



Bundesrepublik Deutschland
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:

Weatherdock

Type:

easyRESCUE

Applying test standards:

IEC 61097-14 Ed. 1.0

Test Report No.:

BSH/4615/4361565/10

Applicant:

Weatherdock AG
Sigmundstr. 180
90431 Nürnberg
Germany

Hamburg, 28 September 2010
Federal Maritime and
Hydrographic Agency

by order

Heinrich Bartels

Test engineer

by order

Hans-Karl von
Arnim
Head of
laboratory/
section

Federal Maritime and Hydrographic Agency
Bernhard-Nocht-Str. 78

D-20359 Hamburg
Germany

nach EN ISO/IEC 17025:2005
akkreditiertes Prüflaboratorium



DAT-P-086/98



DATEch Deutsche Akkreditierungsstelle Technik in der TGA GmbH
Signatory of the Multilateral Agreement of EA and ILAC for the mutual recognition

represented in the

Deutschen AkkreditierungsRat



Akkreditierung

The TGA GmbH, represented by the DATEch Deutsche Akkreditierungsstelle Technik
in der TGA GmbH, confirms that the Testing Laboratory

**Federal Maritime and Hydrographic Agency
Department Shipping
Laboratory for Type Approvals
Bernhard-Nocht-Straße 78
20359 Hamburg**

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out testing in the
fields of

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

according to the annexed list of standards and specifications.

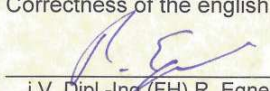
The accreditation is valid until: **2013-12-22**

The annex is deemed part of this certificate and comprises **8** pages.

DAR-Registration No.: **DAT-PL-086/98-02**

Frankfurt/Main, 2008-12-23

Correctness of the english translation confirmed: Frankfurt/Main, 2008-12-23


i.V. Dipl.-Ing. (FH) R. Egner
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: Weatherdock AG, Sigmundstr. 180
90431 Nürnberg, Germany

Equipment under test:

Type: easyRESCUE
Manufacturer: Weatherdock AG, Sigmundstr. 180
90431 Nürnberg, Germany

Place of test: BSH test laboratory Hamburg, Room 916
Start of test: 2010-04-07
End of test: 2010-09-03

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.

GENERAL	3
SUMMARY	3
1 GENERAL INFORMATION	6
1.1 EQUIPMENT HISTORY	6
1.1.1 EUT system no 1	6
1.1.2 Documents	7
1.2 TEST ENVIRONMENT	7
1.2.1 Test environment no 1	7
1.3 LEGEND	8
1.4 TEST NOTES	9
1.4.1 General problems	9
2 6 PERFORMANCE TESTS	10
2.1 6.1 OPERATIONAL TESTS	10
2.2 6.2 BATTERY	12
2.2.1 6.2.1 Battery capacity test	12
2.2.2 6.2.2 Expiry date indication	12
2.2.3 6.2.3 Reverse polarity protection	13
2.3 6.3 UNIQUE IDENTIFIER	13
2.4 6.4 ENVIRONMENT	13
2.5 6.5 RANGE PERFORMANCE	13
2.6 6.6 TRANSMISSION PERFORMANCE	13
2.7 6.7 LABELLING	14
2.8 6.8 MANUALS	14
2.9 6.9 ELECTRONIC POSITON FIXING SYSTEM	15
2.10 6.10 ACTIVATOR	16
2.11 6.11 INDICATOR	17
3 7 PHYSICAL RADIO TESTS	18
4 8 LINK LAYER TESTS	19
4.1 8.1 TESTS FOR SYNCHRONISATION ACCURACY	19
4.2 8.2 ACTIVE MODE TESTS	19
4.2.1 8.2.1 Methode of measurement	19
4.2.2 8.2.2 Initialisation Period	20
4.2.3 8.2.3 Message content of Message 1	20
4.2.4 8.2.4 Message content of Message 14	21
4.2.5 8.2.5 Transmission schedule for Message 1	22
4.2.6 8.2.6 Communication state of Message 1	23
4.2.7 8.2.7 Transmission schedule of message 14	24
4.2.8 8.2.8 Transmission with lost GNSS	24
4.3 8.3 TEST MODE TESTS	26
4.3.1 8.3.1 Transmission with EPFS data available	26
4.3.2 8.3.2 Transmission without EPFS data available	28
ANNEX A TEST EQUIPMENT	30
A.1 TEST EQUIPMENT SUMMARY	30
A.1.1 VDL analyser / generator	30
A.1.2 Target simulator	30
A.1.3 Presentation Interface Monitor	31
A.1.4 DSC Test box	31
A.2 TEST ENVIRONMENT OVERVIEW	32
ANNEX B TEST DIAGRAMS	33

8.1	SYNCHRONISATION ACCURACY.....	33
B.2	8.2.5 ACTIVE MODE, TRANSMISSION SCHEDULE	34
	B.2.1 Minute 1 to 10.....	34
	B.2.2 Minute 30-40.....	37
	B.2.3 Slot distance.....	39
	B.2.4 Minute 40-55 (no GNSS)	41
B.3	8.3 TEST MODE TESTS	44
	B.3.1 8.3.1 Test with GNSS available	44
	B.3.2 8.3.1 Test without GNSS available	45
ANNEX C PHOTOS OF EQUIPMENT UNDER TEST.....		46
C.1	SART UNIT.....	46

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

<u>Transponder</u>				
Type	EasyRescue		Part No.:	
Delivery date	2010-04-07		Serial number	Prototype 1
Test version, internal VHF antenne replaced by an antenna connector				
HW Version:	Delivery date	2010-04-07	Version no	
	Installation date	2010-04-07		
SW Version:	Delivery date	2010-04-07	Version no	1.0.0
	Installation date	2010-04-07		
SW Version:	Delivery date	2010-04-26	Version no	1.0.0
	Installation date	2010-04-26		
SW Version:	Delivery date		Version no	
	Installation date			

<u>GPS antenna</u>			
Type	Internal	Part No.:	
Delivery date		Serial number	

1.1.2 Documents

The assessment of manufacturers documentation is based on the following documents:

Doc. No	Description
1	TÜV-Süd Senton Nr. 70464-02105-1 (Ed.1) / Radio Tests
2	TÜV-Süd Senton Nr. 70464-02105-2 (Ed.1) / EMC Tests
3	TÜV-Süd Senton Nr. 70464-02105-3 (Ed.1) / Battery Capacity Test
4	TÜV-Süd Product Service Nr. 71370050 (R.1) / Salt Mist / Humidity
5	BSH / Weatherdock EasyRescue_Droptest_20m_100509.PDF + Video films (CD 09.05.2010)
6	KRIWAN Testzentrum 100347_01_H_PB / Solar Simulation
7	KRIWAN Testzentrum 100347_02_H_PB / Environmental Simulation
8	Weatherdock EasyRESCUE_Manufacturer_Doc_1.1.docx
9	BSH/4615/4361565/10 GPS Tests
10	TÜV-Süd Product Service Nr. 75905837 / RF Exposure Assessment
11	Manual / Bed_easyRescue_100514_en_A6.pdf

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	2010-04-07	2010-04-07	Bartels
1	2010-04-29	2010-04-29	Bartels
Documents	2010-07-28	2010-09-03	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

Template for additional test notes (copy if required):

Date	Result	Status

Issue of this template: 2009-05-26

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

1.4 Test notes

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

1.4.1 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).

2010-04-07 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		Passed
b) Inadvertent activation	Verify by inspection that the EUT is fitted with means to prevent inadvertent activation		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	visible	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		Passed
	Check if provision for automatic activation is included (optional)	No automatic activation	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	<u>2010-07-28 Ba:</u> Document No. 5 and video films	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	<u>2010-07-28 Ba:</u> Document No. 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	<u>2010-07-28 Ba:</u> Document No. 7	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	<u>2010-07-28 Ba:</u> Document No. 8	Passed

Bundesamt für Seeschifffahrt und Hydrographie
Federal Maritime and Hydrographic Agency



i) Lanyard	Verify by inspection that the EUT is equipped with a buoyant lanyard, suitable for use as a tether	2010-07-28 Ba: Document No. 8	Passed
	Verify by measurement that the length is not less than 10 m		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	Document No. 4 (Salt mist) Document No. 7 (Oil resistance)	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	Document No. 6	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.	2010-07-28 Ba: Yellow color body with blue label	Passed
m) Construction	Verify by inspection that the EUT has a smooth external construction to avoid damaging the survival craft	2010-07-28 Ba:	Passed
n) Antenna height	Verify by inspection that the EUT provided with an arrangement to bring the AIS-SART antenna to a level of at least 1metre above sea level	2010-07-28 Ba: Document No. 8	Passed
	Check that a illustrated instruction is provided. The instructions shall illustrate the minimum requirement of 1 metre above sea level during use along with the installation method	2010-07-28 Ba: Document No. 11 (Manual)	Passed
	Check that the manufacturer provides a visible means of indicating the base of the antenna	2010-07-28 Ba: Document No. 8, 11 There is no special marking but the base of the antenna is clearly visible	Passed
	Verify by measurement that the height to the declared 1 metre mark from sea level is not less than 1 meter	2010-07-28 Ba: Document No. 8	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 8.2	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.

2010-07-28 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	Document No. 8	Passed
Calculation	Check that the manufacturer provides evidence to support the battery life calculations	Document No. 3	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 		Passed
	Verify that the calculations are correct		Passed

2.2.3 6.2.3 Reverse polarity protection

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

2010-07-28 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	Document No. 8	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.

2010-09-28 Ba		Test details: Operational tests	
Test item	Check	Remark	Result
IEC 60945 test report	Review the IEC 60945 test report. Verify that the requirements are fulfilled	Assessment Report BSH 4615/4361565/10-3, dated 2010-09-03	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).

