

Nemko Comlab AS

Office address: Gåsevikeveien 8, Kjeller
Postal address: P.O.Box 96, N-2027 Kjeller
Telephone: +47 64 84 57 00
Facsimile: +47 64 84 57 05
E-mail: post@comlab.no
http://www.comlab.no
Enterprise no: NO 984 592 418 MVA

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Item tested : Simrad AI 80 / AIS 200 (Kongsberg Seatex)

Equipment type : AIS Transponder

Client : Kongsberg Seatex AS

Tested according to :

**Part of
IEC 60945 Fourth edition 2002-08
Lloyds TA1, part 22.3 2002, (IEC 61000-4-16: ed 1.1 2002-07)**

CONTENTS

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Authorised by :



Kjell G. Haga
Managing Director



Geir Antonsen
Technical Supervisor

The results detailed in this test report are valid only for the particular sample(s) tested and with configuration(s) as implemented during testing.

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| | | |
|-----------|--|-----------|
| 1 | GENERAL INFORMATION | 3 |
| 1.1 | Test Laboratory | 3 |
| 1.2 | Client Information | 3 |
| 1.2.1 | Manufacturer | 3 |
| 2 | TEST INFORMATION | 4 |
| 2.1 | Test Item | 4 |
| 2.2 | Test Environment | 4 |
| 2.2.1 | Normal Test Conditions | 4 |
| 2.3 | Test Period | 4 |
| 2.4 | Standards and Regulations | 4 |
| 2.5 | Test Engineers | 4 |
| 2.6 | Additional information | 4 |
| 2.6.1 | Test Methods | 4 |
| 2.6.2 | Test Equipment | 4 |
| 3 | TEST REPORT SUMMARY | 5 |
| 3.1 | Abbreviations | 5 |
| 4 | OTHER COMMENTS | 6 |
| 4.1 | General: | 6 |
| 4.2 | EUT (Equipment Under Test): | 6 |
| 4.3 | List of ports: | 6 |
| 4.4 | RF disturbance tests: | 6 |
| 4.5 | RF immunity tests: | 6 |
| 4.6 | Performance Criteria | 6 |
| 5 | EMISSION MEASUREMENTS | 7 |
| 5.1 | Radiated Disturbance at Enclosure Port EN 55022 (CISPR 22) | 7 |
| 5.2 | Conducted Emission at DC power Ports. IEC 60945 Clause 9.2 | 8 |
| 6 | IMMUNITY AT ENCLOSURE PORT | 9 |
| 6.1 | Electromagnetic Field Immunity at Enclosure port, IEC 60945 Clause 10, EN 61000-4-3 | 9 |
| 6.2 | Electrostatic Discharge (ESD) Immunity Test. EN 61000-4-2 Main AIS transceiver unit. | 10 |
| 7 | CONDUCTED IMMUNITY | 11 |
| 7.1 | Conducted radio-frequency immunity test at DC power port, IEC 60945, IEC 61000-4-6 | 11 |
| 7.2 | Lloyds TA1, part 22.3 conducted low-frequency immunity test at DC power port, IEC 61000-4-16 | 12 |
| 7.3 | Conducted immunity at signal port, IEC 60945 Clause 10, IEC 61000-4-6. | 13 |
| 7.4 | Electrical Fast Transient/Burst (EFT/B) Immunity test at signal ports IEC 60945 Clause 10.5, IEC 61000-4-4 | 14 |
| 7.5 | Electrical Fast Transient/Burst (EFT/B) Immunity Test at DC port IEC 60945 Clause 10.5, IEC 61000-4-4 | 15 |
| 7.6 | Power supply failure i.e. voltage interruption IEC 60945 Clause 10.8 | 16 |
| 8 | TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS | 17 |
| 9 | PLOT OF EMISSION MEASUREMENTS | 18 |
| 9.1 | Radiated emission 0,15 - 30 MHz. | 18 |
| 9.2 | Radiated emission 30 - 200 MHz (horizontal). | 19 |
| 9.3 | Radiated emission 30 - 200 MHz (vertical). | 20 |
| 9.4 | Radiated emission 200 - 1000 MHz (horizontal). | 21 |
| 9.5 | Radiated emission 200 - 1000 MHz (vertical). | 22 |
| 9.6 | Radiated emission 1000 - 2000 MHz (horizontal). | 23 |
| 9.7 | Radiated emission 1000 - 2000 MHz (vertical). | 24 |
| 9.8 | Conducted emission AI 80 AIS on DC Mains 10-150 kHz. | 25 |
| 9.9 | Conducted emission of DC Mains 0,15 – 30 MHz. | 26 |
| 10 | TEST SET-UP | 27 |
| 11 | PHOTO OF TEST SET UP | 28 |

1 GENERAL INFORMATION

1.1 Test Laboratory

Name : Nemko Comlab AS
Address : Gåsevikveien 8, P.O.Box 96
N-2027 Kjeller, Norway
Telephone : +47 64 84 57 00
Fax : +47 64 84 57 05
E-mail : Post@comlab.no
Managing Director: Kjell G. Haga

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1.2 Client Information

Name : Kongsberg Seatex AS
Address : Pirsenteret
N-7462 Trondheim

Telephone : +47 73 54 55 00
Fax : +47 73 51 50 20

Contact:

Name : Sigfred Avdal
E-mail : sigfred.avdal@kongsberg.com

1.2.1 Manufacturer

Same as Client

2 TEST INFORMATION

2.1 Test Item

Name : Simrad AI 80 / AIS 200 (Kongsberg Seatex)
Model/version : AI 80 v.1.0

Remarks

The EUT consists of 2 parts; EUT 1 (AI 80 Class A Mobile Starion, Part Id: A101-11_1) and EUT 2 (Simrad AI80 MKD, Part Id: A101-12_1) see page 27 for test setup. The EUT was powered by a 24 VDC power supply.

For ESD testing the first and second versions showed some upset that required undesired manual intervention. The third sample used the electronics from "Radio testing" installed in slightly upgraded version of mechanical case. "Watch dog" facilities were used to ensure automatic reboot for the cases of upset.

2.2 Test Environment

2.2.1 Normal Test Conditions

| | |
|----------------------|------------------|
| Temperature: | 22,0-24,5 °C |
| Relative humidity: | 30,6-52,31 % |
| Normal test voltage: | 234,8-239,5 V AC |
| Main frequency: | 50 Hz |

The values are the limits registered during the test period.

2.3 Test Period

Test item received date: 14.6.2004
Test period: From 09.08.2004 to 27.08.2004

2.4 Standards and Regulations

IEC 60945 Fourth edition 2002-08
Lloyds TA1, part 22.3 2002, (IEC 61000-4-16: ed 1.1 2002-07)

2.5 Test Engineers

Tore Løvlien, Per Magne Tveiten

2.6 Additional information

2.6.1 Test Methods

Described in relevant basic standards.

2.6.2 Test Equipment

List of used test equipment, see page no. 18

3 TEST REPORT SUMMARY

3.1 Abbreviations

P Passed, the equipment fulfils the requirement

F Failed, the equipment does not fulfil the requirement

NA Not applicable, the requirement is not applicable

NT Not tested, the test is not performed even though the requirement is relevant

Test Summary

| Basic Standard | Port | Measurement | Result (Pass/Fail) |
|---|----------------|---|--------------------|
| IEC 60945 Clause 9.2 | DC port | Conducted emission | P |
| IEC 60945 Clause 9.3 | Enclosure port | Radiated emission | P |
| IEC 60945 Clause 10.3 | DC port | Immunity to conducted radio frequency disturbance | P |
| EIT 60945 Clause 10.3 | Signal port | Immunity to conducted radio frequency disturbance | P |
| IEC 60945 Clause 10.5 IEC 61000-4-4 (1995) | Signal port | Electrical fast transient/burst (EFT/B) immunity test | P |
| IEC 60945 Clause 10.5 IEC 61000-4-4 (1995) | DC port | Electrical fast transient/burst (EFT/B) immunity test | P |
| IEC 60945 Clause 10.4 | Enclosure port | Immunity to radiated radio frequency | P |
| IEC 60945 Clause 10.8 | DC | Power Failure i.e. voltage interruption, 60s | P |
| IEC 60945 Clause 10.9 IEC 61000-4-2 (1995) | Enclosure | Electrostatic discharge (ESD) immunity test | P |
| Lloyds TA1, part 22.3 IEC 61000-4-16 | DC | Conducted low frequency interference 50-10 kHz | P |

4 OTHER COMMENTS

4.1 General:

The RF field tests are performed in a 10 meter semi anechoic room.

