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Federal Republic of Germany

Bundesamt für Seeschifffahrt und Hydrographie
Federal Maritime and Hydrographic Agency



BUNDESAMT FÜR
SEESCHIFFFAHRT
UND
HYDROGRAPHIE

Conformance test report of an

AIS SART

Equipment under test: **AMEC**
Type: **PLOMO-500**

Applying test standards: **IEC 61097-14 Ed. 1.0**

Test Report No.: **BSH/4615/4361928/12-1**

Applicant: **Alltek Marine Electronics Corp.**
7F, No.605, Ruei-Guang Rd. , Neihu
11492, Taipei
Taiwan

Hamburg, 11 April 2012
Federal Maritime and
Hydrographic Agency

by order

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by order

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nach EN ISO/IEC 17025:2005
akkreditiertes Prüflaboratorium



DAT-P-086/98

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Bundesrepublik Deutschland
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Federal Maritime and Hydrographic Agency

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Marine Equipment (Navigation Equipment, Radio-Communication Equipment, Life-Saving Appliances)

according to the annexed list of standards and specifications.

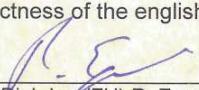
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Head of the Accreditation Body

Member in EA, ILAC, IAF

Translation for information purposes only. The German Accreditation Certificate is authoritative

See notes overleaf

General

Applicant: Alltek Marine Electronics Corp.
7F, No.605, Ruei-Guang Rd. , Neihu
11492, Taipei, Taiwan

Equipment under test:

Type: PLOMO-500

Manufacturer: Alltek Marine Electronics Corp.
7F, No.605, Ruei-Guang Rd. , Neihu
11492, Taipei, Taiwan

Place of test: BSH test laboratory Hamburg, Room 916

Start of test: 20 May 2011

End of test: 11 April 2012

Test standards¹:

IEC 61097-14 Ed. 1.0

Global maritime distress and safety system (GMDSS) –
Part 14: AID search and rescue transmitter (AIS-SART) –
Operational and performance requirements, methods of testing and required test results

Summary

| Test No. | Reference | Section | Result (passed/ not passed / not applicable / not tested) |
|----------|--------------|------------------------|--|
| 2 | IEC 61097-14 | 6 Performance tests | Passed |
| 3 | IEC 61097-14 | 7 Physical Radio tests | Passed |
| 4 | IEC 61097-14 | 8 Link Layer tests | Passed |
| | | | |

¹ Numbers listed in the titles of the test sections of this report refer to the respective sections of IEC 61097-14 if not stated otherwise.

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1 General information

1.1 Equipment history

For each Transponder unit under test an numbered entry is provided here. For the two test environment it is recorded which EUT system is under test in that environment

1.1.1 EUT system no 1

| Transponder | | | | |
|---|-------------------|------------|---------------|-----------------------|
| Type | PLOMO-500 | | Part No.: | Board without housing |
| Delivery date | 2011-05-16 | | Serial number | ID 970160002 |
| Test version, internal VHF antenne replaced by an antenna connector | | | | |
| HW Version: | Delivery date | 2011-05-16 | Version no | Unknown |
| | Installation date | 2011-05-16 | | |
| SW Version: | Delivery date | 2011-05-16 | Version no | Unknown |
| | Installation date | 2011-05-16 | | |
| SW Version: | Delivery date | 2011-06-14 | Version no | Version 1.1 |
| | Installation date | 2011-06-14 | | |
| SW Version: | Delivery date | | Version no | |
| | Installation date | | | |

1.1.2 EUT system no 2

| Transponder | | | | |
|---|-------------------|------------|---------------|--------------------------------|
| Type | PLOMO-500 | | Part No.: | Complete unit |
| Delivery date | 2011-05-16 | | Serial number | S/N A1K 500004 ID 970160004 |
| Test version, internal VHF antenne replaced by an antenna connector | | | | |
| HW Version: | Delivery date | 2011-05-16 | Version no | unknown |
| | Installation date | 2011-05-16 | | |
| SW Version: | Delivery date | 2011-05-16 | Version no | Version 1.1 |
| | Installation date | 2011-05-16 | | |
| SW Version: | Delivery date | | Version no | |
| | Installation date | | | |

1.2 Test environment

Here it is intended to record for which time which EUT system is under test.

1.2.1 Test environment no 1

This Test environment is completely equipped as described in Annex A. Normally mainly VDL related tests and DSC tests are done in this environment

| | |
|---------------|--------------------------------------|
| Room | BSH Room 916 (9 th floor) |
| Test engineer | H. Bartels |
| Location | 9°59,103 E 53°32,822 N |
| | |

| Equipment no | Start of test | End of test | Test engineer |
|--------------|---------------|-------------|---------------|
| 1 | 2011-05-20 | 2011-05-24 | Bartels |
| 1 | 2011-06-14 | 2011-06-15 | Bartels |
| 1, Documents | 2011-08-04 | 2011-08-04 | Bartels |
| Documents | 2012-02-07 | 2012-04-11 | Bartels |
| | | | |

1.3 Legend

Result marking (in the “result” column)²:

Passed Item is ok, test was successful

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

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

This table is a template for more general remarks of some test items and should be copied if required

| Date | Result | Status |
|------|--------|--------|
| | | |
| | | |
| | | |

Issue of this template: 2011-05-20

1.4 Test notes

Here are some effects noted which are observed during the normal test but independent of the actual test items.

1.5 Reviewed documents

| No. | File name | Document title/ description | Test lab, accreditation |
|-----|--|--|----------------------------|
| 1 | F112488E1.pdf | Testreport reverence: F112488E1 Test report of physical radio tests 14. Nov. 2011, Ed. 2 16. Jan 2012 | Phoenix test lab |
| 2 | F112488E1_ANNEC A.pdf | Annex with photos to doc. 3 | Phoenix test lab |
| 3 | U112488E1.pdf | Testreport reverence: U112488E1 Test report of environmental tests 07. Nov. 2011 | Phoenix test lab |
| 4 | HS1108300140A-(PLOMO-500).pdf | Thermal shock and solar radioation test report Report No.: HS1108300140A, 07. Sep. 2011 | IST |
| 5 | HS1106290042A-2 salt+THT.pdf | Salt spray test report Report No.: HS1106290042A-2, 27 July 2011 | IST |
| 6 | AS500-TR-1202-Q01-01 Floating Test.pdf | Test Report for IEC 61097-14 Ed.1, Clause 6.1(h), Floating test for AIS SART PLOMO-500 | AMEC |
| 7 | Floating Test Video Clip - AIS SART Plomo-500.wmv | Video clip showing the floating test | AMEC |
| | | | |

The document number is used in the table below as reference

1.6 General problems

Here are general problems found in the operation of the EUT, not specific to the actual test point.

| General problems | | | |
|------------------|------|--------|--------|
| Date | Item | Remark | Result |
| | | | |
| | | | |

2 6 Performance tests

2.1 6.1 Operational tests

(see 3.2)

The requirements of 3.2 shall be verified as follows (the subclause reference is given in brackets).

| 2011-05-24 Ba | | Test details: Operational tests | |
|----------------------------|---|---|--------|
| Test item | Check | Remark | Result |
| Verify the following items | | | |
| a) easy activation | Verify by inspection that the EUT can be easily activated by unskilled personnel | By removing a cover and pressing a button | Passed |
| b) Inadvertent activation | Verify by inspection that the EUT is fitted with means to prevent inadvertent activation | The activation button is protected cover which has to be removed. | Passed |
| c) Indication | Verify by inspection that the EUT is equipped with a means which is either visual or audible, or both visual and audible, to indicate correct operation | Yellow/red and green LEDs for Test and Activation | Passed |
| d) Activation | Verify by inspection that the EUT is capable of manual activation | | Passed |
| | Verify by inspection that the EUT is capable of manual deactivation | By pressing the Test button | Passed |
| | Check if provision for automatic activation is included (optional) | Not included | Passed |
| e) Drop into water | Verify by review of the IEC 60945 test report (section 8.6.2) that the EUT is capable of withstanding without damage drops from a height of 20 m into water | 2012-02-07 Ba: Doc. 3, Section 1.5 7 2.2.5 | Passed |
| f) Watertight | Verify by review of the IEC 60945 test report (section 8.9.2) that the EUT is watertight at a depth of 10 m for at least 5 min | 2012-02-07 Ba: Doc. 3, Section 1.7 / 2.2.7 | Passed |
| g) Thermal shock | Verify by review of the IEC 60945 test report (section 8.5) that the EUT can maintain water tightness when subjected to a thermal shock of 45 °C under specified conditions of immersion | 2012-02-07 Ba: Doc. 4 Section 2 | Passed |
| h) Floating | Verify by test that the EUT is capable of floating (not necessarily in an operating position) It shall be placed in fresh water for 5 min, as a check that it is capable of floating; the device complete with its one metre mounting system shall float | 2012-02-09 Ba: Doc. 6 and video clip doc. 7 | Passed |

| | | | |
|---------------------------------|---|--|--------|
| i) Lanyard | Verify by inspection that the EUT is equipped with a buoyant lanyard, suitable for use as a tether | <u>2011-08-04 Ba:</u> The EUT is equipped with a lanyard. It is in the carriage bag but not fixed to the SART or the bag. | Passed |
| | Verify by measurement that the length is not less than 10 m | <u>2011-08-04 Ba:</u> | Passed |
| j) Corrosion and oil resistance | Verify by review of the IEC 60945 test report (section 8.11/12) or waiver that the EUT is not unduly affected by seawater or oil | <u>2012-02-07 Ba:</u> Oil resistance: Doc 3, section 1.6 / 2.2.6 <u>2012-02-07 Ba:</u> Corrosion Doc. 5 | Passed |
| k) Sunlight resistance | Verify by review of the IEC 60945 test report (section 8.10) or waiver that the EUT is resistant to deterioration in prolonged exposure to sunlight | <u>2012-02-07 Ba:</u> Doc. 4 Section 3 | Passed |
| l) Colour | Verify by inspection that the EUT is of a highly visible yellow/orange colour on all surfaces where this will assist detection. | Yellow color | Passed |
| m) Construction | Verify by inspection that the EUT has a smooth external construction to avoid damaging the survival craft | | Passed |
| n) Antenna height | Verify by inspection that the EUT is provided with an arrangement to bring the AIS-SART antenna to a level of at least 1 metre above sea level | <u>2011-08-04 Ba:</u> There is a telescop extender in the carriage bag | Passed |
| | Check that an illustrated instruction is provided. The instructions shall illustrate the minimum requirement of 1 metre above sea level during use along with the installation method | <u>2011-08-04 Ba:</u> | Passed |
| | Check that the manufacturer provides a visible means of indicating the base of the antenna | <u>2011-08-04 Ba:</u> Indicated by the text "GPS area" | Passed |
| | Verify by measurement that the height to the declared 1 metre mark from sea level is not less than 1 meter | <u>2011-08-04 Ba:</u> The height of the antenna pole is 113 cm, plus 13 cm to the base of the VHF antenna | Passed |
| o) Reporting rate | Verify by observation of the VDL that the EUT is capable of transmitting with a reporting interval of 1 minute or less | This test is performed in section ... | Passed |
| p) Internal position source | Verify by observation of the VDL that the EUT is equipped with an internal position source and be capable of transmitting its current position in each message | This test is performed in section 8.2 | Passed |

| | | | |
|------------|---|---|--------|
| q) Testing | Verify by observation of manufacturer's instructions that the EUT is capable of being tested for all functionalities using specific test information, and by observation of the VDL | This test with observation of the VDL is performed in section 8.3 | Passed |
| | | | |

2.2 6.2 Battery

2.2.1 6.2.1 Battery capacity test

This test is covered by the Physical Radio Tests.

2.2.2 6.2.2 Expiry date indication

The life of the battery as defined by its expiry date shall be at least three years. The expiry date of the battery shall be the battery manufacturing date plus no more than half the useful life of the battery. The useful life of the battery is defined as the period of time after the date of battery manufacture that the battery will continue to meet the input power requirements of the AIS-SART for at least 96 hours, after allowing for all losses over the useful life of the battery. To define the useful life of the battery, the following losses at the temperature of $+20^\circ\text{C} \pm 5^\circ\text{C}$ shall be included, in addition to the power required to operate the AIS-SART:

- a) self-testing annually with GNSS data available;
- b) self-discharge of the battery;
- c) stand-by loads.

The manufacturer shall provide evidence to support the above battery life calculations including the time for self testing and assuming typical GNSS acquisition time.

The AIS-SART shall be clearly and durably marked with the battery expiry date (see 3.8).

NOTE For example a battery that has a useful life of 10 years from the date of manufacture, cannot have an expiry date that exceeds 5 years from the date of manufacture and would have to be capable of providing enough power for 10 years of self-testing, self-discharge and stand-by loads in addition to the operational power requirement of the AIS-SART.

| 2011-06-15 Ba | | Test details: Expiry date indication | | |
|---------------|---|--|--------|--|
| Test item | Check | Remark | Result | |
| Indication | Verify by inspection that the EUT is clearly and durably marked with the battery expiry date | There are fields to mark the Year and Month of battery expiry. In the prototype these fields are not yet marked but it is assumed that they will be marked at series production. | Passed | |
| Calculation | Check that the manufacturer provides evidence to support the battery life calculations | | Passed | |
| | Check that the battery life calculations include <ul style="list-style-type: none"> • Annual self-testing • Self-discharge of the battery • Stand-by loads • assume typical GNSS acquisition time | <u>2011-08-04 Ba:</u> The useful life of the battery is 10 years. So the expiry time is 5 years. The Calculations are related to a time of 5 years. <ul style="list-style-type: none"> • The annual testing is considered with 10 tests of 5 minutes each • The self-discharge is considered, derived from "Evaluation report", Desay CR17450E-R • There are no standby loads • Typical GNSS acquisition time is considered | Passed | |
| | Verify that the calculations are correct | Could not be finally verified because of lack of information | Passed | |
| | | | | |

2.2.3 6.2.3 Reverse polarity protection

It shall not be possible to connect the battery with the polarity reversed.

| 2011-05-24 Ba | | Test details: Reverse polarity protection | | |
|-------------------|--|--|--------|--|
| Test item | Check | Remark | Result | |
| Reversed polarity | Verify by inspection that it is not possible to connect the battery with the polarity reversed | The battery can be connected only in one direction | Passed | |
| | | | | |

2.3 6.3 Unique identifier

This test is performed in section

- 8.2.3 Message content of Message 1 and
- 8.3.1 Transmission with EPFS data available

2.4 6.4 Environment

The AIS-SART shall meet the environmental condition requirements of IEC 60945 for equipment category Portable.

| 2012-04-11 Ba | | Test details: Operational tests | | |
|---|---|---------------------------------|--------|--------|
| Test item | Check | Remark | Result | |
| Verify by review of external IEC 60945 related test reports that the EUT meets the requirements | | | | |
| Review document: BSH/4615/4361928/12-5 | | | | |
| IEC 60945 test report | Review the IEC 60945 test report. Verify that the requirements are fulfilled | | | Passed |
| | | | | |

2.5 6.5 Range performance

The nominal radiated power (EIRP) of the AIS-SART shall be 1W.

