SENTON

EMV-Prüfzentrum EMI/EMC-Testcenter

Straubing, June 24, 1998

TEST-REPORT

No. 55114-80471

for

RT4-433.9

Transmitter Module

Applicant:	Telecontrolli SpA
Purpose of testing:	To show compliance with I-ETS 300 220 (October 1993) Radio Equipment and Systems (RES); Short range devices Technical characteristics and test methods for radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW

Table of Contents

1. Identification of the Test Laboratory

DETAILS OF THE TEST LABORATORY	
COMPANY NAME:	Senton GmbH EMI/EMC Test Center
ADDRESS:	Aeussere Fruehlingstrasse 45 D-94315 Straubing Germany
LABORATORY ACCREDITATION:	DAR-Registration No. TTI-P-G 062/94-20 DAR-Registration No. TTI-P-G 109/95-10
NAME FOR CONTACT PURPOSES:	Mr. Johann Roidt
TELEPHONE: (+49) 09421 55 22-0	FAX: (+49) 09421 55 22-99

PERSONNEL INVOLVED IN THIS TEST REPORT	
TECHNICAL DIRECTOR:	..... Mr. Johann Roidt
RESPONSIBLE FOR TESTING:	..... Mr. Peter Zisterer
RESPONSIBLE FOR TEST REPORT:	Mr. Peter Zisterer

2. Administrative Data

IDENTIFICATION OF EUT	
TYPE DESIGNATION OF EUT (i.e. system if EUT consists of more than one part):	RT4-433.9
PARTS OF THE SYSTEM (including appropriate type designations)	--
SERIAL NUMBER(S):	sample 4
FREQUENCY RANGE:	433.05 - 434.79 MHz
OPERATING FREQUENCY:	433.92 MHz
CHANNEL SPACING:	--
ITU DESIGNATION:	200KA1D
NUMBER OF RF-CHANNELS:	1
NUMBER OF CONTROL FUNCTIONS:	--
POWER SUPPLY:	DC supply: 2.0 - 12.5V
TYPE OF ANTENNA:	antenna connector (pin)
SIZE / LENGTH OF ANTENNA:	--
INTERFACE(S):	modulation input (2.0 - 5.25V)

ADMINISTRATIVE DATA	
APPLICANT (full address):	Telecontrolli SpA Via Nazionale delle Puglie 177 I - 80026 Casoria (Napoli)
CONTACT PERSON:	Mr. Maurizio D'Arrigo
TELEPHONE NO.:	++39-81-7599033
FAX NO.:	++39-81-7596494
RECEIPT OF EUT:	Week 24
DATE(S) OF TEST:	06/19/98
VERSION OF EUT:	with resistor R1=100k
NOTE:	- power supply range: 2.0 - 12.5 VDC - modulation input range: 2.0 - 5.25 V (≤ 4kHz rectangle) - EUT is mounted on test fixture

3. Deviations from the Test Specifications

All tests were performed without deviations from the test specifications.

4. Summary of Test Results

REFERENCE FOR PERFORMED TESTS	
Reference:	I-ETS 300 220 (October 1993)
Title:	Technical characteristics and test methods for radio equipment to be used in the 25 to 1000 MHz frequency range with power levels ranging up to 500 mW
Result:	The tested sample fully complies with the requirements set forth in I-ETS 300 220 (October 1993).

LIST OF MEASUREMENTS

Clause	Parameter to be measured	Test	Page
	Transmitter parameters		
7.1	Frequency error	N.A.	--
7.2	Carrier output power (conducted) - Maximum	Passed	10
7.3	Effective radiated power - Maximum	N.A.	--
7.5	Adjacent channel power - With signalling - Normal	N.A.	--
7.5	Adjacent channel power - With signalling - Extreme	N.A.	--
7.6	Range of modulation bandwidth - Wideband only	Passed	11
7.7.2	Spurious emissions conducted - Transmitter operating	Passed	12
7.7.2	Spurious emissions conducted - Transmitter on Standby	N.A.	--
7.7.3 / 7.7.4	Spurious emissions radiated - Transmitter operating	Passed	13
7.7.3 / 7.7.4	Spurious emissions radiated - Transmitter on Standby	N.A.	--
	Receiver parameters		
8.1	Spurious radiations - Conducted	N.A.	--
8.1	Spurious radiations - Radiated	N.A.	--

