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Test report no. : 126928/03

Item tested : AIS SART

Type of equipment : AIS Search and Rescue Transmitter

Client : JOTRON AS

NORWEGIAN ACCREDITATION
TEST 033

Nemko AS is granted accreditation by Norwegian Accreditation
under registration number TEST 033

IEC 61097-14
GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM
PART 14: AIS search and rescue transmitter (AIS-SART) –
Operational and performance requirements, methods and required results

IEC 60945
Maritime navigation and radiocommunication equipment and systems –
General requirements – Methods of testing and required test results

2009-11-09

Authorized by : .....
Geir Antonsen
Technical Verificator

CONTENTS

1 GENERAL INFORMATION

1.1 Testhouse Info

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Number of Pages:	68

1.2 Client Information

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Contact:

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1.3 Manufacturer (if other than client)

Name :	/
Address :	/
Telephone :	/
Fax :	/
E-mail :	/

2 Test Information

2.1 Tested Item

Name :	Jotron AIS-SART
Model/version :	TRON AIS-SART
Serial number :	970000011 and 970000013
Hardware identity and/or version:	R0809
Software identity and/or version :	0.3
Frequency Range :	161.975MHz and 162.025 MHz
Type of Power Supply :	Internal battery
Desktop Charger :	NA

Description of Tested Device(s)

The tested EUT is an AIS-SART (Automatic Identification System - Search and Rescue Transponder)

The EUT is approximately 200 x 100 x 100 mm (h x d x w).

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	21 - 23 °C
Relative humidity:	29 - 40 %
Atmospheric pressure:	98 - 102 kPa
Normal test voltage:	NA

All testing has been carried out with the supplied batteries.

The values are the limit registered during the test period.

2.3 Test Period

Item received date: 2009-04-29

Test period : from 2009-04-29 to 2009-06-05, and 2009-11-09

2.4 Standards and Regulations

IEC 61097-14 GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM
PART 14: AIS search and rescue transmitter (AIS-SART) –
Operational and performance requirements, methods and required results
(2009-03)

IEC 60945 Maritime navigation and radiocommunication equipment and systems –
General requirements – Methods of testing and required test results
(2002-08)

2.5 Test Engineer(s)

Gnanamanikan Suhanthakumar, Egil Hauger, Jan G Eriksen

2.6 Additional information

2.6.1 Test Methods

Described in the relevant standards.

2.6.2 Test Equipment

List of used test equipment, see clause 8.

THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.
Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

TESTED BY : _____ **DATE: 9th November 2009**
Jan G Eriksen, Test Engineer

3 TEST REPORT SUMMARY

3.1 Abbreviations

P Passed, the equipment fulfils the requirement
F Failed, the equipment does not fulfil the requirement
I Inconclusive, the test does not give a conclusive verdict
NA Not applicable, the requirement is not applicable
NT Not tested, the test is not performed even though the requirement is relevant

3.2 List of measurements

Standard	Cl.	Measurement	Result (Pass/Fail)
IEC 61097-14	5.5	Preparation of AIS-SART for testing	NA
IEC 61097-14	6.2	Battery capacity check	Pass
IEC 61097-14	7.2	Frequency error	Pass
IEC 61097-14	7.4	Radiated power	Pass
IEC 61097-14	7.5	Modulation spectrum slotted transmission	Pass
IEC 61097-14	7.6	Transmitter test sequence and modulation accuracy	Pass
IEC 61097-14	7.7	Transmitter output power vs. time function	Pass
IEC 61097-14	7.8	Spurious emissions from the transmitter	Pass
IEC 60945	10.4	Radiated Disturbance 30 - 2000 MHz, Enclosure port	Pass
IEC 60945	10.9	Electrostatic discharge (ESD) immunity test	Pass
IEC 60945	11.2	Electrical – Compass Safe Distance	Pass (60 cm)
IEC 60945	8.7	Environmental Tests – Vibration	Pass

3.3 Conclusion

The tested equipment complies with the tested requirements of relevant standards.

3.4 OTHER COMMENTS

General:

The RF field immunity tests are performed in a semi anechoic room. The distance between EUT and field generating antenna was 3 meters and there were absorbers on the floor between the two.

EUT (Equipment Under Test):

The EUT is a AIS-SART transponder. During the immunity tests the EUT was in normal operating mode, i.e receiving GPS signals from GPS satellites and transmitting distress messages and position information to a VHF radio.

List of ports:

Signal port:	Antenna Port (connector of internal antenna available for conducted measurements)
Power ports:	DC (internal battery)

RF immunity tests.

During the RF field immunity test the EUT was rotated to 0, 90, 180, and 270 degrees, and exposed to vertical and horizontal field.

Performance criteria

For the tests in this subclause, the results are evaluated against performance criteria relating to the operating conditions and functional specifications of the EUT, and defined as follows:

– performance criterion A: the EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer;

– performance criterion B: the EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer. During the test, degradation or loss of function or performance which is self-recoverable is however, allowed, but no change of actual operating state or stored data is allowed.

4 Battery capacity test

The battery capacity test has been performed with a battery that was activated for a period of time to be equivalent to loss of battery capacity due to self-testing, stand-by loads as well as self-discharge during the useful life of the battery-pack (see clause 3.3.1). The equipment was activated for 41 hours in ambient temperature. This was according to clients calculations.

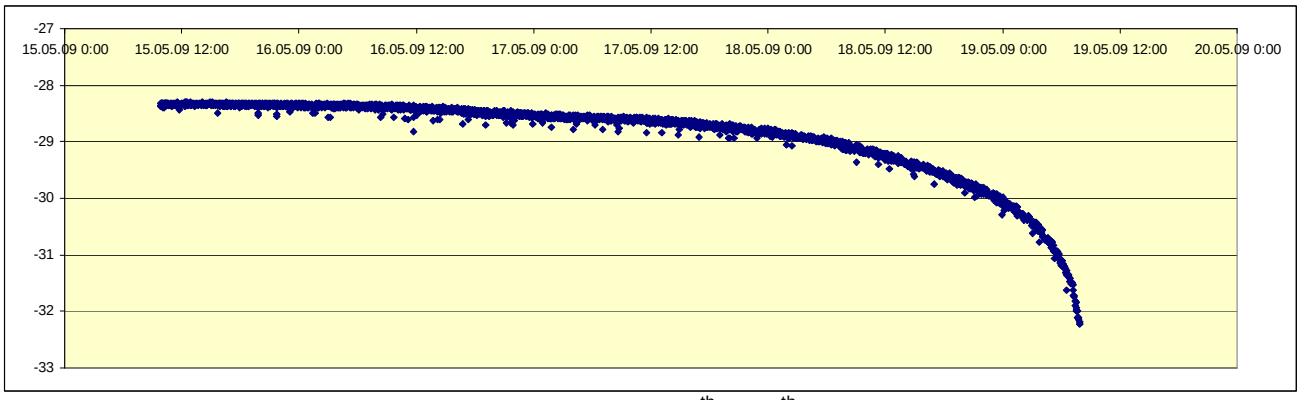
Before battery capacity test started the AIS-SART was placed in a climate chamber, and temperature was reduced and maintained at -20 degrees for 10 to 16 hours.

The output power from the AIS-SART and the transmitted GNSS data was logged on two different computers from May 15th on.

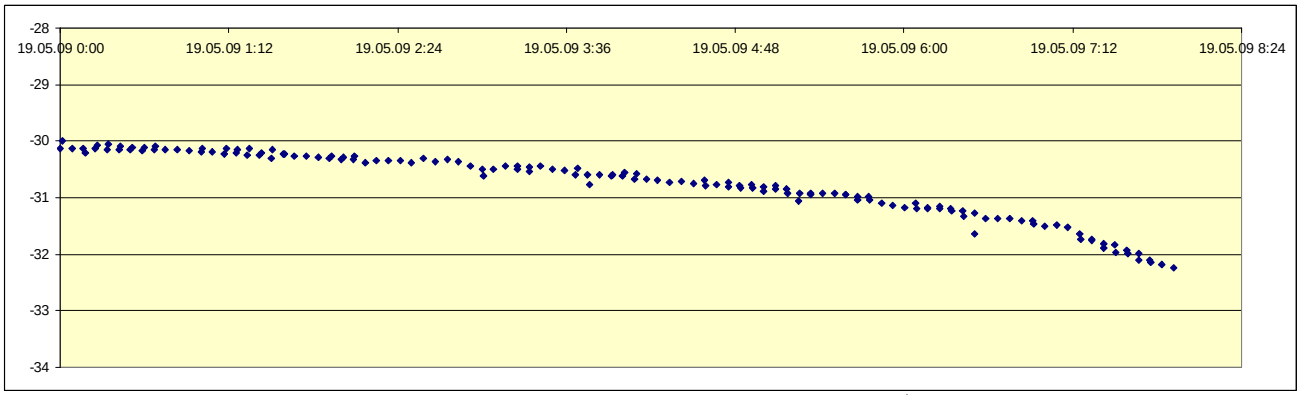
The battery test was started at 09:55 hours May 14th (logging was however started on May 15th).