This radiated power provides the range performance of the AIS-SART as described in Annex

This test is covered by the Physical Radio Tests

2.6 6.6 Transmission performance

This test is performed in section

- 8.2 Active mode tests for the active mode and section
- 8.3 Test mode tests for the test mode

2.7 6.7 Labelling

In addition to the items specified in IEC 60945, the following shall be clearly indicated on the exterior of the equipment:

- a) brief operating and test instructions (in English),
- b) expiry date (in English) for the primary battery used and
- c) the unique identifier (user ID field of the AIS messages)

NOTE Expiry date is battery replacement date (see 3.3.1).

| 2011-05-24 Ba | | Test details: Labelling | |
|--|---|-------------------------|--------|
| Test item | Check | Remark | Result |
| Requirements from IEC 60945 | | | |
| Manufacturer | Check that the identification of the manufacturer is shown | | Passed |
| Equipment type | Check that the equipment type or model identification is shown | | Passed |
| Serial number | Check that the serial number is shown. This number is used as ID in the transmissions | | Passed |
| Compass safe distance | Check that the compass safe distance is shown | 2012-02-07 Ba: | Passed |
| Requirements from IEC 61097-14 | | | |
| Verify by inspection that on the exterior of the equipment it is clearly indicated | | | |
| Operating instructions | - brief operating and test instructions | | Passed |
| | Verify that the operating and test instructions are in English | | Passed |
| Expiry date | - expiry date (in English) for the primary battery used | Tested in section 6.2.2 | Passed |
| Unique identifier | - the unique identifier (user ID field of the AIS messages) | | Passed |
| | | | |

2.8 6.8 Manuals

In addition to the requirements of IEC 60945, the manuals shall include instructions for periodic testing and maintenance for the AIS-SART.

NOTE Instructions on how to operate the AIS-SART in a SART active situation shall be part of the labelling on the device (see 3.8).

| 2011-05-24 Ba | | Test details: Manuals | |
|--------------------------------|--|-----------------------|--------|
| Test item | Check | Remark | Result |
| Requirements from IEC 60945 | | | |
| Language | Verify by inspection that the manuals are written in English language. | | Passed |
| Operation | Verify by inspection that the manuals include information to properly operate the equipment. | | Passed |
| Requirements from IEC 61097-14 | | | |
| Periodic testing | Verify by inspection that the manuals include instructions for periodic testing | | Passed |
| Maintenance | Verify by inspection that the manuals include instructions for maintenance | | Passed |
| | | | |

2.9 6.9 Electronic Position Fixing System

An EPFS shall be used as the source for AIS-SART position reporting.

The internal EPFS shall be a GNSS receiver that meets the following requirements of IEC61108 series: position accuracy, acquisition, re-acquisition, receiver sensitivity, RF dynamic range, position update, effects of specific interfering signals but with a minimum update of once per minute, provide a resolution of one ten-thousandth of a minute of arc and use WGS84 datum.

The manufacturer shall provide evidence that an internal navigation device cold start is forced at every AIS-SART activation (cold start refers to the absence of time dependent or position dependent data in memory, which might affect the acquisition of the GNSS position).

Jotron has declared in a letter "Statement of GPS module.pdf" that the AIS SART includes the same GPS module, **Fastrax iTrax03-S, which is used for the EPIRB Tron40GPS MkII. This EPIRB is approved according to MED.**

Based on this declaration we accept the GPS module without test for the National type approval.

| 2011-06-30 Ba | | Test details: EPFS test | | |
|--|---|---|--------|--|
| Test item | Check | Remark | Result | |
| Check the GNSS test report for the following requirements. | | | | |
| Test report: BSH/4615/4361928/11-2, 2011-06-30 | | | | |
| GNSS test report | Position accuracy | See Note) | Passed | |
| | Aquisition | | Passed | |
| | Re-Aquisition | | Passed | |
| | Receiver sensitivity | | Passed | |
| | RF dynamic range | | Passed | |
| | Position update | | Passed | |
| | Effects of specific interfering signals | | Passed | |
| | Resolution of one ten-thousandths of a minute of arc | | Passed | |
| | Use of WGS84 datum | | Passed | |
| Documentation | Check by review of the documentation that an internal navigation device cold start is forced at every AIS-SART activation | User manual, section 3.1.2 Activation process | Passed | |
| | | | | |

Note)

The GPS module (uBlox AMY5) of the PLOMO-500 is the same as used in the AIS AtoN Mando-301/303. The test of this unit is documented in test report BSH/46162/4321542/11-2.

Further tests have been performed with the PLOMO-500 because of the special operating conditions in an AIS SART (cold start, start/stop operation). This is documented in test report BSH/4615/4361928/11-2.

2.10 6.10 Activator

The Activator provides a means for manual activation and deactivation of the AIS-SART. Manual activation shall provide a means to avoid inadvertent activation such as the use of not less than two simple but independent actions.

The AIS-SART shall be provided with means to indicate that the AIS-SART has been previously activated, to advise the users of a possible reduction of the required battery capacity. These means shall not be capable of reset by the user. For example, manual activation requires the breaking of a seal that cannot be replaced by the user.

This indication of previous activation shall be unaffected when initiating the test mode. The Activator provides a means for manual activation and deactivation of the AIS-SART test mode.

| 2011-05-24 Ba | | Test details: Activator | | |
|---------------|--|---|---|--------|
| Test item | Check | Remark | Result | |
| Activation | | Verify by inspection that the EUT provides means for manual activation | | |
| | | Verify by inspection that the EUT provides a means to avoid inadvertent activation such as the use of not less than two simple but independent actions | - Removing protection cover - Pressing activation button | Passed |
| Deactivation | Verify by inspection that the EUT provides means for manual deactivation | Pressing the "Test" button during the flashing of the active mode. Remark: It should be added at least in the manual that the "Test" button has to be pressed when the Activation LED is flashing! <u>Retest 2011-08-04 Ba:</u> Manual has been adapted | | Passed |

| | | | |
|------------|---|---|--------|
| Indication | Verify by inspection that the EUT provides an indication of previous activation | The Test LED is blinking orange if the unit has been activated or tested more than 10 times | Passed |
| | Verify by inspection that the indication cannot be reset by the user | The orange color (Over usage) of the LED cannot be reset by the user. The cover can not be re-installed by the user after activation | Passed |
| | Verify by inspection that the indication is not affected by initiating the test mode | The cover is not affected by activation of test mode. The LED overusage indication is affected after 10 test activations. This is according to the battery calculation which assumes 10 tests in 5 years. | Passed |
| Test mode | Verify by inspection that the EUT provides means for manual activation of the test mode | | Passed |
| | Verify by inspection that the EUT provides means for manual deactivation of the test mode | By pressing the "Test" button again | Passed |
| | | | |

2.11 6.11 Indicator

The indicator shall be visual and /or audible.

The indicator shall indicate that the AIS-SART:

- *has been activated*
- *is under going test*
- *has completed test*

There shall be indication of the EPFS status whilst the AIS-SART is activated.

| 2011-05-24 Ba | | Test details: Indicator | | |
|-----------------|---|---|--------|--|
| Test item | Check | Remark | Result | |
| Visual/ audible | Check by inspection if the indicator is visual | LEDs | Passed | |
| | Check by inspection if the indicator is audible | No audible indicator | Passed | |
| Indication | Check by inspection that the EUT indicates that it has been activated | Blinking "SOS" once per minute | Passed | |
| | Check by inspection that the EUT indicates that it is under going test | Blinking regulars | Passed | |
| | Check by inspection that the EUT indicates that it has completed test | Long green LED Recommendation: It may be better to indicate by long orange LED instead of green LED if the test has been finished without GNSS available. | Passed | |
| | Check by inspection that the EUT indicates the EPFS status whilst the AIS-SART is activated | Green color of the "SOS" blinking | Passed | |
| | | | | |

3 7 Physical radio tests

The purpose of these tests is to verify that the AIS-SART complies with the RF requirements under normal and extreme conditions. The tests are accomplished by the following procedures.

All the physical radio tests can be performed on either AIS 1 or AIS 2 unless otherwise stated.

Unless otherwise stated all the physical radio tests shall be performed with the modified AIS-SART(see 5.5).

The following tests shall be performed under normal conditions:

- *Conducted output power*
- *Radiated output power with the standard AIS-SART*
- *Conducted spurious emissions*
- *Frequency error*
- *Modulation accuracy*
- *Modulation spectrum slotted transmission*
- *Power vs. time function*
- *Power as a function of time*

The following tests shall be performed under extreme conditions:

- *Conducted power*
- *Frequency error*

These tests are not part of this report; radio tests are performed by an external Radio test lab. The external test report is reviewed to verify that the EUT meets the requirements and only the result of the assessment documented here.

| 2012-02-07 Ba | | Assessment of external Physical radio tests | | |
|---|---|---|------------|--|
| Test item | Check | Remark | assessment | |
| Verify by review of the external Physical radio test report that the EUT meets the requirements | | | | |
| Review document: BSH/4615/4361928/12-4 | | | | |
| Normal conditions | 7.2 Frequency error | | Passed | |
| | 7.3 Conducted output power | | Passed | |
| | 7.4 Radiated output power with the standard AIS-SART | | Passed | |
| | 7.5 Modulation spectrum slotted transmission | | Passed | |
| | 7.6 Transmitter test sequence and modulation accuracy | | Passed | |
| | 7.7 Transmitter output power versus time function | | Passed | |
| | 7.8 Spurious emissions from the transmitter | | Passed | |
| | | | | |
| Extreme conditions | 7.2 Frequency error | | Passed | |
| | 7.3 Conducted output power | | Passed | |
| | 7.6 Transmitter test sequence and modulation accuracy | | Passed | |
| | Test condition | | Passed | |
| | | | | |

4 8 Link layer Tests

4.1 8.1 Tests for Synchronisation accuracy

To measure the synchronisation error of the AIS-SART.

8.1.1 Method of measurement

Activate the AIS-SART with EPFS data available in active mode and record transmissions for 40 minutes.

Record VDL messages and measure the time between the transmission patterns as defined by ITU-R M.1371 and the actual transmission made by the AIS-SART. The transmission timing shall be measured and referenced to the beginning of the start of a transmission packet (start flag) according to ITU-R M.1371.

8.1.2 Required results

The synchronisation error with its additive jitter shall not exceed $\pm 312 \mu\text{s}$ between minutes 15 and 40.

| 2011-05-23 Ba | | Test details: Synchronisation accuracy | | |
|--|---|---|--------|--------|
| Test item | Check | Remark | Result | |
| Evaluate the data recorded under 8.2.1 | | | | |
| Sync jitter | Verify that the additive jitter does not exceed $\pm 312 \mu\text{s}$ between minutes 15 and 40 | <ul style="list-style-type: none"> Sometimes there is an timing offset of $\frac{1}{2}$ slot (about 13 ms). This typically happens if the relation between a PPS and the time sentence (e.g. ZDA) is not correct. This results in an offset of 1 s which is 37.5 slots. For messages without the above timing offset: <ul style="list-style-type: none"> During the first 5 min after activation the timing was correct. After 5 minutes the sync timing is about 150 μs to early. So together with the jitter the limits are exceeded <p><u>Retest 2011-06-14 Ba:</u></p> <ul style="list-style-type: none"> There are no frames with a timing offset of $\frac{1}{2}$ slot. So this item is fixed. The sync timing is about 80 μs too early but all transmissions are clearly inside the required range of $\pm 312 \mu\text{s}$ <p>See Note)</p> | Passed | Passed |
| | | | | |

Note)

The sync timing of all bursts is nearly identical, with very little jitter. But within a burst of 8 messages the timing is from message to message about 30 µs earlier, over the full burst there is a timing change of 210 µs (see diagram).

We recommend to check why the timing inside a burst is drifting from message to message by 30 µs to an earlier timing. Perhaps there is an easy way to avoid this. But this is not required because the timing is clearly within the limits.

4.2 8.2 Active mode tests

These tests require analysis of the transmissions of the AIS-SART.

4.2.1 8.2.1 Methode of measurement

Activate the AIS-SART in active mode and record transmissions for 40 minutes. Inhibit EPFS data and record transmissions for a further 20 minutes.

Record the activation time of the AIS-SART.