4.2 EUT (Equipment Under Test):

The EUT is an AIS transceiver for maritime use consisting of a Radio Module, EUT 1 (Simrad AI 80 or Kongsberg Seatex AIS 200) and Display/Keyboard unit, EUT 2 (Simrad AI80 MKD). See page 27 for test set-up.

4.3 List of ports:

| | |
|---------------|-------------------------------------|
| Signal ports: | Data RS 422 VHF GPS Remote |
| Power ports: | Screened 24 V DC |

4.4 RF disturbance tests:

During the RF field emission test the EUT was rotated in the test chamber and measured with the test antenna both vertical and horizontal.

4.5 RF immunity tests:

The RF field immunity tests are performed at 3 meter distance with absorbers on the floor between the transmitting antenna and the EUT. A log periodic antenna is used in the frequency range 80 - 1000 MHz. Horn antenna is used above 1 GHz.

During the RF field immunity test the EUT was exposed for both vertical and horizontal field. Due to the construction of the EUT 1 and EUT 2 only the rear panel of the AI 80 Mobile Station (with the terminals for connection of data) and the front panel on the Simrad AI 80 MKD was exposed for the E-field.

4.6 Performance Criteria

Special software and ancillary equipment for monitoring of the EUT during immunity tests was supplied by the client

Performance criteria 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 criteria 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.

Performance criteria C

Temporary degradation or loss of function or performance is allowed during the test, provided the function is self-recoverable, or can be restored at the end of the test by the operation of the controls, as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

5 EMISSION MEASUREMENTS

5.1 Radiated Disturbance at Enclosure Port

EN 55022 (CISPR 22)

Test set up:

The test is performed in a semi anechoic chamber with a size of 22 × 13 × 9,5 meters (l × w × h). The EUT was placed on a table with a height of 80 cm. on a turn table. The receiver antenna height was varied between 1 and 4 meters, both with horizontal and vertical polarisation. The EUT was rotated for 360° to maximise the emission. The set-up was according to IEC 60945 Clause 9.3.2. See test set up and photo on pages 27 and 28. The vertical ferrite tubes were not used for emission measurements (only for immunity tests).

Cable configuration during test:

Investigation of the unwanted emission was made with the measuring receiver in "Overview mode". The 5 m cable between the AI80 Mobile Station (EUT 1) and the Simrad AI 80 MKD (EUT 2) was horizontally bundled on the table. Ferrite tubes were mounted on the power cord on the floor.

EUT mode during test:

Normal operation but there was no ancillary equipment connected.

| Frequency (MHz) | Detector / Polarisation | Level (dB μ V/m) | Result (Pass/Fail) |
|--------------------------------|-------------------------|----------------------|--------------------|
| 159,74 | Peak / HP | 26,0 | P |
| 160,00 | Peak /HP | 21,0 | P |
| 163,84 | Peak /HP | 29,0 | P |
| All other 0,15 - 2000 | Peak QP/VP | < limit | P |
| Limits: | | | |
| 0,15 – 0,3 | Q-peak | 80 – 52 | |
| 0,3 - 30 | Q-peak | 52 - 34 | |
| 30 - 156 | Q-peak | 54 | |
| 156 – 165 | Peak | 30 | |
| 165 -2000 | Q-peak | 54 | |
| Measurement Uncertainty | | | |
| 0,15 - 30 | | +1,8/-2,1 dB | |
| 30-200 MHz | | ± 4,7 dB | |
| 200-1000 MHz | | ± 4,8 dB | |

Results:

See frequency plot on page 18 to 24.

Test Equipment Used: 36, 41, 42 ,43, 44, 45 and 48.

5.2 Conducted Emission at DC power Ports.**IEC 60945 Clause 9.2****Test set up:**

The test is performed in a shielded chamber with a size of >2x2 meters.
The EUT was mounted on, and bonded to an earth plane of dimension 1x2 m. The measuring equipment was bonded to the same earth plane.

EMC receiver with the following settings:

| Frequency | | | Settings | | |
|-----------|----------|---------|----------|----------|-----------|
| Start | Stop | Step | IF BW | Detector | Meas Time |
| 0,01 MHz | 0,15 MHz | 100 Hz | 200 Hz | Max peak | 20 ms |
| 0.150 MHz | 30.0 MHz | 4.5 kHz | 9 kHz | Max peak | 20 mS |

Cable configuration during test:

The test set up was according to Clause 9.2.2 IEC 60945. The DC cable was screened and 0,8 meter in length.

EUT mode during test:

EUT was in normal mode during the test.

Conducted Emission at DC power Port:

| Frequency (MHz) | Detector (Peak/ Q-peak/Average) | Level (dB μ V) | Result (Pass/Fail) |
|--------------------------------|---------------------------------|-------------------------|--------------------|
| 0,324353 | QP | 49,5 | P |
| 7,972 | QP | 42,0 | P |
| 11,76 | QP | 46,4 | P |
| All other 0,01 - 30 | QP | < limit | P |
| Limits: | | | |
| 0,01 – 0,15 | QP | 96 – 50 | |
| 0,15 – 0,35 | QP | 60 – 50 | |
| 0,35 – 30,0 | QP | 50 | |
| Measurement Uncertainty | | + 2.9 / - 4.1 dB | |

Results:

See frequency plot on page 25 to 26.

Test Equipment Used: 23, 24 and 25.

6 IMMUNITY AT ENCLOSURE PORT

6.1 Electromagnetic Field Immunity at Enclosure port, IEC 60945 Clause 10, 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 | 1000 MHz | 1 % | 80 % | 400 Hz | 10 V/m |
| 1000 MHz | 2000 MHz | 1 % | 80 % | 400 Hz | (-0/+6dB) |

Dwell time 1,6 sec.

Exclusion band (if any):

The RF signals from and to the EUT was led out of the test chamber, so no exclusion band was used.

Cable configuration during test:

Ferrites were used so only 100 cm. of the cables were exposed for RF field.

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. Due to the construction of the EUT 1 and EUT 2 only the rear panel of the AI 80 Mobile Station (with the terminals for connection of data) and the front panel on the Simrad AI 80 MKD was exposed for the E-field. See photo page 28.

EUT mode during test:

Normal operation.

Test Level:

Test level was 10 V/m

Performance criteria for EUT:

During test: Performance criteria A (see page 6 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 | Front side HP/VP | 10 | 1) | 1) |
| Measurement Uncertainty (generating disturbing signal): | | | +2,1 / -2,4 dB | |

Note:

1) Within the performance criteria described above.

Test Equipment Used: 7, 9, 26, 27, 32 and 46.

6.2 Electrostatic Discharge (ESD) Immunity Test. Main AIS transceiver unit.

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, | +/- 2, 4, 6 | CD | > 10 | P |
| DA | EUT Enclosure, all sides | No susceptible plastic parts exposed | | | |
| IA | Horizontal Coupling Plane (HCP) | +/- 2, 4, 6 | CD | > 10 | P |
| IA | Vertical Coupling Plane (VCP) | +/- 2, 4, 6 | CD | > 10 | P |

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:

Coaxial and data cables were connected to the EUT during the test.

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 mm² 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 1.5 mm 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.

The unit was grounded to HCP by the main bonding plate of the unit.

