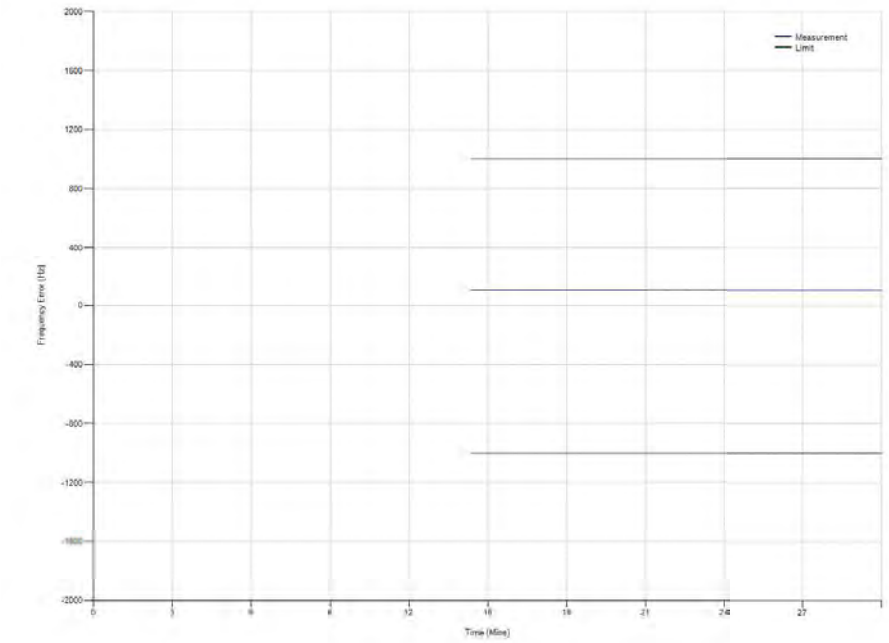
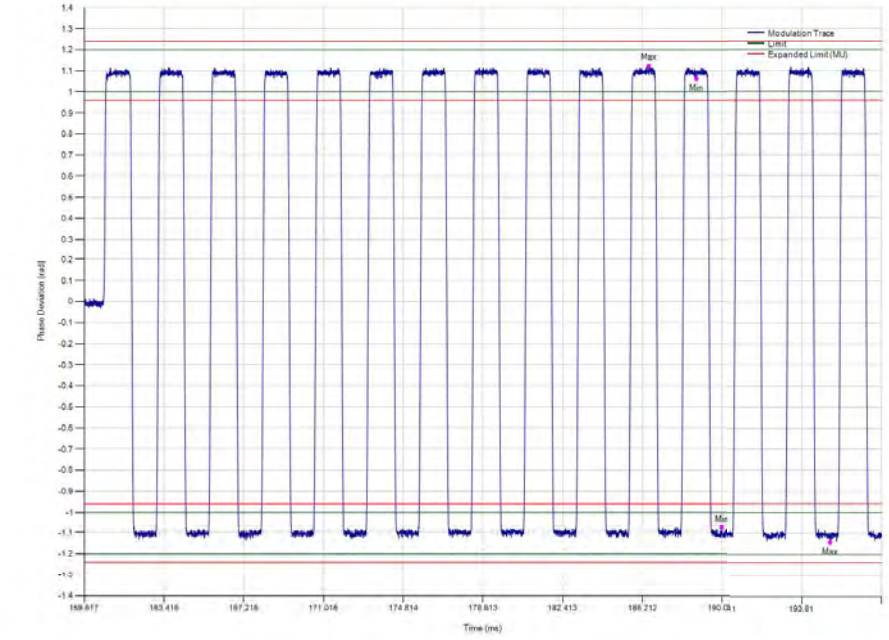
Frequency Plot



Modulation Plot



High Temperature (+55°C)

Decoded Beacon Message

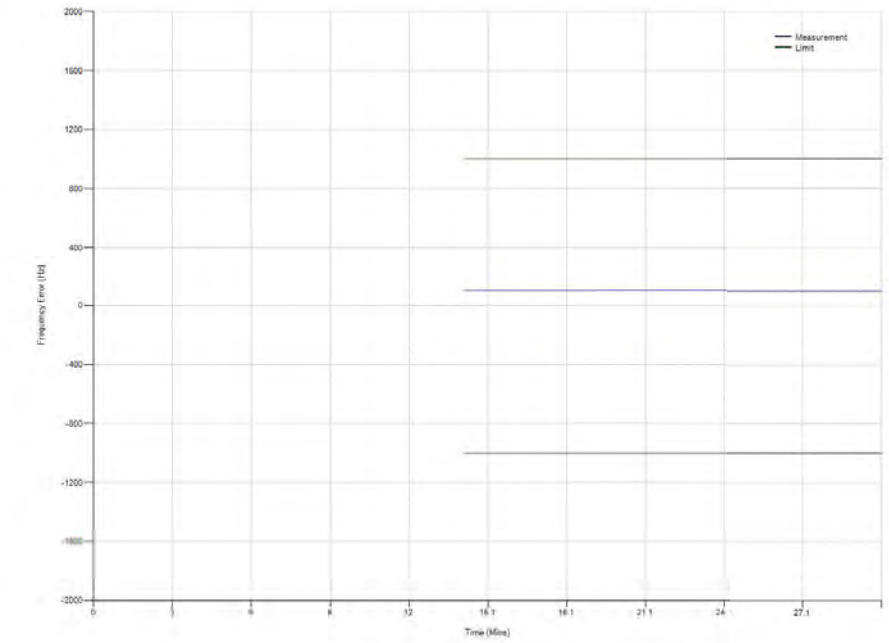
Hexadecimal code: **FFFE2F8C9OFE7018DFEFF8129DF861F0FABE**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev 5

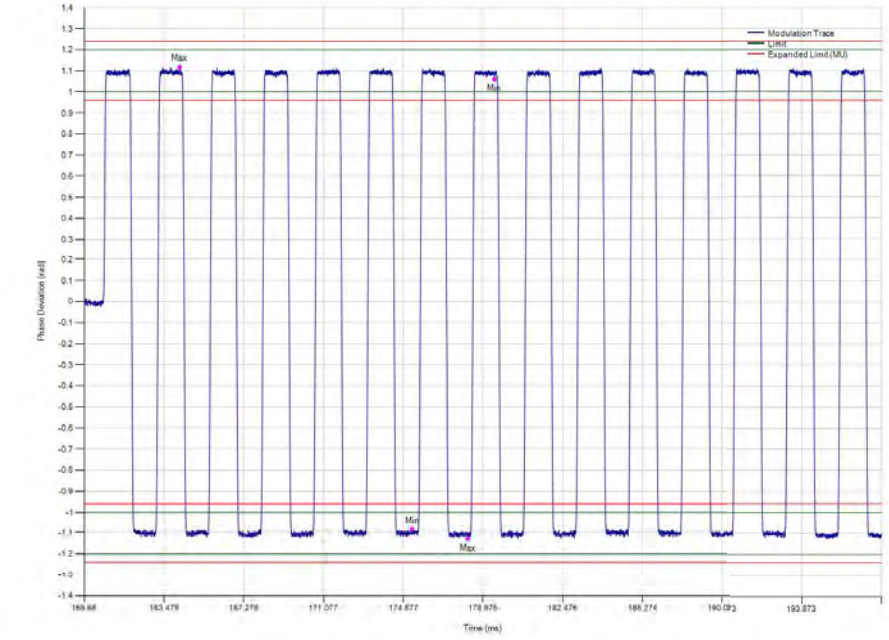
Unique identifier:
190BFCE031BFDFF

Binary Range	Binary Content	Field Name	Decoded Value
1-15	111111111111111	Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions.	True
16-24	000101111	Frame Synchronization Pattern	Normal beacon operation
25	1	Format Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201	Search Contact list here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Test Location
43-45	1111	Identification type	RLS protocol coded with MMSI last 6 digits
47-66	10011100000001100011	Last 6 digits MMSI	639075
67-75	011111111	Latitude	Default - no location (Default - no location)
76-85	0111111111	Longitude	Default - no location (Default - no location)
86-106	00000010010100111011	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	0	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) not received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider Identification	GALILEO Return Link Service Provider
115-123	100001111	Latitude offset	Default value
124-132	100001111	Longitude offset	Default value
133-144	101010111110	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field

Frequency Plot



Modulation Plot



Summary

The EUT complies with clause A.3.3 of Cospas-Sarsat T.007.

2.7 SELF-TEST MODES

2.7.1 Specification

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

2.7.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

2.7.3 Date of Test

24 April 2023 and 25 April 2023

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 Laboratory Environmental Conditions

Ambient Temperature 21.0 - 23.3°C
Relative Humidity 23.2 - 33.0%

2.7.6 Test Results

Note: Self-test at ambient temperature was carried out with navigation data applied. The EUT was activated and allowed to obtain a fix. It was then deactivated and a Self-test was performed to show the EUT encoded default values. This is shown from the decoded message below.

Self-test Mode

Ambient Temperature

Decoded Beacon Message

Hexadecimal code: **FFFED08C9DFE7018DFEFF8129DF861F0FABE**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 issue 4 - Rev.6.

Unique identifier:
1938FCE0318FDFF

Binary Range	Binary Content	Field Name	Decoded Value
1-15	111111111111111	Bit synchronization pattern consisting of "1"s shall occupy the first 15-bit positions	True
16-24	011010000	Frame Synchronization Pattern	Test protocol message coded for non-operational use
25	1	Format Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201.	Search Contact list here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Test Location
43-46	1111	Identification type	RLS protocol coded with MMSI last 6 digits
47-66	1001110000 0001100011	Last 6 digits MMSI	639075
67-75	011111111	Latitude	Default - no location (Default - no location)
76-85	0111111111	Longitude	Default - no location (Default - no location)
86-106	0000001001 0100111011 1	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	0	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) not received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider Identification	GALILEO Return Link Service Provider
115-123	100001111	Latitude offset	Default value
124-132	100001111	Longitude offset	Default value
133-144	1010101111 10	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field

Note: Self-Test at ambient temperature.

Low Temperature (-20°C)

Message	FFFED08C9DFB5018DFEFF84E1D3861F0FABE		
Hex ID	193BF6A031BFDFF		
Position	None - Default Values		
Parameter	Bit	Data Bits	Decoded Value
Bit synchronization	1-15	111111111111111	111111111111111
Frame synchronization	16-24	011010000	011010000
Format Flag	25	1	1
Protocol Flag	26	0	0
Country Code	27-36	0011001001	Albania (Republic of)
Protocol Code	37-40	1101	RLS Location Protocol
Beacon Type	41-42	11	Location Test Protocol
RLS TAC	43-52	1110110101	949
RLS ID Serial Number	53-66	00000001100011	99
N/S	67	0	Default
Latitude Degrees	68-75	11111111	Default
E/W	76	0	Default
Longitude Degrees	77-85	111111111	Default
BCH Code (21 Bit)	86-106	000010011100001110100	000010011100001110100
Calculated BCH Code (21 Bit)	-	000010011100001110100	000010011100001110100
Encoded Position Data Source	107	1	Internal navigation device
121.5 MHz Radio Locating Device	108	1	Yes
Capability to process RLM Type-1:	109	1	Acknowledgement Type-1 accepted by this beacon
Capability to process manually generated RLM	110	0	Manually generated RLM not accepted by this beacon
Feedback on RLM Type-1:	111	0	Acknowledgement Type-1 not (yet) received by this beacon
Feedback on RLM Type-2	112	0	RLM Type-2 not (yet) received by this beacon
RLS Provider Identification:	113-114	01	GALILEO Return Link Service Provider
Delta Latitude +/-	115	1	Default
Delta Latitude Minutes	116-119	0000	Default
Delta Latitude Seconds	120-123	1111	Default
Delta Longitude +/-	124	1	Default
Delta Longitude Minutes	125-128	0000	Default
Delta Longitude Seconds	129-132	1111	Default
BCH Code (12 Bit)	133-144	101010111110	101010111110
Calculated BCH Code (12 Bit)	-	101010111110	101010111110

High Temperature (+55°C)

Decoded Beacon Message

Hexadecimal code: **FFFED08C9DFE7018DFEFF9129DF961FDFABE**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined in T.001 issue 4 - Rev.6.

Unique identifier:
1938FCE0318FDFF

Binary Range	Binary Content	Field Name	Decoded Value
1-15	111111111111111	Bit synchronization pattern consisting of "1"s shall occupy the first 15-bit positions	True
16-24	011010000	Frame Synchronization Pattern	Test protocol message coded for non-operational use
25	1	Format Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201	Search Contact list here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Test Location
43-46	1111	Identification type	RLS protocol coded with MMSI last 6 digits
47-66	10011100000001100011	Last 6 digits MMSI	639075
67-75	011111111	Latitude	Default - no location (Default - no location)
76-85	0111111111	Longitude	Default - no location (Default - no location)
86-106	00000010010100111011	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	0	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) not received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider Identification	GALILEO Return Link Service Provider
115-123	100001111	Latitude offset	Default value
124-132	100001111	Longitude offset	Default value
133-144	101010111110	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field

Self Test Mode

Table F-E.3: Self-test Mode Actions and Indications

No.	Action/Indication	Time-stamp (HH:MM:SS)	Description of action/indication	Duration of action/indication (sec)	Notes
1	Self-Test mode initiation (distinct action)	00:00:00	Press and hold the test button for 2s until the test indicator lights up.	2 sec	
2	Distinct indication of the Self-test initiation	00:00:03			
3	Self-test single burst transmission	00:00:04			Observed on spectrum analyser
4	Self-test message default values	00:00:04	The EUT executes a series of tests depending on the model. A green LED flash held illuminated for ≈ 3s indicates a test has passed.		Decoded using TUV test equipment.
5	Distinct indication of RF transmission	00:00:04	The EUT executes a series of tests depending on the model. A short dark period is observed each time a signal is transmitted.	2s	406 MHz 121.5MHz
6	Distinct indication of the Self-test PASS result	00:00:06	A green LED is illuminated for ≈ 3s indicates a test has passed.	3s	
7	Distinct indication of the Self-test FAIL result	00:00:06	At the end of the normal executed series of tests a red LED flashes at the end of the tests.	2s – 10s	The number of red flashes indicate the type of failure experienced. This can vary from 2 flashes to 10 flashes.
8	Distinct indication of Insufficient Battery Energy	00:00:06	At the end of the normal executed series of tests a red LED flashes 2 times.	2 s	
9	Distinct indication only when a beacon is coded with the RLS Location Protocol (i.e., the RLS functionality is enabled) , and the RLS and RLM indicator(s) are operating as described in section 4.5.4 e) of document C/S T.001.	00:00:04	The EUT executes a standard series of test and includes a blue LED illuminating.	1s	For RLS-capable beacons
10	Automatic termination of the Self-test mode, irrespectively of the switch position		Test Button held in.		If the 'Test' button is held in, the EUT preforms the standard self test and terminates automatically.
11	Duration of the Self-test mode	00:00:09			*(see note)The maximum duration that the manufacturer has declared is 9s. (see note1)

Note:

1. In Self-test failure mode the duration of the Self test can be extended by up to a further 10 seconds depending upon the failure mode observed.

GNSS Self-test mode

Table F-E.4: GNSS Self-test Mode Actions and Indications

No.	Action/Indication	Time-stamp (HH:MM:SS)	Description of action/indication	Duration of action/indication (sec)	Notes
1	GNSS Self-test mode initiation (distinct action)	00:00:00	Hold the 'TEST' button in for seven seconds until the yellow test indicator and green GNSS indicator LED illuminates.	7 sec	
2	Distinct indication of the GNSS Self-test initiation	00:00:07	The green GNSS LED will flash rapidly 3 times in a continuous display until a location fix is obtained.	1 sec	
3	GNSS Self-test single burst transmission			520ms (with Nav input)	Observed on spectrum analyser
4	GNSS Self-test message position encoding		GNSS Self-test message structure and bit values confirmed correct	1 sec (with Nav input)	Decode using TUV test system
5	Distinct indication of the GNSS Self-test PASS result	00:00:34	The GNSS green LED stops the rapid flashing and illuminates for approx. 1s when lock is attained. This is followed by a standard Self-test sequence.	7 sec	406 MHz burst with navigation acknowledgment
6	Distinct indication of the GNSS Self-test FAIL result	00:02:07	The GNSS LED illuminates for 1s followed by the yellow test indicator LED and then the red LED flashes 5 times to indicate a failed result.	8 sec	
7	Distinct indication that the manufacturer-declared limited number of GNSS Self-tests is attained				The GNSS test will fail to initiate and a the red led flashes 7 times to indicate max. number of GNSS test exceeded.
8	Automatic termination of the Self-test mode, irrespectively of the switch position		'Test' button held in	30 sec	If the 'Test' button is held in, the EUT turns off. The EUT ceases to draw residual current after this. See battery current measurements for details.
9	Duration of the GNSS Self-test mode	00:00:41 (with Nav input) 00:02:14 (without Nav input)			

General

All duration measurements below include activation method time, i.e. they start from test switch press and include any “hold for x seconds” requirement and they end when all visual and audible activity appeared to cease.

All positional accuracy values below were calculated using the Haversine Formula; the Earth’s radius was taken as 6367 km.

All temperatures (High, Ambient, Low) were measured, decoded, and found to be compliant for Return Link Test protocol.

GNSS Self-test Observations

Parameter	Actual	Declared
GNSS Self-test count	60	60
GNSS Self-test maximum duration (s) incl. activation method	136	150
Indication of GNSS Self-test activation/completion	A GNSS self-test activation is activated by pressing the black Test button for a minimum of 7 seconds. The green GNSS indicator will start blinking in sequences of 3 fast blinks. This indicates that the EPIRB is searching for a GNSS fix. When GNSS fix is achieved the green GNSS indicator light will remain lit for approximately 1 second and then a normal self test will continue. The test indicator light will illuminate for 3 s if the test is successful. If no GNSS fix is found the Test indicator will blink red 5 times at the end of the test.	
Indication of GNSS Self-test count limit reached	The Test Indicator will blink 7 times.	

Summary: GNSS Self-test with Valid Navigation Input

Protocol	RLS Protocol		
Temperature (°C)	-20	Ambient	+55
Frame sync verification	011010000	011010000	011010000
Format Flag (1 bit)	1	1	1
Single Radiated burst (ms)	521.375	521.500	521.562
Position data	P	P	P
Single burst verification	P	P	P
Actual duration (s) incl. activation method	34	40	33
Position Input Latitude	N 50° 52' 8.1"		
Position Input Longitude	W 1° 14' 42.06"		
Position Output Latitude	N 50° 52' 8"	N 50° 52' 8"	N 50° 52' 8"
Position Output Longitude	W 1° 14 '44"	W 1° 14 '40"	W 1° 14 '40"
Position Error (m)	37.92	40.25	40.25

Protocol	Standard Location Protocol		
Temperature (°C)	-20	+22	+55
Frame sync verification	011010000	011010000	011010000
Format Flag (1 bit)	1	1	1
Single Radiated burst (ms)	521.375	521.500	521.617
Position data	P	P	P
Single burst verification	P	P	P
Actual duration (s) incl. activation method	48.5	44.2	49.0
Position Input Latitude	N 50° 52' 8.1"		
Position Input Longitude	W 1° 14' 42.06""		
Position Output Latitude	N 51° 52' 8"	N 50° 52' 4"	N 50° 52' 8"
Position Output Longitude	W 001° 14' 40"	W 001° 14' 40"	W 001° 14' 40"
Position Error (m)	40.25	40.13	40.25

Protocol	National Location Protocol		
Temperature (°C)	-20	+22	+55
Frame sync verification	011010000	011010000	011010000
Format Flag (1 bit)	1	1	1
Single Radiated burst (ms)	521.273	521.500	521.562
Position data	P	P	P
Single burst verification	P	P	P
Actual duration (s) incl. activation method	36.5	45.4	51.6
Position Input Latitude	N 50° 52' 8.1”		
Position Input Longitude	W 1° 14' 42.06””		
Position Output Latitude	N 51° 52’ 8”	N 51° 52’ 8”	N 50° 52’ 8”
Position Output Longitude	W 001° 14’ 40”	W 001° 14’ 44”	W 001° 14’ 40”
Position Error (m)	40.25	123.5	40.25

Summary: GNSS Self-test without Valid Navigation Input

Protocol	RLS Protocol		
Temperature (°C)	-20	Ambient	+55
Frame sync verification	N/A*	N/A*	N/A*
Format Flag (1 bit)	N/A*	N/A*	N/A*
Single Radiated burst (ms)	N/A*	N/A*	N/A*
Default Position data	N/A*	N/A*	N/A*
Single burst verification	N/A*	N/A*	N/A*
Actual duration (s) incl. activation method	133	136	134

Protocol	Standard Location Protocol		
Temperature (°C)	-20	+22	+55
Frame sync verification	N/A	N/A	N/A
Format Flag (1 bit)	N/A	N/A	N/A
Single Radiated burst (ms)	N/A	N/A	N/A
Default Position data	N/A	N/A	N/A
Single burst verification	N/A	N/A	N/A
Actual duration (s) incl. activation method	134.7	134.9	135.6

Protocol	National Location Protocol		
Temperature (°C)	-20	+22	+55
Frame sync verification	N/A	N/A	N/A
Format Flag (1 bit)	N/A	N/A	N/A
Single Radiated burst (ms)	N/A	N/A	N/A
Default Position data	N/A	N/A	N/A
Single burst verification	N/A	N/A	N/A
Actual duration (s) incl. activation method	135.3	134.8	136.5

*Note: The EUT does not transmit a 406MHz burst if there is no GNSS fix during the GNSS Self-test, instead it displays the error codes after the full duration of the self-test.

GNSS Self-test with Valid Navigation Input decoded message

Decoded Beacon Message

Hexadecimal code: **FFFED08C9DFE7018CCD0153323784FBEA8E5**

The code consists of 35 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev.6.

