SP REPORT
issued by an Accredited Laboratory

SWEDAC ACKREDITERING 1002

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Datum/*Date* 2000-05-12
Beteckning/*Reference* F002464:A
Sida/*Page* 1(2)

EMC tests on SENSOR SENSYS 240

(8 enclosures)

Test object

SENSYS 240, number 10-0008 Rev. D, serial number E5BACB020000.

Summary

The functional specification was supplied by the manufacturer.
The functional tests were performed according to standard.
The functional criteria can be found in enclosure 1.

Standard	Compliant	Enclosure	Remarks
Requirements Specification for ASSS, Rev C 10.2.6 Electromagnetic Compatibility	Yes		
Voltage variations and interruptions	Yes	2	
Supply voltage transients ISO 7637-1:1990	Yes	3	
Transients on signals lines ISO 7637-3:1995	Yes	4	
Radiated radio-frequency EN 61 000-4-3: 1996 **)	Yes	5	
Electrostatic discharge IEC 801-2: 1991	Yes	6	
Radio-frequency emission EN 55 022:1994, class B, radiated *)	Yes	7	
Radio-frequency emission MIL-STD461D, RE 102, Army	Yes	8	Note 1

*) The RF emission reported is not based on measurements on an open area test site, which is the reference method according to EN 55 022, but on measurements performed in an anechoic shielded chamber. The used method does not meet the EN 55 022 requirements for alternative test sites. A 3 m measuring distance has been used that, based on experience from comparative measurements, gives margins to judge compliance.

**) EN 61 000-4-3: 1996 replaces ENV 50 140.

Note 1: SP is not accredited for this standard by Swedac.

SP Swedish National Testing and Research Institute
EMC

Jan Welinder
Technical Manager

Fredrik Isaksson
Technical Officer

Performance test and requirements

Functional tests before, during and after the immunity tests were performed in order to verify compliance with the Performance criterion in the used standards as specified by the manufacturer.

Immunity test

Operation mode during immunity tests:
Normal operation, transmitting. The test object was powered by a 12 V DC traction battery. The 0 V DC was grounded.
A measurement was activated. Manual calibrations were performed every two seconds to verify the function of the EUT.
During the immunity to radiated electromagnetic field the functional test equipment was placed outside the fully anechoic chamber.

Emission measurement

Operation mode during the emission measurements:
Normal operation, transmitting. The test object was powered by a 12 V DC traction battery. The 0 V DC was grounded.
The can cable was connected to the PC, the PC was not in operation.
The PC and the 12 V battery were placed outside the fully anechoic chamber.

Functional test equipment

PC 104 NT with Windows NT 4.0. Art number 10-0016 Rev. A, serial number 00002
Software running on the PC, LCO version 0.1
Monitor Datalux
Keyboard Cherry, art number G84-4100PPASF/01
Mouse Microsoft IntelliMouse, product id 63618-577

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation "FEx-QD1 bilaga 8" (annex 8).

Reservation

The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in the report.

Delivery of test object

The test object was delivered: 2000-02-23.

Sign:

Immunity to voltage variations and interruptions

Date	Temperature	Humidity
2000-04-20	23 °C ± 3 °C	40 % ± 5 %

Severity

Voltage variations:	10.8-16 V
Voltage interruptions:	1-1000 ms
Incorrectly applied supply voltage polarity:	- 12 V

Test Set-up and Procedure

Test set-up: The EUT was placed on a ground plane and insulated from it by a 0.1 m thick insulator. The test object was not grounded.

Five voltage interruptions on each of the following interruptions times, 1, 10, 20, 100 and 1000 ms, were performed and with five minutes recharge time between each interruption.

Performance criteria:
Voltage variation, 10.8-16 V:
The equipment shall operate as intended, for lower supply voltages it shall either continue to operate as intended or shall stop measuring speed, while retaining all stored information.
Voltage interruptions, 1-1000 ms:
During this test, the equipment shall continue to operate normally, with no interruption of measurement and no corruption of stored data.
Incorrectly applied supply voltage polarity:
No corruption of stored information may occur.

Test equipment	SP number
Transient 1000	503 094
Multimeter HP3478A	500 991
Testo 610, Temperature and humidity meter	502 658

Result

Cable	Result
Voltage variation, 10.8-16 V	Ok
Voltage interruptions, 1-1000 ms	Ok
Incorrectly applied supply voltage polarity	Ok, Note 1

Note 1: The messages, Low voltage/Ok and after that Communication lost occurred. When the 12 V DC was applied correctly after the test the equipment operated as intended.

Performance requirements fulfilled?	Yes

Sign:

Immunity to supply voltage transients according to ISO 7637-1:1990

Date	Temperature	Humidity
2000-04-20	23 °C ± 3 °C	40 % ± 5 %

Severity

PULSE	3a	3b	3a	3b
Power supply	12 V	12 V	24 V	24 V
Level	IV	IV	IV	IV
Power terminals	-150 V/ 1 min	100 V/ 1 min	-150 V/ 1 min	100 V/ 1 min
Performance criteria	C	C	D	D

Test Set-up and Procedure

The test object was not grounded.

Pulse 3a and 3b were applied 600 times, with a pulse repetition frequency of 10 Hz.

Performance criteria:
C: A function of a device/system does not perform as designed during exposure but returns automatically to normal operation after exposure is removed.
D: A function of a device/system does not perform as designed during exposure and does not return to normal operation until exposure is removed and the device system is reset by simple "operator/use" action.

Test equipment	SP number
Schaffner NSG 500C, Disturbance generator	501 251
Testo 610, Temperature and humidity meter	502 658

Result

PULSE	3a	3b	3a	3b
Power supply	12 V	12 V	24 V	24 V
Result	Ok	Ok	Ok	Ok

Performance requirements fulfilled?	Yes

Sign:

Immunity to transients on signal lines according to ISO 7637-3:1995

Date	Temperature	Humidity
2000-03-01	22 °C ± 3 °C	34 % ± 5 %

Severity

PULSE	3a	3b
Level	IV	IV
Power terminals	-60 V/ 1 min	40 V/ 1 min
Performance criteria	C	C

Test Set-up and Procedure

The test object was not grounded.

Pulse 3a and 3b were applied 600 times, with a pulse repetition frequency of 10 Hz.

Performance criteria: C: A function of a device/system does not perform as designed during exposure but returns automatically to normal operation after exposure is removed.

Test equipment	SP number
Schaffner NSG 500C, Disturbance generator	501 251
Capacitive clamp Schaffner SL400-07	502 772
Testo 610, Temperature and humidity meter	502 658

Result

PULSE	3a	3b
Result	Ok	Ok

Performance requirements fulfilled?	Yes

SP 511

Sign:

Immunity to radiated radio-frequency according, EN 61 000-4-3: 1996

Date	Temperature	Humidity
2000-04-18	23 °C ± 3 °C	40 % ± 5 %

Severity

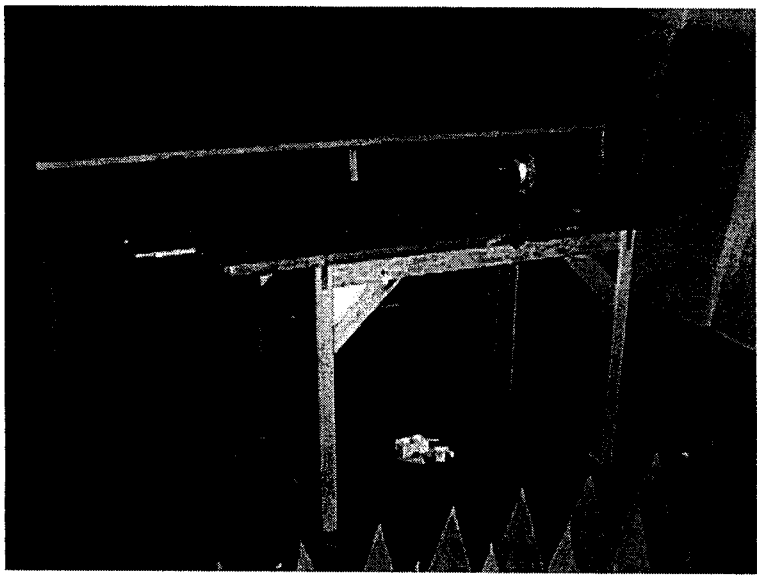
Amplitude: 10 V/m

Test Set-up and Procedure

The tests were performed in a fully anechoic chamber.

The test object was not grounded during the test.

The test set-up can be seen in the picture below.



In the frequency range 26-80 MHz the antenna distance was 1 m.
In the frequency range 80-1000 MHz the antenna distance was 3 m.

Performance criterion: No interference with the performance shall occur during the test.

Test equipment	SP number
Anechoic chamber	7:314
Computer, RST PII system	
Control Program SPIMM 3.20	
R&S SMY01	502 164
HP 33120A	502 026
R&S NAP	501 740
R&S NAP-Z6	501 742
KALMUS 137C	501 607
KALMUS LA600UE	501 690
KALMUS 723FC	502 000
Chase Bilog antenna CBL 6121A	502 461
Testo 610, Temperature and humidity meter	501 782

Sign:

Result

EN 61 000-4-3, Amplitude modulation 80 %, 1 kHz sine wave					
Frequency MHz	EUT side facing antenna	Horisontal		Vertical	
		V/m	Result	V/m	Result
26-1000	0 °	10	Ok	10	Ok
26-1000	90 °	10	Ok	10	Ok
26-1000	180 °	10	Ok	10	Ok
26-1000	270 °	10	Ok	10	OK

Performance requirements fulfilled?	Yes

Sign:

Immunity to electrostatic discharge according to IEC 801-2: 1991

Date	Temperature	Humidity
2000-04-19	24 °C ± 3 °C	46 % ± 5 %

Severity level

Air discharges: 8 kV
Contact discharges: 6 kV

Test Set-up and Procedure

Test set-up: Floor standing equipment.

The test object was not grounded during the test.

Performance criterion: No interference with performance shall occur during the test.

Test equipment	SP number
Schaffner NSG 435	502 549
Testo 610, Temperature and humidity meter	501 782

Results

Test points	Discharge type	Result
Contact shell to can cable	Contact	Ok
Termination	Contact	Ok
Screws between the to halves	Contact	Ok
Near LED	Contact	Ok
Top of black and silver halves	Contact	Ok
Bottom	Contact	Ok
Plastic front	Air	Ok, no discharge occurred
Vertical and horizontal coupling plane	Contact	Ok

Performance requirements fulfilled?	Yes

Sign:

Radiated emission measurements according to EN 55 022:1994, class B

Date	Temperature	Humidity
2000-04-19	24 °C ± 3 °C	46 % ± 5 %

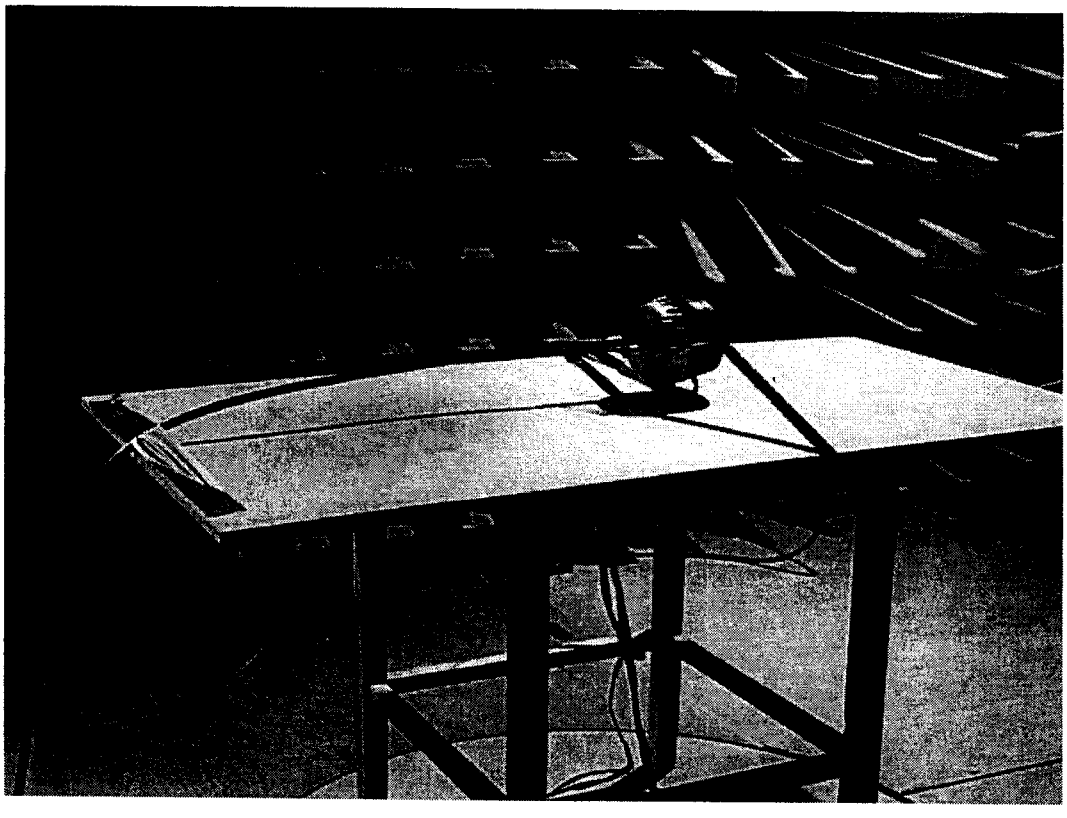
Test set-up and Procedure

The pre-test of radiated emission was performed in a fully anechoic chamber. The EUT was measured in 8 directions with 45 degrees increment. The measurements were performed with both horizontal and vertical polarisation of the antenna. The antenna distance was 3 m and the antenna height 1.3 m.

The measurement is first performed with peak detector. Emission on frequencies close to or above the limit is controlled with quasi-peak detector. Emission lower than the 10 m emission limit is deemed to comply with the requirement when performing the measurement at a distance of 3 m.

The test was performed with 2 configurations: 1. EUT not grounded
2. EUT grounded.

The test set-up during the pre-test can be seen in the picture below.



The RF emission reported is not based on measurements on an open area test site, which is the reference method according to EN 55 022, but on measurements performed in an anechoic shielded chamber. The used method does not meet the EN 55 022 requirements for alternative test sites. A 3 m measuring distance has been used that, based on experience from comparative measurements, gives margins to judge compliance.

Sign:

Measurement equipment	SP number
Anechoic chamber	8:312
R&S ESAI	502 199
Control computer	502 980
Software: R&S ES-K1, ver. 1.60	
Chase Bilog antenna CBL 6121A	502 460
Testo 610, Temperature and humidity meter	502 658

Result

The pre-test emission spectra can be found in the following diagrams:

Diagram 1: Radiated emission vertical and horizontal polarisation, front, EUT not grounded.

Diagram 2: Radiated emission vertical and horizontal polarisation, front, EUT grounded.

