



**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

**406MHz EPIRB**

**Equipment under test:** Orolia Limited Emergency Position Indicating  
Radio Beacon

**Type:** Z701 EPIRB

**Applying test standards:** IEC 61108-1:2003

**Sections:** 4.3.8/5.6.9 Effects of specific interfering signals

**Test Report No.:** BSH/4542/001/4143066/17

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

**Hamburg, 13<sup>th</sup> July 2017**

**For the federal Maritime and Hydrographic Agency**

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Test engineer

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Head of Laboratory  
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akkreditiertes Prüflaboratorium

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Deutsche  
Akkreditierungsstelle  
D-PL-12084-01-00





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**Bundesamt für Seeschifffahrt und Hydrographie  
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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





## Table of contents

1	GENERAL .....	6
1.1	DOCUMENT HISTORY, CHANGE LOG.....	6
1.2	SUMMARY .....	7
1.3	EQUIPMENT HISTORY.....	8
1.4	TEST ENVIRONMENT .....	9
1.5	LEGEND .....	11
1.6	GENERAL OBSERVATIONS.....	11
2	FUNCTIONAL TESTS .....	12
2.1	IEC 61108-1.....	12
	ANNEX A - TEST EQUIPMENT .....	15
A.1	TEST EQUIPMENT SUMMARY.....	16
A.2	DOCUMENTATION OF TEST EQUIPMENT .....	17
A.2.1	<i>L-Band interference signal amplifier</i> .....	17
A.2.2	<i>S-Band interference amplifier</i> .....	18
A.2.3	<i>GNSS Simulation</i> .....	19
A.2.4	<i>Calibration protocol of RF- Chamber (GPS power level)</i> .....	23
	ANNEX B - TEST DIAGRAMS .....	25
B.1	§ 5.6.9 EFFECTS OF SPECIFIC INTERFERING SIGNALS .....	25
B.1.1	§ 5.6.9.1 <i>L-Band interference</i> .....	25
B.1.2	§ 5.6.9.2 <i>S-Band interference</i> .....	26
	ANNEX C - PHOTOS OF EQUIPMENT UNDER TEST.....	29

## 1 General

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

**Equipment under test:** Orolia Limited EPIRB  
**Type:** Z701 EPIRB

**Manufacturer:** Orolia Limited

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

**Start of test:** 5<sup>th</sup> July 2017  
**End of test:** 5<sup>th</sup> July 2017

### 1.1 Document history, change log

Date of change	Section	Changed content
13 <sup>th</sup> July 2017	All	Full report

## 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	<b>passed</b>
--	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 – Orolia 406MHZ EPIRB				
<b>Type</b>	<b>Orolia Z701 EPIRB</b>	<b>Part No.</b>	---	
<b>Delivery date</b>	<b>21<sup>st</sup> June 2017</b>	<b>Serial number</b>	<b>75931946-TSR0084</b>	
<b>HW Version:</b>	<b>Delivery date</b>	<b>21<sup>st</sup> June 2017</b>	<b>Version no</b>	---
	<b>Installation date</b>	<b>21<sup>st</sup> June 2017</b>		
<b>SW Version:</b>	<b>Delivery date</b>	<b>21<sup>st</sup> June 2017</b>	<b>Version no</b>	---
	<b>Installation date</b>	<b>21<sup>st</sup> June 2017</b>		
<b>SW Version:</b>	<b>Delivery date</b>	---	<b>Version no</b>	---
	<b>Installation date</b>	---		
<b>SW Version:</b>	<b>Delivery date</b>	---	<b>Version no</b>	---
	<b>Installation date</b>	---		
<b>SW Version:</b>	<b>Delivery date</b>	---	<b>Version no</b>	---
	<b>Installation date</b>	---		



