



**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 an  
**AIS Transponder**

**Equipment under test:** AIS Transponder  
**Type:** Garmin AIS 800 Class B/SO / easy TRX3  
**Applying test standards:** IEC 61108-1:2003  
**Sections:** 4.3.8/5.6.9 Effects of specific interfering signals

**Test Report No.:** BSH/4542/001/4143218/18

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

**Hamburg, 23<sup>rd</sup> April 2018**  
**For the federal Maritime and Hydrographic Agency**

**Tobias Ehlers**  
Test engineer

**Jochen Ritterbusch**  
Head of Laboratory

**Federal Maritime and Hydrographic Agency**  
**Bernhard-Nocht-Str. 78**  
**D-20359 Hamburg**  
Germany

nach DIN EN 17025  
akkreditiertes Prüflaboratorium







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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





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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:** AIS Class B/SO Transponder  
**Type:** Garmin AIS 800 / easy TRX3

**Manufacturer:** Weatherdock AG  
Emmericher Strasse 17  
90411 Nürnberg  
Germany

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

**Start of test:** 17<sup>th</sup> April 2018  
**End of test:** 17<sup>th</sup> April 2018

### 1.1 Document history, change log

| Date of change              | Section | Changed content |
|-----------------------------|---------|-----------------|
| 23 <sup>rd</sup> April 2018 | 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 - Ocean Signal AIS Transponder |                                  |                                   |                   |            |
|--|----------------------------------|-----------------------------------|-------------------|------------|
| <b>Type</b>                              | <b>Garmin AIS 800 cl. B</b>      | <b>Part No</b>                    | <b>A02087</b>     |            |
| <b>Delivery date</b>                     | <b>9<sup>th</sup> April 2018</b> | <b>Serial number</b>              | <b>5N7000000</b>  |            |
| <b>HW Version:</b>                       | <b>Delivery date</b>             | <b>9<sup>th</sup> April 2018</b>  | <b>Version no</b> | <b>---</b> |
|  | <b>Installation date</b>         | <b>17<sup>th</sup> April 2018</b> |                   |            |
| <b>SW Version:</b>                       | <b>Delivery date</b>             | <b>9<sup>th</sup> April 2018</b>  | <b>Version no</b> | <b>---</b> |
|  | <b>Installation date</b>         | <b>17<sup>th</sup> April 2018</b> |                   |            |
| <b>SW Version:</b>                       | <b>Delivery date</b>             | <b>---</b>                        | <b>Version no</b> | <b>---</b> |
|  | <b>Installation date</b>         | <b>---</b>                        |                   |            |
| <b>SW Version:</b>                       | <b>Delivery date</b>             | <b>---</b>                        | <b>Version no</b> | <b>---</b> |
|  | <b>Installation date</b>         | <b>---</b>                        |                   |            |
| <b>SW Version:</b>                       | <b>Delivery date</b>             | <b>---</b>                        | <b>Version no</b> | <b>---</b> |
|  | <b>Installation date</b>         | <b>---</b>                        |                   |            |





| <b>GPS Antenna Unit</b> |                                  |                                   |                       |                  |
|-------------------------|----------------------------------|-----------------------------------|-----------------------|------------------|
| <b>Type</b>             | <b>Garmin GPS Antenna</b>        |                                   | <b>Part No.:</b>      | <b>GA-30</b>     |
| <b>Delivery date</b>    | <b>9<sup>th</sup> April 2018</b> |                                   | <b>Serial number:</b> | <b>1TU004761</b> |
| <b>HW Version:</b>      |                                  |                                   |                       |                  |
|                         | <b>Delivery date</b>             | <b>9<sup>th</sup> April 2018</b>  | <b>Version no</b>     | ---              |
|                         | <b>Installation date</b>         | <b>17<sup>th</sup> April 2018</b> |                       |                  |
| <b>SW Version:</b>      |                                  |                                   |                       |                  |
|                         | <b>Delivery date</b>             | <b>9<sup>th</sup> April 2018</b>  | <b>Version no</b>     | ---              |
|                         | <b>Installation date</b>         | <b>17<sup>th</sup> April 2018</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</b>   | <b>Ocean Signal AIS-Transponder</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> |  |                                       |



