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Report On

GNSS testing of the
Jotron AS
Tron SA20 PLB
In accordance with IEC 61108-3

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Document 75956621 Report 09 Issue 1 **August 2023**

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REPORT ON

GNSS Testing of the
Jotron AS
Tron SA20 PLB
In accordance with IEC 61108-3

Document 75956621 Report 09 Issue 1

August 2023

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DATED

30-August-2023

CONTENTS

SECTION 1

REPORT SUMMARY

GNSS testing of the
Jotron AS
Tron SA20 PLB
In accordance with IEC 61108-3:2010

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the GNSS testing of the Jotron AS Tron SA20 PLB to limited requirements of IEC 61108-3.

Objective	To perform GALILEO Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Jotron AS
Model Number(s)	Tron SA20 PLB
Part Identify No(s)	TSR00025 TSR00003
Serial Number(s)	120 101
Number of Samples Tested	2
Test Specification/Issue/Date	IEC 61108-3:2010
Order Number Date	P55347 16 September 2022
Date of Receipt of EUT	08 December 2022
Start of Test	23 March 2023
End of Test	19 July 2023
Name of Engineer(s)	Paul Adams Matthew Sellers
Related Document(s)	RTCM11010.4, March 2023

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with IEC 61108-3 is shown below. The scope of testing is as defined by the product specific standard RTCM 11010.4, clause 4.2.9.1.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
-	4.3.1	General	-	
-	4.3.2	Equipment output	-	
2.1	4.3.3.1	Accuracy-Static Accuracy – Galileo	Pass	IEC 61108-3, Clause 5.6.4.2.2
2.2	4.3.3.1	Accuracy-Static Accuracy- Angular Movement of the Antenna	Pass	IEC 61108-3, Clause 5.6.4.3
2.3	4.3.3.2	Dynamic Accuracy – Galileo	Pass	IEC 61108-3, Clause 5.6.4.4.1
2.4	4.3.4	Acquisition Condition A - Initialization	Pass	IEC 61108-3, Clause 5.6.5.1
2.5	4.3.4	Acquisition Condition B – No valid almanac	Pass	IEC 61108-3, Clause 5.6.5.2 a)
	4.3.4	Acquisition Condition B – No valid almanac	Deviation (See below)	IEC 61108-3, Clause 5.6.5.2 b)
	4.3.4	Acquisition Condition C – Brief Interruption of power	Pass	IEC 61108-3, Clause 5.6.5.3)
-	4.3.5	Antenna and input/output connections	N/A	IEC 61108-3, Clause 5.6.6
-	4.3.6	Antenna design	N/A	IEC 61108-3, Clause 5.6.7
2.6	4.3.7	Sensitivity & Dynamic range – Acquisition and Tracking	Pass	IEC 61108-3, Clause 5.6.8
-	4.3.8	Protection from Specific Interfering Signal	-	Refer to BSH Report: BSH/454.GNSS/003/00012#00004.pdf
2.7	4.3.9	Position Update – Slow Speed Update Rate	Pass	IEC 61108-3, Clause 5.6.10.1
2.8	4.3.9	Position Update – High Speed Update Rate	Pass	IEC 61108-3, Clause 5.6.10.2
-	4.3.10	Differential Galileo Input	N/A	N/A
-	4.3.11	Navigational Warnings and Status Indications	N/A	N/A
-	4.3.12	Output of COG, SOG and UTC	N/A	N/A
-	4.3.13	Typical Interference Conditions	N/A	N/A

N/A Not Applicable
N/T Not Tested
N/R Not Requested

Non-compliances:

None.

Deviations:

4.3.4 (Clause 5.6.5.2 a) - Acquisition B (part b). The EUT design GNSS scheduling is to keep the GNSS search on for 90 seconds every approx. 5 minutes if no fix is obtained. If a fix is obtained the GNSS will “wake every 5 minutes to get a new fix and power down once the new position has been received. Post unmasking of the antenna after 24 hrs the EUT routinely obtained an updated fix in accordance with its design, recording an average of 11.5 solutions per “waking” period which averaged a position error of 1.60 meters over 161 solutions. The HDOP solutions during this period ranged between 2.5 and 2.9.

