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Report On

Type Approval Testing of the
Japan Radio Co., Ltd. JHS-183 AIS
In accordance with IEC 61993-2

Document 75917591 Report 03 Issue 2 September 2012

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REPORT ON

Type Approval Testing of the
Japan Radio Co., Ltd.
JHS-183 AIS

Document 75917591 Report 03 Issue 2

September 2012

PREPARED FOR

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DATED 24 September 2012

This report has been up-issued to Issue 2 to correct typographical errors.

Product Service

CONTENTS

SECTION 1

REPORT SUMMARY

Type Approval Testing of the
Japan Radio Co., Ltd. JHS-183 AIS

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Type Approval Testing of the Japan Radio Co., Ltd. JHS-183 AIS to the requirements of IEC 61993-2.

Objective	To witness Type Approval Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Japan Radio Co., Ltd.
Model Number(s)	JHS-183 AIS System parts: AIS Transponder: NTE-183 AIS Controller: NCM-983 Connection box: NQE-5183
Serial Number(s)	BB50302 System parts: AIS Transponder: BB00302 AIS Controller: BB80302 Connection box: Not Serialised
Software Version	V1.00
Hardware Version	N/A
Number of Samples Tested	One
Test Specification/Issue/Date	IEC 61993-2: 2011 IEC 60945: 2002 + Corrigendum 1
Related documents	ITU-R 1371-4: 2010 ITU-R M.1084-4: 2001
Order Number Date	RFQ 22 June 2012
Start of Test	05 April 2012
Finish of Test	25 April 2012
Name of Engineer(s)	Y Fujiwara K Koki T Takahashi R Hampton

1.2 TEST SITE

All tests were witnessed at the JRC Mitaka site by Robert Hampton.

1.3 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with IEC 61993-2 is shown below.

Section	Clause	Test Description	Result	Comments
-	12	Environmental tests	N/A	See separate table, below
2.8	14.7	Operational Tests - Channel Selection	Pass	
2.9	15.1.1	TDMA Transmitter - Frequency Error	Pass	12.5 kHz Channels not tested; see Note, below.
2.10	15.1.2	TDMA Transmitter - Carrier Power	Pass	
2.11	15.1.3	TDMA Transmitter - Modulation Spectrum 25 kHz Channel Mode	Pass	
-	15.1.4	TDMA Transmitter - Modulation Spectrum 12.5 kHz Channel Mode	N/A	See Note, below.
2.12	15.1.5	TDMA Transmitter - Transmitter Attack Time	Pass	
2.13	15.1.6	TDMA Transmitter - Transmitter Release Time	Pass	
-	15.2	DSC Transmissions	N/A	Customer declared that EUT contained no DSC transmitter.
2.14	15.3.1	TDMA Receivers - Sensitivity – 25 kHz Operation	Pass	
-	15.3.2	TDMA Receivers - Sensitivity – 12.5 kHz Operation	N/A	See Note, below.
2.15	15.3.3	TDMA Receivers - Error Behaviour at High Input Levels	Pass	
2.16	15.3.4	TDMA Receivers - Co-Channel Rejection – 25 kHz Operation	Pass	Deviation from the Standard, see Section 1.6
-	15.3.5	TDMA Receivers - Co-Channel Rejection – 12.5 kHz Operation	N/A	See Note, below.
2.17	15.3.6	TDMA Receivers - Adjacent Channel Selectivity – 25 kHz Operation	Pass	Deviation from the Standard, see Section 1.6
-	15.3.7	TDMA Receivers - Adjacent Channel Selectivity – 12.5 kHz Operation	N/A	See Note, below.
2.18	15.3.8	TDMA Receivers - Spurious Response Rejection	Pass	Deviation from the Standard, see Section 1.6
2.19	15.3.9	TDMA Receivers - Intermodulation Response Rejection and Blocking	Pass	
2.20	15.3.10	TDMA Receivers - Transmit to Receive Switching Time	Pass	
2.21	15.4.1	DSC Receiver - Maximum Sensitivity	Pass	
2.22	15.4.2	DSC Receiver - Error Behaviour at High Input Levels	Pass	
2.23	15.4.3	DSC Receiver - Co-Channel Rejection	Pass	
2.24	15.4.4	DSC Receiver - Adjacent Channel Selectivity	Pass	
2.25	15.4.5	DSC Receiver - Spurious Response Rejection	Pass	Deviation from the Standard, see Section 1.6

Section	Clause	Test Description	Result	Comments
2.26	15.4.6	DSC Receiver - Intermodulation Response Rejection	Pass	
2.27	15.4.7	DSC Receiver - Blocking or Desensitisation	Pass	
2.28	15.5.1	Conducted Spurious Emissions Conveyed to the Antenna - Spurious Emissions from the Receiver	Pass	
2.29	15.5.2	Conducted Spurious Emissions Conveyed to the Antenna - Spurious Emissions from the Transmitter	Pass	

N/A Not Applicable

Note: 12.5 kHz bandwidth is no longer applicable according to ITU-R M.1373-3 onwards.

IEC 61993-2 Clause 12 requires testing to IEC 60945 Clause 8. A brief summary of results in accordance with IEC 60945 is shown below.

Section	Clause	Test Description	Result	Comments
2.30	5.2.3	Excessive conditions	Pass	Not required, for information.
2.1	8.2.1	Dry heat - Storage test	Pass	Deviation from the Standard, see Section 1.6
2.2	8.2.2	Dry heat - Functional test	Pass	
2.3	8.3	Damp heat	Pass	
-	8.4.1	Low temperature - Storage test (portable equipment)	N/A	Not portable equipment
2.4	8.4.2	Low temperature - Functional tests	Pass	Deviation from the Standard, see Section 1.6
-	8.5	Thermal shock (portable equipment)	N/A	Not portable equipment
-	8.6	Drop (portable equipment)	N/A	Not portable equipment
2.5	8.7	Vibration	Pass	
2.6	8.8	Rain	N/T	Waiver
-	8.9	Immersion	N/A	Neither submerged nor portable equipment
-	8.10	Solar radiation (portable equipment)	N/A	Not portable equipment
-	8.11	Oil resistance (portable equipment)	N/A	Not portable equipment
2.7	8.12	Corrosion (salt mist)	TBC	Waiver

N/A Not Applicable
N/T Not Tested

1.4 DECLARATION OF BUILD STATUS

Manufacturer	Japan Radio.,Ltd
Country of origin	Japan
Technical Description	AIS (Automatic Identification system)
Model No	JHS-183
Part No	
Serial No	NTE-183 / NCM-983 / NQE-5183 BB00302 BB80302 N/A
Drawing Number	7ZPJD0553 7ZPJD0558
Build Status	
Software Issue	NTE-183 / NCM-983 DISP / NCM-983 LAN V1.00 V1.00 V1.00
Hardware Issue	N/A
FCC ID	
IC ID	
Highest Operating Frequency	162.025MHz
Signature	H Otsuki Hideo Otsuki
Date	21 September, 2012
D of B S Serial No	

Note: This document has been prepared to enable manufacturers with no mechanism for producing their own Declaration of Build Status, to declare the build state of the equipment submitted for test.

1.5 PRODUCT INFORMATION

1.5.1 Technical Description

The Equipment Under Test (EUT) was a Japan Radio Co., Ltd. JHS-183 AIS as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

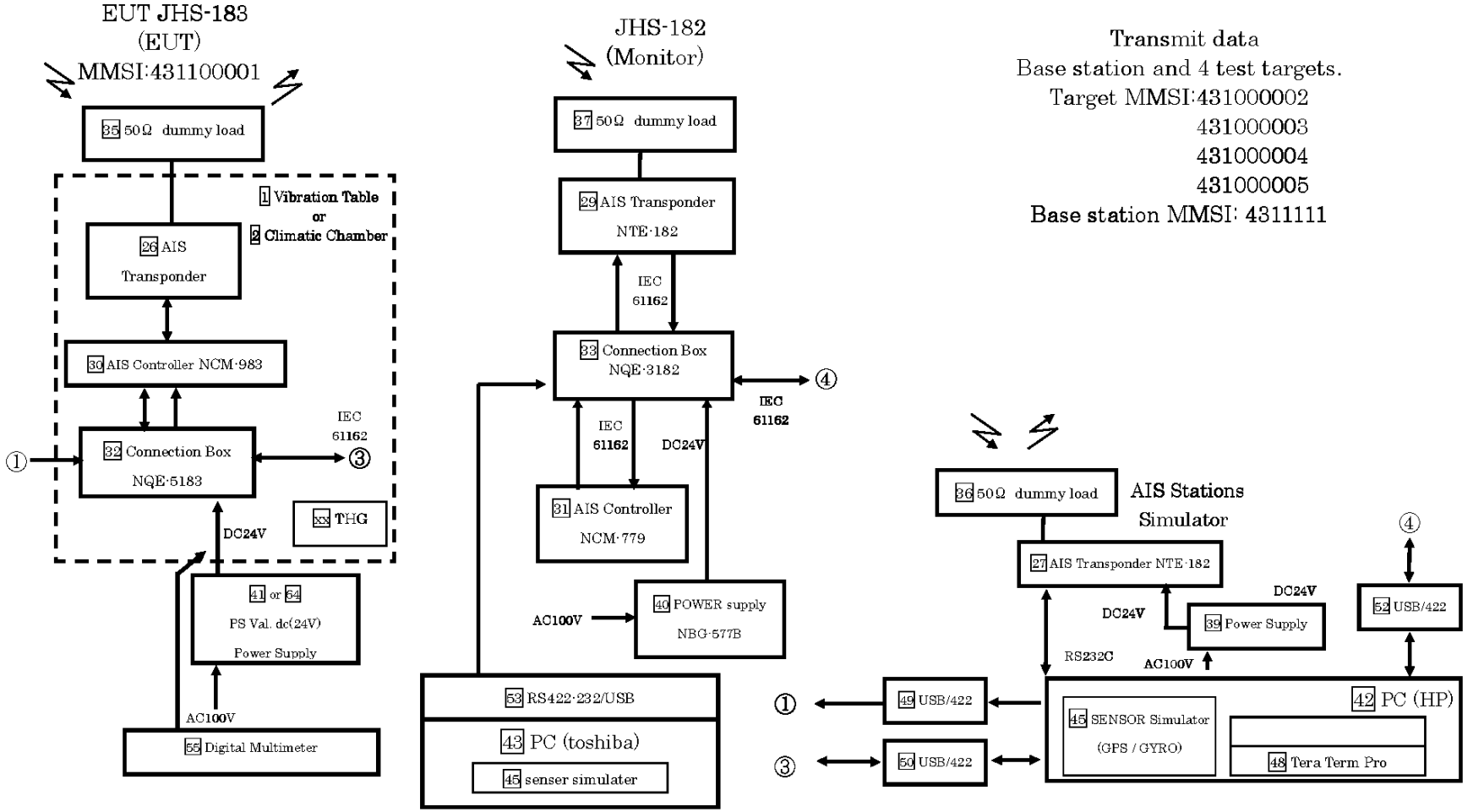
Equipment Under Test

1.5.2 Other Models

No other models were declared

1.5.3 System Configuration

Unless otherwise stated, EUT setup/configuration was as per the following diagram:



System Diagram

Test Signals applied by the Test System are recorded at the appropriate Report Section.

1.5.4 Operating Modes

Modes of operation of the EUT during testing were as follows:

Category	Name	Details
Isolated	Isolated	All power supply connections removed No apparent EUT activity No battery backup declared
Operating	Autonomous	Receiver operating Transmitter operating at a rate consistent with the applied SOG sensor data Screen and user interface active
Operating	Unmodulated	Receiver operating Transmitter operating CW (Continuous Wave)
Operating	Receive	Receiver operating Transmitter inoperative
Reset	Tripped	EUT protection circuitry activated (over-voltage); EUT behaving as if isolated

1.5.5 Physical Test Configuration

No general physical setup guidance is given by IEC 61993-2.

IEC 60945 Clause 8.1 provides general guidance, which was followed; the Physical Configuration for the climatic tests was such that free flow of air was permitted around all items of EUT to the fullest practicable extent, the volume of the test chamber was also deemed “large” compared to the EUT (internal volume is 10:1 or more). Refer to the appropriate Report Section for further information.

RF Signal input levels are detailed in the appropriate Report Section where relevant.

All physical configurations are described or illustrated in the appropriate Report Section where relevant.

1.5.6 Monitoring of Performance

During the Environmental tests, the following testing is required by the specification:

Performance Test

Definition (Environmental Tests, Clause 12):

“The Performance Test to be used for the environmental tests is for the transmitter:
- frequency error (see 15.1.1),
- carrier power (see 15.1.2),
- channel switching (see 14.7),
- transmitter attack time (see 15.1.5),
- transmitter release time (see 15.1.6);

and for the receiver (both TDMA and DSC):
- sensitivity at 25 kHz and 12,5 kHz (see 15.3.1, 15.3.2, 15.4.1),
- channel switching time (see 14.7).”

Method:

The above tests were performed where required; results are documented alongside the normal-condition tests in the following report sections:

Transmitter:
- 2.8, Operational Tests - Channel Switching
- 2.9, TDMA Transmitter - Frequency Error
- 2.10, TDMA Transmitter - Carrier Power
- 2.12, TDMA Transmitter - Transmitter Attack Time
- 2.13, TDMA Transmitter - Transmitter Release Time

Receiver:
- 2.8, Operational Tests - Channel Switching
- 2.14, TDMA Receivers - Sensitivity – 25 kHz Operation
- 2.21, DSC Receiver - Maximum Sensitivity

Performance Check

Definition (Environmental Tests, Clause 12):

“For the Performance Check to be used with the environmental tests, repeat test 14.1.1.

All environmental tests may be combined as appropriate with the tests required in clause 15, as agreed by the manufacturer in order to avoid duplication of testing.”

Method (Autonomous mode, Clause 14.1.1)

“14.1.1.1 Transmit position reports

Method of measurement

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

Required results

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

14.1.1.2 Receive position reports

Method of measurement

Set up a test environment of at least 5 test targets.
a) Switch on Test targets, then start operation of the EUT
b) Start operation of the EUT, then switch on Test targets

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

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

1.6 DEVIATIONS FROM THE STANDARD

Deviations from the applicable test standards or test plan were made during testing; they are summarised below, further details can be found in the relevant Report Section.:

Section 2.1, Environmental Tests - Dry Heat - Storage Test

There was a chamber programming error which led to a deviation from the programmed ramp of 55 minutes from +70 °C to +25 °C, see Applied Conditions plot (at Report Section 2.1) for the exact temperature against time behaviour.

The maximum calculated rate of temperature change (at the beginning of the transition) was approximately 2.9 °C/min. This was considered over-test and the test would have been repeated in the event of an unsatisfactory Performance Check.

Section 2.4, Environmental Tests - Dry Heat - Storage Test

There was a chamber programming error which led to the maximum rate of change of temperature (1 °C/min, IEC 60945 Clause 8.1) being exceeded during the first temperature transition. See Applied Conditions, above, for the exact temperature against time behaviour.

The maximum calculated rate of temperature change (at the beginning of the transition) was approximately 4 °C/min. This was considered over-test and the test would have been repeated in the event of an unsatisfactory results.

Section 2.16, TDMA Receivers - Co-Channel Rejection – 25 kHz Operation

A “fast track” approach was adopted which, although less accurate than the prescribed test method, does demonstrate that the minimum performance requirements are met. The method involves applying the signals with margins equal to or worse than the minimum performance requirement, provided that the PER was within acceptable limits the test was deemed to have been satisfactory.

Section 2.17, TDMA Receivers - Adjacent Channel Selectivity – 25 kHz Operation

A “fast track” approach was adopted which, although less accurate than the prescribed test method, does demonstrate that the minimum performance requirements are met. The method involves applying the signals with margins equal to or worse than the minimum performance requirement, provided that the PER was within acceptable limits the test was deemed to have been satisfactory.

Section 2.18, TDMA Receivers - Spurious Response Rejection

A “fast track” approach was adopted which, although less accurate than the prescribed test method, does demonstrate that the minimum performance requirements are met. The method involves applying the signals with margins equal to or worse than the minimum performance requirement, provided that the PER was within acceptable limits the test was deemed to have been satisfactory.

1.7 MODIFICATION RECORD

Modifications were made to the EUT during testing as per the following table:

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by manufacturer.	-	-
1	Modification fitted to correct vibration failure, see Annex A, Modification Details.	Japan Radio Co., Ltd.	07 April 2012

SECTION 2

TEST DETAILS

Type Approval Testing of the
Japan Radio Co., Ltd. JHS-183 AIS

2.1 ENVIRONMENTAL TESTS - DRY HEAT - STORAGE TEST

2.1.1 Specification Reference

IEC 60945, Clause 8.2.1

2.1.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

Note: Only the AIS Transponder (NTE-183, S/N: BB00302) was exposed to the Environmental Applied Conditions below.

2.1.3 Date of Test and Modification State

12 to 13 April 2012 - Modification State 1

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Method

The following testing is required by the specification:

Test Method, Clause 8.2.1.2

"The EUT shall be placed in a chamber at normal room temperature and relative humidity. The temperature shall then be raised to and maintained at +70 °C ± 3 °C, for a period of 10 h to 16 h.
At the end of the test, the EUT shall be returned to normal environmental conditions and then subjected to a performance check as specified in the relevant equipment standard (see 7.1)."

Performance Standard, Clause 8.2.1.3

"The requirements of the performance check shall be met."

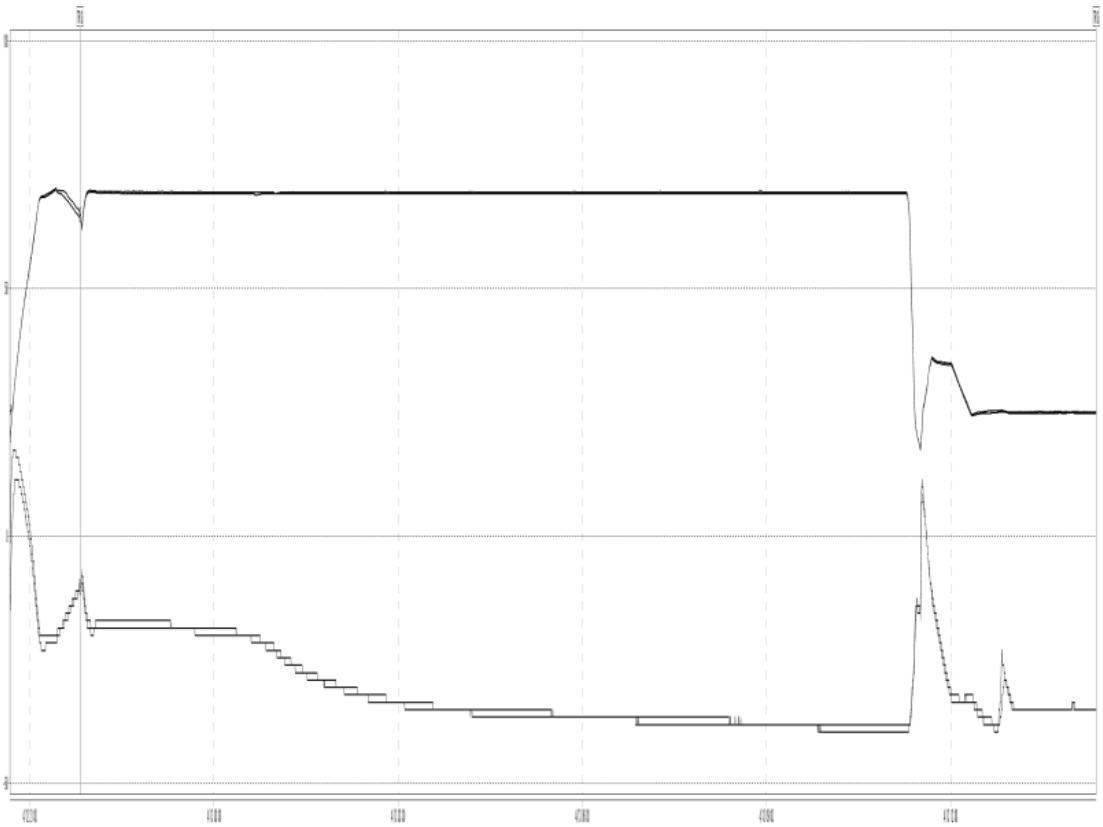
2.1.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Isolated

The EUT was placed in a large Environmental chamber in such a manner as to permit free flow of air around and between the system components as per Section 1.5.5.

2.1.7 Environmental Conditions

Applied Conditions



Environmental Chamber Conditions

Plot shows temperature as the upper trace.
Vertical axis: Temperature, -50 °C to +100 °C with horizontal gridlines every 50 °C
Horizontal axis: Date/Time, 12 April 21:00 to 13 April 12:00 with markers every 3 hours.

Ambient Conditions

	13 April 2012
Ambient Temperature:	26.9 °C
Relative Humidity:	24 %

Note: Environmental conditions for 12 April 2012 were not recorded; this was a pre-conditioning period where ambient temperature effects on test equipment were irrelevant.

2.1.8 Test Results

Deviation from the Standard

There was a chamber programming error which led to a deviation from the programmed ramp of 55 minutes from +70 °C to +25 °C, see Applied Conditions, above, for the exact temperature against time behaviour.

The maximum calculated rate of temperature change (at the beginning of the transition) was approximately 2.9 °C/min. This was considered over-test and the test would have been repeated in the event of an unsatisfactory Performance Check.

The time entered in the results table below indicates the time to transition from +70 °C to a stable +25 °C.

Results

The EUT was subjected to the above test method with the aforementioned Deviation from The Standard, test variables were as per the table below. A Performance Check was conducted at normal environmental conditions, results follow:

Test Parameter	Units	Result	Limit
Test Setup Variables - Environmental conditions			
Temperature 1	°C	+70	+70 ± 3
Temperature 2	°C	+25	15 to 35
Storage time at temperature 1	h	13.3	10 to 16
Transition time to temperature 2	min	55 *	≥ 45 **
General/Test Specific - EUT Setup			
Test Targets	-	5	≥ 5
Performance Check - Post-test			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y

* See Deviation from the Standard, above.

** Temperature change = 70 °C – 25 °C = 45 °C, maximum rate = 1 °C/min (IEC 60945 Clause 8.1) therefore minimum transition time = 45 min

2.2 ENVIRONMENTAL TESTS - DRY HEAT - FUNCTIONAL TEST

2.2.1 Specification Reference

IEC 60945, Clause 8.2.2

2.2.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.2.3 Date of Test and Modification State

16 to 17 April 2012 - Modification State 1

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Method

The following testing is required by the specification:

Test Method, Clause 8.2.2.2

"The EUT shall be placed in a chamber at normal room temperature and relative humidity. The EUT and, if appropriate, any climatic control devices with which it is provided shall then be switched on. The temperature shall then be raised to and maintained at +55 °C ± 3 °C.

At the end of a soak period of 10 h to 16 h at +55 °C ± 3 °C, the EUT shall be subjected to a performance test and check as specified in the relevant equipment standard (see 7.1).

The temperature of the chamber shall be maintained at +55 °C ± 3 °C during the whole performance test period.

At the end of the test, the EUT shall be returned to normal environmental conditions."

Performance Standard, Clause 8.2.2.3

"The requirements of the performance test and check shall be met."

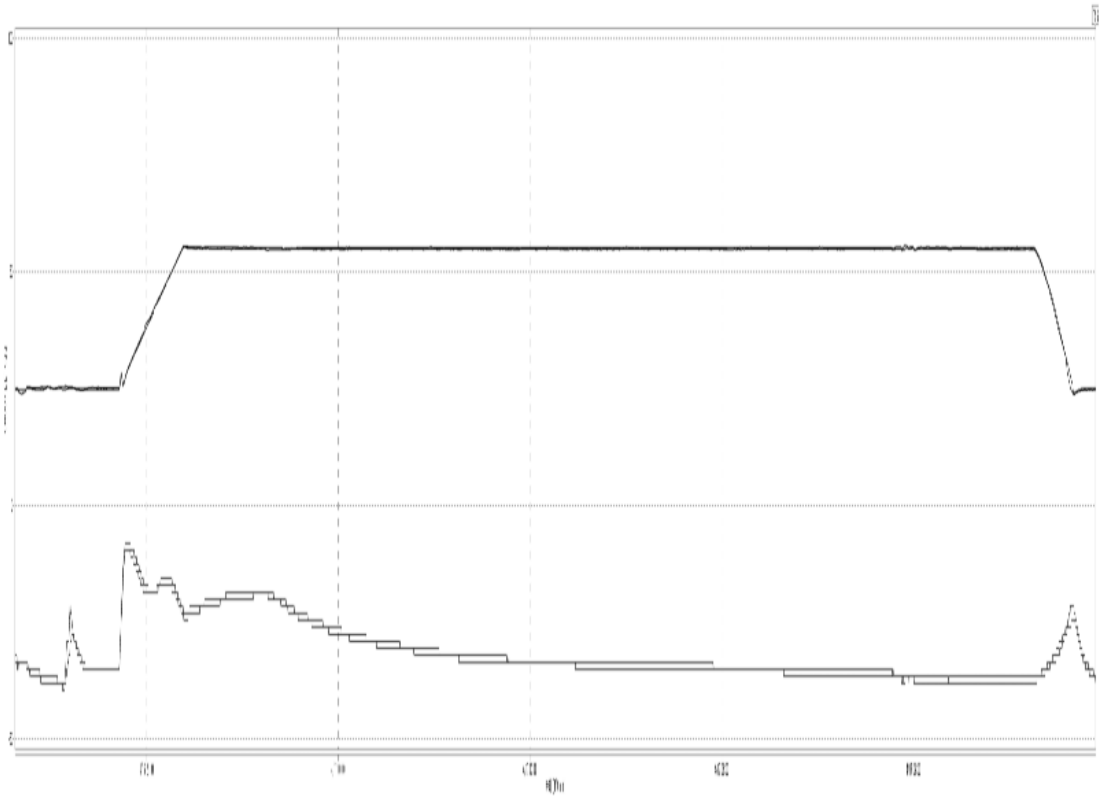
2.2.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Idle (storage period) and Autonomous (Performance Check)

The EUT was placed in a large Environmental chamber in such a manner as to permit free flow of air around and between the system components as per Section 1.5.5.

2.2.7 Environmental Conditions

Applied Conditions



Environmental Chamber Conditions

Plot shows temperature as the upper trace.
Vertical axis: Temperature, -50 °C to +100 °C with horizontal gridlines every 50 °C
Horizontal axis: Date/Time, 16 April 21:00 to 17 April 09:00 with markers every 3 hours.

Ambient Conditions

	17 April 2012
Ambient Temperature:	24.7 °C
Relative Humidity:	35 %

Note: Environmental conditions for 16 April 2012 were not recorded; this was a pre-conditioning period where ambient temperature effects on test equipment were irrelevant.

2.2.8 Test Results

The EUT was subjected to the above test method, test variables were as per the table below. A Performance Check was conducted at/after the time stated below; results were as per the table below.

Test Parameter	Units	Result	Limit
Test Setup Variables - Environmental conditions			
Temperature 1	°C	+55	+55 ± 3
Storage time at temperature 1 before Performance Check	h	10	10 to 16
General/Test Specific - EUT Setup			
DC power supply voltage	V	31.2	31.2 *
Test targets	-	5	≥ 5
Performance Check - At temperature			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y

* As per IEC 61993-2 Clause 10.2.2 and IEC 60945 Clause 7.1: normal voltage, 24 V, plus 30 % is 31.2 V.

A Performance Test was conducted, results can be found at the following Report Sections:

Transmitter:

2.8, Operational Tests - Channel Switching
2.9, TDMA Transmitter - Frequency Error
2.10, TDMA Transmitter - Carrier Power
2.12, TDMA Transmitter - Transmitter Attack Time
2.13, TDMA Transmitter - Transmitter Release Time

Receiver:

2.8, Operational Tests - Channel Switching
2.14, TDMA Receivers - Sensitivity – 25 kHz Operation
2.21, DSC Receiver - Maximum Sensitivity

2.3 ENVIRONMENTAL TESTS - DAMP HEAT

2.3.1 Specification Reference

IEC 60945, Clause 8.3

2.3.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.3.3 Date of Test and Modification State

17 and 18 April 2012 - Modification State 1

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Method

The following testing is required by the specification:

Test Method, Clause 8.3.1.2

"The EUT shall be placed in a chamber at normal room temperature and relative humidity. The temperature shall then be raised to +40 °C ± 2 °C, and the relative humidity raised to 93 % ± 3 % over a period of 3 h ± 0,5 h. These conditions shall be maintained for a period of 10 h to 16 h. Any climatic control devices provided in the EUT may be switched on at the conclusion of this period.

The EUT shall be switched on 30 min later, or after such period as agreed by the manufacturer, and shall be kept operational for at least 2 h during which period the EUT shall be subjected to a performance check as specified in the relevant equipment standard.

The temperature and relative humidity of the chamber shall be maintained as specified during the whole test period.

At the end of the test period and with the EUT still in the chamber, the chamber shall be brought to room temperature in not less than 1 h.

At the end of the test the EUT shall be returned to normal environmental conditions."

Performance Standard, Clause 8.3.1.3

"The requirements of the performance check shall be met."

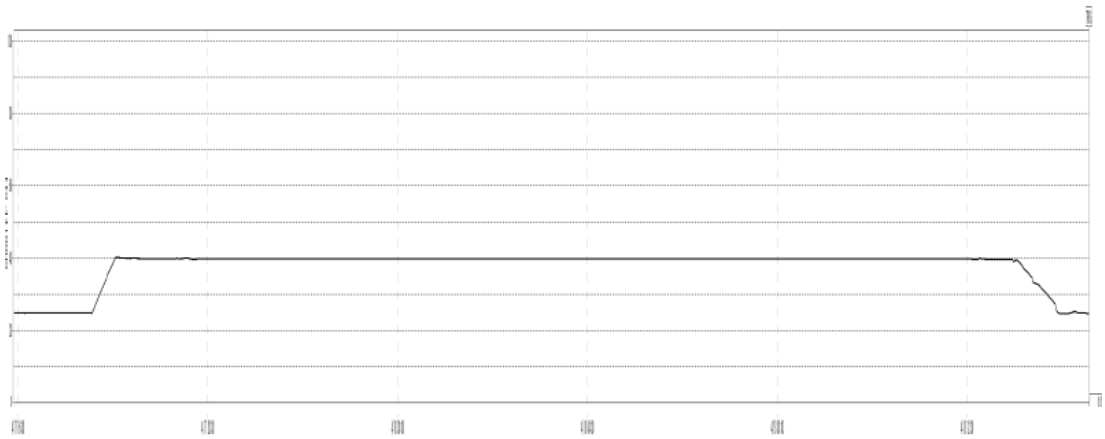
2.3.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Idle (storage period) and Autonomous (Performance Check)

The EUT was placed in a large Environmental chamber in such a manner as to permit free flow of air around and between the system components as per Section 1.5.5.

