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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 system

Equipment under test: **L3**

Type: **A1 update**

Applying test standards: IEC 61993-2 (2001) Sections 14, 16-21

Test Report No.: BSH/4612/4320357/07

Applicant: L3 Communications, Aviation recorders

6000 Fruitville road
Sarasota, FL 34240
United States

Hamburg, 16 March 2007
Federal Maritime and
Hydrographic Agency

by order

Bartels
Test engineer

by order

Preuss
head of
laboratory

nach DIN EN 17025
akkreditiertes Prüflaboratorium

Deutscher Akkreditierungs Rat

DAT-P-086/98-01

Federal Maritime and Hydrographic Agency
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Translation

Deutsche Akkreditierungsstelle Technik (DATech) e.V.
Signatory of the Multilateral Agreement of EA and ILAC for the mutual recognition

represented in the

Deutschen AkkreditierungsRat

Akkreditierung

The **German Accreditation Body Technology (DATech) e.V.** confirms that the Testing Laboratory

Federal Maritime and Hydrographic Agency
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is competent under the terms of DIN EN ISO/IEC 17025 to carry out testing in the fields

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

according to the annexed list of standards and specifications.

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

DAR-Registration No.: **DAT-P-086/98-01**

Frankfurt/Main, November 11th, 2004

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:	L3 Communications, Aviation recorders 6000 Fruitville road, Sarasota, FL 34240, United States
Equipment under test:	
Type:	A1 update
Manufacturer:	L3 Communications, Aviation recorders 6000 Fruitville road, Sarasota, FL 34240, United States
Place of test:	BSH test laboratory Hamburg, Room 916
Start of test:	20. September 2006
End of test:	20. November 2006

Test standards[1]:

IEC 61993-2 (2001)
Maritime navigation and radiocommunication equipment and systems-
Automatic Identification Systems
Part 2: Class A shipborne equipment of the Universal Automatic Identification System (AIS) – Operational and performance requirements, Methods of testing and required test results
IEC 61162-1/ -2
Maritime navigation and radiocommunication equipment and systems Digital Interfaces
Part 1: single talker and multiple listeners (2000)
Part 2: single talker and multiple listeners, high speed transmission (1998)

[1] Numbers listed in the titles of the test sections of this report refer to the respective sections of IEC 61993-2 if not stated otherwise.

Summary

Test No.	Reference	Section	Result (passed/ not passed / not applicable / not tested)
2	IEC 61993-2	14 Operational tests	Passed
3	IEC 61993-2	15 Physical tests	Not included
4	IEC 61993-2	16 Specific tests of link layer	Passed
5	IEC 61993-2	17 Specific tests of network layer	Passed
6	IEC 61993-2	18 Specific tests of transport layer	No test
7	IEC 61993-2	19 Specific presentation interface tests	Passed
8	IEC 61993-2	20 DSC functionality tests	No test
9	IEC 61993-2	21 Long range functionality tests	No test

GENERAL 4

SUMMARY 5

1 GENERAL 8

1.1 EQUIPMENT HISTORY 8
1.1.1 EUT system no 1 8
1.2 TEST ENVIRONMENT 9
1.2.1 Test environment no 1 9
1.3 COMPOSITION 9
1.4 REMARKS 10
1.5 TEST NOTES 10
1.5.1 General problems 11

2 14 OPERATIONAL TESTS 12

2.1 14.1 OPERATING MODES / CAPABILITY 12
2.1.1 14.1.1 Autonomous mode 12
2.1.1.1 14.1.1.1 Transmit Position reports 12
2.1.1.2 14.1.1.2 Receive Position reports 12
2.1.2 14.1.2 Assigned mode 13
2.2 14.4 REPORTING RATES 14
2.2.1 14.4.1 Speed and course change 14
2.3 14.6 INITIALISATION PERIOD 17
2.4 14.7 CHANNEL SELECTION 17
2.5 14.8 TRANSCEIVER PROTECTION 18
2.6 14.9 ALARMS AND INDICATORS, FALL-BACK ARRANGEMENTS 19
2.6.1 14.9.2 Monitoring of functions and integrity 19
2.6.1.1 14.9.2.1 Tx malfunction 19

3 15 PHYSICAL TESTS 21

4 16 SPECIFIC TESTS OF LINK LAYER 22

4.1 16.3 SYNCHRONISATION JITTER 22
4.2 16.6 SLOT ALLOCATION (CHANNEL ACCESS PROTOCOLS) 23
4.2.1 16.6.1 Network entry 23
4.2.2 16.6.2 Autonomous scheduled transmissions (SOTDMA) 24
4.2.3 16.6.4 Assigned operation 26
4.2.3.1 16.6.4.2 Receiving test 26

5 17 SPECIFIC TESTS OF NETWORK LAYER 29

5.1 17.1 DUAL CHANNEL OPERATION 29
5.1.1 17.1.1 Alternate transmissions 29
5.2 17.2 REGIONAL AREA DESIGNATION BY VDL MESSAGE 29
5.3 17.3 REGIONAL AREA DESIGNATION BY SERIAL MESSAGE 33
5.4 17.4 POWER SETTING 34
5.5 17.6 SLOT REUSE (LINK CONGESTION) 36

6 19 SPECIFIC PRESENTATION INTERFACE TESTS 38

6.1 19.7 HIGH SPEED OUTPUT INTERFACE PERFORMANCE 38

ANNEX A TEST EQUIPMENT 39

A.1 TEST EQUIPMENT SUMMARY 39
A.1.1 VDL analyser / generator 39
A.1.2 Target simulator 39
A.1.3 Presentation Interface Monitor 40
A.1.4 DSC Testbox 40

A.2 TEST ENVIRONMENT OVERVIEW 41

ANNEX B TEST SENTENCES 42

B.1 IEC 61162 TEST SENTENCES 42
B.1.1 Sensor input 42
B.1.2 Settings (VSD,SSD) 44
B.1.3 Messages (ABM,BBM) 44
B.1.4 Regional operational settings (ACA) 46
B.1.5 Long range requests 47
B.2 DSC SENTENCES 48

ANNEX C TEST DIAGRAMS 50

GMSK MODULATION 12.5 AND 25 KHZ BANDWIDTH 50
C.2 16.6.1 NETWORK ENTRY PHASE 51
C.3 14.4.1 REPORTING RATE BY SPEED 53
C.4 14.4.1 REPORT RATE BY HEADING 57
C.5 16.6.4.2 ASSIGNED MODE / RATE ASSIGNMENT 59
C.6 16.6.4.2 ASSIGNED MODE / SLOT ASSIGNMENT 61
C.7 17.2 TX/RX MODE 1 SINGLE CHANNEL TRANSMISSION 63
C.8 17.2 AREA ENTRY THROUGH TRANSITIONAL ZONE 65
C.9 19.7 HIGH SPEED OUTPUT PERFORMANCE 67
C.10 16.3 SYNC JITTER 68

ANNEX D PHOTOS OF EQUIPMENT UNDER TEST 69

D.1 TRANSPONDER UNIT 69

1 General

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	Protec A1		Part No.:	AISM0-100-00
Delivery date	19.09.2006		Serial number	000383263
HW Version:	Delivery date	19.09.2006	Version no	
	Installation date	19.09.2006		
SW Version:	Delivery date	19.09.2006	Version no	SW Rev. V1.6.06
	Installation date	19.09.2006		
SW Version:	Delivery date	13.11.2006	Version no	SW Rev V1.6.07 Checksums 6A85I 80BEV F67AF
	Installation date	13.11.2006		
SW Version:	Delivery date	20.11.2006	Version no	SW Rev V1.6.07 Checksums C827I 6A54V F67AF
	Installation date	20.11.2006		
SW Version:	Delivery date		Version no	
	Installation date			

MKD			
Type	Internal	Part No.:	
Delivery date		Serial number	

GPS antenna			
Type	Trimble GPS Antenna	Part No.:	41555-00
Delivery date	----	Serial number	25920058

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 (9th 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	20.09.2006	27.09.2006	Bartels
1	15.11.2006	15.11.2006	Bartels
1	20.11.2006	20.11.2006	Bartels

1.3 Composition

Minimum Keyboard and display (MKD)

☒ Internal ☐ Remote ☐ external

internal GNSS

☐ sync only ☒ backup pos. sensor

1.4 Remarks

Result marking:

Ok	Item is ok, test was successful No colour marking
NA	Not applicable
Acc	slight acceptable deviation, no change required No colour marking
Nok	Test of a required item was not successful, change required Colour marking: yellow
Rec	It is recommended to make a change. Colour marking: green
???	temporarily, has to be clarified or discussed Colour marking: yellow

Not yet tested items are marked with a blue background.

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: 30.11.05

1.5 Test notes

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

The L3 ProTec AIS A1 has already been approved in October 2003, Certificate no. 734.2/0050-1/2003.

The radio hardware of the L3 A1 has been upgraded. Therefore a few basic test which could be related to the radio hardware are performed. This is not a complete test.

1.5.1 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
21.09.06 Ba	IEC Comm error	As soon as I apply external sensor data the EUT outputs the ALR sentence 051 "IEC comm error". Retests 15.11.06 Ba: There is no ALR sentence 051 "IEC comm error" when sensor data are applied.	Ok

2 14 Operational tests

2.1 14.1 Operating modes / Capability

(4.2)

2.1.1 14.1.1 Autonomous mode

(4.2.1, M.1371 A2/3.3.5)

2.1.1.1 14.1.1.1 Transmit Position reports

Method of measurement

Set up a test environment of at least 5 test targets. Record the VDL communication and check for messages of the EUT.

Required results

Confirm that the EUT transmits continuously and that the transmitted data complies with sensor inputs.

This is a first more general check that the EUT is continuously transmitting a position report. Special tests regarding

- Reporting rate
- Message contents
- Slot use

are done in special test items.

21.09.06 Ba	Test details – Transmission of Position reports		
Test item	Check	Remark	Result
Navigation status is set to 0 (travelling using engine) Internal GNSS is in use			
MMSI	Check MMSI		Ok
Transmission rate	Check that the message 1 is transmitted continuously		Ok
Position	Check the values of lat and lon		Ok
Speed	Check the values of SOG and COG		Ok
Heading/ROT	Check that the values of heading and ROT are default		Ok

2.1.1.2 14.1.1.2 Receive Position reports

Method of measurement

Set up a test environment of at least 5 test targets.

a) Switch on Test targets, then start operation of the EUT

b) Start operation of the EUT, then switch on Test targets

Check the VDL communication and Presentation Interface outputs of the EUT.

Required results

Confirm that EUT receives continuously under conditions a) and b) and outputs the received messages via the PI.

20.09.06 Ba	Test details a)– Receive Position reports, Target first started		
Test item	Check	Remark	Result
Switch on Test targets, then start operation of the EUT Check the following items on VDM output at PI compared with the transmitted values			
MMSI	Check MMSI		Ok
Transmission rate	Check that the message 1 is received continuously		Ok
Position	Check the values of lat and lon		Ok
Speed	Check the values of SOG and COG		Ok
Heading/ROT	Check the values of heading and ROT		Ok

20.09.06 Ba	Test details b)– Receive Position reports, EUT first started		
Test item	Check	Remark	Result
Start operation of the EUT, then switch on Test targets Check the following items on VDM output at PI compared with the transmitted values			
MMSI	Check MMSI		Ok
Transmission rate	Check that the message 1 is received continuously		Ok
Position	Check the values of lat and lon		Ok
Speed	Check the values of SOG and COG		Ok
Heading/ROT	Check the values of heading and ROT		Ok

2.1.2 14.1.2 Assigned mode

(4.2.1 M.1371A2/3.3.6)

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode. Transmit an Assigned mode command msg 16 to the EUT with:

a) Slot offset and increment

b) Designated reporting rate.

Record transmitted messages..

Required results

Confirm that the EUT transmits position reports msg 2 according to defined parameters and reverts to SOTDMA msg 1 with standard reporting rate after 4 to 8 min.

This is a test on operational basis. The details of slot allocation are checked in a special test on link layer (see 4.2.3 16.6.4 Assigned operation). A record of this test can be used for evaluation of this slot allocation test point.

This test is completely covered by test 4.2.3 16.6.4 Assigned operation.

2.2 14.4 Reporting rates

(6.5.2)

2.2.1 14.4.1 Speed and course change

(6.5.2)

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode.

a) *start with own speed of 10kn; record all messages on VDL for 10min and evaluate reporting rate for position report of EUT by calculating average slot offset over test period.*

b) *Increase speed and change course (ROT > 10°/min, derived from heading) in accordance with 6.5.2 Table 1 and ITU-R M.1371 A2/4.3.*

c) *Reduce speed and rotation rate to values below those given in Table 1.*

d) *Make speed and/or heading sensor unavailable.*

For b), c), d) record all messages on VDL and check slot offset between two consecutive transmissions.

Required results

a) *Reporting rate shall comply to Table 1 (10sec ±10%).*

b) *Confirm that the new reporting rate has been established (after 2 transmissions ±20%.)*

c) *Confirm that the reporting rate is reduced after 4min (speed reduction) or 20sec (ROT reduction).*

d) *Check that with unavailable sensors the reporting rate reverts to default values (10sec if no sensor connected).*

Record the VDL data of the procedure according to the following test items, generate a table and diagram from that data and check the items using the recorded data.

21.09.06 Ba	Test details – Change of reporting rate by speed		
Test item	Check	Remark	Result
Apply simulated GLL sentence to the sensor input. Set Navigation status to 0 (under way) File name is ais01_gll_vtg_hdt_rot.sst Record the VDL data of the procedure according to the following test items, generate a table and diagram from that data and check the items using the recorded data. Change speed according to the test items and record VDL data. After each change wait until new reporting rate is clearly established. Lines are related to Excel table reprate_speed.xls			
Speed = 10 kn	Check that reporting rate is 10 s		Ok
Speed = 15 kn	Check slot allocation using msg 3 for new reporting rate		Ok
	Check that slot allocation for the new reporting rate has started after 2 transmissions	After 1 transmission	Ok
	Check that new rate is established within 1 minute		Ok
	Check that new reporting rate is 6 s		Ok
Speed = 25 kn	Check slot allocation using msg 3 for new reporting rate		Ok
	Check that slot allocation for the new reporting rate has started after 2 transmissions	After 1 transmission	Ok
	Check that new rate is established within 1 minute		Ok
	Check that new reporting rate is 2 s		Ok
Reduction of speed to Speed = 15 kn	Check slot allocation by deallocation of slots, Msg 3 not required for new reporting rate		Ok
	Check that new rate starts after 3 min and is established within 4 minutes		Ok
	Check that new reporting rate is 6 s		Ok
Reduction of speed to Speed = 10 kn	Check slot allocation using msg 3 for new reporting rate		Ok
	Check that new rate starts after 3 min and is established within 4 minutes		Ok
	Check that new reporting rate is 10 s		Ok

21.09.06 Ba	Test details – Change of reporting rate by heading		
Test item	Check	Remark	Result
Apply simulated GLL sentence to the sensor input. Set Navigation status to 0 (under way) File name is ais01_gll_vtg_hdt_rot.sst Record the VDL data of the procedure according to the following test items, generate a table and diagram from that data and check the items using the recorded data. Change speed according to the test items and record VDL data. After each change wait until new reporting rate is clearly established. Lines are related to Excel table reprate_speed.xls			
Change of heading from 359° to 0°	Check that the reporting rate is not increased		Ok
Change of heading from 0° to 359°	Check that the reporting rate is not increased		Ok
Speed = 10 kn Heading = 0	Check that reporting rate is 10 s		Ok
Speed = 10 kn Increase heading by 10 degr. steps sometimes	Check slot allocation by inserting ITDMA slots (msg 3) for new reporting rate		Ok
	Check that new rate is established immediately		Ok
	Check that new reporting rate is 3 1/3 s		Ok
Speed = 10 kn Stop Increasing heading	Check slot allocation by stopping insertion of ITDMA slots (msg 3)	Insertion of msg 3 is stopped The last message type 3 on each channel should use a slot offset of 0 to indicate the end of the chain. The last messages type 3 use an slot offset different to 0 and therefore allocate a slot which is not used. <u>Retest 15.11.06 Ba:</u> The last msg 3 terminates the chain by offset = 0	Ok Ok
	Check that new rate is established within (30 s averaging+20 s delay =) 50 s after stop of heading change		Ok
	Check that new reporting rate is 10 s again		Ok
Speed = 15 kn	Wait until speed is 6 s with msg type 1		
Speed = 15 kn Decrease heading by 10 degr. steps sometimes	Check slot allocation by inserting ITDMA slots (msg 3) for new reporting rate		Ok
	Check that new rate is established immediately		Ok
	Check that new reporting rate is 2 s		Ok

Speed = 15 kn Stop decreasing heading	Check slot allocation by stopping insertion of ITDMA slots (msg 3)		Ok
	Check that new rate is established within (30 s averaging+20 s delay =) 50 s after stop of heading change		Ok
	Check that new reporting rate is 6 s again		Ok

2.3 14.6 Initialisation period

(6.7 M.1371 A2/3.3.3)

Method of measurement

Set up standard test environment with all sensors available.

a) Switch on EUT with EUT operating in autonomous mode.

b) Switch off EUT for approx. 0.5 s. Record transmitted messages.

Required results

Confirm that the EUT starts transmissions within 2 min after switch on.

21.09.06 Ba	Test details - Initialisation period		
Test item	Check	Remark	Result
Set up standard test environment with all sensors available			
a) Switch on of EUT	Check that EUT starts transmission within 2 min	See diagram of network entry (Test 16.6.1)	Ok
b) Switch off EUT for approx. 0.5 s	Check that EUT starts transmission within 2 min		Ok

2.4 14.7 Channel selection

(6.9)

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode. Switch the EUT to different channels randomly selected from the maritime mobile band as specified by ITU-R M.1084-4, Annex 4 using both 25kHz and 12.5kHz channel spacing (incl. 12.5kHz emission on a 25kHz channel):

a) manually,

b) by transmission of channel management message (msg 22) broadcast and addressed to EUT,

c) by application of ACA sentence to the presentation interface.

d) By transmission of DSC telecommand to EUT

Record the VDL messages.

