

Date: ESPOO 26.11.1999Page: 1 (15)Appendices -Number:
No. 1 / 1**TL 990349B**

Date of handing in: 11.11.1999

Tested by:

**T017 (EN 45001)**

Timo Leismala, Test Engineer

Reviewed by:

Janne Nyman, Product Manager, EMC

Version 2.03

SORT OF EQUIPMENT:

CardBus Interface

MARKETING NAME:

NetHawk N2

TYPE:

N2

MANUFACTURER:

X-Net Oy, Finland

SERIAL NUMBER:

CLIENT:

X-Net Oy, Finland

ADDRESS:

P.O.Box 100, FIN-90501 Oulu

TELEPHONE:

+ 358 8 551 3591

TEST SPECIFICATION:

**CISPR 22 (1997), ANSI C63.4 – 1992 and
FCC 47 CFR PART 15, SUBPART B, CLASS B (1994)****SUMMARY:**

In regard to the performed tests the EUT fulfils the requirements defined in the test specification CISPR 22 (1997), see page 2 for details.

The test results are valid for the tested unit only. Without a written permission of EMCEC Oy it is allowed to copy this report as a whole, but not partially.

Summary of performed tests and test results

Emission tests according to the test specification FCC 47 CFR PART 15, SUBPART B, CLASS B (1994)

Emission test	Test method	Conclusion
Radiated disturbance	CISPR 22 (1997)	Pass, class B, margin 0.5 dB or more
Conducted disturbance at mains ports	CISPR 22 (1997)	Pass, class B, margin 20.3 dB or more

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1. General

The equipment under test (EUT) was a CardBus Interface. The purpose of the performed tests was to see if in regard to these tests the EUT fulfils the EMC requirements defined in the EC Council Directive 89/336/EEC and FCC 47 CFR PART 15, SUBPART B, CLASS B (1994). The tests were performed according to the test specification CISPR 22 (1997) by using accredited test methods.

2. System Configuration

2.1 Test set-up

Equipment under test (EUT):

- CardBus Interface NetHawk N2, type N2, S/N: ---

Peripheral devices:

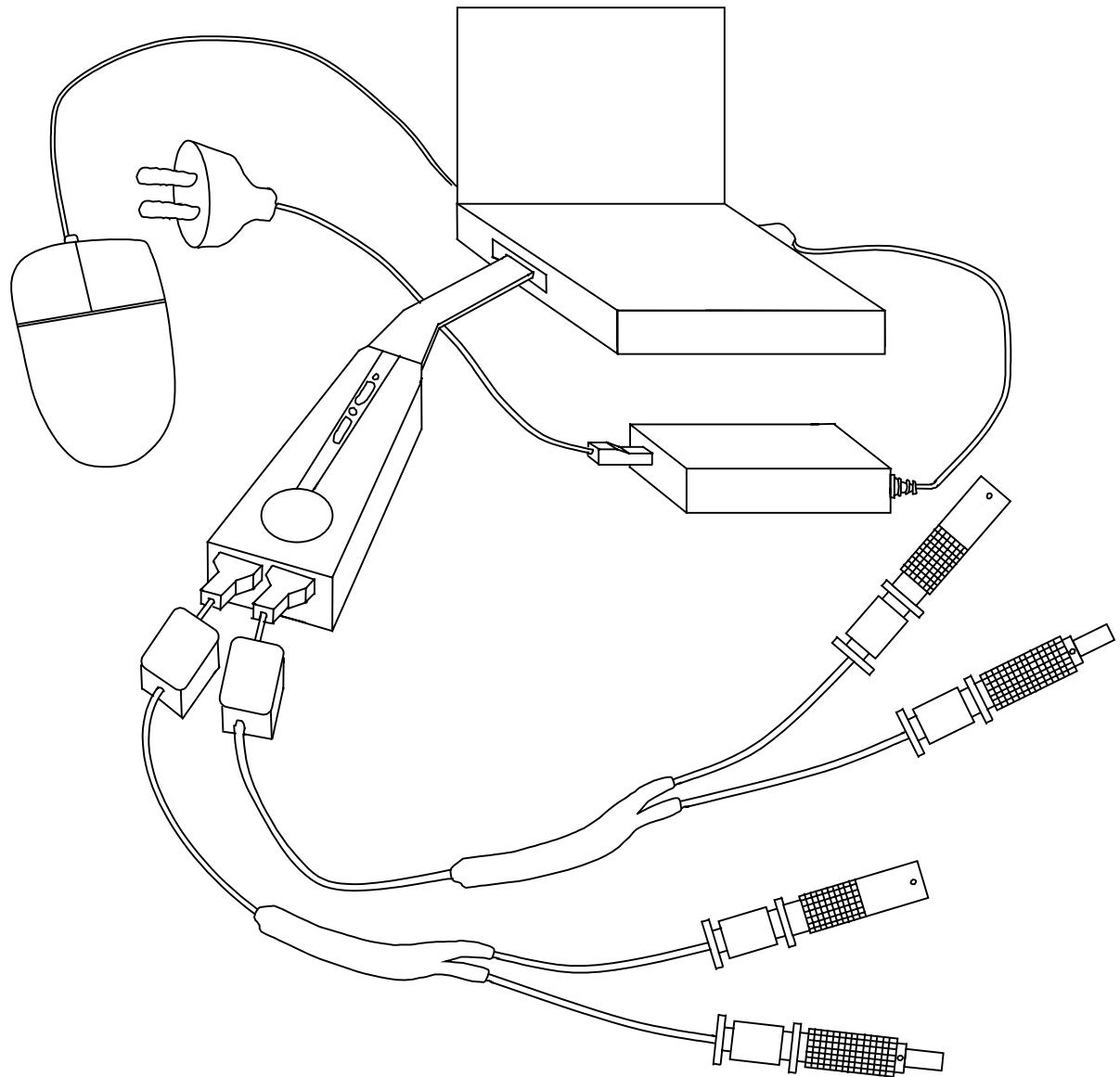
- Laptop computer Fujitsu Lifebook, type B110, Product No FPC01001B, P/N: CP000649-01
- Fujitsu AC adapter, type CA01007-0600, S/N: UJ21 9812497333
- Mouse Compaq, M/N: M-S34, C/T: F13490N5BH51RS2