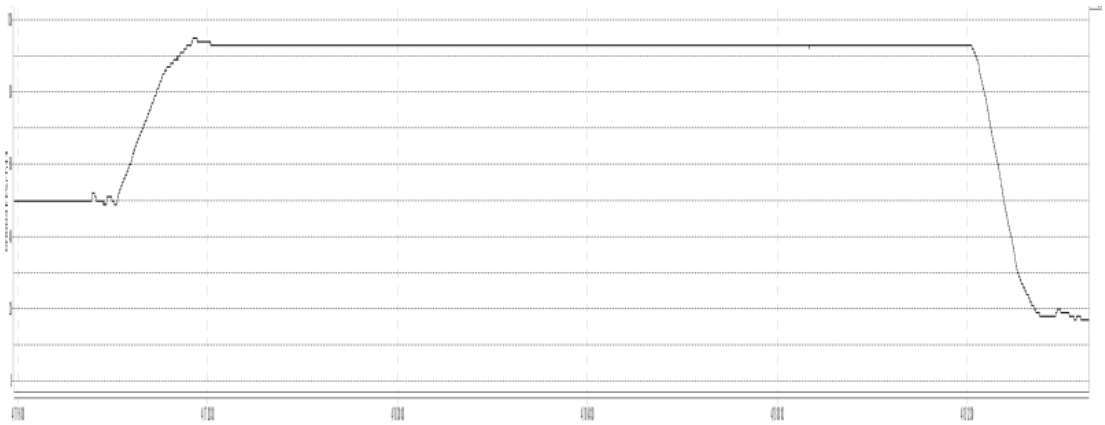
2.3.7 Environmental Conditions

Applied Conditions



Environmental Chamber Conditions - Temperature

Vertical axis: Temperature, 0 °C to 100 °C with horizontal gridlines every 10 °C
Horizontal axis: Date/Time, 17 April 16:00 to 18 April 12:00 with markers every 4 hours.



Environmental Chamber Conditions - Humidity

Vertical axis: Humidity, 0 % to 100 % with horizontal gridlines every 10 %
Horizontal axis: Date/Time, 17 April 16:00 to 18 April 12:00 with markers every 4 hours.

Ambient Conditions

	18 April 2012
Ambient Temperature:	25.3 °C
Relative Humidity:	36 %

2.3.8 Test Results

The EUT was subjected to the above test method, test variables were as per the table below. A Performance Check was conducted at/after the time stated below; results were as per the table below.

Test Parameter	Units	Result	Limit
Test Setup Variables - Environmental conditions			
Temperature	°C	+40	+40 ± 2
Relative humidity	%	93	93 ± 3
Transition time from ambient to above conditions	h	2.5	3 ± 0.5
Storage time at above conditions before Performance Check	h	13.9	10 to 16
Operating time at above conditions	h	2.1	≥ 2
Transition time to ambient	h	1.8	≥ 1
Storage time at ambient before next test	h	N/A *	≥ 3
General/Test Specific - EUT Setup			
DC power supply voltage	V	24	24 **
Test targets	-	5	≥ 5
Performance Check - At above conditions			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y

N/A: Not applicable, this was the last Environmental test.

** As per IEC 61993-2 Clause 10.2.2 and IEC 60945 Clause 7.1: normal voltage, 24 V, plus 30 % is 31.2 V.

After the test a Performance Check was conducted, results follow.

Test Parameter	Units	Result	Limit
Performance Check - Post-test (ambient)			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y

2.4 ENVIRONMENTAL TESTS - LOW TEMPERATURE FUNCTIONAL TESTS

2.4.1 Specification Reference

IEC 60945, Clause 8.4.2

2.4.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.4.3 Date of Test and Modification State

16 April 2012 - Modification State 1

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Method

The following testing is required by the specification:

Note

EUT components fall into more than one category as defined in IEC 60945 Clause 4.4:

"Exposed":
AIS Transponder, NTE-183

"Protected":
AIS Controller, NCM-983
Connection box, NQE-5183

Considering the applicable categories and the corresponding test levels as defined in IEC 60945 Clause 8.1, the worst-case (lowest) Environmental condition for this test is -25 °C.

Test Method, Clause 8.4.2.6

"The EUT shall be subject to the conditions specified for portable equipment except that the temperature of the chamber shall be reduced to, and maintained at –25 °C ± 3 °C."

Referenced Test Method for Portable Equipment, Clause 8.4.2.2

“The EUT shall be placed in a chamber at normal room temperature and relative humidity. The temperature shall then be reduced to, and maintained at –20 °C ± 3 °C, for a period of 10 h to 16 h. Any climatic control devices provided in the EUT may be switched on at the conclusion of this period.

The EUT shall be switched on 30 min later, or after such period as agreed by the manufacturer, and shall be kept operational for at least 2 h during which period the EUT shall be subjected to a performance check test and check as specified in the relevant equipment standard (see 7.1).

The temperature of the chamber shall be maintained at –20 °C ± 3 °C during the whole test period.

At the end of the test the EUT shall be returned to normal environmental conditions.”

Performance Standard, Clause 8.4.2.7

“The requirements of the performance test and check shall be met.”

2.4.6 Test Setup and Operating Modes

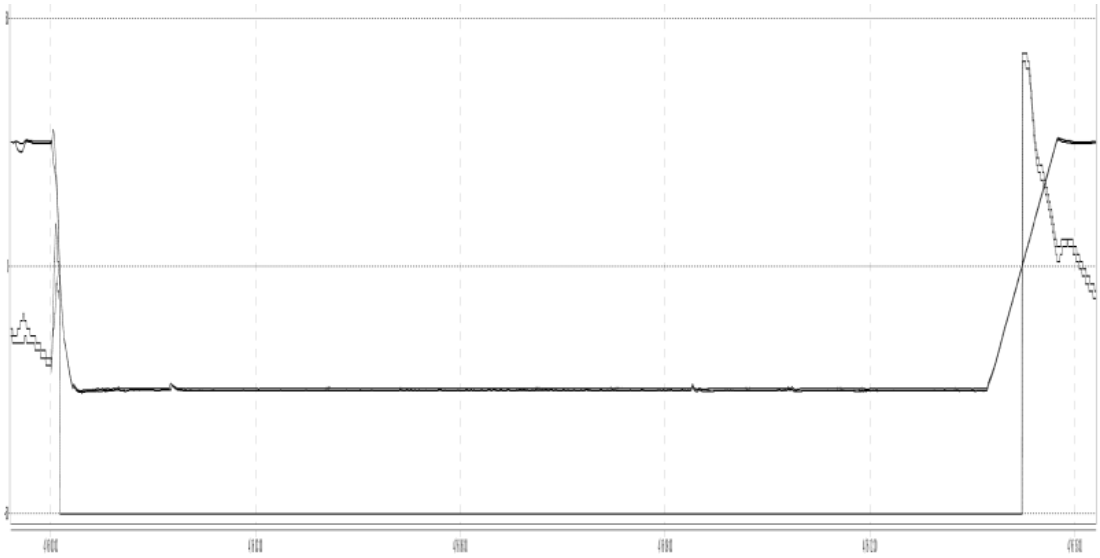
The test was performed with the EUT in the following mode(s): Idle (storage period) and Autonomous (Performance Check)

The EUT and support equipment were set up as per Section 1.5.3.

The EUT was placed in a large Environmental chamber in such a manner as to permit free flow of air around and between the system components as per Section 1.5.5.

2.4.7 Environmental Conditions

Applied Conditions



Environmental Chamber Conditions

Plot shows temperature as the upper trace.
Vertical axis: Temperature, -50 °C to +50 °C with horizontal gridlines every 50 °C
Horizontal axis: Date/Time, 16 April 00:00 to 16 April 15:00 with markers every 3 hours.

Ambient Conditions

	16 April 2012
Ambient Temperature:	23.7 °C
Relative Humidity:	33 %

2.4.8 Test Results

Deviation from the Standard

There was a chamber programming error which led to the maximum rate of change of temperature (1 °C/min, IEC 60945 Clause 8.1) being exceeded during the first temperature transition. See Applied Conditions, above, for the exact temperature against time behaviour.

The maximum calculated rate of temperature change (at the beginning of the transition) was approximately 4 °C/min. This was considered over-test and the test would have been repeated in the event of an unsatisfactory results.

The time entered in the results table below shows the total time to transition from +25 °C to -25 °C (an overall rate of approximately 2.8 °C/min).

Results

The EUT was subjected to the above test method with the aforementioned Deviation from The Standard, test variables were as per the table below. A Performance Check was conducted at/after the time stated below; results were as per the table below.

Test Parameter	Units	Result	Limit
Test Setup Variables - Environmental conditions			
Test temperature	°C	-25	-25 ± 3
Transition time from ambient to above conditions	min	18.5	≥ 50 *
Storage time at above conditions before start of EUT operation	h	10.1	10 to 16
EU T operating time at above conditions	h	3.3	≥ 2
Transition time to ambient	min	62	≥ 50 *
Storage time at ambient before next test	h	6	≥ 3
General/Test Specific - EUT Setup			
DC power supply voltage	V	21.6	21.6 **
Test targets	-	5	≥ 5
Performance Check - At above conditions			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y

* Temperature change = 25 °C – (-25 °C) = 50 °C, maximum rate = 1 °C/min (IEC 60945 Clause 8.1) therefore minimum transition time = 50 min

** As per IEC 61993-2 Clause 10.2.2 and IEC 60945 Clause 7.1: normal voltage, 24 V, minus 10 % is 21.6 V.

Performance Test

A Performance Test was conducted, results can be found at the following Report Sections:

Transmitter:

2.8, Operational Tests - Channel Switching
2.9, TDMA Transmitter - Frequency Error
2.10, TDMA Transmitter - Carrier Power
2.12, TDMA Transmitter - Transmitter Attack Time
2.13, TDMA Transmitter - Transmitter Release Time

Receiver:

2.8, Operational Tests - Channel Switching
2.14, TDMA Receivers - Sensitivity – 25 kHz Operation
2.21, DSC Receiver - Maximum Sensitivity

After the test a Performance Check was conducted, results follow.

Test Parameter	Units	Result	Limit
Performance Check - Post-test (ambient)			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y

2.5 ENVIRONMENTAL TESTS - VIBRATION

2.5.1 Specification Reference

IEC 60945, Clause 8.7

2.5.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.5.3 Date of Test and Modification State

05 and 06 April 2012 - Modification State 0
10 April 2012 - Modification State 1

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Method

The following testing is required by the specification:

Test Method, Clause 8.7.2

"The EUT, complete with any shock and vibration absorbers with which it is provided, shall be fastened to the vibration table by its normal means of support and in its normal attitude. The EUT may be resiliently suspended to compensate for weight not capable of being withstood by the vibration table. Provision may be made to reduce or nullify any adverse effect on EUT performance which might be caused by the presence of an electromagnetic field due to the vibration unit.

The EUT shall be subjected to sinusoidal vertical vibration at all frequencies between:

- 2 Hz to 5 Hz and up to 13,2 Hz with an excursion of ±1 mm ± 10 % (7 m/s^2 maximum acceleration at 13,2 Hz);
- above 13,2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s^2

The frequency sweep rate shall be 0,5 octaves/min in order to allow the detection of resonances in any part of the EUT as mounted.

"A resonance search shall be carried out throughout the test. During the resonance search the EUT shall be externally observed, by unaided visual and aural means, for obvious signs of any resonances of components or sub-assemblies, that may affect the integrity of the EUT. Such observations shall be recorded in the test report. If any resonance, as measured by a sensor fixed to the outside of the EUT at the location where obvious signs of resonance have been observed, has a magnitude ratio ≥5 measured relative to the surface where the EUT is fastened, the EUT shall be subjected to a vibration endurance test at each resonant frequency at the vibration level specified in the test with a duration of 2 h. When resonant frequencies with magnitude ratios ≥5 are harmonically related, only the fundamental frequency shall be tested. If no resonance with a magnitude ratio ≥5 occurs, the endurance test shall be carried out at one single observed frequency. If no resonance occurred, the endurance test shall be carried out at a frequency of 30 Hz.

Performance check(s) shall be carried out at least once during each endurance test period, and once before the end of each endurance test period.

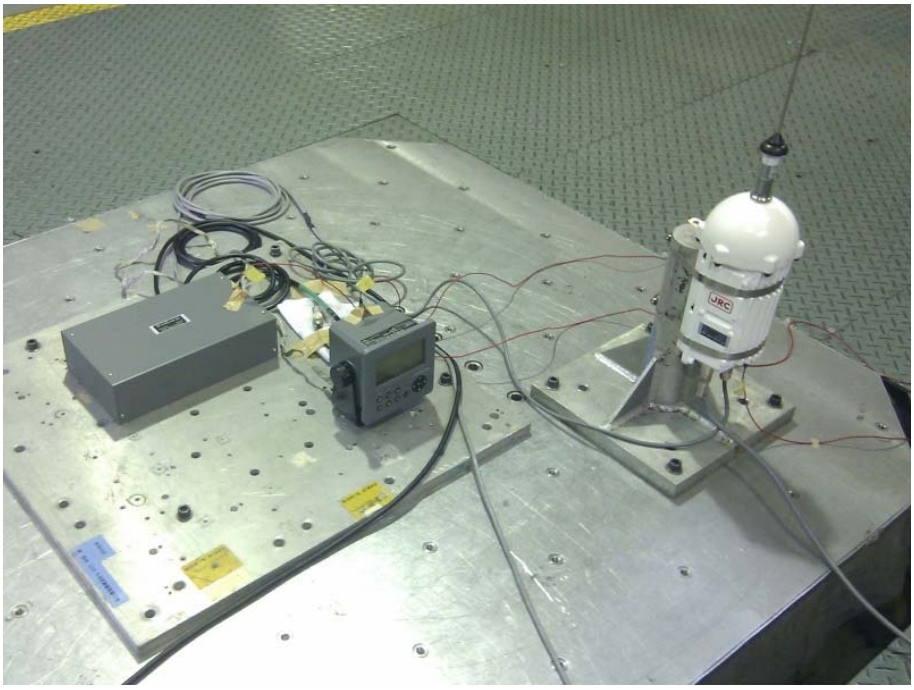
The procedure shall be repeated with vibration in each of two mutually perpendicular directions in the horizontal plane."

Performance Standard, Clause 8.7.3

"The requirements of the performance check shall be met."

2.5.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Test Setup

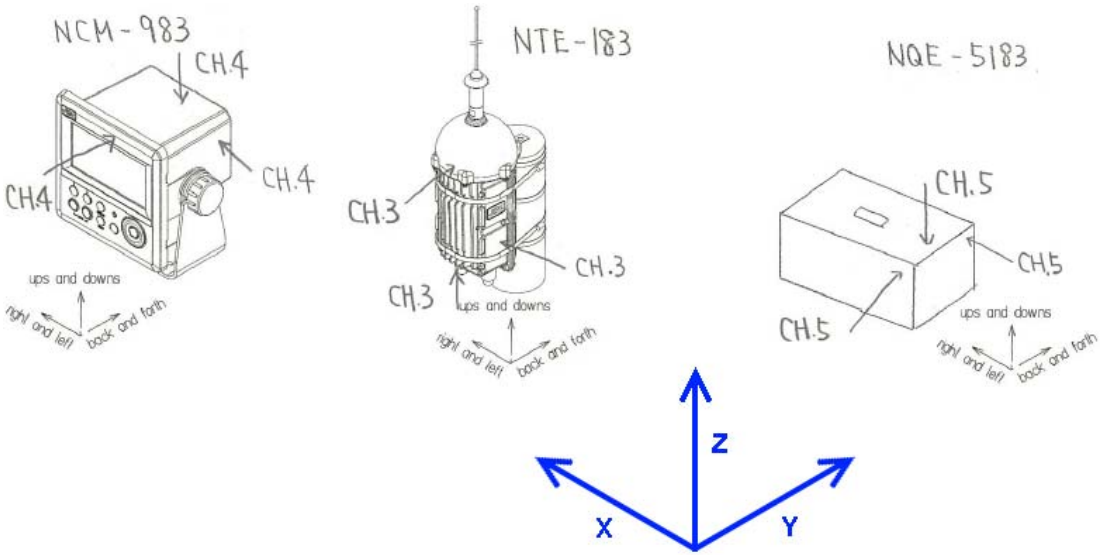
2.5.7 Environmental Conditions

	05 April 2012	06 April 2012	10 April 2012
Ambient Temperature:	20.6 °C	19.5 °C	18.8 °C
Relative Humidity:	38 %	42 %	38 %

2.5.8 Test Results

The EUT was subjected to the above test method, test variables were as per the tables below, applied levels and EUT response(s) are as per the following plots. Performance Checks were conducted "during" (approximately 60 min ± 10 min) and "at the end" (approximately 110 min (± 10 min) from the beginning of each endurance run (120 min total duration); results were as per the tables below.

The test was conducted in each of the three mutually perpendicular planes, as follows:



Axis Definitions

Sequence of events

For clarity, a chronological sequence of events is summarised below:

05 April 2012:

- Resonance searches in all 3 axes (without antenna*)
- Y-axis endurance run and Performance Checks (without antenna*)

* The antenna was not initially included in the test setup but was included in the tests below. The above X and Z Axis resonance searches were retested with antenna and those results used for their respective endurance runs, hence the results of the above are not reported here. However, the resonance search for the Y Axis is reported to show similarity between results with and without antenna. This is intended to validate the above endurance run test results without the antenna.

06 April 2012

- Antenna CAV-2180 fitted
- Repeated Z Axis resonance search (no change)
- Z Axis endurance run and Performance Checks
- Repeated Y Axis resonance search, no change - i.e. no need to repeat endurance run
- Repeated X Axis resonance search (no change)
- X Axis endurance run and failure

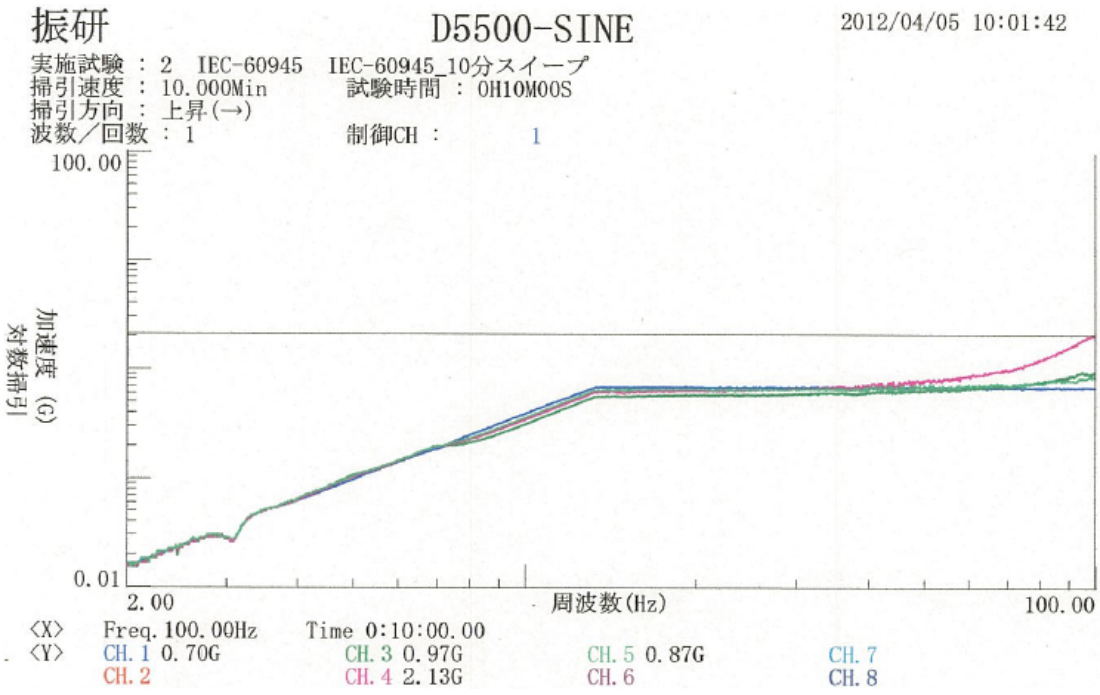
06 to 10 April 2012

- EUT modified

10 April 2012

- Repeated X Axis resonance search (no change)
- X Axis endurance run and Performance Checks

Y Axis - Longitudinal ("back and forth") - Without Antenna - Modification State 0



Y Axis - Resonance Search - Without Antenna - Modification State 0

Note: CH. 1 = Vibration Table Sensor

Measurements:

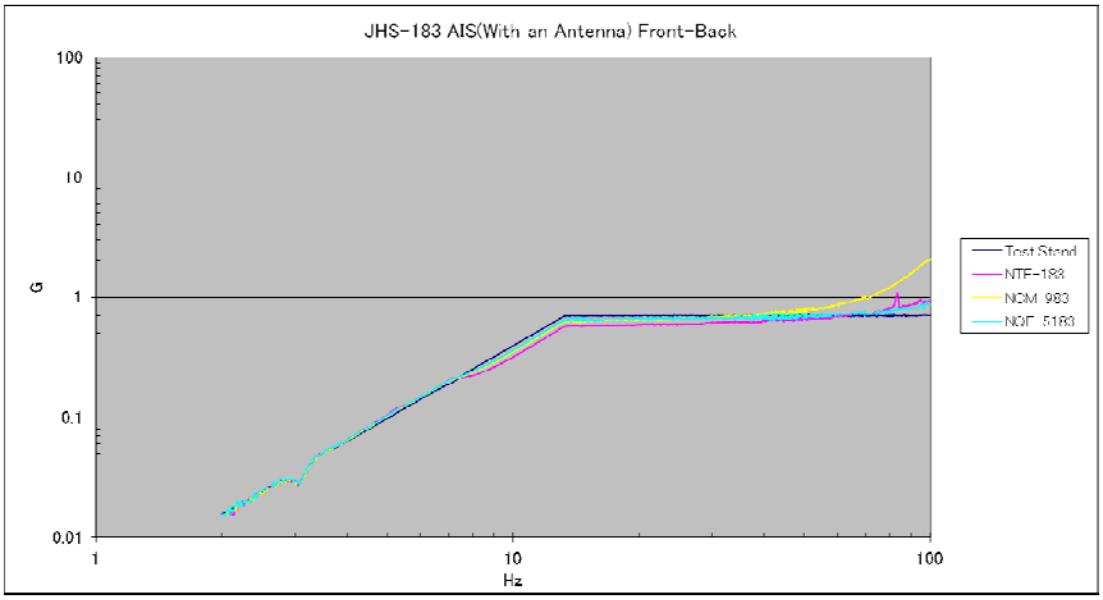
Test Parameter	Units	Result	Limit
Test Setup Variables - Resonances Found			
Peak resonance sensor	-	CH. 4 (NCM-983)	-
Peak resonance frequency	Hz	100	-
Peak resonance acceleration, a	g	2.13	-
Applied acceleration at above resonance, a_{IN}	g	0.7	-
Peak resonance magnitude, $Q = a / a_{IN}$	-	3.04	-
General/Test Specific - EUT Setup			
DC power supply voltage	V	24	-
Test targets	-	5	≥ 5
Endurance run frequency	Hz	30	-

Performance Checks:

Test Parameter	Units	Result	Limit
Performance Check - During endurance run			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y
Performance Check - At the end of endurance run			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y

Y Axis - Longitudinal (“back and forth”) - With Antenna - Modification State 0

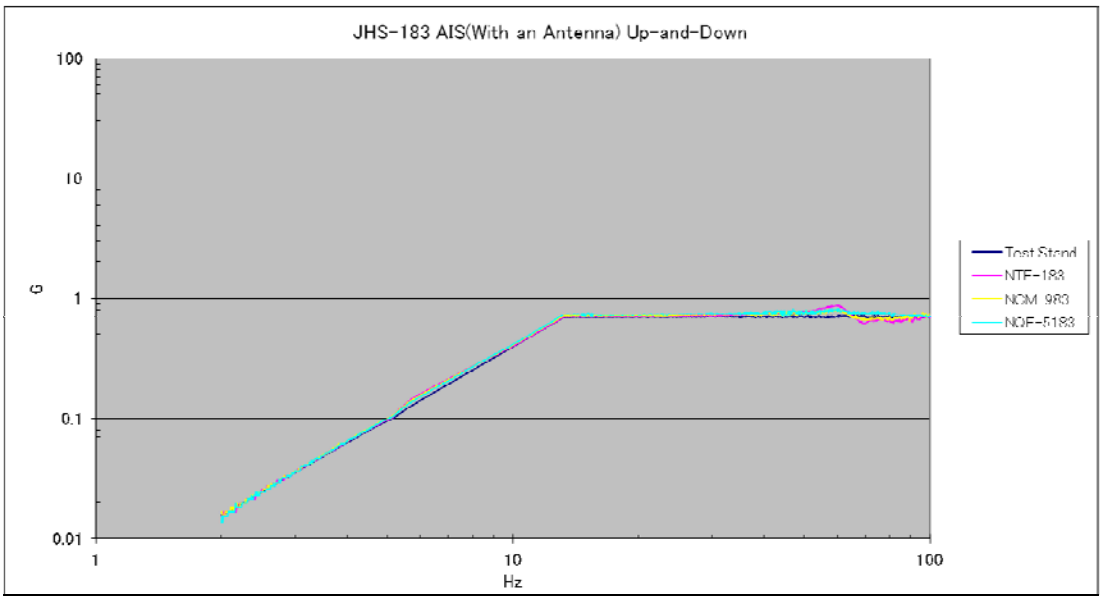
With the antenna attached, the resonance search was repeated; there was no significant change and hence the endurance run was not repeated.



Y Axis - Resonance Search - With Antenna - Modification State 0

From raw data: Maximum (NCM-983) = 2.06 g (magnitude, Q = 2.93)

Z Axis - Vertical Axis (“ups and downs”) - With Antenna - Modification State 0



Z Axis - Resonance Search - With Antenna - Modification State 0

Note: There was no significant resonance in this axis; values below indicate the peak EUT response only.

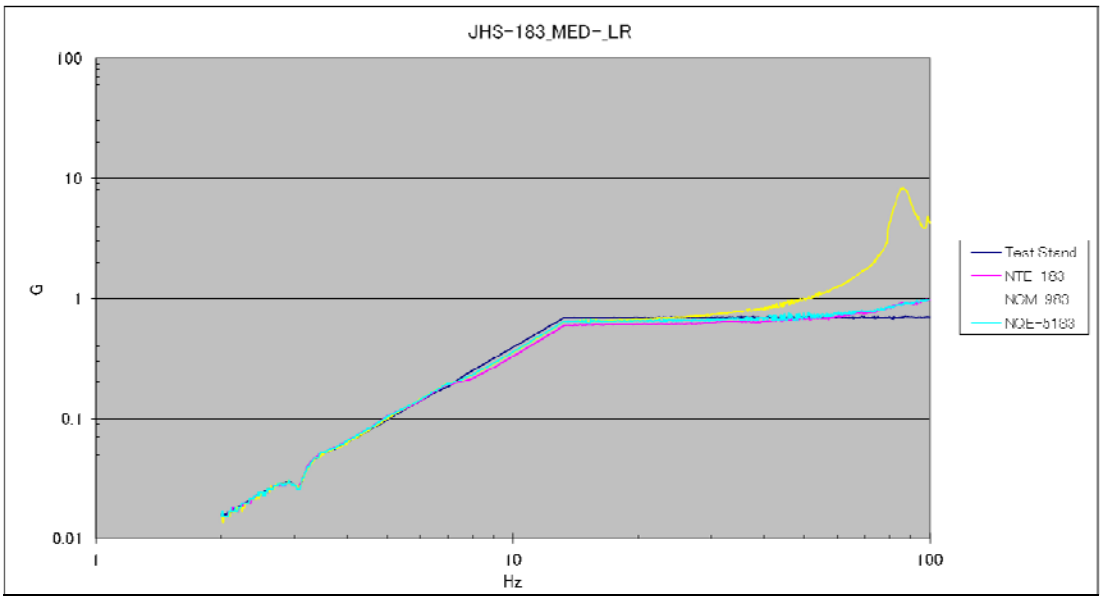
Test Parameter	Units	Result	Limit
Test Setup Variables - Resonances Found			
Peak resonance sensor	-	CH. 4 (NCM-983)	-
Peak resonance frequency	Hz	60.15	-
Peak resonance acceleration, a	g	0.88	-
Applied acceleration at above resonance, a_{IN}	g	0.71	-
Peak resonance magnitude, Q = a / a_{IN}	-	1.25	-
General/Test Specific - EUT Setup			
DC power supply voltage	V	24	-
Test targets	-	5	≥ 5
Endurance run frequency	Hz	30	-

Performance Checks:

Test Parameter	Units	Result	Limit
Performance Check - During endurance run			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y
Performance Check - At the end of endurance run			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y

X Axis - Lateral Axis (“right and left”) - With Antenna - Modification State 0

Note: This initial test at Modification State 0 led to a failure that was noted just before the first Performance Check of the endurance run; the EUT that had been running in Autonomous mode was found to be apparently off and could not be restarted. Upon internal inspection, a component failure was observed see Section 1.7 for further details.