---

|                          |     |
|--------------------------|-----|
| <b>Test engineer</b>     |     |
| <b>T. Ehlers (S3301)</b> | --- |
| ---                      | --- |

| <b>Equipment no</b> | <b>Start of test</b>              | <b>End of test</b>                | <b>Test engineer</b>     |
|---------------------|-----------------------------------|-----------------------------------|--------------------------|
| <b>1 (at BSH)</b>   | <b>17<sup>th</sup> April 2018</b> | <b>17<sup>th</sup> April 2018</b> | <b>T. Ehlers (S3301)</b> |

## 1.5 Legend

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

|            |   |
|------------|---|
| Passed     | Item was OK, test successful<br>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.

---

<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             |

## 2 Functional Tests

### 2.1 IEC 61108-1

| No. of test | IEC 61108-1 | Requirement/Condition   | Remark | Result                                    |
|-------------|-------------|---|--------|---|
| 1           | 4.3.8       | <p><b>Effects of specific interfering signals</b><br/>                     The GPS receiver equipment shall meet the following requirements:</p> <p>a) In a normal operating mode, i.e. switched on and with antenna attached, it is subject to radiation of 3W/m<sup>2</sup> at a frequency of 1636.5MHz for 10min. When the unwanted signal is removed and the GPS receiver antenna is exposed to the normal GPS satellite signals, the GPS receiver equipment shall calculate valid position fixes within 5min without further operator intervention.</p> <p>b) In a normal operating mode, i.e. switched on and with antenna attached, it is subject to radiation consisting of a burst of 10pulses, each 1.0μs to 1.5μs long on a duty cycle of 1600:1 at a frequency lying between 2.9GHz and 3.1GHz at power density of about 7.5kW/m<sup>2</sup>. The condition shall be maintained for 10min with the bursts of pulses repeated every 3s. When the unwanted signal is removed and the GPS receiver antenna is exposed to the normal GPS satellite signals, the receiver shall calculate valid position fixes within 5min without further operator intervention. Advice shall be given in the manual for adequate installation of the antenna unit, to minimise interference with other radio equipment such as marine radars, Inmarsat SES's, etc.</p> |        | <p><b>Passed</b></p> <p><b>Passed</b></p> |



| 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> | <p><b>L-Band Interference</b><br/>                     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.<br/>                     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><b>Note</b><br/>                     EUT is an AIS Transponder with integrated GPS module and external GPS antenna.</p> | <b>Passed</b> |
| <b>3</b>    | <b>5.6.9.2 (4.3.8 b)</b> | <p><b>S-Band Interference</b><br/>                     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.</p> <p><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.<br/>                     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 5.2W/m<sup>2</sup> CW signal</p>  | <b>Passed</b> |



## 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<br>roof of BSH building                                 |  | Lat: 53 32.8136481666'<br>Lon:9 58. 1016981666'  | All test using real satellite signals  |
| GNSS Simulation Unit<br>GPS L1 and Galileo E1, E5                          | SPIRENT<br>Communications<br><br>Hardware:Typ: GSS8000,<br>S/N: 8628/9<br><br>Software:<br>PosApp Ver. 3.5 | Function tests performed<br>successfully according documented<br>test procedures before performance<br>of tests                                | Simulated GPS and Galileo<br>testing   |
| GNSS Simulation Unit<br>GPS L1, L2, L5<br>GLONASS L1, L2<br>Galileo E1, E5 | IFEN<br><br>Typ: NCS TITAN<br>S/N:<br>Software:  | Calibration date 2017/05/12<br>Function tests performed<br>successfully according documented<br>test procedures before performance<br>of tests | Simulated multi-GNSS testing   |
| Trimble Net R9<br>GNSS reference receiver                                  | 5112K74564   | Function tests performed<br>successfully   | Reference and differential<br>data source for GLONASS<br>and GPS   |
| MiniCircuits RF- Amplifier   | ZHL-5W-2G-S+   | Function tests performed<br>successfully   | L-Band interference  |
| MiniCircuits RF- Amplifier   | ZHL-16W-43-S+  | Function tests performed<br>successfully   | S-Band interference  |
| Signal Generator<br>R&S SMJ100   | S/N: 100858  | Function tests performed<br>successfully   | Interference tests IEC 61108-<br>1 Ed.2, §5.6.9; §5.7  |
| Agilent spectral analyzer<br>E4440A  | S/N: MY44022884  | 2016/11/03   | Calibration of GPS<br>measurement inside RF-<br>chamber  |
| Narda Broadband Field Meter  | NBM550   | 2016/11/25   | Induced Power of L/S-Band  |
| Horn-Antenna<br>Schwarzbeck BBHA 9120A                                     | BBHA 9120A 535   | 2009/11/26   | Calibration of GPS<br>measurement inside RF-<br>chamber and high power<br>interference transmitting<br>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

