Limited Radio Testing of the Navico AIS Class B Transponder, Model: NAIS-500 In accordance with IEC 62287-1

Prepared for: SRT Marine Technology Limited
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Product Service

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Date: October 2017
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Sarah Jones	07 November 2017	
Authorised Signatory	Matthew Russell	07 November 2017	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

EXECUTIVE SUMMARY
A sample of this product was tested and found not to be compliant with IEC 62287-1: Edition 2.0 (2010-11) for the tests detailed in section 1.3.

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Product Service

Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	30 October 2017
2	To amend the manufacturer name in section 1.2.	30 October 2017
3	Executive Summary changed to state **NOT Compliant** as the EUT has failed.	07 November 2017

Table 1

1.2 Introduction

Applicant	SRT Marine Technology Limited
Manufacturer	AMEC
Model Number(s)	NAIS-500
Serial Number(s)	TEST#001
Hardware Version(s)	CAMINO-108
Software Version(s)	V1.2.7.17
Number of Samples Tested	1
Test Specification/Issue/Date	IEC 62287-1: Edition 2.0 (2010-11)
Order Number Date	QAF/AOR01 22-September-2017
Date of Receipt of EUT	29-September-2017
Start of Test	29-September-2017
Finish of Test	04-October-2017
Name of Engineer(s)	Dan Ralley

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with IEC 62287-1 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: DC Powered - AIS - CSTDMA				
2.1	11.2.1	Sensitivity	Pass	
2.2	11.2.4	Adjacent Channel Selectivity	Fail	
2.3	11.2.5	Spurious Response Rejection	Fail	

Table 2

Product Service

1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	NAIS-500
Part Number	NAIS-500
Hardware Version	CAMINO-108
Software Version	V1.2.7.17
Technical Description (Please provide a brief description of the intended use of the equipment)	Automatic Identification System (AIS) Class B Transponder (marine)

EXTREME TEMPERATURE RANGE (over which equipment is to be type tested)
☒ Not Applicable (no extreme temperature testing required)
☐ Category I (General)
☐ Category II (Portable equipments)
☐ Other (please specify):

TYPE OF EQUIPMENT			
☐ Fixed Station	☐ Transmitter	☐ Simplex	☐ Integral Antenna
	☐ Receiver	☒ Duplex	☒ Single Antenna
☒ Mobile Station	☒ Transceiver		☐ Two Antenna Connector
			☐ Multiple Antenna Connectors No.
☐ Portable Station	☐		
☐ Transponder (Tag)	☐ Active	☐ Passive	

TRANSMITTER TECHNICAL CHARACTERISTICS		
FREQUENCY CHARACTERISTICS		
Transmitter frequency alignment range	156.025 to 162.025	MHz
Transmitter channel switching frequency range	156.025 to 162.025	MHz

TRANSMITTER RF POWER CHARACTERISTICS		
Maximum rated transmitter output power as stated by manufacturer (if applicable)		
2	W	At transmitter permanent external 50 Ω RF output connector
and/or		
	W	Effective radiated power (for equipment with integral antenna)
Minimum rated transmitter output power as stated by manufacturer (if applicable)		
	W	At transmitter permanent external 50 Ω RF output connector
and/or		
	W	Effective radiated power (for equipment with integral antenna)

Is transmitter intended for :

Continuous duty	☐	Yes	☒	No			
Intermittent duty only	☒	Yes	☐	No			
If intermittent duty state DUTY CYCLE							
Transmitter ON	0.027	Seconds			Transmitter OFF	3	Seconds

TRANSMITTER - MODULATION			
Amplitude	☐	Other	☒
Frequency	☐	Details :	GMSK-TDMA
Phase	☐	Channel Spacing	25kHz
Can the transmitter be operated without modulation? * See definition below	☐ Yes	☒ No	

RECEIVER TECHNICAL CHARACTERISTICS	
FREQUENCY CHARACTERISTICS	
Receiver frequency alignment range	156.025 MHz to 162.025 MHz
Receiver channel switching frequency range	156.025 MHz to 162.025 MHz
Channel Separation (if applicable)	25 kHz
State the maximum number of channels over which the equipment can operate:	241

