TEST REPORT

on

IEC 62287-1 Edition 2

**Sections 10,12,13,
Amendment 1**

**Maritime navigation and radiocommunication equipment and systems
Class B shipborne equipment of the automatic identification system (AIS)
Part 1: Carrier sense time division multiple access (CSTDMA) techniques**

Test Report Reference: F130840E2 2nd Version

Equipment under Test:

CAMINO-108 / CAMINO-108W

Serial Number: -

Applicant: Alltek Marine Electronics Corp.

Manufacturer: Alltek Marine Electronics Corp.

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1 IDENTIFICATION

1.1 APPLICANT

Name:	Alltek Marine Electronics Corp.
Address:	7F, No. 605, Ruei Guang Rd., Neihu 11492 Taipei
Country:	Taiwan
Name for contact purposes:	Mr. Leslie Yang
Tel:	+886-2-2627-1599
Fax:	+886-2-2627-1600
e-mail address:	leslieyang@alltekmarine.com

1.2 MANUFACTURER

Name:	Alltek Marine Electronics Corp.
Address:	7F, No. 605, Ruei Guang Rd., Neihu 11492 Taipei
Country:	Taiwan
Name for contact purposes:	Mr. Leslie Yang
Tel:	+886-2-2627-1599
Fax:	+886-2-2627-1600
e-mail address:	leslieyang@alltekmarine.com

1.3 DATES

Date of Receipt of Test Sample:	28 February 2013
Start of test:	28 February 2013
Finish of test:	20 August 2013

1.4 TEST LABORATORY

The tests were carried out at: **PHOENIX TEST-LAB GmbH**
Königswinkel 10
D-32825 Blomberg   **Tel:**   **+49 (0) 52 35 / 95 00-0**
Germany   **Fax:**   **+49 (0) 52 35 / 95 00-10**

Test engineer:	Raimund BLASK		8 October 2013
	Name	Signature	Date
Authorized reviewer:	Michael DINTER		8 October 2013
	Name	Signature	Date

1.5 RESERVATION

T h i s   t e s t   r e p o r t   i s   o n l y   v a l i d   i n   t h e   o r i g i n a l   f o r m .

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1.6 REFERENCES

[1] IEC 62287-1 Edition 2
Maritime navigation and radiocommunication equipment and systems
Class B shipborne equipment of the automatic identification system (AIS)
Part 1: Carrier sense time division multiple access (CSTDMA) techniques

2 TECHNICAL DATA OF EQUIPMENT

Type:	AIS Class B Transponder
Type designation:	CAMINO-108 / CAMINO-108W
Serial No.:	-
Alignment range:	156.025 to 162.025 MHz
Switching range:	156.025 to 162.025 MHz
Channel separation:	25 kHz
Rated RF output power:	2 W / 33 dBm
Supply Voltage :	U_{nom}= 12.0 V DC U_{min}= 9.6 V DC U_{max}= 31.2 V DC
Printed circuit designation:	M-PCB-B108MBV1
Software:	V1.2.6

Ports/Connectors

Identification	Connector		Length
	EUT	Ancillary	
DC-power-supply	DC-Plug	none	1 m
GPS-antenna	TNC	-	3 m
VHF-antenna	SO-239	N-Connector	3 m
NMEA0183	12-PIN-Connector	D-Sub	3 m
USB	Mini-USB	USB	1 m

Test Report History:

Test Report Number:	Date of issue:	Report Status:
F130840E2	10 September 2013	First issue
F130840E2_2nd Version	8 October 2013	Editorial changes
-	-	-

3 ADDITIONAL INFORMATION

General information:

Wanted signal:

Unwanted signal:

All unwanted-signals were generated by the calibrated RF-Generators from Phoenix Test-Lab.

4 10 GENERAL INFORMATION

4.1 EQUIPMENT HISTORY

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

4.1.1 EUT SYSTEM NO 1

Transponder				
Type	AIS Class B Transponder		Part No.:	AMEC CAMINO-108W
Delivery date	28 February 2013		Serial number	-
HW Version:	Delivery date	28 February 2013	Version no	-
	Installation date	-		
SW Version:	Delivery date	28 February 2013	Version no	V1.2.1
	Installation date	-		
SW Version:	Delivery date	15 August 2013	Version no	V1.2.6
	Installation date	-		
SW Version:	Delivery date	-	Version no	-
	Installation date	-		
SW Version:	Delivery date	-	Version no	-
	Installation date	-		

GPS antenna				
Type	GPS-Antenna		Part No.:	ANT-21
Delivery date	28 February 2013		Serial number	-
HW Version:	Delivery date	-	Version no	-
	Installation date	-		

4.1.2 EUT SYSTEM NO 2

Transponder				
Type	AIS Class B Transponder		Part No.:	-
Delivery date	-		Serial number	-
HW Version:	Delivery date	-	Version no	-
	Installation date	-		
SW Version:	Delivery date	-	Version no	-
	Installation date	-		
SW Version:	Delivery date	-	Version no	-
	Installation date	-		
SW Version:	Delivery date	-	Version no	-
	Installation date	-		
SW Version:	Delivery date	-	Version no	-
	Installation date	-		

GPS antenna				
Type	GPS-Antenna	Part No.:		ANT-21
Delivery date	-	-		-
HW Version:	Delivery date	-	Version no	-
	Installation date	-		

4.2 TEST ENVIRONMENT

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

4.2.1 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	Phoenix Testlab
Test engineer	Raimund Blask
Location	Blomberg, Germany

Equipment no	Start of test	End of test	Test engineer
1	28 February 2013	20 August 2013	R. Blask
-	-	-	-
-	-	-	-

4.2.2 TEST ENVIRONMENT NO 2

This Test environment is completely equipped as described in Annex A except the DSC test box.
Mainly operational and interface related tests are done in this environment

Room	-
Test engineer	-
Location	-

Equipment no	Start of test	End of test	Test engineer
-	-	-	-
-	-	-	-
-	-	-	-

4.3 COMPOSITION

Display

☐ Internal   ☐ Remote   ☒ not available

DSC

☐ Dedicated DSC Rx   ☒ Time sharing with TDMA Rx

RF Band ability

☐ Only upper band   ☒ upper and lower band can be used

Channel management by msg 22

☒ Msg 22 implemented   ☐ Only AIS 1 and AIS 2 can be used

Serial Interface
☒ Available   ☐ Not available

Standard of serial interface:	NMEA-0183

If not available, a serial test interface is required

Sync signal for Carrier sense test
Required for testing

Parameters	
Polarity:	Active positive
Level	TTL-Level

4.4 REMARKS

Result marking:

Passed	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:

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

4.5.1 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

5 4. GENERAL REQUIREMENTS

5.1 4.2 MANUALS

The manuals shall include:

- *the type of external connectors if applicable;*

- *the required information for correct sitting of the antennas;*

- *the required information for compass safe distance.*

It is checked that the required documentation items are available.

	Test details – General documentation		
Test item	Check	Remark	Result
Composition of customer documentation	Check the composition of customer documentation.	See Manual of CAMINO-108/W	passed
Description of AIS	Check that an general function description of AIS as a new system is included. This is not required but recommended in the introduction phase of a new system.	See page 1 (Sec.1) of the manual.	passed
Operating information	Check that an operating manual is included	See page 18-22 (Sec.5) of the manual.	passed
Technical information	Check that an technical manual is included	See page 23-27 (Sec.6) of the manual.	passed
Installation information	Check that an installation manual is included	See page 10-17 (Sec.4) of the manual.	passed
Language	Check that the documentation is written in English	See Manual of CAMINO-108/W	passed
Some details of installation information			
System overview	Check that an AIS system overview diagram is available	See page 5-7 (Sec.2) of the manual.	passed
Mechanical dimensions	Check that mechanical dimension drawings of transponder are available	See page 26 (Sec.6.2) of the manual.	passed
	Check that mechanical dimension drawings of GPS antenna are available	See page 7 (Sec.2.3) of the manual.	passed
	Check that mechanical dimension drawings of VHF antenna are available	See page 7 (Sec.2.3) of the manual.	passed

	Test details – Requirements of IEC 62287		
Test item	Check	Remark	Result
Type of external Connectors	Check that type of external connectors is included	See page 7 (Sec.2.3) of the manual.	passed
Sitting of antennas	Check that information about sitting the GPS antenna is included	See page 7 (Sec.2.3) of the manual.	passed
	Check that information about sitting the VHF antenna is included	See page 7 (Sec.2.3) of the manual.	passed
Compass safety distance	Check that information about the compass safety distance is included	See BSH-Test-Report "Compass Safety"	passed

5.2 MARKING AND IDENTIFICATION

Each unit of the equipment shall be marked externally with the following information which, where practicable, shall be clearly visible when the equipment is installed in its recommended position:

- *identification of the manufacturer;*

- *equipment type number or model identification;*

- *serial number of the unit;*

- *power supply requirements; and*

- *compass safe distance.*

Alternatively, the marking may be presented on a display at equipment start-up.

The version of software shall be either marked or displayed on command on the equipment.

When the marking and the title and version of the software are presented only on the display, such information shall also be included in the equipment manual.

	Test details – Marking and identification		
Test item	Check	Remark	Result
Type of marking and identification	Check if the equipment is marked	See EUT- Type- Designation	passed
	Check if the marking and identification is shown on a display	No display available	NA
Marking items	Check that the Identification of the manufacturer is available	See EUT- Type- Designation	passed
	Check that the equipment type number or model identification is available	See EUT- Type- Designation	passed
	Check that the serial number of the unit is available	See EUT- Type- Designation	passed
	Check that power supply requirements information is available	See EUT- Type- Designation	passed
	Check that the compass safety distance is available	See EUT- Type- Designation	passed
Software version	Check that the software version is displayed	AMEC AIS Configuration Utility used to read S/W- Version	passed
	Note if the software version is displayed on the equipment or on the display	No display available	NA
	If displayed only on the display: check that the software version is also included in the manual	No display available	NA

6 OPERATIONAL TESTS

6.1 10.2 MODES OF OPERATING

(see 4.1.5)

6.1.1 10.2.1 AUTONOMOUS MODE

(see 4.1.5.1)

6.1.1.1   10.2.1.1 Transmit Position reports

10.2.1.1.1 Method of measurement

Set up standard test environment. Record the VDL communication and check for messages transmitted by the EUT.

10.2.1.1.2 Required results

Confirm that the EUT transmits Messages 18 and 24 following the nominal schedule and alternates between channel A and channel B.

	Test details – Transmission of Position reports		
Test item	Check	Remark	Result
Set up standard test environment			
Msg 18	Check that message 18 is transmitted continuously	-	passed
	Check the transmission schedule of msg 18	-	passed
	Check that msg 18 alternates between channel A and B	-	passed
Msg 24	Check that message 24 is transmitted continuously	-	passed
	Check that msg 24 part A and B are transmitted.	-	passed
	Check the transmission schedule of msg 24	-	passed
	Check that msg 24 alternates between channel A and B	-	passed

6.1.1.2   10.2.1.2 Receive Class A position reports

10.2.1.2.1   Method of measurement

Set up standard test environment.

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

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

c)   Transmit test targets using same time periods on channel A and channel B.

Check the VDL communication, test output, and where provided, display or external interface of the EUT.

10.2.1.2.2   Required results

Confirm that EUT receives continuously under conditions 10.2.1.2.1 a), b) and c) and, where provided, outputs the received messages on the external interface or display.

	Test details a)– Receive Position reports, Target started first		
Test item	Check	Remark	Result
Switch on Test targets, then start operation of the EUT Check the following items on external interface and display			
Check for continuous receiving	On test output	Not available	-
	On external interface	-	passed
	On display	Not available	-
Channels	Check that the position reports are received on channel A	-	passed
	Check that the position reports are received on channel B	-	passed

	Test details a)– Receive Position reports, EUT started first		
Test item	Check	Remark	Result
Switch on EUT, then start Test targets Check the following items on external interface and display			
Check for continuous receiving	On test output	Not available	-
	On external interface	-	passed
	On display	Not available	-
Channels	Check that the position reports are received on channel A	-	passed
	Check that the position reports are received on channel B	-	passed

Dual Slot 0		Test details a)– Receive Position reports in same time periods		
Test item	Check		Remark	Result
Start 2 test targets using the same time slots on channel A and B Check the following items on external interface and display				
Check for continuous receiving	On test output		Not available	-
	On external interface		-	passed
	On display		Not available	-
Channels	Check that the position reports of one target are received on channel A		-	passed
	Check that the position reports of the other target are received on channel B		-	passed
Remark:	This test result has been derived from the Rx performance test (6.1.1.5) because in this test the EUT is receiving in the same time slots on both channels.			

6.1.1.3   10.2.1.3 Receive Class B"CS" position reports

This test is only applicable if a display or display interface for the received messages is provided.

