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Report On

Emergency Beacons Testing of the
Ocean Signal Limited
EPIRB3 Pro and EPIRB3
In accordance with Cospas-Sarsat T.007

Document 75952867 Report 01 Issue 5

August 2022



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DATED

02 August 2022





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SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
Ocean Signal Limited
EPIRB3 Pro and EPIRB3



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Ocean Signal Limited EPIRB3 Pro to the requirements of Cospas-Sarsat T.007.

Objective	To perform Emergency Beacon Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Ocean Signal Limited
Model Number(s)	EPIRB3 Pro
Manufacturer Declared Variant	EPIRB3* ¹
Serial Number(s)	TA000004 TA000005 TA000011 TA000013 TA000021
Number of Samples Tested	5
Test Specification/Issue/Date	Cospas-Sarsat T.007 Issue 5 Rev 7 June 2021
Date of Receipt of Test Samples	15 November 2021
Order Number	PO37718
Date	11 April 2022
Start of Test	13 January 2022
Finish of Test	26 April 2022
Name of Engineer(s)	M Sellers P Adams C Bland
Related Documents	Cospas-Sarsat T.001 Issue 4 Revision 8 June 2021 Cospas-Sarsat T.IP (TCXO) Issue 1 Revision 5 October 2013

*¹Refer to Manufacturer document 5.(q) Differences Between Beacon Model Variants.pdf. The scope of the additional testing for the variant (EPIRB3 – see section 3) was agreed between the Manufacturer and Cospas-Sarsat Secretariate under pre-application PA21-10.



1.2 APPLICATION FORM

G.1 - Beacon Manufacturer and Beacon Model	
Beacon Manufacturer	Ocean Signal Ltd, ACR Electronics Inc.
Beacon Manufacturer's Address	Ocean Signal Ltd, Unit 4 Ocivan Way, Margate, Kent, CT9 4NN, UK
Beacon Model Name	ACR Electronics Inc, 5757 Ravenswood Road, Fort Lauderdale, FL 33312, USA
Additional Beacon Model Names	RLB-44 , EPIRB3 Pro, EPIRB3 GlobalFix V5, SafeSea EPIRB3 Pro, rescueME EPIRB3

G.1 - Beacon Type and Operational Configurations		Tick Where Appropriate (X)
Beacon Type	Beacon Used While	
EPIRB Float Free	Floating in water or on deck or in a safety raft	X
EPIRB Non-Float Free (automatic and manual activation)	Floating in water or on deck or in a safety raft	X
EPIRB Non-Float Free (manual activation only)	Floating in water or on deck or in a safety raft	
EPIRB Float Free with VDR	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	
	On ground, above ground, and on a personal flotation device*	
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(DT)	Distress Tracking 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)	N/A	

* Applicable only to PLBs with integral antennas operated while attached to personal flotation devices (e.g. lifejackets) where the PLB and its antenna are mounted on PFD in such a position, that, in the nominal mode of operation, they are kept above water.



G.1 - Beacon Characteristics		
Characteristic	Declared Value	
Operating frequency (406 MHz operating channel = 406.nnn)	406.031 MHz	
Operating temperature range	Tmin = -20 °C Tmax= 55 °C	
Temperature, at which minimum duration of continuous operation is expected (Submit C/S T.007 Section 5, part s, if applicable)	Tmin ✓ OR Other (-20°C) N/A	
Manufacturer-declared Minimum Operating Lifetime* * this value is specified by National Administrations or International Organisations	No	24 hours, or
	Yes	48 hours, or
	No	168 hours, or
	No	Other hours
	N/A	Other hours, (specify)
Beacon power supply type (internal non-rechargeable, internal re-chargeable, external, combined, other)	Internal non-rechargeable	
External power supply parameters (AC/DC, nominal voltage, nominal minimum and nominal maximum voltage)	Current (AC / DC):	N/A
	Nominal Voltage (V):	N/A
	Nominal Minimum Voltage (V):	N/A
	Nominal Maximum Voltage (V):	N/A
Is external power supply needed to energise the beacon or its ancillary devices in any of operational modes (N/A or Yes or No)	No	
Battery cell chemistry	Lithium Iron Disulphide	
Battery cell model name, cell size, number of cells in a battery pack, and details of the battery pack electrical configuration	Cell Model Name:	L91
	Cell Size:	50.5mm x 14.5mm dia
	Number of Cells in Battery Pack:	6
	Details of the battery pack electrical configuration:	3 series packs of 2 cells in series (6 cells in series)
Battery cell manufacturer	Energizer	
Battery pack manufacturer and part number	Battery Pack Manufacturer Name:	Ocean Signal Ltd and/or ACR Electronics Inc
	Battery Pack Part Number:	901S-03925
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	2	years
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	10.5	years



Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	Rakon
Oscillator model name/ part number	Model Name: E6907LF Part Number: E6907LF
Oscillator satisfies long-term frequency stability requirements (Yes or No)	Yes
Antenna type: Integral or Other (e.g. External, Detachable – specify type)	Integral
Antenna manufacturer	Ocean Signal Ltd and/or ACR Electronics Inc
Antenna part name and part number (OEM, if applicable, and beacon manufacturer's)	OEM Model Name: N/A
	OEM Part Number: N/A
	Beacon Manufacturer's Model Name: 130S-03877(RLB-44) / 130S-03273(EPIRB3 Pro) / 130S-01404(EPIRB3)
	Beacon Manufacturer's Part Number: 130S-03877(RLB-44) / 130S-03273(EPIRB3 Pro) / 130S-01404(EPIRB3)
Antenna cable assembly min/max RF- losses at 406 MHz, if applicable	Minimum loss (dB): N/A
	Maximum loss (dB): N/A
Navigation device type (Internal, External or None)	Internal
Features in beacon that prevent degradation to 406 MHz signal or other beacon performances resulting from a failure of navigation device or failure to acquire position data (Yes, No, or N/A)	Yes
Features in beacon that ensure erroneous position data is not encoded into the beacon message (Yes, No or N/A)	Yes
Navigation device capable of supporting global coverage (Yes, No or N/A)	Yes
Encoded position update capability (Yes, No, N/A) and	Yes
Encoded position update interval value (range)	3:57.5 to 15:00 minutes:seconds
For Internal Navigation Devices	
Geodetic reference system (WGS 84 or GTRF)	WGS 84
GNSS receiver cold start forced at every beacon activation (Yes or No)	Yes
Navigation device manufacturer	Ublox
Navigation device model name and part number	Model Name: MAX-M8Q
	Part Number: MAX-M8Q
Internal navigation device antenna type(integrated, internal, external, passive/active) , manufacturer and model	Internal, AEL Crystals Ltd, DAE1575R1820A
GNSS system supported (e.g. GPS, GLONASS, Galileo)	GPS, Galileo
For External Navigation Devices	
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 device (if applicable)	N/A	
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
Activated by a separate switch/ separate switch position (Yes or No)	Yes	Yes
Self-test/GNSS self-test mode switch automatically returns to normal position when released (Yes or No)	Yes	Yes
Self-test/ GNSS self-test activation can cause an operational mode transmission (Yes or No)	No	No
Results in transmission of a single self-test burst only, regardless of how long the self-test activation mechanism is applied (Yes or No)	Yes	Yes
Results of self-test / GNSS self-test are indicated by (provide details, e.g. Pass / Fail indicator light, strobe light, etc.)	Indicator LED / Strobe	Indicator LED / Strobe
The content of the encoded position data fields of the self-test message has default values	Yes	No
Performs an internal check and indicates that RF-power is being emitted at 406 MHz and 121.5 MHz, if beacon includes a 121.5 Hz homer (Yes or No)	Yes	No
Self-test results in transmission of a signal other than at 406 MHz (Yes & details or No)	Yes, 121.5MHz for 1sec, AIS	Yes, AIS
Self-test can be activated directly at beacon (Yes or No)	Yes	Yes
List of Items checked by self-test	406 Freq Generation & RF Power, AIS Freq Generation & RF Power, 121.5 RF Power, Battery Status, GNSS Module status	GNSS, AIS*, 406* *(The GNSS self-test is limited to checking operation of the internal GNSS receiver; if a fix is acquired during the test the beacon shall encode the position and perform a burst of 8 AIS test transmissions followed by a 406MHz test transmission. If a fix is not obtained the beacon shall not perform any transmission).
Self-test/ GNSS self-test 406 MHz burst duration (440 or 520 ms)	520ms	520ms
Self-test message length format flag in bit 25, ("0" or "1")	1	1
Maximum duration of a self-test mode, sec	16	140



Maximum recommended number of self-tests / GNSS self-tests during battery pack replacement period (as applicable)	120	60
Distinct indication of self-test start (Yes or No)	Yes	Yes
Indication of self-test results (Yes or No)	Yes	Yes
Distinct indication of insufficient battery capacity (Yes or No)	Yes	N/A
Automatic termination of self-test mode immediately after completion of the self-test cycle (Yes or No)	Yes	Yes
GNSS Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No)	N/A	No
Self-test / GNSS self-test can be activated from beacon remote activation points (Yes & details or No)	No	No
List all methods of Self-test mode and GNSS Self-test modes activation. Provide details on a separate sheet to describe	Test key only	Test key only
Repetitive Automated Interrogation of a Beacons Status (Yes & details per section 5.1, item (Y), or No)	No	No
Message Coding Protocols	Protocol Option	Tick Where Appropriate (X)
User Protocol	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)	
	EPIRB with MMSI	X
	EPIRB with Serial Number	X
Standard Location Protocol	ELT with 24-bit Address	
	ELT with Aircraft Operator Designator	
	ELT with Serial Number	
	PLB with Serial Number	
National Location Protocol	National Location: EPIRB	
	National Location: ELT	



	National Location: PLB	
ELT(DT) Location Protocol	ELT with Serial Number	
	ELT with Aircraft Operator and Serial Number	
	ELT with Aircraft 24-bit Address	
	ELT with Serial Number and 3LD in PDF-2	
	ELT with Aircraft 24-bit Address and 3LD in PDF-2	
RLS Location Protocol (TAC or NRN and Serial Number)	EPIRB	X
	ELT	
	PLB	
	EPIRB	X
RLS Location Protocol (MMSI)	PLB	
	Maritime with MMSI	
	Maritime with Radio Call Sign	
	EPIRB Float Free with Serial Number	
User Location Protocol	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	



Other Declarations	Declared Value	Yes / No
Beacon includes a homer transmitter(s) (Yes or No)	Yes	Yes / No
- homer transmitter(s) frequency and power	Frequency	Power (dBm)
	121.5 MHz	16dBm $\pm$ 2dBm
	243.0 MHz	N/A
	AIS	31.5 $\pm$ 0.5dBm
	Other (MHz)	N/A
homer transmitter(s) duty cycle	Description:	N/A
	50 - 98 (121.5MHz)	%
duty cycle of homer swept tone	35 (121.5MHz)	%
Beacon includes a high intensity flashing light (e.g. Strobe)	Yes	
- light intensity	>0.5	cd
- flash rate	24	flashes per minute
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.	Yes, non-visible IR strobe	
Beacon includes automatic activation mechanism (Yes or No). Specify type of automatic beacon activation mechanism	Yes / No :	Yes
Beacon includes a voice-transceiver (Yes or No), and if Yes specify: Voice transmitter nominal output power Voice transmitter operating frequencies - provides prevention against continuous operation of voice transmitter (Yes or No), and if Yes specify: - maximum continuous voice-transmission operation ("time-out timer") - maximum cumulative transmit-mode on-time ("On time")	Description:	Water contacts
	Yes / No :	No
	If Yes, specify: (dBm)	N/A
	If Yes, specify: (MHz)	N/A
	Yes / No :	N/A
	"Time-out timer" (minutes):	N/A
	On time (hours : minutes):	N/A
Beacon includes features and functions not listed above, related or non-related to 406 MHz (Yes or No). List features and use a separate sheet if insufficient space	Yes	
	Description:	Near-Field Communication (NFC)



