



TTI-P-G166/98-30

Accredited Bluetooth™ Test Facility (BQTF)

Test report no.: 2_2729-01-01/01
FCC Part 15.231
HS(M) 2/4 ; HE1/2 ; HER1 (40 MHz)

CETECOM – ICT Services GmbH
Untertürkheimerstr. 6-10
66117 Saarbrücken, Germany

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1 General information

1.1 Notes

The test results of this test report relate exclusively to the item tested as specified in 1.5.

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1.2 Testing laboratory

CETECOM ICT Services GmbH

Untertürkheimer Straße 6 - 10

66117 Saarbrücken

Deutschland

Telefon : + 49 681 598 - 9100

Telefax : + 49 681 598 - 9075

E-mail : Michael.Berg@ict.cetecom.de

Internet : www.cetecom.de

Accredited testing laboratory

DAR-registration number : TTI-P-G-166/98-30

Accredited Bluetooth™ Test Facility (BQTF)

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1.3 Details of applicant

Name : Hörmann KG Antriebstechnik

Street : Carl-Bosch-Straße 1

City : D-33790 Halle i. Westfalen

Country : Germany

Telephone : +49 (0)5201-855-0

Telefax : +49 (0)5201-855-150

Contact : Mr. F. Ziesche

Telephone : +49 (0)5201-855-173

Fax : +49 (0)5201-855-170

1.4 Application details

Date of receipt of application : 15.11.2001

Date of receipt of test item : 16.11.2001

Date of test : 21.11.2001

1.5 Test item

Type of equipment : Remote controle (door openers)

Type designation : **Tx: HS(M) 2/4** **Rx: HE1/2 , HER1**

Manufacturer : DELTRON Elektronische Systeme GmbH

Street : Alltronikstraße 1-5

City : D-99994 Schlotheim

Country : Germany

Serial number :

Additional informations: :

Frequency : 40,685 MHz / 1K20A1D BN Channel separation: -

Number of channels : 1

Antenna : Ferrit antenna

Power supply : Tx : 12V DC Battery Rx: HE1/2 24V DC, HER1: 115V AC

Max ERP : 2183,1 µV/m in 3m / 0.848 µW / 1.39µW EIRP

1.6 Test standards

FCC Part §15.231 / §15.209 / §15.107/207

2 Technical test

The radiated measurements were performed vertical and horizontal over the whole frequency range. We start at 1 m high with vertical receiving antenna and rotate the dish continuously. During rotation we use the antenna lift system to vary the high from 1 to 4 m. So we find maximum radiation output. At this points we do manual remeasurements. After this we do the same measurements in horizontal position of the receiving antenna. This (horizontal and vertical) is made for all the three planes of the test sample. We use the maximum received results.

The detector function and selection of bandwidth are according ANSI C63.2-1996 item 8.2.1 and ANSI C63.4-1992 Item 4.2.

Antennas are conform with ANSI C63.2-1996 item 15.

150 kHz - 30 MHz: Quasi Peak measurement, 9kHz Bandwidth, passive loop antenna.

30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna

200MHz - 1GHz: Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna

1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horn

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed. (only spurious emissions was tested)

FINAL VERDICT : PASS

Technical responsibility for area of testing :

11.12.2001	RSC8411	Berg M.
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Date

Section

Name

Signature



11.12.2001	RSC8414	Ames H.
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Date

Section

Name

Signature



2.2 Testreport

TEST REPORT

FCC Part §15.231

Testreport no.: 2_2729-01-01/01

TEST REPORT REFERENCE

LIST OF MEASUREMENTS

The list of measurements called for in FCC Part 15.231 is given below.

Paragraph	PARAMETER TO BE MEASURED	PAGE
	Transmitter parameters	
§15.231 (b)	Maximum field strength of emission	7
§15.231(a)	Automatic deactivation	13
§15.231(d)	Bandwidth of emission	14
§15.231(d)	Frequency tolerance	15
	Receiver parameters	
§ 15.209	Spurious radiations - Radiated	17
\$ 15.107/207	Conducted Emissions	20
	Test equipment listing	22
	Photographs of the equipment	24

Equipment under test : HS(M) 2

Ambient temperature : 23,4°C

Relative humidity : 33 %

EMISSION LIMITATIONS RADIATED (40,685 MHz)

§15.231(b)

EMISSION LIMITATIONS					
all measurements are made up to the 10 th harmonic at 3m					
f (MHz)	polarization	amplitude of emission (µV/m)	limit max. allowed emmission power (interpolation)	actual attenuation below frequency of operation (dB)	results
40,685	vertical	2183,1	2250 µV/m	-	Operating frequency
410.04	vertical	58.9	225 µV/m 200µV/m (209)	31.4	complies
449.95	vertical	45.7	225 µV/m 200µV/m (209)	33.6	complies
491.33	vertical	40.3	225 µV/m 200µV/m (209)	34.7	complies
1144.5	vertical	46.8	225 µV/m 500µV/m (209)	33.4	complies
All other peaks > 10 db below the Limit §15.209 (see plots)					
Measurement uncertainty		± 3dB			

LIMITS

SUBCLAUSE § 15.231

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

All measurements are made with a CISPR quasi-peak equipment.