10.2.1.3.1   Method of measurement

Set up standard test environment. Simulate at least one additional Class B"CS" test target (bit stuffing shall not increase 4 bit)

Check the VDL communication, test output, and display or external interface of the EUT.

10.2.1.3.2   Required results

Confirm that EUT receives the Class B"CS" test target continuously and, where provided, outputs the received Messages 18 and 24 on the external interface.

		Test details a)– Receive Class B "CS" position reports		
Test item	Check		Remark	Result
Switch on Test targets, then start operation of the EUT Check the following items on external interface and display				
Check for continuous receiving of msg 18	On test output		Not available	-
	On external interface		-	passed
	On display		Not available	-
Check for continuous receiving of msg 24	On test output		Not available	-
	On external interface		-	passed
	On display		Not available	-
	Check that msg 24 A and B are received		-	passed
Channels	Check that the position reports are received on channel A		-	passed
	Check that the position reports are received on channel B		-	passed

6.1.1.4   10.2.1.4 Receive in adjacent time periods

10.2.1.4.1 Method of measurement

Set up standard test environment. Simulate additional targets so that the first 4 of each 5 time periods are used. The reporting rate may be increased for the purpose of this test.

Check the VDL communication, test output, and where provided, display or external interface of the EUT.

10.2.1.4.2 Required results

Confirm that EUT continuously receives messages in the time periods adjacent to own transmission period with an acceptable loss of 5 %.

	Test details - Receive in adjacent time periods		
Test item	Check	Remark	Result
Simulate targets in 4 of 5 time periods (80 % channel load, VDL tester set "test 80% 4-1") Check the following items on external interface			
Received targets	Check that the targets transmitting in the time periods before the EUT transmission slot are received	-	passed
	Check that the targets transmitting in the time periods after the EUT transmission slot are received	-	passed
	Check that the Rx loss is < 5 %	-	passed

6.1.1.5   10.2.1.5 Rx performance test

10.2.1.5.1 Method of measurement

Set up standard test environment. Simulate additional targets so that 9 of 10 time periods are used.

Check the VDL communication, test output, and where provided, display or external interface of the EUT.

10.2.1.5.2 Required results

Confirm that EUT continuously receives messages and, where provided, outputs the received messages on the external interface with a loss of not more than 5 %.

	Test details - Receive in adjacent time periods		
Test item	Check	Remark	Result
Simulate targets in 9 of 10 time periods (90 % channel load), record the test or external interface			
Rx probability	Check that at least 95 % of the target position reports are received	Channel 1: 0.25% Channel 2: 0.29%	passed

6.1.2 10.2.2 ASSIGNED MODE

(see 4.1.5.2)

6.1.2.1   10.2.2.1 Group assignment

10.2.2.1.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Transmit a group assignment command Message 23 to the EUT addressing stations by

- *region,*

- *station type and*

- *type of ship*

and commanding for

- *Tx/Rx mode,*

- *reporting rate,*

- *quiet time.*

Record transmitted messages.

10.2.2.1.2 Required results

Confirm that the EUT transmits position reports Message 18 according to the defined parameters and reverts to standard reporting rate after 4 min to 8 min.

Confirm that the operation of the EUT is not affected when not addressed.

	Test details - Group assignment, addressed		
Test item	Check	Remark	Result
Test 1: Send a msg 23 with the following parameters: speed = 10 kn			
Region: inside Station type: 0 = all types Type of ship: 0 = all types	check that the reporting rate = 5 s	4s…6s	passed
Tx/ Rx mode = 0: Tx A and B Reporting interval: 8 = 5 s Quiet time: 0 = no quiet time Msg "B Msg 23 Test 10.2.2.1 T1"	Check that EUT reverts to standard reporting rate after 4...8 min	switching after 6min	passed
Test 2: Send a msg 23 with the following parameters:			
Region: inside Station type: 2 = all class B Type of ship: 37 = pleasure craft	check that the reporting rate = 15 s	15s	passed
Tx/ Rx mode = 0: Tx A and B Reporting interval: 9 = next shorter Quiet time: 0 = no quiet time Msg "B Msg 23 Test 10.2.2.1 T2"	Check that EUT reverts to standard reporting rate after 4...8 min	switching after 5min	passed
Test 3: Send a msg 23 with the following parameters:			
Region: inside Station type: 5 = all class B CS Type of ship: 37 = pleasure craft Tx/ Rx mode = 0: Tx A and B Reporting interval: 7 = 10 s Quiet time: 0 = no quiet time Msg "B Msg 23 Test 10.2.2.1 T3"	check that the reporting rate = 10 s	10s	passed
After 2 minutes send the same msg 23 but Reporting interval: 10 = next longer interval	check that the reporting rate = 15 s	15s	passed
Msg "B Msg 23 Test 10.2.2.1 T3", manually change reporting interval to 10	Check that EUT reverts to standard reporting rate after 4...8 min	switching after 6min	passed
Test 4: Send a msg 23 with the following parameters:			
Region: inside Station type: 5 = all class B CS Type of ship: 37 = pleasure craft	check that the reporting rate = 30 s	30s	passed
Tx/ Rx mode = 1: Tx A Reporting interval: 6 = 15 s Quiet time: 0 = no quiet time Msg "B Msg 23 Test 10.2.2.1 T4"	Check that all transmissions are on channel A	-	passed
After 3 minutes send the same msg 23 but Tx/ Rx mode = 2: Tx B	check that the reporting rate = 30 s	30s	passed
Msg "B Msg 23 Test 10.2.2.1 T4", manually change Tx/Rx mode to 2	Check that all transmissions are on channel B	-	passed

Test 5: Send a msg 23 with the following parameters:			
Region: inside Station type: 5 = all class B CS Type of ship: 37 = pleasure craft Tx/ Rx mode = 0: Tx A and B Reporting interval: 0 = auto. Quiet time: 8 = 8 min Msg "B Msg 23 Test 10.2.2.1 T5"	Check that EUT stops transmission for 8 min	-	passed
	Check that the EUT reverts to 30 s reporting rate after 8 min.	30s	Passed

	Test details - Group assignment, not addressed		
Test item	Check	Remark	Result
Send a msg 23 with the following parameters: speed = 10 kn, EUT ship type = 0 Tx/ Rx mode = 0: Tx A and B Reporting interval: 8 = 5 s Quiet time: 0 = no quiet time			
Test 6: Region: outside Station type: 0 = all types Type of ship: 0 = all types Msg "B Msg 23 Test 10.2.2.1 T6"	check that the reporting interval = 30 s	30s	Passed
Test 7: Region: inside Station type: 4 = AtoN Type of ship: 0 = all types Msg "B Msg 23 Test 10.2.2.1 T7"	check that the reporting interval = 30 s	30s	Passed
Test 8: Region: inside Station type: 0 = all types Type of ship: 70 = cargo vessel Msg "B Msg 23 Test 10.2.2.1 T8"	check that the reporting interval = 30 s	30s	Passed

6.1.2.2　10.2.2.2 Base station reservations

10.2.2.2.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Transmit a reservation Message 20 to the EUT specifying reserved time periods.

Record transmitted messages.

10.2.2.2.2 Required results

Confirm that the EUT transmits position reports Message 18 without using reserved time periods.

	Test details - Base station reservations		
Test item	Check	Remark	Result
Test 1: Send a msg 20 with the following parameters: Msg: "B Msg 20 Test 10.2.2.2"			
Tx-slot: 0 offset number: 5 number of slots: 4 slot increment: 5 time-out = 7 Repetition of msg 20: 10 times	Check that only the time periods 0,1..4, 9, 14, 19 ... are used for transmissions	-	passed
	check that after 18 minutes (Tx of msg 20 + time-out) all time periods are used for transmissions	-	passed

6.1.3 10.2.3 POLLED MODE/INTERROGATION RESPONSE　　(SEE 4.1.5.3)
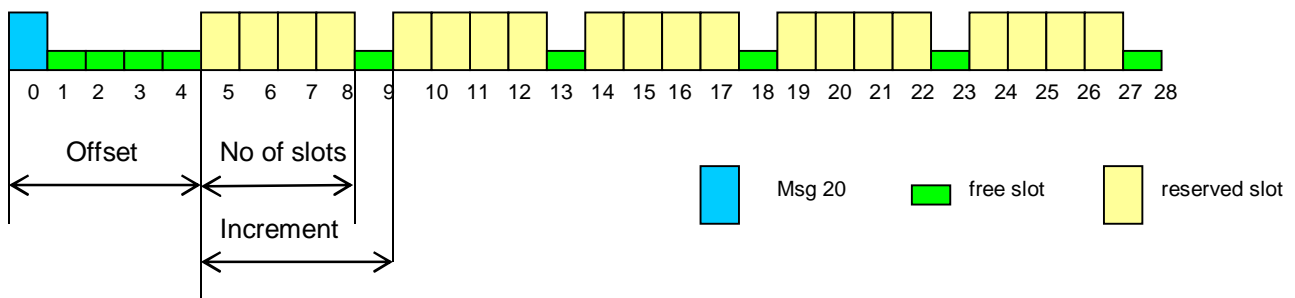
10.2.3.1 Interrogation for Messages 18 and 24

10.2.3.1.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Apply an interrogation message (Message 15; EUT as destination) to the VDL according to message table (ITU-R M.1371 table13) for responses with Message 18, Message 24:

a)   with transmission offset = 0,

b)   with transmission offset = defined value,

c)   with a Message 23 "quiet time" command transmitted before the interrogation.

Record transmitted messages and frame structure.

10.2.3.1.2 Required results

Check that the EUT transmits the appropriate interrogation response message as requested after defined transmission offset. Confirm that the EUT transmits the response to the interrogation on the same channel as that received.

	Test details - Interrogation for msg 18, 20		
Test item	Check	Remark	Result
a) Test 1: Send a msg 15 transmission offset = 0:			
Interrogation for msg 18 and 24 for destination 1, on channel A Msg: "B Msg15 Test 10.2.3.1 T1",	Check that msg 18 is responded	-	passed
	Check that the response was within 30 s	responding within 1s	passed
	Check that the response is transmitted on channel A	-	passed
	Check that msg 24 A is responded within 60 s	responding within 3.8s	passed
	Check that msg 24 B is responded within 90 s	responding within 5.9s	passed
b) Test 2: Send a msg 15 transmission offset = 10:			
Interrogation for 24 for destination 1, offset = 20, 30 and for msg 18, destination 2, offset = 10 Request on channel B Msg: "B Msg15 Test 10.2.3.1 T2",	Check that msg 18 is responded with the defined offset	-	passed
	Check that msg 24 A is responded with the defined offset	-	passed
	Check that msg 24 B is responded with the defined offset	-	passed
	Check that the responses are transmitted on channel B	-	passed
c) Test 3: Send a msg 23 commanding quiet time for 8 min, (setting "B Msg23 Test 10.2.2.1 T5") Send a msg 15 with transmission offset = 10: (setting "B Msg15 Test 10.2.3.1 T2", same as Test 2)			
Interrogation for msg 18 for destination 2	Check that msg 18 is responded with the defined offset	-	passed

6.1.3.1   10.2.3.2 Interrogation for Message 19

10.2.3.2.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Apply an interrogation message (Message 15; EUT as destination) to the VDL according to message table (M.1371 Table13) for responses with Message 19:

a)   with transmission offset = 0,

b)   with transmission offset = defined value.

Record transmitted messages and frame structure.

10.2.3.2.1 Required results

Check that

a)   the EUT does not respond,

b)   the EUT transmits the appropriate interrogation response message as requested after defined transmission offset.

Confirm that the EUT transmits the response on the same channel as that received and the data content is identical with that in Message 24.

	Test details - Interrogation for msg 19		
Test item	Check	Remark	Result
Test 1: Send a msg 15 transmission with interrogation for msg 19: (setting "B Msg 15 Test 10.2.3.2");			
Offset = 0, destination 1	Check that msg 19 is not responded	Only 18 and 24, no message 19	passed
Offset = 15, destination 1 channel = B	Check that msg 19 is responded	-	passed
	Check that msg 19 is responded with the defined offset	-	passed
	Check that the response is transmitted on channel B	-	passed

6.2 10.3 MESSAGES EXTENDING ONE TIME PERIOD
(see 4.1.5)

10.3.1 Method of measurement

Check the documentation for a possibility to initiate transmission of messages longer than one time period.

10.3.2 Required results

It shall not be possible for the user to initiate the transmission of messages longer than one time period.

	Test details - Tx of msg with more than 1 slot		
Test item	Check	Remark	Result
Check documentation	Check that there is no way to initiate the transmission of message longer than 1 time period	Declared by the applicant	passed

6.3 10.4 CHANNEL SELECTION
(see 6.2)

6.3.1 10.4.1 VALID CHANNELS

10.4.1.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Switch the EUT to different channels within the operating band as specified in 6.2 by transmission of channel management message (Message 22) broadcast and addressed to EUT,

Record the VDL messages on the designated channels and check "band flag" and "Message 22 flag" in Message 18. (note that DSC command is covered in Annex C)

10.4.1.2 Required results

Confirm that the EUT switches to the required channel accordingly.