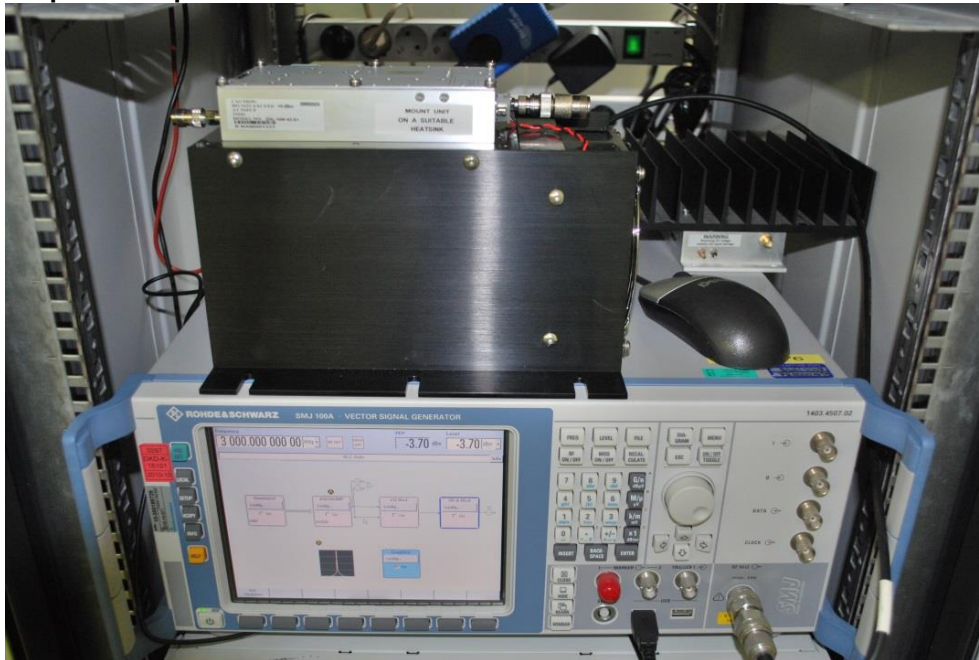


Signal generation for high power L-Band signals



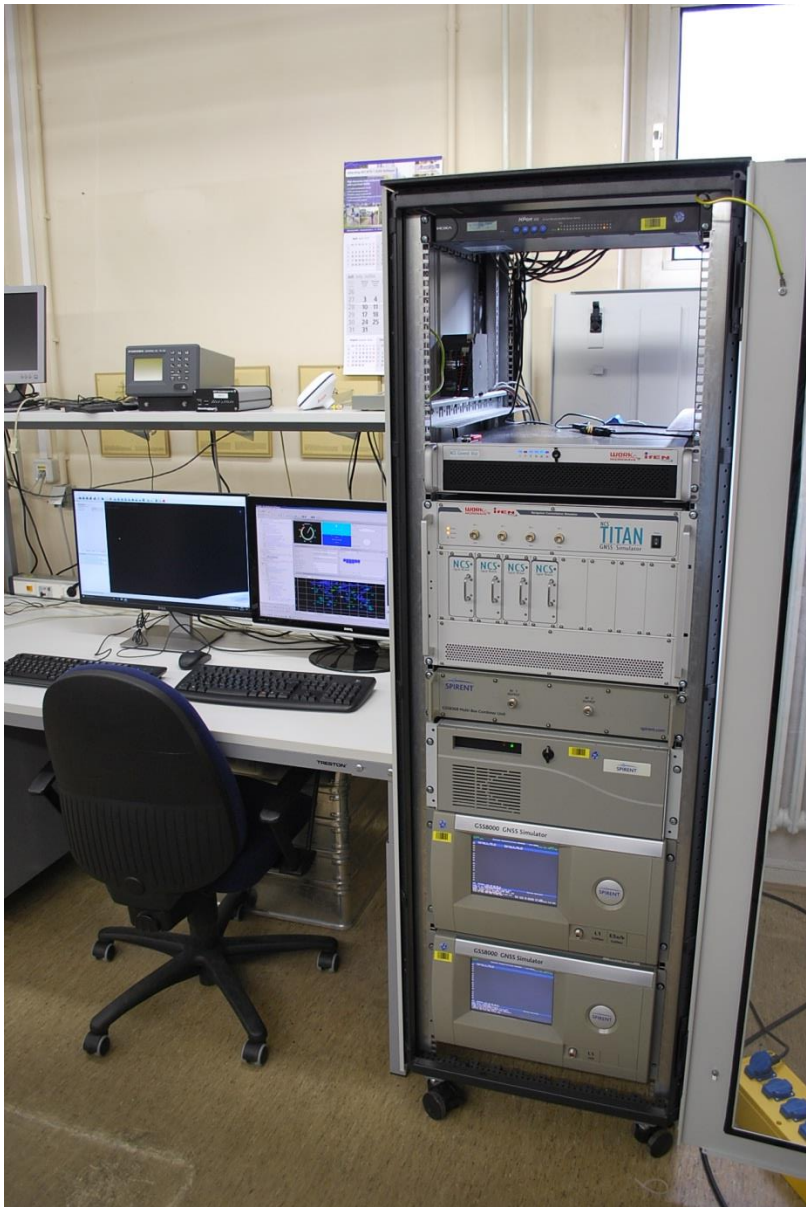
## A.2.2 S-Band interference signal amplifier