5. Additional References

ADDITIONAL REFERENCES	
[X]	The EUT meets the requirements of BAPT 222 ZV 125, section 3.3, i.e. transmission without information is not possible (transmission is terminated within 0.1 seconds after releasing button)
[ ]	The EUT complies with performance specification MPT 1312 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1328 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1329 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1330 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1336 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1338 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1340 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1344 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1346 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1360 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1361 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1374 published by Radiocommunications Agency
[ ]	The EUT complies with performance specification MPT 1601 published by Radiocommunications Agency

6. Test Results

Ambiente temperature: +20.0 °C

Relative humidity: 50 %

TRANSMITTER CARRIER OUTPUT POWER (CONDUCTED)

SUBCLAUSE 7.2

Rated output power level (maximum) 10 mW

Test conditions		Transmitter power (W)		
		CH 1	CH 2	CH 3
T_{nom} +20.0 °C	V_{nom} 12.0 V	$7.1 \cdot 10^{-3}$		
T_{min} -20.0 °C	V_{min} 2.0 V	$4.8 \cdot 10^{-4}$		
	V_{max} 12.5 V	$4.2 \cdot 10^{-3}$		
T_{max} +55.0 °C	V_{min} 2.0 V	$3.6 \cdot 10^{-4}$		
	V_{max} 12.5 V	$8.5 \cdot 10^{-3}$		
Maximum deviation from output power under normal test conditions (dB)		--		
Maximum deviation from output power under extreme test conditions (dB)		-12.9		
Measurement uncertainty		± 2 dB		

LIMIT:

SUBCLAUSE 7.2.3

For normal or extreme test conditions

Class	Frequency range MHz	Power level radiated mW
I	25 to 1000	10
II	300 to 1000	25
III	25 to 1000	100
IV	300 to 1000	500

☐ Carrier modulated ☑ Carrier not modulated

Reference number(s) of test equipment used (for reference see test equipment listing): 007, 008, 020, 022, 102, 106

Ambiente temperature: +20.0 °C

Relative humidity: 50 %

RANGE OF MODULATION BANDWIDTH FOR WIDEBAND EQUIPMENT (>25 KHZ)

SUBCLAUSE 7.6

Test conditions		Limit
		Frequency (MHz)
T_{nom} +20.0 °C	V_{nom} 12.0 V	F_L = 433.7322
		F_H = 433.9528
T_{min} -20.0 °C	V_{min} 2.0 V	F_L = 433.7927
		F_H = 433.8533
	V_{max} 12.5 V	F_L = 433.7844
		F_H = 433.9017
T_{max} +55.0 °C	V_{min} 2.0 V	F_L = 433.8055
		F_H = 433.8494
	V_{max} 12.5 V	F_L = 433.7655
		F_H = 433.9344
Measurement uncertainty (Hz)		± 100

Where F_L Lowest frequency at the appropriate spurious emission level
F_H Highest frequency at the appropriate spurious emission level

Band edge limits

F_{LM} Lowest F_L (measured): 433.7322 MHz

and

F_{HM} Highest F_H (measured): 433.9528 MHz

Spurious Emission Limits (Transmitter Operating) SUBCLAUSE 7.7.5 TABLE 10

47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1000 MHz	Frequencies > 1000 MHz
4.0 nW	250 nW	1.0 µW

Reference number(s) of test equipment used (for reference see test equipment listing):
007, 008, 020, 022, 102

Ambiente temperature: +20.0 °C

Relative humidity: 50 %

TRANSMITTER SPURIOUS EMISSIONS CONDUCTED

SUBCLAUSE 7.7.2

Power level at which the measurement has been performed $7.1 \cdot 10^{-3}$ W

Transmitter operating ~~Modulated~~/Unmodulated*

*(delete whichever is inappropriate)

Spurious Emissions Level (nW)								
CH 1			CH 2			CH 3		
f (MHz)	Band-width (kHz)	Level (nW)	f (MHz)	Band-width (kHz)	Level (nW)	f (MHz)	Band-width (kHz)	Level (nW)
869.3	100	188.4						
1306.7	1000	68.7						
1736.7	1000	236.0						
2173.3	1000	97.1						
2610.0	1000	54.1						
3043.3	1000	0.2						
3480.0	1000	1.6						
Measurement uncertainty						± 2 dB		