	Test details - Channel selection by msg 22			
Test item	Check	Remark	Result	
Test 1: Send a msg 22 broadcast, EUT inside the area				
Channels 2060, 2062 (msg "B Msg 22 Test 10.4.1 a")	Check that EUT transmits on the assigned channels	-	passed	
	Check that EUT receives on the assigned channels	-	passed	
	Check and note the band flag	-	passed	
	Check that the Msg 22 flag = 1	-	passed	
Send an addressed msg 22 to the EUT, channels 2084, 2086 (msg "B Msg 22 Test 10.4.1 b")	Check that EUT transmits on the assigned channels	-	passed	
	Check that EUT receives on the assigned channels	-	passed	

6.3.2 10.4.2 INVALID CHANNELS

10.4.2.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Check units capability on the "band flag" and "Message 22 flag" in Message 18. Switch the EUT to channels outside the operating band as specified in 6.2.

Record the VDL messages on the designated channels.

10.4.2.2 Required results

Confirm that the EUT does not switch to the respective channels and stops transmissions.

	Test details - Channel selection by msg 22		
Test item	Check	Remark	Result
Test 1: Send a msg 22 broadcast, EUT inside the area			
If the EUT is able to operate in the lower band: Channels 1084, 2084 (msg "B Msg 22 Test 10.4.1 a"), modify channels manually	Check that EUT transmits on the assigned channels	-	passed
	Check that EUT receives on the assigned channels	-	passed
	Check the band flag = 1	-	passed
	Check that the Msg 22 flag = 1	-	passed
If the EUT is not able to operate in the lower band: Channels 1084, 2084 (msg "B Msg 22 Test 10.4.1 a"), modify channels manually	Check that EUT stops transmission	Not applicable	-
	Check that EUT receives on AIS 1 and AIS 2 (default)		-
	Check the band flag = 0		-
	Check that the Msg 22 flag = 1		-
Send a msg 22 broadcast with invalid channels (msg "B Msg 22 Test 10.4.1 a"), modify channels manually	Check that EUT stops transmission	EUT operates at the last correct received channels, no stop of transmission	passed
	Check that EUT receives on AIS 1 and AIS 2 (default)	-	passed

6.4 10.5 INTERNAL GNSS RECEIVER
(see 6.3)

Relevant tests according to IEC 61108-1shall be performed with regard to

- *position accuracy, static;*

- *position accuracy, dynamic;*

- *COG/SOG accuracy;*

- *position update;*

- *status indications (including RAIM, where fitted).*

Note: The GNSS receiver test is not part of this test report. The GNSS receiver is tested in a separate test with a separate test report.

6.5 10.6 AIS INFORMATION
(see 6.5)

6.5.1 10.6.1 INFORMATION CONTENT
(see 6.5.1)

6.5.1.1   10.6.1.1 Defaults

10.6.1.1.1 Method of measurement

Set up the standard test environment and reset the equipment to enable the manufacturers static data delivery defaults. Attempt to set the equipment to operate in autonomous mode.

10.6.1.1.2 Required results

Confirm that the default MMSI is set at 000000000 and that other static data defaults unambiguously identify that the equipment has been properly initialised. Confirm that the transmissions are inhibited and that an indication is given that transmissions are inhibited.

	Test details - Defaults		
Test item	Check	Remark	Result
Reset the EUT to the default settings			
Default settings	Check that the MMSI is 00000000	-	passed
	Check that the other static data are set to default values	-	passed
	Check that the EUT does not transmit	-	passed
	Check that the transmission stop is indicated on the EUT	-	passed

6.5.1.2   10.6.1.2 Required information

10.6.1.2.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Apply all static data to the EUT.

Record all messages on VDL and check the contents of position report Message 18 and static data report Messages 24 A and B.

10.6.1.2.2 Required results

Confirm that data transmitted by the EUT complies with static data and position sensor data.

	Test details - Required information		
Test item	Check	Remark	Result
Apply all necessary data to the EUT			
Required information of msg 18	Check the MMSI	-	passed
	Check the SOG	-	passed
	Check the PA-flag	-	passed
	Check the Longitude	-	passed
	Check the Latitude	-	passed
	Check the COG	-	passed
	Check the Heading	-	passed
	Check the Time stamp	-	passed
	Check the class B unit flag	-	passed
	Check the Display flag	-	passed
	Check the DSC flag	-	passed
	Check the band flag	-	passed
	Check the msg 22 flag	Should be "1" (default)	passed
	Check the Mode flag	-	passed
	Check the RAIM flag	-	passed
Required information of msg 24A	Check the MMSI	-	passed
	Check the Part number = 0	-	passed
	Check the Name	-	passed
Required information of msg 24B	Check the MMSI	-	passed
	Check the Part number = 1	-	passed
	Check the Type of ship and cargo	-	passed
	Check the Vendor ID	-	passed
	Check the Call Sign	-	passed
	Check the Dimension of ship/ reference for position (A, B, C, D)	-	passed

6.5.1.3   10.6.1.3 External sensor information
(see 6.3, 6.6.3)

This test is applicable only if an <u>optiona</u>l interface for external sensors is provided.
This interface is not provided (as declared by the applicant), therefore no tests are applicable

10.6.1.3.1 Method of measurement

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

a)   *Apply external position data with expected error <10m (from GBS sentence) and within 26 m of internal position.*

b)   *Simulate unavailable/invalid external sensor data and missing/incorrect checksum.*

c)   *Apply a non-WGS-84 or unspecified (no DTM) position input.*

d)   *Apply a low accuracy position input with expected error >10m or without RAIM information (no GBS).*

e)   *Apply position data with more than 26 m apart from internal position*

Record all messages on VDL and check the contents of position report Message 18 for position and COG/SOG.

10.6.1.3.2 Required results

a) Confirm that data transmitted by the EUT complies with external sensor inputs.

b), c), d), e) Confirm that external data is not used.

Confirm that accuracy and RAIM flags are set accordingly; confirm that position and COG/SOG are of the same source.

	Test details - Check for implementation		
Test item	Check	Remark	Result
Check the manufacturers documentation			
Implementation of optional function	Check if the input of external sensor data is implemented	Implemented	-

	Test details - External sensor input not implemented		
Test item	Check	Remark	Result
This test is applicable only if external sensor input is not implemented Apply Position sentences, GBS and DTM sentence to the EUT: • Valid position data, • Position within 26 m from internal GPS • GBS < 10 m • GBS = WGS 84			
Apply GLL sentence	Check that external position is not used	optional for later applications	-
	Check that external speed is not used		
	Check that external heading is not used		
Apply GGA sentence	Check that external position is not used		
	Check that external speed is not used		
Apply GNS sentence	Check that external position is not used		
	Check that external speed is not used		
Apply RMC sentence	Check that external position is not used		
	Check that external speed is not used		

	Test details - External GNSS data		
Test item	Check	Remark	Result
This test is applicable only if external sensor input is implemented. Apply a GLL, GBS and DTM sentence to the EUT, if not other specified: • Valid GLL data, • Position within 26 m from internal GPS • GBS < 10 m • GBS = WGS 84			
Valid data as above	Check that external Lat is used	-	passed
	Check that external LON is used	-	passed
	Check that external SOG is used	-	passed
	Check that external COG is used	-	passed
Set GLL status flag to invalid	Check that internal Lat is used	-	passed
	Check that internal LON is used	-	passed
	Check that internal SOG is used	-	passed
	Check that internal COG is used	-	passed
Checksum incorrect	Check that internal Lat is used	-	passed
	Check that internal LON is used	-	passed
	Check that internal SOG is used	-	passed
	Check that internal COG is used	-	passed
DTM not WGS 84	Check that internal Lat is used	-	passed
	Check that internal LON is used	-	passed
	Check that internal SOG is used	-	passed
	Check that internal COG is used	-	passed
Remove DTM	Check that internal Lat is used	-	passed
	Check that internal LON is used	-	passed
	Check that internal SOG is used	-	passed
	Check that internal COG is used	-	passed
Set GBS > 10 m	Check that internal Lat is used	-	passed
	Check that internal LON is used	-	passed
	Check that internal SOG is used	-	passed
	Check that internal COG is used	-	passed
Remove GBS	Check that internal Lat is used	-	passed
	Check that internal LON is used	-	passed
	Check that internal SOG is used	-	passed
	Check that internal COG is used	-	passed
Set external position more than 26 m from the internal position	Check that internal Lat is used	-	passed
	Check that internal LON is used	-	passed
	Check that internal SOG is used	-	passed
	Check that internal COG is used	-	passed

For the following test information about supported sensor sentences is required.

	Test details - External GNSS sentences		
Test item	Check	Remark	Result
This test is applicable only if external sensor input is implemented Apply other Position sentences, GBS and DTM sentence to the EUT, if not other specified: • Valid position data, • Position within 26 m from internal GPS • GBS < 10 m • GBS = WGS 84			
Apply GGA sentence	Check that external Lat is correct	-	passed
	Check that external LON is correct	-	passed
	Check that external SOG is correct	-	passed
	Check that external COG is correct	-	passed
Apply GNS sentence	Check that external Lat is correct	-	passed
	Check that external LON is correct	-	passed
	Check that external SOG is correct	-	passed
	Check that external COG is correct	-	passed
Apply RMC sentence	Check that external Lat is correct	-	passed
	Check that external LON is correct	-	passed
	Check that external SOG is correct	-	passed
	Check that external COG is correct	-	passed

6.5.2 10.6.2 INFORMATION UPDATE RATES
(see 6.5.2)

6.5.2.1　10.6.2.1 Nominal reporting interval

10.6.2.1.1 Method of measurement

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

a)　Start with own SOG of 1 kn; record all messages on VDL for 10 min and evaluate reporting rate for position report of EUT by calculating average transmission offset over test period.

b)　Increase speed to 10 kn.

c)　Reduce speed to 1 kn.

Record all messages on VDL and check transmission offset between two consecutive transmissions.

10.6.2.1.2 Required results

a)　Reporting interval shall be 3 min (±10 s).

b)　Confirm that the reporting interval of 30 s (±5 s) has been established after the next transmission in the old schedule at the latest. The average reporting interval calculated over at least 25 transmissions shall be 30 s (±2 s).

c)　Confirm that the reporting rate is reduced after 3 min (speed reduction).

	Test details - Autonomous reporting rate		
Test item	Check	Remark	Result
Apply SOG according to the test items and check the reporting rate			
a) SOG = 1 kn for 10 min	Check that the reporting rate = 3 min +/- 10s	2min54s	passed
b) Change SOG to 10 kn for 15 min	Check that the reporting rate = 30 s +/- 5s	New reporting interval is 31.7s	passed
	Check that the reporting rate is established after the next transmission of the old schedule	-	passed
	Change of reporting rate	-	passed
	Check that the average reporting rate of 25 Tx = 30 s +/- 2s	30.1s	passed
c) SOG = 1 kn for 10 min	Check that the reporting rate = 3 min +/- 10s	3min+/-1.3s	passed
	Check that the reporting rate is reduced after 3 min	-	passed

6.5.2.2   10.6.2.2 Assigned reporting interval

10.6.2.2.1 Method of measurement

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

a)   *Transmit an assigned mode command Message 23 to the EUT with designated reporting intervals of 5 s to 3 min according to Table 17.*

b)   *Transmit an assigned mode command Message 23 to the EUT with designated reporting interval of 10 min.*

c)   *Transmit Messages 23 with a refresh rate of 1 min with designated reporting intervals of 6 min and 10 min.*

d)   *Transmit Messages 23 designated reporting interval field settings of 11-15*

e)   *Change course, speed. Record transmitted messages.*

10.6.2.2.2 Required results

a)   *Confirm that the EUT transmits position reports Message 18 according to the parameters defined by Message 23. The EUT shall revert to autonomous mode with nominal reporting interval after 4 min to 8 min.*

b)   *Confirm that the EUT reverts to autonomous mode with nominal reporting interval after 4 min to 8 min.*

c)   *Confirm that the EUT transmits position reports Message 18 according to the parameters defined by Message 23.*

d)   *Confirm that the EUT does not change its nominal behaviour.*

e)   *The reporting interval shall not be affected by course or speed.*

Remark: Reporting rates 5, 10, 15 s are tested in 10.2.2.1

	Test details - Assigned reporting interval		
Test item	Check	Remark	Result
Test a: Send a msg 23 with the following parameters: speed = 1 kn			
Region: inside Reporting interval: 5 = 30 s Msg "B Msg 23 Test 10.6.2.2. Ta1"	Check that the reporting interval = 30 s	30.0s	passed
	Check that EUT reverts to standard reporting rate after 4...8 min	8min	passed
Test a: Send a msg 23 with the following parameters: speed = 10 kn			
Region: inside Reporting interval: 3 = 3 min Msg "B Msg 23 Test 10.6.2.2. Ta2"	check that the reporting interval = 3 min	3min	passed
	Check that EUT reverts to standard reporting rate after 4...8 min	4min	passed
Test b: Send a msg 23 with the following parameters:			
Reporting interval: 1 = 10 min Msg "B Msg 23 Test 10.6.2.2. Tb"	Check that EUT reverts to standard reporting rate after 4...8 min	4min	passed
Test c1: Send a msg 23 with the following parameters and repeat it every minute for at least 15minutes			
Reporting interval: 2 = 6 min Msg "B Msg 23 Test 10.6.2.2. Tc1"	check that the reporting rate = 6 min	6min	passed
	Check that EUT reverts to standard reporting rate 4...8 min after last msg 23	8min	passed
Test c2: Send a msg 23 with the following parameters and repeat it every minute for at least 22 minutes			
Reporting interval: 1 = 10 min Msg "B Msg 23 Test 10.6.2.2. Tc2"	check that the reporting rate = 10 min	10min	passed
	Check that EUT reverts to standard reporting rate 4...8 min after last msg 23	8min	passed
Test d: Send a msg 23 with the following parameters:			
Reporting interval:11 Msg "B Msg 23 Test 10.6.2.2. Td1"	check that the reporting rate is not affected	no change	passed
Reporting interval:15 Msg "B Msg 23 Test 10.6.2.2. Td2"	check that the reporting rate is not affected	no change	passed
Test e: Send a msg 23 with the following parameters: Reporting rate: 4 = 1 min, Msg "B Msg 23 Test 10.6.2.2. Te"			
Speed = 1 kn	Check that the reporting rate is 1 min	1min	passed
Change speed to 15 kn	check that the reporting rate is not affected	1min	passed
Change heading with 20 deg/min	check that the reporting rate is not affected	1min	passed

6.5.2.3 10.6.2.3 Static data reporting interval

10.6.2.3.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Record the transmitted messages and check for static data (Message 24).