1.4 Test environment

**Documentation of equipment tests and dates of tests.**

**Test environment is completely equipped as described in Annex A.**

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

**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.**

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

<b>Equipment under test</b>	
<b>Position in lab room</b>	
<input checked="" type="checkbox"/> <b>relevant</b>	<input type="checkbox"/> <b>not relevant</b>
<b>Mounting at test bed</b>	
<input checked="" type="checkbox"/> <b>relevant</b>	<input type="checkbox"/> <b>not relevant</b>
<b>Type of equipment</b>	
<b>1 Orolia 406MHz EPIRB</b>	<b>Refer to 1.2 Equipment history</b>
<b>Refer to Annex C – Photos of Equipment under Test</b>	
<b>Remarks</b>	
<b>Test environment and EUT are suitable for operating under normal indoor conditions, in a non condensating atmosphere.</b>	



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<b>Test engineer</b>	
T. Ehlers (S3301)	---
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<b>Equipment no</b>	<b>Start of test</b>	<b>End of test</b>	<b>Test engineer</b>
1 (at BSH)	5 <sup>th</sup> July 2017	5 <sup>th</sup> July 2017	T. Ehlers (S3301)

## 1.5 Legend

### **Result marking** (in the "result" column)<sup>2</sup>:

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.

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<sup>2</sup> 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
	<b>5.6.9 (4.3.8)</b>	<b>Effects of specific interfering signals</b>		
<b>2</b>	<b>5.6.9.1 (4.3.8 a)</b>	<b>L-Band Interference</b> In a normal operating mode, using an appropriate signal source, the EUT shall be subjected to radiation of 3W/m <sup>2</sup> at a frequency of 1636.5MHz for 10min. The signal shall be removed and a successful performance check shall be carried out within 5min.	For test results see Annex B of this report  <b>Note</b> EUT is a 406MHz EPIRB with integrated GPS receiver and antenna	<b>Passed</b>
<b>3</b>	<b>5.6.9.2 (4.3.8 b)</b>	<b>S-Band Interference</b> 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/m <sup>2</sup> . This condition shall be maintained for 10min with the bursts of pulses repeated every 3s.  <b>NOTE</b> The peak power density is 7.5kW/m <sup>2</sup> to be measured at the EUT, this is approximately 4.7W/m <sup>2</sup> average power at a fixed transmitting antenna. The signal shall be removed and a successful performance check shall be carried out within 5min.	S-Band interference test was carried out using a 5.2W/m <sup>2</sup> CW signal	<b>Passed</b>





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## Annex A - Test equipment

## A.1 Test equipment summary

Model / Program	Serial No. / Version No.	Calibrated / Function test	Used for
Reference position roof of BSH building		Lat: 53 32.8136481666' Lon:9 58. 1016981666'	All test using real satellite signals
GNSS Simulation Unit	SPIRENT Communications  Hardware:Typ: GSS8000, S/N: 8628/9  Software: PosApp Ver. 3.5	Calibration date 2012/10/22 Function tests performed successfully according documented test procedures before performance of tests	All GPS testing, unless stated otherwise
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	2016/10/31	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