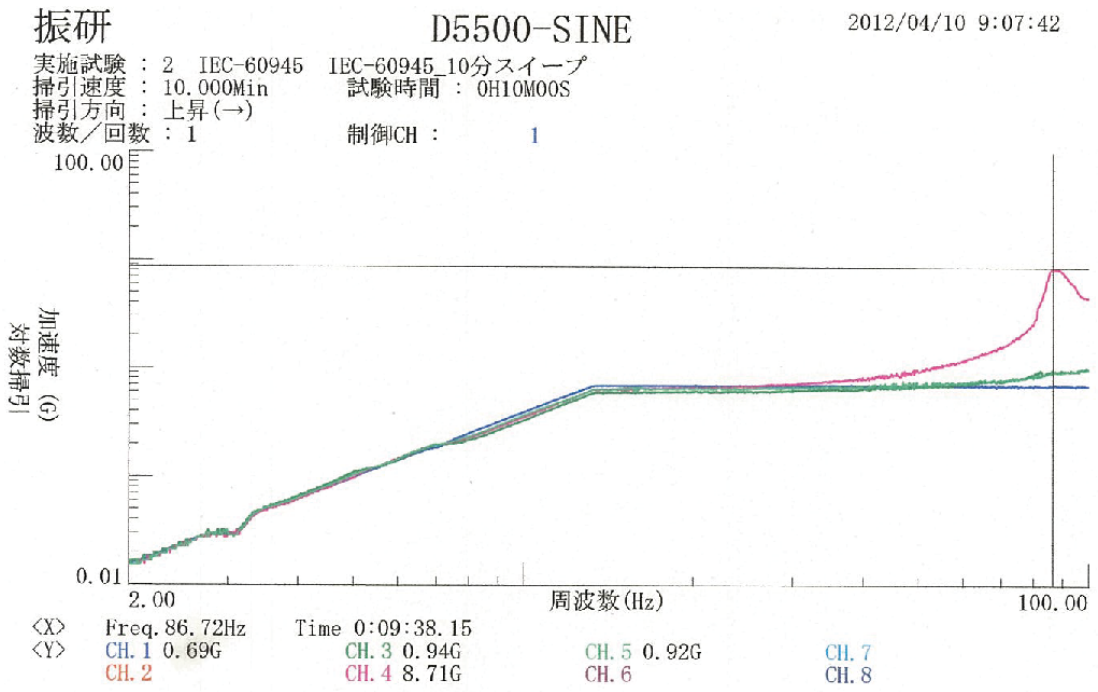
X Axis - Resonance Search - With Antenna - Modification State 0

Note: CH. 1 = Vibration Table Sensor

Test Parameter	Units	Result	Limit
Test Setup Variables - Resonances Found			
Peak resonance sensor	-	CH. 4 (NCM-983)	-
Peak resonance frequency	Hz	86.44	-
Peak resonance acceleration, a	g	8.29	-
Applied acceleration at above resonance, a_{IN}	g	0.69	-
Peak resonance magnitude, Q = a / a_{IN}	-	12.0	-
General/Test Specific - EUT Setup			
DC power supply voltage	V	24	24 **
Test targets	-	5	≥ 5
Endurance run frequency	Hz	86.44	-

X Axis - Lateral Axis (“right and left”) - With Antenna - Modification State 1

With the modification in place, the Resonance Search and Endurance runs were repeated, as follows:



X Axis - Resonance Search - With Antenna - Modification State 1

Note: CH. 1 = Vibration Table Sensor

Test Parameter	Units	Result	Limit
Test Setup Variables - Resonances Found			
Peak resonance sensor	-	CH. 4 (NCM-983)	-
Peak resonance frequency	Hz	86.72	-
Peak resonance acceleration, a	g	8.71	-
Applied acceleration at above resonance, a_{IN}	g	0.69	-
Peak resonance magnitude, Q = a / a_{IN}	-	12.6	-
General/Test Specific - EUT Setup			
DC power supply voltage	V	24	24 **
Test targets	-	5	≥ 5
Endurance run frequency	Hz	86.72	-

Performance Checks:

Test Parameter	Units	Result	Limit
Performance Check - During endurance run			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y
Performance Check - At the end of endurance run			
Transmit - interval check	s	10	10
Transmit - confirm correct MMSI	Y / N	Y	Y
Transmit - confirm Message 1 is continuously transmitted	Y / N	Y	Y
Transmit - confirm correctly encoded sensor data	Y / N	Y	Y
Receive - condition a) - confirm continuous receive	Y / N	Y	Y
Receive - condition a) - confirm message output to PI	Y / N	Y	Y
Receive - condition b) - confirm continuous receive	Y / N	Y	Y
Receive - condition b) - confirm message output to PI	Y / N	Y	Y

Visual Inspection

Following all the endurance runs the EUT was visually inspected, externally and internally; there was no sign of harmful deterioration visible to the naked eye.

2.6 ENVIRONMENTAL TESTS - RAIN AND SPRAY

2.6.1 Specification Reference

IEC 60945, Clause 8.8

2.6.2 Waiver

Test waivered by submission of manufacturer data (see Annex A).

2.7 ENVIRONMENTAL TESTS - CORROSION (SALT MIST)

2.7.1 Specification Reference

IEC 60945, Clause 8.12

2.7.2 Waiver

Test waivered by submission of manufacturer data (see Annex A).

2.8 OPERATIONAL TESTS - CHANNEL SELECTION

2.8.1 Specification Reference

IEC 61993-2, Clause 14.7

2.8.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.8.3 Date of Test and Modification State

16, 17 and 23 April 2012 - Modification State 1

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.5 Test Method

The following testing is required by the specification:

Test Method, Clause 14.7

"Set up standard test environment and operate EUT in autonomous mode. Switch the EUT to different channels randomly selected from the maritime mobile band as specified by ITU-R M.1084-4, Annex 4 using both 25 kHz and 12,5 kHz channel spacing (incl. 12,5 kHz emission on a 25 kHz channel):

a) manually,

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

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

d) by transmission of DSC telecommand to EUT.

Record the VDL messages."

Performance Standard, Clause 14.7

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

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

2.8.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous

The EUT and support equipment were set up as per Section 1.5.3.

2.8.7 Environmental Conditions

	16 April 2012	17 April 2012	23 April 2012
Ambient Temperature:	23.7 °C	24.9 °C	25.4 °C
Relative Humidity:	33 %	38 %	45 %

2.8.8 Test Results

Client Test Procedure

Test condition

EUT position: N 35.41 / E 139.34

EUT SOG/COG: 0

Default channel setting: Ch A 2087,Ch B 2088

Channel manage setting

TX/RX Mode:0-(TXA/TXB,RXA/RXB)

Power :HIGH

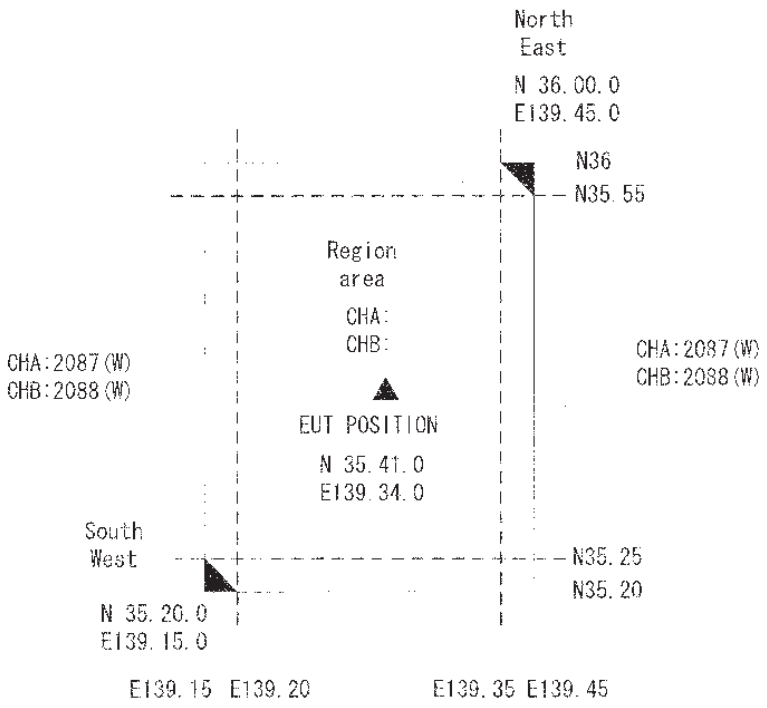
Latitude1 : N 36° 00.0

Longitude1 : E139° 45.0

Latitude2 : N 35° 20.0

Longitude2 : E139° 15.0

Trasitional Zone:5nm



Measurement Results

The EUT was subjected to the above test procedure; results were as follows:

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Test Setup Variables							
Temperature	°C	-25	25.4	25.4	25.4	+55	-
DC power supply voltage	V	21.6	21.6	24	31.2	31.2	-
General/Test Specific - EUT Setup							
Test Targets	-	5					≥ 5
Required results - a) Manually							
VDL Message	-	See below.					-
Check EUT switches to channel/bandwidth and duplex/simplex	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers a TXT-sentence with ID 036	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers appropriate ACA-sentences	Y / N	Y	Y	Y	Y	Y	Y
Required results - b) (msg 22) broadcast							
VDL Message	-	See below.					-
Check EUT switches to channel/bandwidth and duplex/simplex	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers a TXT-sentence with ID 036	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers appropriate ACA-sentences	Y / N	Y	Y	Y	Y	Y	Y
Required results - b) (msg 22) addressed to EUT							
VDL Message	-	See below.					-
Check EUT switches to channel/bandwidth and duplex/simplex	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers a TXT-sentence with ID 036	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers appropriate ACA-sentences	Y / N	Y	Y	Y	Y	Y	Y
Required results - c) ACA sentence to the presentation interface							
VDL Message	-	See below.					-
Check EUT switches to channel/bandwidth and duplex/simplex	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers a TXT-sentence with ID 036	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers appropriate ACA-sentences	Y / N	Y	Y	Y	Y	Y	Y

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Required results - d) DSC telecommand to EUT							
VDL Message	-	See below.					-
Check EUT switches to channel/bandwidth and duplex/simplex	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers a TXT-sentence with ID 036	Y / N	Y	Y	Y	Y	Y	Y
Check EUT delivers appropriate ACA-sentences	Y / N	Y	Y	Y	Y	Y	Y

VDL Messages

a) Manual input by MKD

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,1,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2080,0,2087,0,0,0,M,1,105041.00

*33

c) ACA command by PI

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,2,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2087,0,2088,0,0,0,C,1,110303.00

*37

b-1) Message 22 (broadcast) from Base station

!AIVDM,1,1,,B,F@478Aj2MvD2SiADH56GRU`20000,0*2A

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,3,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2087,0,2021,0,0,0,B,1,110710.00

*32

b-2) Message 22 (addressed) from Base station

!AIVDM,1,1,,A,F@478Aj0j2L3=T8<8000000B0000,0*30

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,4,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2060,0,2087,0,0,0,A,1,110850.00

*38

d) DSC command

$AIDSR,2,1,0043100070,04,09,208100,04,10,208800*62

$AIDSR,2,2,,04,12,036000139450,04,13,035200139150*64

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,6,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2081,0,2088,0,0,0,D,1,111441.00

*32

Extreme Low

a) Manual input by MKD

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,1,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2080,0,2087,0,0,0,M,1,083442.00
*3B

c) ACA command by PI

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,2,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2087,0,2088,0,0,0,C,1,083750.00
*3E

b-1) Message 22 (broadcast) from Base station

!AIVDM,1,1,,B,F@478Aj2MvD2SiADH56GRU`20000,0*2A

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,3,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2087,0,2021,0,0,0,B,1,083854.00
*36

b-2) Message 22 (addressed) from Base station

!AIVDM,1,1,,A,F@478Aj0j2L3=T8<8000000B0000,0*30

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,4,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2060,0,2087,0,0,0,A,1,084158.00
*35

d) DSC command

$AIDSR,2,1,0043100070,04,09,208100,04,10,208800*62

$AIDSR,2,2,,04,12,036000139450,04,13,035200139150*64

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,5,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2081,0,2088,0,0,0,D,1,084459.00
*35

Normal - Low Supply

a) Manual input by MKD

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,1,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2080,0,2087,0,0,0,M,1,084642.00
*3E

c) ACA command by PI

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,2,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2087,0,2088,0,0,0,C,1,084750.00
*39

b-1) Message 22 (broadcast) from Base station

!AIVDM,1,1,,B,F@478Aj2MvD2SiADH56GRU`20000,0*2A

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,3,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2087,0,2021,0,0,0,B,1,084854.00
*31

b-2) Message 22 (addressed) from Base station

!AIVDM,1,1,,A,F@478Aj0j2L3=T8<8000000B0000,0*30

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,4,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2060,0,2087,0,0,0,A,1,085158.00
*34

d) DSC command

$AIDSR,2,1,0043100070,04,09,208100,04,10,208800*62

$AIDSR,2,2,,04,12,036000139450,04,13,035200139150*64

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,5,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2081,0,2088,0,0,0,D,1,085459.00
*34

Normal

a) Manual input by MKD

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,1,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2080,0,2087,0,0,0,M,1,085742.00
*3E

c) ACA command by PI

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,2,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2087,0,2088,0,0,0,C,1,090050.00
*3B

b-1) Message 22 (broadcast) from Base station

!AIVDM,1,1,,B,F@478Aj2MvD2SiADH56GRU`20000,0*2A

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,3,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2087,0,2021,0,0,0,B,1,090454.00
*38

b-2) Message 22 (addressed) from Base station

!AIVDM,1,1,,A,F@478Aj0j2L3=T8<8000000B0000,0*30

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,4,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2060,0,2087,0,0,0,A,1,090658.00
*37

d) DSC command

$AIDSR,2,1,0043100070,04,09,208100,04,10,208800*62

$AIDSR,2,2,,04,12,036000139450,04,13,035200139150*64

$AITXT,01,01,36,Channel management parameters changed*5D

$AIACA,5,3600.0,N,13945.0,E,3520.0,N,13915.0,E,5,2081,0,2088,0,0,0,D,1,090959.00
*3D

Normal - High supply

Regional setting

a) manual input

N 36.00, E 139.45 / N 35.20, E 139.15

Ch A 2080,ChB 2087, TX POWER: HIGH, ZONE SIZE 5NM

c) ACA command

N 36.00, E 139.45 / N 35.20, E 139.15

Ch A 2087,ChB 2088, TX POWER: HIGH, ZONE SIZE 5NM

$AIACA,,3600.00,N,13945.00,E,3520.00,N,13915.00,E,5,2087,0,2088,0,0,0,C,,*1A

b) Message 22 (broadcast)

N 36.00, E 139.45 / N 35.20, E 139.15

Ch A 2087,ChB 2021, TX POWER: HIGH, ZONE SIZE 5NM

!AIVDM,1,1,,B,F0478Aj2MvD2SlADH56GRU`20000,0*59

b) Message 22 (addressed)

N 36.00, E 139.45 / N 35.20, E 139.15

Ch A 2060,ChB 2087, TX POWER: HIGH, ZONE SIZE 5NM

!AIVDM,1,1,,A,F0478Aj0j2L3=T8<8000000B0000,0

d) DSC telecommand

N 36.00, E 139.45 / N 35.20, E 139.15

Ch A 2081,ChB 2088, TX POWER: HIGH, ZONE SIZE 5NM

$AIDSI,2,1,431100001,,,,,,,,,,

$AIDSI,2,2,,,,,4,09208700,4,10208800,4,12036000139450,4,13035200139150,127

Extreme High

2.9 TDMA TRANSMITTER - FREQUENCY ERROR

2.9.1 Specification Reference

IEC 61993-2, Clause 15.1.1

2.9.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.9.3 Date of Test and Modification State

16, 17 and 23 April 2012 - Modification State 1

2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.1.1

“The carrier frequency shall be measured in the absence of modulation. The measurement shall be made under normal test conditions and extreme test conditions.

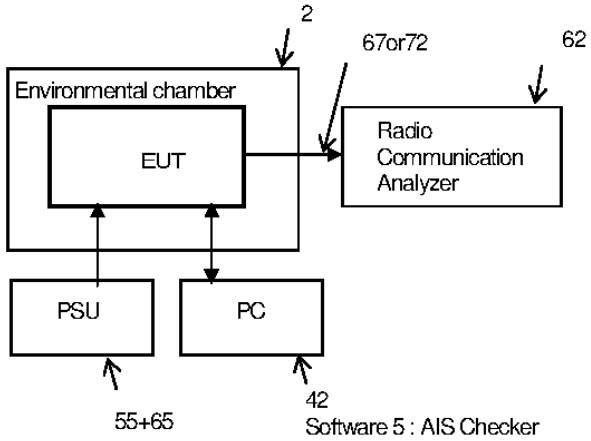
Tests shall be performed on 4 channels (156,025 MHz, 157,4125 MHz, 160,6375 MHz, 162,025 MHz).”

Performance Standard, Clause 15.1.1

“The frequency error shall not exceed ±0,5 kHz under normal and ±1 kHz under extreme test conditions.

2.9.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Unmodulated



Setup Schematic

2.9.7 Environmental Conditions

	16 April 2012	17 April 2012	23 April 2012
Ambient Temperature:	23.7 °C	25.9 °C	25.4 °C
Relative Humidity:	33 %	37 %	45 %

2.9.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.1.1
b) Set the following transmitter condition
TX channel 1060 (156.025 MHz)
TX Power High
Modulation Unmodulated
c) Measure the transmit frequency with frequency counter
d) Repeat step b) and c) as the following channel number 2088 (162.025 MHz)
e) Repeat step b) through d) under the extreme conditions

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Test Setup Variables							
Temperature	°C	-25	25.4	25.4	25.4	+55	-
DC power supply voltage	V	21.6	21.6	24	31.2	31.2	-
General/Test Specific - EUT Setup							
Test Targets	-	5	5	5	5	5	≥ 5
Unmodulated	Y / N	Y	Y	Y	Y	Y	Y
Required results - Frequency error							
156.0250 MHz channel	kHz	0.23	-0.20	-0.20	-0.20	-0.14	± 0.5 *
157.4125 MHz channel	kHz	N/T	N/T	N/T	N/T	N/T	
160.6375 MHz channel	kHz	N/T	N/T	N/T	N/T	N/T	
162.0250 MHz channel	kHz	0.23	-0.20	-0.20	-0.20	-0.14	

* Limit for Extreme Test Conditions is ± 1 kHz

N/T: Not Tested; ITU-R M.1084-4 details 157.4125 MHz as a 12.5 kHz channel and 160.6375 MHz as a 6.5 kHz channel. Neither channel is supported by the EUT.

2.10 TDMA TRANSMITTER - CARRIER POWER

2.10.1 Specification Reference

IEC 61993-2, Clause 15.1.2

2.10.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.10.3 Date of Test and Modification State

16, 17 and 23 April 2012 - Modification State 1

2.10.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.1.2

“The measurement shall be carried out under normal and extreme test conditions on both high and low power settings.”

Performance Standard, Clause 15.1.2

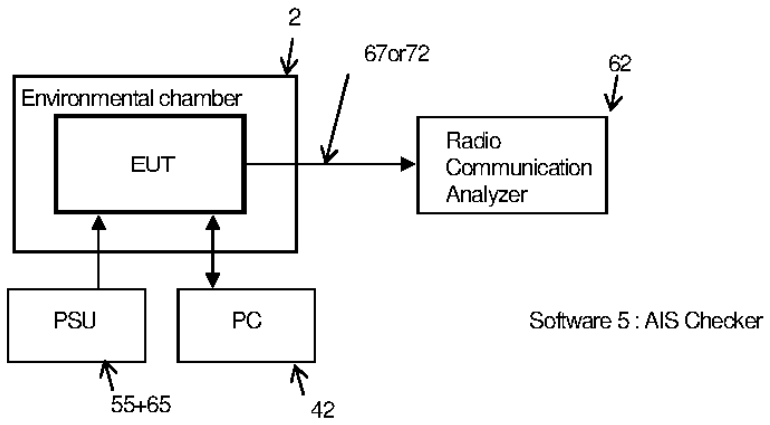
“The carrier power (conducted) shall be within ±1,5 dB of the rated carrier power (conducted).

The carrier power (conducted) under extreme test conditions shall be within +2,0 dB and –3,0 dB of the rated output power.”

Note: nominal high power is 12.5 W and nominal low power is 1.0 W (see ITU-R 1371-4, Clause 2.12.2); limits in the Test Results section are calculated from these figures.

2.10.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Unmodulated



Setup Schematic

2.10.7 Environmental Conditions

	16 April 2012	17 April 2012	23 April 2012
Ambient Temperature:	23.7 °C	25.9 °C	25.4 °C
Relative Humidity:	33 %	37 %	45 %

2.10.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.1.2
b) Set the following transmitter condition
TX channel 1060 (156.025 MHz)
TX Power HIGH
TX type Unmodulated
c) Measure the carrier power with power meter.
d) Set the TX power “LOW “and measure the carrier power.
e) Repeat step b) through d) as the following channel number.
2088 (162.025 MHz)
f) Repeat step b) through d) under the extreme conditions

Product Service

Measurement Results

The EUT was subjected to the above test procedure, test variables were as per the table below. A Performance Check was conducted at/after the time stated below; results were as per the table below.

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Test Setup Variables							
Temperature	°C	-25	25.4	25.4	25.4	+55	-
DC power supply voltage	V	21.6	21.6	24	31.2	31.2	-
General/Test Specific - EUT Setup							
Unmodulated	Y / N	Y	Y	Y	Y	Y	Y
Required results - Carrier power, Channel 1060							
Nominal high power setting	W	11.7	12.3	12.1	12.2	10.9	8.9 to 17.6*
Nominal low power setting	W	0.80	0.80	0.74	0.76	0.97	0.71 to 1.4*
Required results - Carrier power, Channel 2088							
Nominal high power setting	W	12.0	12.1	12.1	12.2	11.0	8.9 to 17.6*
Nominal low power setting	W	0.84	0.76	0.80	0.77	0.93	0.71 to 1.4*

* Limit for Extreme Test Conditions is between +2.0 dB and -3 dB of the rated output power, this gives limits of: 6.3 to 19.8 for the nominal high power setting and 0.51 to 1.6 for the nominal low power setting.

2.11 TDMA TRANSMITTER - MODULATION SPECTRUM 25 kHz CHANNEL MODE

2.11.1 Specification Reference

IEC 61993-2, Clause 15.1.3

2.11.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.11.3 Date of Test and Modification State

23 April 2012 - Modification State 1

2.11.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.11.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.1.3

"This test is produced to insure that the modulation sidebands produced by the specified test patterns, fall within the allowable masks.

Two methods of measurements are accepted.

a) The test shall be performed using the modulation and transmitter keying of the EUT.

b) Alternatively, to perform this test the manufacturer shall provide access to the modulator and the transmitter key. An external test signal shall be applied to the EUT.

The test shall be carried out using standard modulation, for both DSC and TDMA modes, using successively standard test signals 1, 2 and 3. See 10.4.

Using standard modulation, for both DSC and TDMA modes, the emission mask for 25 kHz channel mode is:

– At ±10 kHz removed from the carrier, the modulation sidebands is below –25 dBc.

– At ±25 kHz removed from the carrier, the modulation sidebands is below –70 dBc, without any need to be below 0,25 µW.

In the region between ±10 kHz and ±25 kHz removed from the carrier, the modulation sidebands is below a line specified between these two points."

Performance Standard, Clause 15.1.3

“The modulation spectrum shall be within the mask specified in figure 4.

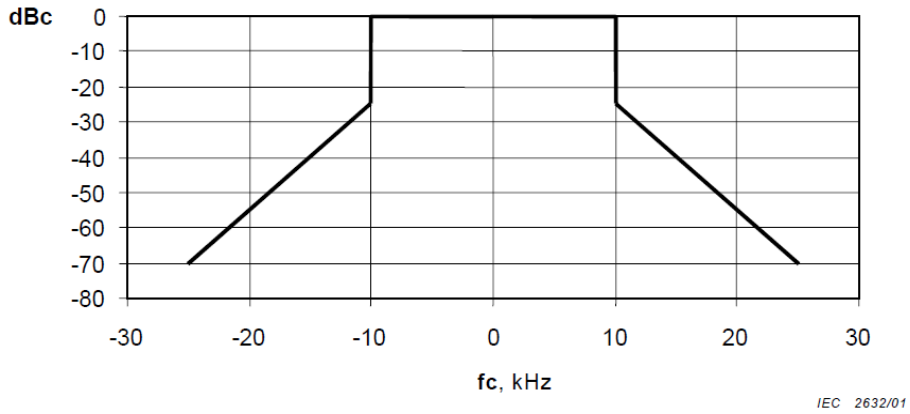
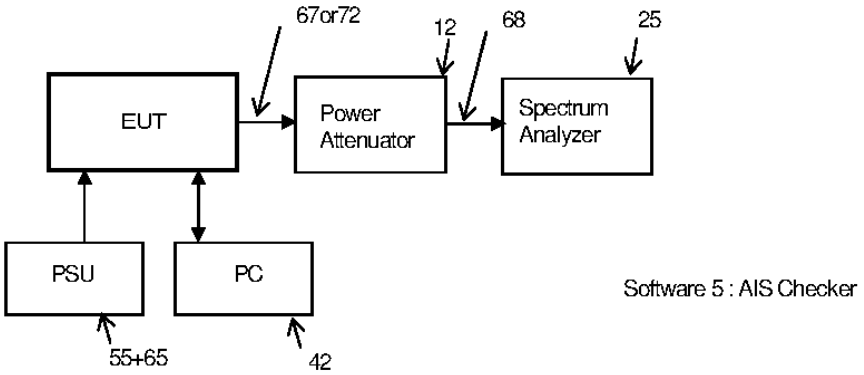


Figure 4 – Modulation spectrum 25 kHz”

2.11.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.11.7 Environmental Conditions

	23 April 2012
Ambient Temperature:	25.4 °C
Relative Humidity:	45 %

2.11.8 Test Results

Note: the following client test procedure is based on method “a” from Test Method, above.

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.1.3
b) Set the following transmitter condition
TX channel 1060 (156.025 MHz)
Bandwidth WIDE
TX type Standard test signal No. 2 (010101)
TX Power HIGH
c) Measure the modulation spectrum with spectrum analyzer.
d) Change the TX type “Standard test signal No. 3(00110011) and measure the modulation spectrum.
e) Repeat step b) through c) as TX channel “2088 (162.025 MHz)”.

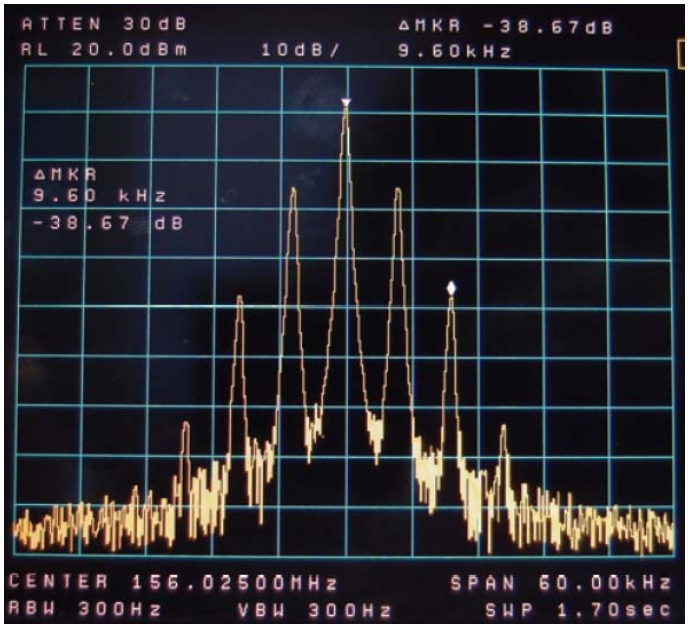
Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

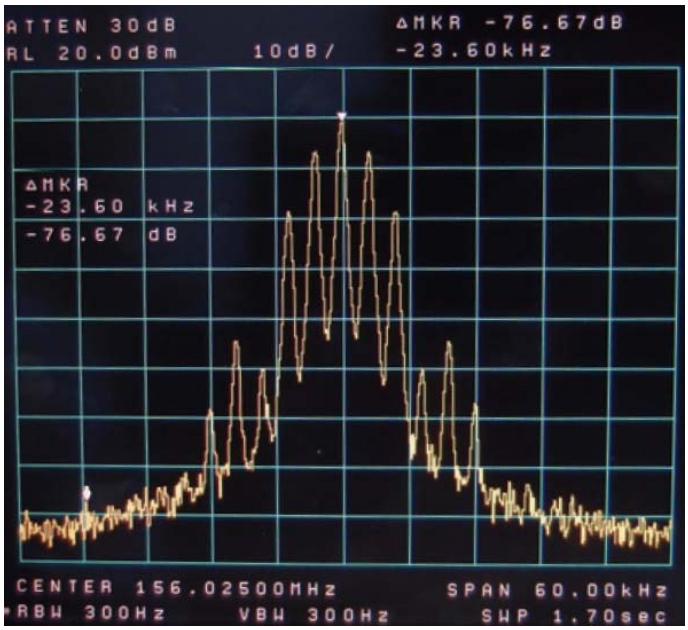
Note: DSC Transmissions not tested; customer declared that there is no DSC transmitter in the EUT.

Test Parameter	Units	Result	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
General/Test Specific - EUT Setup			
Standard modulation	Y / N	Y	Y
Required results - Modulation spectrum 12.5 kHz channel mode			
Modulation spectrum complies with mask, Channel 1060, 0101	Y / N	Y	Y
Modulation spectrum complies with mask, Channel 1060, 0011	Y / N	Y	Y
Modulation spectrum complies with mask, Channel 2088, 0101	Y / N	Y	Y
Modulation spectrum complies with mask, Channel 2088, 0011	Y / N	Y	Y

Modulation Spectrum - Channel 1060

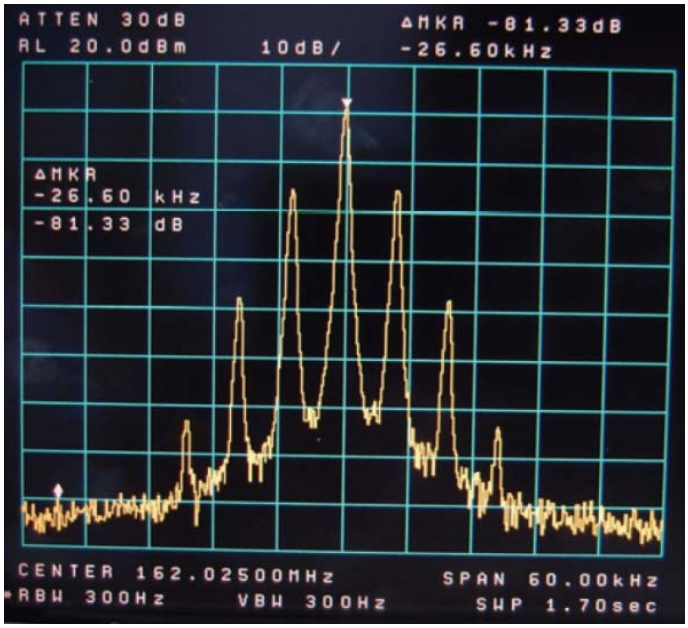


Modulation Spectrum - Test Signal 2 (0101)

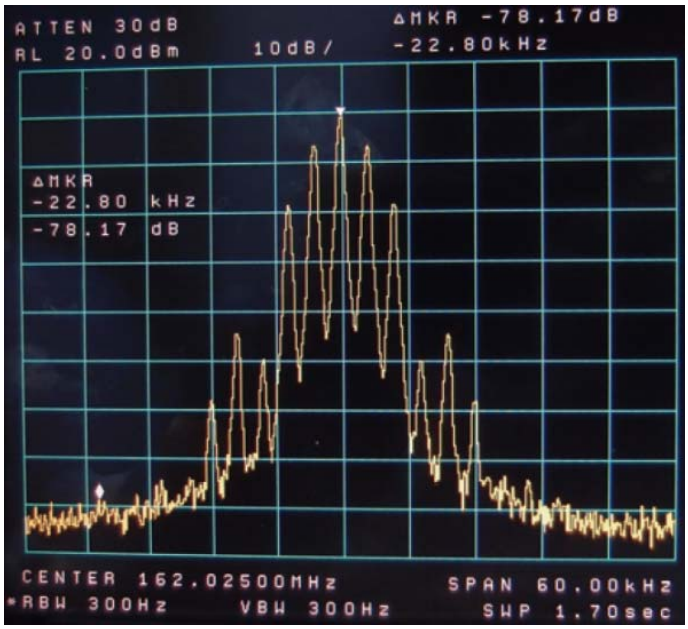


Modulation Spectrum - Test Signal 3 (0011)

Modulation Spectrum - Channel 2088



Modulation Spectrum - Test Signal 2 (0101)



Modulation Spectrum - Test Signal 3 (0011)

2.12 TDMA TRANSMITTER - TRANSMITTER ATTACK TIME

2.12.1 Specification Reference

IEC 61993-2, Clause 15.1.5

2.12.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.12.3 Date of Test and Modification State

16, 17 and 23 April 2012 - Modification State 1

2.12.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.12.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.1.5

“The measurement is carried out with an unmodulated carrier.

