



Bundesrepublik Deutschland
Federal Republic of Germany

Bundesamt für Seeschifffahrt und Hydrographie
Federal Maritime and Hydrographic Agency



Conformance test report of a

GPS receiver module
integrated into a
Personal Locating Beacon (PLB)

Equipment under test: Orolia Limited Personal Locating Beacon
Type: Z423 FastFind 220

Applying test standards: IEC 61108-1:2003
Sections: 4.3.8/5.6.9 Effects of specific interfering signals

Test Report No.: BSH/4542/001/4143254/18

Applicant: TÜV SÜD Product Service Ltd.
Octagon House, Concorde Way
Segensworth North, Fareham
Hampshire PO15 5RL, UK

Hamburg, 24th September 2018
For the federal Maritime and Hydrographic Agency

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nach DIN EN 17025
akkreditiertes Prüflaboratorium



Bundesamt für Seeschifffahrt und Hydrographie
Federal Maritime and Hydrographic Agency



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Bernhard-Nocht-Straße 78, 20359 Hamburg**

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Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 20.04.2017 mit der Akkreditierungsnummer D-PL-12084-01 und ist gültig bis 19.04.2022. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 11 Seiten.

Registrierungsnummer der Urkunde: **D-PL-12084-01-00**

Frankfurt am Main, 20.04.2017

Im Auftrag Dipl.-Ing. (FH) Ralf Egner
Abteilungsleiter

Siehe Hinweis auf der Rückseite





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1 General

Applicant: TÜV SÜD Product Service Ltd.
Octagon House, Concorde Way
Segensworth North, Fareham
Hampshire PO15 5RL, UK

Equipment under test: Orolia Limited Personal Locating Beacon
Type: Z423 FastFind 220
Manufacturer: Orolia Limited

Place of test: BSH test laboratory Hamburg,
Room 015, GNSS Lab

Start of test: 10th September 2018
End of test: 12th September 2018

1.1 Document history, change log

Date of change	Section	Changed content
24 th September 2018	All	Full report
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1.2 Summary

Test standard: IEC 61108-1 Ed. 2, 2003

Test No.	Reference	Section	Result (passed/ not passed / not applicable / not tested)
--	IEC 61108-1	4.1 Object compliance with IEC 61162-1 compliance with IEC 60945	not tested
--	IEC 61108-1	4.2 GPS receiver equipment	not tested
--	IEC 61108-1	4.3.1 General	not tested
--	IEC 61108-1	4.3.2 Equipment output	not tested
--	IEC 61108-1	4.3.3 Accuracy	not tested
--	IEC 61108-1	4.3.4 Acquisition	not tested
--	IEC 61108-1	4.3.5 Protection	not tested
--	IEC 61108-1	4.3.6 Antenna design	not tested
--	IEC 61108-1	4.3.7 Dynamic range	not tested
1-3	IEC 61108-1	4.3.8 Effects of specific interfering signals	passed
--	IEC 61108-1	4.3.9 Position update	not tested
--	IEC 61108-1	4.3.10 Differential GPS input	not tested
--	IEC 61108-1	4.3.11 Failure warnings and status indications	not tested
--	IEC 61108-1	4.3.12 Output of COG, SOG and UTC	not tested
--	IEC 61108-1	4.3.13 Typical interference conditions	not tested

1.3 Equipment history

Main Unit – 406MHz Personal Location Beacon				
Type	Z423 FastFind 220	ID Tag No.	75942209/ TSR06	
Delivery date	5th September 2018	Serial number	---	
HW Version:	Delivery date	5th Sep. 2018	Version no	1001488 Issue A
	Installation date	5th Sep. 2018		
SW Version:	Delivery date	5th Sep. 2018	Version no	1001767 Issue A
	Installation date	5th Sep. 2018		
SW Version:	Delivery date	---	Version no	---
	Installation date	---		
SW Version:	Delivery date	---	Version no	---
	Installation date	---		
SW Version:	Delivery date	---	Version no	---
	Installation date	---		

1.4 Test environment

Documentation of equipment tests and dates of tests.

Test environment is completely equipped as described in Annex A.

Room	BSH room 908 / 015
Test engineer	T. Ehlers (S3301)
Location	BSH, Hamburg (Germany)

Overview Listing:

- lab spatial conditions,
- equipment under test conditions and type,
- test periodes and tested equipment.

The test environment is completely equipped as described in Annex A.

