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Report On

Emergency Beacons Limited Testing of the
Jotron AS TRON 40VDR
In accordance with Cospas-Sarsat T.007

Document 75928407 Report 01 Issue 3 June 2015

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

REPORT ON

Emergency Beacons Limited Testing of the
Jotron AS
TRON 40VDR

Document 75928407 Report 01 Issue 3

June 2015

PREPARED FOR

Jotron AS
Østbyveien 1
PO Box 54
Tjodalyng
3280
Norway

PREPARED BY

Martin Hardy
Engineer

APPROVED BY

Ryan Henley
Authorised Signatory

DATED

01 June 2015

UKAS TESTING
0141

Product Service

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Product Service

SECTION 1

REPORT SUMMARY

Emergency Beacons Limited Testing of the
Jotron AS
TRON 40VDR

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Limited Testing of the Jotron AS TRON 40VDR 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	Jotron AS
Model Number(s)	TRON 40VDR
Serial Number(s)	02699 00001
Number of Samples Tested	2
Test Specification/Issue/Date	Cospas-Sarsat T.007 Issue 4 - Rev 9 October 2014
Incoming Release Date	Application Form 03 February 2015
Date of Receipt of Test Samples	18 November 2014
Order Number Date	SL1444001 31 October 2014
Start of Test	21 November 2014
Finish of Test	9 April 2015
Name of Engineer(s)	M Hardy
Related Documents	Cospas-Sarsat T.001 Issue 3 Revision 15 October 2014

1.2 APPLICATION FORM

Beacon Manufacturer and Beacon Model

Beacon Manufacturer	Jotron AS
Beacon Model Name	Tron 40VDR
Additional Beacon Model Names	

Beacon Type and Operational Configurations

Beacon Type	Beacon used while:	Tick where appropriate
EPIRB Float Free	Floating in water or on deck or in a safety raft	
EPIRB Non-Float Free (automatic and manual activation)	Floating in water or on deck or in a safety raft	
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	X
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)		

Beacon Characteristics

Characteristic	Specification
Operating frequency	406.037 MHz
Operating temperature range	Tmin = -20°C Tmax= +55°C
Temperature, at which minimum duration of continuous operation is expected	-20°C
Operating lifetime	168 hours
Beacon power supply type (internal non-rechargeable, internal re-chargeable, external, combined, other)	internal non-rechargeable
External power supply parameters (AC/DC and nominal voltage)	
Is external power supply needed to energise the beacon or its ancillary devices in any of operational modes (N/A or Yes or No)	
Battery cell chemistry	Lithium-thionyl chloride (Li-SOCl2)
Battery cell model name, cell size, number of cells in a battery pack, and details of the battery pack electrical configuration	LSH14 light, C-size, 10cells, 5 batteries in parallel each with 2 cells in serial.
Battery cell manufacturer	SAFT
Battery pack manufacturer and part number	Jotron AS, X-87457
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	1,5 years
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	5 years
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	RAKON
Oscillator model name/ part number	E4520L
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	Jotrn AS
Antenna part name and part number	X-83053
Antenna cable assembly min/max RF- losses at 406 MHz, if applicable	
Navigation device type (Internal, External or None)	Internal

Characteristic	Specification
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)	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)	6-16 min
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	MAX-7Q-0
Internal navigation device antenna type(integrated, internal, external, passive/active) , manufacturer and model	Internal, Allis Comm. GPS-P1P
GNSS system supported (e.g. GPS, GLONASS, Galileo)	GPS/QZSS L1 C/A, GLONASS L1 FDMA, SBAS: WAAS, EGNOS, MSAS
For External Navigation Devices	
Data protocol for GNSS receiver to beacon interface	
Physical interface for beacon to navigation device	
Electrical interface for beacon to navigation device	
Part number of the external navigation interface device (if applicable)	
Navigation device model and manufacturer (if beacon designed to use specific devices)	

Self-Test Mode Characteristics:	Self-Test Mode	Optional GNSS Self-test Mode
Activated by a separate switch/ separate switch position (Yes or No)	Yes	No
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.)	Number of Strobe light flashes. One=OK	Number of Strobe light flashes + audio beep's.
The content of the encoded position data fields of the self-test message has default values	Yes	N/A
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	Yes
Self-test results in transmission of a signal other than at 406 MHz (Yes & details or No)	Yes, 121.5MHz	Yes, 121.5MHz
Self-test can be activated directly at beacon (Yes or No)	Yes	Yes
List of Items checked by self-test	Supported in product manuals	Supported in product manuals
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	13 sec. if OK and no GNSS test	130 sec. for GNSS and 6sec. for self-
Maximum recommended number of self-tests during battery pack replacement period	60	N/A
Distinct indication of self-test start (Yes or No)	No	Yes
Indication of self-test results(Yes or No)	Yes	Yes
Distinct indication of insufficient battery capacity (Yes or No)	Yes	Yes
Automatic termination of self-test mode immediately after completion of the self-test cycle (Yes or No)	Yes	Yes
Maximum number of GNSS Self Tests (beacons with internal navigation devices only)	N/A	60

Self-Test Mode Characteristics:	Self-Test Mode	Optional GNSS Self-test Mode
GNSS Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No)	N/A	No
Maximum number of self-tests during battery pack replacement period	No limit	N/A
Self-test/ GNSS self-test can be activated from beacon remote activation points (Yes & details or No)	N/A	N/A
List all methods of Self-test mode and GNSS Self-test modes activation. Provide details on a separate sheet to describe	Move and hold switch in TEST position for 15 sec	Move switch to TEST position twice within 3 sec. and release.
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)	X	EPIRB with MMSI
	X	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
Beacon includes a homer transmitter(s) (Yes or No) - homer transmitter(s) frequency - homer transmitter(s) power	Yes 121.5 MHz 17dBm±3dBdBm	
- homer transmitter(s) duty cycle - duty cycle of homer swept tone	96 % 37%	
Beacon includes a high intensity flashing light (e.g. Strobe)	Yes	
- light intensity	>0.7 cd	
- flash rate	21flashes per minute	
Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon's repetition periods are not synchronized 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.	No	
Beacon includes automatic activation mechanism (Yes or No). Specify type of automatic beacon activation mechanism	Yes. Water contacts	
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. VDR storage module	

Beacon model hardware part number (P/N) and version	X-87910
Beacon model software/firmware P/N, version, date of issue/releases	X-87934, 2.1.1, Oct. 22 - 2014
Beacon model printed circuit board P/N and version	X-87454, R1405
Known non-compliances with C/S T,001 requirements(Yes or No) If Yes, provide details (or use a separate sheet if insufficient space)	No
Beacon Manufacturer Point of Contact (POC) for this Type Approval application:	Name and Job Title: Øyvind Eggen Phone: +47 45 666 911 E-mail: oyvind.eggen@jotron.com

Dated: 3 Feb 2015 Signed: ØYVIND EGGEN, Manager R&D GMDSS & AIS

(Name, Position and Signature of Beacon Manufacturer Representative)

Øyvind L. Eggen

(Continued on Next Page)

Information Provided by the Cospas-Sarsat Accepted Test Facility

Name and Location of Beacon Test Facility: TÜV SÜD Product Service

Date of Submission for Testing: November 2014

Applicable C/S Standards:

Document	Issue	Revision	Date
C/S T.001	3	15	Oct 2014
C/S T.007	4	9	Oct 2014

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) for limited tests 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:

Phase Modulation (sections 2.2 and 2.4): Outside limits of T.007, inside the Test Facility Accuracy stated in T.008

Signed: Ryan Henley

Name: Ryan Henley

Position Held: Authorised Signatory

Date: 01 June 2015

1.1 PRODUCT INFORMATION

1.1.1 Technical Description

The Equipment Under Test (EUT) was a Jotron AS TRON 40VDR as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test

1.1.2 Physical Test Configuration

The Equipment Under Test (EUT) was operated using its own power source (internal battery). One EUT was configured so that the antenna port was connected to the 50Ω test system using a coaxial cable. The test configuration for all tests is identical with the exception of Antenna Characteristics, Satellite Qualitative and Position Accuracy Time and Position Accuracy. This EUT was modified to allow a 50 Ω impedance output. To achieve this, the manufacturer bypassed a matching network integral to the EUT. This resulted in a higher output power that required correcting in accordance with the manufacturers data supplied in Annex A.

The second EUT was a fully packaged beacon, similar to the proposed production beacons equipped with its proper antenna. 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.