The measurement procedure shall be as follows:

a) The transmitter is connected to a RF detector and to a test discriminator via a matched test load. The attenuation of the test load shall be chosen in such a way that the input of the test discriminator is protected against overload and the limiter amplifier of the test discriminator operates correctly in the limiting range as soon as the transmitter carrier power (before attenuation) exceeds 1 mW. A dual trace storage oscilloscope (or a transient recorder) records the amplitude transient from the detector on a logarithmic scale and the frequency transient from the discriminator.

A trigger device may be required to ensure that the start of the sweep of the oscilloscope time base occurs at the instant at which the "transmitter on" function is initiated. The measuring arrangement is shown in figure 6 below.

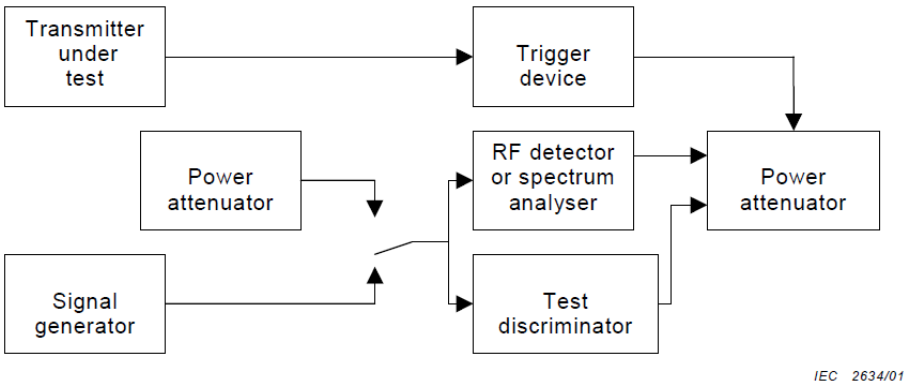


Figure 6 – Test arrangement for transient behaviour of transmitter power and frequency, including transmitter attack and release time

The test discriminator may consist of a mixer and a local oscillator (providing the auxiliary frequency) used to convert the transmitter frequency to be measured into the frequency fed to the (broadband) limiter amplifier and the associated broadband discriminator:

– the test discriminator shall be sensitive enough to measure input signals down to Pc – 30 dB;
– the test discriminator shall be fast enough to display the frequency deviations (approximately 100 kHz/100 ms);
– the test discriminator output shall be d.c. coupled.

A spectrum analyser and a test discriminator/storage oscilloscope can also be used.

b) The traces of the oscilloscope shall be calibrated in power and frequency (y-axis) and in time (x-axis), using the signal generator.

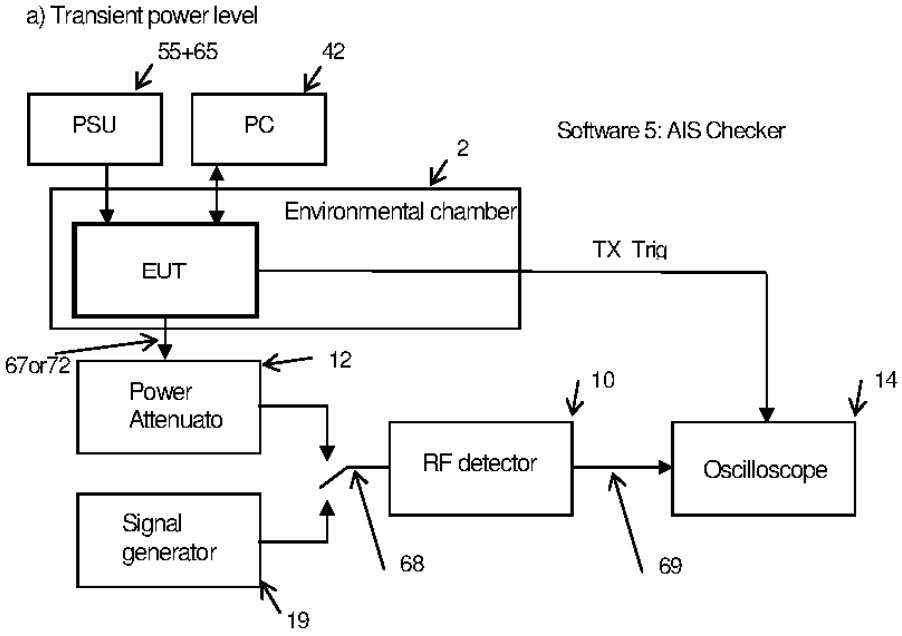
c) The transmitter attack time may (preferably) be measured by direct reading on the oscilloscope while the transmitter is unmodulated."

Performance Standard, Clause 15.1.5

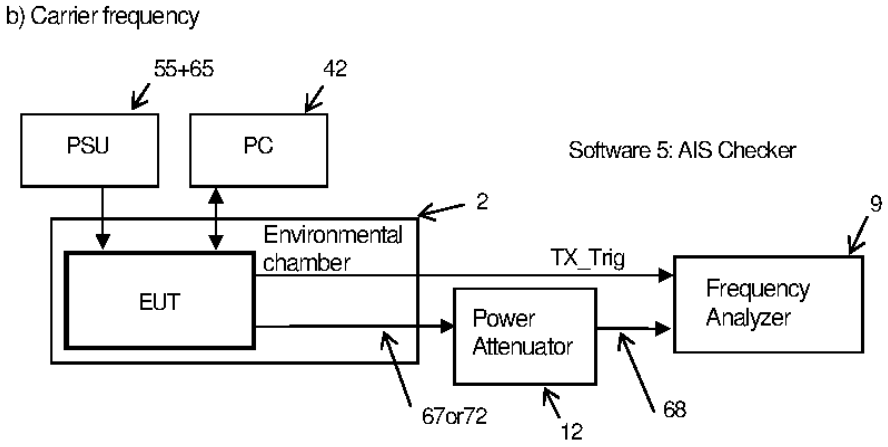
"The transmitter attack time shall not exceed 1 ms, and the transient power level shall not exceed +1,5 dB of its final value at any time. The carrier frequency shall not exceed ±1 kHz of its required value after 1 ms."

2.12.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Unmodulated

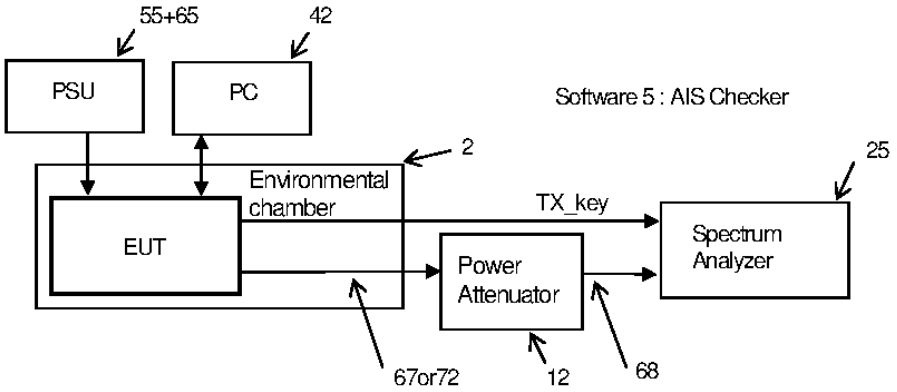


Setup Schematic - Power



Setup Schematic - Frequency

c)Transmitter attack time



Setup Schematic - Transmitter Attack Time

2.12.7 Environmental Conditions

	16 April 2012	17 April 2012	23 April 2012
Ambient Temperature:	23.7 °C	25.9 °C	25.4 °C
Relative Humidity:	33 %	37 %	45 %

2.12.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.1.5
b) Calibrate the power and frequency using the signal generator
c) Set the following transmitter condition
TX channel 2088 (162.025 MHz)
TX type unmodulated
TX Power HIGH
d) Measure the transmitter attack time, the transient power level and the carrier frequency by direct reading on the oscilloscope while the transmitter is unmodulated.

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Note: Definition of the transmitter attack time is the greater of the two following measurements (from the moment of the “transmitter on” function):

Transmitter attack time a)

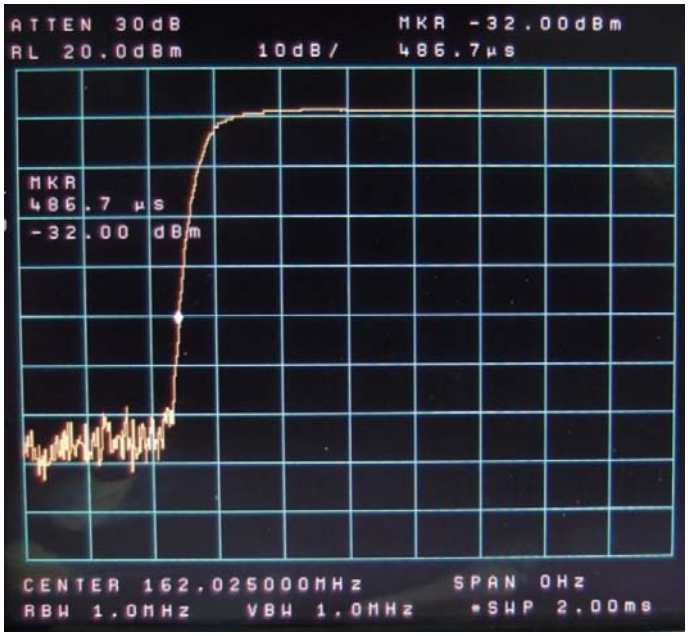
The moment when the transmitter output power has reached a level 1 dB below or 1,5 dB above the steady-state power (Pc) and maintains a level within +1,5 dB/–1 dB from Pc thereafter

Transmitter attack time b)

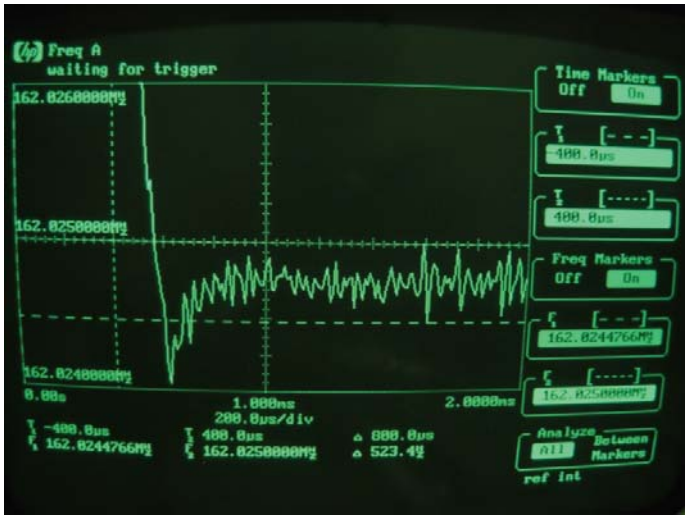
The moment after which the frequency of the carrier always remains within ±1 kHz of its steady state frequency, Fc

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Test Setup Variables							
Temperature	°C	-25	25.4	25.4	25.4	+55	-
DC power supply voltage	V	21.6	21.6	24	31.2	31.2	-
General/Test Specific - EUT Setup							
Transmitter channel number	-	2088					-
Transmitter channel frequency	MHz	162.0250					-
Transmitter power setting	-	Nominal High (12.5 W)					-
Required results - Transmitter attack time Channel 2088 (162.0250 MHz)							
Maximum transmitter attack time	ms	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	1
Maximum transient power deviation from final value	dB	0.4	0.4	0.4	0.4	0.4	≤ +1.5
Maximum carrier frequency deviation after 1 ms	kHz	0.523	-0.437	-0.484	-0.430	-0.352	≤ ±1

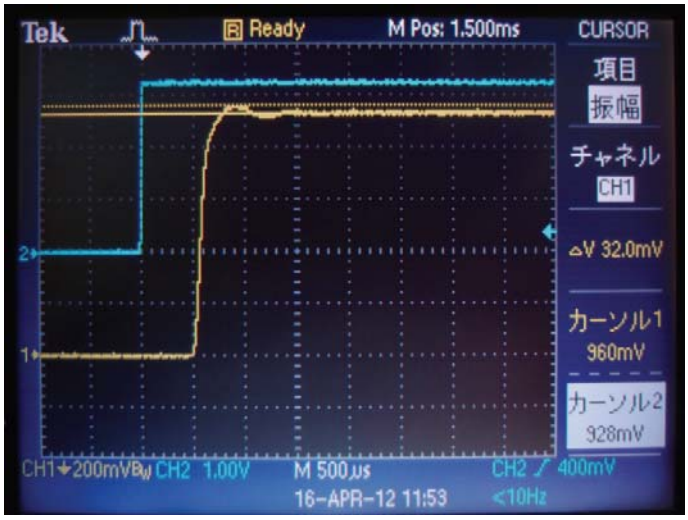
Extreme Temperature and Power Supply - Low



Transmitter Attack Time - Power

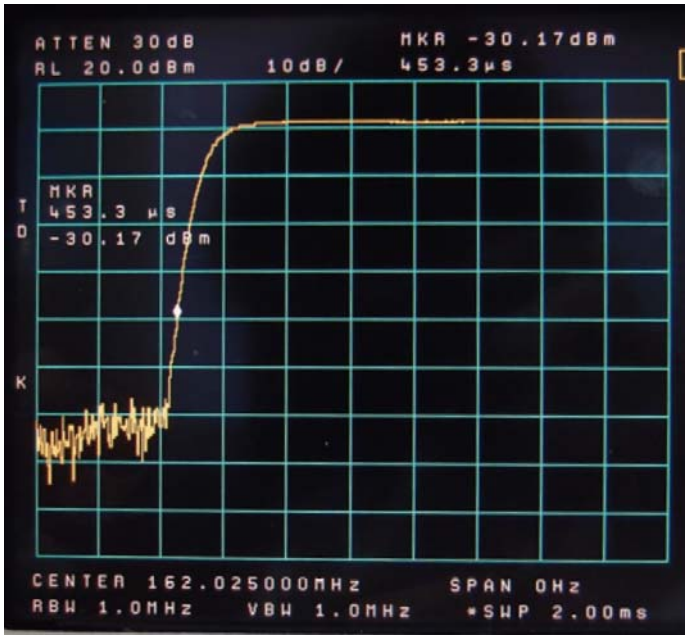


Transmitter Attack Time - Frequency

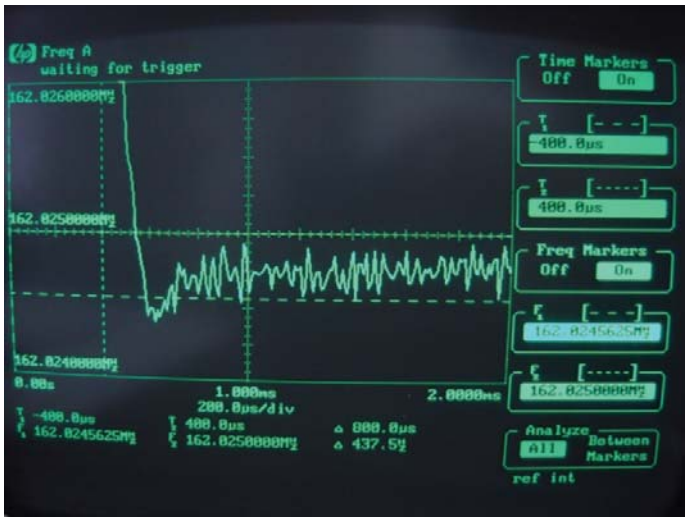


Maximum Transient Power Deviation from Final Value

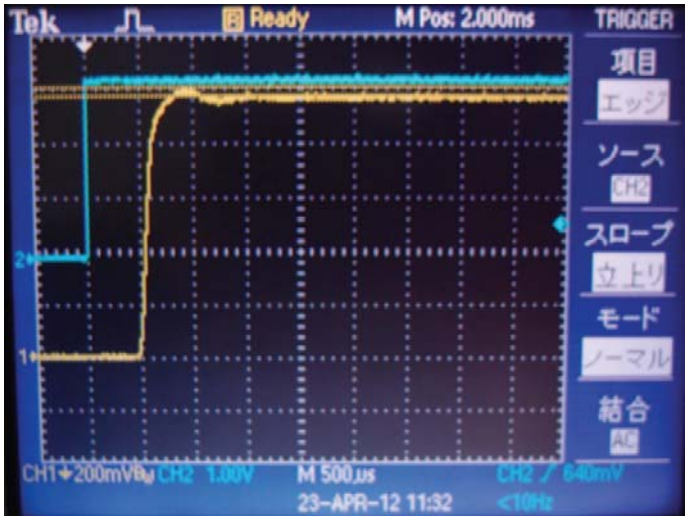
Normal Temperature - Low Power Supply



Transmitter Attack Time - Power

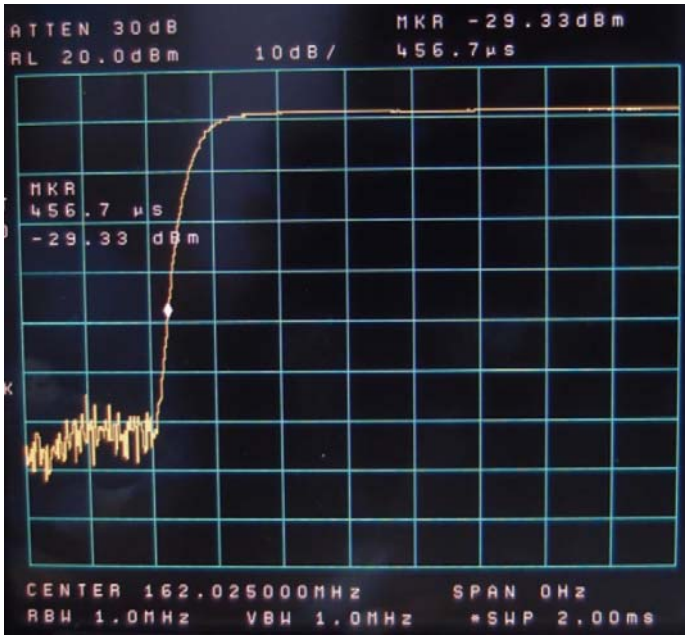


Transmitter Attack Time - Frequency

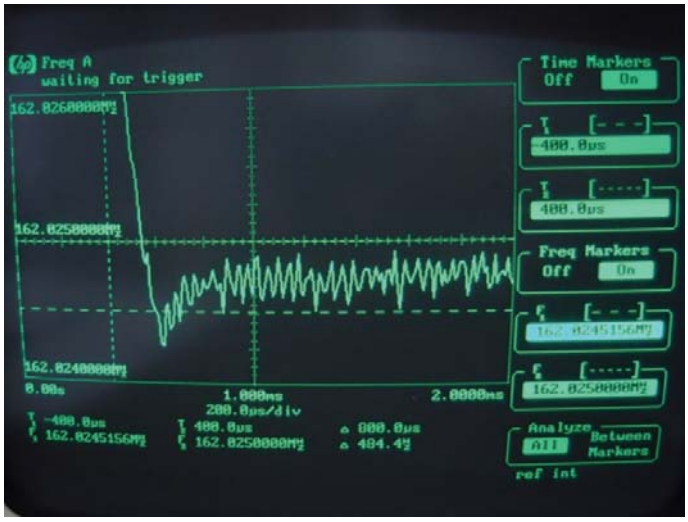


Maximum Transient Power Deviation from Final Value

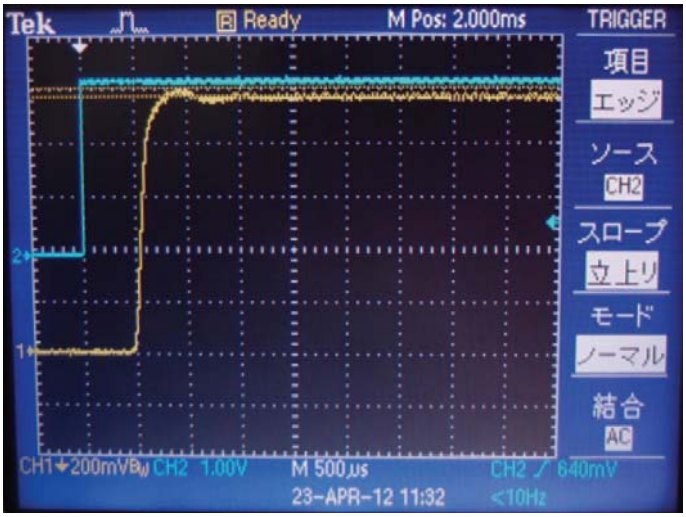
Normal Temperature - Normal Power Supply



Transmitter Attack Time - Power

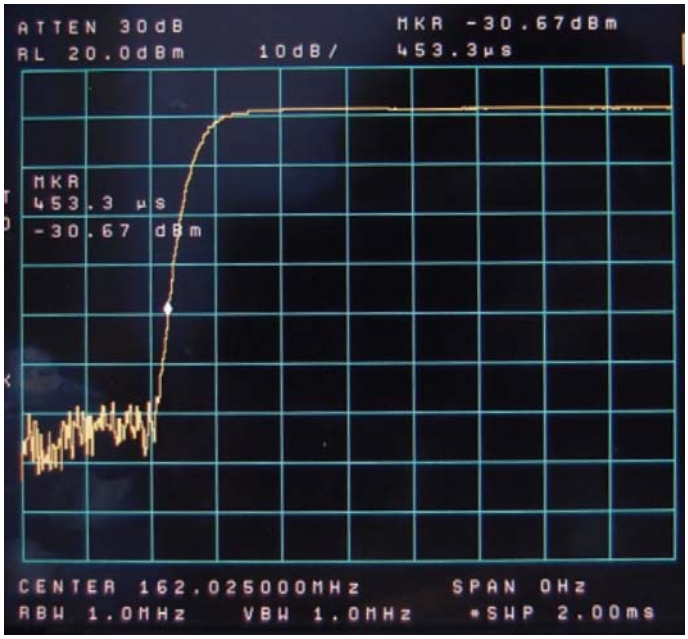


Transmitter Attack Time - Frequency

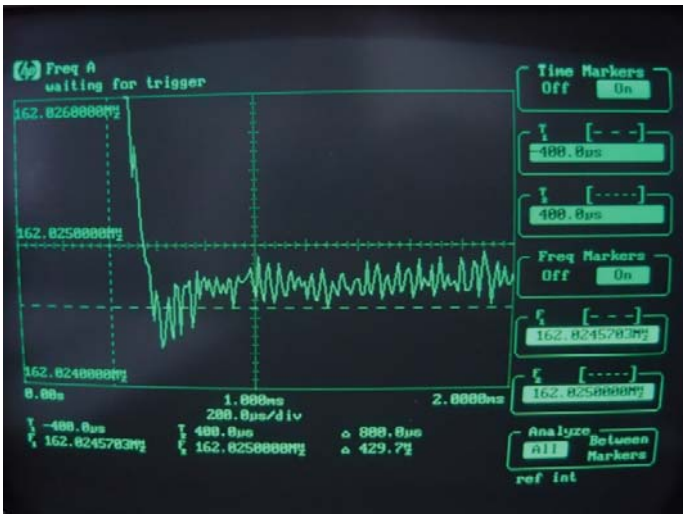


Maximum Transient Power Deviation from Final Value

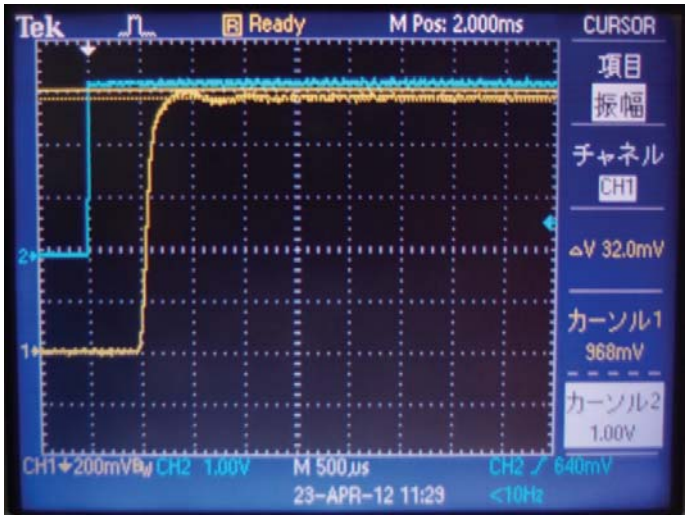
Normal Temperature - High Power Supply



Transmitter Attack Time - Power

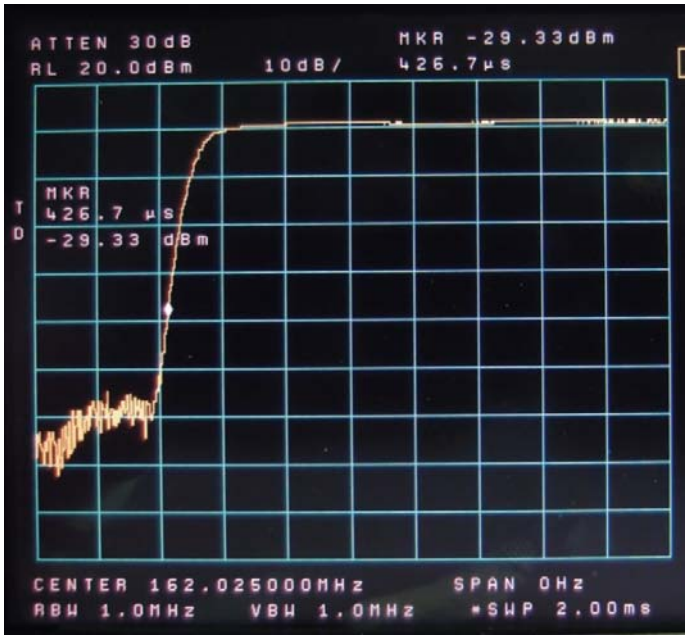


Transmitter Attack Time - Frequency

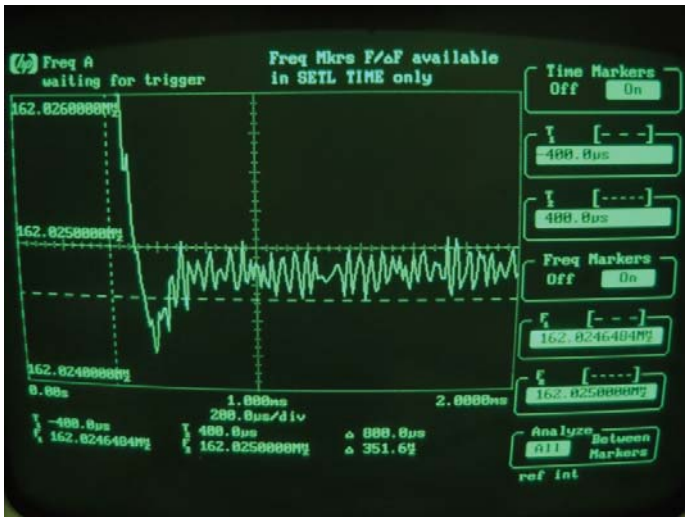


Maximum Transient Power Deviation from Final Value

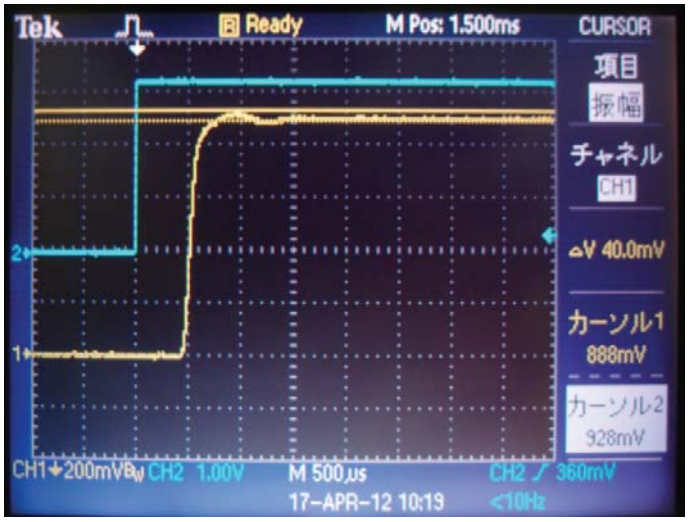
Extreme Temperature and Power Supply - High



Transmitter Attack Time - Power



Transmitter Attack Time - Frequency



Maximum Transient Power Deviation from Final Value

2.13 TDMA TRANSMITTER - TRANSMITTER RELEASE TIME

2.13.1 Specification Reference

IEC 61993-2, Clause 15.1.6

2.13.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.13.3 Date of Test and Modification State

16, 17 and 23 April 2012 - Modification State 1

2.13.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.13.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.1.6

“For the test arrangement, see paragraph 15.1.5, figure 6.

The measurement is carried out with an unmodulated carrier.

The measurement procedure shall be as follows:

a) The transmitter is connected to a RF detector and to a test discriminator via a matched power attenuator. Its attenuation shall be chosen in such a way that the input of the test discriminator is protected against overload and that the limiter amplifier of the test discriminator operates correctly in the limiting range as long as the transmitter carrier power (before attenuation) exceeds 1 mW. A dual trace storage oscilloscope (or a transient recorder) records the amplitude transient from the detector on a logarithmic scale and the frequency transient from the discriminator. A trigger device may be required to ensure that the start of the sweep of the oscilloscope timebase occurs the instant at which the "transmitter off" function is initiated. If the transmitter possesses an automatic powering down facility (e.g. in the case of fixed length message transmission), it may replace the trigger device for starting the sweep of the oscilloscope.

A spectrum analyser and a test discriminator/storage oscilloscope may also be used.

b) The traces of the oscilloscope shall be calibrated in power and frequency (y-axis) and in time (x-axis) by replacing the transmitter and test load by the signal generator.