For all transmitted messages record:

- *transmission time (UTC time)*
- *transmission slot*
- *in-slot timing*
- *transmission channel*
- *message content*

The records will be evaluated in the following test items.

| 2011-05-23 Ba | | Test details: Operational tests | |
|--|--------------------------------------|---------------------------------|--------|
| Test item | Check | Remark | Result |
| Activate the AIS-SART in active mode and record transmissions for 40 minutes | | | |
| Activation time | Record the activation time | | Passed |
| Inhibit EPFS data and record transmissions for further 20 minutes | | | |
| Time of inhibit | Record the time of inhibit EPFS data | | Passed |

4.2.2 8.2.2 Initialisation Period

- a) *The first message is transmitted within 1 min after activation.*
- b) *The first message with a valid position is transmitted within 15 minutes.*

| 2011-05-23 Ba | | Test details: Initialisation period | | |
|-------------------------------------|--|--|--------|--|
| Test item | Check | Remark | Result | |
| Evaluate the data recorded in 8.2.1 | | | | |
| a) First transmission | Verify that the first message is transmitted within 1 min after activation | EUT starts transmission about 40 s after activation | Passed | |
| b) Valid position | Verify that the first message with a valid position is transmitted within 15 minutes | The first transmission already includes a valid position | Passed | |
| | | | | |

4.2.3 8.2.3 Message content of Message 1

For position reports transmitted after 15 minutes and before 40 minutes the following is required:

- a) *Message ID = 1.*
- b) *Repeat indicator = 0.*
- c) *User ID as configured in the AIS-SART.*
- d) *Navigational status = 14.*
- e) *Rate of turn = default.*
- f) *SOG = actual SOG from GNSS receiver.*
- g) *Position accuracy = according to the RAIM result if provided, otherwise 0.*
- h) *Position = actual position from internal GNSS receiver.*
- i) *Position is updated at least once per minute, for each burst.*
- j) *COG = actual COG from internal GNSS receiver.*
- k) *True heading = default.*
- l) *Time stamp = actual UTC second (0...59).*
- m) *Verify correct indication according to manufacturer's documentation.*

| Test details – Message content of msg 1 | | | |
|---|--|---|--------|
| Test item | Check | Remark | Result |
| Evaluate the data recorded in 8.2.1 | | | |
| a) Message ID | Check that message ID = 1 | = 1 | Passed |
| b) Repeat indicator | Check that repeat indicator = 0 | = 0 | Passed |
| c) User ID | Check that User ID as configured in the AIS-SART | = 970160002 | Passed |
| d) Navigational status | Check that Navigational status = 14 | = 14 | Passed |
| e) ROT | Check that ROT = default | = default | Passed |
| f) SOG | Check that SOG = SOG from internal GNSS | = 0.0 | Passed |
| g) Position accuracy flag | Check that Position accuracy flag according to RAIM or 0 | = 0 | Passed |
| h) Position | Check that values of lat and lon are according to actual position | | Passed |
| i) Position update | Check that the position is updated once per minute, for each burst | The position is updated for each burst The position is also updated from message to message inside the burst. This is not necessary. The same position can be used for all messages of a burst | Passed |
| j) COG | Check that COG = COG from internal GNSS | COG is set to default. This is correct for a SOG = 0 because in this case it is not possible to calculate a COG | Passed |
| k) Heading | Check that heading = default | | Passed |
| l) Time stamp | Check time stamp = actual UTC second (0...59) | = acutal UTC | Passed |
| m) Indication | Verify the correct indication of operation | The EUT is blinking SOS ones per minute: <ul style="list-style-type: none"> - in yellow/red color if GNSS is not available - in green colour if GNSS is available | Passed |
| | | | |

4.2.4 8.2.4 Message content of Message 14

- a) Message ID = 14.
- b) Repeat indicator = 0.
- c) Source ID = as configured in the AIS-SART.
- d) Text = "SART ACTIVE".

| 2011-05-23 Ba | | Test details: Operational tests | |
|-------------------------------------|--|--|--------|
| Test item | Check | Remark | Result |
| Evaluate the data recorded in 8.2.1 | | | |
| a) Message ID | Check that message ID = 14 | | Passed |
| b) Repeat indicator | Check that repeat indicator = 0 | | Passed |
| c) User ID | Check that User ID as configured in the AIS-SART | | Passed |
| d) Text | Check that text = "SART ACTIVE" | Text = "SART ACTIVE@" The "@" results from adding 6 bit to get byte boundary (106 bit + 6 bit = 112 bit = 14 byte) | Passed |
| | | | |

4.2.5 8.2.5 Transmission schedule for Message 1

For position reports transmitted after 15 minutes and before 40 minutes the following applies:

- a) Verify that the AIS-SART has operated in sync mode 0 (UTC direct).
- b) The AIS-SART transmits one burst of messages once per minute.
- c) The duration of a burst is 14 s.
- d) A burst consists of 8 messages.
- e) The transmissions in a burst are alternating between AIS 1 and AIS 2.
- f) Consecutive messages are 75 slots apart and on the other channel.
- g) The same set of slots are used in each burst for 8 minutes
- h) A new set of slots is randomly selected after 8 minutes.
- i) The first slot of the new set of slots is within the interval of 1 minute +/- 6s from the first slot of the previous set of slots, that is the increment is randomly selected in the range 2025 to 2475 slots.
- j) The manufacturer is to provide documentation on how the increment is selected randomly.

| 2011-05-23 Ba | | Test details: Operational tests | |
|--|--|---|--------|
| Test item | Check | Remark | Result |
| Evaluate the data recorded in 8.2.1, minute 15 (GNSS active) to 40 | | | |
| a) Sync mode | Check sync mode = 0 (UTC direct) | = 0 | Passed |
| b) Burst rate | Check burst rate = 1 per minute | | Passed |
| c) Burst duration | Check burst duration = 14 s | | Passed |
| d) Number of message | Check that a burst consists of 8 messages | | Passed |
| e) Channel alternation | Check that the transmissions in a burst are alternating between AIS 1 and AIS 2 | | Passed |
| f) Slot distance | Check that the slot distance between two messages in a burst is 75 slots | | Passed |
| g) Burst time-out | Check that the same set of slots are used in each burst for 8 minutes | Remark: Because of the occasion timing shift of 1 s there is sometimes a shift of 75 slots from frame to frame | Passed |
| h) Random selection | Check that a new set of slots is randomly selected after 8 minutes | | Passed |
| i) Selection range | Check that the new burst is at 1 min +/- 6s (increment = 2025 to 2475 slots, slot distance = 1725 +/- 225 = 1500 ... 1950) | | Passed |
| j) Random selection methode | Verify the manufacturer's documentation on how the increment is selected randomly | Documentation has been provided in Document No. TN-1001, AMEC Plomo-500 Technical Note | Passed |
| | | | |

4.2.6 8.2.6 Communication state of Message 1

For position reports transmitted after 15 minutes and before 40 minutes:

- a) The SOTDMA communication state as defined for message 1 is used.
- b) The sync state = 0.
- c) The time-out starts with 7 for all messages of the first burst after a change in slots.
- d) The time-out value is decremented by 1 for each frame.
- e) The time-out value is reset to 7 after time-out = 0.
- f) The sub message for time-out 3,5,7 = number of received stations (0).
- g) The sub message for time-out 2,4,6 = slot number.
- h) The sub message for time-out 1 = UTC hour and minute.
- i) The sub message for time-out 0 = slot offset to the transmission slot in the next frame.

| 2011-05-23 Ba | | Test details: Operational tests | | |
|--|---|---------------------------------|--------|--|
| Test item | Check | Remark | Result | |
| Evaluate the data recorded in 8.2.1, minute 15 (GNSS active) to 40 | | | | |
| a) Comm state | Check that a SOTDMA comm state as defined for message 1 is used | | Passed | |
| b) Sync state | Check sync state = 0 | | Passed | |
| c) Time-out start | Check that the time-out starts with 7 for all messages of the first burst after a change in slots | | Passed | |
| d) Time-out decrement | Check that the time-out value is decremented by 1 for each frame | | Passed | |
| e) Time-out reset | Check that the time-out value is reset to 7 after time-out = 0 | | Passed | |
| f) Number of received stations | Check that the sub message for time-out 3,5,7 = number of received stations = 0 | | Passed | |
| g) Slot number | Check that sub message for time-out 2,4,6 = actual slot number | | Passed | |
| h) UTC | Check that sub message for time-out 1 = UTC hour and minute | | Passed | |
| i) Slot offset | Check that sub message for time-out 0 = slot offset to the transmission slot in the next frame (2025 to 2475) | | Passed | |
| | | | | |

4.2.7 8.2.7 Transmission schedule of message 14

- a) Message 14 is transmitted every 4 minutes.
- b) The transmissions of Message 14 are alternating between AIS 1 and AIS 2.
- c) Message 14 is transmitted in a Message 1 slot, replacing the Message 1, on the channel for which the Message 1 was scheduled.
- d) Message 14 did not replace a Message 1 with a time-out value = 0.

| 2011-05-23 Ba | | Test details: Operational tests | | |
|-------------------------------------|--|---|--------|--|
| Test item | Check | Remark | Result | |
| Evaluate the data recorded in 8.2.1 | | | | |
| a) Tx interval | Check that Message 14 is transmitted every 4 minutes | | Passed | |
| b) Channel alternating | Check that transmissions of Message 14 are alternating between AIS 1 and AIS 2 | | Passed | |
| c) Message 1 slot | Check that Message 14 is transmitted in a Message 1 slot, replacing the Message 1 | | Passed | |
| | Check that Message 14 is transmitted on the same channel as the replaced Message 1 | | Passed | |
| d) Time-out 0 | Check that Message 14 did not replace a Message 1 with a time-out value = 0 but with time-out 7 and 3 (according to 3.7.2) | Message 14 is replacing Message 1 with time-out 7 and 3 | Passed | |
| | | | | |

4.2.8 8.2.8 Transmission with lost GNSS

For position reports transmitted after 45 minutes the following applies:

- a) The AIS-SART continues transmission.
- b) The same transmission schedule is used as with EPFS data available.
- c) Communication State Sync state = 3.
- d) SOG = last valid SOG.
- e) Position accuracy = low.
- f) Position = last valid position.
- g) COG = last valid COG.
- h) Time stamp = 63.
- i) RAIM-flag = 0.
- j) Verify correct indication as per manufacturer's documentation.

| Test details: Operational tests | | | |
|--|---|--|--------|
| Test item | Check | Remark | Result |
| Evaluate the data recorded in 8.2.1, minute > 45 (GNSS disabled) | | | |
| a) Continued transmission | Check that the EUT continues transmission | | Passed |
| b) Tx schedule | Check that the same transmission schedule is used as with GNSS data available | The slots are changing from frame to frame See Note) <u>Retest 2011-06-14 Ba:</u> The slots are continuously used from frame to frame | Passed |
| c) Sync state | Check that State Sync state = 3 | | Passed |
| d) SOG | Check that SOG = last valid SOG | | Passed |
| e) PA-Flag | Check that Position accuracy = low | | Passed |
| f) Position | Check that position = last valid position | | Passed |
| g) COG | Check that COG = last valid COG | | Passed |
| h) Time stamp | Check that Time stamp = 63 | Time stamp = 62 (dead reckoning). The standard requires 63 (GNSS inoperative). Does 62 mean that the unit performs dead reckoning based on the last SOG/COG? This seems not to be appropriate because in the test COG was default (not available), so dead reckoning is not possible. <u>Retest 2011-06-14 Ba:</u> The Time stamp is 63 | Passed |
| i) RAIM flag | Check that RAIM-flag = 0 | | Passed |
| j) Indication | Verify correct indication as per manufacturer's documentation | The EUT is blinking SOS ones per minute: - in green colour if GNSS is available | Passed |
| | | | |

4.3 8.3 Test mode tests

These tests require analysis of the transmissions of the AIS-SART.

4.3.1 8.3.1 Transmission with EPFS data available

8.3.1.1 Method of measurement

Activate the AIS-SART in test mode with EPFS data available and record transmissions.

8.3.1.2 Required results

- a) The AIS-SART starts transmission once valid GNSS data is available.
- b) A single burst of 8 messages in the correct order and correctly populated as per 3.7.2.
- c) User ID as configured in the AIS-SART.
- d) Navigational status = 15 (not defined).
- e) SOG = actual SOG from GNSS receiver.
- f) Position accuracy = according to the RAIM result if provided otherwise 0.
- g) Position = actual position from internal GNSS receiver.
- h) COG = actual COG from internal GNSS receiver.
- i) Time stamp = actual UTC second (0...59).
- j) The communication state time-out always = 0 with sub message = 0.
- k) The transmission of Messages 1 and 14 stops after one burst of 8 messages.
- l) The text message in Message 14 is “SART TEST”.
- m) Verify correct indication as per manufacturer’s documentation.

| 2011-05-23 Ba | | Test details: Operational tests | | |
|--|--|--|--------|--|
| Test item | Check | Remark | Result | |
| Activate the AIS-SART in test mode with EPFS data available and record transmissions | | | | |
| a) Start of transmission | Check that the EUT starts transmission when valid GNSS is available | | Passed | |
| b) Single burst | Check that one burst is transmitted | | Passed | |
| | Check that the burst consists of 8 messages | | Passed | |
| | Check that messages according to 3.7.2 are transmitted (1 msg 14, 6 msg 1, 1 msg 14) | | Passed | |
| c) User ID | Check that User ID as configured in the AIS-SART | | Passed | |
| d) Navigational status | Check that Navigational status = 15 | | Passed | |
| e) SOG | Check that SOG = SOG from internal GNSS | = 0.0 | Passed | |
| f) Position accuracy flag | Check that Position accuracy flag according to RAIM or 0 | = 0 | Passed | |
| g) Position | Check that values of lat and lon are according to actual position | | Passed | |
| h) COG | Check that COG = COG from internal GNSS | = default | Passed | |
| i) Time stamp | Check time stamp = actual UTC second (0...59) | | Passed | |
| j) Comm state | Check that time-out = 0 | | Passed | |
| | Check that sub message = 0 | | Passed | |
| k) Stop of transmission | Check that transmission stops after one burst | | Passed | |
| l) Msg 14 text | Check that the text in msg 14 is "SART TEST" | | Passed | |
| m) Indication | Verify the correct indication according to manufacturers documentation | The "Test" LED is blinking yellow/red during the test, and is on for a few seconds when the test transmission has been successfully finished | Passed | |
| | | | | |

4.3.2 8.3.2 Transmission without EPFS data available

8.3.2.1 Method of measurement

Activate the AIS-SART in test mode with no EPFS data available and record transmissions.