EUT mode during test:

A radio communication link was established between the EUT and an "AIS auxiliary unit". During the exposure sequence the auxiliary PC-equipment logged message throughput.

Test Level:

The selected test levels were according to EN 60945.

Performance criteria for EUT:

After each exposure: No user noticeable loss of the communication link.
No unintentional transmission (during or after each exposure)

After the test: Operate as intended.
No loss of function
No degradation of performance
No loss of stored data or user programmable functions

Remarks:

The initial and second test sample showed susceptibility.

A Third set of circuit boards (The boards from Radio parameters test) was installed in slightly modified version of chassis/cabinet.

Results:

"Watch-dog" facilities in the programmes ensured automatic rapid reboot for the cases of upset.
The associated auxiliary PC showed no unintentional transmission.

Test Equipment Used:.28 and auxiliary equipment from the manufacturer

7 CONDUCTED IMMUNITY

7.1 Conducted radio-frequency immunity test at DC power port, IEC 60945, IEC 61000-4-6

Test signal:

Test generator settings:

| Frequency | | | Settings | | |
|-----------|--------|-------|------------|-----------|-------------------------|
| Start | Stop | Step | Modulation | Mod.freq. | Voltage |
| 0,15 MHz | 80 MHz | 1.0 % | 80 % | 400 Hz | 3/10 V (EMF) Note 1) |

Note 1) 10 V at spot frequencies: 2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 MHz.

Dwell time 1,6 sec.

Exclusion band (if any):

No exclusion band.

Cable configuration during test:

According to IEC 61000-4-6 with EUT 0,1 m above ground reference plane and with cable length of 0,2 m from CDN to EUT. See page 28 for photo of test set-up.

Test method:

EUT was tested as tabletop equipment, and the RF injection was made with coupling networks. A ground plane was placed on a wooden table with a height of 80 cm, and the coupling network was placed on the ground plane. The EUT was placed on a non-conducting stand with a height of 10 cm. above the ground plane.

EUT mode during test:

Normal operation.

Test Level:

The test level was 3 V (EMF) in the range 0,15 – 80 MHz and 10 V on spot frequencies, see above.

Performance criteria for EUT:

During test: Performance criteria A (see page 6 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) | Port | Test method | Voltage (V EMF) | Performance (se Note) | |
|--|---------------|------------------|-----------------|-------------------------|-----------------------|
| | | | | During test | After test |
| 0.150 - 80 | DC power port | Coupling network | 3/10 | 1) | 1) |
| Measurement Uncertainty (generating disturbing signal): | | | | 150kHz – 26 MHz: | +2,5 / -2,8 dB |
| | | | | 26 MHz – 80 MHz | +3,3 / -3,7 dB |

Note:

- 1) Within the performance criteria described above.

Test Equipment Used: 1, 5, 6 and 47.

7.2 Lloyds TA1, part 22.3 conducted low-frequency immunity test at DC power port, IEC 61000-4-16**Test signal:**

Test generator settings:

| Frequency | | | Settings | | |
|-----------|--------|-------|-------------|-----------|-----------|
| Start | Stop | Sweep | Modulation | Mod.freq. | Voltage |
| 50 Hz | 10 kHz | 20 s | Unmodulated | - | 3 V (EMF) |

Exclusion band (if any):

No exclusion band.

Cable configuration during test:

According to IEC 61000-4-16 with EUT 0,1 m above ground reference plane and with cable length of 0,2 m from DC power equipment to EUT.

Test method:

EUT was tested as tabletop equipment, and the RF injection was made with a Wavetek function generator type 90 (LT 5229), and a Comlab DC power equipment (LR1474). A ground plane was placed on a wooden table with a height of 80 cm, and the coupling network was placed on the ground plane. The EUT was placed on a non-conducting stand with a height of 10 cm. above the ground plane. This test is not under the scope of Nemko Comlab's accreditation.

EUT mode during test:

Normal operation.

Test Level:

The test level was 3 V (EMF).

Performance criteria for EUT:

During test: Performance criteria A (see page 6 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 (Hz) | Port | Test method | Voltage (V EMF) | Performance (se Note) | |
|----------------|---------------|------------------|-----------------|-----------------------|------------|
| | | | | During test | After test |
| 50 – 10 kHz | DC power port | Coupling network | 3 | 1) | 1) |

Note:

1) Within the performance criteria described above.

Test Equipment Used: 11, Wavetek function generator type 90 (LT 5229) and Comlab DC power equipment (LR1474)

7.3 Conducted immunity at signal port, IEC 60945 Clause 10, IEC 61000-4-6.**Test signal:**

Test generator settings:

| Frequency | | | Settings | | |
|-----------|--------|-------|------------|-----------|-------------------------|
| Start | Stop | Step | Modulation | Mod.freq. | Voltage |
| 0,15 MHz | 80 MHz | 1.0 % | 80 % | 400 Hz | 3/10 V (EMF) Note 1) |

Note 1) 10 V at spot frequencies: 2, 3, 4, 6.2, 8.2, 12.6 16.5, 18.8, 22 and 25 MHz.

Dwell time 1,6 sec.

Exclusion band (if any):

No exclusion band.

Cable configuration during test:

According to IEC 61000-4-6 with EUT 0,1 m above ground reference plane and with cable length of 0,2 m from injection clamp to EUT. See page 28 for photo of test set-up.

Test method:

EUT was tested as tabletop equipment, and the RF injection was made with injection clamp. A ground plane was placed on a wooden table with a height of 80 cm, and the injection clamp was placed on the ground plane. The EUT was placed on a non-conducting stand with a height of 10 cm. above the ground plane.

EUT mode during test:

Normal operation.

Test Level:

The test level was 3 V (EMF) in the range 0,15 – 80 MHz and 10 V on spot frequencies, see above.

Performance criteria for EUT:

During test: Performance criteria A (see page 6 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) | Port | Test method | Voltage (V EMF) | Performance (se Note) | |
|--|--------------|-----------------|-----------------|-------------------------|-----------------------|
| | | | | During test | After test |
| 0.150 - 80 | Signal ports | Injection clamp | 3/10 | 1) | 1) |
| Measurement Uncertainty (generating disturbing signal): | | | | 150kHz – 26 MHz: | +2,5 / -2,8 dB |
| | | | | 26 MHz – 80 MHz | +3,3 / -3,7 dB |

Note:

1) Within the performance criteria described above.

Test Equipment Used: 1, 6, 12 and 47.

7.4 Electrical Fast Transient/Burst (EFT/B) Immunity test at signal ports IEC 60945 Clause 10.5, IEC 61000-4-4

The Electrical Fast Transients were applied as follows:

Signal port (capacitive clamp):

| Test voltage peak (kV) | Repetition rate (kHz) | Burst duration (ms) | Burst period (ms) | Test period (min) | Result |
|-----------------------------|----------------------------|--------------------------|------------------------|------------------------|--------|
| ±1 | 5 | 15 | 300 | 3 | P |

Comments: The EUT was tested according to IEC 61000-4-4 clause 7.2.2.

Cable configuration during test:

The cables from the EUT were isolated from the Horizontal Coupling Plane (HCP) by positioning them on a wooden table with a height of 80 cm.

Test set-up:

The test set-up was according to IEC 61000-4-4 clause 7.2. 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 mm² thick copper cable. The EFT/B-generator including the coupling/decoupling network was placed on the GRP and connected to the GRP with a braided copper band (which provides minimum inductance).

The EUT was tested as a TABLE TOP EQUIPMENT and placed on a wooden table (0.8 m high) located on the GRP during the test.

Test on the signal port was performed by applying the EFT/B pulses to the capacitive coupling clamp. The cable was stretched through the capacitive clamp, and the clamp was closed as much as possible during the test. The clamp was located on a secondary GRP (1.5 mm thick aluminium 0.8mx1.6m). The HV-cable from the EFT/B-generator was connected to the end of the clamp nearest to the EUT.

