



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: **Jotron**
Type: **TR-8000**

Applying test standards: IEC 61993-2 Ed.1.0, 2001 Section 15

Assessment Report No.: BSH/46121/4321890/12-4

Applicant: Jotron
Østbyveien 1
3280 Tjodalyng
Norway

Hamburg, 20 April 2012
Federal Maritime and
Hydrographic Agency

by order

Heinrich Bartels
Test engineer

by order

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nach EN ISO/IEC 17025:2005
akkreditiertes Prüflaboratorium



DAT-P-086/98

DATEch Deutsche Akkreditierungsstelle Technik in der TGA GmbH
Signatory of the Multilateral Agreement of EA and ILAC for the mutual recognition

represented in the

Deutschen AkkreditierungsRat



Akkreditierung

The TGA GmbH, represented by the DATEch Deutsche Akkreditierungsstelle Technik in der TGA GmbH, confirms that the Testing Laboratory

**Federal Maritime and Hydrographic Agency
Department Shipping
Laboratory for Type Approvals
Bernhard-Nocht-Straße 78
20359 Hamburg**

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out testing in the fields of

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

according to the annexed list of standards and specifications.

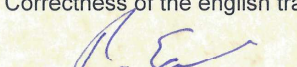
The accreditation is valid until: **2013-12-22**

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

DAR-Registration No.: **DAT-PL-086/98-02**

Frankfurt/Main, 2008-12-23

Correctness of the english translation confirmed: Frankfurt/Main, 2008-12-23


i.V. Dipl.-Ing.(FH) R. Egner
Head of the Accreditation Body

Member in EA, ILAC, IAF

Translation for information purposes only. The German Accreditation Certificate is authoritative

See notes overleaf

Order: Your application for MED type approval
dated 2011-01-10

Basics of assessment:

No.	File name	Document title/ description	Test lab, accreditation
1	TR-8000 61993-2 radio_tests.pdf	TEST REPORT IEC 61993-2 ed.2 Class A Nemko Project no: 150521 Date: January 14th, 2011	Jotron, witness by Nemko
2	TR-8000 61993-2 selected radio_tests.pdf		Jotron, witness by Nemko
3	7 Witness testing report TR 8000.pdf	Witness testing report Dok. No. 150521/7 Rev. 3.0, 2011-02-25	Nemko
4	TR-8000 Test report_S3_rev4.pdf	TEST REPORT IEC 61993-2 ed.2 Class A Nemko Project no: 150521 Date: April 18 th , 2012-04-19 Rev. 4	Jotron, witness by Nemko
5	2 206707 Witness testing report TR 8000.pdf	Witness testing report Dok. No. 150521/7-206707/2 Rev. 4.0, 2012-04-19	Nemko

The document number is used in the table below as reference

Result:

All test items fulfill the requirements.

Enclosures^[BQB-S1]:

Checklist

Remarks:

The test has been performed according to IEC 61993-2 Ed.2 (CDV).
 It is reviewed for conformity to Ed. 1 because the certificate will be provided according to Ed. 1. Relevant deviations between Ed. 1 and 2 are mentioned.

Power supply voltages:

Normal: 24 V
Extreme low: 10.8 V
Extreme high: 31.2 V

Extreme temperatures: -25°/ +55°

Checklist: Review of external test reports – 15 Physical radio tests						
	Test items	Test conditions	Limits	√	Results	Comments
15.1	TDMA transmitter					
	Low frequency	Manufacturers definition	Low frequency =		156.025 MHz	
15.1.1	Frequency error -25 kHz operation -normal condition	Low frequency	±0,5 kHz	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
	Frequency error -extreme condition -low temperature -low voltage	Low frequency	±1 kHz	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
	Frequency error, -extreme condition -high temperature -high voltage	Low frequency	±1 kHz	√	Passed	
		High frequency (162.025 MHz)		√	Passed	