Repeat the test at an assigned reporting interval of 5 s.

10.6.2.3.2 Required results

Confirm that the EUT transmits submessages 24A and 24B every 6 min (24B following 24A within 1 min). Transmission shall alternate between channel A and channel B and be independent of the Message 18 reporting interval.

*

	Test details - Static data reporting interval		
Test item	Check	Remark	Result
Speed = 1 kn			
Msg 18 reporting rate	check that the msg 18 reporting rate = 3 min	-	passed
Msg 24 reporting rate	check that the reporting rate of msg 24 A and B is 6 min	-	passed
	Check that the distance between msg 24 A and B is < 1 min	-	passed
	Check that 24 A/B alternate between channel A and B	-	passed
Speed = 10 kn			
Msg 18 reporting rate	check that the msg 18 reporting rate = 30 s	-	passed
Msg 24 reporting rate	check that the reporting rate of msg 24 A and B is 6 min	-	passed
	Check that the distance between msg 24 A and B is < 1 min	-	passed
	Check that 24 A/B alternate between channel A and B	-	passed
Send a msg 23 with the reporting interval: 8 = 5s. Msg "B Msg 23 Test 10.2.2.1 T1"			
Msg 18 reporting rate	check that the msg 18 reporting rate = 5 s	-	passed
Msg 24 reporting rate	check that the reporting rate of msg 24 A and B is 6 min	-	passed
	Check that the distance between msg 24 A and B is < 1 min	-	passed
	Check that 24 A/B alternate between channel A and B	-	passed

6.6 10.7 INITIALISATION PERIOD
(see 6.5.3)

10.7.1 Method of measurement

Set up standard test environment with SOG>2 kn.

a) Switch on the EUT from cold (off-time minimum 1 h) with EUT operating in autonomous mode.

b) Switch off the EUT for a period of time between 15 min to 60 min and switch on again.

c) Make the GNSS sensor unavailable for a period of time between 1 min to 5 min

Record transmitted messages.

10.7.2 Required results

Confirm that the EUT starts regular transmission of Message 18 including valid position:

a) within 30 min after switch on;

b) within 5 min;

c) stops transmitting after the next transmission and resumes within 1 min after enabling the position source.

Test details - Initialisation period			
Test item	Check	Remark	Result
Switch the On and Off according to the test items			
a) Switch the EUT on in the morning (> 1 h off)	Check that the EUT starts msg 18 within 30 min	4min	passed
b) Switch the unit of for 15 ... 60 min and on again	Check that the EUT starts msg 18 within 5 min	4min13s	passed
c) Disable GNSS for 1 ... 5 min	Check that the EUT stops transmission	-	passed
Enable GNSS again	Check that the EUT starts msg 18 within 1 min.	35s	passed

6.7 10.8 ALARMS AND INDICATIONS, FALL-BACK ARRANGEMENTS
(see 6.6)

6.7.1 10.8.1 BUILT IN INTEGRITY TEST
(see 6.6.1)

10.8.1.1 Method of measurement

Check manufacturer's documentation on built-in integrity test.

10.8.1.2 Required result

Verify that an indication is provided if a malfunction is detected.

	Test details - Built in integrity test		
Test item	Check	Remark	Result
Check manufacturer's documentation			
Malfunction detection	Check that the EUT indicates the detection of a malfunction	-	passed
	Note the kind of indication	GPS-disconnect more than 30min	passed

6.7.2 10.8.2 TRANSCEIVER PROTECTION

10.8.2.1 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 5 min each.

10.8.2.2 Required results

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

		Test details - Transceiver protection		
Test item	Check	Remark		Result
Open circuit of VHF antenna terminal for > 5 min	Check that the EUT generates an antenna VSWR exceeded alarm	-		passed
Continued: Open circuit of VHF antenna terminal for > 5 min	Check that EUT starts transmission within 2 min after refitting the antenna	-		passed
Short circuit of VHF antenna terminal for > 5 min	Check that the EUT generates an antenna VSWR exceeded alarm	-		passed
	Check that EUT starts transmission within 2 min after refitting the antenna	-		passed

6.7.3 10.8.3 TRANSMITTER SHUTDOWN PROCEDURE
(see 6.6.2)

10.8.3.1 Method of measurement

Check manufacturer's documentation on transmitter shutdown procedure.

10.8.3.2 Required result

Verify that a transmitter shutdown procedure independent of the operating software is provided.

		Test details - Transmitter shutdown procedure		
Test item	Check	Remark		Result
Check manufacturer's documentation				
Malfunction detection	Check that the transmitter shutdown procedure is described	Hardware shutdown implemented		passed
	Check that the transmitter shutdown procedure is independent of the software	(declared by the applicant).		passed

10.8.3.4 POSITION SENSOR FALLBACK CONDITIONS (SEE 6.6.3)

Not applicable because no additional position sensor available (declared by the applicant).
EUT operates with internal GPS-Position only.

10.8.3.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Where an option for an external GNSS sensor is not provided, then the respective tests shall be omitted.

Apply position sensor data in a way that the EUT operates in the states defined below:

a)   external DGNSS in use if implemented;

b)   internal DGNSS in use (corrected by Message 17) if implemented;

c)   internal DGNSS in use (corrected by a beacon) if implemented;

d)   external GNSS in use if implemented;

e)   internal GNSS in use ;

f)   no sensor position in use.

Check the position accuracy and RAIM flag in the VDL Message 18 and, where provided, the ALR sentence.

10.8.4.2 Required result

Verify that the use of position source, position accuracy flag, RAIM flag and position information complies with Table 1

Verify that the position sensor status is maintained for the next scheduled report and changed after that.

	Test details - Position priority – Position sensor fallback with external sensor input			
Test item	Check	Remark	Result	
Connect sensor inputs and correction data according to the test items. Sensor input file name: AIS01_gll_vtg_hdt_near.sst Internal GPS: RAIM expected, external: RAIM.				
Changing downwards				
a) Set: • Internal GNSS available • External DGNSS	Check that external position is used	-	passed	
	Check that position accuracy flag = 1	-	passed	
	Check that the RAIM flag = 1	-	passed	
b) Change from a: • Internal DGNSS available msg 17 • External GNSS	Check that internal position is used	Msg 17 is not supported, so not applicable	-	
	Check that position accuracy flag = 1		-	
	Check that RAIM flag = 1		-	
	Check that sensor source is changed after the next scheduled position report		-	
c) Change from a: • Internal DGNSS available beacon input • External GNSS	Check that internal position is used	Beacon input is not supported, so not applicable	-	
	Check that position accuracy flag = 1		-	
	Check that RAIM flag = 1		-	
	Check that sensor source is changed after the next scheduled position report		-	
d) Change from b: • Internal GNSS • External GNSS	Check that external position is used	-	passed	
	Check that position accuracy flag = 0	-	passed	
	Check that RAIM flag = 1	-	passed	
	Check that sensor source is changed after the next scheduled position report	-	passed	
e) Change from d: • Internal GNSS • Remove external GNSS	Check that internal position is used	-	passed	
	Check that position accuracy flag = 1	-	passed	
	Check that RAIM flag = 1	-	passed	
	Check that there is an ALR output ID 025 (External EPFS lost)	ALR is not supported	-	
	Check that sensor source is changed after the next scheduled position report	-	passed	
f) Change from e: • Inhibit internal GNSS • No external GNSS	Check that there is an ALR output ID 026 (no sensor position in use) - optional	-	passed	
	Check that EUT stops transmission of position report after the next scheduled position report	-	passed	

Changing upwards			
e) Change from f: • Internal GNSS • No external GNSS	Check that the EUT starts transmission	-	passed
	Check that internal position is used	-	passed
	Check that position accuracy flag = 0	PA-flag is high	passed
	Check that RAIM flag = 1	-	passed
	Check that the ALR output ID 025 (External EPFS lost) is updated - optional	Not supported	-
d) Change from e: • Internal GNSS • External GNSS	Check that external position is used	-	passed
	Check that position accuracy flag = 0	-	passed
	Check that RAIM flag = 1	-	passed
	Check if there is an indication of the source change - optional	Not supported	-
c) Change from d: • Internal DGNSS available beacon input • External GNSS	Check that internal position is used	Not supported, so not applicable	-
	Check that position accuracy flag = 1		-
	Check that RAIM flag = 1		-
	Check if there is an indication of the source change - optional		-
b) Change from d: • Internal DGNSS available msg 17 • External GNSS	Check that internal position is used	Not supported, so not applicable	-
	Check that position accuracy flag = 1		-
	Check that RAIM flag = 1		-
	Check if there is an indication of the source change - optional		-
a) change from b: • DGNSS available • External DGNSS	Check that external position is used	-	passed
	Check that position accuracy flag = 1	PA-flag is high	passed
	Check that the RAIM flag = 1	-	passed
	Check if there is an indication of the source change - optional	Not supported	-

	Test details - Position priority – Position sensor fall back without external sensor input		
Test item	Check	Remark	Result
Connect sensor inputs and correction data according to the test items. Sensor input file name: AIS01_gll_vtg_hdt_near.sst Internal GPS: RAIM expected, external: RAIM.			
Changing downwards			
b) Internal DGNSS available msg 17	Check that the internal position is used	Not applicable	NA
	Check that position accuracy flag = 1	-	NA
	Check that RAIM flag = 1	-	NA
c) Internal DGNSS available beacon input	Check that the internal position is used	-	NA
	Check that position accuracy flag = 1	-	NA
	Check that RAIM flag = 1	-	NA
d) Change from b: • Internal GNSS	Check that the internal position is used	-	passed
	Check that position accuracy flag = 0 (Depending on the RAIM result it can also be 1)	-	passed
	Check if there is an source change indication – optional	-	passed
	Check that RAIM flag = 0	-	passed
f) Change from e: • Inhibit internal GNSS	Check that there is an ALR output ID 026 (no sensor position in use)	-	NA
	Check that EUT stops transmission of position report after the next scheduled position report	-	passed
d) Change from f: • Internal GNSS	Check that the EUT starts transmission	-	passed
	Check that the ALR output is updated	-	NA
	Check if there is a source change indication - optional	-	NA
	Check that position accuracy flag = 0 (Depending on the RAIM result it can also be 1)	-	passed
	Check that RAIM flag = 1	-	passed

b) Change from d) Internal DGNSS available msg 17	Check that the internal position is used	Not applicable	NA
	Check if there is a source change indication - optional	-	NA
	Check that position accuracy flag = 1	-	NA
	Check that RAIM flag = 1	-	NA
c) Change from d) Internal DGNSS available beacon input	Check that the internal position is used	-	NA
	Check if there is a source change indication - optional	-	NA
	Check that position accuracy flag = 1	-	NA
	Check that RAIM flag = 1	-	NA

10.8.5 SPEED SENSORS (SEE 6.6.4)

Not applicable because no additional speed sensor available (declared by the applicant).
EUT operates with internal GPS-Position only.

10.8.5.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Where an option for an external GNSS sensor is not provided, this test shall be omitted.