EUT mode during test:

Normal operation.

Test Level:

The test level for communication / signal ports selected on basis of IEC 60945 is ±1kV.

Performance criteria for EUT:

After each exposure: Performance criteria B (see page 6 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:

No change in state was noticed. A performance check at the conclusion of the total test showed that no stored data or user control functions were lost, and the EUT was operating as intended. No unintentional transmissions were observed.

Test Equipment Used: 16 and 40.

7.5 Electrical Fast Transient/Burst (EFT/B) Immunity Test at DC port IEC 60945 Clause 10.5, IEC 61000-4-4

The Electrical Fast Transients were applied as follows:

DC power supply input port (coupling network):

| Test voltage peak (kV) | Repetition rate (kHz) | Burst duration (ms) | Burst period (ms) | Test period (min) | Result |
|-----------------------------|----------------------------|--------------------------|------------------------|------------------------|--------|
| ±1, ±2 | 5 | 15 | 300 | 3 | P |

Comments: The EUT was tested according to IEC 61000-4-4 clause 7.2.2.

Cable configuration during test:

The cables from the EUT were isolated from the Horizontal Coupling Plane (HCP) by positioning them on a wooden table with a height of 80 cm.

Test set-up:

The test set-up was according to IEC 61000-4-4 clause 7.2. 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 mm² thick copper cable. The EFT/B-generator including the coupling/decoupling network was placed on the GRP and connected to the GRP with a braided copper band (which provides minimum inductance).

The EUT was tested as a TABLE TOP EQUIPMENT and placed on a wooden table (0.8 m high) located on the GRP during the test.

EUT mode during test:

Normal operation.

Test Level:

The test is not a part of IEC 60945, but applicable according to other maritime standards. Level is ±1 kV but test level was up to ±2kV for easily detecting of any malfunction.

Performance criteria for EUT:

After each exposure: Performance criteria B (see page 6 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:

No change in state was noticed. A performance check at the conclusion of the total test showed that no stored data or user control functions were lost, and the EUT was operating as intended. No unintentional transmissions were observed.

Test Equipment Used: 16.

7.6 Power supply failure i.e. voltage interruption**IEC 60945 Clause 10.8**

The different type of disturbances were applied as follows on the DC power supply input port:

Voltage interruptions:

| Operation voltage | Interrupted voltage | Duration |
|-------------------|---------------------|------------|
| 24 Volt DC | 0V | 60 seconds |

3 sequences

The supply lead was disconnected. IEC 60945 does not specify pull down of DC supply during this test.

Test Set-up:

The test set-up was according to IEC 61000-4-11, clause 7

EUT mode during test:

Normal operation.

Test Level:

The test level was 100% 60 Seconds

Performance criteria for EUT:

During the test: N.A.

After the test: Resume operating and operate as intended.
No loss of functions.
No degradation of performance.
No loss of stored data or user programmable functions.

Results:

The results comply with the performance criteria described above during and after the test.

Comments:

The EUT resumed operating.

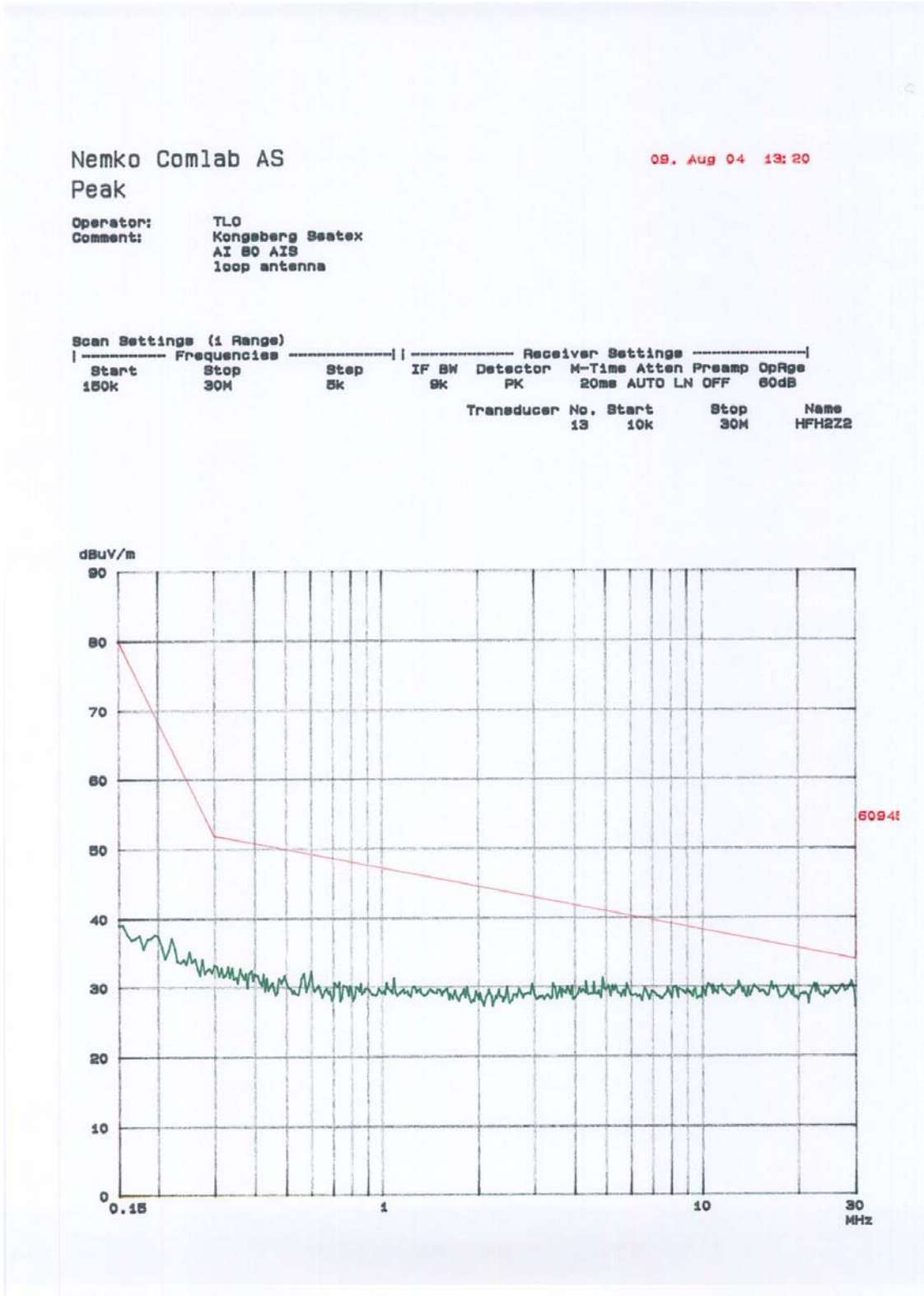
8 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

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.