Unique identifier:
193BFCE031BFDFF

Binary Range	Binary Content	Field Name	Decoded Value
1-15	111111111111111	Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions	True
16-24	011010000	Frame Synchronization Pattern	Test protocol message coded for non-operational use
25	1	Format Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201	Search Context for here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Test Location
43-46	1111	Identification type	RLS protocol coded with MMSI last 6 digits
47-66	10011100000001100011	Last 6 digits MMSI	639075
67-75	001100110	Latitude	51.0 Degrees North (51.0)
76-85	1000000010	Longitude	1.0 Degrees West (-1.0)
86-106	10100110011001000110 1	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	0	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) not received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider Identification	GALILEO Return Link Service Provider
115-123	001111101	Latitude offset	7.0 minutes 52.0 seconds (negative)
124-132	111101010	Longitude offset	14.0 minutes 40.0 seconds (positive)
133-144	100011100101	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field
		Composite location	50.869 -1.244

Full Hex Messages	
National Location Protocol with Navigation data applied	
+55°C	FFFED08C9B70464CB5013BF54BF785280AED
Ambient	FFFED08C9B70464CB5013BF54BF7852C0204
-20°C	FFFED08C9B70464CB5013BF54BF785280AED
National Location Protocol without Navigation data applied	
+55°C	N/A *
Ambient	N/A *
-20°C	N/A *
Standard Location Protocol with Navigation data applied	
+55°C	FFFED08C97F9C06332E02CE8E9B79C8051C4
Ambient	FFFED08C97F9C06332E02CE8E9B79C405383
-20°C	FFFED08C97F9C06332E02CE8E9B79C8051C4
Standard Location Protocol without Navigation data applied	
+55°C	N/A *
Ambient	N/A *
-20°C	N/A *
RLS Protocol with Navigation data applied	
+55°C	FFFED08C9DFE7018CCD0153323784FBEA8E5
Ambient	FFFED08C9DFE7018CCD0153323784FBEA8E5
-20°C	FFFED08C9DFB5018CCD0156FA3B84FBEBDDC
RLS Protocol without Navigation data applied	
+55°C	N/A *
Ambient	N/A *
-20°C	N/A *

Note*:

The EUT GNSS Self-Test design includes a timeout. In this instance no 406MHz burst is provided.

Testing Insufficient Battery Energy

Table F-E.5: Indication of Insufficient Battery Energy

Parameter	Units	Declared by beacon manufacturer	Verified and evaluated by accepted test facility	Notes
Minimum duration of continuous operation (C_{CO})	hours	24		C_{CO} is declared in Annex G as "Operating Lifetime". C_{CO} is required for the test. Minimum duration of continuous operation (C_{CO})
Full Battery Pack Capacity **(C_{BP})**	hours	-		If needed to calculate C_{SP-AMB}
Battery Pre-Operational Losses **(C_{PO})**	hours	-		Corresponds to L_{CDC}, as defined in the Table F- E.2
Spare Battery Capacity at ambient temperature **(C_{SP-AMB})**	hours	-		C_{SP-AMB} is required for the test and shall be defined by testing (see Footnote 4 to section A.3.6.2.2), or by calculation, as follows: **CSP-AMB = CBP – (CPO + CCO)**
Criteria and conditions to trigger **PIE** indication		Activation of the beacon for 120 minutes or performing more than 400 self-tests beyond the 150 defined in annex G or a combination of the above.	The EUT was activated for a total period of 150 minutes with checks being performed at 90 minutes and again at 150 minutes.	Description of PIE criteria and conditions to be met to trigger PIE indication. Use a separate sheet if needed
Step-1: battery pack discharge	hours	-	Discharge = 1.5 hours	Battery discharge shall correspond to: C_{PO} - **30 minutes,** or the value declared by the beacon manufacturer less 30 minutes
Step-1: beacon conditions (if applicable)		-.	The EUT was placed in a faraday box and activated for a period of 90 minutes.	Description of conditions recreated during the Step-1 for which the PIE criteria is not met
Step-1: observations of self-test indication		-	The EUT was deactivated after 90 minutes of operation and a Self-Test was performed. The Self-Test performed as indicated in the Manufacturers manual and concluded with a green led illuminating for approx. 3s indicating a successful Self-Test operation.	Test facility observations of self-test indication: time, duration, type of indication

Step-2: battery pack discharge	hours	-	The EUT was re-activated in the faraday box for a further 60 minute period.	Total battery discharge shall correspond to: **C_{PO} + C_{SP-AMB} + 30 minutes** or the value declared by the beacon manufacturer plus 30 minutes
Step-2: beacon conditions (if applicable)	-	-	The EUT remained in the faraday box for a further one hour period (60 minutes + 90 minutes = 150 minutes	Description of conditions recreated during the Step-2 for which the PIE criteria is met
Step-2: observations of distinct PIE indication			Standard self-test was observed with a red final led followed by a further single red led indicating the failure of the self-test due to battery condition.	Test facility observations of PIE indication: time, duration, type of indication

Summary

The EUT complies with clause A.3.6 of Cospas-Sarsat T.007.

2.8 THERMAL SHOCK

2.8.1 Specification

Cospas-Sarsat T.007, Clause A.2.2

2.8.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

2.8.3 Date of Test

19 January 2023

2.8.4 Test Equipment Used

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

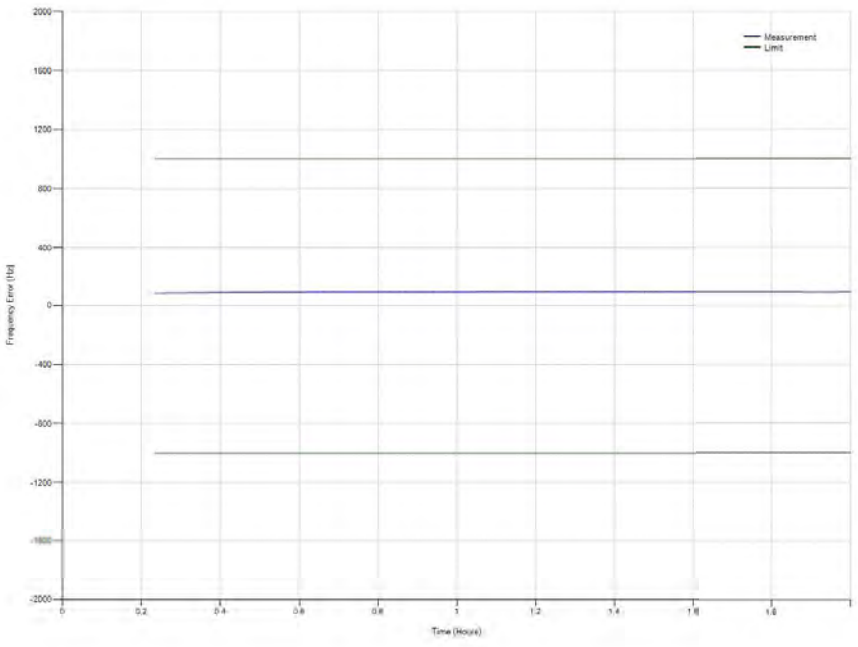
2.8.5 Laboratory Environmental Conditions

Ambient Temperature 25.0°C
Relative Humidity 18.7 %

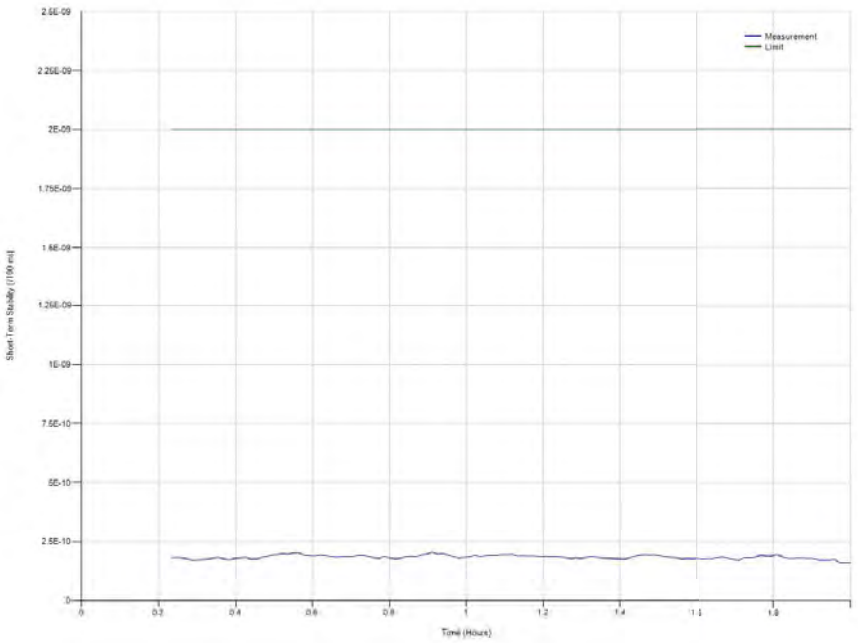
2.8.6 Test Results

Soak Temperature 22°C
Test Temperature - 8°C

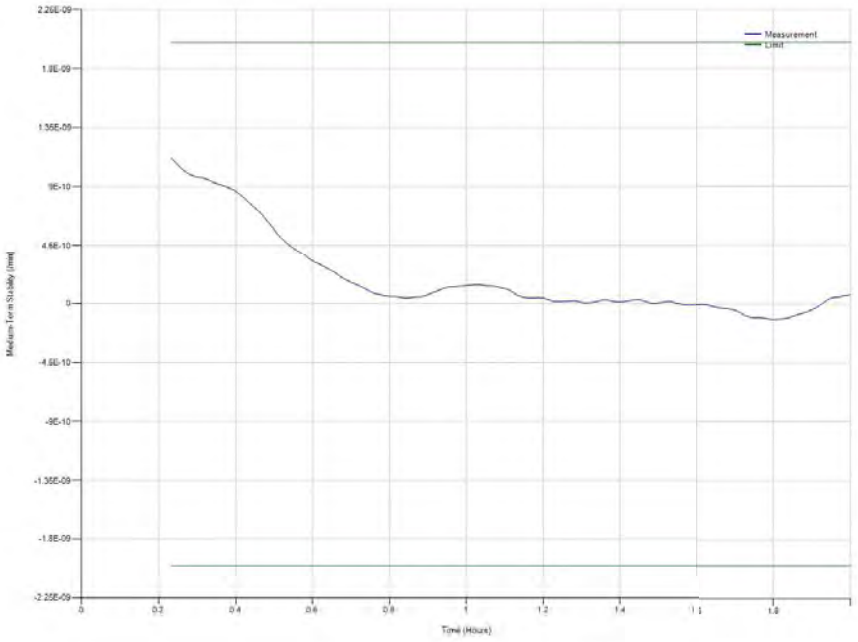
Nominal Frequency



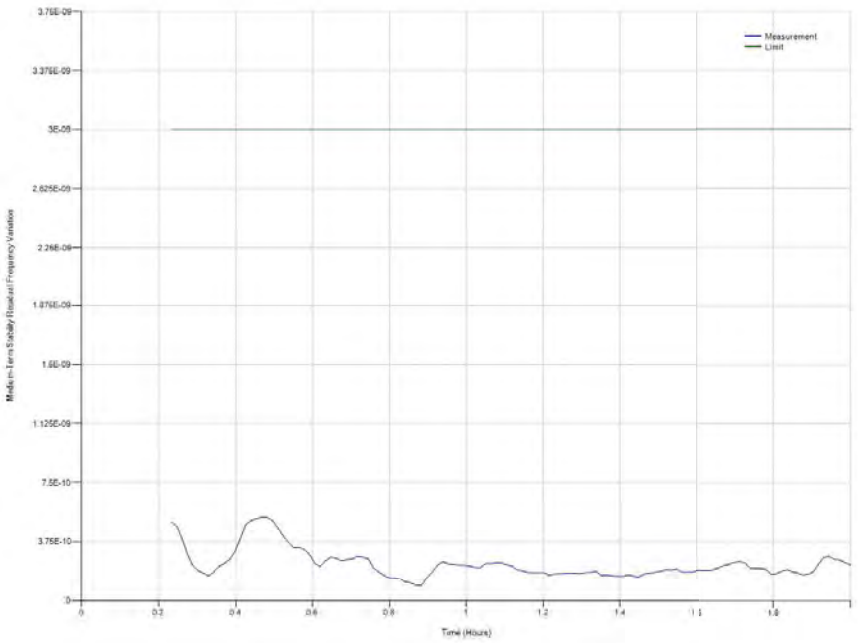
Short Term Stability



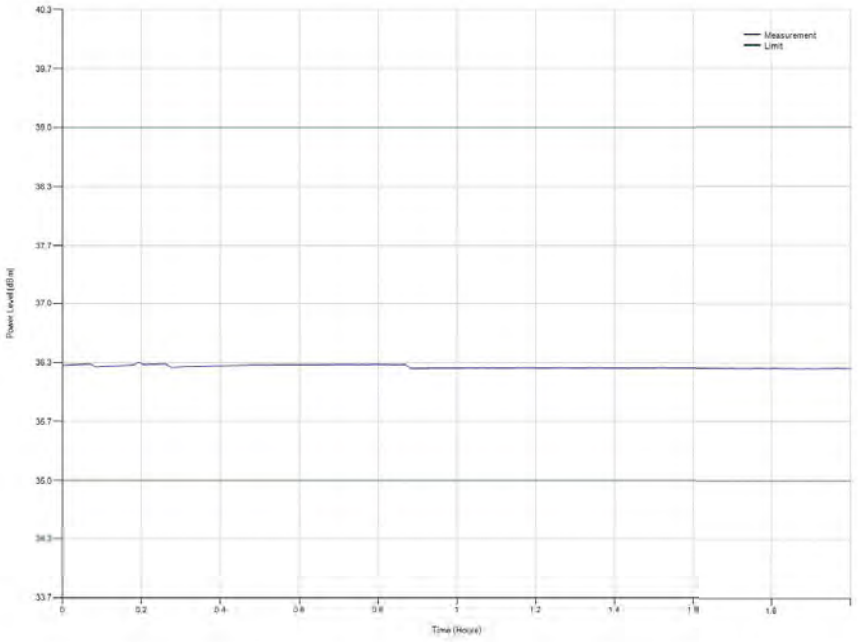
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

Decoded Beacon Message

Hexadecimal code: **FFFE2F8C9OFE7018DFEFF8129DF861F0FABE**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev 5.

Unique identifier:
190BFCE031BFDFF

Binary Range	Binary Content	Field Name	Decoded Value
1-15	111111111111111	Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions.	True
16-24	000101111	Frame Synchronization Pattern	Normal beacon operation
25	1	Format Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201	Search Contact list here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Test Location
43-45	1111	Identification type	RLS protocol coded with MMSI last 6 digits
47-66	10011100000001100011	Last 6 digits MMSI	639075
67-75	011111111	Latitude	Default - no location (Default - no location)
76-85	0111111111	Longitude	Default - no location (Default - no location)
86-106	00000010010100111011	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	0	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) not received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider Identification	GALILEO Return Link Service Provider
115-123	100001111	Latitude offset	Default value
124-132	100001111	Longitude offset	Default value
133-144	101010111110	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field

Summary

The EUT complies with clause A.2.2 of Cospas-Sarsat T.007.

2.9 OPERATING LIFETIME AT MINIMUM TEMPERATURE

2.9.1 Specification

Cospas-Sarsat T.007, Clause A.2.3

2.9.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

2.9.3 Date of Test

15 December 2022, 16 December 2022, 19 December 2022 – Battery Current measurements
26 March 2023 – Operating Lifetime at minimum temperature test

2.9.4 Test Equipment Used

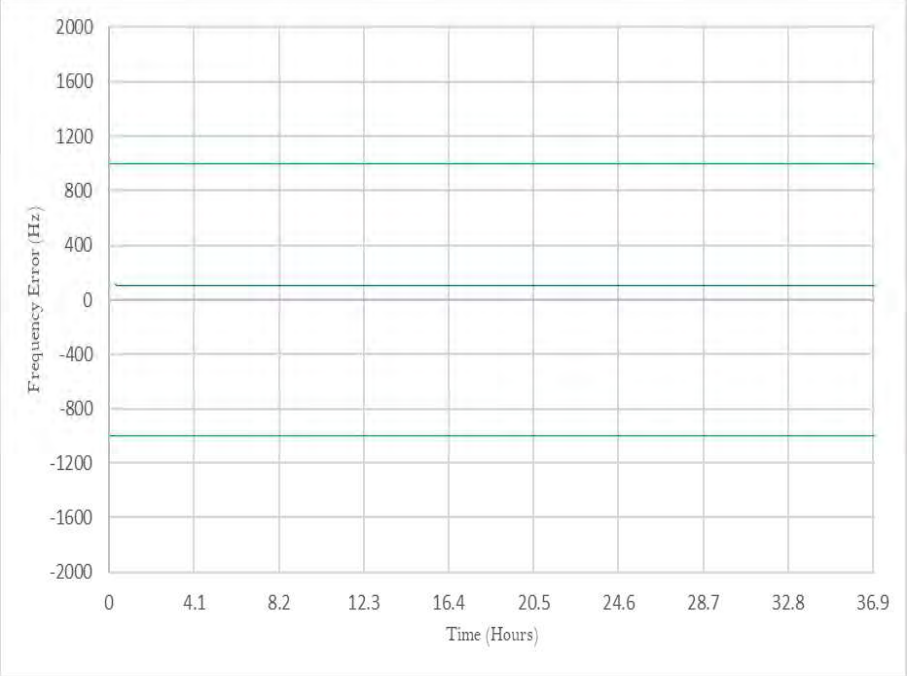
The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.5 Laboratory Environmental Conditions

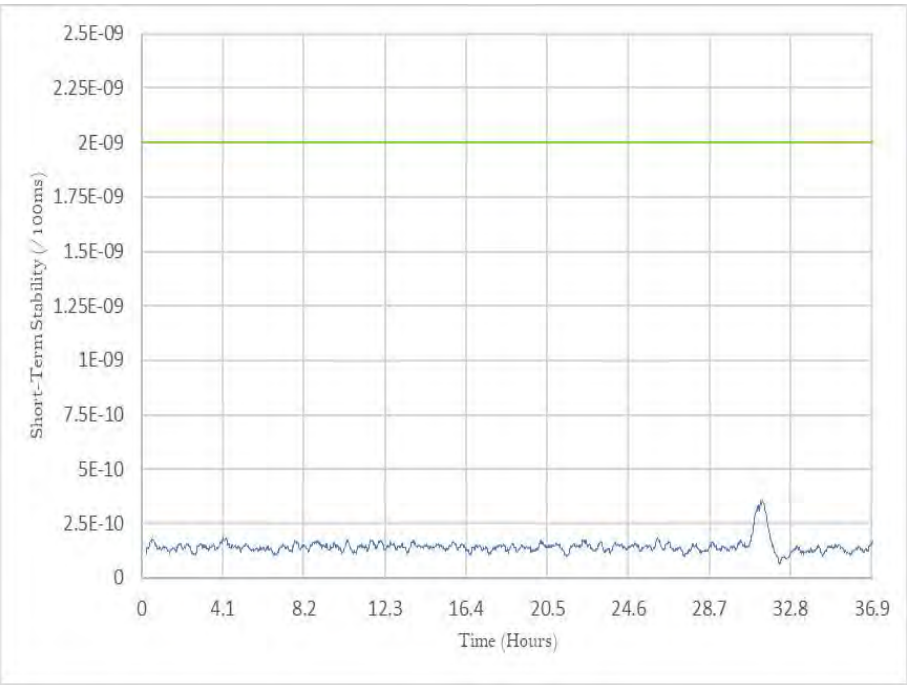
Ambient Temperature 18.9 - 25.4°C
Relative Humidity 18.9 - 44.9%

2.9.6 Test Results

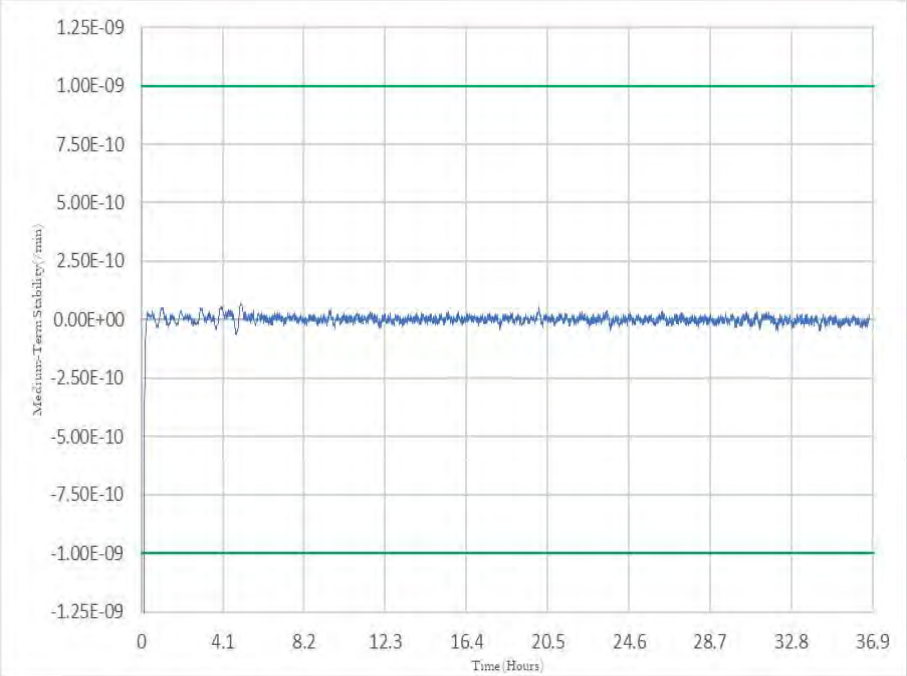
Nominal Frequency



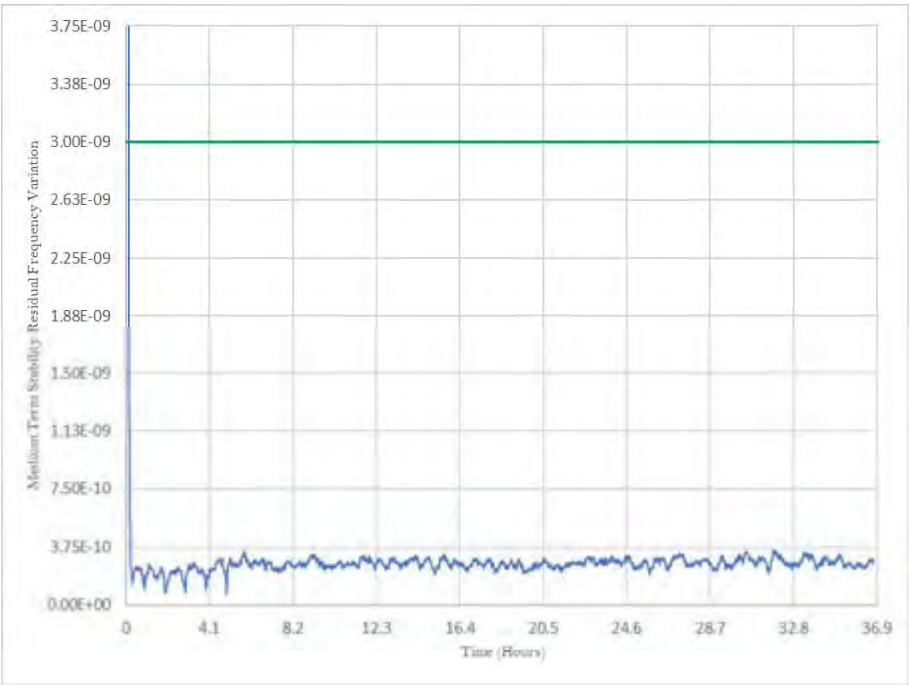
Short Term Stability



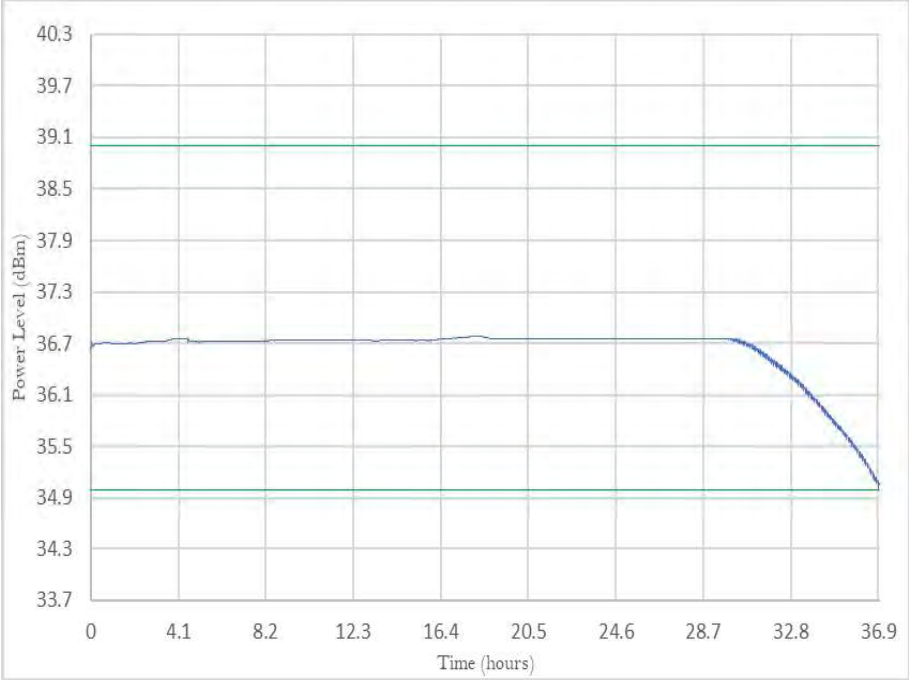
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