Apply valid external DGNSS position and speed data.

Make external DGNSS position invalid (for example. by wrong checksum, "valid/invalid" flag) .

10.8.5.1 Required result

Check that the external data for SOG/COG is transmitted in Message 18.

Check that the internal data for SOG/COG is transmitted in Message 18.

	Test details - Speed sensors		
Test item	Check	Remark	Result
Connect sensor inputs and correction data according to the test items. Sensor input file name: AIS01_gll_vtg_hdt_near.sst Internal GPS: RAIM expected, external: RAIM active.			
Set: • Internal GNSS available • External DGNSS	Check that external SOG is used	-	passed
	Check that external COG is used	-	passed
Change to: • Internal GNSS available • External DGNSS invalid	Check that internal SOG is used	-	passed
	Check that internal COG is used	-	passed

6.8 10.9 USER INTERFACE (SEE 6.7)

6.8.1 10.9.1 DISPLAY (SEE 6.7.1)
No display available (as declared by the applicant)

10.9.1.1 Method of measurement

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

*a)	Check status indications for power, Tx timeout, Error.*

*b)	Apply Message 23 "quiet time" of >7 min.*

*c)	Simulate VDL load in order to make it impossible for the EUT to find free candidate periods.*

10.9.1.2 Required results

*a)	Indicators shall be available and working correctly according to manufacturer's documentation.*

*b)	Check that the Tx timeout indication is activated.*

*c)	Check that the Tx timeout indication is activated.*

Test details - Display			
Test item	Check	Remark	Result
Operate EUT in autonomous mode			
a) Check for indicators	Check that a power indicator is available	LED (green)	passed
	Check that the power indicator is on	available	passed
	Check that a TX timeout indicator is available	LED (red, flashing)	passed
	Check that an error indicator is available.	LED (red)	passed
b) Apply msg 23 for quiet time > 7 min Msg "B Msg 23 Test 10.2.2.1 T5"	Check that the Tx indicator is on	"silent LED" (red)	passed
c) Simulate high channel load to disable transmission	Check that the Tx indicator is on	LED (red, flashing)	passed
Disable position	Check that the Tx indicator is on	LED (red, flashing)	passed
Simulate an error according to documentation, if possible	Check that the error indicator is on	Without MMSI (default 0) error-LED is stated	passed

6.8.2 10.9.2 MESSAGE DISPLAY
No display available (as declared by the applicant)

10.9.2.1 Method of measurement

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

Transmit a Message 14.

10.9.2.2 Required results

Verify that the EUT displays the message.

	Test details - Message display		
Test item	Check	Remark	Result
Only applicable if a message display is provided			
Send a msg 14 from another station	Check that the msg 14 is correctly displayed	No display available	-

6.8.3 10.9.3 STATIC DATA INPUT (SEE 6.7.2)

10.9.3.1 Method of measurement

Verify that static data can be input to the unit according to the manufacturer's documentation. Set up standard test environment and operate EUT in autonomous mode.

10.9.3.2   Required results

Check that static data are transmitted correctly by the EUT and that the MMSI cannot be altered by the user.

	Test details - Static data input		
Test item	Check	Remark	Result
Input static data according to manufacturers documentation, as far as not yet set by the manufacturer			
Check the static data transmitted in msg 18 and 24	Check the User ID (MMSI)	-	passed
	Check the Name	-	passed
	Check the Type of ship and cargo	-	passed
	Check the Vendor ID	-	passed
	Check the call sign	-	passed
	Check the dimension of ship/reference for position	-	passed
Input protection	Check that the MMSI cannot be altered by the user	Programmable once	passed
	Check that the Vendor ID cannot be changed by the user	Not programmable, fixed value	passed

6.8.4 10.9.4 EXTERNAL INTERFACES (SEE 6.7.3)

6.8.4.1   10.9.4.1 Display interface
No display available (as declared by the applicant)

10.9.4.1.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Apply a safety related broadcast Message 14 through the VDL to the EUT.

Check the output on the display interface.

10.9.4.1.2 Required results

The interface shall be compliant with IEC61162 series protocol and the manufacturer's documentation of interface hardware.

	Test details - Display interface		
Test item	Check	Remark	Result
Only applicable if a display interface is provided			
Send a msg 14 from another station	Check that the msg 14 is correctly output on the display interface	-	passed
	Check that the format is according to IEC 61162	-	passed

7 12   SPECIFIC TESTS OF LINK LAYER (SEE 7.3)
7.1 12.1 TDMA SYNCHRONISATION

7.1.1 12.1.1 SYNCHRONISATION TEST SYNC MODE 1

Not available (as declared by the applicant) because EUT uses UTC-synchronization received from the GPS-Signal !!!

12.1.1.1 Definition

Synchronisation jitter (transmission timing error) is the time between nominal start of the transmission time period as determined by a UTC synchronisation source ($T_{o\ ref}$) and T_o of the EUT ($T_{o\ EUT}$).

12.1.1.2 Method of measurement

Set up standard test environment and set the EUT to assigned mode for a reporting rate of 5 s. Enable test conditions for the following:

- *station transmitting Message 1 or 2, 3, 4, 18, 19 not subject to a CS-delay, with repeat indicator = 0, with no propagation delay and with position available is received by the EUT;*

- *no sync source (switched off);*

- *with the internal clock of the EUT out of sync (sync jitter > 1000 μs), transmit messages not to be used as sync source (see 7.3.1.1) to the EUT;*

- *repeat test a) using a sync source transmitting Message 4; simulate the position of the station providing the sync source (for example a base station 60 NM = 416 μs away from EUT position) in order to simulate a propagation delay;*

- *Repeat test d) with an additional source transmitting Message 1 or 2, 3, 4, 18 not subject to a CS-delay, with repeat indicator = 0, with no propagation delay and with position available is received by the EUT.*

Record VDL messages and measure the time between $T_{o\ ref}$ of the synchronisation source and the initiation of the "transmitter on" function T_A and calculate back to $T_{o\ EUT}$ (a sync output may be used for the purpose of this test). Alternative methods, for example by evaluating the start flag are allowed.

12.1.1.3 Required results

d)   *The EUT shall synchronise on the received source and the synchronisation jitter shall not exceed ±312 μs (sync mode 1).*

e)   *The synchronisation jitter shall not exceed ±312 μs during a 30 s period from the time a proper sync source was last received.*

f)   *The EUT shall not synchronise on these received messages.*

g)   *The synchronisation jitter of the EUT shall be within –416 μs ±312 μs .*

h)   *The synchronisation jitter of the EUT shall be –208 μs ±312 μs within 60 s.*

	Test details - Synchronisation test sync mode 1		
Test item	Check	Remark	Result
Setup an assigned reporting rate of 5 s The correct timing is T_{classA}+ 1568 μs			
a) Transmit an appropriate position report as sync source Msg "B Msg 23 Test 10.2.2.1 T1"	Check that the EUT does synchronise to the sync source	-	passed
	Check that the sync jitter does not exceed ±312 μs from the sync source	-	passed
	Check that the sync mode value in the comm state is 3	-	passed
b) Remove sync source	Check that the sync jitter does not exceed ±312 μs for the next 30 s after last received sync msg	-	passed
	Check that the sync mode value in the comm state is 3	-	passed
c) Restart the EUT to get it out of sync (>1000μs) Transmit a position report with repeat indicator not 0. Msg "B Msg 1 Test 12.1.1 c"	Check that EUT does not synchronise to the msg	-	passed
d) Transmit msg 4, range to EUT = 60 NM Msg "B Msg 4 Test 12.1.1 d"	Check that the sync jitter of the EUT is within –416 μs ±312 μs from the msg 4	-	passed
e) Transmit msg 4, range to EUT = 60 NM, and msg 1/3, range = 0 Msg "B Msg 1 Test 12.1.1 d"	Check that the sync jitter of the EUT is within –208 μs ±312 μs from the msg 1, after 60 s	-	passed

Note)
To make the behaviour clearer I performed test e) in 3 phases:

- Phase 1: Msg 4 with 60 NM distance only, like in test d)
- Phase 2: Msg 4 with 60 NM distance + Msg 1 with 0 NM distance, as e) requirement
- Phase 3: Msg 1 with 0 NM distance only, like in test a)

7.1.2 12.1.2 SYNCHRONISATION TEST SYNC MODE 2

Not available (as declared by the applicant) because EUT uses UTC-synchronization received from the GPS-Signal !!!

12.1.2.1 Method of measurement

Set up standard test environment and enable test conditions for the following:

i) operate EUT in sync mode 2 for more than 5 min.

j) Switch on sync source immediately after scheduled transmission of EUT. Sync source shall be a station transmitting Message 1 or 2,3,4,18,19 not subject to a CS-delay, with repeat indicator = 0 and with position available with a reporting rate of 10 s.

Record VDL messages and measure the time between $T_{o\,ref}$ of the synchronisation source and the initiation of the "transmitter on" function T_A and calculate back to $T_{o\,EUT}$ (a sync output may be used for the purpose of this test). Alternative methods, for example by evaluating the start flag are allowed.

12.1.2.2 Required results

Verify that the EUT synchronises its next scheduled transmission on the sync source. The synchronisation jitter shall not exceed ±312 μs.

	Test details - Synchronisation test sync mode 2		
Test item	Check	Remark	Result
Operate in autonomous mode The correct timing is T_{classA}+ 1568 μs			
a) Operate in sync mode 2 for more than 5 min	Check that the EUT is not synchronised	-	passed
b) After scheduled transmission start appropriate sync source	Check that the sync jitter of the next transmission does not exceed ±312 μs from the sync source	-	passed

7.1.3 12.1.3 SYNCHRONISATION TEST WITH UTC

This test is only relevant if optional synchronisation sources providing UTC are implemented.

12.1.3.1 Method of measurement

Set up standard test environment and enable test conditions in a way that EUT operates in UTC synchronised mode.

12.1.3.2 Required results

The synchronisation jitter shall not exceed ±312 μs.

	Test details - Synchronisation test sync mode 1		
Test item	Check	Remark	Result
Connect the optional synchronisation source The correct timing is T_{classA}+ 20 bit (2083μs)			
Optional synchronisation	Check that the sync does not exceed ±312 μs from the correct UTC timing	-	passed

7.2 12.2 CARRIER-SENSE TESTS

7.2.1 12.2.1 THRESHOLD LEVEL

12.2.1.1 Definition

Carrier-Sense threshold is the signal level below that which a time period shall be regarded as unused and a transmission may take place.

12.2.1.2 Method of measurement

The test configuration is described here in its most basic form, using three signal sources with RF (PIN) switches selecting when each signal is applied to the EUT. Other equipment configurations may be used if they fulfil the same requirements (for example a single RF source fed via a switched attenuator, which is controlled by a timing circuit).
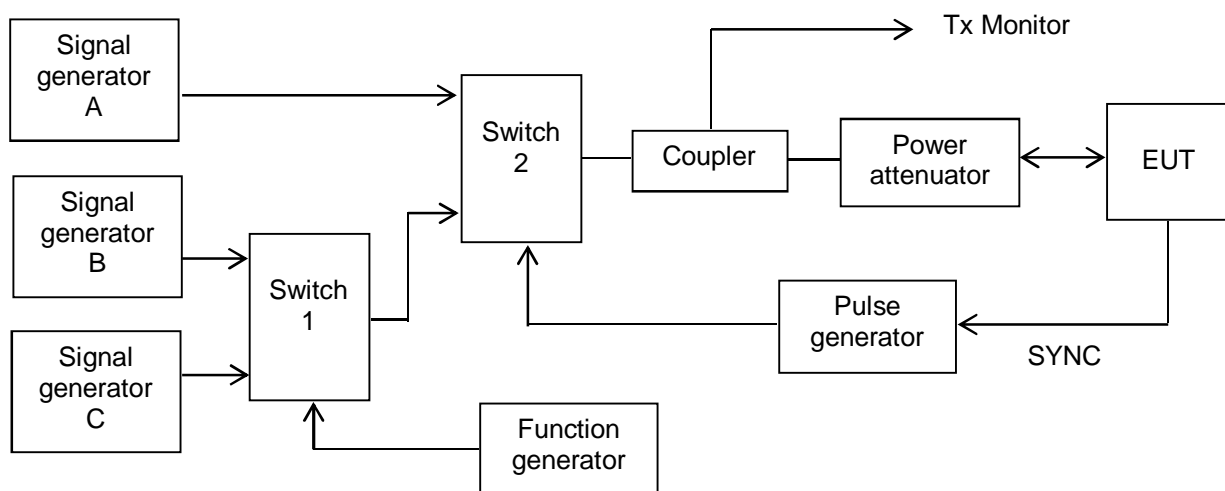
Figure 1 – Configuration for Carrier-Sense threshold test

a)   *Signal C is a carrier modulated with a 400 Hz FM signal with a deviation of 3 kHz equivalent to –60 dBm at the EUT. The switches connect this signal to the EUT most of the time to mimic 100 % channel loading with strong traffic.*

b)   *Signal B is a carrier modulated with a 400 Hz FM signal with a deviation of 3 kHz equivalent to –87 dBm at the EUT. Switch 1 replaces signal C with signal B for 26,67 ms. The function generator makes this happen once every 2 s. This imitates one vacant time period in a 99 % loaded channel. The level of Signal B can be manually switched between –87 dBm and OFF to mimic high and low background levels (resulting in a threshold level of –77 dBm and –107 dBm).*

c)   *Signal A is a carrier modulated with a 400 Hz FM signal with a deviation of 3 kHz equivalent to –104 dBm at the EUT. When the EUT attempts a transmission, switch 2 replaces the 'background traffic' with signal A to imitate an incoming message intended to inhibit the transmission attempt. The level of signal A can be manually set to –74 dBm, –104 dBm and OFF (defined as less than –117 dBm).*

d)   All three signal generators are tuned to the same frequency. The test shall be carried out on the lowest frequency declared by the manufacturer and AIS 2 (162,025 MHz).

e)   For the purposes of this test, the EUT will be equipped with a test signal (SYNC) indicating the start of each time period that it intends to transmit into. This is used to trigger the pulse generator which after a delay of 0,8 ms (8 bits) generates a 23,3 ms (224 bits) pulse for switch 2.

f)   With the signal levels set to the levels shown in the first row of the following table, the EUT shall be observed making routine scheduled position reports. Levels shall then be adjusted as per subsequent steps and the EUT monitored for 10 min (or at least 20 reporting attempts) to confirm if transmission has ceased.