1.3 DECLARATION OF BUILD STATUS

MAIN EUT			
MANUFACTURING DESCRIPTION	Personal Locator Beacon (PLB)		
MANUFACTURER	Jotron AS		
MODEL	Tron SA20 PLB		
PART NUMBER	103675		
HARDWARE VERSION	2137		
SOFTWARE VERSION	1.3		
PSU VOLTAGE/FREQUENCY/CURRENT	6.0V		
HIGHEST INTERNALLY GENERATED FREQUENCY	19.200 MHz		
FCC ID (if applicable)	VRVTRONSA20		
INDUSTRY CANADA ID (if applicable)	2131A-TRONSA20		
TECHNICAL DESCRIPTION (a brief technical description of the intended use and operation)	RLS capable Personal Locator Beacon (PLB)		
COUNTRY OF ORIGIN	Norway		
RF CHARACTERISTICS (if applicable)			
TRANSMITTER FREQUENCY OPERATING RANGE(MHzl	121.5 MHz/ 406.031 MHz		
RECEIVER FREQUENCY OPERATING RANGE(MHz)	N/A		
INTERMEDIATE FREQUENCIES	N/A		
EMISSION DESIGNATOR(S): **httos://fccid.io/Emissions-Desianator/**	3K20A3X (121.5)-16K0G1D (406.031)		
MODULATION TYPES: (i.e. GMSK, QPSK)	Phase modulation 1.1 Rad (406 MHz) AM Homing (121.5 MHz)		
OUTPUT POWER (W or dBm)	36.6 dBm (406 MHz) 20.6 dBm (121.5 MHz) (see "Tron SA20 PLB 5(k) Matching network statement, description and analysis")		
SEPARATE BATTERY/POWER SUPPLY (if applicable)			
MANUFACTURING DESCRIPTION			
MANUFACTURER			
TYPE			
PART NUMBER			
PSU VOLTAGE/FREQUENCY/CURRENT			
COUNTRY OF ORIGIN			
MODULES (if applicable)			
MANUFACTURING DESCRIPTION			
MANUFACTURER			
TYPE			
POWER			
FCCID			
INDUSTRY CANADA ID			
EMISSION DESIGNATOR			
DHSS/FHSS/COMBINED OR OTHER			
COUNTRY OF **ORIGIN**			
ANCILLARIES (if applicable)			
MANUFACTURING DESCRIPTION			
MANUFACTURER			
TYPE			
PART NUMBER			
SERIAL NUMBER			
COUNTRY OF ORIGIN			

I hereby declare that the information supplied is correct and complete.

Name: Frank L0ke
Position held: Certification Manager Date: 03.02.2023

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Jotron AS Tron SA20 PLB. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test

1.4.2 Physical Test Configuration

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Where simulated GNSS signals were applied, the tests were carried out with the EUT situated in a shielded enclosure.

The NMEA data was recorded directly from the data cable connected to the EUT. The EUT was powered by its internal battery except in regard of the static accuracy and static accuracy with angular movement which was powered by an external power supply.

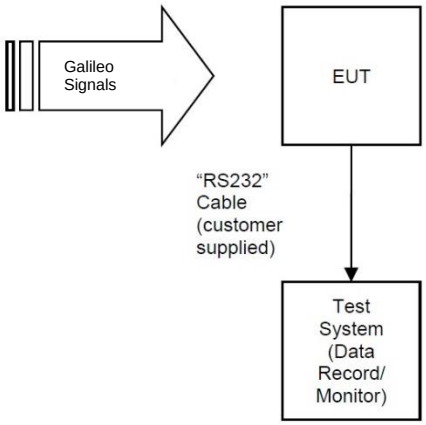


Figure 1. System Configuration A Schematic

EUT output data was monitored via Terra Term; a serial terminal program that records the NMEA output of the EUT and adds a timestamp (with 1 ms resolution) to each sentence.

Any GNSS signals applied are recorded at the appropriate test section.

The physical set up was defined by the standard for Static Accuracy tests (Angular Movement of the antenna). GNSS signal input was as per "live" (real world) conditions at the time/location.

All other tests were performed using a GNSS simulator in a shielded enclosure. GNSS signal input was checked using the reference receiver and set to the levels required by the standard. The frequency band used for testing was set to E1.

All relevant physical configurations are described or illustrated in the appropriate test section.

1.5 TEST LOCATIONS

TUV SUD, Octagon House, Fareham Test Laboratory.
Solent Airport, Daedalus Drive, Lee-on Solent

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.7 MODIFICATION RECORD

All testing was carried out in modification state 0 (previous modification states were not applicable to this test program).

1.8 REPORT MODICATION RECORD

Issue 1: First Issue

SECTION 2

TEST DETAILS

GNSS testing of the
Jotron AS
Tron SA20 PLB
In accordance with IEC 61108-3

2.1 STATIC ACCURACY – GALILEO

2.1.1 Specification Reference

IEC 61108-3, Clause 4.3.3.1 (5.6.4.1)

2.1.2 Equipment Under Test

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

2.1.3 Date of Test

11 July 2023 to 12 July 2023

2.1.4 Test Equipment Used

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

2.1.5 Environmental Conditions

Ambient Temperature	27.31°C
Relative Humidity	42.70%

2.1.6 Test Methods

Following testing is required by specification:

Static Test Site Clause 5.6.4.2.1

“The antenna shall be mounted according to the manufacturer's instructions at a height of between 1 m and 1,5 m above the electrical ground in an area providing clear line of sight to the satellites from zenith through to an angle of +5° above horizontal. The position of the antenna shall be known, with reference to WGS 84 to an accuracy of better than 0,1 m in (x, y, z). Maximum cable lengths as specified by the manufacturer shall be used during testing.