Location		
Lab room no.	BSH room 908 / 015	
Lab room air temperature	N/A	°C
Lab room air pressure	N/A	hPa
Lab room relative air humidity	N/A	%
---	---	

Equipment under test		
Position in lab room		
<input checked="" type="checkbox"/> relevant	<input type="checkbox"/> not relevant	
Mounting at test bed		
<input checked="" type="checkbox"/> relevant	<input type="checkbox"/> not relevant	
Type of equipment		
1	Garmin AIS 800 - Transponder	Refer to 1.2 Equipment history
Refer to Annex C – Photos of Equipment under Test		
Remarks		
Test environment and EUT are suitable for operating under normal indoor conditions, in a non condensating atmosphere.		



Test engineer	
T. Ehlers (S3301)	---
---	---

Equipment no	Start of test	End of test	Test engineer
1 (at BSH)	10th September 2018	12th September 2018	T. Ehlers (S3301)

1.5 Legend

Result marking (in the "result" column)²:

Passed	Item was OK, test successful No colour marking
Not passed	Test of a required item was not successful, change required
N/T	Not tested
N/A	Not applicable

Specific remarks (in the "remark" column, marked "bold italic"):

REC	recommendation (in terms of IEC17025 "opinion"); an improvement or change is recommended
Note	Note or comment (in terms of IEC17025 "interpretation"); rationale for specific results or interpretation of requirements as appropriate

1.6 General observations

General observations unrelated to any paragraphs of applied test standards.

² Test items maybe colour marked in draft versions of the report as follows:

Passed	no colour marking
Not passed	yellow
N/T	blue
N/A	no colour marking
REC	green



No. of test	IEC 61108-1	Requirement/Condition	Remark	Result
	5.6.9 (4.3.8)	Effects of specific interfering signals		
2	5.6.9.1 (4.3.8 a)	<p>L-Band Interference In a normal operating mode, using an appropriate signal source, the EUT shall be subjected to radiation of 3W/m² at a frequency of 1636.5MHz for 10min. The signal shall be removed and a successful performance check shall be carried out within 5min.</p>	<p>For test results see Annex B of this report</p> <p>Note EUT is a 406MHZ PLB with integrated GPS module and GPS antenna.</p>	Passed
3	5.6.9.2 (4.3.8 b)	<p>S-Band Interference In a normal operating mode, using an appropriate signal source, the EUT shall be subjected to radiation consisting of a burst of 10 pulses, each 1.0μs to 1.5μs long on a duty cycle of 1600:1 at a frequency in the range of 2.9GHz to 3.1GHz at power density of approximately 7.5kW/m². This condition shall be maintained for 10min with the bursts of pulses repeated every 3s.</p> <p>NOTE The peak power density is 7.5kW/m² to be measured at the EUT, this is approximately 4.7W/m² average power at a fixed transmitting antenna. The signal shall be removed and a successful performance check shall be carried out within 5min.</p>	<p>S-Band interference test was carried out using a 5.3W/m² CW signal</p>	Passed



Annex A - Test equipment

A.1 Test equipment summary

<i>Model / Program</i>	<i>Serial No. / Version No.</i>	<i>Calibrated / Function test</i>	<i>Used for</i>
Reference position roof of BSH building		Lat: 53 32.8136481666' Lon:9 58. 1016981666'	All test using real satellite signals
GNSS Simulation Unit GPS L1 and Galileo E1, E5	SPIRENT Communications Hardware:Typ: GSS8000, S/N: 8628/9 Software: PosApp Ver. 3.5	Function tests performed successfully according documented test procedures before performance of tests	Simulated GPS and Galileo testing
GNSS Simulation Unit GPS L1, L2, L5 GLONASS L1, L2 Galileo E1, E5	IFEN Typ: NCS TITAN S/N: Software:	Calibration date 2017/05/12 Function tests performed successfully according documented test procedures before performance of tests	Simulated multi-GNSS testing
Trimble Net R9 GNSS reference receiver	5112K74564	Function tests performed successfully	Reference and differential data source for GLONASS and GPS
MiniCircuits RF- Amplifier	ZHL-5W-2G-S+	Function tests performed successfully	L-Band interference
MiniCircuits RF- Amplifier	ZHL-16W-43-S+	Function tests performed successfully	S-Band interference
Signal Generator R&S SMJ100	S/N: 100858	Function tests performed successfully	Interference tests IEC 61108- 1 Ed.2, §5.6.9; §5.7
Agilent spectral analyzer E4440A	S/N: MY44022884	2016/11/03	Calibration of GPS measurement inside RF- chamber
Narda Broadband Field Meter	NBM550	2016/11/25	Induced Power of L/S-Band
Horn-Antenna Schwarzbeck BBHA 9120A	BBHA 9120A 535	2009/11/26	Calibration of GPS measurement inside RF- chamber and high power interference transmitting antenna