12.2.1.3   Required results

Table 24 – Required threshold test results

Step	Description	Signal A (dBm)	Signal B (dBm)	EUT transmission
1	Time period free	OFF	OFF	Yes
2	Time period used	−104	OFF	Ceased
3	Recovery	OFF	OFF	Yes
4	Raised background	OFF	−87	Yes
5	Time period used	−74	−87	Ceased
6	Recovery	OFF	−87	Yes

	Test details - Threshold level		
Test item	Check	Remark	Result
Run the test automatically with all steps, using the automatic test adapter. Record the transmissions of the EUT and the step information output of the test adapter			
Step 1	Check that the EUT has transmitted	Test will be carried out by the BSH. Additional Test-Report available.	
Step 2	Check that the EUT has not transmitted		
Step 3	Check that the EUT has transmitted		
Step 4	Check that the EUT has transmitted		
Step 5	Check that the EUT has not transmitted		
Step 6	Check that the EUT has transmitted		

7.2.2 12.2.2 CARRIER SENSE TIMING

12.2.2.1 Definition

This test is to verify that signals that are received before the CS detection window starts are not used for the detection of used time periods.

12.2.2.2 Method of measurement

Use the test configuration and signals of test 12.2.1.

Signal B is switched off, signal A can be manually set to -74 dBm, -104 dBm and OFF.

The SYNC signal of the EUT indicating the start of each time period that it intends to transmit into is used to trigger the pulse generator to generate a 0,7 ms (7 bits) pulse for switch 2 starting at the SYNC signal (this pulse ends 1 bit before start of the CS detection window of the EUT)

f) Levels shall be adjusted as per the steps given in Table 25 and the EUT monitored for 10 min (or at least 20 reporting attempts) to confirm if EUT transmits.

12.2.2.3 Required results

Table 25 Required carrier sense timing results

Step	Description	Signal A (dBm)	Signal B (dBm)	EUT transmission
1	Time period free	OFF	OFF	Yes
2	Time period free	-104	OFF	Yes
3	Time period free	-74	OFF	Yes

	Test details - Carrier sense timing		
Test item	Check	Remark	Result
Run the test automatically with all steps, using the automatic test adapter. Record the transmissions of the EUT and the step information output of the test adapter			
Step 1	Check that the EUT has transmitted	Test will be carried out by the BSH. Additional Test-Report available.	
Step 2	Check that the EUT has transmitted		
Step 3	Check that the EUT has transmitted		

7.3 12.3 VDL STATE/RESERVATIONS

12.3.1 Method of measurement

Set up standard test environment and operate EUT with assigned reporting interval of 10 s. Record transmitted scheduled position reports Message 18 and check time periods used for transmission.

k) Transmit a Message 20 to the EUT reserving a block of time periods including timeout.

l) Transmit a Message 20 to the EUT reserving a block of time periods without timeout.

12.3.2 Required results

m) Verify that the reserved block is not used and used again after the timeout specified in Message 20.

n) Verify that the reserved block is not used and used again after a timeout of 3 min.

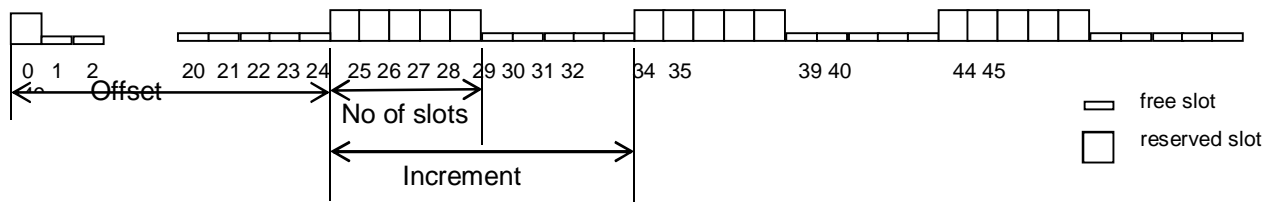|	Test details – VDL state/ reservations		
Test item	Check	Remark	Result
Send a message 20 from VDL Generator with slot offset and increment for slot reservation according to the description below. Set time-out according to the test item. Set assigned reporting interval of 10 s.			
a) Timeout = 6 Msg "B Msg 20 Test 12.3 a" Msg "B Msg 23 Test 12.3"	Check that the reserved slots are not used by the EUT within the time-out	-	passed
	Check that after end of reservation all slots are used again.	-	passed
b) Timeout = 0 (not available) Msg "B Msg 20 Test 12.3 b" Msg "B Msg 23 Test 12.3"	Check that the reserved slots are not used by the EUT within 3 min	-	passed
	Check that after end of reservation all slots are used again.	-	passed

Test scenario: Msg 20 transmission by test system.
Msg 20 reserves slots which should not be used by mobile stations.
Msg 20 parameters:
- Msg 20 is transmitted in slot 0 in each frame
- Offset number 1:   25
- Number of slots: 5
- Time out 1:   6 / 0 depending on test item
- Increment: 10

FATDMA reservation

7.4 12.4 DATA ENCODING (BIT STUFFING)

12.4.1 Method of measurement

Set up standard test environment.

Set ships name to a value that requires bit-stuffing for example "wwwww" and check the VDL (note that this might require that the manufacturer provides means to input this data).

12.4.2 Required results

Confirm that transmitted VDL Message 24 conforms to data input.

	Test details - Data encoding (bit stuffing)		
Test item	Check	Remark	Result
Set ships name to a value requiring bit stuffing			
Msg 24 content	Check that the ships name in msg 24 on VDL is correct	-	passed

7.5 12.5 FRAME CHECK SEQUENCE

12.5.1 Method of measurement

Apply simulated position report messages with wrong CRC bit sequence to the VDL.

o)   Check test output; if a display interface is provided, check this.

p)   Repeat test 12.1.1 and check that a station transmitting messages with wrong CRC are not used for synchronisation.

12.5.2 Required results

Confirm that messages with invalid CRC are not accepted by the EUT in cases a) and b).

	Test details - Frame check sequence		
Test item	Check	Remark	Result
Transmit position report message from VDL generator			
Set CRC bit sequence to ok Msg "B Msg 1"	Check that position report is received from EUT (VDO output)	received	passed
a) Set CRC bit sequence to false	Check that position report is not received from EUT (VDO output)	not received	passed
	Check that the target is not displayed on the display	-	-
b) Disable GPS, apply external position. Transmit position report with wrong CRC	Check that the EUT does not synchronise to the incorrect message	-	passed

7.6 12.6 SLOT ALLOCATION (CHANNEL ACCESS PROTOCOL)

7.6.1 12.6.1 AUTONOMOUS MODE ALLOCATION

12.6.1.1 Method of measurement

Set up standard test environment and operate EUT with assigned reporting interval of 10 s. Record transmitted scheduled position reports Message 18 and check time periods used for transmission. Check the Communication State of transmitted messages.

Repeat the test with additional simulated channel load of 80 % (4 time periods used, 1 time period unused).

12.6.1.2 Required results

The time periods used for transmission shall in both tests

- *not exceed the transmission interval TI;*

- *not always use the same time period;*

- *not always use the first unused time period.*

Check that the Communication state of Message 18 is the default value as defined in 7.3.3.5.

	Test details - Autonomous mode allocation		
Test item	Check	Remark	Result
Set assigned reporting rate of 10 s (Msg "B Msg 23 Test 12.3") Record the transmission slots for at least 30 min and evaluate the used slots			
Test 1: No channel load	Check that the slots do not exceed the TI	-	passed
	Check that the EUT does not always use the same time period	-	passed
	Check that the EUT not always uses the first unused time period	-	passed
Test 1: 80% channel load	Check that the slots do not exceed the TI	-	passed
	Check that the EUT does not always use the same time period	-	passed
	Check that the EUT does not always use the first unused time period	-	passed
	Check that the EUT does not use slot used by the received targets	-	passed
Communication state	Check that the com state of msg 18 is always as defined in 7.3.3.5	"1100000000000000110"	passed

7.6.2 12.6.2 DSC LISTENING PERIODS

12.6.2.1 Method of measurement

No DSC functionality available (as declared by the applicant)

Set up standard test environment and operate EUT with assigned reporting interval of 10 s. Enable DSC functionality. Record transmitted scheduled position reports Message 18 and check time periods used for transmission.

12.6.2.2 Required results

During the DSC monitoring times, scheduled transmissions of Message 18 shall continue.

	Test details - DSC listening periods		
Test item	Check	Remark	Result
Set assigned reporting rate of 10 s Enable DSC functionality			
Tx of msg 18	Check that the scheduled Tx of msg 18 continues	-	passed

7.7 12.7 ASSIGNED OPERATION

7.7.1 12.7.1 ASSIGNMENT PRIORITY

12.7.1.2 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Transmit an Assigned mode command (Message 23) to the EUT with TX/RX mode 1.

a)   Transmit a Message 22 defining a region with the EUT inside that region. Transmit a Message 22 to the EUT individually addressed and specifying Tx/Rx mode 2.

b)   Repeat the test, clear the region defined by Message 22 under a) [1]. Transmit Message 22 to the EUT with regional settings specifying Tx/Rx mode 2.

Record transmitted messages.

12.7.1.2 Required results

a)   The Tx/Rx mode field setting of Message 22 shall take precedence over the Tx/Rx mode field setting of Message 23.

b)   The Tx/Rx mode field setting of Message 23 shall take precedence over the Tx/Rx mode field setting of Message 22. The receiving station shall revert to its previous Tx/Rx mode after a timeout value randomly chosen between 240 s and 480 s.

Remark for b)
In my opinion the time to revert to its previous (by msg 22 defined) Tx/Rx mode is defined by the time-out of msg 23, not by a random value of 240 to 480 s.

---

[1] This can be carried out using the method used in 13.3.1 b) step 2 or by assigning a new simulated position to the EUT.

		Test details - Autonomous mode allocation		
Test item	Check		Remark	Result
Send a msg 23 with Tx/Rx mode = 1 Msg "B Msg 23 Test 10.2.2.1 T4"				
a) Send a msg 22 defining a region with EUT inside (Tx/Rx mode = 2) Msg "B Msg 22 Test 12.7.1 a1"	Check that the EUT uses Tx/Rx mode 1 as defined by msg 23 (Tx on channel A)		-	passed
Send an addressed msg 22 to EUT with Tx/Rx mode = 2 Msg "B Msg 22 Test 12.7.1 a2"	Check that the EUT uses Tx/Rx mode 2 as defined by msg 22 (Tx on channel B)		-	passed
Clear the region defined in test a)				
b) Send a msg 22 defining a *region with EUT inside, Tx/Rx mode = 2 Msg "B Msg 22 Test 12.7.1 b1"	Check that the EUT uses Tx/Rx mode 2 (Tx on channel B)		-	passed
Send one msg 23 to the EUT with Tx/Rx mode = 1 Msg "B Msg 23 Test 10.2.2.1 T4"	Check that the EUT uses Tx/Rx mode 1 as defined by msg 23 (Tx on channel A)		-	passed
	Check that the EUT reverts to Tx/Rx mode 2 after 4...8 min (time-out of msg 23)		6min	passed

7.7.2 12.7.2 ENTERING RATE ASSIGNMENT

12.7.2.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Transmit a Group Assignment command (Message 23) to the EUT with a reporting interval of 10 s assigned, monitor the VDL, reset by assigning 30 s rate; repeat 10 times.

