Bundesrepublik Deutschland
*Federal Republic of Germany*

**Bundesamt für Seeschifffahrt und Hydrographie**
*Federal Maritime and Hydrographic Agency*

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Assessment of internal / external documents for

# AIS Class A

| | |
|---|---|
| Equipment under test: | **Seatex** |
| Type: | **AIS300** |
| Applying test standards: | IEC 61993-2 Ed.2.0, 2012, Section 15 |
| Assessment Report No.: | BSH/4543/001/4322719/15-4 |
| Applicant: | Kongsberg Seatex<br>Pirsenteret<br>7462 Trondheim<br>NORWAY |

Hamburg, 21 April 2015
For the Federal Maritime and Hydrographic Agency

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**Order:** Your application for MED type approval
Dated 2014-01-24

**Basics of assessment:**

| No. | File name | Document title/ description | Test lab, accreditation |
|---|---|---|---|
| 1 | 3885 Test report NEMKO AIS-300 RF.pdf | Test Report No. 253637-2<br>Issue date: 2014-03-26 | Nemko |
| 2 | 3 191625 Test report IEC62320 V2.pdf | Test Report No. 191625-3<br>of the base station BS600<br>Issue date: 2012-05-07 | Nemko |
| 3 | 274308 Test report AIS-300 IEC61993-2.pdf | Test Report No. 274308-1<br>Issue date: 2015-03-16 | Nemko |
| 4 | 20150514 274308 NEMKO Test report AIS-300 IEC61993-2 IIII.pdf | Test Report No. 274308-1<br>Issue date: 2015-04-13 | Nemko |
| 5 | 20150411 Letter BSH Assessment of NEMKO report 274308_01.pdf | Letter Nr. TA/AIS 300/2015/CE with comments to Nemko test report<br>Regarding tests 15.2.5 and D.2.5 | Kongsberg Seatex |
| | | | |

The document number is used in the table below as reference

**Edition of the assessment report**

| Ed. | Date | Doc. | Change | Author |
|---|---|---|---|---|
| 1 | 2014-09-25 | 1,2 | First edition | Bartels |
| 2 | 2015-04-02 | 3 | Assessment of doc. No. 3 | Bartels |
| 3 | 2015-04-21 | 4,5 | Assessment of doc. No 4 and 5 | Bartels |
| | | | | |

**Result:**
All requirements are fulfilled

**Enclosures:**
Checklist

**Note 1)**
**In most tests the test conditions are not mentioned (e.g. level of wanted signal, level of unwanted signal ...). We have assumed in these cases that the levels and frequencies according to IEC 61993-2 have been used and accepted the tests. But it would be better for future test reports to mention the test conditions as it is done for a few tests.**

**Note 2)**
**The BS600 tests have been performed with 230 V AC input power. The AIS300 uses 24 VDC input power. So the tests under extreme conditions are not applicable for the AIS300.**