If a Galileo RFCS is used, the simulator scenario shall be chosen such that clear line of sight views to all satellites above a +5° mask angle is ensured for the duration of the test.”

Test Method Clause 5.6.4.2.2

“Position fix measurements shall be taken at the required sampling interval over a period of not <24 h. The absolute horizontal position accuracy shall be within 15 m (95 %) for a single frequency receiver and within 10 m (95 %) for a dual frequency receiver, having discarded measurements taken in conditions of HDOP ≥ 2 and PDOP ≥ 3,5. The horizontal position of the antenna shall be known to within 0,1 m in the datum used for position fixing.”

Performance Standard Clause 4.3.3.1

"(M.233/A3.5) The Galileo receiver equipment shall have static accuracy such that the position of the antenna is determined to within:

i) 15 m horizontal (95 %) and 35 m vertical (95 %) for single frequency operations on the L1 frequency;
ii) 10 m horizontal (95 %) and 10 m vertical (95 %) for dual frequency operations on L1 and E5a or L1 and E5b frequencies.

NOTE: The minimum accuracy requirements specified for dual frequency processing are based on the performance requirements established in IMO resolution A.915(22) and IMO resolution A.953(23) for navigation in harbour entrances, harbour approaches and coastal waters. The Galileo Safety of Life service is expected be able to provide better accuracy (4 m horizontal 95 % and 8 m vertical 95 %)."

2.1.7 Test Results

EUT was placed on static test site with non-conductive platform. It was operated and monitored continuously for the period of measurements as given below

Test Parameters	Units	Result	Limit
Test Specific			
Non-Conductive Platform Height	M	1.37	1-1.5
General			
Time to Acquire Valid Position	S	40.6	-
Performance Check			
Start Time / Event of Performance Check	-	Position Lock	-
Measurement Duration	hh:mm:ss	24:25:37	>24h
Total Number of Position Solutions	-	87939	-
Number of Solutions with HDOP≤2 and PDOP≤6	-	82791	-
Measurement of error ≤15m	%	100	>95

Table 1

Photo of EUT at test site

2.2 STATIC ACCURACY – ANGULAR MOVEMENT OF THE ANTENNA

2.2.1 Specification Reference

IEC61108-3, Clause 4.3.3.1 (5.6.4.3)

2.2.2 Equipment Under Test

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

2.2.3 Date of Test

18 July 2023 and 19 July 2023

2.2.4 Test Equipment Used

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

2.2.5 Environmental Conditions

Ambient Temperature	25.91 – 26.48 °C
Relative Humidity	40.44 – 51.61 %

2.2.6 Test Methods

The following testing is required by the specification:

Test Method Clause 5.6.4.3

"The static tests specified in 5.6.4.2.1 and 5.6.4.2.3 shall be repeated with the antenna performing an angular displacement of ±22,5° (simulating roll) in a period of about 8 s (see IEC 60721-3-6) during the duration of the tests.

The results shall be as in 5.6.4.1.2 and 5.6.4.1.3."

Performance Standard Clause 4.3.3.1

"(M.233/A3.5) The Galileo receiver equipment shall have static accuracy such that the position of the antenna is determined to within:

i) 15 m horizontal (95 %) and 35 m vertical (95 %) for single frequency operations on the L1 frequency;
ii) 10 m horizontal (95 %) and 10 m vertical (95 %) for dual frequency operations on L1 and E5a or L1 and E5b frequencies.

NOTE: The minimum accuracy requirements specified for dual frequency processing are based on the performance requirements established in IMO resolution A.915(22) and IMO resolution A.953(23) for navigation in harbour entrances, harbour approaches and coastal waters. The Galileo Safety of Life service is expected be able to provide better accuracy (4 m horizontal 95 % and 8 m vertical 95 %)."

2.2.7 Test Results

EUT was placed on static test site on a non-conductive platform. It was operated and monitored continuously for the period of measurement as given below.