Required results

Confirm that the EUT switches to Channel / bandwidth and duplex / simplex channels accordingly.

Confirm that the EUT delivers a TXT-sentence with ID 036, followed by the ACA-sentences needed to inform of changes in the AIS use of regional operating settings.

27.09.06 Ba	Test details - Channel selection		
Test item	Check	Remark	Result
Select channels and bandwidth according to the test items in a regional area around the actual position so that is in use. The VDL analyser has to be switched to the selected channels			
a) Enter manually: 2 simplex channels 25 kHz spacing 25 kHz bandwidth	Check that channels are used		Ok
	Check bandwidth		Ok
	Check TXT output at PI		Ok
	Check ACA output at PI		Ok
b) Enter by using msg 22: 1 duplex channel 25 kHz spacing 25 kHz bandwidth	Check that channels are used		Ok
	Check bandwidth		Ok
	Check TXT output at PI		Ok
	Check ACA output at PI		Ok
c) Enter by ACA sentence: 1 duplex channel 25 kHz spacing 12.5 kHz bandwidth	Check that channels are used		Ok
	Check bandwidth		Ok
	Check TXT output at PI		Ok
	Check ACA output at PI		Ok

2.5 14.8 Transceiver protection

(6.9 ; M.1371 A2/2.14, 2.15)

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode. Open circuit and short circuit VHF-antenna terminals of the EUT for at least 60 s each.

Required results

The EUT shall be operative again within 2 min after refitting the antenna without damage to the transceiver.

This test should be done as the last test to be able to do all other tests in case of transmitter damage.

26.09.06 Ba	Test details - Transceiver protection		
Test item	Check	Remark	Result
Open circuit of VHF antenna terminal	Check that EUT starts transmission within 2 min after refitting the antenna		Ok
Short circuit of VHF antenna terminal	Check that EUT starts transmission within 2 min after refitting the antenna		Ok

2.6 14.9 Alarms and indicators, fall-back arrangements

(6.10)

2.6.1 14.9.2 Monitoring of functions and integrity

(6.10.2)

2.6.1.1 14.9.2.1 Tx malfunction

Method of measurement

Disable the transmitter by disconnecting the antenna.

Required result

Verify that an alarm sentence ALR with alarm ID 001 is sent and the relay output signals the failure state.

Verify that relay deactivates when the EUT receives an ACK and that the status field in the ALR sentence is updated.

Alternatively an ALR 001 when TX active between TX-slots is accepted; disconnecting antenna is also alarmed by ALR 002.

26.09.06 Ba	Test details - Tx malfunction		
Test item	Check	Remark	Result
Disconnect VHF antenna or: make TX active between scheduled slots (e.g. CW carrier)			
Stop of transmission	Check if transmission is stopped	Tx continous with reduced power.	Ok
ALR output	Check that ALR sentence ID 001 is output at PI	And ALR ID 002	Ok
ALR output repetition	Check that the ALR sentence is repeated with a rate of 30 s		Ok
Alarm relay	Check that alarm relay is activated		Ok
MKD display	Check that the alarm is displayed on the MKD		Ok
Send an ACK sentence	Check that alarm relay deactivated		Ok
	Check that ALR sentence is updated		Ok
	Check that alarm display on the MKD is updated	Alarms are removed from display	Ok
Reconnect VHF antenna	Check that ALR sentence is updated		Ok
	Check that alarm display on the MKD is updated		Ok

3 15 Physical tests

Physical test are not part of this test document.

Physical tests are done in a separate test.

4 16 Specific tests of Link Layer

(7.3)

4.1 16.3 Synchronisation jitter

(M.1371 A1/3.2.2.8.4)

Definition

Synchronisation jitter (transmission timing error) is the time between nominal slot start as determined by the UTC synchronisation source and the initiation of the "transmitter on" function (T_0see figure 3.2.2.10 in Rec. ITU-R M.1371-1).

Method of measurement

Set-up standard test environment. Set the EUT to 25 kHz bandwidth, max reporting rate of 2 sec and using

a) UTC direct synchronisation

b) UTC indirect synchronisation by disconnecting the GNSS antenna of the EUT.

Record VDL messages and measure the time between the nominal beginning of the slot interval and the initiation of the "transmitter on" function. Alternative methods, e.g. by evaluating the start flag and calculating back to $T_0$are allowed.

Repeat the test for 12.5 kHz bandwidth.

Required results

The synchronisation jitter shall not exceed

a) ±104 μ s using UTC direct synchronisation

b) ±312 μ s using UTC indirect synchronisation .

22.09.06 Ba	Test details - Synchronisation jitter		
Test item	Check	Remark	Result
Operate device at 25 kHz bandwidth at a reporting rate of 2 s (speed = 25 kn). C heck the slot start time T2 using the VDL analyser.			
UTC direct	Check that T2 is in the range of 3.328 ms +/- 0.108 ms The measured value of the VDL analyser (in units of 10 µs) should be in the range of 330 ... 360 (RMS, inc. Tolerance of VDL analyser)	The sync jitter is outside the limits. The timing is about 100 µs to late (see diagram) Remark: The previous A1 version also was too late but it had been accepted because it was most of the time within the limits. The D1 version nearly had the exact timing Retests 15.11.06 Ba: Sync jitter timing is ok now	Ok
UTC indirect	Check that T2 is in the range of +/- 0.312 ms compared to the T2 value of the sync source The measured value of the VDL analyser (in units of 10 µs) should be in the range of +/- 31 of the measured values of the sync source		Ok

4.2 16.6 Slot allocation (Channel access protocols)

(M.1371 A1/3.3.1)

4.2.1 16.6.1 Network entry

Method of measurement

Set up standard test environment; switch on EUT. Record transmitted scheduled position reports for the first 3 frames after initialisation period. Check CommState for channel access mode

Required results

EUT shall start autonomous transmissions of msg 3 (position report) with ITDMA CommState with KeepFlag set true for first frame and msg 1 with SOTDMA CommState for consecutive frames.

Record the VDL data of the first 12 frames after switching on the EUT, 3 frames for this test and 8 frames for test 4.2.2. Generate a table and diagram from that data and check the following test items using the recorded data.

21.09.06 Ba	Test details – Channel access protocol		
Test item	Check	Remark	Result
Switch on EUT and record data with VDL analyser. Note the switch on time in UTC			
Transmission time	Check that first transmission of position report is within 2 min after switch on		Ok
Initial message type	Check that the network entry is done with msg 3		Ok
Keep flag	Check that the keep flag is set in msg 3		Ok
Slot offsets	Check that the slot offsets of msg 3 are in the range 750 +/- 75= 675 ... 825		Ok
Slot use	Check that the allocated slots are used in the next frame		Ok
Message type	Check that the message type is changed to 1 after initial frame		Ok
Timeout	Check that the time-out in the 2nd frame is between 2 and 6 (decremented from initial 3..7)		Ok

4.2.2 16.6.2 Autonomous scheduled transmissions (SOTDMA)

(M.1371 A1/3.3.2)

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode. Record transmitted scheduled position reports msg 1 and check frame structure. Check CommState of transmitted messages for channel access mode and parameters slot timeout, slot number and slot offset

Required results

Check that nominal reporting rate is achieved ±20% (allocating slots in selection interval SI). Confirm that the EUT allocates new slots NTS within SI after 3 to 8min. Check that slot offset indicated in CommState matches slots used for transmission.

21.09.06 Ba	Test details – Autonomous scheduled transmissions (SOTDMA)		
Test item	Check	Remark	Result
Record the VDL data of 8 frames operating with autonomously scheduled transmissions. Generate a table and diagram from that data and check the following test items using the recorded data. Set the condition so that the reporting rate is 10 s.			
Reporting rate	Check that the reporting rate is 10 s, 6 msg per frame		Ok
Nominal increment and selection interval	Check that the allocated slots match the nominal and selection interval of 10 s reporting rate		Ok
Slot interval	Check that the slot intervals are in the range 375 +/- 75 = 300 ... 450		Ok
Timeout	Check that the time-out is counting from 3...7 to 0		Ok
Slots used	Check that the slots indicated in CommState match the slots used		Ok
Slots allocated at time-out 0	Check that the slots are used in the next frame		Ok
	Check the slot offset is 2250 +/- Selection Interval (2175...2325)		Ok
CommState sub message	Check that for time-out 3,5,7 the number of received stations is indicated		Ok
	Check that for time-out 2,4,6 the slot number is indicated		Ok
	Check that for time-out 1 the correct value of UTC is indicated		Ok
	Check that for time-out 0 the slot increment is indicated		Ok
Alternating channels	Check that the position reports are transmitted on alternating channels		Ok
Msg 5	Check that the channel alternating of position report is not impaired by msg 5		Ok
Others	Check the recorded data for other possibly incorrect items		Ok

4.2.3 16.6.4 Assigned operation

(M.1371 A2/3.3.6)

A fast and simple test of assigned operation has been made in paragraph 2.1.2 14.1.2 Assigned mode).

A record of the complete operation from assignment message until end of switch back to SOTDMA should be made and evaluated.

4.2.3.1 16.6.4.2 Receiving test

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode. Transmit an Assigned mode command (msg 16) to the EUT with:

- *slot offset and increment*
- *designated reporting rate.*

Record transmitted messages.

Required results

Confirm that EUT transmits position report msg 2 according to defined parameters and reverts to SOTDMA msg 1 with standard reporting rate after 4 to 8 min (ITU-R M.1371 A2/3.3.8.2.12).

21.09.06 Ba	Test details a)– Slot offset and increment		
Test item	Check	Remark	Result
Send an assignment message 16 with offset A = offset to first assigned slot = 40 and slot increment parameter = 4 (increment = 125) Within the time-out time repeat the message 16 Record VDL messages and evaluate record			
VDM output	Check VDM output of msg 16		Ok
First message	Check that first message is sent after 40 slots		Ok
Message type	Check that message type of position report is 2		Ok
Initialisation phase	Check that EUT starts immediately (after offset slots) with message 2		Ok
Deallocation of previously used slots	Check that the slot used before assignment are deallocated using timeout value = 0 and slot offset = 0		Ok
Alternating channels	Check that position report is sent alternating on channel A and B		Ok
Increment	Check that the increment is 125 slots		Ok
Timeout	Check that all slots of the first msg2 frame have the same timeout		Ok
	Check that the timeout is between 3 and 7		Ok
	Check that the timeout is decremented after 1 min		Ok
Comstate	Check that the ComState is like the ComState of msg 1		Ok
Switch back to autonomous mode	Check that the EUT deallocates all msg 2 slots with timeout 0		Ok
	Check that the EUT changes slots with timeout 0 on each channel to ITDMA slot msg 3 to start autonomous mode	EUT uses unallocated slots to start the autonomous mode reporting rate. The use of unallocated slots should be avoided as much as possible because all unallocated slots increase the danger of collision <u>Retest 15.11.06 Ba:</u> Assigned mode slots are used to start the autonomous mode reporting rate.	Ok
	Check that EUT initialises autonomous mode like network entry		Ok

21.09.06 Ba	Test details b)– Rate assignment		
Test item	Check	Remark	Result
Send an assignment message 16 with offset=reporting rate of 300msg/10 min, increment=0 Within the timeout time repeat the message 16 Record VDL messages and evaluate record			
VDM output	Check VDM output of msg 16		Ok
Initialisation phase	Check that EUT starts immediately with rescheduling to the new reporting rate		Ok
Message type	Check that message type of position report is 2 instead of msg 1		Ok
Reporting rate	Check that the reporting is 300 msg/10 min = 30msg/frame = 2 s		Ok
Alternating channels	Check that position report is sent alternating on channel A and B		Ok
Initialisation	Check that the Initialisation is according to changing reporting rate using msg 3 to allocate new slots		Ok
Timeout	Check that the assigned timeout is between 2 and 6		Ok
Assignment repetition	Check that the timeout is extended by repetition of msg 16: Switch back is between 3 and 7 minutes after last repetition		Ok
Switch back to autonomous mode	Check that the EUT reverts to normal reporting rate between 4 and 8 minutes after last msg 16	5 minutes after last msg 16	Ok

5 17 Specific tests of Network Layer

(7.4)

5.1 17.1 Dual channel operation

(M.1371 A1/4.1)

5.1.1 17.1.1 Alternate transmissions

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode on default channels AIS1, AIS2. Record transmitted scheduled position reports on both channels. Check CommState for slot allocation.

Required results

Confirm that EUT allocates slots in both channels alternating. Repeat check for data link access period.

21.09.06 Ba	Test details – Alternate transmissions		
Test item	Check	Remark	Result
Set-up EUT in autonomous mode, set report rate to 10sec with external sensor input. Record transmitted scheduled position reports on both channels. Check Comm State for slot allocation.			
Alternate transmissions	Check that the EUT transmission is alternating		Ok
Comm state	Check that the slots of each channel are allocated on the same channel		Ok
Same test on network entry (data link access period)			
Alternate transmissions	Check that the EUT transmission is alternating		Ok
Comm state	Check that the slots of each channel are allocated on the same channel		Ok

5.2 17.2 Regional area designation by VDL message

(M.1371 A1/4.1))

Method of measurement

Set-u p standard test environment and operate EUT in autonomous mode. Apply Channel management messages (msg 22) to the VDL defining two adjacent regional areas 1 and 2 with different channel assignments for both regions and a transitional zone extending 4nm either side of the regional boundary. At least one channel shall be 12.5kHz channel. Let the EUT approach region 1 from outside region 2 more than 5 nm away from region boundary transmitting on default channels. Record transmitted messages on all 6 channels.

Region	*Primary channel*	*Secondary channel*
Region 1	*CH A1*	*CH B1*
Region 2	*CH A2*	*CH B2*
Default region	*AIS 1*	*AIS 2*

Required results

Check that the EUT transmits and receives on the primary channels assigned for each region alternating channels and doubling reporting rate when passing through the transitional zones. EUT shall revert to default autonomous operation on the regional channels after leaving the transitional zones.

Item	*Area*	*Channels in use*
1	*default region*	*AIS1, AIS2*
2	*first transitional zone*	*AIS1, CH A 2*
3	*region 2*	*CH A 2, CH B 2*
4	*second transitional zone*	*CH A 2, CH A 1*
5	*region 1*	*CH A 1, CH B 1*

This Test is divided in 2 parts:

- The first part checks the general behaviour including check of ACA and TXT output, check of the borders of area an transitional zone, check of the correct frequency use.
- The second part concentrates on the slot allocation and use during a transition from one area (high sea) into another.

Main scope of this table is the correct slot allocation and use on the different channels.

22.09.06 Ba	Test details part 2 – Channel management by VDL msg 22		
Test item	Check	Remark	Result
The same area and movement is used as in test part 1.			
Item 1: In high sea area	Record 1 frame before entering the area		
	Check that channels AIS1 and AIS2 are in use		Ok
Item 2: Move position into transitional area of region 2, first frame after transition	Check that EUT continues TX on AIS1 and AIS2 for 1 frame		Ok
	Check that EUT releases the slots on AIS2 by msg 1 with time-out 0 and no slot offset	The slots of both channels AIS1 and AIS2 are released	Ok
	Check that channel AIS 1 and **A2** are used for **Rx**		Ok

Item 3: In outer transitional area of region 2, next frames after transition	Check allocation of additional slots on channel A (AIS1) using msg 3	There is a complete slot allocation	Ok
	Check complete slot allocation on channel B (A2) using msg 3		Ok
	Check that channel AIS 1 and A2 are used for Tx		Ok
	Check that channel AIS 1 and A2 are used for Rx		Ok
	Check that reporting rate is doubled		Ok
	Check that msg on AIS1 are output on PI (VDM/VDO) as channel A and A2 as channel B		Ok
Item 4: Move into inner transitional area of region 2, crossing the area border,	Check that msg on AIS1 are output on PI (VDM/VDO) as channel B and A2 as channel A (channels reverted)		Ok
Item 5: Move position into the area of region 2 (out of TZ), first frame after transition	Check that EUT continues TX on AIS1 and A2 for 1 frame		Ok
	Check that EUT releases all slots on AIS1 by msg 1 with time-out 0 and no slot offset		Ok
	Check that EUT releases every second slot on channel A2 by msg 1 (for reversion to normal reporting rate		Ok
	Check that channel A2 and **B2** are used for **Rx**		Ok
Item 6: Inside area of region 2, next frames after transition	Check allocation of Slots on channel B (B2) using msg 3		Ok
	Check that channels A2 and B2 are used for Tx		Ok
	Check that channel A2 and B2 are used for Rx		Ok
	Check that reporting rate is back to normal reporting rate		Ok
	Check that msg on A2 are output on PI (VDM/VDO) as channel A and B2 as channel B		Ok

26.09.06 Ba	Test details – Check of Tx/Rx mode		
Test item	Check	Remark	Result
Set Tx/Rx-Mode in msg 22 to 0	Check that mode is correctly stored		Ok
	Check that channel A and B are used for Tx		Ok
	Check that channel A and B are used for Rx		Ok
Set Tx/Rx- Mode in msg 22 to 1	Check that mode is correctly stored	Display: TARxAB	Ok
	Check that channel A only is used for Tx	Tx on channel A and B Retest 15.11.06 Ba: Tx on channel A and B Retest 20.11.06 Ba: Tx on channel A	Ok
	Check that channel A and B are used for Rx		Ok
	Check that the reporting rate is correct	Retest 15.11.06 Ba: Remark: The reporting rate is doubled as required for transmission on one channel, but Tx on both channels is still active	Ok
Set Tx/Rx-Mode in msg 22 to 2	Check that mode is correctly stored	Display: TBRxAB	Ok
	Check that channel B only is used for Tx	Tx on channel A and B Retest 15.11.06 Ba: Tx on channel A and B Retest 20.11.06 Ba: Tx on channel B	Ok
	Check that channel A and B are used for Rx		Ok

5.3 17.3 Regional area designation by serial message

(M.1371 A1/4.1.3)

Repeat test 17.2 using ACA serial message for channel assignment.