**<u>Retest 2015-04-02 Ba:</u>**
**The tests of doc. 3 have been performed with the AIS300 AIS Class A unit.**

| **Checklist: Review of external test reports – 15 Physical radio tests D.2 DSC receiver tests** | | | | | | |
|---|---|---|---|---|---|---|
| | **Test items** | **Test conditions** | **Limits** | **D.** | **Results** | **Comments** |
| 15.1 | TDMA transmitter | | | | | |
| | Wanted signal test frequencies | Defined by the standard | Low frequency = | | 156.025 MHz | |
| | | | High frequency = | | 162.025 MHz | |
| 15.1.1 | Frequency error -25 kHz operation -normal condition | Low frequency | ±0,5 kHz | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | Frequency error -extreme condition -low temperature -low voltage | Low frequency | ±1 kHz | 3 | Passed | Different power supply See Note 2) <u>2015-04-02 Ba:</u> Test with AIS300 |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | Frequency error, -extreme condition -high temperature -high voltage | Low frequency | ±1 kHz | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15.1.2 | Carrier Power -normal condition | Low frequency | Nominal low power 1 W = 30 dBm +/-1.5 dB | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | Carrier power -extreme condition -low temperature -low voltage | Low frequency | Nominal low power 1 W = 30 dBm +2 /-3 dB | 3 | Passed | See Note 2) |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | Carrier power -extreme condition -high temperature -high voltage | Low frequency | Nominal low power 1 W = 30 dBm +2 /-3 dB | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | Carrier power -normal condition | Low frequency | Nominal high Power 12.5 W = 41 dBm +/-1.5 dB | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | Carrier power -extreme condition -low temperature -low voltage | Low frequency | Nominal high Power 12.5 W = 41 dBm +/-3 dB | 3 | Passed | See Note 2) |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | Carrier power -extreme condition -high temperature -high voltage | Low frequency | Nominal high Power 12.5 W = 41 dBm +/-3 dB | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| 15.1.3 | Slotted transmission spectrum Test signal No. 4 | Low frequency | Mask: 10 kHz: -25 dBc 25 kHz: -70 dBc | 2 | Passed | |
| | | High frequency (162.025 MHz) | | 2 | Passed | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15.1.4 | Modulation accuracy -normal condition | Low frequency | Test signal 2 1740 Hz+/-175 Hz | 3 | Passed | Doc. 2: Mesurement uncertainty = +/- 802 Hz This seems to be a typing error, 2015-04-02 Ba: Measurement uncertainty: +/-17Hz |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | | Low frequency | Test signal 3 2400 Hz+/-240 Hz | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | Modulation accuracy -extreme condition -low temperature -low voltage | Low frequency | Test signal 2 1740 Hz+/-350 Hz | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | | Low frequency | Test signal 3 2400 Hz+/-480 Hz | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | Modulation accuracy -extreme condition -high temperature -high voltage | Low frequency | Test signal 2 1740 Hz+/-350 Hz | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| | | Low frequency | Test signal 3 2400 Hz+/-480 Hz | 3 | Passed | |
| | | High frequency (162.025 MHz) | | 3 | Passed | |
| 15.1.5 | Transmitter output power characteristics | Low frequency | Figur 2, Table 10 T0 + 0.625 ms: +1.5/- 3 dBc T0 + 0.83 ms: +1.5 / - 1 dB Rampdown: 0.83 ms to –50 dBc | 2 | Passed | |
| | | High frequency (162.025 MHz) | | 2 | Passed | |