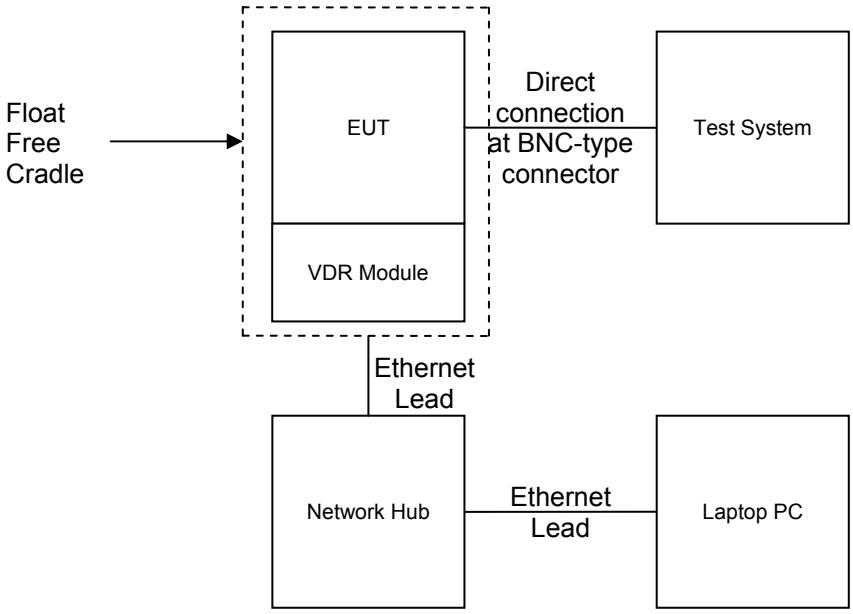
For all tests (unless otherwise stated), the EUT was configured with the VDR module fitted to the base of the EUT. To enable data to be sent to the VDR module, the EUT was fitted into a Float Free Case (Docking Module, as shown in the setup information shown below. (Information is transferred to the VDR module via the Float Free case). Measurements for Satellite Qualitative and Position Accuracy Time and Position Accuracy were performed with the EUT in 'Stand Alone' configuration as shown in the photographs in Section 4 of this report.

The test time interval was extended and consecutive 406 bursts were measured over 35 minutes for the following tests:

- Transmitter power output
- Digital message
- Digital message generator
- Modulation
- 406 MHz transmitted frequency
- 406 MHz VSWR check

This was to ensure that measurements were made during the operating modes described in section 1.3.3. The manufacturer advised that after the first burst from switch on, the GPS receiver operates in the following duty cycle: On for 2 minutes, Off for 6 minutes, On for 2 minutes, Off for 7* minutes... (in the absence of a GPS signal). A test time of 35 minutes includes at least 4 cycles of the GPS receiver operation.
* The Off time increments by 1 minute each cycle, up to a maximum of 16 minutes.

System Configuration



1.1.3 Modes of Operation

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

Off/Standby Mode
- Main switch to “OFF” position

Self-test
- Main Switch to “TEST” position (hold for 15 seconds)
- List of items checked as per Customer Supplied Information (Application Form)
- Additional Information supplied in Annex A

GNSS Self-test
- Main Switch to “TEST” position (twice in 3 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 ‘fast acquisition’)
- Additional Information supplied in Annex A

Operating
- Main switch to “ON” position
- 121 Homer active and offset
- GPS operating in normal duty cycle
- Physical configuration as shown in ‘System Configuration’

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.

1.2 MODIFICATIONS

Modification 0 - No modifications were made to the test sample during testing.

1.3 REPORT MODIFICATION RECORD

Issue 1 – First Issue
Issue 2 – BCS results added and self test details revised.
Issue 3 – Battery current measurement comparison analysis added

SECTION 2

TEST DETAILS

Emergency Beacons Limited Testing of the
Jotron AS
TRON 40VDR

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							**Result: Pass**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0							
Transmitter power output	(maximum)	35 - 39	dBm	-	38.57*	-	*Results include a 1.78dB deduction for the Antenna matching network. See manufacturer information, Annex A.
	(minimum)			-	38.38*	-	
Power output rise time	(maximum)	< 5	ms	-	0.03	-	
	(minimum)			-	0.02	-	
Power output 1ms before burst	(maximum)	< -10	dBm	-	-32.33	-	
	(minimum)			-	-37.02	-	
2. Digital Message Coding							**Result: Pass**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0							
Bit Sync	1 - 15	15 bits “1”	P / F	-	P	-	
Frame sync	16 - 24	“000101111”	P / F	-	P	-	
Format flag	25	1 bit	bit value	-	1	-	
Protocol flag	26	1 bit	bit value	-	0	-	
Identification / position data	27 - 85	59 bits	P / F	-	P	-	
BCH code	86 -106	21 bits	P / F	-	P	-	
Emerg. Code/nat. use/supplem. Data	107 - 112	6 bits	bit value	-	110111	-	
Additional data / BCH (if applicable)	112 - 144	32 bits	P / F	-	P	-	
Position Error (if applicable)		< 5	km	-	n/a	-	

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
3. Digital Message Generator						**Result: Pass**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0						
Repetition rate, T_R:						
Average T_R	48.5 ≤ T_{Ravg} ≤ 51.5	seconds	-	50.339	-	
Minimum T_R	47.5 ≤ T_{Rmin} ≤ 48.0	seconds	-	47.705	-	
Maximum T_R	52.0 ≤ T_{Rmax} ≤ 52.5	seconds	-	52.448	-	
Standard deviation	0.5 - 2.0	seconds	-	1.62	-	
Bit rate						
Minimum fb	≥ 396	bits/sec	-	399.71	-	
Maximum fb	≤ 404	bits/sec	-	399.72	-	
Total transmission time						
Short message (maximum)	435.6 - 444.4	ms	-	n/a	-	
Short message (minimum)			-	n/a	-	
Long message (maximum)	514.8 - 525.2	ms	-	520.02	-	
Long message (minimum)			-	519.90	-	
Unmodulated carrier						
Minimum T1	≥ 158.4	ms	-	160.59	-	
Maximum T1	≤ 161.6	ms	-	160.70	-	
First burst delay	≥ 47.5	seconds	-	55	-	

Parameters to be Measured		Range of Specification	Units	Test Results			Comments
				Tmin	Tamb	Tmax	
				(-20°C)	(+21°C)	(+55°C)	
4. Modulation							**Result: Non-compliance**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0							
Biphase-L		P / F	P / F	-	P	-	* Phase Deviation outside the limit stated in T.007, however is inside the Test Facility Accuracy stated in T.008
Rise time	(maximum)	50 - 250	µs	-	147.4	-	
	(minimum)	50 - 250	µs	-	141.3	-	
Fall time	(maximum)	50 - 250	µs	-	146.7	-	
	(minimum)	50 - 250	µs	-	141.6	-	
Phase deviation: positive	(maximum)	+(1.0 to 1.2)	radians	-	1.1680	-	
	(minimum)	+(1.0 to 1.2)	radians	-	0.9852*	-	
Phase deviation: negative	(maximum)	-(1.0 to 1.2)	radians	-	-1.1599	-	
	(minimum)	-(1.0 to 1.2)	radians	-	-0.9845*	-	
Symmetry measurement		≤ 0.05		-	0.0271	-	
5. 406 MHz Transmitted Frequency							**Result: Pass**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0							
Nominal Value	(maximum)	C/S T.001	MHz	-	406.0369199	-	
	(minimum)			-	406.0369199	-	
Short-term stability	(maximum)	≤ $2x10^{-9}$	/100ms	-	36.332E-11	-	
	(minimum)			-	31.549E-11	-	
Medium-term stability – Slope	(maximum)	(-1 to +1)$x10^{-9}$	/minutes	-	69.281E-13	-	
	(minimum)			-	-26.876E-12	-	
Medium-term stability – Residual frequency variation	(maximum)	≤ $3x10^{-9}$		-	20.706E-11	-	
	(minimum)			-	13.790E-11	-	
6. Spurious Emissions into 50ohms							**Result: Pass**
Model: TRON 40VDR, S/N: 02699, TUV Ref: TSR1 and Modification State 0							
In band (406.0 – 406.1 MHz)		C/S T.001 mask	P / F	-	P	-	

Parameters to be Measured		Range of Specification	Units	Test Results			Comments
				Tmin	Tamb	Tmax	
				(-20°C)	(+21°C)	(+55°C)	
7. 406 MHz VSWR Check							**Result: Non-compliance**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0							
Nominal transmitted frequency		C/S T.001	MHz	-	406.0369193	-	* Phase Deviation outside the limit stated in T.007, however is inside the Test Facility Accuracy stated in T.008
Modulation rise time	(maximum)	50-250	µs	-	146.4	-	
	(minimum)	50-250	µs	-	141.3	-	
Modulation fall time	(maximum)	50-250	µs	-	146.6	-	
	(minimum)	50-250	µs	-	141.6	-	
Modulation phase deviation: positive	(maximum)	+ (1.0 to 1.2)	radians	-	1.2162*	-	
	(minimum)	+ (1.0 to 1.2)	radians	-	1.0118	-	
Modulation phase deviation: negative	(maximum)	- (1.0 to 1.2)	radians	-	-1.1557	-	
	(minimum)	- (1.0 to 1.2)	radians	-	-0.9771*	-	
Modulation symmetry measurement		≤ 0.05		-	0.0271	-	
Digital Message		correct	P / F	-	P	-	