Product Service

RECEIVER TECHNICAL CHARACTERISTICS			
POWER SOURCE			
☐ AC mains		State voltage	
AC supply frequency	(Hz)		
VAC			
Max Current			
Hz			
☐ Single phase		☐ Three phase	
And / Or			
☒ External DC supply			
Nominal voltage	12 V	Max Current	A
Extreme upper voltage	31.2 V		
Extreme lower voltage	9.6 V		
Battery			
☐ Nickel Cadmium		☐ Lead acid (Vehicle regulated)	
☐ Alkaline		☐ Leclanche	
☐ Lithium		☐ Other Details :	
Volts nominal.			
End point voltage as quoted by equipment manufacturer		V	

AUTOMATIC EQUIPMENT SWITCH OFF	
If the equipment is designed to automatically switch off at a predetermined voltage level which is higher or lower in value than the battery minimum and minimum calculated values this shall be clearly stated.	
☐ Applies	V cut-off voltage
☒ Does not apply	

CHANNEL IDENTIFICATION

Each equipment, whether one or more submitted for tests shall carry clear identification (such as a serial number), together with the frequencies associated with the channel identification displayed on the equipment.

Equipment Identification eg Serial Number	Channel No.	Transmit Nominal Freq MHz	Receive Nominal Freq MHz
TEST#0001	AIS2	162.025	162.025
TEST#0002	AIS2	162.025	162.025

I hereby declare that the information supplied is correct and complete.

Name: P. Longhurst Position held: RF Engineer
Date: 26/09/2017

1.5 Product Information

1.5.1 Technical Description

Automatic Identification System (AIS) Class B Transponder (marine).

1.6 Deviations from the Standard

The EUT was fixed on two receive channels. Receive path RX1 was set to 161.975 MHz and RX2 was set to 162.025 MHz. The EUT is an off the shelf unit for evaluation. The sample therefore could not have its receiver channels modified.

For evaluation purposes, the maximum usable sensitivity test was conducted on the centre wanted frequency only i.e the wanted frequency was not offset by ±500 Hz. This test was also not conducted at extreme operating conditions.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: TEST#001			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: DC Powered - AIS - CSTDMA		
Sensitivity	Dan Ralley	UKAS
Adjacent Channel Selectivity	Dan Ralley	UKAS
Spurious Response Rejection	Dan Ralley	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Sensitivity

2.1.1 Specification Reference

IEC 62287-1, Clause 11.2.1

2.1.2 Equipment Under Test and Modification State

NAIS-500, S/N: TEST#001 - Modification State 0

2.1.3 Date of Test

29-September-2017 to 04-October-2017

2.1.4 Test Method

This test was performed in accordance with IEC 62287-1, clause 11.2.1.2.

2.1.5 Environmental Conditions

Ambient Temperature	22.4 °C
Relative Humidity	56.8 %

2.1.6 Test Results

DC Powered - AIS - CSTDMA

Frequency Offset (Hz)	161.975 MHz	162.025 MHz
	PER (%) - Rx1	PER (%) - Rx2
0	0	0.5

Table 5 - Sensitivity Results at 22.4 °C

Maximum sensitivity for RX2 was determined at -112.15 dBm.
Maximum sensitivity for RX1 was determined at -110.39 dBm.

In comparison to the NAIS-400:
Maximum sensitivity on RX2 determined at -113.7 dBm.
Maximum sensitivity on RX1 determined at -113.15 dBm.

IEC 62287-1, Limit Clause 11.2.1.3

The PER shall not exceed 20%.

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Directional Coupler	Narda	3020A	419	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	12-Mar-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Programmable Modulation Waveform Generator	Sine Qua Non	PMG1	3291	-	TU
Attenuator (20dB, 150W)	Narda	769-20	3367	12	31-May-2018
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	02-May-2018
DC to TTL Converter	TUV SUD Product Service	-	3599	-	TU
'N' - 'N' RF Cable (2m)	Rhophase	NPS-1803-2000-NPS	3698	12	12-Oct-2017
TRUE RMS MULTIMETER	Fluke	179	4006	12	13-Dec-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	12-Mar-2018
2 metre N-Type Cable	Florida Labs	NMS-235SP-78.8-NMS	4508	12	02-Mar-2018
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4517	12	19-Sep-2018
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	12-Jan-2018
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon
Vector Signal Generator	Rohde & Schwarz	SMBV100A	4886	12	11-May-2018

Table 6

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

2.2 Adjacent Channel Selectivity

2.2.1 Specification Reference

IEC 62287-1, Clause 11.2.4

2.2.2 Equipment Under Test and Modification State

NAIS-500, S/N: TEST#001 - Modification State 0

2.2.3 Date of Test

29-September-2017

2.2.4 Test Method

This test was performed in accordance with IEC 62287-1, clause 11.2.4.2.