Test Parameters	Units	Result	Limit
Test Specific			
Non-Conductive Platform Height	m	1.34	1-1.5
General			
Time to Acquire Valid Position	s	52.6	-
Performance Check			
Start Time / Event of Performance Check	-	Position Lock	-
Measurement Duration	hh:mm:ss	24:14:56	>24h
Total Number of Position Solutions	-	87298	-
Number of Solutions with HDOP≤2 and PDOP≤6	-	85502	-
Measurement of error ≤15m	%	99.96	>95

Table 2

2.3 DYNAMIC ACCURACY – GALILEO

2.3.1 Specification Reference

IEC 61108-3, Clause 4.3.3.2 (5.6.4.4)

2.3.2 Equipment Under Test

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

2.3.3 Date of Test

23 March 2023

2.3.4 Test Equipment Used

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

2.3.5 Environmental Conditions

Ambient Temperature	24.83 - 24.84°C
Relative Humidity	40.67 - 42.64 %

2.3.6 Test Method

The following testing is required by the specification:

IEC-61108:2003 Clause 5.6.4.4.1

“The tests for dynamic accuracy are a practical interpretation of the conditions set out in IEC 60721-3-6, Table V, item e), X – direction (surge) and Y – direction (sway). These are stated as surge 5 m/s2 and sway 6 m/s2 for all classes of environment.

The accuracy tests shall be performed using a Galileo RFCS and the simulator characteristics shall accurately represent the signals required.

The Galileo RFCS shall generate the correct signal in space associated with the following dynamic situations:

a) a fully locked and settled EUT travelling in a straight line at 48 knots ± 2 knots for a minimum of 1,2 min which is reduced to 0 knots in the same straight line in 5 s;
b) a fully locked and settled EUT travelling at least 100 m at 24 knots ± 1 knot in a straight line then subjected, for at least 2 min, to smooth deviations either side of the straight line of approximately 2 m at a period of 11 s to 12 s.

For both dynamic situations, the receiver shall remain in lock and the deviation from the programmed simulator positions shall be within the accuracies stated in 5.6.4.2.2.”

2.3.7 Test Results

EUT and GNSS simulator were started simultaneously. The EUT acquired position lock after the acquisition time stated in the table below. The simulator ran a dynamic position travelling at 48 knots in a straight line for 10 minutes before decelerating to 0 knots in 5 seconds. The position output 10 second after coming to rest was determined by NMEA 0183 output.

Test Parameters	Units	Result	Limit
General			
Signal Type	Live / Simulated	Simulated	-
EUT Started Simultaneously	Y/N	Y	-
Time to Acquire Valid Position	s	21.9	-
Test Specific			
Position Error 10s after coming to rest	m	2.54m	≤15
Performance Specific			
Start Time / Event of Performance Check	-	Position Lock	-
Measurement Duration	min	10	5< and ≥10
Total Number of Position Solutions	-	601	-
Number of Solutions with HDOP≤2 and PDOP≤3.5	-	601	-
Measurement of error ≤15m	%	100	>95
Number of Solutions with HDOP≤2 and PDOP≤3.5 with a measurement error ≤15m	-	601	-

Table 3

Dynamic Accuracy B

EUT and GNSS simulator were started simultaneously. The EUT acquired the position lock after the acquisition time stated in the table below. The simulator ran a dynamic position travelling at 24 knots in a straight line for 10 minutes before starting to oscillate smoothly ±2m either side of the original path for further 20 minutes.

EUT position output error compared to the dynamic position was determined from EUT NMEA output.

Test Parameters	Units	Result	Limit
General			
Signal Type	Live / Simulated	Simulated	-
EUT Started Simultaneously	Y/N	Y	-
Initial Acquisition Time	s	29.7s	-
Performance Check			
Start Time / Event of performance check	-	Start of Oscillation	-
Measurement Duration	Min	10	5< and ≥10
Total Number of Measurement	-	601	-
Number of solutions with HDOP ≤2 and PDOP ≤3.5	-	601	≥100
Measurement of error ≤15m	%	100	>95
Number of Solutions with HDOP≤2 and PDOP≤3.5 with a measurement error ≤15m	-	601	-

Table 4

2.4 ACQUISITION CONDITION A - INITIALIZATION

2.4.1 Specification Reference

IEC 61108-3, Clause 4.3.4 (5.6.5)

2.4.2 Equipment Under Test

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

2.4.3 Date of Test

28 March 2023

2.4.4 Test Equipment Used

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

2.4.5 Environmental Conditions

Ambient Temperature	25.3 °C
Relative Humidity	40.2 %

2.4.6 Test Methods

The following testing is required by the specification:

Test Method Clause 5.6.5.1

“The EUT shall be either:

a) Initialised to a false position at least 1000 km and not greater than 10000 km from the test position, or alternatively, by deletion of the current almanac; or
b) Isolated from a power source for >7 days; or
c) when using a Galileo RFCS, simulator scenario date and position should be changed by a large amount; the date by more than 7 days and position by more than 1000 km.

A performance check shall be carried out after the time limit contained in Table 1.”