Reference position

Made by FREIE UND HANSESTADT HAMBURG
 Vermessungsamt –VA311-

Description of point	geocentrically co-ordinates (WGS84)		geodetical geographical co-ordinates (WGS84)		Gauß-Krüger (Bessel)	
North	x(m)	3740601.680	N	53°32' 49".49049	x(m)	5935502.790
	y(m)	657439.492	E	9°58' 6".10408	y(m)	3564257.804
	z(m)	5107029.673	Height over Ellipsoid	95.900 m	Altitude above sea level	55.969 m
South	x(m)	3740618.106	N	53°32' 48".81889	x(m)	5935482.027
	y(m)	657442.338	E	9°58' 6".10189	y(m)	3564258.046
	z(m)	5107017.296	Height over Ellipsoid	95.849 m	Altitude above sea level	55.917

Accuracy of survey = 0.02 m - last survey dated 2009-05-04

A.2 Documentation of test equipment

A.2.1 L-Band interference signal amplifier

RF-power amplifier for L-Band interference simulation

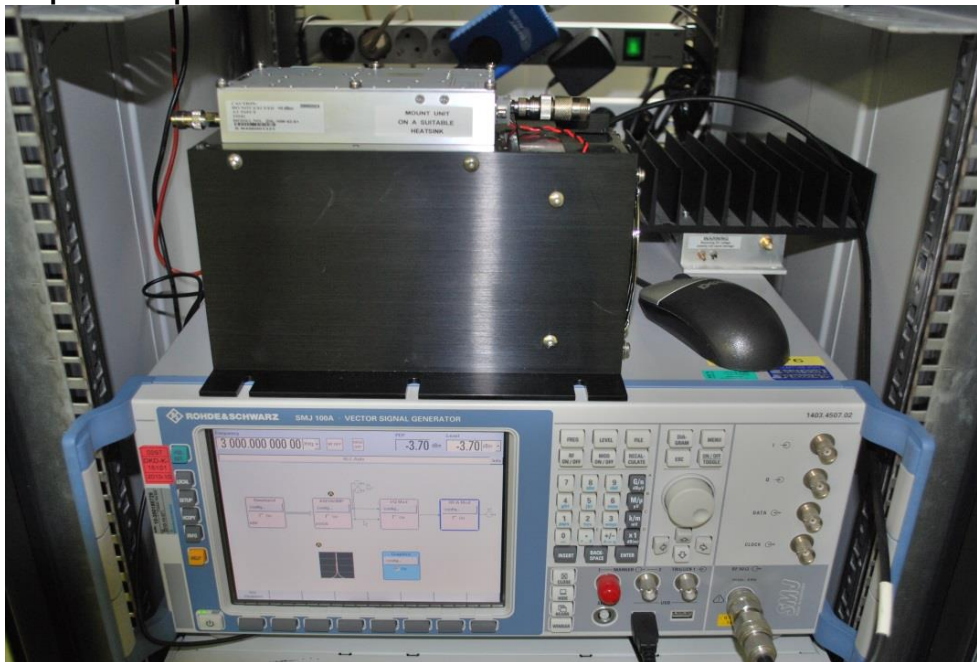


Signal generation for high power L-Band signals



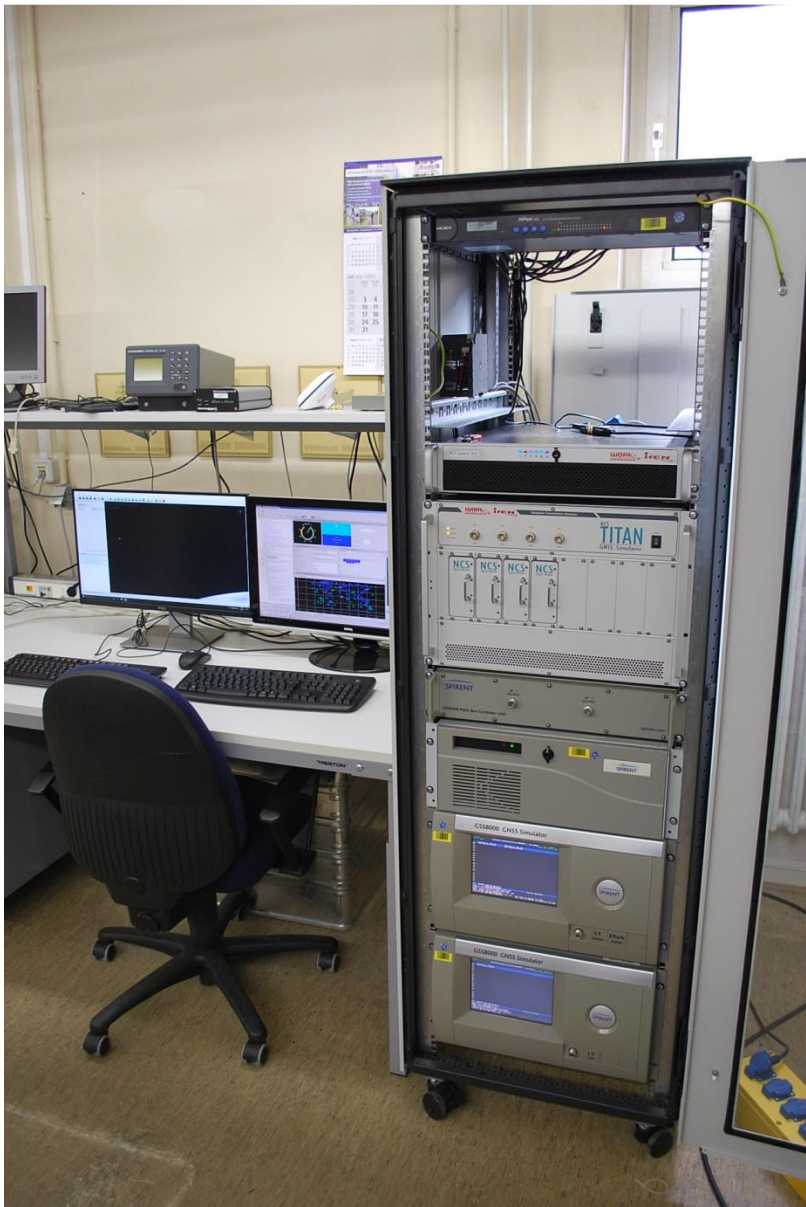
A.2.2 S-Band interference signal amplifier

Signal generation for high power S-Band signals
RF-power amplifier for S-Band interference simulation