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						**Result: Non-compliance**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0						
Frame sync	011010000	P / F	-	P	-	
Format flag	1 / 0	bit value	-	1	-	
Single radiated burst	≤440 / 520 (±1%)	ms	-	519.891	-	
Default position data (if applicable)	correct	P / F	-	P	-	
Description	provided	Y / N	Y			
Design data on protection against repetitive self-test mode transmissions	provided	Y / N	Y			Applicant's data: See Annex A
Single burst verification	one burst	P / F	-	P	-	
Provides for 15 Hex ID	correct	P / F	-	P	-	
121.5 MHz RF power (if applicable)	verify that RF power emitted	P / F	-	P	-	
406 MHz power	verify that RF power emitted	P / F	-	P	-	
Distinct indication of Self-Test	provided	Y / N	-	Y	-	
Distinct indication of RF power being emitted	provided	Y / N	-	N*	-	* In accordance with the manufacturer's information, a Self-Test was initiated by holding the activation switch in the 'TEST' position for >15 seconds. The EUT strobe flashed once to indicate completion of a Self-Test. Whilst there was no clear indication that RF power has been emitted, output RF power is one of the parameters checked during the Self-Test procedure. The manufacturer operating manual advises that the EUT strobe will flash more than once if a fault is found. The number of flashes depends on the type of fault.
Indication of Self-Test result	provided	Y / N	-	Y	-	
Maximum duration of Self-Test mode	≤ maximum duration of Self-Test	sec	-	17.5	-	
Automatic termination of Self-Test mode upon completion of Self-Test and indication of Self-Test results	verify automatic termination	Y / N	-	Y	-	

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
8 (b). GNSS Self-Test Mode (if applicable)						**Result: Pass**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0						
Frame sync	011010000		-	P	-	
Format flag	1 / 0	bit value	-	1	-	
Single radiated burst	≤ 520 (+1%)	ms	-	519.864	-	
Position data (if applicable)	must be within 500m (or 5.25km for User Location Protocol) of the actual position	P / F	-	P	-	
Design data showing how GNSS Self-test is limited in number of transmissions and duration	provided	Y / N		-		
Single burst verification	one burst	P / F	-	P	-	
121.5 MHz RF power (if applicable)	GNSS self-test checks that RF power is emitted	Y / N		-		
406 MHz power	GNSS self-test checks that RF power is emitted	Y / N		-		
Maximum duration of GNSS Self-test	-	s	-	125	-	
Actual duration of Self-test with encoded location	Less than maximum duration	s	-	43	-	
Maximum number of GNSS Self-tests (only beacons with internal navigation devices)	-	Number	-	60	-	
Distinct indication to register successful completion or failure of the GNSS self-test	must be provided	Y/N	-	*	-	*In accordance with the manufacturer's information, a GNSS Self-Test is initiated by moving the activation switch in the 'TEST' position twice within 3 seconds. The EUT emitted an audible tone approximately every 3 seconds until a GPS position was found, whereupon the EUT strobe flashed once and an audible tone indicated that RF had been emitted. If no GPS position was available, a series of 5 audible tones sounded after the timeout period (128 seconds), then the GNSS Self-Test terminated with no further action, as verified in the battery current measurement results. If a GNSS Self-Test was attempted after the maximum number had been performed, the EUT emitted a series of 10 audible beeps to indicate that no further tests were allowed.

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
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 of further GNSS receiver current drain	must be provided	Y/N	-	Y	-	See comment above.
10. Operating Lifetime at Minimum Temperature						**Result: See Comment**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0						
Battery Current Measurements Only			-			See Section for measurement results comparison
14. Satellite Qualitative Tests						**Result: Pass**
Model: TRON 40VDR, S/N: 02699, TUV Ref: TSR1 and Modification State 0						
Test Configuration	As per C/S T.007		Configuration			
			5	6	7	8
15 Hex ID Decoded by LUT	correct	P / F	P	-	-	-
Doppler Location results with error ≤ 5km	≥ 80	%	100	-	-	-
16. Beacon Coding Software						**Result: Pass**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0						
Sample message for each coding option of the applicable coding types	correct	P / F	P			
Sample self-test message for each coding option of the applicable coding types	correct	P / F	P			

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
17. Navigation System				**Result: Pass**
Model: TRON 40VDR, S/N: 00001, TUV Ref: TSR2 and Modification State 0				
Standard Location protocol	C/S T.001			
A.3.8.1 - Position data default values	correct	P / F	P	
Configuration 5				
A.3.8.2.1 - Position accuracy	C/S T.001	m	60.9	
A.3.8.2.1 - Position Acquisition Time	<10/1	min	0.91	
A.3.8.2.2 - Position accuracy	C/S T.001	m	99.8	
A.3.8.2.2 - Position Acquisition Time	<10/1	min	0.91	
A.3.8.3 - Encoded position data update interval	> 5	min	7.62	
A.3.8.4 - Position clearance after deactivation	cleared	P / F	P	
A.3.8.5 - Position data input update interval (as applicable)	<1.0 min (ELT) <20 min (EPIRB/PLB)	Min	N/A	
A.3.8.6 - Retained last valid position after navigation input lost	240(±5)	min	240.1	
A.3.8.6 - Default position data transmitted after 240(±5) minutes without valid position data	cleared	P / F	P	
A.3.8.7 - Position data encoding	correct	P / F	P	See Annex A. Results checked for compliance against Annex D of T.007
Information on protection against beacon degradation due to navigation device, interface or signal failure or malfunction	provided	Y / N	-	

2.1 DIGITAL MESSAGE

2.1.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (b)

2.1.2 Equipment Under Test and Modification State

Tron 40 VDR S/N: 00001 - Modification State 0

2.1.3 Date of Test

3 December 2014

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 21.4°C
Relative Humidity 31.2%

2.1.6 Test Results

Test Duration: 35 minutes
No. of bursts: 44

Ambient Temperature

Full 36 hex message	FFFE2F902EF9C0017FDFFF3E4EB783E0F66C

ITU List of MID Country Code Numbers

ITEM	BITS	VALUE
Message format: long format	25	1
Protocol: Location Protocol	26	0
Country code: 258 - **Norway**	27-36	0100000010
Type of location protocol: Standard Location - Test	37-40	1110
Test Protocol: Test Protocol (No Decode information in bits 41 to 64)	41-64	1111100111000000000000001
Latitude Sign: default	65	0
Latitude Degrees: default	66-72	1111111
Latitude Minutes: default	73-74	11
Longitude Sign: default	75	0
Longitude Degrees: default	76-83	11111111
Longitude Minutes: default	84-85	11
BCH 1 Encoded:	86-106	11100111100100111010
BCH 1 Calculated:	N/A	11100111100100111010
Fixed bits (1101): Pass	107-110	1101
Position Data: Encoded Position Data Source From Internal Navigation Device	111	1
Aux Device: 121.5 MHz homer	112	1
Latitude Offset Sign: default	113	1
Latitude Offset Minutes: default	114-118	00000
Latitude Offset Seconds: default	119-122	1111
Longitude Offset Sign: default	123	1
Longitude Offset Minutes: default	124-128	00000
Longitude Offset Seconds: default	129-132	1111
BCH 2 Encoded:	133-144	011001101100
BCH 2 Calculated:	N/A	011001101100
Composite Latitude: default	N/A	Composite Longitude: default
15 Hex ID:	N/A	205DF38002FFBFF

2.2 MODULATION

2.2.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (d)

2.2.2 Equipment Under Test and Modification State

Tron 40 VDR S/N: 00001 - Modification State 0

2.2.3 Date of Test

3 December 2014

2.2.4 Test Equipment Used

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

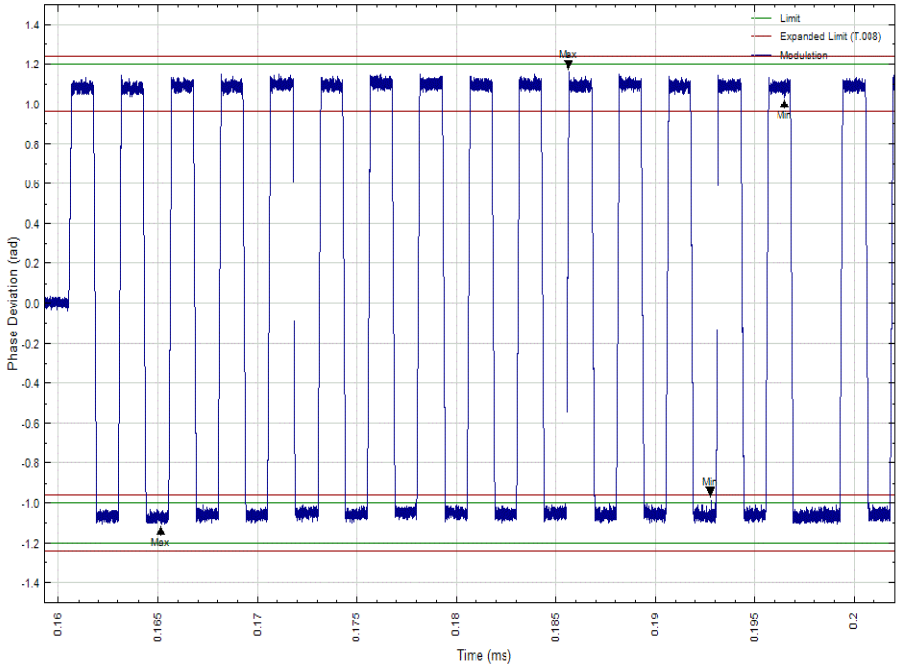
2.2.5 Environmental Conditions

Ambient Temperature 21.4°C
Relative Humidity 32.5%

2.2.6 Test Results

Test Duration: 35 minutes
No. of bursts: 44

Ambient Temperature



Phase Deviation outside the limit stated in T.007, however is inside the Test Facility Accuracy stated in T.008

