TEST REPORT

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		Appendices	–

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FINAS AKKREDITOINTI SUOMI FINLAND

T017 (EN 45001)

SORT OF EQUIPMENT:	**Radio modem**
MARKETING NAME:	***Satelline-3ASd***
TYPE:	***Satelline-3ASd***
MANUFACTURER:	***Satel Oy, Finland***
SERIAL NUMBER:	**98260003 and 98260005**
CLIENT:	**Satel Oy, Finland**
ADDRESS:	**Meriniitynkatu 17, FIN-24100 Salo**
TELEPHONE:	**+ 358 2 777 7800**
TEST SPECIFICATION:	**ETS 300 683 (June 1997)**

SUMMARY:

In regard to the performed tests the EUT fulfils the requirements defined in the test specifications ETS 300 683 (June 1997), see page 3 for details.

Summary of performed tests and test results

Immunity tests according to the test specification ETS 300 683 (June 1997)

Immunity test	Test method	Conclusion
Radiated radio-frequency electromagnetic field	EN 61000-4-3 (1996)	Pass
Radiated radio-frequency electromagnetic field (GSM)	ENV 50204 (1995)	Pass
Electrostatic discharge (ESD)	EN 61000-4-2 (1995)	Pass
Conducted radio-frequency common mode	EN 61000-4-6 (1996)	Pass
Electrical fast transients (EFT/B)	EN 61000-4-4 (1995)	Pass
Transients and surges in vehicular environment	ISO 7637-1 (1990)	Pass

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 EC Council Directive 89/336/EC. The tests were performed according to the test specifications ETS 300 683 (June 1997) by using accredited test methods.

2. System Configuration

2.1 Test set-up

Equipment under test (EUT):

- Radio modem, type Satelline-3ASd, S/N: 98260003 and 98260005

Peripheral devices:

- Rohde & Schwarz RF high power attenuator, attenuation 30 dB, type RBU, S/N: 300706/53
- Rohde & Schwarz variable attenuator 0-2000 MHz, attenuation 0-140 dB, type DPU, S/N: 180433-50
- Toshiba microcomputer, type S300CDS, S/N: 28378612E PCN0085, used for generating the data to the EUT during the immunity tests
- Olivetti microcomputer, type 860C, S/N: A5049F 0502259, used for the monitoring of the EUT during the immunity tests
- Battery 12 V, type Biltema, S/N: -

Cables:

From	To	Type	Length [m]
Battery	EUT (transmitting device)	Untwisted pair, unshielded	1.8
Toshiba microcomputer	EUT (transmitting device)	Serial cable, unshielded	1.3
EUT (transmitting device)	Attenuator 30 dB	Coaxial cable	1.2
Variable attenuator	EUT (receiving device)	Coaxial cable	1.2
Battery	EUT (receiving device)	Untwisted pair, unshielded	0.5
EUT (receiving device)	Olivetti microcomputer	Serial cable, unshielded	1.8

Operating voltage of the EUT:

12 V DC

2.2 Operating conditions and monitoring of the EUT

Immunity tests:

The EUT was tested as a system. For the duration of the tests the EUT was set to a test mode of operation, in which the transmitting device was transmitting data sent by the Toshiba microcomputer to the receiving device. The attenuation between the devices was adjusted to 60 dB.

The monitoring of the EUT was performed visually by watching the received data displayed by the Olivetti microcomputer.

2.3 Performance criteria for immunity tests

Performance criterion A:

The EUT shall continue to operate as intended during and after the test. No degradation of performance is allowed.

Performance criterion B:

The EUT shall continue to operate as intended after the test. However, moderate degradation of performance is allowed. No change of actual operating state or loss of memory functions is allowed.

3. Test procedures

3.1 Immunity tests

3.1.1 Radiated radio-frequency electromagnetic field immunity test

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

Parameter	Specification
Test method	EN 61000-4-3 (1996)
Frequency range	80 - 1000 MHz
Modulation	AM 80% 400 Hz
Sweep	Step: 1 %, Time/step: 3 s
Test level	3 V/m
Performance criterion	A
Site name	EMCEC Oy / Perkkaa
Date of testing	19.02.1999
Test equipment	176, 184, 201, 291, 292, 293, 340, 417
Test conditions	22 °C, 30 % RH

The test was carried out in an absorber-lined shielded room. The EUT was placed on a non-conductive turntable 1 m above the floor absorbers. The distance between the transmitting log-periodic antenna and the EUT was 2.06 m measured from the tip of the antenna (see photograph 1). The communication link was set up by using a coaxial cable (see photograph 2). The EUT cables were arranged into a position anticipated to be the worst-case. The test was performed with the field generating antenna facing each of the four sides of the EUT. Both vertical and horizontal polarisations were tested. The field strength was checked with a calibrated field sensor. The uniformity of field has been calibrated.