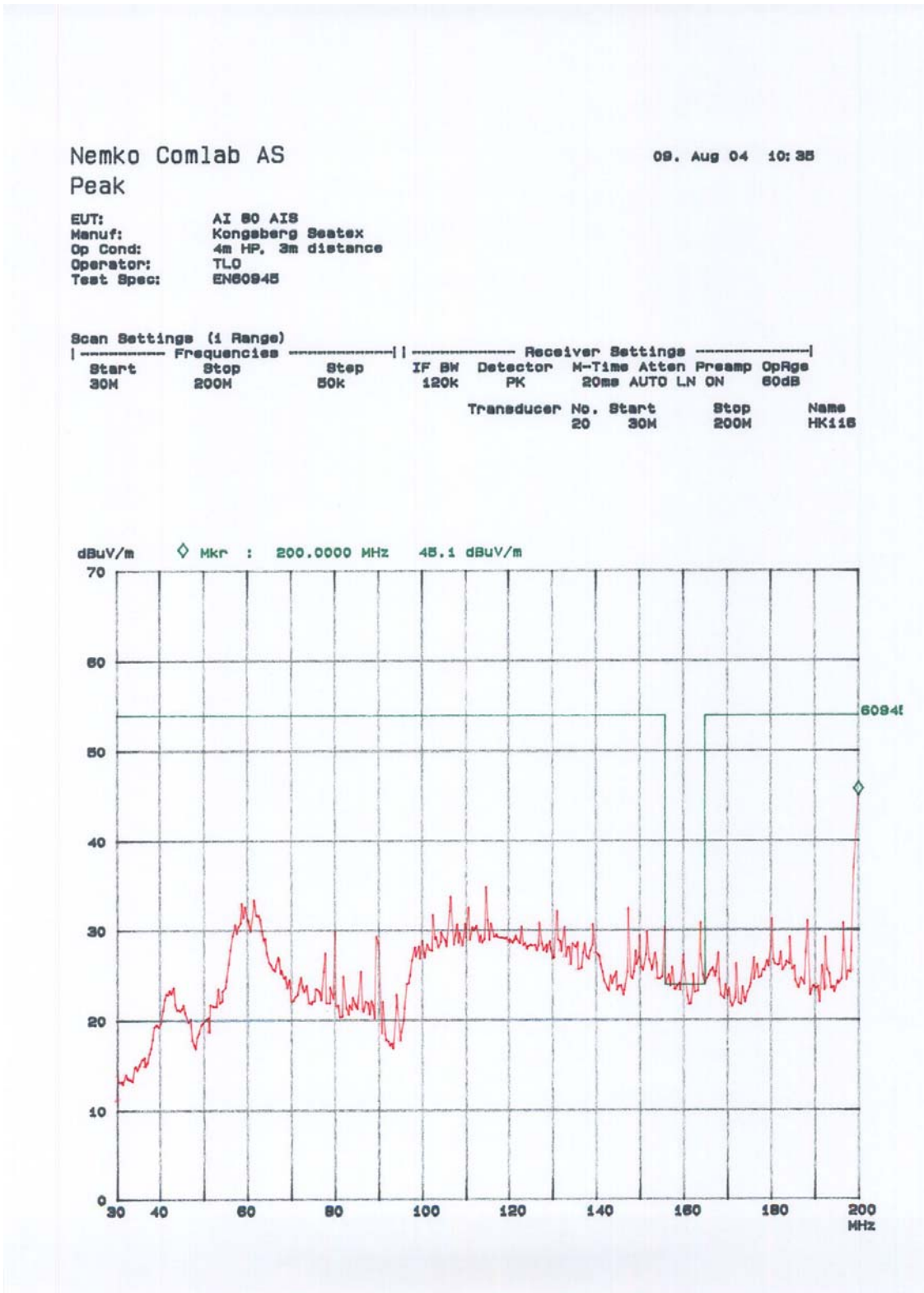
| No | Instrument/Ancillary | Type | Manufacturer | Ref. No. |
|----|-----------------------------|---------------|--------------------|--------------|
| 1 | Amplifier | 25A100M1 | Amplifier Research | LR 1155 |
| 2 | Test fixture | | B&K | |
| 3 | Measuring Amp. w/microphone | 2606 | B&K | LT 0508 |
| 4 | Power Amp. | 2706 | B&K | LT 5002 |
| 5 | Coupling/decoupling network | FCC-801-M3-16 | Fischer | LR1314 |
| 6 | Power meter | URV 5 | R&S | LR192 |
| 7 | Antenna | AT4002 | AR | RL 1451 |
| 8 | Field probe | FP4000 | Amplifier Research | LR 1352 |
| 9 | System Interface | SI-200 | EMC Automation | LR 1353 |
| 10 | Switch Module | SM-1 | EMC Automation | LR 1153 |
| 11 | Power supply | D100 | Farnell | LT 5149 |
| 12 | Current probe (injection) | F-120-9 | Fischer | LR 1316 |
| 13 | Current probe | F-33-2 | Fischer | LR 1315 |
| 14 | Coupling/decoupling network | FCC-801-M2-16 | Fischer | LR 1312 |
| 15 | Coupling/decoupling network | FCC-801-T2 | Fischer | LR 1320 |
| 16 | EFT/B generator | PEFT Junior | Haefely | LR 1297 |
| 17 | Line Interference tester | PLINE 1610 | Haefely | LR 1298 |
| 18 | Surge tester | PSURGE | Haefely | LR 1307 |
| 19 | Plotter | HP 7475A | Hewlett Packard | LR 1063 |
| 20 | Audio Analyser | 3582A | HP | LR 1019 |
| 21 | Spectrum Analyser | HP8561B | HP | LR 1085 |
| 22 | Radiocom. Analyser | CMD60 | R&S | LR 1335 |
| 23 | Test Receiver | ESAI | R&S | LR 1089/1090 |
| 24 | Pulse Limiter | ESH3-Z2 | R&S | LR 1074 |
| 25 | AMN | ESH3-Z5 | R&S | LR 1076 |
| 26 | Antenna | HL 023A1 | R&S | LR 282 |
| 27 | Generator | SMT 03 | R&S | LR 1230 |
| 28 | ESD generator | NSG435 | Schaffner | LR 1281 |
| 29 | T-ISN | NTFM8132 | Schwarzbeck | LR 1254 |
| 30 | Cable | RG223 | Suhner | No. 1 |
| 31 | GTEM | 5311 | EMCO | LR 1171 |
| 32 | Amplifier | 500W AF500 | Amplifier Research | LR 1354 |
| 33 | Generator, AF | Mod. 23 | Wavetek | LT 5142 |
| 34 | Radiocom. Analyser | CMTA | R&S | LR 1047 |
| 35 | Radiocom. Analyser | CMTA | R&S | LR 1113 |
| 36 | Amplifier | 8449B | HP | LR1322 |
| 37 | Coupling network | IP6.2 | Haefely | LR 1305 |
| 38 | Decoupling network | DEC1A | Haefely | LR 1306 |
| 39 | Radiocom. Analyser | CMTA | R&S | LR 1087 |
| 40 | Coupling Clamp | IP4A | Haefely | LR 1301 |
| 41 | Test receiver | ESN | R&S | LR1237 |
| 42 | Antenna | HK116 | R&S | LR1260 |
| 43 | Antenna | HL223 | R&S | LR1261 |
| 44 | Amplifier | 10855A | hp | LR1445 |
| 45 | Antenna loop | HFH 2-Z2 | R&S | LR 285 |
| 46 | Amplifier | 25S1GAA | AR | LR1432 |
| 47 | Generator | SME03 | R&S | LR1238 |
| 48 | Antenna | 3115 | EMCO | LR1330 |