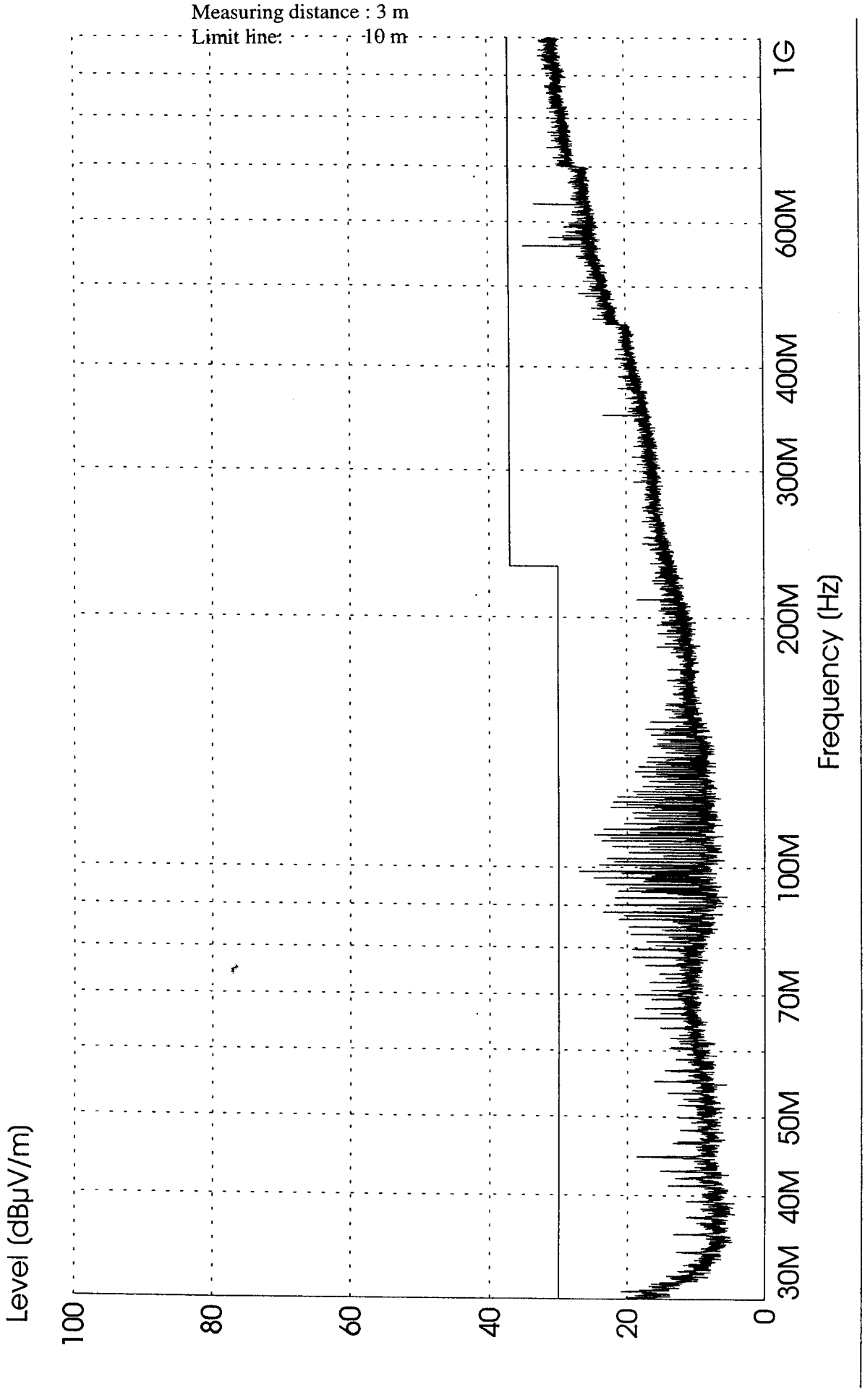
Diagram 3: Radiated emission vertical and horizontal polarisation, 8 directions, EUT not grounded.

Diagram 4: Radiated emission vertical and horizontal polarisation, 8 directions, EUT grounded.

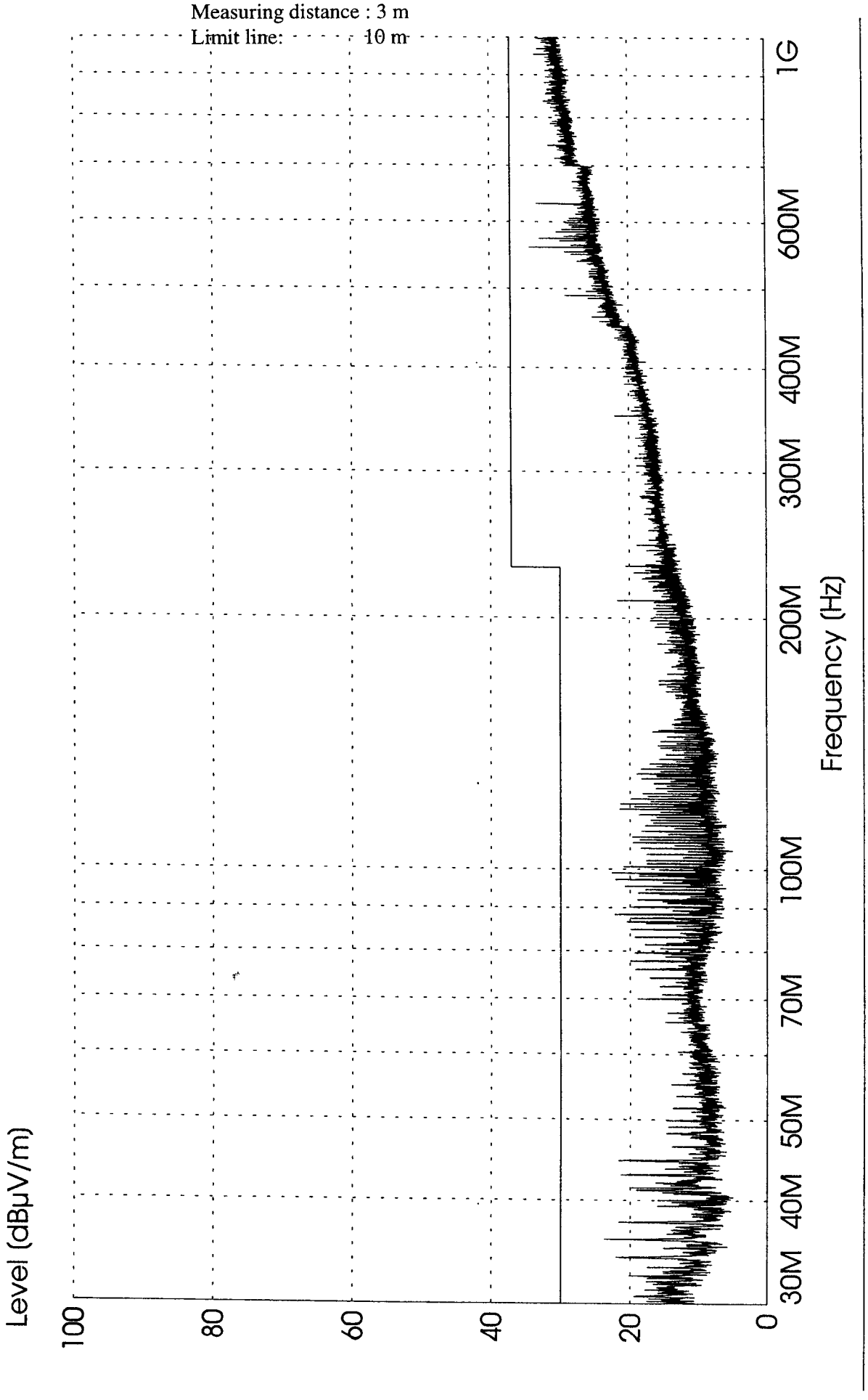
Diagram 5: Radiated emission vertical and horizontal polarisation, Ambient, EUT grounded.

Emission below limit?	Yes

Sign:


Measuring distance : 3 m
Limit line: 10 m
Level (dBµV/m)
100
80
60
40
20
0
30M 40M 50M 70M 100M 200M 300M 400M 600M 1G
Frequency (Hz)
MES FI000419-1_pre PK
LIM EN 55022 F QP
Field Strength QP Limit

Sign:



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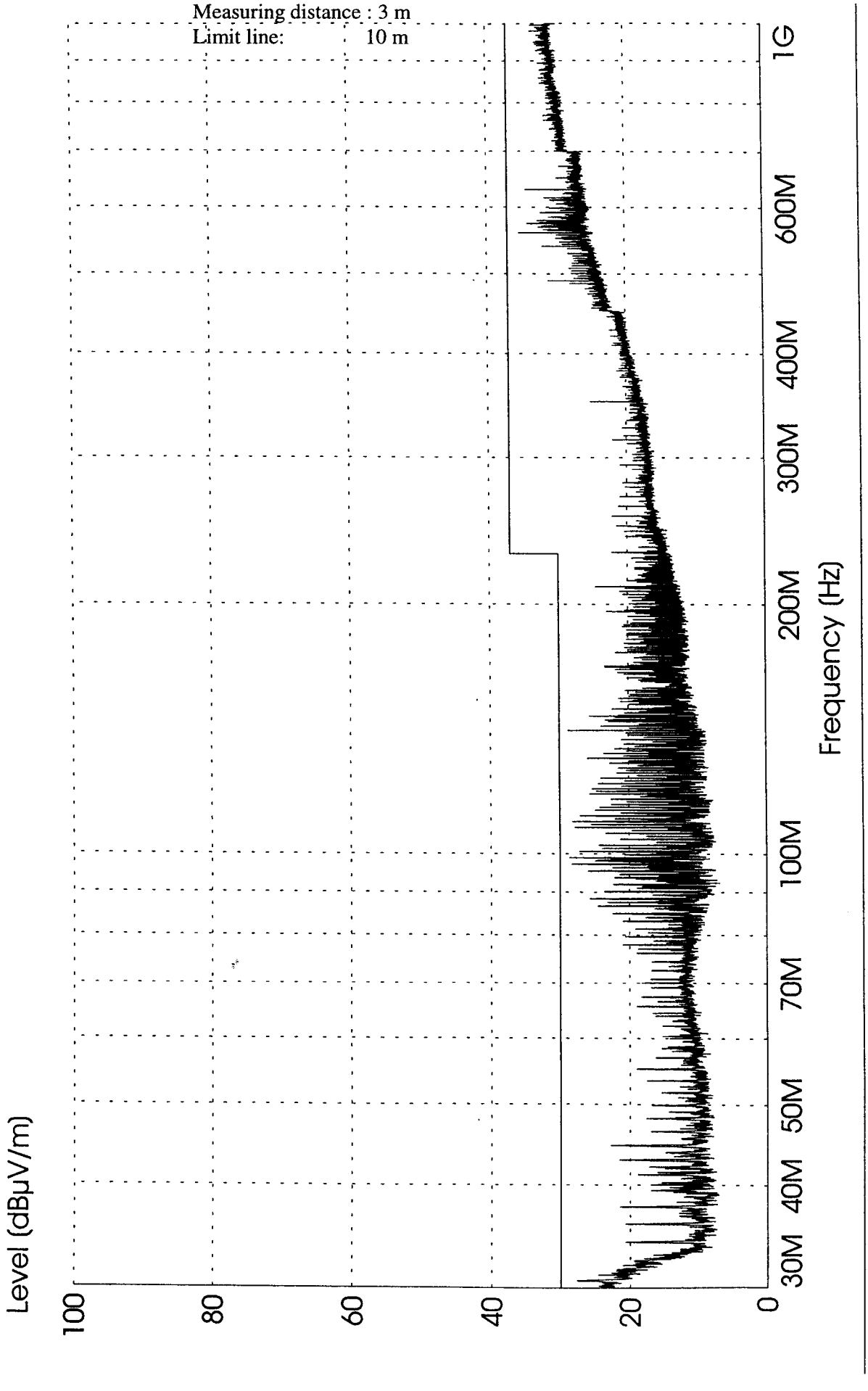
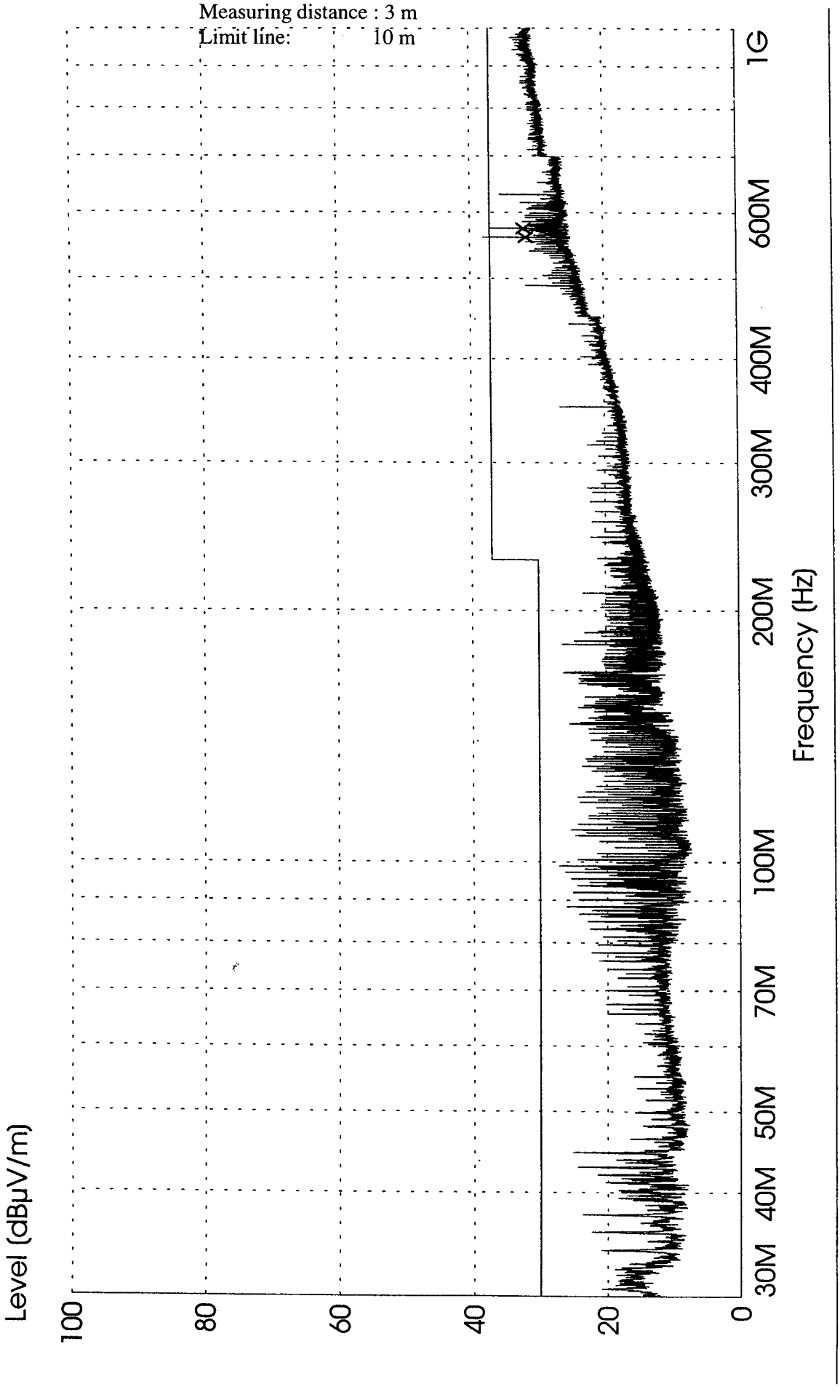
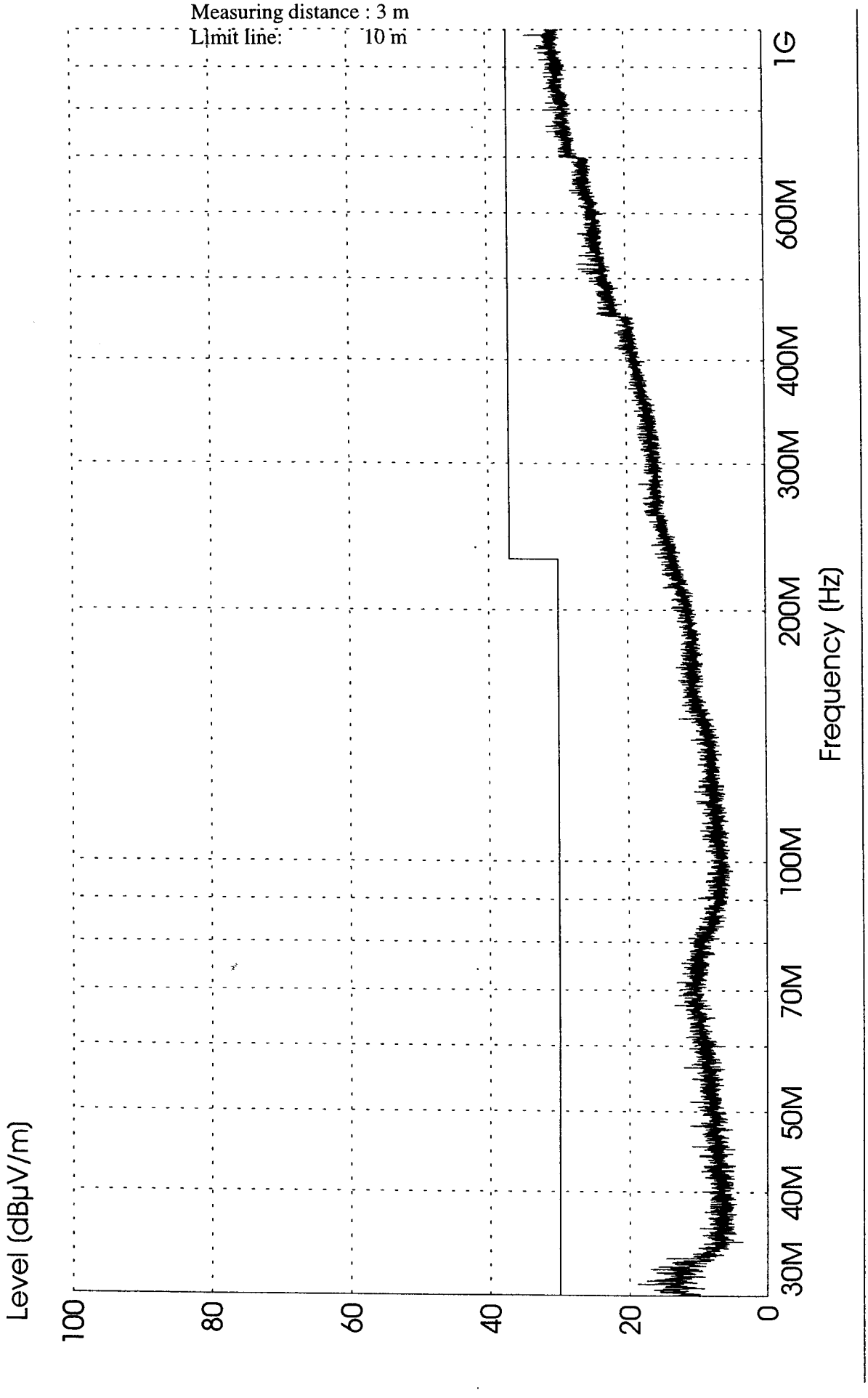
Sign:


Measuring distance : 3 m
Limit line: 10 m
Level (dBµV/m)
100
80
60
40
20
0
30M 40M 50M 70M 100M 200M 300M 400M 600M 1G
Frequency (Hz)
MES FI000419-5_pre PK
LIM EN 55022 F QP
Field Strength QP Limit

Sign:


Measuring distance : 3 m
Limit line: 10 m
Level (dBµV/m)
100
80
60
40
20
0
30M 40M 50M 70M 100M 200M 300M 400M 600M 1G
Frequency (Hz)
x x MES FI000419-4_fin QP
MES FI000419-4_pre PK
LIM EN 55022 F QP
Field Strength QP Limit

Sign:


Measuring distance : 3 m
Limit line: 10 m
Level (dBµV/m)
100
80
60
40
20
0
30M 40M 50M 70M 100M 200M 300M 400M 600M 1G
Frequency (Hz)
MES FI000419-3_pre PK
LIM EN 55022 F QP
Field Strength QP Limit

Sign:

Radio-frequency emission measurements according to MIL-STD-461D, RE 102, Army

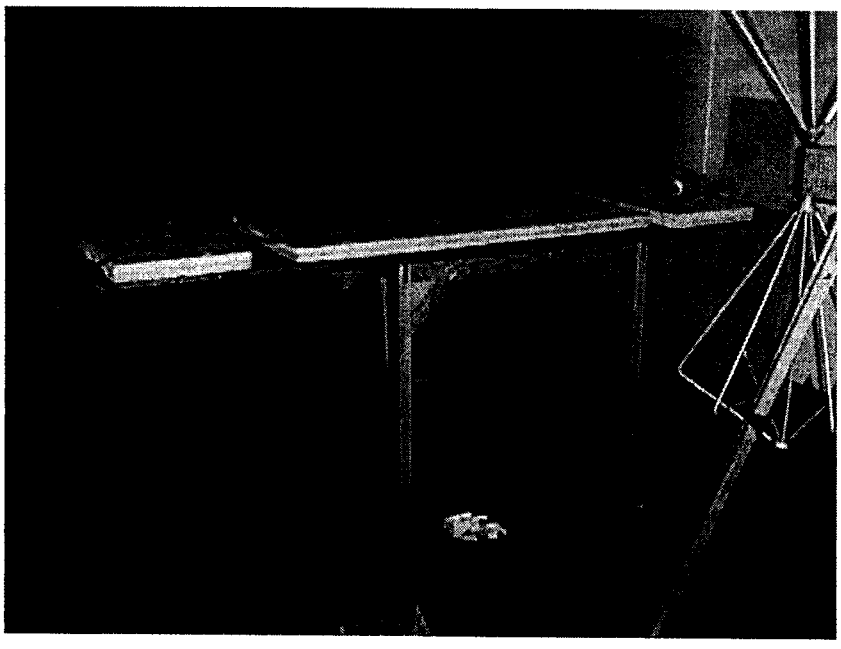
Date	Temperature	Humidity
2000-02-28	23 °C ± 3 °C	41 % ± 5 %

Test set-up and Procedure

The pre-test of radiated emission was performed in a fully anechoic chamber. The measurements were performed with both horizontal and vertical polarisation of the antenna. The antenna distance was 1 m and the antenna height 1.2 m.

The test was performed with 2 configurations: 1. EUT grounded
2. EUT not grounded.

The test set-up during the test, 78-80 MHz, can be seen in the picture below.



Measurement equipment	SP number
Anechoic chamber	7:314
HP 8568B Spectrum analyser	500 158
HP 85685A Preselector	500 157
HP 85650A Quasipeak adapter	500 183
Control computer	502 018
HP 85869PC EMI measurement software	Rev. A.00.01
EMCO Bicon 3109	501 747
EMCO Horn 3106	503 093
Testo 610, Temperature and humidity meter	501 782

Sign:

Result

The emission spectra can be found in the following diagrams:

Diagram 1: Radiated emission, 78-80 MHz, vertical polarisation, EUT grounded.

Diagram 2: Radiated emission, 78-80 MHz, horizontal polarisation, EUT grounded.

Diagram 3: Radiated emission, 78-80 MHz, vertical polarisation, EUT not grounded.

Diagram 4: Radiated emission, 78-80 MHz, horizontal polarisation, EUT not grounded.

Diagram 5: Radiated emission, 380-413 MHz, vertical polarisation, EUT grounded.

Diagram 6: Radiated emission, 380-413 MHz, horizontal polarisation, EUT grounded.

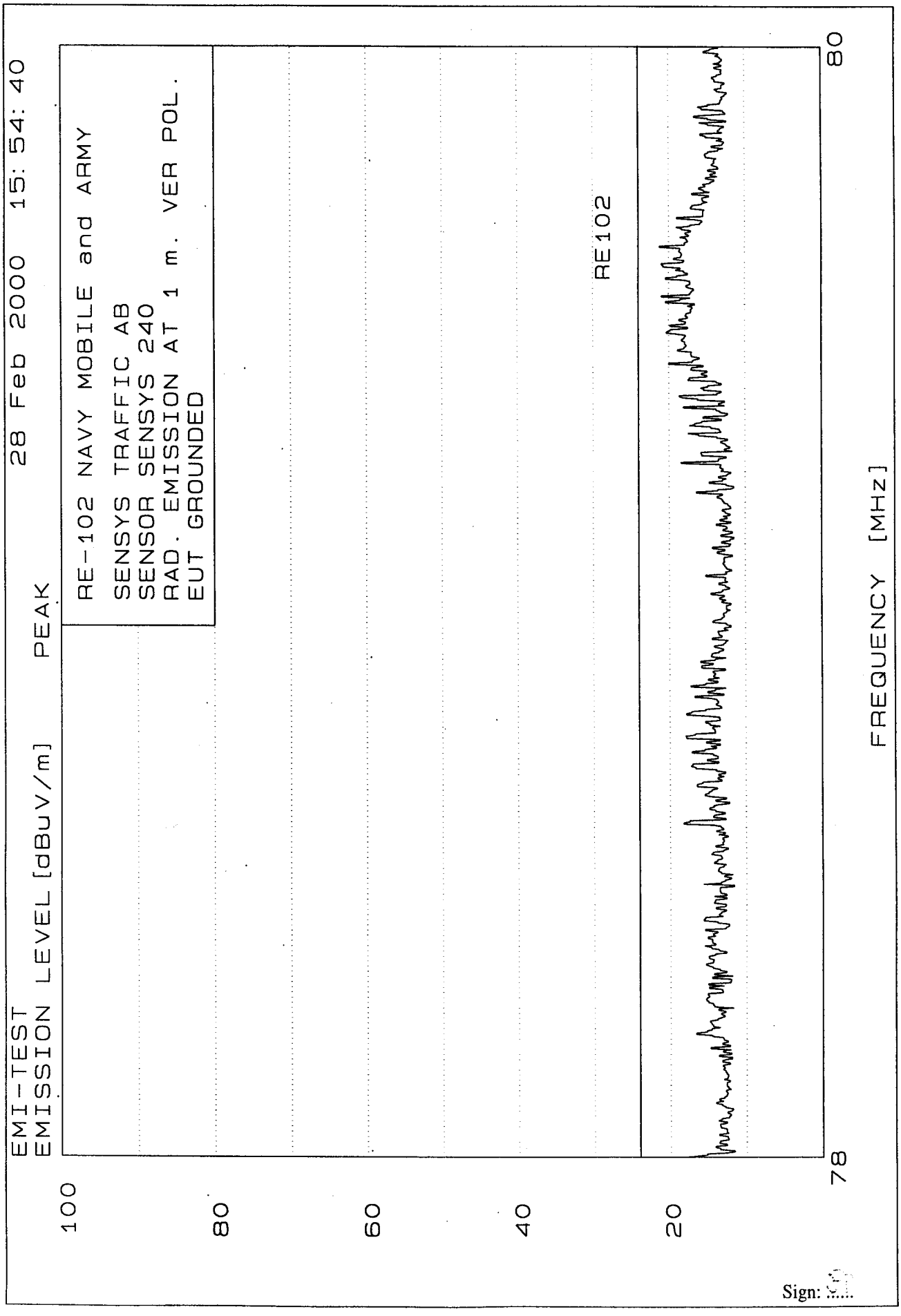
Diagram 7: Radiated emission, 380-413 MHz, vertical polarisation, EUT not grounded.

Diagram 8: Radiated emission, 380-413 MHz, horizontal polarisation, EUT not grounded.

Emission below limit?	Yes

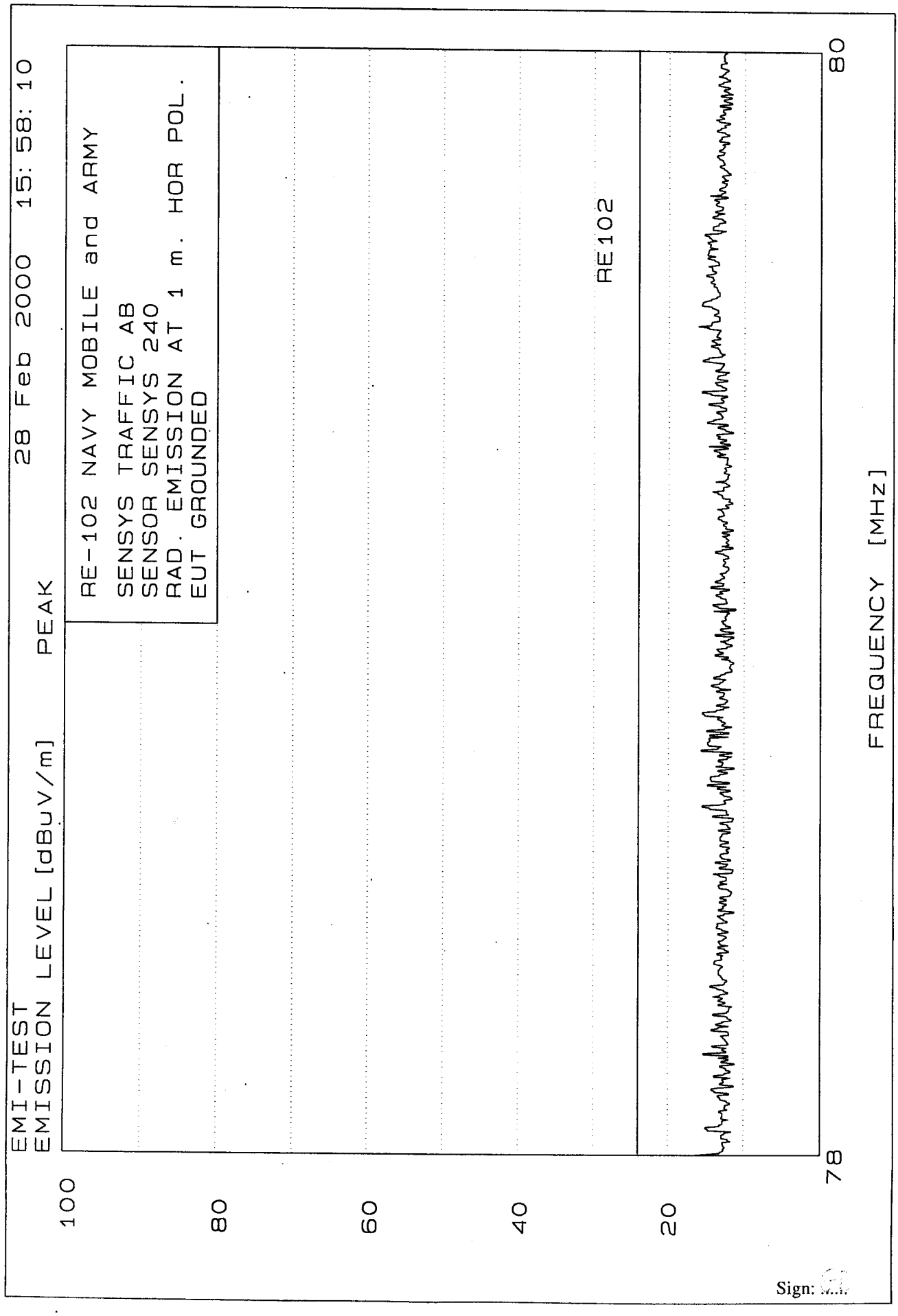
Sign:

Measuring distance : 1 m
Limit line: 1 m



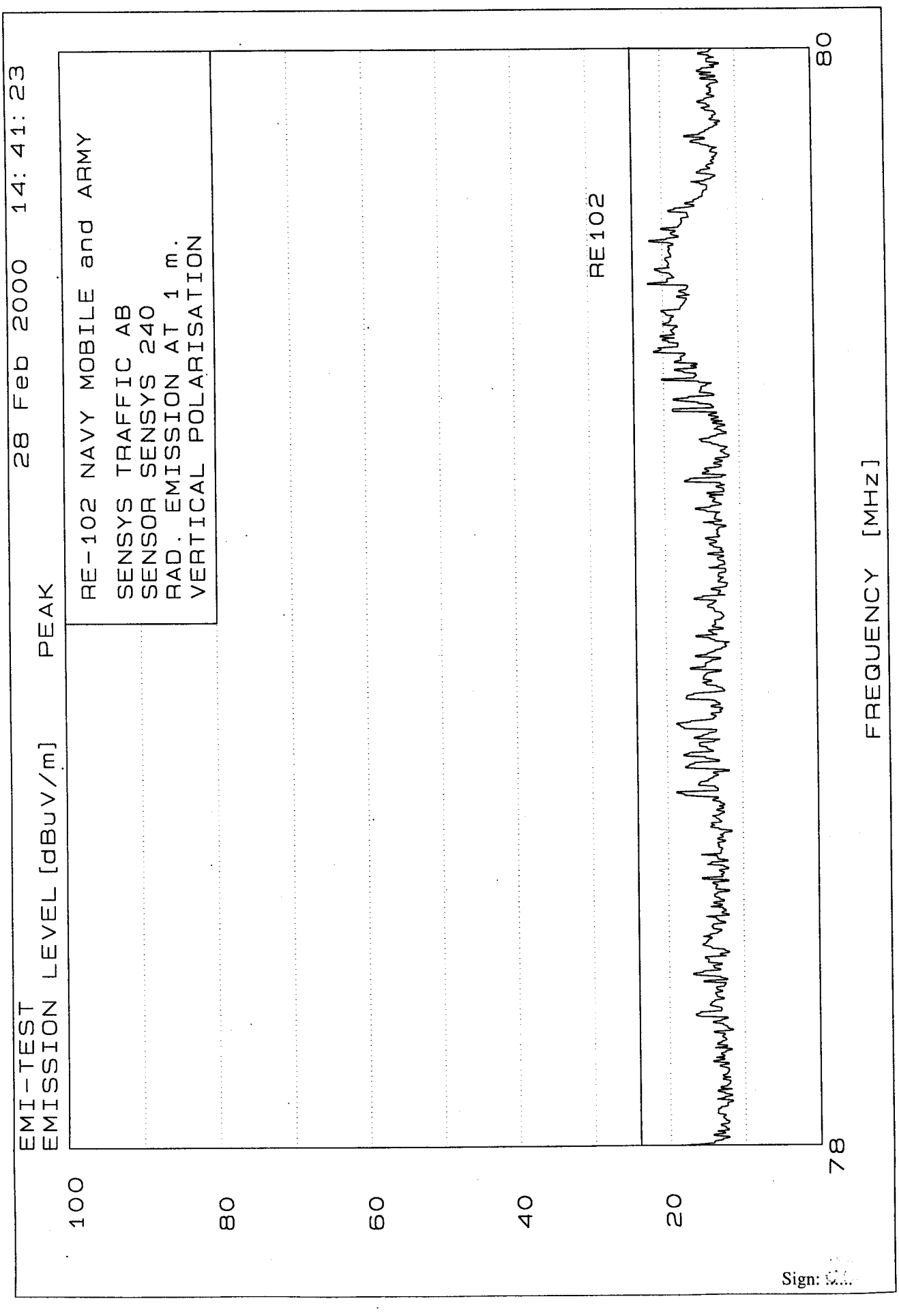
Sign: .....

Measuring distance : 1 m
Limit line: 1 m



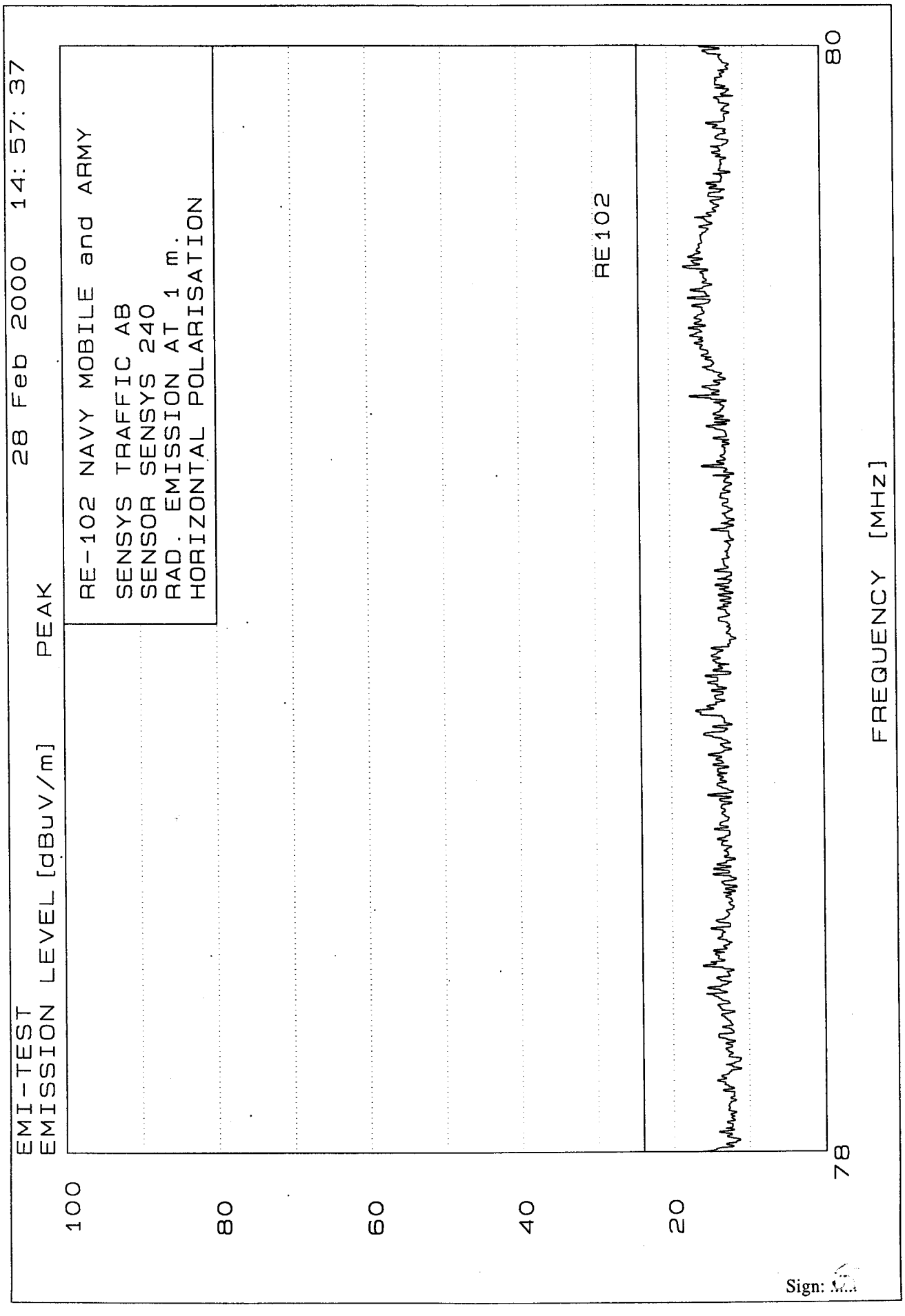
Sign:

Measuring distance : 1 m
Limit line: 1 m



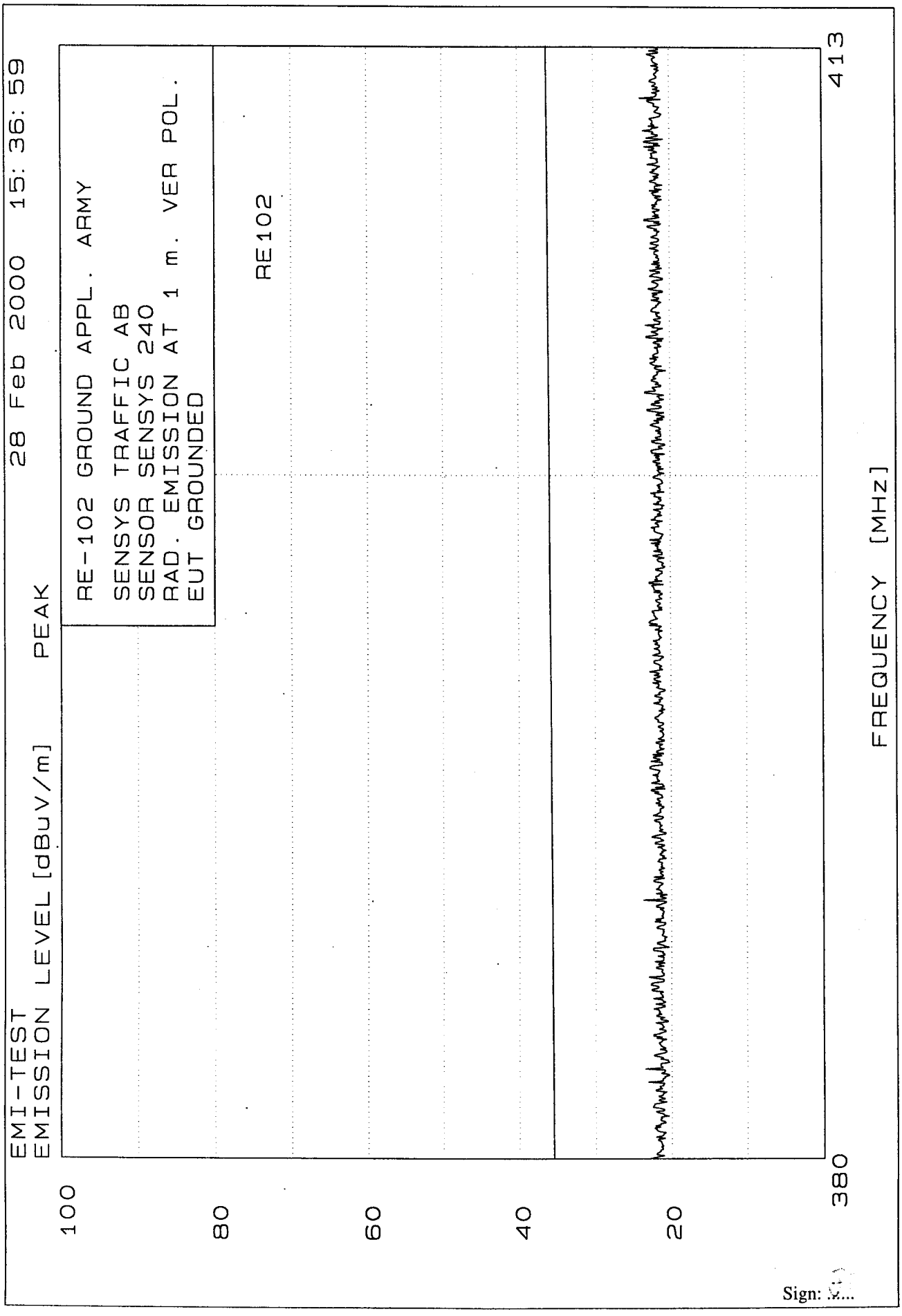
Sign:

Measuring distance : 1 m
Limit line: 1 m



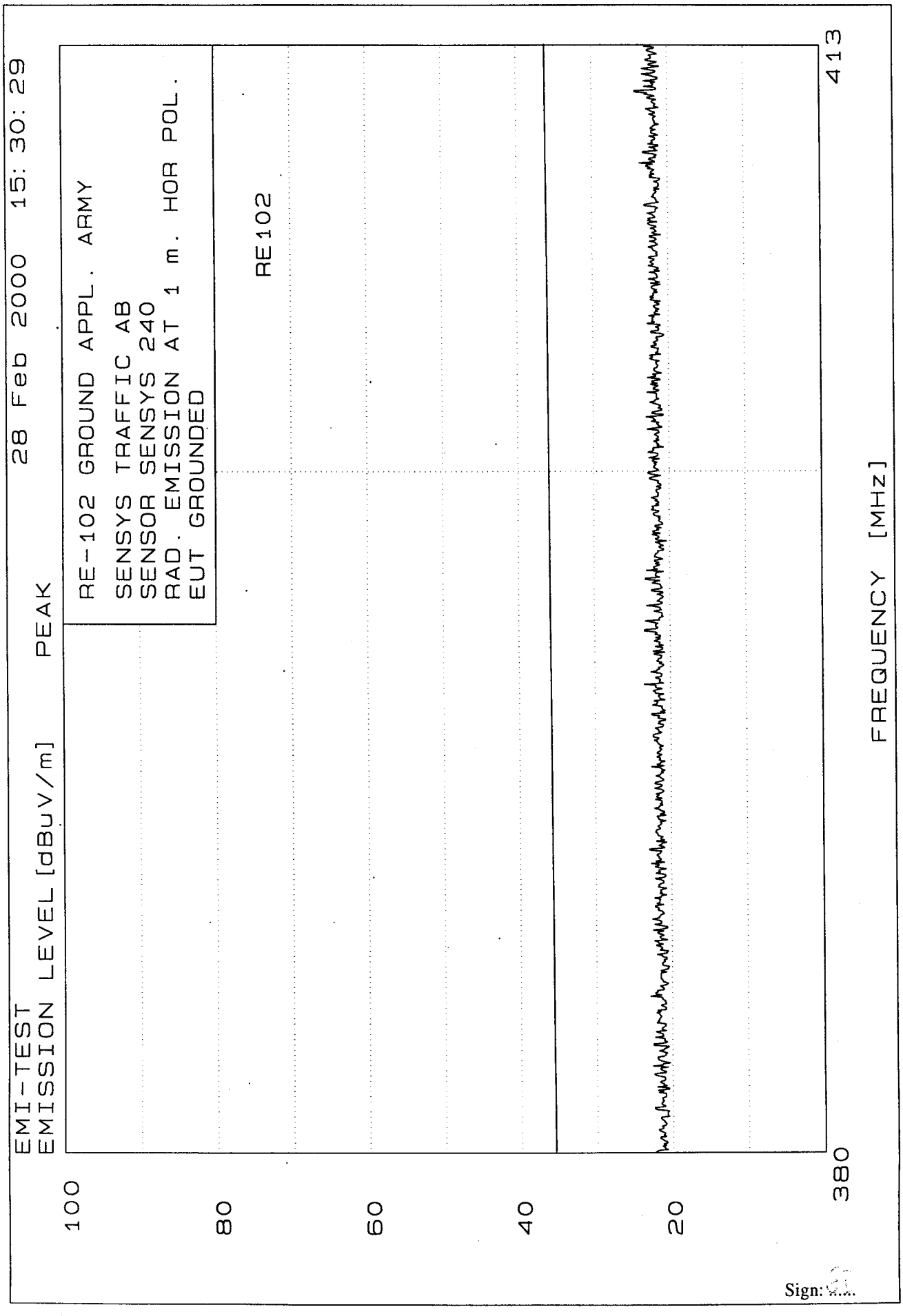
Sign:

Measuring distance : 1 m
Limit line: 1 m



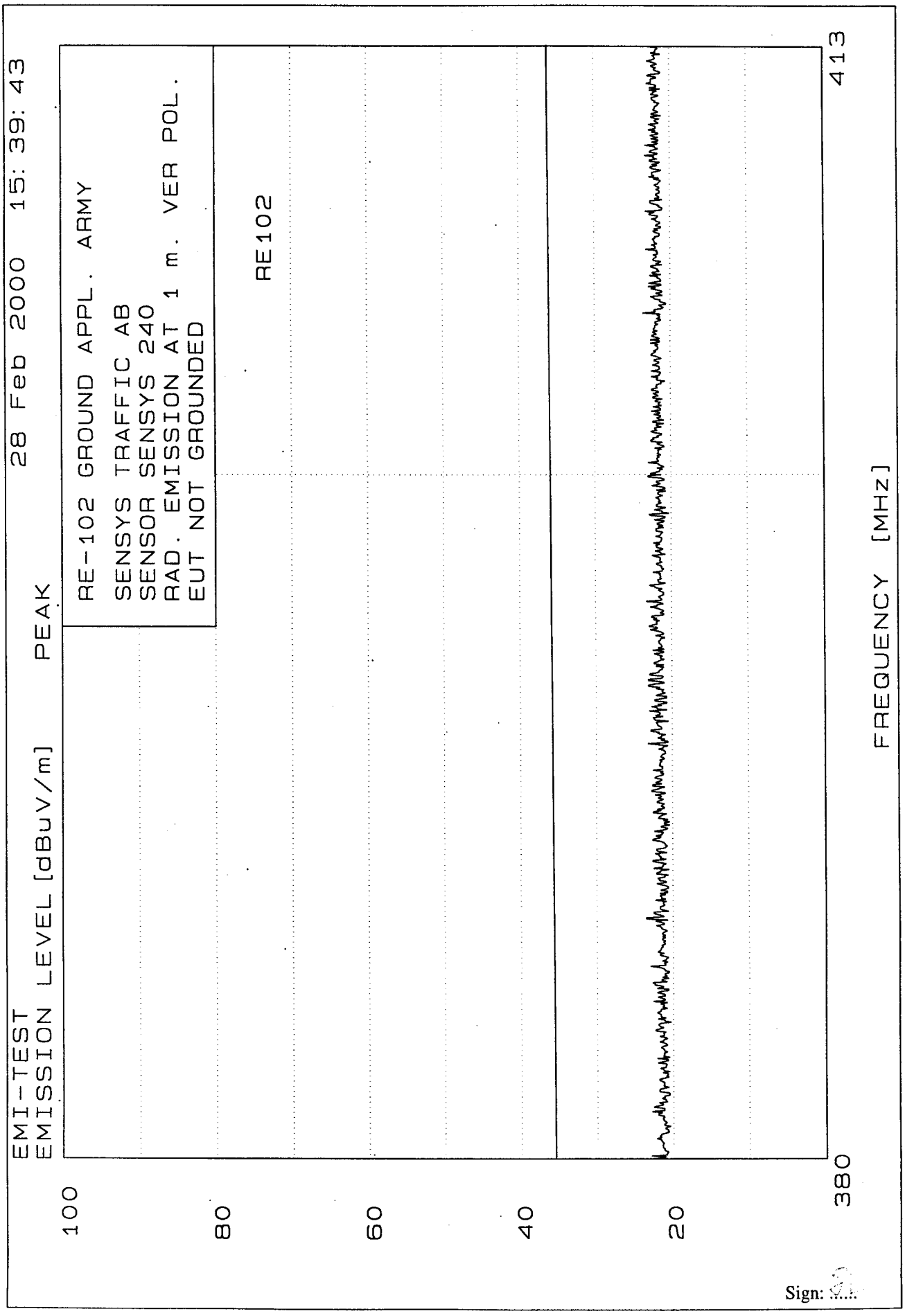
Sign: ...