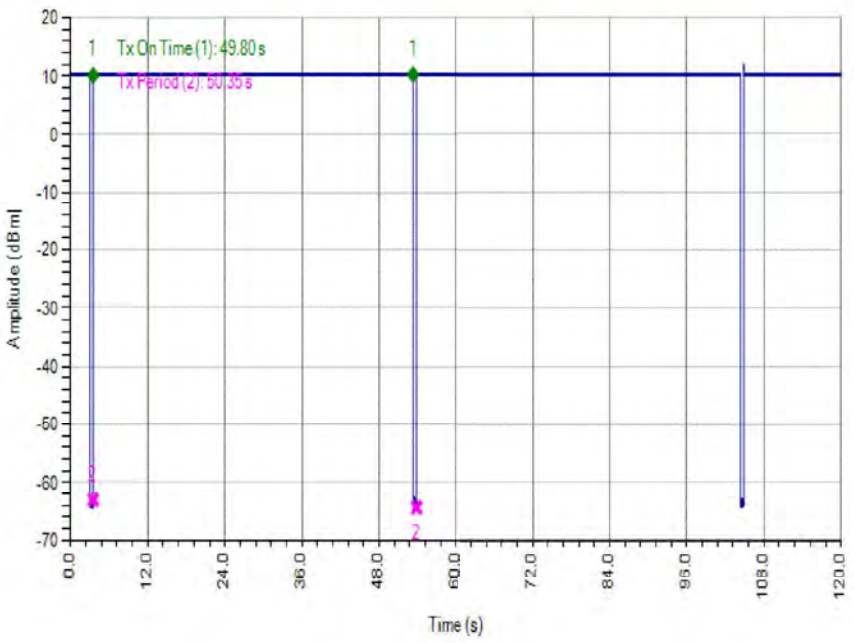
Message	FFFE2F8C9DFB5018DFEFF84E1D3861F0FABE		
Hex ID	193BF6A031BFDFF		
Position	None - Default Values		
Parameter	Bit	Data Bits	Decoded Value
Bit synchronization	1-15	111111111111111	111111111111111
Frame synchronization	16-24	000101111	000101111
Format Flag	25	1	1
Protocol Flag	26	0	0
Country Code	27-36	0011001001	Albania (Republic of)
Protocol Code	37-40	1101	RLS Location Protocol
Beacon Type	41-42	11	Location Test Protocol
RLS TAC	43-52	1110110101	949
RLS ID Serial Number	53-66	00000001100011	99
N/S	67	0	Default
Latitude Degrees	68-75	11111111	Default
E/W	76	0	Default
Longitude Degrees	77-85	111111111	Default
BCH Code (21 Bit)	86-106	000010011100001110100	000010011100001110100
Calculated BCH Code (21 Bit)	-	000010011100001110100	000010011100001110100
Encoded Position Data Source	107	1	Internal navigation device
121.5 MHz Radio Locating Device	108	1	Yes
Capability to process RLM Type-1:	109	1	Acknowledgement Type-1 accepted by this beacon
Capability to process manually generated RLM	110	0	Manually generated RLM not accepted by this beacon
Feedback on RLM Type-1:	111	0	Acknowledgement Type-1 not (yet) received by this beacon
Feedback on RLM Type-2	112	0	RLM Type-2 not (yet) received by this beacon
RLS Provider Identification:	113-114	01	GALILEO Return Link Service Provider
Delta Latitude +/-	115	1	Default
Delta Latitude Minutes	116-119	0000	Default
Delta Latitude Seconds	120-123	1111	Default
Delta Longitude +/-	124	1	Default
Delta Longitude Minutes	125-128	0000	Default
Delta Longitude Seconds	129-132	1111	Default
BCH Code (12 Bit)	133-144	101010111110	101010111110
Calculated BCH Code (12 Bit)	-	101010111110	101010111110

Test Data (0 min - 30 min)

#	Nominal Frequency (Hz)	Short Term Stability (/100 ms)	Medium Term Stability – Slope (/min)	Medium Term Stability – Residual Frequency Variation (no units)	Output Power (dBm)	Time (h)
1	-	-	-	-	36.64	0
2	-	-	-	-	36.71	0.015
3	-	-	-	-	36.71	0.028
4	-	-	-	-	36.71	0.042
5	-	-	-	-	36.72	0.055
6	-	-	-	-	36.67	0.07
7	-	-	-	-	36.67	0.083
8	-	-	-	-	36.67	0.098
9	-	-	-	-	36.67	0.111
10	-	-	-	-	36.67	0.125
11	-	-	-	-	36.67	0.139
12	-	-	-	-	36.68	0.152
13	-	-	-	-	36.68	0.166
14	-	-	-	-	36.68	0.179
15	-	-	-	-	36.68	0.194
16	-	-	-	-	36.69	0.208
17	-	-	-	-	36.69	0.222
18	406.0311	1.12E-10	1.24E-08	-1.02E-08	36.69	0.236
19	406.0311	1.20E-10	1.40E-08	-9.40E-09	36.69	0.25
20	406.0311	1.37E-10	1.51E-08	-8.40E-09	36.69	0.264
21	406.0311	1.37E-10	1.56E-08	-7.28E-09	36.69	0.278
22	406.0311	1.34E-10	1.53E-08	-6.10E-09	36.69	0.292
23	406.0311	1.35E-10	1.41E-08	-4.90E-09	36.69	0.306
24	406.0311	1.32E-10	1.24E-08	-3.78E-09	36.7	0.32
25	406.0311	1.37E-10	1.01E-08	-2.76E-09	36.7	0.334
26	406.0311	1.35E-10	7.45E-09	-1.88E-09	36.7	0.347
27	406.0311	1.38E-10	4.56E-09	-1.17E-09	36.7	0.361
28	406.0311	1.41E-10	2.27E-09	-7.12E-10	36.7	0.375
29	406.0311	1.42E-10	1.37E-09	-4.83E-10	36.7	0.389
30	406.0311	1.53E-10	1.02E-09	-3.53E-10	36.7	0.403
31	406.0311	1.52E-10	7.87E-10	-2.57E-10	36.7	0.417
32	406.0311	1.64E-10	5.98E-10	-1.87E-10	36.7	0.431
33	406.0311	1.68E-10	4.42E-10	-1.29E-10	36.7	0.445
34	406.0311	1.66E-10	3.33E-10	-8.35E-11	36.7	0.458
35	406.0311	1.68E-10	2.61E-10	-5.01E-11	36.7	0.472
36	406.0311	1.70E-10	2.05E-10	-3.02E-11	36.7	0.486

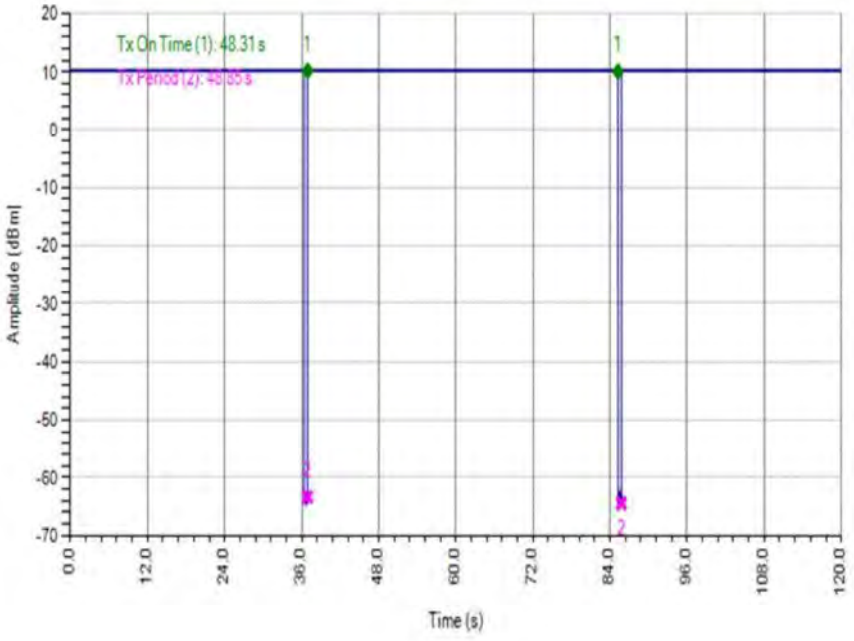
Results outside of the specification are marked in red text.

121MHz Homing Transmitter - Duty Cycle (Start of Test)



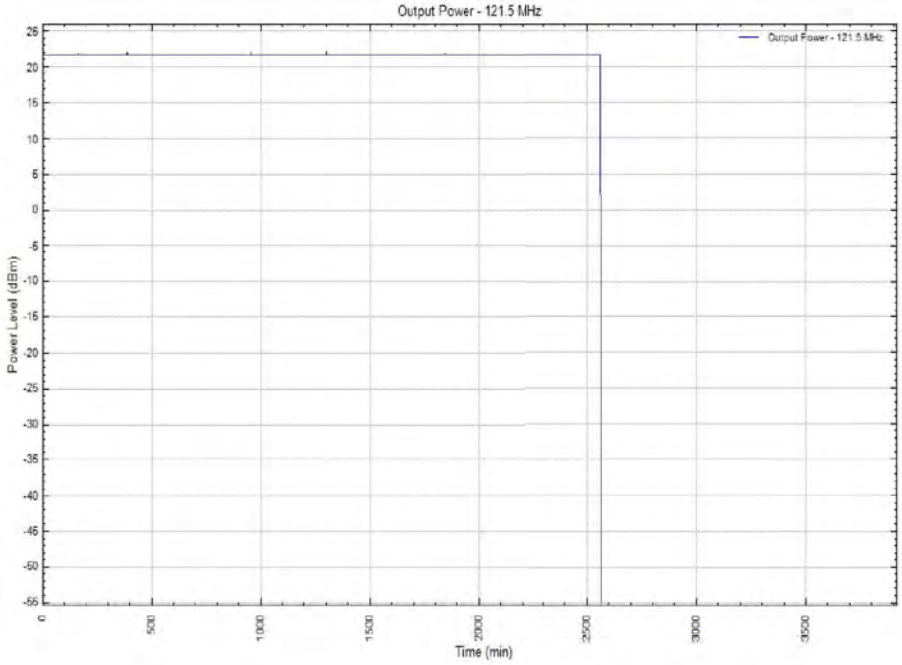
Duty Cycle = 49.805 / (49.805+0.542) = 98.92%

121MHz Homing Transmitter - Duty Cycle (End of Test)

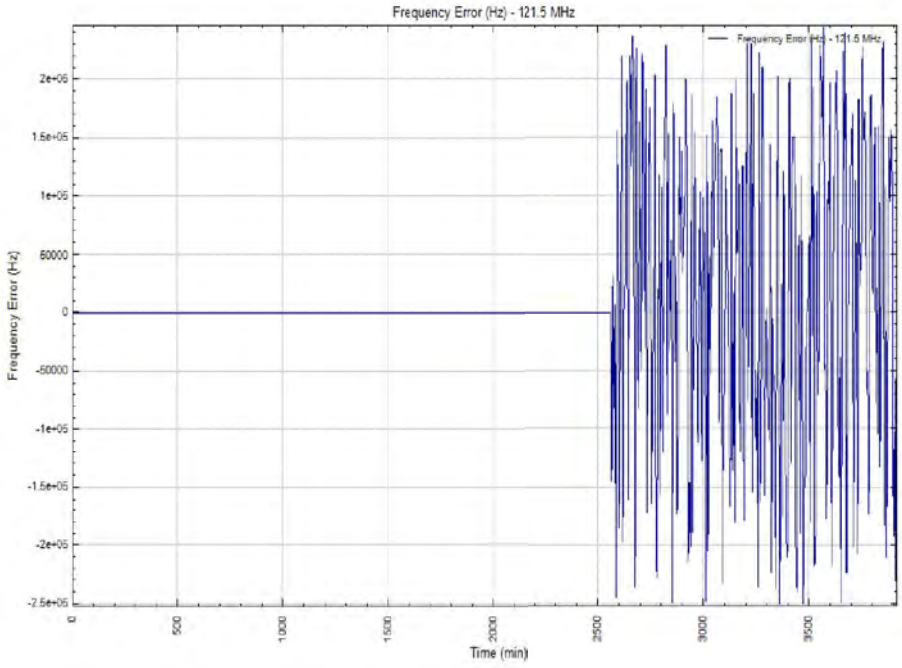


Duty Cycle = 48.31 / (48.31+0.542) = 98.89%

121MHz Homing Transmitter Power



121MHz Homing Transmitter Frequency



Operating Current Measurements and Analysis

Jotron Tron SA20

System Configuration → / Operational Mode ↓	A, No Ancillaries 100% duty cycle	B, No Ancillaries 40% duty cycle
1, Standby	**A1**	N/A
2, ON at EUT (Average)	**A2**	**B2**
3, ON at EUT (GNSS Search)	**A3**	**B3**
4, ON at EUT (GNSS Sleep)	**A4**	**B4**
5, Self-Test	**A5**	N/A
6, Self-Test (Held)	**A6**	N/A
7, GNSS Self-Test (Timeout)	**A7**	N/A
8, GNSS Self-Test (Burst)	**A8**	N/A
9, On at EUT (GNSS Fix await RLS Ack)	**A9**	N/A
10, On at EUT (GNSS Fix, RLM Ack Rx).	**A10**	N/A
11, NFC Configuration	**A11**	
12, NFC Read	**A12**	

Notes:

GNSS Search refers to the automatic period of search activity performed by the PLB.

GNSS Sleep refers to the automatic period where the search activity is deactivated in the PLB

GNSS Timeout refers to a test where no GNSS signal is provided.

GNSS Burst refers to the test where a GNSS signal is available to the PLB.

For the RLS and RLM tests a simulated GNSS scenario was applied which provided GNSS signal only for the initial 10 minutes followed thereafter by an RLM acknowledgement message once a minute.

The PLB operation is such that holding the Self-Test button for longer than 3 seconds will initiate the GNSS Self-Test. For 6 above the resulting data reflects the GNSS long test.

The NFC configuration will only be performed in the case where a trained distributor needs to re-configure the PLB for a customer.

The NFC Read is referred to in Manufacturer documentation, but no process to use is stated.

Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement interval, sec	Average Current, mA	Peak Current, mA
A, No Ancillaries 100% duty cycle - 1, Standby		2000	1.794E-06	0.000005
A, No Ancillaries 100% duty cycle - 2, ON at EUT (Average)		2600	55.04	1873
B,No Ancillaries 40% duty cycle - 2, ON at EUT (Average)		2600	38.69	1575
A, No Ancillaries 100% duty cycle - 3, ON at EUT (GNSS Search)		215	55.39	1873
B,No Ancillaries 40% duty cycle - 3, ON at EUT (GNSS Search)		215	44.73	1554
A, No Ancillaries 100% duty cycle - 4, ON at EUT (GNSS Sleep)		215	54.73	1864
B,No Ancillaries 40% duty cycle - 4, ON at EUT (GNSS Sleep)		215	37.80	1556
A, No Ancillaries 100% duty cycle - 5, Self-Test		8.5	122.9	1544
A, No Ancillaries 100% duty cycle - 6, Self-Test (held)		7	0.17	0.217
A, No Ancillaries 100% duty cycle - 7, GNSS Self Test (timeout)		137	17.1	57.57
A, No Ancillaries 100% duty cycle - 8, GNSS Self-Test (Burst)		47.8	38.71	1585
A, No Ancillaries 100% duty cycle - 9, On at EUT (GNSS Fix await RLS Ack)		215	62.02	1804
A, No Ancillaries 100% duty cycle - 10, On at EUT (GNSS Fix,RLM ACK RXd).		215	62.21	1801
A, No Ancillaries 100% duty cycle – 11, NFC Configuration*		2.072	21.09	63.21
A, No Ancillaries 100% duty cycle – 12, NFC Read		500	0.00002	0.00002

The sampling interval was a nominal 100 ms for all measurements.

* NOTES, GNSS sleep denoted as Automatic; upon beacon activation the beacon enters GNSS search mode for 30 minutes. The 121.5 homing mode is initiated after a period of 5 minutes from activation. The GNSS sleep mode is initiated after the initial 30 minutes and

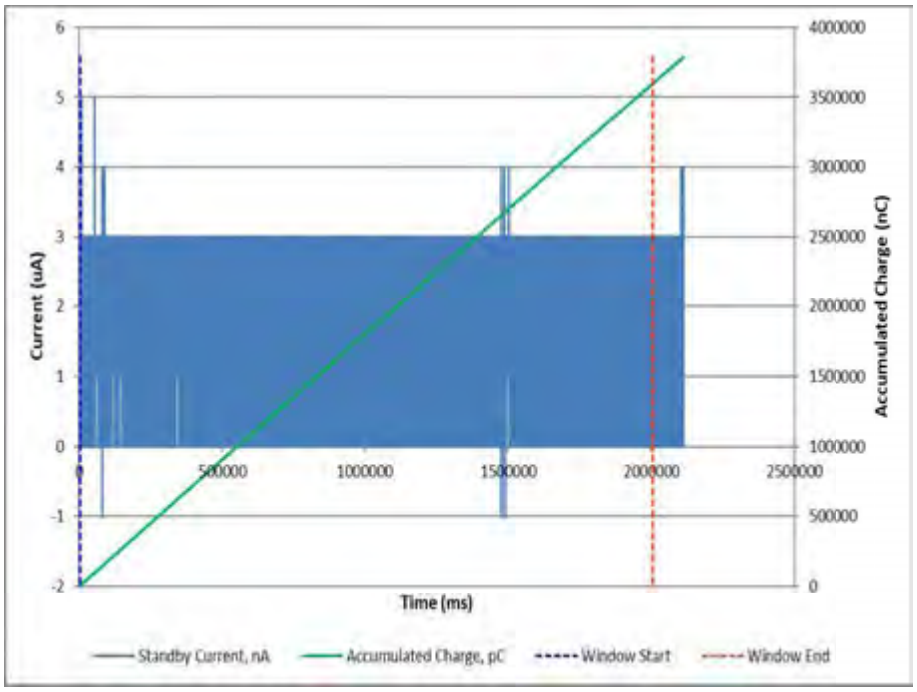
remain in sleep mode for 3.5 minutes followed by a 1.8 minute search period. This continues cycling until a GNSS signal is attained.

When the Self-Test mode was pressed and held the PLB returned to an average of 0.17mA when held for a period of 6 mins.