2010-07-28 Ba		Test details: Labelling	
Test item	Check	Remark	Result
Verify by inspection that on the exterior of the equipment it is clearly indicated			
Operating instructions	- brief operating and test instructions	Document No. 8, 11	Passed
	Verify that the operating and test instructions are in English	Document No. 8, 11	Passed
Expiry date	- expiry date (in English) for the primary battery used	Document No. 8 Photo of the lable on the backside	Passed
Unique identifier	- the unique identifier (user ID field of the AIS messages)	Document No. 8 Photo of the lable on the backside	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).

2010-07-28		Test details: Manuals	
Test item	Check	Remark	Result
Periodic testing	Verify by inspection that the manuals include instructions for periodic testing	Document No. 11	Passed
Maintenance	Verify by inspection that the manuals include instructions for maintenance	Document No. 11 No information about maintenance found <u>Retest 2010-07-29 Ba:</u> A section about maintenance has been added to Document No 11, Rev 1.4	Passed

2.9 6.9 Electronic Positon 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 an 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).

2010-07-28 Ba		Test details: EPFS test	
Test item	Check	Remark	Result
Check the GNSS test report for the following requirements			
GNSS test report	Position accuracy	Document No. 9	Passed
	Aquisition		Passed
	Re-Aquisition		Passed
	Receiver sensivity		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	Not found <u>Retest 2010-07-29 Ba:</u> A declaration about GNSS cold start has been added to Document NO. 9, Rev. 1.2	Passed

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.

2010-04-07 Ba		Test details: Activator	
Test item	Check	Remark	Result
Activation	Verify by inspection that the EUT provides means for manual activation		Passed
	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	By a protecting slider which covers the activation button	Passed
Deactivation	Verify by inspection that the EUT provides means for manual deactivation	By pressing the "Activate" and "Test" button for 3 s	Passed
Indication	Verify by inspection that the EUT provides an indication of previous activation	The moving of the slider for activation break a indicator pin.	Passed
	Verify by inspection that the indication cannot be reset by the user	The indicator pin cannot be replaced by the user.	Passed
	Verify by inspection that the indication is not affected by initiating the test mode	For the activation of test mode the slider is moved in the opposite direction and therefore does not break the indicator pin.	Passed
Test mode	Verify by inspection that the EUT provides means for manual activation of the test mode	A "Test" button	Passed
	Verify by inspection that the EUT provides means for manual deactivation of the test mode	There is no description in the manual how the test mode can be deactivated <u>Retest 2010-07-28 Ba:</u> A description of inactivation in test mode has been added	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.

2010-04-07 Ba		Test details: Indicator	
Test item	Check	Remark	Result
Visual/ audible	Check by inspection if the indicator is visual		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	By flashing "Activated" LED	Passed
	Check by inspection that the EUT indicates that is under going test	By flashing "Test" LED	Passed
	Check by inspection that the EUT indicates that it has completed test	The "Test" LED is on for 5 s	Passed
	Check by inspection that the EUT indicates the EPFS status whilst the AIS-SART is activated	By flashing green "GPS" LED	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

This test is performed by a Radio test lab. The test report is reviewed to verify that the EUT meets the requirements.

See assesment test report BSH/4615/4361565/10-2

2010-07-28 Ba		Test details: Physical radio tests	
Test item	Check	Remark	Result
Verify by review of the Physical radio test report that the EUT meets the requirements			
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 form 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

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.

2010-04-07 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		Passed

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.

2010-04-07 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.*

2010-04-07 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		Passed
b) Valid position	Verify that the first message with a valid position is transmitted within 15 minutes	The first or second burst contains 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.*

2010-04-07 Ba		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		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) Navigational status	Check that Navigational status = 14		Passed
e) ROT	Check that ROT = default	-128	Passed
f) SOG	Check that SOG = SOG from internal GNSS	= 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		Passed
j) COG	Check that COG = COG from internal GNSS	variable	Passed
k) Heading	Check that heading = default		Passed
l) Time stamp	Check time stamp = actual UTC second (0...59)		Passed
m) Indication	Verify the correct indication of operation		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".

2010-04-07 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"		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.*

2010-04-07 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)		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		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		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.*

2010-04-07 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	The UTC is one minute earlier than the actual time. The reasons seems to be that the UTC is derived from the position fix short time before the transmission of the burst which is made during the previous frame <u>Retest 2010-04-28 Ba:</u> The UTC time is correct	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.

2010-04-07 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.

Bundesamt für Seeschifffahrt und Hydrographie
Federal Maritime and Hydrographic Agency



2010-04-07 Ba		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		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		Passed
i) RAIM flag	Check that RAIM-flag = 0		Passed
j) Indication	Verify correct indication as per manufacturer's documentation	The GPS LED stopped flashing	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.*

Bundesamt für Seeschifffahrt und Hydrographie
Federal Maritime and Hydrographic Agency



2010-04-07 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		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		Passed
i) Time stamp	Check time stamp = actual UTC second (0...59)	Time stamp = 63 63 is incorrect because a position is available. Perhaps 62 is also acceptable if the correct time (leap second) is not available. <u>Retest 2010-04-28 Ba:</u> The time stamp is 62	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		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.*

Bundesamt für Seeschifffahrt und Hydrographie
Federal Maritime and Hydrographic Agency



2010-04-07 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	15 minutes after activation	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		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 PC5593 SW AISterm V1.0rev47 AISmain V1.47011120R
2	Target simulator	Simutech	BSH PC3007 SW BSHSIM7T
3	Presentation Interface Monitor	BSH	BSH PC 3481 BSH PC 5508 SW NewMoni V2.1
4	DSC Test box	DEBEG 3817 DEBEG 6348	S/N 475533
	Auxiliaries:		
5	Digital Multimeter	Voltcraft	S/N 1010365036
6	Oscilloscope	Le Croy Wavesurver 422	BSH 106106/2005
7	5 Converters RS 422 to RS 232		
8	1 fixed voltage power supply (24 V/10A)		
9	3 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

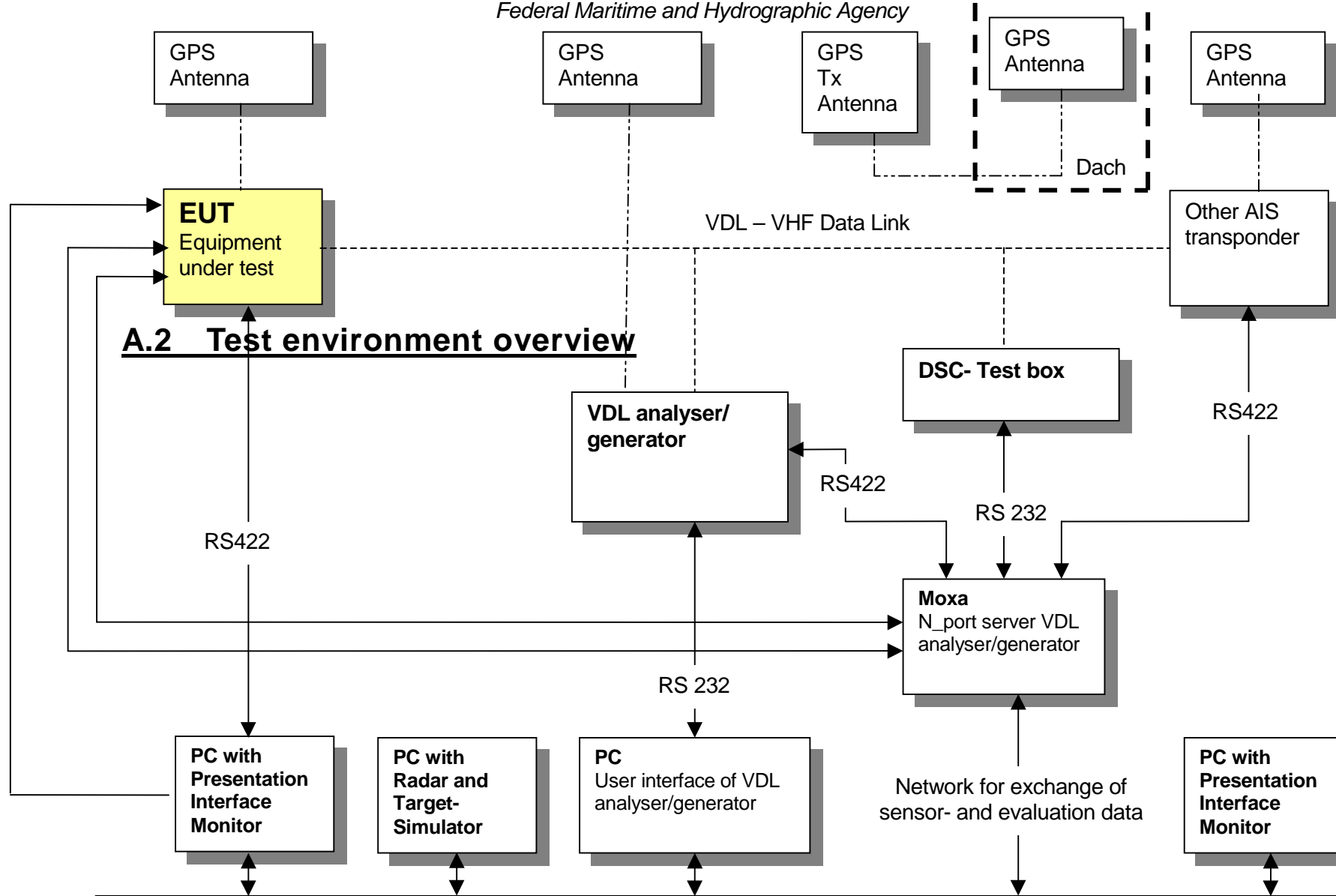
The software modification of the DSC controller comprises a remote control input/output facility

- 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.

