Nemko TEST REPORT

Date:	**ESPOO 31.08.2009**	Page:	**1 (13)**
		Appendices	**–**

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Tested by:

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FINAS
Finnish Accreditation Service
T017 (EN ISO/IEC 17025)

Reviewed by:

Timo Leismala, Testing Manager

SORT OF EQUIPMENT:	**Radio Modem (PCB unit)**
MARKETING NAME:	***SATELLINE-M3-TR1***
TYPE:	***SATEL-TA13***
MANUFACTURER:	***Satel Oy, Finland***
SERIAL NUMBER:	**0926 21**
CLIENT:	**Satel Oy**
ADDRESS:	**P.O. Box 142 (Meriniitynkatu 17), FI-24101 Salo, Finland**
TELEPHONE:	**+358 (0)50 5998411 / Marita Latovehmas**
TEST SPECIFICATION:	**Council Directive 72/245/EEC, as last amended by Commission Directive 2006/28/EC**

SUMMARY:

In regard to the performed tests the EUT fulfils the requirements defined in the Council Directive 72/245/EEC, as last amended by Commission Directive 2006/28/EC, see page 2 for details.

According to the standards the emission measurement results have been compared directly with the limit lines without considering measurement uncertainties.

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Summary of performed tests and test results

Emission tests according to the Council Directive 72/245/EEC, as last amended by Commission Directives 2004/104/EC, 2005/49/EC, 2005/83/EC and 2006/28/EC

Emission test	Test method	Conclusion
Measurement of radiated interference field strength in the frequency range 30 – 1000 MHz	2005/83/EC, ANNEXES VII and VIII	Pass [1)]
Measurement of conducted disturbances	2005/83/EC, ANNEX X	Not tested [2)] [3)]

1) Limit values according to the Council Directive 2005/83/EC ANNEX I, paragraphs 6.5 and 6.6
2) Limit values according to the Council Directive 2005/83/EC ANNEX I, paragraphs 6.9
3) ESAs that are not switched, contain no switches or do not include inductive loads need not be tested for conducted emission and shall be deemed to comply with paragraph 6.9 of ANNEX 9

Immunity tests according to the Council Directive 72/245/EEC, as last amended by Commission Directives 2004/104/EC, 2005/49/EC, 2005/83/EC and 2006/28/EC

Immunity test	Test method	Conclusion
Radiated radio-frequency electromagnetic field	2005/83/EC, ANNEX IX	not tested [4)] [6)]
Immunity to transient disturbances conducted along supply lines	2005/83/EC, ANNEX X	Pass [5)]

4) The requirements defined in the Council Directive 2005/83/EC, ANNEX I, paragraph 6.7.
5) The requirements defined in the Council Directive 2005/83/EC, ANNEX I, paragraph 6.8.
6) ESAs with no immunity-related functions need not be tested for immunity to radiated disturbances and shall be deemed to comply with paragraph 6.7 of ANNEX I.

Contents

1. General

The equipment under test (EUT) was a radio modem. The purpose of the performed tests was to see if in regard to these tests the EUT fulfils the EMC requirements defined in the Council Directive 72/245/EEC, as last amended by Commission Directives 2004/104/EC, 2005/49/EC, 2005/83/EC and 2006/28/EC. The tests were performed by using accredited test methods.

2. System Configuration

2.1 Test set-up

Equipment under test (EUT):

unit	type	S/N
Radio modem	SATEL-TA13	0926 21
Adapter	Satel, ARS-1F-4A	-

Peripheral devices:

unit	type	S/N
Radio modem *)	SATEL-TA13	0926 20
Adapter *)	Satel, ARS-1F-4A	-
Computer 1	Compaq Admada, 1540D	0509Q114
Computer 2 *)	Fujitsu LifeBook, 555T	R6Y00015
20 dB 50W attenuator	Narda, 765-20	9605
Variable attenuator *)	R&S, DPU-BN 18043/50	2519/1

*) not used during Radiated disturbance emission test

Cables, Immunity to transient disturbances conducted along supply lines test:

from	to	type	length [m]
Radio modem EUT	Computer 1	unshielded	10
Radio modem EUT RX/TX port	Attenuator, 20dB + Variable	coaxial	1
Attenuator, 20dB + Variable	Radio modem RX/TX port	coaxial	1
Radio modem	Computer 2	unshielded	10
Radio modem EUT	DC power source	unshielded	0.5
Radio modem	DC power source	unshielded	1.7