2.3 SPURIOUS EMISSION INTO 50 OHMS

2.3.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (f)

2.3.2 Equipment Under Test and Modification State

Tron 40 VDR S/N: 00001 - Modification State 0

2.3.3 Date of Test

3 December 2014

2.3.4 Test Equipment Used

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

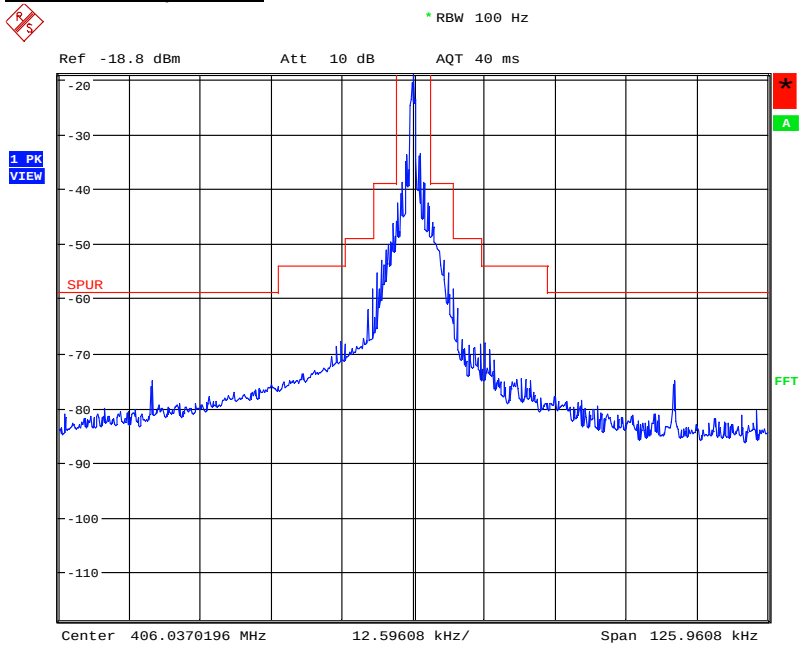
2.3.5 Environmental Conditions

Ambient Temperature 21.4°C
Relative Humidity 31.2%

2.3.6 Test Results

Test Duration: 35 minutes
No. of bursts: 44

Ambient Temperature



2.4 406 MHz VSWR CHECK

2.4.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (g)

2.4.2 Equipment Under Test and Modification State

Tron 40 VDR S/N: 00001 - Modification State 0

2.4.3 Date of Test

4 December 2014

2.4.4 Test Equipment Used

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

2.4.5 Environmental Conditions

Ambient Temperature 23.1°C
Relative Humidity 29.8%

2.4.6 Test Results

Test Duration: 35 minutes
No. of bursts: 44

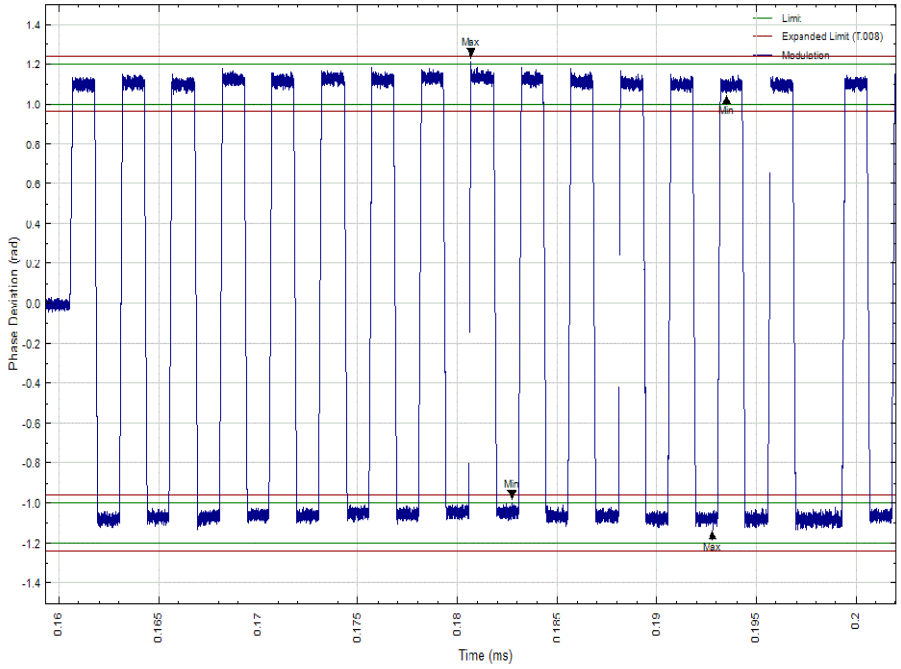
Ambient Temperature

Full 36 hex message	FFFE2F902EF9C0017FDFFF3E4EB783E0F66C

ITU List of MID Country Code Numbers

ITEM	BITS	VALUE
Message format: long format	25	1
Protocol: Location Protocol	26	0
Country code: 258 - **Norway**	27-36	0100000010
Type of location protocol: Standard Location - Test	37-40	1110
Test Protocol: Test Protocol (No Decode information in bits 41 to 64)	41-64	1111100111000000000000001
Latitude Sign: default	65	0
Latitude Degrees: default	66-72	1111111
Latitude Minutes: default	73-74	11
Longitude Sign: default	75	0
Longitude Degrees: default	76-83	11111111
Longitude Minutes: default	84-85	11
BCH 1 Encoded:	86-106	11100111100100111010
BCH 1 Calculated:	N/A	11100111100100111010
Fixed bits (1101): Pass	107-110	1101
Position Data: Encoded Position Data Source From Internal Navigation Device	111	1
Aux Device: 121.5 MHz homer	112	1
Latitude Offset Sign: default	113	1
Latitude Offset Minutes: default	114-118	00000
Latitude Offset Seconds: default	119-122	1111
Longitude Offset Sign: default	123	1
Longitude Offset Minutes: default	124-128	00000
Longitude Offset Seconds: default	129-132	1111
BCH 2 Encoded:	133-144	011001101100
BCH 2 Calculated:	N/A	011001101100
Composite Latitude: default	N/A	Composite Longitude: default
15 Hex ID:	N/A	205DF38002FFBFF

Modulation



Phase Deviation outside the limit stated in T.007, however is inside the Test Facility Accuracy stated in T.008

2.5 SELF-TEST MODES

2.5.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (h)

2.5.2 Equipment Under Test and Modification State

Tron 40 VDR S/N: 00001 - Modification State 0

2.5.3 Date of Test

5 December 2014

2.5.4 Test Equipment Used

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

2.5.5 Environmental Conditions

Ambient Temperature 21.5 - 22.8°C
Relative Humidity 38.7 - 45.3%

2.5.6 Test Results

Ambient Temperature

Full 36 hex message	FFFED0902EF9C0017FDFFF3E4EB783E0F66C

ITU List of MID Country Code Numbers

ITEM	BITS	VALUE
Message format: long format	25	1
Protocol: Location Protocol	26	0
Country code: 258 - **Norway**	27-36	0100000010
Type of location protocol: Standard Location - Test	37-40	1110
Test Protocol: Test Protocol (No Decode information in bits 41 to 64)	41-64	1111100111000000000000001
Latitude Sign: default	65	0
Latitude Degrees: default	66-72	1111111
Latitude Minutes: default	73-74	11
Longitude Sign: default	75	0
Longitude Degrees: default	76-83	11111111
Longitude Minutes: default	84-85	11
BCH 1 Encoded:	86-106	11100111100100111010
BCH 1 Calculated:	N/A	11100111100100111010
Fixed bits (1101): Pass	107-110	1101
Position Data: Encoded Position Data Source From Internal Navigation Device	111	1
Aux Device: 121.5 MHz homer	112	1
Latitude Offset Sign: default	113	1
Latitude Offset Minutes: default	114-118	00000
Latitude Offset Seconds: default	119-122	1111
Longitude Offset Sign: default	123	1
Longitude Offset Minutes: default	124-128	00000
Longitude Offset Seconds: default	129-132	1111
BCH 2 Encoded:	133-144	011001101100
BCH 2 Calculated:	N/A	011001101100
Composite Latitude: default	N/A	Composite Longitude: default
15 Hex ID:	N/A	205DF38002FFBFF

Ambient Temperature – GNSS Self-test (With Valid Position Data Input)