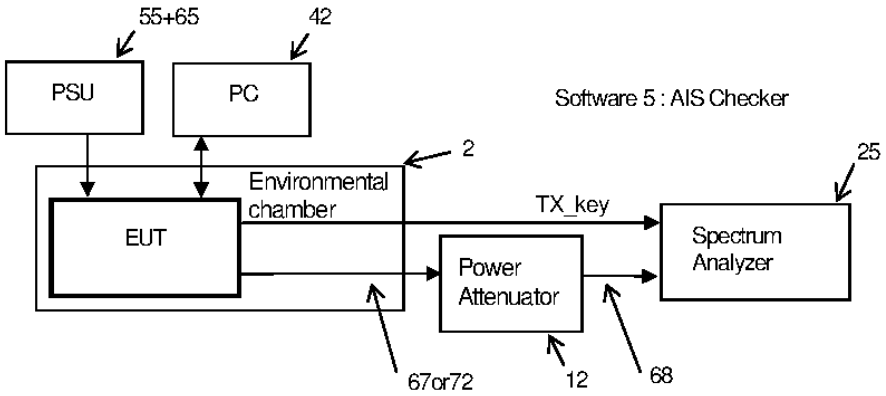
c) The transmitter release time shall be measured by direct reading on the oscilloscope while the transmitter is preferably unmodulated.”

Performance Standard, Clause 15.1.6

“The transmitter release time shall not exceed 1 ms.”

2.13.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Unmodulated



Software: 5
Test Equipment : 2. 12. 25. 42. 55. 65. 68. 67or 72
(Dry heat and Low temp test 72,the other 67)

Setup Schematic

2.13.7 Environmental Conditions

	16 April 2012	17 April 2012	23 April 2012
Ambient Temperature:	23.7 °C	25.9 °C	25.4 °C
Relative Humidity:	33 %	37 %	45 %

2.13.8 Test Results

Client Test Procedure

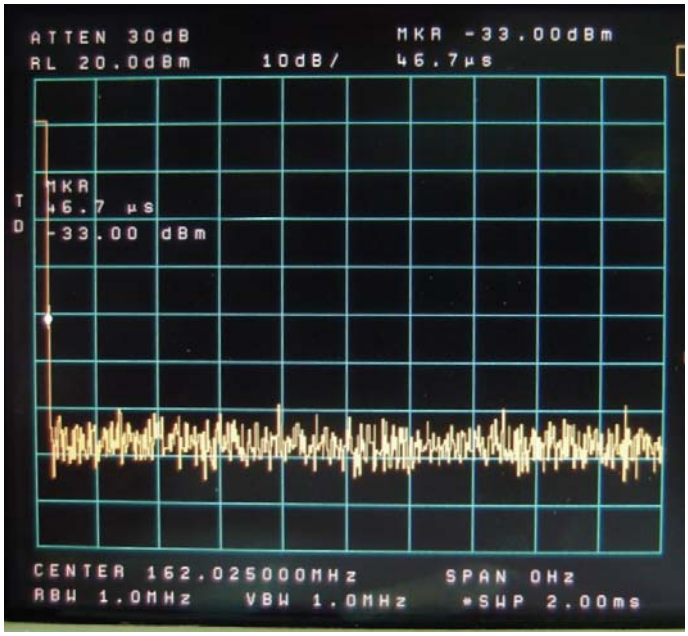
a) Set up the test equipment as shown in Fig. 15.1.6
b) Calibrate the power and frequency using the signal generator
c) Set the following transmitter condition
TX channel 2088 (162.025 MHz)
TX type unmodulated
TX Power HIGH
d) Measure the transmitter release time, by direct reading on the oscilloscope while the transmitter is preferably unmodulated.

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

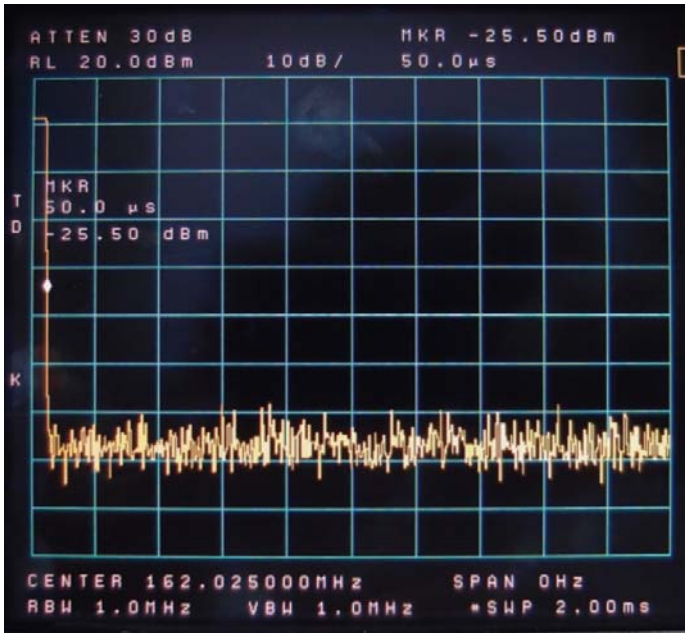
Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Test Setup Variables							
Temperature	°C	-25	25.4	25.4	25.4	+55	-
DC power supply voltage	V	21.6	21.6	24	31.2	31.2	-
General/Test Specific - EUT Setup							
Transmitter channel number	-	2088					-
Transmitter channel frequency	MHz	162.0250					-
Required results - Transmitter attack time Channel 2088 (162.0250 MHz)							
Transmitter release	ms	0.047	0.050	0.050	0.050	0.053	≤ 1

Extreme Temperature and Power Supply - Low



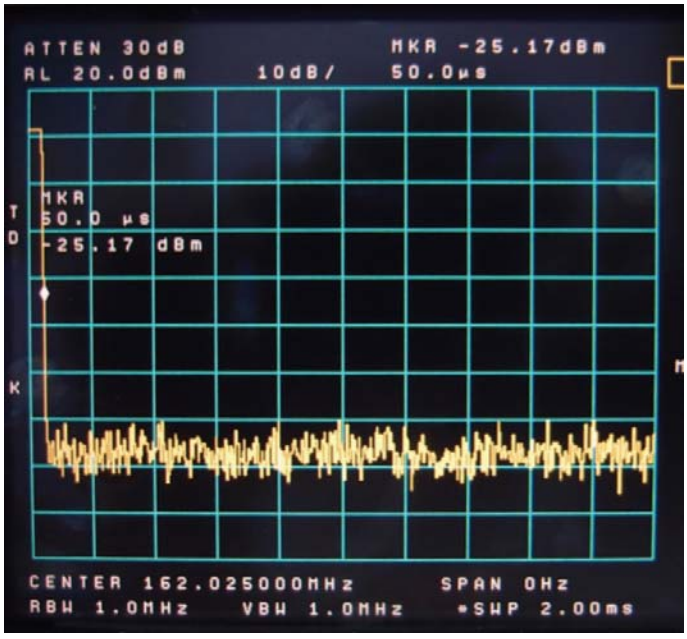
Transmitter release time

Normal Temperature and Low Power Supply



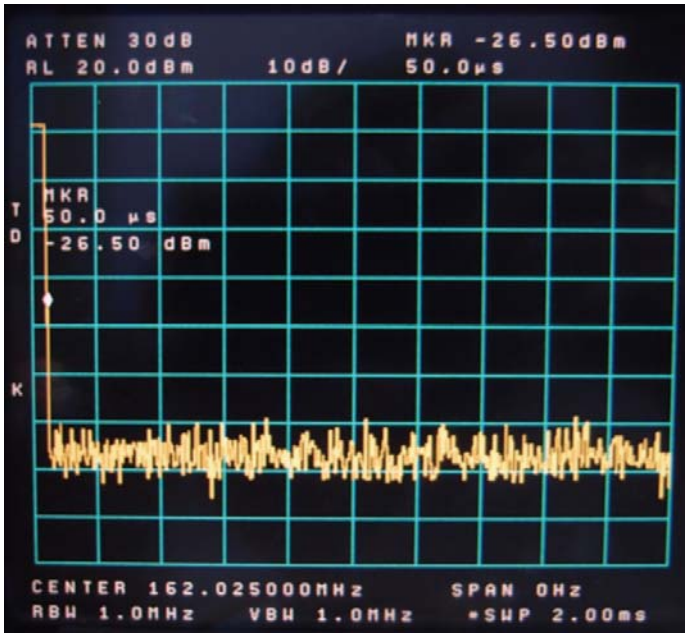
Transmitter release time

Normal Temperature and Normal Power Supply



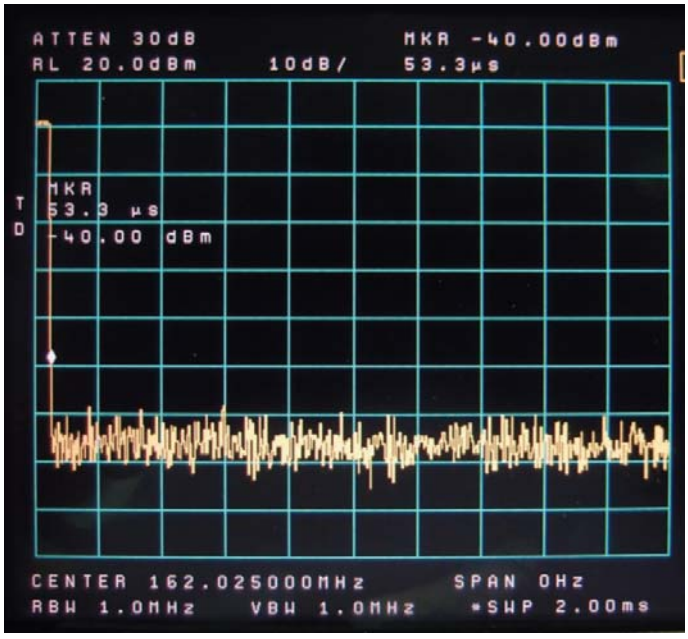
Transmitter release time

Normal Temperature and High Power Supply



Transmitter release time

Extreme Temperature and Power Supply - High



Transmitter release time

2.14 TDMA RECEIVERS - SENSITIVITY – 25 kHz OPERATION

2.14.1 Specification Reference

IEC 61993-2, Clause 15.3.1

2.14.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.14.3 Date of Test and Modification State

16, 17 and 24 April 2012 - Modification State 1

2.14.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.14.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.3.1

“Two (2) types of packets shall be used: one which has a data field with a bit pattern consisting of alternating ones and zeroes (101010101…), one, which has a bit pattern with alternating double ones and double zeroes (110011001100…). The test shall alternate between the two types during the test process.

NOTE A broadcast binary message structure is allowed to be used for this test. In this case, the data field is reduced by 40 bits, which will be occupied by the message id for broadcast binary message and the unique identifier for the transmitting station (MMSI). The application identifier shall be selected so that it corresponds with the selected bit pattern.

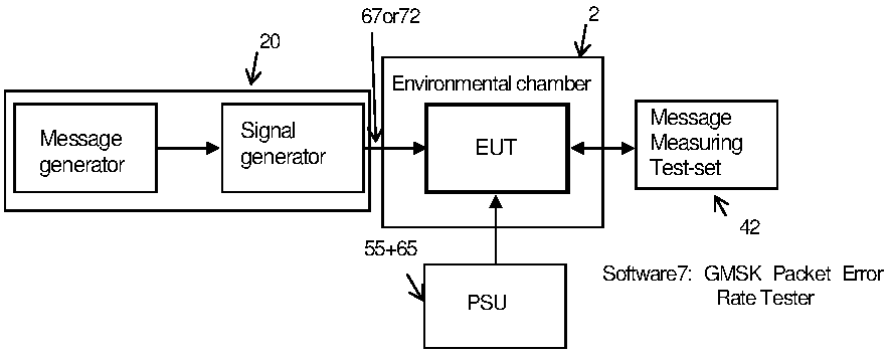
A minimum of 1 000 packets shall be transmitted during the test. The PER shall be derived by dividing the received packets with the number of transmitted packets. The test shall be performed with the frequencies 156,025 MHz and 162,025 MHz.”

Performance Standard, Clause 15.3.1

“The sensitivity shall be –107 dBm under normal test conditions, and –101 dBm under extreme test conditions, when operating on a 25 kHz channel with a PER of 20 %.”

2.14.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.14.7 Environmental Conditions

	16 April 2012	17 April 2012	24 April 2012
Ambient Temperature:	23.7 °C	25.9 °C	23.5 °C
Relative Humidity:	33 %	37 %	57 %

2.14.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.3.1
b) Set the RX _A channel 1060 (156.025 MHz).
c) Set the Signal generator the following condition

Frequency	156.025 MHz
Modulation type	GMSK
Symbol rate	9600 sym/s
Filter	Gauss/BT = 0.4
Message bit pattern	10101010 and 11001100

d) Transmit the 1000 packet from signal generator
e) Measure the receiving PER.
f) Repeat step d) through e) under the following condition
RX channel: 2088 (162.025 MHz)
Signal generator frequency: 162.025 MHz.
g) Repeat step b) through f) under the RX_B channel.
h) Repeat step b) through g) under the extreme conditions

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Note: In the results, "≤" denotes that the EUT performance was likely better than the associated value as said value produced a PER of less than 20 %.

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Test Setup Variables							
Temperature	°C	-25	23.5	23.5	23.5	+55	-
DC power supply voltage	V	21.6	21.6	24	31.2	31.2	-
Required results - Sensitivity, Channel 1060							
Channel A, 0101	dB	≤ -101	≤ -114	≤ -114	≤ -114	≤ -101	≤ -107*
Channel A, 0011	dB	≤ -101	≤ -114	≤ -114	≤ -114	≤ -101	
Channel B, 0101	dB	≤ -101	≤ -114	≤ -114	≤ -114	≤ -101	
Channel B, 0011	dB	≤ -101	≤ -114	≤ -114	≤ -114	≤ -101	
Required results - Sensitivity, Channel 2088							
Channel A, 0101	dB	≤ -101	≤ -113	≤ -113	≤ -113	≤ -101	≤ -107*
Channel A, 0011	dB	≤ -101	≤ -113	≤ -113	≤ -113	≤ -101	
Channel B, 0101	dB	≤ -101	≤ -114	≤ -114	≤ -114	≤ -101	
Channel B, 0011	dB	≤ -101	≤ -114	≤ -114	≤ -114	≤ -101	

* Limit for Extreme Test Conditions is -101 dBm.

2.15 TDMA RECEIVERS - ERROR BEHAVIOUR AT HIGH INPUT LEVELS

2.15.1 Specification Reference

IEC 61993-2, Clause 15.3.3

2.15.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.15.3 Date of Test and Modification State

24 April 2012 - Modification State 1

2.15.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.15.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.3.3

"The measurement procedure shall be as follows:

a) an input signal with a frequency equal to the nominal frequency of the receiver, having normal test modulation (see 10.4.2 and 10.4.3), in accordance with the instructions of the manufacturer and agreed by the testing laboratory, shall be applied to the receiver input terminals;

b) the level of the input signal shall be adjusted to a level which is –77 dBm for the degradation measurements;

c) the normal test signal shall then be transmitted 1 000 times whilst observing in each case whether or not a message is successfully received;

d) the number of messages not successfully received shall be recorded;

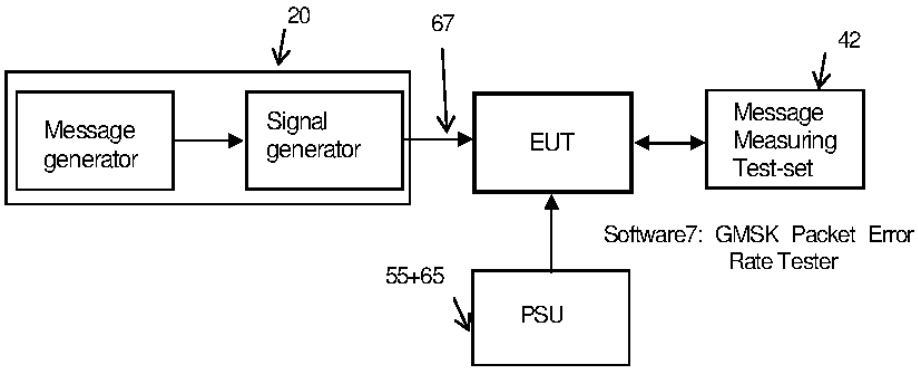
e) the measurement shall be repeated with the input signal of the receiver at a level of -7 dBm for the degradation measurements."

Performance Standard, Clause 15.3.3

"The number of messages not correctly received (lost or corrupted) at -7 dBm shall not differ by more than 10 from that recorded at -77 dBm."

2.15.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.15.7 Environmental Conditions

	24 April 2012
Ambient Temperature:	23.5 °C
Relative Humidity:	57 %

2.15.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.3.3
b) Set the RX_A channel 1060 (156.025 MHz).
c) Set the Signal generator the following condition

Frequency	156.025 MHz
Modulation type	GMSK
Symbol rate	9600 sym/s
Filter	Gauss/BT=0.4
Message bit pattern	10101010

d) Adjust the receiver input level –77 dBm and transmit 1000 messages.
e) Transmit the 1000 packet from signal generator and count the number of the not successfully message.
f) Change the receiver input level –7 dBm.
g) Transmit the 1000 packet from signal generator and count the number of the not successfully message.
h) Repeat step d) through g) under the following condition:

RX _A channel :	2088 (162.025 MHz)
Signal generator frequency:	162.025 MHz.

i) Repeat step b) through h) at RX_B channel.

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Test Parameter	Units	Results	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Required results - Difference in incorrectly received messages - Channel 1060 (156.025 MHz)			
Channel A, 0101	-	0	≤ 10
Channel A, 0011	-	0	
Channel B, 0101	-	0	
Channel B, 0011	-	0	
Required results - Difference in incorrectly received messages - Channel 2088 (162.025 MHz)			
Channel A, 0101	-	0	≤ 10
Channel A, 0011	-	0	
Channel B, 0101	-	0	
Channel B, 0011	-	0	

2.16 TDMA RECEIVERS - CO-CHANNEL REJECTION – 25 kHz OPERATION

2.16.1 Specification Reference

IEC 61993-2, Clause 15.3.4

2.16.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.16.3 Date of Test and Modification State

24 April 2012 - Modification State 1

2.16.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.16.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.3.4

“Method of measurement

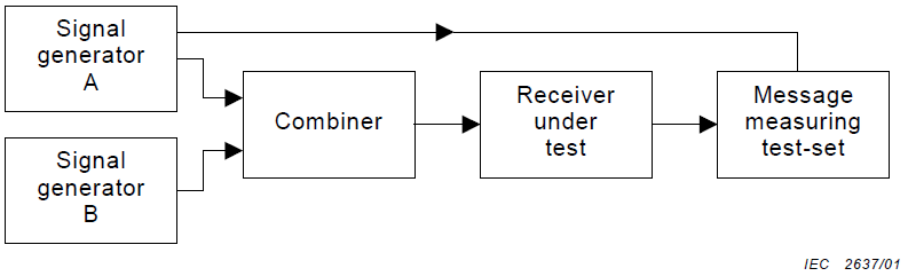


Figure 9 – Measurement arrangement with messages”

The measurement procedure shall be as follows:

a) Two signal generators, A and B, shall be connected to the receiver via a combining network.

The wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall have normal test modulation (see 10.4 and method of measurement in 15.3.1).

The unwanted signal, provided by signal generator B, shall be modulated with a 400 Hz signal with a deviation of 12 % of the channel separation. Both input signals shall be at the nominal frequency of the receiver.

b) Initially, signal generator B (unwanted signal) shall be switched off (maintaining the output impedance).

The level of the wanted signal from generator A shall be adjusted to a level which is 3 dB above the level of the limit of the maximum usable sensitivity as specified in 15.3.1 at the receiver input terminals."

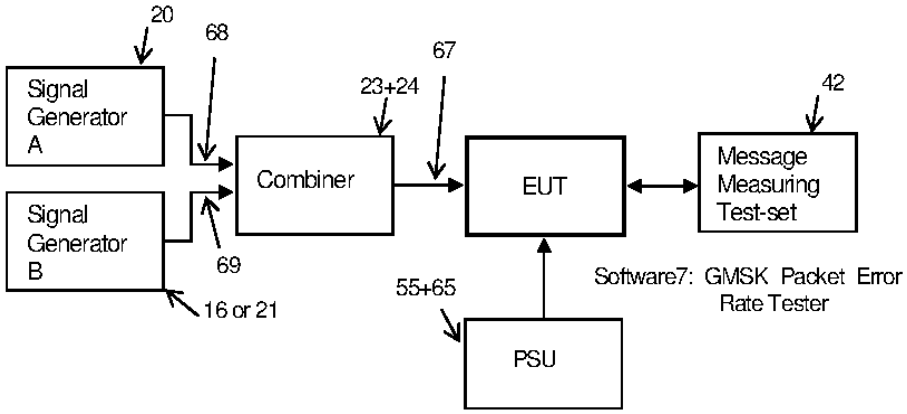
Note: The test method clause continues, but for the "fast track" method (see Deviation from the Standard, below) is not applicable.

Performance Standard, Clause 15.3.4

"The value of the co-channel rejection ratio, expressed in dB, at the signal displacements given in the method of measurement, shall be between -10,0 dB and 0 dB. Any positive value is also acceptable."

2.16.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.16.7 Environmental Conditions

	24 April 2012
Ambient Temperature:	22.8 °C
Relative Humidity:	53 %

2.16.8 Test Results

Deviation from the Standard

A "fast track" approach was adopted which, although less accurate than the prescribed test method, does demonstrate that the minimum performance requirements are met. The method involves applying the signals with margins equal to or worse than the minimum performance requirement, provided that the PER was within acceptable limits the test was deemed to have been satisfactory. The exact procedure was as per the following Client Test Procedure.

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.3.4
b) Set the RX _A channel 1060 (156.025 MHz).
c) Set the Signal generator_A (for wanted signal) the following condition

Frequency	156.025 MHz
Modulation type	GMSK
Symbol rate	9600 sym/s
Filter	Gauss/BT=0.4
Message bit pattern	10101010 and 11001100

d) Adjust the wanted signal level at the receiver input to –104 dBm.
e) Set the Signal generator_B (for unwanted signal) the following condition

Frequency	156.025 MHz
Modulation type	FM
Frequency Deviation	3 kHz
Modulation Frequency	400 Hz

f) Measure the PER with the changing the co-channel rejection ratio
g) Note the co-channel rejection ratio in dB when the successful message ratio of 80 %.
h) Change the Signal generator B frequency the following condition and repeat this test step f) and g).

Signal generator A frequency + 3 kHz
Signal generator A frequency - 3 kHz

i) Repeat step c) through h) under the following condition

RX_A channel:	2088 (162.025 MHz)
Signal generator_A frequency:	162.025 MHz.
Signal generator_B frequency:	162.025 MHz.

j) Set the signal generator_B under the following condition and repeat this test step f) through i)

Modulation type	GMSK
Symbol rate	9600 sym/s
Filter	Gauss/BT=0.4
Message bit pattern	10101010

k) Repeat step b) through j) in RX_B channel.

Product Service

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the tables below.

Test Parameter	Units	Result			Limit
		In-band	-3 kHz	+3 kHz	
Test Setup Variables					
DC power supply voltage	V	24			-
Required results - Co-channel rejection, Channel 1060 (156.025 MHz), Interferer modulation: FM					
Signal generator B, frequency	MHz	156.025	156.022	156.028	-
Channel A, 0101	dB	-7	-7	-7	≥ -10
Channel A, 0011	dB	-7	-6	-6	
Channel B, 0101	dB	-8	-7	-7	
Channel B, 0011	dB	-7	-6	-6	
Required results - Co-channel rejection, Channel 2088 (162.025 MHz) , Interferer modulation: FM					
Signal generator B, frequency	MHz	162.025	162.022	162.028	-
Channel A, 0101	dB	-7	-7	-7	≥ -10
Channel A, 0011	dB	-7	-7	-6	
Channel B, 0101	dB	-7	-7	-7	
Channel B, 0011	dB	-7	-6	-7	
Required results - Co-channel rejection, Channel 1060 (156.025 MHz), Interferer modulation: GMSK					
Signal generator B, frequency	MHz	156.025	156.022	156.028	-
Channel A, 0101	dB	-7	-7	-7	≥ -10
Channel A, 0011	dB	-7	-7	-6	
Channel B, 0101	dB	-7	-6	-8	
Channel B, 0011	dB	-7	-6	-7	
Required results - Co-channel rejection, Channel 2088 (162.025 MHz) , Interferer modulation: GMSK					
Signal generator B, frequency	MHz	162.025	162.022	162.028	-
Channel A, 0101	dB	-7	-8	-6	≥ -10
Channel A, 0011	dB	-5	-6	-6	
Channel B, 0101	dB	-7	-7	-8	
Channel B, 0011	dB	-5	-6	-7	

2.17 TDMA RECEIVERS - ADJACENT CHANNEL SELECTIVITY – 25 kHz OPERATION

2.17.1 Specification Reference

IEC 61993-2, Clause 15.3.6

2.17.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.17.3 Date of Test and Modification State

16, 17 and 24 April 2012 - Modification State 1

2.17.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.17.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.3.6

“Method of measurement

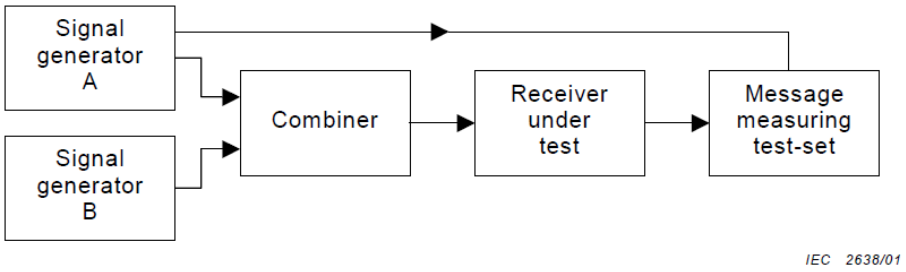


Figure 10 – Measurement arrangement with messages

The measurement procedure shall be as follows:

a) Two signal generators, A and B, shall be connected to the receiver via a combining network.

The wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall be modulated by the normal test signal (see 10.4).

The unwanted signal, provided by signal generator B, shall be a modulated signal and shall be at the frequency of the channel immediately above that of the wanted signal.

b) Initially, signal generator B (unwanted signal) shall be switched off (maintaining the output impedance).

The level of the wanted signal from generator A shall be adjusted to the level which is 3 dB above the level of the limit of the maximum usable sensitivity as specified in subclause 15.3.1, at the receiver input terminals."

Note: The test method clause continues, but for the "fast track" method (see Deviation from the Standard, below) is not applicable.

Performance Standard, Clause 15.3.6

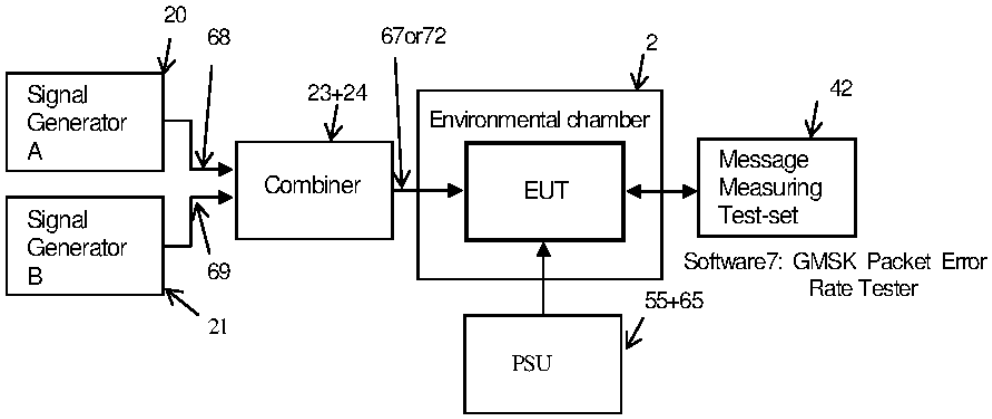
"The adjacent channel selectivity shall be no less than the values given in table 16.

Table 16 – Adjacent channel selectivity 25 kHz

Channel separation	25 kHz
Normal test conditions	70,0 dB
Extreme test conditions	60,0 dB"

2.17.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.17.7 Environmental Conditions

	16 April 2012	17 April 2012	24 April 2012
Ambient Temperature:	23.7 °C	24.9 °C	23.5 °C
Relative Humidity:	33 %	38 %	57 %

2.17.8 Test Results

Deviation from the Standard

A “fast track” approach was adopted which, although less accurate than the prescribed test method, does demonstrate that the minimum performance requirements are met. The method involves applying the signals with margins equal to or worse than the minimum performance requirement, provided that the PER was within acceptable limits the test was deemed to have been satisfactory. The exact procedure was as per the following Client Test Procedure.

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.3.6
b) Set the RX _A channel 1060 (156.025 MHz)
c) Set the Signal generator_A (for wanted signal) the following condition

Frequency	156.025 MHz
Modulation type	GMSK
Symbol rate	9600 sym/s
Filter	Gauss/BT = 0.4
Message bit pattern	10101010 and 11001100

d) Adjust the wanted signal level at the receiver input to –104 dBm.
e) Set the Signal generator_B (for unwanted signal) the following condition

Frequency	156.050 MHz
Modulation type	FM
Frequency Deviation	3 kHz
Modulation Frequency	400 Hz

f) Measure the PER with the changing the adjacent channel selectivity ratio
g) Record the adjacent channel selectivity ratio in dB when the successful message ratio of 80 %.
h) Change the Signal generator B frequency the following condition and repeat this test step f) and g).

Signal generator A frequency	-25 kHz

i) Repeat step c) through h) under the following condition

RX_A channel:	2088 (162.025 MHz)
Signal generator_A frequency:	162.025 MHz.
Signal generator_B frequency:	162.050 MHz.

j) Repeat step b) through i) in RX_B channel.
k) Repeat step b) through j) under the extreme conditions

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Note: In the results, “≥” denotes that the EUT performance was likely better than the associated value as said value produced a PER of less than 20 %.

General:

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Test Setup Variables							
Temperature	°C	-25	23.5	23.5	23.5	+55	-
DC power supply voltage	V	21.6	21.6	24	31.2	31.2	-

Channel 1060 - Upper Channel:

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
General/Test Specific - Setup							
Signal Generator A, Frequency	MHz	156.025					-
Signal generator B, Frequency	MHz	156.050					-
Required results - Adjacent channel selectivity							
Channel A, 0101	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	≥ 70*
Channel A, 0011	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	
Channel B, 0101	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	
Channel B, 0011	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	

* Limit for Extreme Test Conditions is ≥ 60 dB.

Channel 1060 - Lower Channel:

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
General/Test Specific - Setup							
Signal Generator A, Frequency	MHz	156.025					-
Signal generator B, Frequency	MHz	156.000					-
Required results - Adjacent channel selectivity							
Channel A, 0101	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	≥ 70*
Channel A, 0011	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	
Channel B, 0101	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	
Channel B, 0011	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	

* Limit for Extreme Test Conditions is ≥ 60 dB.