8.3.2.2 Required Results

- a) The AIS-SART starts transmission within 15 minutes.
- b) A single burst of 8 messages in the correct order and correctly populated as per 3.7.2.
- c) User ID as configured in the AIS-SART.
- d) Navigational status = 15 (not defined).
- e) SOG = default value.
- f) Position accuracy = low.
- g) Position = default values.
- h) COG = default value.
- i) Time stamp = 63.
- j) The communication state time-out always = 0 with sub message = 0.
- k) RAIM-flag = 0.
- l) The transmission of Messages 1 and 14 stops after one burst of 8 messages.
- m) The text message in Message 14 is “SART TEST”.
- n) Verify correct indication as per manufacturer’s documentation.

| 2011-05-23 Ba | | Test details: Operational tests | | |
|---|--|---|--------|--|
| Test item | Check | Remark | Result | |
| Activate the AIS-SART in test mode with no EPFS data available and record transmissions | | | | |
| a) Start of transmission | Check that the EUT starts transmission within 15 minutes | EUT starts after about 5 minutes | Passed | |
| b) Single burst | Check that one burst is transmitted | | Passed | |
| | Check that the burst consists of 8 messages | | Passed | |
| | Check that messages according to 3.7.2 are transmitted (1 msg 14, 6 msg 1, 1 msg 14) | | Passed | |
| c) User ID | Check that User ID as configured in the AIS-SART | | Passed | |
| d) Navigational status | Check that Navigational status = 15 | | Passed | |
| e) SOG | Check that SOG = default | | Passed | |
| f) Position accuracy flag | Check that Position accuracy flag = 0 | | Passed | |
| g) Position | Check that position values = default | | Passed | |
| h) COG | Check that COG = default | | Passed | |
| i) Time stamp | Check time stamp = 63 | | Passed | |
| j) Comm state | Check that time-out = 0 | | Passed | |
| | Check that sub message = 0 | | Passed | |
| k) RAIM flag | Check that RAIM flag = 0 | | Passed | |
| k) Stop of transmission | Check that transmission stops after one burst | | Passed | |
| l) Msg 14 text | Check that the text in msg 14 is "SART TEST" | | Passed | |
| m) Indication | Verify the correct indication according to manufacturers documentation | The "Test" LED is blinking yellow/red during the test, and is on with green color for a few seconds when the test transmission has been successfully finished <u>Recommendation:</u> It may be better to indicate by long orange LED instead of green LED if the test has been finished without GNSS available, to clearly indicate that the test was not completely successful | Passed | |
| | | | | |

Annex A Test equipment

A.1 Test equipment summary

| # | description | type | identification |
|----|--|------------------------------|--|
| 1 | VDL analyser / Generator | Attingimus UAIS Test unit | S/N 001 BSH PC10745 SW AISterm V1.0rev47 AISmain V1.47011120R |
| 2 | Target simulator software | Furuno Navintra | BSH PC 9169 |
| 3 | Presentation Interface Monitor | BSH | BSH PC 8441 BSH PC 9457 SW NewMoni V3.1 |
| 4 | GMDSS-AIS-Testbox (DSC) | Futronic I/S | 200 30 405 |
| | | | |
| | Auxiliaries: | | |
| 5 | True RMS Multimeter DMM 916 | Tektronix | S/N 138531 |
| 6 | 2-Kanal-Digital-Oszilloskop Wavesurfer 422 | Le Croy | LCRY 0301 J 15673 |
| 7 | 8 Converters RS 422 to RS 232 | | |
| 8 | 2 fixed voltage power supply (24 V/10A) | | |
| 9 | 2 adjustable power supplies (30 V/5 A) | | |
| 10 | Active retransmitting GPS antenna | | |

For a description of pos. 1-4 see below

A.1.1 VDL analyser / generator

The VDL analyser/generator:

- receives the radio data telegrams transmitted by the AIS under test, slotwise evaluates their radio parameters (field strength, SNR, etc.) and provides a transparent display of the decoded radio data telegrams (VDL messages).
- transmits radio data telegrams which have been entered/edited via a control panel. The AIS under test receives these messages and either passes the received data to its presentation interface and/or responds as appropriate.
- records all data contained in the received radio telegrams and radio parameters in a data base for offline evaluation and documentation purposes.
- simulates AIS targets by transmitting position reports of virtual targets up to the maximum channel capacity.

A.1.2 Target simulator

The target simulator consists of a standard PC with

- special Radar and Target Simulator software
- extension boards for generation of Radar signals and RS422 serial output signals

Connection of AIS Test system

For tests of AIS transponders the data of 60 moving targets defined in the Radar Simulator are transferred to the VDL Generator and transmitted on VHF. Thus the AIS VHF data link is loaded with simulated AIS targets.

Connection of display systems

Radar systems as well as ECDIS systems will have the ability to receive, process and display AIS information in the near future. In order to test this feature the data of moving targets defined in the Radar Simulator are transferred to the RADAR (together with video, sensor data etc as known).

Connection of AIS under Test

The AIS under test can be connected to the own ship sensor outputs in order to provide full control over own ships dynamic data (for tests of reporting rates, channel management...).

A.1.3 Presentation Interface Monitor

The Presentation Interface Monitor is a PC software running on two standard PCs.

It is used to

- simulate Sensor inputs
- analyse the AIS high speed input / output
- analyse the AIS long range function
- generate DSC calls for the DSC test box and to display, log and evaluate the received DSC calls from EUT.

For that purpose it includes the functions:

- coding / decoding of NMEA 6-bit data fields
- online AIS message filtering
- online AIS message editing
- load and transmit predefined sequences
- online modification of transmitted sequences

A.1.4 DSC Test box

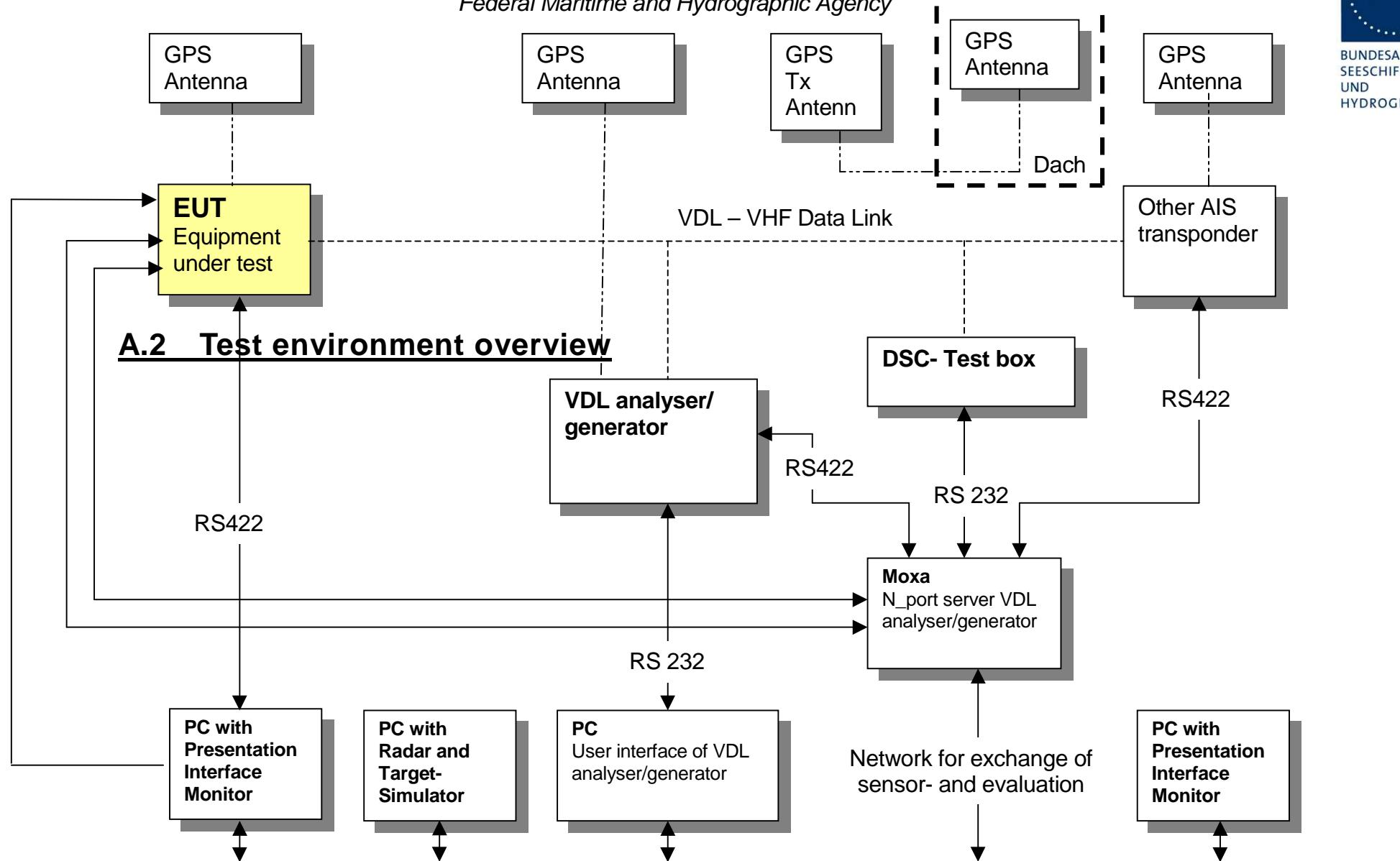
The DSC test box includes:

- A standard VHF DSC controller DEBEG 3817 with open interface
- A standard VHF radiotelephone DEBEG 6348

The software modification of the DSC controller comprises a remote control input/output facility

- to transmit DSC calls according to ITU 825-3 generated in an external device on DSC channel 70 and
- to output received DSC calls from the EUT to the external device.

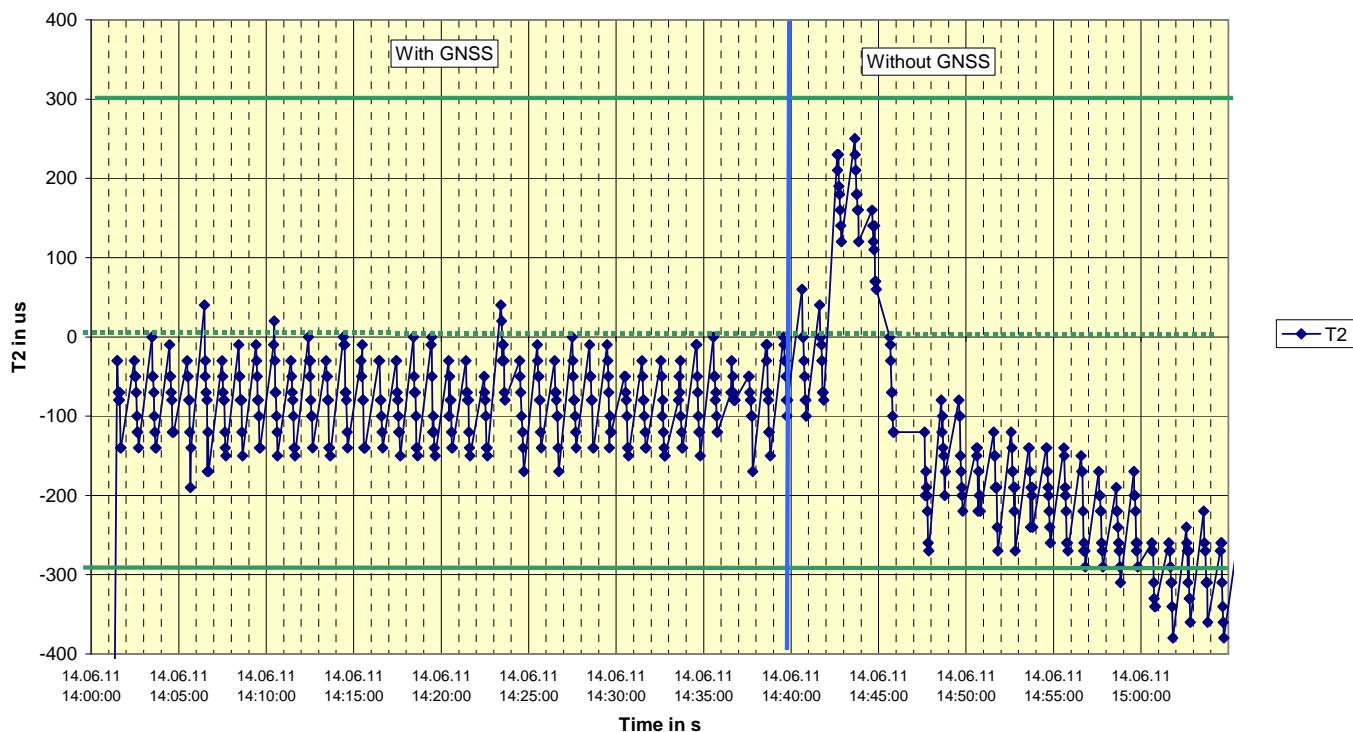
The Presentation Interface Monitor is used to generate the DSC calls and to display, log and evaluate the received DSC calls.