Full 36 hex message	FFFED0902EF9C00133A039C93D771DA4D4D0

ITU List of MID Country Code Numbers

ITEM	BITS	VALUE
Message format: long format	25	1
Protocol: Location Protocol	26	0
Country code: 258 - **Norway**	27-36	0100000010
Type of location protocol: Standard Location - Test	37-40	1110
Test Protocol: Test Protocol (No Decode information in bits 41 to 64)	41-64	1111100111000000000001
Latitude Sign: North	65	0
Latitude Degrees: 51	66-72	0110011
Latitude Minutes: 30	73-74	10
Longitude Sign: West	75	1
Longitude Degrees: 1	76-83	00000001
Longitude Minutes: 45	84-85	11
BCH 1 Encoded:	86-106	00111001001011110101
BCH 1 Calculated:	N/A	00111001001011110101
Fixed bits (1101): Pass	107-110	1101
Position Data: Encoded Position Data Source From Internal Navigation Device	111	1
Aux Device: 121.5 MHz homer	112	1
Latitude Offset Sign: -	113	0
Latitude Offset Minutes: 7	114-118	00111
Latitude Offset Seconds: 24	119-122	0110
Longitude Offset Sign: +	123	1
Longitude Offset Minutes: 4	124-128	00100
Longitude Offset Seconds: 52	129-132	1101
BCH 2 Encoded:	133-144	010011010000
BCH 2 Calculated:	N/A	010011010000
Composite Latitude: 51.376666666666665 Degrees North	N/A	Composite Longitude: 1.8311111111111111 Degrees West
15 Hex ID:	N/A	205DF38002FFBFF

GNSS self-test with valid position	Actual	Declared
Count	60	60
Maximum Duration (s)	125	130
Indication of GNSS ST activation/completion	Upon activation the EUT emits an audible tone every few seconds until either : • No GPS fix is found, and the test terminates • A GPS fix is found, the EUT emits two and the strobe flashes to indicate completion of the test	
Indication of counter limit reached	Audible Tone	

With Valid GPS Input

Standard Location Test Protocol Used

	Standard Location Protocol
	+22°C
Frame sync verification	011010000
Format Flag (1 bit)	1
Single Radiated burst (ms)	519.86
Position data	P
Single burst verification	P
Actual duration (sec)	43
Position Input Latitude	N51° 22.583'
Position Input Longitude	W1° 49.833'
Position Output Latitude*	N51°22'36"
Position Output Longitude*	W1°49'52"
Position Error (m)	50.1

Without Valid GPS Input

	Standard Location Protocol
	+22°C
Frame sync verification	N/A
Format Flag (1 bit)	N/A
Single Radiated burst (ms)	N/A
Default Position data	N/A
Single burst verification	N/A
Actual duration (sec)*	125

* The EUT does not transmit a 406 burst if there is no valid GPS data is present. The measured duration was taken from activating the GNSS Self Test switch to when all activity ceased.

2.6 OPERATING LIFETIME AT MINIMUM TEMPERATURE (BATTERY CURRENT MEASUREMENTS ONLY)

2.6.1 Specification

Cospas-Sarsat T.007, Clause A.2.3

2.6.2 Equipment Under Test and Modification State

Tron 40 VDR S/N: 00001 - Modification State 0

2.6.3 Date of Test

21 November 2014

2.6.4 Test Equipment Used

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

2.6.5 Environmental Conditions

Ambient Temperature 22.5°C
Relative Humidity 56.4%

2.6.6 Test Results

Beacon Operating Current

As per C/S T.007 Table F-E.1:

Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement interval, sec	Average Current, mA	Peak Current, mA
Standalone (VDR fitted to Base) - Standby	A	899.9	0.0000	0.0007
Standalone (VDR fitted to Base) - ON at EUT switch	M	2099	49.07	1929
Standalone (VDR fitted to Base) - ON at EUT (GPS Sleep)	M	366.9	46.94	1917
Standalone (VDR fitted to Base) - ON at Water Contacts	A	2093	47.19	1986
Standalone (VDR fitted to Base) - ON @WCs (GPS Sleep)	A	360.1	44.41	1943
Standalone (VDR fitted to Base) - Self-test	M	17.68	66.42	1929
Standalone (VDR fitted to Base) -GNSS Self-test (Timeout)	M	130.5	27.27	29.29
Standalone (VDR fitted to Base) - GNSS Self-test (Burst)	M	73.76	38.12	1925
Float-free bracket (VDR powered) - Standby	A	899.9	0.0000	0.0007
Float-free bracket (VDR powered) - ON at EUT switch	M	2100	50.44	1997
Float-free bracket (VDR powered) - ON at EUT switch (GPS Sleep)	M	359.7	46.82	1962
Float-free bracket (VDR powered) - Self-test	M	15.52	67.65	1984
Float-free bracket (VDR powered) - GNSS Self-test (Timeout)	M	133.4	27.45	31.54
Float-free bracket (VDR powered) - GNSS Self-test (Burst)	M	50.31	41.76	1985

At all times the sampling interval was 80 ms nominal.

The measurements recorded above are to be compared to those made in TUV Report 75924802. For ease of comparison those results are shown in the table below:

Comparison results taken from TUV Report 75924802:

Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement interval, sec	Average Current, mA	Peak Current, mA
No Ancillaries (VDR Fitted to EUT base) - Standby	A	899.9	0.0015	0.0034
No Ancillaries (VDR Fitted to EUT base) - ON at EUT switch[note2]	M	1799	46.08	1951
No Ancillaries (VDR Fitted to EUT base) - ON at EUT (GPS Sleep)	M	420.2	42.83	1916
No Ancillaries (VDR Fitted to EUT base) - ON at Water Contacts	A	1799	47.16	1938
No Ancillaries (VDR Fitted to EUT base) - ON @WCs (GPS Sleep)	A	420.1	43.11	1912
No Ancillaries (VDR Fitted to EUT base) - Self-test	M	15.37	66.43	1904
No Ancillaries (VDR Fitted to EUT base) - GNSS Self-test (No GPS present)	M	128.1	32.65	34.92
No Ancillaries (VDR Fitted to EUT base) - GNSS Self-test (GPS present)	M	59.76	43.03	1997
Automatic release bracket (VDR powered) - Standby	A	899.9	0.0007	0.0007
Automatic release bracket (VDR powered) - ON at EUT switch[note1]	M	1798	45.43	1872
Automatic release bracket (VDR powered) - ON at EUT (GPS Sleep)	M	420.0	41.65	1842
Automatic release bracket (VDR powered) - Self-test	M	15.35	63.90	1887
Automatic release bracket (VDR powered) - GNSS Self-test (No GPS present)	M	128.0	30.02	32.67
Automatic release bracket (VDR powered) - GNSS Self-test (GPS present)	M	51.84	46.60	1855

Note: Battery current predischarge figures are shown in the table below. The resultant predischarge time for the EUT for this report is 75.11 hours, compared to 82.81 hours for the calculation of report 75924802.

The difference in predischarge time can be accounted for, in that although the self test current is higher for than originally measured in 75924802, the standby current is lower, which has a larger impact on the predischarge figure.

Battery Discharge Current

The discharge current for the batteries was measured for each of the following beacon states.

- Beacon in the Off or Standby State, "Standby Current"
- Beacon performing a Self-test, "Self-test Current"
- Beacon activated and transmitting, "Operating Current"
- Beacon performing a GNSS Self-test without GPS Data present, "Time-out GNSS ST Current"
- Beacon performing a GNSS Self-test with GPS Data present, "Fast GNSS ST Current"

The individual tests were conducted for the following durations:

Standby Current	:	14.9989 minutes		(899932 ms)
Self-test Current	:	15.5 seconds		15531 ms
Time-out GNSS ST Current	:	133.4 seconds		133375 ms
Fast GNSS ST Current	:	50.3 seconds		(50320 ms)
Operating Current	:	34.9 minutes		2093044 ms

Assumptions / Supplied Data

Battery Replacement Interval	: 6.5 years	5 Years + 1.5 Shelf Life
Battery Capacity	: 18 Ah	
Battery Self Drain	: 3.00 % per year	
Self-test Interval	: 12 tests per year	
GNSS Self-test Interval	: 12 tests per year	

Test Results

Mode Current	=	Accumulated Charge / Time				
Standby Current	=	613117653.4 pC	/	(899932 ms)	=	681.29 nA
Self-test Current	=	1050108.61 uC	/	15531 ms	=	67.61 mA
Time-out GNSS ST Current	=	3661526.86 uC	/	133375 ms	=	27.45 mA
Fast GNSS ST Current	=	2100774.43 uC	/	(50320 ms)	=	41.75 mA
Operating Current	=	98667192.78 uC	/	2093044 ms	=	47.14 mA