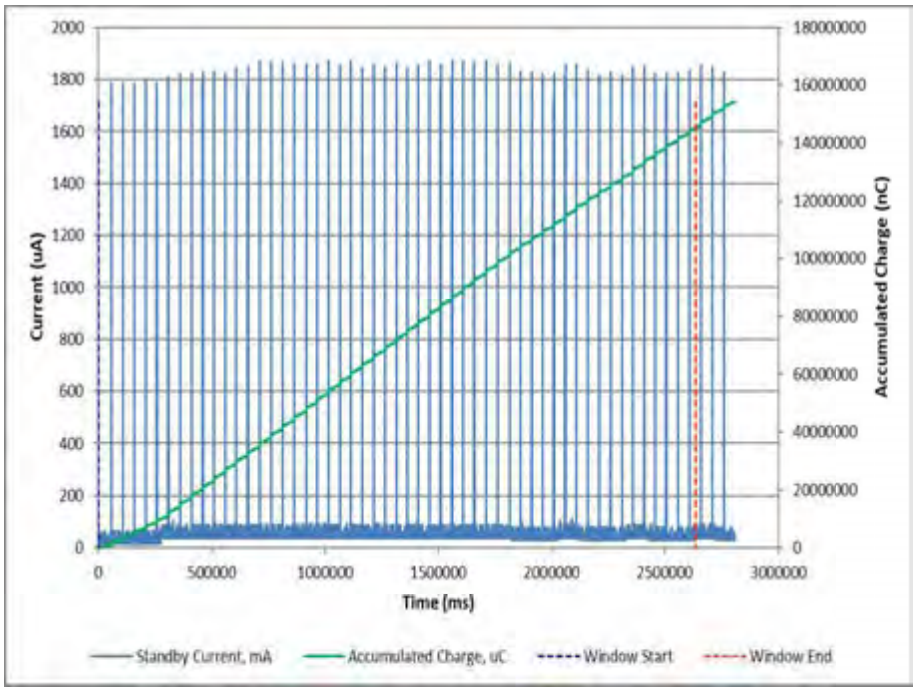
Observations:

The PLB exhibited slight variations in current dependent upon duty cycle and GNSS search / sleep patterns.

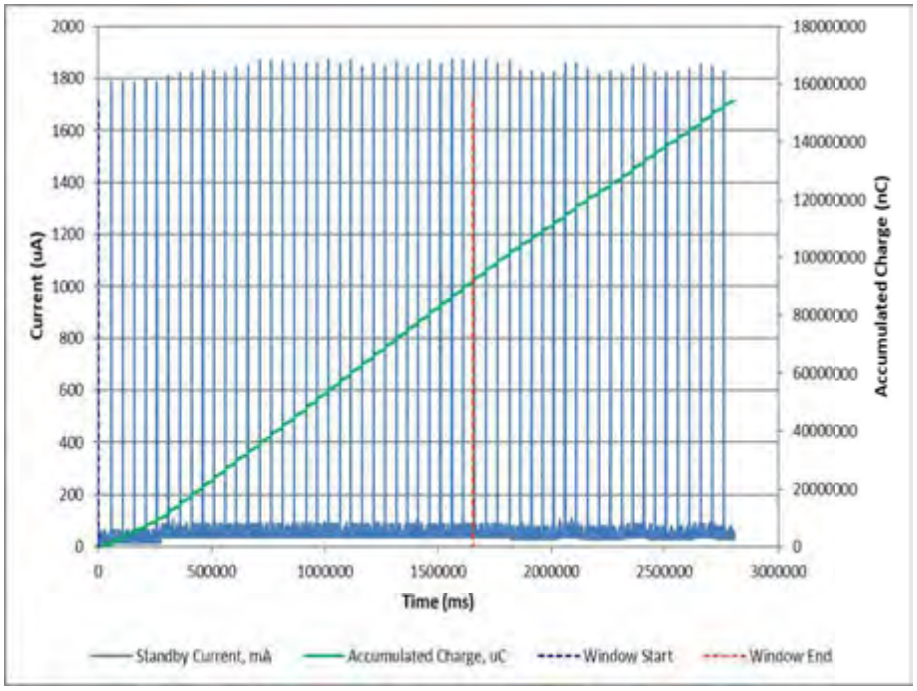
Current Measurement Plots



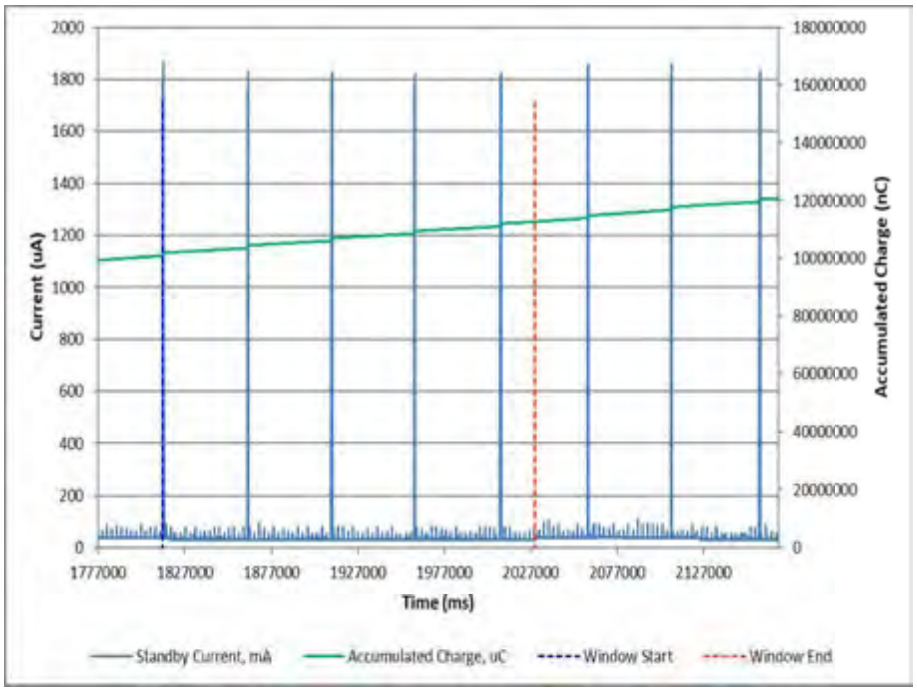
Standby: A1



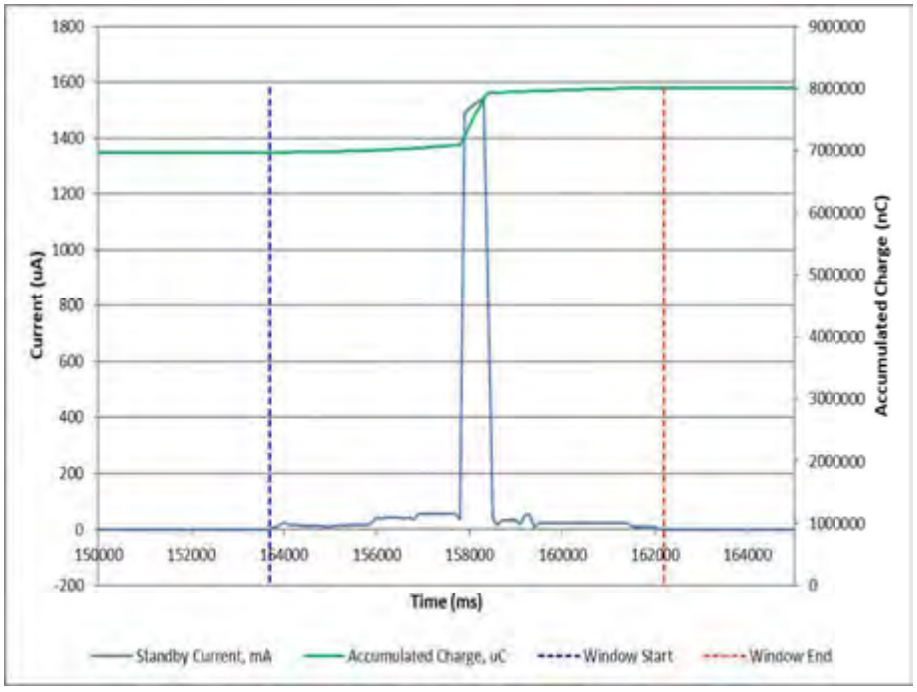
Worst Case On at EUT Average: A2



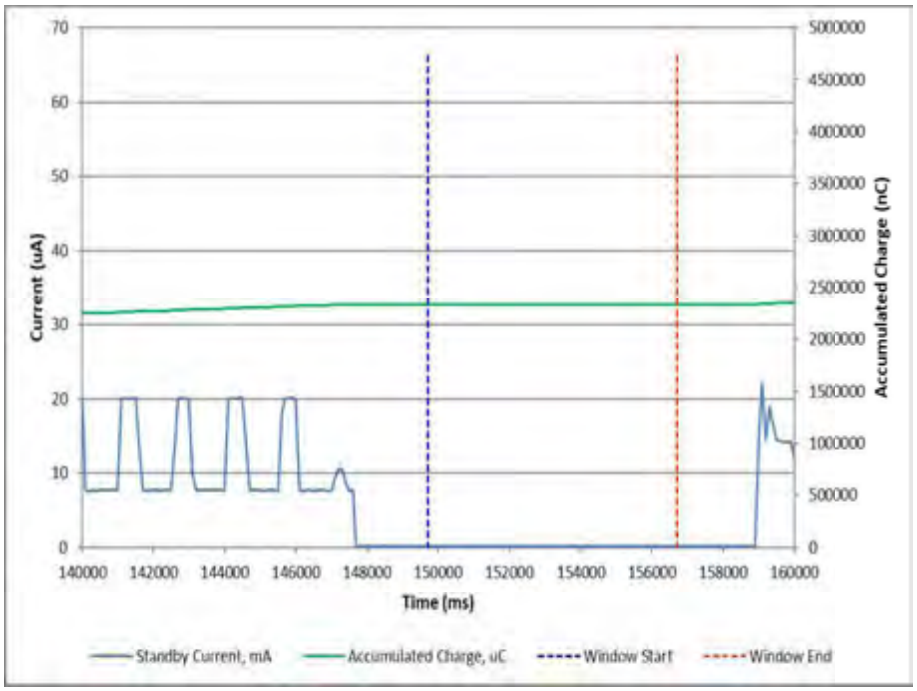
Worst Case On at EUT (GNSS Search): A3



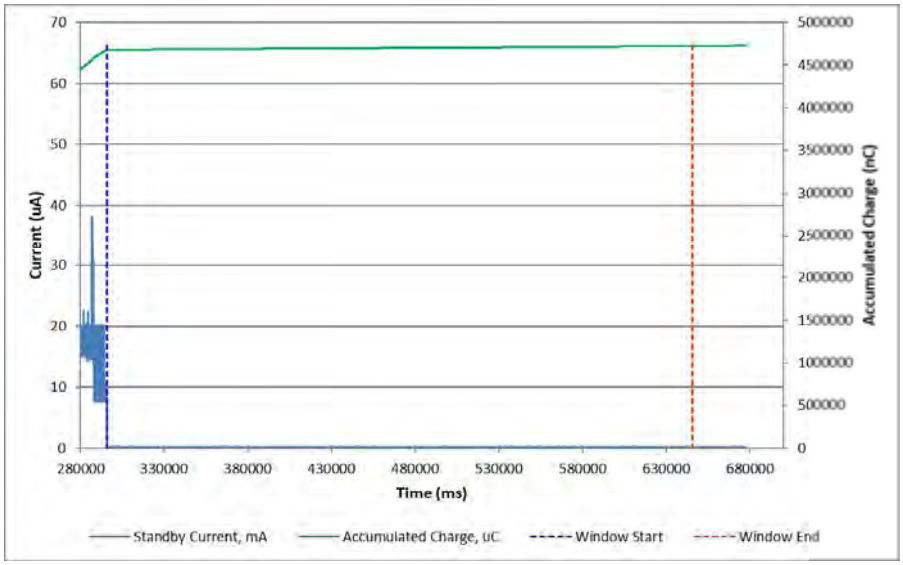
Worst Case On at EUT (GNSS Sleep): A4



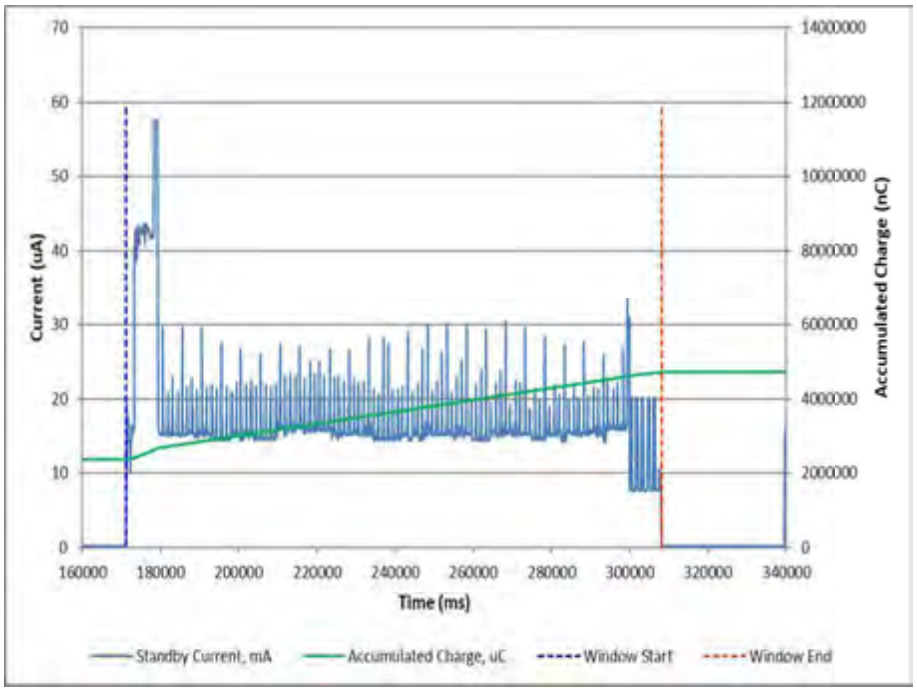
Self-test: A5



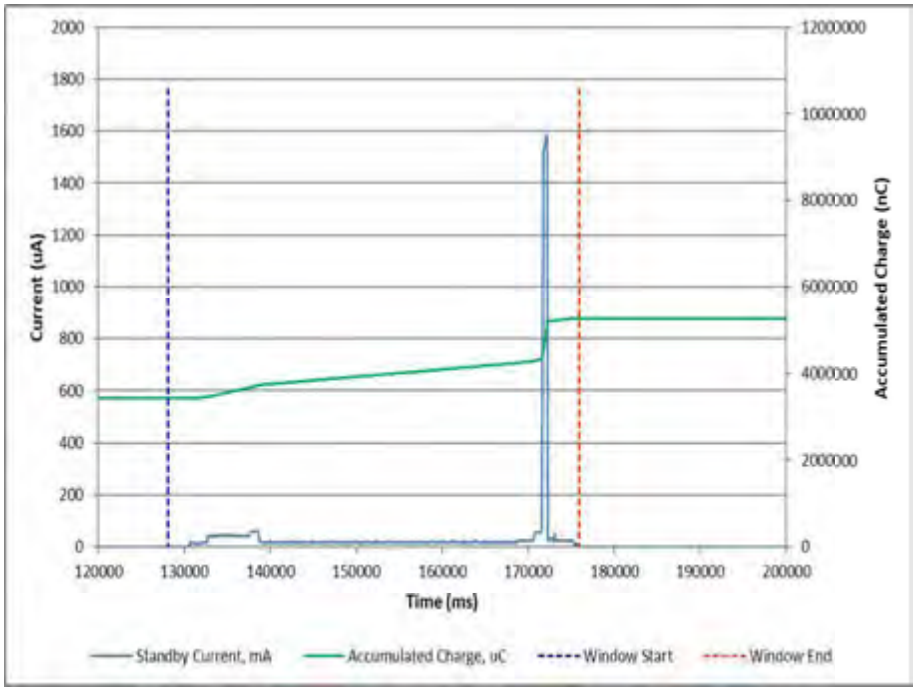
Self-test held: A6 Pre button hold



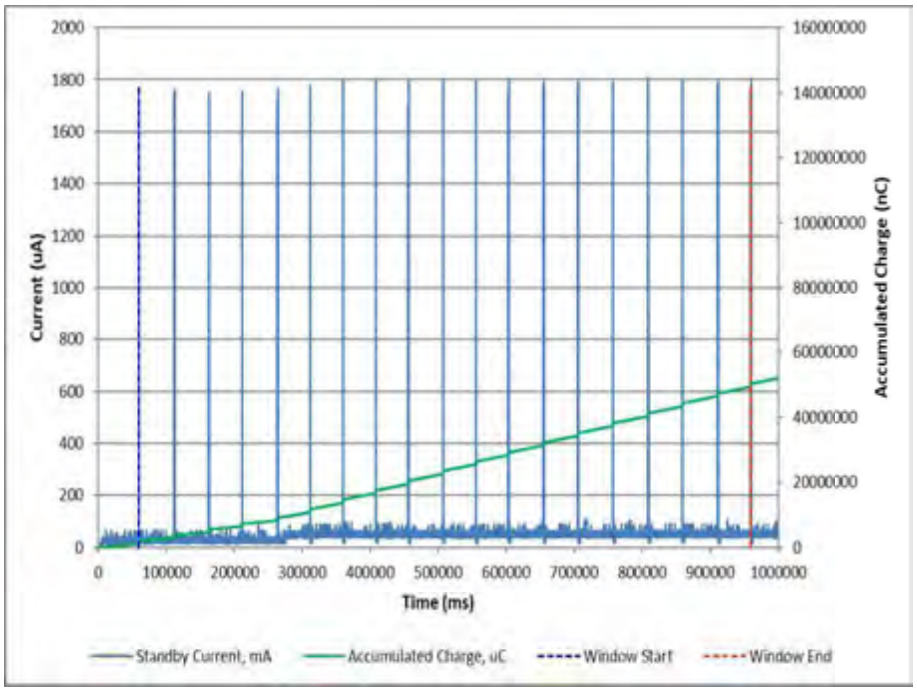
Self-test held: A6 Post button hold



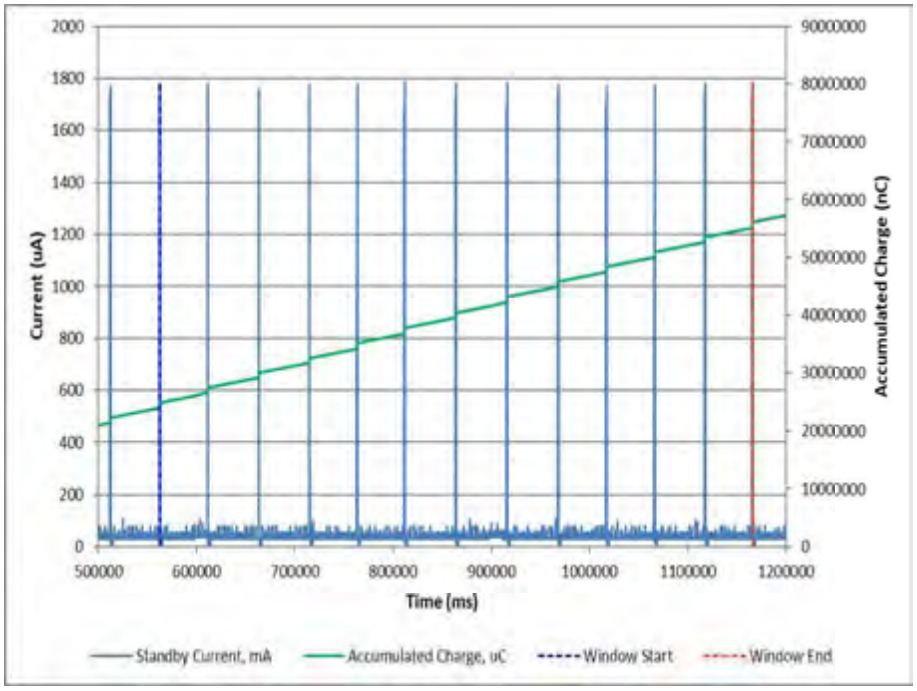
GNSS Self-test (Timeout): A7



GNSS Self-test (Burst): A8



On at EUT (GNSS fix, waiting RLM acknowledgement): A9



On at EUT (GNSS fix, RLM acknowledgement received): A10

Battery Conditioning Calculations

As per C/S T.007 Table F-E.2:

Characteristic	Designation	Units	Value	Comments
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	T_{CS} or TCS	Years	1	
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	T_{BR} or TBR	Years	12.5	
Battery pack electrical configuration	-	-		
Cell model and cell chemistry	-	-		
Nominal cell capacity	-	Ah	3.4	
Nominal battery pack capacity	C_{BN}	Ah	3.4	
Annual battery cell capacity loss (self-discharge) due to aging, as specified by cell manufacturer at ambient temperature	L_{SDC}	%	0.42	Declared for C/S
Calculated battery pack capacity loss due to self-discharge: $L_{CBN} = C_{BN} - [C_{BN} * (1 - L_{SDC} /100)^{TBR+TCS}]$	L_{CBN}	Ah	0.1878	
Number of self-tests per year	N_{ST}	-	12	Manufacturer Declared Value
Average battery current during a self-test	I_{ST}	mA	122.93	
Maximum duration of a self-test	T_{ST}	s	9	Manufacturer Declared Value
Calculated battery pack capacity loss due to self-tests during battery replacement period: $L_{ST} = I_{ST} * T_{ST} * T_{BR} * (N_{ST} / 3600)$	L_{ST}	mAh	46.10	
Maximum Number of GNSS self-tests between battery replacements	N_{GST}	-	60	
Average battery current during a GNSS self-test of maximum duration	I_{GST}	mA	17.1	
Maximum duration of a GNSS self-test	T_{GST}	s	150	
Average battery current during a self-test of maximum duration	$I_{GST\#}$	mA	38.71	
Maximum duration of a self-test	$T_{GST\#}$	s	47.8	
Calculated battery pack capacity loss due to GNSS self-tests during battery replacement period: $L_{GST} = I_{GST} * T_{GST} * (N_{GST} / 3600) + IGST\# * TGST\# * (NGST / 3600)$	L_{GST}	mAh	73.58896667	
Average stand-by battery pack current	I_{SB}	mA	0.00000179	
Other Capacity Losses	L_{OTH}	mAh	0	None declared
Battery pack capacity loss due to constant operation of circuitry prior to beacon activation: $L_{ISB} = I_{SB} * T_{BR} * 8760$	L_{ISB}	mAh	0.1960	
Calculated value of the battery pack pre-test discharge $L_{CDC} = L_{CBN} + 1.65((L_{ST} + L_{GST} + L_{ISB})/1000) + (L_{OTH}/1000)$	L_{CDC}	Ah	0.3856	

Battery Discharge Calculations

Characteristic	Designation	Units	Value	Comments
Method of discharge	-	-	Constant Current	A4
Discharge current	L_D	mA	50	Worst Case
Discharge duration, $T_D = L_{CDC} / (L_D * 1000)$	T_D	h	7.71	

Battery Conditioning Results

A fresh battery was used for the test; it was discharged by connection to a resistive load for the pre-test discharge duration calculated as follows:

Pre-test discharge (L_{CDC}) [mAh] = 385.6

Constant current [mA] = 50

Pre-test discharge duration [h] = $\frac{385.6}{50}$

Pre-test discharge duration [h] (calculated) = 7.71

Actual Discharge duration [h]= 8.73

This is an over discharge of 1.02 h or 13%*.