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



### A.2.3 GNSS Simulation

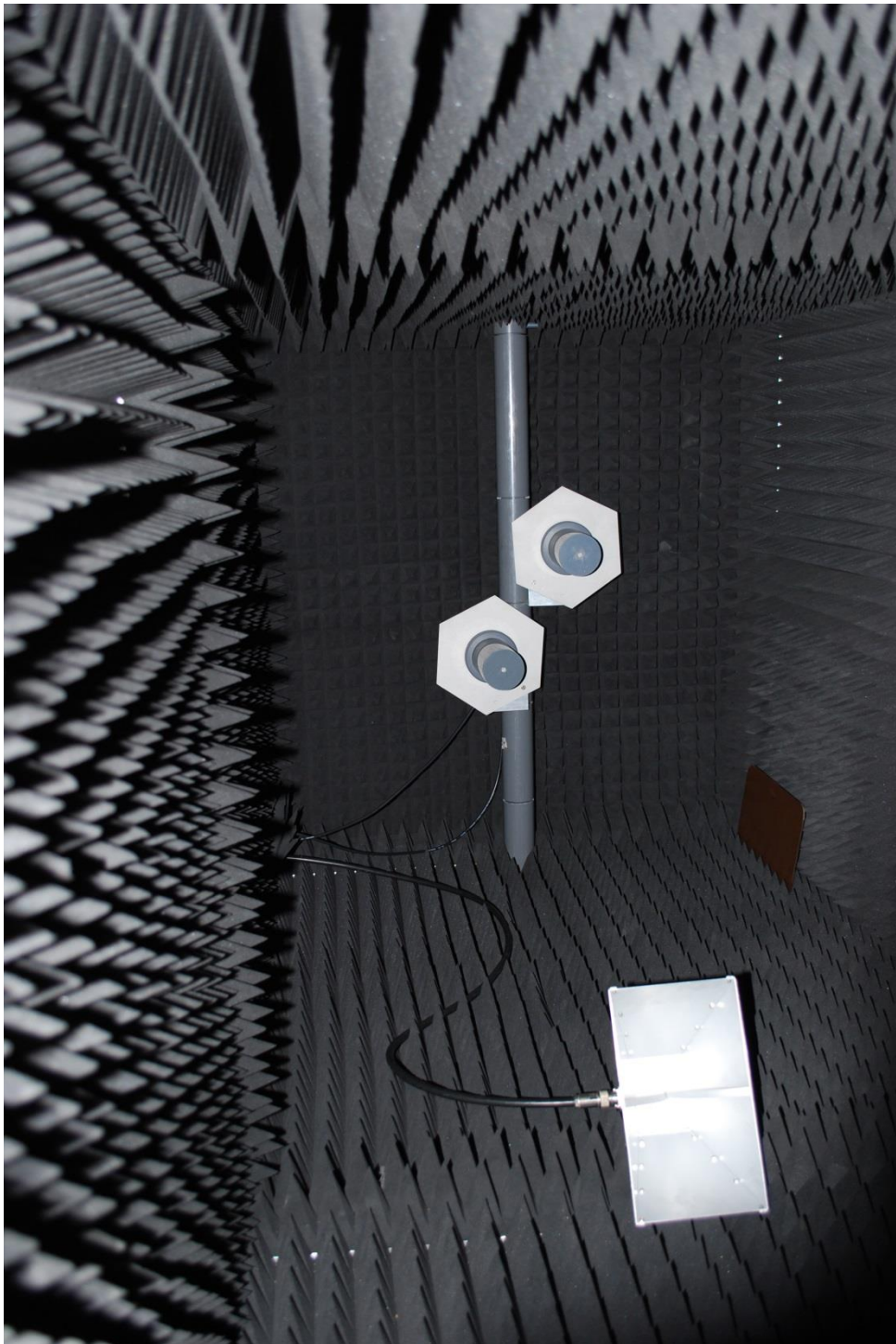
#### GNSS Simulation at BSH



**Arrangement of GPS- and noise/ interference transmitting antennas**



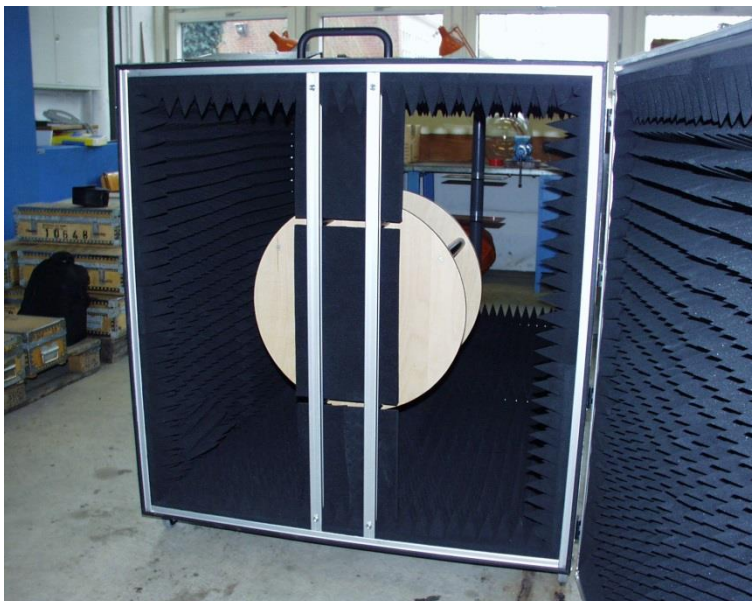
Arrangement of GPS-, interference- and high power (horn-antenna) transmitting antennas



GPS test box, exterior view



GPS test box, interior view







## A.3 Calibration protocol of RF- Chamber

### Calibration protocol

|                      |                |
|----------------------|----------------|
| <b>Date</b>          | 4th April 2018 |
| <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