The attenuation between AIS SART and measurement receiver of 63,7 dB is not included in the level figures on the left side axis of the figures below.

Performance test of the AIS-SART (reception of GNSS data and check of integrity of transmitted bursts), was performed throughout the whole test.



Graph showing logging of output power from SART from 15th to 19th of May 2009.



Same as above except graph is showing only last operating hours of May 19th 2009.

The AIS-SART stopped transmitting of data at 07:50 hours May 19th, with GNSS data being transmitted (and received by the VHF-receiver) during the whole period).

The AIS SART was transmitting for 117 hours and 55 minutes.

Test equipment used: 1 + computers and VHF-radio

5 PHYSICAL RADIO TESTS IEC 61097-14

The following performance tests have been done:

Under normal operating conditions:
- Conducted output power
- Radiated output power width the standard AIS-SART
- Conducted spurious emissions
- Frequency error
- Modulation accuracy
- Modulation spectrum slotted transmission
- Power vs. time function
- Power as a function of time

The following tests were done under extreme conditions:
- Conducted output power
- Frequency error
- Modulation spectrum slotted transmission

During low temperature extreme conditions (-20 degrees), the tests have been performed with a battery at the end of its useful lifetime (more than 92 hours).

During high temperature extreme conditions (+55 degrees), the tests have been performed with a fresh battery.

5.1 Frequency error

This test has been performed according to IEC 61097-14 clause 7.2

The output frequency was measured with a spectrum analyzer, see plots inn Annex.

	AIS1		AIS2	
	Measured	Required result	Measured	Required result
Normal conditions	-238 Hz	+- 500 Hz	+132 Hz	+- 500 Hz
Extreme conditions -20 ºC	-217 Hz	+- 1000 Hz	+188 Hz	+- 1000 Hz
Extreme conditions +55 ºC	-145 Hz	+- 1000 Hz	+206 Hz	+- 1000 Hz

Result: Pass

Test equipment used: 1 - 4

5.2 Conducted power units # 970000011 and # 970000013

Preparation of AIS-SART for type-approval testing, Cl. 5.5 (AIS WG 2009-10-28 V2)

Output power on one unit (# 970000011) was measured directly on the antenna connector from the main board and on the other unit (# 970000013) including a short piece of cable assembled by the manufacturer.

The output power was measured under normal operating conditions.

Result

	Conducted output power P_{20} (dBm)	
	AIS1	AIS2
# 970000011	36,4	36,4
# 970000013	36,3	36,3
Deviation (P_d)	0,1	0,1

Test equipment used: 23

5.3 Conducted power

This test has been performed according to IEC 61097-14 clause 7.3

The output conducted power was measured with a spectrum analyzer, see plots inn Annex.

	Conducted output power P_{20} (dBm)	
	AIS1	AIS2
Normal conditions	36,5	36,3
Extreme conditions -20 ºC	35,4	35,5
Extreme conditions +55 ºC	36,2	36,3

Test equipment used: 1 - 4

5.4 Radiated power

This test has been performed according to IEC 61097-14 clause 7.4

The output radiated power was measured with a spectrum analyzer, see plots inn Annex.

Radiated power under normal conditions (+20 °C):

	Effective Isotropic Radiated Power EIRP P_R (dBm)			
EUT position	AIS1		AIS2	
	Measured	Required result	Measured	Required result
0 deg	31,3	> 27,0	31,1	> 27,0
90 deg	31,3	> 27,0	31,3	> 27,0
180 deg	31,6	> 27,0	31,5	> 27,0
270 deg	31,5	> 27,0	31,5	> 27,0

Result: Pass

Test equipment used: 1 - 4

Calculated gain ($G = P_R - P_{20}$) [dB]:

	Gain (dB)	
EUT position	AIS1	AIS2
0 deg	-5,2	-5,4
90 deg	-5,2	-5,2
180 deg	-4,9	-5,0
270 deg	-5,0	-5,0

NOTE: results have been calculated using a spreadsheet and rounded to the nearest 0,1 dB resolution

Radiated power under extreme conditions:

Radiated power $_{-20 \& +55 dC}$ (dBm) = Conducted power $_{-20 \& +55 dC}$ (dBm) + calculated gain (dB)

	Effective Isotropic Radiated Power EIRP P_R (dBm)			
	AIS1		AIS2	
	Calculated	Required result	Calculated	Required result
-20 d C:				
EUT 0 deg	30,2	> 27,0	30,1	> 27,0
EUT 90 deg	30,3	> 27,0	30,2	> 27,0
EUT 180 deg	30,5	> 27,0	30,4	> 27,0
EUT 270 deg	30,4	> 27,0	30,4	> 27,0
+55 d C:				
EUT 0 deg	31,0	> 27,0	30,8	> 27,0
EUT 90 deg	31,0	> 27,0	31,0	> 27,0
EUT 180 deg	31,2	> 27,0	31,2	> 27,0
EUT 270 deg	31,1	> 27,0	31,2	> 27,0

NOTE: results have been calculated using a spreadsheet and rounded to the nearest 0,1 dB resolution

Result: PASS

5.5 Modulation spectrum slotted transmission

This test has been performed according to IEC 61097-14 clause 7.5

The modulation spectrum was measured with a spectrum analyzer, see plots inn Annex.

Requirements of the modulated spectrum:

- Within +- 10 kHz from the carrier the modulation and transient sidebands shall be less than 0 dBc
- At +- 10 kHz from the carrier the modulation and transient sidebands shall be less than -20 dBc.
- At +- 25 kHz from the carrier the modulation and transient sidebands shall be less than -40 dBc.
- In the region +-10 to +-40 kHz from the carrier the carrier the modulation and transient sidebands shall be below a line between the two points -20 dBc and -40 dBc.

The reference level is the conducted power recorded for the appropriate test frequency.

Result: Pass

Test equipment used: 1 - 4

5.6 Transmitter test sequence and modulation accuracy

This test has been performed according to IEC 61097-14 clause 7.6

The modulation spectrum was measured with a spectrum analyzer, see plots inn Annex.

To assess the modulation accuracy it was necessary to export the trace data from the spectrum analyzer into Excel and in the spreadsheet calculate the frequency deviation vs. time, see plots in Annex.

Requirements of the peak frequency deviation versus time:

Measurement period from centre to centre of each bit	Test signal 1		Test signal 2	
	Normal	Extreme	Normal	Extreme
Bit 0 to Bit 1	< 3400 Hz			
Bit 2 to Bit 3	2400 Hz ±480 Hz			
Bit 4 to Bit 31	2400 Hz ±240 Hz	2400Hz ±480 Hz	2400 Hz ±240 Hz	2400Hz ±480 Hz
Bit 32 to Bit 199	1740 Hz ±175 Hz	1740 Hz ±350 Hz	2400 Hz ±240 Hz	2400 Hz ±480 Hz

Result: Pass

Test equipment used: 1 - 4

5.7 Transmitter output power vs. time function

This test has been performed according to IEC 61097-14 clause 7.7

The transmitter output power was measured with a spectrum analyzer, see plots inn Annex.

Requirements of power versus time:

- Transmitter delay time (T_A - T_O) is the time between the start of the slot and the moment when the transmit power may exceed -50 dB of the steady state power (P_{ss}).
- Transmitter attack time (T_{B2} - T_A) is the time between the transmit power exceeding -50 dBc and the moment when the transmit power maintains a level within +1,5 - -1,0 dB from P_{ss}.
- Transmitter release time (T_F - T_E) is the time between the end flag being transmitted and the moment when the transmitter output power has reduced to a level 50 dB below P_{ss} and remains below this level hereafter.
- Transmission duration (T_F - T_A) is the time from when power exceeds -50 dBc to when the power returns to and stays below -50 dBc.