Cables:

From	To	Type	Length [m]
Mains supply network	AC adapter	Mains cable, unshielded	1.85
AC adapter	Laptop computer	DC power input cable, unshielded, ferrite at the laptop computer end of the cable	1.9
Laptop computer	Mouse	Mouse cable, unshielded, ferrite at the laptop computer end of the cable (not shown in picture 1)	1.9
EUT	–	Data cable 2x2/0.14mm ² , ABB P/N: 791411, Prod. No: 623310, unterminated, ferrite at the EUT end of the cable	2.1
EUT	–	Data cable 2x2/0.14mm ² , ABB P/N: 791411, Prod. No: 623310, unterminated, ferrite at the EUT end of the cable	2.1

Operating voltage of the laptop computer:

- 115 V AC, 50 Hz



Picture 1. The test set-up.

2.2 Operating conditions and monitoring of the EUT

Emission tests:

For the duration of the tests the EUT was set to a test mode of operation. In the test mode the EUT was searching for possible error messages.

3. Test procedures

3.1 Emission tests

3.1.1 Radiated disturbance emission test

The test was performed as a compliance test. The test parameters concerned were as follows:

Parameter	Specification
Test method	CISPR 22 (1997)
Frequency range	30 – 1000 MHz
Site name	EMCEC Oy / Perkkaa
Date of testing	11.11.1999
Test equipment	184, 319, 338, 350, 397
Test uncertainty U95	+3.1 dB / -4.0 dB
Test conditions	22 °C, 30 % RH

The test was performed in a semi-anechoic shielded room. For the duration of the test the EUT was placed on the turntable 0.8 m high (photographs 1 to 4). During the test the distance from the EUT to the measuring antenna was 10 meters. In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna and the lay-out of the EUT cables were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarisations.

3.1.2 Conducted disturbance at mains ports emission test

The test was performed as a compliance test. The test parameters concerned were as follows:

Parameter	Specification
Test method	CISPR 22 (1997)
Frequency range	0.150 – 30 MHz
Site name	EMCEC Oy / Perkkaa
Date of testing	12.11.1999
Test equipment	5, 167, 184, 348
Test uncertainty U95	+2.3 dB / -2.9 dB
Test conditions	22 °C, 32 % RH