A.2.3 GNSS Simulation

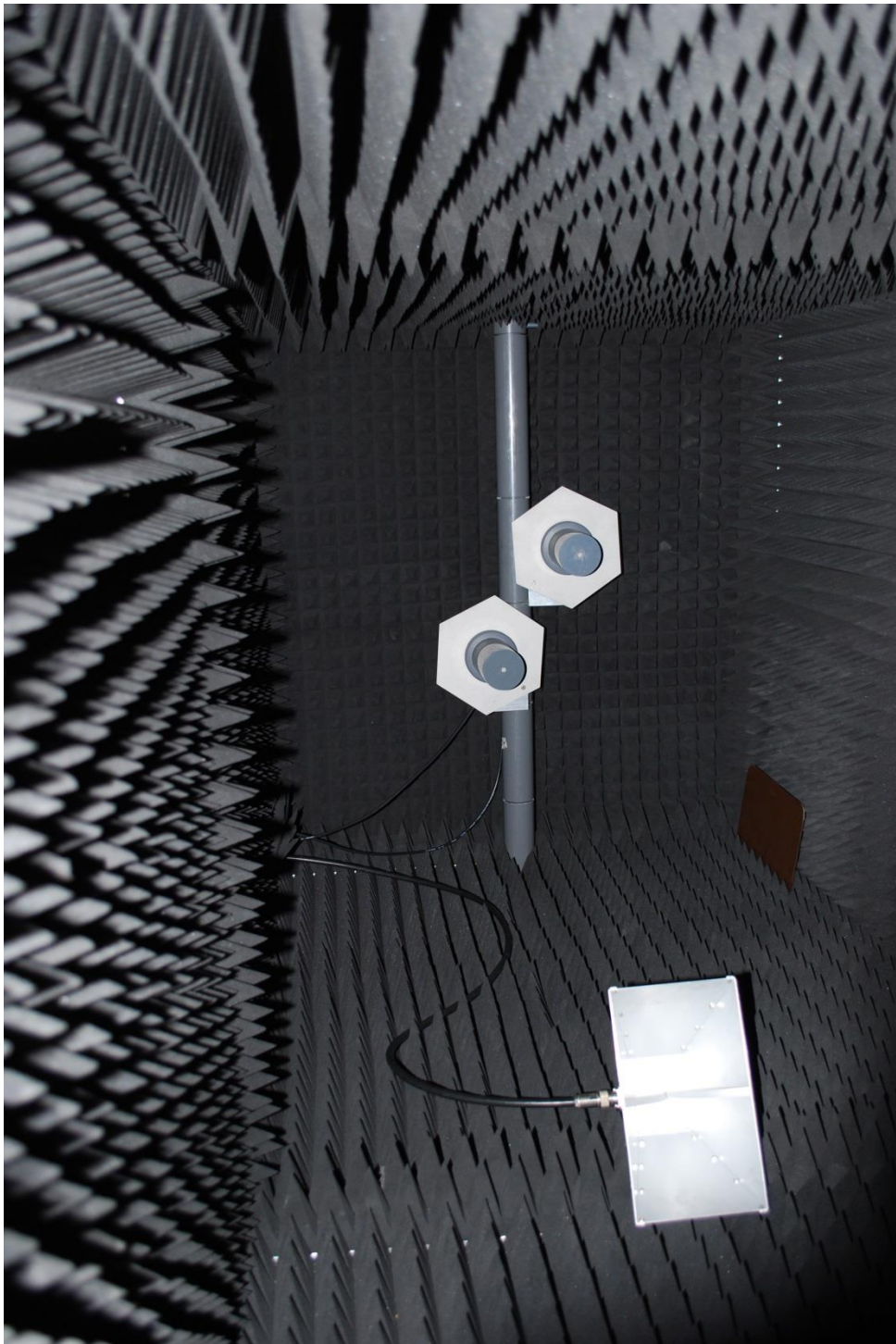
GNSS Simulation at BSH



Arrangement of GPS- and noise/ interference transmitting antennas



Arrangement of GPS-, interference- and high power (horn-antenna) transmitting antennas



GPS test box, exterior view



GPS test box, interior view





A.3 Calibration protocol of RF- Chamber

Calibration protocol

Date	10 th September 2018
Test eng.	Ehlers
Place of test	BSH, Room 015

Equipment

R&S SMJ100A Signalgenerator
 Helixantenna H1116R6, No. 1 and No. 2
 Schwarzbeck BBHA 9120 Hornantenna
 Agilent spectral analyser E4440A

Ifen NCS Titan Multi-Constellation-Simulation

Pdef.	-130	dBm	ICD GPS200 defines -130dBm as minimum received power at 3dBi antenna IEC61108-1:2003 defines -125dBm for typ. interference testing up to -120dBm
G trans. Ant.	4,5	dBi	
Prec.	-125,32	dBm	Gain of GPS- transmitting antenna Needed received power @ Schwarzbeck BBHA9120
Grec.ant.	9	dBi	Gain of calibrated Schwarzbeck BBHA 9120 @ 1575MHz
Adapt. Factor	5	dB	Adaption factor of Schwarzbeck BBHA9120 vs. 3dB antenna incl. Cable loss
GPS Power Level	33	dBW	adjusted power level @ NCS RF-Constellation Simulator

Calibration for L- and S-Band Interference §5.6.9.1, RF-Chamber

Date	10 th September 2018
Engineer	Ehlers

Test equipment used

R&S SMJ100A signal generator
MiniCircuits ZHL-5W-2G-S L-Band RF-Ampifier
MiniCircuits ZHL-16W-43-S S-Band RF-Amplifier
Schwarzbeck BBHA 9120 antenna
Narda fieldmeter
Agilent spectral analyzer

L-Band

Powerlevel @ SMJ	-5,7	dBm
Fieldstrength @ EUT	3,35	W/m ²

Start of test 15:30:00 Simulated UTC
Start Int. 15:38:00
Stop Int. 15:48:00

S-Band

Powerlevel @ SMJ	-3,7	dBm
Fieldstrength @ EUT	5,32	W/m ²

Start Int. 16:00:00 Simulated UTC
Stop Int. 16:10:00
End of Test 16:20:00

Annex B - Test diagrams

B.1 § 5.6.9 Effects of specific interfering signals

B.1.1 § 5.6.9.1 L-Band interference

In a normal operating mode, using an appropriate signal source, the EUT shall be subjected to radiation of 3 W/m^2 at a frequency of 1636.5 MHz for 10 min. The signal shall be removed and a performance check shall be carried out.

Conditions of tests performed:

Simulated GPS-Signal, Trajectory: Fixed point

Interference:

Frequency: 1636.5 MHz

Radiation: 3 W/m^2

Duration of test: 10 min

Test results

After removing the signal, the performance of the EUT was checked and found operating properly.

Test result: Passed

For details of validation of recorded data see the following pages.

B.1.2 §5.6.9.2 S-Band interference

In a normal operating mode, using an appropriate signal source, the EUT shall be subjected to radiation consisting of a burst of 10 pulses, each 1.0 to 1.5 μs long on a duty cycle of 1600:1 at a frequency in the range of 2.9 to 3.1 GHz at a power density of approximately 7.5 kW/ m^2 . This condition shall be maintained for 10 min with the bursts of pulses repeated every 3 s.

The signal shall be removed and a performance check shall be carried out.

Note:

IEC61108-1:2003 defines a CW-Signal with a fieldstrength of at least 4.7W/ m^2 as the equivalent CW signal power over a period of not less than 10 Minutes.