Reference	Bits	Time (ms)
T_O	0	0
T_O - T_A	0 – 6	0 – 0,625
T_{B1}	6	0,625
T_{B2}	8	0,833
T_E (includes 1 stuffing bit)	231	24,063
T_F (includes 1 stuffing bit)	239	24,896
T_F	256	26,667

There shall be no modulation of the RF after the termination of transmission (T_E) until the power has reached zero and next slot begins (T_G).

Result: Pass

Test equipment used: 1 - 4

5.8 Spurious emissions from the transmitter

This test has been performed according to IEC 61097-14 clause 7.8

The spurious emissions from the transmitter was measured with a spectrum analyzer, see plots inn Annex.

Requirements: Measured with a bandwidth between 100 and 120 kHz, the measured level in the following frequency bands shall not exceed 25 uW: 108 to 137 MHz, 156 to 161,5 MHz, 406,0 to 406,1 MHz, and 1525 to 1610 MHz.

Result: Pass

Test equipment used: 1 - 4

6 EMC TESTS IEC 60945

6.1 Electromagnetic Field Immunity On Enclosure Port. EN 61000-4-3

The test is performed in a 10 meter semi anechoic chamber.
Test signal:
Test generator settings:

Frequency			Settings		
Start	Stop	Step	Modulation	Mod. freq.	Field strength
80 MHz	2000 MHz	1 %	80 %	1000 Hz	10 V/m (-0/+6dB)

Dwell time 1,6 sec.

Exclusion band (if any):

EUT configuration during test:
EUT was placed on a wooden table with a height of 80 cm with the front facing the transmitting antenna and exposed for both horizontal and vertical RF field. The EUT was turned to 0, 90, 180, and 270 degrees.

EUT mode during test:
The EUT was in normal operating mode. It was receiving GPS data and transmitting distress data to a VHF receiver. The distress data was demodulated and logged on a PC to ensure compliance of integrity to interfering signal.

Test Level:
Test level was 10 V/m (+ 2dB).

Performance criteria for EUT:
During test: Performance criteria A (see clause 3.4 in this report).
After test: Operate as intended.
No loss of functions
No degradation of performance
No loss of stored data or user programmable functions

Results:

Frequency (MHz)	EUT side facing the RF field and polarity of the RF field	Field strength (V/m)	Performance (se Note)	
			During test	After test
80 - 2000	0, 90, 180, 270 deg vert / hor	10	Pass 1)	Pass 1)
Measurement Uncertainty (generating disturbing signal):			**+2,1 / -2,4 dB**	

Note:
1) Within the performance criteria described above.

Test Equipment Used: 5 – 13

6.2 Electrostatic Discharge (ESD) Immunity Test. EN 61000-4-2

The Electrostatic Discharges were applied according to the following test plan:

Discharges applied to EUT		ESD generator:			Result
Application mode:	Test point	Voltage (kV)	Coupling mode:	Number of discharges	
DA	EUT Enclosure, all sides	+/- 8,8	AD	> 10	Pass
IA	Horizontal Coupling Plane (HCP)	+/- 6,6	CD	> 10	Pass
IA	Vertical Coupling Plane (VCP)	+/- 6,6	CD	> 10	Pass

ABBREVIATIONS USED IN THE TABLE:
Application mode: DA = Direct application of discharges; IA = Indirect application of discharges
Coupling mode: CD = Contact discharges mode; AD = Air discharges mode

Cable configuration during test:

AC adapter cable and telecomm. cable were placed in parallel on a 0.5 mm thick bakelite plate on the ground plane and connected to the mains and to the feeding bridge.

Test set-up:

The test set-up was according to EN 61000-4-2 clause 7.1. A Ground Reference Plane (GRP) of 5 mm thick aluminium (2mx4m) was placed on the floor. The GRP was connected to the protective earth with a 10 mm^2 thick copper cable.
The EUT was tested as a TABLE TOP EQUIPMENT according to EN 61000-4-2, clause 7.1.1 and the test set-up consists of the following: A wooden table (0.8 m high) was located on the GRP. A Horizontal Coupling Plane (HCP) consisting of 1.5mm thick aluminium (0.8mx1.6m) was placed on the table. An insulating bakelite plate (0.5 mm thick) was placed on the HCP and the EUT was placed on the insulating plate during the test.

EUT mode during test:

The EUT was in normal operating mode. It was receiving GPS data and transmitting distress data to a VHF receiver. The distress data was demodulated and logged on a PC to ensure compliance of integrity to interfering signal.

Test Level:

The test level was selected on basis of EN 60 945 (+10 %).

Performance criteria for EUT:

During the test: Performance criteria B (see clause 3.4 in this report).
After the test: Operate as intended.
No loss of functions
No degradation of performance
No loss of stored data or user programmable functions

Results:

Pass (within the performance criteria described above)

Test Equipment Used: 14

6.3 Electrical – Compass Safe Distance

Test Description

Method
EN 60945 (2002), Section 11.2
EN ISO 694 (2001)
Ships and marine technology. Positioning of magnetic compasses in ships.

Procedure
Compass safe distance is the distance between the nearest point of the EuT and the subject compass, where an unacceptable compass deviation occur
For a standard compass, the horizontal magnetic flux shall be less than 0.942 mGauss (compass deviation of 5.4ºH).
For a steering/standby/emergency compass, the horizontal magnetic flux shall be less than 3.142 mGauss (compass deviation of 5.4ºH).

The compass safe distance is measured with a DC milligaussmeter. The EuT is first rotated to determine the worst case direction. Secondly the EuT is moved towards/away from the measurement probe until the required field is measured. The distance is then measured.

Measurements are made at 3 EuT conditions:

1) Non-energized (in the magnetic condition received from customer)
2) Non-energized after magnetisation in a 1 Gauss (80A/m) DC field, with a superimposed stabilising 50Hz AC field of 18 Gauss (1430A/m) *
3) Energized and in normal operating condition

* Test 2) may be omitted if the application of a strong magnetic field may damage the EuT

Instruments used during measurement

Instrument list: Magnetometer: Alphalab DC Milligauss (N-4046) (10/09)
Magnetization Coil: Nemko HC-1 (N-4216) (NA)
AC Magnetometer: Combinova MFM 10 (N-4286) (09/09)
DC Magnetometer: Alphalab DC Magnetometer (N-4258) (10/09)

Comments
No recorded comments.

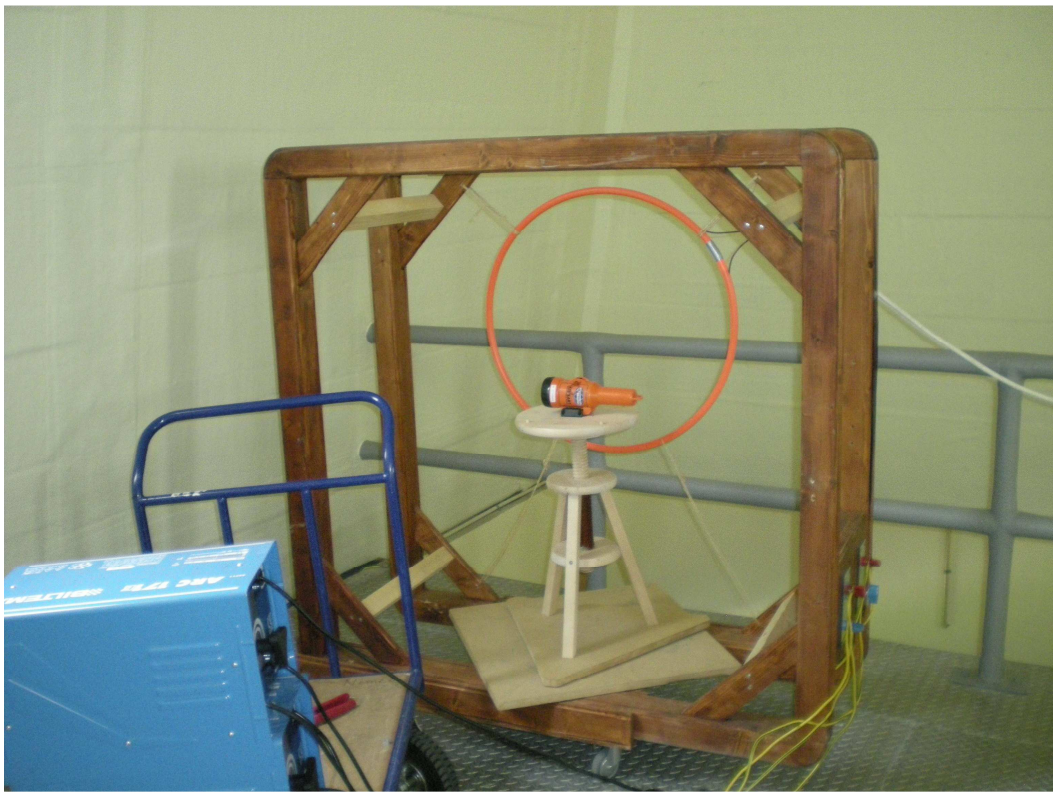
Conformity
Test engineer: Nguyen Trung Cang