3.1.2 Radiated radio-frequency electromagnetic field (GSM) immunity test

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

Parameter	Specification
Test method	ENV 50204 (1995)
Frequency range	900 ± 5 MHz
Modulation	Keyed carrier, repetition frequency 200 Hz, duty cycle 50%
Sweep	Step: 1 %, Time/step: 3 s
Test level	3 V/m
Performance criterion	A
Site name	EMCEC Oy / Perkkaa
Date of testing	19.02.1999
Test equipment	176, 184, 201, 291, 292, 293, 340, 417
Test conditions	22 °C, 30 % RH

The test was carried out in an absorber-lined shielded room. The EUT was placed on a non-conductive turntable 1 m above the floor absorbers. The distance between the transmitting log-periodic antenna and the EUT was 2.06 m measured from the tip of the antenna (see photograph 1). The communication link was set up by using a coaxial cable (see photograph 2). The EUT cables were arranged into a position anticipated to be the worst-case. The test was performed with the field generating antenna facing each of the four sides of the EUT. Both vertical and horizontal polarisations were tested. The field strength was checked with a calibrated field sensor. The uniformity of field has been calibrated.

3.1.3 Electrostatic discharge (ESD) immunity test

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

Parameter	Specification
Test method	EN 61000-4-2 (1995)
Test level	Contact discharge: ± 2 and ± 4 kVp Air discharge: ± 2, ± 4 and ± 8 kVp
Performance criterion	B
Site name	EMCEC Oy / Perkkaa
Date of testing	22.02.1999
Test equipment	184, 349, 405, 406, 409
Test conditions	24 °C, 31 % RH

The test was carried out inside a shielded room. A horizontal coupling plane (HCP) was placed on a non-conductive table 0.8 m high. The EUT was placed on the table and it was isolated from the HCP by means of PVC-sheets. Indirect contact discharges were applied on the EUT by discharging to a vertical coupling plane (VCP, see photograph 3) and HCP. Direct contact discharges were applied on the conductive parts of the EUT and air discharges were applied on the non-conductive parts of the EUT (see photograph 4). At least 10 discharges of both polarities were applied on each test point at each test level.

3.1.4 Conducted radio-frequency common mode immunity test

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

Parameter	Specification
Test method	EN 61000-4-6 (1996)
Frequency range	0.150 - 80 MHz
Modulation	AM 80% 1 kHz
Sweep	0.150 – 5 MHz: Step: 50 kHz, Time/step: 3 s 5 – 80 MHz: Step: 1 %, Time/step: 3 s
Test level	3 Vemf
Performance criterion	A
Site name	EMCEC Oy / Perkkaa
Date of testing	22.02.1999
Test equipment	38, 56, 184, 294, 299, 326, 349, 366
Test conditions	24 °C, 31 % RH

The test was carried out inside a shielded room. The EUT was placed on a non-conductive support 0.1 m above the reference ground plane (RGP). An EM-clamp was used to realize a defined impedance for the test signal and to prevent the test signal from reaching the assisting equipment (see photograph 5). The EUT cables were placed 50 mm above the RGP. The distance between the CDNs and the EUT was 0.3 m.

3.1.5 Electrical fast transients (EFT/B) immunity test

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

Parameter	Specification
Test method	EN 61000-4-4 (1995)
Test pulse	5 (Tr) / 50 (Th) ns, repetition frequency 5 kHz, duration 1 minute
Test level	Signal port: ± 1.0 kVp
Performance criterion	B
Site name	EMCEC Oy / Perkkaa
Date of testing	22.02.1999
Test equipment	184, 224, 225, 348
Test conditions	24 °C, 31 % RH

The test was carried out inside a shielded room. The EUT was placed on non-conductive table 0.8 m above the RGP. The capacitive coupling clamp was used to test the signal cable of the EUT (see photograph 6). The distance between the generator or the clamp and the EUT was 0.5 - 1.0 m. The cable between the generator and the clamp was 1.0 m in length.