Bundesamt für Seeschifffahrt und Hydrographie

Federal Maritime and Hydrographic Agency

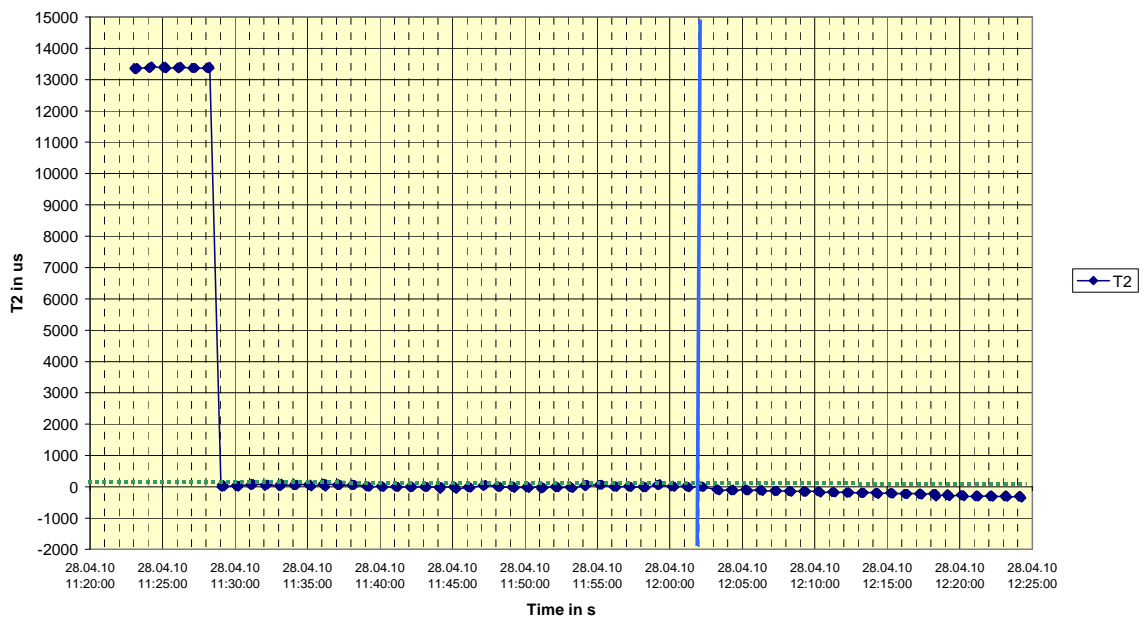


A.2 Test environment overview

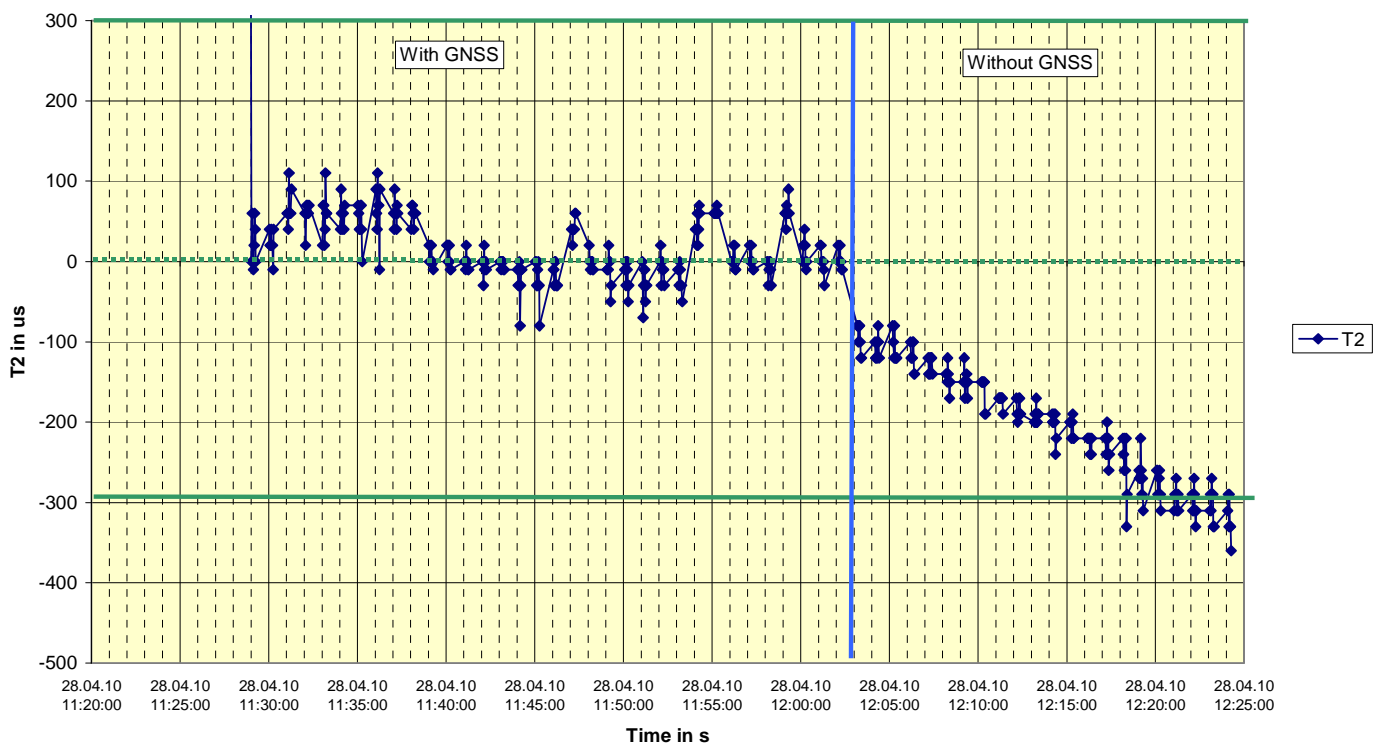
Annex B Test diagrams

B.1 8.1 Synchronisation accuracy

2010-04-28 Weatherdock easyRESCUE - 8.1 - Synchronisation accuracy



2010-04-28 Weatherdock easyRESCUE - 8.1 - Synchronisation accuracy



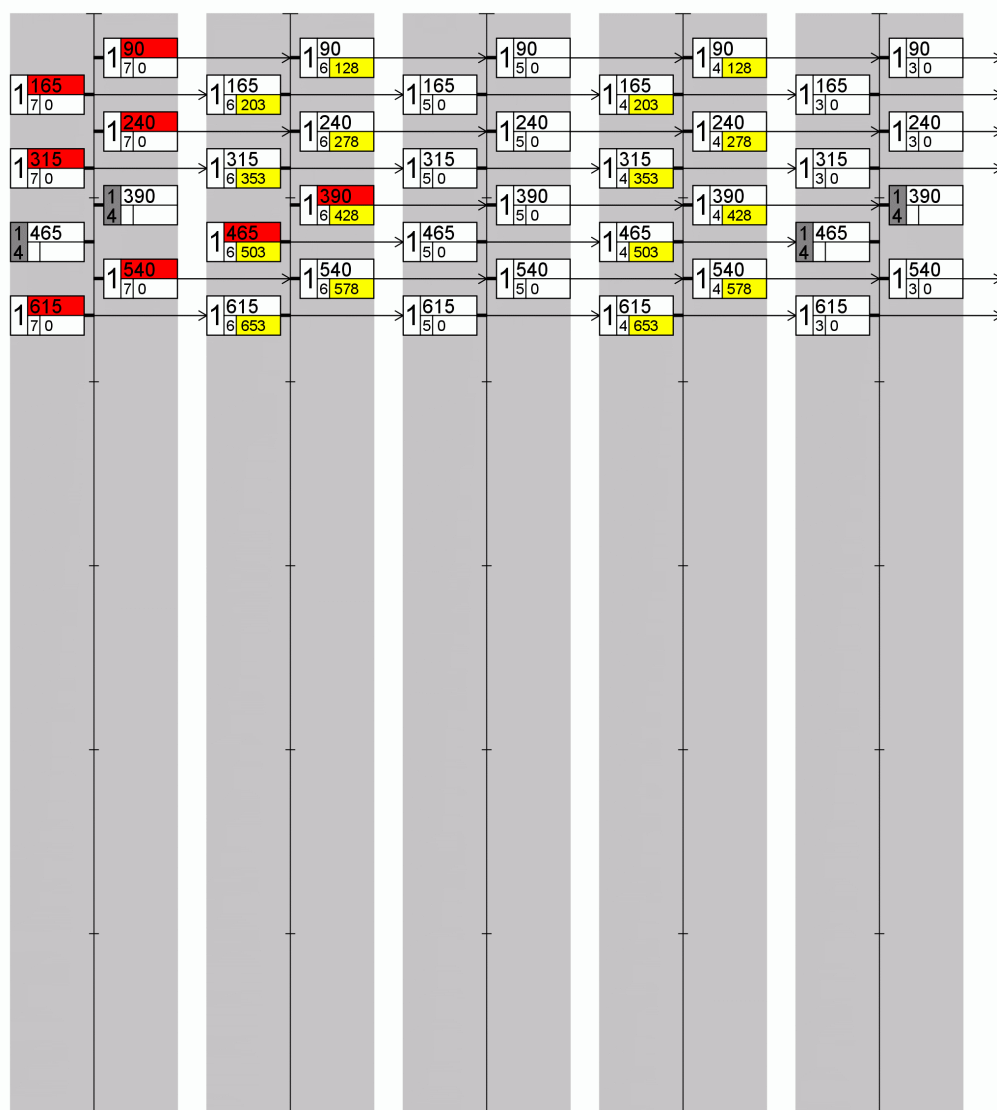
B.2 8.2.5 Active mode, Transmission schedule

B.2.1 Minute 1 to 10

2010-04-28 Ba: Weatherdock easyRESCUE Test 8.2 Active mode with GNSS, Minute 1-15

Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
2010-04-28 11:23:02	2010-04-28 11:24:02	2010-04-28 11:25:02	2010-04-28 11:26:02	2010-04-28 11:27:02
Channel A	Channel A	Channel A	Channel A	Channel A
Channel B	Channel B	Channel B	Channel B	Channel B