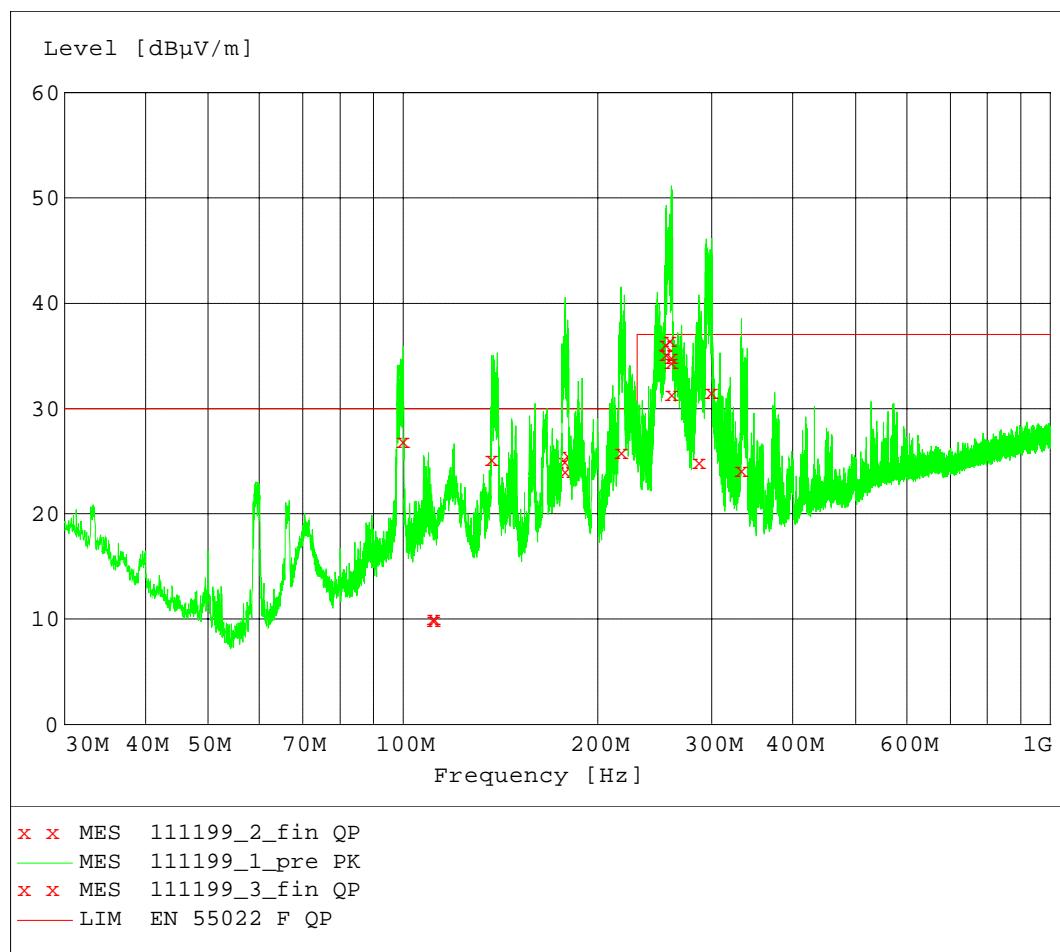
The test was performed inside a shielded room where the floor and one of the walls of the test site comprised the reference ground plane (RGP). For the duration of the test the EUT was placed on the non-conductive table 0.8 m high so that the distance between the EUT and the artificial mains network (AMN) was 0.8 m (see photographs 5 and 6). The distance between the EUT and the vertical ground plane was 0.4 m. The excess length of the cables of the EUT were made into bundles 30-40 cm in length. The power input cable of the laptop computer was connected to the AMN. The test was performed separately on the phase and also on the neutral wire.

The disturbances were first examined by performing a spectrum scan by using a peak detector. The general procedure in the conducted disturbance emission test is that no further measurements are necessary if the disturbance levels measured by using the peak detector are below the limit value defined for the measurement performed by using an average detector. If not, then at the test frequencies concerned the measurement is performed also by using a quasi-peak detector. If the disturbance levels measured by using the quasi-peak detector are below the limit value defined for the measurement performed by using an average detector, then measurements by using the average detector are not necessary.

4. Test results

4.1 Emission tests

4.1.1 Radiated disturbance emission test



Horizontal and vertical polarizations in the frequency range 30 - 1000 MHz measured by using the peak detector. The highest levels of the radiated interference field strength measured by using the quasi-peak detector were recorded.