* This was an intentional over-test to meet the requirements of the RTCM standard that requires a more stringent pre-discharge.

Summary

The EUT complies with clause A.2.3 of Cospas-Sarsat T.007.

2.10 FREQUENCY STABILITY TEST WITH TEMPERATURE GRADIENT

2.10.1 Specification

Cospas-Sarsat T.007, Clause A.2.4

2.10.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

2.10.3 Date of Test

13 January 2023

2.10.4 Test Equipment Used

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

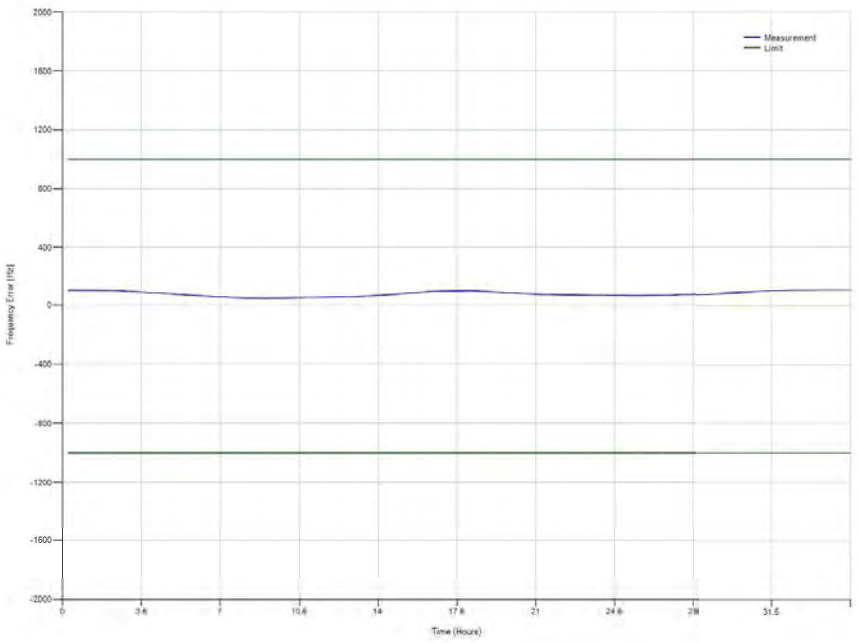
2.10.5 Laboratory Environmental Conditions

Ambient Temperature 23.9°C
Relative Humidity 35.9%

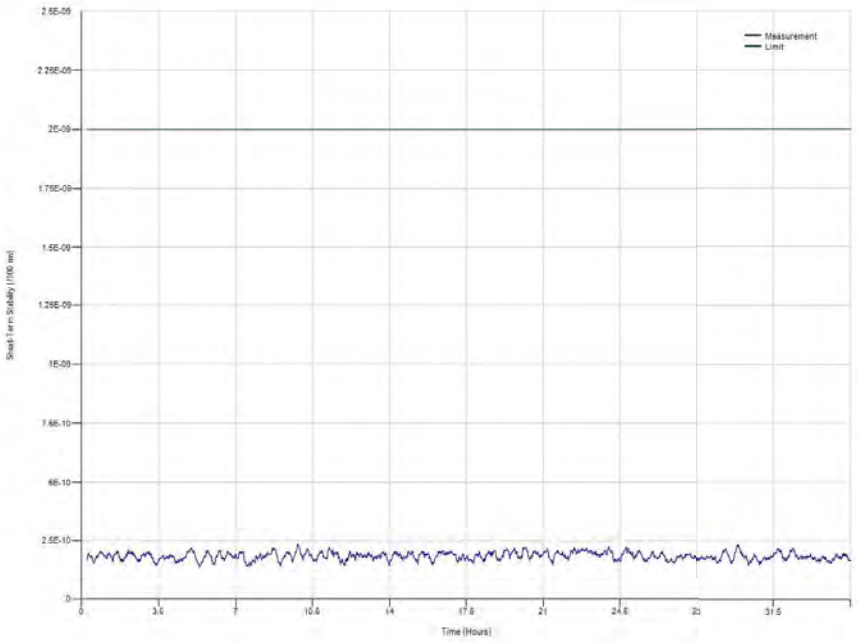
2.10.6 Test Results

Full Test

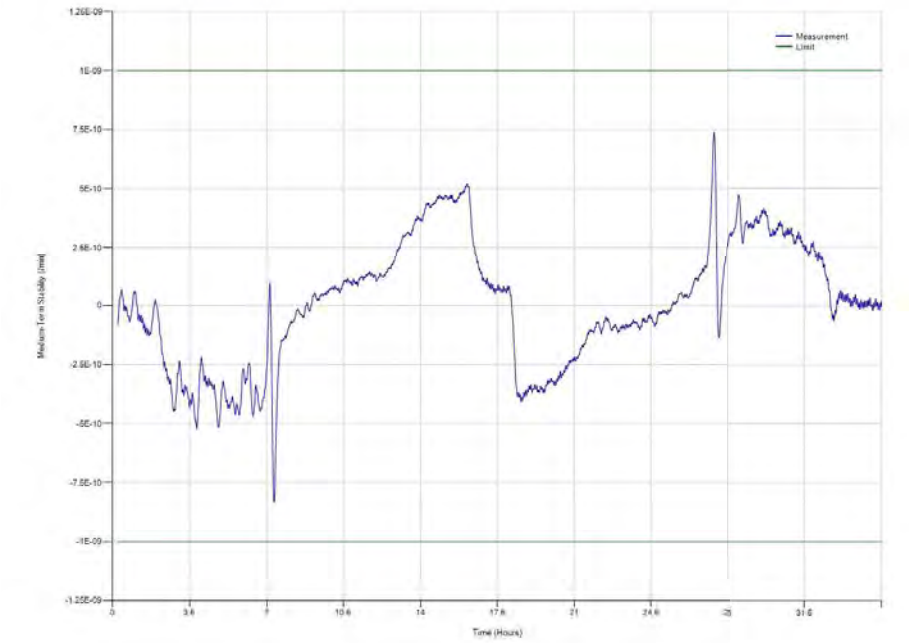
Nominal Frequency



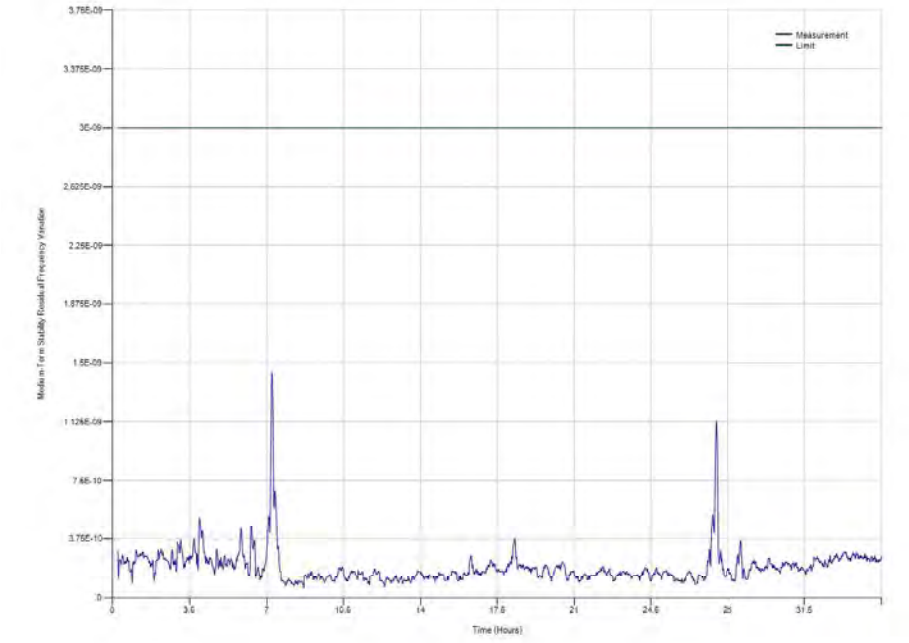
Short Term Stability



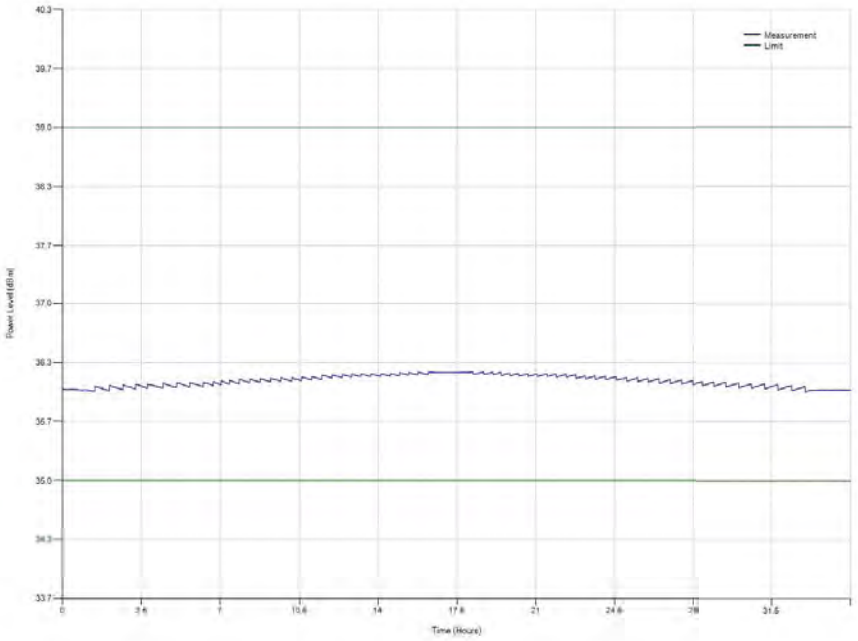
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

Decoded Beacon Message

Hexadecimal code: **FFFE2F8C9OFE7018DFEFF8129DF861F0FABE**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev 5.

Unique identifier:
190BFCE031BFDFF

Binary Range	Binary Content	Field Name	Decoded Value
1-15	111111111111111	Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions.	True
16-24	000101111	Frame Synchronization Pattern	Normal beacon operation
25	1	Format Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201	Search Contact list here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Test Location
43-45	1111	Identification type	RLS protocol coded with MMSI last 6 digits
47-66	10011100000001100011	Last 6 digits MMSI	639075
67-75	011111111	Latitude	Default - no location (Default - no location)
76-85	0111111111	Longitude	Default - no location (Default - no location)
86-106	00000010010100111011	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	0	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) not received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider Identification	GALILEO Return Link Service Provider
115-123	100001111	Latitude offset	Default value
124-132	100001111	Longitude offset	Default value
133-144	101010111110	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field

Interim TCXO Procedure - Complete Test

TCXO Part Number*: E8149
TCXO S/N*: 5578
* As advised by the Manufacturer

Table A-2: Point-By-Point Analysis

MTS Characteristic	Time (h)	Temp. (°C)	tot	osc	beacon_wc	MAX-OSC	beacon_max	Ageing factor	beacon_5 year	Limit	Result
Residual	7.26	11.0	1.416E-09	5.831E-10	1.290E-09	2.00E-09	2.380E-09	2.00E-10	2.580E-09	3.0E-09	Pass
Static Positive Mean Slope	16.25	55.0	4.462E-10	2.425E-11	4.455E-10	7.00E-10	8.298E-10	1.00E-10	9.298E-10	1.0E-09	Pass
Static Negative Mean Slope	17.01	55.0	9.295E-11	1.572E-10	-1.268E-10	7.00E-10	-7.114E-10	-1.00E-10	-8.114E-10	-1.0E-09	Pass
Gradient Positive Mean Slope	7.12	10.3	6.069E-11	-9.002E-10	9.022E-10	1.70E-09	1.925E-09	1.00E-10	2.025E-09	2.0E-09	Fail
Gradient Negative Mean Slope	7.34	11.5	-8.339E-10	-3.302E-10	-7.657E-10	1.70E-09	-1.864E-09	-1.00E-10	-1.964E-09	-2.0E-09	Pass

Summary

The EUT fails to comply with the limits stated in Cospas-Sarsat IP (TCXO) – Rev.5 October 2013. However, the results fall within the MU provided in Cospas-Sarsat IP (TCXO) – Rev.5 October 2013.

2.11 SATELLITE QUALITATIVE TESTS

2.11.1 Specification

Cospas-Sarsat T.007, Clause A.2.5

2.11.2 Equipment Under Test and Modification State

Tron SA20, S/N: 115 - Modification State 0

2.11.3 Date of Test

30 January 2023, 31 January 2023 and 1 February 2023

2.11.4 Test Equipment Used

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

2.11.5 Laboratory Environmental Conditions

Ambient Temperature 9.3 - 15.5°C
Relative Humidity 49.8 - 74.6%

2.11.6 Test Results

Configuration 7

Test Start:	30-01-2023 15:17
Test End:	31-01-2023 08:23
15 Hex ID:	193BF6A031BFDFF

RLM indications visually observed as below:

RLM Reception:	30-01-2023 15:19

Actual location of the test beacon:	50.814305
(Daedalus Airfield, Lee-on-the-Solent, Central)	-1.2017598

Satellite ID	Satellite Pass	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	TCA	CTA (deg)	Location Error
114	18573	193BF6A03199A02*	50.816	-1.203	2023-01-30 15:37:59	-11.8	0.208
12	72028	193BF6A03199A02*	50.816	-1.2	2023-01-30 17:22:25	18.798	0.225
7	28586	193BF6A03199A02*	50.818	-1.194	2023-01-30 17:45:13	9.852	0.682
12	72029	193BF6A03199A02*	50.819	-1.196	2023-01-30 19:01:53	5.475	0.660
13	53805	193BF6A03199A02*	50.818	-1.199	2023-01-30 20:07:53	6.664	0.454
12	72030	193BF6A03199A02*	50.817	-1.203	2023-01-30 20:42:45	-10.119	0.312
13	53806	193BF6A03199A02*	50.814	-1.203	2023-01-30 21:48:04	-8.773	0.093
10	91210	193BF6A03199A02*	50.823	-1.221	2023-01-30 23:27:04	-16.104	1.661
10	91208	193BF6A03199A02*	50.825	-1.208	2023-01-30 20:05:38	14.293	1.267
114	18579	193BF6A03199A02*	50.816	-1.2	2023-01-31 02:07:52	-16.024	0.225
114	18581	193BF6A03199A02*	50.814	-1.206	2023-01-31 05:27:50	14.208	0.300
12	72036	193BF6A03199A02*	50.815	-1.203	2023-01-31 07:17:37	-17.478	0.116
7	28594	193BF6A03199A02*	50.815	-1.201	2023-01-31 07:34:16	-6.647	0.094
13	53812	193BF6A03199A02*	50.815	-1.188	2023-01-31 08:18:48	-18.793	0.969

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

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

$$= \frac{14}{14}$$

$$= 100\%$$

*NOTE: Hex ID is provided with location but the Hex ID with default values is: 193BF6A031BFDFF.

The LUTs and MCC, which received RLS message and generated RLM request to FMCC are listed below:

MCC Code N	Name	Associated MEOLUT	Country, City
2240	SPMCC	2244	Las Palmas, Spain
2270	FMCC	2275	Toulouse, France
2710	TRMCC	2325	Ankara, Türkiye
3660	USMCC	3669	Suitland, MD, USA
2240	SPMCC	6504	Las Palmas, Spain
4660	QAMCC	6601	Lusail, Qatar

Configuration 8

Test Start: 31-01-2023 15:22
Test End: 01-02-2023 08:47
15 Hex ID: 193BF6A031BFDFF

RLM indications visually observed as below:

RLM Reception: 31-01-2023 15:23

Actual location of the test beacon: 50.814305
(Daedalus Airfield, Lee-on-the-Solent, Central) -1.2017598

Satellite ID	Satellite Pass	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	TCA	CTA (deg)	Location Error
114	18587	193BF6A03199A02*	50.812	-1.205	2023-01-31 15:14:51	-8.121	0.343
12	72042	193BF6A03199A02*	50.815	-1.198	2023-01-31 17:10:41	20.148	0.275
7	28600	193BF6A03199A02*	50.819	-1.198	2023-01-31 17:20:08	13.318	0.585
12	72043	193BF6A03199A02*	50.819	-1.198	2023-01-31 18:49:59	7.236	0.585
13	53819	193BF6A03199A02*	50.818	-1.2	2023-01-31 19:47:19	9.633	0.429
12	72044	193BF6A03199A02*	50.817	-1.205	2023-01-31 20:30:41	-8.183	0.376
13	53820	193BF6A03199A02*	50.819	-1.204	2023-01-31 21:27:13	-5.475	0.545
114	18594	193BF6A03199A02*	50.816	-1.201	2023-01-01 03:25:35	-3.735	0.196
114	18593	193BF6A03199A02*	50.814	-1.201	2023-01-01 01:44:33	-19.696	0.063
114	18595	193BF6A03199A02*	50.815	-1.204	2023-01-01 05:05:10	11.136	0.175
7	28608	193BF6A03199A02*	50.814	-1.201	2023-01-01 07:08:42	-10.697	0.063
7	28602	193BF6A03199A02*	50.818	-1.2	2023-01-31 20:39:58	-17.092	0.429
7	28601	193BF6A03199A02*	50.824	-1.206	2023-01-31 18:59:20	-1.207	1.118
12	72051	193BF6A03199A02*	50.821	-1.259	2023-01-01 08:47:10	-3.379	4.087
12	72050	193BF6A03199A02*	50.812	-1.202	2023-01-01 07:05:25	-19.413	0.257
10	91224	193BF6A03199A02*	50.829	-1.201	2023-01-31 23:14:45	-14.159	1.634
10	91223	193BF6A03199A02*	50.835	-1.204	2023-01-31 21:33:29	1.727	2.305
10	91222	193BF6A03199A02*	50.833	-1.222	2023-01-31 19:53:40	15.845	2.517
7	28609	193BF6A03199A02*	50.777	-1.147	2023-01-01 08:48:45	4.904	5.655

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

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

= $\frac{18}{19}$

= 94.7%

*NOTE: Hex ID is provided with location but the Hex ID with default values is: 193BF6A031BFDFF

The LUTs and MCC, which received RLS message and generated RLM request to FMCC are listed below:

MCC Code N	Name	Associated MEOLUT	Country, City
2270	FMCC	2275	Toulouse, France
3660	USMCC	3669	Suitland, MD, USA
5030	AUMCC	5035	Canberra, Australia

Summary

The EUT complies with clause A.2.5 of Cospas-Sarsat T.007.

2.12 BEACON ANTENNA TEST

2.12.1 Specification

Cospas-Sarsat T.007, Clause A.2.6

2.12.2 Equipment Under Test and Modification State

Tron SA20, S/N: 157 - Modification State 0

2.12.3 Date of Test

22 March 2023 and 31 March 2023.

2.12.4 Test Equipment Used

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

2.12.5 Laboratory Environmental Conditions

Ambient Temperature 6.1 - 12.5°C
Relative Humidity 52.5 - 59.3%

2.12.6 Test Results

Configuration 3

Legend: ~~Strikeout~~ **Under-range** **Over-range** Vv-Vh < 10 dB

	Elevation Angle (degrees)									
	10		20		30		40		50	
Azimuth Angle (Degrees)	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi
0	38.95	2.3	41.65	5.0	42.05	5.4	40.28	3.6	34.61	-2.0
30	38.86	2.2	41.64	5.0	42.04	5.4	40.14	3.5	34.63	-2.0
60	38.94	2.3	41.64	5.0	42.12	5.5	40.22	3.6	34.49	-2.2
90	39.02	2.4	41.79	5.1	42.16	5.5	40.23	3.6	34.79	-1.9
120	39.00	2.3	41.74	5.1	42.19	5.5	40.33	3.7	34.63	-2.0
150	39.10	2.4	41.72	5.1	42.28	5.6	40.36	3.7	34.65	-2.0
180	39.14	2.5	41.79	5.1	42.17	5.5	40.36	3.7	34.69	-2.0
210	39.01	2.4	41.75	5.1	42.16	5.5	40.34	3.7	34.58	-2.1
240	39.07	2.4	41.76	5.1	42.25	5.6	40.36	3.7	34.44	-2.2
270	39.05	2.4	41.82	5.2	42.19	5.5	40.36	3.7	34.62	-2.0
300	38.88	2.2	41.85	5.2	42.13	5.5	40.37	3.7	34.50	-2.1
330	38.94	2.3	41.77	5.1	42.10	5.5	40.35	3.7	34.58	-2.1

	Elevation Angle (degrees)									
	10		20		30		40		50	
Azimuth Angle (Degrees)	dBµVv	dBµVh	dBµVv	dBµVh	dBµVv	dBµVh	dBµVv	dBµVh	dBµVv	dBµVh
0	105.4	74.5	107.6	79.3	107.3	81.9	104.5	84.4	97.2	81.0
30	105.3	74.6	107.6	79.7	107.3	81.3	104.3	83.8	97.3	78.4
60	105.3	75.6	107.6	79.9	107.4	80.1	104.4	83.0	97.2	75.5
90	105.4	75.6	107.8	79.6	107.4	79.6	104.4	82.8	97.5	71.5
120	105.4	76.3	107.7	79.4	107.5	79.5	104.5	78.2	97.3	68.9
150	105.5	76.4	107.7	79.3	107.6	79.7	104.6	79.9	97.3	70.1
180	105.5	77.1	107.8	78.3	107.5	79.5	104.6	79.8	97.4	75.0
210	105.4	76.6	107.7	77.9	107.4	80.3	104.6	80.7	97.2	78.5
240	105.5	76.3	107.8	78.9	107.5	80.3	104.6	81.2	97.0	81.0
270	105.5	74.8	107.8	79.8	107.5	81.3	104.6	82.8	97.2	82.5
300	105.3	73.9	107.8	79.9	107.4	81.7	104.6	83.6	97.0	83.1
330	105.3	75.0	107.8	79.5	107.4	82.6	104.5	84.4	97.2	80.8
Min (Vv-Vh)	28.5		27.7		24.8		20.1		14.0	

$EIRP_{LOSS} = Pt_{ambient} - Pt_{EOL} =$ 36.65- 36.94 = -0.29 dB

$EIRP_{maxEOL} = Max[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] =$ Max[42.3, 42.6]= 42.57 dBm

$EIRP_{minEOL} = Min[EIRP_{min}, (EIRP_{min} - EIRP_{LOSS})] =$ Min[34.4, 34.7]= 34.44 dBm

Configuration 4

Legend: ~~**Strikeout**~~ **Under-range** **Over-range** Vv-Vh < 10 dB

	Elevation Angle (degrees)									
	10		20		30		40		50	
Azimuth Angle (Degrees)	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi
0	37.64	1.0	40.76	4.1	40.34	3.7	39.15	2.5	38.65	2.0
90	37.29	0.6	40.94	4.3	40.42	3.8	39.60	2.9	38.95	2.3
180	37.06	0.4	40.63	4.0	39.97	3.3	38.84	2.2	37.93	1.3
270	37.47	0.8	40.47	3.8	39.97	3.3	38.39	1.7	37.60	0.9

$EIRP_{LOSS} = Pt_{ambient} - Pt_{EOL} =$ 36.65 - 36.94 = -0.29 dB

$EIRP_{maxEOL} = Max[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] =$ Max[40.9, 41.2]= 41.23dBm

$EIRP_{minEOL} = Min[EIRP_{min}, (EIRP_{min} - EIRP_{LOSS})] =$ Min[37.1, 37.3]= 37.06dBm

Summary

The EUT complies with clause A.2.6 of Cospas-Sarsat T.007.