2.2.5 Environmental Conditions

Ambient Temperature	22.7 °C
Relative Humidity	63.1 %

2.2.6 Test Results

DC Powered - AIS - CSTDMA

Unwanted Signal Frequency Offset (kHz)	161.975 MHz	162.025 MHz
	PER (%) - Rx1	PER (%) - Rx2
-25	99.5	99.5
25	93.97	92.46

Table 7 - Adjacent Channel Selectivity Results

A visual inspection of the EUT was made to determine the level at which an acceptable number of packets were received by the EUT in the presence of adjacent interference. The visual inspection was agreed as a minimum of 4 out of 5 blocks of received packets witnessed on the terminal output of the EUT.

RX1:
-25 kHz adjacent interference:
pass criteria achieved at blocking level: -31.69 dBm

25 kHz adjacent interference:
customer defined pass criteria achieved at blocking level: -32.66 dBm

RX2
-25 kHz adjacent interference:

customer defined pass criteria achieved at blocking level: -34.7 dBm

25 kHz adjacent interference:

customer defined pass criteria achieved at blocking level: -33.66 dBm

IEC 62287-1, Limit Clause 11.2.4.3

The PER shall not exceed 20%.

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Directional Coupler	Narda	3020A	419	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	12-Mar-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Programmable Modulation Waveform Generator	Sine Qua Non	PMG1	3291	-	TU
Attenuator (20dB, 150W)	Narda	769-20	3367	12	31-May-2018
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	02-May-2018
DC to TTL Converter	TUV SUD Product Service	-	3599	-	TU
'N' - 'N' RF Cable (2m)	Rhophase	NPS-1803-2000-NPS	3698	12	12-Oct-2017
TRUE RMS MULTIMETER	Fluke	179	4006	12	13-Dec-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	12-Mar-2018
2 metre N-Type Cable	Florida Labs	NMS-235SP-78.8-NMS	4508	12	02-Mar-2018
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4517	12	19-Sep-2018
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	12-Jan-2018
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon
Vector Signal Generator	Rohde & Schwarz	SMBV100A	4886	12	11-May-2018

Table 8

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

2.3 Spurious Response Rejection

2.3.1 Specification Reference

IEC 62287-1, Clause 11.2.5

2.3.2 Equipment Under Test and Modification State

NAIS-500, S/N: TEST#001 - Modification State 0

2.3.3 Date of Test

29-September-2017 to 04-October-2017

2.3.4 Test Method

This test was performed in accordance with IEC 62287-1, clause 11.2.5.4 and 11.2.5.5.

2.3.5 Environmental Conditions

Ambient Temperature	20.4 - 22.2 °C
Relative Humidity	45.3 - 61.0 %

2.3.6 Test Results

DC Powered - AIS - CSTDMA

Test Parameter	Value
List of Intermediate Frequencies	IF1 = 21.7 MHz (RX1) and 21.4 MHz (RX2); IF2 = 0.455 MHz
Switching Range of the Receiver	6 MHz
Frequency of the Local Oscillator at 162.025 MHz (AIS2)	140.625 (RX2)
Frequency of the Local Oscillator at 156.025 MHz	140.275 (RX1)
Calculated Limited Frequency Range	RX1 = 109.17 MHz to 165.48 MHz; RX2 = 109.77 MHz to 165.48 MHz

Table 9 - Test Parameters for Spurious Response Rejection

Frequency (MHz)	PER (%)
161.275	100
161.625	100
160.230	100
160.930	100
161.680	100
159.170	99.0
162.275	100
162.325	100
162.675	100
162.885	100
163.025	88.4

Table 10 - Spurious Responses - 161.975 MHz

No other responses were identified during the Limited Frequency Range Sweep.

Frequency (MHz)	PER (%)
160.625	100
161.325	100
161.675	100
162.375	100
162.725	100
162.935	100

Table 11 - Spurious Responses - 162.025 MHz

No other responses were identified during the Limited Frequency Range Sweep.