Detailed Test Log

Condition	Standard Compass	Other Compass
Non-energized	60 cm	30 cm
Non-energized after magnetisation	45 cm	30 cm
Energized and operating	60 cm	30 cm

Conclusion
Based on the above measurements the overall Compass Safe Distance is considered to be = 60 cm

Photos



Notes: Test set-up for Compass Safe Distance

Notes: Test set-up for Compass Safe Distance

Notes: EuT

Notes: EuT

7 ENVIRONMENTAL TESTS - VIBRATION IEC 60945

7.1 Test Description

7.1.1 Method

EN 60068-2-06 (2008) (IEC 60068-2-06 (2007))
Test Fc: Vibration (sinusoidal)

Reference standard

IEC 60945 (2002) Ed.4; Maritime navigation and radiocommunication equipment and systems § 8.7 Vibration

7.1.2 Procedure

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. The requirements of the performance check shall be met.

Severity		**Conformity**	
Frequency range:	5Hz – 100Hz	Verdict:	PASS
Amplitude:	5Hz – 13.2Hz: 2mm (p-p) 13.2Hz – 100Hz: 7 m/s^2	Test engineer:	Jarle Skogland
Sweep rate:	0.5 octave/min		
Amplification criteria:	-		
Endurance criteria:	Endurance at each resonance ≥ 5:1, if none, one single observed frequency. if no observed freq., then 30Hz.		
Endurance Duration:	120 min. at each chosen frequency		
Number of axes:	3 mutually perpendicular		

7.2 Resonant Positions

Axis	Position	Sweep number	Resonance Amplification Factor	Frequency
X	EUT Top	1 (ch.2)	2.3 : 1	100Hz
	EUT bottom	1 (ch.3)	-	-
	-	1 (ch.4)	-	-
Y	EUT Top	2 (ch.2)	4.2 : 1	62.1Hz
	EUT centre	2 (ch.3)	5.1 : 1	61.9Hz
	-	2 (ch.4)	-	-
Z	EUT top	3 (ch.2)	4.6: 1	93.5Hz
	-	3 (ch.3)	-	-
	-	3 (ch.4)	-	-

7.3 Endurance Test Log

Axis	Frequency	Duration	Functional test	Result
X	100Hz	120 min.	Before, during and after exposure	PASS
Y	62Hz	120 min.	Before, during and after exposure	PASS
Z	93.5Hz	120 min.	Before, during and after exposure	PASS

7.4 Conclusion

No operation errors or damages were detected during or after the applied test(s)

See sweep plots in annex.

Test equipment used: 15 – 22

8 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

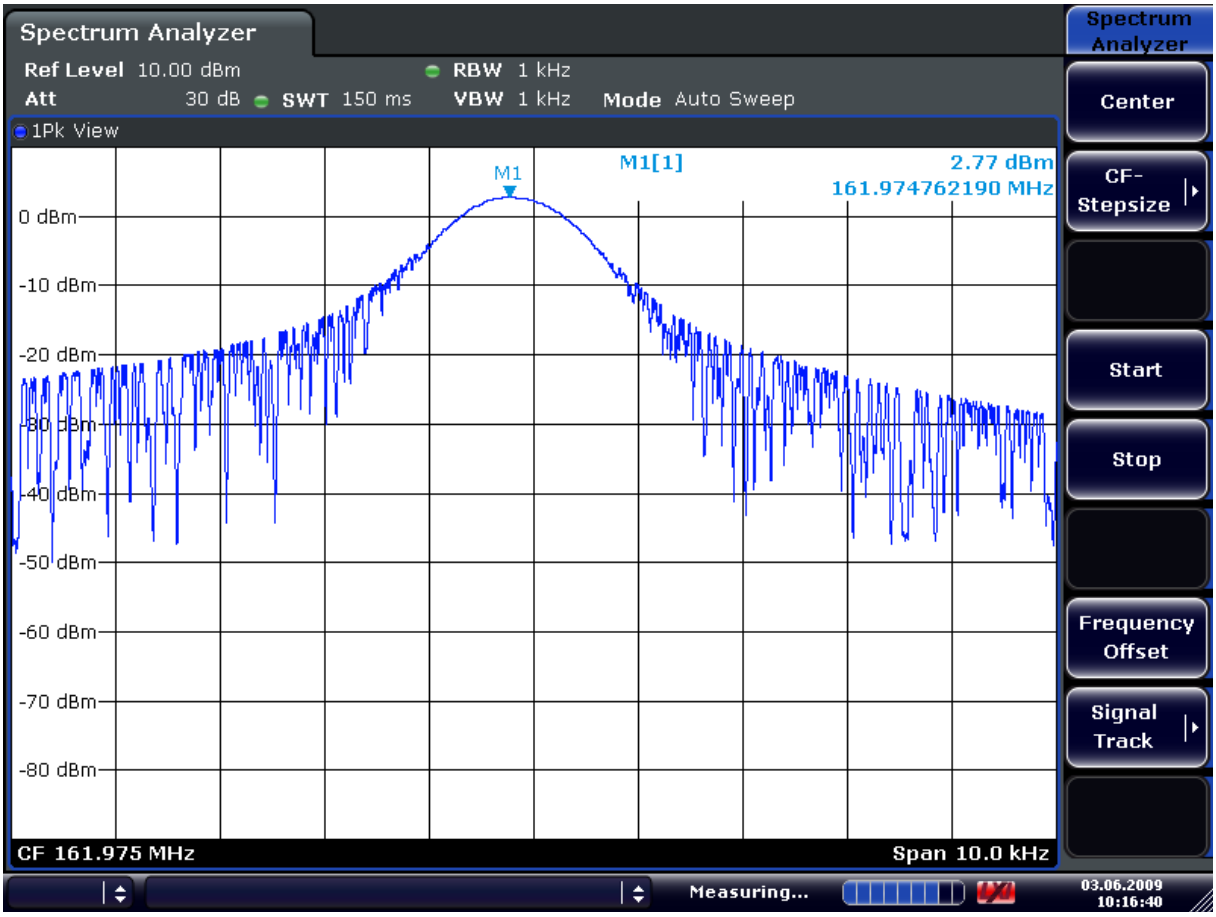
To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory.

No	Instrument/Ancillary	Type	Manufacturer	Ref. No.
1	Spectrum Analyzer	FSEK	R&S	LR 1337
2	Spectrum Analyzer	FSV	R&S	Serial No 101591
3	Spectrum Analyzer	FSIQ	R&S	
4	Antenna	HK116	R&S	LR 1260
5	Generator	SME03	R&S	LR 1238
6	Amplifier	25A100M1	Amplifier Research	LR 1155
7	Amplifier	500W AF500	Amplifier Research	LR 1354
8	Amplifier	25S1G4A	Amplifier Research	LR 1432
9	Field probe	FP4000	Amplifier Research	LR 1352
10	System Interface	SI-200	EMC Automation	LR 1353
11	Switch Module	SM-1	EMC Automation	LR 1153
12	Antenna	HL 023A1	R&S	LR 282
13	Antenna Horn	3161-01	EMCO	LR 1178
14	ESD generator	NSG435	Schaffner	LR 1281
15	Accelerometer	8702B50M1	Kistler	N-4335
16	Accelerometer	8732A500	Kistler	N-4349
17	Accelerometer	3225M23	Dytran	N-4434
18	Power Amplifier	DPA 10/5 K	LDS	N-4333.02
19	Shaker	V730	LDS	N-4333.01
20	Power Amplifier	SPA30KCE	LDS	N-4332.02
21	Shaker	V850	LDS	N-4332
22	Vibration controller	Puma	Spectral Dynamics	N-4332-3
23	Spectrum analyzer	FSU 26	R&S	LR 1504

