1 cell Battery pack configuration : 1P1S
Battery cell manufacturer	PROLLION, GRENOBLE, FR

Characteristic	Specification
Battery pack manufacturer and part number	PROLLION, P/N: PLB-00018
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	1 year
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	2 years
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	RAKON UK Ltd in the Lincoln, UK
Oscillator part name and number	E5829LF
Oscillator satisfies long-term frequency stability requirements (Yes or No)	YES
Antenna type: Integral or Other (e.g. External, Detachable – specify type)	Integrated
Antenna manufacturer	BREITLING
Antenna part name and number	Antenne 406 - 121.5 MHz, P/N: 109.024
Navigation device type (Internal, External or None)	None
Features in beacon that prevent degradation to 406 MHz signal or beacon lifetime resulting from a failure of navigation device or failure to acquire position data (Yes, No, or N/A)	N/A
Features in beacon that ensures erroneous position data is not encoded into the beacon message (Yes, No or N/A)	N/A
Navigation device capable of supporting global coverage (Yes, No or N/A)	N/A
For Internal Navigation Devices	N/A
- Geodetic reference system (WGS 84 or GTRF)	N/A
- GNSS receiver cold start forced at every beacon activation (Yes or No)	N/A
- Navigation device manufacturer	N/A
- Navigation device model name and part Number	N/A
- Internal navigation device antenna type (integrated, internal, external, passive/active), manufacturer and model	N/A
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	N/A
For External Navigation Devices	N/A
- Data protocol for GNSS receiver to beacon interface	N/A
- Physical interface for beacon to navigation device	N/A
- Electrical interface for beacon to navigation device	N/A
- Part number of the external navigation interface	N/A

Characteristic	Specification	
device (if applicable)		
- Navigation device model and manufacturer (if beacon designed to use specific devices)	N/A	
Self-Test Mode Characteristics	Self-Test Mode	Optional GNSS Self-Test Mode
- Self-test has separate switch position (Yes or No)	No	N/A
- Self-test switch automatically returns to normal position when released (Yes or No)	N/A	N/A
- Self-test activation can cause an operational mode transmission (Yes or No)	No	N/A
- Self-test causes a single beacon self-test message burst only regardless of how long the self-test activation mechanism applied (Yes or No)	Yes	N/A
- Results of self-test indicated by (e.g. Pass / Fail Indicator Light, Strobe Light, etc.)	Red/green Light	N/A
- The content of the encoded position data fields of the self-test message has default values	N/A	N/A
- Self-test can be activated from beacon remote activation points (Yes or No)	No	N/A
- Self-test performs an internal check and indicates that RF power emitted at 406 MHz and 121.5 MHz if beacon includes a 121.5 MHz homer (Yes or No)	Yes	N/A
- Self-test transmits a signal(s) other than at 406 MHz (Yes & details or No)	No	N/A
- Self-test can be activated directly at beacon (Yes or No)	No	N/A
- List of Items checked by self-test		N/A
- Self-test transmission burst duration (440 or 520 ms)	440	
- Self-test format bit (“0” or “1”)	0	
- Maximum duration of Self Test	3s	N/A
- Maximum number of GNSS Self Tests (beacons with internal navigation devices only)	N/A	
- Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No)	Yes	
- Maximum number of self-tests during battery pack replacement period	Min. 12 (Each two months) Max. is not determined because self test carry out each full battery charge.	N/A
- List all methods of Self-test mode and GNSS Self-test mode activation. Provide details on a separate sheet, if insufficient space to describe		

Characteristic	Specification	
Message Coding Protocols:	(x) Tick the boxes below against the intended protocol options	
User Protocol (tick where appropriate)	☐	Maritime with MMSI
	☐	Maritime with Radio Call Sign
	☐	EPIRB Float Free with Serial Number
	☐	EPIRB Non Float Free with Serial Number
	☐	Radio Call Sign
	☐	Aviation
	☐	ELT with Serial Number
	☐	ELT with Aircraft Operator and Serial Number
	☐	ELT with Aircraft 24-bit Address
	☒	PLB with Serial Number
	☐	National (Short Message Format)
	☐	National (Long Message Format)
Standard Location Protocol (tick where appropriate)	☐	EPIRB with MMSI
	☐	EPIRB with Serial Number
	☐	ELT with 24-bit Address
	☐	ELT with Aircraft Operator Designator
	☐	ELT with Serial Number
	☐	PLB with Serial Number
National Location Protocol (tick where appropriate)	☐	National Location: EPIRB
	☐	National Location: ELT
	☐	National Location: PLB
RLS Location Protocol (tick where appropriate) [1]	☐	EPIRB
	☐	ELT
	☐	PLB
User Location Protocol (tick where appropriate)	☐	Maritime with MMSI
	☐	Maritime with Radio Call Sign
	☐	EPIRB Float Free with Serial Number
	☐	EPIRB Non Float Free with Serial Number
	☐	Radio Call Sign
	☐	Aviation
	☐	ELT with Serial Number
	☐	ELT with Aircraft Operator and Serial Number
	☐	ELT with Aircraft 24-bit Address
	☐	PLB with Serial Number