Conditions of tests performed:

Simulated GPS-Signal, Trajectory: Fixed point

Interference:

Frequency range:	3.0 GHz
Radiation:	5.3W/ m^2 CW-Signal
Duration of interference:	10 min

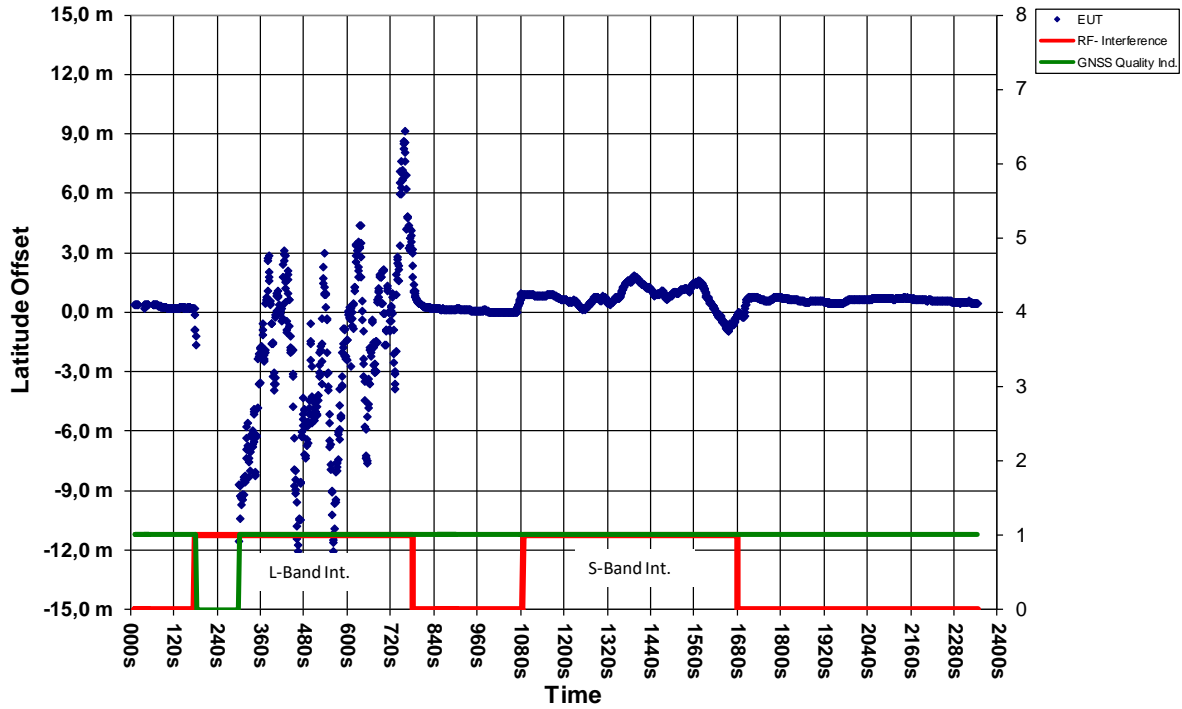
Test results

After removing the signal, the performance of the EUT was checked and found operating properly.