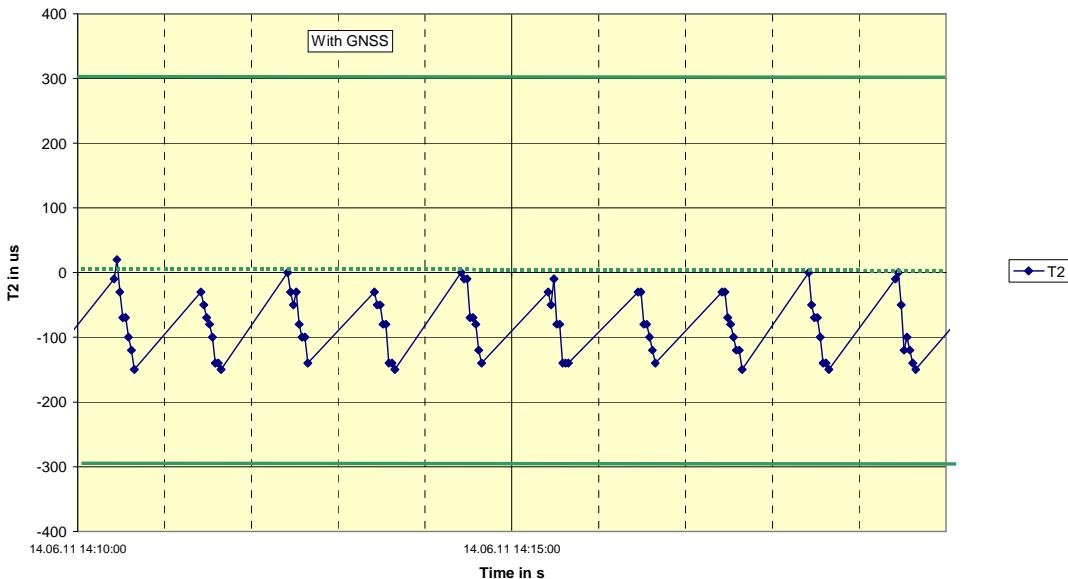
Annex B Test diagrams

B.1 8.1 Synchronisation accuracy

2011-06-14 - AMEC SART PLOMO-500 - 8.1 - Synchronisation accuracy, Test 2



2011-06-14 - AMEC SART PLOMO-500 - 8.1 - Synchronisation accuracy, Test 2



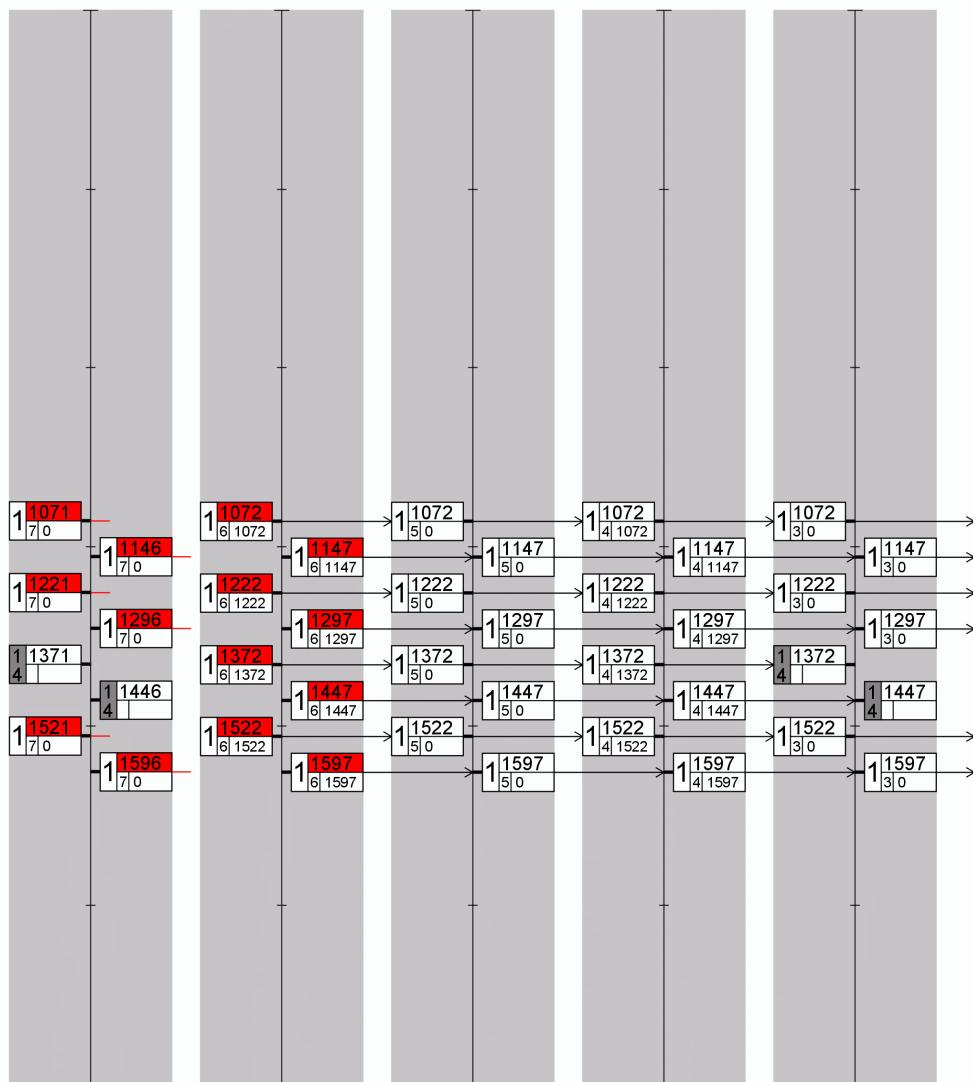
B.2 8.2.5 Active mode, Transmission schedule

B.2.1 Minute 1 to 10

2011-06-14: AIS SART Test 8.2.5 Active mode, Minute 1-15, GNSS available

| Frame 1 | Frame 2 | Frame 3 | Frame 4 | Frame 5 |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 2011-06-14 08:52:28 | 2011-06-14 08:53:28 | 2011-06-14 08:54:28 | 2011-06-14 08:55:28 | 2011-06-14 08:56:28 |
| Channel A | Channel B | Channel A | Channel B | Channel A |

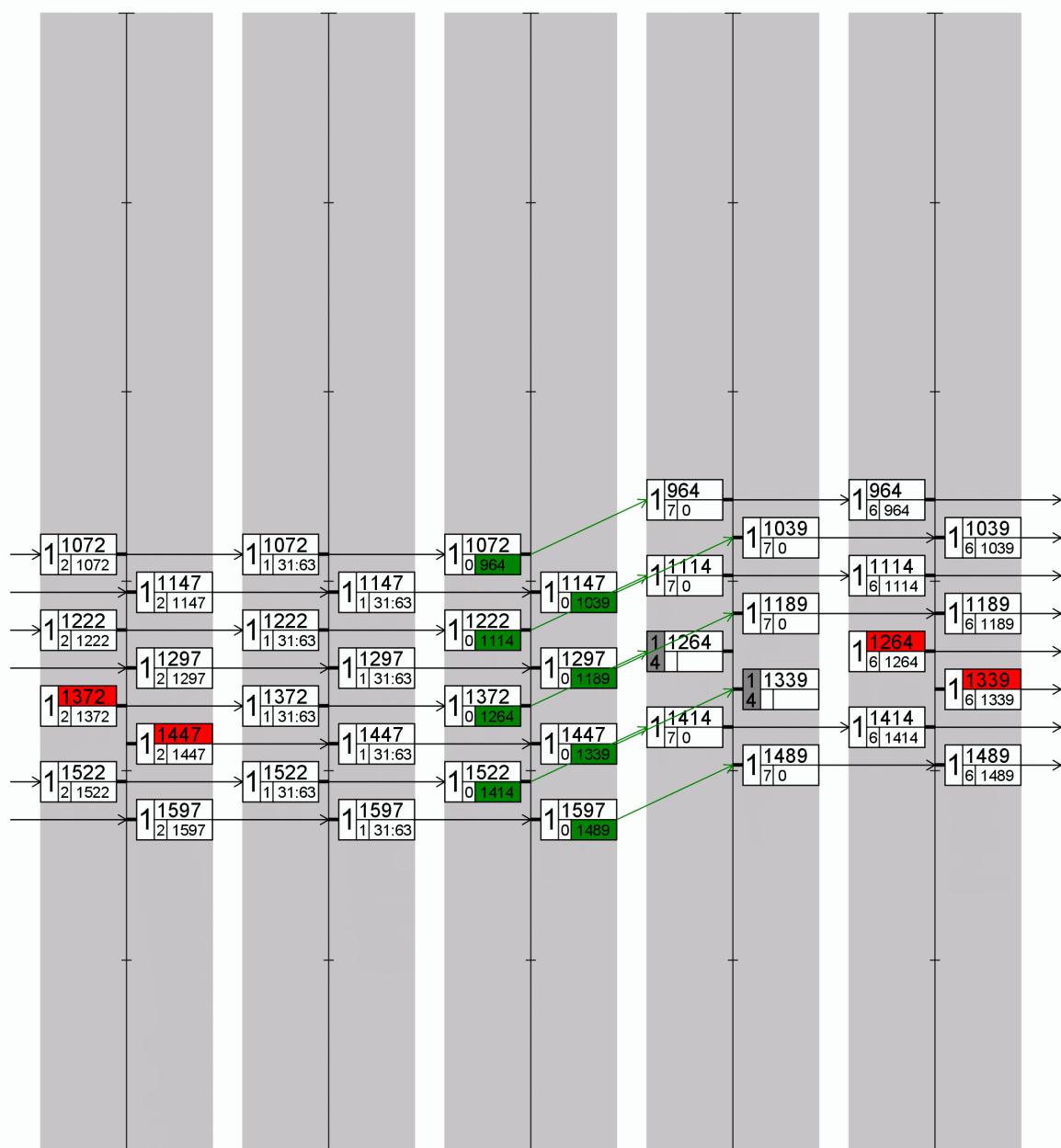
!-- Activation of active mode



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2011-06-14: AIS SART Test 8.2.5 Active mode, Minute 1-15, GNSS available

| Frame 6 | Frame 7 | Frame 8 | Frame 9 | Frame 10 |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 2011-06-14 08:57:28 | 2011-06-14 08:58:28 | 2011-06-14 08:59:28 | 2011-06-14 09:00:25 | 2011-06-14 09:01:25 |
| Channel A | Channel B | Channel A | Channel B | Channel A |

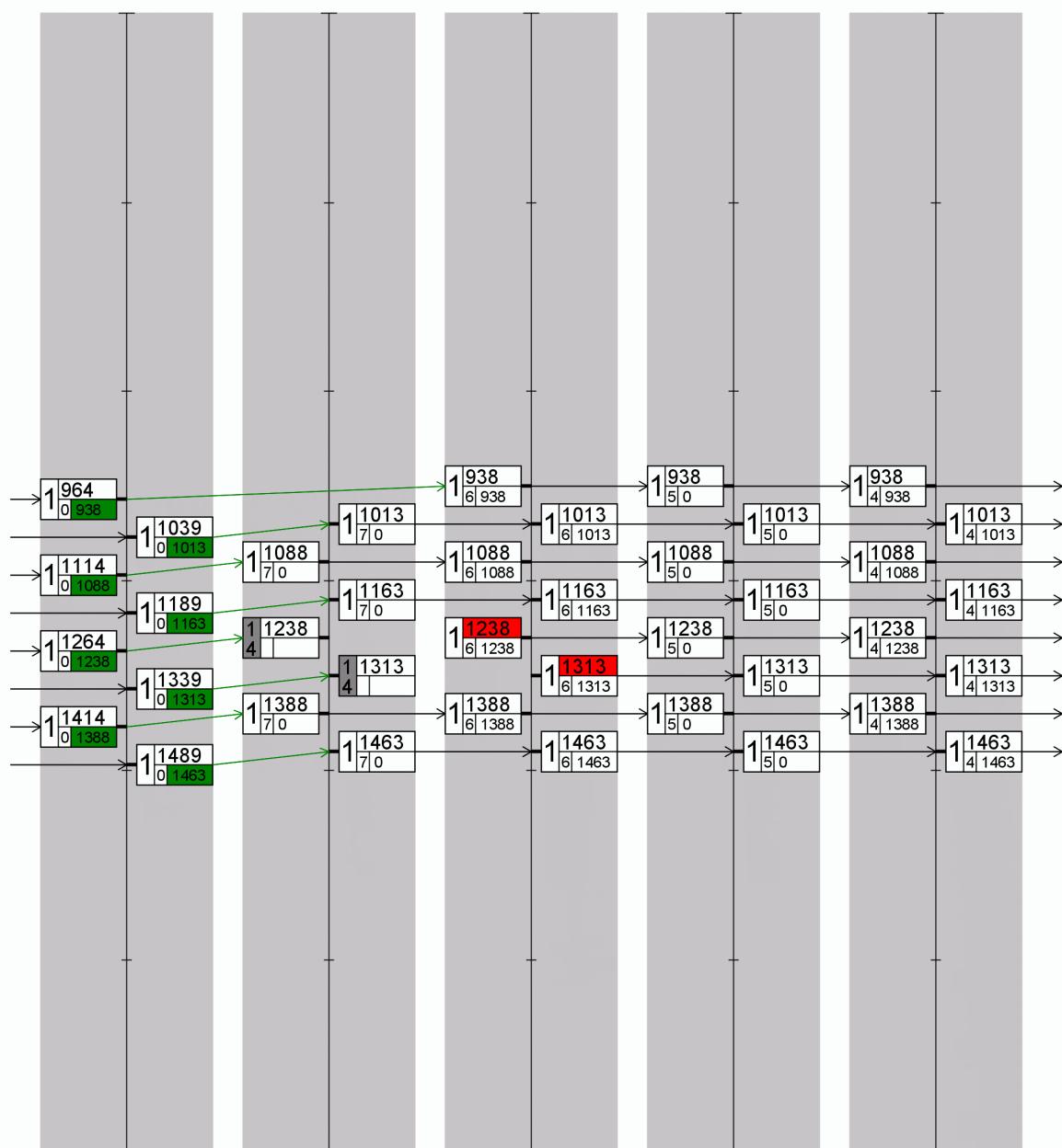


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B.2.2 Minute 15-40

2011-06-14: AIS SART Test 8.2.5 Active mode, Minute 16-40, GNSS available

| Frame 1 | Frame 2 | Frame 3 | Frame 4 | Frame 5 |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 2011-06-14 09:07:25 | 2011-06-14 09:08:27 | 2011-06-14 09:09:25 | 2011-06-14 09:10:25 | 2011-06-14 09:11:25 |
| Channel A | Channel B | Channel A | Channel B | Channel A |



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2011-06-14: AIS SART Test 8.2.5 Active mode, Minute 16-40, GNSS available