15.1.2	Carrier Power -normal condition	Low frequency	Nominal low power +/-1.5 dB	√	Passed	Low power = 1 W = 30 dBm
		High frequency (162.025 MHz)		√	Passed	
	Carrier power -extreme condition -low temperature -low voltage	Low frequency	Nominal low power +2 /-3 dB	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
	Carrier power -extreme condition -high temperature -high voltage	Low frequency	Nominal low power +2 /-3 dB	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
	Carrier power -normal condition	Low frequency	Nominal high power +/-1.5 dB	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
Carrier power -extreme condition -low temperature -low voltage	Low frequency	Nominal high power +2 /-3 dB	√	Passed		
	High frequency (162.025 MHz)		√	Passed		
Carrier power -extreme condition -high temperature -high voltage	Low frequency	Nominal high power +2 /-3 dB	√	Passed		
	High frequency (162.025 MHz)		√	Passed		
15.1.3	Modulation spectrum -25 kHz	Low frequency	Mask: 10 kHz: -25 dBc 25 kHz: -70 dBc or 25 µW / -36 dBm	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
15.1.4	Modulation accuracy Normal conditions Test signal 2 (010101..)	Low frequency	1740 Hz +/- 175	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
	Modulation accuracy -extreme condition -low temperature -low voltage -Test signal 2	Low frequency	1740 Hz +/- 350	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
	Modulation accuracy -extreme condition -high temperature -high voltage -Test signal 2	Low frequency	1740 Hz +/- 350	√	Passed	
		High frequency (162.025 MHz)		√	Passed	



15.1.4	Modulation accuracy Normal conditions Test signal 3 (00001111..)	Low frequency	2400 Hz +/- 240	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
	Modulation accuracy -extreme condition -low temperature -low voltage -Test signal 3	Low frequency	2400 Hz +/- 480	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
	Modulation accuracy -extreme condition -high temperature -high voltage -Test signal 3	Low frequency	2400 Hz +/- 480	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
15.1.5	Transmitter attack time	Low frequency	Mask: 1 ms from slot start to +1.5/- 3 dBc Frequency < +/-1 kHz	√	Passed	
		High frequency (162.025 MHz)		√	Passed	
15.1.6	Transmitter release time	Low frequency	Mask: 1 ms from + 1.5/-1 dBc to -50 dBc	√	Passed	
		High frequency (162.025 MHz)		√	Passed	

15.3	TDMA receivers						
15.3.1	Sensitivity -25 kHz -normal conditions	Low frequency	-107 dBm <20% PER	√	Passed	Test has also been performed with +/- 500 Hz offset with -104 dBm acc. to Ed.2	
		High frequency (162.025 MHz)		√	Passed		
	Sensitivity - normal conditions - 500 Hz	Low frequency	-104 dBm <20% PER	√	Passed		
		High frequency (162.025 MHz)		√	Passed		
	Sensitivity - normal conditions + 500 Hz	Low frequency	-104 dBm <20% PER	√	Passed		
		High frequency (162.025 MHz)		√	Passed		
	Sensitivity -extreme condition -high temperature -high voltage	Low frequency	-101 dBm <20% PER	√	Passed		
		High frequency (162.025 MHz)		√	Passed		
	Sensitivity -extreme condition -low temperature -low voltage	Low frequency	-101 dBm <20% PER	√	Passed		
		High frequency (162.025 MHz)		√	Passed		
	15.3.3	Error behaviour at high input levels	161.975 MHz	1 % PER at - 77 dBm	√	Passed	Test has been performed at low and high frequency
				1 % PER at -7 dBm	√	Passed	
15.3.4	Co-Channel rejection -for 25 kHz	unwanted nominal frequency	PER < 20% for wanted: -104 dBm unw.: -114 dBm	√	Passed	Test has been performed at low and high frequency	
		unw.: - 3 kHz (neu: 1kHz)		√	Passed		
		unw.: + 3 kHz (neu: 1kHz)		√	Passed		

15.3.6	Adjacent channel selectivity -25 kHz	Low frequency unw.: + 25 kHz	PER < 20% for wanted: -104 dBm unw.: -34 dBm	√	Passed	.
		Low frequency unw.: - 25 kHz		√	Passed	
		High frequency unw.: + 25 kHz		√	Passed	
		High frequency unw.: - 25 kHz		√	Passed	
	Adjacent channel selectivity -25 kHz -extreme condition -high temperature -high voltage	Low frequency, unw.: + 25 kHz	PER < 20% for wanted: -98 dBm unw.: -38 dBm	√	Passed	
		Low frequency, unw.: - 25 kHz		√	Passed	
		High frequency, unw.: + 25 kHz		√	Passed	
		High frequency, unw.: - 25 kHz		√	Passed	
	Adjacent channel selectivity -25 kHz -extreme condition -low temperature -low voltage	Low frequency, unw.: + 25 kHz	PER < 20% for wanted: -98 dBm unw.: - 38 dBm	√	Passed	
		Low frequency, unw.: - 25 kHz		√	Passed	
		High frequency, unw.: + 25 kHz		√	Passed	
		High frequency, unw.: - 25 kHz		√	Passed	
15.3.8	Spurious response rejection -25 kHz	Frequencies from search over limited range	PER < 20% for wanted: -104 dBm unw.: -27 dBm (> 70 DB)	√	Passed	
		$2 f_{LOH} + IF_1$		√	Passed	
		$3 f_{LOH} + IF_1$		√	Passed	
		$4 f_{LOH} + IF_1$		√	Passed	
		$2 f_{LOL} - IF_1$		√	Passed	
		$3 f_{LOL} - IF_1$		√	Passed	
		$4 f_{LOL} - IF_1$		√	Passed	
15.3.9	Inter-modulation response rejection -25 kHz	Test 1 High frequency -500 /-1000 kHz	PER < 20% for wanted: -101dBm unw.: -27 dBm	√	Passed	
		Test 2 Low frequency +500 /+1000 kHz		√	Passed	
15.3.9	Blocking or desensitisation -25 kHz	Low frequency unw.: 161.75 MHz	PER < 20% for wanted: -101 dBm unw.: -15 dBm	√	Passed	
		High frequency unw.: 156.3 MHz	PER < 20% for wanted: -101 dBm unw.: -15 dBm	√	Passed	