2.13 NAVIGATION SYSTEM TEST

2.13.1 Specification

Cospas-Sarsat T.007, Clause A.2.7

2.13.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

2.13.3 Date of Test

20 January 20213, 24 January 2023, 25 January 2023, 267 January 2023, 31 January 2023, 01 February 2023, 12 April 2023, 13 April 2023, 17 April 2023 and 20 April 2023, 03 May 2023

2.13.4 Test Equipment Used

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

2.13.5 Laboratory Environmental Conditions

Ambient Temperature 15.3 - 24.0°C
Relative Humidity 36.1 - 55.3%

2.13.6 Test Results

Additional Test Information

Where a GNSS simulator was used the following settings applied:

Band: I1
Frequency: 1575.42
Path loss (Freespace path loss & antenna gain) 1m used for signal strength calibration: 27.94dB

RLS 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
FFFE2F8C9DFB5018DFEFF84E1D3861F0FABE	37

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

Locations:

A.3.8.2.1:	50 52.1423' N	1 14.6799'W	①
A.3.8.2.2:	50° 48.8584'N	1° 12.1056'W	①

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 7	52.5	22.19	55.5	35.53
Configuration 8	52.0	22.19	57.0	35.53

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

① GNSS Site Survey – Live Location

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

Location: N 51° 22.583' W 1° 49.833' ②		
Data Acquired at	14:05:45	FFFE2F8C97F9C06333A039E6C1F71DA4D4D0
Location: N 50° 48.683' W 1° 37.417' ②		
Data Updated at	14:10:45	FFFE2F8C97F9C06332E0363260F78EA76951
Data Update Interval	4 min 59s	

② Input from GNSS simulator.

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

Locations: N 45.25752° W 73.5913° (Start location). N 45.73752° W 73.5913° (Location 2) N 45.73752° W 73.5513° (Location 3) N 45.25752° W 73.5513° (Location 4) ②		
Parameter	Update interval	Limit
0 h to 2 h – Minimum	04:56	≥ 04:25
0 h to 2 h – Maximum	05:08	≤ 16:30
2 h to 6 h – Minimum	04:55	≥ 04:25
2 h to 6 h – Maximum	05:10	≤ 16:30
6 h to 24 h – Minimum	04:50	≥ 04:25
6 h to 24 h – Maximum	05:09	≤ 16:30
Assessment	Result	Limit
Results indicate that data changes as per C/S T.001 4.5.5.4 (Y/N)	Y	
Results indicate that data changes as per manufacturer's update scheme (Y/N)	Y	

② Input from GNSS simulator.
Locations cycled through 1 to 4 continuously with an update interval of 02:00. Scenario moves in 2.225 km steps between locations 1 to 2 and 3 to 4. Steps size 3.105 km between locations 2 to 3 and 4 to 1.

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 50° 52' 11.9994" W 1° 14' 39.8394" ②		
Data Acquired at	08:21:19	FFFE2F8C9B70464CB5013BF54BF787280812
GPS Signal Navigation Data Removed		
Last Message with Encoded Data	12:22:42	FFFE2F8C9B70464CB5013BF54BF787280812
Data Updated at	12:23:31	FFFE2F8C9B70465FC0FF0120A9379F3C0010
Last Valid Position Held	241 min 23 s	
Return to Default Position	✓	

② Input from GNSS simulator

National 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
FFFE2F8C9B70465FC0FF0120A9379F3C0010	37

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

Locations:

A.3.8.2.1:	50° 52.1423' N	1° 14.6799'W	①
A.3.8.2.2:	50° 48.8584'N	1° 12.1056'W	①

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 7	52.69	22.82	52.92	35.53
Configuration 8	52.45	64.90	56.91	35.53

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

① GNSS Site Survey – Live Location

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

Location: N 51° 22.583'	W 1° 49.833' ②	
Data Acquired at	14:38:54	FFFE2F8C9B70464CD701CD8757379208025B
Location: N 50° 48.683'	W 1° 37.417' ②	
Data Updated at	14:43:49	FFFE2F8C9B70464CB101984208F794240FCD
Data Update Interval	4 min 56s	

② Input from GNSS simulator.

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

Locations: N 45.25752° W 73.5913° (Start location). N 45.73752° W 73.5913° (Location 2) N 45.73752° W 73.5513° (Location 3) N 45.25752° W 73.5513° (Location 4) ①		
Parameter	Update interval	Limit
0 h to 2 h – Minimum	05:43	≥ 04:25
0 h to 2 h – Maximum	05:55	≤ 16:30
2 h to 2.25 h – Minimum	05:41	≥ 04:25
2 h to 2.25 h – Maximum	05:50	≤ 16:30
Assessment	Result	Limit
Results indicate that data changes as per C/S T.001 4.5.5.4 (Y/N)	Y	
Results indicate that data changes as per manufacturer's update scheme (Y/N)	Y	

① Input from GNSS simulator.

Note: Limited testing in accordance with C/S T.007 A.3.8.3.
Locations cycled through 1 to 4 continuously with an update interval of 02:00. Scenario moves in 2.225 km steps between locations 1 to 2 and 3 to 4. Steps size 3.105 km between locations 2 to 3 and 4 to 1.

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 50° 52' 11.9994" W 1° 14' 39.8394" ①		
Data Acquired at	08:21:19	FFFE2F8C9B70464CB5013BF54BF787280812
GPS Signal Navigation Data Removed		
Last Message with Encoded Data	12:22:42	FFFE2F8C9B70464CB5013BF54BF787280812
Data Updated at	12:23:31	FFFE2F8C9B70465FC0FF0120A9379F3C0010
Last Valid Position Held	241 min 23 s	
Return to Default Position	✓	

① Input from GNSS simulator.

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
FFFE2F8C97F9C0637FDFFF11B23783E0F66C	37

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

Locations:

A.3.8.2.1:	50° 52.1423' N	1° 14.6799'W	①
A.3.8.2.2:	50° 48.8584'N	1° 12.1056'W	①

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 7	51.15	22.18	53.45	35.53
Configuration 8	52.31	22.18	52.56	35.53

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

① GNSS Site Survey – Live Location

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

Location: N 51° 22.583'	W 1° 49.833' ②	
Data Acquired at	14:05:45	FFFE2F8C97F9C06333A039E6C1F71DA4D4D0
Location: N 50° 48.683'	W 1° 37.417' ②	
Data Updated at	14:10:45	FFFE2F8C97F9C06332E0363260F78EA76951
Data Update Interval	4 min 59s	

② Input from GNSS simulator.

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

Locations: N 0° 00.000' E 0° 00.000' (Start location). The position changes by 20km every 4m 55s, moving in a NE direction (045 bearing). ①		
Parameter	Update interval	Limit
0 h to 2 h – Minimum	05:46	≥ 04:25
0 h to 2 h – Maximum	05:55	≤ 16:30
2 h to 2.25 h – Minimum	05:44	≥ 04:25
2 h to 2.25 h – Maximum	05:52	≤ 16:30
Assessment	Result	Limit
Results indicate that data changes as per C/S T.001 4.5.5.4 (Y/N)	Y	
Results indicate that data changes as per manufacturer's update scheme (Y/N)	Y	

① Locations cycled through 1 to 4 continuously with an update interval of 02:00. Scenario moves in 2.225 km steps between locations 1 to 2 and 3 to 4. Steps size 3.105 km between locations 2 to 3 and 4 to 1. Input from GPS simulator.

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

Location: N 50° 52' 11.9994" W 1° 14' 39.8394" ②		
Data Acquired at	08:22:31	FFFE2F8C97F9C06332E02CE8E9B79CC05CEE
GPS Signal Navigation Data Removed		
Last Message with Encoded Data	12:23:39	FFFE2F8C97F9C06332E02CE8E9B79CC05CEE
Data Updated at	12:24:28	FFFE2F8C97F9C0637FDFFF11B23783E0F66C
Last Valid Position Held	241 min 57 s	
Return to Default Position	√	

② Input from GNSS simulator

Summary

The EUT complies with clause A.2.7 of Cospas-Sarsat T.007.

2.14 RLM RECEPTION VERIFICATION

2.14.1 Specification

Cospas-Sarsat T.007, Clause A.3.8.8

2.14.2 Equipment Under Test and Modification State

Tron SA20, S/N: 120 - Modification State 0

2.14.3 Date of Test

17 May 2023 and 22 May 2023

2.14.4 Test Equipment Used

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

2.14.5 Laboratory Environmental Conditions

Ambient Temperature 25.1 - 28.1°C
Relative Humidity 29.1 - 31.6%

2.14.6 Test Results

RLS Indication Test

Requirement	Comments
Description of RLS indication as observed during the test	When requesting RLS, the EUT's strobe light will perform a triple flash to indicate a 406 MHz transmission and the RLS indicator will perform a triple flash. The indicator will continue performing a triple flash until RLM has been received.
Description of RLM indication as observed during the test	Once RLM has been received, the EUT's RLS indicator will perform a single flash to indicate RLM has been acknowledged and it will continue doing a single flash.
Description of message encoding used to demonstrate that the RLS indication remain inactive at all times when the beacon is encoded with any protocol other than the RLS Location Protocol or RLS Location Test Protocol.	The Tron SA20 is a RLS beacon which will also be used with Standard Location Protocol and National Location Protocol. A description of the message encoding is supplied in the manufacturer supplied beacon coding software.

Moffset – Configuration 8

Action	Timestamp (hh:mm:ss UTC)	Comments
Timestamp of the beacon activation	08:12:02	
Timestamp of the first message with RLS request	08:12:56	
Timestamp of RLS indication	08:12:57	
RLS request – 36 HEX with bit 111 set to 0 and a decode of this message[1]	-	FFFE2F8C9DFB5018CCD0156FA3B84FBEA8E5
Timestamp of the internal GNSS activation	08:12:03	GNSS receiver activates at beacon start up.
Timestamp of UTC	08:12:12	
Timestamp of the navigation data sent to the beacon from the internal GNSS	08:12:36	
Timestamp of the beacon message with navigation data encoded	08:12:56	
Timestamp when the RLM was received	08:13:44	
Timestamp of the RLM indication	08:13:44	
Timestamp with the beacon message with bit 111 reverted to 1, beacon message content in 36-HEX and a decode of this message[2]	08:13:47	FFFE2F8C9DFB5018CCD0156FA3BA4FBEA421
Timestamp when the beacon was de-activated	08:39:32	

[1]Message Decode

Decoded Beacon Message

Hexadecimal code: **FFFE2F8C9DFB501BCCD0156FA7B84FBEA8E5**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev.5

Unique identifier
193BF6A031BFDFF

Binary Range	Binary Content	Field Name	Decoded Value
1-16	1111111111111111	Bit synchronization pattern consisting of "1"s shall occupy the first 15-bit positions	True
16-24	000101111	Frame Synchronization Pattern	Normal beacon operation
25	1	Formal Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201	Search Contact list here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Location Test Protocol
43-46	1110	Identification type	RLS protocol coded with TAC or National RLS and Serial Number
43-52	1110110101	RLS TAC# truncated or national assigned RLS	949
		RLS TAC included missing leading digit prefix	[Unkown beacon type]949
53-66	00000001100011	Production or National assigned serial No	00099
67-75	001100110	Latitude	51.0 Degrees North (51.0)
76-85	1000000010	Longitude	1.0 Degrees West (-1.0)
86-106	10101101111101000111 0	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	0	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) not received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider Identification	GALILEO Return Link Service Provider
115-123	001111101	Latitude offset	7.0 minutes 52.0 seconds (negative)
124-132	111101010	Longitude offset	14.0 minutes 40.0 seconds (positive)
133-144	100011100101	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field
		Composite location	50.869 -1.244

[2]Message Decode

Decoded Beacon Message

Hexadecimal code: **FFFE2F9C9DFB5018CCD0156FA3BA4FBEA421**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev.6

Unique identifier:
193BF6A031BFDFF

Binary Range	Binary Content	Field Name	Decoded Value
1-15	111111111111111	Bit synchronization pattern consisting of "1"s shall occupy the first 15-bit positions	True
16-24	000101111	Frame Synchronization Pattern	Normal beacon operation
25	1	Format Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201	Search Contact list here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Location Test Protocol
43-46	1110	Identification type	RLS protocol coded with TAC or National RLS and Serial Number
43-52	1110110101	RLS TAC# (national or national assigned RLS	949
		RLS TAC included missing leading digit prefix	[Unkown beacon type]949
53-66	00000001100011	Production or National assigned serial No	00099
67-75	001100110	Latitude	51.0 Degrees North (51.0)
76-85	1000000010	Longitude	1.0 Degrees West (-1.0)
86-106	10101101111101000111 0	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	1	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider identification	GALILEO Return Link Service Provider
115-123	001111101	Latitude offset	7.0 minutes 52.0 seconds (negative)
124-132	111101010	Longitude offset	14.0 minutes 40.0 seconds (positive)
133-144	010000100001	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field
		Composite location	50.869 -1.244

UTC – Configuration 8

Action	Timestamp (hh:mm:ss UTC)	Comments
Timestamp of the beacon activation	13:16:12	
Timestamp of the first message with RLS request	13:17:08	
Timestamp of RLS indication	13:17:09	
RLS request – 36 HEX with bit 111 set to 0 and a decode of this message[1]	-	FFFE2F8C9DFE7018CCD0153323784FBEA8E5
Timestamp of the internal GNSS activation	13:16:13	GNSS receiver activates at beacon start up.
Timestamp of UTC	13:16:21	
Timestamp of the navigation data sent to the beacon from the internal GNSS	13:16:44	
Timestamp when the navigation signal was denied	13:17:17	
Duration of GNSS receiver stayed active since turn on	00:30:13	GNSS Sleep at 13:46:25
Timestamp when navigation signal was allowed	14:54:56	
Timestamp when RLM was received	14:57:57	
Timestamp of the RLM indication	14:57:58	
Timestamp with the beacon message with bit 111 reverted to 1, beacon message content in 36-HEX format and a decode of this message[2]	14:58:09	FFFE2F8C9DFB5018CCD0156FA3BA4FBEB118
Timestamp when the beacon was de-activated	15:10:14	

[1]Message Decode

Decoded Beacon Message

Hexadecimal code: **FFFE2F8C9DFB501BCCD0156FA7B84FBEA8E5**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev.5

Unique identifier
193BF6A031BFDFF

Binary Range	Binary Content	Field Name	Decoded Value
1-16	1111111111111111	Bit synchronization pattern consisting of "1"s shall occupy the first 15-bit positions	True
16-24	000101111	Frame Synchronization Pattern	Normal beacon operation
25	1	Format Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201	Search Contact list here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Location Test Protocol
43-46	1110	Identification type	RLS protocol coded with TAC or National RLS and Serial Number
43-52	1110110101	RLS TAC# truncated or national assigned RLS	949
		RLS TAC included missing leading digit prefix	[Unkown beacon type]949
53-66	00000001100011	Production or National assigned serial No	00099
67-75	001100110	Latitude	51.0 Degrees North (51.0)
76-85	1000000010	Longitude	1.0 Degrees West (-1.0)
86-106	10101101111101000111 0	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	0	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) not received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider Identification	GALILEO Return Link Service Provider
115-123	001111101	Latitude offset	7.0 minutes 52.0 seconds (negative)
124-132	111101010	Longitude offset	14.0 minutes 40.0 seconds (positive)
133-144	100011100101	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field
		Composite location	50.869 -1.244

[2]Message Decode

Decoded Beacon Message

Hexadecimal code: **FFFE2F8C9DFB5018CCD0156FA3BA4FBEB118**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev.6

Unique identifier
193BF6A03187DFF

Binary Range	Binary Content	Field Name	Decoded Value
1-15	111111111111111	Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions	True
15-24	000101111	Frame Synchronization Pattern	Normal beacon operation
25	1	Format Flag	Long Message
26	0	Protocol Flag	Location, further information provided in "Protocol Code"
27-36	0011001001	Country code	Albania - 201
		For associated SAR Points of Contact (SPOC) related to Albania - 201	Search Contact list here
37-40	1101	Protocol Code	RLS Location Protocol
41-42	11	Beacon type	RLS Location Test Protocol
43-46	1110	identification type	RLS protocol coded with TAC or National RLS and Serial Number
43-52	1110110101	RLS TAC# truncated or national assigned RLS	949
		RLS TAC included missing leading digit prefix	[Unkown beacon type]949
53-66	00000001100011	Production or National assigned serial No	00099
67-75	001100110	Latitude	51.0 Degrees North (51.0)
76-85	1000000010	Longitude	1.0 Degrees West (-1.0)
86-106	10101101111101000111 0	BCH-1 error correcting code	BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field
107	1	Encoded position source	Encoded position data is provided by an internal navigation device
108	1	121.5 Mhz Homing Device	Included in beacon
109	1	Beacon capability to process and automatically generated RLM Type-1	Capable to process an automatically generated RLM Type-1
110	0	Beacon capability to process a manually generated RLM Type-1 RLM Type-2	Not capable to process a manually generated RLM Type-2
111	1	Beacon Feedback on receipt of RLM Type-1	RLM Type-1 (automatic) received by this beacon
112	0	Beacon Feedback on receipt of RLM Type-2	RLM Type-2 (manual) not received by this beacon
113-114	01	RLS Provider identification	GALILEO Return Link Service Provider
115-123	001111101	Latitude offset	7.0 minutes 52.0 seconds (negative)
124-132	111101011	Longitude offset	14.0 minutes 44.0 seconds (positive)
133-144	000100011009	BCH-2 error correcting code	BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field
		Composite location	50.869 -1.246

Summary

The EUT complies with clause A.3.8.8 of Cospas-Sarsat T.007.

2.15 TESTING OF OPERATOR CONTROLS

2.15.1 Specification

Cospas-Sarsat T.007, Clause A.3.10

2.15.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

2.15.3 Date of Test

23 January 2023

2.15.4 Test Equipment Used

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

2.15.5 Laboratory Environmental Conditions

Ambient Temperature 20.9°C
Relative Humidity 24.1%

2.15.6 Test Results

Testing Self-Test Controls

The EUT has a common Self-Test and GNSS button and a separate activation button. The self-Test button is also the "PLB off" button for cancelling accidental activations. For Self-Test in accordance with the manufacturer design, the lower "test / off" button is pressed the self test routine is initiated with a 2 second press and a 7 second press will initiate the long GNSS Test. The EUT is activated by removing the protective cover and pressing red button underneath for 2 seconds.

In accordance with C/S T.007, section A.3.10, the EUT was tested as follows:

Self-Test

Test 1

The Self-Test button was pressed for 6 seconds and released . By design the EUT performs a single Self-Test and returns to a rest state after completion.
The EUT performed a single Self-Test burst and then returned to the rest state.

Test 2
The Self test button was held down for a total period of 7minutes and 40 seconds. During this period the EUT failed to achieve a GNSS lock and returned to a rest state after 155 seconds as per the design requirements. No further transmissions or indicators were observed.

Testing Operational Controls

The EUT is activated by removing the protective cover and pressing red button underneath for 2 seconds.

Test 1

The EUT was activated by its 'ON' switch and was maintained in an operational mode for a period of 3 minutes longer than the manufacturer declared time to transmit the first 406 MHz distress message.
The EUT continued to transmit 406MHz distress messages within the repetition rate limits stated in C/S T.007. The maximum and minimum repetition rate times observed were 50.9 seconds and 48.5 seconds respectively.

Test 2

The EUT was switched to the "Self-Test" position and then after approximately 2 seconds, the switch was released and the On button pressed. The EUT was then maintained in this condition for a period of 3 minutes longer than the manufacturer declared time to transmit the first 406 MHz distress message.
After the self test had initiated the "on" mode was activated, the EUT continued to transmit 406MHz distress messages within the repetition rate limits stated in C/S T.007. The maximum and minimum repetition rate times observed were:- 51.8 seconds and 48.0 seconds respectively.

Test 3

The EUT was activated by depressing the "On" button for 5seconds and then depressing and holding the "Self-Test" button The EUT was maintained in this condition for a period of 3 minutes longer than the manufacturer declared time to transmit the first 406 MHz distress message.
The EUT initially activated and then deactivated in accordance with the design. No bursts were observed during the period.

2.15.7 Conclusions

The EUT does not transmit more than one 406MHz burst in Self-Test Mode as required by C/S T.001.
The EUT does not transmit more frequently than the repetition rate defined by C/S T.001.