Battery Preconditioning / Discharge Time Calculations

Battery Self Drain	=	Capacity - [(100% - Self Drain/Year%)$^{\text{Replacement Interval}}$ x Capacity]
	=	18- ((1- 0.0300) $^{6.5}$ x 18) = 3.2331 Ah
Standby Drain	=	Hours per year x Battery Replacement Interval x Standby Current
	=	365 x 24 x 6.5 x 681.29 x 10^{-9} = 0.038793 Ah
Worst Case	=	1.65 x 0.0388 Ah = 0.064008 Ah
Self-test Drain	=	Self-tests per battery x Self-test Current x Self-test duration (in hours)
	=	12 x 6.5 x 67.61 x 10^{-3} x (15.5 / 3600) = 0.0227 Ah
Worst Case	=	1.65 x 0.0227 Ah = 0.0375 Ah
Time-out GNSS ST Drain	=	GNSS STs per battery x Time-out GNSS ST Current x Time-out GNSS ST duration (hours)
	=	12 x 6.5 x 27.45 x 10^{-3} x (133.38 / 3600) = 0.0793 Ah
Worst Case	=	1.65 x 0.0793 Ah = 0.1309 Ah
Fast GNSS ST Drain	=	GNSS STs per battery x Fast GNSS ST Current x Fast GNSS ST duration (hours)
	=	12 x 6.5 x 41.75 x 10^{-3} x (50.32 / 3600) = 0.0455 Ah
Worst Case	=	1.65 x 0.0455 Ah = 0.0751 Ah
Total Drain	=	Self Drain + Standby Drain (Worst Case) + Self-test Drain (Worst Case)
		+ Time-out GNSS ST Current (Worst Case) + Fast GNSS ST Current (Worst Case)
	=	3.2331 + 0.064008 + 0.0375 + 0.1309 + 0.0751 = 3.5406 Ah

Battery Preconditioning / Discharge Time	=	Worst Case drain / Operational Current
	=	3.5406 / (47.14 x 10^{-3})
	=	75.11 hours

Battery Current Analysis

To ensure that the EUT will continue to meet the required lifetime limits of 168 hours (declared by the manufacturer), the results can be analysed using the following equation:

Calculation for previous report 75924802

Battery Capacity (18Ah) / Average Operating current (44.14mA) = 407.7 hours – predischarge time (82.8 hours) = **324.9 hours* (Effective Operating Lifetime duration)**

* The actual Effective Lifetime duration was 303.7 hours. This is most likely because the operating current will increase slightly at -20°C, compared to the current measurements made at ambient temperature.

Calculation for measurements made in this report

Battery Capacity (18Ah) / Average Operating current (50.44mA) = 356.8 hours – predischarge time (75.11 hours) = **281.7 hours* (Effective Operating Lifetime duration)**

The calculated value can be further reduced by the effect of the average current increasing at -20°C. Report 75924802 showed a reduction of 6.5% on the measured value against the calculated value.

Applying the same reduction to the calculation for this report gives a final estimated Effective Operating Lifetime duration of:

281.7 – (281.7/100*6.5) = **263.3 hours**

Conclusion

Based on the calculations made above, the EUT would meet the manufacturer declared Operating Lifetime of 168 hours.

2.7 SATELLITE QUALITATIVE TESTS

2.7.1 Specification

Cospas-Sarsat T.007, Clause A.2.5

2.7.2 Equipment Under Test and Modification State

Tron 40 VDR S/N: 02699 - Modification State 0

2.7.3 Date of Test

18 December 2014 & 19 December 2014

2.7.4 Test Equipment Used

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

2.7.5 Environmental Conditions

Ambient Temperature 9.8 - 11.4°C
Relative Humidity 85.8 - 92.7%

2.7.6 Test Results

Configuration 5

Test Start: 1600 18/12/14
Test End: 0930 19/12/14
15 Hex ID: 203C5C9516FFBFF

Actual location of the test beacon: 50.818263
(Daedalus Airfield, Lee-on-the-Solent, West) -1.197454

Satellite ID	Satellite Pass Number	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	Mean Rx Power (dBm)	TCA	CTA (deg)	Location Error (km)
S10	49360	203C5 C9516 FFBFF	50.83095	-1.18654	-126.44	16:22:33	-4.295	1.605
S7	86313	203C5 C9516 FFBFF	50.83273	-1.18838	-125.63	17:12:43	-5.443	1.729
S10	49361	203C5 C9516 FFBFF	50.82736	-1.18793	-128.10	18:04:25	-20.363	1.212
S11	42364	203C5 C9516 FFBFF	50.82336	-1.20688	-130.14	18:22:43	20.507	0.871
S13	11680	203C5 C9516 FFBFF	50.83695	-1.19461	-127.24	19:14:18	14.241	2.086
S11	42366	203C5 C9516 FFBFF	50.83072	-1.18948	-132.64	21:41:31	-7.682	1.493
S13	11682	203C5 C9516 FFBFF	50.82344	-1.19284	-133.18	22:34:34	-16.005	0.660
S11	42365	203C5 C9516 FFBFF	50.82233	-1.20264	-111.53	20:01:25	7.652	0.580
S12	30207	203C5 C9516 FFBFF	50.81021	-1.20627	-128.90	01:12:13	-15.361	1.088
S10	49367	203C5 C9516 FFBFF	50.81329	-1.20484	-127.16	04:39:13	-7.269	0.758
S7	86320	203C5 C9516 FFBFF	50.80934	-1.20375	-126.32	05:22:36	-6.554	1.086
S10	49368	203C5 C9516 FFBFF	50.81307	-1.19943	-126.81	06:19:53	8.055	0.594
S7	86321	203C5 C9516 FFBFF	50.81162	-1.20157	-126.75	07:02:18	8.614	0.793
S10	49369	203C5 C9516 FFBFF	50.82344	-1.18946	-125.90	07:59:08	20.745	0.804
S11	42372	203C5 C9516 FFBFF	50.81338	-1.19449	-123.49	08:12:11	-19.875	0.581
S13	11688	203C5 C9516 FFBFF	50.81170	-1.20604	-131.73	09:05:27	-11.593	0.946
S12	30209	203C5 C9516 FFBFF	50.82262	-1.19483	-118.79	04:33:38	14.885	0.518

Location Errors greater than 5 km are marked in red text.

$$\text{Ratio of Successful Solutions} = \frac{\text{number of Doppler solutions within 5 km with } 1^\circ<\text{CTA}<21^\circ}{\text{number of satellite passes over test duration with } 1^\circ<\text{CTA}<21^\circ}$$

$$= \frac{17}{17}$$

$$= 100\%$$

2.8 NAVIGATION SYSTEM TEST

2.8.1 Specification

Cospas-Sarsat T.007, Clause A.2.7

2.8.2 Equipment Under Test and Modification State

Tron 40 VDR S/N: 00001 - Modification State 0
Tron 40 VDR S/N: 02699 - Modification State 0

2.8.3 Date of Test

12 December 2014 & 15 December 2014

2.8.4 Test Equipment Used

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

2.8.5 Environmental Conditions

Ambient Temperature 9.6 - 22.3°C
Relative Humidity 31.8 - 67.9%

2.8.6 Test Results

Standard Protocol

Position Data Default Values (C/S T.007 A.3.8.1):

No position data was provided for > 4 hours before the test started. The beacon was activated and operated for 30 minutes without providing data. Message content was checked for all bursts during this period.

36 Hex Message	Message Count
FFFE2F902EF9C0017FDFFF3E4EB783E0F66C	37*

* The first message transmitted by the EUT was a self-test message approximately 9 seconds after activation: FFFED0902EF9C0017FDFFF3E4EB783E0F66C. This is correct in accordance with the manufacturer's design.

Position Acquisition Time and Position Accuracy (C/S T.007 A.3.8.2)

Locations:

A.3.8.2.1:	N 50° 52.121'	W 1° 14.685'	①
A.3.8.2.2:	N 51° 22.583'	W 1° 49.833'	②

The appropriate position was applied, the EUT activated and time to first message containing valid position data timed.

Configuration as per C/S T.007	C/S T.007 Section A.3.8.2.1		C/S T.007 Section A.3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
Configuration 5	50	60.9	50	99.8

Positional accuracy was calculated using the Haversine Formula, The Earth's radius was taken as 6367 km.

① GPS Site Survey – Live Location
② Input from GPS simulator

Encoded Position Data Update Interval (C/S T.007 A.3.8.3):

Location: N 51° 22.583' W 1° 49.833' ①		
Data Acquired at	16:26:31	FFFE2F902EF9C00133A039C93D771DA4D4D0
Location: N 50° 48.683' W 1° 37.417' ①		
Data Updated at	16:34:08	FFFE2F902EF9C00132E0361D9C778EA76951
Data Update Interval	7 min 37 s	

① Input from GPS simulator

Position Clearance After Deactivation (C/S T.007 A.3.8.4)

Following the Encoded Position Data Update Interval test, the beacon was deactivated and reactivated without providing navigation data. The Digital Message output was encoded with the default position data.