### Ifen NCS Titan Multi-Constellation-Simulation

|                        |                    |   |
|------------------------|--------------------|---|
| <b>Pdef.</b>           | <b>-130 dBm</b>    | ICD GPS200 defines -130dBm as minimum received power at 3dBi antenna<br>IEC61108-1:2003 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  |
| <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>NCS Power Level</b> | <b>26 dBW</b>      | adjusted power level at NCS Control @ rear monitor output 1 connected to antenna inside RF-Chamber  |
|                        |                    |   |
|                        |                    |   |
|                        |                    |   |

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

|                 |                             |
|-----------------|-----------------------------|
| <b>Date</b>     | 17 <sup>th</sup> April 2018 |
| <b>Engineer</b> | Ehlers                      |

**Test equipment used**

GNSS- Simulation NCS Titan  
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    | -8,7 | dBm              |
|                     |      |                  |
| Fieldstrength @ EUT | 3,12 | W/m <sup>2</sup> |

Start Int. 17:35:00 Simulated UTC  
Stop Int. 17:47:00

S-Band

|                     |      |                  |
|---------------------|------|------------------|
| Powerlevel @ SMJ    | -3,7 | dBm              |
|                     |      |                  |
| Fieldstrength @ EUT | 5,12 | W/m <sup>2</sup> |

Start Int. 17:53:00 Simulated UTC  
Stop Int. 18:05:00

---

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

Duration of test: 12 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  $7.5 \text{ kW/m}^2$ . 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  $4.7\text{W/m}^2$  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:                | $5.2\text{W/m}^2$ CW-Signal |
| Duration of interference: | 13 min                      |