| 15.2 | TDMA receivers | | | | | |
|---|---|---|---|---|---|---|
| 15.2.1 | Sensitivity<br>-25 kHz<br>-normal conditions<br><br>(Test signal 5) | Low frequency | -107 dBm<br><20% PER | 2,3 | Passed | |
| | | High frequency<br>(162.025 MHz) | | 2,3 | Passed | |
| | | Low frequency<br>- 500 Hz | -104 dBm<br><20% PER | 3 | Passed | |
| | | Low frequency<br>+ 500 Hz | | 3 | Passed | |
| | | High frequency<br>- 500 Hz | -104 dBm<br><20% PER | 3 | Passed | |
| | | High frequency<br>+ 500 Hz | | 3 | Passed | |
| | Sensitivity<br>-extreme condition<br>-high temperature<br>-high voltage | Low frequency | -101 dBm<br><20% PER | 3 | Passed | See Note 2) |
| | | High frequency<br>(162.025 MHz) | | 3 | Passed | |
| | Sensitivity<br>-extreme condition<br>-low temperature<br>-low voltage | Low frequency | -101 dBm<br><20% PER | 3 | Passed | |
| | | High frequency<br>(162.025 MHz) | | 3 | Passed | |
| 15.2.2 | Error behaviour<br>at high input levels<br><br>(Test signal 5) | Low frequency | 1 % PER<br>at – 77 dBm | 2 | Passed | |
| | | | 1 % PER<br>at –7 dBm | 2 | Passed | |
| | | High frequency<br>(162.025 MHz) | 1 % PER<br>at – 77 dBm | 2 | Passed | |
| | | | 1 % PER<br>at –7 dBm | 2 | Passed | |
| 15.2.3 | Co-Channel rejection<br><br>Low frequency | unwanted<br>nominal<br>frequency | PER < 20%<br>for<br>wanted: -104 dBm<br>unw.: -114 dBm | 2 | Passed | |
| | | Unwanted:<br>– 1 kHz | | 3 | Passed | |
| | | unwanted:<br>+ 1 kHz | | 3 | Passed | |
| | Co-Channel rejection<br><br>High frequency | unwanted<br>nominal<br>frequency | PER < 20%<br>for<br>wanted: -104 dBm<br>unw.: -114 dBm | 2 | Passed | |
| | | Unwanted:<br>– 1 kHz | | 3 | Passed | |
| | | unwanted:<br>+ 1 kHz | | 3 | Passed | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15.2.4 | Adjacent channel selectivity | Low frequency unw.: + 25 kHz | PER < 20% for wanted :-104 dBm unw.: –34 dBm (70 dB) | 2 | Passed | |
| | | Low frequency unw.: - 25 kHz | | 2 | Passed | |
| | | High frequency unw.: + 25 kHz | | 2 | Passed | |
| | | High frequency unw.: - 25 kHz | | 2 | Passed | |
| | Adjacent channel selectivity -extreme condition -high temperature -high voltage | Low frequency, unw.: + 25 kHz | PER < 20% for wanted: -98 dBm unw.: –38 dBm (60 dB) | 3 | Passed | |
| | | Low frequency, unw.: - 25 kHz | | 3 | Passed | |
| | | High frequency, unw.: + 25 kHz | | 3 | Passed | |
| | | High frequency, unw.: - 25 kHz | | 3 | Passed | |
| | Adjacent channel selectivity -extreme condition -low temperature -low voltage | Low frequency, unw.: + 25 kHz | PER < 20% for wanted: -98 dBm unw.: – 38 dBm (60 dB) | 3 | Passed | |
| | | Low frequency, unw.: - 25 kHz | | 3 | Passed | |
| | | High frequency, unw.: + 25 kHz | | 3 | Passed | |
| | | High frequency, unw.: - 25 kHz | | 3 | Passed | |
| 15.2.5 | Spurious response Rejection<br><br>Low frequency | Frequencies from search over limited range | PER < 20% for wanted: -104 dBm unw.: -27 dBm | 2<br>3<br>5 | Passed | The search range is not defined (Calculation missing)<br>2015-04-02 Ba:<br>There is no information that the search has been performed<br>2015-04-21 Ba:<br>Clarified with doc. 5 |
| | | $2 f_{LOL} + IF_1$ | PER < 20% for wanted: -104 dBm unw.: -34 dBm (70 dB) | 3,4 | Passed | See Note 3<br>2015-04-02 Ba:<br>The signal levels are missing<br>2015-04-21 Ba:<br>Levels have been added. Unwanted = -27dBm |
| | | $3 f_{LOL} + IF_1$ | | 3,4 | Passed | |
| | | $4 f_{LOL} + IF_1$ | | 3,4 | Passed | |
| | | $2 f_{LOL} - IF_1$ | | 3,4 | Passed | |
| | | $3 f_{LOL} - IF_1$ | | 3,4 | Passed | |
| | | $4 f_{LOL} - IF_1$ | | 3,4 | Passed | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Spurious response rejection<br><br>High frequency | Frequencies from search over limited range | PER < 20% for wanted: -104 dBm unw.: -27 dBm | 2<br><br>3<br><br>4 | Passed | The search range is not defined<br>2015-04-02 Ba:<br>There is no information that the search has been performed<br>2015-04-21 Ba:<br>Clarified with doc. 5 |
| | | $2 f_{LOH} + IF_1$ | PER < 20% for wanted: -104 dBm unw.: -34 dBm (70 dB) | 3,4 | Passed | See Note 3<br>2015-04-02 Ba:<br>The signal levels are missing<br>2015-04-21 Ba:<br>Levels have been added. Unwanted = -27dBm |
| | | $3 f_{LOH} + IF_1$ | | 3,4 | Passed | |
| | | $4 f_{LOH} + IF_1$ | | 3,4 | Passed | |
| | | $2 f_{LOH} - IF_1$ | | 3,4 | Passed | |
| | | $3 f_{LOH} - IF_1$ | | 3,4 | Passed | |
| | | $4 f_{LOH} - IF_1$ | | 3,4 | Passed | |
| 15.2.6 | Inter-modulation response rejection and blocking | Test 1<br>Low frequency<br>+500 /+1000 kHz<br>D=161.750 | PER < 20% for wanted: -101dBm unwanted:<br>B and C: –27 dBm<br>D: -15 dBm | 3 | Passed | . |
| | | Test 2<br>High frequency<br>-500 /-1000 kHz<br>D=156.300 | | 3 | Passed | |
| 15.2.7 | Transmit to receive switching time<br><br>(Test signal 5) | Low frequency | PER < 20% for wanted: -107 dBm In slots after Tx | 1 | Passed | |
| | | High frequency | PER < 20% for wanted: -107 dBm In slots after Tx | 1 | Passed | |
| 15.2.8 | Immunity to out-of-band energy | Low frequency<br>Unwanted:<br>174 MHz | PER < 20% for wanted: -101 dBm unw.: –5 dBm | 1 | Passed | |
| | | High frequency<br>Unwanted:<br>174 MHz | PER < 20% for wanted: -101 dBm unw.: –5 dBm | 1 | Passed | |