Bandwidth (kHz) refers to the bandwidth of the measuring receiver

LIMITS:

SUBCLAUSE 7.7.5 TABLE 10

47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1000 MHz	Frequencies > 1000 MHz
4.0 nW	250 nW	1.0 µW

Reference number(s) of test equipment used (for reference see test equipment listing):
006, 008, 010, 011, 102, 106

Ambiente temperature: +20.0 °C Relative humidity: 50 %

TRANSMITTER SPURIOUS EMISSIONS RADIATED

SUBCLAUSE 7.7.3 & 7.7.4

Power level at which the measurement has been performed 7.1·10^{-3} W

Transmitter operating ~~Modulated~~/Unmodulated*
*(delete whichever is inappropriate)

Spurious Emissions Level (nW)								
CH 1			CH 2			CH 3		
f (MHz)	Band-width (kHz)	Level (nW)	f (MHz)	Band-width (kHz)	Level (nW)	f (MHz)	Band-width (kHz)	Level (nW)
867.8	120	182.0						
1306.7	1000	457.1						
1736.7	1000	660.7						
2173.3	1000	467.7						
2606.7	1000	132.1						
3480.0	1000	49.5						
Measurement uncertainty						± 3 dB		

Bandwidth (kHz) refers to the bandwidth of the measuring receiver

LIMITS:

SUBCLAUSE 7.7.5 TABLE 10

47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1000 MHz	Frequencies > 1000 MHz
4.0 nW	250 nW	1.0 µW

Reference number(s) of test equipment used (for reference see test equipment listing):
001, 004, 011, 012, 015, 101, 106, 113, 114, 141, 142, 143, 144, 145

7. Test Equipment and Ancillaries used for Tests

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the test laboratory (version 11/20/1995), below.

General Test Equipment and Ancillaries

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer
001	Open area test site	EG 1		Senton
002	Shielded room	No. 1	1451	Senton
003	Shielded room	No. 2	1452	Senton
004	Semi-anechoic room	No. 3	1453	Siemens
005	Shielded room	No. 4	3FD 100 544	Euroshield
006	Shielded room	No. 5	5468	Ray Proof Division
007	Temperature test chamber	HT4010	07065550	Heraeus
008	Cable	RG214	1309	Senton
009	Cable	200CM_001	1357	Rosenberger
010	Cable	150CM_001	1479	Rosenberger
011	Cable	150CM_002	1480	Rosenberger
012	Cable set EG1	RG214	1189 - 1191	Senton
013	Cable set cabin no. 1	RG214		Senton
014	Cable set cabin no. 2	RG214		Senton
015	Cable set cabin no. 3	RG214		Senton
016	Cable set cabin no. 4	RG214		Senton
017	DC power supply	NGSM 32/10	203	Rohde & Schwarz
018	DC power supply	NGB	2455	Rohde & Schwarz
019	DC power supply	NGA	386	Rohde & Schwarz
020	Isolating transformer	RT 5A	10387	Grundig
021	Isolating transformer	RT 5A	10416	Grundig
022	Digital multimeter	199	463386	Keithley
023	Multimeter	HP E2373A	2927J03345	Hewlett Packard