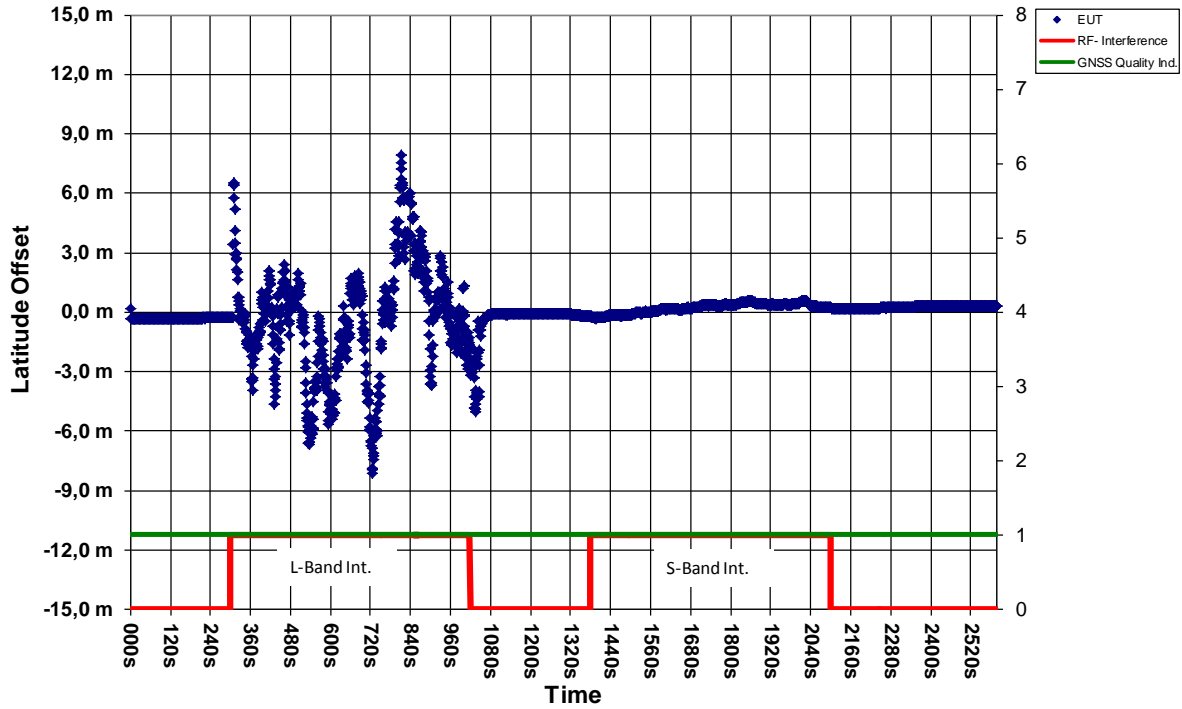
### **Test results**

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

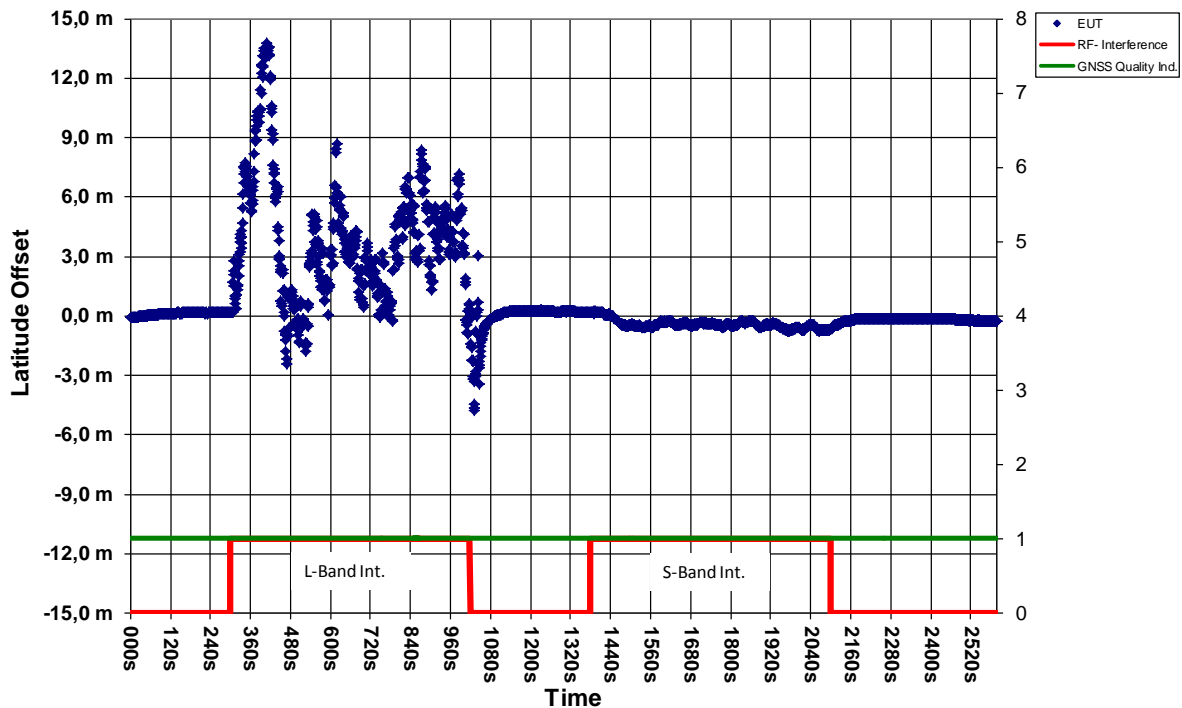
**Test result: Passed**