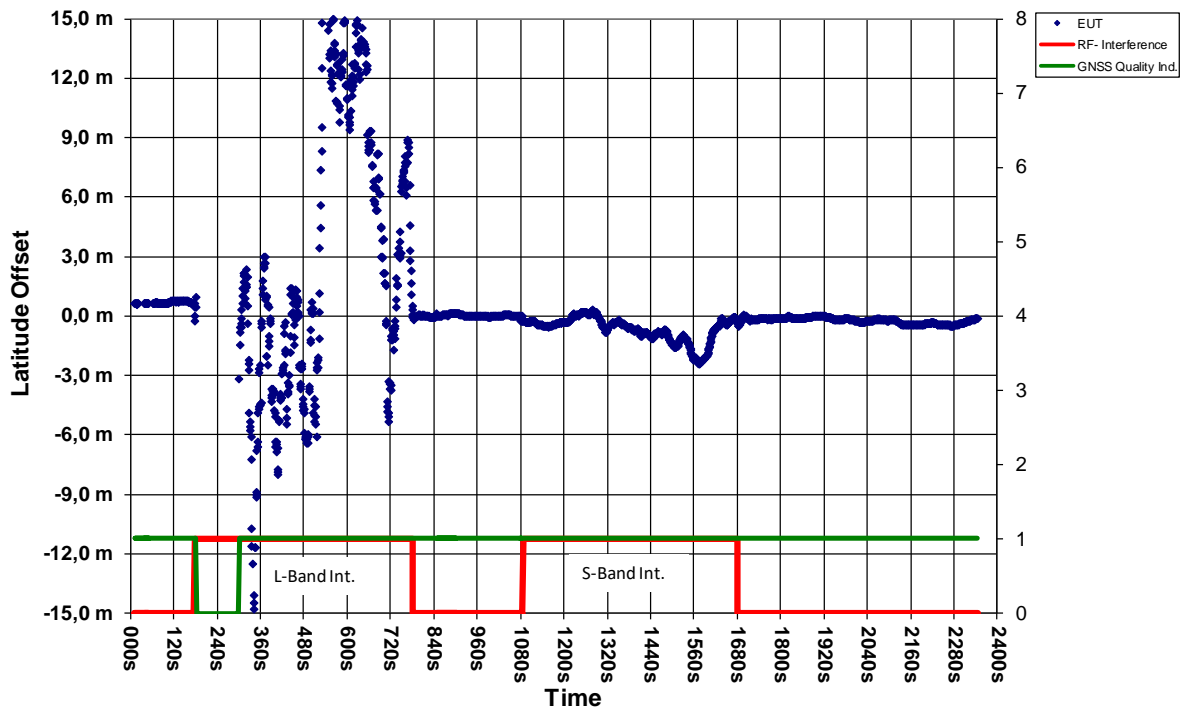
Test result: Passed

For details of validation of recorded data see the following pages.