3.1.6 Transients and surges in vehicular environment immunity test

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

Parameter	Specification
Test method	ISO 7637-1 (1990)
Test pulse	3a: duration 1 h, cycle time 100 ms 3b: duration 1 h, cycle time 100 ms 4: 25 ms (t_6) / 5 s (t_8), five pulses
Test level	Pulse 3a: -50 V (level 2) Pulse 3b: +50 V (level 2) Pulse 4: -5 V / -2.5 V (level 2)
Performance criterion	B
Site name	EMCEC Oy / Perkkaa
Date of testing	02.02.1999
Test equipment	184, 347, 348
Test conditions	22 °C, 30 % RH

The test was carried out inside a shielded room. The EUT was placed on a non-conductive support 0.8 m above the RGP. The cable between the test generator and the EUT was 0,5 m in length.

4. Test results

4.1 Immunity tests

4.1.1 Radiated radio-frequency electromagnetic field immunity test

Standby mode of operation:

Polarisation	Frequency MHz	Test level V/m	Remarks	Conclusion Pass/Fail
Vertical	80 – 1000	3	–	Pass
Horizontal	80 – 1000	3	–	Pass

Receiving / transmitting mode of operation:

Polarisation	Frequency MHz	Test level V/m	Remarks	Conclusion Pass/Fail
Vertical	80 – 1000	3	–	Pass
Horizontal	80 – 1000	3	–	Pass

4.1.2 Radiated radio-frequency electromagnetic field (GSM) immunity test

Standby mode of operation:

Polarisation	Frequency MHz	Test level V/m	Remarks	Conclusion Pass/Fail
Vertical	890 – 960	3	–	Pass
Horizontal	890 – 960	3	–	Pass

Receiving / transmitting mode of operation:

Polarisation	Frequency MHz	Test level V/m	Remarks	Conclusion Pass/Fail
Vertical	890 – 960	3	–	Pass
Horizontal	890 – 960	3	–	Pass

4.1.3 Electrostatic discharge (ESD) immunity test

Standby mode of operation:

Discharge mode	Test points	Test level kVp	Remarks	Conclusion Pass/Fail
Direct contact	Conductive parts of the EUT	±2 and ±4	–	Pass
Indirect contact	HCP and VCP	±2 and ±4	–	Pass
Air	Non-conductive parts of the EUT	±2, ±4 and ±8	–	Pass

Receiving / transmitting mode of operation:

Discharge mode	Test points	Test level kVp	Remarks	Conclusion Pass/Fail
Direct contact	Conductive parts of the EUT	±2 and ±4	–	Pass
Indirect contact	HCP and VCP	±2 and ±4	–	Pass
Air	Non-conductive parts of the EUT	±2, ±4 and ±8	–	Pass

4.1.4 Conducted radio-frequency common mode immunity test

Standby mode of operation:

Port	Frequency MHz	Test level Vemf	Remarks	Conclusion Pass/Fail
Signal	0.150 - 80	3	–	Pass

Receiving / transmitting mode of operation:

Port	Frequency MHz	Test level Vemf	Remarks	Conclusion Pass/Fail
Signal	0.150 - 80	3	–	Pass

4.1.5 Electrical fast transients (EFT/B) immunity test

Standby mode of operation:

Port	Test level kVp	Remarks	Conclusion Pass/Fail
Signal	± 0.25, ± 0.5 and ± 1.0	–	Pass

Receiving / transmitting mode of operation:

Port	Test level kVp	Remarks	Conclusion Pass/Fail
Signal	± 0.25, ± 0.5 and ± 1.0	–	Pass

4.1.6 Transients and surges in vehicular environment immunity test

Standby mode of operation:

Port	Pulse	Remarks	Conclusion Pass/Fail
DC power input	3a	–	Pass
	3b	–	Pass
	4	–	Pass

Receiving / transmitting mode of operation:

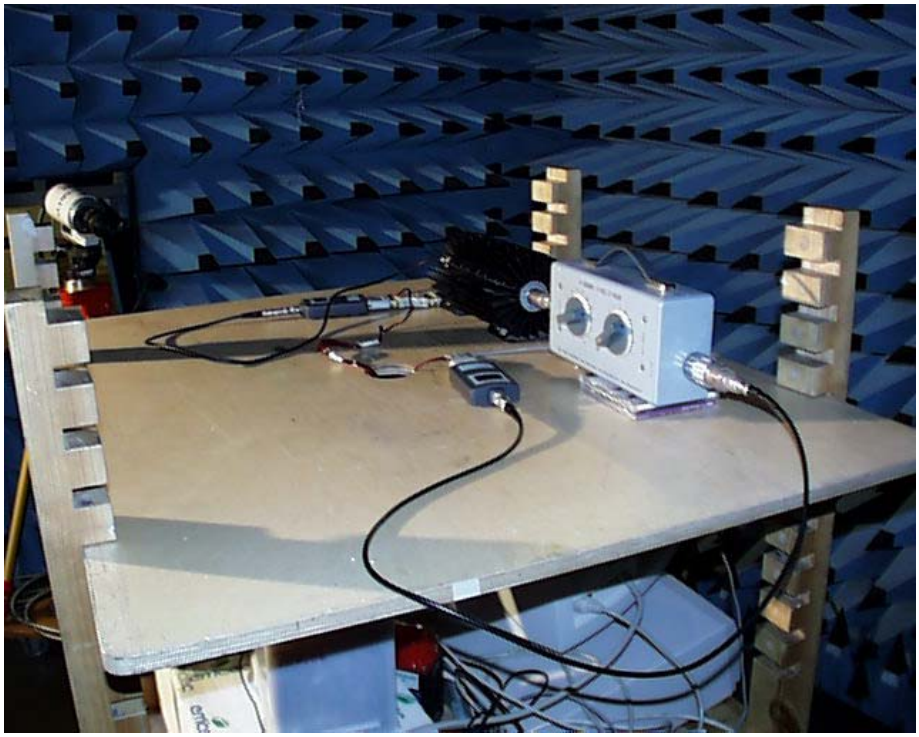
Port	Pulse	Remarks	Conclusion Pass/Fail
DC power input	3a	–	Pass
	3b	–	Pass
	4	–	Pass

5. List of test equipment

No.	Equipment	Type	Manufacturer	Serial Number
3	Test receiver	ESH-2	Rohde & Schwarz	871544/061
5	Test receiver	ESH-3	Rohde & Schwarz	894718/015
6	Test receiver	ESVP	Rohde & Schwarz	861743/022
165	Spectrum monitor	EZM	Rohde & Schwarz	862065/011
338	Test receiver	ESS	Rohde & Schwarz	847151/009
42	Spectrum analyzer	8566B	Hewlett Packard	2637A04102
45	Spectrum analyzer	FSBS	Rohde & Schwarz	862563/010
38	RF generator	SMG	Rohde & Schwarz	883590/035
201	RF generator	2042	Marconi	119571/062
317	RF generator	2052	Marconi	119754/058
351	RF generator	SMT 06	Rohde & Schwarz	845715/001
199	RF amplifier	ZHL-1042J	Mini-Circuits	012288-10
205	RF amplifier	ZHL-1042J	Mini-Circuits	012288-11
340	RF-power amplifier	7100LC-CE	Kalmus	7583B1
354	RF power amplifier	AR 500W1000M7	Amplifier Research	20487
355	RF power amplifier	LA100V - CE	Kalmus	7809-1
366	RF-amplifier	AR15A25	Amplifier Research	10783
397	RF-amplifier	ZFL-2000	Mini-Circuits	-
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
167	Artificial mains network	NSLK 8126	Schwartzbeck	8126101
168	Artificial mains network	NSLK 8127	Schwartzbeck	8127162
343	Artificial mains network	NSLK 8128	Schwartzbeck	8128177
367	LISN	NNB-4/200	Rolf Heine	4/200X-96009
57	Power meter	NAUS 3	Rohde & Schwarz	87076/088
58	Power meter	NAUS 4	Rohde & Schwarz	87089/103
184	Temp. & humidity meter	HMI 32	Vaisala	63837
291	Field sensor	BA05		
292	Optical repeater	ORO1		
293	Isotropic field meter	PMM 8051		
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	-
326	Power attenuator	765-6	Narda	-
176	Anechoic chamber	RFD-60	Euroshield Oy	509
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