Test Equipment and Ancillaries used for Emission Tests

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer
101	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
102	Spectrum analyzer	R 3271	05050023	Advantest
103	Test receiver	ESH 3	880112/032	Rohde & Schwarz
104	Test receiver	ESHS 10	860043/016	Rohde & Schwarz
105	Test receiver	ESV	881414/009	Rohde & Schwarz
106	Test receiver	ESVP	881120/024	Rohde & Schwarz
107	Audio analyzer	UPA	862954	Rohde & Schwarz
108	Radio communication service monitor	CMS 54	838384/030	Rohde & Schwarz
109	Power meter	NRVS	836856/015	Rohde & Schwarz
110	Power sensor	NRV-Z52	837901/030	Rohde & Schwarz
111	Power sensor	NRV-Z4	863828/015	Rohde & Schwarz
112	Preamplifier	ESV-Z3	860907/004	Rohde & Schwarz
113	Preamplifier	R14601		Advantest
114	Preamplifier	ACX/080-3030	32640	CTT
115	Preamplifier	ACO/180-3530	32641	CTT
116	Signal generator	SMS	872166/039	Rohde & Schwarz
117	Signal generator	HP 8673 D	2930A00966	Hewlett Packard
118	Waveform generator	HP 33120 A	US34005375	Hewlett Packard
119	UHF attenuator set	DPU	300771/075	Rohde & Schwarz
120	UHF attenuator set	DPU	300788/006	Rohde & Schwarz
121	Attenuator	4776-10	9412	Narda
122	Attenuator	4776-20	9503	Narda
123	Pulse limiter	ESH 3-Z2	1144	Rohde & Schwarz
124	Pulse limiter	11947 A	3107A00566	Hewlett Packard
125	V-network	ESH 3-Z5	862770/018	Rohde & Schwarz
126	V-network	ESH 3-Z5	894785/005	Rohde & Schwarz
127	V-network	ESH 3-Z5	830952/025	Rohde & Schwarz
128	V-network	ESH 3-Z6	830722/010	Rohde & Schwarz
129	V-network	NSLK 8127	8127152	Schwarzbeck
130	Artificial mains network	ESH 2-Z5	842966/004	Rohde & Schwarz
131	T-network	ESH 3-Z4	890602/011	Rohde & Schwarz
132	T-network	ESH 3-Z4	890602/012	Rohde & Schwarz
133	Diode detector negative	8473D	01492	Hewlett Packard

Test Equipment and Ancillaries used for Emission Tests (continued)

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer
134	High impedance probe	TK 9416	01	Schwarzbeck
135	High impedance probe	TK 9416	02	Schwarzbeck
136	Current probe	ESH 2-Z1	863366/18	Rohde & Schwarz
137	Current probe	ESV-Z1	862553/3	Rohde & Schwarz
138	Absorbing clamp	MDS 21	80911	Lüthi
139	Absorbing clamp	MDS 21	79690	Lüthi
140	Loop antenna	HFH2-Z2	882964/1	Rohde & Schwarz
141	Biconical antenna	HK 116	836239/02	Rohde & Schwarz
142	Biconical antenna	HK 116	842204/001	Rohde & Schwarz
143	Log. periodic antenna	HL 223	834408/12	Rohde & Schwarz
144	Log. periodic antenna	HL 223	841516/023	Rohde & Schwarz
145	Horn antenna	3115	9508-4553	Emco
146	Horn antenna	3160-03	9112-1003	Emco
147	Horn antenna	3160-04	9112-1001	Emco
148	Horn antenna	3160-05	9112-1001	Emco
149	Horn antenna	3160-06	9112-1001	Emco
150	Horn antenna	3160-07	9112-1008	Emco
151	Horn antenna	3160-08	9112-1002	Emco
152	Horn antenna	3160-09	9403-1025	Emco
153	Stub tuner	904N	04	Narda
154	Mains analyzer	DPA 503	496 - 02	EM Test
155	Controller	HIS 500	X71010	EM Test
156	AC Amplifier	ACS 500	HK51736	EM Test
157	Mains impedance	AIF 500	X71062	EM Test

Test Equipment and Ancillaries used for Immunity Tests

No.	Type	Model	Serial Number	Manufacturer
201	ESD simulator	NSG 435	000290	Schaffner
202	EFT generator	NSG 1025	3020	Schaffner
203	Ultra compact simulator	UCS	1195-30	EM Test
204	Coupling clamp	CDN 8014	131	Schaffner
205	Coupling clamp	SL 400-071D	007	Schaffner
206	Coupling filter	FP 16	080554-14-84	Haefely
207	Oscilloscope	2225	203550	Tektronix
208	Signal generator	SMT 03	838129/029 837533/032	Rohde & Schwarz
209	Power amplifier	150 L	8835	Amplifier Research
210	Power amplifier	200 W 1000	12904	Amplifier Research
211	Power meter	NRVS	838624/016	Rohde & Schwarz
212	E-field generator	3107 B	2302	Emco
213	Biconical antenna	VHBA 9123	1018	Schwarzbeck
214	Log. periodic antenna	AT 1080	12834	Amplifier Research
215	Isotropic field probe	FP 2000	12847	Amplifier Research
216	Isotropic field monitor	FM 2004	12632	Amplifier Research
217	Ultra compact simulator	UCS	1195-30	EM Test
218	Surge generator	NSG 650	1679204	Schaffner
219	Coupling network	CDN 110	1649135	Schaffner
220	Coupling network	CDN 115	132	Schaffner
221	Dropping resistor	INA 110-40	121	Schaffner
222	Oscilloscope	HM 408	9005 F 3144	Hameg
223	Signal generator	SMX	883184/018	Rohde & Schwarz
224	Power amplifier	411 LA	299	ENI
225	Power amplifier	HVV 250	836956/004	Rohde & Schwarz
226	Power meter	NRV	863825/018	Rohde & Schwarz
227	Coupling network	FCC - 801- M3-25	117	FCC
228	Coupling network	FCC - 801- M4-25	17	FCC
229	Coupling network	FCC - 801- M5-25	16	FCC
230	Coupling network	FCC - 801- AF4	47	FCC
231	Coupling network	FCC - 801- AF4	48	FCC
232	Coupling network	FCC - 801-T4	68	FCC
233	Coupling network	FCC - 801- C1	64	FCC
234	Coupling network	CDN 801-M3	–	Senton
235	Coupling network	CDN 801-S37	–	Senton
236	Current clamp	FCC-120-9B	15	FCC
237	EM injection clamp	EM 101	35354	Lüthi
238	Ultra compact simulator	UCS 500	1195-30	EM Test
239	Transformer			Senton
240	Oscilloscope	54602B	US35060304	Hewlett Packard