Cables, Radiated disturbance emission test:

from	to	type	length [m]
Radio modem EUT	Computer 1	unshielded	10
Radio modem EUT	Power supply / Line Impedance Stabilizing Network	unshielded	1.7
Radio modem EUT RX/TX port	20 dB attenuator	-	-

Operating voltage of the EUT during the tests:

- 12 or 24 VDC

2.2 Operating conditions and the monitoring of the EUT

Radiated disturbance emission test:

The radio modem was connected to the computer. The antenna port of the radio modem was terminated. The computer was set to send a data pack. TX frequency was 438 MHz.

Immunity to transient disturbances conducted along supply lines test:

The radio modems were connected to the computers. The antenna ports of the radio modems were connected together via the attenuators. One computer was set to send a data pack. That data pack was received with the second computer. Quality of the data transfer was monitored. TX/RX frequency was 438 MHz.

2.3 Classification of functional status

Class A:

All functions of a device/system perform as designed during and after exposure to disturbance.

Class B:

All functions of a device/system perform as designed during and after exposure to disturbance. However, one or more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed. Memory functions shall remain class A.

Class C:

One or more functions of a device/system do not perform as designed during exposure but return automatically to normal operation after exposure is removed.

Class D:

One or more functions of a device/system do not perform as designed during exposure and do not return to normal operation until exposure is removed and a device/system is reset by simple “operator/use” action.

Class E:

One or more functions of a device/system do not perform as designed during exposure and cannot be returned to operation without repairing the device/system.

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	Annexes VII and VIII
Frequency range	30 – 1000 MHz
Site name	Nemko / Perkkaa
Date of testing	07.08.2009
Test equipment	227, 319, 338, 350, 497, 544
Test uncertainty U95	± 4.6 dB
Test conditions	22 °C, 43 % RH
Tested operation states	12 VDC

Frequency	Limit value
Broadband: 30 MHz - 75 MHz 75 MHz - 400 MHz 400 MHz - 1 GHz	Limit (quasi-peak) 62 dBµV/m - 52 dBµV/m 52 dBµV/m - 63 dBµV/m 63 dBµV/m
Narrowband: 30 MHz - 75 MHz 75 MHz - 400 MHz 400 MHz - 1 GHz	Limit (average) 52 dBµV/m - 42 dBµV/m 42 dBµV/m - 53 dBµV/m 53 dBµV/m

The test was performed in a semi-anechoic shielded room. For the duration of the test the EUT and its cables were placed on a non-conductive support 5 cm above the conductive ground plane placed on a non-conductive table 100 cm high (see photograph 1). During the test the distance from the edge of the conductive ground plane to the tip of the bilog measuring antenna was 100 cm. The measuring antenna was placed at a height of 115 cm above the test site floor. The test was performed separately with the measuring antenna being both in horizontal and vertical polarisation.

3.2 Immunity tests

3.2.1 Immunity to transient disturbances conducted along supply lines

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

Parameter	Specification
Test method	Annex X
12 V input, Pulse	1: 1/2000 µs, -75 V, 1000 pulses 2a: 1/50 µs, +37 V, 1000 pulses 2b: 20V, 220 ms, 1 pulse 3a: 5/100 ns, -112 V, 60 minutes 3b: 5/100 ns, +75 V, 60 minutes 4: 25 ms -6.0 (8.0) V, 5 s -2.5 (12.0) V, 1 pulses
24 V input, Pulse	1: 3/2000 µs, -450 V, 5000 pulses 2a: 1/50 µs, +37 V, 5000 pulses 2b: 20V, 220 ms, 10 pulses 3a: 5/100 ns, -150 V, 60 minutes 3b: 5/100 ns, +150 V, 60 minutes 4: 50 ms -12 V, 5 s -5 V, 1 pulses
Classification of functional status	1: D 2a: D 2b: D 3a: D 3b: D 4: D
Site name	Nemko / Perkkaa
Date of testing	27.-28.08.2009
Test equipment	347, 348
Test conditions	22°C, 40 % RH
Tested operation states	12 VDC and 24 VDC

The test was carried out inside a shielded room. The EUT was placed on a non-conductive support 0.05 m above the RGP (see photograph 2). The internal coupling network of the test generator was used to test the DC power port of the EUT. The cable between the generator and the EUT was 0.5 m in length.