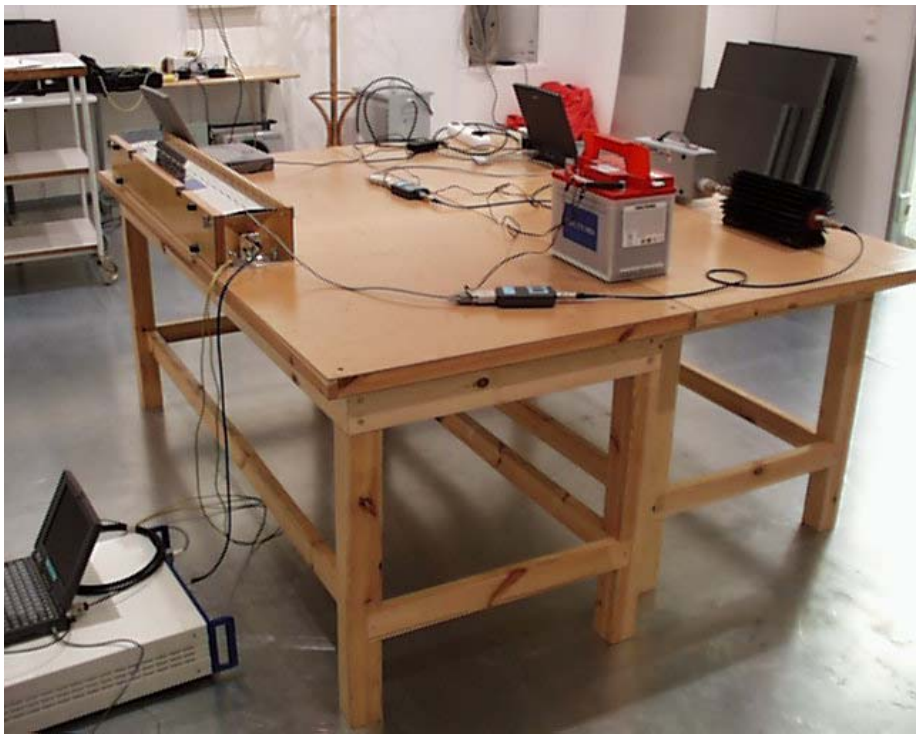
Photograph 1. Radiated radio-frequency electromagnetic field immunity test.



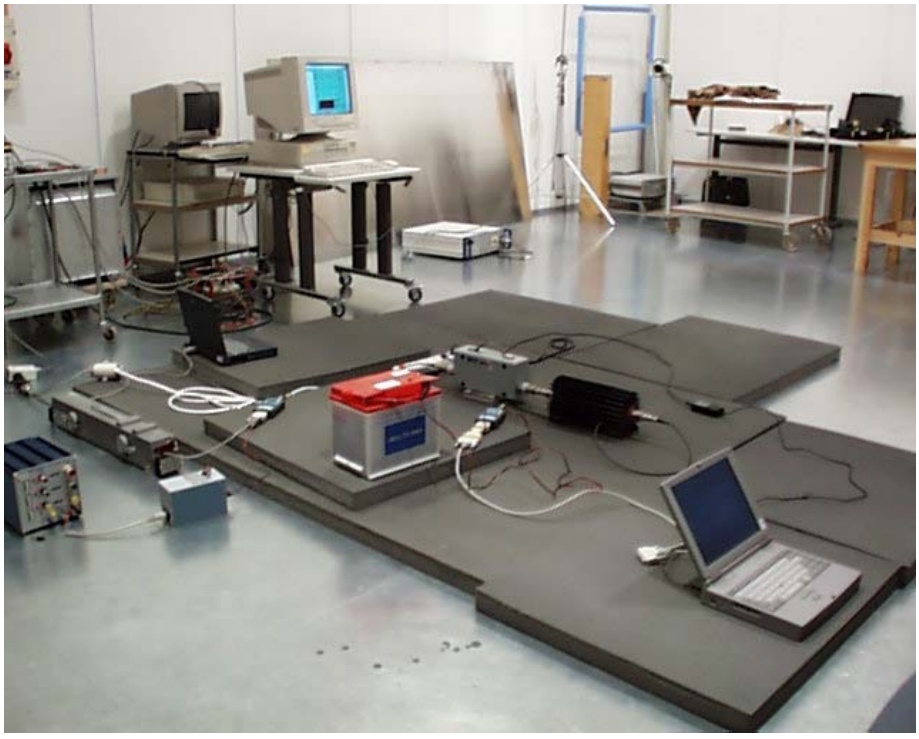
Photograph 2. Radiated radio-frequency electromagnetic field immunity test.

Photograph 3. Electrostatic discharge (ESD) immunity test.

Photograph 4. Electrostatic discharge (ESD) immunity test.



Photograph 5. Conducted radio-frequency common mode immunity test.



Photograph 6. Electrical fast transient / burst (EFT/B) immunity test.