9 PLOT OF EMISSION MEASUREMENTS

9.1 Radiated emission 0,15 - 30 MHz.



9.2 Radiated emission 30 - 200 MHz (horizontal).



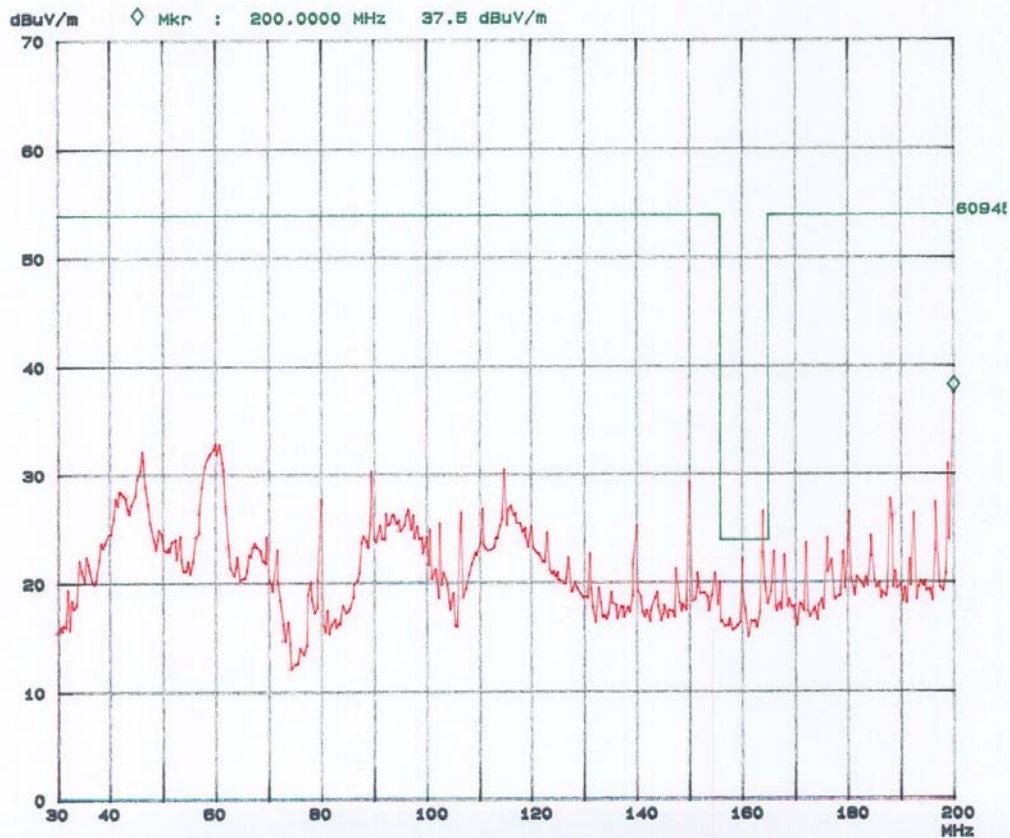
9.3 Radiated emission 30 - 200 MHz (vertical).

Nemko Comlab AS
Peak

09. Aug 04 10:45

EUT: AI 80 AIS
Manuf: Kongsberg Seatex
Op Cond: 1m VP, 3m distance
Operator: TLO
Test Spec: EN50945

| Scan Settings (1 Range) | | | Receiver Settings | | | | | |
|-------------------------|------|------------|-------------------|----------|--------|-------|--------|-------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 30M | 200M | 50k | 120k | PK | 20ms | AUTO | LN ON | 60dB |
| | | Transducer | No. | Start | Stop | Name | | |
| | | | 20 | 30M | 200M | HK118 | | |



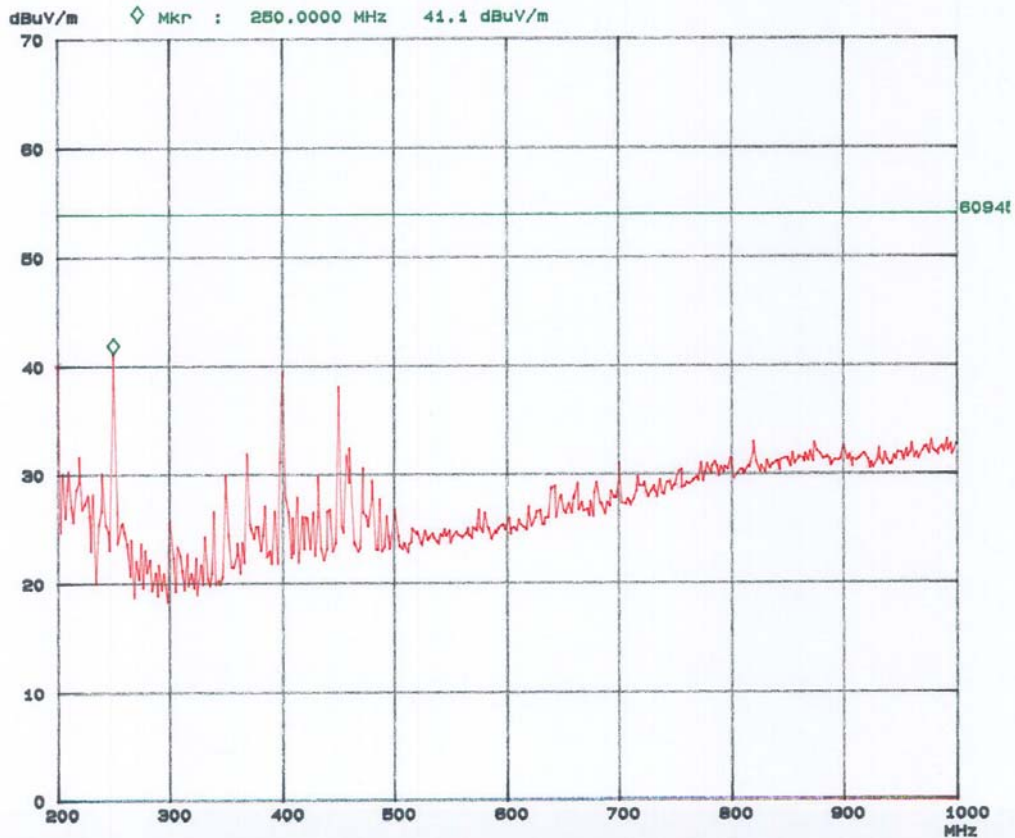
9.4 Radiated emission 200 - 1000 MHz (horizontal).

Nemko Comlab AS
Peak

09. Aug 04 12:16

EUT: AI 80 AIS
Manuf: Kongberg Seatex
Op Cond: 4m HP, 3m distance
Operator: TLO
Test Spec: EN60945

| Scan Settings (1 Range) | | | Receiver Settings | | | | | |
|-------------------------|-------|-------|-------------------|----------|--------|-------|--------|-------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 200M | 1000M | 50k | 120k | PK | 20ms | AUTO | LN ON | 60dB |
| Transducer | No. | Start | Stop | Name | | | | |
| | 21 | 200M | 1000M | HL223 | | | | |



9.5 Radiated emission 200 - 1000 MHz (vertical).

Nemko Comlab AS
Peak

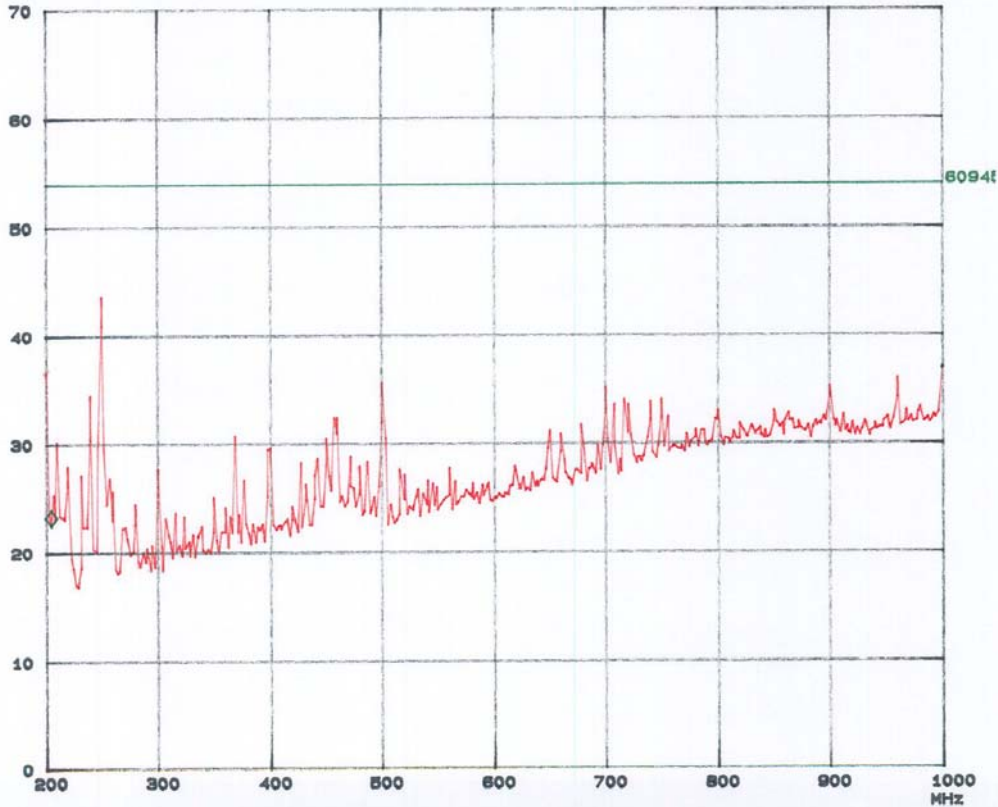
09. Aug 04 11:49

EUT: AI 80 AIS
Manuf: Kongsberg Seatex
Op Cond: in VP, 3m distance
Operator: TLO
Test Spec: EN60945

Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | | | | | | | | |
|-------------|-------|------|-------------------|----------|--------|-------|--------|-------|------------|------|-------|-------|------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge | Transducer | No. | Start | Stop | Name |
| 200M | 1000M | 50k | 120k | PK | 20ms | AUTO | LN ON | 60dB | 21 | 200M | 1000M | HL223 | |

dBuV/m ◇ Mkr : 204.6000 MHz 22.5 dBuV/m



9.6 Radiated emission 1000 - 2000 MHz (horizontal).

Nemko Comlab AS

09. Aug 04 12:54

Peak

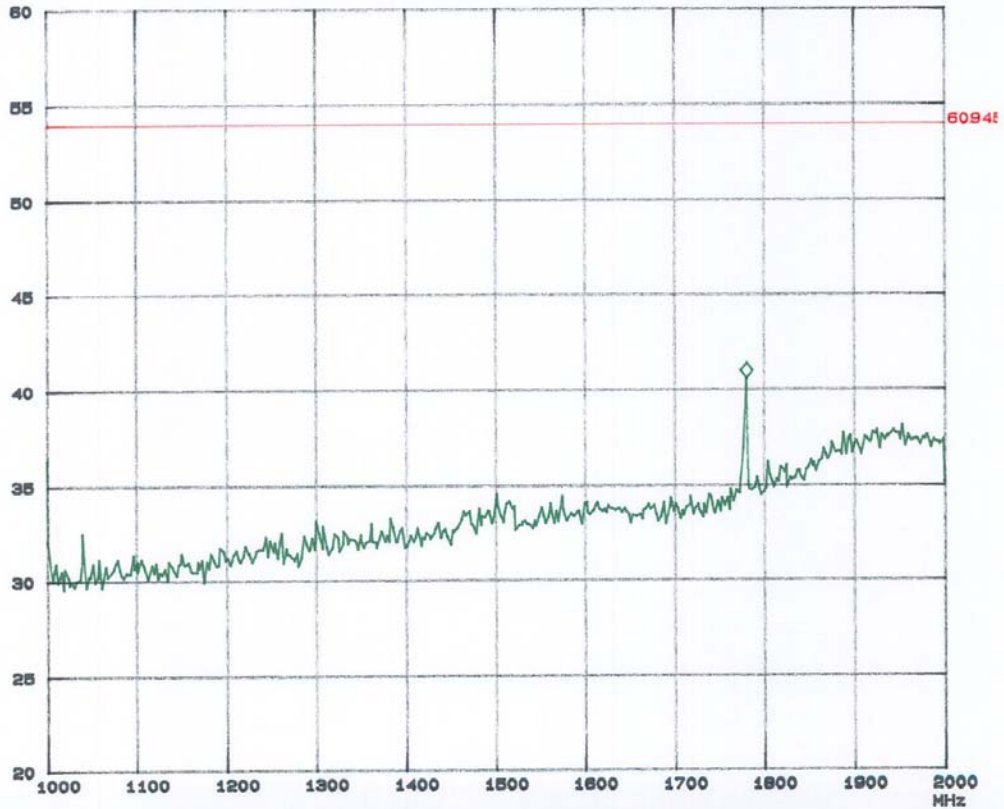
Operator: TLO
Comment: Kongsberg Seatex
AI 90 AIS
1m HP, 3m distance

Scan Settings (1 Range)

| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
|-------|-------|------|-------|----------|--------|-------|--------|-------|
| 1000M | 2000M | 50k | 120k | PK | 20ms | AUTO | LN ON | 60dB |

| Transducer | No. | Start | Stop | Name |
|------------|-----|-------|-------|------|
| | 10 | 1000M | 2000M | 1330 |

dBuV/m ◇ Mkr : 1779.8500 MHz 40.5 dBuV/m



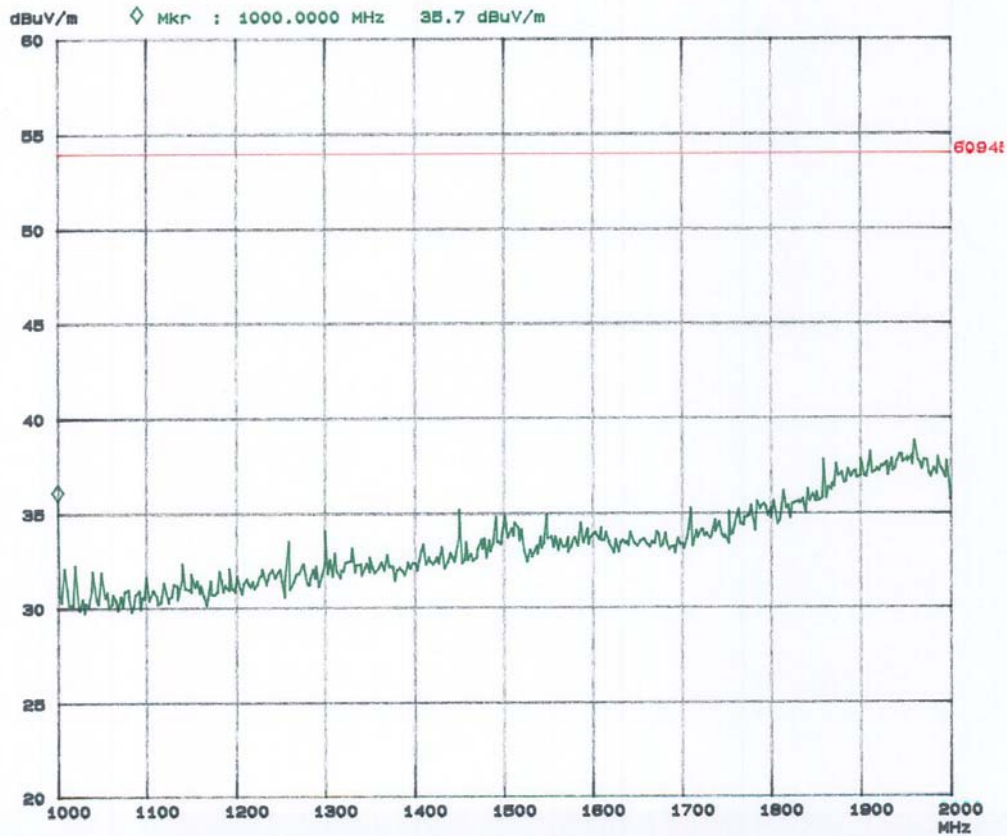
9.7 Radiated emission 1000 - 2000 MHz (vertical).