4. Test results

4.1 Emission tests

4.1.1 Radiated disturbance emission test

12 VDC

Frequency MHz	Conclusion Pass/Fail
30 - 1000	Pass

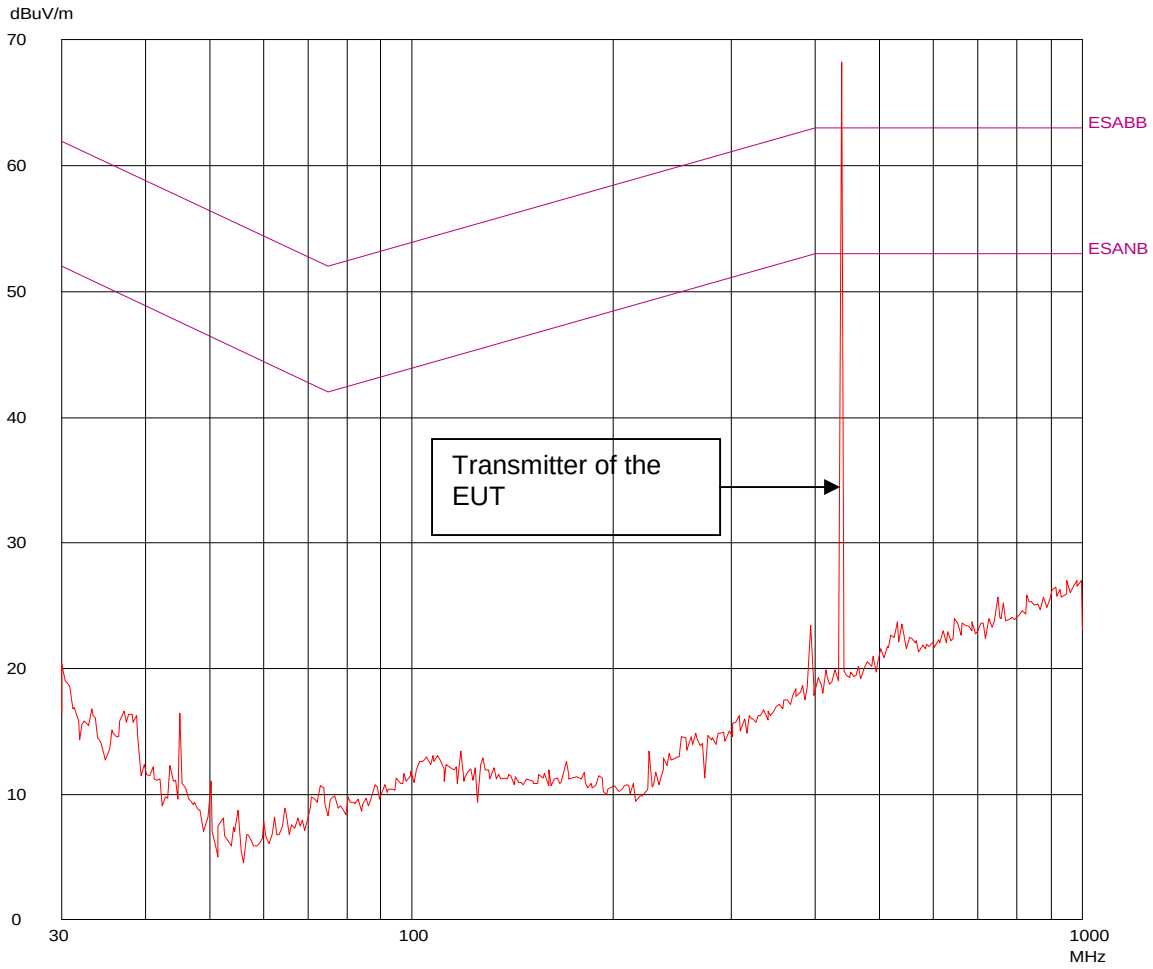
See graphs on pages 9 - 10

12 VDC, Vertical polarisation

Final Measurement Results:

07. Aug 09 12:06

no Results

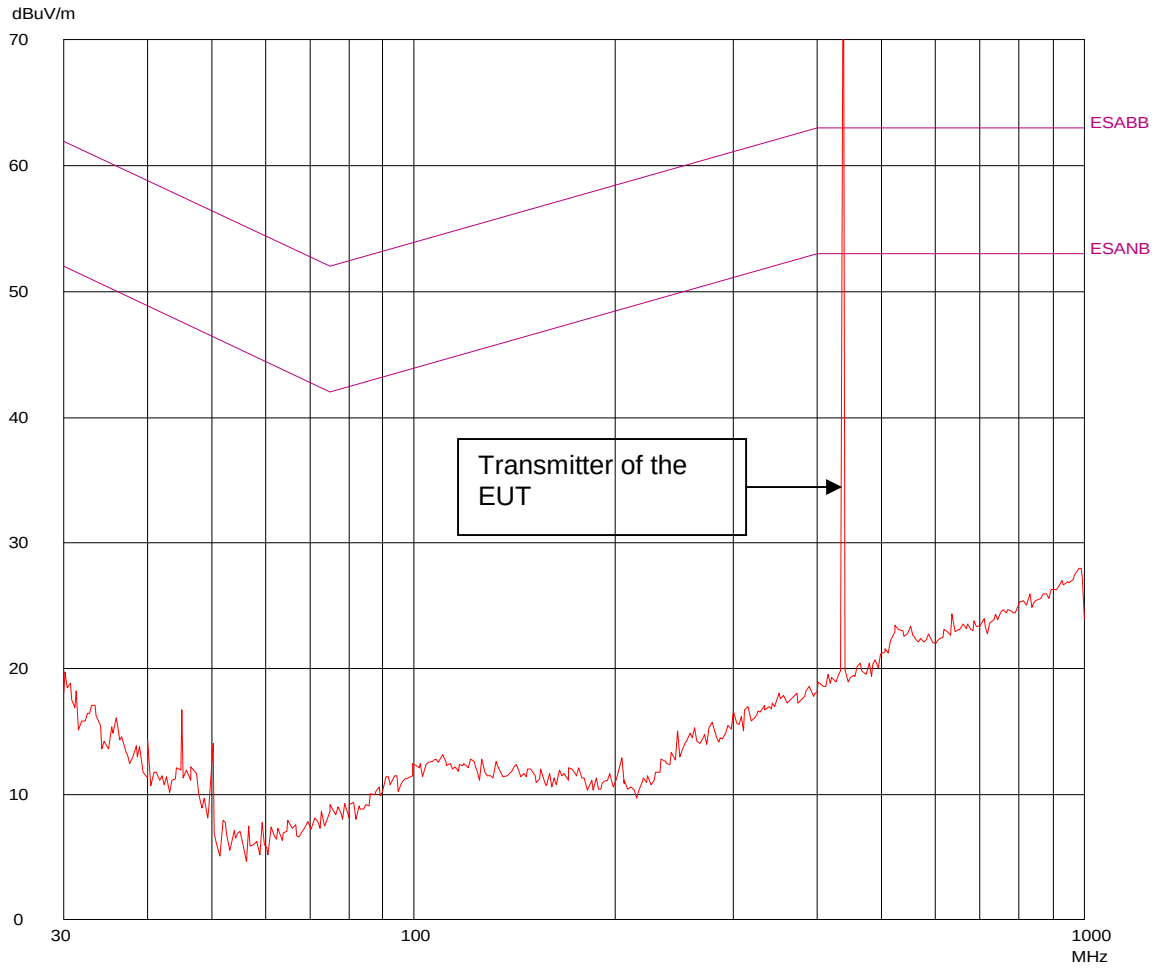


12 VDC, Horizontal polarisation

Final Measurement Results:

07. Aug 09 12:09

no Results



4.2 Immunity tests

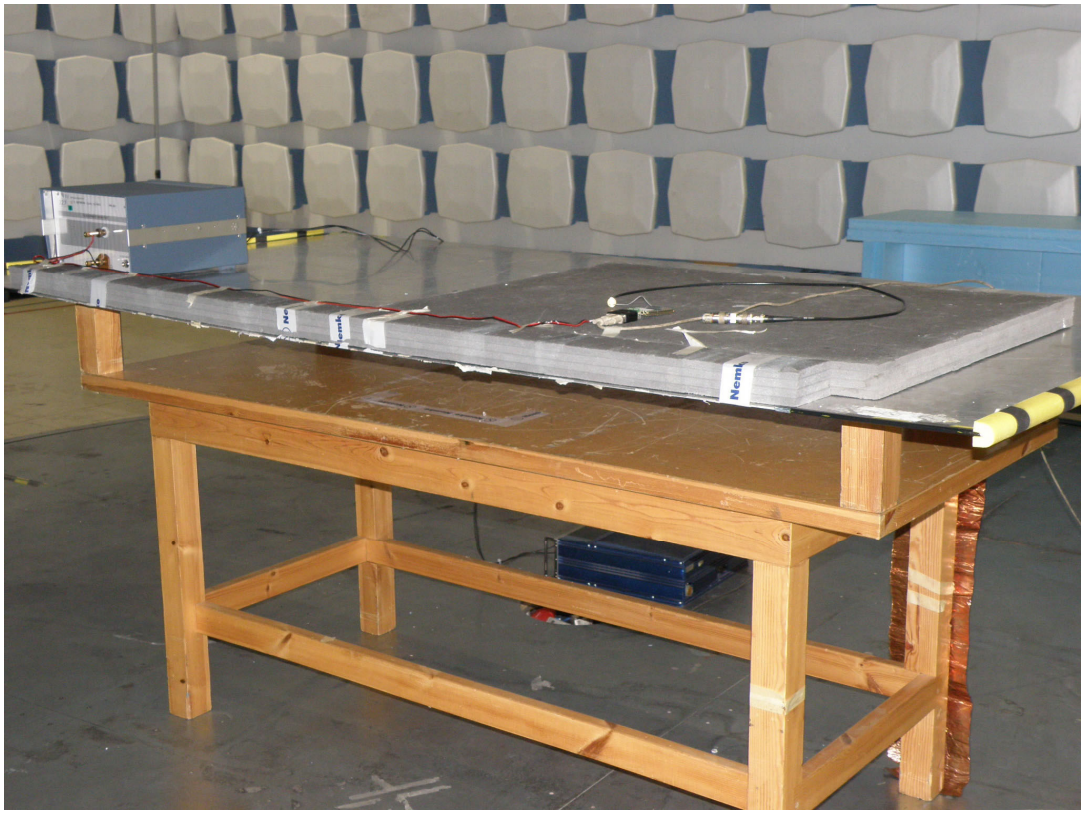
4.2.1 Immunity to transient disturbances conducted along supply lines

Port	Pulse	Remarks	Conclusion Pass/Fail
12V DC input	1	–	Pass
	2a	–	Pass
	2b	–	Pass
	3a	–	Pass
	3b	–	Pass
	4	–	Pass
24V DC input	1	–	Pass
	2a	–	Pass
	2b	–	Pass
	3a	–	Pass
	3b	–	Pass
	4	–	Pass