26.09.06 Ba	Test details – Check of Tx/Rx mode		
Test item	Check	Remark	Result
Set Tx/Rx-Mode to 0	Check that mode is correctly stored		Ok
	Check that channel A and B are used for Tx		Ok
	Check that channel A and B are used for Rx		Ok
Set Tx/Rx-Mode to 1	Check that mode is correctly stored		Ok
	Check that channel A only is used for Tx	Tx on channel A and B Retest 15.11.06 Ba: Tx on channel A and B Retest 20.11.06 Ba: Tx on channel A	Ok
	Check that channel A and B are used for Rx		Ok
	Check that the reporting rate is correct	Retest 15.11.06 Ba: Remark: The reporting rate is doubled as required for transmission on one channel only, but Tx on both channels is still active	Ok
Set Tx/Rx-Mode to 2	Check that mode is correctly stored		Ok
	Check that channel B only is used for Tx	Tx on channel A and B Retest 15.11.06 Ba: Tx on channel A and B Retest 20.11.06 Ba: Tx on channel B	Ok
	Check that channel A and B are used for Rx		Ok
	Check that the reporting rate is correct	Retest 15.11.06 Ba: Remark: The reporting rate is doubled as required for transmission on one channel only, but Tx on both channels is still active	Ok

Set Tx/Rx-Mode to 3	Check that mode is correctly stored	See Note)	Ok
	Check that EUT is not transmitting	Tx on channel A and B See Note) Retest 15.11.06 Ba: Remark: The reporting rate is doubled as required for transmission on one channel only, but Tx is still active Retest 20.11.06 Ba: No Tx	Ok
	Check that channel A and B are used for Rx		Ok

Note: It is not clearly defined if Tx/Rx mode has to be implemented. If it is not implemented the EUT should refuse the area setting command and keep the Tx/Rx mode on 0. If it accepts and stores the Tx/Rx mode 3 it should implement the mode.

5.4 17.4 Power setting

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode. Transmit channel management message (msg 22) defining output power high/low.

Repeat test using ACA and manual input.

Required result

Check that EUT sets output power as defined.

26.09.06 Ba	Test details – Power setting by msg 22		
Test item	Check	Remark	Result
The EUT has to be in an area with regional operating settings and the channels as used in the following msg 22. Transmit a msg 22 from VDL generator like the following: 22,0,2345,0,2086,1086,0,1,[MMSI(MSB)],[MMSI(LSB)],1,0,0,,0			
Channel switch	Check that the EUT doesn't switch channels		Ok
Power low	Check that the transmitting power is changed from high to low		Ok
MKD	Check the low power settings are displayed on MKD	MKD displays high level Retest 15.11.06 Ba: MKD displays low level	Ok
Transmit the same message 22, but power setting to 0 = high power			
Power high	Check that EUT reverts to high power		Ok

26.09.06 Ba	Test details – Power setting by ACA		
Test item	Check	Remark	Result
Apply the following message at PI: File name = AIACA_region_in_ch86.sst. Set power flag to 1 = low power and channels to actually used channels			
Power low	Check that the transmitting power is changed from high to low		Ok
MKD	Check the low power settings are displayed on MKD	MKD displays high level Retest 15.11.06 Ba: MKD displays low level	Nok
Transmit the same ACA sentence, but power setting to 0 = high power			
Power high	Check that EUT reverts to high power		Ok
	Check the low power settings are displayed on MKD	MKD displays low level Retest 15.11.06 Ba: MKD displays high level	Ok

26.09.06 Ba	Test details – Power setting by manual input		
Test item	Check	Remark	Result
Set the power level of the region in use to low power, Don't change the channels			
Power low	Check that the transmitting power is changed from high to low	When setting power level on MKD to "L" the output power is set to high power Retest 15.11.06 Ba: Tx is set to low power	Ok
Set power level back to high power.			
Power high	Check that EUT reverts to high power	When setting power level on MKD to "HL" the output power is set to high power Retest 15.11.06 Ba: Tx is set to high power	OK

5.5 17.6 Slot reuse (link congestion)

(M.1371 A1/4.4)

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode. Transmit a Data Link Management message (msg 20) to the EUT with slot offset and increment to allocate slots for a base station. Assure that at test receiver location the signal level received from EUT exceeds the signal level received from test transmitter. Record transmitted messages and check frame structure. Set up additional test targets to simulate a VDL load of >90% until slot reuse by EUT is observed.

Required results

Check that the nominal reporting rate for Position Report msg 1 is achieved ±10% (allocating slots in selection interval SI) under link congestion conditions. Confirm that the slot occupied by the most distant station (within selection interval) is used by the slot reuse algorithm.

Check that a station is not subject to slot reuse more than once a frame. Check that slots allocated by a local base station are not subject to slot reuse.

Used test procedure:

In one frame 3 blocks of 60 targets are transmitted in consecutive slot. The 3 blocks start at slot 1, 751 and 1501.

The EUT is set to 2 s reporting rate to increase the probability that the relevant selection intervals are completely covered by targets..

The grey area is covered by targets, the red area is the selection interval of 15 slots.

The targets are numbered from 1 to 60 and transmitted in the order of the IDs. They are divided into 2 groups:

- The even numbered targets have a low distance (1..2 Nm),
- the odd numbered targets have a high distance to the EUT (about 30 Nm)

This test have to be run for at minimum 30 minutes to observe a sufficient number of slot allocations (every 3-8 min). The selected slots of the selection intervals covered by targets have to be checked.

26.09.06 Ba	Test details – Slot reuse		
Test item	Check	Remark	Result
This test can be done as described before.			
Reporting rate, use of selection interval	Check that the slots are selected within the SI		Ok
Slot reuse	Check that only the slots of odd numbered targets are used	Several times the target 18 has been reused I have checked the position and the range display on the MKD: the range was about 1 NM, the range of the distant targets is more than 30 NM I have also checked that the target 18 has been received in the previous frames (see extract from PI output log). Retest 15.11.06 Ba: Only slots of distant targets are reused	Ok
	Check that a the slot of a target is not used twice in a frame	Sometimes distant targets are reused twice in a frame See markings in the Excel sheet Retest 15.11.06 Ba: No targets are re-used more than once in a frame, considering the msg time-out.	Ok

6 19 Specific Presentation Interface Tests

(7.6)

6.1 19.7 High speed output Interface performance

(7.6.3)

Method of measurement

Set-up standard test environment and operate EUT in autonomous mode. Increase the VDL load to >90%. Record transmitted messages and check PI output of EUT on port for "external Display" and "auxiliary Display".

Required results

Confirm that EUT outputs all received messages to the PI. Repeat test for port "auxiliary display".

Date	Result	Status
21.09.06 Ba	Output performance: Channel A = 100%, channel B = 98,6 % Remark: This is nearly the same result as for the previous version of the A1 with some missing messages on channel B.	Ok

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 3544 SW NewMoni V2.1
4	DSC Testbox	DEBEG 3817 DEBEG 6348	S/N 475533
	Auxiliaries:		
5	Digital Multimeter	Voltcraft	S/N 1010365036
6	Fluke Scopemeter	123	BSH 101275/2001
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 it's 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 Testbox

The DSC test box includes:

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

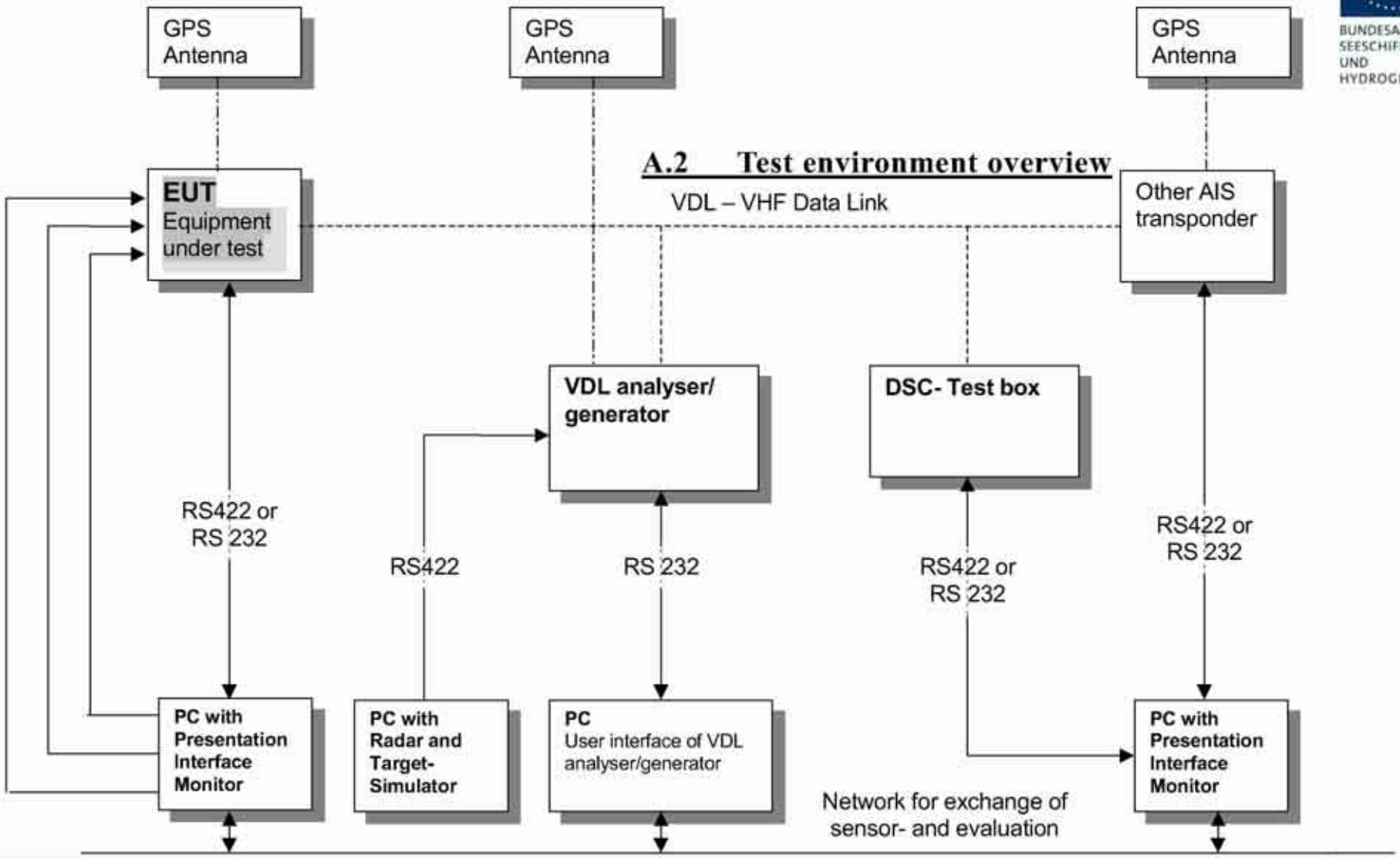
The software modification of the DSC controller comprises a remote control input/output facility

- 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

A.2 Test environment overview



Annex B Test sentences

B.1 IEC 61162 test sentences

Many of the test sentences are modified manually during the test according to the requirements of the actual test items.
Mainly the MMSI in all addressed sentences are adapted to the actual MMSI of the EUT or of the unit the EUT communicates with.
In addition the files containing these sentences contain also some control information used by the monitor program like:

<UTC>	is replaced by the actual UTC time at time of output
<WAIT EVENT>	waiting for user action before next output
<WAIT xxxx>	waiting xxx ms before next output

This control information is not shown in the following sentence examples because it is not sent to the EUT.

B.1.1 Sensor input

Sensor input sentences	
File name	Description
Sentences	
AIS01_gll_vtg_hdt_rot.sst	Standard sensor input sentences
$GPGLL,5330.1234,N,01001.2345,E,141800.00,A,A $GPVTG,350.0,T,,M,10.0,N,,K,A $TIHDT,359.9,T $TIROT,0.0,A	
AIS01d_dtm_gll_vtg_hdt_rot.sst	Standard sensor input with DTM
Similar files with an additional DTM sentence are also available for the other position sentence sets and not listed explicitely	
$GPDTM,w84,,,,,,P90 $GPGLL,5330.1234,N,01001.2345,E,141800.00,A,A $GPVTG,350.0,T,,M,10.0,N,,K,A $TIHDT,359.9,T $TIROT,0.0,A	
AIS01g_gll_vtg_gbs_hdt_rot.sst	Standard sensor input with GBS sentence
$GPGLL,5330.1234,N,01001.2345,E,141800.00,A,A $GPVTG,350.0,T,,M,10.0,N,,K,A $GPGBS,141800.00,2.6,2.8,4.2,,,, $TIHDT,359.9,T $TIROT,0.0,A	
AIS01x_gll_vtg_hdt_rot_180.sst	Standard sensor input at Longitude of 180°

$GPGLL,0001.00,N,17959.00,W,141800.00,A,A $GPVTG,350.0,T,,M,10.0,N,,K,A $TIHDT,359.9,T $TIROT,0.0,A	
AIS02_gga_vtg_hdt_rot.sst	Sensor Input set with GGA position
$GPGGA,092854,5330.1234,N,01001.2345,E,1,3,1.2,65.2,M,45.1,M,, $GPVTG,350.0,T,,M,10.0,N,,K,A $TIHDT,359.9,T $TIROT,0.0,A	
AIS02d_dtm_gga_vtg_hdt_rot.sst	Sensor Input set with GGA position and DTM
$GPDTM,999,,,,,,,P90 $GPGGA,092854,5330.1234,N,01001.2345,E,1,3,1.2,65.2,M,45.1,M,, $GPVTG,350.0,T,,M,10.0,N,,K,A $TIHDT,359.9,T $TIROT,0.0,A	
AIS03_gns_vtg_hdt_rot.sst	Sensor input set with GNS position
$GNGNS,122500.00,5330.1234,N,01001.2345,E,AA,5,1.2,35.5,41.1,, $GNVTG,350.0,T,,M,10.0,N,,K,A $TIHDT,359.9,T $TIROT,0.0,A	
AIS04_rmc_hdt_rot.sst	Sensor input set with RMC position and speed
$GPRMC,122500.00,A,5330.1234,N,01001.2345,E,11.2,352.2,120202,2.0,E,A $TIHDT,359.9,T $TIROT,0.0,A	
AIS06_gll_vtg_vbw_hdt_rot.sst	Sensor input set with speed by VBW and VTG
$GPGLL,5330.1234,N,01001.2345,E,141800.00,A,A $GPVTG,350.0,T,,M,10.0,N,,K,A $VDVBW,11.00,01.00,A,12.00,02.00,A,,V,,V $TIHDT,359.9,T $TIROT,0.0,A	
AIS07_osd.sst	Single OSD sentence
$INOSD,359.9,A,5.2,B,12.6,B,150.0,1.2,N	
AIS08_gll_vbw_hdt_rot.sst	Standard sensor input with VBW instead of VTG
$GPGLL,5330.1234,N,01001.2345,E,141800.00,A,A $VDVBW,11.00,01.00,A,12.00,02.00,A,,V,,V $TIHDT,359.9,T $TIROT,0.0,A	
AIS09_gll_osd.sst	Sensor input set with GLL and OSD
$GPGLL,5330.1234,N,01001.2345,E,141800.00,A,A $INOSD,359.9,A,5.2,B,12.6,B,150.0,1.2,N	
AIS10_gll_vtg.sst	GPS receiver sentences (GLL and VTG)
$GPGLL,5330.1234,N,01001.2345,E,141800.00,A,A $GPVTG,350.0,T,,M,10.0,N,,K,A	
AIS11_vbw.sst	Log sentence VBW
$VDVBW,11.00,01.00,A,12.00,02.00,A,,V,,V	
AIS12_hdt_rot.sst	Gyro sentences (HDT and ROT)
$TIHDT,359.9,T $TIROT,0.0,A	

B.1.2 Settings (VSD,SSD)

Settings (VSD,SSD)	
File name	Description
Sentences	
AISSD_transpondertype.sst	Settings of static data, specific set for each transponder type
`$AISSD,callsign,name,100,20,15,10,1,GP`	
AIVSD_Hamburg.sst	Settings of voyage related data
`$AIVSD,51,11.5,26,HAMBURG,131020,20,05,0,0`	

B.1.3 Messages (ABM,BBM)

The addressed messages include a MMSI number which is changed according to the actual MMSI number of the EUT

Messages (ABM,BBM)	
File name	Description
Sentences	
AIABM_bin.sst	Standard addressed binary message
`!AIABM,1,1,2,000001005,1,6,06P0test,0`	
AIABM_safety.sst	Standard addressed safety related message
`!AIABM,1,1,2,000001005,1,12,D5CD,0`	
AIABM_4_bin.sst	Set of 4 addressed binary messages

`!AIABM,1,1,3,000008001,1,6,06P0test,0`
`!AIABM,1,1,0,000008001,2,6,06P0test,0`
`!AIABM,1,1,1,000008001,1,6,06P0test,0`
`!AIABM,1,1,2,000008001,2,6,06P0test,0`	

AIABM_4_safety.sst	Set of 4 addressed safety related messages

`!AIABM,1,1,0,000001005,1,12,D5CD,0`
`!AIABM,1,1,1,000001005,1,12,D5CD,0`
`!AIABM,1,1,2,000001005,1,12,D5CD,0`
`!AIABM,1,1,3,000001005,1,12,D5CD,0`	

AIBBM_bin.sst	Standard binary broadcast message
`!AIBBM,1,1,6,1,8,06P0test,0`	
AIBBM_safety.sst	Standard safety related broadcast message
`!AIBBM,1,1,6,1,14,D5CD,0`	
AIBBM_5_bin.sst	Set of 5 binary broadcast messages