12.7.2.2 Required result

Verify that the first transmission after receiving the Message 23 is within a time randomly selected between the time the Message 23 has been received and the assigned interval.

		Test details - Entering rate assignment		
Test item	Check		Remark	Result
Send 10 times: Msg 23 with 10 s reporting interval (Msg "B Msg 23 Test 12.7.2 10s") After 20 s: Msg 23 with 30 s reporting interval. (Msg "B Msg 23 Test 12.7.2 30s") Repeat after 45 s				
10 s reporting interval	Check that the first Tx is randomly selected in 0 ...10 s after msg 23		-	passed
30 s reporting interval	Check that the first Tx is randomly selected in 0 ...30 s after msg 23		-	passed

Msg 23 (7)   Msg 23 (5)

```
          ┌──────────────┐   ┌──────────────────────────────────────┐
          │ 10 s = 375 slot │   │         30 s = 1125 slot              │
          └──────────────┘   └──────────────────────────────────────┘
0   150       525  750                        1875    2249
```

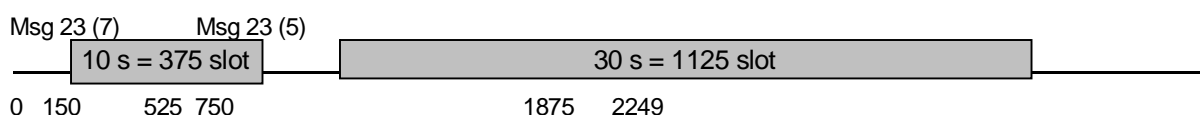### 7.7.3 12.7.3 REVERTING FROM RATE ASSIGNMENT

12.7.3.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Transmit a Group Assignment command (Message 23) to the EUT with a reporting interval of 10 s assigned, monitor the VDL until at least 1 min after timeout occurred; repeat 10 times (transmissions of Message 23 shall not be synchronised to the initial transmission schedule of the EUT).

Measure the time T_{rev} between the reception of Message 23 and first transmission after timeout.

12.7.3.2 Required result

T_{rev} shall be randomly distributed between 240 s and 480 s.

	Test details - Reverting from rate assignment		
Test item	Check	Remark	Result
Send 10 times: Msg 23 with 10 s reporting interval, Msg "B Msg 23 Test 10.2.2.1 T3" Wait until time-out + 1 min.			
Measure time T_{rev}	Check that T_{rev} is randomly distributed between 4 and 8 min	6min	passed

7.7.4 12.7.4 REVERTING FROM QUIET MODE

12.7.4.1 Method of measurement

Set up standard test environment and operate EUT with a reporting interval of 10 s assigned. Transmit a Group Assignment command (Message 23) to the EUT with quiet time = 1 min.

12.7.4.2 Required results

Verify that the first transmission after the quiet period is within the schedule that was in place before the quiet period.

	Test details - Reverting from mode		
Test item	Check	Remark	Result
Send Msg 23 with 10 s reporting interval Msg "B Msg 23 Test 10.2.2.1 T3"			
Reporting rate	Check reporting interval = 10 s	10s	passed
Send msg 23 with quiet time = 1 min	Check that EUT does not transmit during quiet time	-	passed
	Check that the transmissions after end of quiet time matches the previous schedule.	-	passed

7.7.5 12.7.5 RETRY OF INTERROGATION RESPONSE

12.7.5.1 Method of measurement

Set up standard test environment. Interrogate the EUT by Message 15 for a response with Message 18.

a)   Simulate full VDL load for the following 30 s.

b)   Simulate full VDL load for the following 60 s

12.7.5.2 Required result

a)   Verify that a response is transmitted between 30 s and 60 s after the transmission of Message 15.

b)   Verify that no response is transmitted.

Test item	Test details - Retry of interrogation response		
Test item	Check	Remark	Result
Send an interrogation for msg 18			
Apply full channel load for 30s Target simulation: "50_slotsVer2"	Check that a response is transmitted within 30 ... 60 s after msg 15	-	passed
Send an interrogation for msg 18			
Apply full channel load for 60s Target simulation: "50_slotsVer2"	Check that no response is transmitted (because retry is inhibited)	-	passed

7.8 12.8 MESSAGE FORMATS

7.8.1 12.8.1 RECEIVED MESSAGES

12.8.1.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Apply messages according to Table 11 to the VDL. Record messages output by the PI of EUT where provided.

12.8.1.2 Required results

Confirm that EUT responds as appropriate. Check that EUT outputs the corresponding sentences with correct field contents and format via the PI where provided.

Verify that the EUT does not process addressed messages.

	Test details - Received messages		
Test item	Check	Remark	Result
Send all message to the EUT and check PI output			
Msg 1,2,3 Position report	Check that message is output	-	passed
	Check format and content	-	passed
Msg 4 base station report	Check that message is output	-	passed
	Check format and content	-	passed
Msg 5 Static and voyage related data	Check that message is output	-	passed
	Check format and content Fill bits: ,2	-	passed
Msg 6 Addressed binary message	Check that message is not output	not received	passed
Msg 7 Binary acknowledgement	Check that message is not output	not received	passed
Msg 8 Binary broadcast message	Check that message is output	-	passed
	Check format and content Fill bits: ,4	-	passed
Msg 9 SAR Aircraft position report	Check that message is output	-	passed
	Check format and content	-	passed
Msg 10 UTC and date inquiry	Check that message is not output	not received	passed
Msg 11 UTC/Date response	Check that message is output	-	passed
	Check format and content	-	passed
Msg 12 Safety related addressed message, addressed to EUT	Check that message is output	-	passed
	Check format and content	-	passed
Msg 12 Safety related addressed message, not addressed to EUT	Check that message is not output	not received	passed
Msg 13 Safety related acknowledge	Check that message is not output	not received	passed
Msg 14 Safety related broadcast message	Check that message is output	not received	passed
	Check format and content	not received	passed
Msg 15 Interrogation	Check that message is output	-	passed
	Check format and content Fill bits: 2	-	passed
Msg 16 Assigned mode command	Check that message is not output	not received	passed
Msg 17 DGNSS broadcast binary message	Check that message is output	-	passed
	Check format and content	-	passed
Msg 18 Class B equipment position report	Check that message is output	-	passed
	Check format and content	-	passed
Msg 19 Extended Class B equipment position report	Check that message is output	-	passed
	Check format and content	-	passed

Msg 20 Data link management message	Check that message is output	-	passed
	Check format and content	-	passed
Msg 21 Aids to navigation report	Check that message is output	-	passed
	Check format and content	-	passed
Msg 22 Channel management message	Check that message is output	-	passed
	Check format and content	-	passed
Msg 23 Group assignment	Check that message is output	-	passed
	Check format and content	-	passed
Msg 24 Class B "CS" static data, Part A	Check that message is output	-	passed
	Check format and content	-	passed
Msg 24 Class B "CS" static data, Part B	Check that message is output	-	passed
	Check format and content	-	passed

7.8.2 12.8.2 TRANSMITTED MESSAGES

12.8.2.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Initiate the transmission of messages relevant for a Class B mobile station according to Table 11 by the EUT. Record transmitted messages.

12.8.2.2 Required results

Confirm that only messages as allowed by Table 11 are transmitted by the EUT.

	Test details - Transmitted messages		
Test item	Check	Remark	Result
Initiate transmission of the messages according to table 11 by interrogation with msg 15			
Msg 1,2,3 Position report	Check that message is not transmitted	-	passed
Msg 4 base station report	Check that message is not transmitted	-	passed
Msg 5 Static and voyage related data	Check that message is not transmitted	-	passed
Msg 6 Addressed binary message	Check that message is not transmitted	-	passed
Msg 7 Binary acknowledgement	Check that message is not transmitted	-	passed
Msg 8 Binary broadcast message	Check that message is not transmitted	-	passed
Msg 9 SAR Aircraft position report	Check that message is not transmitted	-	passed
Msg 10 UTC and date inquiry	Check that message is not transmitted	-	passed
Msg 11 UTC/Date response	Check that message is not transmitted	-	passed
Msg 12 Safety related addressed message, addressed to EUT	Check that message is not transmitted	-	passed
Msg 12 Safety related addressed message, not addressed to EUT	Check that message is not transmitted	-	passed
Msg 13 Safety related acknowledge	Check that message is transmitted when msg 12 is processed (Response on msg 12)	-	passed
Msg 14 Safety related broadcast message	Check that message is not transmitted	-	passed
Msg 15 Interrogation	Check that message is not transmitted	-	passed
Msg 16 Assigned mode command	Check that message is not transmitted	-	passed
Msg 17 DGNSS broadcast binary message	Check that message is not transmitted	-	passed
Msg 18 Class B equipment position report	Check that message is transmitted (Interrogation and automatically)	-	passed
Msg 19 Extended Class B equipment position report	Check that message is transmitted (Interrogation with offset)	-	passed

Msg 20 Data link management message	Check that message is not transmitted	-	passed
Msg 21 Aids to navigation report	Check that message is not transmitted	-	passed
Msg 22 Channel management message	Check that message is not transmitted	-	passed
Msg 23 Group assignment	Check that message is not transmitted	-	passed
Msg 24 Class B "CS" static data, Part A	Check that message is transmitted (Interrogation and automatically)	-	passed
Msg 24 Class B "CS" static data, Part B	Check that message is transmitted (Interrogation and automatically)	-	passed

7.8.3 12.8.3 USE OF SAFETY RELATED MESSAGE 14

Message 14 is not available (as declared by the applicant)

This test is only applicable if Message 14 is implemented.

12.8.3.1 Method of measurement

Check manufacturer's documentation.

q)   *Initiate transmission of Message 14 as specified by the manufacturer.*

r)   *Repeat initiation twice a minute*

12.8.3.2 Required results

s)   *Verify that the data content of Message 14 is predefined and the transmission cannot exceed one time period (see Table 12).*

t)   *Verify that the EUT only accepts the initiation of a Message 14 once a minute without automatic repetition.*

|	Test details - Use of safety related message 14		
Test item	Check	Remark	Result
Check manufacturers documentation			
a) Send msg 14	Check that the content of msg 14 is predefined	This test is only applicable if Message 14 is implemented.	NA
	Check that msg 14 cannot exceed one time period	This test is only applicable if Message 14 is implemented.	NA
	Check content of msg 14 on VDL	This test is only applicable if Message 14 is implemented.	NA
b) Repeat initiation of msg 14 twice a minute	Check that msg 14 is transmitted only once	This test is only applicable if Message 14 is implemented.	NA

8 13 SPECIFIC TESTS OF NETWORK LAYER (SEE 7.4)

8.1 13.1 REGIONAL AREA DESIGNATION BY VDL MESSAGE

13.1.1 Method of measurement

Set up standard test environment. Apply channel management messages (Message 22) to the VDL defining two adjacent regional areas 1 and 2 with different channel assignments for both regions and a transitional zone extending 4 NM either side of the regional boundary

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. This can be accomplished by either using a dedicated test input for simulated position information or a GNSS simulator.
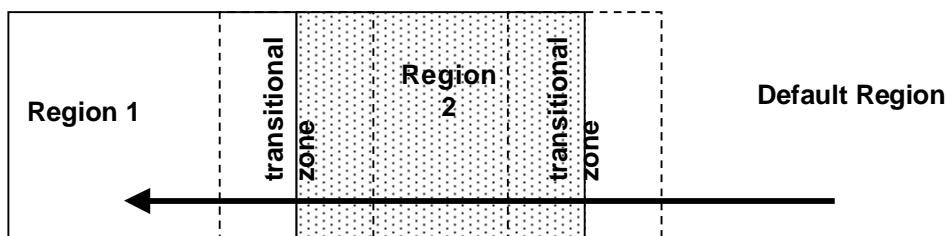
	Primary channel	Secondary channel
Region 1	CH A 1	CH B 1
Region 2	CH A 2	CH B 2
Default region	AIS 1	AIS 2

Figure 2 – Regional area scenario

13.1.2 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 (see Table 26). EUT shall revert to default autonomous operation on the regional channels after leaving the transitional zones.

