4 TEST REPORTS

- Test Report to EN 300 220-1
- Test Report to ETS 300 683

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TEST REPORT

Date: ESPOO 07 / 10 1998 Page: 1 (25)

Number: TL 980212

Date of handing in: 24.06.1998

Measured by:

Pekka Kälviäinen B.Sc.(Eng)

FINAS AKKREDITOINTI SUOMI FINLAND

T017 (EN 45001)

Approved by:

Risto Hietanen Product Manager

SORT OF EQUIPMENT: **Radio Modem**

MARKETING NAME: ***SATELLINE***

TYPE: ***3ASd***

MANUFACTURER: ***SATEL OY***

SERIAL NUMBER: **98260001, 98260002, 98260003, 98260004**

CUSTOMER: **SATEL Oy**

ADDRESS: **Meriniitynkatu 17, FIN-24100 Salo**

TELEPHONE: **+358 2 777 7800 / Tapio Malmivaara**

TESTSPESIFICATION: **EN 300 220-1**

REMARKS: **Five original identical test reports have been prepared.**
All have been delivered to the client. This test report is No. 4 (of 5).

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

Type:	**3ASd**
Alignment range:	**90 MHz**
Switching range:	**One channel**
Category:	**AR3**

	Equipment 1 and 4	Equipment 2	Equipment 3
Measurement Frequencies Tx/Rx:	Serial no. **98260001 / 98260004** 1) **380.000 MHz** 4) **470.000 MHz**	Serial no. **98260002** 2) **410.000 MHz**	Serial no. **98260003** 3) **440.000 MHz**

	Normal	Minimum	Maxmum
Voltages:	**13.5 VDC**	**9.0 VDC**	**30.0 VDC**
Temperatures:	**23.2 to 25.8 °C**	**- 20 °C (Categpry: I)**	**+ 55 °C**
Humidity:	**36.5 to 56.5 %**		

Carrier power:	**0.4 mW (Class: 12)**	Antenna:	**TNC-connector (50 Ω)**
Class of emission:	**F1D**	If frequencies:	**77 550 khz, 455 kHz**
Number of channels:	**1**	Production model:	**No**
Channel separation:	**25 kHz**	Mode of DATA	**FSK, 19200 bps, direct**

The following measurements according to EN 300 220-1 standard have been performed:

Eq. 2 Ch. 2)	Eq. 1 and 4 Channels 1)	Eq. 1 and 4 Channels 4)	Eq. 3 Ch. 3)		
				8.	**Transmitter**
x	x	x	x	8.1	Frequency error
x	x	x	x	8.2	Carrier power (conducted)
na	na	na	na	8.3	Effective radiated power (radiated)
na	na	na	na	8.4.1.2	Analogue signals within the audio bandwidth (FM)
na	na	na	na	8.4.1.3	Analogue signals above the audio bandwidth (FM)
na	na	na	na	8.4.2.2	Analogue signals within the audio bandwidth (AM)
na	na	na	na	8.4.2.3	Analogue signals above the audio bandwidth (AM)
na	x	x	na	8.5	Adjacent channel power
na	na	na	na	8.6	Range of modulation bandwidth for wide band equipment (>25 kHz)
na	x	x	na	8.7.2	Conducted spurious emissions / 8.7.1 a) i)
na	x	x	na	8.7.3	Spurious emissions (cabinet radiation) / 8.7.1 a) ii)
na	na	na	na	8.7.4	Spurious emissions (cabinet radiation) / 8.7.1 b)
na	x	x	na	8.8	Frequency stability under low voltage conditions
na	na	na	na	8.9	Duty Cycle (*
				9.	**Receiver**
na	x	x	na	9.1.2	Conducted spurious emissions / 9.7.1 a) i)
na	x	x	na	9.1.3	Spurious emissions (cabinet radiation) / 9.7.1 a) ii)
na	na	na	na	9.1.4	Spurious emissions (cabinet radiation) / 9.7.1 b)
na	x	x	na	9.2	Spurious response rejection and blocking / desensitization

REMARKS

na: no applicable

***) See the application form (Appendix)**

Ambient temperature: 23.3 °C Relative humidity: 46.8 % Date: 10.09.1998

TRANSMITTER FREQUENCY ERROR CLAUSE 8.1

TEST CONDITIONS		FREQUENCY ERROR (Hz)			
Channel		1	2	3	4
Tnom	Vnom	+ 224	+ 378	+ 555	+ 752
Tmin	Vmin	+ 1286	+ 1218	+ 1497	+ 1563
	Vmax	+ 1387	+ 1222	+ 1589	+ 1577
Tmax	Vmin	- 271	- 776	+ 198	- 242
	Vmax	- 230	- 745	+ 218	- 226
Maximum freq. error. (Hz)					
Measurement uncertainty (U95)		6.1×10^{-8}	6.1×10^{-8}	6.1×10^{-8}	6.1×10^{-8}

LIMITS CLAUSE 8.1.3

CHANNEL SPACING kHz	FREQUENCY RANGES				
	Below 47MHz	Above 47 to 137MHz	Above 137 to 300MHz	Above 300 to 500MHz	Above 500 to 1000MHz
	LIMITS kHz				
10.0 / 12.5	± 0.60	± 1.00	± 1.00 (b) ± 1.50 (m) ± 2.00 (p)	± 1.00 (b) ± 1.50 (m) ± 2.50 (p)	No value specified
20.0 / 25.0	± 0.60	± 1.35	± 2.00	± 2.00 (mb) ± 2.50 (p)	± 2.50 (mb) ± 3.00 (p)

b = fixed station (base)
m = mobile station
p = portable station

TEST EQUIPMENT USED: 53, 394, 157, 230, 362, 195

Ambient temperature: 23.3 °C Relative humidity: 46.8 % Date: 10.09.1998

CARRIER POWER (CONDUCTED) CLAUSE 8.2

Rated output power: 0.4 W.