!AIBBM,1,1,7,0,8,06P0test1,0 !AIBBM,1,1,8,0,8,06P0test2,0 !AIBBM,1,1,9,0,8,06P0test3,0 !AIBBM,1,1,0,0,8,06P0test4,0 !AIBBM,1,1,1,0,8,06P0test5,0	
AIBBM_5_safety.sst	Set of 5 safety related broadcast messages
!AIBBM,1,1,6,0,14,D5CDi,0 !AIBBM,1,1,7,0,14,D5CDj,0 !AIBBM,1,1,8,0,14,D5CDk,0 !AIBBM,1,1,9,0,14,D5CDl,0 !AIBBM,1,1,0,0,14,D5CDm,0	
AIBBM_bin_stuffing.sst	Special message for bit stuffing test
!AIBBM,1,1,6,1,8,06Qv>khvOP,4	
AIBBM_multi_bin.sst	Long 5 slot binary broadcast message
!AIBBM,4,1,6,2,8,06P0456789012345678901234567890123456789,0 !AIBBM,4,2,6,2,8,0123456789012345678901234567890123456789,0 !AIBBM,4,3,6,2,8,0123456789012345678901234567890123456789,0 !AIBBM,4,4,6,2,8,012345678901234567890123456789012345678901,4	
AIBBM_multi_safety.sst	Long 5 slot safety related broadcast message
!AIBBM,4,1,6,2,14,0123456789012345678901234567890123456789,0 !AIBBM,4,2,6,2,14,0123456789012345678901234567890123456789,0 !AIBBM,4,3,6,2,14,0123456789012345678901234567890123456789,0 !AIBBM,4,4,6,2,14,0123456789012345678901234567890123456789,0	
AIBBM_multi_bin_1.sst	Longer than 5 slots binary broadcast message, all bits 1
!AIBBM,4,1,1,1,8,wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww,0 !AIBBM,4,2,1,1,8,wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww,0 !AIBBM,4,3,1,1,8,wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww,0 !AIBBM,4,4,1,1,8,wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww,0	
AIBBM_ABM_17_5.sst	Set of 2 long messages 8 and 12 for message priority test
!AIBBM,4,1,6,2,8,06P0456789012345678901234567890123456789,0 !AIBBM,4,2,6,2,8,0123456789012345678901234567890123456789,0 !AIBBM,4,3,6,2,8,0123456789012345678901234567890123456789,0 !AIBBM,4,4,6,2,8,0123456789012345678901234567890123456789,0 !AIABM,4,1,2,000001005,1,12,0123456789012345678901234567890123456789,0 !AIABM,4,2,2,000001005,1,12,0123456789012345678901234567890123456789,0 !AIABM,4,3,2,000001005,1,12,0123456789012345678901234567890123456789,0 !AIABM,4,4,2,000001005,1,12,0123456789012345678901234567890123456789,0	
AIBBM_25.sst	25 broadcast message to check 20 slots per frame rule

!AIBBM,1,1,6,1,8,06P0test1,0 !AIBBM,1,1,6,1,14,D5CD1,0 !AIBBM,1,1,7,1,8,06P0test2,0 !AIBBM,1,1,7,1,14,D5CD2,0 !AIBBM,1,1,8,1,8,06P0test3,0 !AIBBM,1,1,8,1,14,D5CD3,0 !AIBBM,1,1,9,1,8,06P0test4,0 !AIBBM,1,1,9,1,14,D5CD4,0 !AIBBM,1,1,0,1,8,06P0test5,0 !AIBBM,1,1,0,1,14,D5CD5,0 !AIBBM,1,1,1,1,8,06P0test6,0 !AIBBM,1,1,1,1,14,D5CD6,0 !AIBBM,1,1,2,1,8,06P0test7,0 !AIBBM,1,1,2,1,14,D5CD7,0 !AIBBM,1,1,3,1,8,06P0test8,0 !AIBBM,1,1,3,1,14,D5CD8,0 !AIBBM,1,1,4,1,8,06P0test9,0 !AIBBM,1,1,4,1,14,D5CD9,0 !AIBBM,1,1,5,1,8,06P0test10,0 !AIBBM,1,1,5,1,14,D5CD10,0 !AIBBM,1,1,6,1,8,06P0test11,0 !AIBBM,1,1,6,1,14,D5CD11,0 !AIBBM,1,1,7,1,8,06P0test12,0 !AIBBM,1,1,7,1,14,D5CD12,0 !AIBBM,1,1,7,1,8,06P0test13,0

AIAIR_5.sst	Simple interrogation for msg 5
$AIAIR,000001005,5,,,,,	
AIAIR_35_5.sst	Interrogation of msg 3 and 5 from ID1 and msg 5 from ID2
$AIAIR,000005002,3,,5,,000007001,5,,	
AIS_DSI.sst	Test that EUT ignores command to send a DSC msg
$AIDSI,1,1,2210393930,,,,03,,11,,	

B.1.4 Regional operational settings (ACA)

Regional operational settings (ACA)	
File name	Description
Sentences	
AIACA_Region_in_ch86.SST	Region around standard position with test channels
$ECACA,2,5400.0,N,01030.0,E,5300.0,N,00930.0,E,4,2086,0,1086,0,0,1,,,	
AIACA_Region_out_ch74_76.SST	Region not including standard position with channels 74 and 76
$ECACA,2,5500.0,N,00900.0,E,5400.0,N,00800.0,E,4,0074,0,0076,0,0,1,,,	
AIACA_Region_17_3_SW.SST	2 adjacent regions in SW quadrant, for test 17.3

$ECACA,2,3000.00,S,01200.00,W,3100.00,S,01300.00,E,1,2081,0,1081,0,0,1,,, $ECACA,2,3000.00,S,01100.00,W,3100.00,S,01200.00,E,1,2082,0,1082,0,0,1,,,	
AIACA_8_Regions_17_7_1.SST	8 different regions to fill quickly the complete list, for test 17.7.1
$ECACA,,5400.00,N,01030.00,E,5300.00,N,00930.00,E,2,72,0,74,0,0,1,,, $ECACA,,5200.00,N,00700.00,E,5100.00,N,00600.00,E,2,2060,0,1060,0,0,1,,, $ECACA,,5200.00,N,00900.00,E,5100.00,N,00800.00,E,2,2061,0,1061,0,0,1,,, $ECACA,,5200.00,N,01100.00,E,5100.00,N,01000.00,E,2,2062,0,1062,0,0,1,,, $ECACA,,5200.00,N,01300.00,E,5100.00,N,01200.00,E,2,2063,0,1063,0,0,1,,, $ECACA,,5200.00,N,01500.00,E,5100.00,N,01400.00,E,2,2064,0,1064,0,0,1,,, $ECACA,,5100.00,N,00800.00,E,5000.00,N,00700.00,E,2,2065,0,1065,0,0,1,,, $ECACA,,5100.00,N,01000.00,E,5000.00,N,00900.00,E,2,2066,0,1066,0,0,1,,,	
AIACA_Region_17_7_2_c.SST	Region for test 17.7.2 c
$ECACA,2,5430.00,N,01200.00,E,5300.00,N,01100.00,E,4,2083,0,1083,0,0,1,,,	
AIACA_Region_17_7_2_f.SST	Region for test 17.7.2 f
$ECACA,2,5300.00,N,01320.00,E,5200.00,N,01200.00,E,4,2081,0,1081,0,0,1,,,	
AIACA_Region_17_7_4.SST	4 adjacent regions for test 17.7.2 f
$ECACA,2,5800.00,N,00800.00,E,5700.00,N,00700.00,E,4,2081,0,1081,0,0,1,,, $ECACA,2,5800.00,N,00900.00,E,5700.00,N,00800.00,E,4,2082,0,1082,0,0,1,,, $ECACA,2,5700.00,N,00800.00,E,5600.00,N,00700.00,E,4,2083,0,1083,0,0,1,,, $ECACA,2,5700.00,N,00900.00,E,5600.00,N,00800.00,E,4,2084,0,1084,0,0,1,,,	
AIACA_Region_lon180.SST	Special region at longitude = 180°
$ECACA,2,0100.00,N,17900.00,W,0100.00,S,17900.00,E,2,0074,0,0076,0,0,1,,,	
AIACA_Set_channel.SST	Set channel command, without area co-ordinates
$ECACA,,N,,W,,N,,W,2,2074,0,2076,0,0,1,,,,	
Request_ACA.SST	Request of ACA sentences from EUT
$ECAIQ,ACA	

B.1.5 Long range requests

The of long range requests include a MMSI number which is changed according to the actual MMSI number the EUT

Long Range (LRI, LRF)

File name	Description
Sentences	
LRI_LRF_MMSI_all.sst	Request of all data addressed by MMSI
`$LRLRI,5,0,211003000,000002002,,,,,,,,` `$LRLRF,5,211003000,VTS,ABCEFIOPUW,`	
LRI_LRF_area_CEF.sst	Request of some data addressed by area
`$LRLRI,6,1,211003000,,6000.0,N,2000.0,E,4000.0,N,0500.0,E` `$LRLRF,6,211003000,VTS,CEF,`	
LRI_LRF_out_area_CEF.sst	Request of some data addressed by area, standard position not in area
`$LRLRI,6,1,211003000,,6000.0,N,1500.0,E,5500.0,N,0800.0,E` `$LRLRF,6,211003000,VTS,CEF,`	
LRI_LRF_area_at_180_CEF.sst	Request of some data addressed by area, area around longitude of 180° and latitude of 0°
`$LRLRI,6,1,211003000,,0500.0,N,17500.0,W,0500.0,S,17500.0,E` `$LRLRF,6,211003000,VTS,CEF,`	
LRF_ack_all.sst	For external confirmation of request
`$LRLRF,5,211003000,VTS,ABCEFIOPUW,`	

B.2 DSC sentences

The sentences are listed as they are applied to the DSC Testbox for transmission of DSC test calls. There is a special format used based on an earlier definition of NMEA private sentences.

The frame for transmitting a DSC call is:
`$PDEBT,CCDSC,T,00014600<call content>FF`

The <call content> has to be entered in Hex code, 2 hex numbers for each 7 bit DSC symbol, without spaces, beginning with the format specifier which included only ones. The DSC coding and addition of redundancy (3 bit symbol redundancy and symbol repetition) are done by the test box. The content description of the calls is available on request.

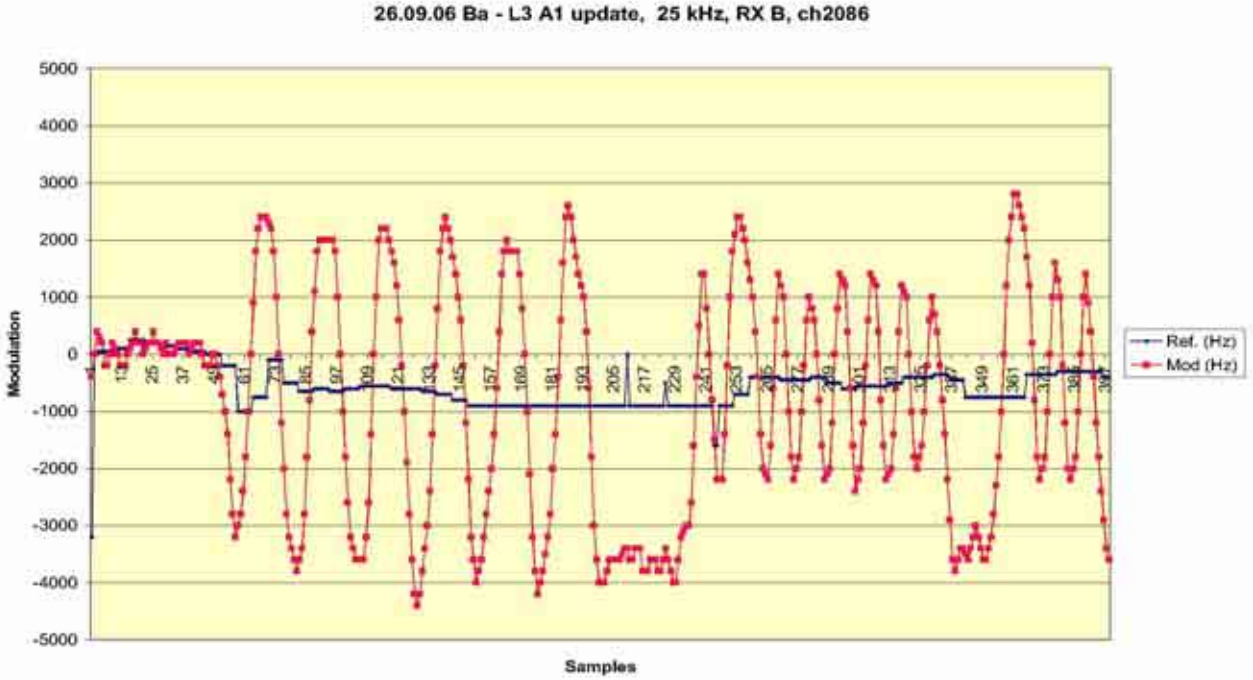
The DSC sentences include MMSI number which is changed according to the actual MMSI number the EUT

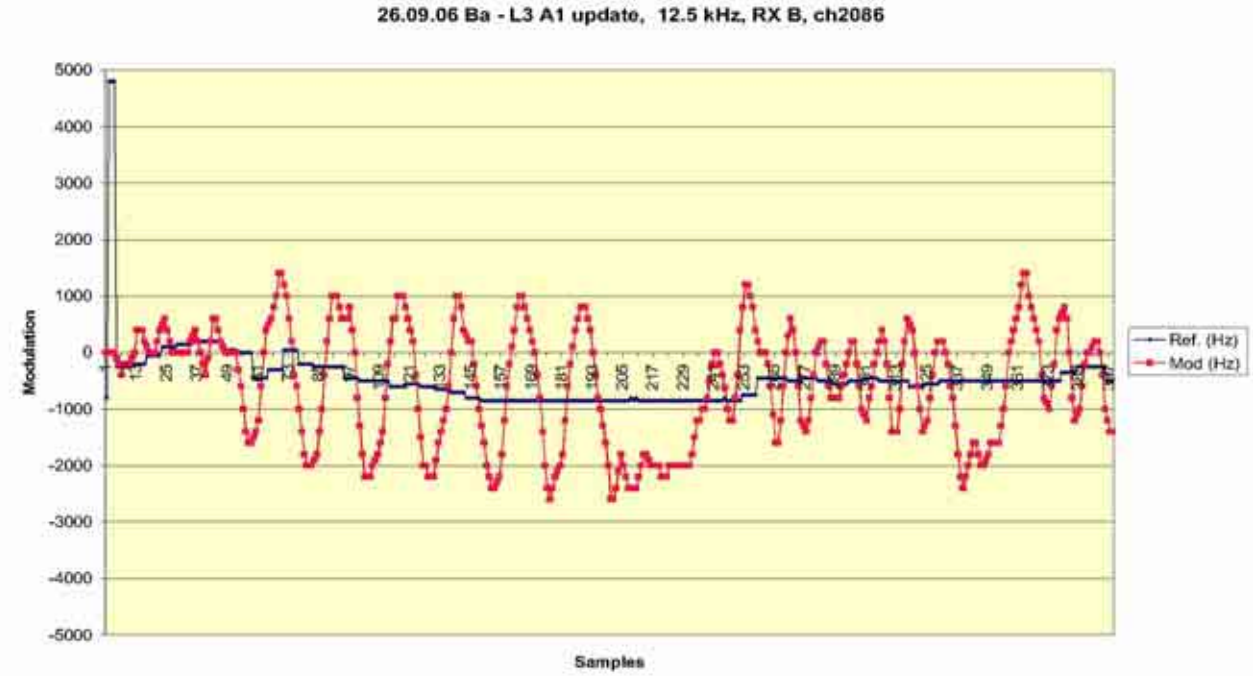
DSC Sentences	
File name	Description
Sentences	

Test_Signal_1.sst	Standard test signal no 1, selective position and name request.
$PDEBT,CCDSC,T,0001460078000001005067150A27271E676F75FF	
area_pos_name_rq.sst	Position and name request addressed to an area, standard position inside
$PDEBT,CCDSC,T,000146006705280000091E003C003C0067150A27271E676F75FF	
area_pos_name_rq_180.sst	Position and name request addressed to an area around a longitude of 180° and latitude of 0°.
$PDEBT,CCDSC,T,000146006700030014F1E003C003C0067150A27271E676F75FF	
sel_set_region.sst	Selective regional setting by DSC, standard pos. outside, channel 61
$PDEBT,CCDSC,T,0001460078000001005067150A27271E68090A3D00680A143D00680C053C0001140068 0D053200010A0075FF	
sel_set_region_in.sst	Selective regional setting, standard position inside, channel 72, 73, 12.5 kHz
$PDEBT,CCDSC,T,0001460078000001005067150A27271E680900480A680A00490A680C05280001030068 0D051E00005D0075FF	
sel_set_ais_channel_ch65.sst	Setting AIS channel to 65
$PDEBT,CCDSC,T,0001460078000001005067150A27271E68090A4100680A14410075FF	
sel_check_channel.sst	Test of channel use in 20.4
$PDEBT,CCDSC,T,0001460078000001010067150A27271E654875FF $PDEBT,CCDSC,T,000146006705280000091E003C003C0067150A27271E676F75FF	
area_set_region.sst	Area addressed regional setting, standard position inside address, but not inside area, Ch 60
$PDEBT,CCDSC,T,000146006705280000091E003C003C0067150A27271E68090A3C00680A143C00680C05 1400005A00680D050A0000500075FF	
area_set_region_20_2.sst	Area addressed regional setting for test 20.2
$PDEBT,CCDSC,T,00014600670F3200000E00005A005A0067150A27271E6809145200680A0A5200680C0F 1E00011E00680D0F140001280075FF $PDEBT,CCDSC,T,00014600670F3200000E00005A005A0067150A27271E6809145100680A0A5100680C0F 1400011E00680D0F0A0001280075FF	
Sequence_20_1sst	Area addressed regional setting, standard position inside address, but not inside area, Ch 60
$PDEBT,CCDSC,T,0001460078000001010067150A27271E676F75FF $PDEBT,CCDSC,T,000146006606000050A0A64150A27271E646E5A00487E7E7E7FFF $PDEBT,CCDSC,T,0001460078000001010067150A27271E676F75FF $PDEBT,CCDSC,T,0001460078000001010067150A27271E646E5A00487E7E7E75FF $PDEBT,CCDSC,T,0001460078000001010067150A27271E676F75FF	
Test_sequence_20_3.sst	Sequence of an area addressed call and continues transmission of other call for test of free channel check
$PDEBT,CCDSC,T,000146006705320000091E003C003C0067150A27271E676F75FF $PDEBT,CCDSC,T,000846007800000001010167150A27271E676F75FF	
Sel_act_alt_system.sst	Activate an alternative system
$PDEBT,CCDSC,T,0001460078000000A0567150A27271E6803017875FF	