Channel 2088 - Upper Channel:

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
General/Test Specific - Setup							
Signal Generator A, Frequency	MHz	162.025					-
Signal generator B, Frequency	MHz	162.050					-
Required results - Adjacent channel selectivity							
Channel A, 0101	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	≥ 70*
Channel A, 0011	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	
Channel B, 0101	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	
Channel B, 0011	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	

* Limit for Extreme Test Conditions is ≥ 60 dB.

Channel 2088 - Lower Channel:

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
General/Test Specific - Setup							
Signal Generator A, Frequency	MHz	162.025					-
Signal generator B, Frequency	MHz	162.000					-
Required results - Adjacent channel selectivity							
Channel A, 0101	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	≥ 70*
Channel A, 0011	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	
Channel B, 0101	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	
Channel B, 0011	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	

* Limit for Extreme Test Conditions is ≥ 60 dB.

2.18 TDMA RECEIVERS - SPURIOUS RESPONSE REJECTION

2.18.1 Specification Reference

IEC 61993-2, Clause 15.3.8

2.18.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.18.3 Date of Test and Modification State

19, 20, 21 and 24 April 2012 - Modification State 1

2.18.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.18.5 Test Method

The following testing is required by the specification:

Note: Method of measurement with messages is not applicable; see Test Results section, below.

Test Method, Clause 15.3.8

"To determine the frequencies at which spurious responses can occur the following calculations shall be made:

a) calculation of the "limited frequency range":
The limited frequency range is defined as the frequency of the local oscillator signal (f_{LO}) applied to the first mixer of the receiver plus or minus the sum of the intermediate frequencies ($f_{I1},...f_{In}$) and half the switching range (*sr*) of the receiver (156 MHz–163 MHz); hence, the frequency f_I of the limited frequency range is:

$$f_{LO} - \sum_{j=1}^{j=n} f_{Ij} - \frac{sr}{2} \le f_I \le f_{LO} + \sum_{j=1}^{j=n} f_{Ij} + \frac{sr}{2}$$

b) calculation of frequencies outside the limited frequency range:
A calculation of the frequencies at which spurious responses can occur outside the range determined in a) is made for the remainder of the frequency range of interest.
The frequencies outside the limited frequency range are equal to the harmonics of the frequency of the local oscillator signal (f_{LO}) applied to the first mixer of the receiver plus or minus the first intermediate frequency (fI1) of the receiver; hence, the frequencies of these spurious responses are:

$$nf_{LO} \pm fI_1$$

where n is an integer greater than or equal to 2.

The measurement of the first image response of the receiver shall initially be made to verify the calculation of spurious response frequencies.

For the calculations a) and b) above, the manufacturer shall state the frequency of the receiver, the frequency of the local oscillator signal (f_{LO}) applied to the 1st mixer of the receiver, the intermediate frequencies (f_{I1}, f_{I2} etc.), and the switching range (sr) of the receiver."

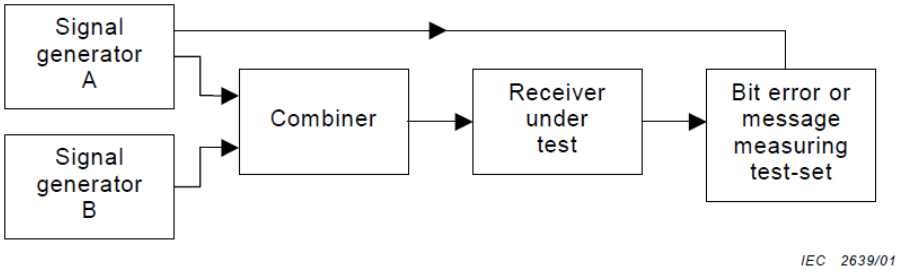


Figure 11 – Measurement arrangement

The measurement procedure shall be as follows:

a) Two signal generators, A and B, shall be connected to the receiver via a combining network. The wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall have the normal test signal or modulation (see 10.4).
The unwanted signal, provided by signal generator B, shall be modulated with a 400 Hz signal with a deviation of ±3 kHz."

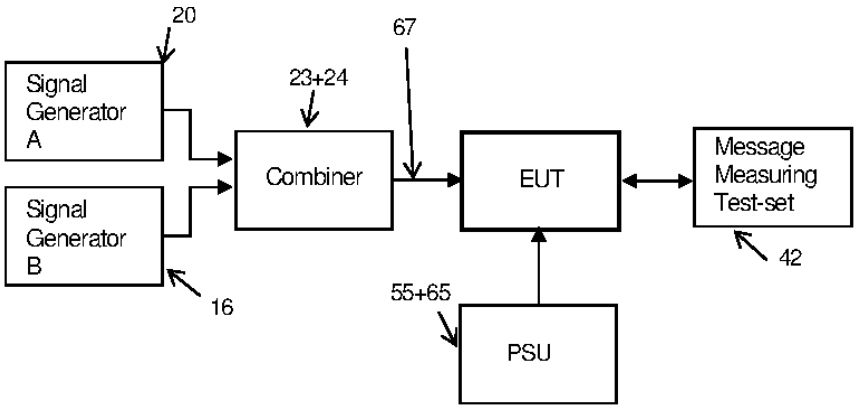
Note: The test method clause continues, but for the "fast track" method (see Deviation from the Standard, below) is not applicable.

Performance Standard, Clause 15.3.8

"At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious response rejection shall not be less than 70,0 dB."

2.18.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Receive



Setup Schematic

2.18.7 Environmental Conditions

	19 April 2012	20 April 2012	21 April 2012	24 April 2012
Ambient Temperature:	22.3 °C	21.5 °C	20.1 °C	23.6 °C
Relative Humidity:	40 %	42 %	46 %	51 %

2.18.8 Test Results

Note: A continuous bit stream was used; hence, method of measurement with messages is not applicable.

Deviation from the Standard

A “fast track” approach was adopted which, although less accurate than the prescribed test method, does demonstrate that the minimum performance requirements are met. The method involves applying the signals with margins equal to or worse than the minimum performance requirement, provided that the PER was within acceptable limits the test was deemed to have been satisfactory.

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.3.8
b) Set the RX _A channel 1060(156.025 MHz)
c) Set the Signal generator_A (for wanted signal) the following condition

Frequency	156.025 MHz
Modulation type	GMSK
Symbol rate	9600 sym/s
Filter	Gauss/BT = 0.4
Message bit pattern	10101010

d) Adjust the wanted signal level at the receiver input to –104 dBm.
e) Set the Signal generator_B (for unwanted signal) the following condition

Modulation type	FM
Frequency Deviation	3 kHz
Modulation Frequency	400 Hz

f) Measure the PER with the changing the spurious response rejection ratio
g) Record the spurious response rejection ratio in dB when the successful message ratio of 80 %.
h) Change the Signal generator A frequency the following condition and repeat this test step f) and g).

i) Change the Signal generator _A receiving message bit pattern “11001100” and repeat this test step f) through h).
j) Repeat step c) through j) under the following condition
RX_A channel: 2088 (162.025 MHz)
k) Repeat step b) through j) in RX_B channel.

Product Service

Manufacturer Supplied Data

The following information was supplied, by the manufacturer, about the EUT:

	intermediate frequencies		Local oscillator		
	IF1	IF2	flo1 (CH2088)	flo1 (CH2088)	flo2
RX1	50.75 MHz	0.45 MHz	212.775 MHz	206.775 MHz	51.2 MHz
RX2	38.85 MHz	0.45 MHz	200.875 MHz	194.875 MHz	38.4 MHz
DSC	44.1 MHz	0.45 MHz	112.425 MHz	112.425 MHz	44.55 MHz

limited freq range	
LFR_{HI}	LFR_{LO}
266.975 MHz	153 MHz
243.175 MHz	153 MHz
0.1 MHz	2000 MHz

By Software, CHA and CHB are decided.

JHS-182: RX1 -> CHA, RX2 -> CHB

JHS-183: RX1 -> CHB, RX2 -> CHA

	frequencies outside the limited freq range			
n	$n*f_{LOH}+f_{I1}$	$n*f_{LOH}-f_{I1}$	$n*f_{LOL}+f_{I1}$	$n*f_{LOL}-f_{I1}$
2	440.6 MHz	362.9 MHz	428.6 MHz	350.9 MHz
3	641.48 MHz	563.78 MHz	623.475 MHz	545.775 MHz
4	842.35 MHz	764.65 MHz	818.35 MHz	740.65 MHz
2	476.3 MHz	374.8 MHz	464.3 MHz	362.8 MHz
3	689.08 MHz	587.58 MHz	671.075 MHz	569.575 MHz
4	901.85 MHz	800.35 MHz	877.85 MHz	776.35 MHz

JHS-183 Calculated spurious response frequency list

	n	CHA (CH2088)	CHA (CH1060)	CHB (CH2088)	CHB (CH1060)	DSC
n × flo1 - fif1	1	~~162.025 MHz~~	~~156.025 MHz~~	~~162.025 MHz~~	~~156.025 MHz~~	68.325 MHz
n × flo1 + fif1	1	239.725 MHz	233.725 MHz	263.525 MHz	257.525 MHz	~~156.52~~5 MHz
n × flo1 - fif1	2	362.9 MHz	350.9 MHz	374.8 MHz	362.8 MHz	180.75 MHz
n × flo1 + fif1	2	440.6 MHz	428.6 MHz	476.3 MHz	464.3 MHz	268.95 MHz
	3	--	--	--	--	293.175 MHz
	3	--	--	--	--	381.375 MHz
	4	--	--	--	--	405.6 MHz
	4	--	--	--	--	493.8 MHz
	5	--	--	--	--	518.025 MHz
	5	--	--	--	--	606.225 MHz
	6	--	--	--	--	630.45 MHz
	6	--	--	--	--	718.65 MHz
	7	--	--	--	--	742.875 MHz
	7	--	--	--	--	831.075 MHz
	8	--	--	--	--	855.3 MHz
	8	--	--	--	--	943. 5 MHz
	9	--	--	--	--	967.725 MHz
	9	--	--	--	--	1055.93 MHz
	10	--	--	--	--	1080.15 MHz
	10	--	--	--	--	1168.35 MHz
	11	--	--	--	--	1192.58 MHz
	11	--	--	--	--	1280.78 MHz
	12	--	--	--	--	1305 MHz
	12	--	--	--	--	1393.2 MHz
	13	--	--	--	--	1417.43 MHz
	13	--	--	--	--	1505.63 MHz
	14	--	--	--	--	1529.85 MHz
	14	--	--	--	--	1618.05 MHz
	15	--	--	--	--	1642.28 MHz
	15	--	--	--	--	1730.48 MHz
	16	--	--	--	--	1754.7 MHz
	16	--	--	--	--	1842.9 MHz
	17	--	--	--	--	1867.13 MHz
	17	--	--	--	--	1955.33 MHz
	18	--	--	--	--	1979.55 MHz
	18	--	--	--	--	293.175 MHz

		162.025	156.025	162.025	156.025	156.525
	p	CHA (CH2088)	CHA (CH1060)	CHB (CH2088)	CHB (CH1060)	DSC
p × frx - fif1	1	123.175 MHz	117.175 MHz	111.275 MHz	105.275 MHz	112.425 MHz
p × frx - fif1	1	200.875 MHz	194.875 MHz	212.775 MHz	206.775 MHz	200.625 MHz
p × frx - fif1	2	285.2 MHz	273.2 MHz	273.3 MHz	261.3 MHz	268.95 MHz
p × frx - fif1	2	362.9 MHz	350.9 MHz	374.8 MHz	362.8 MHz	357.15 MHz
	3	--	--	--	--	425.475 MHz
	3	--	--	--	--	513.675 MHz
	4	--	--	--	--	582 MHz
	4	--	--	--	--	670.2 MHz
	5	--	--	--	--	738.525 MHz
	5	--	--	--	--	826.725 MHz
	6	--	--	--	--	895.05 MHz
	6	--	--	--	--	983.25 MHz
	7	--	--	--	--	1051.58 MHz
	7	--	--	--	--	1139.78 MHz
	8	--	--	--	--	1208.1 MHz
	8	--	--	--	--	1296.3 MHz
	9	--	--	--	--	1364.63 MHz
	9	--	--	--	--	1452.83 MHz
	10	--	--	--	--	1521.15 MHz
	10	--	--	--	--	1609.35 MHz
	11	--	--	--	--	1677.68 MHz
	11	--	--	--	--	1765.88 MHz
	12	--	--	--	--	1834.2 MHz
	12	--	--	--	--	1922.4 MHz
	13	--	--	--	--	1990.73 MHz

	CHA (CH2088)	CHA (CH1060)	CHB (CH2088)	CHB (CH1060)	DSC
flo1 - (flo2 + fif2)	~~162.025 MHz~~	~~156.025 MHz~~	161.125 MHz	155.125 MHz	67.425 MHz
flo1 - (flo2 - fif2)	162.925 MHz	156.925 MHz	~~162.025 MHz~~	~~156.025 MHz~~	68.325 MHz
flo1 + (flo2 - fif2)	238.825 MHz	232.825 MHz	263.525 MHz	257.525 MHz	~~156.525 MHz~~
flo1 + (flo2 + fif2)	239.725 MHz	233.725 MHz	264.425 MHz	258.425 MHz	157.425 MHz

Note: Manufacturer Supplied Data supplied also pertains to the DSC receiver; this is tested at Section 2.25 where the above data is referenced.

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Wanted and unwanted frequency combinations as per Manufacturer Supplied Data, above, were applied and the rejection ratio was ≥80 dB except for the responses listed below:

Test Parameter	Units	Result	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Required results - Spurious Response Rejection Ratio (Responses < 80 dB)			
SG_A:156.025 (CH2088), SG_B:156.925, RF+2*IF2, LO1-LO2+IF2, Channel A, 0101	dB	78	≥ 70
SG_A:156.025 (CH2088), SG_B:156.925, RF+2*IF2, LO1-LO2+IF2, Channel A, 0011		78	
SG_A:156.025 (CH2088), SG_B:156.925, RF+2*IF2, LO1-LO2+IF2, Channel B, 0101		78	
SG_A:156.025 (CH2088), SG_B:156.925, RF+2*IF2, LO1-LO2+IF2, Channel B, 0011		≥80	
SG_A:162.025 (CH1060), SG_B:162.925, RF+2*IF2, LO1-LO2+IF2, Channel A, 0101		78	
SG_A:162.025 (CH1060), SG_B:162.925, RF+2*IF2, LO1-LO2+IF2, Channel A, 0011		79	
SG_A:162.025 (CH1060), SG_B:162.925, RF+2*IF2, LO1-LO2+IF2, Channel B, 0101		79	
SG_A:162.025 (CH1060), SG_B:162.925, RF+2*IF2, LO1-LO2+IF2, Channel B, 0011		≥80	

2.19 TDMA RECEIVERS - INTERMODULATION RESPONSE REJECTION AND BLOCKING

2.19.1 Specification Reference

IEC 61993-2, Clause 15.3.9

2.19.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.19.3 Date of Test and Modification State

24 April 2012 - Modification State 1

2.19.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.19.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.3.9

"Four signal generators shall be connected to the AIS transponder under test (see figure 12). The wanted signals, represented by signal generator A, shall be set up in accordance with the packet error rate measurement (see paragraph 15.3.3) to the TDMA AIS test in accordance with table 6. The wanted signal levels at the RF input of the AIS transponder shall be set to -101 dBm."

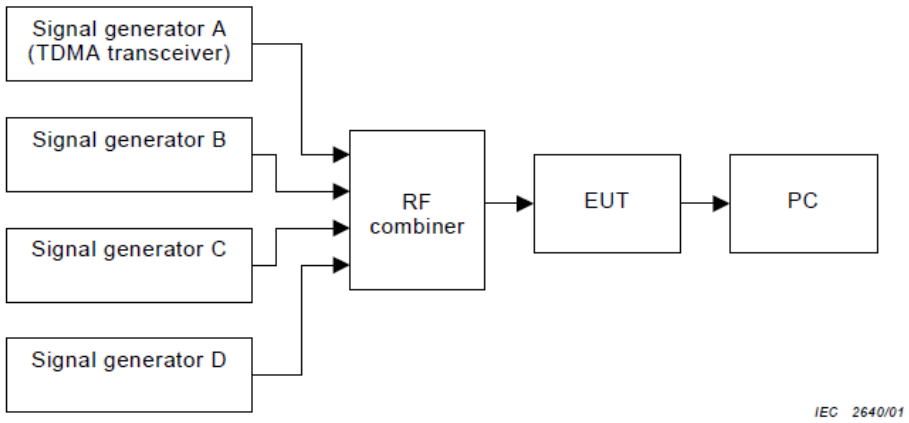


Figure 12 – Test set-up

The unwanted signal from signal generator B shall be modulated by 400 Hz with a deviation of ±3 kHz and adjusted to a frequency 500 kHz above or below the frequency of the AIS1 channel. The unwanted signal from signal generator C shall be unmodulated and adjusted to a frequency 1 000 kHz above or below the frequency of the AIS channel. The unwanted signal levels from signal generators B and C at the RF input of the AIS transponder shall be set to –27 dBm.

The unwanted signal from signal generator D shall be unmodulated and adjusted to a frequency 5,725 MHz above or below the frequency of the AIS channel. The unwanted signal level from signal generator D at the RF input of the AIS transponder shall be set to –15 dBm.

Table 16 – Adjacent channel selectivity 25 kHz

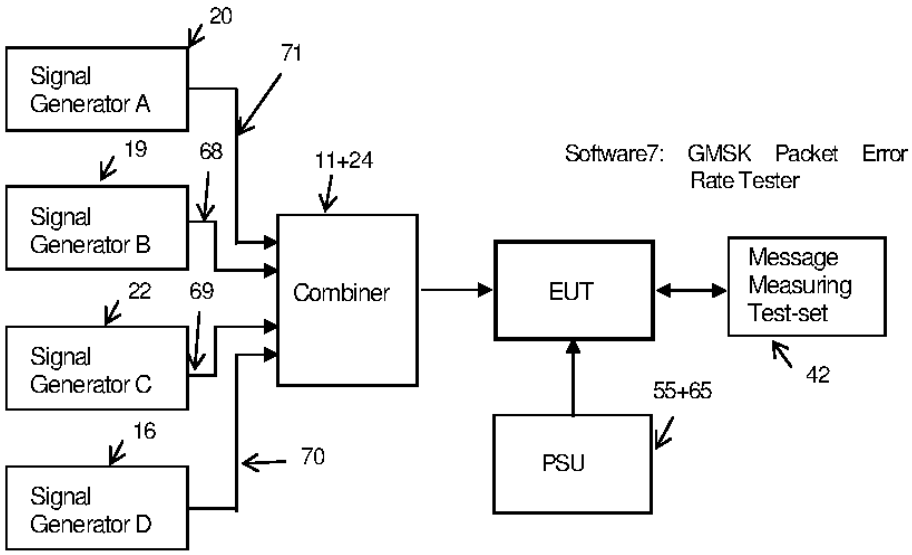
	Generator A	Generator B	Generator C	Generator D
Test #1	156,025	156,525	157,025	161,750
Test #2	162, 025	161,525	161,025	156,300”

Performance Standard, Clause 15.3.9

“The packet error rate, with the outputs of signal generators B, C, and D switched on, shall be 20 % or less.”

2.19.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.19.7 Environmental Conditions

	24 April 2012
Ambient Temperature:	22.8 °C
Relative Humidity:	53 %

2.19.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.3.9
b) Set the RX_A channel 1060 (156.025 MHz)
c) Set the test#1 each signal generators the following condition and measure the PER.

	Signal Generator A	Signal Generator B	Signal Generator C	Signal Generator D
Modulation	GMSK BT:0.4 9600 bps	FM dev: 3 kHz Mod freq: 400 Hz	Unmodulated	Unmodulated
RX input level	-101 dBm	-27 dBm	-27 dBm	-15 dBm
Frequency	156.025 MHz	156.525 MHz	157.025 MHz	161.750 MHz

d) Set the RX_A channel 2088 (162.025 MHz)
e) Set the test#2 each signal generators the following condition and measure the PER.

	Signal Generator A	Signal Generator B	Signal Generator C	Signal Generator D
Modulation	GMSK BT:0.4 9600 bps	FM dev: 3 kHz Mod freq: 400 Hz	Unmodulated	Unmodulated
RX input level	-101 dBm	-27 dBm	-27 dBm	-15 dBm
Frequency	162.025 MHz	161.525 MHz	161.025 MHz	156.300 MHz

f) Repeat this test step c) through e) at RX_B channel.

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Test Parameter	Units	Result	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Required results - PER, Test #1 (Channel 1060)			
Channel A, 0101	%	0.0	≤ 20
Channel A, 0011	%	0.0	
Channel B, 0101	%	0.0	
Channel B, 0011	%	0.0	
Required results - PER, Test #2 (Channel 2088)			
Channel A, 0101	%	0.0	≤ 20
Channel A, 0011	%	0.0	
Channel B, 0101	%	0.0	
Channel B, 0011	%	0.0	

2.20 TDMA RECEIVERS - TRANSMIT TO RECEIVE SWITCHING TIME

2.20.1 Specification Reference

IEC 61993-2, Clause 15.3.10

2.20.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.20.3 Date of Test and Modification State

25 April 2012 - Modification State 1

2.20.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

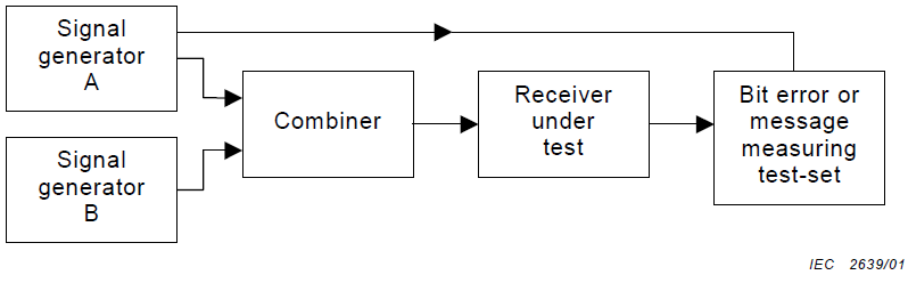
2.20.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.3.10

"Configure the measurement in accordance with figure 11, but add a 30 dB power attenuator between the receiver under test and the signal generator from the TDMA transmitter in the unit under test. Set the TDMA transmitter in the unit under test to transmit at the default power setting (nominal 12,5 Watts) in the slot immediately preceding the slot used for performing the receiver sensitivity measurement specified in 15.3.1."

Referenced Clause (Figure 11), Clause 15.3.8



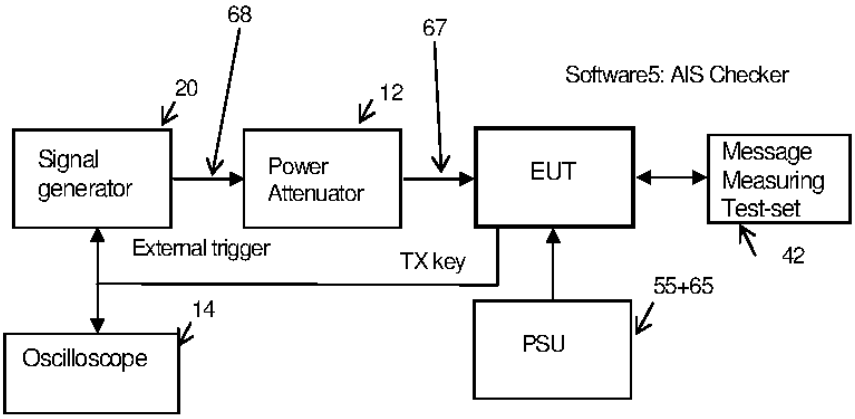
"Figure 11 – Measurement arrangement"

Performance Standard, Clause 15.3.10

"The sensitivity shall be –107 dBm with a PER of at most 20 % under normal test conditions."

2.20.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Unmodulated



Setup Schematic

2.20.7 Environmental Conditions

	25 April 2012
Ambient Temperature:	22.7 °C
Relative Humidity:	63 %

2.20.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.3.10
b) Set the RX_A channel 1060(156.025 MHz).
c) Set the Signal generator the following condition

Frequency	156.025 MHz
Modulation type	GMSK
Symbol rate	9600 sym/s
Filter	Gauss/BT=0.4
Message bit pattern	10101010

d) Set the signal generator the external single trigger mode.
e) Measure the received successful message ratio after transmitter slot
f) Repeat step d) through e) under the following conditions

RX_A channel:	2088(162.025 MHz)
Signal generator frequency:	162.025 MHz.

g) Repeat step b) through f) under the RX_B channel.

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Note: In the results, "≤" denotes that the EUT performance was likely better than the associated value as said value produced a PER of less than 20 %.

Test Parameter	Units	Result	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Signal generator output level	dBm	-77	-
Attenuation	dB	30	-
EUT input level	dBm	-107	-
Required results - Sensitivity, Channel 1060			
Channel A, 0101	dBm	≤ -107	≤ -107
Channel A, 0011	dBm	≤ -107	
Channel B, 0101	dBm	≤ -107	
Channel B, 0011	dBm	≤ -107	
Required results - Sensitivity, Channel 2088			
Channel A, 0101	dBm	≤ -107	≤ -107
Channel A, 0011	dBm	≤ -107	
Channel B, 0101	dBm	≤ -107	
Channel B, 0011	dBm	≤ -107	

2.21 DSC RECEIVER - MAXIMUM SENSITIVITY

2.21.1 Specification Reference

IEC 61993-2, Clause 15.4.1

2.21.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.21.3 Date of Test and Modification State

24 April 2012 - Modification State 1

2.21.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.21.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.4.1

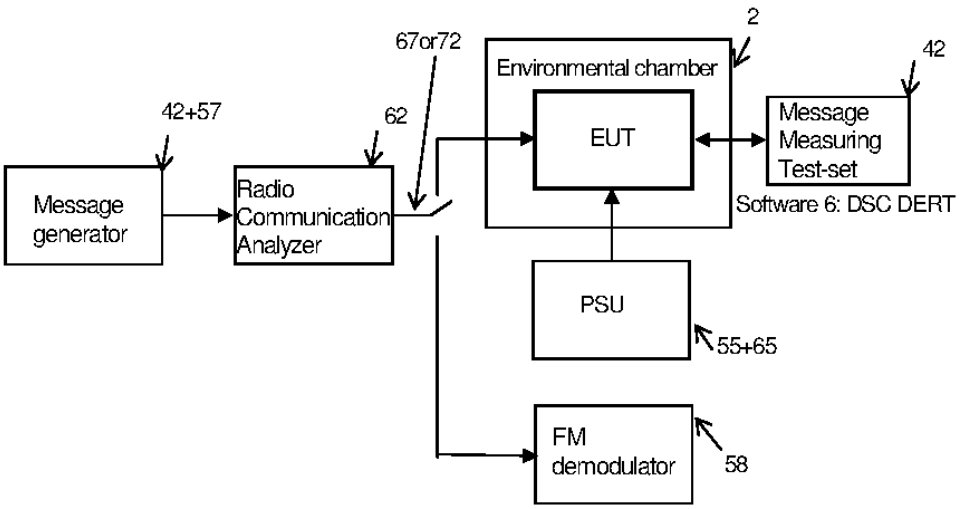
“The test equipment shall be set to transmit continuous DSC dot pattern as the test modulation of the RF signal generator connected to the EUT. The EUT shall provide a logic level test output from its internal DSC demodulator to measure bit error rate.”

Performance Standard, Clause 15.4.1

“The maximum usable sensitivity shall not be less sensitive than –107 dBm under normal test conditions, and –101 dBm under extreme test conditions. The test shall be repeated at the nominal carrier frequency (156,525 MHz) ±1,5 kHz.”

2.21.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.21.7 Environmental Conditions

	24 April 2012
Ambient Temperature:	23.3 °C
Relative Humidity:	52 %

Environmental conditions for Extreme High and Extreme Low are as per applied conditions in the following sections:

2.2 Environmental Tests - Dry Heat - Functional Test
2.4 Environmental Tests - Low Temperature Functional tests

2.21.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.4.1
b) Set the Signal generator the following condition
   Frequency 156.525 MHz
   Modulation type Phase modulation
c) Adjust the receiver input level.
d) Adjust the PM deviation
   Continuous B deviation: 2.6 kHz ± 10 %
   Continuous Y deviation: 4.2 kHz ± 10 %
e) Transmit the dot pattern from message generator and measure the receiving BER.
f) Repeat step b) under the following condition and measure the BER.
   Signal generator frequency 156.5265 MHz
   Signal generator frequency 156.5235 MHz
g) Repeat step b) through f) under extreme conditions.

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Note: In the results, "≤" denotes that the EUT performance was likely better than the associated value as said value produced a BER of less than 10^{-2}.

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Test Setup Variables							
Temperature	°C	-25	23.5	23.5	23.5	+55	-
DC power supply voltage	V	21.6	21.6	24	31.2	31.2	-
Required results - Sensitivity							
Nominal carrier frequency, 156.5250 MHz	dB	≤ -101	≤ -113	≤ -113	≤ -113	≤ -101	≤ -107
Nominal carrier frequency +1.5 kHz, 156.5265 MHz	dB	≤ -101	≤ -113	≤ -113	≤ -113	≤ -101	
Nominal carrier frequency -1.5 kHz, 156.5235 MHz	dB	≤ -101	≤ -111	≤ -112	≤ -111	≤ -101	

* Limit for Extreme Test Conditions is -101 dBm.

2.22 DSC RECEIVER - ERROR BEHAVIOUR AT HIGH INPUT LEVELS

2.22.1 Specification Reference

IEC 61993-2, Clause 15.4.2

2.22.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.22.3 Date of Test and Modification State

24 April 2012 - Modification State 1

2.22.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.22.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.4.2

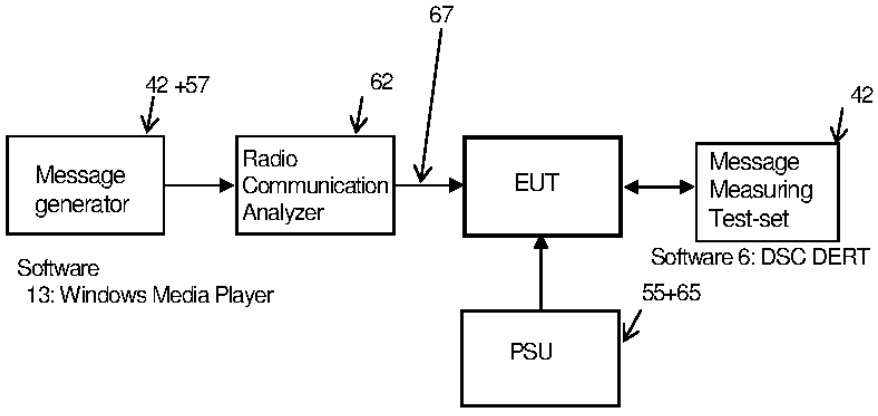
"A test signal, in accordance with standard test signal number 1, shall be applied to the receiver input. The level of the test signal shall be –7 dBm."