Beacon model hardware part number (P/N) and version	900S-03858 Issue 01.00 (RLB-44, GlobalFix V5), 900S-03887 Issue 01.00 (EPIRB3 Pro, SafeSea EPIRB3 Pro), 900S-03886 Issue 01.00 (EPIRB3, rescueME EPIRB3)	
Beacon model firmware P/N, version, date of issue/releases	500S-03885 Issue 00.03.00, Release date 07/04/2022 Tested Version. Production version Issue 01.00 01/06/2022	
Beacon model software P/N, version, date of issue/releases	N/A	
Beacon model printed circuit board P/N and version	101S-03721 Issue 01.00	
Beacon model multiple programmable options, except message coding protocols (Yes/No)	If Yes, List all programmable options associated with this type-approval application:	No
Known non-compliances with C/S T.001 requirements (Yes or No). If Yes, provide details (Submit C/S T.007 Section 5, part t, if applicable)	No	
Beacon Manufacturer Point of Contact (POC) for this Type Approval application:		
Name and Job Title:	Mark Newton / Approvals Manager	
Phone:	+44 1843 808028	
E-mail:	mark.newton@oceansignal.com	
Dated(*)	28-07-2022	
Signed(*)		
(Name, Position and Signature of Beacon Manufacturer Representative)	Mark Newton / Approvals Manager	



Information Provided by the Cospas-Sarsat Accepted Test Facility

Name and Location of Beacon Test Facility: TÜV SÜD, United Kingdom

Date of Submission for Testing: 06 January 2022

Applicable C/S Standards:

Document	Issue	Revision	Date
C/S T.001	4	8	June 2021
C/S T.007	5	7	June 2021
IP (TCXO)	-	5	October 2013

I hereby confirm that the 406 MHz beacon described above has been successfully tested in accordance with the Cospas-Sarsat Type Approval Standard (C/S T.007) and complies with the Specification for Cospas-Sarsat 406 MHz Distress Beacons (C/S T.001) as demonstrated in the attached report

Detail any observed non-compliances and/or deviations from standard test procedures here:

Non-compliances:

For the EPIRB3 Pro, the results are outside the limits stated in clause A.2.1 (d) of C/S T.007. However, the measurements are within the Test Facility Accuracy stated in C/S T.008.

For the EPIRB3 Pro, the results are outside the limits stated in clause A.2.1 (g) of C/S T.007. However, the measurements are within the Test Facility Accuracy stated in C/S T.008.

For the EPIRB3, the results are outside the limits stated in clause A.2.1 (g) of C/S T.007. However, the measurements are within the Test Facility Accuracy stated in C/S T.008.

For Clause A.2.7 of Cospas Sarsat T.007, the minimum update interval during A.3.8.3 testing was found to be outside of the limit requirement. Discussions between the manufacturer and the Secretariate concluded that this could be considered acceptable. Refer to manufacturer document 921S-04094 Cospas-Sarsat Beacon Update rate. See also Deviation below.



Deviations:

For Clause A.2.3 of Cospas Sarsat T.007, the battery that was used for testing was discharged more than the required amount. This was required to comply with RTCM Standard 11000.5.

As a result of discrepancies observed during testing (refer to section 1.5 for details), the beacon firmware was modified and limited regression testing of the modified beacon was carried out (as per C/S T.007, section 4.9). Other tests not required for regression testing were included based on the previous modification states as indicated for each test in the summary table and relevant test sections within this report.

For A.3.8.3 an additional test was carried out with a Manufacturer supplied scenario with constant motion (refer to Annex A of TÜV SÜD document 75953445 report 01 - Additional Test of the GNSS Receiver Update Interval) to verify the Manufacturer's declared encoded position update rate. Refer also to Manufacturer supplied document 921S-04094 Issue 01.40 Cospas-Sarsat Beacon Update rate.

Notes:

None.

Signed:

A handwritten signature in black ink, appearing to be 'M. P. H. H.', written over a horizontal line.

Position Held:

Authorised Signatory

Date:

02 August 2022

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was an Ocean Signal Limited EPIRB3 Pro as shown in the photograph below. 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 operated using its own power source (internal battery). Three EUT's were configured so that the antenna port was connected to the 50 Ω test system using a coaxial cable (TA000004, TA000005, TA000021). The test configuration for all tests is identical with the exception of Antenna Characteristics, Satellite Qualitative, Position Acquisition Time and Position Accuracy and the RLM Reception Verification tests.

Another EUT was a fully packaged beacon, similar to the proposed production beacons equipped with its proper antenna (TA000013). This EUT was used to perform Antenna Characteristics, Satellite Qualitative and Position Acquisition Time and Position Accuracy. The test configuration for these tests is a function of the beacon type and the operational environments supported by the beacon, as declared by the manufacturer.



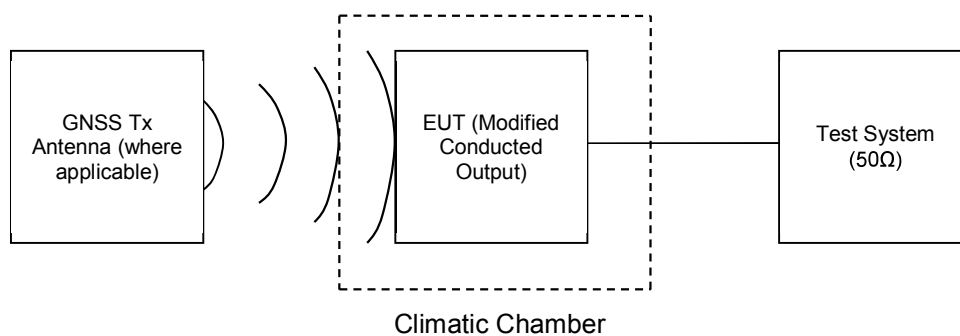
The final EUT was a fully packaged beacon with an additional NMEA data output which enabled monitoring of the GNSS Receiver for the RLM Reception Verification tests (TA000011).