Annex C test diagrams

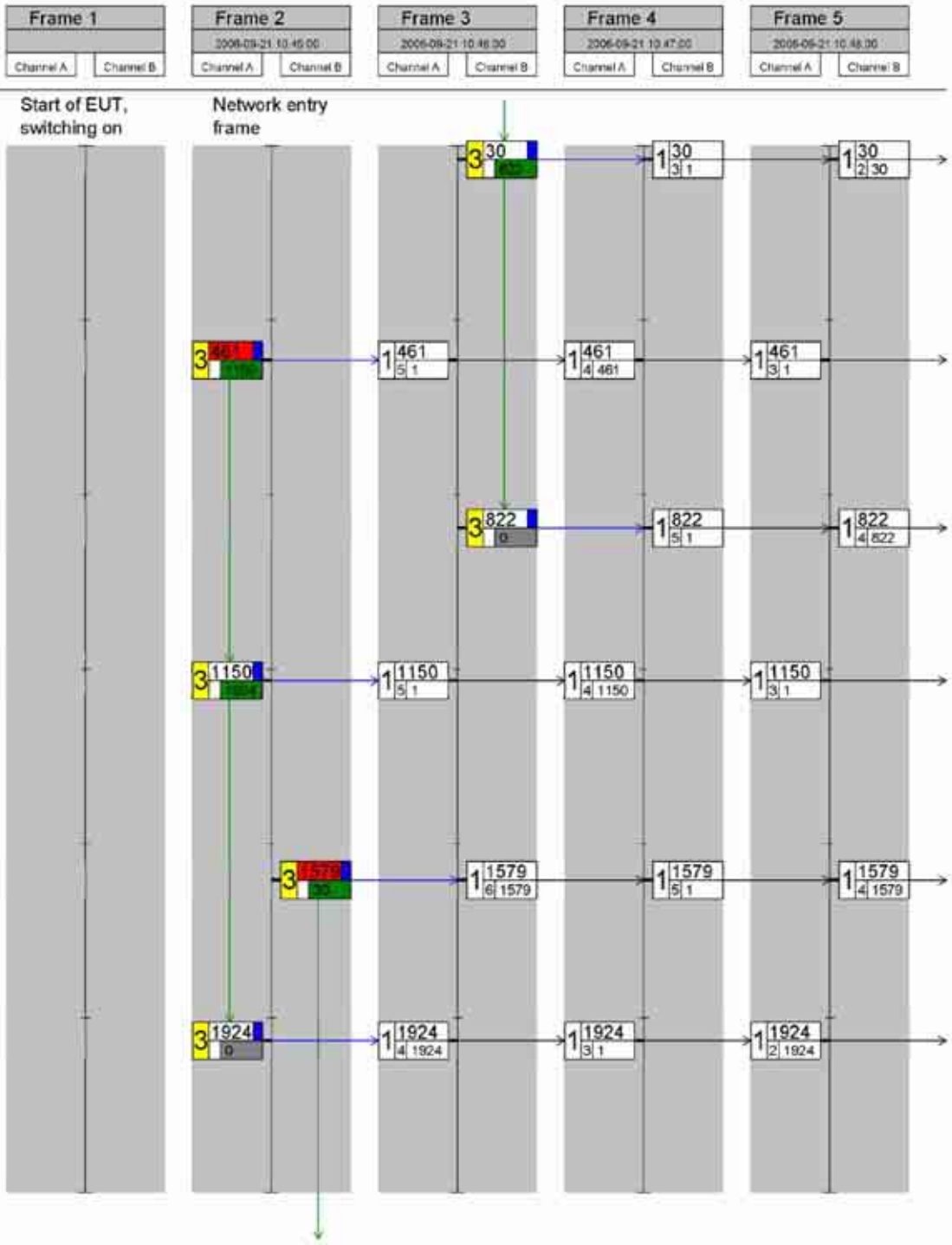
C.1 GMSK modulation 12.5 and 25 kHz bandwidth



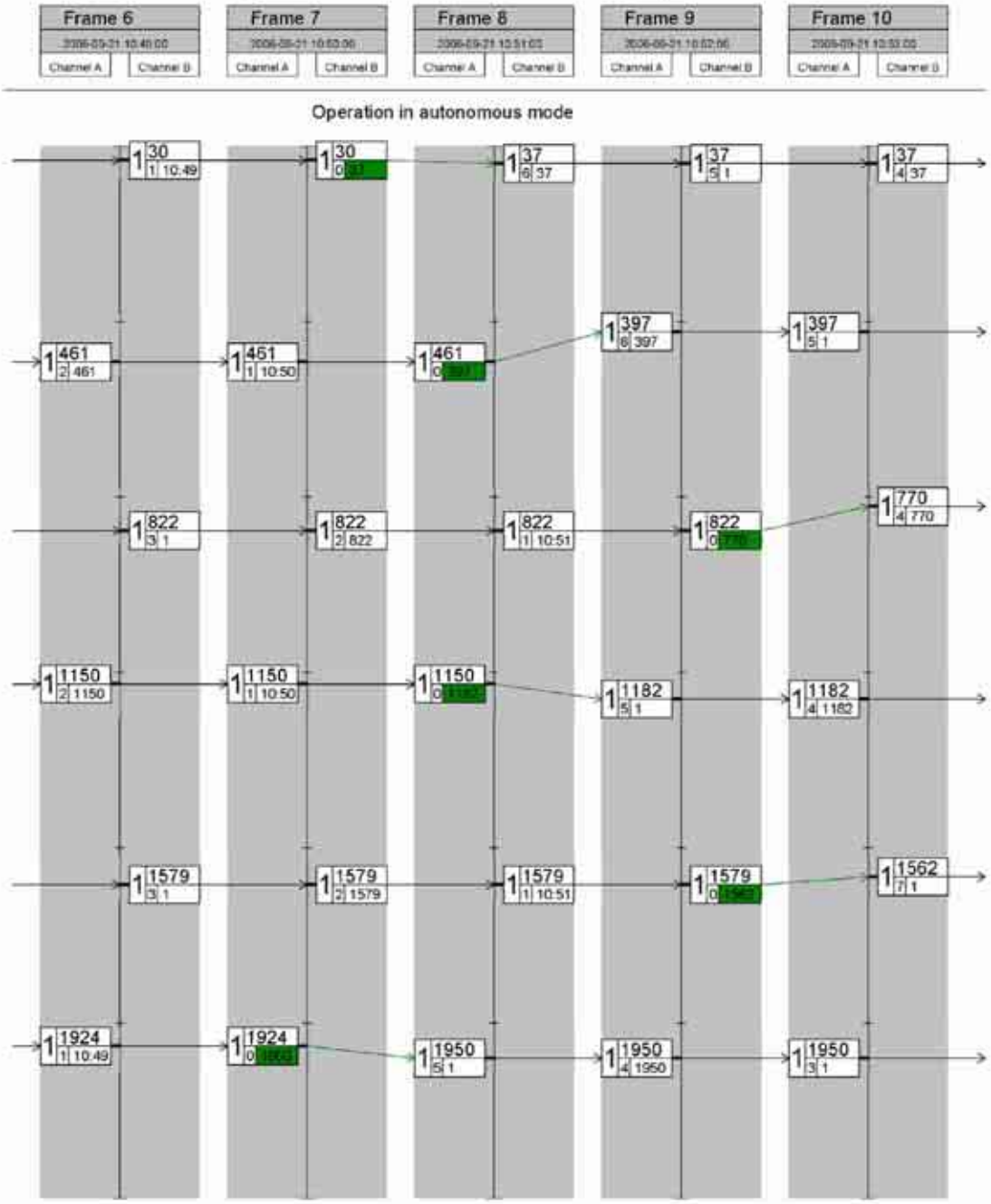


C.2 16.6.1 Network entry phase

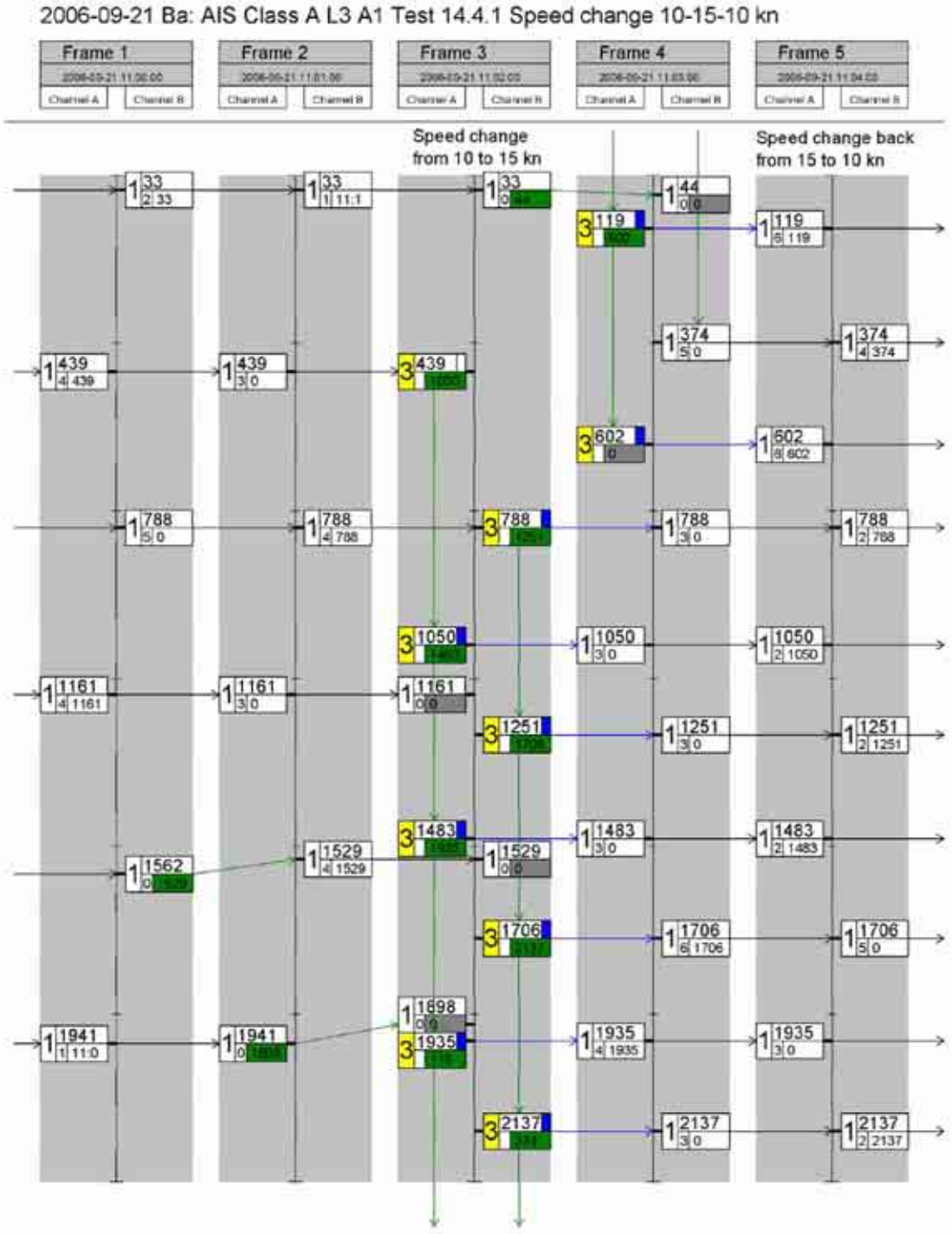
2006-09-21 Ba: AIS Class A L3 A1 Test 16.6.1 Network entry



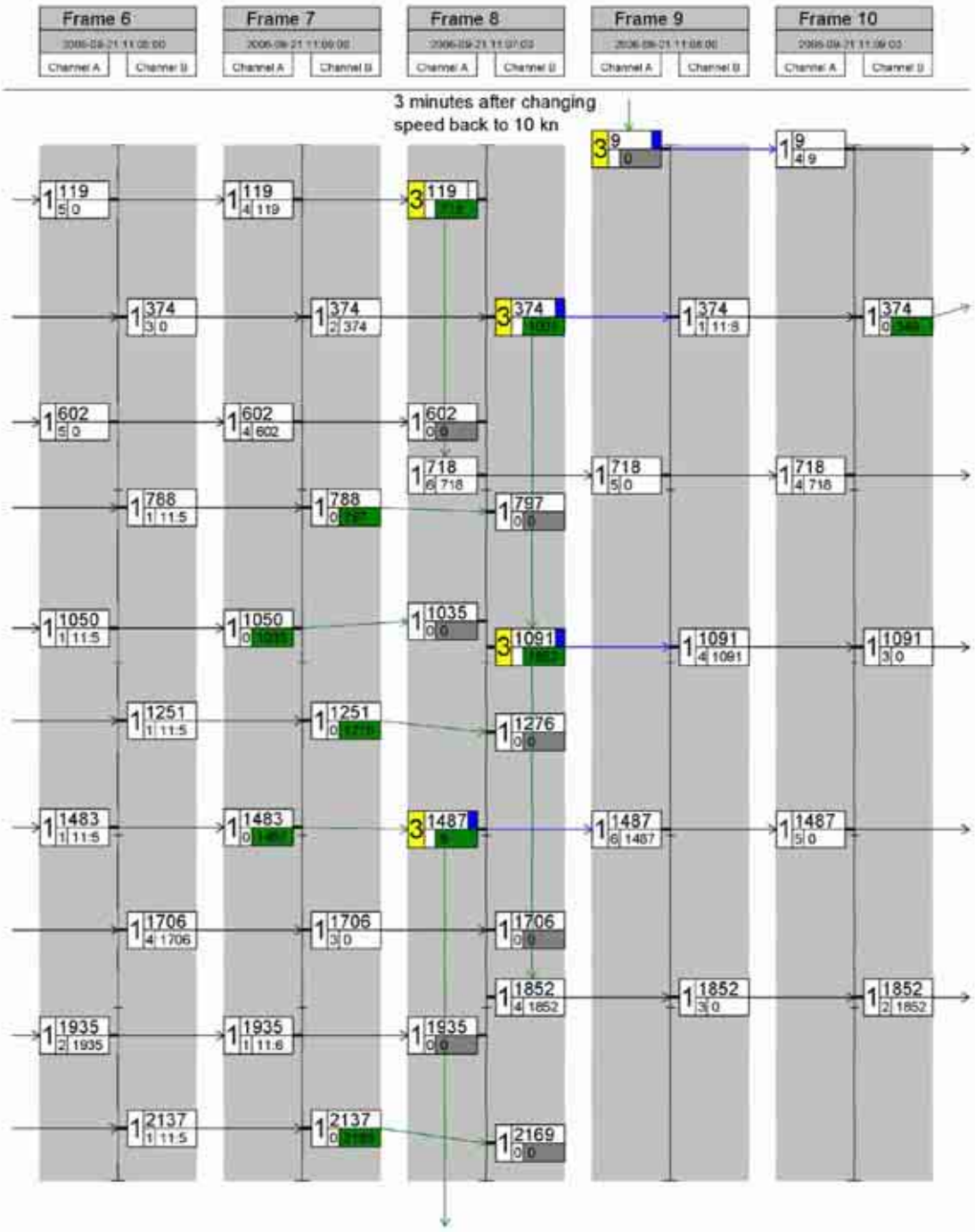
2006-09-21 Ba: AIS Class A L3 A1 Test 16.6.1 Network entry