K	Calculated Frequency (MHz)	161.975 MHz
		PER (%) - Rx1
-2	258.85	0
2	302.25	0.5
-3	399.125	0
3	442.525	0
-4	539.4	0
4	582.8	0

Table 12 - Identified Frequencies Spurious Responses for 161.975 MHz - Rx1

Formula	Calculated Frequency (MHz)	162.025 MHz
		PER (%) - Rx2
-2	259.85	0
2	302.65	0
-3	400.475	0
3	443.275	0
-4	541.1	0.5
4	583.9	0

Table 13 - Identified Frequencies Spurious Responses for 162.025 MHz – Rx2

The EUT was tuned to 161.975 MHz on the RX1 receiver path. This is an unavoidable deviation because the equipment under test is an off the shelf unit being evaluated.

The spurious responses, identified above, were examined further to determine the level of the blocking signal at which the agreed visual inspection criteria was met. The visual inspection was agreed as a minimum of 4 out of 5 blocks of received packets witnessed on the terminal output of the EUT.

For receiver path RX1 = 161.975 MHz
The following spurious response failures (SR) were examined:
SR = 161.275 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -52.64 dBm at receiver input.

SR = 161.625 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -59.74 dBm at receiver input

SR = 160.23 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -34.69 dBm at receiver input

SR = 160.93 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -35.76 dBm at receiver input.

SR = 161.68 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -55.71 dBm at receiver input.

SR = 159.17 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -34.67 dBm at receiver input.

SR = 162.275 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -56.70 dBm at receiver input.

SR = 162.325 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -74.51 dBm at receiver input.

SR = 162.675 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -40.64 dBm at receiver input.

SR = 162.885 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -44.65 dBm at receiver input.

SR = 163.025 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -44.65 dBm at receiver input.

For receiver path RX2 = 162.025 MHz
The following spurious response failures (SR) were examined:

SR = 160.625 MHz
Level of unwanted signal at which packets are received at an acceptable visual = -37.70 dBm at receiver input.

SR = 161.325 MHz
level of unwanted signal at which packets are received at an acceptable visual = -47.62 dBm at receiver input.

SR = 161.675 MHz
level of unwanted signal at which packets are received at an acceptable visual = -74.51 dBm at receiver input.

SR = 162.375 MHz
level of unwanted signal at which packets are received at an acceptable visual = -58.68 dBm at receiver input.

SR = 162.725 MHz
level of unwanted signal at which packets are received at an acceptable visual = -49.58 dBm at receiver input.

SR = 162.935 MHz
level of unwanted signal at which packets are received at an acceptable visual = -40.59 dBm at receiver input.

IEC 62287-1 Limit Clause 11.2.5.6

At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious responses shall not result in a PER of greater than 20%.

2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal Generator	Rohde & Schwarz	SMY 01	49	12	25-Oct-2017
Directional Coupler	Narda	3020A	419	-	O/P Mon
Audio Analyser	Hewlett Packard	8903B	576	12	3-Jan-2018
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	12-Mar-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Programmable Modulation Waveform Generator	Sine Qua Non	PMG1	3291	-	TU
Attenuator (20dB, 150W)	Narda	769-20	3367	12	31-May-2018
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	2-May-2018
DC to TTL Converter	TUV SUD Product Service	-	3599	-	TU
'N' - 'N' RF Cable (2m)	Rhophase	NPS-1803-2000-NPS	3698	12	12-Oct-2017
TRUE RMS MULTIMETER	Fluke	179	4006	12	13-Dec-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	12-Mar-2018
2 metre N-Type Cable	Florida Labs	NMS-235SP-78.8-NMS	4508	12	2-Mar-2018
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4517	12	19-Sep-2018
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	12-Jan-2018
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon
Vector Signal Generator	Rohde & Schwarz	SMBV100A	4886	12	11-May-2018

Table 14

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

3 Photographs

3.1 Equipment Under Test (EUT)

Figure 1 - Top View

Figure 2 - Bottom View

Figure 3 - Rear View

Figure 4 - Front View

4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Sensitivity	± 1.8 dB
Adjacent Channel Selectivity	± 2.6 dB
Spurious Response Rejection	± 2.6 dB

Table 15