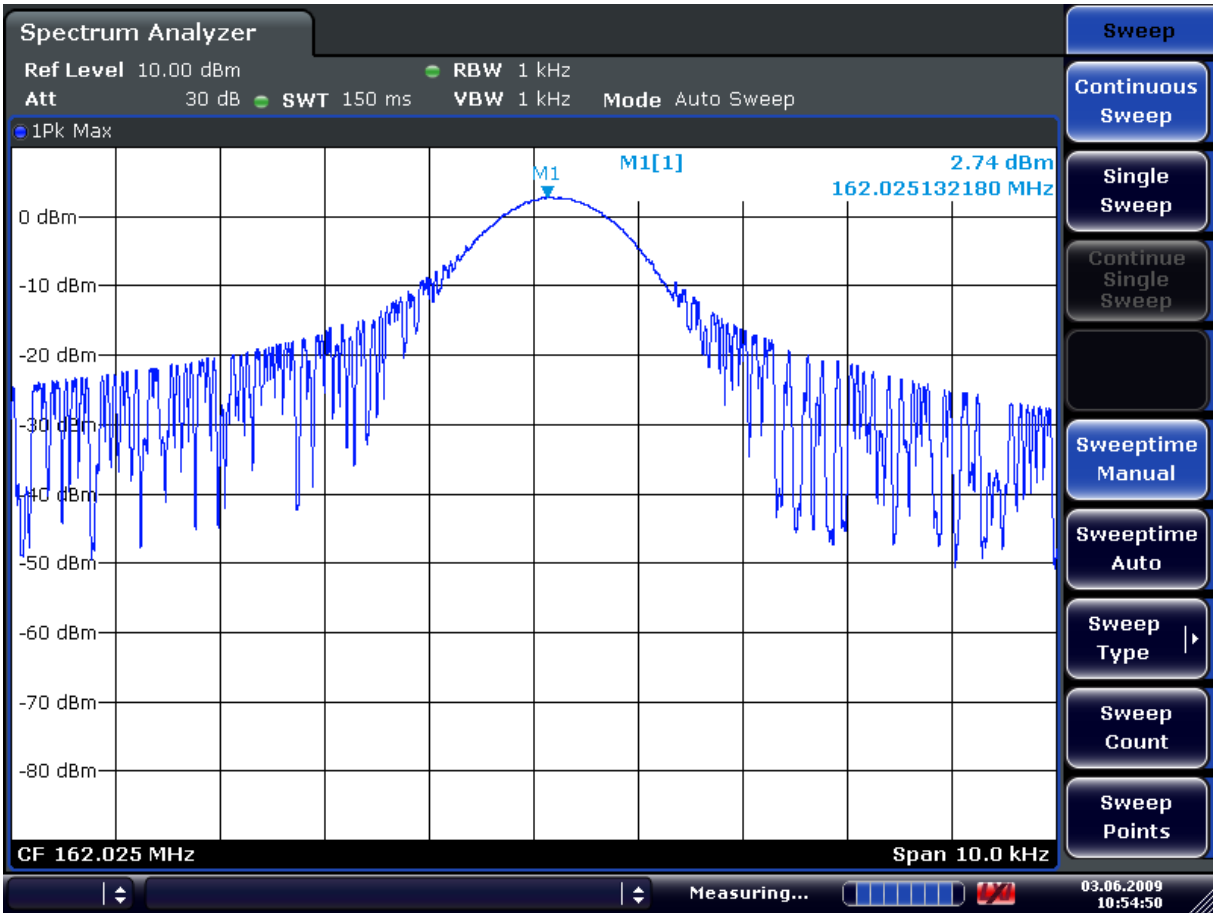
9 Annex I - Measurement Plots

NOTE: power levels given in graphics are not to correct as attenuation in cables, attenuators, couples, etc must be taken into account.