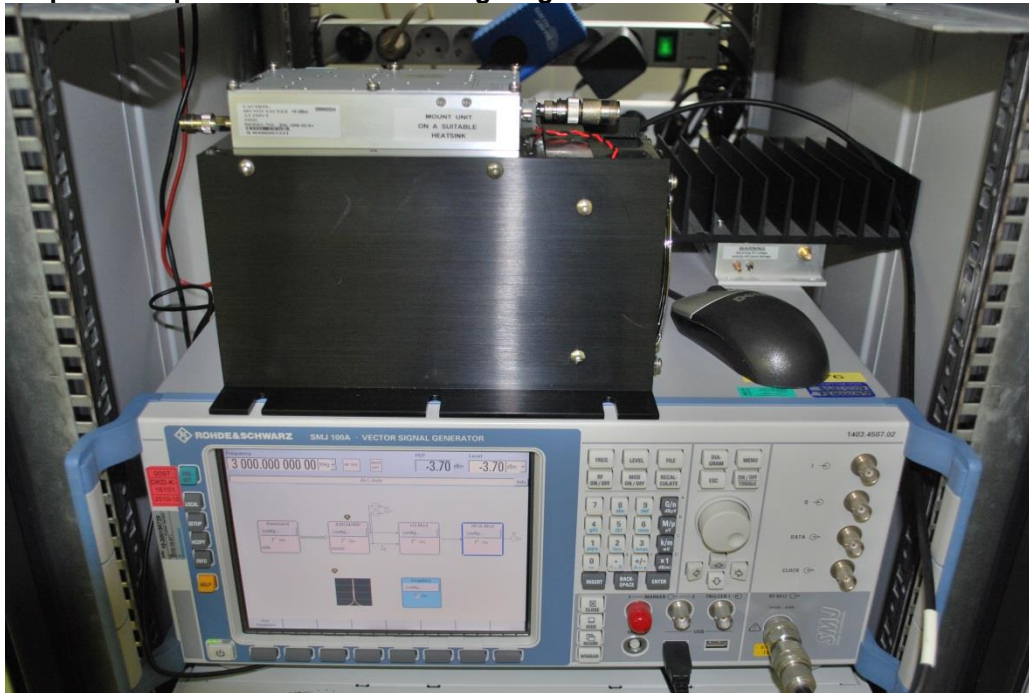


#### Signal generation for high power L-Band signals



## A.2.2 S-Band interference amplifier

### RF-power amplifier for S-Band and signal generator

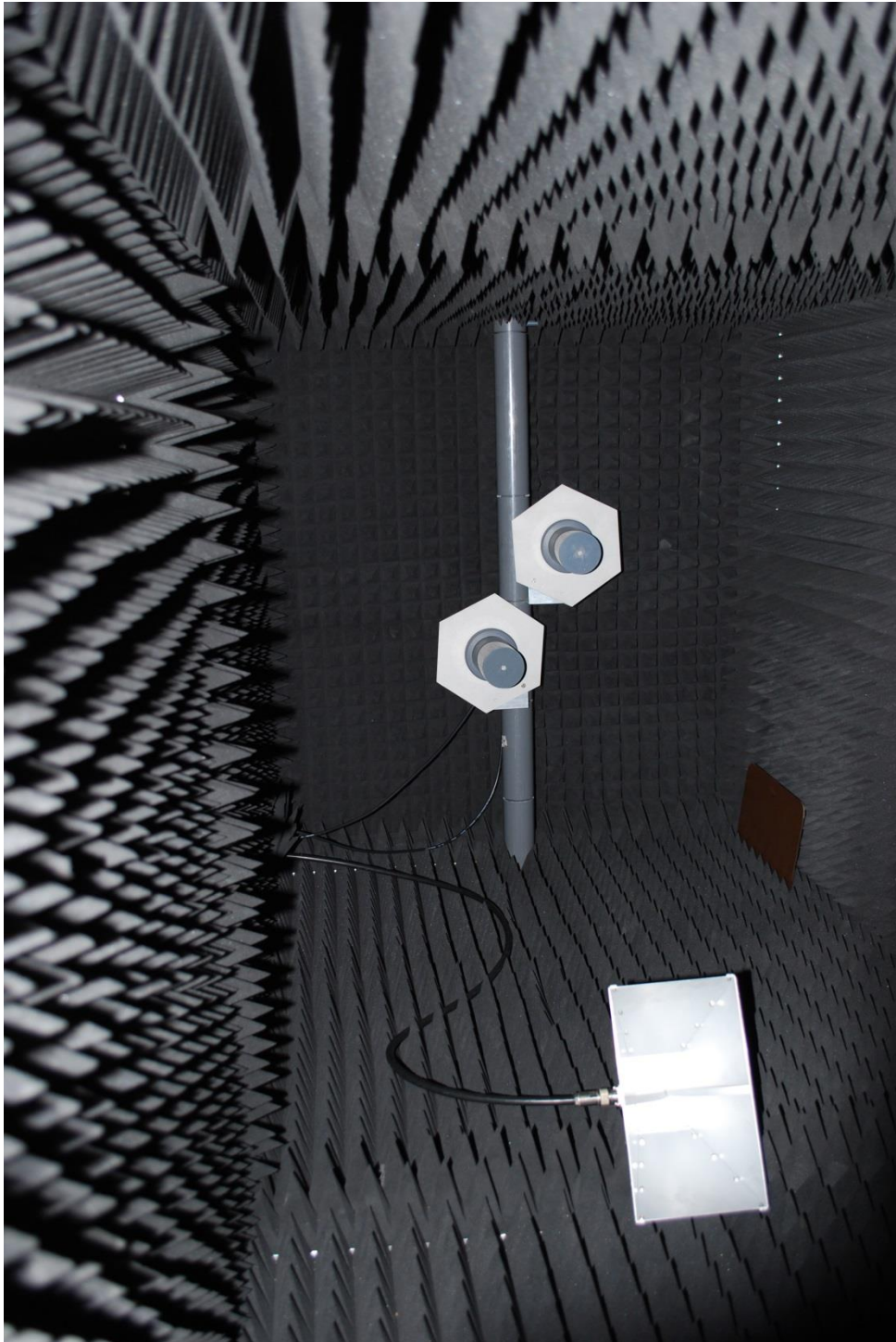


### A.2.3 GNSS Simulation

#### GNSS Simulation at BSH



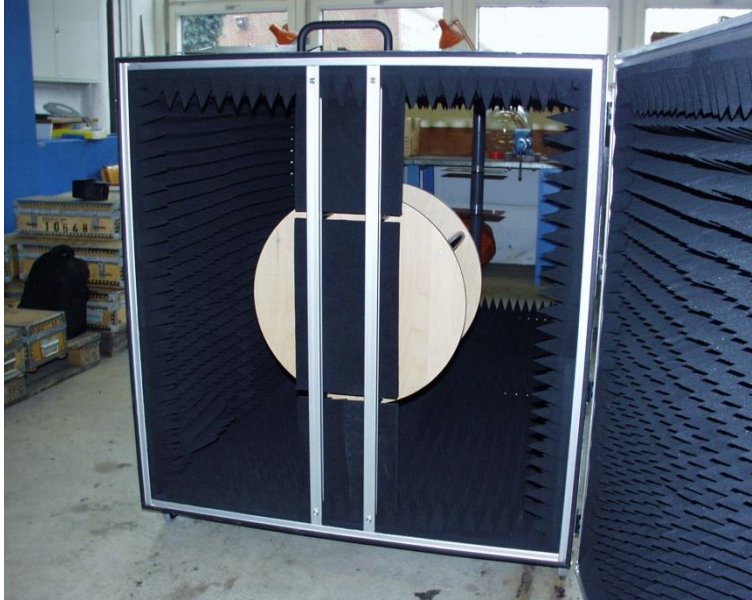
Arrangement of GPS-, interference- and high power (horn-antenna) transmitting antennas



GPS test box, exterior view



GPS test box, interior view





## A.2.4 Calibration protocol of RF- Chamber (GPS power level)

### Calibration protocol

<b>Date</b>	4 <sup>th</sup> July 2017
<b>Test eng.</b>	Ehlers
<b>Place of test</b>	BSH, Room 015

### Equipment

R&S SMJ100A Signalgenerator  
 Helixantenna H1116R6, No. 1 and No. 2  
 Schwarzbeck BBHA 9120 Hornantenna  
 Agilent spectral analyser E4440A  
 Spirent GSS8000  
 Ifen NCS TITAN