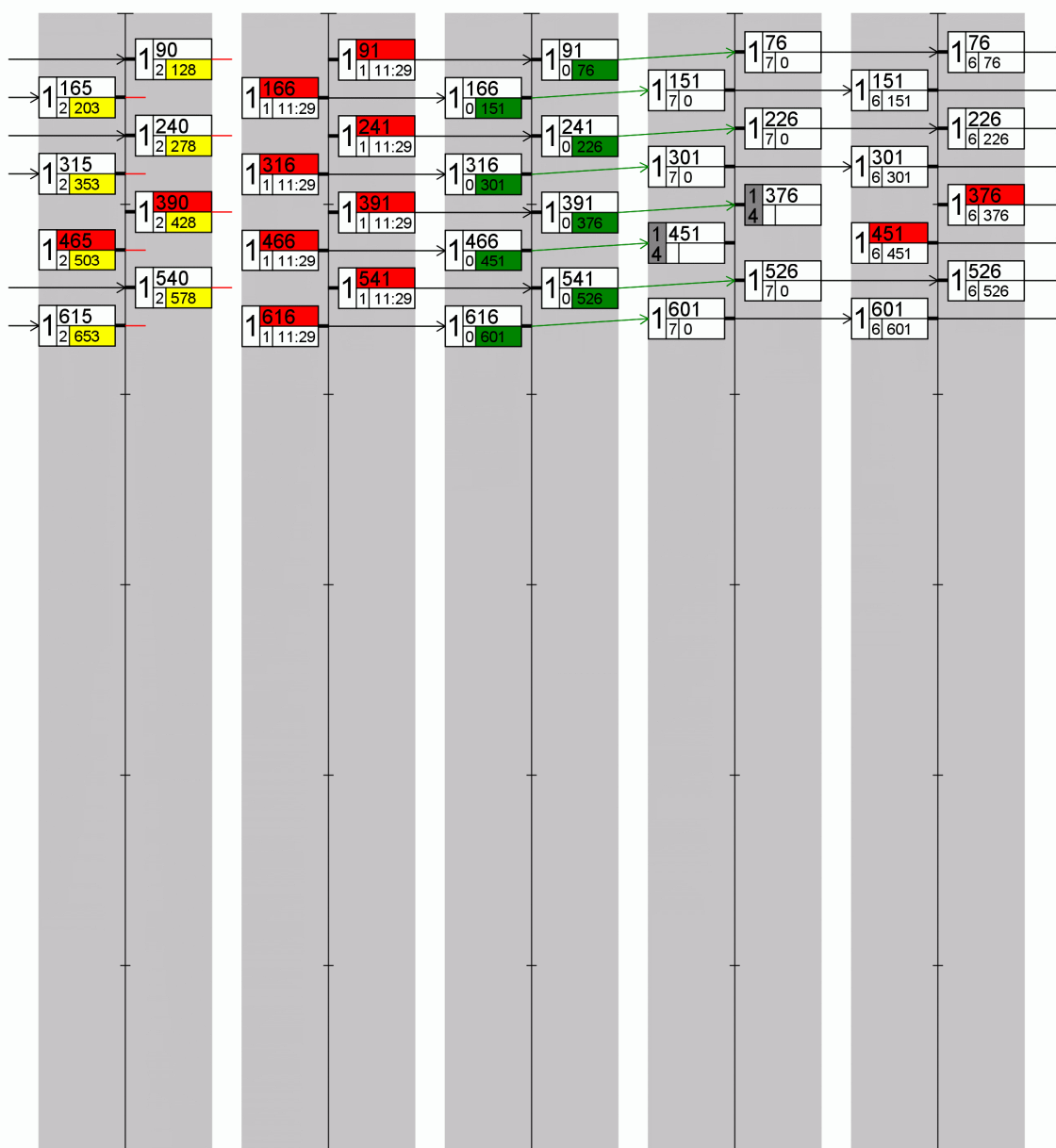
!-- 1 minute after activation of Active mode



During the first 6 minutes the SART has not yet got the correct timing from the GPS module. Therefore the Slot numbers are not correct (marked yellow).

2010-04-28 Ba: Weatherdock easyRESCUE Test 8.2 Active mode with GNSS, Minute 1-15

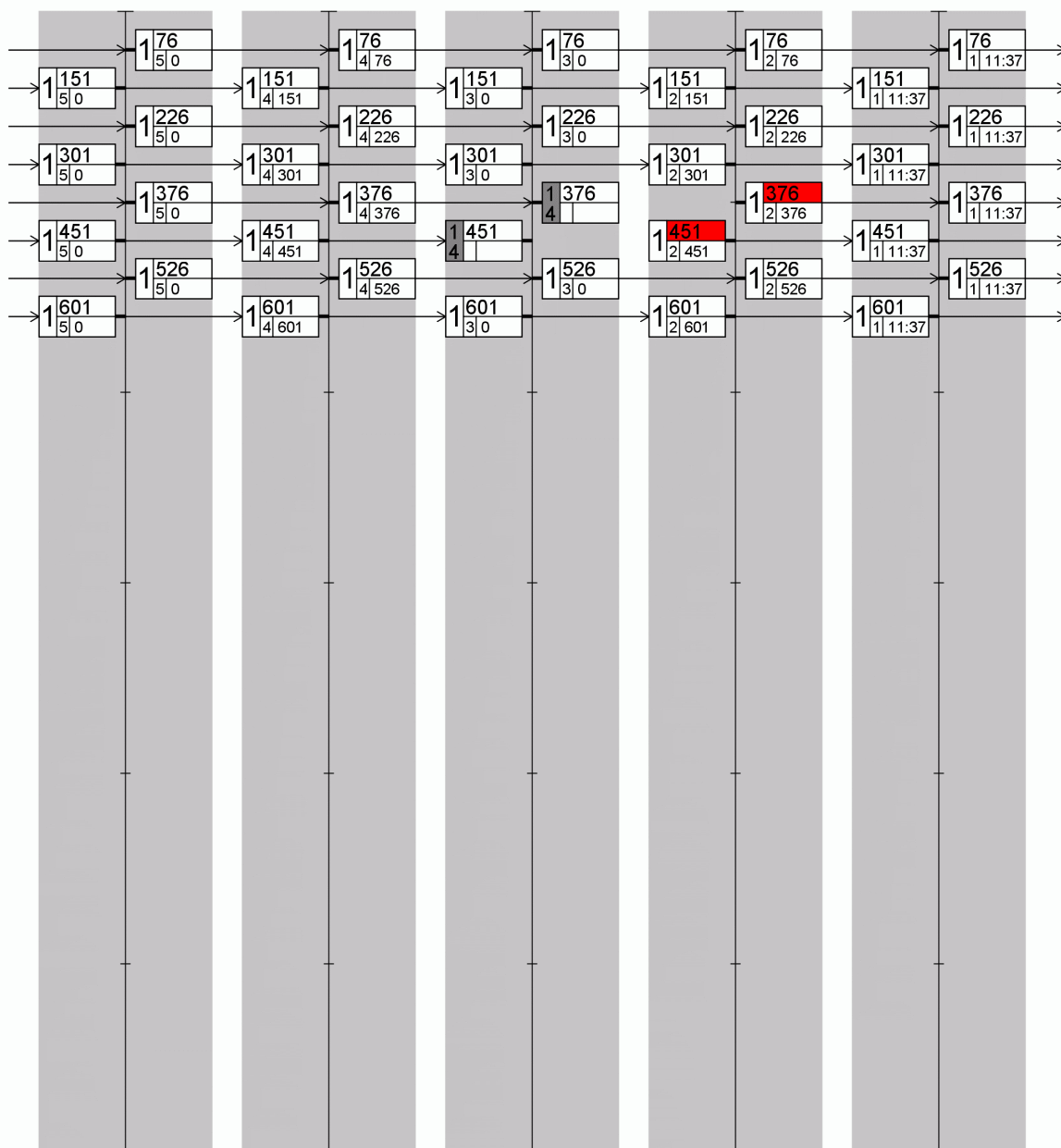
Frame 6		Frame 7		Frame 8		Frame 9		Frame 10	
2010-04-28 11:28:02		2010-04-28 11:29:02		2010-04-28 11:30:02		2010-04-28 11:31:02		2010-04-28 11:32:02	
Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B



In frame 7 the EUT gets the correct timing. Because of the correction of the in-slot timing there is a slot offset of 1, resulting in red marking of the Tx slot in the new frame. The red marking of the Tx slots in the frame after message 14 is a feature of the evaluation program. The Tx slots are correct.

2010-04-28 Ba: Weatherdock easyRESCUE Test 8.2 Active mode with GNSS, Minute 1-15