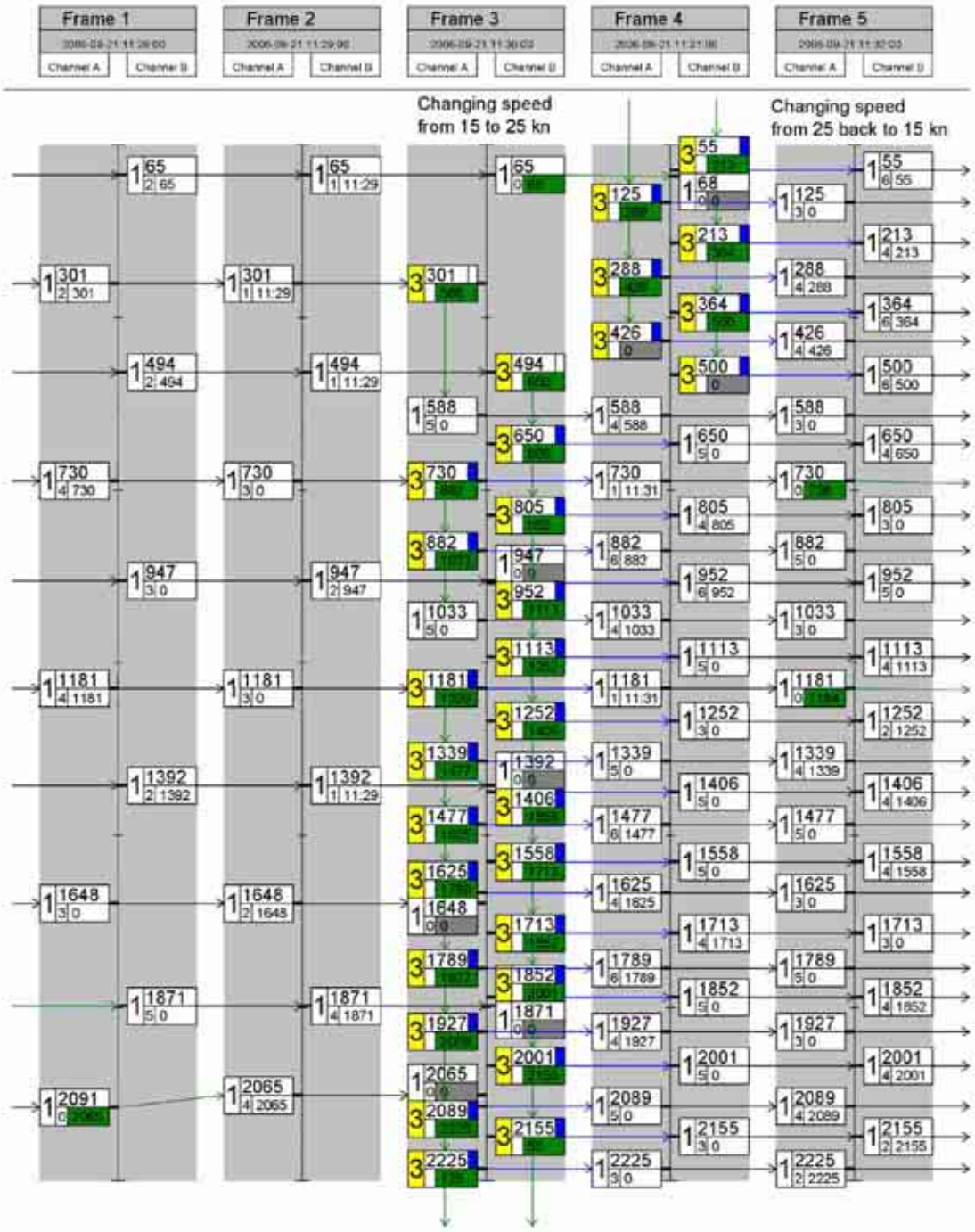
C.3 14.4.1 Reporting rate by speed



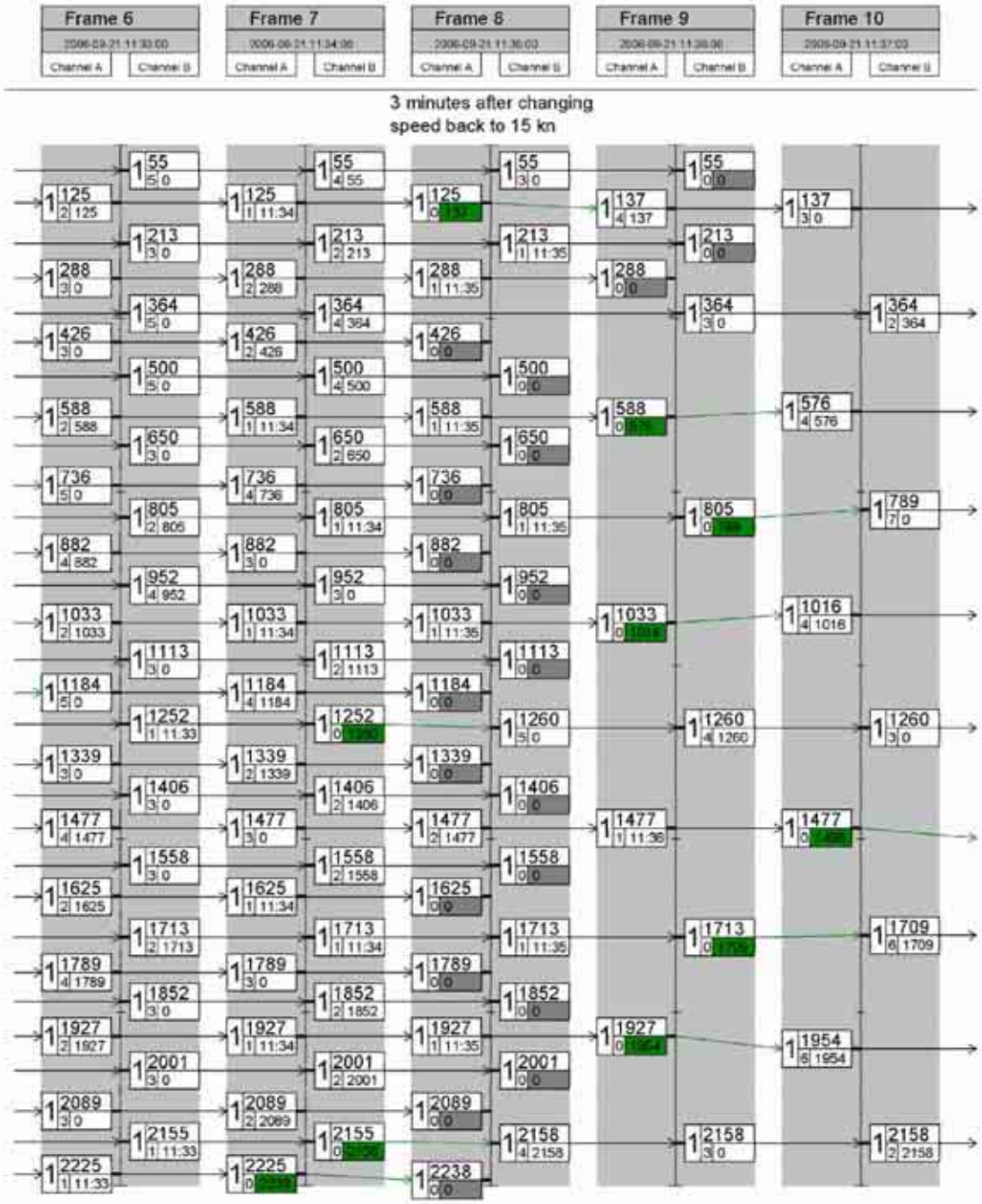
2006-09-21 Ba: AIS Class A L3 A1 Test 14.4.1 Speed change 10-15-10 kn



2006-09-21 Ba: AIS Class A L3 A1 Test 14.4.1 Speed change 15-25-15 kn

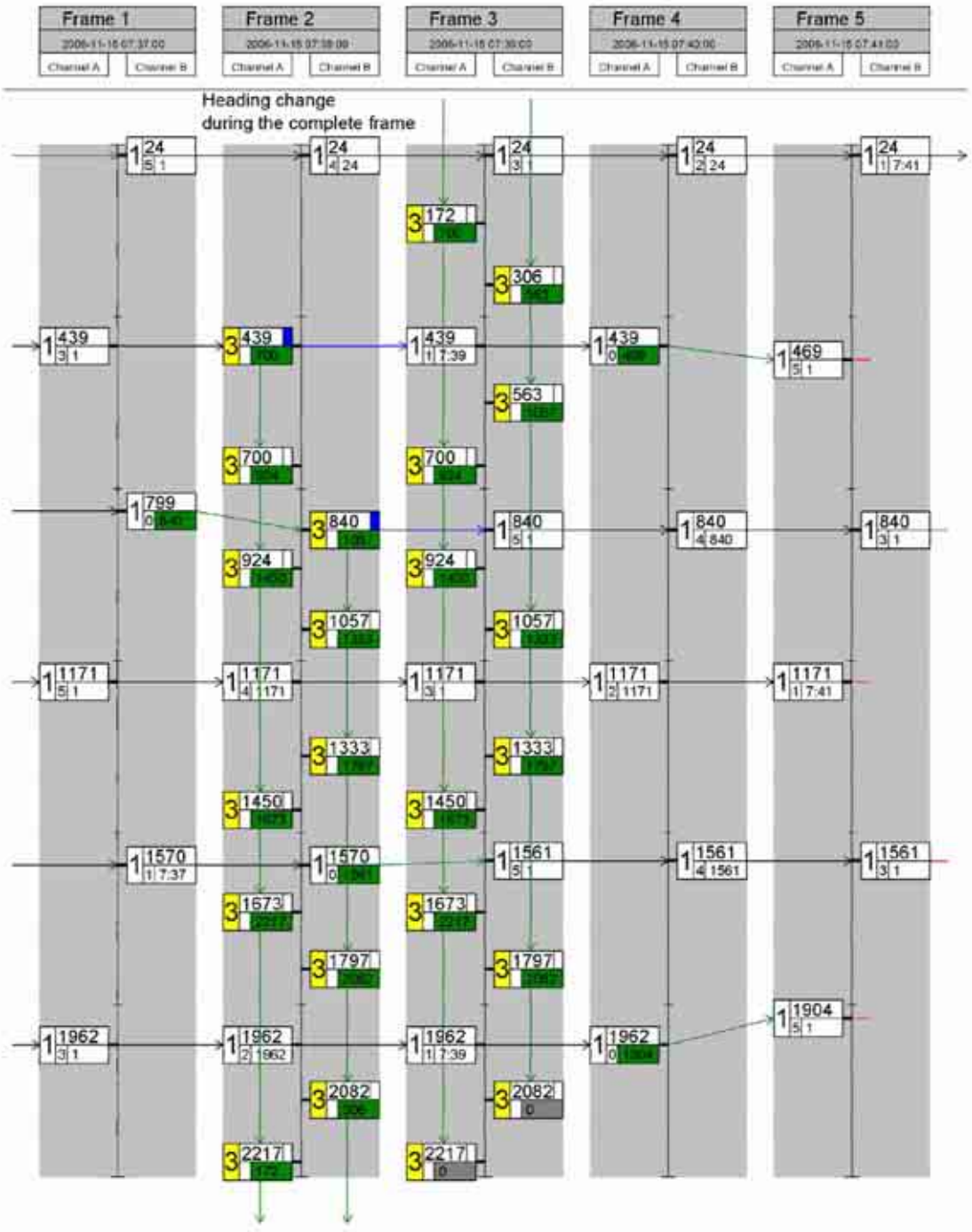


2006-09-21 Ba: AIS Class A L3 A1 Test 14.4.1 Speed change 15-25-15 kn

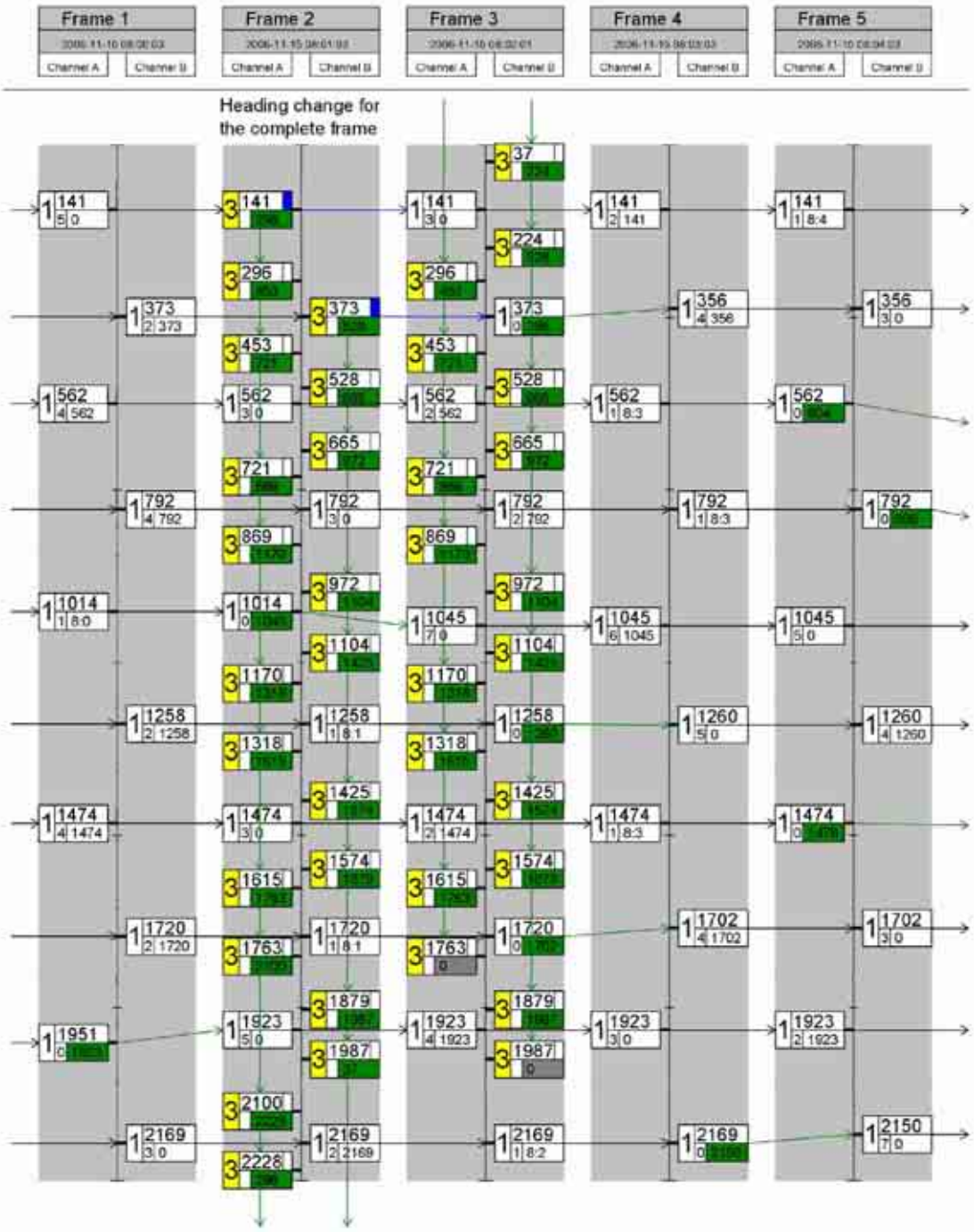


C.4 14.4.1 Report rate by heading

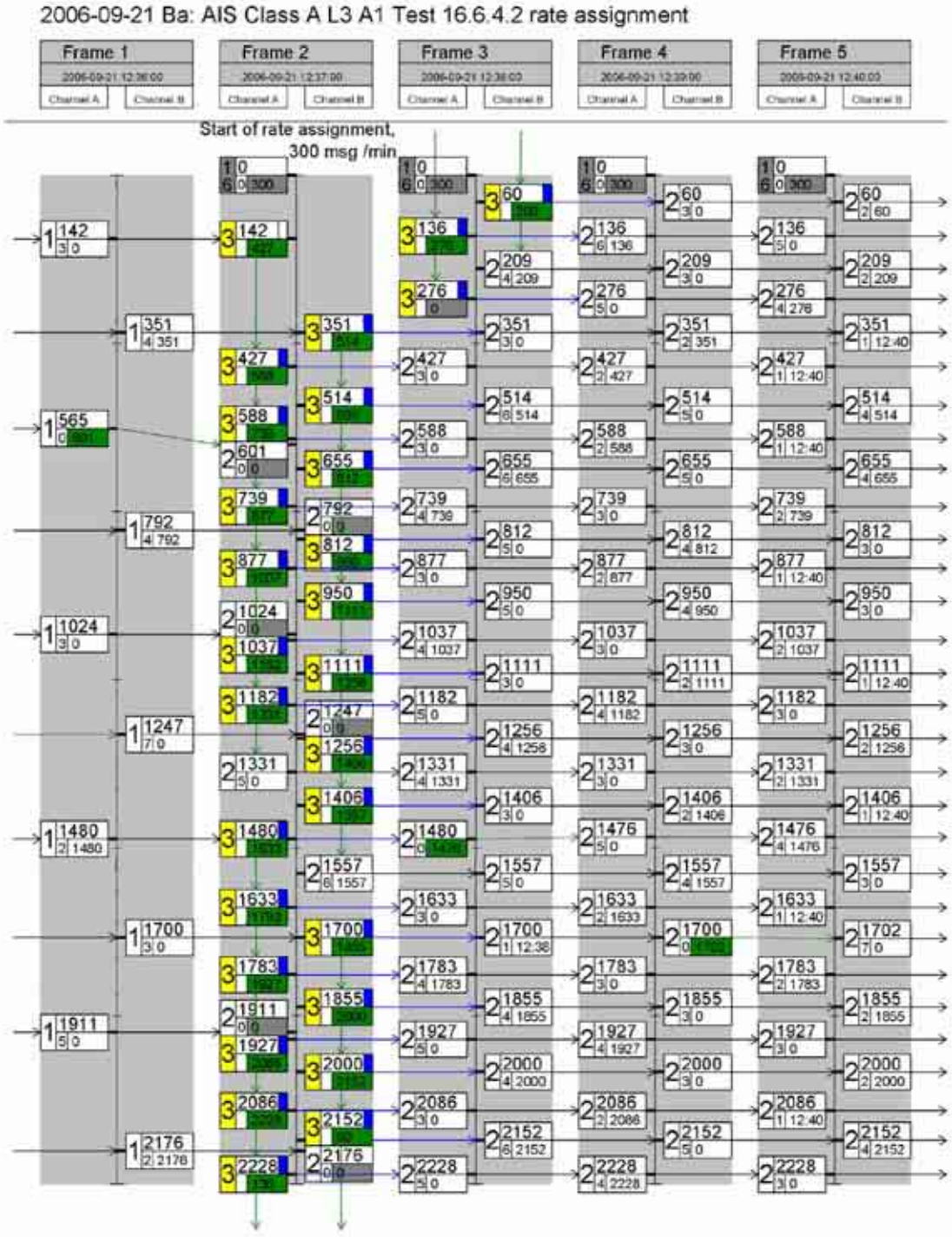
2006-11-15 Ba: AIS Class A L3 A1 Test 14.4.1 Heading change at 10 kn