Performance Standard Clause 4.3.4

“(M.233/A3.12) The Galileo receiver equipment shall be capable of acquiring position, velocity and time to the required accuracy within 5 min when there is no valid almanac data (cold start).”

2.4.7 Test Results

EUT was initialised to a false position as per table below.

Time to lock was measurement and a performance check was started once the position lock was obtained. The simulator ran a static position for a sufficient time for the test to complete.

Test Parameter	Units	Results	Limit
Test Specific			
False position difference from test position	km	1679.28	>1000 and <10000
Initial position		Lat 36° 0.000777	Lon -5° 0.0001
Performance check position		Lat 50° 52.135	Lon -1.14.701
Time to acquire valid position	mm:ss	02:12	<5 min
Performance Check			
Start time / event	-	Position Lock	-
Measurement duration	Min	10	5 ≤ and ≥ 10
Total number of position solutions	-	601	-
Number of solutions with HDOP≤2 and PDOP≤3.5	-	601	≥100
Measurement with position error ≤ 15m	%	100	>95
Number of Solutions with HDOP≤2 and PDOP≤3.5 with a measurement error ≤15m	-	601	-

Table 5

2.5 ACQUISITION CONDITION B – NO VALID ALMANAC

2.5.1 Specification Reference

IEC 61108-3, Clause 4.3.4 (5.6.5.2)

2.5.2 Equipment Under Test

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

2.5.3 Date of Test

Part A – 27 March 2023
Part B – 29 March 2023 – 30 March 2023

2.5.4 Test Equipment Used

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

2.5.5 Environmental Conditions

Part A

Ambient Temperature	20.8°C
Relative Humidity	35.9 %

Part B

Ambient Temperature	21.4 °C
Relative Humidity	34.8 %

2.5.6 Test Methods

The following testing is required by the specification:

Test Method Clause 5.6.5.2

“a) The EUT shall be isolated from the power source for a period within 24 h to 25 h.

At the end of the period, a performance check shall be carried out after the time limit contained in Table 1.

b) During normal operation of the EUT, the antenna shall be completely masked for a period between 24 h and 25 h.

At the end of the period, a performance check shall be carried out after the time limit contained in Table 1.

Performance Standard Clause 4.3.4

“(M.233/A3.13) The Galileo receiver equipment shall be capable of acquiring position, velocity and time to the required accuracy within 1 min when there is valid almanac data (warm start).”

2.5.7 Test Results

EUT was position locked and stable when the power was removed for the power isolation period as below.

Part A – Power source isolation

Test Parameter	Units	Results	Limit
Test Specific			
Power isolation period	hh:mm:ss	24:06:04	≥ 24 and ≤ 25
Time to acquire valid position	mm:ss	00:30	<1 min
Performance Check			
Start time / event	-	Position Lock	-
Measurement duration	Min	10	5 ≤ and ≥ 10
Total number of position solutions	-	601	-
Number of solutions with HDOP≤2 and PDOP≤3.5	-	601	≥100
Measurement with position error ≤ 15m	%	100	≥95

Table 6

The EUT was position locked and Stable when the Antenna of the EUT was masked from the Galileo signal for the period as detailed below prior to a performance check being completed.

Part B – GNSS antenna mask

Test Parameter	Units	Results	Limit
Test Specific			
Antenna mask period	hh:mm:ss	24:01:35	24h - 25h
Time to acquire valid position	s	45.3	<1 min
Performance Check			
Start time / event	-	Position Lock	-
Measurement duration	Min	3.26	≥ 5 and ≤ 10
Total number of position solutions	-	161	-
Number of solutions with HDOP≤2 and PDOP≤6	-	0	≥100
Measurement with position error ≤ 13m	%	0	≥95

Note: The duty cycle of the EUT is such that only 161 solutions were received over a 60 minute period. All 161 solutions had position error of 2.4 meters or less. In all 161 results the EUT indicated an HDOP of 2.5 – 2.9.

Table 7

2.6 SENSITIVITY AND DYNAMIC RANGE - ACQUISITION AND TRACKING

2.6.1 Specification Reference

IEC 61108-3, Clause 4.3.7 (5.6.8.1) and (5.6.8.2)

2.6.2 Equipment Under Test

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

2.6.3 Date of Test

23 March 2023

2.6.4 Test Equipment Used

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

2.6.5 Environmental Conditions

Ambient Temperature	25.27 °C
Relative Humidity	40.17 %

2.6.6 Test Methods

The following testing is required by the specification:

Acquisition

Test Clause 5.6.8.1

“This is tested by using a simulator

a) Transmit the simulator signal over a suitable antenna.
b) Adjust the signal power by use of a calibrated test receiver to -125 dBm $\pm$ 5 dBm.
c) Replace the antenna of the calibrated test receiver by the receiving unit of the EUT.
d) A performance check shall be carried out.”