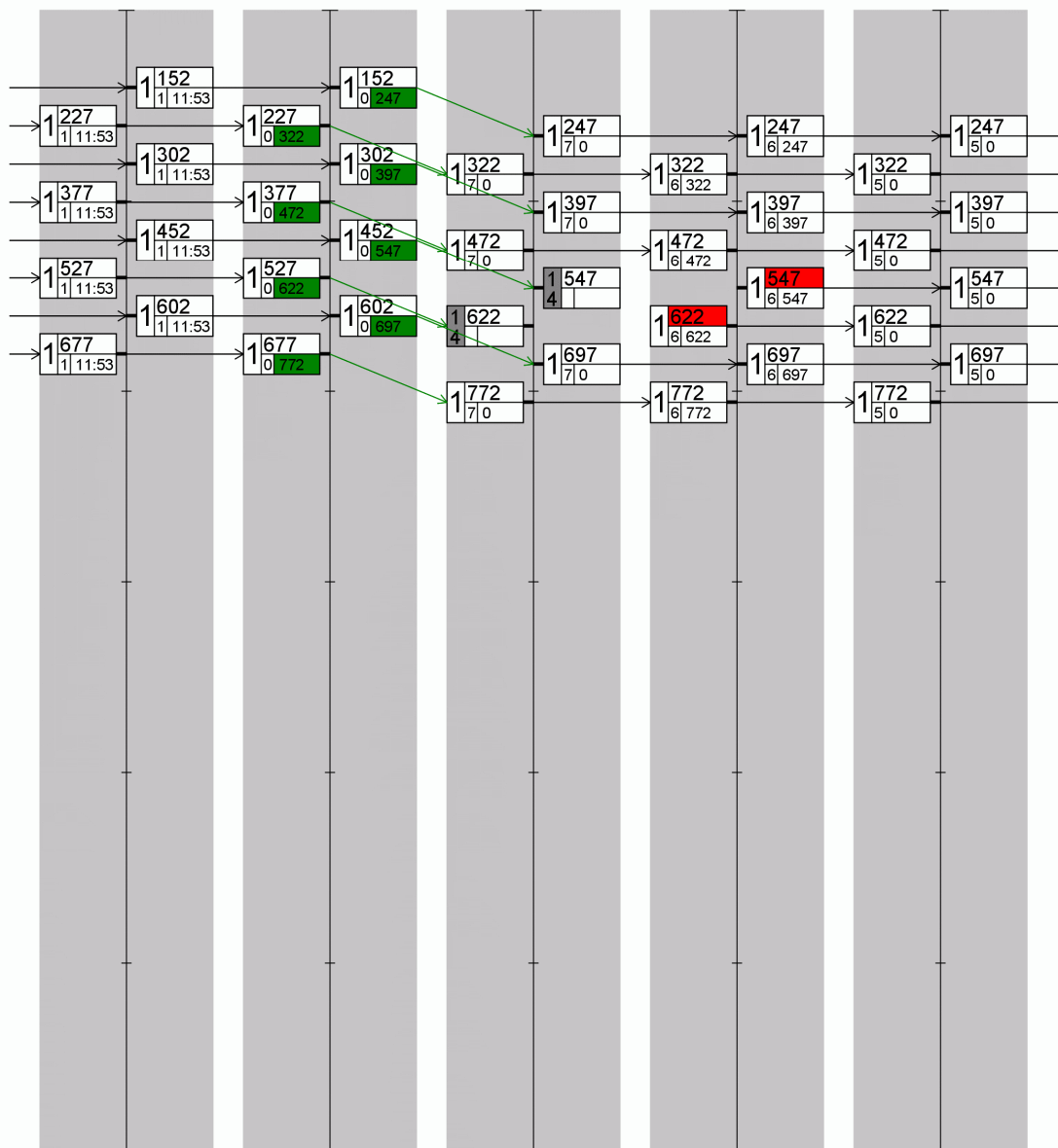
Frame 11		Frame 12		Frame 13		Frame 14		Frame 15	
2010-04-28 11:33:02		2010-04-28 11:34:02		2010-04-28 11:35:02		2010-04-28 11:36:02		2010-04-28 11:37:02	
Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B



B.2.2 Minute 30-40

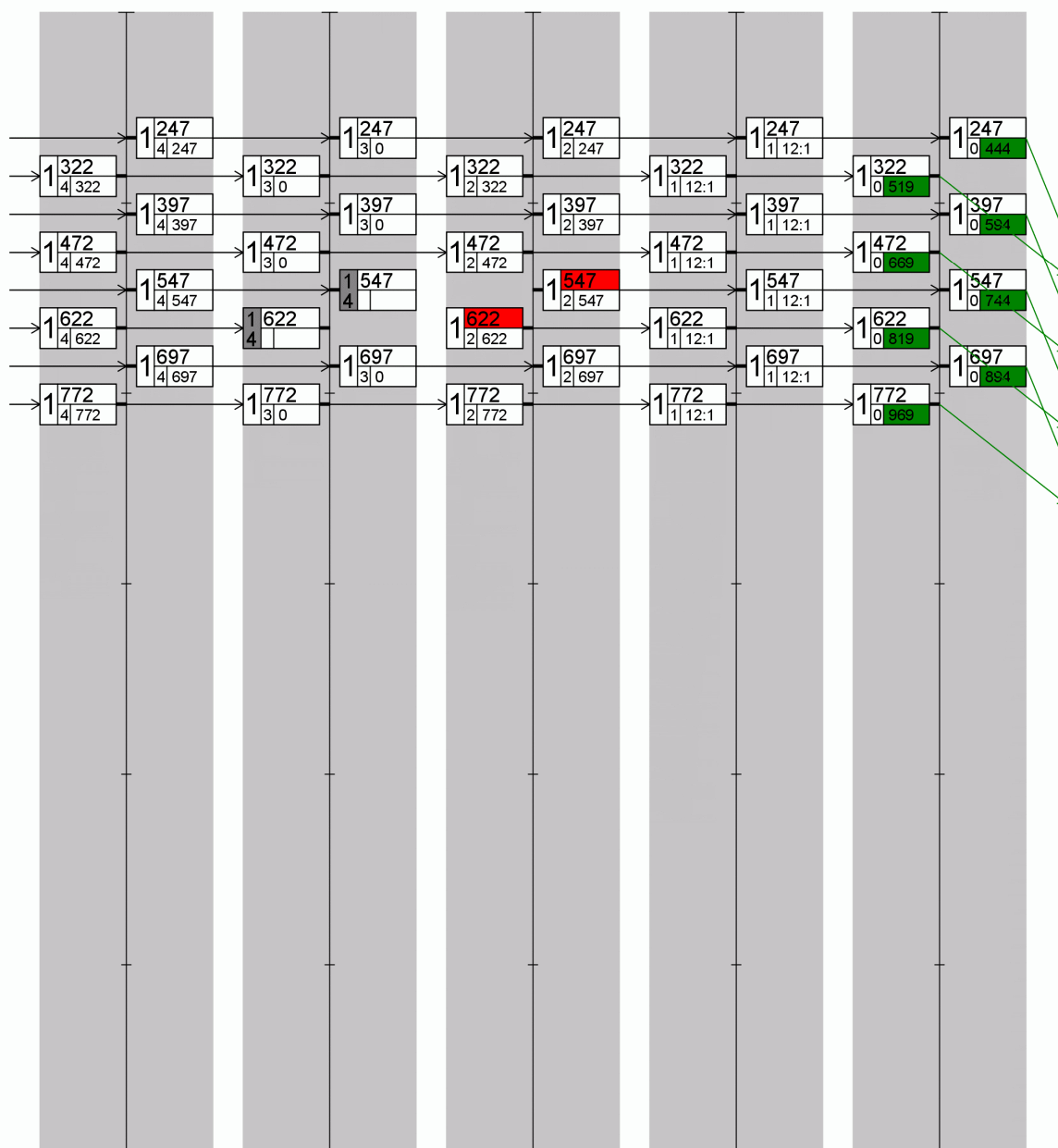
2010-04-28 Ba: Weatherdock easyRESCUE Test 8.2 Active mode with GNSS, Minute 15-40

Frame 16		Frame 17		Frame 18		Frame 19		Frame 20	
2010-04-28 11:53:04		2010-04-28 11:54:04		2010-04-28 11:55:06		2010-04-28 11:56:06		2010-04-28 11:57:06	
Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B



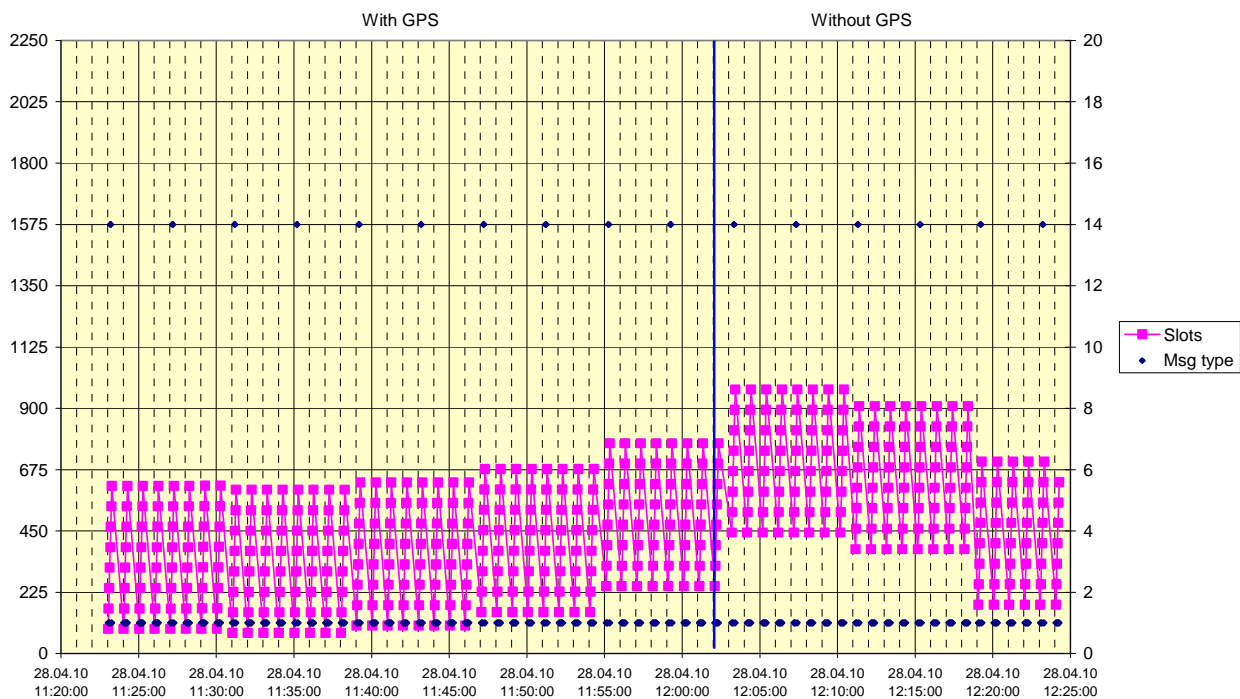
2010-04-28 Ba: Weatherdock easyRESCUE Test 8.2 Active mode with GNSS, Minute 15-40

Frame 21		Frame 22		Frame 23		Frame 24		Frame 25	
2010-04-28 11:58:06		2010-04-28 11:59:06		2010-04-28 12:00:06		2010-04-28 12:01:06		2010-04-28 12:02:06	
Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B