[1] RLS protocols will be effective as of 1 November 2014. The use of RLS-enabled beacons will be regulated by national administrations. Since the RLS functionality might affect the 406 MHz beacon performance, amendments to the type approval procedure for these beacons could be required. Beacon manufacturers should consult the Cospas-Sarsat Secretariat before undertaking the type approval of RLS-enabled beacon models.

Characteristic	Specification
Beacon includes a homer transmitter (Yes or No)	Yes
-Homer transmitter(s) frequency	121.500 MHz
-Homer transmitter(s) Power	15 dBm
-Homer transmitter(s) Duty Cycle	33%
-Duty Cycle of Homer Swept Tone	35%
Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon's repetition periods are not synchronised closer than a few seconds over 5 minute period, and the time intervals between transmissions are randomly distributed on the interval 47.5 to 52.5 seconds (Yes or No)	Yes
Other ancillary devices (e.g. voice transceiver, remote control, external audio and light indicators, external activation device). List details on a separate sheet if insufficient space to describe.	Charger
Beacon includes automatic activation mechanism (Yes or No) Specify type of automatic beacon activation mechanism	Yes The 121.5MHz transmitter is cut off under 0°C to allow the best OLT for 406MHz at low temperature
Beacon includes features and functions not listed above, related or nonrelated to 406 MHz (Yes or No) List features and use a separate sheet if insufficient space	No
Beacon model hardware part number (P/N) and version	Spin5-PCB-Emergency-Watch-II
Beacon model software/firmware P/N and version, date of issues/releases	P/N :breitling_7.15 Version: 7.15 Release: 29th Aug 2013
Beacon model printed circuit board P/N and version	P/N : CIU_B001390 Version : 4A

Dated: October 4th 2013 October 4th, 2013.

BREITLING
P.O. BOX 1132
2540 GRENCHEN
SWITZERLAND

Signed: Jean-Paul GIRARDIN - Vice President
(Name, Position and Signature of Beacon Manufacturer Representative)

PROLLiON
ALCEN

Technical Data Sheet

EnerSi 250 battery

Ref : T11-0041
Rev : 05
Date : 10/02/2014

Product type Rechargeable Li-ion battery
Reference 1INP63438
Electrochemistry NMC / Si

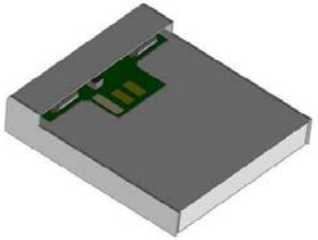
Electrical characteristics

Nominal voltage*	(V)	3.40
Nominal capacity*	(Ah)	1.15
Minimum capacity*	(Ah)	1.09
Nominal energy*	(Wh)	3.9
Specific energy*	(Wh/kg)	240
Energy density*	(Wh/dm^3)	480
Specific power**	(W/kg)	962
Power density**	(W/dm^3)	961

*under 230 mA after charge at 4.2 V
** 30 s peak 50% DOD

Mechanical characteristics

Thickness (max)	(mm)	5.95
Width (max)	(mm)	34.0
Height (max)	(mm)	37.4
Volume	(cm^3)	8
Typical weight	(g)	16



Operating conditions

End charge voltage	(V)	4.20
Discharge cut-off voltage	(V)	2.00
Max continuous discharge current	(A)	2.3
Pulse (30s) discharge current	(A)	4.6
Maximum storage time before used	(months)	12
Electronic protection circuit consumption	(µA)	12.0
Discharge temperature range	(°C)	-20 to +55
Irreversible losses in storage***	(%)	3.5
Irreversible losses in standby mode****	(%)	7.0

*** 20°C/12 months @ 25%SOC ***** 20°C/24 months@ 100% SOC