Measurement results (QP)

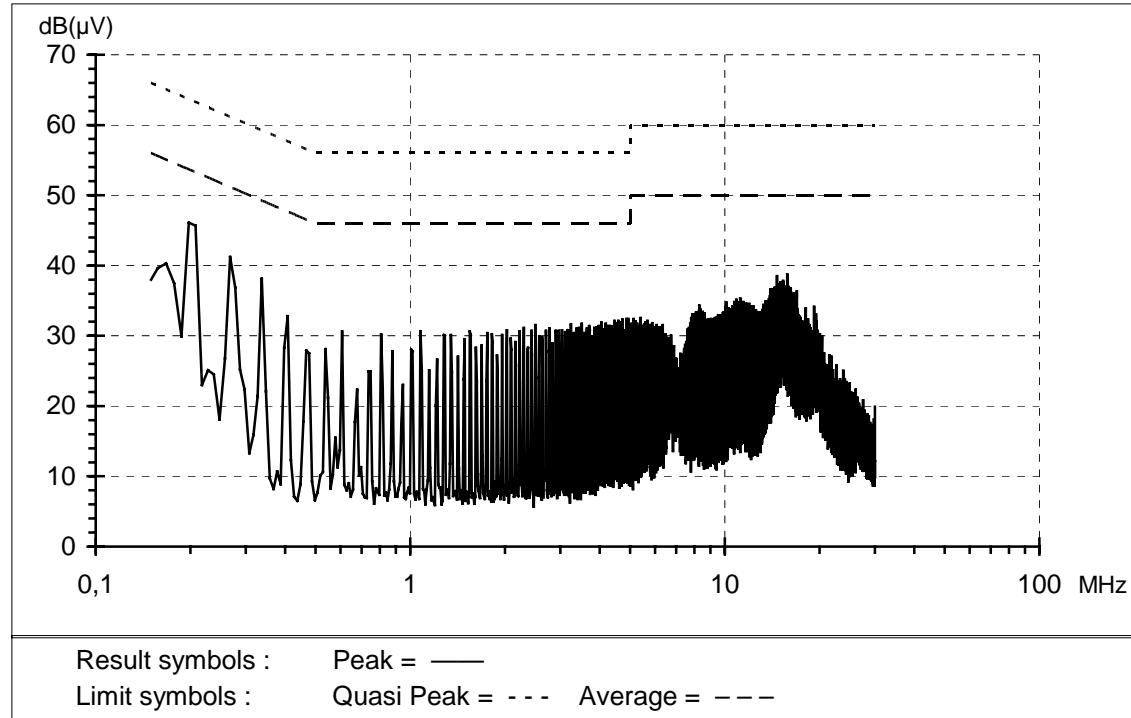
Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed	Height cm	Azimuth degrees	Polarization Hor/Ver
100.00	26.9	30.0	3.1	–	101.0	259.0	Vertical
111.56	10.1	30.0	19.9	–	121.0	357.0	Horizontal
137.12	25.2	30.0	4.8	–	102.0	205.0	Vertical
177.76	25.0	30.0	5.0	–	100.0	117.0	Vertical
177.84	24.1	30.0	5.9	–	112.0	252.0	Vertical
179.80	25.6	30.0	4.4	–	103.0	216.0	Vertical
217.32	25.9	30.0	4.1	–	102.0	187.0	Vertical
254.72	36.1	37.0	0.9	–	101.0	148.0	Vertical
255.08	35.2	37.0	1.8	–	100.0	137.0	Vertical
258.44	36.5	37.0	0.5	–	101.0	151.0	Vertical
259.72	34.4	37.0	2.6	–	122.0	139.0	Vertical
259.84	34.9	37.0	2.1	–	100.0	149.0	Vertical
260.20	31.4	37.0	5.6	–	102.0	142.0	Vertical
286.44	24.9	37.0	12.1	–	102.0	140.0	Vertical
299.60	31.6	37.0	5.4	–	100.0	160.0	Vertical
333.16	24.2	37.0	12.8	–	104.0	160.0	Vertical