Measuring distance : 1 m
Limit line: 1 m



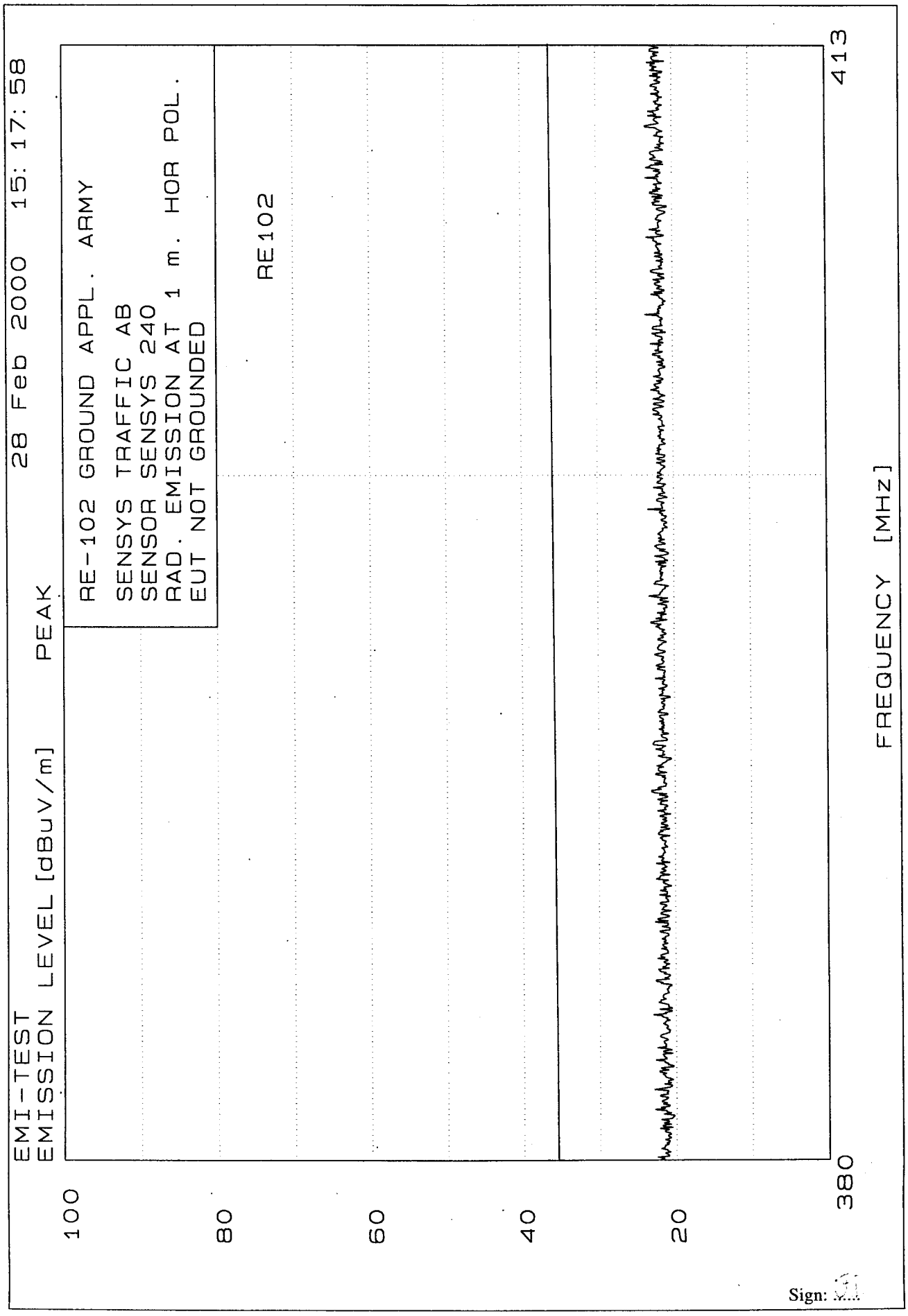
Sign:

Measuring distance : 1 m
Limit line: 1 m



Sign: .....

Measuring distance : 1 m
Limit line: 1 m



Sign: ....

SP PROVNING · FORSKNING

REPORT

issued by an Accredited Laboratory

SWEDAC ACKREDITERING 1002

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2000-04-26	F002464:B	1(2)

EMC tests on SENSOR SENSYS 240

Type I, class 2
(8 enclosures)

Test object

SENSYS 240, number 10-0008 Rev. D, serial number E5BACB020000.

Summary

The functional specification was supplied by the manufacturer.
The functional tests were performed according to standard.
The functional criteria can be found in enclosure 1.

Standard	Compliant	Enclosure	Remarks
Emission: Draft ETSI EN 300 683 :1999	Yes		
EN 55 022:1994, class B, radiated	Not applicable		Note 1
EN 55 022:1994, class B, conducted	Yes	2	
EN 61 000-3-2:1995	Not applicable		Note 2
EN 61 000-3-3:1995	Not applicable		Note 2
Immunity: Draft ETSI EN 300 683 :1999	Yes		
EN 61 000-4-2: 1995	Yes	3	
EN 61 000-4-3: 1996	Yes	4	
EN 61 000-4-4: 1995	Yes	5	
EN 61 000-4-5: 1995	Yes	6	
EN 61 000-4-6: 1996	Yes	7	
ISO 7637-1:1990	Yes	8	

Note 1: Only applicable on ancillary equipment.

Note 2: Only applicable to AC powered equipment.

SP Swedish National Testing and Research Institute
EMC

Jan Welinder
Technical Manager

Fredrik Isaksson
Technical Officer

Performance test and requirements

Functional tests before, during and after the immunity tests were performed in order to verify compliance with the Performance criteria as specified in the standard Draft ETSI EN 300 683:1999.

Immunity test

Operation mode during immunity tests:
The test object could only be set to transmitting mode, therefore no test with the test object in standby mode could be done.
Normal operation, transmitting. The test object was powered by a 12 V DC traction battery. The 0 V DC was grounded.
A measurement was activated. Manual calibrations were performed every two seconds to verify the function of the EUT.
During the immunity to radiated electromagnetic field the functional test equipment was placed outside the fully anechoic chamber.

Performance criteria for continuous phenomena CT:
During test: Operate as intended. No loss of function.
After the test: No degradation of performance and no loss of stored data of user programmable functions.

Performance criteria for transient phenomena TT:
During test: May be loss of function (one or more).
After the test: Lost function(s) shall be self-recoverable, no degradation of performance and no loss of stored data of user programmable functions.

Emission measurement

Operation mode during the emission measurements:
Normal operation, transmitting. The test object was powered by a 12 V DC traction battery. The 0 V DC was grounded.
The can cable was connected to the PC, the PC was not in operation.
During the to radiated measurements the functional test equipment was placed outside the fully anechoic chamber.

Functional test equipment

PC 104 NT with Windows NT 4.0. Art number 10-0016 Rev. A, serial number 00002
Software running on the PC, LCO version 0.1
Monitor Datalux
Keyboard Cherry, art number G84-4100PPASF/01
Mouse Microsoft IntelliMouse, product id 63618-577

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation "FEx-QD1 bilaga 8" (annex 8).

Sign:

Reservation

The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in the report.

Delivery of test object

The test object was delivered: 2000-02-23.

Sign.:

Conducted emission measurements according to EN 55 022:1994, class B

Date	Temperature	Humidity
2000-04-19	24 °C ± 3 °C	46 % ± 5 %

Test set-up and Procedure

Measurements were performed on the 0 V DC and the 12 V DC.

The test object was not grounded during the test.

The test was performed in two different test set-ups: 1: Floor standing equipment
2: Table top equipment

Measurement equipment	SP number
R&S ESAI	502 199
Control computer	502 980
Software: R&S ES-K1, ver. 1.60	
Schwartzbeck NNLK 8121	502 112
Testo 610, Temperature and humidity meter	502 658

Result

The emission spectra can be found in the following diagrams:

Diagram 1: Conducted emission, floor standing equipment, 0 V DC.

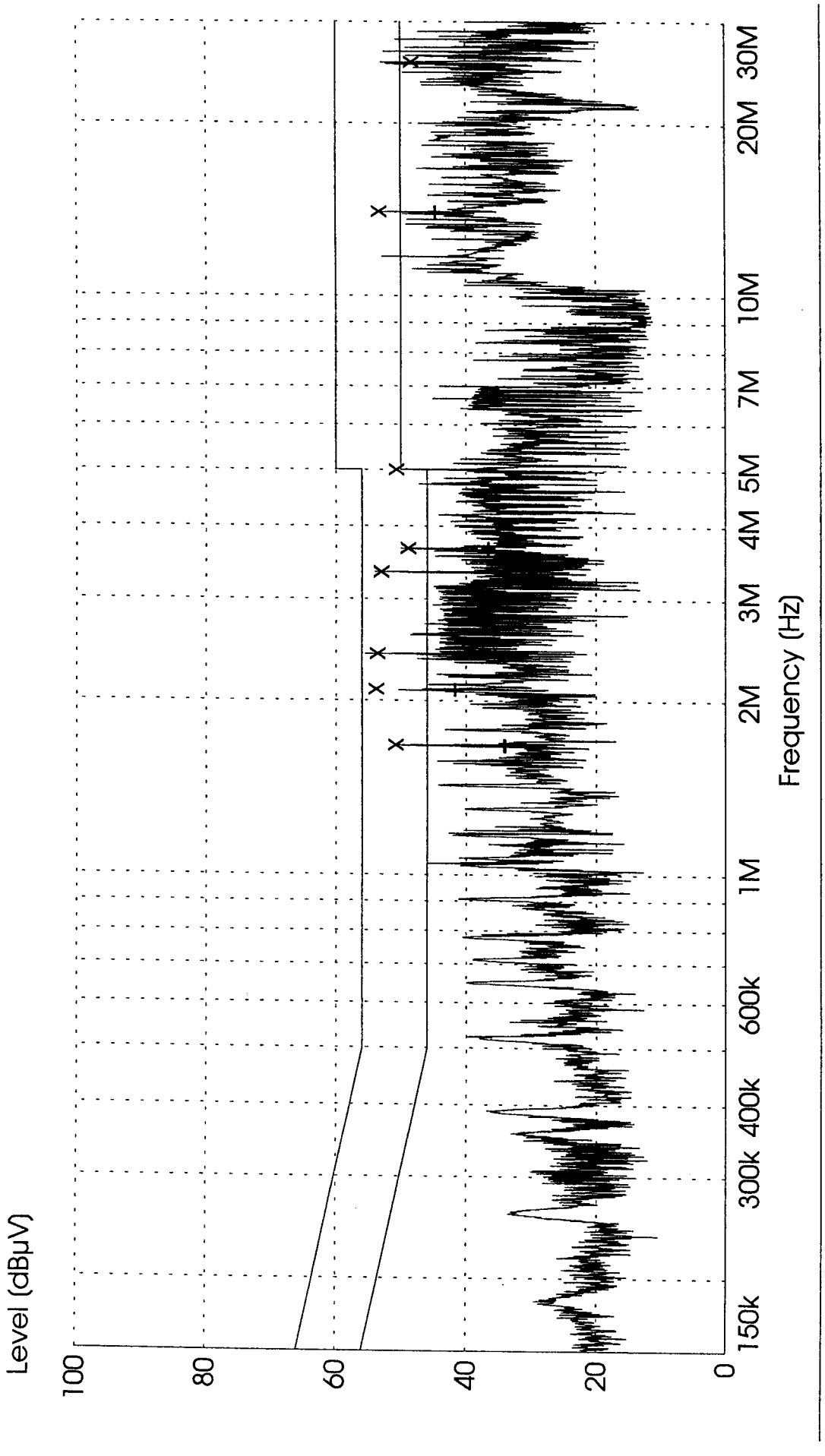
Diagram 2: Conducted emission, floor standing equipment, 12 V DC.

Diagram 3: Conducted emission, table top equipment, 0 V DC.

Diagram 4: Conducted emission, table top equipment, 12 V DC.