Performance Standard, Clause 15.4.2

"The BER shall not exceed 10^{-2}."

2.22.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.22.7 Environmental Conditions

24 April 2012
Ambient Temperature: 23.3 °C
Relative Humidity: 52 %

2.22.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.4.2
b) Set the Signal generator the following condition
Frequency 156.525 MHz
Modulation type Phase Modulation (see 15.4.1)
c) Adjust the receiver input level.-7 dBm
d) Set the standard test signal number 1 (DSC call command sets 103 and 111.) by message generator and measure the receiving BER.

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Test Parameter	Units	Results	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Signal generator output level	dBm	-7	-7
Required results - BER			
Nominal carrier frequency, 156.5250 MHz	-	0	$\leq 10^{-2}$
Nominal carrier frequency +1.5 kHz, 156.5265 MHz	-	0	
Nominal carrier frequency -1.5 kHz, 156.5235 MHz	-	0	

2.23 DSC RECEIVER - CO-CHANNEL REJECTION

2.23.1 Specification Reference

IEC 61993-2, Clause 15.4.3

2.23.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.23.3 Date of Test and Modification State

24 April 2012 - Modification State 1

2.23.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.23.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.4.3

"The wanted signal shall be standard test signal number 1. The level of the wanted signal shall be -104 dBm.

The unwanted signal shall be frequency modulated by 400 Hz with a deviation of ±3 kHz. The input level of the unwanted signal shall be -112 dBm.

Both input signals shall be at the nominal frequency of the receiver under test and the measurement shall be repeated for displacements of the unwanted signal of up to ±3 kHz."

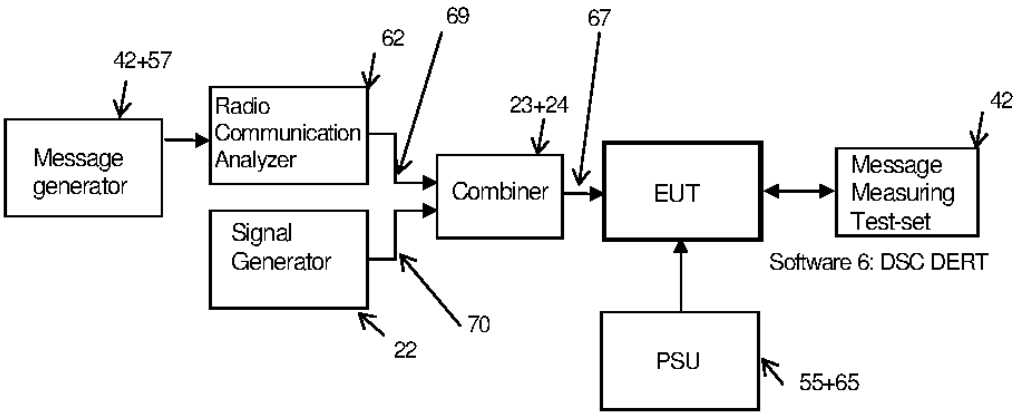
Performance Standard, Clause 15.4.3

"The value of the co-channel rejection ratio, expressed in dB, at the signal displacements given in the method of measurement, shall be between -10,0 dB and 0 dB.

The BER shall not exceed 10^{-2}."

2.23.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.23.7 Environmental Conditions

	24 April 2012
Ambient Temperature:	23.3 °C
Relative Humidity:	52 %

2.23.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.4.3
b) Set the Signal generator_A (for wanted signal) the following condition
Frequency 156.525 MHz
Modulation type Phase Modulation (see 15.4.1)
c) Set the standard test signal number 1 (DSC call command sets 103 and 111.)
d) Adjust the wanted signal at the receiver input level to –104 dBm.
e) Set the Signal generator_B (for unwanted signal) the following condition
Frequency 156.525 MHz
Modulation type FM
Frequency Deviation 3 kHz
Modulation Frequency 400 Hz
f) Measure the BER with the changing the co-channel rejection ratio
g) Record the co-channel rejection ratio in dB when the BER less than 10^{-2}.
h) Change the Signal generator B frequency the following condition and repeat this test step f) and g).
156.522 MHz
156.528 MHz

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Test Parameter	Units	Results	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Receiver setting	MHz	156.5250	-
Required results - Co-channel rejection, unwanted signal at 156.525 MHz			
Co-channel rejection ratio	dB	-6	-10 to 0
BER < 10^{-2}	Y / N	Y	Y
Required results - Co-channel rejection, unwanted signal at 156.528 MHz			
Co-channel rejection ratio	dB	-5	-10 to 0
BER < 10^{-2}	Y / N	Y	Y
Required results - Co-channel rejection, unwanted signal at 156.522 MHz			
Co-channel rejection ratio	dB	-5	-10 to 0
BER < 10^{-2}	Y / N	Y	Y

2.24 DSC RECEIVER - ADJACENT CHANNEL SELECTIVITY

2.24.1 Specification Reference

IEC 61993-2, Clause 15.4.4

2.24.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.24.3 Date of Test and Modification State

24 April 2012 - Modification State 1

2.24.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.24.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.4.4

"The wanted signal shall be standard test signal number 1. The level of the wanted signal shall be -104 dBm.

The unwanted signal shall be frequency modulated by 400 Hz with a deviation of ±3 kHz. The input level of the unwanted signal shall be -34 dBm. The unwanted signal shall be tuned to the centre frequency of the upper adjacent channels.

The measurement shall be repeated with the unwanted signal tuned to the centre frequency of the lower adjacent channel."

Performance Standard, Clause 15.4.4

"The adjacent channel selectivity for different channel separations shall not be less than the values given in table 19.

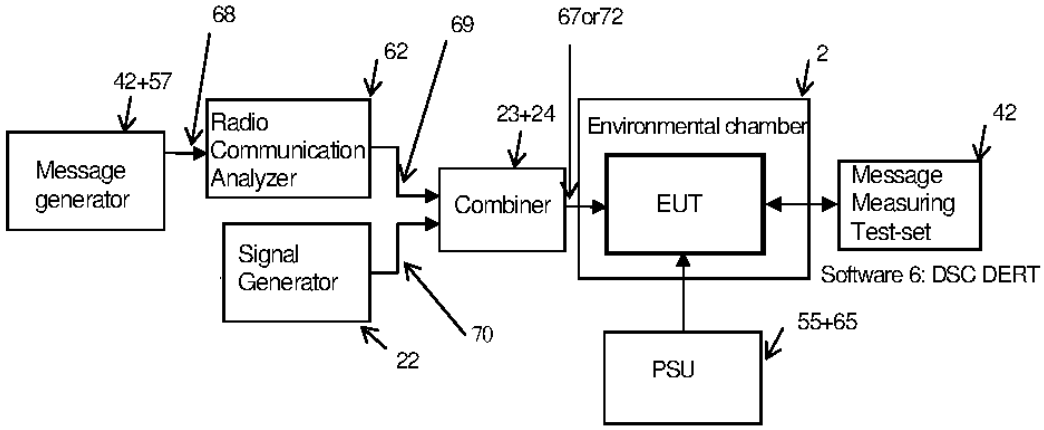
Table 19 – Adjacent channel selectivity DSC

Normal test conditions	70,0 dB
Extreme test conditions	60,0 dB"

The BER shall not exceed 10^{-2}."

2.24.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.24.7 Environmental Conditions

	24 April 2012
Ambient Temperature:	23.3 °C
Relative Humidity:	52 %

Environmental conditions for Extreme High and Extreme Low are as per applied conditions in the following sections:

2.2 Environmental Tests - Dry Heat - Functional Test
2.4 Environmental Tests - Low Temperature Functional tests

2.24.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.4.4
b) Set the Signal generator_A (for wanted signal) the following condition
   Frequency 156.525 MHz
   Modulation type Phase Modulation (see 15.4.1)
c) Set the standard test signal number 1 (DSC call command sets 103 and 111.)
d) Adjust the wanted signal at the receiver input level to –104 dBm.
e) Set the Signal generator_B (for unwanted signal) the following condition
   Frequency 156.550 MHz
   Modulation type FM
   Frequency Deviation 3 kHz
   Modulation Frequency 400 Hz
f) Measure the BER with the changing the adjacent channel selectivity ratio.
g) Record the adjacent channel selectivity ratio in dB when the BER is not exceed 10^{-2}.
h) Change the Signal generator B frequency the following condition and repeat this test step c) through g).
   Signal generator B frequency 156.500 MHz
i) Repeat step b) through h) under extreme conditions

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Note: In the results, "≥" denotes that the EUT performance was likely better than the associated value as said value produced a BER of less than 10^{-2}.

Test Parameter	Units	Result					Limit
		Extreme Low	Normal Low supply	Normal	Normal High supply	Extreme High	
Test Setup Variables							
Temperature	°C	-25	23.3	23.3	23.3	+55	-
DC power supply voltage	V	21.6	21.6	24	31.2	31.2	-
General/Test Specific - EUT Setup							
Receiver setting	MHz	156.525					-
Required results - Adjacent channel selectivity, unwanted signal at upper adjacent channel							
Unwanted signal frequency	MHz	156.550					
Adjacent channel selectivity	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	≥ 70 *
BER < 10^{-2}	Y/ N	Y	Y	Y	Y	Y	Y
Required results - Adjacent channel selectivity, unwanted signal at lower adjacent channel							
Unwanted signal frequency	MHz	156.500					
Adjacent channel selectivity	dB	≥ 61	≥ 80	≥ 80	≥ 80	≥ 61	≥ 70 *
BER < 10^{-2}	Y/ N	Y	Y	Y	Y	Y	Y

* Limit for Extreme Test Conditions is ≥ 60 dB.

2.25 DSC RECEIVER - SPURIOUS RESPONSE REJECTION

2.25.1 Specification Reference

IEC 61993-2, Clause 15.4.5

2.25.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.25.3 Date of Test and Modification State

19, 20, 21 and 24 April 2012 - Modification State 1

2.25.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.25.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.4.5

"The wanted signal shall be standard test signal number 1. The level of the wanted signal shall be -104 dBm.

The unwanted signal shall be unmodulated. The frequency shall be varied between 100 kHz and 2 GHz. The level of the unwanted signal shall be -24 dBm."

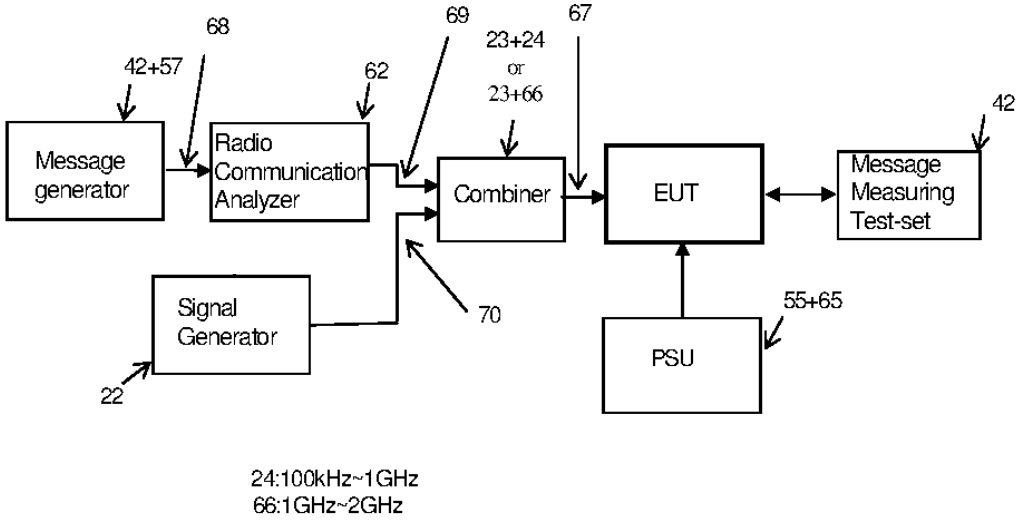
Performance Standard, Clause 15.4.5

"At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious response rejection shall not be less than 70 dB.

The BER shall not exceed 10^{-2}."

2.25.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Receive



Setup Schematic

2.25.7 Environmental Conditions

	19 April 2012	20 April 2012	21 April 2012	24 April 2012
Ambient Temperature:	22.3 °C	21.5 °C	20.1 °C	23.6 °C
Relative Humidity:	40 %	42 %	46 %	51 %

2.25.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.4.5
b) Set the Signal generator_A (for wanted signal) the following condition
   Frequency 156.525 MHz
   Modulation type Phase Modulation (see 15.4.1)
c) Set the standard test signal number 1 (DSC call command sets 103 and 111.)
d) Adjust the wanted signal at the receiver input level to –104 dBm.
e) Set the Signal generator_B (for unwanted signal) unmodulated carrier.
f) Measure the BER with the changing the spurious response rejection ratio.
g) Record the spurious response rejection ratio in dB when the BER is not exceed 10^{-2}.
h) Change the Signal generator B frequency the spurious response frequency and repeat this test step c) through g).

Manufacturer Supplied Data

Information was supplied, by the manufacturer, about the EUT that enabled the frequency list to be calculated. The data can be found at Section 2.18.

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Unwanted frequencies as per Manufacturer Supplied Data, above, in addition to the responses of the previous model (JHS-182) were applied and the rejection ratio was ≥80 dB except for the responses listed below:

Test Parameter	Units	Result	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Frequency of the wanted signal	MHz	156.525	-
Required results - Spurious Response Rejection Ratio (Responses < 80 dB)			
SG_B: 161.065 MHz, response of the previous model (JHS-182)	dB	80.1	≥ 70
SG_B: 172.795 MHz, response of the previous model (JHS-182)		78.8	

2.26 DSC RECEIVER - INTERMODULATION RESPONSE REJECTION

2.26.1 Specification Reference

IEC 61993-2, Clause 15.4.6

2.26.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.26.3 Date of Test and Modification State

24 April 2012 - Modification State 1

2.26.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.26.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.4.6

"The wanted signal represented by signal generator A shall be at the nominal frequency of the receiver and shall be standard test signal number 1. The level of the wanted signal shall be –104 dBm.

The unwanted signal from signal generator B shall be unmodulated and adjusted to a frequency 50 kHz above the nominal frequency of the receiver. The second unwanted signal from signal generator C shall be modulated by 400 Hz with a deviation of ±3 kHz and adjusted to a frequency 100 kHz above the nominal frequency of the receiver. The input level of each unwanted signal shall be -39 dBm. The test shall be repeated with the frequency of the unwanted signals below the nominal frequency of the receiver."

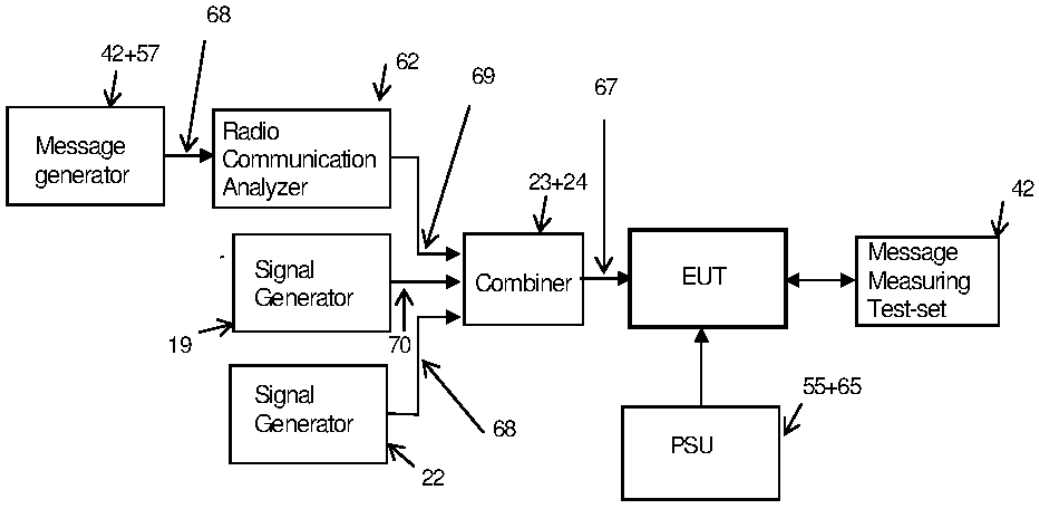
Performance Standard, Clause 15.4.6

"The intermodulation response rejection ratio shall not be less 65,0 dB.

The BER shall not exceed 10^{-2}."

2.26.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.26.7 Environmental Conditions

	24 April 2012
Ambient Temperature:	23.3 °C
Relative Humidity:	52 %

2.26.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.4.6
b) Set the standard test signal number 1 (DSC call command sets 103 and 111).
c) Set the test#1 each signal generators the following condition and measure the BER.

	Signal Generator A	Signal Generator B	Signal Generator C
Modulation	Phase Modulation (see 15.4.1)	Unmodulated	FM dev: 3 kHz Mod freq: 400 Hz
RX input level	-104 dBm	-39 dBm	-39 dBm
Frequency	156.525 MHz	156.575 MHz	156.625 MHz

d) Set the test#2 each signal generators the following condition and measure the BER.

	Signal Generator A	Signal Generator B	Signal Generator C
Modulation	Phase Modulation (see 15.4.1)	Unmodulated	FM dev: 3 kHz Mod freq: 400 Hz
RX input level	-104 dBm	-39 dBm	-39 dBm
Frequency	156.525 MHz	156.475 MHz	156.425 MHz

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Note: In the results, "≥" denotes that the EUT performance was likely better than the associated value as said value produced a BER of less than 10^{-2}.

Test Parameter	Units	Result	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Required results - Intermodulation response rejection, unwanted signals above nominal frequency of the receiver			
Signal generator A frequency	MHz	156.5250	-
Signal generator B frequency	MHz	156.5750	-
Signal generator C frequency	MHz	156.6250	-
Intermodulation response rejection ratio	dB	≥ 69	≥ 65
BER ≤ 10^{-2}	Y / N	Y	Y
Required results - Intermodulation response rejection, unwanted signals below nominal frequency of the receiver			
Signal generator A frequency	MHz	156.5250	-
Signal generator B frequency	MHz	156.4750	-
Signal generator C frequency	MHz	156.4250	-
Intermodulation response rejection ratio	dB	≥ 69	≥ 65
BER ≤ 10^{-2}	Y / N	Y	Y

2.27 DSC RECEIVER - BLOCKING OR DESENSITISATION

2.27.1 Specification Reference

IEC 61993-2, Clause 15.4.7

2.27.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.27.3 Date of Test and Modification State

24 April 2012 - Modification State 1

2.27.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.27.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.4.7

"The wanted signal shall be standard test signal number 2. The level of the wanted signal shall be –104 dBm.

The unwanted signal shall be unmodulated. The frequency shall be varied between -10 MHz and -1 MHz and also between +1 MHz and +10 MHz relative to the nominal frequency of the wanted signal. The level of the unwanted signal shall be -20 dBm."

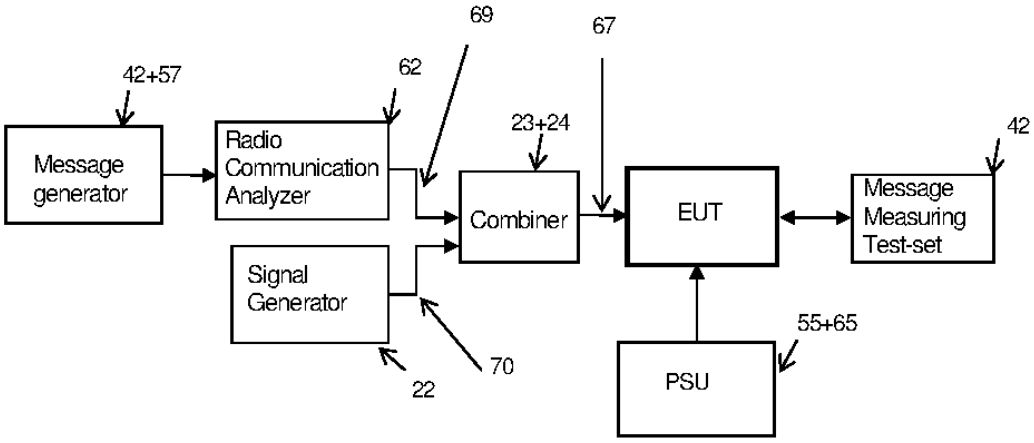
Performance Standard, Clause 15.4.7

"The blocking ratio for any frequency within the specified ranges shall not be less than 84 dB, except at frequencies on which spurious responses are found.

The BER shall not exceed 10^{-2}."

2.27.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous



Setup Schematic

2.27.7 Environmental Conditions

	24 April 2012
Ambient Temperature:	23.3 °C
Relative Humidity:	52 %

2.27.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.4.7
b) Set the Signal generator_A (for wanted signal) the following condition
   Frequency 156.525 MHz
   Modulation type Phase Modulation (see 15.4.1)
c) Set the standard test signal number 1 (DSC call command sets 103 and 111).
d) Adjust the wanted signal at the receiver input level to –104 dBm.
e) Set the Signal generator_B (for unwanted signal) to unmodulated and vary between –10 MHz and –1 MHz and also between +1 MHz and +10 MHz relative to nominal frequency of wanted signal.
f) Measure the BER with the blocking ratio for any frequency.
g) Record the blocking ratio in dB when the BER is not exceed 10^{-2}.
h) Change the Signal generator B blocking frequency and repeat this test step c) through g).

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Test Parameter	Units	Result	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Signal generator A frequency	MHz	156.525	-
Required results - Blocking or desensitisation, unwanted signals at SG A - 10 MHz			
Signal generator B frequency	MHz	146.525	-
Blocking ratio	dB	95	≥ 84
BER ≤ 10^{-2}	Y / N	Y	Y
Required results - Blocking or desensitisation, unwanted signals at SG A - 5 MHz			
Signal generator B frequency	MHz	151.525	-
Blocking ratio	dB	94	≥ 84
BER ≤ 10^{-2}	Y / N	Y	Y
Required results - Blocking or desensitisation, unwanted signals at SG A - 1 MHz			
Signal generator B frequency	MHz	155.525	-
Blocking ratio	dB	93	≥ 84
BER ≤ 10^{-2}	Y / N	Y	Y
Required results - Blocking or desensitisation, unwanted signals at SG A + 1 MHz			
Signal generator B frequency	MHz	157.525	-
Blocking ratio	dB	90	≥ 84
BER ≤ 10^{-2}	Y / N	Y	Y
Required results - Blocking or desensitisation, unwanted signals at SG A + 5 MHz			
Signal generator B frequency	MHz	161.525	-
Blocking ratio	dB	94	≥ 84
BER ≤ 10^{-2}	Y / N	Y	Y
Required results - Blocking or desensitisation, unwanted signals at SG A + 10 MHz			
Signal generator B frequency	MHz	166.525	-
Blocking ratio	dB	95	≥ 84
BER ≤ 10^{-2}	Y / N	Y	Y

2.28 SPURIOUS EMISSIONS FROM THE RECEIVER

2.28.1 Specification Reference

IEC 61993-2, Clause 15.5.1

2.28.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.28.3 Date of Test and Modification State

25 April 2012 - Modification State 1

2.28.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.28.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.5.1

“Conducted spurious emissions shall be measured as the power level of any frequency component to the antenna terminals of the receiver. The receiver antenna terminals are conducted to a spectrum analyser or selective voltmeter having an input impedance of 50 Ω and the receiver is switched on.

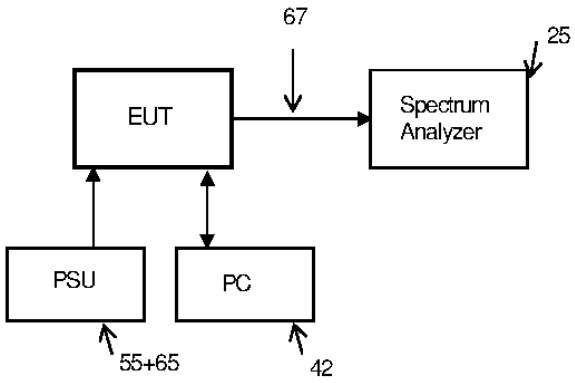
If the detecting device is not calibrated in terms of power input, the level of any detected components shall be determined by a substitution method using a signal generator. The measurement shall extend over the frequency range 150 kHz to 2 GHz.”

Performance Standard, Clause 15.5.1

“The power of any spurious emission in the specified range at the antenna terminal shall not exceed -57 dBm (2 nW) in the frequency range 150 kHz to 1 GHz and -47 dBm (20 nW) in the frequency range 1 GHz to 2 GHz.”

2.28.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Receive



Setup Schematic

2.28.7 Environmental Conditions

	25 April 2012
Ambient Temperature:	22.3 °C
Relative Humidity:	49 %

2.28.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.5.1
b) Set the EUT receiver mode.
c) Measure the conducted spurious emission level at the antenna port with the spectrum analyzer

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Test Parameter	Units	Result	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
Required results - Spurious emissions			
Maximum observed emission power level, 150 kHz to 1 GHz	dBm	≤ -67 *	≤ -57
Maximum observed emission power level, 1 GHz to 2 GHz	dBm	≤ -57 *	≤ -47

* No emissions were detected within 10 dB of the limit.

2.29 SPURIOUS EMISSIONS FROM THE TRANSMITTER

2.29.1 Specification Reference

IEC 61993-2, Clause 15.5.2

2.29.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.29.3 Date of Test and Modification State

25 April 2012 - Modification State 1

2.29.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.29.5 Test Method

The following testing is required by the specification:

Test Method, Clause 15.5.2

“Conducted spurious emissions shall be measured with the unmodulated transmitter connected to the artificial antenna. The measurement shall be made over a frequency range from 150 kHz to 2 GHz, excluding the channel on which the transmitter is operating and its adjacent channels.”

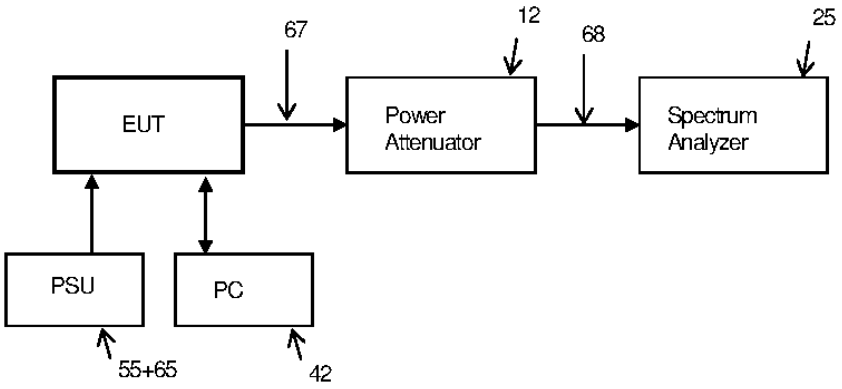
Performance Standard, Clause 15.5.2

“The power of any spurious emission on any discrete frequency shall not exceed -36 dBm (0,25 µW) in the frequency range 150 kHz to 1 GHz and -30 dBm (1 µW) in the frequency range 1 GHz to 2 GHz.”

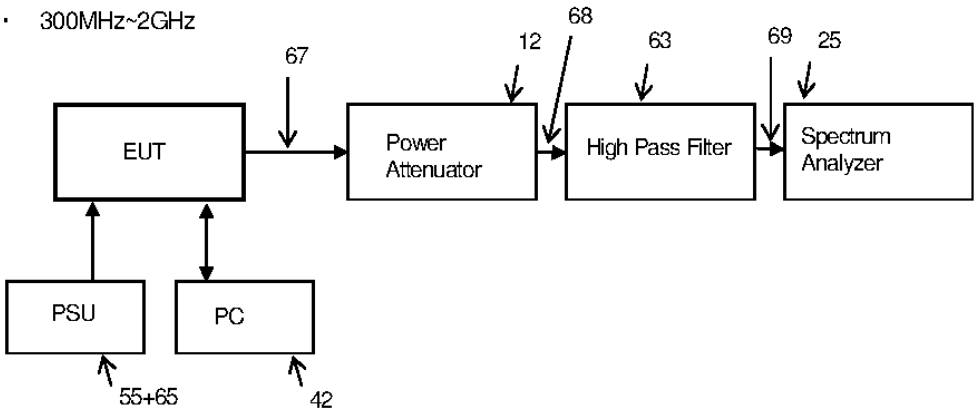
2.29.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Unmodulated

- 150kHz~300MHz
  1GHz~2GHz



- 300MHz~2GHz



Setup Schematic

2.29.7 Environmental Conditions

	25 April 2012
Ambient Temperature:	22.3 °C
Relative Humidity:	49 %

2.29.8 Test Results

Client Test Procedure

a) Set up the test equipment as shown in Fig. 15.5.2
b) Set the following transmitter condition
   TX channel 1060 (156.025 MHz)
   TX Power High
   Modulation Unmodulated
c) Measure the conducted spurious emissions with spectrum analyzer.
d) Repeat step b) and c) as the following channel
   TX CH2088 (162.025 MHz)

Measurement Results

The EUT was subjected to the above test procedure, test variables and results were as per the table below.

Test Parameter	Units	Result	Limit
Test Setup Variables			
DC power supply voltage	V	24	-
EUT Setup			
Power output	-	Nominal high (12.5 W)	-
Required results - Spurious emissions, Channel 1060 (156.025 MHz)			
Maximum observed emission power level, 150 kHz to 1 GHz *	dBm	≤ -46 **	≤ -36
Maximum observed emission power level, 1 GHz to 2 GHz	dBm	≤ -40 **	≤ -30
Required results - Spurious emissions, Channel 2088 (162.025 MHz)			
Maximum observed emission power level, 150 kHz to 1 GHz *	dBm	≤ -46 **	≤ -36
Maximum observed emission power level, 1 GHz to 2 GHz	dBm	≤ -40 **	≤ -30

* Excluding transmit channel and adjacent channels

** No emissions were detected within 10 dB of the limit.

2.30 EXCESSIVE CONDITIONS

2.30.1 Specification Reference

IEC 60945, Clause 5.2.3

2.30.2 Equipment Under Test

JHS-183 AIS, S/N: BB50302

2.30.3 Date of Test and Modification State

25 April 2012 - Modification State 1

2.30.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.30.5 Test Method

The following testing is required by the specification:

Test Method, Clause 5.2.3

"The power supply shall be adjusted to cause activation of the protection and after EUT reset, a performance check under normal test conditions shall be carried out.