Nemko Comlab AS
Peak

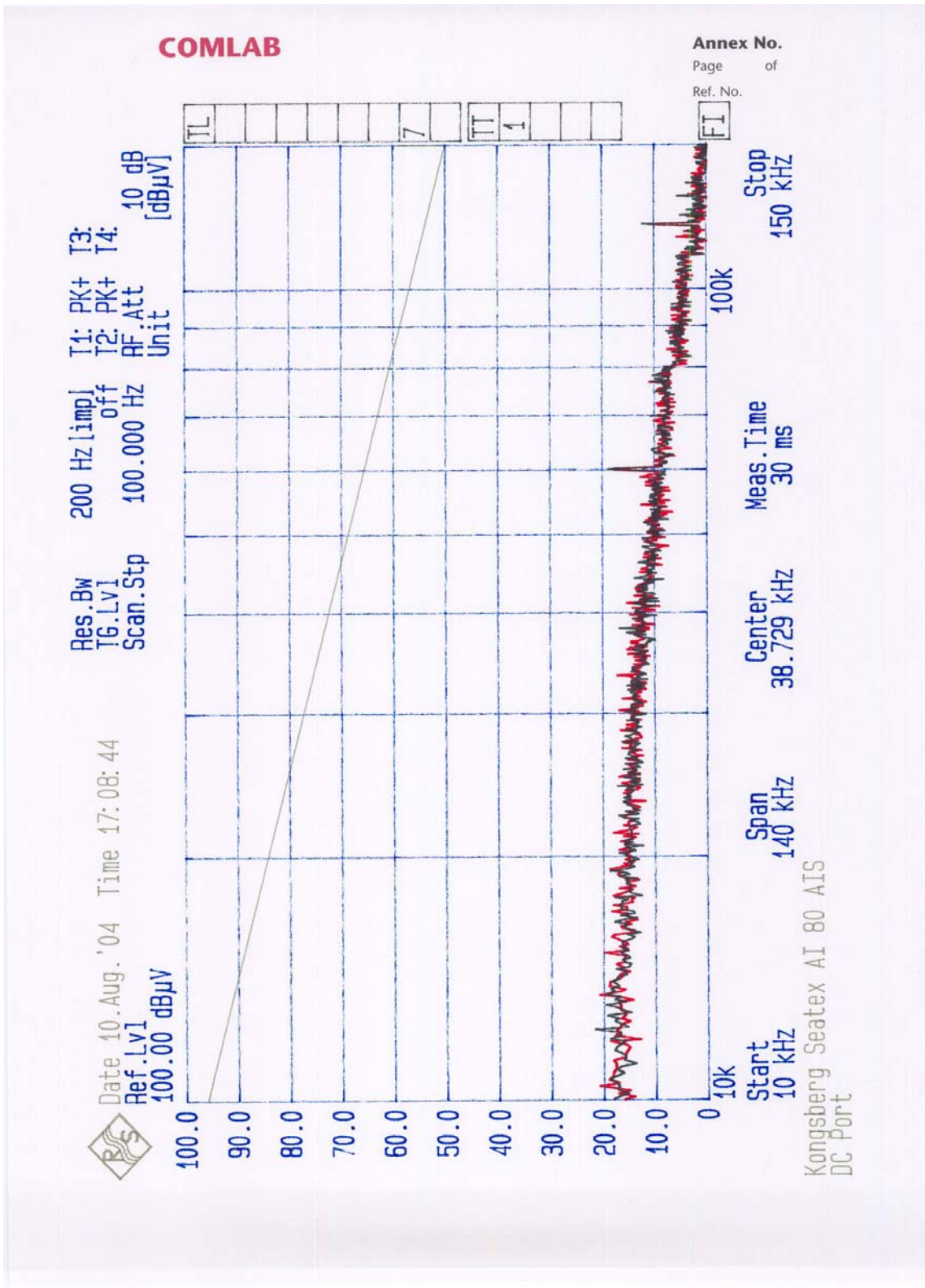
09. Aug 04 12:37

Operator: TLO
Comment: Kongsberg Seatex
AI 80 AIS
1m VP, 3m distance

| Scan Settings (1 Range) | | | Receiver Settings | | | | | |
|-------------------------|-------|------|-------------------|----------|--------|-------|--------|-------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 1000M | 2000M | 50k | 120k | PK | 20ms | AUTO | LN ON | 60dB |
| | | | Transducer | No. | Start | Stop | Name | |
| | | | 10 | 1000M | 2000M | 1330 | | |

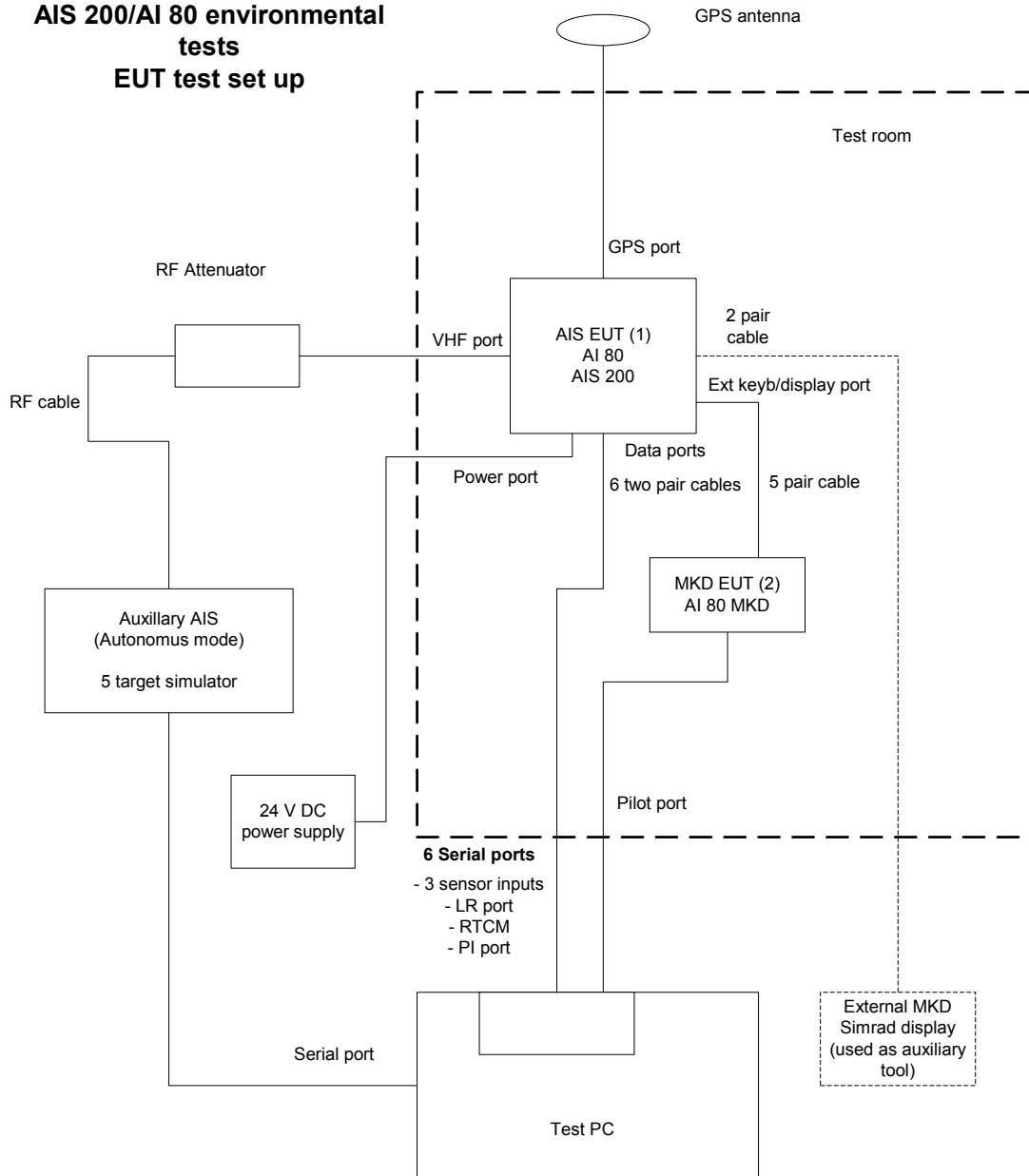


9.8 Conducted emission AI 80 AIS on DC Mains 10-150 kHz.



10 TEST SET-UP

AIS 200/AI 80 environmental tests EUT test set up



11 PHOTO OF TEST SET UP



Radiated Immunity test



Conducted Immunity test