TEST CONDITIONS		TRANSMITTER POWER (Watts)			
Channel		1	2	3	4
Tnom	Vnom	0.36	0.42	0.37	0.29
Tmin	Vmin	0.48	0.53	0.49	0.32
	Vmax	0.48	0.53	0.49	0.32
Tmax	Vmin	0.32	0.40	0.34	0.25
	Vmax	0.32	0.40	0.34	0.25
Variation in output power under normal test conditions					
Variation in output power under extreme test conditions					
Measurement uncertainty		± 0.75 dB	± 0.75 dB	± 0.75 dB	± 0.75 dB

LIMITS CLAUSE 8.2.3

CLASS	POWER LEVEL mW
7a	5
8	10
9	25
11	100
12	500

TEST EQUIPMENT USED: 59, 218, 394, 157, 230, 362, 195

Ambient temperature: 23.7 °C Relative humidity: 52.6 % Date: 01.07.1998

ADJACENT CHANNEL POWER CLAUSE 8.5

MEASUREMENT	BELOW CARRIER POWER (dBc)			
Equipment	1	2	3	4
+ 25.0 kHz	74.5	72.5	73.5	72.0
- 25.0 kHz	71.5	73.5	70.5	71.5
Measurement uncertainty (U95)	± 1.6 dB			

LIMITS: CLAUSE 8.5.3 TABLE 11

	Channel separation < 20 kHz	Channel separation ≥ 20 kHz
Normal test conditions	10 µW	200 nW
Extreme test conditions	32 µW	640 nW

TEST EQUIPMENT USED: 9, 33, 394, 390, 362, 195

Ambient temperature: 23.7 °C Relative humidity: 52.6 % Date: 01.07.1998 (channel 1)
Ambient temperature: 23.3 °C Relative humidity: 52.7 % Date: 11.09.1998 (channel 4)

TRANSMITTER SPURIOUS EMISSIONS CONDUCTED CLAUSE 8.7.2 / 8.7.1 a) i)

FREQUENCY (MHz)	CHANNEL 1	FREQUENCY (MHz)	CHANNEL 4	Remarks
Tx operating		Tx operating		
372.20	11.8 nW	472.33	1.7 nW	
527.30	0.24 nW	471.90	2.9 nW	
760.00	2.2 nW	1880.00	250 nW	
1520.00	1.7 nW	2820.00	0.50 nW	
2280.00	4.9 nW	3760.00	0.74 nW	
2660.00	6.2 nW	others 25 MHz to 4 GHz	< 0.2 nW	
3040.00	5.8 nW			
all 1 GHz to 4 GHz	< 5.0 nW			
Tx on standby				
				see clause 9.1.2
				page 8
Measurement uncertainty	± 1.8 dB			

LIMITS: CLAUSE 8.7.5 TABLE 12

State	47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies below 1000 MHz	Frequencies above 1000 MHz
Operating	4 nW	250 nW	1 μW
Standby	2 nW	2 nW	20 nW

TEST EQUIPMENT USED: 41, 211, 212, 145, 120, 201, 390, 394, 262, 195

Ambient temperature: 25.8 °C Relative humidity: 36.5 % Date: 03.07.1998

TRANSMITTER SPURIOUS EMISSIONS RADIATED CLAUSE 8.7.3 / 8.7.1 a) ii)

FREQUENCY (MHz)	CHANNEL 1	FREQUENCY (MHz)	CHANNEL 4	Remarks
Tx operating		Tx operating		
760.00	0.45 nW	940.00	0.96 nW	
1140.00	5.3 nW	1410.00	12.9 nW	
1520.00	28.8 nW	1880.00	60.3 nW	
1900.00	2.9 nW	2350.00	1.1 nW	
3040.00	1.6 nW	2820.00	2.0 nW	
		3290.00	1.2 nW	
		3760.00	5.6 nW	
Tx on standby				
				See clause 9.1.3
				page 9
Measurement uncertainty	+ 3.4 dB - 4.4 dB			

LIMITS: CLAUSE 8.7.5 TABLE 12

State	47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies below 1000 MHz	Frequencies above 1000 MHz
Operating	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

TEST EQUIPMENT USED: 45, 176, 89, 185, 91, 205, 119, 135, 362, 195

Ambient temperature: 24.4 °C Relative humidity: 47.6 % Date: 21.08.1998

FREQUENCY STABILITY UNDER LOW VOLTAGE CONDITIONS CLAUSE 8.8

VOLTAGE (V)	FREQUENCY / POWER Hz / mW		
	1	4	REMARKS
9	+ 260 / 360	+ 720 / 280	
8	+ 220 / 360	+ 720 / 280	
7.7	/	- 640 / 280	the equipment "4" ceases to function below this point
7.8	- 960 / 360	/	the equipment "1" ceases to function below this point
	/	/	
	/	/	
	/	/	
	/	/	
	/	/	
	/	/	
Measurement uncertainty	P: ± 1.8 dB F: 6.1 x 10^{-8}		

LIMITS: CLAUSE 8.8.3

The equipment shall either:

a) **remain on the operating frequency, within the limits stated in subclause 8.1.3 whilst the radiated or or conducted power is greater than the spurious emission limits; or**

b) **the equipment ceases to function below the applicants declared operating voltage.**

TEST EQUIPMENT USED: 33, 43, 102, 131, 119, 120, 362, 195

Ambient temperature: 24.0 °C Relative humidity: 56.5 % Date: 13.07.1998 (channel 1)
Ambient temperature: 23.3 °C Relative humidity: 52.7 % Date: 11.09.1998 (channel 4)

RECEIVER SPURIOUS EMISSIONS CONDUCTED CLAUSE 9.1.2 / 9.1.1 a) i)

FREQUENCY (MHz)	CHANNEL 1	FREQUENCY (MHz)	CHANNEL 4	Remarks
2722.00	0.53 nW	392.44	0.071 nW	
3025.00	14.1 nW	2747.10	1.4 nW	
others 9 kHz to 4 GHz	< 0.05 nW	3139.60	0.20 nW	
		others 9 kHz to 4 GHz	< 0.04 nW	
Measurement uncertainty	± 1.8 dB			

LIMITS: CLAUSE 9.7.5

— 2 nW below 1000 MHz
— 20 nW above 1000 MHz

TEST EQUIPMENT USED: 42, 362,195

Ambient temperature: 24.0 °C Relative humidity: 56.5 % Date: 13.07.1998

RECEIVER SPURIOUS EMISSIONS RADIATED CLAUSE 9.1.3 / 9.1.1 a) ii)

FREQUENCY (MHz)	CHANNEL 1	FREQUENCY (MHz)	CHANNEL 4	Remarks
all 25 MHz to 1 GHz	< 0.01 nW	784.90	1.4 nW	
3024.50	5.9 nW	2747.15	16.6 nW	
others 1 GHz to 4 GHz	< 1.0 nW	3139.60	17.8 nW	
		3532.05	1.7 nW	
		3924.50	43.7 nW	
Measurement uncertainty	+ 3.4 dB - 4.4 dB			