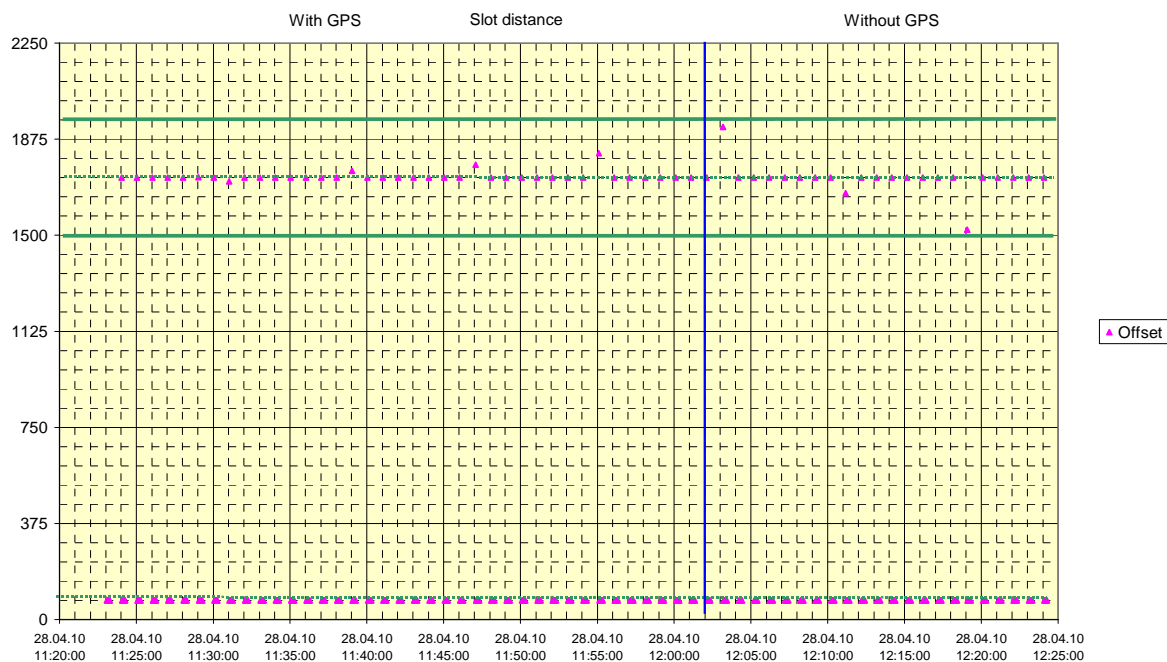


B.2.3 Slot distance

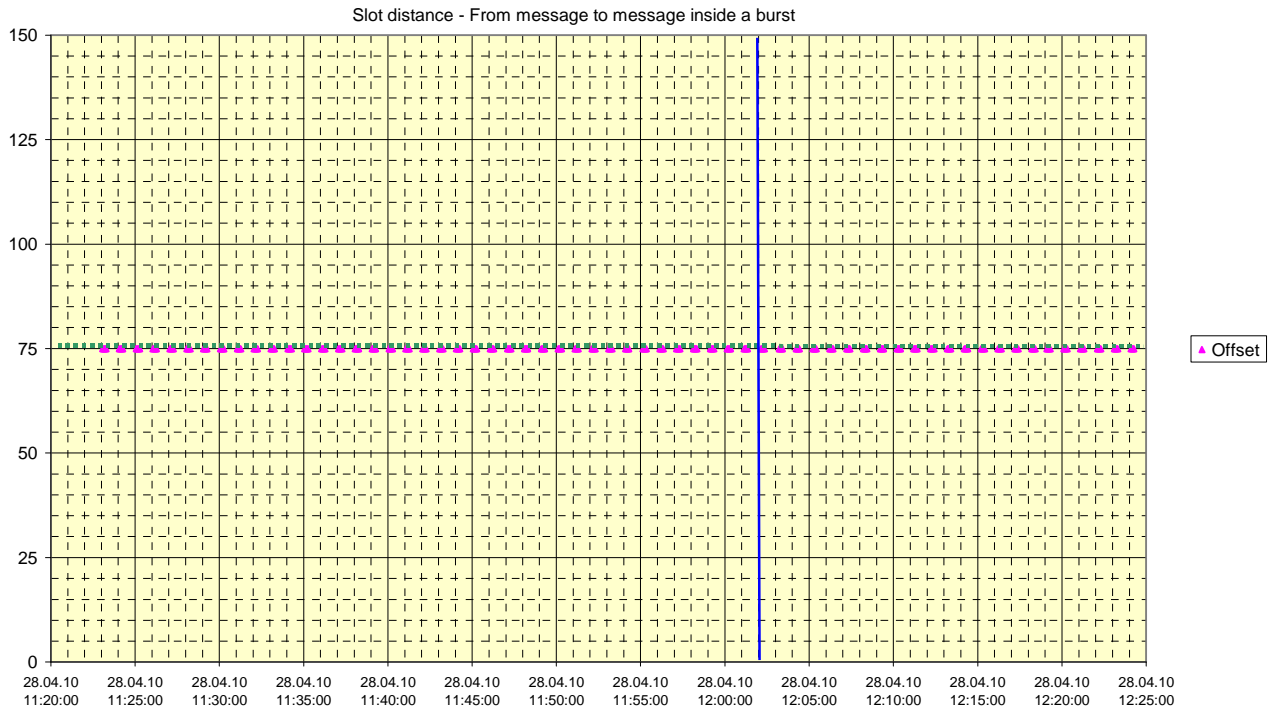
2010-04-28 Weatherdock easyRESCUE - 8.2.5 - Transmission schedule for message 1



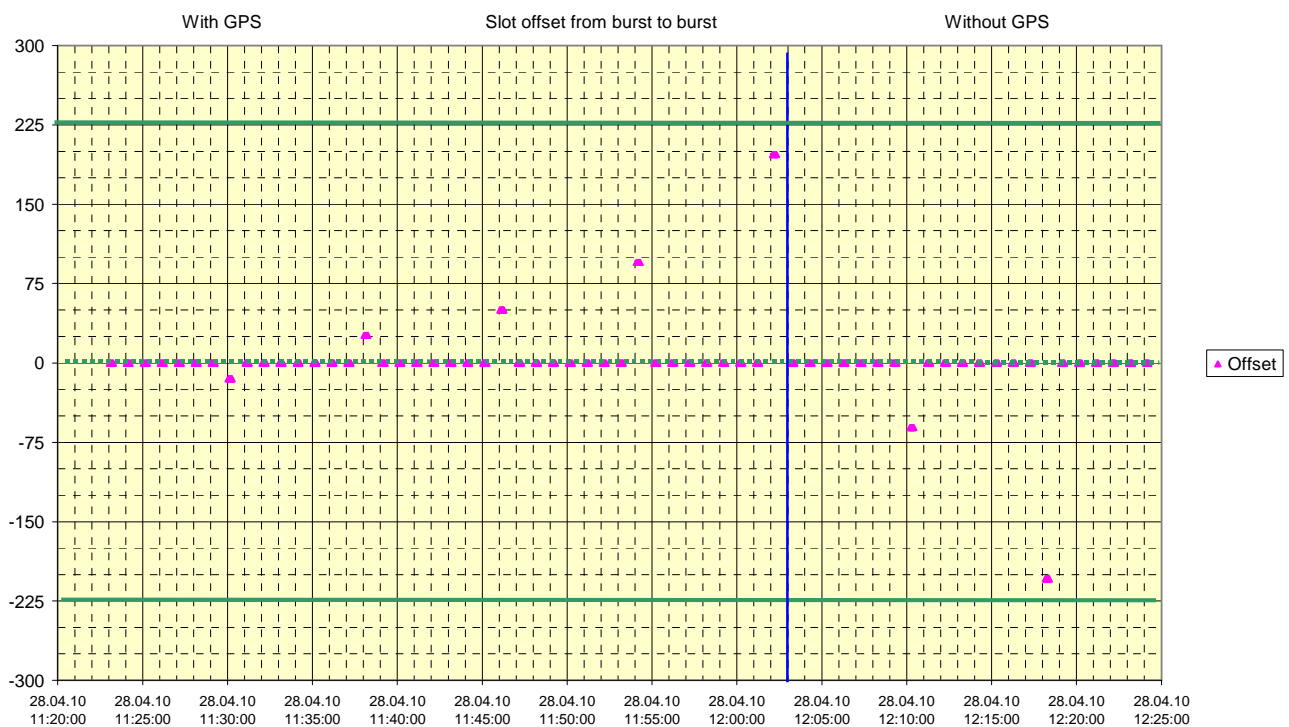
2010-04-28 Weatherdock easyRESCUE - 8.2.5 - Transmission schedule for message 1