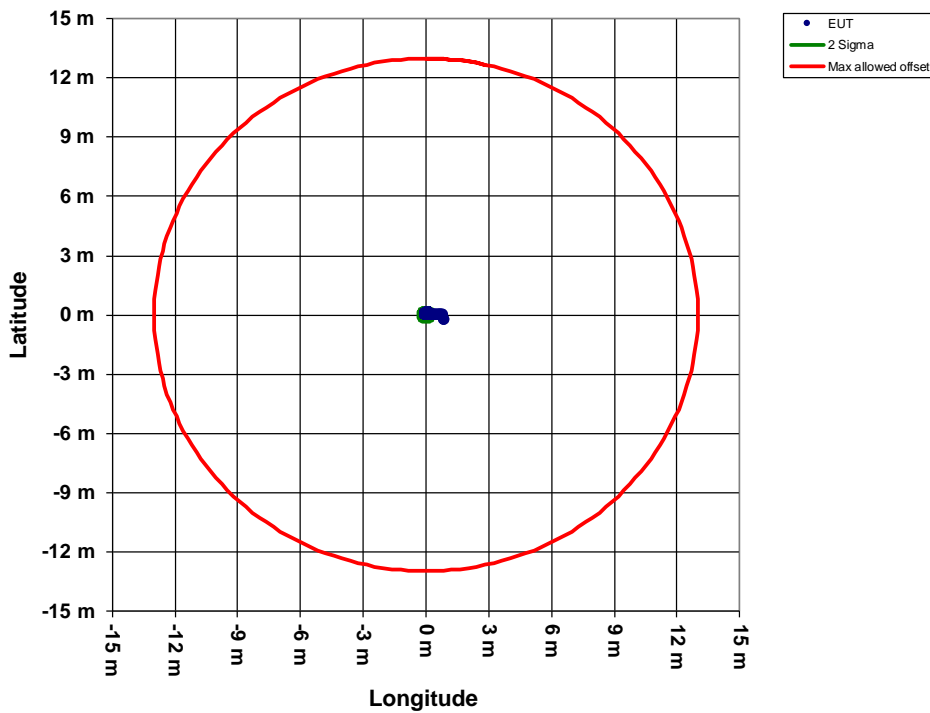
Latitude vs. time



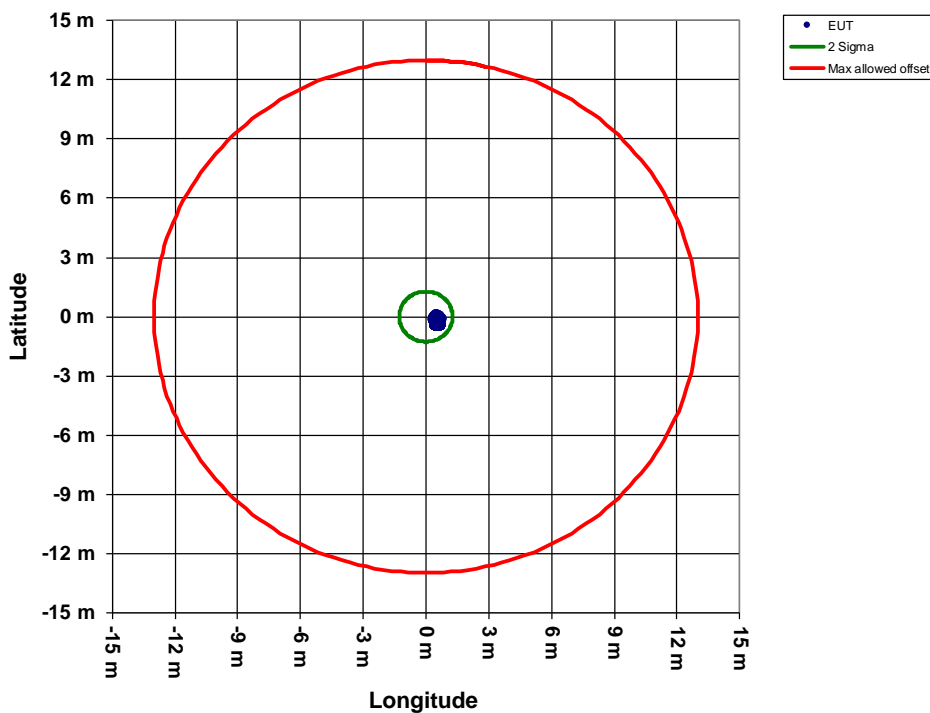
Longitude vs. time



Position output after L-Band interference



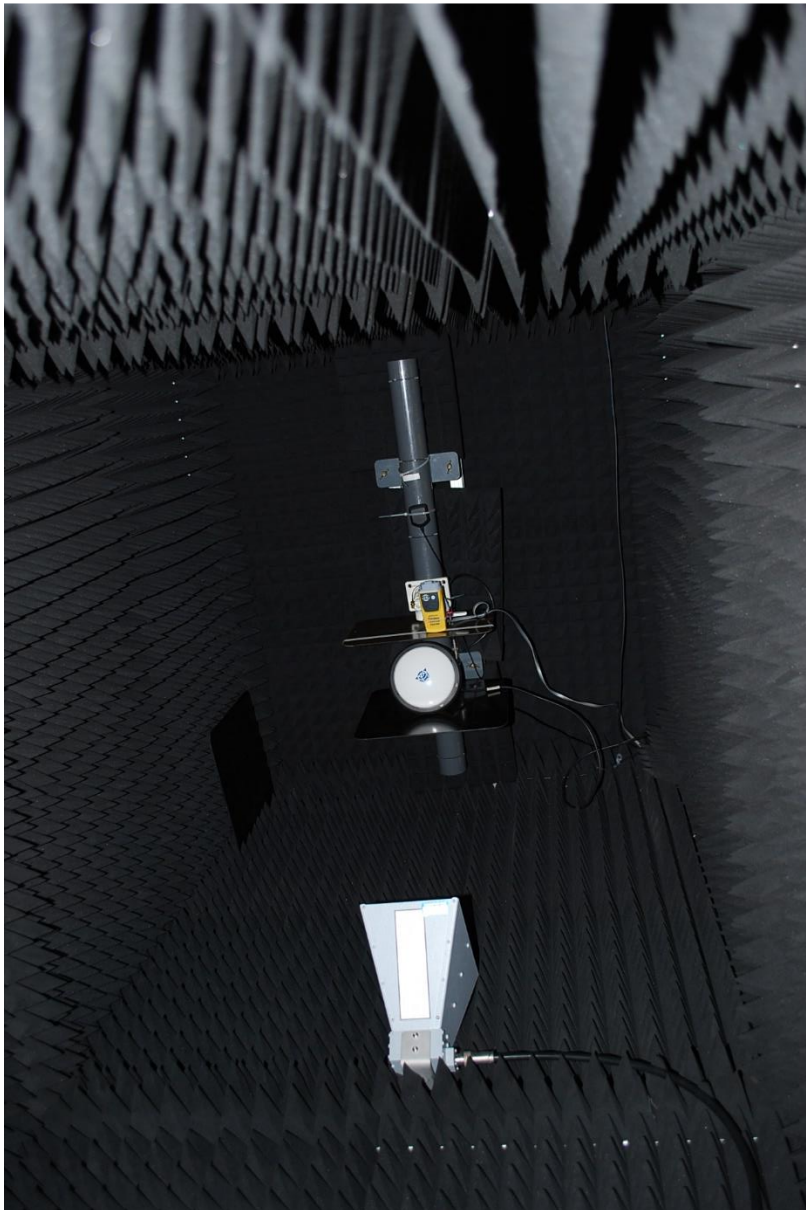
Position output after S-Band interference





Annex C - Photos of equipment under test

EUT at testside, inside RF-Chamber at BSH Hamburg



EUT, ID-Tag



EUT, Front-View