Manufacturer Reference	TUV SUD Reference	Configuration
TA000004	TSR1	Conducted
TA000005	TSR2	Conducted
TA000011	TSR4	Radiated with NMEA data output
TA000013	TSR3	Radiated
TA000021	TSR17	Conducted

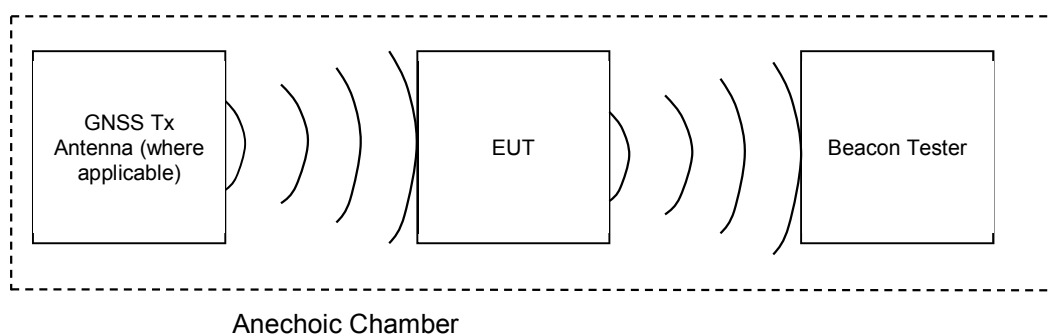
Two EUT's (TA000005 and TA000013) were originally configured as model EPIRB3 Pro. They were reconfigured as an EPIRB3 by removing the fixed antenna and replacing with the extending antenna. This was to demonstrate the different antennas on both models returned comparable results.

System Configurations

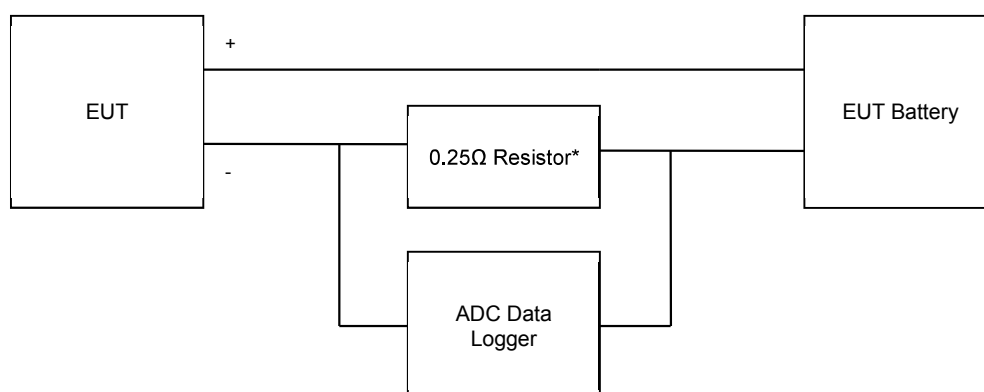
Conducted Laboratory Tests



A.3.8.3 Navigation Test



Battery Current Measurements



Note: The resistor in series with negative line of battery.

* Removed for Standby mode measurements. Leakage current measured through Data Logger (Nominal resistance 1MΩ).

For other Navigation, Satellite and Antenna test configurations, see photographs in section 5 of this report.

Further Information

Battery current measurements (see 'Operating lifetime', section 2.10) concluded that the 'worst case' (highest current) operating mode of the EUT was B6 – ON at EUT Water Contacts, RLS Protocol, No Ancillaries, GNSS in normal operating duty cycle.

All tests were carried out in this mode.

The EUT is fitted with an internal GNSS receiver. From cold start, without GNSS signal data present, the duty cycle of the receiver is as described in the manufacturer information (T.007: 5.(n-i) GNSS Operation cycle and its phases.pdf). After a 15 minute warm up, electrical and functional tests were carried out for 30 minutes to ensure that measurements were made during periods when the GNSS receiver was active and inactive.

Power Alignment

The power alignment comparison of conducted test samples is presented below. Measurements were carried out at ambient temperature over a 15 minute period following a 15 minute warm up. The comparison was carried out with all test samples in Modification State 1.

Test Date: 23 February 2022, 24 February 2022 and 06 April 2022

406MHz

Sample Number	Average Power Output (dBm)	Maximum Difference (dB)*
TSR1 – TA000004	36.26	0.22
TSR2 – TA000005	36.18	
TSR17 – TA000021	36.04	

* The overall maximum difference was 0.22dB, between samples TSR1 – TA000004, sample TSR2 – TA000005 and sample TSR17 – TA000021.

121.5 MHz

Sample Number	Peak Power Output (dBm)	Maximum Difference (dB)*
TSR1 – TA000004	17.68	0.18
TSR2 – TA000005	17.86	
TSR17 – TA000021	17.85	

* The overall maximum difference was 0.18dB, between samples TSR1 – TA000004, sample TSR2 – TA000005 and sample TSR17 – TA000021.

162 MHz

Sample Number	Peak Power Output (dBm)	Maximum Difference (dB)*
TSR1 – TA000004	32.02	0.1
TSR2 – TA000005	31.98	
TSR17 – TA000021	32.08	

* The overall maximum difference was 0.1dB, between samples TSR1 – TA000004, sample TSR2 – TA000005 and sample TSR17 – TA000021.