<b>Pdef.</b>	<b>-130 dBm</b>	ICD GPS200 defines -130dBm as minimum received power at 3dBi antenna IEC61108-1/2:2003 defines -125dBm for typ. interference testing up to -120dBm
<b>G trans. Ant.</b>	<b>4,5 dBi</b>	Gain of GPS- transmitting antenna
<b>Prec.</b>	<b>-125,32 dBm</b>	Needed received power @ Schwarzbeck BBHA9120 (Value from calculation)
<b>Grec.ant.</b>	<b>9 dBi</b>	Gain of calibrated Schwarzbeck BBHA 9120 @ 1575MHz
<b>Adapt. Factor</b>	<b>5 dB</b>	Adaption factor of Schwarzbeck BBHA9120 vs. 3dB antenna incl. Cable loss
<b>Attenuation</b>	<b>15 dB</b>	attenuation needed for adjusted power level

**Calibration for L- and S-Band Interference §5.6.9, RF-Chamber**

<b>Date</b>	5 <sup>th</sup> July 2017
<b>Engineer</b>	T. 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  
Spirent GSS8000

L-Band

Powerlevel @ SMJ	-8,2	dBm
Fieldstrength @ EUT	3,4	W/m <sup>2</sup>

Start Int. 15:30:00 Simulated UTC  
Stop Int. 15:40:00

S-Band

Powerlevel @ SMJ	-3,3	dBm
Fieldstrength @ EUT	5,3	W/m <sup>2</sup>

Start Int. 15:15:00 Simulated UTC  
Stop Int. 15:25:00



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## 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  $3 \text{ W/m}^2$  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:  $3.4 \text{ W/m}^2$

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  $\mu\text{s}$  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<sup>2</sup>. 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<sup>2</sup> as the equivalent CW signal power over a period of 10 Minutes.

Conditions of tests performed:

Simulated GPS-Signal, Trajectory: Fixed point

Interference:

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

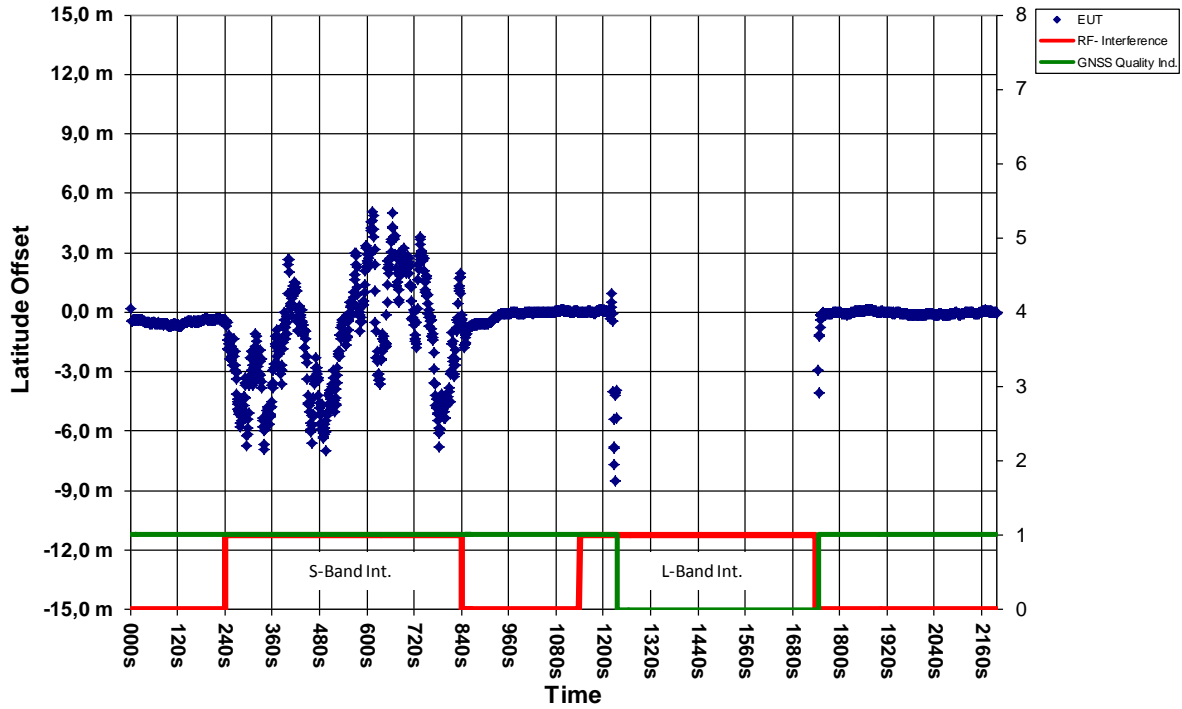
### **Test results**

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

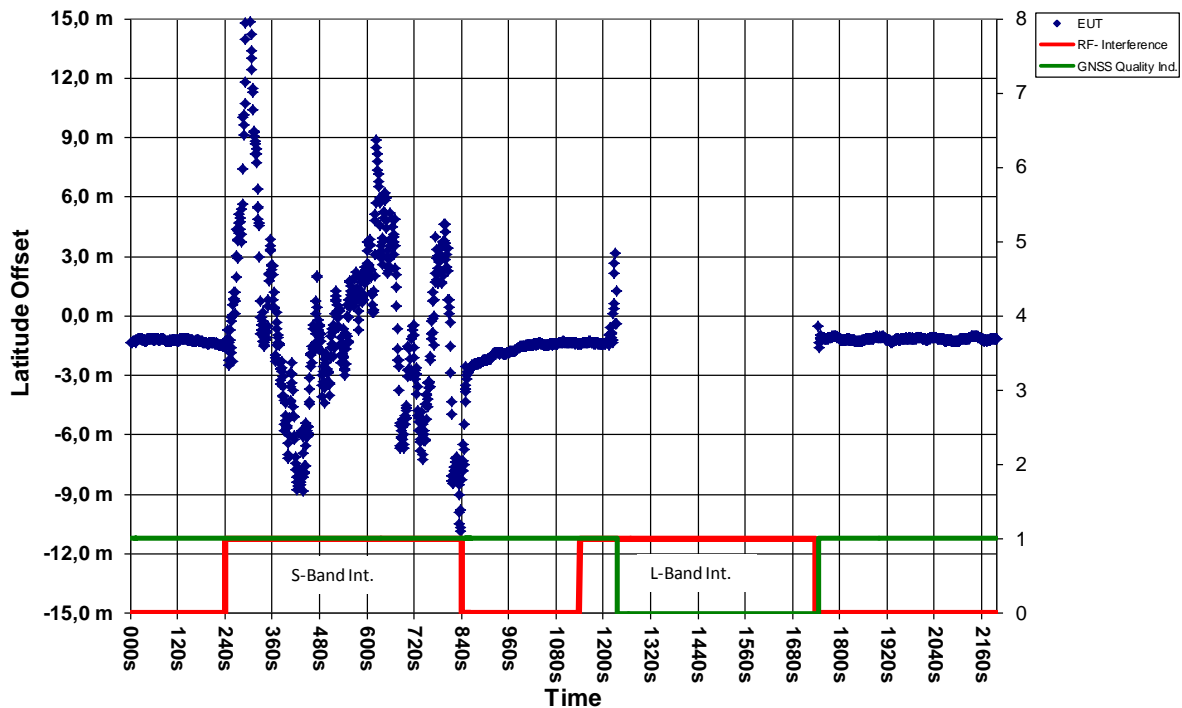
**Test result: Passed**

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

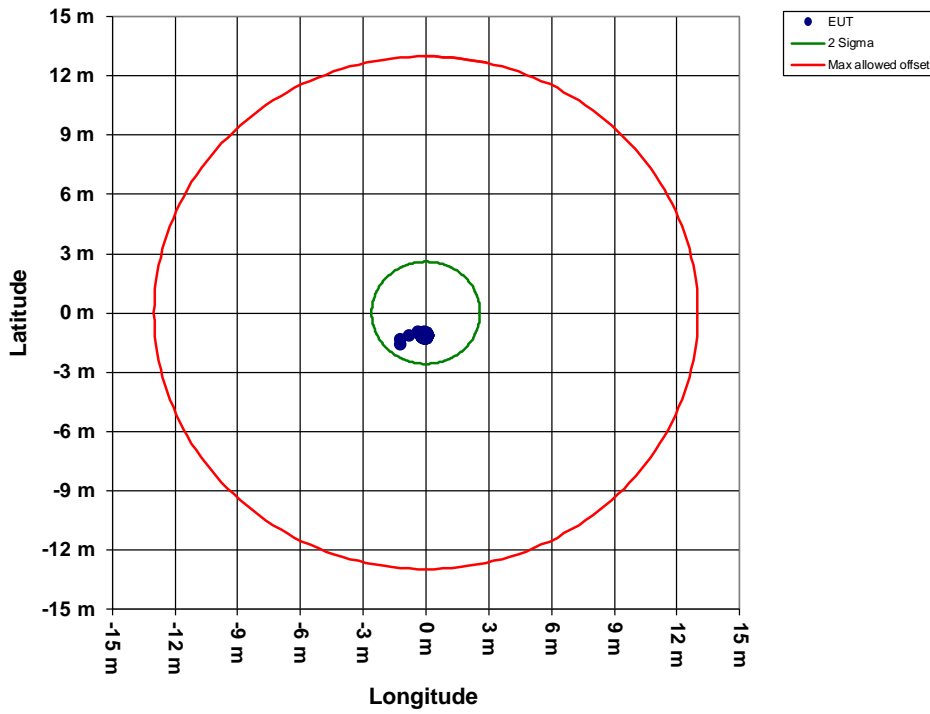