Note 3)
Spurious response rejection (Doc. 2):
1) There are the following problems with the spurious respons rejection test:
IEC 61993-2 defines –104 dBm for the wanted signal and –34 dBm for the unwanted signal.
The test has been performed with –101 dBm for the wanted signal and –33 dBm for the unwanted signal.

2) EC 61993-2 defines that the test shall be performed on 156,025 MHz and (lowest channel) and 162.025 MHz (highest channel). The test report does not mention for which wanted signal frequency the test has been performed.

- The SFI for k=1 (mirror frequency) is calculated for a wanted signal of 156,025 MHz
- The SFIs for k=2,3,4 are calculated for AIS1 (161,975 MHz)
- The example below the table shows the LO frequency for a wanted frequency of 162,025 MHz

Under these conditions the wanted signal frequency is and clear and the test cannot be verified.

The receiving frequencies shall be 156,025 MHz and 162,025 MHz.
All SFIs have to be calculated for these Rx frequencies. The resulting SFIs have to be tested.
It is very important that the correct SFIs according to the wanted signal frequency are used in the test.

Retest 2015-04-02 Ba:

1) The levels of the wanted and unwanted signals are not mentioned. Because in the tests of doc. 2 were incorrect the levels used in the test should be mentioned
2) The SFI frequencies are calculated correctly.
3)

Retest 2015-04-21Ba:
The levels of the wanted and unwanted signals have been added, -104 dBm for wanted and –27 dBm for unwanted. The unwanted signal is stronger than required by the standard (-27 dBm instead of –34 dBm). This is accepted because the stronger unwanted signal is the harder test.

| | | | | | | |
|---|---|---|---|---|---|---|
| 15.3 | Conducted spurious emissions | | | | | |
| 15.3.1 | Spurious emissions from the transmitter | 9 kHz ...1 GHz | -36 dBm | 1 | Passed | |
| | | 1 GHz ... 4 GHz | -30 dBm | 1 | Passed | |
| 15.3.1 | Spurious emissions from the receiver | 9 kHz ... 1 GHz | -57dBm | 1,3 | Passed | |
| | | 1 GHz ... 4 GHz | -47 dBm | 1,3 | Passed | |

Note 4)
There are no dedicated DSC receiver tests in Doc. 2.

There are some tests for an RX3 which may be the DSC receiver.

The tests of RX3

- are not performed on the DSC frequency of 156,525 MHz as required by IEC 61993-2 D.2 but either on AIS1 or on the lowest (156,025 MHz) and highest (162,025 MHZ) frequency.
- are not performed by evaluation of a bit error rate as required by IEC 61993-2 D.2 but by evaluation of a PER as it is used for AIS TDMA messages. It seems the tests are not performed with DSC signals but with AIS TDMA messages.