8. Measurement Uncertainty Values

8.1. Radio Interference Emission Testing

8.1.1. Conducted Emission 9 kHz - 30 MHz

Used measuring instrument	Maximum deviation
Test receiver ESHS 10 (CISPR-detector, S/N ≥ 16 dB)	± 1.5 dB
Test receiver ESH 3 (CISPR-detector, S/N ≥ 16 dB)	± 1.5 dB
Pulse Limiter ESH 3-Z2	± 0.3 dB
Network ESH 3-Z4, ESH 3-Z5 or ESH 3-Z6	± 1.0 dB
High impedance probe TK 9416	± 1.0 dB
Cable attenuation (determined with power meter NRVS)	± 0.2 dB

8.1.2. Radiated Emission 9 kHz - 30 MHz

Used measuring instrument	Maximum deviation
Test receiver ESHS 10 (CISPR-detector, S/N ≥ 16 dB)	± 1.5 dB
Test receiver ESH 3 (CISPR-detector, S/N ≥ 16 dB)	± 1.5 dB
Loop Antenna HFH 2-Z2	± 1.0 dB
Cable attenuation (determined with power meter NRVS)	± 0.2 dB

8.1.3. Radiated Emission / Equivalent Radiated Power 25 MHz - 1 GHz

Used measuring instrument	Maximum deviation
Spectrum analyzer R3261A	± 1.5 dB
Spectrum analyzer R3271	± 1.5 dB
Test receiver ESVP (CISPR-detector, S/N > 15 dB)	± 1.5 dB
Test receiver ESV (CISPR-detector, S/N ≥ 10 dB)	± 1.5 dB
Preamplifier ESV-Z3	+ 2.0 dB / - 1.0 dB
Biconical antenna HK 116	± 1.0 dB
Logarithmic-periodic antenna HL 223	± 1.0 dB
Open area test site (related to theoretical site attenuation)	± 3.0 dB
Cable attenuation (determined with power meter NRVS)	± 0.2 dB

8.1.4. Interference Power 30 MHz - 1000 MHz

Used measuring instrument	Maximum deviation
Spectrum analyzer R3261A	± 1.5 dB
Spectrum analyzer R3271	± 1.5 dB
Test receiver ESVP (CISPR-detector, S/N > 15 dB)	± 1.5 dB
Test receiver ESV (CISPR-detector, S/N ≥ 10 dB)	± 1.5 dB
Preamplifier ESV-Z3	+ 2.0 dB / - 1.0 dB
Absorbing clamp MDS 21	± 1.0 dB
Cable attenuation (determined with power meter NRVS)	± 0.2 dB

8.2. Immunity Testing

8.2.1. Electrostatic Discharge

Used measuring instrument	Maximum deviation
ESD simulator NSG 435	± 5% of selected discharge voltage

8.2.2. Electromagnetic Fields (RF-Fields)

Used measuring instrument	Maximum deviation
Field probe FP 2000 / field monitor FM 2004	
Selected range up to 10 V/m	± 0.7 V/m
Selected range up to 30 V/m	± 1.9 V/m
Selected range up to 100 V/m	± 6.1 V/m
Selected range up to 300 V/m	± 18.1 V/m