15.3.10	Transmit to receive switching time	161.975 MHz	-107 dBm at 20% PER in slots after Tx slot	√	Passed	
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15.4	DSC receiver					
15.4.1	Sensitivity -DSC -normal conditions	Channel 70	-107 dBm <1% BER	√	Passed	Test has also been performed with +/- 1.5 Hz offset
	Sensitivity -extreme condition -high temperature -high voltage	Channel 70	-101 dBm <1% BER	√	Passed	
	Sensitivity -extreme condition -low temperature -low voltage	Channel 70	-101 dBm <1% BER	√	Passed	
15.4.2	Error behaviour at high input levels	Channel 70	< 1 % BER at -7 dBm	√	Passed	
15.4.3	Co-Channel rejection	unwanted nominal frequency	<1% BER for wanted: -104 dBm unw.: -112 dBm	√	Passed	
		unw.: +3 kHz		√	Passed	
		unw.: - 3 kHz		√	Passed	
15.4.4	Adjacent channel selectivity	Channel 70 unw.: + 25 kHz	BER < 1% for wanted: -104 dBm unw.: -34 dB	√	Passed	Test has been performed with the unwanted signal at +/- 50 kHz IEC 61993-2 Ed.1 and Ed.2 require the unwanted signal at +/- 25 kHz <u>Retest 2012-04-19 Ba:</u> Doc. 4,5: Test has been repeated with correct unwanted signals. Test report has been updated.
		Channel 70 unw.: - 25 kHz		√	Passed	
	Adjacent channel selectivity -extreme condition -high temperature -high voltage	u	BER < 1% for wanted: -98 dBm unw.: -38 dB	√	Passed	
	Channel 70 unw.: - 25 kHz	√		Passed		
	Adjacent channel selectivity -extreme condition -low temperature -low voltage	Channel 70 unw.: + 25 kHz	BER < 1% for wanted: -98 dBm unw.: -38 dB	√	Passed	
Channel 70 unw.: - 25 kHz	√	Passed				

15.4.5	Spurious response rejection	Channel 70 unwanted: 100 kHz to 2 GHz	BER < 1% for wanted: -104 dBm unw.: -24 dBm (> 70 DB)	√	Passed	Unwanted signal: -34 dBm according to Ed. 2
15.4.6	Intermodulation response rejection	Channel 70 unwanted: + 50 kHz +100 kHz	BER < 1% for wanted: -104 dBm unw.: -39 dBm (> 65 dB)	√	Passed	
		Channel 70 unwanted: - 50 kHz -100 kHz		√	Passed	
15.4.7	Blocking or desensitisation	Channel 70 unwanted: -10 .. - 1 MHz	BER < 1% wanted: -104dBm unw.: -20 dBm (> 84 dBm)	√	Passed	Test has been performed at +/- 1 MHz and +/- 10 MHz according to Ed. 2
		Channel 70 unwanted: +1 .. + 10 MHz		√	Passed	

15.5	Conducted spurious emissions at the antenna					
15.5.1	Spurious emissions from the receiver	150 kHz ... 1 GHz	-57dBm	√	Passed	The test range was extended: 9 kHz ... 4 GHz according to Ed. 2
		1 GHz ... 2 GHz	-47 dBm	√	Passed	
15.5.2	Spurious emissions from the transmitter	150 kHz ...1 GHz	-36 dBm	√	Passed	
		1 GHz ... 2 GHz	-30 dBm	√	Passed	