Table 26 – Required channels in use

	Area	Channels in use
1	Default region	AIS 1, AIS 2
2	First transitional zone	AIS 1, 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

	Test details part 1 – Channel management by VDL msg 22		
Test item	Check	Remark	Result
Set-up EUT in autonomous mode transmitting on channel AIS 1/AIS 2, send 2 Msg 22 by VDL generator, defining 2 adjacent areas with channels A1, B1 and A2, B2. Use external sensor input to simulate a voyage through both areas. Set transitional zone to 4nm. Set the position outside the areas. "TZ" is used for "transitional zone" Set the positions near the limits of the transitional zones to check the dimensions Msg: "B Msg 22 Test 13.1 Area1" and " B Msg 22 Test 13.1 Area2"			
Area 1: In high sea area	Check that channels AIS 1 and AIS 2 are in use	-	passed
Area 2: Move position into outer TZ of region 2	Check the limit of the TZ (5 NM = 8.8 minutes)	-	passed
	Check that channel AIS 1 and A2 are used	-	passed
	Check that reporting rate is doubled	-	passed
Crossing the area border	Check the border of area	-	passed
Area 3: Move position into region 2 (out of TZ)	Check the limit of the TZ (4 NM = 7 minutes)	-	passed
	Check that channel A2 and B2 are used	-	passed
	Check that reporting rate is changed back to normal reporting rate	-	passed
Area 4: Move position into TZ between region 1 and 2, inside area 2	Check that channels A2 and A1 are used	-	passed
	Check that reporting rate is doubled	-	passed
crossing the area border	Check the border of area	-	passed
Area 5: Move position into region 1 (out of TZ)	Check that channels A1 and B1 are used	-	passed
	Check the limit of the TZ (4 NM = 7 minutes)	-	passed
	Check that reporting rate is changed back to normal reporting rate	-	passed
Item 6: Move position into TZ of region 1 to high sea	Check that channels A1 and AIS 1 are used	-	passed
	Check that reporting rate is doubled	-	passed
Area 7: Move position out of the TZ of region 1, into high sea	Check that channels AIS 1 and AIS 2 are used	-	passed
	Check that reporting rate is changed back to normal reporting rate	-	passed

8.2 13.2 REGIONAL AREA DESIGNATION BY SERIAL MESSAGE OR MANUALLY

13.2.1 Method of measurement

Check documentation.

13.1.2   Required result

Verify that the user cannot allocate channels (directly or by ACA sentence).

	Test details - Regional area designation		
Test item	Check	Remark	Result
Check documentation			
Serial message or manual input	Check that the user cannot enter area settings	-	passed
	Check that the user cannot change the channels on another way	-	passed

8.3 13.3 MANAGEMENT OF RECEIVED REGIONAL OPERATING SETTINGS

8.3.1 13.3.1 REPLACEMENT OR ERASURE OF DATED OR REMOTE REGIONAL OPERATING SETTINGS

13.3.1.1   Method of measurement

Set up standard test environment. Send a valid regional operating setting to the EUT by Message 22 with the regional operating area including the own position of the EUT. Consecutively send a total of seven valid regional operating settings to EUT, using Message 22, with regional operating areas not overlapping to the first and to each other. Perform the following in the order shown:

u)   send a ninth Message 22 to the EUT with valid regional operating areas not overlapping with the previous eight regional operating areas;

v)   Step 1: set own position of EUT into any of the regional operating areas defined by the second to the ninth Message 22 sent to the EUT previously;

Step 2: send a tenth Message 22 to the EUT, with a regional operating area which partly overlaps the regional operating area to which the EUT was set by step 1 but which does not include the own position of the EUT;

w)   Step 1: move own position of EUT to a distance of more than 500 miles from all regions defined by previous commands;

Step 2: consecutively set own position of EUT to within all regions defined by the previous Message 22.

This test can be accomplished by either using the test input for simulated position information or a GNSS simulator (see also Annex D).

13.3.2 Required results

After the initialisation, the EUT shall operate according to the regional operating settings defined by the first Message 22 sent.

x)   *The EUT shall return to the default operating settings.*

y)   *Step 1: check that the EUT changes its operating settings to those of that region which includes own position of the EUT.*

Step 2: check that the EUT reverts to the default operating settings.

NOTE   Since the regional operating settings to which the EUT was set in Step 1 are erased due to Step 2, and since there is no other regional operating setting due to their non-overlapping definition, the EUT returns to default.

z)   *Step 1: check that the EUT operates with the default settings.*

Step 2: check that the EUT operates with the default settings.

	Test details – Test of replacement or erasure of dated or remote regional operating settings		
Test item	Check	Remark	Result
Send by msg 22 • 1 area including own position • 7 areas not overlapping, not including own position Msg: "B Msg 22 Test 13.3.1 Area1... Area8"			
Check active area	Check that EUT uses the channels of area 1	-	passed
a) Send a 9. msg 22 to the EUT not overlapping the previous areas Msg: "B Msg 22 Test 13.3.1 Area9"	Check that the EUT returns to the default operating settings (the area is deleted)	-	passed
b) step 1: Set own position to any of the 7 areas	Check channels of area 2	-	passed
	Check channels of area 3	-	passed
	Check channels of area 4	-	passed
	Check channels of area 5	-	passed
	Check channels of area 6	-	passed
	Check channels of area 7	-	passed
	Check channels of area 8	-	passed
	Check channels of area 9	-	passed
b) step 2: Send an area 10, overlapping the area of step 1 not including own position Msg: "B Msg 22 Test 13.3.1 Area10"	Check that the EUT returns to the default operating settings (the area is deleted)	-	passed
c) Step 1: Erasure by distance: Move own position of EUT to a distance of more than 500 miles from all regions defined by previous commands	Check that the EUT operates with the default settings	-	passed
Step 2: Check of erasure: Set own position of EUT to within all regions defined by the previous telecommands. b) step 1: Set own position to any of the 7 areas	Check area 2 = default	-	passed
	Check area 3 = default	-	passed
	Check area 4 = default	-	passed
	Check area 5 = default	-	passed
	Check area 6 = default	-	passed
	Check area 7 = default	-	passed
	Check area 8 = default	-	passed
	Check area 10 = default	-	passed

8.3.2 13.3.2 CHANNEL MANAGEMENT BY ADDRESSED MESSAGE 22

13.3.2.1 Method of measurement

Set up a standard test environment and operate EUT in autonomous mode. Perform the following tests in the following order:

aa) send Message 22 with valid regional operating settings that are different from the default operating settings to the EUT with a regional operating area, which contains the current position of own station;

bb) send an addressed Message 22 to the EUT with different regional operating settings than the previous command;

cc) move the EUT out of the regional operating area defined by the previous addressed command into an area without regional operating settings.

13.3.2.2   Required results

dd) Check, that the EUT uses the regional operating settings commanded to it in a).

ee) Check, that the EUT uses the regional operating settings commanded to it in b).

ff)   Check, that the EUT reverts to default.

	Test details – Test of addressed message 22		
Test item	Check	Remark	Result
All areas are erased by the previous test			
a) Send msg 22 with a new area, position inside Msg: "B Msg 22 Test 10.4.1"	Check, that the EUT uses the regional operating settings	-	passed
b) Send an addressed msg 22 to the EUT with different regional operating settings Msg: "B Msg 22 Test 13.3.2 b"	Check, that the EUT uses the settings of the new message	-	passed
c) Move the position out of the area	Check, that the EUT uses the default channels	-	passed

8.3.3 13.3.3 INVALID REGIONAL OPERATING AREAS

This test is to check the rejection of invalid regional operating areas (three regional operating areas with same corner).

13.3.3.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Perform the following tests in the following order after completion of all other tests related to change of regional operating settings:

gg) *send three different valid regional operating settings with adjacent regional operating areas, their corners within eight miles of each other, to the EUT by Message 22. The current own position of the EUT shall be within the regional operating area of the third regional operating setting;*

hh) *move current own position of the EUT consecutively to the regional operating areas of the first two valid regional operating settings.*

13.3.3.2 Required test results

ii) *Check, that the EUT uses the operating settings that were in use prior to receiving the third regional operating setting.*

jj) *Check, that the EUT consecutively uses the regional operating settings of the first two received regional operating areas.*

Test details – Test for invalid regional operating areas			
Test item	Check	Remark	Result
a) Send three different valid regional with adjacent corners by msg 22, Position inside 3rd area. Msg: "B Msg 22 Test 13.3.1 Area6" Msg: "B Msg 22 Test 13.3.1 Area7" Msg: "B Msg 22 Test 13.3.3"	Check, that the default channels are used	-	passed
b) Move own position to the first area	Check, that the EUT uses the operational settings of the first area	-	passed
Move own position to the second area	Check, that the EUT uses the operational settings of the second area	-	passed

8.3.4 13.3.4 CONTINUATION OF AUTONOMOUS MODE REPORTING RATE

13.3.4.1 Method of test

When in the presence of an assigned mode command and in a transition zone, check that the EUT continues to report at the autonomous mode reporting interval.

13.3.4.2 Required result

Ensure that the autonomous reporting interval is maintained.

	Test details – Continuation of autonomous mode reporting rate		
Test item	Check	Remark	Result
Set the EUT into a transitional zone Send an assignment command using msg 23 to the EUT with a different reporting interval Area setting msg Msg: "B Msg 22 Test 10.4.1" Reporting interval: Msg: "B Msg 23 Test 10.2.2.1 T1"			
Assignment command in a transitional zone	Check that an rate assignment command is ignored in a transitional zone	-	passed

8.3.5 6.3 GNSS RECEIVER FOR POSITION REPORT

10.6.1.3.2 Method of measurement

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

	Test details – GNSS-Receiver for position report		
Test item	Check	Remark	Result
External position data with expected error <10m and within 26m of internal position	External sensor input data is transmitted by the EUT	Both external sensor inputs are checked.	passed
Unavailable / invalid external sensor data and missing / incorrect checksum	External sensor input data is not used	Both external sensor inputs are checked.	passed
Non-WGS-84 position input	External sensor input data is not used	Both external sensor inputs are checked.	passed
Low accuracy position input with expected error >10m or without RAIM information	External sensor input data is not used	Both external sensor inputs are checked.	passed
Position data with more than 26m apart from internal position	External sensor input data is not used	Both external sensor inputs are checked.	passed
Internal GNSS-antenna disconnected	External sensor input data is not used	Both external sensor inputs are checked.	passed

8.3.6 13.3.5 OTHER CONDITIONS

The fulfilment of all other conditions of 7.4.2 shall be self-certified by the manufacturer.

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

9 TEST EQUIPMENT

No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
01	Spectrum Analyser	FSU	Rohde & Schwarz	200125	480956
02	Measuring Receiver	ESI 40	Rohde & Schwarz	837808/007	480335
03	Power amplifier	25A250A	AR	18647	480154
04	Signal generator	SMHU	Rohde & Schwarz	844170/017	480266
05	Signal generator	SMG	Rohde & Schwarz	8334497/030	480013
06	Signal generator	83650L	Agilent	3844A00554	480333
07	Radio communication analyser	CMTA 54	Rohde & Schwarz	841904/011	480169
08	Combiner	ZFSC-2-11	Mini Circuits	-	410089
09	Combiner	ZFSC-2-11	Mini Circuits	-	410090
10	Regulating transformer	BR1000	Block	-	480341
11	Power supply	TOE 8872	Toellner	61005	480833
12	Power supply	TOE 8852	Toellner	51712	480233
13	Climatic chamber	-	Binder	-	480462
14	Directional coupler	DC3510	AR	312259	480470
15	Notch Filter	TTR 190-3EE	TELONIC Berkeley	97284-6	480331
16	Variable Attenuator / 0-11 dB	8494B	Hewlett Packard	3308A38264	480264
17	Variable Attenuator 0 - 110 dB	8496B	Hewlett Packard	3308A71365	480265
18	Attenuator / 10 dB / 5 W	WA2-10	Weinschel	8259	410121
19	Attenuator / 10 dB / 5 W	WA2-10	Weinschel	8260	410122
20	Attenuator / 10 dB / 5 W	WA2-10	Weinschel	8261	410123
21	Attenuator / 10 dB / 10 W	WA8-10	Weinschel	7538	410112
22	Attenuator / 10 dB / 25 W	33-10-34	Weinschel	BH 4878	410129
23	Attenuator / 10 dB / 25 W	33-10-34	Weinschel	BH 4856	410130
24	RF-cable No. 1	RTK 081	Rosenberger	-	410093
25	RF-cable No. 2	RTK 081	Rosenberger	-	410094
26	RF-cable No. 7	Sucoflex	Huber + Suhner	-	410099
27	RF-cable No. 8	RG223	Phoenix-Test-Lab	-	410100
28	RF-cable No. 9	RG223	Phoenix-Test-Lab	-	410101
29	Zirkulator	156-162MHz	DFE	-	410162

No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
30	Zirkulator	156-162MHz	DFE	-	410163
31	Zirkulator	156-162MHz	DFE	-	410164
32	Zirkulator	156-162MHz	DFE	-	410165

10 LIST OF ANNEXES

ANNEX A   PHOTOGRAPHS   9 pages

EXTERNAL PHOTOGRAPHS OF THE TEST SAMPLE

EUT, 3D-view	130840eut1.jpg
EUT, front-view	130840eut2.jpg
EUT, 3D-rear view	130840eut3.jpg
EUT, rear-view	130840eut4.jpg

INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE

EUT, internal-view	130840eut5.jpg
RF-PCB, front-view	130840eut6.jpg
RF-PCB, rear-view	130840eut7.jpg
Main-PCB, front-view	130840eut8.jpg
Main-PCB, rear-view	130840eut9.jpg