LIMITS: CLAUSE 9.7.5

— 2 nW below 1000 MHz
— 20 nW above 1000 MHz

TEST EQUIPMENT USED: 45, 176, 89, 185, 205, 119, 135, 362, 195

Ambient temperature: 23.2 °C Relative humidity: 46.8 % Date: 22.07.1998 (channel 1)
Ambient temperature: 23.8 °C Relative humidity: 46.7 % Date: 10.08.1998 (channel 4)

SPURIOUS RESPONSE REJECTION AND BLOCKING / DESENSITISATION CLAUSE 9.2

FREQUENCY OF WANTED SIGNAL	CHANNEL		
	RATIO (dB)		
	1	4	
f+10MHz	87.0 dB	85.5 dB	
f+5MHz	87.5 dB	88.5 dB	
f+2MHz	85.6 dB	91.2 dB	
f+1MHz	88.8 dB	89.7 dB	
f-1MHz	84.7 dB	85.3 dB	
f-2MHz	86.2 dB	86.5 dB	
f-5MHz	86.4 dB	85.8 dB	
f-10MHz	85.7 dB	84.4 dB	
Measurement uncertainty	+ 2.4 dB, - 3.0 dB		

LIMIT: CLAUSE 4.2.8 (ETS 300 113)

(The blocking ratio, for any frequency within the specified ranges shall not be less than 84dB, except at frequencies on which spurious responses are found, clause 8.6 refers.)

TEST EQUIPMENT USED: 314, 33, 99, 132, 9, 62, 10, 362, 195

List of measuring equipment:

No.	Equipment	Type	Manufacturer	Serial Number
1	Audio analyzer	8903A	Hewlett Packard	2016A00211
9	Modulation analyzer	8901B	Hewlett Packard	2718A01220
10	Oscilloscope	9400A	LeCroy	8878
30	RF generator	8642A	Hewlett Packard	2644A00601
31	RF generator	8642B	Hewlett Packard	2427A00131
32	RF generator	8642B	Hewlett Packard	2521A00226
33	RF generator	8642B	Hewlett Packard	2521A00232
35	RF generator	8656B	Hewlett Packard	2506A00751
41	Spectrum analyzer	8566B	Hewlett Packard	2005A01452
42	Spectrum analyzer	8568B	Hewlett Packard	2039a01256
43	Spectrum analyzer	8568B	Hewlett Packard	2039A01256
45	Spectrum analyzer	FSBS	Rohde & Schwarz	862563/010
48	Counter	351DCCN150	EiP Incorcorated	00369
53	Counter	1999	Racal-Dana	1321
59	Power meter	435A	Hewlett Packard	1430000505
61	Audio amplifier	PRL 737	Self made	
62	Audio amplifier	PRL ?	Self made	
70	RF amplifier	510L	EIN	
71	RF amplifier	25W1000M7	Amplifier Research	11128
79	Power supply	B60-15R	Oltronix	512
89	Antenna	3147	EMCO	9202-1078
91	Antenna	VHA 9103 BBA 9106	Schwarzbeck	
92	Antenna	VHA 9103 BBA 9106	Schwarzbeck	
99	Hybrid	H 9	Anzac	
100	Hybrid	H 9	Anzac	
101	Hybrid	H 9	Anzac	
102	Hybrid	H 9	Anzac	
109	Audio load	1840-A	General Radio	4749
117	RF High-Power Attenuator	RBU	Rohde & Schwarz	300741/13
119	RF High-Power Attenuator	765	Narda	
120	RF High-Power Attenuator	765	Narda	
131	Termination 50Ω	908A	Hewlett Packard	
132	Termination 50Ω	908A	Hewlett Packard	
133	Termination 50W	370 BNM	Narda	
134	Termination 50W	370 BNM	Narda	
135	Termination 50W	370 BNM	Narda	
145	Notch Filter	TTR - 375 - 3EE	Telonic	3062 - 1
146	Dual directional coupler	778D	Hewlett Packard	1144A02333
156	Temp. test chamber	VMT 04/140	Vötch	17031
157	Temp. test chamber	VMT 04/240	Vötch	31884
158	Temp. test chamber	VKT 08/130	Vötch	17984
159	Temp. test chamber	VMT 04/140	Vötch	16227
165	Spectrum monitor	EZM	Rohde & Schwartz	862065/011
176	Anechoic chamber	888 cm x 585 cm x 416 cm	length of absorber 66 cm	
177	Keimola	Open area radiation measurement site		
185	Antenna	PRL LogPer	Self made	1A93
188	Antenna	CBL6111	Chase	1028
195	Calibrator	Fluke 515A	Fluke	18522
201	RF-Generator	2042	Marconi	119571/062
205	RF- Amplifier	ZHL-1042J	Mini-Circuits	012288-11
211	Bandpass Filter	TTF 1500-5-5EE	Telonic Berkeley Inc	93037-3
212	Bandpass Filter	TTF 3000-5-5EE	Telonic Berkeley Inc	93039-1
218	Power sensor	HP 8485A	Hewlett Packard	2942A08711
230	Thermometer	MT 120 KC	Eirelec Ltd.	0894/83

246	Notch filter 900 MHz	-	Self made	-
279	Lowpass filter	874-F185	General Radio Co.	-
280	Lowpass filte	874-F500	General Radio Co.	-
281	Attenuator 20dB/600Ω	-	Self made	-
307	Temp. test chamber	VMT 04/140	Heraeus VÖTCH GmbH	27045
308	Internet advisor	J2300A	Hewlett Packard	3530A00685
314	RF generator	HP 8642B	Hewlett Packard	2535A00464
317	RF generator	2052	Marconi	119754/058
318	Power supply	B 603D/F	Oltronix	416
319	Antenna	CBL6112	Chase	2018
326	Power attenuator	765-6	Narda	-
327	Power attenuator	765-20	Narda	-
328	Power attenuator	765-20	Narda	-
329	Power attenuator	BN 745392	Spinner12/93	
330	Power attenuator	BN 745394	Spinner	36009
332	IF-filter	10.7MHz/25kHz	Ultracom Oy	-
333	IF-filter	10.7MHz/20kHz	Ultracom Oy	-
334	IF-filter	10.7MHz/12.5kHz	Ultracom Oy	-
335	Mixer	ZFM-150	Mini-Circuits	-
338	Test receiver	ESS	Rohde & Schwarz	847151/009
350	Semiunechoic shielded room, 10 m test site, hybrid absorber			
362	Power supply	B32-20R	Oltronix	653
381	Audio load	1840-A	General Radio	4752
386	RF attenuator PAD	WA2-3	Weinschel	3780
387	RF attenuator PAD	WA2-6	Weinschel	3781
388	RF attenuator PAD	WA2-6	Weinschel	3782
389	RF attenuator PAD	WA2-10	Weinschel	3783
390	RF attenuator PAD	WA2-10	Weinschel	3784
391	RF attenuator PAD	1A (3dB)	Weinschel	
392	RF attenuator PAD	1A (6dB)	Weinschel	
393	RF attenuator PAD	1A (10dB)	Weinschel	
394	RF attenuator PAD	1A (20dB)	Weinschel	
395	RF attenuator PAD	757 C - 10 dB	Narda	
396	Termination 50W	370 BNM	Narda	
397	RF-amplifier	ZFL-2000	Mini-Circuits	
402	Power supply	B60-10R	Oltronix	508