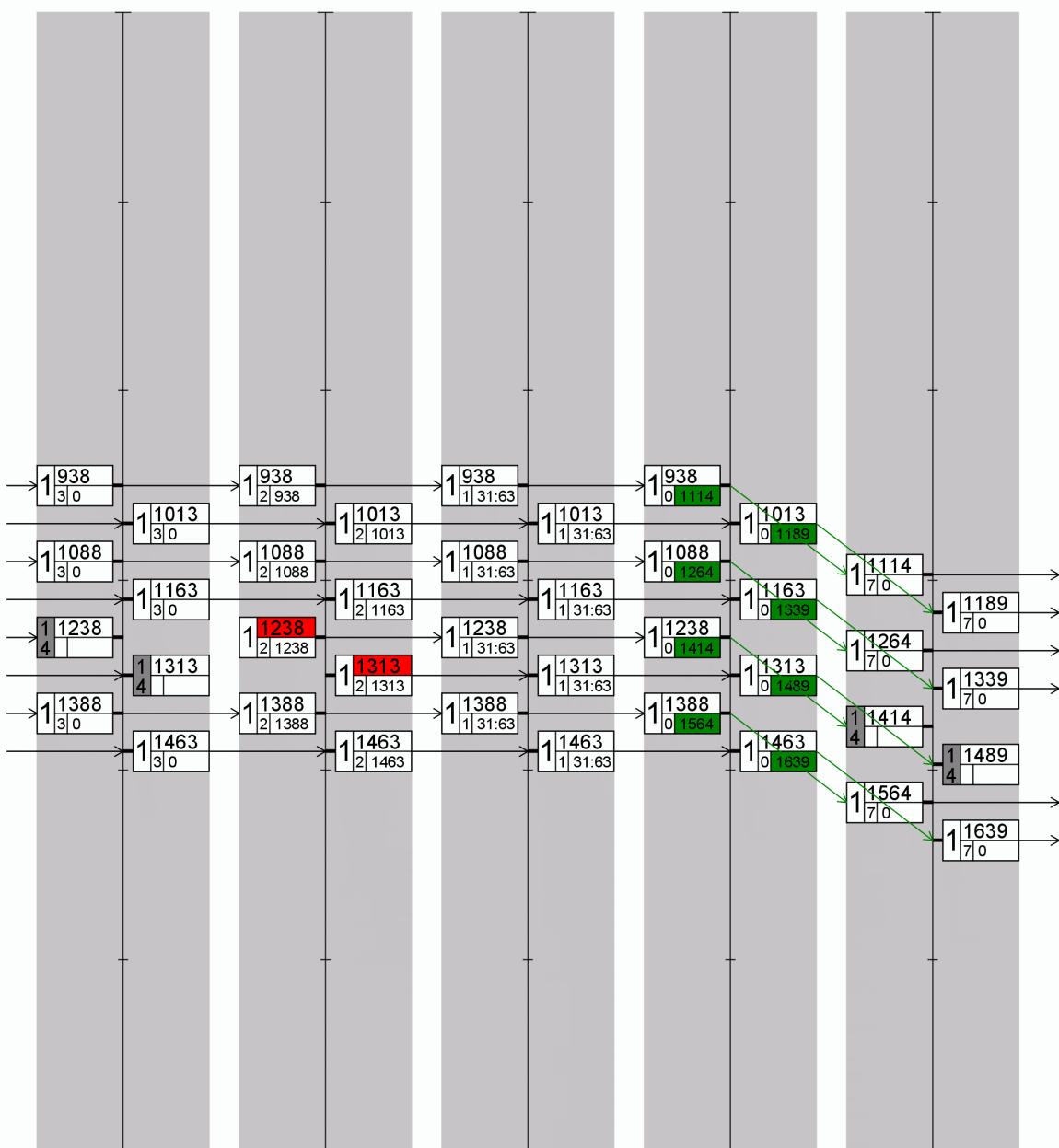
| Frame 6 | |
|---------------------|-----------|
| 2011-06-14 09:12:25 | |
| Channel A | Channel B |

| Frame 7 | |
|---------------------|-----------|
| 2011-06-14 09:13:25 | |
| Channel A | Channel B |

| Frame 8 | |
|---------------------|-----------|
| 2011-06-14 09:14:25 | |
| Channel A | Channel B |

| Frame 9 | |
|---------------------|-----------|
| 2011-06-14 09:15:25 | |
| Channel A | Channel B |

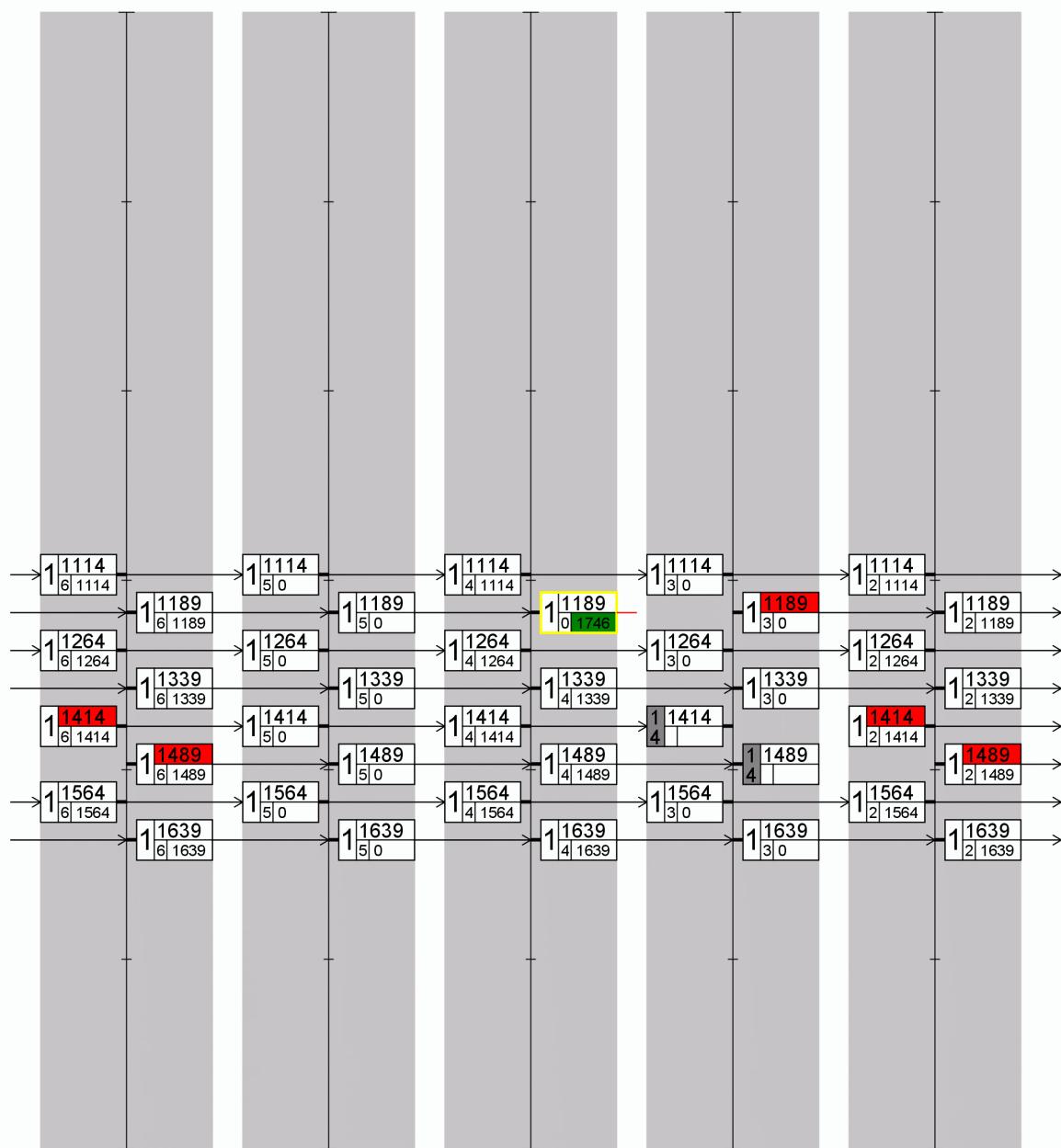
| Frame 10 | |
|---------------------|-----------|
| 2011-06-14 09:16:29 | |
| Channel A | Channel B |



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2011-06-14: AIS SART Test 8.2.5 Active mode, Minute 16-40, GNSS available

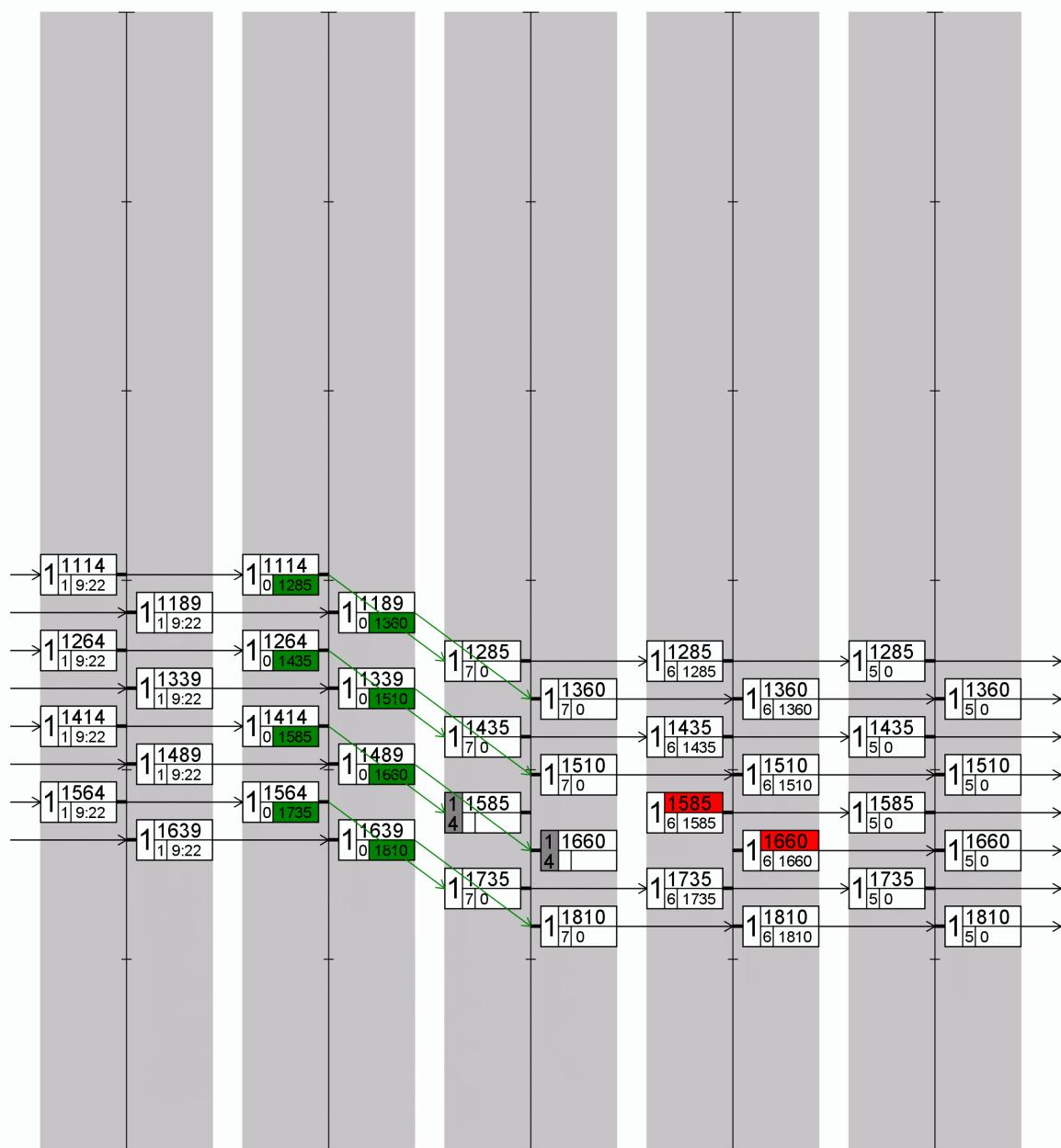
| Frame 11 | Frame 12 | Frame 13 | Frame 14 | Frame 15 |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 2011-06-14 09:17:29 | 2011-06-14 09:18:29 | 2011-06-14 09:19:29 | 2011-06-14 09:20:29 | 2011-06-14 09:21:29 |
| Channel A | Channel B | Channel A | Channel B | Channel A |



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2011-06-14: AIS SART Test 8.2.5 Active mode, Minute 16-40, GNSS available

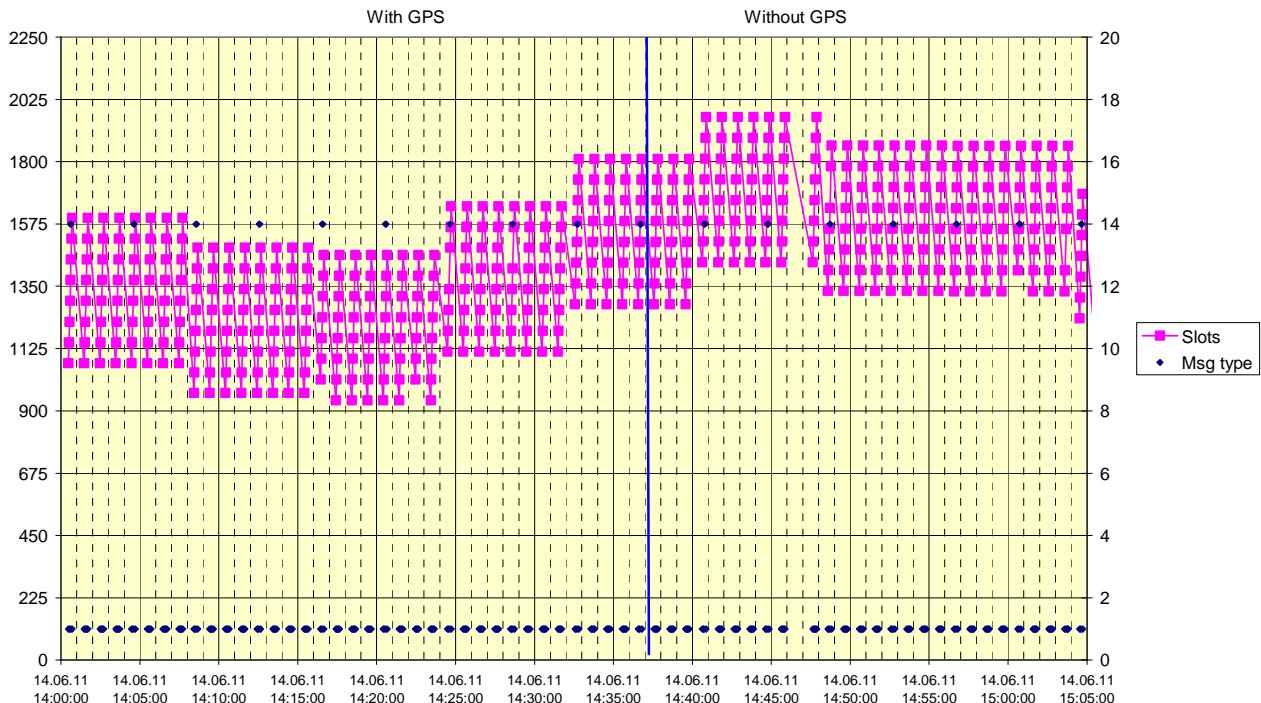
| Frame 16 | Frame 17 | Frame 18 | Frame 19 | Frame 20 |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 2011-06-14 09:22:29 | 2011-06-14 09:23:29 | 2011-06-14 09:24:34 | 2011-06-14 09:25:34 | 2011-06-14 09:26:34 |
| Channel A | Channel B | Channel A | Channel B | Channel A |