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)

Equipment under test : HS(M) 2

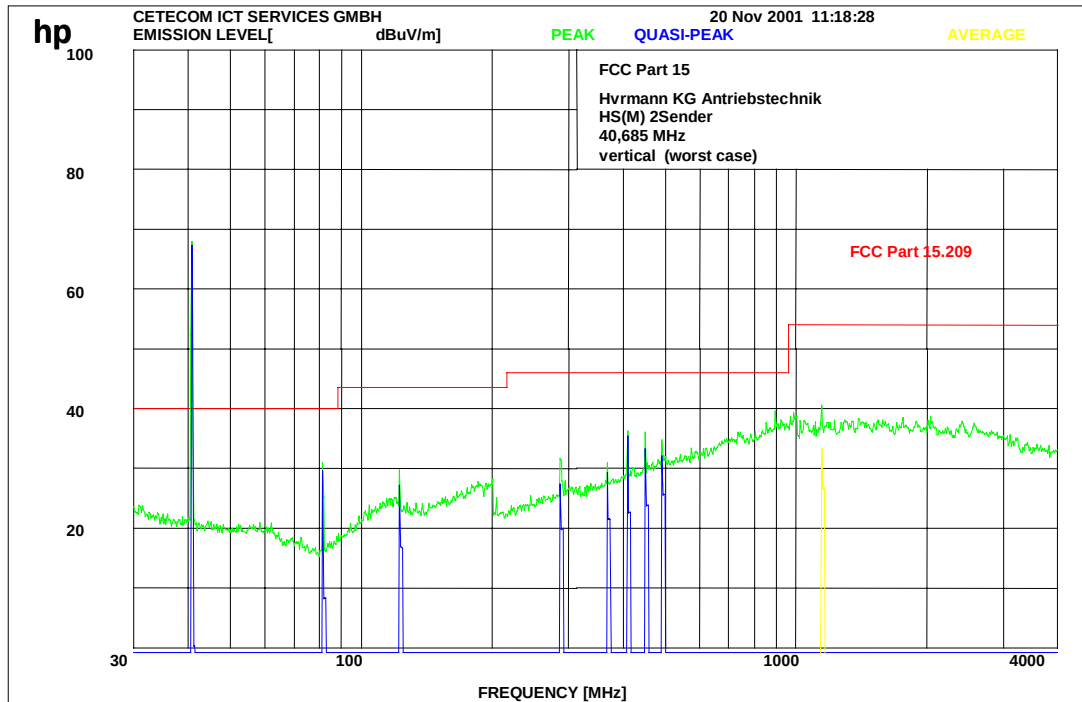
Ambient temperature : 23,4°C

Relative humidity : 33 %

EMISSION LIMITATIONS RADIATED (40,685 MHz)

§15.231(b)

Vertical (worst case)



LIMITS

SUBCLAUSE § 15.231

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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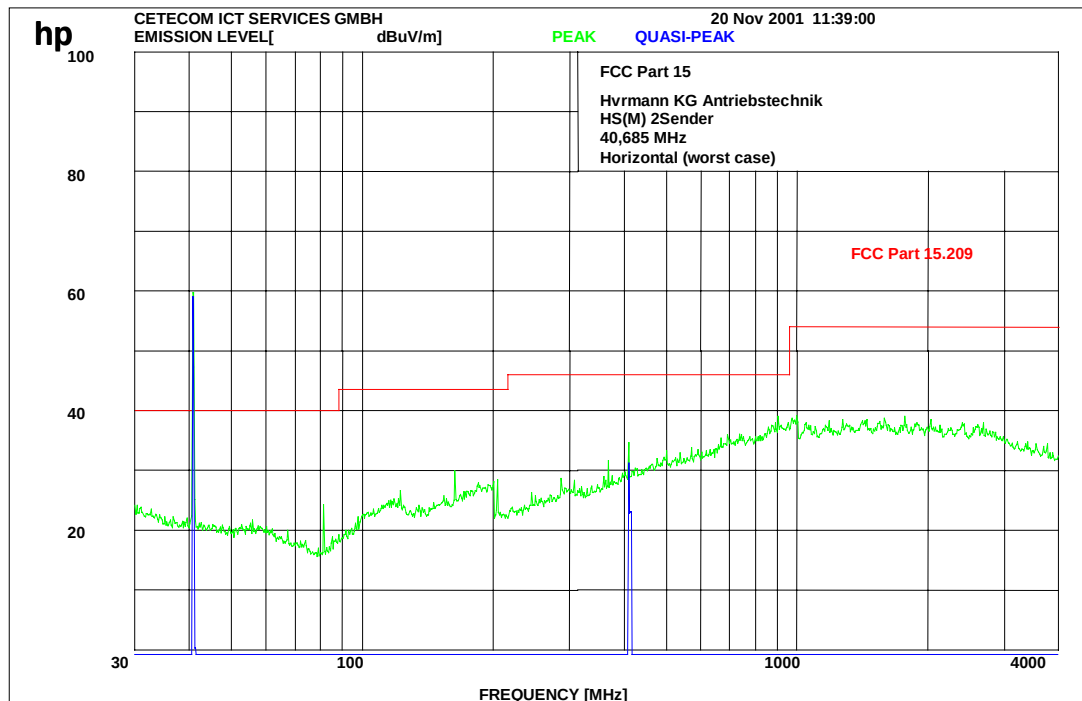
Ambient temperature : 23,4°C