APPENDIX

Application form for testing to ETS 300 220 from the client Copy

APPLICATION FORM FOR TESTING TO I-ETS 300 220

The application form shall be used for equipment submitted for type testing in accordance with I-ETS 300 220 intended for the transmission of speech, telemetry, telecommand, etc., over a short range.

The application form shall be completed by the applicant and submitted to a test laboratory accredited in accordance with EN45001 or ISO guide 25 or a national standard conforming to EN45001 or ISO guide 25.

PLEASE READ THE FOLLOWING Notes:

Note (a)

More than one item of equipment may be required to be submitted for type testing where an equipment needs to be modified to provide connections to facilitate testing, i.e. measurements requiring direct connections to be made. In such cases a second un-modified equipment may be required for radiated i.e. case or cabinet radiation or ERP (effective radiated power) measurements to be performed.
Full details of modifications are to be provided, where applicable.

Note (b)

I-ETS 300 220 allows for variations in frequency range, maximum power, channel separation etc to reflect differing national regulatory requirements. Manufacturers producing equipment to this I-ETS may wish to offer an equipment of the same basic design in a number of different forms with different RF characteristics, such as the frequency range, channel separation, temperature range, transmitter power etc. This is subsequently referred to as a family of equipments. Each equipment in the family must be given a unique Type Designation.

In the case of equipment with different frequency ranges and channel separations, a separate set of test results will be required for each frequency range and each channel separation offered. In the case of equipment with different transmitter powers and temperature ranges, the procedures laid down in I-ETS 300 220 permit use of a single set of test results.

Equipment with differing optional features

If an applicant wishes to obtain type approval, on the basis of a single set of test results for a family of equipments derived from the same basic design, where the equipments in the family have different operational features, such as audio output powers, which are not a requirement of I-ETS 300 220, then the following considerations shall be observed.

i) Any operational feature in hardware or software, which can effect any of the performance parameters (not including signalling), shall be clearly defined by the applicant at the time of application. This will enable the National Regulatory Authority to determine whether further testing is needed.

ii) It is further intended to provide systematic guidance on the above in an ETSI Technical Report, to be produced in consultation with CEPT WGRR. It is intended to periodically revise the Technical Report as new operational features are developed.

Note (c) - Speech part of the equipment

In the case of combined full bandwidth analogue speech/full bandwidth non-speech equipment, adjacent channel power (Subclause 7.5), shall be measured for both combinations.

Note (d)

ACCESSORIES

It is the applicants responsibility when submitting equipment(s) to the test laboratory to provide appropriate connectors or alternative coupling arrangements to facilitate the connection of test equipment by the test laboratory to the equipment under test (E.U.T.). This should enable:

i) access to the equipment RF power output (transmitter);

ii) operation of the equipment to transmit (transmitter);

iii) access to the equipment modulator input;

iv) access to the analogue output of the RF part;

v) coupling arrangement (e.g. optical or acoustic coupling for equipment having no external audio connection);

vi) means of connecting the equipment to an external power supply.

vii) means of turning the modulation and signalling on/off, if applicable.

Note (e)

For type approval to be granted on the basis of tests conducted on a pre-production model, that model must be manufactured to the same production drawings and manufacturer's specification as the later production models.

Where this is not the case the national regulatory authority reserves the right to require either partial or full type testing to be carried out on the final production models.

Note (f)

It is the applicant's responsibility to ensure that the equipment meets all the regulatory requirements for marking in the country where type approval is being sought.

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ETS 300 220 APPLICATION FORM

APPLICANT'S DETAILS

CATEGORY OF APPLICANT
(please tick relevant box opposite)

(a) [X] MANUFACTURER
(b) [ ] IMPORTER
(c) [ ] DISTRIBUTOR
(d) [ ] AGENT

COMPANY NAME Satel Oy

ADDRESS Meriniitynkatu 17
FIN-24100 Salo

NAME FOR CONTACT PURPOSES Tapio Malmivaara

TELEPHONE No: +358 2 777 7891 FAX No: +358 2 777 7810

TELEX No:

If box (a) is ticked and the equipment is manufactured at a different address to that of the applicant, or if box (b), (c) or (d) is ticked, complete details in the box below with respect to the manufacturer.

MANUFACTURER'S DETAILS

COMPANY NAME

ADDRESS

NAME FOR CONTACT PURPOSES

TELEPHONE No: FAX No:

TELEX No:

INTENDED USE (For information only)

Details wireless data communication

Product brochures included [X] Yes [ ] No

TYPE DESIGNATION
(See Note 1)

The type designation may be either a single alphanumeric code or an alphanumeric/code divided into two parts.

Please fill in

EITHER TYPE DESIGNATION AS A SINGLE ALPHANUMERIC CODE:

S	A	T	E	L	L	I	N	E	-	3	A	S	d							

OR TYPE DESIGNATION IN TWO PARTS:

1. EQUIPMENT SERIES No. (See Note 2)

2. EQUIPMENT SPECIFIC No. (See Note 3)

Note 1 This is the manufacturer's numeric or alphanumeric code or name that is specific to a particular equipment. It may contain information in coded form on the characteristics of the equipment e.g. frequency, power. The manufacturer is free to choose the form of the type designation.

Note 2 This is the number, code or trade name used by the manufacturer to describe a series or 'family' of equipment of substantially the same mechanical and electrical construction which will include a number of related equipments. This number is often referred to as the "model no.".

Note 3 This is the manufacturer's identification number given to a specific equipment in the series or 'family' of equipments. It is often referred to as the "identification number".

TYPE APPROVAL TO OTHER ETS

Has the equipment been previously type approved to any other ETS or I-ETS ?

Yes ☐ No ☒

If Yes please provide details of the previous type approval.