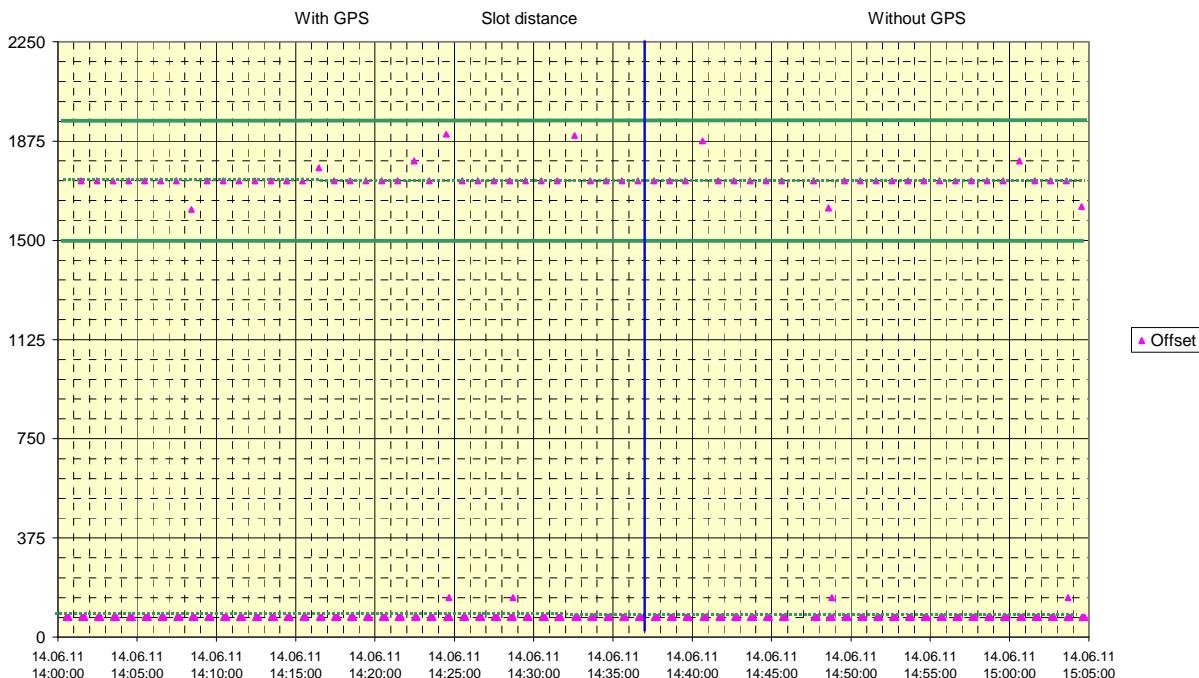
Generated by BSH AISlog Version 2.59

B.2.3 Slot distance

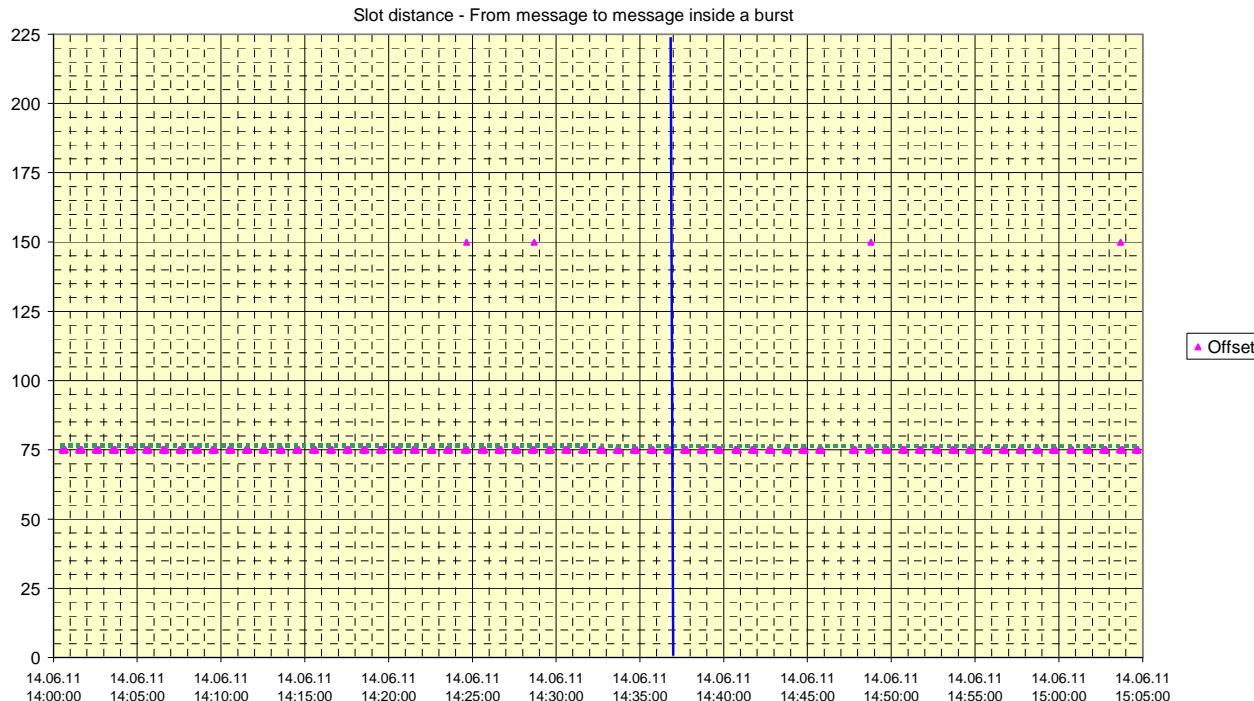
2011-06-14 - AMEC SART PLOMO-500 - 8.2.5 - Transmission schedule for message 1, Test 2



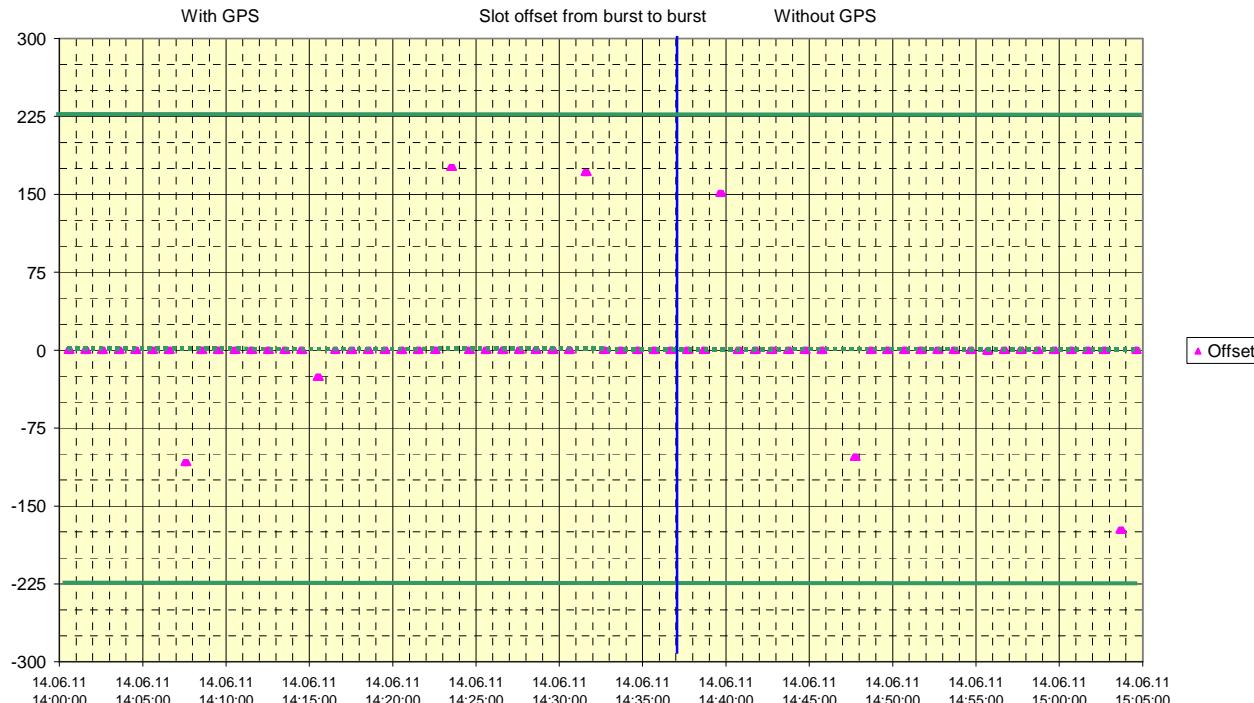
2011-06-14 - AMEC SART PLOMO-500 - 8.2.5 - Transmission schedule for message 1, Test 2



2011-06-14 - AMEC SART PLOMO-500 - 8.2.5 - Transmission schedule for message 1, Test 2



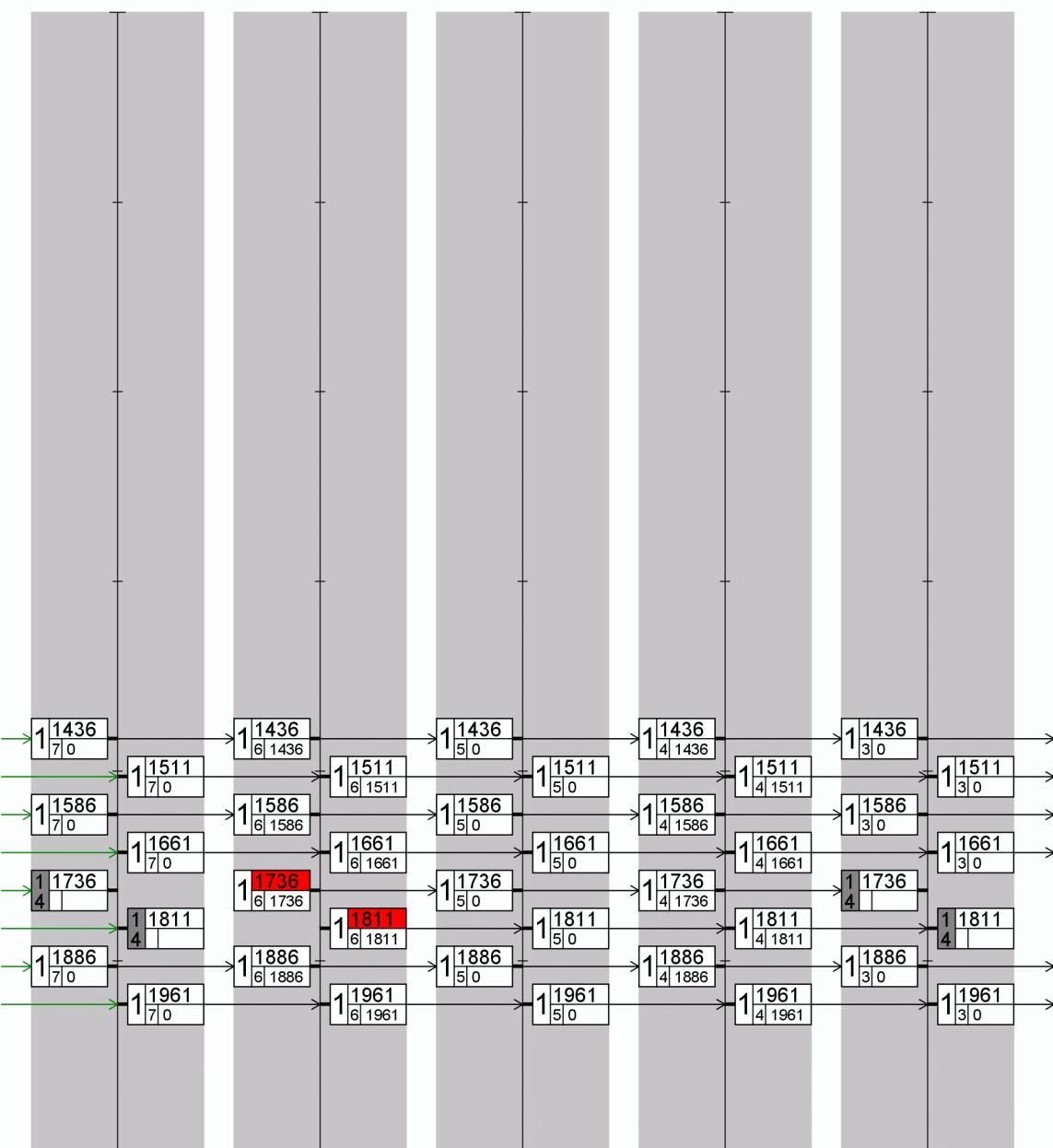
2011-06-14 - AMEC SART PLOMO-500 - 8.2.5 - Transmission schedule for message 1, Test 2



B.2.4 Minute 45-55 (no GNSS)