2010-04-28 Weatherdock easyRESCUE - 8.2.5 - Transmission schedule for message 1



2010-04-28 Weatherdock easyRESCUE - 8.2.5 - Transmission schedule for message 1

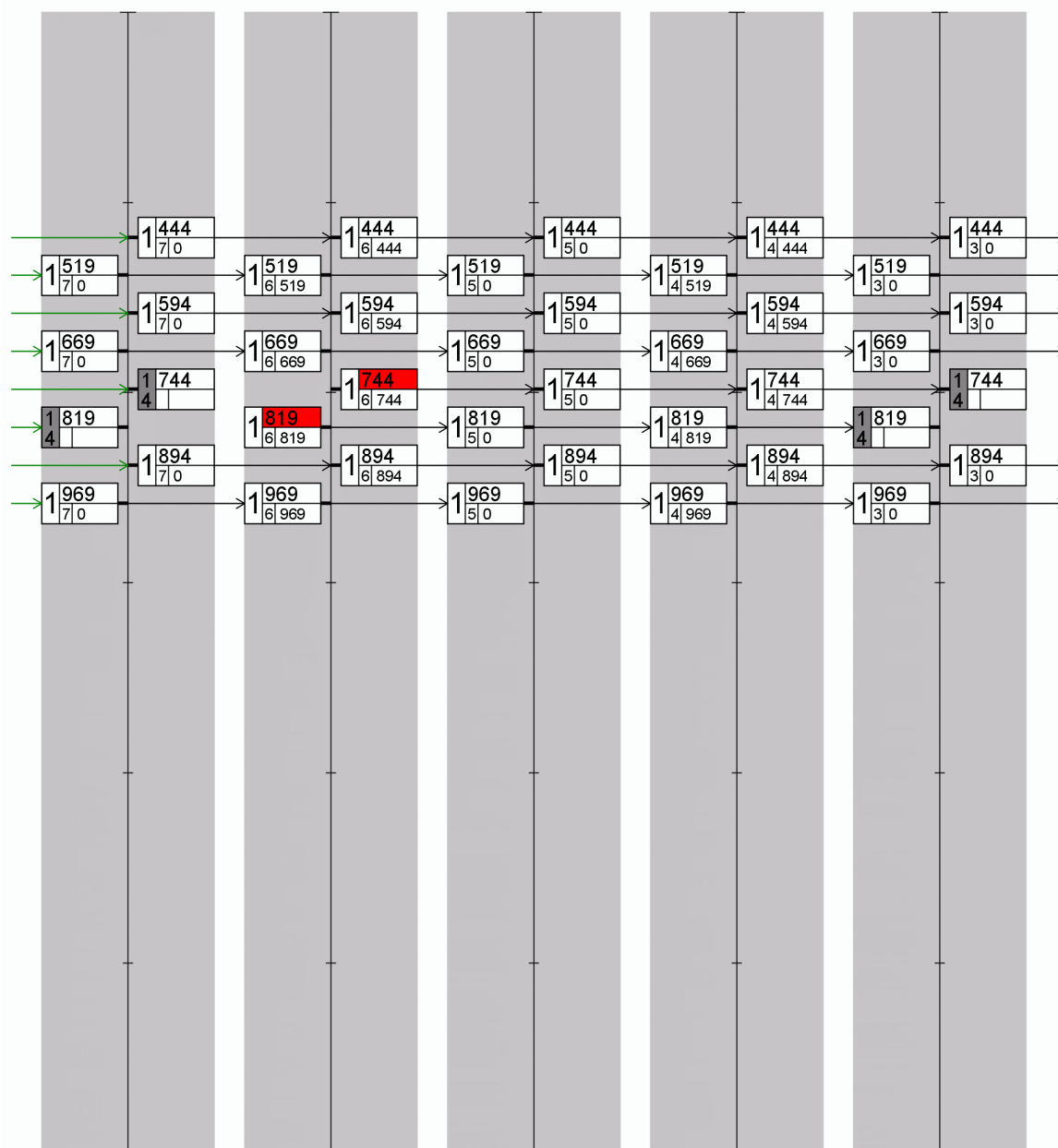


B.2.4 Minute 40-55 (no GNSS)

2010-04-28 Ba: Weatherdock easyRESCUE Test 8.2 Active mode without GNSS, Minute 40-60

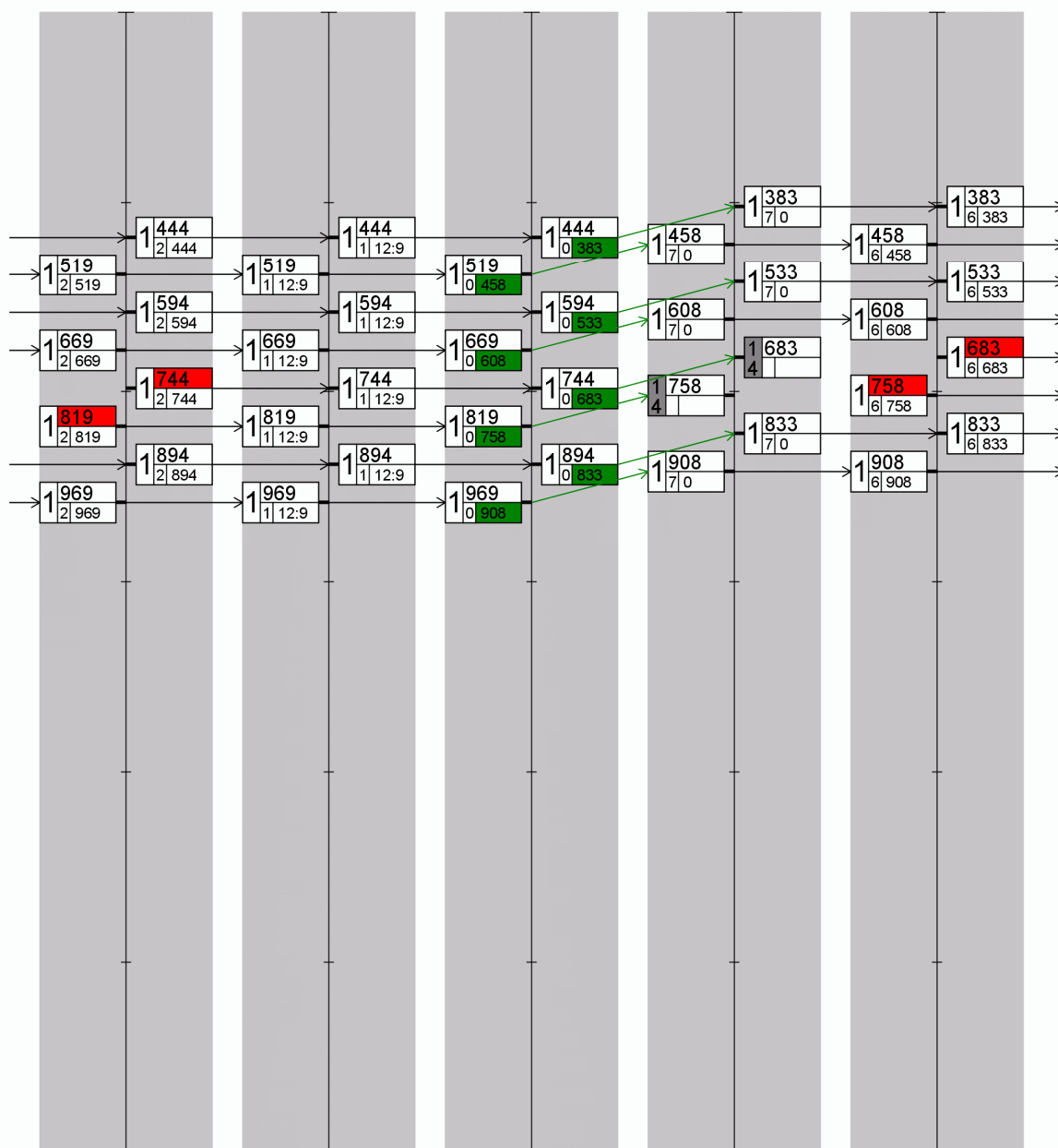
Frame 1		Frame 2		Frame 3		Frame 4		Frame 5	
2010-04-28 12:03:11		2010-04-28 12:04:11		2010-04-28 12:05:11		2010-04-28 12:06:11		2010-04-28 12:07:11	
Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B

!-- GPS signal removed



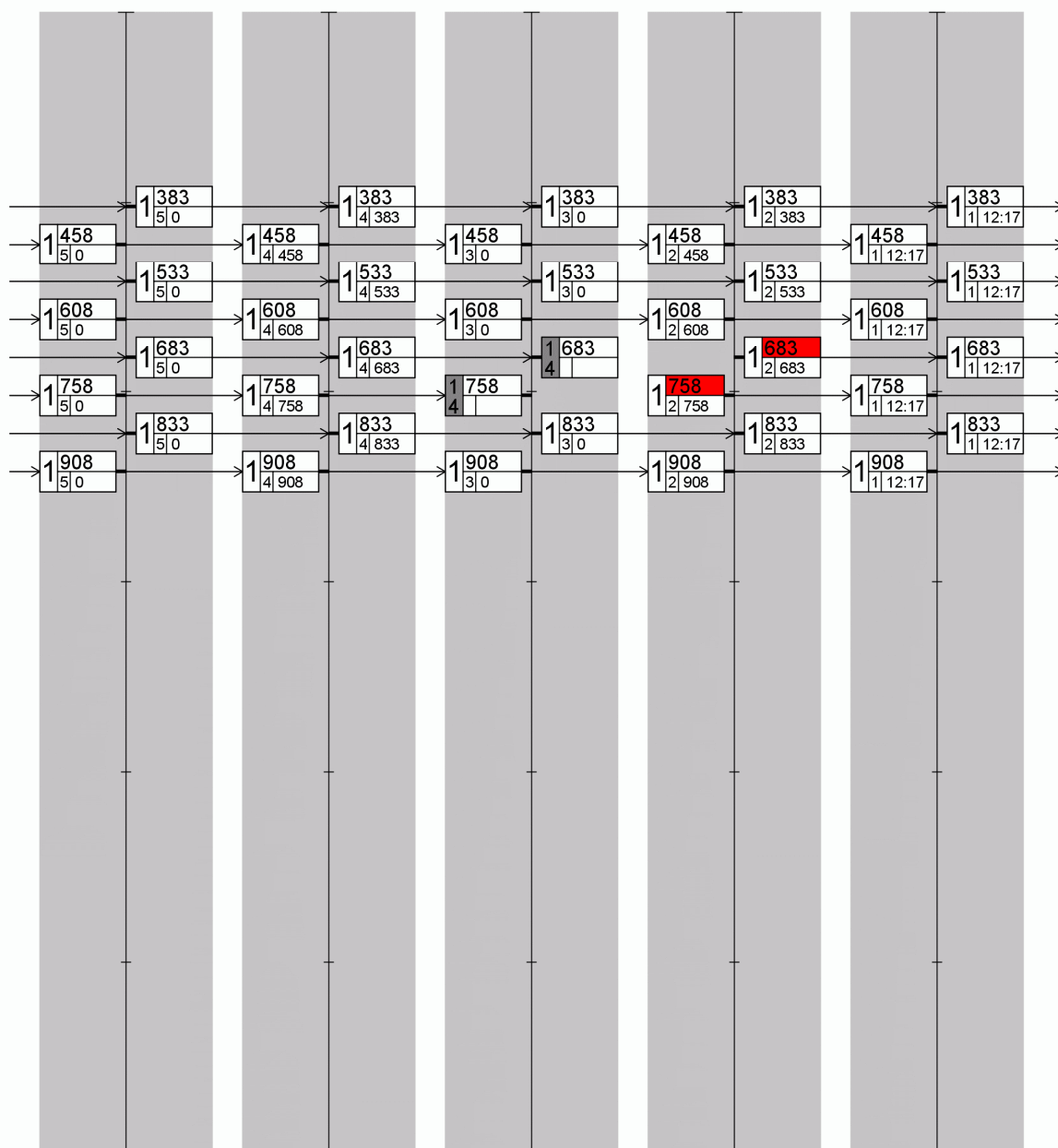
2010-04-28 Ba: Weatherdock easyRESCUE Test 8.2 Active mode without GNSS, Minute 40-60