Performance Standard Clause 4.3.7

“(M.233/A3.10) The Galileo receiver equipment shall be capable of acquiring satellite signals with input signals having carrier levels in the range of –128 dBm to –118 dBm. Once the satellite signals have been acquired, the equipment shall continue to operate satisfactorily with satellite signals having carrier levels down to –131 dBm.”

Performance Standard Clause 5.6.8.1

Required result

“The EUT shall meet the requirements of this check, within this signal range.”

Tracking

Test Clause 5.6.8.2

“The received satellite signals shall be monitored by a suitable test receiver. These signals shall be attenuated down to −133 dBm. Under these conditions, the performance requirements shall be met.

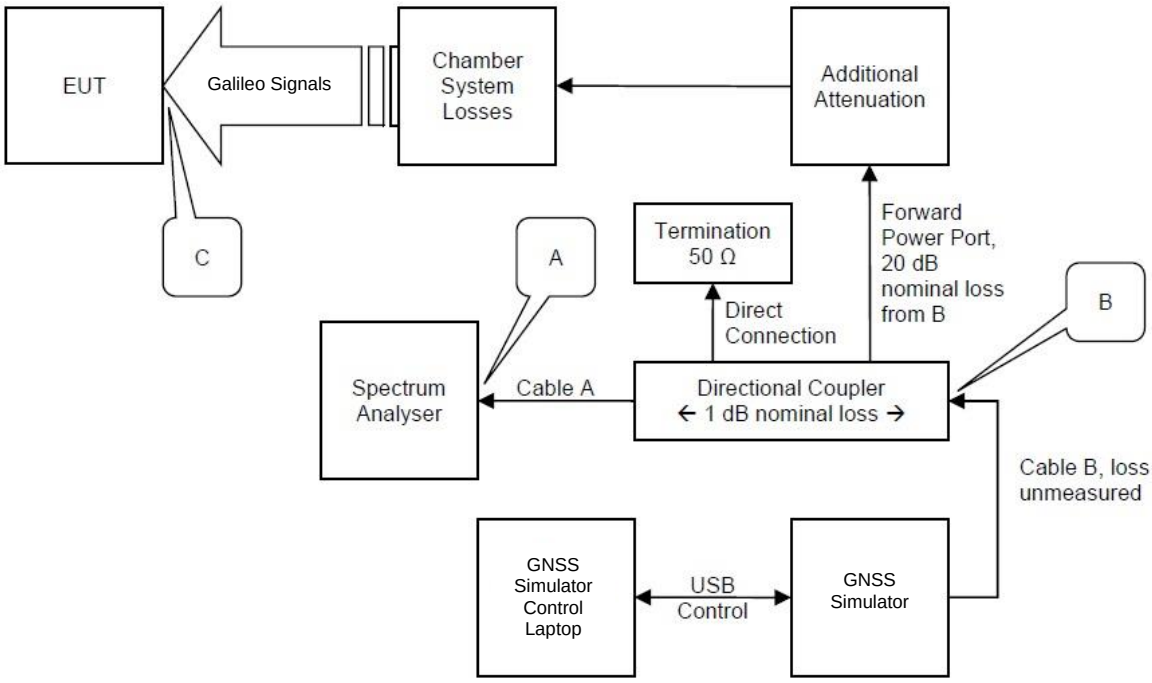
This is tested by using a Galileo RFCS as follows:

Method:

a) Transmit the simulator signal over a suitable antenna;
b) Adjust the signal power by use of a calibrated test receiver to −123 dBm ± 5 dBm;
c) Replace the antenna of the calibrated test receiver by the receiving unit of the EUT;
d) After the start of transmission and tracking with the nominal transmission level condition, gradually reduce transmission level down to −131 dBm.

Required Result

“The EUT shall continue tracking at least 4 satellites and provide a valid position solution”



Calibrated Field Set Up

The basic premise of field schematic is that the power at C equals power at B minus loss from B to C. Power at B equals power at A minus loss from B to A.

2.6.7 Test Results

EUT was activated in the above test setup, acquisition time was measured, and performance check was carried out.