1.3.3 Modes of Operation

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

Off/Standby Mode

- No apparent activity

NFC Mode

- Interrogate the NFC device with an NFC field

Self-test

- Test button held and released between 1 and 5 seconds
- List of items checked as per Customer Supplied Information (Application Form)
- Navigation data applied at ambient temperature

GNSS Self-test

- Test button held and released between >5 and 10 seconds
- List of items checked as per Customer Supplied Information (Application Form)
- Navigation data applied as applicable (e.g. none applied for timeout, data applied for 'burst')

Operating

- On button pressed
- 121.5 Homer active and offset
- AIS active
- GNSS operating in normal duty cycle
- No navigation data applied (unless otherwise stated)

All modes

All mode descriptions are applicable to all tests unless otherwise stated. Additional methods of activation include:

- Water contacts

All Navigation input descriptions are applicable to all tests unless otherwise stated.



1.4 TEST LOCATIONS

Satellite Qualitative/Navigation test A.3.8.2.2: Daedalus Airfield, Lee-on-the-Solent, Hants, UK
All other tests: Octagon House Laboratory, Fareham, Hampshire, UK

1.5 MODIFICATIONS

Modification State (Mod State)	Date of Implementation	Reasons for modification	Description of modification, HW/FW P/Ns, SW version/release after modification
0	N/A	N/A	As supplied by manufacturer. Hardware: 01.00 Firmware: 00.01.00 Software: N/A
1	22/02/2022	Update to fix GNSS Timings via factory NVM settings and AIS Timings (self test burst) via factory NVM settings	Hardware: 01.00 Firmware: 00.01.00 Software: N/A
2	07/04/2022	Change to AIS stack for True Heading parameter	Hardware: 01.00 Firmware: 00.03.00 Software: N/A

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

Following the modification of the original EUT design an additional scope of testing was agreed between the Cospas-Sarsat Secretariat and the device manufacturer:

Additional Testing Requirement	Reference(s)	Details
See Details column.	N/A	A change from MS0 to MS1 was made following identification of an update to the factory NVM settings for the GNSS Timings and AIS Timings in self test only. The only test carried out in Modification State 0 was the Antenna characteristics test. The Manufacturer confirmed that the factory NVM settings change would have no impact on the outcome of this Antenna Characteristics test. Whilst the change was recorded as a modification state for the purpose of this document, no firmware or hardware was changed and therefore contact with the Secretariate was not made.
- Functional tests at ambient temperature (A.2.1). - Satellite Qualification in one configuration (A.2.5) Worst case current measurements comparisons	Ref email dated: 12 April 2022 14:29 RE: Plb3 worksheet	A change from MS1 to MS2 was made following identification of errors in the AIS stack, which caused an incorrect True Heading reading. Discussion with the C/S Secretariate indicated the scope of testing as per the Additional Testing Requirement column. Refer to Annex B for Modification State Comparison data. NOTE: this firmware issue was originally identified within another Ocean Signal product. The case was discussed, and the logic of repeat testing applied to this EUT/project.

Battery current comparison measurements between modification states can be found in annex A.

1.6 REPORT MODIFICATION RECORD

Issue 1 – First Issue.

Issue 2 – Revisions in line with Cospas Sarsat worksheet: 2022-11_Worksheet-01_FTA_RLB-44_09_JUL_2022. Modification including: reference to annex A (battery current comparison measurement data) added to section 1.5 and 2.10. Updated bit rate for the summary table of Section 2 and 3 in relation to RLS requirements. Results for the PIE test were relocated to the Self-Test area of Section 2.7. Summary table updated with correct pass rate for Configuration 7 of Satellite Qualitative Test. Sample used has been updated to TA000021 to relevant test sections. Reference to manufacturer GNSS duty cycle documentation revised in section 1.3 (Further Information section). Revised annex G as supplied by Manufacturer.

Issue 3 – Corrections to firmware version in section 1.5.

Issue 4 – Revised application form as supplied by Manufacturer (WS02).

Issue 5 – Issue 5 – Reference to Manufacturer report for RLS GNSS Satellite Tracking added (summary table section 18 and report section 2.15).



SECTION 2

TEST DETAILS – EPIRB3 Pro

Emergency Beacons Testing of the
Ocean Signal Limited
EPIRB3 Pro



TEST RESULTS TABLE

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
1. Power Output						
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1 (-20°C and +55°C)						
Model: EPIRB3 Pro, S/N: TA000021, TUV Ref: TSR17 and Modification State 2 (Ambient Only)						
Transmitter power output	(maximum) 35 - 39 (minimum)	dBm	36.57 36.51	35.82 35.76	35.38 35.35	
Power output rise time	(maximum) < 5 (minimum)	ms	0.50 0.49	0.42 0.41	0.52 0.51	
Power output 1ms before burst	(maximum) < -10 (minimum)	dBm	-31.41 -31.24	-21.88 -35.28	-32.01 -31.98	
2. Digital Message Coding						
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1 (-20°C and +55°C)						
Model: EPIRB3 Pro, S/N: TA000021, TUV Ref: TSR17 and Modification State 2 (Ambient Only)						
Bit Sync	1 - 15	15 bits "1"	P / F	P	P	
Frame sync	16 - 24	"00010111"	P / F	P	P	
Format flag	25	1 bit	bit value	1	1	
Protocol flag	26	1 bit	bit value	0	0	
Identification / position data	27 - 85	59 bits	P / F	P	P	
BCH code	86 -106	21 bits	P / F	P	P	
Emerg. Code/nat. use/supplem. Data	107 - 112	6 bits	bit value	111000	111000	
Additional data / BCH (if applicable)	112 - 144	32 bits	P / F	P	P	
Position Error (if applicable)	< 5	km	N/A	N/A	N/A	
Result: Pass						



Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
3. Digital Message Generator						
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1 (-20°C and +55°C)						
Model: EPIRB3 Pro, S/N: TA000021, TUV Ref: TSR17 and Modification State 2 (Ambient Only)						
Repetition rate, T _R :						
Average T _R	48.5 ≤ T _{Ravg} ≤ 51.5	seconds	50.002	50.088	50.128	
Minimum T _R	47.5 ≤ T _{Rmin} ≤ 48.0	seconds	47.531	47.893	47.890	
Maximum T _R	52.0 ≤ T _{Rmax} ≤ 52.5	seconds	52.282	52.202	52.204	
Standard deviation	0.5 - 2.0	seconds	1.70	1.65	1.68	
Bit rate						
Minimum fb	≥ 399.6	bits/sec	399.94	399.91	399.95	
Maximum fb	≤ 400.4	bits/sec	399.97	400.00	399.97	
Total transmission time						
Short message	(maximum)		N/A	N/A	N/A	
	(minimum)	ms	N/A	N/A	N/A	
Long message	(maximum)		520.15	519.53	520.15	
	(minimum)	ms	520.09	519.50	520.06	
Unmodulated carrier						
Minimum T1	≥ 158.4	ms	160.66	160.32	160.62	
Maximum T1	≤ 161.6	ms	160.72	160.33	160.71	
First burst delay	≥ 47.5	seconds	53	53	53	
Result: Pass						



Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
4. Modulation						
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1 (-20°C and +55°C)						
Model: EPIRB3 Pro, S/N: TA000021, TUV Ref: TSR17 and Modification State 2 (Ambient Only)						
Biphase-L	P / F	P / F	P	P	P	
Rise time	(maximum) (minimum)	µs	120.3 107.4	109.0 91.1	115.3 106.4	
Fall time	(maximum) (minimum)	µs	158.7 146.7	146.3 128.6	153.7 139.7	
Phase deviation: positive	(maximum) (minimum)	radians radians	1.1409 1.0171	1.139 1.039	1.1943 1.0833	
Phase deviation: negative	(maximum) (minimum)	radians radians	-1.1423 -1.0271	-1.197 -1.092	-1.2039* -1.0853	
Symmetry measurement	≤ 0.05		0.0282	0.0228	0.0278	
5. 406 MHz Transmitted Frequency						
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1 (-20°C and +55°C)						
Model: EPIRB3 Pro, S/N: TA000021, TUV Ref: TSR17 and Modification State 2 (Ambient Only)						
Nominal Value	(maximum) (minimum)	C/S T.001 MHz	406.0311055 406.0311038	406.0309992 406.0309988	406.0310645 406.0310643	
Short-term stability	(maximum) (minimum)	≤ 2x10 ⁻⁹ /100ms	95.762E-11 90.796E-11	3.27E-10 2.91E-10	22.953E-11 20.583E-11	
Medium-term stability – Slope	(maximum) (minimum)	(-1 to +1)x10 ⁻⁹ /minutes	41.271E-11 -71.385E-12	1.27E-10 -3.07E-11	14.241E-11 -93.826E-12	
Medium-term stability – Residual frequency variation	(maximum) (minimum)	≤ 3x10 ⁻⁹	13.225E-10 74.349E-11	6.12E-10 2.58E-10	10.929E-10 59.437E-11	
6. Spurious Emissions into 50ohms						
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1 (-20°C and +55°C)						
Model: EPIRB3 Pro, S/N: TA000021, TUV Ref: TSR17 and Modification State 2 (Ambient Only)						
In band (406.0 – 406.1 MHz)	C/S T.001 mask	P / F	P	P	P	
Result: Pass						



Parameters to be Measured		Range of Specification	Units	Test Results			Comments
				Tmin (-20°C)	Tamb (+21°C)	Tmax (+55°C)	
7. 406 MHz VSWR Check							
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1							
Nominal Value	(maximum) (minimum)	C/S T.001	MHz	406.0310962 406.0310885	406.0310463 406.0310461	406.0310643 406.0310638	
Modulation rise time	(maximum) (minimum)	50-250	µs	119.4 108.3	118.4 106.3	115.4 106.3	
Modulation fall time	(maximum) (minimum)	50-250	µs	157.7 146.6	155.7 141.7	152.6 141.7	
Modulation phase deviation: positive	(maximum) (minimum)	+ (1.0 to 1.2)	radians	1.1534 1.0120	1.1722 1.0502	1.2113* 1.0789	* At maximum temperature, the positive phase deviation falls outside of T.007. However, it is within the Test Facility limits stated in T.008.
Modulation phase deviation: negative	(maximum) (minimum)	- (1.0 to 1.2)	radians	-1.1509 -1.0267	-1.1826 -1.0562	-1.2037* -1.0675	* At maximum temperature, the negative phase deviation falls outside of T.007. However, it is within the Test Facility limits stated in T.008.
Modulation symmetry measurement	≤ 0.05		radians	0.0282	0.0278	0.0278	
Digital Message	correct		P / F	P	P	P	

Result: Non-Compliance



Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
8(a). Self-test Mode						
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1 (-20°C and +55°C)						
Model: EPIRB3 Pro, S/N: TA000021, TUV Ref: TSR17 and Modification State 2 (Ambient Only)						
Frame sync	011010000	P / F	P	P	P	
Format flag	1 / 0	bit value	1	1	1	
Single radiated burst	≤440 / 520 (±1%)	ms	520.185	519.500	520.107	
Default position data (if applicable)	correct	P / F	P	P	P	
Description	provided	Y / N		Y		
Design data on protection against repetitive self-test mode transmissions	provided	Y / N		Y		
Single burst verification	one burst	P / F	P	P	P	
Provides for 15 Hex ID	correct	P / F	P	P	P	
121.5 MHz RF power (if applicable)	verify that RF power emitted	P / F	P	P	P	
406 MHz power	verify that RF power emitted	P / F	P	P	P	
Distinct indication of Self-Test	provided	Y / N	Y	Y	Y	
Distinct indication of RF power being emitted	provided	Y / N	Y	Y	Y	
Indication of Self-Test result	provided	Y / N	Y	Y	Y	
Distinct indication of insufficient battery capacity	provided	Y / N		Y		
Maximum duration of Self-Test mode	≤ maximum duration of Self-Test	sec	15	16	14	
Automatic termination of Self-Test mode upon completion of Self-Test and indication of Self-Test results	verify automatic termination, irrespective of the switch position	Y / N	Y	Y	Y	
Result: Pass						



Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin (-20°C)	Tamb (+21°C)	Tmax (+55°C)	
8 (b). GNSS Self-Test Mode (if applicable)						
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1 (-20°C and +55°C)						
Model: EPIRB3 Pro, S/N: TA000004, TUV Ref: TSR1 and Modification State 1 (PIE Test - Ambient)						
Model: EPIRB3 Pro, S/N: TA000021, TUV Ref: TSR17 and Modification State 2 (Ambient Only)						
Frame sync	011010000	P / F	P	P	P	
Format flag	1 / 0	bit value	1	1	1	
Radiated burst duration	≤ 520 (+1%) must be within 500 m (or 5.25 km for User Location Protocol) of the actual position	ms	520.097	520.124	520.124	
Position data except for ELT (DT) (if applicable)		P / F	P	P	P	
Position data for ELT(DT)	must be within 200 m of the actual horizontal position and 700 m of the altitude	P / F	N/A	N/A	N/A	
Design data showing how GNSS Self-test is limited in number of transmissions and duration	provided	Y / N		Y		
Single burst verification (if applicable)	one burst	P / F	P	P	P	
121.5 MHz RF power (if applicable)	verify that RF power is emitted	Y / N	Y	Y	Y	
406 MHz power (if applicable)	verify that RF power is emitted	Y / N	Y	Y	Y	
Maximum duration of GNSS Self-tests	Manufacturer to specify value	s	109	113	113	Manufacturer specified value: 140
Actual duration of Self-test with encoded location	Less than maximum duration	s	56	73	64	
Maximum number of GNSS Self-tests (only beacons with internal navigation devices)	Manufacturer to specify number	Number		60*		Manufacturer specified number: 60
Distinct indication to register successful completion or failure of the GNSS self-test	must be provided	Y/N	Y	Y	Y	*The PIE test was carried out at ambient temperature in Modification State 1.
Distinct indication that a maximum number of GNSS self-tests has been attained after GNSS self-test mode activation and without transmission of a test message or further GNSS receiver current drain	must be provided	Y/N		Y*		
Automatic termination of the GNSS self-test mode upon completion of the GNSS self-test cycle and indication of the results	verify automatic termination of GNSS self- test mode, irrespective of the switch position	Y/N		Y		
Result: Pass						



Parameters to be Measured	Range of Specification	Units	Test Results	Comments
9. Thermal Shock				
Model: EPIRB3 Pro, S/N: TA000005, TUV Ref: TSR2 and Modification State 1				
Soak Temperature	30°C difference	°C	10	Result: Pass
Measurement Temperature		°C	-20	
Transmitted Frequency			Min	
Nominal value			Max	
Short-term stability	C/S T.001 ≤ 2x10 ⁻⁹	MHz /100ms	406.0310501 48.274E-11	
Medium-term stability – Slope	(-2 to +2)x10 ⁻⁹	/min	-31.126E-12 58.027E-11	
Medium-term stability – Residual frequency variation	≤ 3x10 ⁻⁹		36.15	
Transmitter power output	35 - 39	dBm		
Digital message	correct	P/F	P	



Parameters to be Measured	Range of Specification	Units	Test Results	Comments
10. Operating Lifetime at Minimum Temperature				
Model: EPIRB3 Pro, S/N: TA000021, TUV Ref: TSR17 and Modification State 2				
Pre-test battery discharge duration (operating) required		mAh	346.4	Result: Pass
Pre-test battery discharge duration (operating)		mAh	439.89*	*The battery was discharged more than what is required for Cospas Sarsat T.007. This was necessary to meet the requirements of RTCM 11000.5.
Duration	>48	Hours	68.33 Hours at Tmin = -20°C	
Effective Operating Lifetime duration	>48	Hours	68.33 Hours at Tmin = -20°C	Min/Max results are up to the manufacturer declared lifetime of 48hrs. MTS results exclude the first 30 mins of data (included in the test results section of this report).
Transmitted Frequency			Min Max	
Nominal value		MHz	406.0310675	RLS Protocol
Short-term stability	C/S T.001	/100ms	8.810E-10	
Medium-term stability – Slope	≤ 2x10 ⁻⁹	/min	-1.340E-10	**At the manufacturers request, the EUT was switched off once 406 MHz transmissions had terminated. The 121 MHz was still operating but no further measurements were made past this point.
Medium-term stability – Residual frequency variation	(-1 to +1)x10 ⁻⁹		4.880E-10	
Transmitter power output	≤ 3x10 ⁻⁹	dBm	35.76	End of test taken as 48hrs (Manufacturer declared lifetime).
Digital message	35 - 39	P/F	36.49	
Homer transmitter continuous operation during the lifetime test	correct	hours	P	End of test taken as 48hrs (Manufacturer declared lifetime).
			70.34**	
Homer frequency		MHz	Start of Test	End of Test
Homer peak power level		dBm	121.5045	
Homer transmitter duty cycle		%	14.9	End of Test
			98.13	
			98.2	