Emission below limit?	Yes

Sign:



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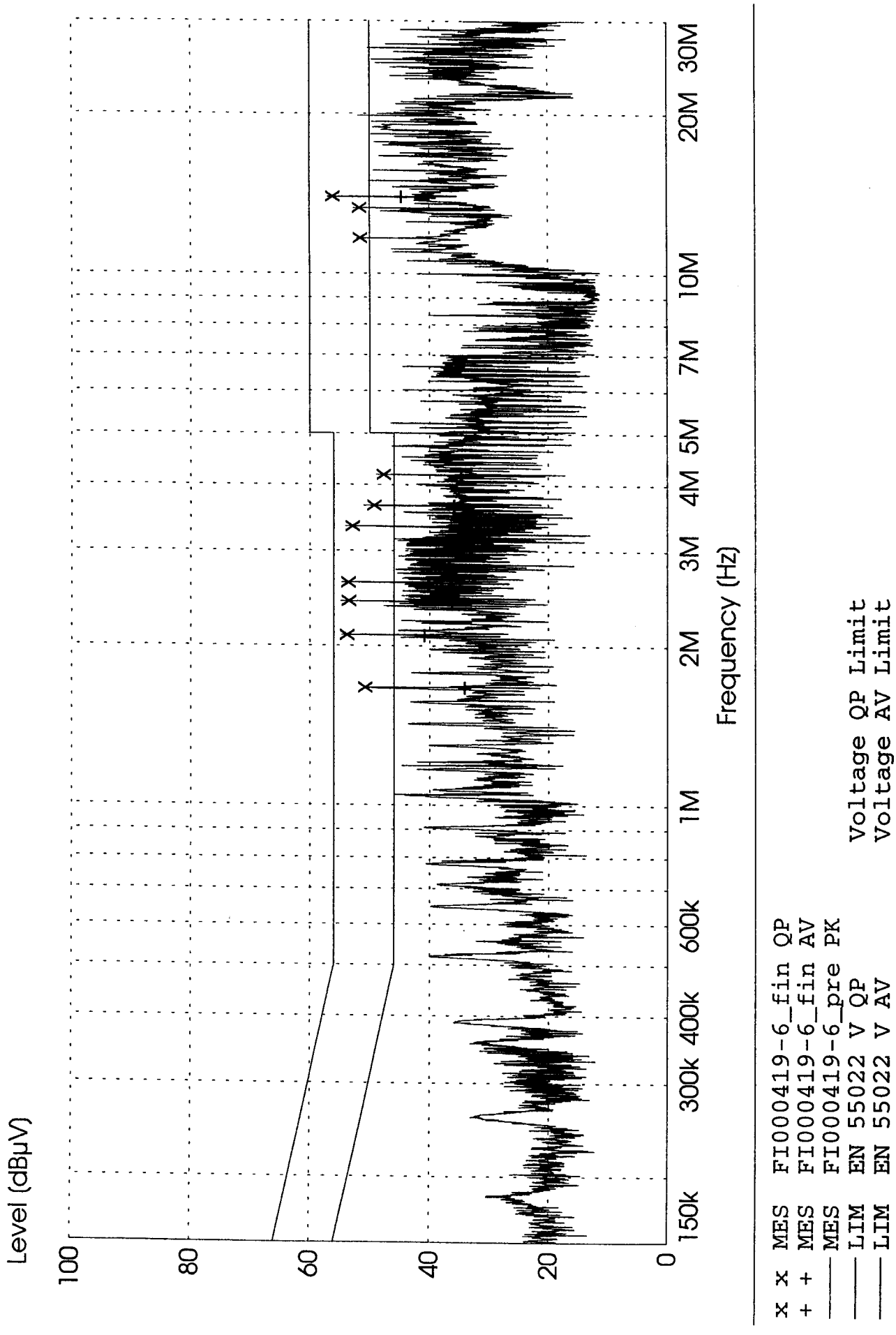
Sign:



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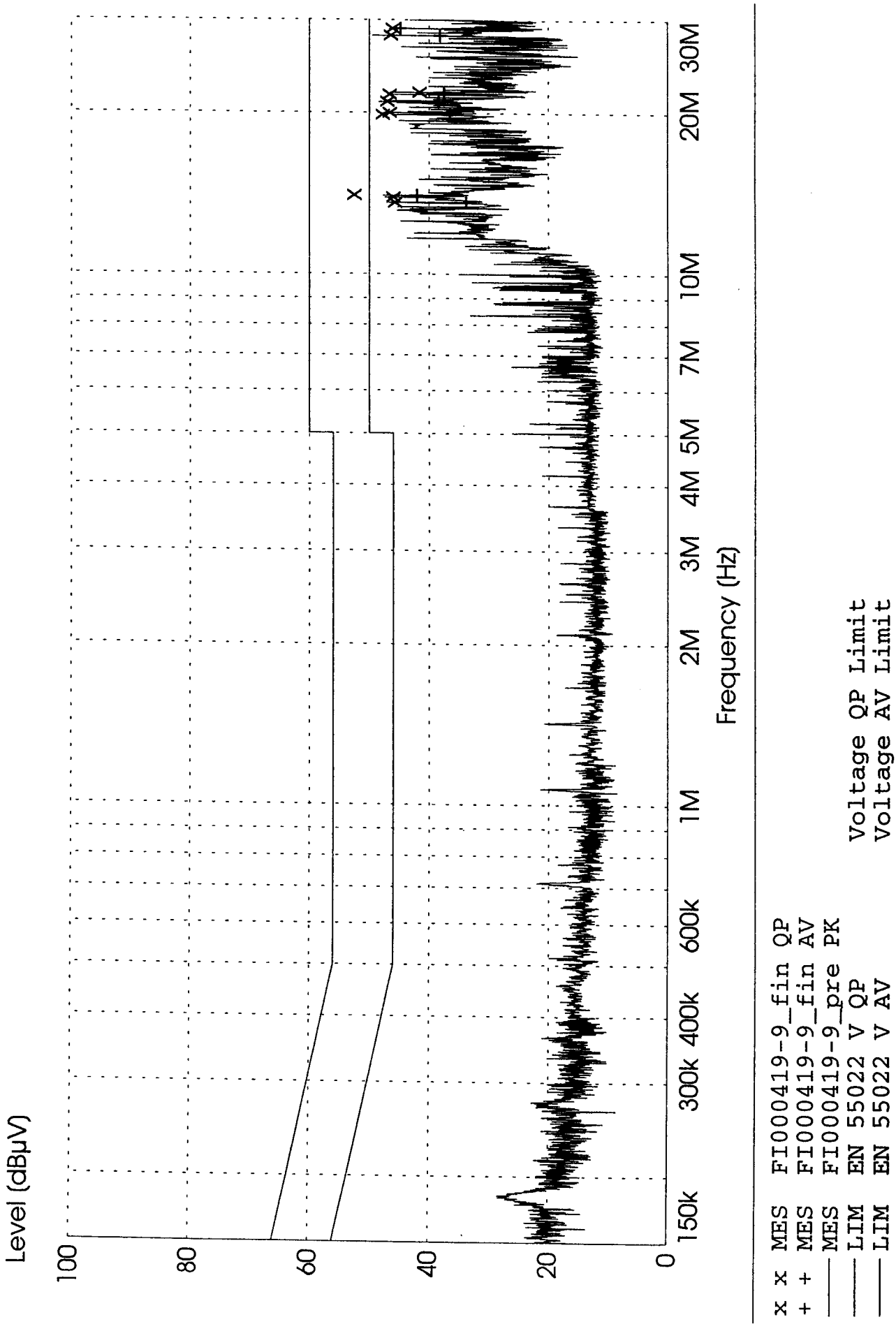
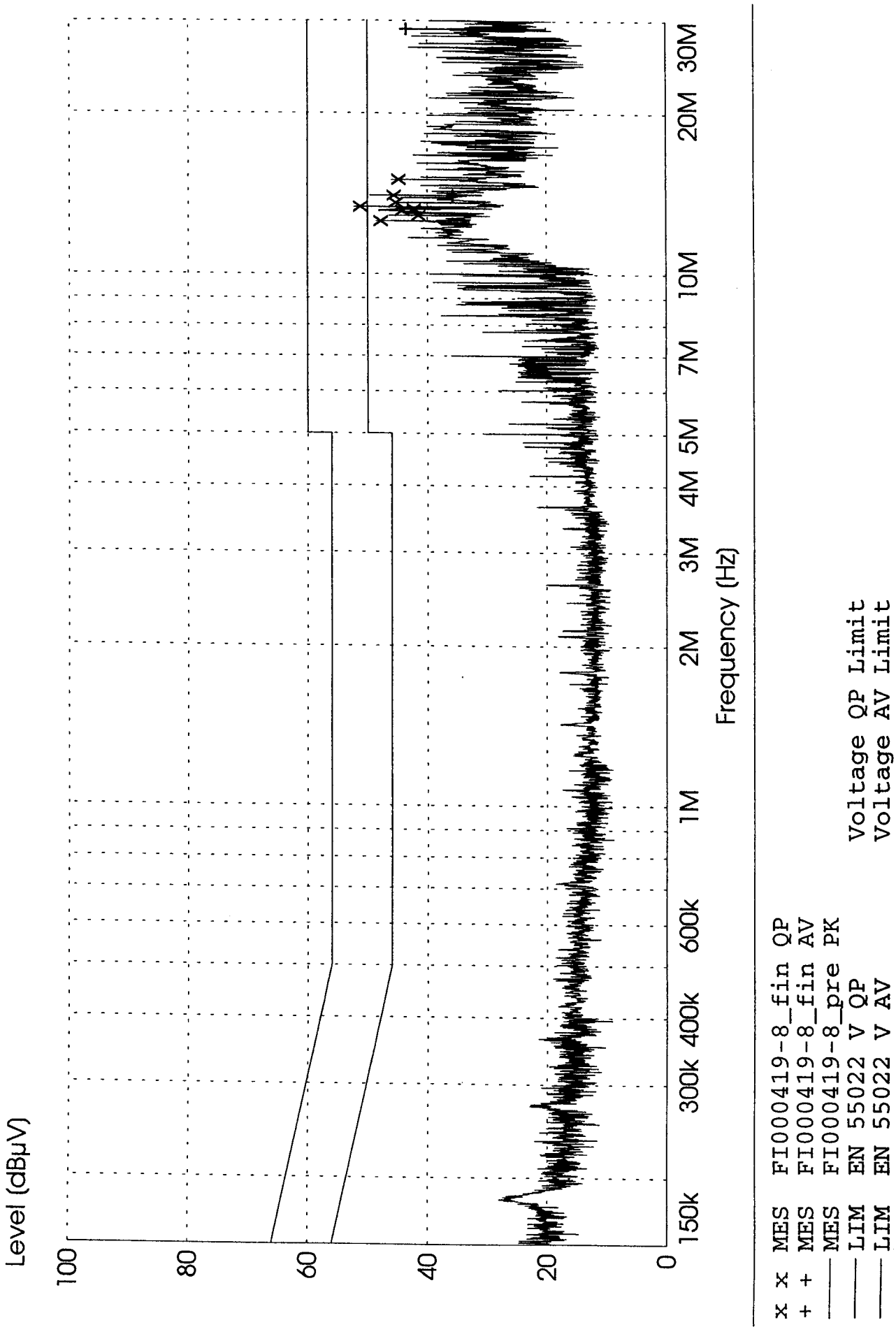
Sign:


Level (dBµV)
100
80
60
40
20
0
150k
300k
400k
600k
1M
2M
3M
4M
5M
7M
10M
20M
30M
Frequency (Hz)
x x MES FI000419-9_fin QP
+ + MES FI000419-9_fin AV
MES FI000419-9_pre PK
LIM EN 55022 V QP
LIM EN 55022 V AV
Voltage QP Limit
Voltage AV Limit
Page 1 2000-04-19 17:33

Sign: .....



Page 1 2000-04-19 17:25

Sign:

Immunity to electrostatic discharge according to EN 61 000-4-2: 1995

Date	Temperature	Humidity
2000-04-19	24 °C ± 3 °C	46 % ± 5 %

Severity level

Air discharges: 8 kV
Contact discharges: 4 kV

Test Set-up and Procedure

Test set-up: Floor standing equipment.

The test object was not grounded during the test.

Performance criterion: TT

Test equipment	SP number
Schaffner NSG 435	502 549
Testo 610, Temperature and humidity meter	502 658

Results

Test points	Discharge type	Result
Contact shell to can cable	Contact	Ok
Termination	Contact	Ok
Screws between the to halves	Contact	Ok
Near LED	Contact	Ok
Top of black and silver halves	Contact	Ok
Bottom	Contact	Ok
Plastic front	Air	Ok, no discharge occurred
Vertical and horizontal coupling plane	Contact	Ok

Performance requirements fulfilled?	Yes

Sign:

Immunity to radiated electromagnetic field according EN 61 000-4-3: 1996

Date	Temperature	Humidity
2000-04-18	23 °C ± 3 °C	40 % ± 5 %

Severity

Amplitude: 3 V/m (according to standard).

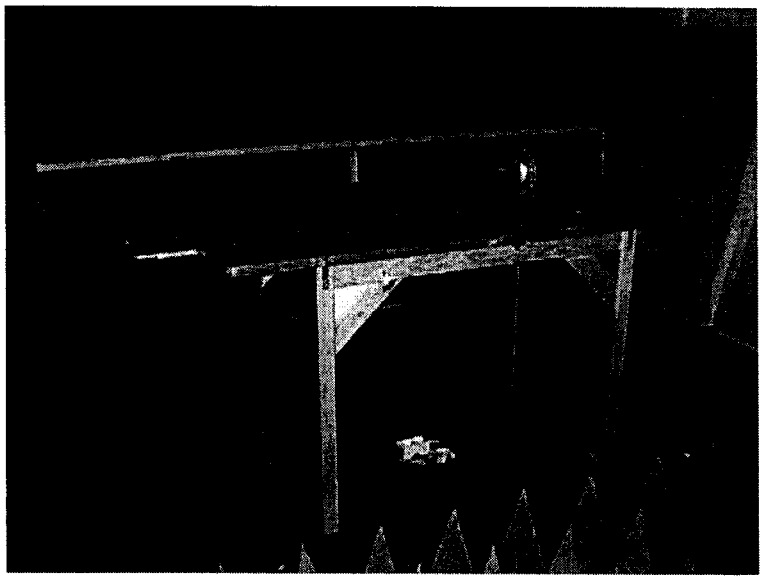
The tests were performed with 10 V/m.

Test Set-up and Procedure

The tests were performed in a fully anechoic chamber.

The test object was not grounded during the test.

The test set-up can be seen in the picture below.



The antenna distance during the test was 3 m.

Performance criterion: CT

Test equipment	SP number
Anechoic chamber	7:314
Computer, RST PII system	
Control Program SPIMM 3.20	
R&S SMY01	502 164
HP 33120A	502 026
R&S NAP	501 740
R&S NAP-Z6	501 742
KALMUS 137C	501 607
KALMUS LA600UE	501 690
KALMUS 723FC	502 000
Chase Bilog antenna CBL 6121A	502 461
Testo 610, Temperature and humidity meter	501 782

Sign:

Result

EN 61 000-4-3, Amplitude modulation 80 %, 1 kHz sine wave					
Frequency MHz	EUT side facing antenna	Horisontal		Vertical	
		V/m	Result	V/m	Result
26-1000	0 °	10	Ok	10	Ok
26-1000	90 °	10	Ok	10	Ok
26-1000	180 °	10	Ok	10	Ok
26-1000	270 °	10	Ok	10	Ok

Note: The test was performed with a sinusoidal audio signal of 1000 Hz instead of 400 Hz.

Performance requirements fulfilled?	Yes

Sign:....

Immunity to electrical fast burst/transient EN 61 000-4-4: 1995

Date	Temperature	Humidity
2000-04-26	25 °C ± 3 °C	35 % ± 5 %

Severity

Direct injection: 2 kV
Capacitive injection: 1 kV

Test Set-up and Procedure

Test set-up: The EUT was placed on a ground plane and insulated from it by a 0.1 m thick insulator. The EUT was not grounded.

The tests were performed with positive and negative polarity for 1 minute each.

Performance criterion: TT

Test equipment	SP number
TRANSIENT 1000	502 667
Capacitive clamp Schaffner CDN125	502 770
Testo 610, Temperature and humidity meter	502 658

Result

The tested cable was according to the following table:

Cable	Dir / Cap	Result
Can cable	Cap	Ok

Dir = Tested by direct injection.
Cap = Tested with the capacitive coupling clamp

Performance requirements fulfilled?	Yes

Sign:

Immunity to surges according to EN 61 000-4-5: 1995

Date	Temperature	Humidity
2000-04-26	25 °C ± 3 °C	35 % ± 5 %

Severity

Signal and control ports: 0.5 kV

Test Set-up and Procedure

Test set-up: The EUT was placed on a ground plane and insulated from it by a 0.1 m thick insulator.
The EUT was grounded.
The test was performed on a shielded cable, grounded at both ends, with a length of 8 m.

The pulse was applied 5 times in each polarity at 60 seconds intervals.

Performance criterion: TT

Test equipment	SP number
TRANSIENT 1000	502 667
Testo 610, Temperature and humidity meter	502 658

Result

The tested cable was according to the following table:

Cable	Result
Can cable	Ok

Note 1: The test was performed with a cable with a length of 8 m.

Performance requirements fulfilled?	Yes

Sign:

Immunity to injected radio frequent disturbances according to EN 61 000-4-6: 1996

Date	Temperature	Humidity
2000-04-18	23 °C ± 3 °C	40 % ± 5 %

Severity

Amplitude: 3 V

Test Set-up and Procedure

Test set-up: Table top. The test object was placed on a ground plane and insulated from it by a 0.1 m thick insulator. The test object was not grounded.