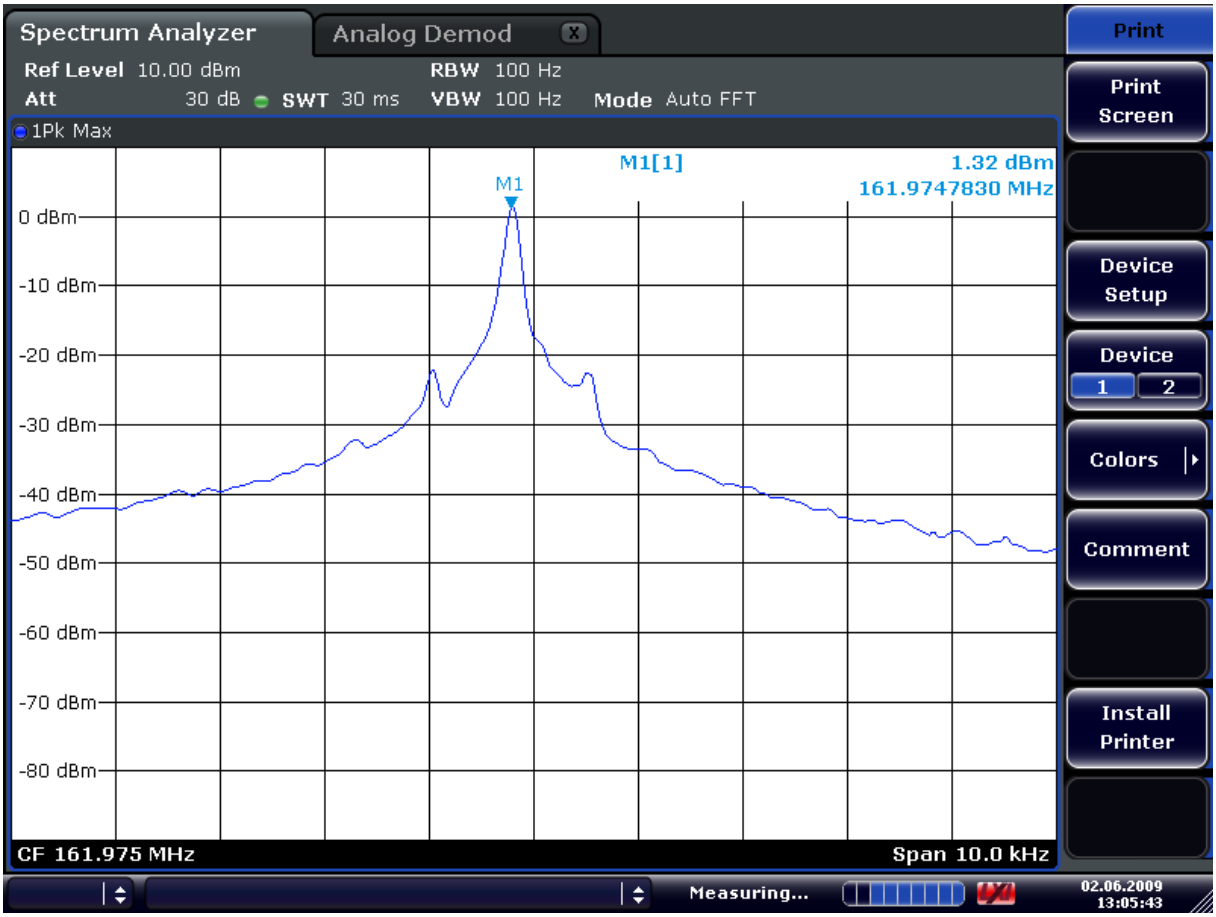
9.1 Frequency error



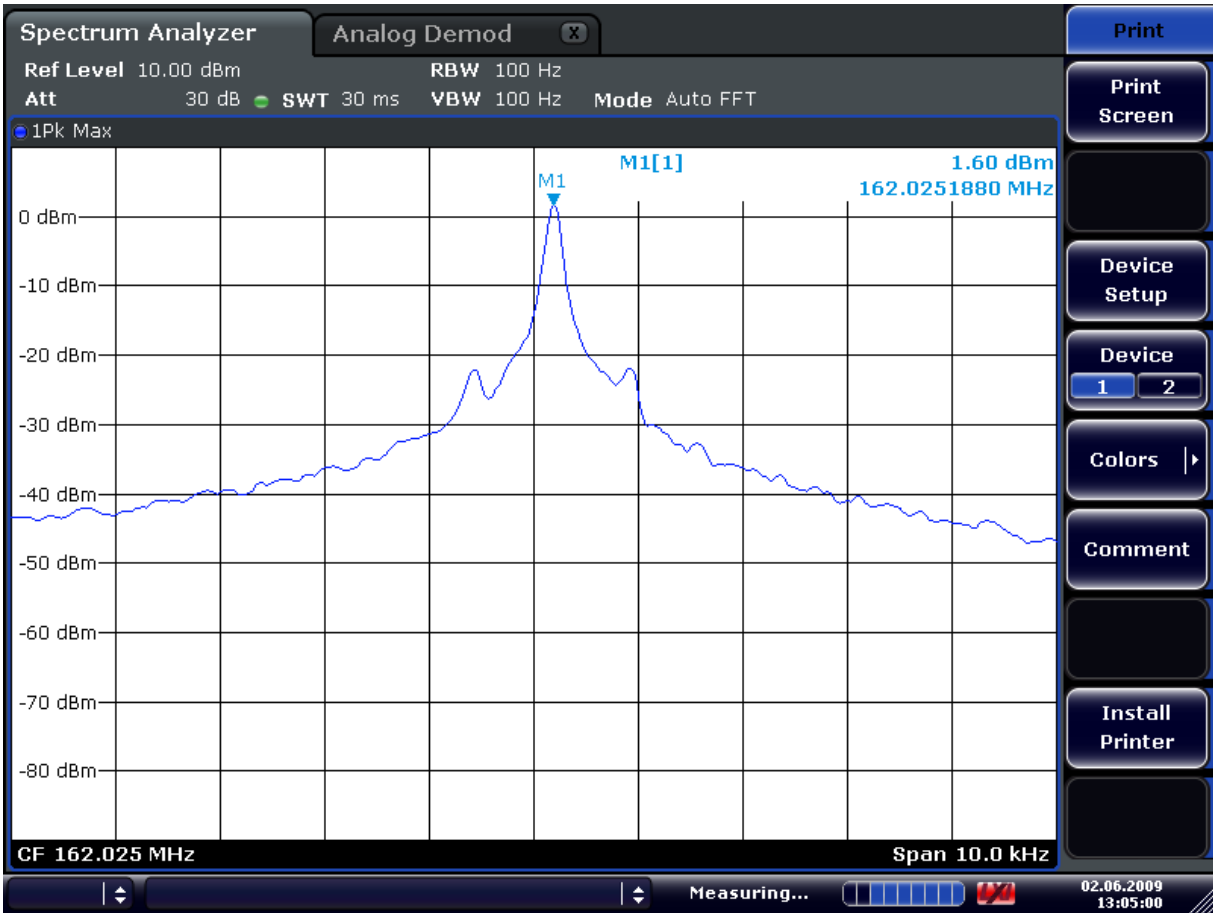
AIS 1: Normal conditions



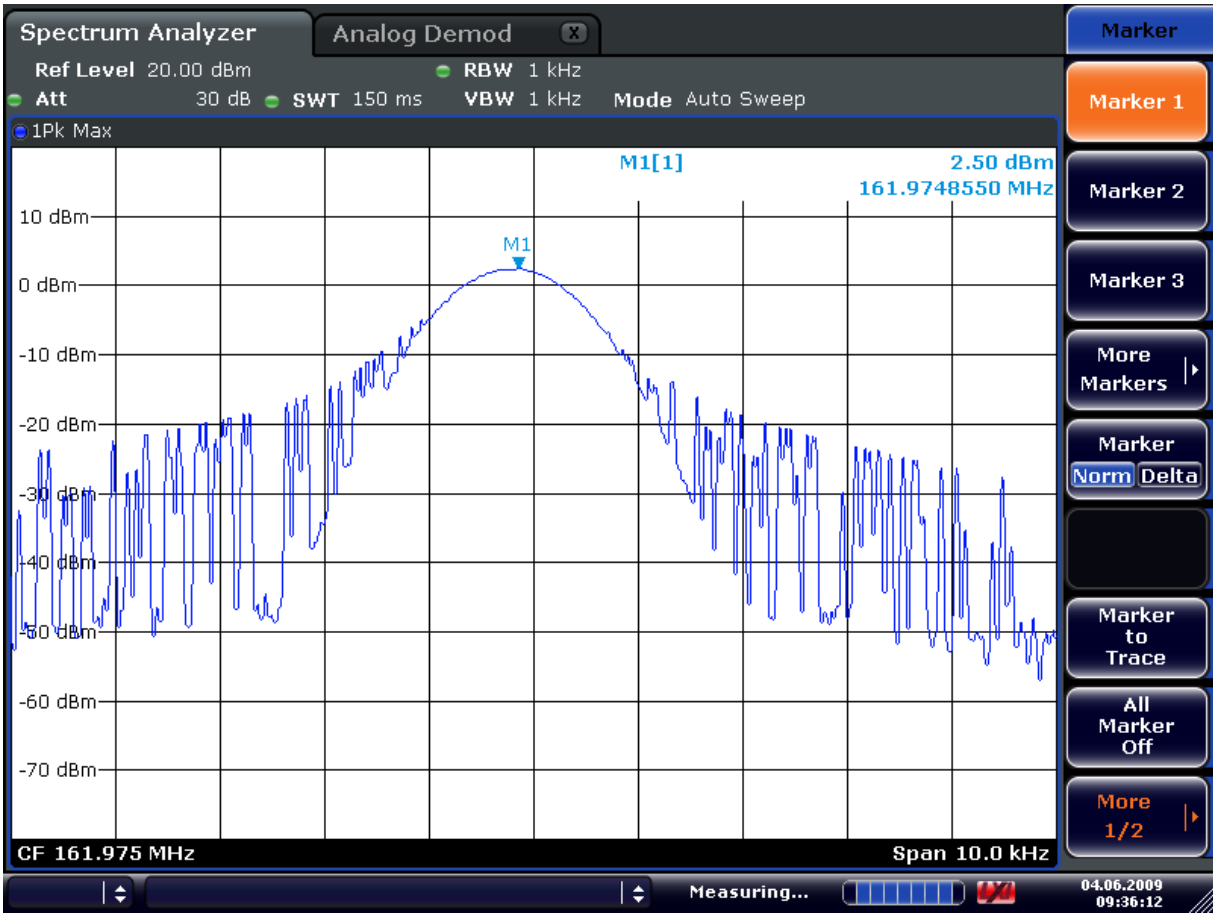
AIS 2: Normal conditions



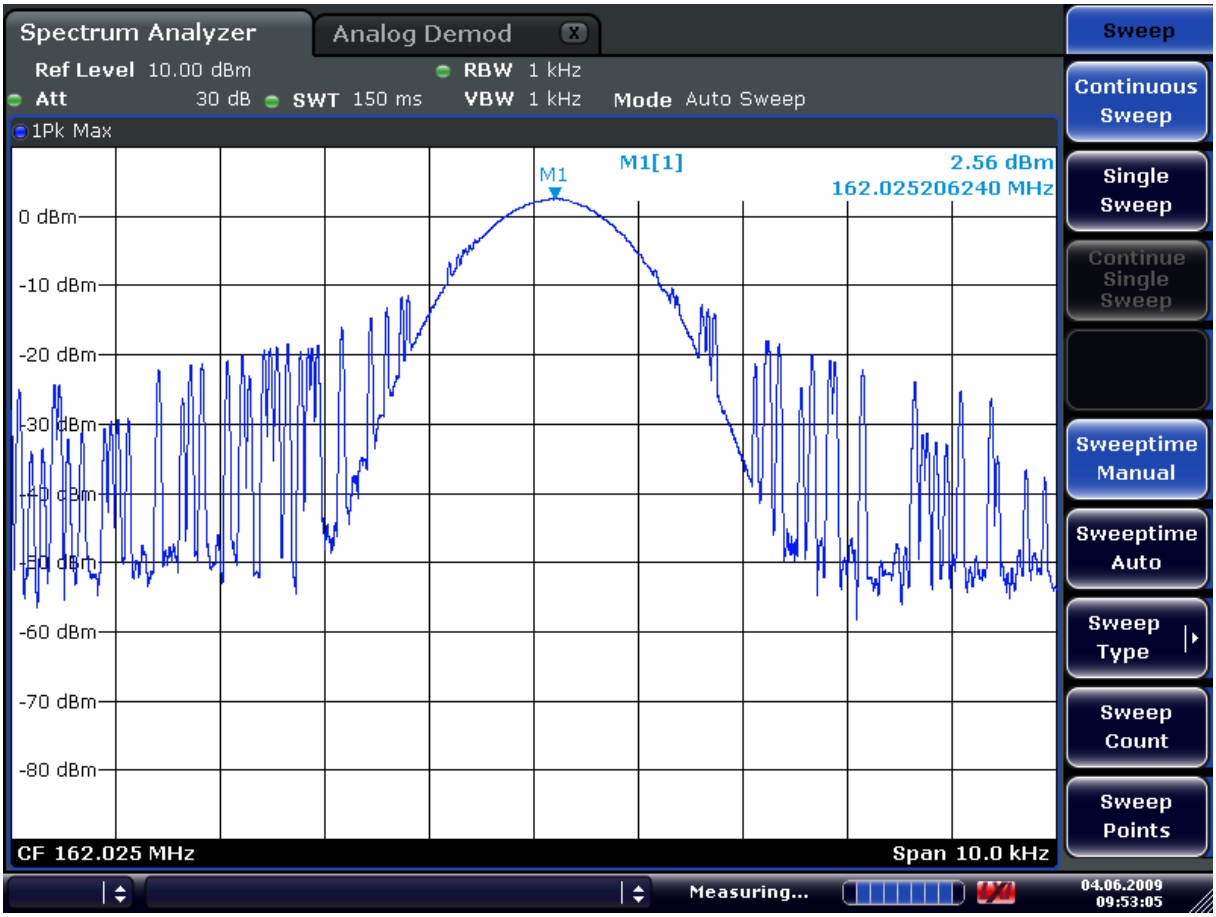