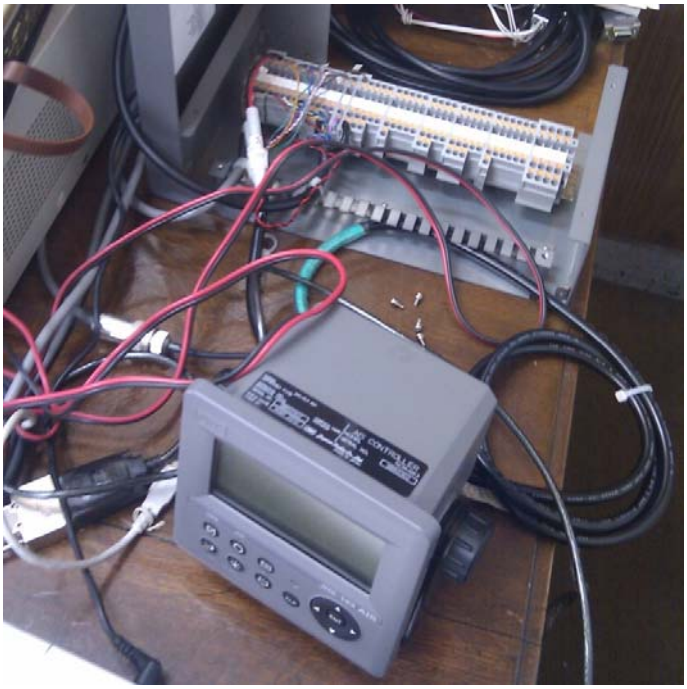
Power supply misconnections are also regarded as excessive conditions. Where appropriate, the EUT shall be subjected to an input from a power supply of reversed polarity or improper phase sequence for a period of 5 min. After completion of the test, and reset of the protection of the EUT, if required, the power supply shall be connected normally and a performance check shall be carried out."

Performance Standard, Clause 5.2.3

"Protection shall be provided against such excesses at an appropriate level chosen by the manufacturer and, when activated, may require the EUT to be reset, for example by fuse replacement."

2.30.6 Test Setup and Operating Modes

The test was performed with the EUT in the following mode(s): Autonomous and Tripped



Test Setup

2.30.7 Environmental Conditions

	25 April 2012
Ambient Temperature:	22.1 °C
Relative Humidity:	49 %

2.30.8 Test Results

The EUT was subjected to the above test method, test variables and results were as per the table below. A Performance Assessment was conducted at normal conditions; results were as per the table below. Note: Performance Assessment differs from the Performance Check or Performance Test as defined by the standard, for this test there are no specified performance criteria. The Performance Assessment results were compared with previous values and deemed satisfactory.

Test Parameter	Units	Result	Limit
Test Setup Variables - Applied conditions			
Overvoltage - level at which trip* occurred	V	37.8	≥ 37 *
Reverse polarity, DC voltage	V	24	-
Reverse polarity, time applied	min	< 1 **	5
General/Test Specific - EUT Responses			
Response to overvoltage	-	Tripped (ceased operating)	Protection must activate where appropriate
Response upon removal of overvoltage	-	Resumed normal operation automatically	Reset allowed
Response to reverse polarity	-	Fuse destroyed (EUT thereby isolated from power supply)	Protection must activate where appropriate
Response upon removal of reverse polarity	-	Resumed normal operation after fuse replacement	Reset allowed
Performance Assessment, Post-test			
Transmitter, carrier power (nominal high power setting)	W	12.4	-
Transmitter, frequency error (Channel 1060)	kHz	-0.210	-
TDMA Receiver (Channel A), Sensitivity, Channel 2088, 0101	dBm	≤ -113	-
TDMA Receiver (Channel B), Sensitivity, Channel 2088, 0101	dBm	≤ -114	-
DSC Receiver, Sensitivity	dBm	≤ -113	-

* Manufacturer supplied limit.

** Immediately upon application of the reverse polarity, the EUT fuses were destroyed and made open circuit, the EUT was therefore electrically isolated from the power supply; hence, there was no need to maintain the applied condition for the full 5 minutes.

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.1 - Environmental Tests - Dry Heat - Storage Test					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
AIS Transponder (base & other 4 ships simulate)	JRC	NTE-182	BB34626	-	TU
AIS Transponder (for monitor)	JRC	NTE-182	BB76553	-	TU
AIS Controller(monitor)	JRC	NCM-779	BB14635	-	TU
Connection Box	JRC	NQE-3182	BB200007	-	TU
EUT Dummy Load (EUT)	Diamond Antenna	DL1000	NONE	-	TU
EUT Dummy Load (base)	Diamond Antenna	DL-30N	NONE	-	TU
EUT Dummy Load (monitor)	MFJ	MFJ-264	NONE	-	TU
Power Supply (base & DSC)	JRC		NONE	-	OP MON
Power Supply (monitor)	JRC	NBD-577B	NONE	-	OP MON
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Section 2.2 - Environmental Tests - Dry Heat - Functional Test					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
AIS Transponder (base & other 4 ships simulate)	JRC	NTE-182	BB34626	-	TU
AIS Transponder (for monitor)	JRC	NTE-182	BB76553	-	TU
AIS Controller(monitor)	JRC	NCM-779	BB14635	-	TU
Connection Box	JRC	NQE-3182	BB200007	-	TU
EUT Dummy Load (EUT)	Diamond Antenna	DL1000	NONE	-	TU
EUT Dummy Load (base)	Diamond Antenna	DL-30N	NONE	-	TU
EUT Dummy Load (monitor)	MFJ	MFJ-264	NONE	-	TU
Power Supply (base & DSC)	JRC		NONE	-	OP MON
Power Supply (monitor)	JRC	NBD-577B	NONE	-	OP MON
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.3 - Environmental Tests - Damp Heat					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
AIS Transponder (base & other 4 ships simulate)	JRC	NTE-182	BB34626	-	TU
AIS Transponder (for monitor)	JRC	NTE-182	BB76553	-	TU
AIS Controller(monitor)	JRC	NCM-779	BB14635	-	TU
Connection Box	JRC	NQE-3182	BB200007	-	TU
EUT Dummy Load (EUT)	Diamond Antenna	DL1000	NONE	-	TU
EUT Dummy Load (base)	Diamond Antenna	DL-30N	NONE	-	TU
EUT Dummy Load (monitor)	MFJ	MFJ-264	NONE	-	TU
Power Supply (base & DSC)	JRC		NONE	-	OP MON
Power Supply (monitor)	JRC	NBD-577B	NONE	-	OP MON
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Section 2.4 - Environmental Tests - Low Temperature - Functional Tests					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
AIS Transponder (base & other 4 ships simulate)	JRC	NTE-182	BB34626	-	TU
AIS Transponder (for monitor)	JRC	NTE-182	BB76553	-	TU
AIS Controller(monitor)	JRC	NCM-779	BB14635	-	TU
Connection Box	JRC	NQE-3182	BB200007	-	TU
EUT Dummy Load (EUT)	Diamond Antenna	DL1000	NONE	-	TU
EUT Dummy Load (base)	Diamond Antenna	DL-30N	NONE	-	TU
EUT Dummy Load (monitor)	MFJ	MFJ-264	NONE	-	TU
Power Supply (base & DSC)	JRC		NONE	-	OP MON
Power Supply (monitor)	JRC	NBD-577B	NONE	-	OP MON
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Section 2.5 - Environmental Tests - Vibration					
Vibration System	Shinken	G-8230	SG-4085	-	OP MON
AIS Transponder (base & other 4 ships simulate)	JRC	NTE-182	BB34626	-	TU
AIS Transponder (for monitor)	JRC	NTE-182	BB76553	-	TU
AIS Controller(monitor)	JRC	NCM-779	BB14635	-	TU
Connection Box	JRC	NQE-3182	BB200007	-	TU
EUT Dummy Load (EUT)	Diamond Antenna	DL1000	NONE	-	TU
EUT Dummy Load (base)	Diamond Antenna	DL-30N	NONE	-	TU
EUT Dummy Load (monitor)	MFJ	MFJ-264	NONE	-	TU
Power Supply (base & DSC)	JRC		NONE	-	OP MON
Power Supply (monitor)	JRC	NBD-577B	NONE	-	OP MON
Power Supply (vibration test)	Takasago	GP035-30R	NONE	-	OP MON
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Accelerometer	Endevco	224C	LB28	12	26-Mar-2013
Accelerometer	Endevco	224C	LB14	12	26-Mar-2013
Accelerometer	Endevco	224C	NK60	12	26-Mar-2013

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.8 - Operational Tests - Channel Selection					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Signal generator	Agilent Technologies	8664A	3035A00136	12	31-Jan-2013
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849593/014	12	06-Apr-2013
Signal generator	Agilent Technologies	8664A	3203A00225	12	28-Feb-2013
50 ohm dummy load	-	-	-	-	TU
Four Port Junction Pad	ANRITSU	MP659A	NONE	12	31-Mar-2013
Spectrum Analyzer	Agilent Technologies	8560EC	4103A00314	12	27-Mar-2013
AIS Transponder (for DSC transmit)	JRC	NTE-182	BB73317	-	TU
AIS Transponder (for monitor)	JRC	NTE-182	BB76553	-	TU
AIS Controller(monitor)	JRC	NCM-779	BB14635	-	TU
EUT Dummy Load (EUT)	Diamond Antenna	DL1000	NONE	-	TU
EUT Dummy Load (base)	Diamond Antenna	DL-30N	NONE	-	TU
EUT Dummy Load (monitor)	MFJ	MFJ-264	NONE	-	TU
EUT Dummy Load (DSC)	MFJ	MFJ-264	NONE	-	TU
Power Supply (base & DSC)	JRC		NONE	-	OP MON
Power Supply (vibration test)	Takasago	GP035-30R	NONE	-	OP MON
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Signal generator	Agilent Technologies	8664A	3035A00136	12	31-Jan-2013
Section 2.9 - TDMA Transmitter - Frequency Error					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Radio Communication Analyzer	ANRITSU	MT2605B1	MT80331	12	28-Feb-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 6 (3 m)	-	-	-	-	TU
Section 2.10 - TDMA Transmitter - Carrier Power					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Radio Communication Analyzer	ANRITSU	MT2605B1	MT80331	12	28-Feb-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 6 (3 m)	-	-	-	-	TU

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.11 - TDMA Transmitter - Modulation Spectrum 25 kHz Channel Mode					
Attenuator	Agilent Technologies	8498A	1801A03283	12	31-Mar-2013
Spectrum Analyzer	Agilent Technologies	8560EC	4103A00314	12	27-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 6 (3 m)	-	-	-	-	TU
Section 2.12 - TDMA Transmitter - Transmitter Attack Time					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Modulation Analyser	Agilent Technologies	53310A	3121A00781	12	02-Apr-2013
Crystal Detector	Agilent Technologies	423B	MY51340109	12	01-Dec-2012
Attenuator	Agilent Technologies	8498A	1801A03283	12	31-Mar-2013
Oscilloscope	Tektronix	TDS2024B	C030881	12	22-Dec-2012
Signal generator	Agilent Technologies	8664A	3035A00136	12	31-Jan-2013
Spectrum Analyzer	Agilent Technologies	8560EC	4103A00314	12	27-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Coaxial cable 6 (3 m)	-	-	-	-	TU
Section 2.13 - TDMA Transmitter - Transmitter Release Time					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Attenuator	Agilent Technologies	8498A	1801A03283	12	31-Mar-2013
Spectrum Analyzer	Agilent Technologies	8560EC	4103A00314	12	27-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 6 (3 m)	-	-	-	-	TU
Section 2.14 - TDMA Receivers - Sensitivity – 25 kHz Operation					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849192/061	12	08-Dec-2012
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 6 (3 m)	-	-	-	-	TU

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.15 - TDMA Receivers - Error Behaviour at High Input Levels					
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849192/061	12	08-Dec-2012
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Section 2.16 - TDMA Receivers - Co-Channel Rejection – 25 kHz Operation					
Signal generator	Agilent Technologies	8642A	2611A00341	12	30-Apr-2013
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849192/061	12	08-Dec-2012
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849593/014	12	06-Apr-2013
50 ohm dummy load	-	-	-	-	TU
Four Port Junction Pad	ANRITSU	MP659A	NONE	12	31-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Section 2.17 - TDMA Receivers - Adjacent Channel Selectivity – 25 kHz Operation					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849192/061	12	08-Dec-2012
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849593/014	12	06-Apr-2013
50 ohm dummy load	-	-	-	-	TU
Four Port Junction Pad	ANRITSU	MP659A	NONE	12	31-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Section 2.18 - TDMA Receivers - Spurious Response Rejection					
Signal generator	Agilent Technologies	8642A	2611A00341	12	30-Apr-2013
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849192/061	12	08-Dec-2012
Signal generator	Agilent Technologies	8664A	3203A00225	12	28-Feb-2013
Four Port Junction Pad	ANRITSU	MP659A	NONE	12	31-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Section 2.19 - TDMA Receivers - Intermodulation Response Rejection and Blocking					
T-Pad	ANRITSU	Z-164A	M7523	12	30-Apr-2013
Signal generator	Agilent Technologies	8642A	2611A00341	12	30-Apr-2013
Signal generator	Agilent	8664A	3035A00136	12	31-Jan-2013

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
	Technologies				
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849192/061	12	08-Dec-2012
Signal generator	Agilent Technologies	8664A	3203A00225	12	28-Feb-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Coaxial cable 4 (50 cm)	-	-	-	-	TU
Coaxial cable 5 (1 m)	-	-	-	-	TU
Section 2.20 - TDMA Receivers - Transmit to Receive Switching Time					
Attenuator	Agilent Technologies	8498A	1801A03283	12	31-Mar-2013
Oscilloscope	Tektronix	TDS2024B	C030881	12	22-Dec-2012
Signal generator	ROHDE & SCHWARZ	SMIQ 03B	849192/061	12	08-Dec-2012
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Section 2.21 - DSC Receiver - Maximum Sensitivity					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Audio Amp	ONKYO	SE-U33GX	1870123382	-	TU
FM Linear Detector	ANRITSU	MS61C	M65845	12	31-Mar-2013
Radio Communication Analyzer	ANRITSU	MT2605B1	MT80331	12	28-Feb-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 6 (3 m)	-	-	-	-	TU
Section 2.22 - DSC Receiver - Error Behaviour at High Input Levels					
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Audio Amp	ONKYO	SE-U33GX	1870123382	-	TU
Radio Communication Analyzer	ANRITSU	MT2605B1	MT80331	12	28-Feb-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.23 - DSC Receiver - Co-Channel Rejection					
Signal generator	Agilent Technologies	8664A	3203A00225	12	28-Feb-2013
50 ohm dummy load	-	-	-	-	TU
Four Port Junction Pad	ANRITSU	MP659A	NONE	12	31-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Audio Amp	ONKYO	SE-U33GX	1870123382	-	TU
Radio Communication Analyzer	ANRITSU	MT2605B1	MT80331	12	28-Feb-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Coaxial cable 4 (50 cm)	-	-	-	-	TU
Section 2.24 - DSC Receiver - Adjacent Channel Selectivity					
Climatic Chamber	Espec Corp.	TBE-13H30W5P4C4L	3014004463	-	OP MON
Signal generator	Agilent Technologies	8664A	3203A00225	12	28-Feb-2013
50 ohm dummy load	-	-	-	-	TU
Four Port Junction Pad	ANRITSU	MP659A	NONE	12	31-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Audio Amp	ONKYO	SE-U33GX	1870123382	-	TU
Radio Communication Analyzer	ANRITSU	MT2605B1	MT80331	12	28-Feb-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Coaxial cable 4 (50 cm)	-	-	-	-	TU
Coaxial cable 6 (3 m)	-	-	-	-	TU
Section 2.25 - DSC Receiver - Spurious Response Rejection					
Signal generator	Agilent Technologies	8642A	2611A00341	12	30-Apr-2013
Four Port Junction Pad	ANRITSU	MP659A	NONE	12	31-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Audio Amp	ONKYO	SE-U33GX	1870123382	-	TU
Radio Communication Analyzer	ANRITSU	MT2605B1	MT80331	12	28-Feb-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Four Port Junction Pad	ANRITSU	MA1612A	6200672362	12	18-Apr-2013
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Coaxial cable 4 (50 cm)	-	-	-	-	TU

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.26 - DSC Receiver - Intermodulation Response Rejection					
Signal generator	Agilent Technologies	8664A	3035A00136	12	31-Jan-2013
Signal generator	Agilent Technologies	8664A	3203A00225	12	28-Feb-2013
Four Port Junction Pad	ANRITSU	MP659A	NONE	12	31-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Audio Amp	ONKYO	SE-U33GX	1870123382	-	TU
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Coaxial cable 4 (50 cm)	-	-	-	-	TU
Section 2.27 - DSC Receiver - Blocking or Desensitisation					
Signal generator	Agilent Technologies	8664A	3203A00225	12	28-Feb-2013
50 ohm dummy load	-	-	-	-	TU
Four Port Junction Pad	ANRITSU	MP659A	NONE	12	31-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
Audio Amp	ONKYO	SE-U33GX	1870123382	-	TU
Radio Communication Analyzer	ANRITSU	MT2605B1	MT80331	12	28-Feb-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Coaxial cable 4 (50 cm)	-	-	-	-	TU
Section 2.28 - Spurious Emissions from the Receiver					
Spectrum Analyzer	Agilent Technologies	8560EC	4103A00314	12	27-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Section 2.29 - Spurious Emissions from the Transmitter					
Spectrum Analyzer	Agilent Technologies	8560EC	4103A00314	12	27-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
High Pass Filter	ADVANTEST	MEP-294	60520016	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON
Coaxial cable 1 (50 cm)	-	-	-	-	TU
Coaxial cable 2 (50 cm)	-	-	-	-	TU
Coaxial cable 3 (50 cm)	-	-	-	-	TU
Section 2.30 - Excessive Conditions					
Attenuator	Agilent Technologies	8498A	1801A03283	12	31-Mar-2013
Spectrum Analyzer	Agilent Technologies	8560EC	4103A00314	12	27-Mar-2013
Temperature and humidity meter	Testo	Testo 650	009952/009953	12	29-Mar-2013
Digital Multimeter	Hiokidenki	3200	175633	12	31-Mar-2013
power supply	Kenwood	PD36-10A	-	-	OP MON

TU – Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Discipline	Measurement Uncertainties
Frequency error	± 0.1 kHz
RF Power, 50 Ω	± 0.45 dB
Adjacent channel power	N/A
Conducted spurious emissions of transmitter	± 2 dB
Conducted spurious emissions of receiver	± 2 dB
Two Signal Measurement	± 1.7 dB
Three Signal Measurement	± 1.7 dB
Radiated emission of transmitter	N/A
Radiated emission of receiver	N/A
Transmitter attack time	± 0.02 ms
Transmitter release time	± 0.02 ms
Transmitter transient frequency (frequency difference)	N/A
Sensitivity	± 1.05 dB

N/A: Not Applicable, no such measurements contained within this test report.

Limits: IEC 61993-2, Clause 10.12

Maximum values of absolute measurement uncertainties shall be as follows:

Parameter	Limit
RF frequency	$\pm 1 \times 10^{-7}$
RF power	±0.75 dB
Adjacent channel power	±5 dB
Conducted spurious emissions of transmitter	±4 dB
Conducted spurious emissions of receiver	±3 dB
Two Signal Measurement	±4 dB
Three Signal Measurement	±3 dB
Radiated emission of transmitter	±6 dB
Radiated emission of receiver	±6 dB
Transmitter attack time	±20 %
Transmitter release time	±20 %
Transmitter transient frequency (frequency difference)	±250 Hz

For the test methods according to this standard, these uncertainty figures are valid to a confidence level of 95 %.

The interpretation of the results recorded in a test report for the measurements described in this standard shall be as follows:

a) the measured value related to the corresponding limit shall be used to decide whether an equipment meets the requirements of this standard;

b) the actual measurement uncertainty of the test laboratory carrying out the measurements, for each particular measurement, shall be included in the test report;

c) the values of the actual measurement uncertainty shall be, for each measurement, equal to or lower than the figures given in this clause (absolute measurement uncertainties).

Limits: IEC 60945, Clause 5.3

“The measured test results shall be compared with the corresponding acceptable performance limits, and the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty. The test report shall show, for each test measurement, the test result, its associated measurement uncertainty, the acceptable performance limits, and the performance margin, as applicable.”

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Complete System

AIS Controller, Front Aspect

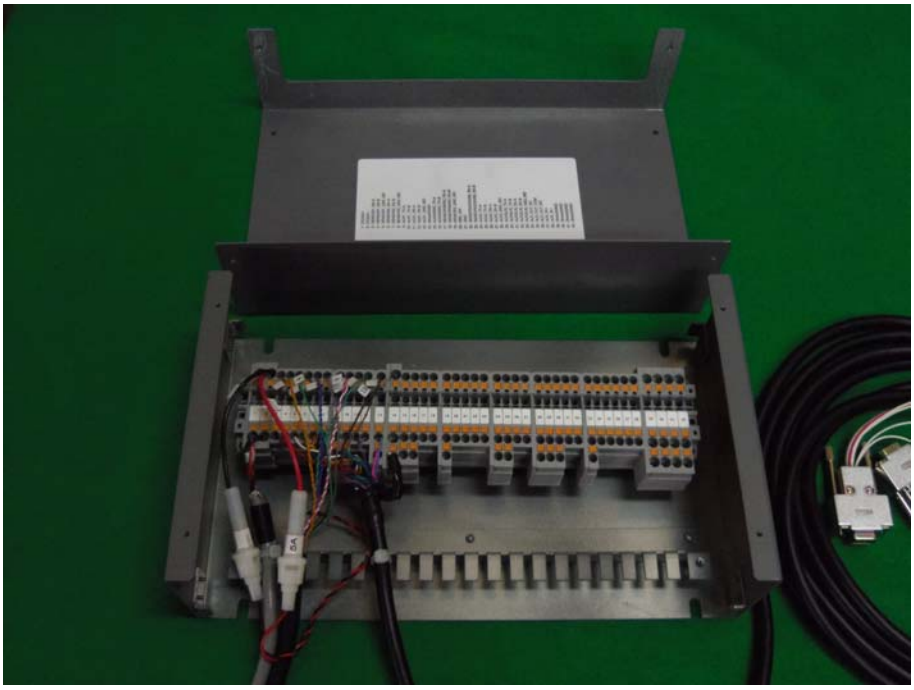
AIS Controller, Rear Aspect

AIS Controller, Rear Panel Removed

AIS Transponder, Front Aspect

AIS Transponder, Rear Aspect

Connection Box, Front Aspect



Connection Box, Cover Lifted

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

ANNEX A

CUSTOMER SUPPLIED INFORMATION

Product Service

Customer Supplied Information - Modification Details

7th April 2012
Japan Radio Co.,Ltd
Hirofumi Tamaoki

JHS-183 AIS
Report of the potting material change for the CBD-2983 PSU within the controller

JRC changed the material of the potting for the CBD-2983 PSU because it was long curing time of the material chosen first. Figure 1 is a picture of the PSU after material change.

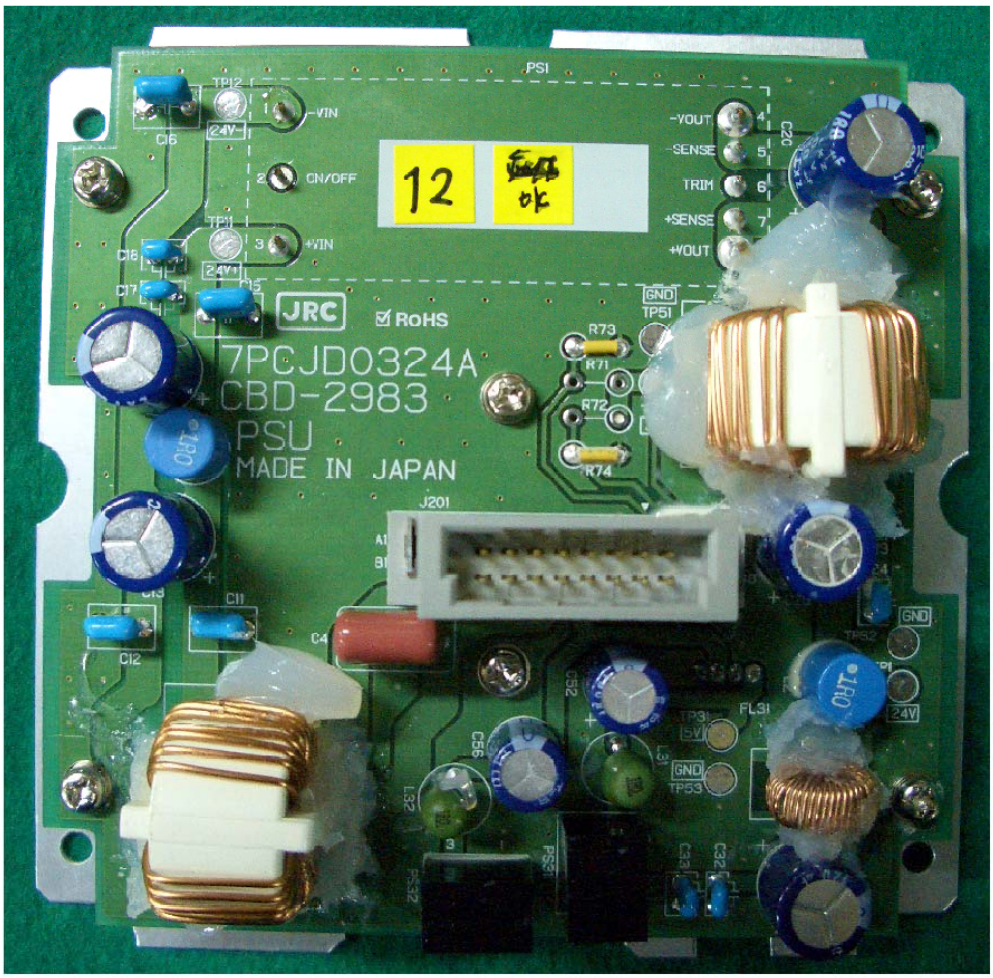
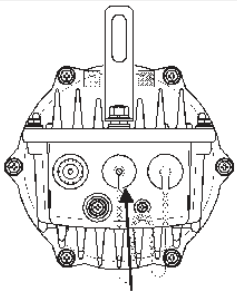
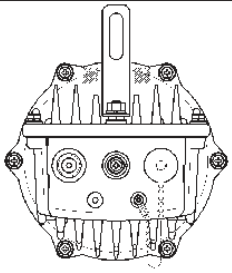


Figure 1

JRC Japan Radio Co., Ltd.

Customer Supplied Information - Corrosion Test

Comparison list of NTE-182 and NTE-183

Item	NTE-182	NTE—183
appearance	 NTE-182	 NTE-183
Changed part	 unused connector	 Remove the connector.
IP	IP56	<·
Feature	No need two antenna cables. NTE-183 needs only one standard coaxial cable.	<·

JRC Japan Radio Co., Ltd.

CORROSION TEST

The corrosion test was conducted on the basis of the IEC60945.

The surface materials with actual results used in similar models of our transceiver, for instance the JSS-850 which have been approved in 1997, are used for units of JHS-183.

DESCRIPTION OF TEST

The test parts which were the same as materials used for the equipment were placed in the chamber described below and subjected to a saline environment as stipulated in the IEC60945 clause 8.12.

The conditions as stipulated in the IEC60945 clause 8.12 were maintained.

On completion of the above test, the test parts were visually examined and it was confirmed that there were no undue deterioration or corrosion of the metal parts, finishes to the naked eye.
The results were prints taken (copies included).

Salt spray instrument:
It is internationally accepted apparatus for evaluating corrosion resistance of metal finishing, anodized aluminum, rust preventing oil and electric parts.

1. Model	CASSER- ll R-IS0-3
2. Manufacturer	SUGA TEST INSTRUMENTS CO..LTD
3. Applicable standards	JIS D0201. H8502. H8610. H8611. H8681
	H8617. K5400. Z2371
	ISO 3768. 3769. 3770/ASTM B117. B258
4 . Dimensions	1540mm(W) x 860mm(D) x 1260mm(H)

Product Service

The contents of the corrosion test

1.Facilities

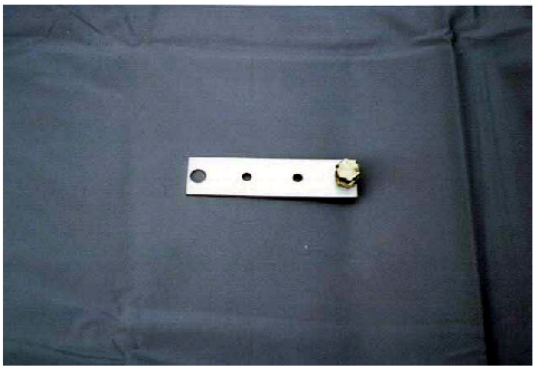
1-1) Chamber view

1-2) The inside of the chamber

2.Aluminium alloy plate

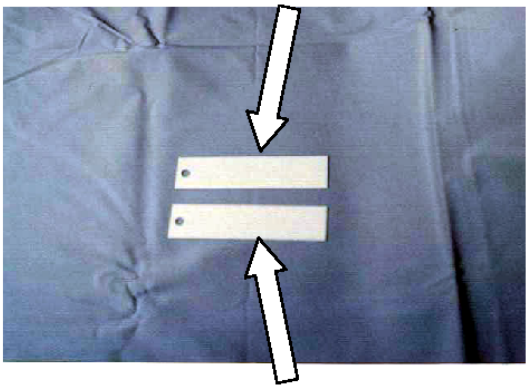
2-1)Chromate treatment

After test



2-2)Baking finish with melamine

After test

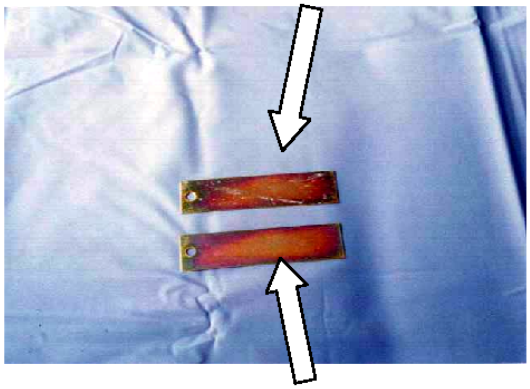


Original

3.Cold rolled steel plate

3.1) Zinc electroplating

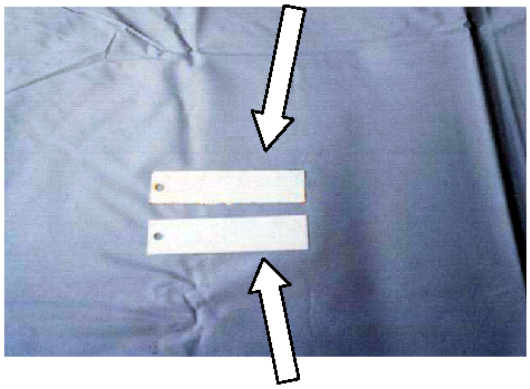
After test



Original

3.2) Baking finish with melamine

After test



Original