Last Valid Position (C/S T.007 A.3.8.6)

Location: N 51° 22.583' W 1° 49.833' ①		
Data Acquired at	16:54:48	FFFE2F902EF9C00133A039C93D771DA4D4D0
GPS Signal Navigation Data Removed		
Data Updated at	20:54:54	FFFE2F902EF9C0017FDFFF3E4EB783E0F66C
Last Valid Position Held	240min 06s	
Return to Default Position	✓	

① Input from GPS simulator

2.9 BEACON CODING SOFTWARE

2.9.1 Specification

Cospas-Sarsat T.007, Clause A.2.8

2.9.2 Equipment Under Test and Modification State

Tron 40 VDR S/N: 00001 - Modification State 0

2.9.3 Date of Test

18 February 2015 & 9 April

2.9.4 Test Equipment Used

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

2.9.5 Environmental Conditions

Ambient Temperature 20.8°C
Relative Humidity 34.8%

2.9.6 Test Results

Protocol	Operational Message		Self-Test Message	GNSS Self Test Message
	Location A	Location B		Location A
Standard Location: EPIRB with MMSI	FFFE2F8C92F423F133A03FFACBF71DA4D4D0	FFFE2F8C92F423F132E0302E6AF78EA76951	FFFED08C92F423F17FDFF90DB83783E0F66C	FFFED08C92F423F133A03FFACBF71DA4D4D0
Standard Location: EPIRB with Serial Number	FFFE2F8C962E406333A03BC0B0F71DA4D4D0	FFFE2F8C962E406332E0341411F78EA76951	FFFED08C962E40637FDFFD37C33783E0F66C	FFFED08C962E406333A03BC0B0F71DA4D4D0
Standard Location: Test	FFFE2F8C9EF423F033A03CA484371DA4D4D0	FFFE2F8C9EF423F032E0337025378EA76951	FFFED08C9EF423F07FDFFA53F7F783E0F66C	FFFED08C9EF423F033A03CA484371DA4D4D0

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
Section 2.6 Beacons - Battery Current Measurements					
Hygromer	Rotronic	I-1000	2829	12	27-Oct-2015
8 Channel Datalogger + Terminal Board	Pico Technology Ltd	ADC-16	3287	12	12-Dec-2014
Resistor (Nominal 0.25ohm)	TUV SUD Product Service	2x RS Components 188-071 R5/100W Resistors	3343	12	24-Oct-2015
Section 2.1, 2.2, 2.4, 2.5 Beacons - Constant Temperature Tests					
Power Meter	Hewlett Packard	436A	83	12	29-Aug-2015
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	30-Jan-2015
Termination (50ohm)	Diamond Antenna	DL-30N	337	12	8-Oct-2015
Signal Generator	Hewlett Packard	8663A	765	12	4-Nov-2015
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	21-Aug-2015
Distress Beacon RF Unit	TUV SUD Product Service	-	2445	-	TU
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	30-Jun-2015
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	16-Sep-2015
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	17-Sep-2015
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	11-Nov-2015
ScopeCorder	Yokogawa	DL750 701210	3254	12	10-Nov-2015
Power Sensor	Agilent Technologies	8482A	3289	12	14-Jan-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	29-Apr-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	29-Apr-2015
Section 2.8 Beacons - Navigation System					
Antenna (Double Ridge Guide)	EMCO	3115	34	12	28-Nov-2015
Spectrum Analyser	Rohde & Schwarz	FSEM	37	6	5-Sep-2015
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Load (50ohm/30W)	Weinschel	50T-054	285	12	16-Sep-2015
Directional Coupler	Narda	3020A	419	-	O/P Mon
Screened Room (8)	Rainford	Rainford	1548	-	TU
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	4-Jun-2015
Section 2.3 Beacons - Spurious Emissions					
Distress Beacon RF Unit	TUV SUD Product Service	-	2445	-	TU
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	9-Jan-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	30-Jun-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	4-Jun-2015
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	16-Sep-2015
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	17-Sep-2015
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	29-Apr-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	29-Apr-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	29-Apr-2015
Section 2.9 Beacons – Beacon Coding Software					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Hygromer	Rotronic	Hygropalm	2404	12	22-May-2015
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU

TU – Traceability Unscheduled

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Standalone - Conducted Sample

EUT with Float Free Case

Satellite Qualitative Configuration 5

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

Jotron AS
Jotron UK Ltd.
Jotron Phontech AS
Jotron Consultas AS
Jotron Asia Pte. Ltd.
Jotron USA, Inc.
UAB Jotron

Tron 40VDR

Loss in antenna matching network

Background:

Measuring of output power on 406MHz is done both in 50 ohm connector and radiated. The output power differs due to loss in antenna matching network. This network is bypassed on the unit with 50 ohm connector and therefore the measurements have to be corrected to match the radiated power.

This document describes the correction factor to subtract to the measurements done in the 50 ohm connector.

Reason:

D6 and FB4 have to be removed on the unit with connector, and with it also the antenna matching network and the output filter for the 121.5MHz transmitter. This leads to a higher output power in the connector than what reaches the antenna.

Scope:

This applies to the 406MHZ connector on Tron 40VDR.

Conclusion:

1.78dB has to be subtracted from the measurements done in the 50 ohm connector.

DNB Nor Bank ASA | 0021 Oslo | Norway | Bank account: 24400508514 | IBAN: NO6624400508514 | BIC: DNBANOKK | Reg.no.: NO917713324 MVA
QA Certificate: NS-EN ISO 9001:2008

www.jotron.com

Jotron AS
P.O. Box 54 | NO-3281 Tjodalyng | Norway

Tel: +47 33 13 97 00
Fax: +47 33 12 67 80

Tron 40VDR

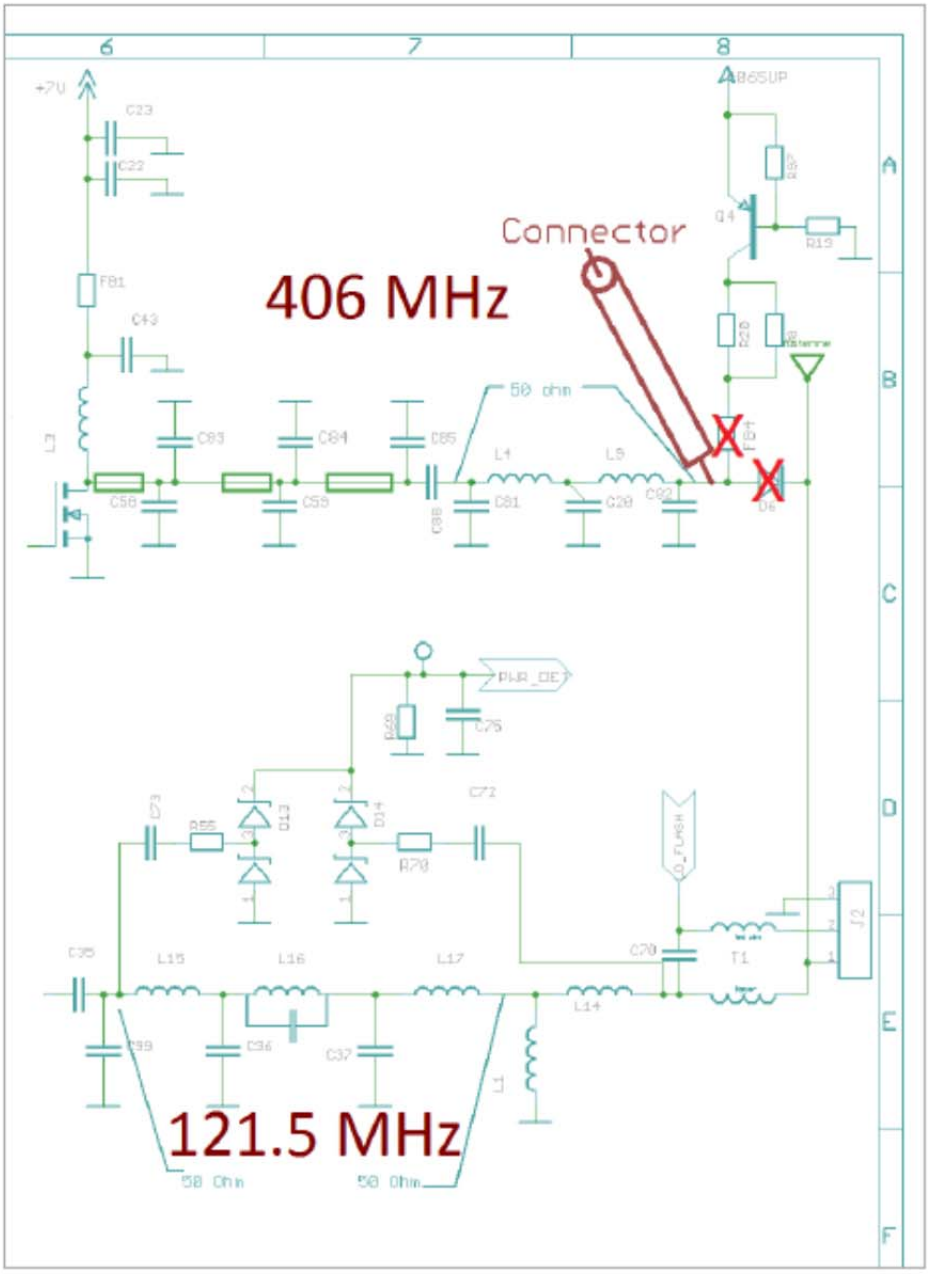


Figure 1: Modification for 50 ohm connector

Tron 40VDR

Measurement:

One problem is that the EPIRB antenna (connected to J2) is not 50 ohm and therefore we need an impedance transformer to measure the loss. Another EPIRB is used to solve this issue. The two EPIRBS is connected together via the antenna connector J2 (blue lines in Figure 2). The ideal solution would be to measure from the 50 ohm connector, but as this point only is 50 ohm when you remove D6 and FB4, this is not possible. The solution is to include the output filter in the measurement and then subtract them afterwards.