8.2.3. Electrical Fast Transients (Burst)

Used measuring instrument	Maximum deviation
EFT generator NSG 1025	± 10% of selected pulse amplitude

8.2.4. Surge Immunity

Used measuring instrument	Maximum deviation
Surge generator NSG 650	± 10% of selected pulse amplitude

9. Photographs of the Equipment Under Test

Photo No. 1

Top view of RT4-433.9 Module

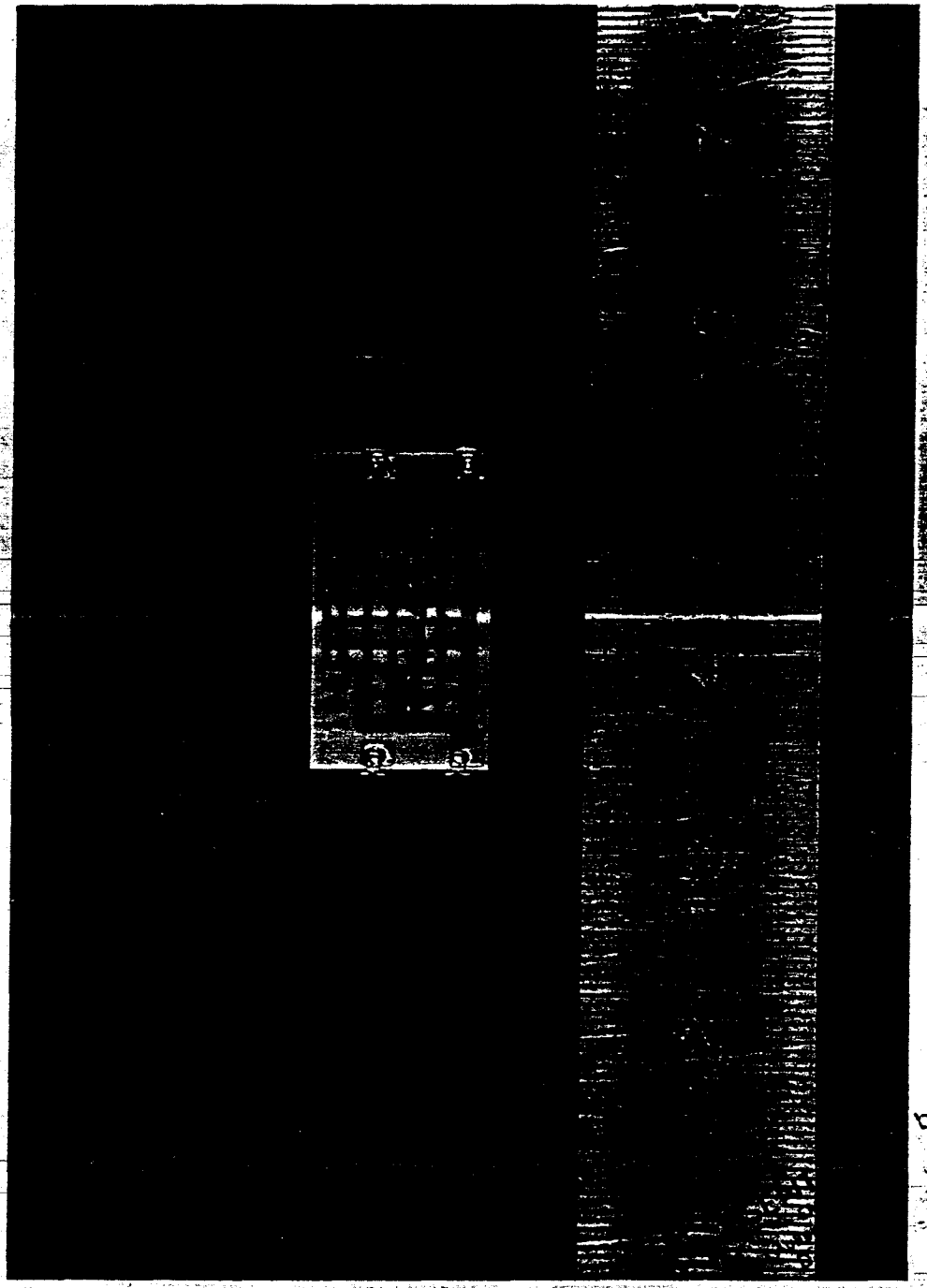
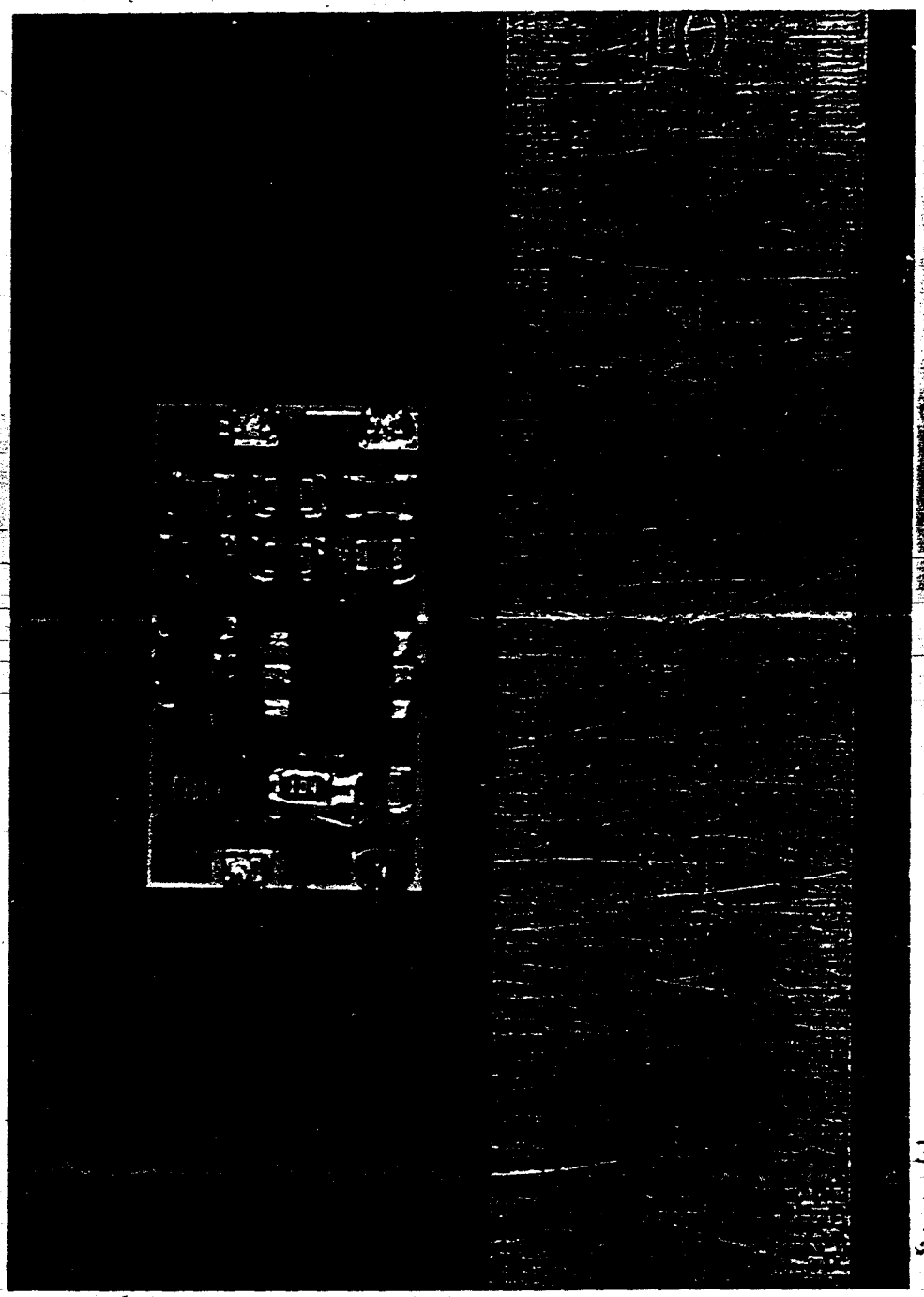


Photo No. 2

Bottom view of RT4-433.9 Module



10. Additional Information supplementary to the Test Report

Technical documentation:
- Circuit diagram (1 page)
- Parts list (1 page)
- Application form (I-ETS 300 220)