Parameter	Units	Result	Limit
Performance Check			
Start time / event	-	Acquisition	-
Measurement duration	Min	10	5 ≤ and ≥ 10
Total number of position solutions	-	601	-
Number of solutions with HDOP≤2 and PDOP≤3.5	-	601	≥100
Measurement with position error ≤ 15m	%	100	≥95
Number of Solutions with HDOP≤2 and PDOP≤3.5 with a measurement error ≤15m	-	601	-
Signal Reduction Procedure			
Received signal strength (per SV) - Initial	dBm	-123	-123 ± 5
Received signal strength (per SV) - Final	dBm	-131	-131
Reduction increments	dB	1 / 45s	
Reduction procedure duration	s	360	
Required Results - EUT Response			
Satellites tracked	-	10	≥ 1

Table 8

2.7 POSITION UPDATE – SLOW SPEED UPDATE RATE

2.7.1 Specification Reference

IEC 61108-3, Clause 4.3.9 (5.6.10.1)

2.7.2 Equipment Under Test

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

2.7.3 Date of Test

23 March 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 Environmental Conditions

Ambient Temperature	25.7 °C
Relative Humidity	41.0 %

2.7.6 Test Methods

The following testing is required by the specification:

Test Method Clause 5.6.10.1

“The EUT shall be placed upon a platform, moving in approximately a straight line, at a speed of 5 knots ± 1 knot. The position output of the EUT shall be checked at intervals of 10 s, over a period of 10 min. The output position shall be observed to be updated on each occasion.

This test may be carried out by using a simulator.

Record the IEC 61162 output of the EUT during this test and confirm that received positions at the end of each interval are in compliance with the real or simulated reference position.”

Performance Standard Clause 4.3.9

“(M.233/A3.15) The Galileo receiver equipment shall generate and output to a display and digital interface (conforming to IEC 61162) a new position solution at least once every 1 s for conventional craft and at least once every 0,5 s for high speed craft;

NOTE: For high speed craft purposes the equipment should provide an IEC 61162-2 interface with a position update rate of 2 Hz.

(M.233/A3.7) The Galileo receiver equipment shall have position resolution equal or better than 0,001 minutes of latitude and longitude.”

2.7.7 Test Results

Initially, the EUT was locked and settled on a static simulated position. The simulated scenario then started a period of motion at a speed of 5 knots in approximately a straight line. During the observation period of ten minutes, the position output of the EUT was observed to be updated on each occasion.

Test Parameter	Units	Result	Limit
Scenario velocity	knot	4.86	
Minimum position change (min[d_{Lat}+d_{Lon}])	Decimal degrees	0.000020	> 0
Average position update interval	s	1.0	≤ 10
Performance Check			
Measurement duration	min	10	≥ 10
Total number of measurements	-	601	-
Number of solutions with HDOP ≤ 2 and PDOP ≤ 3.5	-	601	≥ 100
Measurements with position error ≤ 15 m	%	100	≥ 95
Number of Solutions with HDOP≤2 and PDOP≤3.5 with a measurement error ≤15m	-	601	-

Table 9

2.8 POSITION UPDATE – HIGH SPEED UPDATE RATE

2.8.1 Specification Reference

IEC 61108-3, Clause 4.3.9 (5.6.10.2)

2.8.2 Equipment Under Test

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

2.8.3 Date of Test

23 March 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 Environmental Conditions

Ambient Temperature	25.3 °C
Relative Humidity	40.2 %

2.8.6 Test Methods

The following testing is required by the specification:

Test Method Clause 5.6.10.2

“The EUT shall be placed upon a platform, moving in approximately a straight line, at a speed of 50 knots ± 5 knots. The position output of the EUT shall be checked at intervals of 1 s, over a period of 10 min. The output position shall be observed to be updated on each occasion.

This test may be carried out by using a Galileo RFCS with a speed of 70 knots at intervals of 0,5 s.

The minimum resolution of position, that is latitude and longitude, shall be checked by observation during 5.6.10.1 and 5.6.10.2 above.

Record the output of the EUT during this test and confirm that received positions at the end of each interval are in compliance with the real or simulated reference position.”

Performance Standard Clause 4.3.9

“(M.233/A3.15) The Galileo receiver equipment shall generate and output to a display and digital interface (conforming to IEC 61162) a new position solution at least once every 1 s for conventional craft and at least once every 0,5 s for high speed craft;

NOTE: For high speed craft purposes the equipment should provide an IEC 61162-2 interface with a position update rate of 2 Hz.

(M.233/A3.7) The Galileo receiver equipment shall have position resolution equal or better than 0,001 minutes of latitude and longitude.”

Performance standard clause 5.6.10.2

"[….] received positions at the end of each interval are in compliance with the real or simulated reference position."

2.8.7 Test Results

Initially the EUT was locked and settled in the static simulated position. The simulated scenario then started period of motion at the speed given in the table below. During the observation period of ten minutes, the time between position output messages and the time between position updates was checked.