AIS 1: Extreme conditions -20 degrees



AIS 2: Extreme comditions -20 degrees

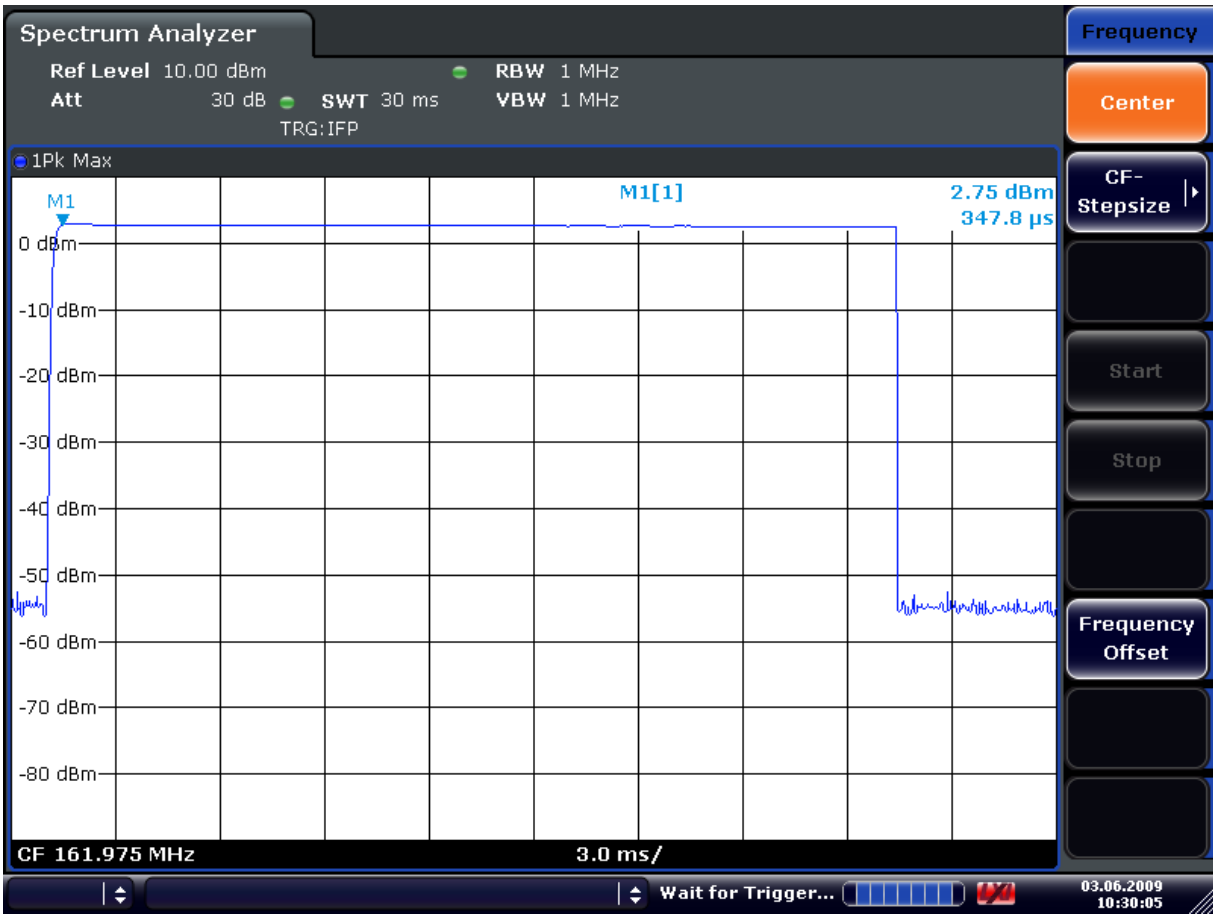


AIS 1: Extreme conditions +55 degrees

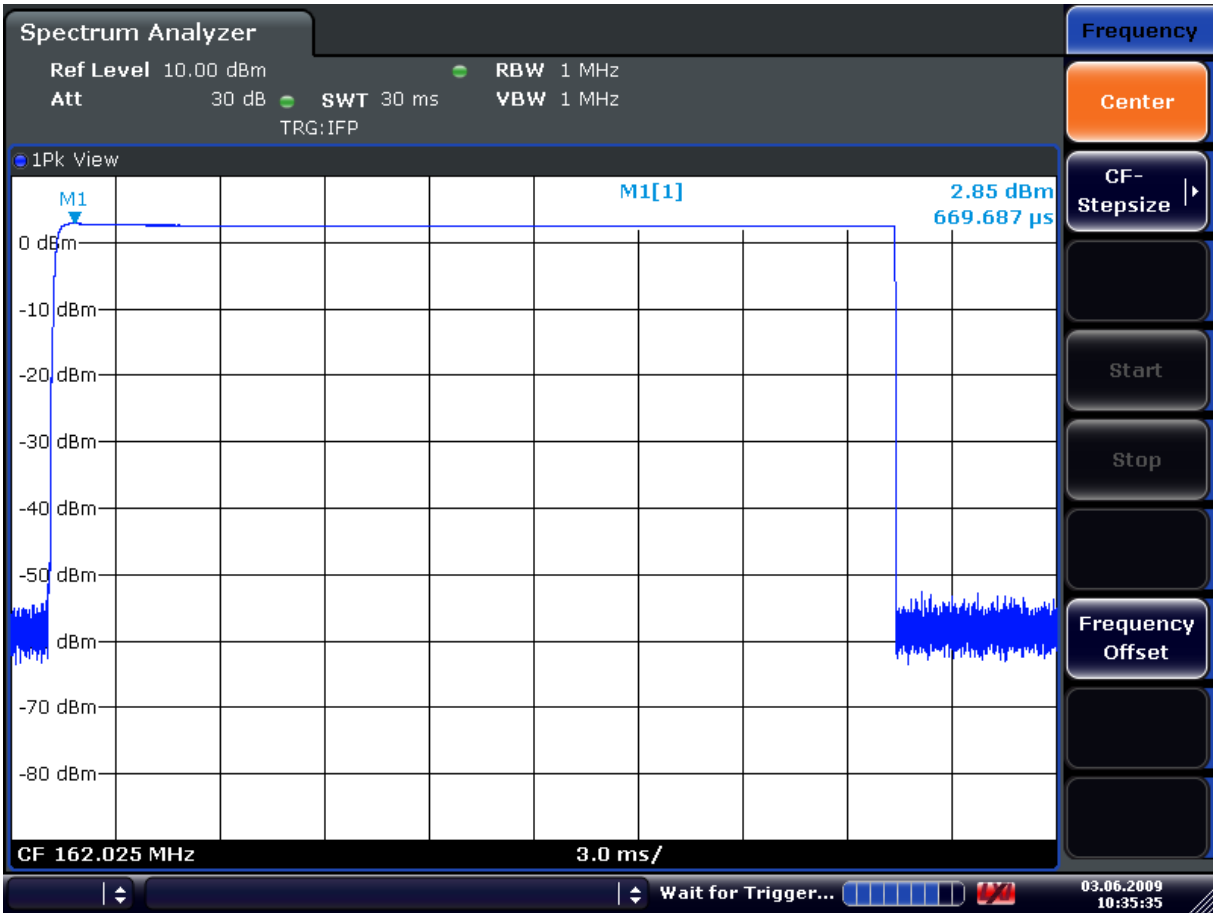


AIS 2: Extreme conditions +55 degrees