Frame 6		Frame 7		Frame 8		Frame 9		Frame 10	
2010-04-28 12:08:11		2010-04-28 12:09:11		2010-04-28 12:10:11		2010-04-28 12:11:10		2010-04-28 12:12:10	
Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B



2010-04-28 Ba: Weatherdock easyRESCUE Test 8.2 Active mode without GNSS, Minute 40-60

Frame 11		Frame 12		Frame 13		Frame 14		Frame 15	
2010-04-28 12:13:10		2010-04-28 12:14:10		2010-04-28 12:15:10		2010-04-28 12:16:10		2010-04-28 12:17:10	
Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B



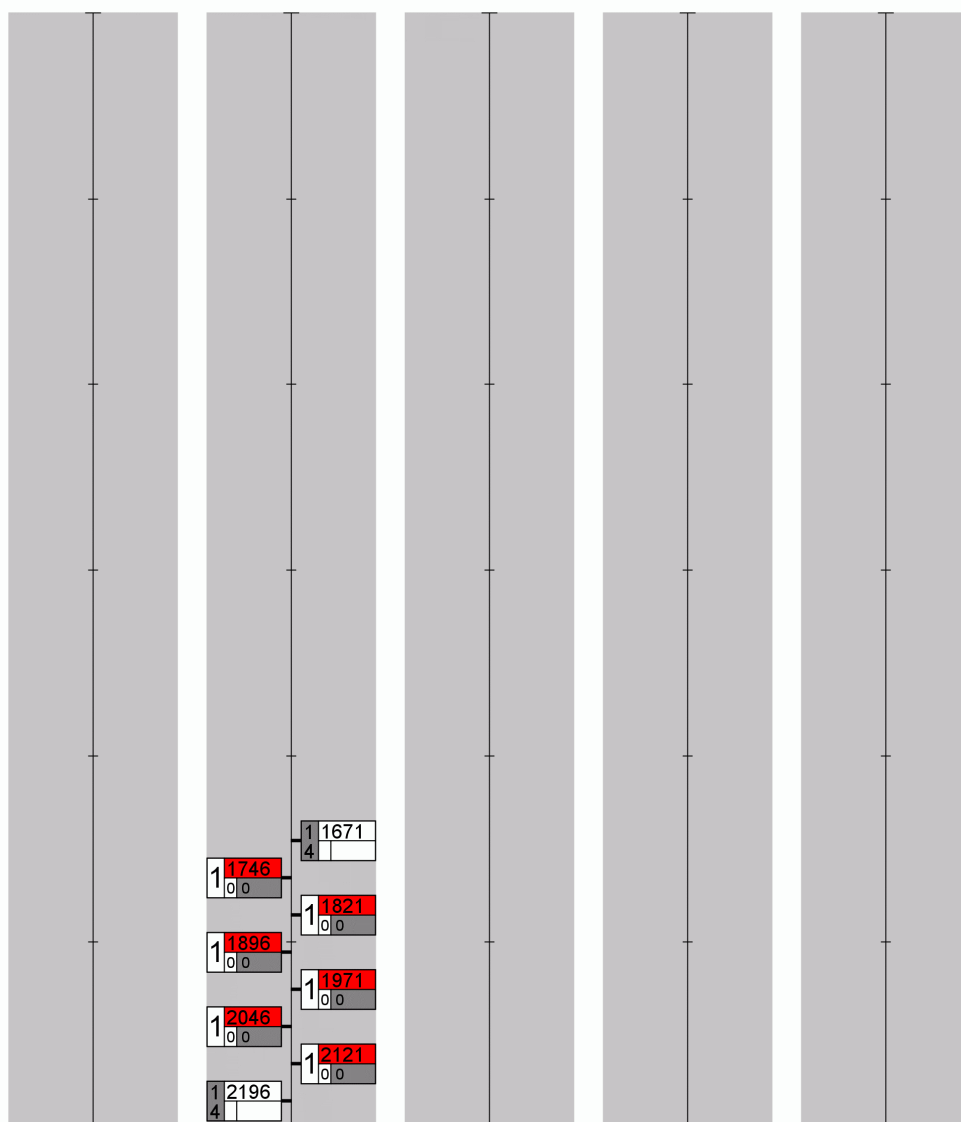
B.3 8.3 Test mode tests

B.3.1 8.3.1 Test with GNSS available

2010-04-07 Ba: Weatherdock easyRESCUE Test 8.3.1 Test mode with GNSS

Frame -4		Frame -3		Frame -2		Frame -1		Frame 1	
Channel A		Channel B		Channel A		Channel B		Channel A	

!--- Activation of test mode

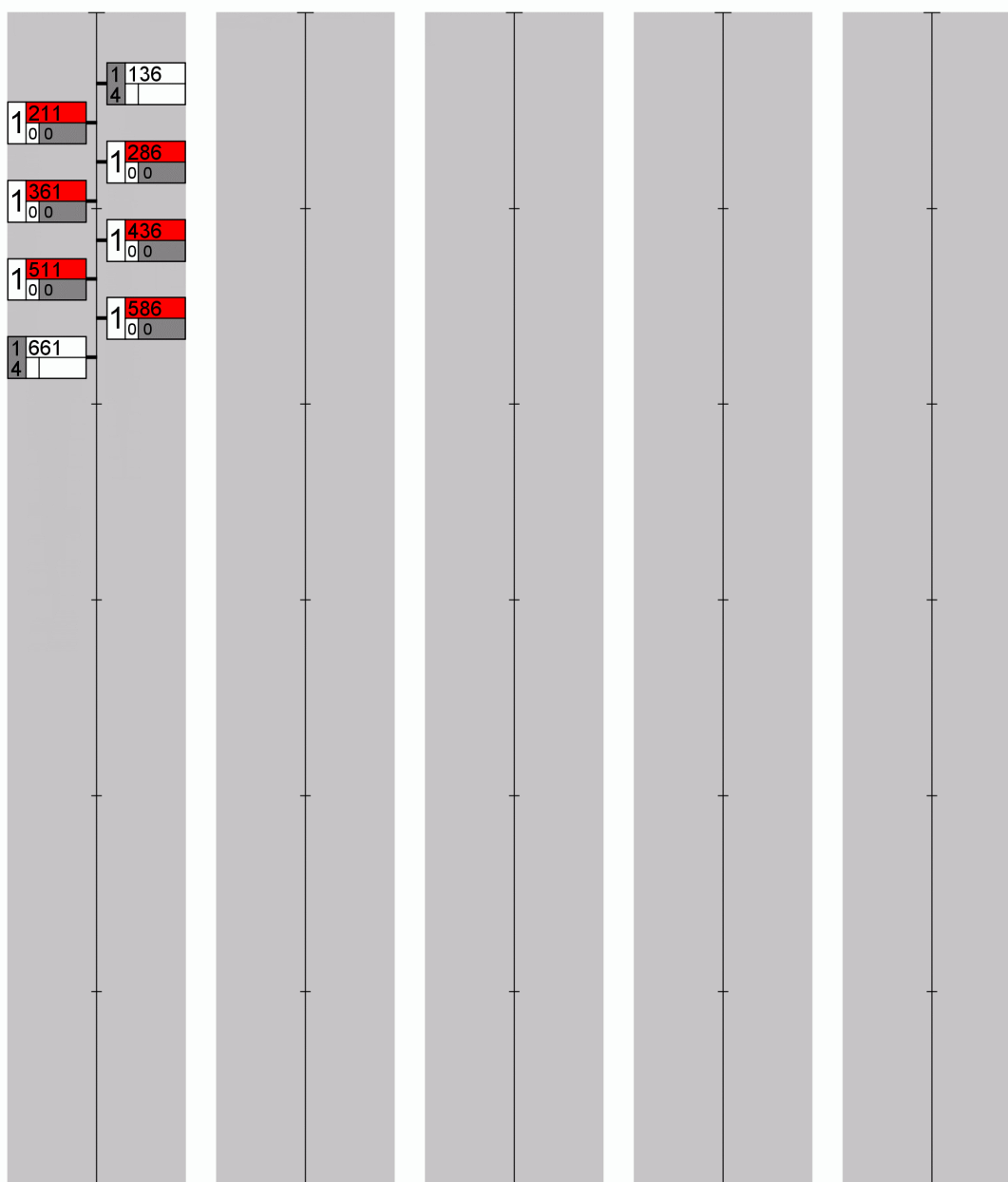


B.3.2 8.3.1 Test without GNSS available

2010-04-07 Ba: Weatherdock easyRESCUE Test 8.3.1 Test mode without GNSS

Frame 1		Frame 2		Frame 3		Frame 4		Frame 5	
2010-04-07 12:12:03									
Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B	Channel A	Channel B

!-- 15 min. after activation of test mode (11:57)



Annex C Photos of equipment under test

C.1 SART Unit