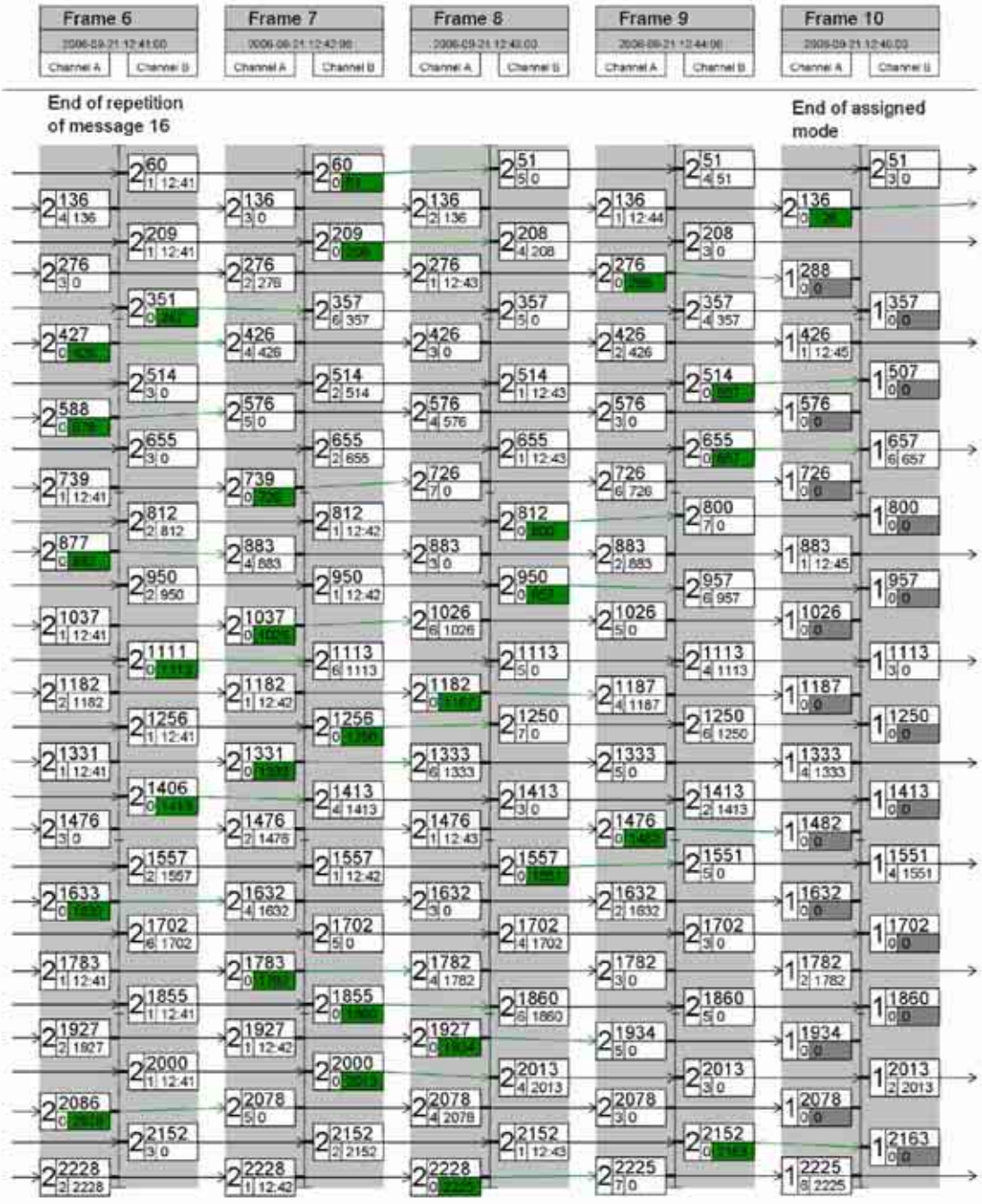
2006-11-15 Ba: AIS Class A L3 A1 Test 14.4.1 Heading change at 15 kn



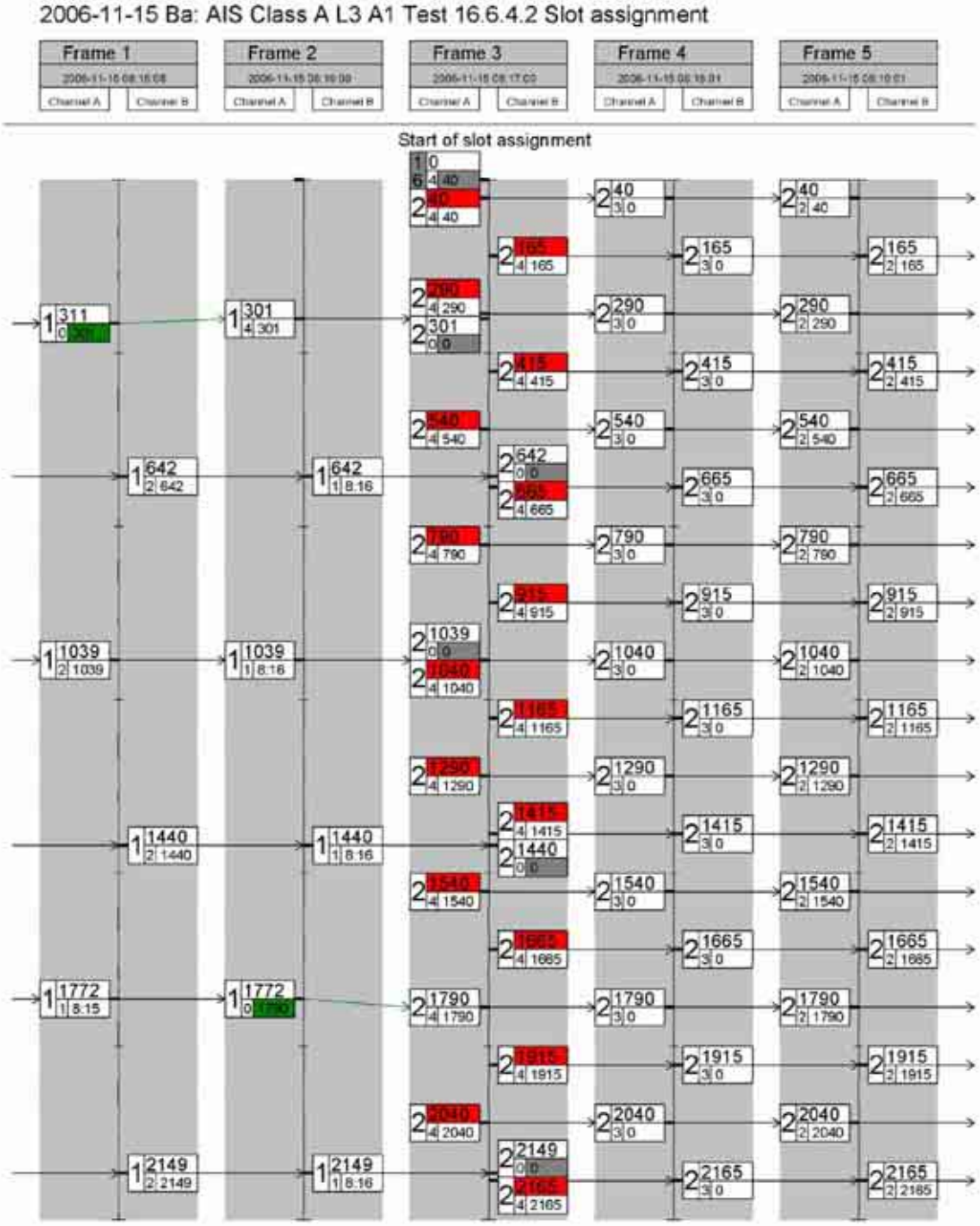
C.5 16.6.4.2 Assigned mode / rate assignment



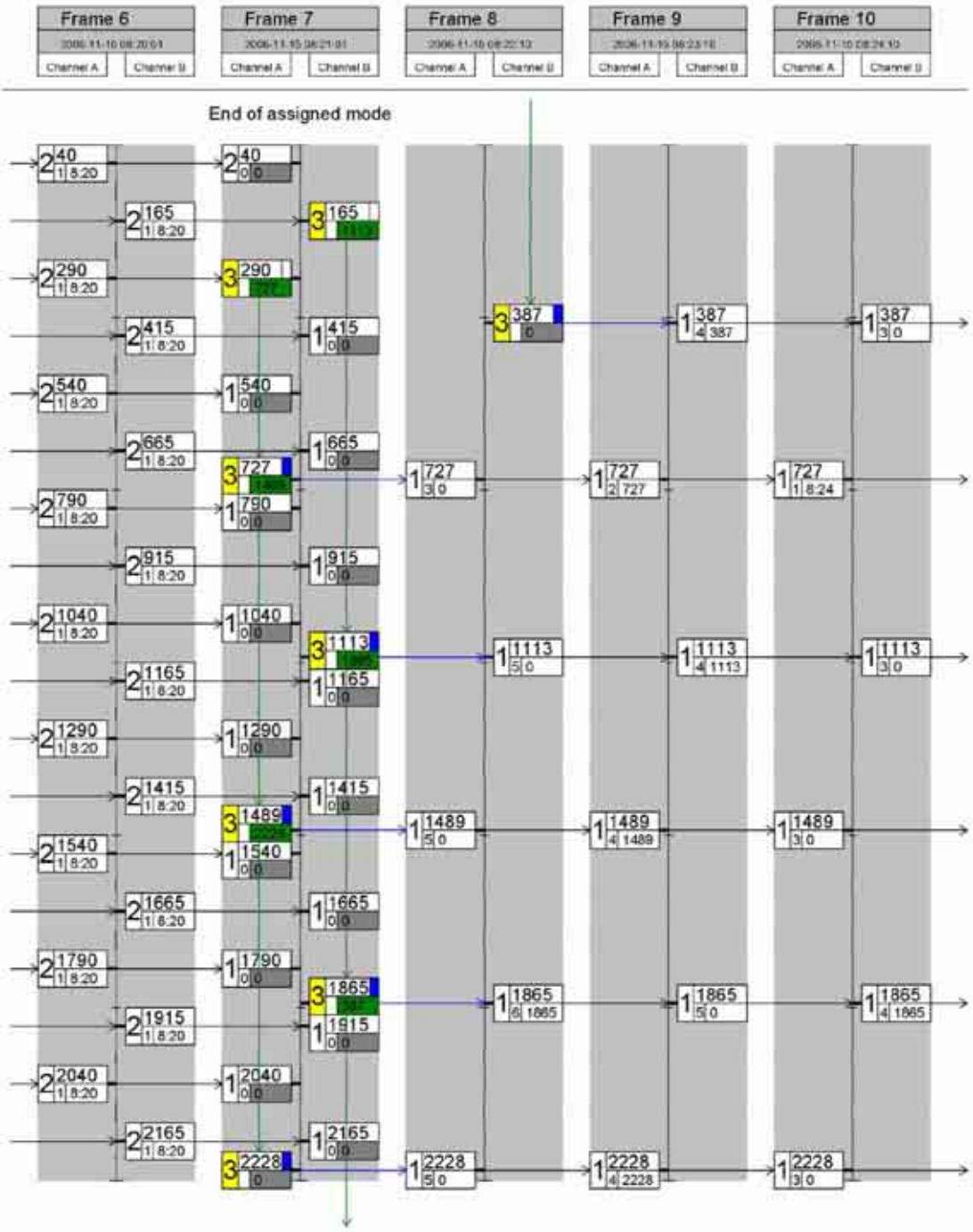
2006-09-21 Ba: AIS Class A L3 A1 Test 16.6 4.2 rate assignment