Test Parameter	Units	Result	Limit
Scenario velocity	knot	50	
Minimum position change (min[d_{Lat}+d_{Lon}])	Decimal degrees	0.000362	> 0
Average position update interval	s	1	1
Performance Check			
Measurement duration	min	10	5 ≤ and ≥ 10
Total number of measurements	-	601	-
Number of solutions with HDOP ≤ 2 and PDOP ≤ 3.5	-	601	≥ 100
Measurements with position error ≤ 15 m	%	100	≥ 95

Table 10

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

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

GNSS Acquisition, Dynamic Accuracy, Position Update, Sensitivity and Dynamic Range (Acquisition and Tracking)						
Antenna (Double Ridge Guide)	EMCO	3115	34	29/03/2023	12	16/10/2023
Power Meter	Hewlett Packard	436A	94	29/03/2023	12	05/04/2023
Signal Generator	Rohde & Schwarz	SMY 01	118	29/03/2023	12	16/02/2024
Termination (50ohm)	Meca	405-1	364	29/03/2023	12	19/12/2023
Attenuator (10dB, 10W)	Weinschel	23/10/1934	470	29/03/2023	12	15/02/2024
Spectrum Analyser	Agilent Technologies	E4407B	1154	29/03/2023	12	04/01/2024
Directional Coupler	Narda	3022	1323	29/03/2023	12	11/07/2023
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23/03/1934	3162	29/03/2023	12	06/07/2023
GPS Simulator	Spirent	GSS7000	4978	29/03/2023	12	10/08/2023
Desktop Stopwatch	Radio Spares	RS Pro	5570	29/03/2023	12	30/11/2023
50 ohm Termination Load (10 Watt)	Telegartner	N/A	5905	29/03/2023	6	12/04/2023
Cable (N to N 2m)	Amphenol RF	N/A	5952	29/03/2023	12	15/05/2023
Cable (N to N 2m)	Amphenol RF	N/A	5953	29/03/2023	12	15/05/2023
Cable (N to N 2m)	Amphenol RF	N/A	5954	29/03/2023	12	15/05/2023
Humidity & Temperature meter	Rotronic	HP31 HygroPalm	6247	29/03/2023	12	21/09/2023
GNSS Static Accuracy, Angular Movement of the Antenna						
Multimeter	Iso-tech	IDM101	2421	21/07/2023	12	08/11/2023
Power Supply	Iso-tech	IPS 2010	2439	21/07/2023	12	O/P Mon
Humidity & Temperature meter	Rotronic	HP31 HygroPalm	6247	21/07/2023	12	21/09/2023

TU – Traceability Unscheduled
O/P Mon – Output monitored using calibrated equipment

SECTION

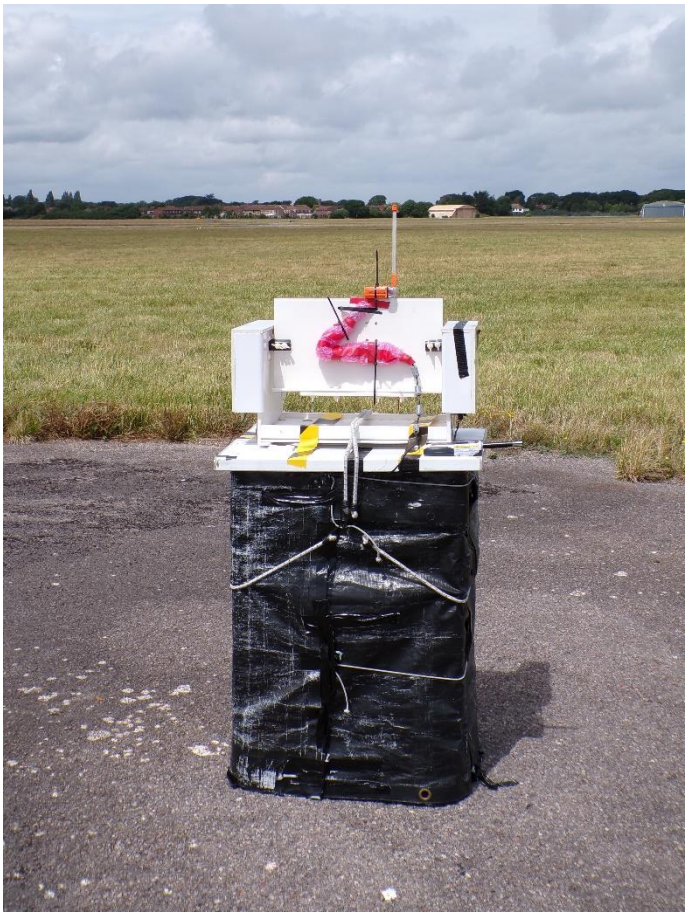
PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Photo of EUT (Front View)

Photo of EUT- (Rear View)

4.2 PHOTOGRAPHS OF TEST CONFIGURATIONS



Test setup for Clause 5.6.4.2 Static accuracy tests

Test setup for Clause 5.6.5 and remaining tests

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).