.....

.....

EXTREME TEMPERATURE RANGE
(over which equipment is to be type tested)

[X]	Category I (General)	-20°C to +55°C
[ ]	Category II (Portable equipments)	-10°C to +55°C

CONSTRUCTION OF EQUIPMENT

[X] Single unit (See Note 4)

[ ] Multiple units

If multiple units describe each one clearly

Note 4 "UNIT" means a physically separate item of the equipment. The equipment under test may consist of two separate units. For example a car alarm with automatic paging consists of two units; the portable transceiver and associated mobile transceiver.

In this particular case additional sheets covering the transmitter and receiver characteristics for both units would be required, if unit 1 and unit 2 are covered by the same TYPE DESIGNATION.

TYPE OF EQUIPMENT		
FIXED STATION		
☐ Transmitter	☐ Simplex	☐ Integral antenna
☐ Receiver	☐ Duplex	☐ Single antenna connector
☐ Transceiver		☐ Two antenna connector
MOBILE STATION		
☐ Transmitter	☒ Simplex	☐ Integral antenna
☐ Receiver	☐ Duplex	☒ Single antenna connector
☒ Transceiver		☐ Two antenna connector
☐ Remote Control Head		
PORTABLE STATION		
☐ Transmitter	☐ Simplex	☐ Integral antenna
☐ Receiver	☐ Duplex	☐ Single antenna connector
☐ Transceiver		☐ Two antenna connector
☐ Battery charger		☐ Vehicle battery adaptor

TRANSMITTER TECHNICAL CHARACTERISTICS

FREQUENCY CHARACTERISTICS

Method of frequency generation

☐ CRYSTAL

☒ SYNTHESIZER

☐ OTHER .....

Transmitter frequency alignment range (see subclause 4.1.2 of Standard)

380 - 470 MHz

Transmitter channel switching frequency range (see subclause 4.1.2 of Standard)

- (equipment operates on one channel)

CHANNEL SEPARATION 25 kHz

State the maximum number of channels over which the equipment can operate

1 (without reprogramming) 80 (by reprogramming)

TRANSMITTER RF POWER CHARACTERISTICS

MAXIMUM RATED TRANSMITTER OUTPUT POWER

0.4 Watts AT TRANSMITTER PERMANENT EXTERNAL 50 Ω RF OUTPUT CONNECTOR

and/or

.... Watts EFFECTIVE RADIATED POWER (FOR EQUIPMENT WITH INTEGRAL ANTENNA)

Is transmitter intended for:

Continuous duty ☐ Yes ☒ No

Intermittent duty only ☒ Yes ☐ No

If intermittent duty state DUTY CYCLE

Transmitter ON < 10 ~~seconds~~/minutes

Transmitter OFF > 10ms seconds/~~minutes~~

Is transmitter output power variable? ☐ Yes ☒ No

If Yes

RF output power (Watts) Maximum ..... Minimum .....

Is the RF power

continuously variable ☐ Yes ☐ No

or

stepped ☐ Yes ☐ No

If stepped ..... dB per step

TRANSMITTER - MODULATION

☐ Amplitude ☐ Other

☒ Frequency Details: .....

☐ Phase .....

Can the transmitter be operated without modulation (see Note 5)

☒ Yes ☐ No

CLASS OF EMISSION

ITU DESIGNATION 1: F

(if applicable) 2: 1

(if applicable) 3: D

If more than three classes of emission, list separately

TRANSMITTER MODULATION INPUT CHARACTERISTICS - ANALOGUE

Frequency or Phase Modulation;

☐ for ≤ 12% of the channel separation at ..... Hz

Amplitude Modulation;

☐ for 60% modulation depth

or in the case that 60% modulation can not be achieved due to audio limiting, declare the maximum modulation depth

.....%

Modulation input signal level at:

Microphone socket ..... mV Impedance ..... Ohms

Accessory socket ..... mV Impedance ..... Ohms

Other (See Note 6) ..... mV Impedance ..... Ohms

Lowest audio modulation frequency transmitted by the equipment

.....Hz

Note 5 If No, frequency error (subclause 7.1 from the standard) is not measured, however, the adjacent channel power under normal and extreme conditions shall be measured.

Note 6 For use where direct connection is provided for test purposes.

TRANSMITTER MODULATION INPUT CHARACTERISTICS - DIGITAL

Modulation bit rate 19200 .bit/s

Type of modulation:

SUBCARRIER:

MSK	☐ Yes	☒ No
FFSK	☐ Yes	☒ No

DIRECT:

Direct FSK	☐ Yes	☒ No
GMSK	☐ Yes	☒ No
Generalised Tamed FM	☐ Yes	☒ No
Multilevel State FM	☐ Yes	☒ No
PLL-4PSK	☐ Yes	☒ No
8 PSK	☐ Yes	☒ No

Other 4-level FSK

INTERFACE FOR DATA TRANSMISSION

SIGNAL LEVEL

☐ V28

☐ Other Details: .....

.....

DEFINITION OF SIGNALS

☐ V24

☐ Other Details: .....

.....

NORMAL TEST SIGNAL

Can the equipment transmit continuous bit streams

☐ Yes ☒ No

If No, give details of the format and information agreed with the National Regulatory Authority (subclause 6.1.2 of I-ETS 300 220 refers).

Note: It is recommended that details of the agreed format are stated on the page of the type test report titled "Additional information supplementary to the test report".

TYPE OF CONNECTOR

☐ 25 Pin (RS232)

☐ 9 Pin (RS232)

☐ Male

☒ Female

☒ Other Details: 15 Pin (RS232, RS485 or RS422)

.....

RECEIVER TECHNICAL CHARACTERISTICS

FREQUENCY CHARACTERISTICS

Receiver frequency alignment range (see subclause 4.1.2 of standard)

380 - 470 MHz

Receiver channel switching frequency range (see subclause 4.1.2 of standard)

–

CHANNEL SEPARATION 25 kHz

State the maximum number of channels over which the equipment can operate

1 (without reprogramming), 80 (by reprogramming)

CLASS OF EMISSION USED

ITU DESIGNATION	1:	F
(if applicable)	2:	1
(if applicable)	3:	D

If more than three classes of emission, list separately

POWER SOURCE(S)

☐ AC SUPPLY ..... State voltage ☐ Single phase

..... AC SUPPLY FREQUENCY (Hz) ☐ Three phase

AND/OR

☒ EXTERNAL DC SUPPLY

Nominal voltage 13.5 V Extreme upper voltage 30 V

.....