C.6 16.6.4.2 Assigned mode / slot assignment

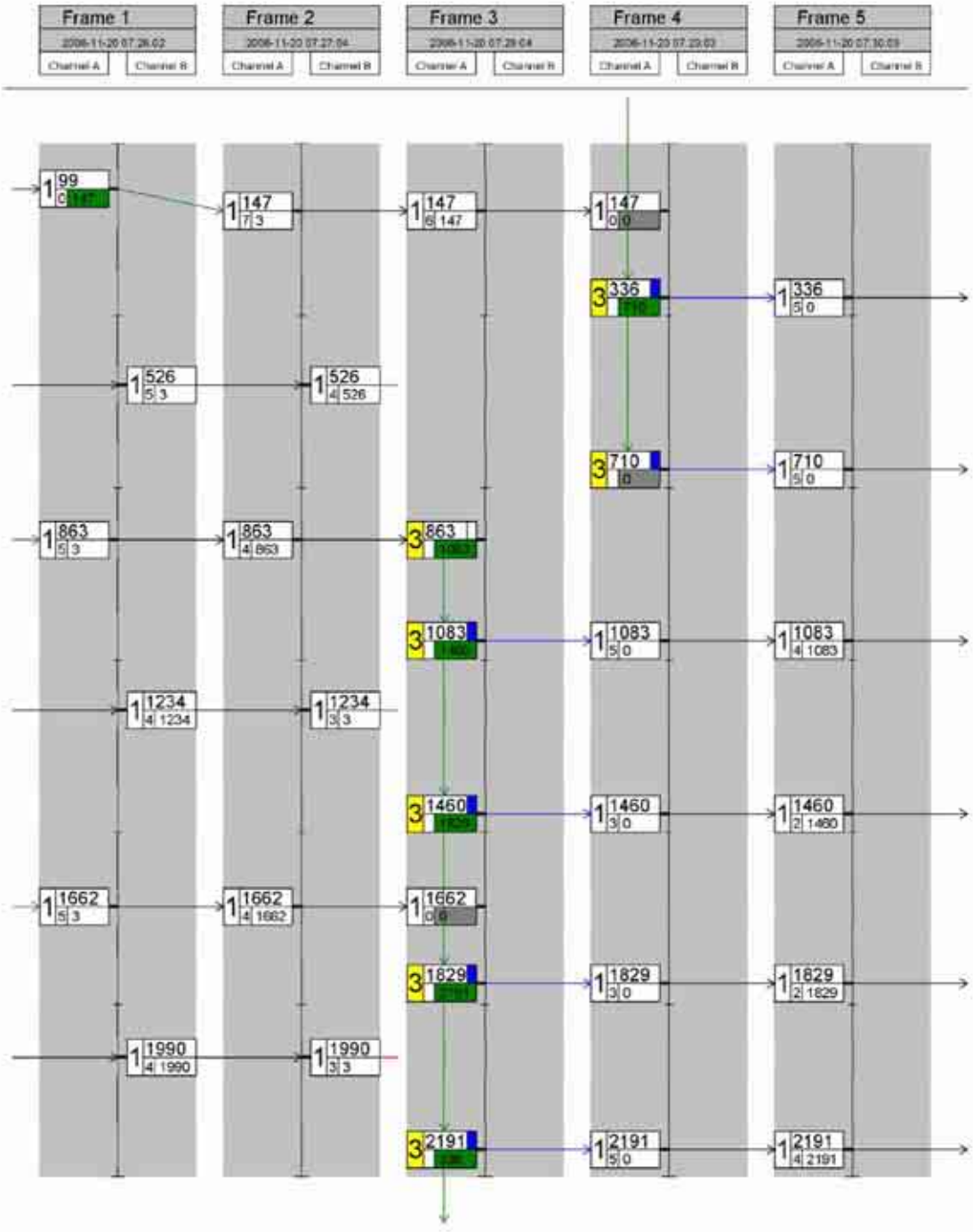


2006-11-15 Ba: AIS Class A L3 A1 Test 16.6.4.2 Slot assignment

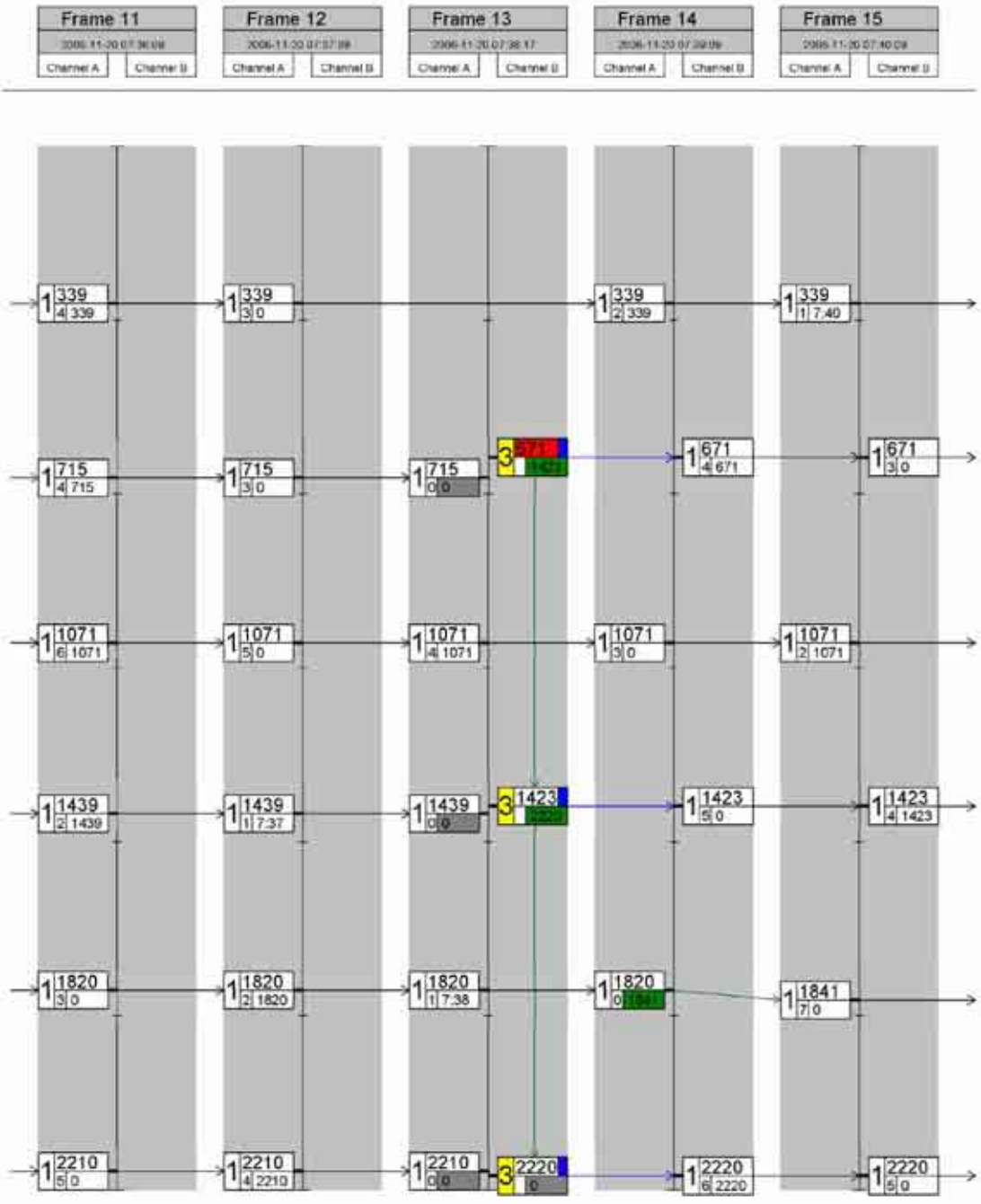


C.7 17.2 Tx/Rx mode 1 Single channel transmission

2006-11-20 Ba: AIS Class A L3 A1 Test 17.2 Tx/Rx mode 1

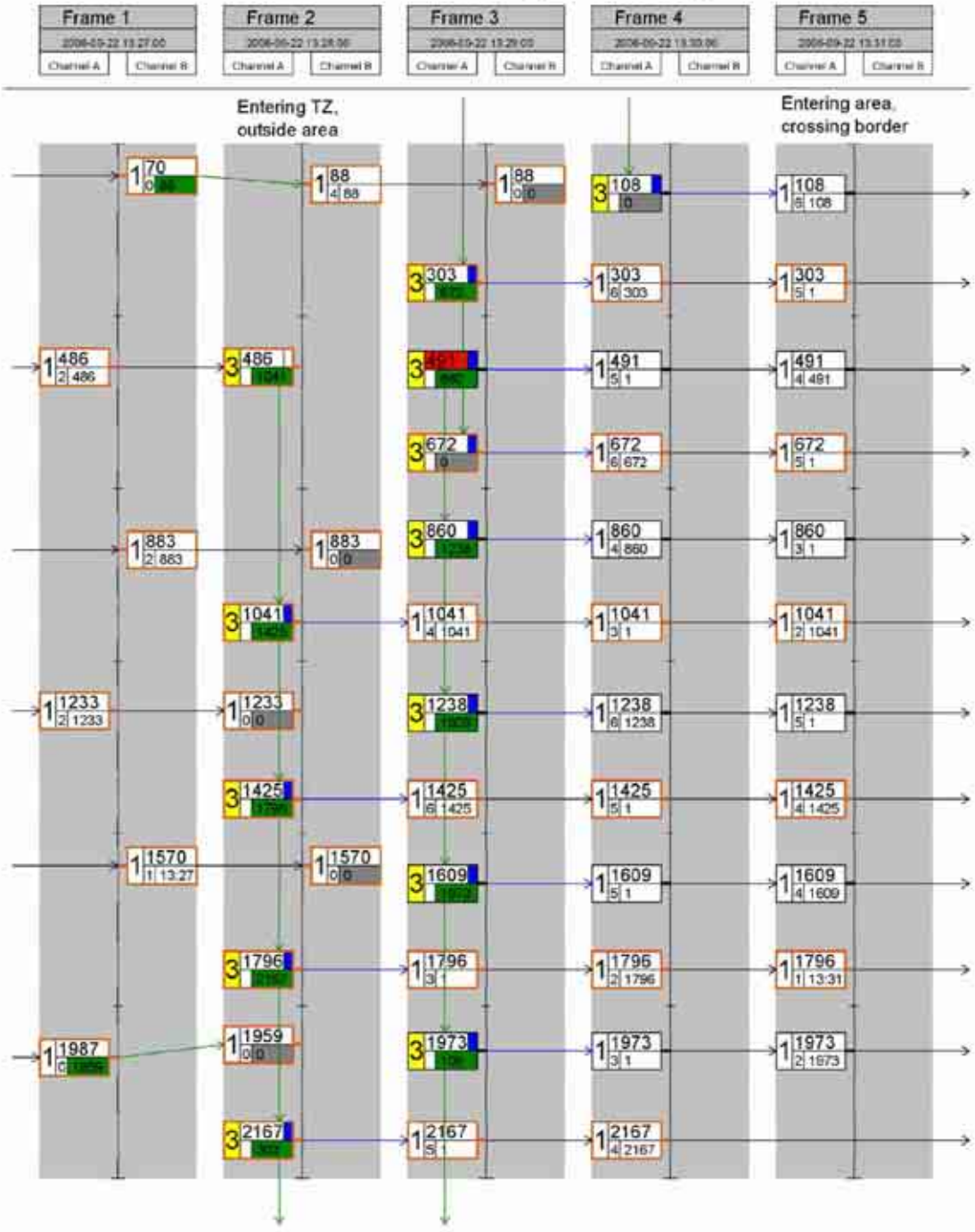


2006-11-20 Ba: AIS Class A L3 A1 Test 17.2 Tx/Rx mode 1

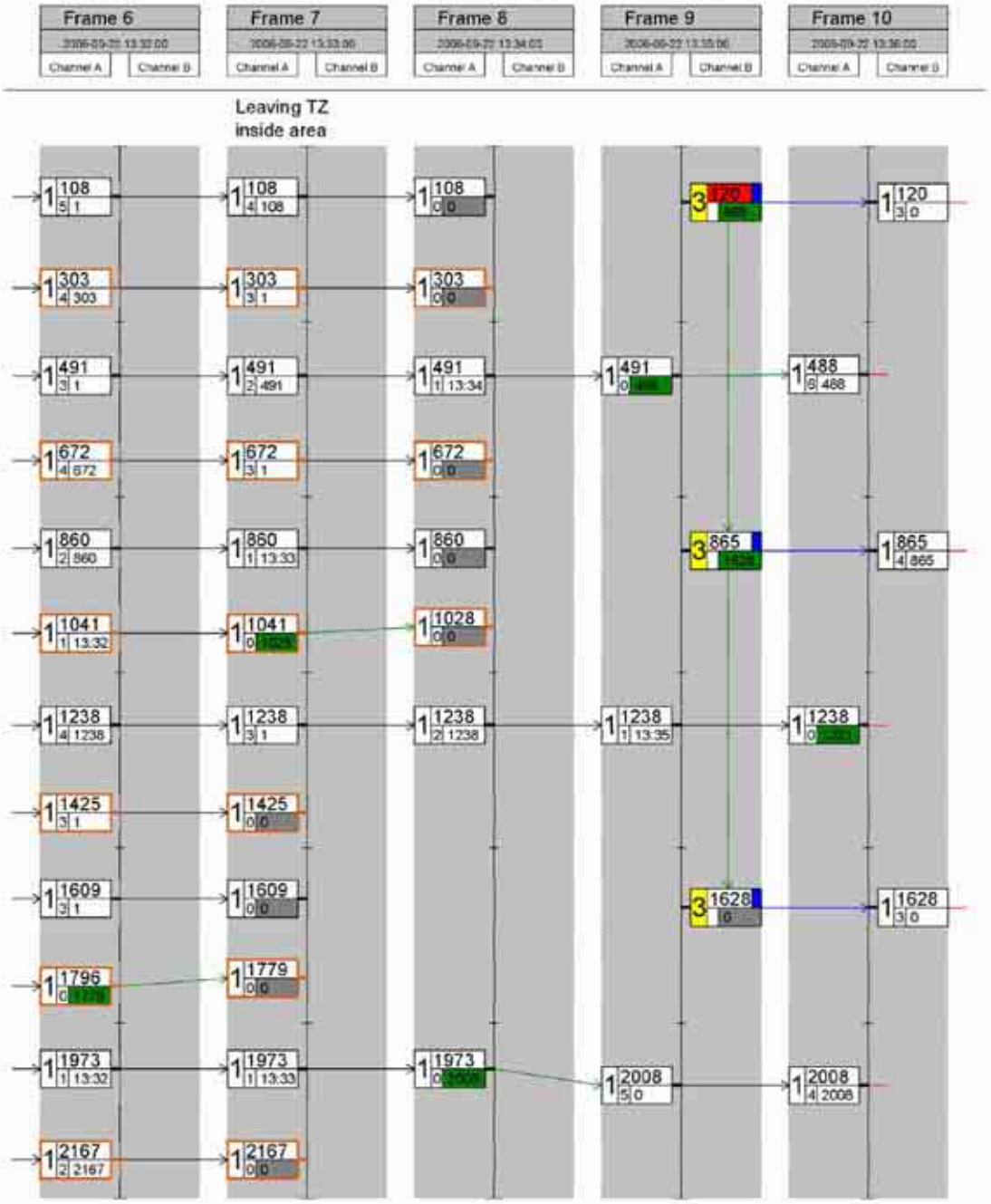


C.8 17.2 Area entry through transitional zone

2006-09-22 Ba: AIS Class A L3 A1 Test 17.2 Regional area designation



2006-09-22 Ba: AIS Class A L3 A1 Test 17.2 Regional area designation



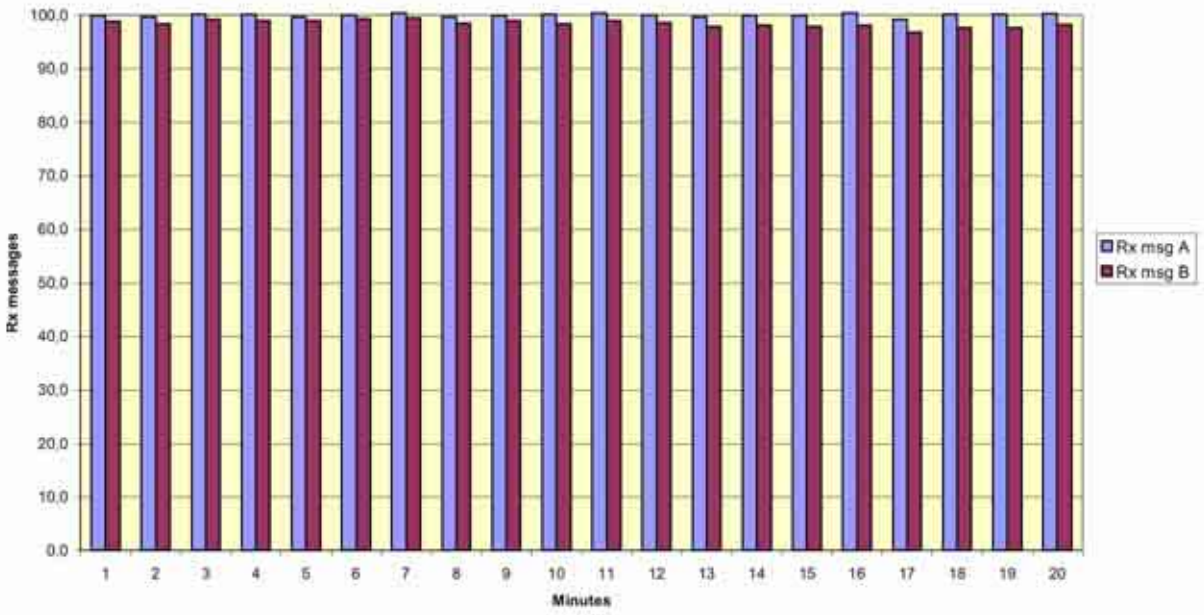
Red frame: Frequency/channels of the old area
Black frame: Frequency/channel of the new area

C.9 19.7 High speed output performance

21.09.06 - L3 A1 - 19.7 PI output performance, PI port

Result: Average = A= 100 %, B=98.6%

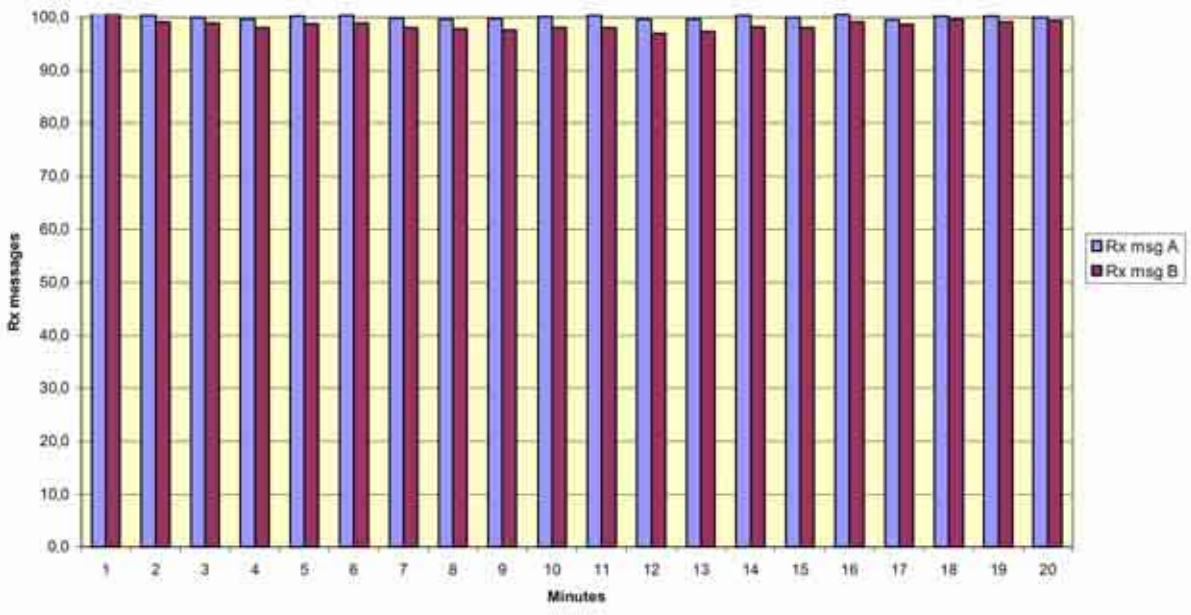
Ch A: 2084 Ch B: 2086



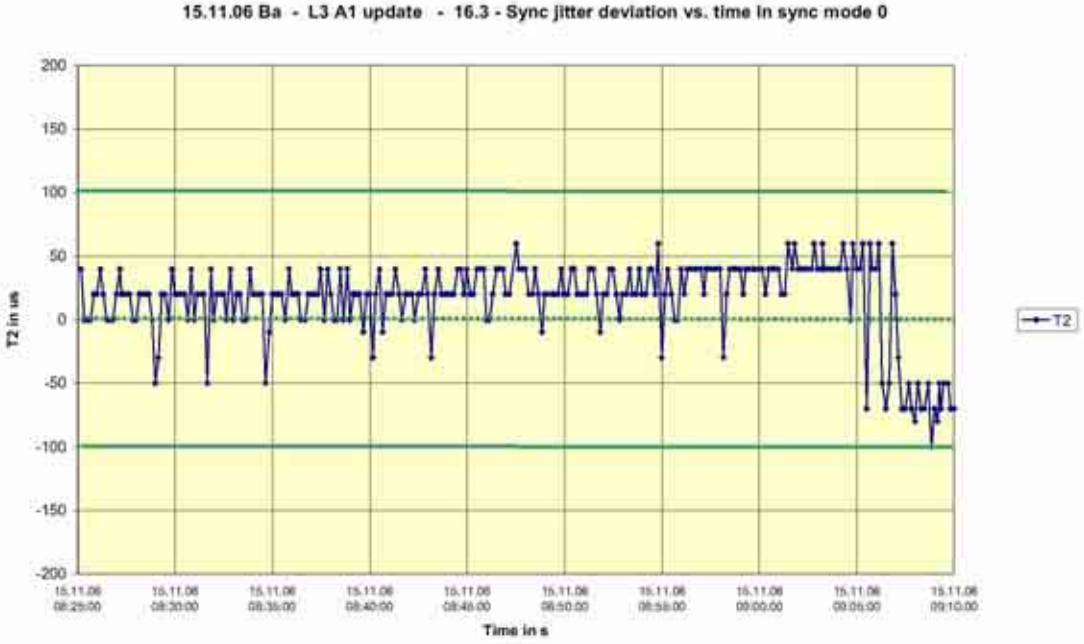
21.09.06 - L3 A1 - 19.7 PI output performance, ECDIS port

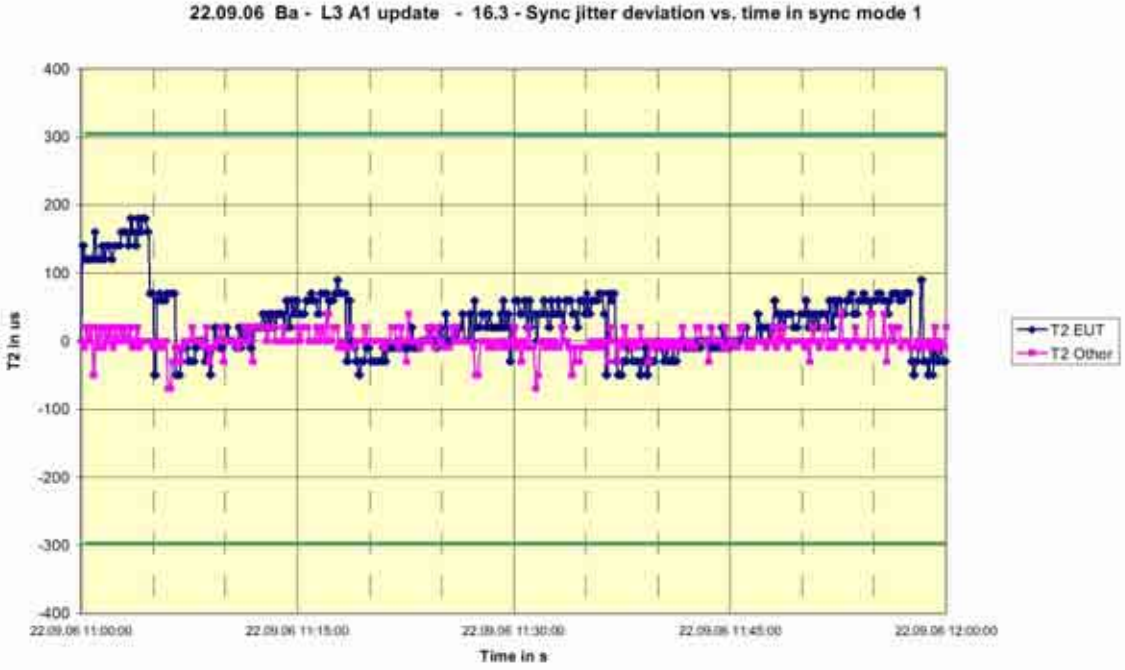
Result: Average = A= 100,1 %, B=98.6%

Ch A: 2084 Ch B: 2086



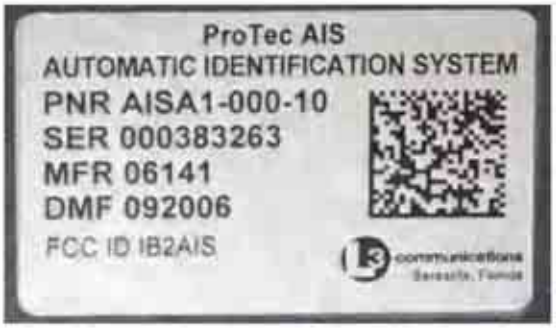
C.10 16.3 Sync jitter





Annex D Photos of equip m ent under test

D.1 Transponder Unit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