Therefore these measurements cannot be accepted as measurements according to IEC 61993-2 D.2

Retest 2015-04-02 Ba:
Dedicated DSC receiver tests have been performed

| D.2 | DSC receiver tests | | | | | |
|---|---|---|---|---|---|---|
| D.2.1 | Maximum Sensitivity<br>-DSC<br>-normal conditions | Channel 70 = 156,525 MHz | -107 dBm<br><1% BER | 3 | Passed | |
| | | 156,525 MHz – 1,5 kHz | | 3 | Passed | |
| | | 156,525 MHz + 1,5 kHz | | 3 | Passed | |
| | Maximum Sensitivity<br>-extreme condition<br>-high temperature<br>-high voltage | Channel 70 | -101 dBm<br><1% BER | 3 | Passed | |
| | Sensitivity<br>-extreme condition<br>-low temperature<br>-low voltage | Channel 70 | | 3 | Passed | |
| D.2.2 | Error behaviour<br>at high input levels | Channel 70 | < 1 % BER<br>at –7 dBm | 3 | Passed | |
| D.2.3 | Co-Channel rejection | unwanted nominal frequency | <1% BER<br>for<br>wanted: -104 dBm<br>unw.: -114 dBm | 3 | Passed | |
| | | Unwanted: +3 kHz | | 3 | Passed | |
| | | Unwanted: – 3 kHz | | 3 | Passed | |
| D.2.4 | Adjacent channel selectivity | Channel 70<br>unw.: + 25 kHz | BER < 1%<br>for<br>wanted: -104 dBm<br>unw.: –34 dB | 3 | Passed | |
| | | Channel 70<br>unw.: - 25 kHz | | 3 | Passed | |
| | Adjacent channel selectivity<br>-extreme condition<br>-high temperature<br>-high voltage | Channel 70<br>unw.: + 25 kHz | BER < 1%<br>for<br>wanted: -98 dBm<br>unw.: –38 dB | 3 | Passed | |
| | | Channel 70<br>unw.: - 25 kHz | | 3 | Passed | |
| | Adjacen channel selectivity<br>-extreme condition<br>-low temperature<br>-low voltage | Channel 70<br>unw.: + 25 kHz | | 3 | Passed | |
| | | Channel 70<br>unw.: - 25 kHz | | | | |

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|---|---|---|---|---|---|---|
| D.2.5 | Spurious response Rejection<br><br>Channel 70 | Frequencies from search over limited range | BER < 1%<br><br>for<br>wanted: -104 dBm<br>unw.: -34 dBm | 3<br><br>5 | Passed | The search range is not defined<br>There is no information that the search has been performed<br>2015-04-21 Ba:<br>Clarified with doc. 5 |
| | | $2\ f_{LOH} + IF_1$ | | 3,4 | Passed | • The SFI are calculated correctly.<br>• There is no information about the signal levels (not passed)<br>2015-04-21 Ba:<br>Levels have been added. The values are correct. |
| | | $3\ f_{LOH} + IF_1$ | | 3,4 | Passed | |
| | | $4\ f_{LOH} + IF_1$ | | 3,4 | Passed | |
| | | $2\ f_{LOL} - IF_1$ | | 3,4 | Passed | |
| | | $3\ f_{LOL} - IF_1$ | | 3,4 | Passed | |
| | | $4\ f_{LOL} - IF_1$ | | 3,4 | Passed | |
| D.2.6 | Intermodulation response rejection | Channel 70<br>unwanted:<br>+ 50 kHz<br>+100 kHz | BER < 1%<br>for<br>wanted: -104 dBm<br>unw.: –39 dBm<br>(> 65 dB) | 3 | Passed | |
| | | Channel 70<br>unwanted:<br>- 50 kHz<br>-100 kHz | | 3 | Passed | |
| D.2.7 | Blocking or desensitisation | Channel 70<br>unwanted:<br>–1 MHz | BER < 1%<br>wanted: -104dBm<br>unw.: –20 dBm<br>(> 84 dBm) | 3 | Passed | |
| | | Channel 70<br>unwanted:<br>-10 MHz | | 3 | Passed | |
| | | Channel 70<br>unwanted:<br>+1 MHz | | 3 | Passed | |
| | | Channel 70<br>unwanted:<br>+ 10 MHz | | 3 | Passed | |
| D.2.8 | Conducted spurious emissions<br>from the receiver | 9 kHz ...<br>1 GHz | -57dBm | 3 | Passed | See 15.3.1 |
| | | 1 GHz ...<br>4 GHz | -47 dBm | 3 | Passed | |