Extreme lower voltage 9 V

.....

BATTERY

☒ Nickel Cadmium

☒ Lead acid

☒ Leclanche

☒ Lithium

☒ Other Details: .....

Extreme test voltages ..... DC (V)

..... Nominal DC Voltage (V)

..... DC Maximum Current (A)

AUTOMATIC EQUIPMENT SWITCH OFF

If the equipment is designed to automatically switch off at a predetermined voltage level which is higher or lower in value than the battery minimum voltage calculated values this shall be clearly stated.

☐ Applies ..... Cut-off voltage

☒ Does not apply

DUPLEX OPERATION

Is the equipment intended for

Duplex operation

☐ Yes

☒ No

Is the equipment fitted with separate transmitter and receiver antenna sockets

☐ Yes

☐ No

Is the equipment fitted with a duplex filter as an integral part of the equipment with a single antenna connection socket

☐ Yes

☐ No

Is the duplex filter externally fitted and connected to the main equipment by co-axial cable(s)

☐ Yes

☐ No

If Yes state type and make of duplex filter

.....

ALIGNMENT RANGE

The definition of the alignment range AR1 and AR2 are given in subclauses 4.1.2 and 4.1.3 of the Standard. The applicant should ensure that the sample equipment(s) submitted are operational on the appropriate frequencies as given in subclauses 4.1.5 through to 4.1.11 and tick the appropriate box.

	4.1.5	One sample single frequency equipment of category AR1	☐
or	4.1.6	Three samples of single frequency equipments of category AR2	☐
or	4.1.7	One sample two frequency equipment of category AR1	☐
or	4.1.8	Three samples of two frequency equipment of category AR2	☐
or	4.1.9	One sample multifrequency equipment of category AR1	☐
or	4.1.10	Three samples of multifrequency equipment of category AR2	☐
or	4.1.11	One sample of multifrequency equipment of category AR2 where the switching range equals the alignment range	☐

If more than one option of the equipment is being submitted with different Type Designations, one or three samples, as appropriate, of each version shall be submitted for testing.

FREQUENCY IDENTIFICATION

Each equipment, whether one or more submitted for tests shall carry clear identification (such as a serial number), together with the frequency identification displayed on the equipment.

Equipment identification eg serial number	Channel No. (if applicable)	Transmit Nominal Freq. MHz	Receive Nominal Freq. MHz
98260001		380.0000	380.0000
98260002		410.0000	410.0000
98260003		440.0000	440.0000
98260004		470.0000	470.0000

OTHER ITEMS SUPPLIED

Spare batteries e.g. (portable equipment)	☐ Yes	☒ No
Battery charging device	☐ Yes	☒ No
Special tools for dismantling equipment	☐ Yes	☒ No
Encoder/Decoder	☒ Yes	☐ No
Test interface box (if applicable)	☐ Yes	☒ No

Full documentation on equipment:

Operating instructions	☐ Yes	☒ No
User manual	☐ Yes	☒ No
Circuit diagrams	☒ Yes	☐ No
P.C. board layout, including component positioning	☒ Yes	☐ No
Parts list	☒ Yes	☐ No
Other	☒ Yes	☐ No

If Yes, please specify

brochure

DECLARATION

Are the equipments submitted representative production models?

☐ Yes ☒ No

If not are the equipments pre-production models?

☒ Yes ☐ No

If pre-production equipments are submitted will the final production equipments be identical in all respects with the equipment tested

☒ Yes ☐ No

If no, supply full details of differences:

.....

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature .....

Name Pekka Aura

Position held Managing Director

Date July 6, 1998

LOCAL AREA WIRELESS COMMUNICATIONS • SATEL OY •

emcec

TEST REPORT

Date: ESPOO 26.02.1999

Page: 1 (16)

Appendices –

Number: No. 1 / 1

TL 990011

Date of handing in: 03.02.1999

Tested by:

Timo Leismala, Test Engineer

FINAS AKKREDITOINTI SUOMI FINLAND

T017 (EN 45001)

Reviewed by:

Tero Turunen, Product Manager, ~~EMC~~

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.

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

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 4

2. System Configuration 4

2.1 Test set-up 4

2.2 Operating conditions and monitoring of the EUT 5

2.3 Performance criteria for immunity tests 5

3. Test procedures 6

3.1 Immunity tests 6

3.1.1 Radiated radio-frequency electromagnetic field immunity test 6
3.1.2 Radiated radio-frequency electromagnetic field (GSM) immunity test 7
3.1.3 Electrostatic discharge (ESD) immunity test 7
3.1.4 Conducted radio-frequency common mode immunity test 8
3.1.5 Electrical fast transients (EFT/B) immunity test 8
3.1.6 Transients and surges in vehicular environment immunity test 9

4. Test results 10

4.1 Immunity tests 10

4.1.1 Radiated radio-frequency electromagnetic field immunity test 10
4.1.2 Radiated radio-frequency electromagnetic field (GSM) immunity test 10
4.1.3 Electrostatic discharge (ESD) immunity test 10
4.1.4 Conducted radio-frequency common mode immunity test 11
4.1.5 Electrical fast transients (EFT/B) immunity test 11
4.1.6 Transients and surges in vehicular environment immunity test 12

5. List of test equipment 13

6. Photographs 14

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

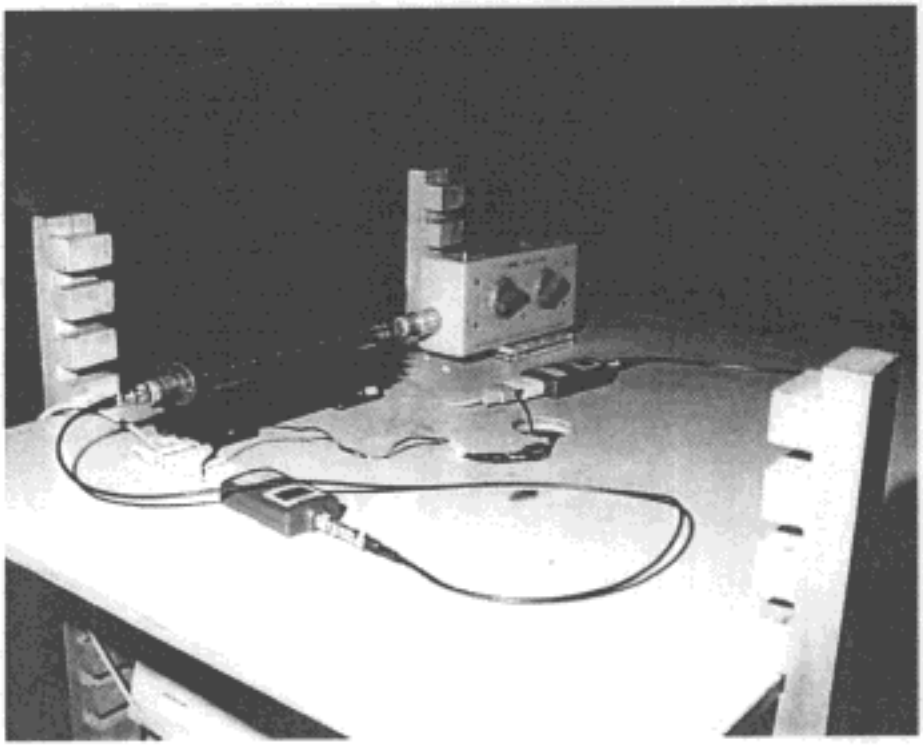
Receiving / transmitting mode of operation:

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

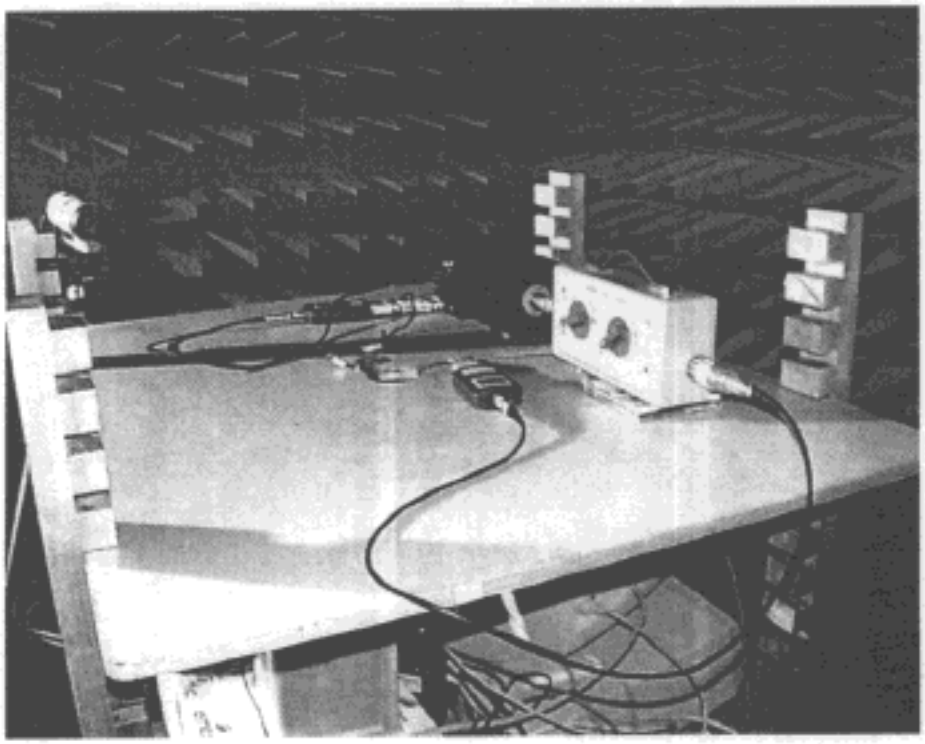
5. List of test equipment

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

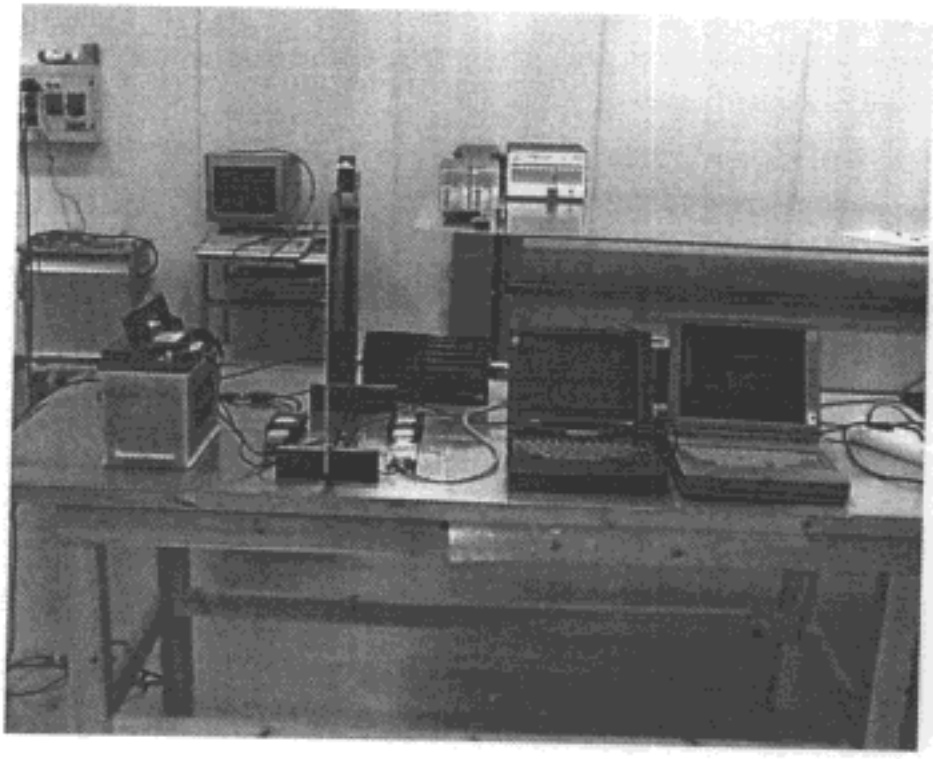
6. Photographs



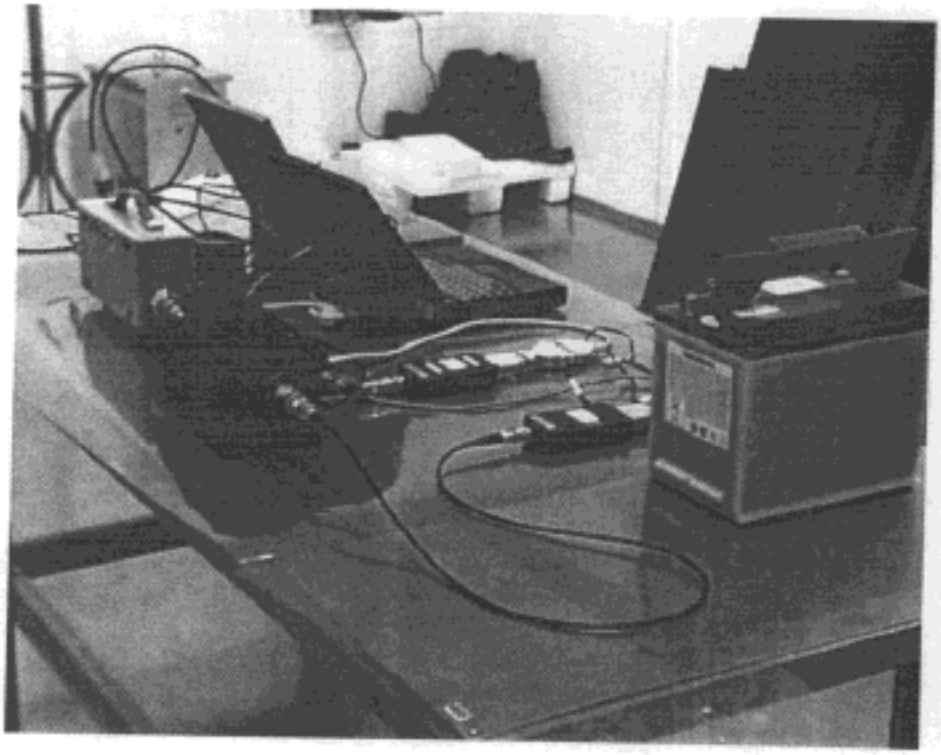