Parameters to be Measured	Range of Specification	Units	Test Results			Comments
11. Temperature Gradient (5°C/hr)						
Model: EPIRB3 Pro, S/N: TA000005, TUV Ref: TSR2 and Modification State 1						
Full Test						
Transmitted Frequency	C/S T.007 ≤ 2x10 ⁻⁹ (-1 to +1)x10 ⁻⁹ (-2 to +2)x10 ⁻⁹ ≤ 3x10 ⁻⁹ 35 – 39 correct	MHz /100ms /min /min dBm P/F	Min	Max	Data for points A to B, C+15 min to D and E+15 min to F Data for points B to C+15 min and D to E+15 min	
Nominal value			406.0310127	406.0310591		
Short-term stability			4.04E-11	8.14E-10		
Medium-term stability – Slope ¹			-5.12E-11	2.58E-10		
Medium-term stability – Residual frequency variation			-3.00E-10	3.00E-10		
Transmitter power output	1.88E-10	1.32E-09				
Digital message	35.43	P	36.71			
12. Oscillator Aging						
Result: Pass						
5 year carrier nominal frequency variation	provided	Y / N	Y	Refer to Manufacturer document RTR026A E6907LF MTS 5-year prediction		
MTS analysis (if applicable)	Must demonstrate compliance	P / F	P			
13. Protection Against Continuous Transmission						
Result: Pass						
Description	provided	Y / N	Y			
14. Satellite Qualitative Tests						
Result: Pass						
Model: EPIRB3 Pro, S/N: TA000013, TUV Ref: TSR3 and Modification State 1 (SLP Configurations 5 and 8)						
Model: EPIRB3 Pro, S/N: TA000013, TUV Ref: TSR3 and Modification State 2 (SLP Configuration 7)						
Test Configuration	As per C/S T.007	Configuration				
15 Hex ID Decoded by LUT Doppler Location results with error ≤ 5km	correct ≥ 80	P / F %	5	6	7	8
			P	N/T	P	P
			100	N/T	91.67	100
Result: Pass						



Parameters to be Measured	Range of Specification	Units	Test Results	Comments
15. Antenna Characteristics				
Model: EPIRB3 Pro, S/N: TA000013, TUV Ref: TSR3 and Modification State 0				
Test Configuration	As per C/S T.007		Configuration	
Polarisation	linear or RHCP		1	2
VSWR	≤ 1.5		Linear	N/T
EIRP _{Loss}			N/A	N/T
EIRP _{maxEOL}	≤ 43*	dB	0.30	N/T
EIRP _{minEOL}	≥ 32**	dBm	42.7	N/T
		dBm	34.1	N/T
16. Beacon Coding Software				
Sample message for each coding option of the applicable coding types	correct	P / F	P	Refer to Manufacturer supplied document: 921S-04214-RLB-44_EPIRB3 Pro_EPIRB3 - Nav. System, Beacon and Msg. Coding_01.03
Sample self-test message for each coding option of the applicable coding types	correct	P / F	P	

Detachable Antennas Only

* ≤ 45 for PLB on PFD

** EIRP_{minEOL} limit decreases to 30 dBm for Configuration 4

Result: Pass



Parameters to be Measured	Range of Specification	Units	Test Results		Comments
17. Navigation System					
Model: EPIRB3 Pro, S/N: TA000005, TUV Ref: TSR2 and Modification State 1 (RLS A.3.8.1, A.3.8.6 and A.3.8.3 Short) Model: EPIRB3 Pro, S/N: TA000005, TUV Ref: TSR2 and Modification State 2 (RLS A.3.8.4 and A.3.8.3 Long) Model: EPIRB3 Pro, S/N: TA000005, TUV Ref: TSR2 and Modification State 1 (SLP A.3.8.1, A.3.8.6 and A.3.8.3 Short) Model: EPIRB3 Pro, S/N: TA000005, TUV Ref: TSR2 and Modification State 2 (SLP A.3.8.4 and A.3.8.3 Long) Model: EPIRB3 Pro, S/N: TA000013, TUV Ref: TSR3 and Modification State 2 (RLS A.3.8.2) Model: EPIRB3 Pro, S/N: TA000013, TUV Ref: TSR3 and Modification State 2 (SLP A.3.8.2)					
Location protocol	C/S T.001	P / F	Standard	RLS	* Refer to manufacturer document 921S-04094 Cospas-Sarsat Beacon Update rate. See also section 1.2 for known non-compliances and deviations.
Position data default values	correct		P	P	
Configuration 5					
Position accuracy - A.3.8.2.1	C/S T.001	m	22.82	22.82	
Position Acquisition Time - A.3.8.2.1	<10/1	min	0.88	0.88	
Position accuracy - A.3.8.2.2	C/S T.001	m	35.53	35.53	
Position Acquisition Time - A.3.8.2.2	<10/1	min	0.95	0.88	
Configuration 7					
Position accuracy - A.3.8.2.1	C/S T.001	m	22.82	22.82	
Position Acquisition Time - A.3.8.2.1	<10/1	min	0.91	0.91	
Position accuracy - A.3.8.2.2	C/S T.001	m	35.53	35.53	
Position Acquisition Time - A.3.8.2.2	<10/1	min	0.93	0.93	
Configuration 8					
Position accuracy - A.3.8.2.1	C/S T.001	m	22.82	22.82	
Position Acquisition Time - A.3.8.2.1	<10/1	min	0.93	0.91	
Position accuracy - A.3.8.2.2	C/S T.001	m	35.53	35.53	
Position Acquisition Time - A.3.8.2.2	<10/1	min	0.93	0.93	
Encoded position data update interval (short)	>4m 25s, <16m 30s	min sec	4m 13s*	5m 01s	
Encoded position data update interval (long) - maximum	>4m 25s, <16m 30s	min sec	5m 06s	9m 18s	
Encoded position data update interval (long) - minimum	>4m 25s, <16m 30s	min sec	4m 10s*	4m 05s*	
Position clearance after deactivation	cleared	P / F	P	P	
Position data input update interval (as applicable)	20/1	Min	N/A	N/A	



Position data encoding	correct	P / F	P	P	Refer to Manufacturer supplied document: 921S-04214-RLB-44_EPIRB3 Pro_EPIRB3 - Nav. System, Beacon and Msg. Coding_01.03
Retained last valid position after navigation input lost	240(±5)	min	239.45	239.46	
Default position data transmitted after 240(±5) minutes without valid position data	cleared	P / F	P	P	
Information on protection against beacon degradation due to navigation device, interface or signal failure or malfunction	provided	Y / N	Y		Refer to Manufacturer supplied document: 5.(J) Design Compliance Statements.pdf