4.1.2 Conducted disturbance at mains ports emission test

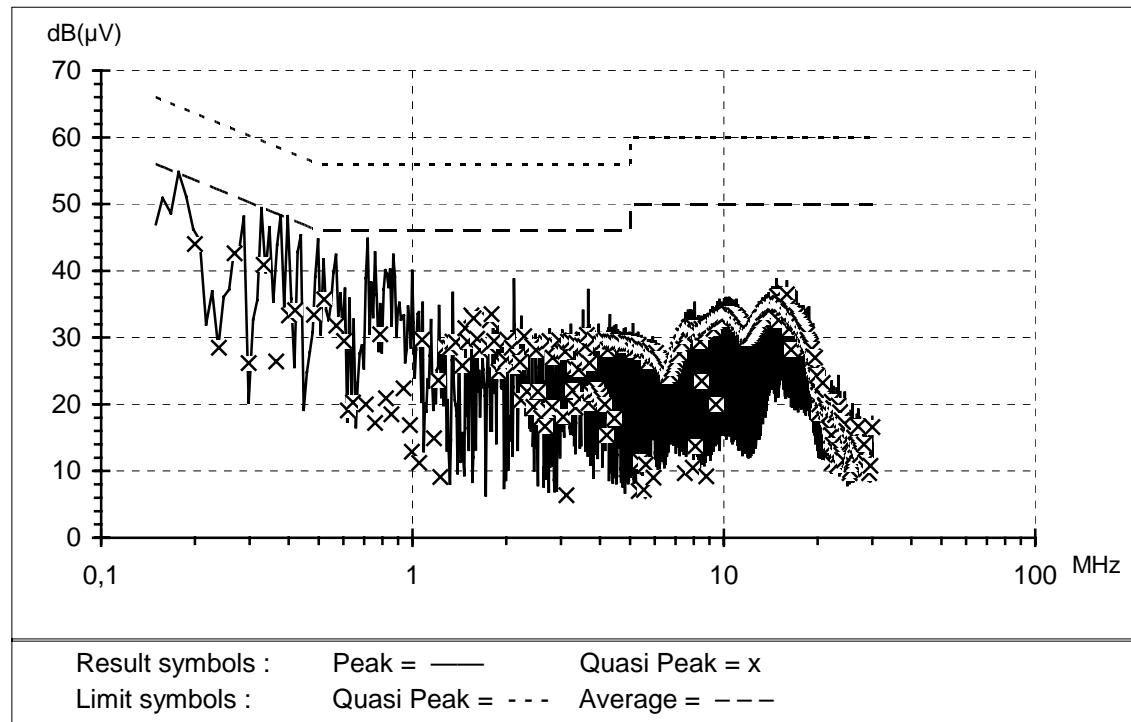
Measurement results:

Frequency MHz	Phase	Conducted disturbance				Conclusion Pass/Fail
		Result Quasi-peak dB(µV)	Limit value Quasi-peak dB(µV)	Result Average dB(µV)	Limit value Average dB(µV)	
0.150 – 30	0	–	66 / 56 / 60	–	56 / 46 / 50	Pass
0,200	1	44,0	63,6	–	53,6	Pass
0,268	1	42,6	61,2	–	51,2	Pass
0,333	1	40,9	59,4	–	49,4	Pass
0,520	1	35,7	56,0	–	46,0	Pass
14,393	1	35,0	60,0	–	50,0	Pass
14,458	1	35,0	60,0	–	50,0	Pass
14,528	1	35,2	60,0	–	50,0	Pass
14,663	1	35,2	60,0	–	50,0	Pass
14,728	1	35,1	60,0	–	50,0	Pass
14,798	1	36,2	60,0	–	50,0	Pass
15,133	1	35,2	60,0	–	50,0	Pass
15,333	1	35,1	60,0	–	50,0	Pass
15,403	1	35,1	60,0	–	50,0	Pass
15,938	1	36,5	60,0	–	50,0	Pass