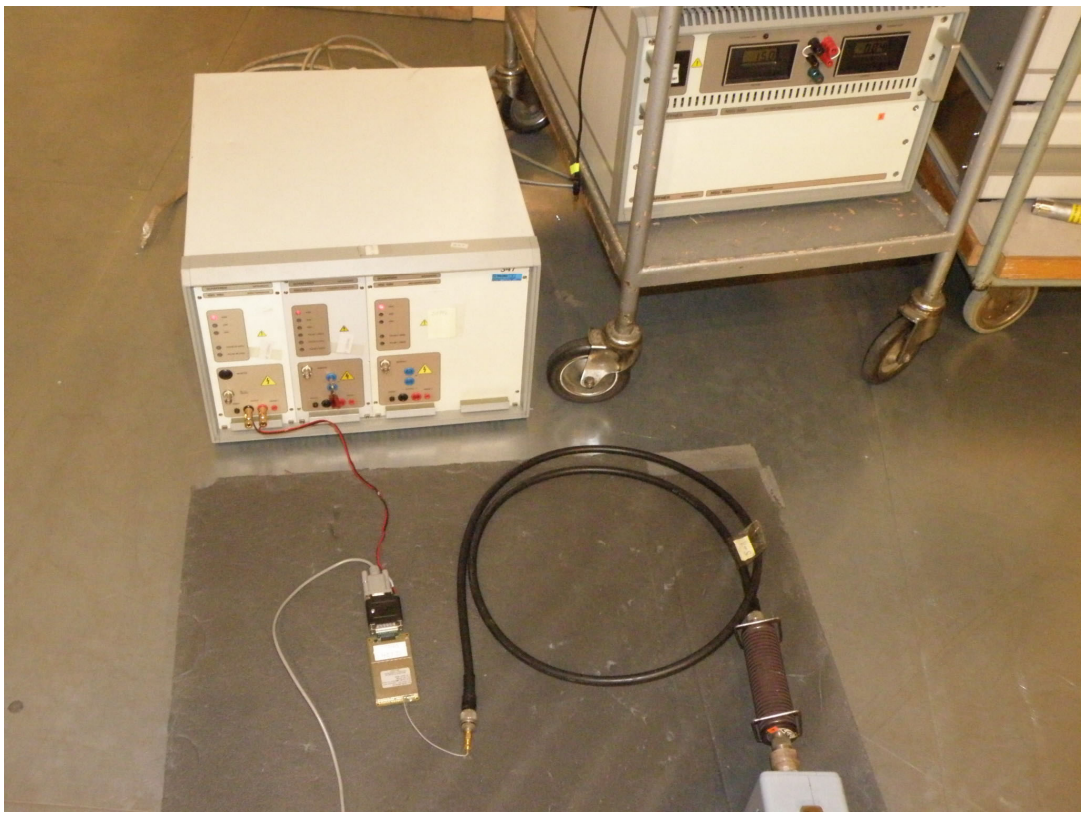
5. List of test equipment

No.	Equipment	Type	Manufacturer	Serial Number
338	Test receiver	ESS	Rohde & Schwarz	847151/009
578	Digital Oscilloscope	Wave Surfer 42Xs	LeCroy	LCRY0304M15037
351	RF generator	SMT 06	Rohde & Schwarz	845715/001
567	RF generator	E8257C	Agilent	MY43320736
340	RF-power amplifier	7100LC-CE	Kalmus	7583B1
355	RF power amplifier	LA100V - CE	Kalmus	7809-1
575	RF power amplifier	AS0825-65	Milmega	1011966
584	RF power amplifier	AR 500W1000am4	Amplifier Research	0325886
544	RF-amplifier	ZFL-1000VH2	Mini-Circuits	D01080
89	Antenna, logperiodic	3147	EMCO	9202-1078
90	Antenna, biconical	3109	EMCO	9109-2582
188	Antenna, bilog	CBL 6111	Chase	1028
319	Antenna	CBL6112	Chase	2018
352	Antenna	3142	EMCO	9701-1122
417	Antenna, bilog	CBL 6141	Chase	4028
525	Double-Ridged Horn	3115	EMCO	6691
167	Artificial mains network	NSLK 8126	Schwartzbeck	8126101
168	Artificial mains network	NSLK 8127	Schwartzbeck	8127162
227	Artificial mains network	PRL 951	Self made	150295
343	Artificial mains network	NSLK 8128	Schwartzbeck	8128177
356	V-network	ESH3-Z6	Rohde & Schwarz	845757/020
184	Temp. & humidity meter	HMI 32	Vaisala	63837
359	E-field probe	HI-4422	Holaday	95835
411	E-field probe	HI-4433-GRE	Holaday	96730
193	ESD generator	NSG435	Schaffner	316
405	Horizontal coupling plane	HCP1	Self made	-
406	Vertical coupling plate	VCP1	Self made	-
409	ESD generator	NSG435	Schaffner	2288
222	Impulse tester	PSURGE4	Haefely	083070-10
322	Coupling network	HV-SURGE 63.3	EMCEC OY	011996
224	EFT/Burst generator	PEFT JUNIOR	Haefely	083180-46
225	HF coupling clamp	IP4A	Haefely	083078-008
320	Voltage dip tester	PLINE 1610	Haefely Trench AG	083690-22
347	Automotive test system	NSG5000	Shaffner	EK3396-021
369	Discont.Interf.analyzer	DIA 1512A	Chase	5115
370	AC Power source	15003i-400/3	California Instr.	
294	DCN-network	801-M2/M3	Lüthi GmbH	
299	RF injection clamp	EM 100	Lüthi GmbH	-
497	ESA ground plane	-	Self made	971
581	Automotive pulse generator	ZCP 40-100	Zenone Elettronica	502
582	Automotive electronic switch	SWE-25A	Zenone Elettronica	499
348	Shielded room	RFSD-100	Euroshield Oy	1320
349	Shielded room	RFSD-100	Euroshield Oy	1319
350	Semi-anechoic shielded room	RFD-F-100	Euroshield Oy	1327

6. Photographs



Photograph 1. Radiated disturbance emission test.



Photograph 2. Immunity to transient disturbances conducted along supply lines test.