Performance criterion: CT

Test equipment	SP number
Anechoic chamber	7:314
Computer RST PII System	
Control Program SPIMM 3.20	
R&S SMY01	502 164
R&S NAP	501 740
R&S NAP Z-8	501 741
KALMUS 137C	501 607
Lüthi EM101	502 489
Lüthi FTC101	502 771
Testo 610, Temperature and humidity meter	501 782

Result

The tested cables were according to the following table:

EN 61 000-4-6, Amplitude modulation 80 %, 400 Hz sine wave				
Frequency (MHz)	CDN	Cable	Amplitude (V)	Result
0.15-80	EM-clamp	Can cable	3	Ok, Note 1

Note 1: The communication was lost at the following frequencies 200 kHz, 270 kHz, and 65 MHz, the communication was re-established automatically after 10 seconds.
The influence could not be repeated when test were repeated at the frequencies above.

Performance requirements fulfilled?	Yes

Sign:

Immunity to electrical transient according to ISO 7637-1:1990

Date	Temperature	Humidity
2000-04-20	23 °C ± 3 °C	40 % ± 5 %

Severity

PULSE	1	2	3a	3b	4
Level	II	II	II	II	II
Power terminals	-50V/ 10 pulses	+50V/ 10 pulses	-50V/ 5 min	50V/ 5 min	Vs=-5V Va=-2.5V t6=25ms t8=5s tf=5ms

Test Set-up and Procedure

The test object was not grounded.

Pulse 1 and 2 was applied with a pulse repetition rate of 0,2 Hz and 0,4 Hz respectively. Pulse 3a and 3b were applied 3000 times, with a pulse repetition frequency of 10 Hz. Pulse 4 was applied 5 times.

Functional criteria: CT for pulse 3a and 3b
TT for pulse 1, 2, 4 and 7

Test equipment	Required for	SP number
Schaffner NSG 500C, Disturbance generator	Pulse 1,2 3a and 3b	501 251
Pulse 4 generator (own manufacture)	Pulse 4	no number
HP33120A, Function generator	Pulse 4	502 026
Oscilloscope HP Infinium	All	502 784
Testo 610, Temperature and humidity meter	All	501 782

Result

PULSE	1	2	3a	3b	4
Result	Ok	OK	Ok	Ok	Ok

Performance requirements fulfilled?	Yes

Sign:

REPORT

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Handläggare, enhet/*Handled by, department*
Fredrik Isaksson
Physics and Electrotechnics
Tel +46 (0)33 16 55 80

Datum/*Date*	Beteckning/*Reference*	Sida/*Page*
2000-04-17	F002464:C	1 (1)

Type approval tests on Radio equipment, class II

(6 enclosures)

Test object

Sensor SENSYS 240, number 10-0008, Rev: C, serial number EEBCCB020000.

Summary

Standard		Compliant	Enclosure	Remarks
I-ETS 300 440: 1995		Yes		
Equivalent isotropically radiated power (eirp)	7.1	Yes	2	
Permitted range of operating frequencies	7.2	Yes	3	
Spurious emissions	7.3	Yes	4	
Spurious emissions (Receiver)	8.1	Not applicable		Note 1

Note 1: As the test object only could be set to transmitting mode the test was not applicable.

SP Swedish National Testing and Research Institute
EMC

Jan Welinder
Technical Manager

Fredrik Isaksson
Technical Officer

SP 511

Test object-Technical description

Sensor Sensys 240	Transmitter
Frequency:	24.1 GHz
Power:	380 mW
Modulation:	FM
Power supply:	12 V DC

Functional test equipment

See enclosure 5.

Reservation

The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in the report.

Date of arrival for EUT

The test object was delivered: 2000-02-23.

Sign:

Equivalent isotropically radiated power (Eirp), subclause 7.1

Date	Temperature	Humidity
2000-03-28	20 °C ± 3 °C	20 % ± 5 %

Rated output power level (maximum): 500 mW

Test mode: Normal operating modulation.

Polarisation of the measurements for the larger power level: Vertical.

Bandwidth of measurement receiver: 1 MHz

Results

Test conditions		Transmitter power (mW)
T_{nom} 20°C	V_{nom} 12.0 V	380
Measurement uncertainty		< 6 dB

Remark: As the test object is equipped with an integral antenna and had no RF connector, measurements under extreme conditions are not required.

Limit, subclause 7.1.3

For normal test conditions.

Class	Radiated peak power (Eirp) W		
	1.0 ≤ f ≤ 5.0 GHz	5.0 < f ≤ 20.0 GHz	20.0 < f GHz
I	10 mW	25 mW	100 mW
II	500 mW		
III	500 mW	2 W	

Reference number(s) of test equipment used

(for reference see test equipment listing)

I02, I04, I08, A05 and A06.

Performance requirements fulfilled?	Yes

Sign: .....

Permitted range of operating frequencies, subclause 7.2

Date	Temperature	Humidity
2000-03-28	20 °C ± 3 °C	20 % ± 5 %
Date	Temperature	Humidity
2000-04-11	25 °C ± 3 °C	23 % ± 5 %

Permitted range of operating frequency band: 24.00 – 24.25 GHz

Test mode: Normal operating modulation.

Results

Test conditions		Frequency GHz	
T_{nom} 25°C	V_{nom} 12.0 V	FL	24.099
		FH	24.104
T_{min} -20°C	V_{min} 10.8 V	FL	24.102
		FH	24.107
	V_{max} 15.6 V	FL	24.102
		FH	24.107
T_{max} 55°C	V_{min} 10.8 V	FL	24.094
		FH	24.099
	V_{max} 15.6 V	FL	24.094
		FH	24.099
Measurement uncertainty		< 6 dB	

Spurious emission limits (Transmitter operating), subclause 7.3.7

Frequencies > 1000 MHz
1.0 µW = -30dBm

Reference number(s) of test equipment used

(for reference see test equipment listing)

I02, I07, I08, A06 and X01.

Performance requirements fulfilled?	Yes

SP 511

Sign: .....

Transmitter spurious emissions radiated, subclause 7.3

Date	Temperature	Humidity
2000-04-03	22 °C ± 3 °C	32 % ± 5 %

Power level at which the measurement has been performed: 380 mW.

Test mode: Normal operating modulation.

Results

Frequency (MHz)	Measuring receiver bandwidth (Hz)	Spurious emission level (W)	
		Transmitter Operating	
		Vertical	Horizontal
25-1000	100 kHz	All emission > 10 dB below limit	
29 217	1 MHz	0.2 µW	—
30 108	1 MHz	0.3 µW	—
36 337	1 MHz	0.2 µW	—
37 449	1 MHz	0.4 µW	—
1000-24000	1 MHz	All other emission > 6 dB below limit	
Measurement uncertainty		< 6 dB	

Remark: The test object could only be set to operating mode, thus no measurements could be done with the test object in standby mode.

Limits, subclause 7.3.7

Conditions	47 MHz to 74 MHz 87,5 to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1000 MHz	Frequencies > 1000 MHz
Tx Operating	4 nW = -54 dBm	250 nW = -36 dBm	1 µW = -30dBm
Tx Standby	2 nW = -57 dBm	2 nW = -57 dBm	20 nW = -47 dBm

Sign: .....

Reference number(s) of test equipment used
(for reference see test equipment listing)

I02, I04, I08, A01, A02, A04, A05, A06, A07; X02 and X03.

Performance requirements fulfilled?	Yes

Sign:

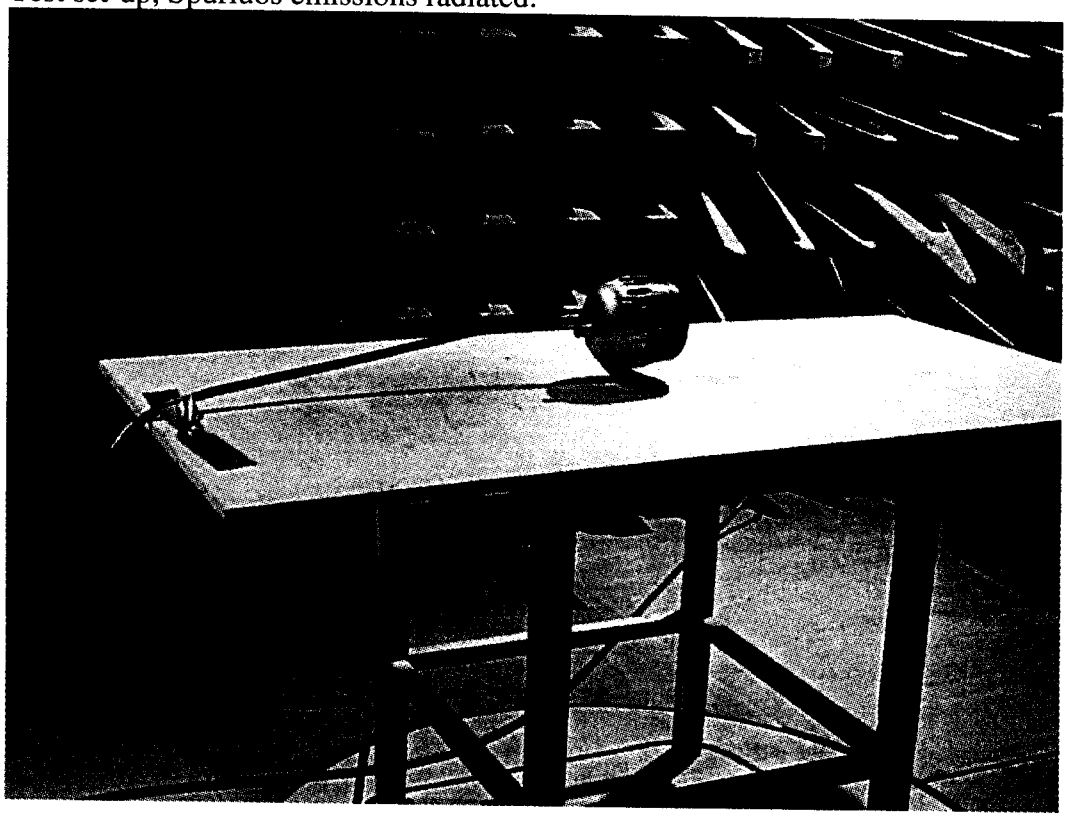
Test equipment and ancillaries used for tests

Ref No.	Instrument/Ancillary	Manufacturer	SP No.
I01	Radio communication analyzer CMTA 54	R&S	502 173
I02	Spectrum analyzer ESI	ESI	503 125
I03	Network analyzer HP8753	HP	501 650
I04	Signal generator SMR40	R&S	503 524
I05	Signal generator SME06	R&S	502 755
I06	Power meter	Boonton	501 608
I07	DC power supply XKW 40-25	XANTREX	502 942
I08	12 V DC Traction battery	-	-
A01	Bilog antenna CBL 6111A	Chase	502 181
A02	Bilog antenna CBL 6121	Chase	502 460
A03	Horn antenna 3115	Emco	501 548
A04	Horn antenna 3115	Emco	502 175
A05	Horn antenna 3116	Emco	-
A06	Standard gain horn antenna 20240-20	Flann	-
A07	Standard gain horn antenna 22240-20	Flann	-
X01	Climate chamber	-	Fee
X02	Amplifier 0.1-26.5 GHz	MITEQ	
X03	Amplifier 18-40 GHz	MITEQ	
X04	Attenuator 2069-20dB	Inmet	502 985
X05	Attenuator 2043-10dB	Inmet	502 986
X06	Notch Filter TNF-208	Eagle	502 759
X07	HP Filter NHP-500	Mini-circuits	-
X08	HP Filter 3HP7-1000-SR	Lorch Microw.	502 758
X09	Terminator TN180M-10W	Inmet	502 989
X10	Power Divider DL 307/N	TRM	502 553

Sign: ...

Photos,EUT

Test set-up, Spuriuos emissions radiated:



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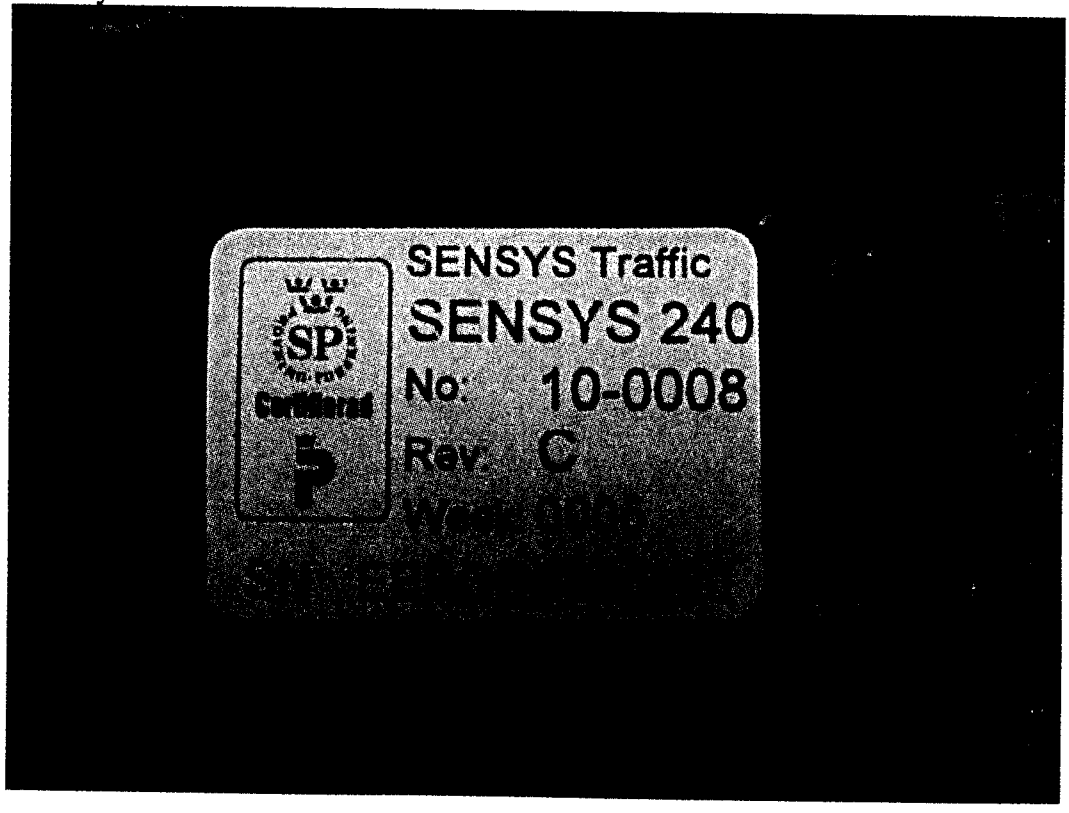
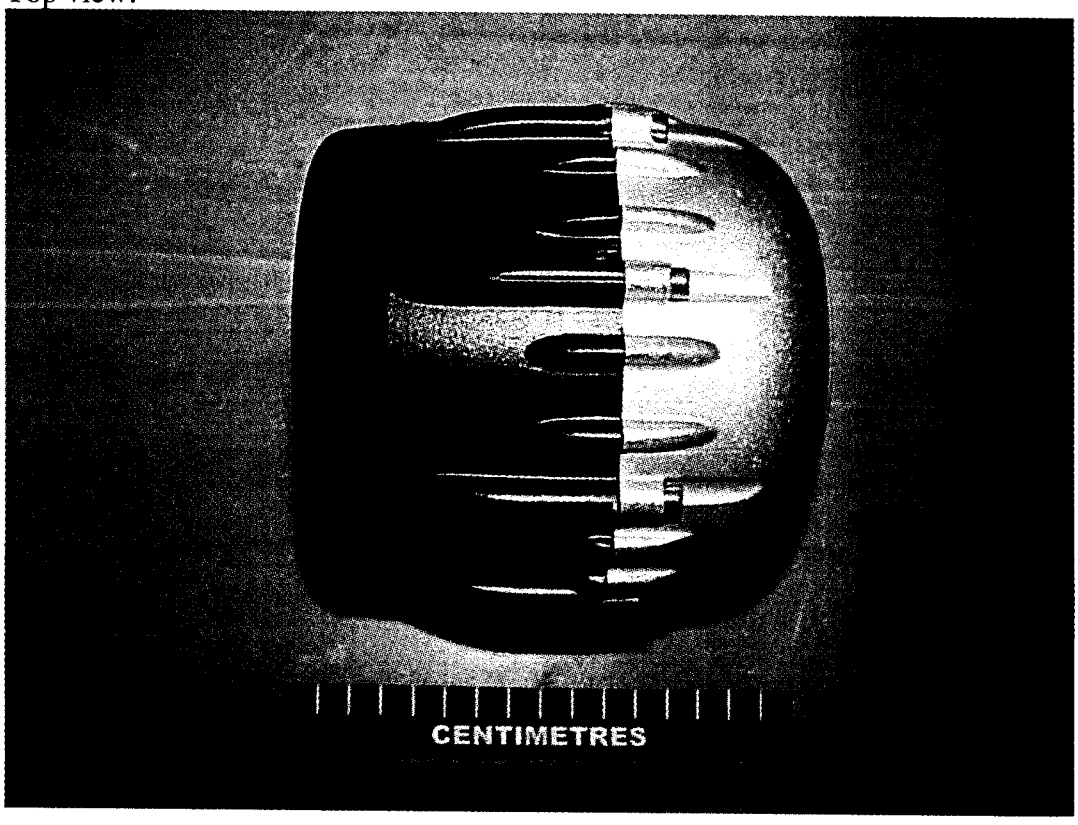
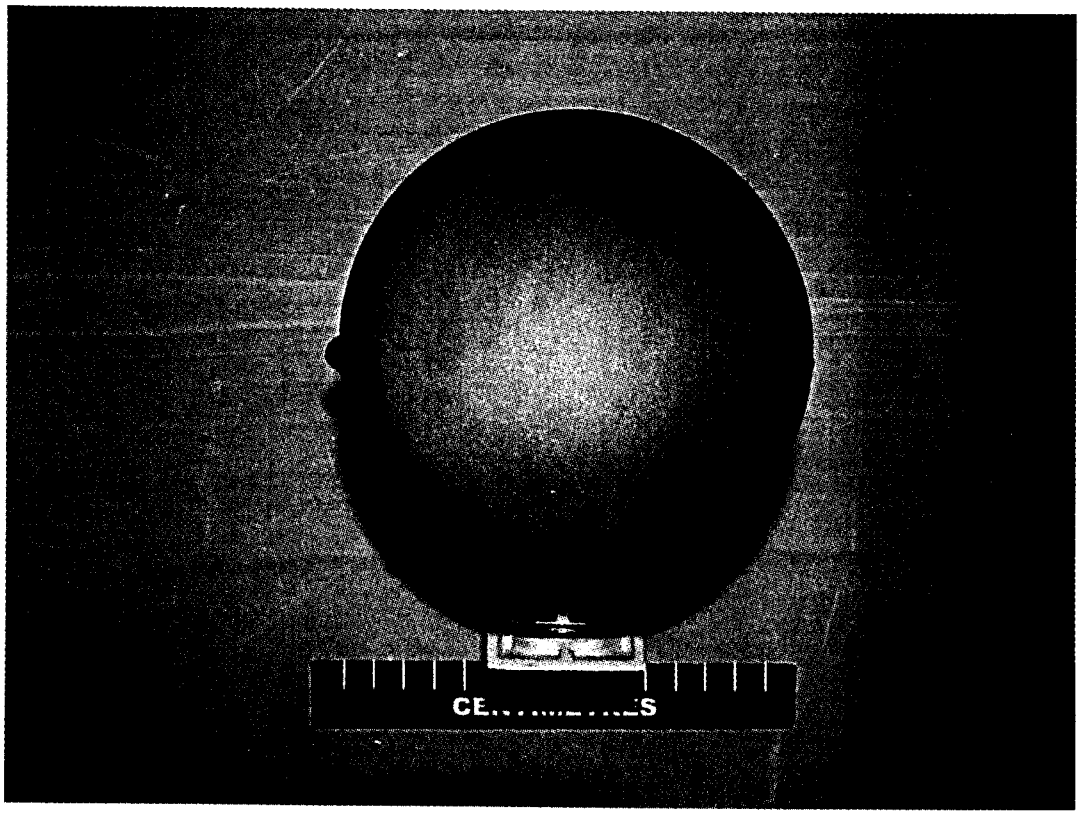


Sign:

Top view:

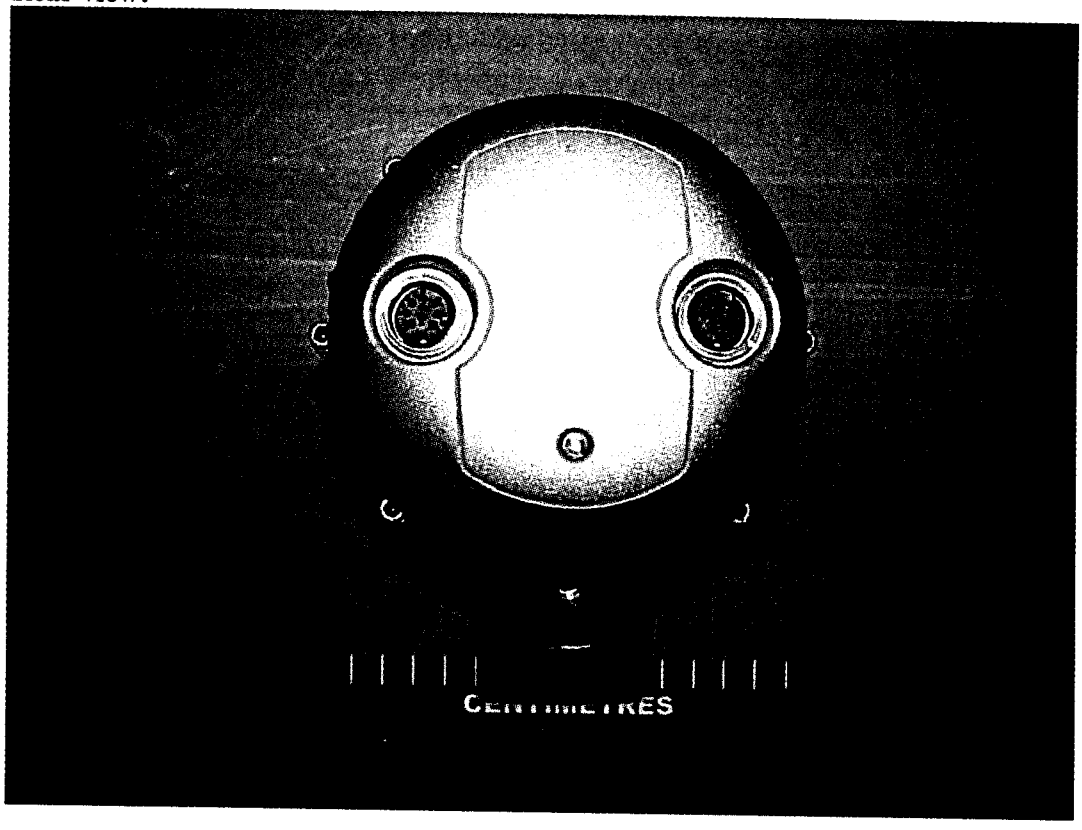


Front view:

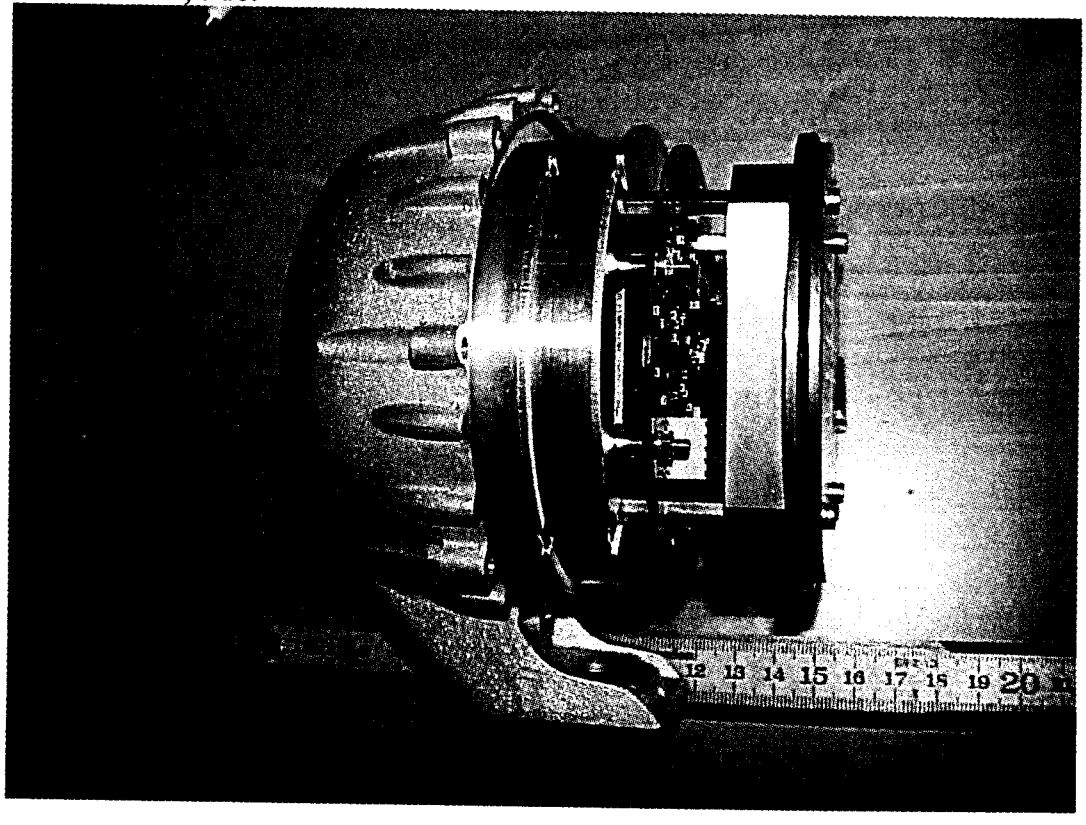


Sign:

Rear view:

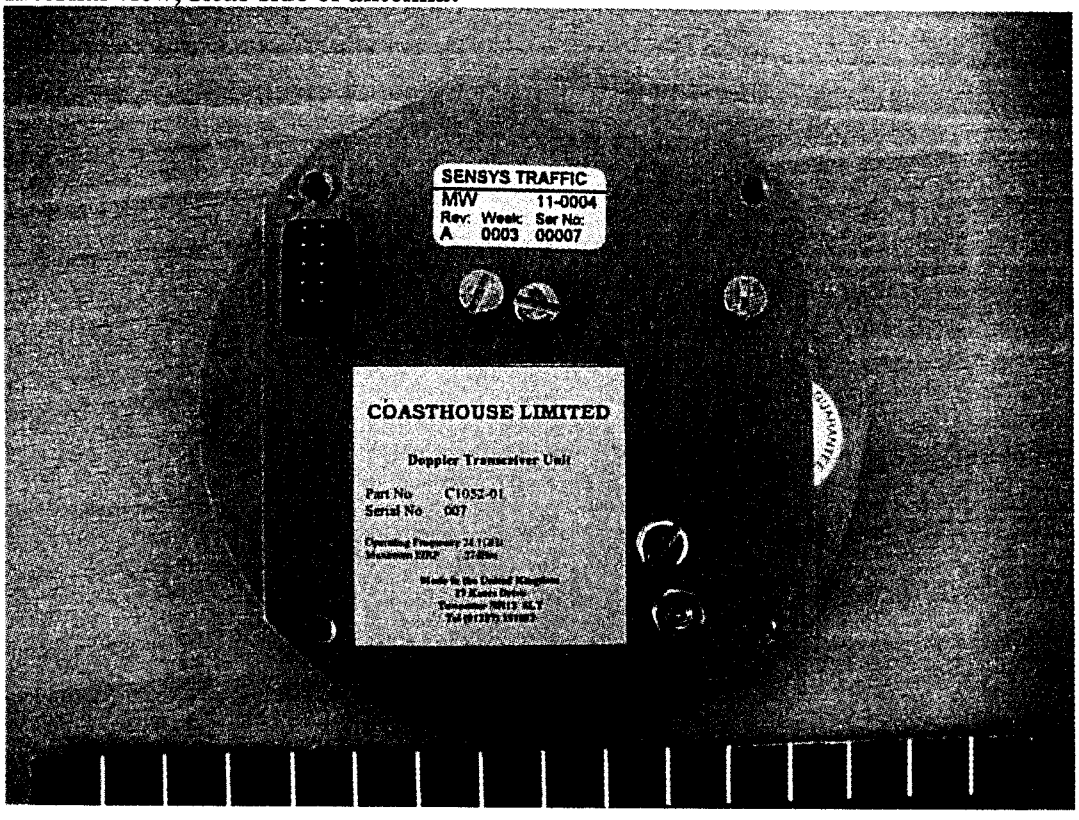


Internal view, side:

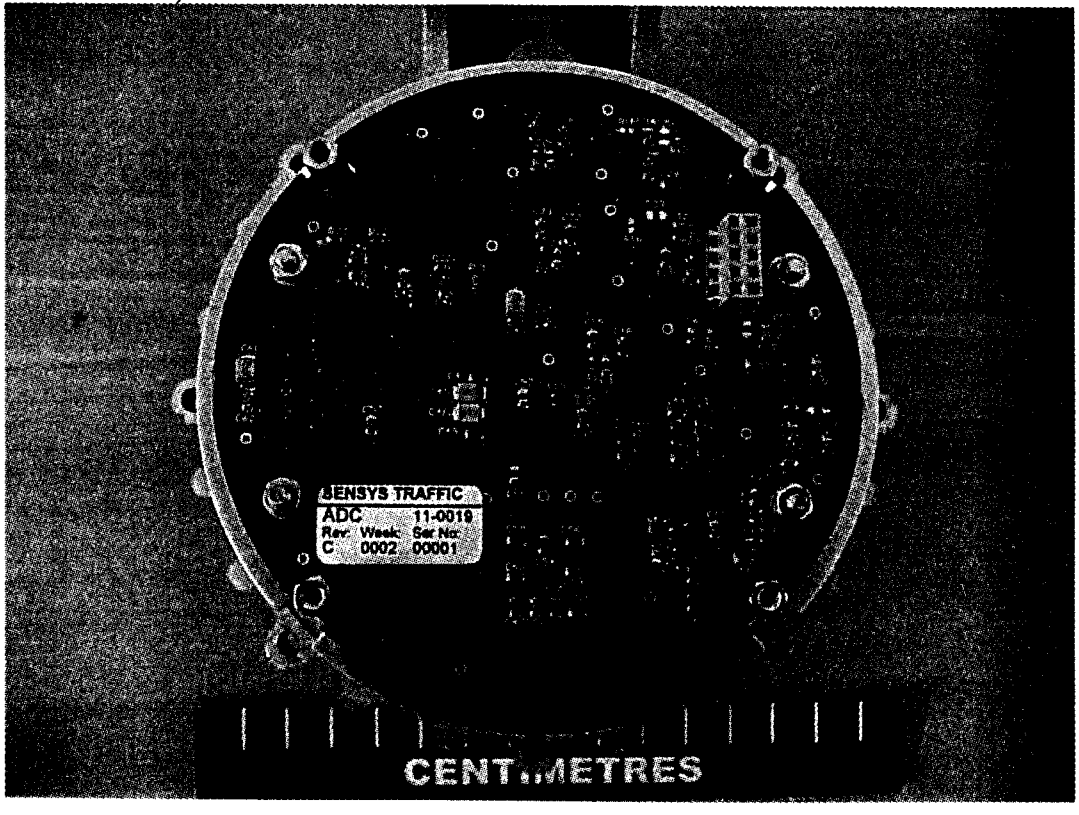


Sign:

Internal view, Rear side of antenna:



Internal view, PCB under antenna:



Sign: .....