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 Expiry Date
Section 2.1, 2.2, 2.3 and 2.4 Beacons - Constant Temperature Tests					
Attenuator (10dB, 75W)	Bird	8308-100	469	12	21-Apr-2023
Signal Generator	Marconi	2031	2015	12	31-Mar-2023
Hygrometer	Rotronic	I-1000	2829	12	19-Apr-2023
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	20-Jun-2023
Cable (18 GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
USB Power Sensor	Boonton	RTP5006	5187	12	17-Jun-2023
ACS 4 Climatic Chamber	ACS	DY110C	5448	-	O/P Mon
Desktop Stopwatch	Radio Spares	RS Pro	5572	12	12-Sep-2023
RF distribution box	TUV SUD		5626	12	-
Thermocouple Data Logger	Pico Technology Ltd	TC-08 + Type T Thermocouple	5740	12	04-Mar-2023
MXA Spectrum Analyser	Keysight Technologies	N9020B-ATO-43105	5743	24	10-Feb-2024
Portable Network Analyser	Rohde & Schwarz	ZVH4	6250	12	15-Jul-2023
Section 2.5 Beacons - Spurious Emissions					
Attenuator (10dB, 75W)	Bird	8308-100	469	12	21-Apr-2023
Signal Generator	Marconi	2031	2015	12	31-Mar-2023
Hygrometer	Rotronic	I-1000	2829	12	19-Apr-2023
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	20-Jun-2023
Cable (18 GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
ACS 4 Climatic Chamber	ACS	DY110C	5448	-	O/P Mon
Desktop Stopwatch	Radio Spares	RS Pro	5572	12	12-Sep-2023
RF distribution box	TUV SUD		5626	12	-
Thermocouple Data Logger	Pico Technology Ltd	TC-08 + Type T Thermocouple	5740	12	04-Mar-2023
MXA Spectrum Analyser	Keysight Technologies	N9020B-ATO-43105	5743	24	10-Feb-2024

Section 2.6 Beacons - VSWR					
Load (50ohm/30W)	Weinschel	50T-054	285	12	28-Jul-2023
Attenuator (10dB, 75W)	Bird	8308-100	469	12	21-Apr-2023
Signal Generator	Marconi	2031	2015	12	31-Mar-2023
Hygrometer	Rotronic	I-1000	2829	12	19-Apr-2023
Short Circuit	TUV SUD	Short Cicuit	3272	-	TU
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	20-Jun-2023
Cable (18 GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
USB Power Sensor	Boonton	RTP5006	5187	12	17-Jun-2023
ACS 4 Climatic Chamber	ACS	DY110C	5448	-	O/P Mon
Desktop Stopwatch	Radio Spares	RS Pro	5572	12	12-Sep-2023
RF distribution box	TUV SUD		5626	12	-
Thermocouple Data Logger	Pico Technology Ltd	TC-08 + Type T Thermocouple	5740	12	04-Mar-2023
MXA Spectrum Analyser	Keysight Technologies	N9020B-ATO-43105	5743	24	10-Feb-2024
50 ohm Termination Load (10 Watt)	Telegartner	N/A	5910	12	12-Apr-2023
Portable Network Analyser	Rohde & Schwarz	ZVH4	6250	12	15-Jul-2023
Section 2.7 Beacons - GNSS Self-Test					
Signal Generator	Rohde & Schwarz	SMY 01	118	12	16-Feb-2024
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	15-Feb-2024
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	04-Jan-2024
Hygrometer	Rotronic	I-1000	2891	12	17-Nov-2023
Termination (50ohm, 6W)	Microndе	R404613	3074	12	02-Dec-2023
Power Meter	Rohde & Schwarz	NRP	3491	12	13-Jan-2024
Thermocouple Data Logger	Pico Technology Ltd	TC-08	3783	12	24-Jun-2023
GNSS Simulator	Spirent	GSS7000	4978	12	10-Aug-2023
Cable (18 GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-1000	5032	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
USB Power Sensor	Boonton	RTP5318	5185	12	10-Feb-2024
Desktop Stopwatch	Radio Spares	RS Pro	5572	12	12-Sep-2023
Environmental Chamber	ACS	DY110TC	5589	-	O/P Mon
RF distribution box	TUV SUD		5626	12	-

Section 2.8 Beacons - Thermal Shock					
Attenuator (10dB, 75W)	Bird	8308-100	469	12	21-Apr-2023
Signal Generator	Marconi	2031	2015	12	31-Mar-2023
Hygrometer	Rotronic	I-1000	2829	12	19-Apr-2023
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	20-Jun-2023
Thermocouple Data Logger	Pico Technology Ltd	TC-08	3783	12	24-Jun-2023
Cable (18 GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
USB Power Sensor	Boonton	RTP5006	5187	12	17-Jun-2023
ACS 4 Climatic Chamber	ACS	DY110C	5448	-	O/P Mon
Desktop Stopwatch	Radio Spares	RS Pro	5572	12	12-Sep-2023
Environmental Chamber	ACS	DY110TC	5589	-	O/P Mon
RF distribution box	TUV SUD		5626	12	-
Thermocouple Data Logger	Pico Technology Ltd	TC-08 + Type T Thermocouple	5740	12	04-Mar-2023
MXA Spectrum Analyser	Keysight Technologies	N9020B-ATO-43105	5743	24	10-Feb-2024
Portable Network Analyser	Rohde & Schwarz	ZVH4	6250	12	15-Jul-2023
Section 2.9 Beacons - Operating Lifetime					
Spectrum Analyser	Hewlett Packard	8542E	18	-	TU
Power Meter	Hewlett Packard	436A	94	12	5-Apr-2023
Attenuator (10dB, 75W)	Bird	8308-100	469	12	21-Apr-2023
Termination (50ohm, 6W)	Micronde	R404613	3074	12	2-Dec-2023
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3410	12	25-Nov-2023
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	20-Jun-2023
Cable (18 GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-1000	5027	-	O/P Mon
USB Power Sensor	Boonton	RTP5318	5185	12	10-Feb-2024
Thermocouple Data Logger	Pico Technology Ltd	TC-08 + Type T Thermocouple	5740	12	9-Mar-2024
MXA Spectrum Analyser	Keysight Technologies	N9020B-ATO-43105	5743	24	10-Feb-2024
RF distribution box	TUV SUD		5626	12	Class 1 (Int)
High resolution data logger	Pico Technology Ltd	PicoLog ADC20	6252	12	27-Sep-2023
Variable Resistive Load	TUV SUD	N/A	5057	12	04-Feb-2023
Termination (50ohm)	Weinschel	50T-054	285	12	28-Jul-2023
Cable (N to N 2m)	Amphenol RF	N/A	5949	12	15-May-2023

Section 2.10 Beacons - Temperature Gradient Combined					
Hygrometer	Rotronic	I-1000	2829	12	19-Apr-2023
Termination (50ohm, 6W)	Micronde	R404613	3074	12	2-Dec-2023
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	20-Jun-2023
Cable (18 GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-1000	5027	-	O/P Mon
USB Power Sensor	Boonton	RTP5006	5187	12	17-Jun-2023
ACS 4 Climatic Chamber	ACS	DY110C	5448	-	O/P Mon
Desktop Stopwatch	Radio Spares	RS Pro	5570	12	30-Nov-2023
RF distribution box	TUV SUD		5626	12	-
Thermocouple Data Logger	Pico Technology Ltd	TC-08 + Type T Thermocouple	5740	12	04-Mar-2023
MXA Spectrum Analyser	Keysight Technologies	N9020B-ATO-43105	5743	24	10-Feb-2024
Portable Network Analyser	Rohde & Schwarz	ZVH4	6250	12	15-Jul-2023
Section 2.11 Beacons - Satellite Qualitative Test					
HygroPalm	Rotronic	HygroPalm 0	3484	12	30-Aug-2023
Copper GRP	TUV SUD	27cm Diameter	3538	-	TU
Non Conductive Standoff Box	TUV SUD	Non Conductive Standoff Box	4966	-	TU
Tester (Beacon)	WS Technologies	BT200-1100Y	5394	-	TU
Desktop Stopwatch	Radio Spares	RS Pro	5571	12	19-Jul-2023
Desktop Stopwatch	Radio Spares	RS Pro	5572	12	12-Sep-2023
Section 2.12 Beacons - Antenna Characteristics					
Roberts Antenna 406MHz	Compliance Design		1860	24	17-Aug-2024
Roberts Antenna 406MHz	Compliance Design	-	1861	24	21-Jun-2023
HygroPalm	Rotronic	HygroPalm 0	3484	12	30-Aug-2023
Inclinometer	R.S Components	667-3916	5297	12	30-Nov-2023
30m LMR-300-DB COAXIAL CABLE	IntelliConnect Limited	C-NPNP-LMR300DB-30M	5588	12	04-Apr-2023
Portable Network Analyser	Rohde & Schwarz	ZVH4	6250	12	15-Jul-2023

Section 2.13 Beacons - Navigation System					
Antenna (Double Ridge Guide)	EMCO	3115	34	12	16-Oct-2023
Signal Generator	Rohde & Schwarz	SMY 01	118	12	16-Feb-2024
RF Shielded Enclosure	Rittal	AE1380	162	-	TU
Termination (50ohm)	Meca	405-1	364	12	19-Dec-2023
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	15-Feb-2024
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	04-Jan-2024
Directional Coupler	Narda	3022	1323	12	11-Jul-2023
Termination (50ohm, 1W)	Suhner	50ohm 1W	3080	12	04-May-2023
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	13-Oct-2023
Antenna (DRG Horn)	ETS-Lindgren	3115	3125	12	16-Oct-2023
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	06-Jul-2023
HygroPalm	Rotronic	HygroPalm 0	3484	12	30-Aug-2023
Power Meter	Rohde & Schwarz	NRP	3491	12	13-Jan-2024
Non Conductive Standoff Box	TUV SUD	Non Conductive Standoff Box	4966	-	TU
1 MHz / 10 MHz reference	Quartzlock	E10-X	4973	12	23-Feb-2024
GNSS Simulator	Spirent	GSS7000	4978	12	10-Aug-2023
Cable (18 GHz)	Rosenberger	LU7-036-1000	5032	-	O/P Mon
Analyser (Spectrum)	Rohde & Schwarz	FPL1003	5349	12	02-Jan-2024
Tester (Beacon)	WS Technologies	BT200-1100Y	5394	-	TU
Desktop Stopwatch	Radio Spares	RS Pro	5570	12	30-Nov-2023
Desktop Stopwatch	Radio Spares	RS Pro	5571	12	19-Jul-2023
RF Distribution Box	TUV SUD	N/A	5904	-	O/P Mon
50 ohm Termination Load (10 Watt)	Telegartner	N/A	5905	6	12-Apr-2023
Cable (N to N 2m)	Amphenol RF	N/A	5952	12	15-May-2023
Cable (N to N 2m)	Amphenol RF	N/A	5953	12	15-May-2023
Cable (N to N 2m)	Amphenol RF	N/A	5954	12	15-May-2023
Humidity & Temperature meter	Rotronic	HP31 HygroPalm	6247	12	21-Sep-2023

Section 2.14 Beacons – RLM Reception Verification					
Non Conductive Standoff Box	TUV SUD	Non Conductive Standoff Box	4966	-	TU
Tester (Beacon)	WS Technologies	BT200-1100Y	5395	-	TU
Desktop Stopwatch	Radio Spares	RS Pro	5570	12	30-Nov-2023
Humidity & Temperature meter	Rotronic	HP31 HygroPalm	6247	12	21-Sep-2023
Section 2.15 Beacons – Testing of Operator Controls					
Termination (50ohm, 6W)	Microndе	R404613	3074	12	02-Dec-2023
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	20-Jun-2023
Cable (18 GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-1000	5026	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-1000	5027	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
USB Power Sensor	Boonton	RTP5318	5185	12	10-Feb-2024
Thermocouple Data Logger	Pico Technology Ltd	TC-08 + Type T Thermocouple	5740	12	09-Mar-2024
MXA Spectrum Analyser	Keysight Technologies	N9020B-ATO-43105	5743	24	10-Feb-2024

Note: some tests took place over one or more days and consequently it may appear that some of the test equipment could have been outside of the valid calibration period at the time of testing. However, we confirm that all equipment held a valid and in-date calibration when used, and we hold this information on record.

TU – Traceability Unscheduled
OP MON – Output Monitored with Calibrated Equipment

3.2 MEASUREMENT UNCERTAINTY

The following table shows the measurement uncertainties for two signal analysers that are supported by DBT1.

Parameter	R&S FPL	Keysight MXA	C/S T.008 Requirement	Unit of Measurement
Repetition Time	1.134	1.134	± 10.0	ms
Total Transmission Time	0.012	0.009	± 1.0	ms
Fist Burst Delay	1.134	1.134	± 10.0	ms
CW Preamble	0.001	0.009	± 1.0	ms
Bit Rate	0.010	0.100	± 0.6	bps
Nominal frequency	34.00	1.70	± 100.0	Hz
Frequency stability	0.05	0.05	< 0.1	ppb
Transmitted Power	0.26	0.26	± 0.5	dB
Spurious Power Level	1.17	0.92	± 2.0	dB
Power Output Rise time	0.012	0.009	± 0.2	ms
Power Level 1 ms before Burst	1.17	0.92	± 2.0	dB
Modulation Rise	0.924	9.238	± 25.0	µs
Modulation Symmetry	0.005	0.002	< 0.01	-
Phase Modulation	0.004	0.006	± 0.04	rad

2

Parameter	Height	Distance (d)	C/S T.008 Requirement	Unit of Measurement
EIRP Antenna Setup Measurement Distances	0.6	0.2	± 1	%

3

Parameter	R&S FPL	Keysight MXA	C/S T.008 Requirement	Unit of Measurement
Internal Navigation Timing	85.1	85.1	Up to 1 hour ±1 sec	ms
Internal Navigation Timing	340.2	340.2	> 1 hour ±10 sec	ms

4

Parameter	Fluke 51 Digital Thermometer	C/S T.008 Requirement	Unit of Measurement
Temperature (near beacon)	0.84	± 2°C	°C

All uncertainty calculations were carried out in accordance with UKAS M3003.

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Satellite Qualitative Test (A.2.5) – Configuration 7

Position Acquisition Time and Position Accuracy (A.3.8.2.1) – Configuration 7

Position Acquisition Time and Position Accuracy (A.3.8.2.2) – Configuration 7

Satellite Qualitative Test (A.2.5) – Configuration 8

Position Acquisition Time and Position Accuracy (A.3.8.2.1) – Configuration 8

Position Acquisition Time and Position Accuracy (A.3.8.2.2) – Configuration 8

Antenna Characteristics (A.2.6)– Configuration 3

Antenna Characteristics (A.2.6) – Configuration 4

Moffset Test (A.3.8.8.1) – Configuration 8

UTC Test (A.3.8.8.2) – Configuration 8

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

MANUFACTURER SUPPLIED INFORMATION

Statements and descriptions

Tron SA20 PLB

JOTRON
Performance for Life

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Performance for Life

Table of Contents

Revision history

Revision	Date	Reason for revision	Author
01	10.10.2022	First edition	MK
Draft 02	06.02.2023	Incomplete cap 6 and 8	MK
03	03.03.2023	Release	MK
04	07.08.2023	Added NFC configuration in chapter 9.1 and 9.2	MK

1 Protection against continuous transmission 406

When Key-406 signal goes high, the power amplifier section consisting of U701 and Q708 will be enabled during 406 transmission. It is done by Q703A pull down the gate voltage for Q705, and Q705 will start to conduct. The driver transistor U701 will then be supplied with power, and power amplifier transistor Q708 will be supplied with a bias voltage.

In case of continuous transmissions, the C705 will start to charge through R710. After approx. 3.6 sec, the transistor Q703B will start to conduct, and will pull down the bias voltage on base Q703A. This will prevent Q703A to conduct, and the gate voltage at Q705 will not be set to low. Transistor Q705 will not conduct, the driver transistor U701 will not be powered, and power amplifier transistor Q708 will not be biased by a voltage.

The bias voltage on Q703A will be hold low, which prevent transmission, as long the key-406 is hold high and the C705 is charged. If Key-406 goes low, the C705 will discharge trough R711, basis – emitter Q703b and R714, and the circuit will turn back to normal state.

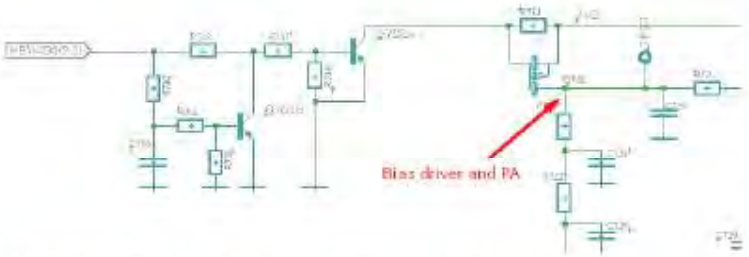
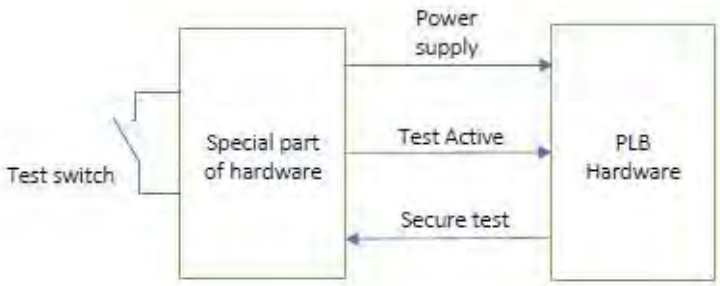


Figure 1: schematic of prevent of continuous transmission 406 circuit

Figure 2: picture of continuous key-406 signal (yellow) and bias pulled low (red) after 3.64sec

2 5(j-ii): Avoid repetitiv selftests

To ensure that only one self-test or GNSS self-test is done, a combination of hardware and software is used. This arrangement will effectively prohibit a second or more self-tests, even if the test switch is left on by force or accident.



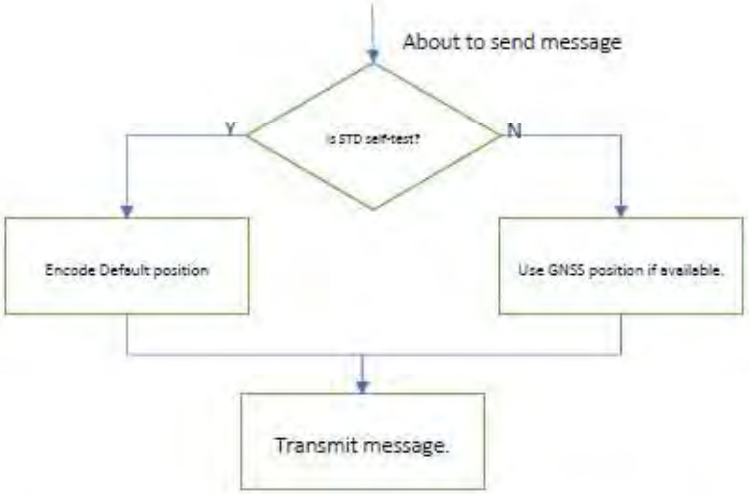
3 Hardware /software arrangement

When the test switch is activated, power is applied, and the micro controller can determine that the test switch is activated. However, this information will be present for a short time due to a hardware timeout unless the microcontroller sets the Secure test I/O. Power and test active will then continue to be present. Now the test can be performed, and at the end the Secure test I/O is reset, leading to that power is removed and the PLB turns off.

If the test switch still is activated after the test has finished, nothing will happen. If the test switch is released after the test has finished, it will need a recovery time of 10-20 sec to allow the hardware protection to discharge before a new test can be activated. This recovery time has no impact on normal activation of the PLB.

3 5(j-iii): Default position in test messages

When the standard test is executed, the Cospas-Sarsat transmitter is set up with a special attribute during initialization. When the transmission is about to happened, the following code is executed:



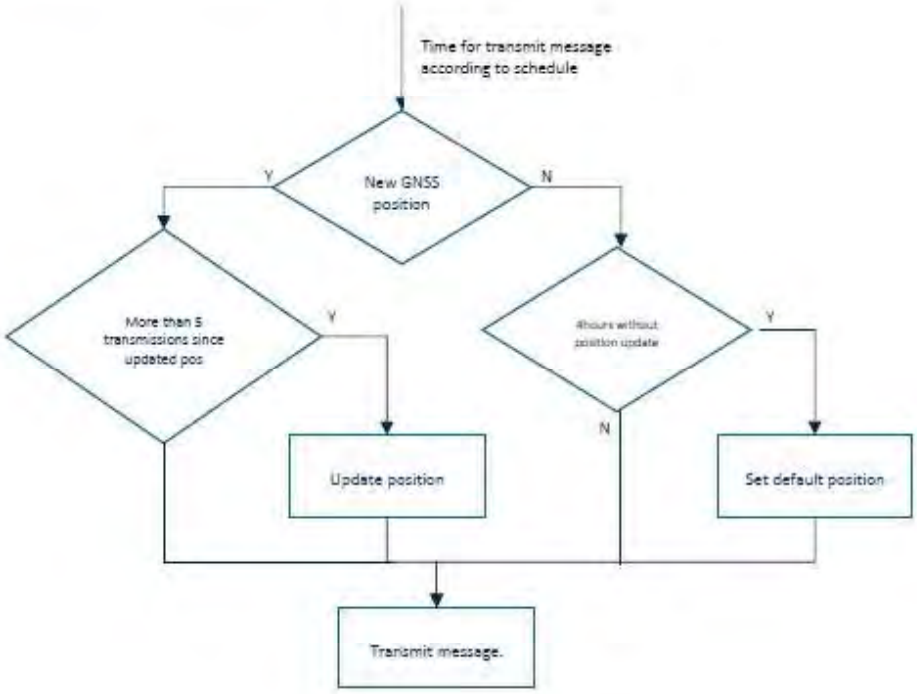
4 Transmission of Cospas Sarsat message with or without test message.

4 5(j-iv): protection against GNSS receiver faulty operation

The GNSS used is Ublox MAX-M10S. This unit is a multi GNSS module capable of concurrently receive signals from GPS, GLONASS and Galileo and combine these GNSS systems. Although the M10S can be enabled for standard IEC 61162 /NMEA messages used during test, the proprietary u-blox binary protocol is preferred for internal usage. This protocol is protected by a CRC, and if a faulty message is detected, it will be discarded.

The proprietary binary protocol can output more detailed position information. It contains information if the position is valid or not, and supply access to parameters like maximum estimated position error calculated by the GNSS itself.

The transmission of Cospas Sarsat messages and GNSS position are controlled by separate processes which have a peripheral connection and no mutual synchronization. Whenever the GNSS acquires a position lock which accuracy is guaranteed to be within 500m, it is made available to the Cospas Sarsat transmit process which may or may not use it according to update requirements.