The measurement is done with a network analyzer.

Loss between Port1 and Port2: 3.42dB
Loss in each output filter: 0.12dB

Total loss without output filters: (3.42 - 2x0.12) = 3.18

Loss for one EPIRB: 3.18 : 2 = **1.59dB.**

The network analyzer is measuring at 0dBm and the loss in D6 is increasing with the power. A new measurement is done with a generator at +38dBm and a power meter.

This gives **1.78dB** at +38dBm.

Tron 40VDR

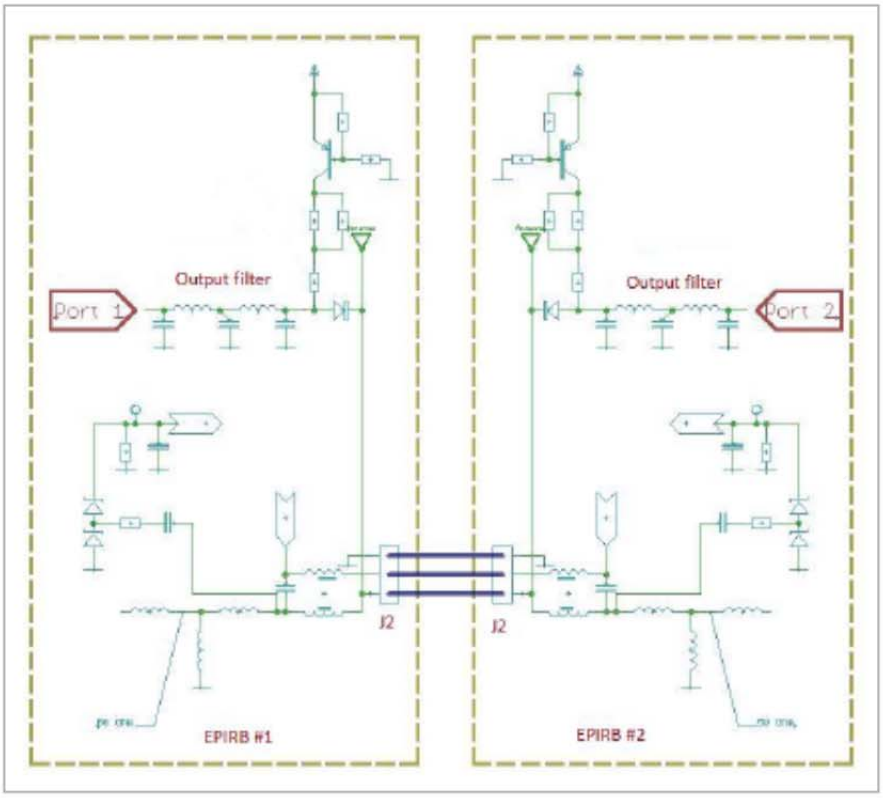


Figure 2: Measurement setup

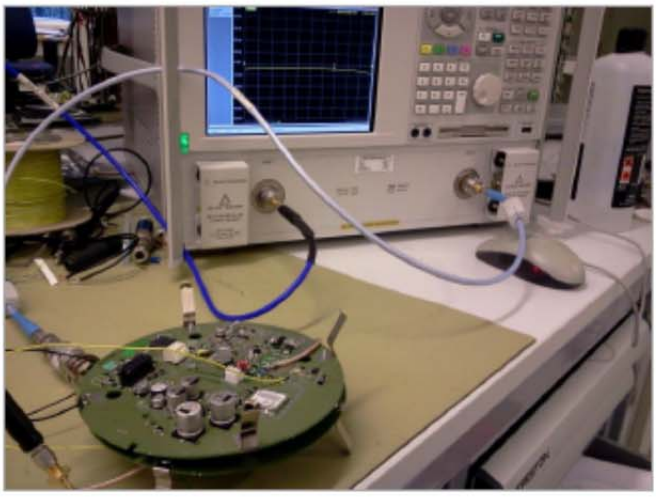


Figure 3: Picture of test setup

Tron 40VDR

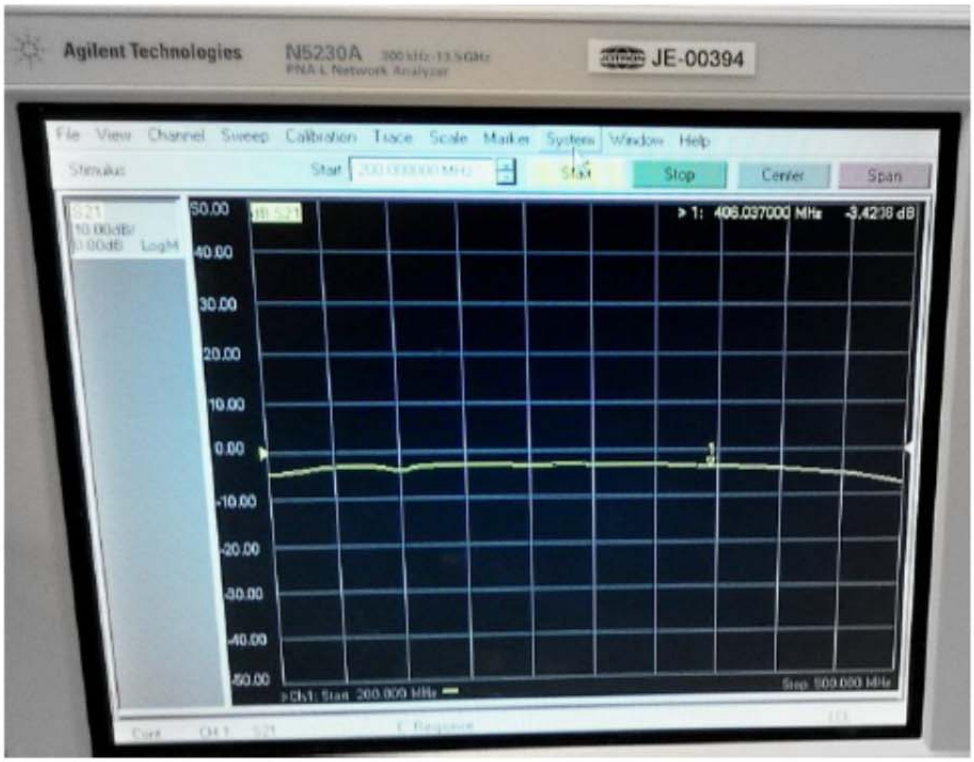


Figure 4: Readout from the network analyser

Position data encoding (A.3.8.7)

Model: Tron40VDR
Serial number: 02704
Beacon SW：v2.1.1
Protocol: Standard Location Protocol
Test Date: 17.12.2014

Table F-C.2: Position Data Encoding Results Standard Location Protocol

Script Reference (See Table D.2)	Value of Encoded Location Bits Transmitted by Beacon	Confirmation that BCH Correct (√)
1	Bits 65-85=0FFBFF Bits 113-132=83E0F	√
2	Bits 65-85=100400 Bits 113-132= 8420E Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 22s	√
3	Bits 65-85= 000000 Bits 113-132= 8360D	√
4	Bits 65-85= 000ACF Bits 113-132= 0F222	√
5	Bits 65-85= 0012CE Bits 113-132= 93A60	√
6	Bits 65-85= 100ECF Bits 113-132= 0FA10	√
7	Bits 65-85= 1B2964 Bits 113-132= 80A00	√
8	Bits 65-85= 1B2D64 Bits 113-132= 84E00	√
9	Bits 65-85= 0B46D0 Bits 113-132= 03801	√
10	Bits 65-85= 0B42D0 Bits 113-132= 08009	√
11	Bits 65-85= 14962A Bits 113-132= 80200	√
12	Bits 65-85= 0FFBFF Bits 113-132= 83E0F	√
13	Bits 65-85= 0FFBFF Bits 113-132= 83E0F	√

Jotron AS
Jotron UK Ltd.
Jotron Deutschland AS
Jotron Canada AS
Jotron Asia Pte Ltd.
Jotron USA, Inc.
SAB Jotron

Tron 40VDR

To whom it may concern

Skoppum December 19, 2014

Statement self-test message

Jotron hereby confirms that the self-test message (except for GNSS self-test) has default values encoded in the position fields at all times and irrespective of the navigation data input.

This is ensured by always loading default position values in the position fields before the self-test message is sent (except for GNSS self-test)

Best regards

Jotron AS.

Øyvind L. Eggen
R&D Manager GMDSS & AIS

Jotron AS
Jotron UK Ltd.
Jotron Photech AS
Jotron Consultas AS
Jotron Asia Pte. Ltd.
Jotron USA, Inc.
UAB Jotron

Tron 40VDR

Protection against erroneous position encoding into the beacon message

Tron 40VDR uses the GPS module MAX-7 / NEO-7 from u-blox of Switzerland.

The RMC messages are used for position update.

Only messages with status flag 'A' (Active) and with the correct checksum are used.
Valid means 2D or 3D fix.

Øyvind L Eggen
R&D Manage GMDSS & AIS

December 19 2014