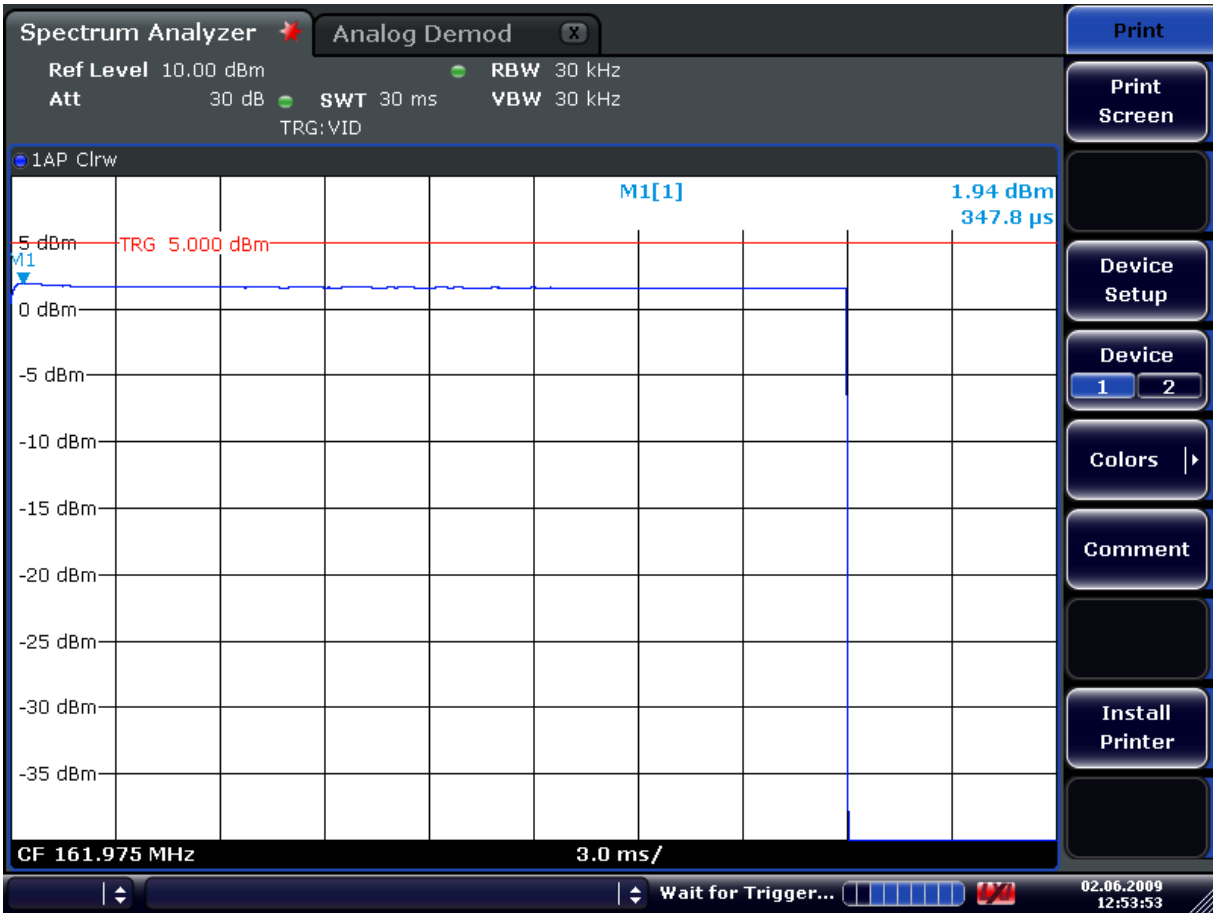
9.2 Conducted power



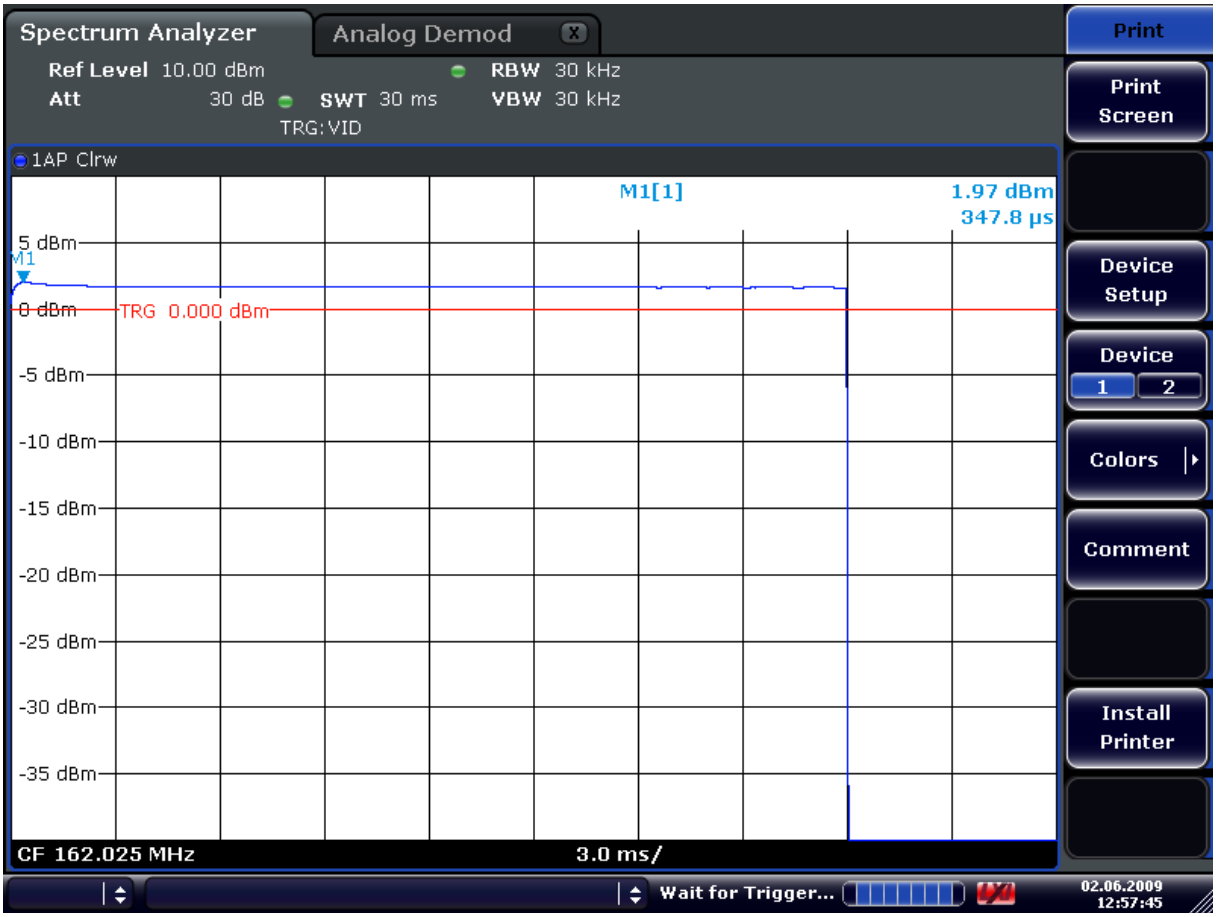
AIS 1: normal conditions



AIS 2: Normal conditions



AIS 1: Extreme conditions, -20 degrees



AIS2: extreme conditions, -20 degrees