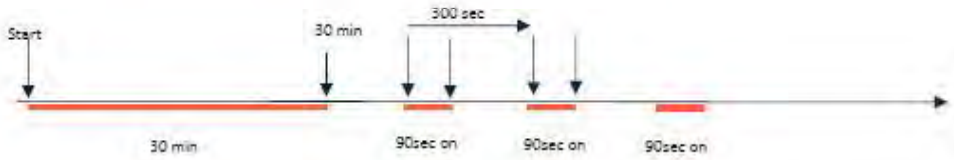
5 Simplified transmission of 406 message

The above diagram shows that whatever the status of the GNSS is, the Cospas Sarsat 406 message transmission is not halted or suppressed.

5 5(n-i): Description of GNSS receiver operation

5.1 Startup when no valid position can be obtained without RLS

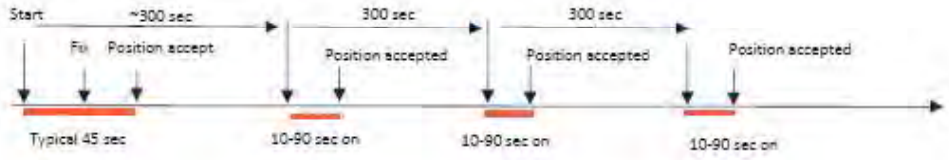
When the PLB is powered up, the GNSS module will always be turned on, waiting for a valid position. If no position can be obtained, the GNSS module will be continuous on for 30 minutes. After this the GNSS is enabled every 5 minutes and will be kept on for 90 seconds if no position can be obtained.



6 GNSS power save with no position available.

5.2 Startup when valid position can be obtained without RLS

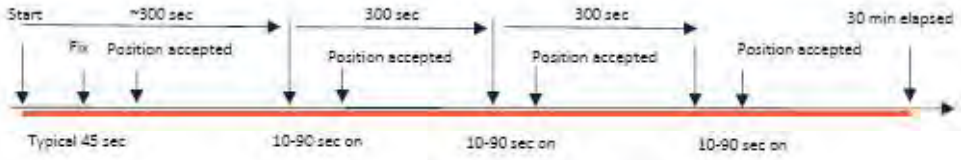
When an acceptable position is obtained, we will disable the GNSS immediately and continue with a 5-minute cycle to obtain new positions. The GNSS will be woken up every 5 minutes and will stay on until it gets a new position fix or for a maximum of 90 seconds before being shut off again.



7 GNSS start up with position achieved after approx. 30 sec

5.3 Startup with valid position and RLS protocol encoded

When RLS protocol is used the GNSS must stay active for 30 minutes before entering power save. In addition, it must turn on for 15 minutes every hour until 6 hours has elapsed unless an RLM message is received. A successfully received RLM message will revert the GNSS to normal operation as described above.



9 GNSS with RLS protocol first 30 min.

8 GNSS with RLS protocol 30 min to 5 hours

6 5(n-ii): Battery current for GNSS receiver operation phases

Current measurements are performed directly at the 3.3v supply. The 3.3v supply is generated by a switch mode buck supply with 90% efficiency and the current drawn from the battery pack can be calculated.

The current consumption at 6v with an SMPS with 90% efficiency can be written as:

$$I_{bat} = \frac{3.2v \cdot I}{6v} \cdot (2 - 0.9) \qquad [A]$$

- GNSS receiver – ON but not yet acquired a position.
  12.63 mA AVG at 3.2v

$$I_{bat} = \frac{3.2v \cdot 12.63\ mA}{6v} \cdot (2 - 0.9) = 7.41\ mA$$

- GNSS receiver – ON with a position acquired.
  13.68 mA AVG at 3.2v

  $I_{bat} = \frac{3.2v \cdot 13.68\ mA}{6v} \cdot (2 - 0.9) = 8.02$ mA

- GNSS receiver – OFF or in sleep mode
  97uA AVG at 3.2v
  $I_{bat} = \frac{3.2v \cdot 97\ uA}{6v} \cdot (2 - 0.9) = 57$ uA

7 5(n-v): GNSS cold start requirement

- The PLB has no battery backup of the backup ram, neither any kind of external memory capable of storing any data downloaded from the satellite when the PLB is shut down
- During startup, the GNSS module receives a configuration message telling it to clearly perform a cold start.

8 Statements

8.1 5(n-iv) Encoded position timings for declared protocol types

Larvik: 28.02.2023

Statement of Conformity

Jotron AS hereby states that Tron SA20 PLB with the encoded position data update timings are identical, for the declared Standard, National and RLS protocols.

On behalf of Jotron AS:

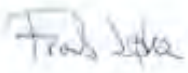
Frank Løke
Certification Manager
Jotron AS

8.2 Statement Output Power Levels

Statement of Conformity

Jotron AS hereby states that all our Tron SA20 PLB samples provided for type approval testing are aligned in 406 MHz conducted output power levels to within 0.3 dB of each other.

On behalf of Jotron AS:



Frank Løke
Certification Manager
Jotron AS

9 Battery Energy

9.1 5(v) Indication of Insufficient Battery Energy

With reference to Table F-E.5 of T.007

The indication of possible insufficient battery energy is triggered by:

- Activation of the PLB for more than 120 minutes; or
- Performing more than 400 self-tests beyond the number defined in Annex G; or
- Performing more than 9000 NFC configurations; or
- A combination of the above.

Test method:

- Step 1: On a PLB with a fresh battery, activate the PLB for 1 hour and 30 minutes.
- Step 2: Continue to activate the PLB for an additional 1 hour.

9.2 Table F-E.5: Indication of Insufficient Battery Energy

Tron SA20 PLB

Parameter	Units	Declared by beacon manufacturer	Verified and evaluated by accepted test facility	Notes
Beacon manufacturer-declared Minimum operating lifetime (C_{CO})	hours	24	-	C_{CO} is declared in Annex G as "Manufacturer-declared Minimum Operating Lifetime". C_{CO} is required for the test.
Full Battery Pack Capacity (C_{BP})	hours	-		If needed to calculate $C_{SP\text{-}AMB}$
Battery Pre-Operational Losses (C_{PO})	hours			corresponds to L_{CDC}, as defined in the Table F-E.2
Spare Battery Capacity at ambient temperature ($C_{SP\text{-}AMB}$)	hours			$C_{SP\text{-}AMB}$ is required for the test, and shall be defined by testing (see Footnote 4 to section A.3.6.2.2), or by calculation, as follows: $C_{SP\text{-}AMB} = C_{BP} - (C_{PO} + C_{CO})$
Criteria and conditions to trigger PIE indication		Activation of the beacon for more than 120 minutes or performing more than 400 self-tests beyond the 150 defined in Annex G or 9000 NFC configurations or a combination of the above.	-	description of PIE criteria and conditions to be met to trigger PIE indication. Use a separate sheet if needed
Step-1: battery pack discharge	hours	-		Battery discharge shall correspond to: C_{PO} - 30 minutes, or the value declared by the beacon manufacturer less 30 minutes
Step-1: beacon conditions (if applicable)		-		description of conditions recreated during the Step-1 for which the PIE criteria is not met
Step-1: observations of self-test indication		-		test facility observations of self-test indication: time, duration, type of indication
Step-2: battery pack discharge	hours	-		Total battery discharge shall correspond to: $C_{PO} + C_{SP\text{-}AMB}$ + 30 minutes or the value declared by the beacon manufacturer plus 30 minutes
Step-2: beacon conditions (if applicable)	-	-		description of conditions recreated during the Step-2 for which the PIE criteria is met
Step-2: observations of distinct PIE indication		-		test facility observations of PIE indication: time, duration, type of indication

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Technical information on Tron SA20 PLB TCXO

Doc. No.: 5(i) Reference oscillator_rev.A

Table of Contents

Revision history

Revision	Date	Reason for revision	Author
A	2022.10.26	First issue	JHE

1 Introduction

In this document we present the documentation on the Cospas-Sarsat approved reference oscillator used in Tron SA20. Test reports from the manufacturer for all the oscillators used under approval is also provided.

2 5(i): Reference oscillator

2.1 5(i-i): Type and specification

Oscillator type is an TCXO from the manufacturer RAKON. Model Name is Pluto and the part number is E8149LF. The first page of the datasheet with frequency characteristics is shown in Figure 1. For more details, please see the file *5(i-iii) E8149LF FGB 19.200 MHz Class 2 Pluto.pdf*

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rakon

Pluto™ TCXO designed for use in Cospas-Sarsat Emergency Beacons

E8149LF

1.0 Specification References

Parameter	Description
a. Rakon part number	E8149LF
b. Description	19.2MHz RFPT100 TCXO FG Class 2
c. Version	A (2020-02-26)
d. Package	L x W: 7.0 x 5.0 mm nom, H: 2.25mm max (10 pad)

2.0 Absolute Maximum Ratings [1]

Parameter	Min	Max	Unit
a. Storage temperature	-55	125	°C
b. Supply voltage (Vcc)	-0.5	7	V
c. Other inputs	-0.5	Vcc + 0.5	V
d. Power dissipation		100	mW

3.0 Frequency Characteristics

Parameter	Min	Typ.	Max.	Unit	Test Condition / Description
a. Nominal frequency (Fn)		19.2		MHz	
b. Calibration tolerance			±0.8	ppm	At 25°C ±1°C, reference to Fn
c. Reflow shift, 2x reflow			±1	ppm	Pre to post reflow ΔF (measured ≥ 60 minutes after reflow)
d. Operating temperature range	-20		+55	°C	
e. Frequency stability over temperature			±0.2	ppm	Reference to $(F_{MAX} + F_{MIN})/2$
f. Supply voltage stability			±0.1	ppm	±10% variation, reference to frequency at 3.3V
g. Load sensitivity			±0.1	ppm	±10% variation, reference to frequency at 15pF
h. Medium term stability (MTS) [2], class 2 profile (-20°C to 55°C)			±0.7	ppb/min	Mean slope (dF/dt), steady state conditions
			±1.7	ppb/min	Mean slope (dF/dt), during and 15 minutes after variable temperature conditions
			±2.0	ppb	Residual dF from slope
i. Long term stability (aging)			±1 ±3	ppm	1 year 10 years
j. Root Allan Variance			1	ppb	Tau=100ms

Figure 1 -First page of the datasheet for Rakon E8149LF

2.2 5(i-ii): Long-term frequency stability

From this datasheet we find: Aging first year:< ±1.0ppm and aging 10 years: <±3.0ppm. This gives a maximum change in output frequency at 406.031MHz after 10 years of 1218.10 Hz.

This is within the requirement of ± 5kHz in 5 years.

2.3 5(i-iii): Description of the beacon frequency-generation circuitry

The TXCO is used as a reference clock to the fractional-N PLL in the AX5043 and is scaled up to the generated 406.031 MHz signal. This ensures that the 406.031 MHz signal is generated with the same LTS, and MTS as the TXCO itself.

3 5(i-v) Serial Number and temperature gradient test results

TCXO MTS test reports are provided by Rakon and included below for the connectorized PLBs.

PLB serial number 101 has a TCXO with serial number VP8476; the report is shown in Figure 2. Furthermore, PLB serial number 151 has TCXO with serial number VO8385, and the detailed report is shown in Figure 3.

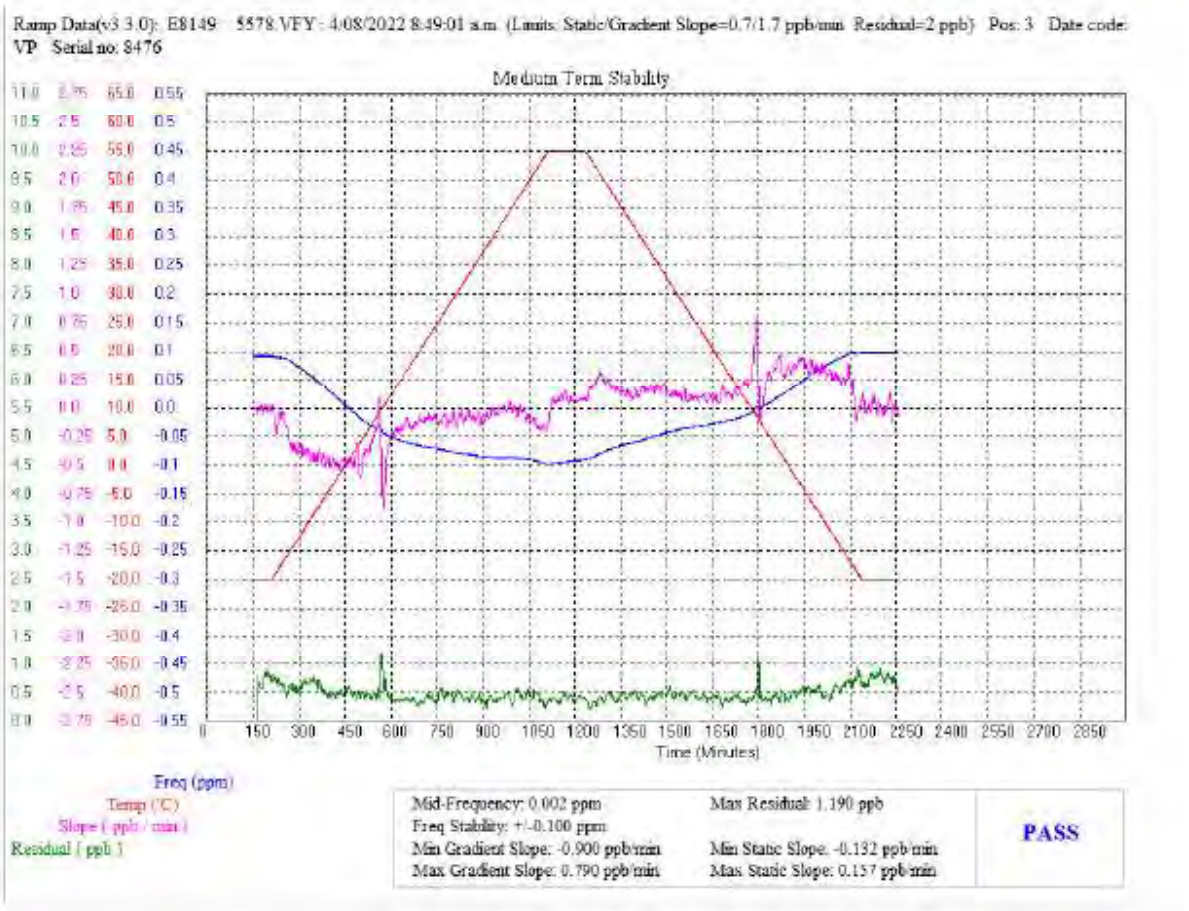

Figure 2 – Rakon test report for TCXO Serial number VP 8476 used in PLB 101

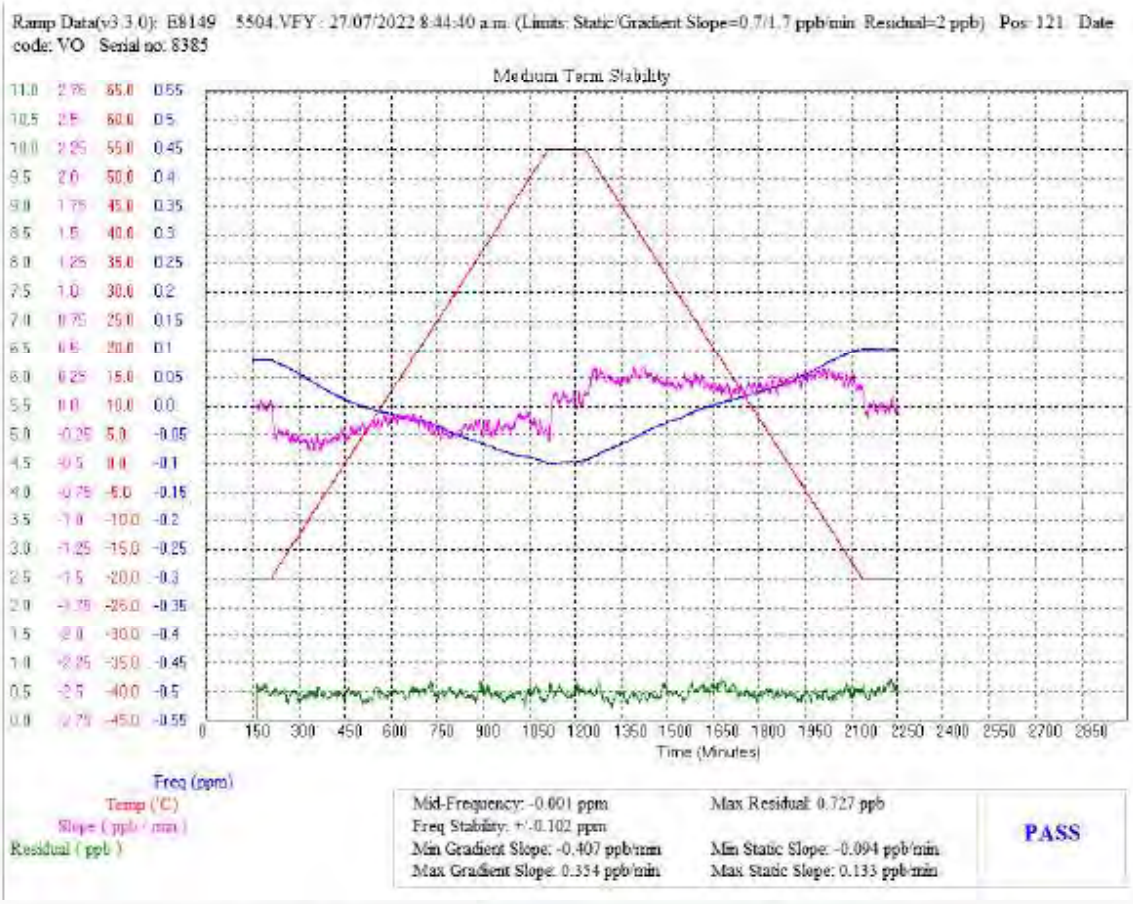

Figure 3 - Rakon test report for TCXO Serial number VO 8385 used in PLB 151

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Characterized connector loss

TRON SA20 PLB

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Table of Contents

Revision history

Revision	Date	Reason for revision	Author
A	13.12.2022	Issued for release	HE

1 Introduction

The connectorized PLB is equipped with two measuring ports, one for 121.5 MHz and one for 406 MHz. The measuring ports consist of soldering two SMA-terminated coaxial cables to the 50 Ohm point on the PCB after the 406 MHz and 121.5 MHz PA.

The 406 MHz and 121.5 MHz measuring ports are connected after the transmitter filter, and before the antenna-matching network as shown in Figure 1, and Figure 2.

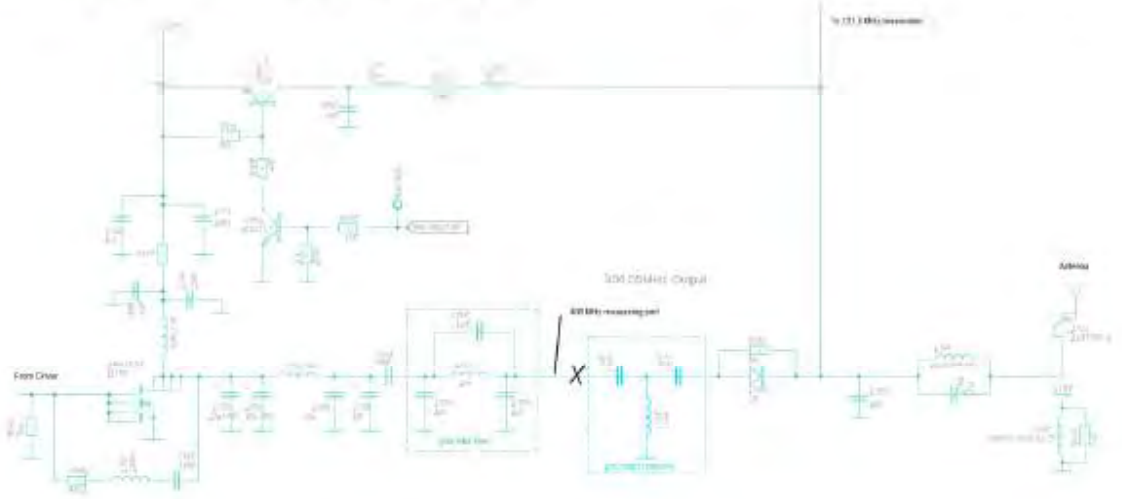

Figure 1 - 406 MHz measuring port

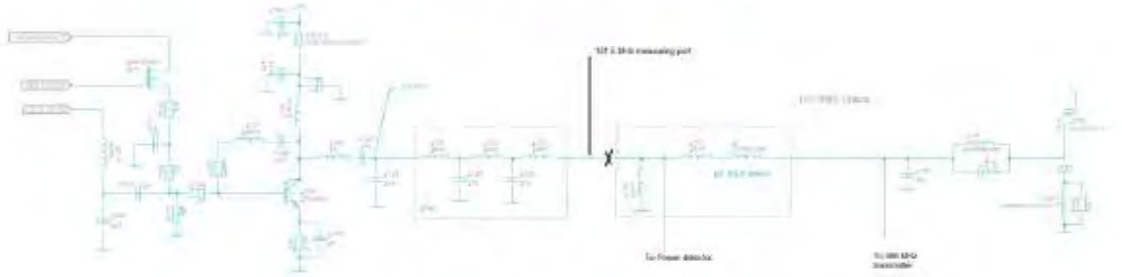

Figure 2 - 121.5 MHz measuring port

2 Measuring loss

The only added loss in Figure 1, and Figure 2, is from the coaxial cables. Each cable is measured at the associated frequency, and the results are given in Table 1. Consequently, the losses in Table 1 must be added when measuring power at 121.5 MHz / 406 MHz ports.

Table 1 – Port loss

Port	Loss
121.5 MHz	0.1 dB
406 MHz	0.3 dB

3 Conclusion

Power measured at the 121.5 MHz port is 0.1 dB lower than the power going to the matching network and antenna, because of the added cable loss, while power measured at the 406 MHz port is 0.3 dB lower. The added cable losses must be added when measuring absolute power.

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Larvik: 20.01.2023

Tron SA20 PLB worst Operating Mode during the operating lifetime

RLS protocol will require highest power consumption.

We will recommend current scenario to ensure highest power consumption during operating lifetime test:

- Activate the PLB without GNSS signal present.
- No GNSS signal prenset for the rest of the test

On behalf of Jotron AS:

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Certification Manager
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