Phase 0



Phase 1



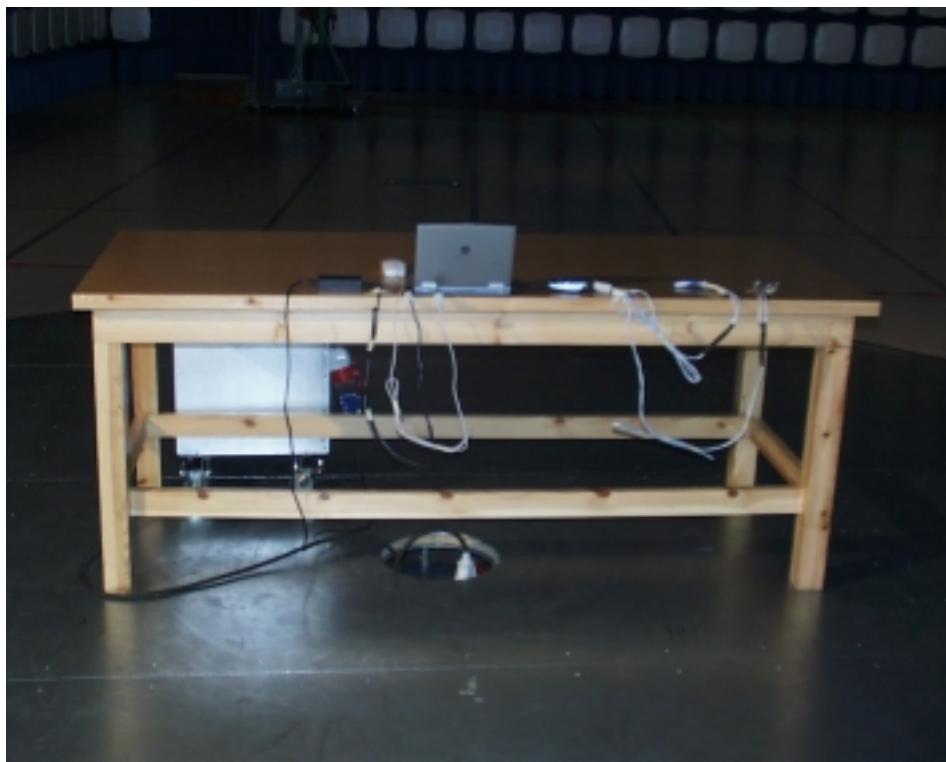
5. List of test equipment

No.	Equipment	Type	Manufacturer	Serial Number	Date of calibration
5	Test receiver	ESH-3	Rohde & Schwarz	894718/015	1999/23/08
338	Test receiver	ESS	Rohde & Schwarz	847151/009	1999/15/10
397	RF-amplifier	ZFL-2000	Mini-Circuits	–	1999/02/09
319	Antenna	CBL6112	Chase	2018	1998/02/12
167	Artificial mains network	NSLK 8126	Schwartzbeck	8126101	1999/28/07
184	Temp. & humidity meter	HMI 32	Vaisala	63837	1998/16/12
348	Shielded room	RFSD-100	Euroshield Oy	1320	–
350	Semi-anechoic shielded room	RFD-F-100	Euroshield Oy	1327	1999/23/04

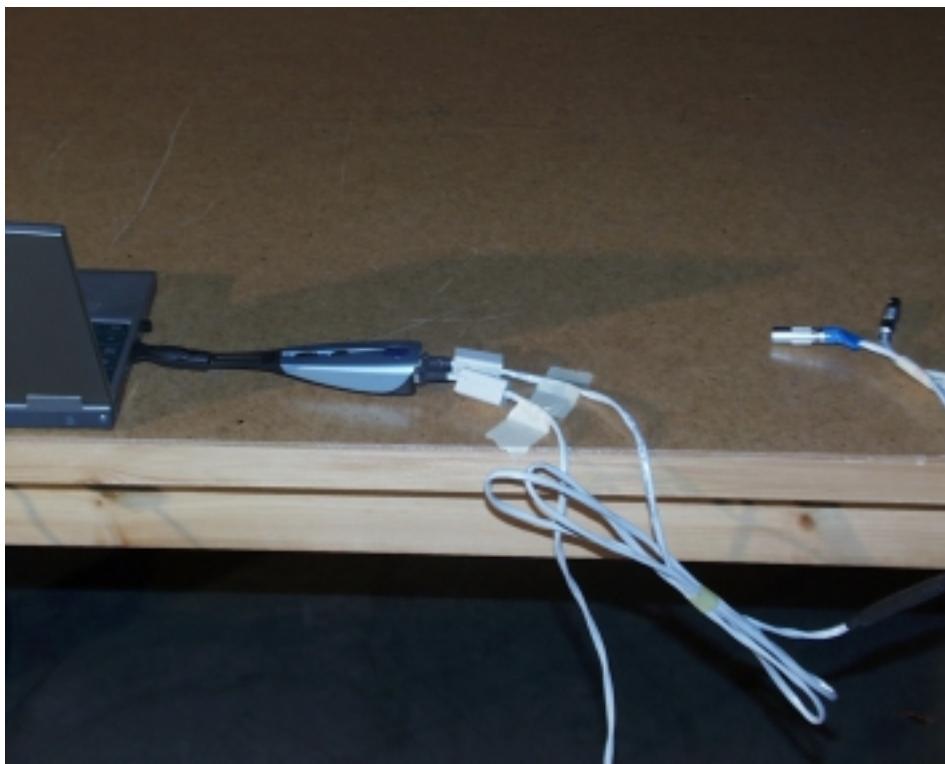
6. Photographs



Photograph 1. Radiated disturbance emission test.



Photograph 2. Radiated disturbance emission test.



Photograph 3. Radiated disturbance emission test.



Photograph 4. Radiated disturbance emission test.



Photograph 5. Conducted emissions at mains ports emission test.



Photograph 1. Conducted emissions at mains ports emission test.