Latitude vs. time



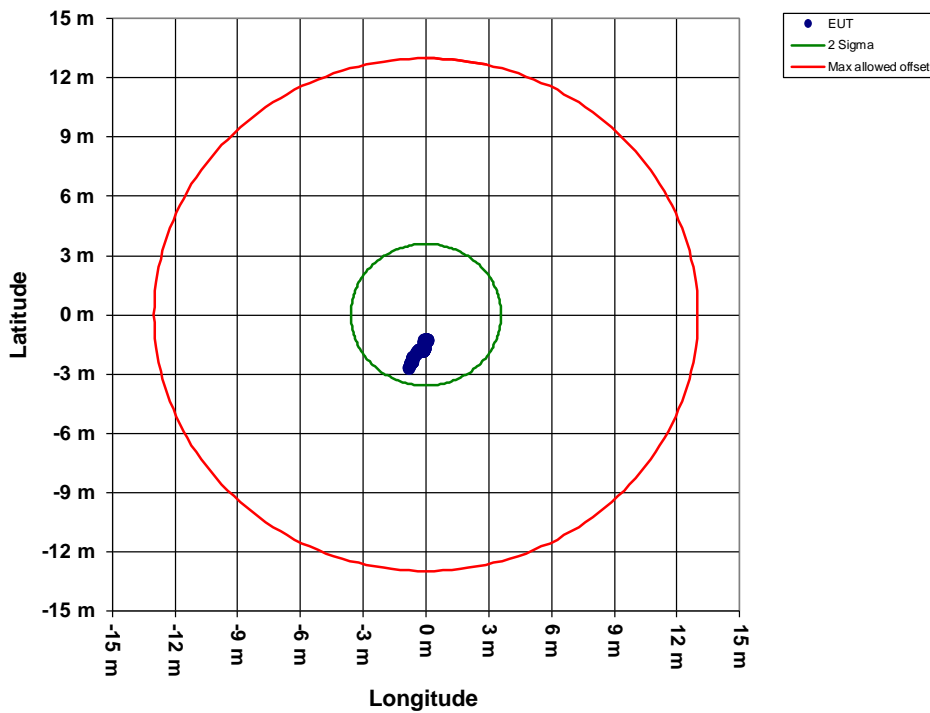
Longitude vs. time



Position output after L-Band interference



Position output after S-Band interference



## Annex C - Photos of equipment under test

**EUT at testside, BSH Hamburg**  
GPS- Antenna inside RF-Chamber



ID-Tag