Photograph 1. Radiated radio-frequency electromagnetic field immunity test.



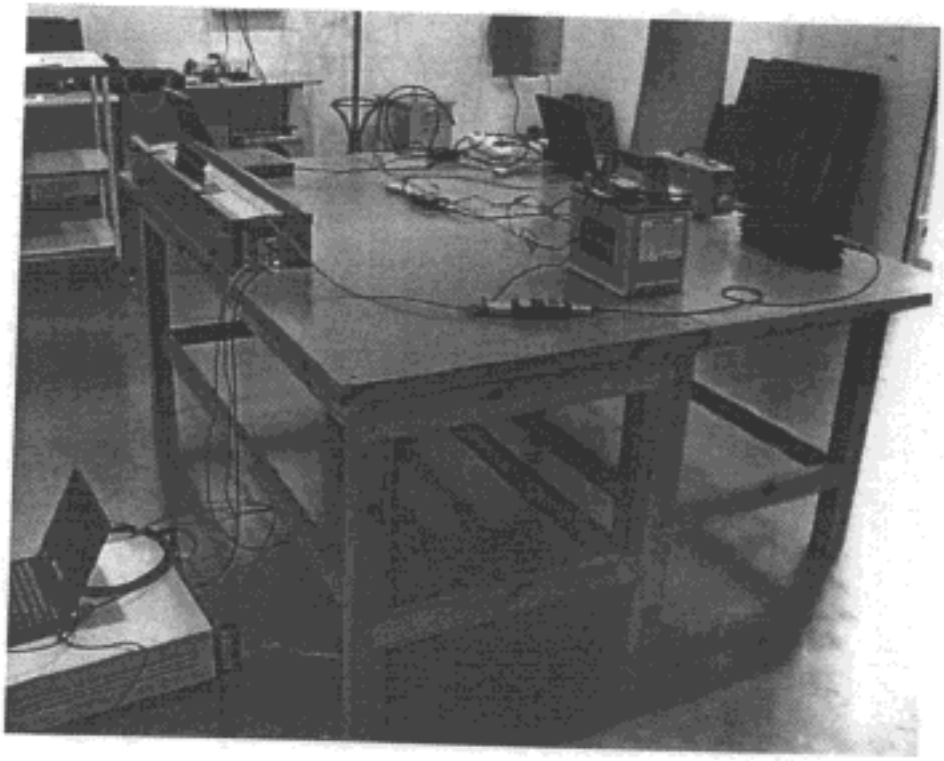
Photograph 2. Radiated radio-frequency electromagnetic field immunity test.



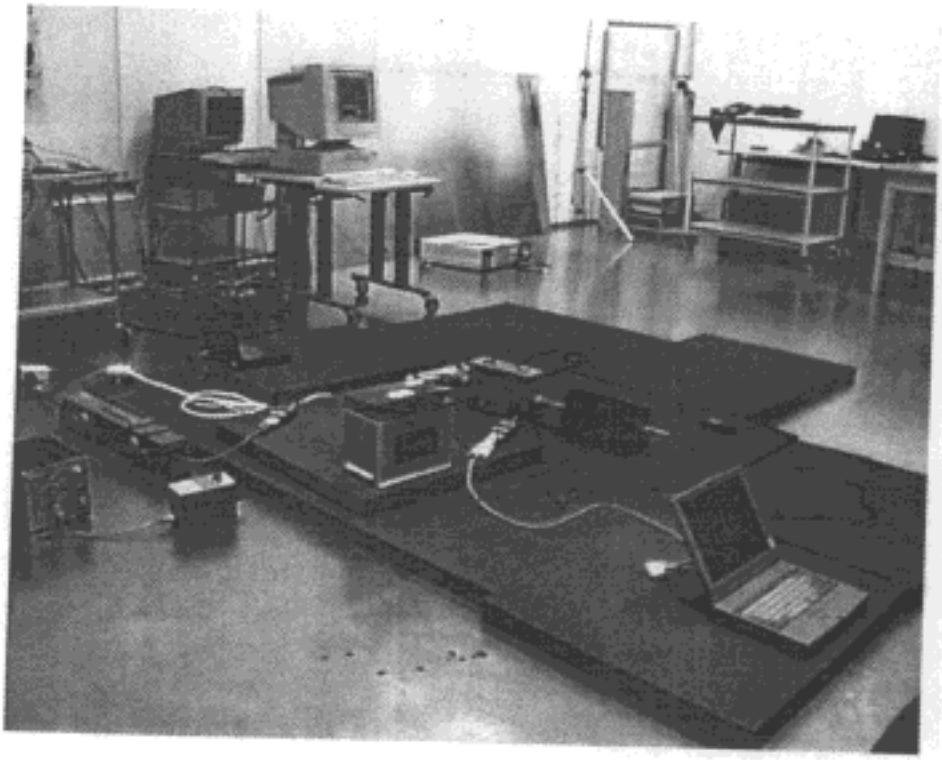
Photograph 3. Electrostatic discharge (ESD) immunity test.



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.