2011-06-14: AIS SART Test 8.2.5 Active mode, GNSS not available

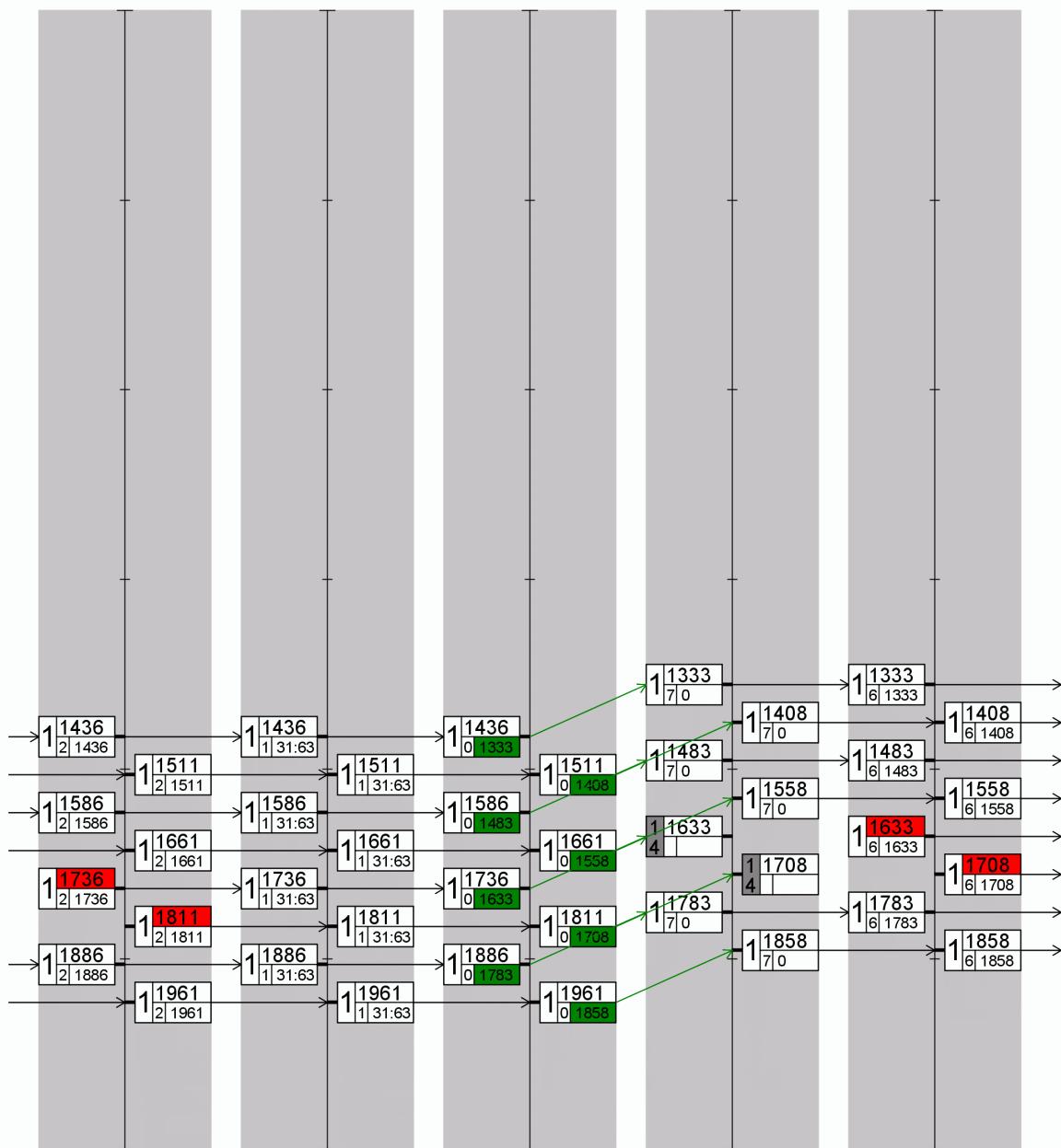
| Frame 1 | Frame 2 | Frame 3 | Frame 4 | Frame 5 |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 2011-06-14 09:32:38 | 2011-06-14 09:33:38 | 2011-06-14 09:34:38 | 2011-06-14 09:35:38 | 2011-06-14 09:36:38 |
| Channel A | Channel B | Channel A | Channel B | Channel A |



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2011-06-14: AIS SART Test 8.2.5 Active mode, GNSS not available

| Frame 6 | Frame 7 | Frame 8 | Frame 9 | Frame 10 |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 2011-06-14 09:37:38 | 2011-06-14 09:38:38 | 2011-06-14 09:39:38 | 2011-06-14 09:40:35 | 2011-06-14 09:41:35 |
| Channel A | Channel B | Channel A | Channel B | Channel A |



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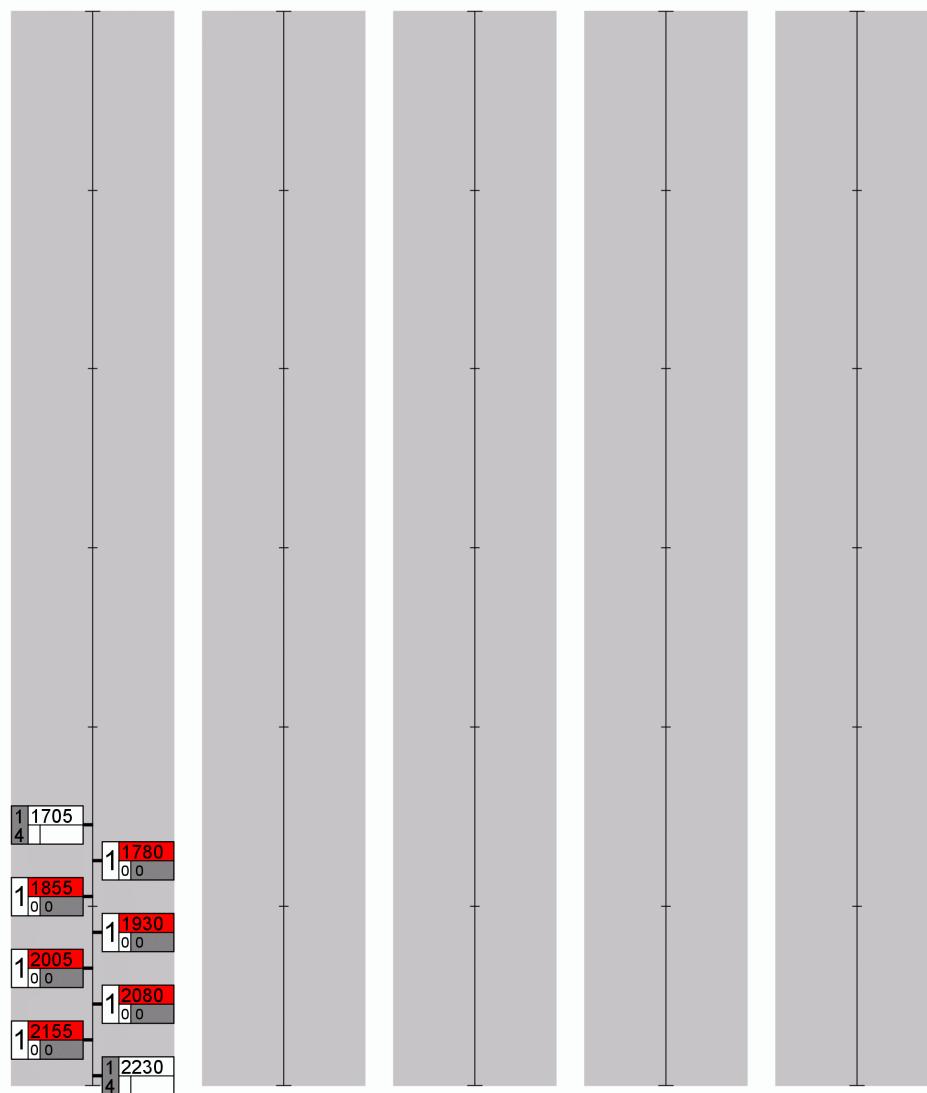
B.3 8.3 Test mode tests

B.3.1 8.3.1 Test with GNSS available

2011-05-20: AIS SART Test 8.3.1 Test mode, GNSS available

| Frame 1 | Frame 2 | Frame 3 | Frame 4 | Frame 5 |
|---------------------|-----------|-----------|-----------|-----------|
| 2011-05-20 10:48:45 | | | | |
| Channel A | Channel B | Channel A | Channel B | Channel A |

!-- Activation of test mode



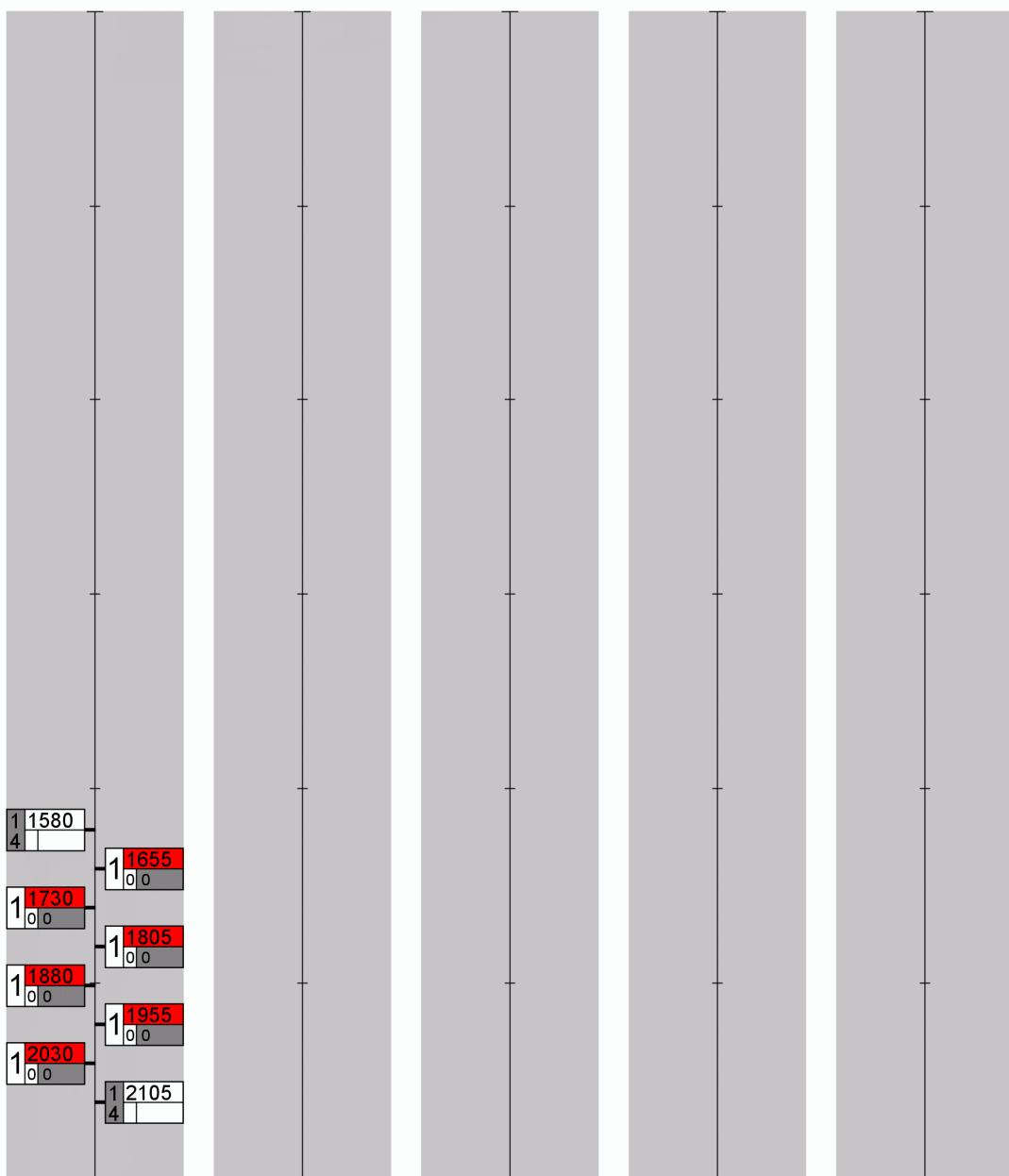
Generated by BSH AISlog Version 2.59

B.3.2 8.3.1 Test without GNSS available

2011-05-20: AIS SART Test 8.3.2 Test mode, GNSS not available

| Frame 1 | Frame 2 | Frame 3 | Frame 4 | Frame 5 |
|---------------------|-----------|-----------|-----------|-----------|
| 2011-05-20 12:14:42 | | | | |
| Channel A | Channel B | Channel A | Channel B | Channel A |

-- 4 minutes after activation of test mode



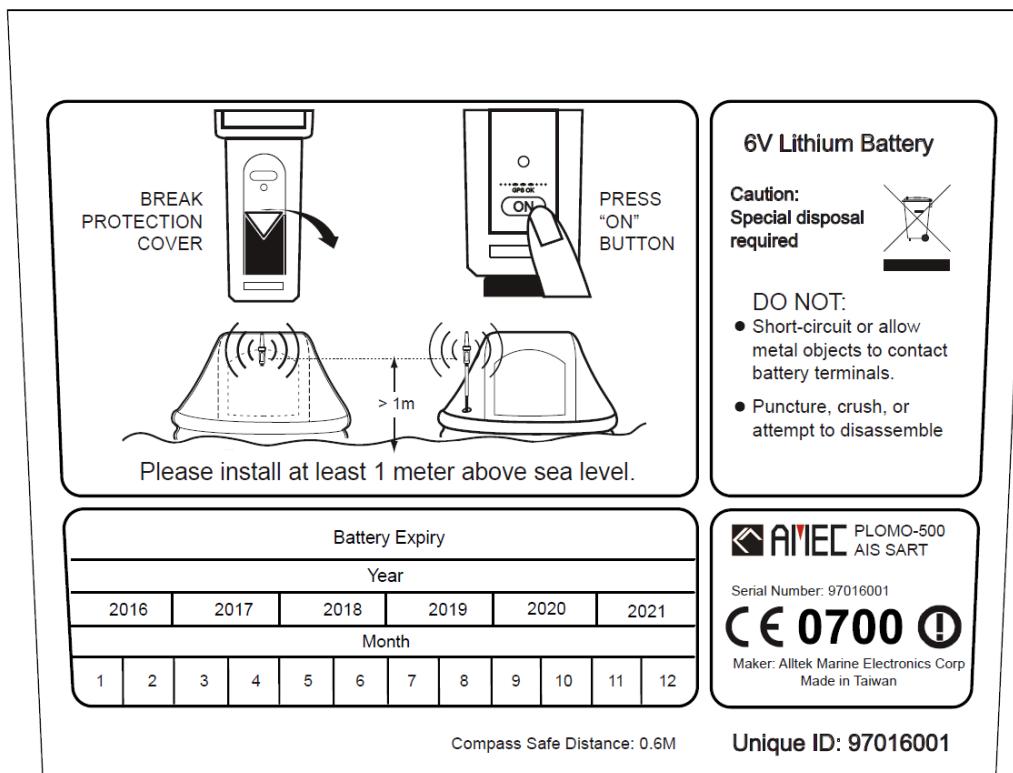
Generated by BSH AISlog Version 2.59

Annex C Photos of equipment under test

C.1 SART Unit 2







C.2 SART Unit 1