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

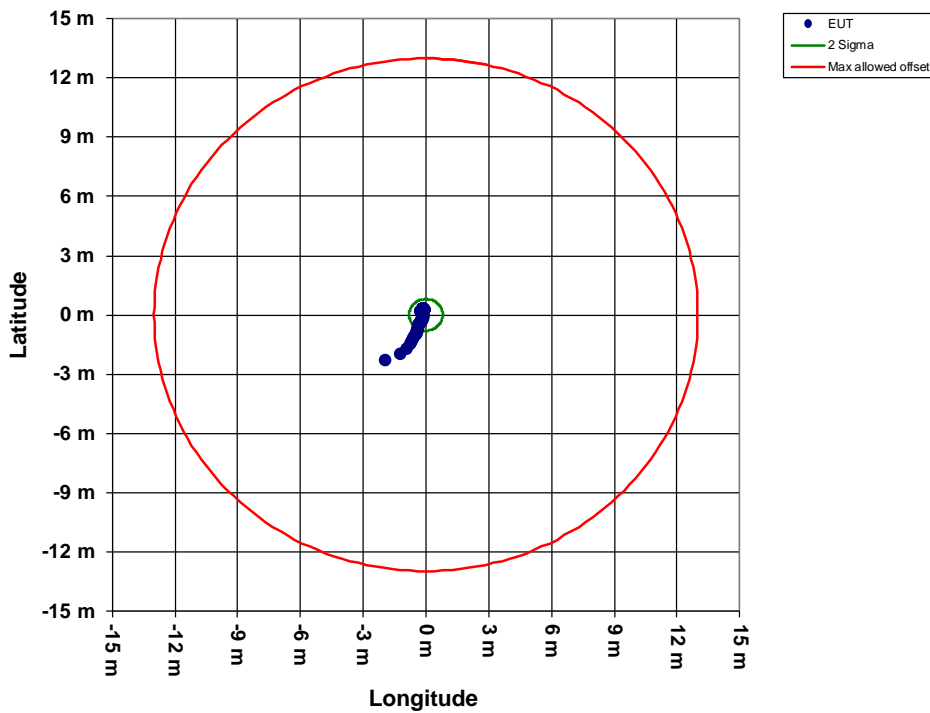
Latitude vs. time



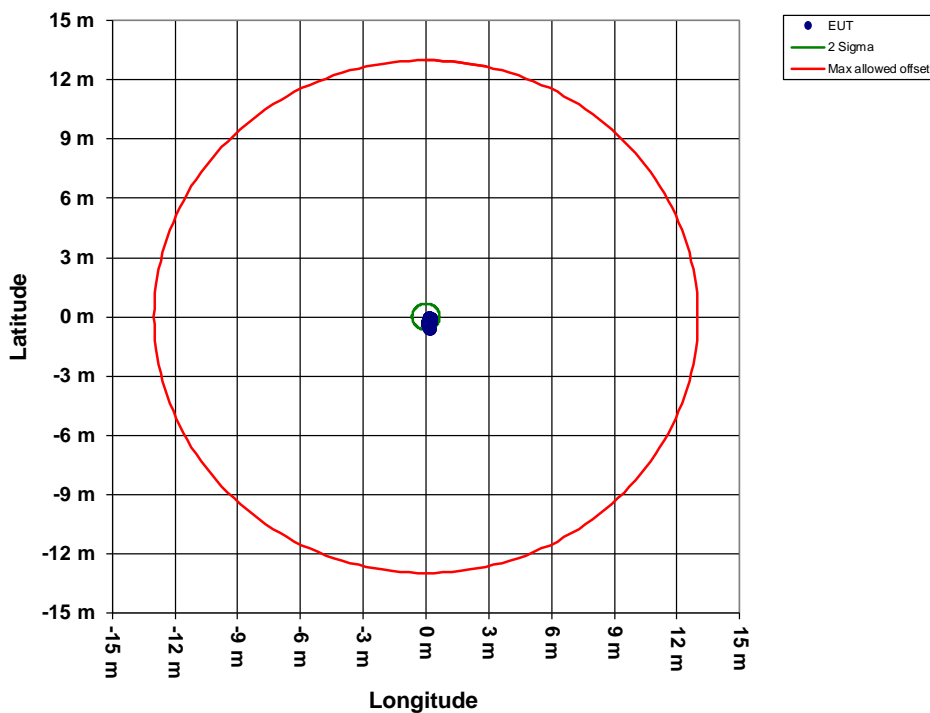
Longitude vs. time



Position output after L-Band interference



Position output after S-Band interference





## Annex C - Photos of equipment under test

EUT at testside, BSH Hamburg





**EUT at testside, BSH Hamburg**  
GPS-Antenna



GPS-Antenna ID-Tag