Relative humidity : 33 %

EMISSION LIMITATIONS RADIATED (40,685 MHz)

§15.231(b)

Horizontal (worst case)



LIMITS

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REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : HS(M) 4

Ambient temperature : 23,4°C

Relative humidity : 33 %

EMISSION LIMITATIONS RADIATED (40,685 MHz)

§15.231(b)

EMISSION LIMITATIONS					
all measurements are made up to the 10 th harmonic at 3m					
f (MHz)	polarization	amplitude of emission (µV/m)	limit max. allowed emmission power (interpolation)	actual attenuation below frequency of operation (dB)	results
40,685	horizontal	732.8	2250 µV/m	-	Operating frequency
950.5	vertical	33.1	225 µV/m 200µV/m (209)	26.9	complies
963.66	horizontal	146.2	225 µV/m 500µV/m (209)	14.0	complies
978.79	horizontal	153.1	225 µV/m 500µV/m (209)	13.6	complies
1017.8 to 1667.5	horizontal	Max 160.3	225 µV/m 500µV/m (209)	13.2	complies
	vertical	46.8		33.4	complies
All other peaks > 10 db below the Limit §15.209 (see plots)					
Measurement uncertainty		± 3dB			

LIMITS

SUBCLAUSE § 15.231

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

All measurements are made with a CISPR quasi-peak equipment.

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)

Equipment under test : HS(M) 4

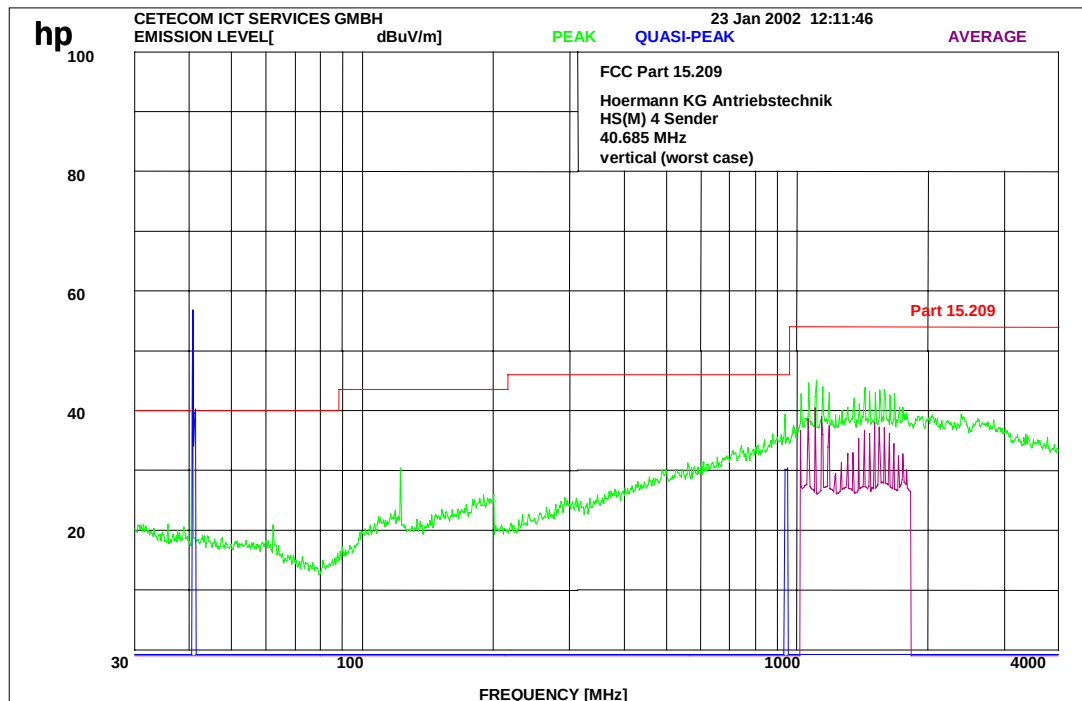
Ambient temperature : 23,4°C

Relative humidity : 33 %

EMISSION LIMITATIONS RADIATED (40,685 MHz)

§15.231(b)

Vertical (worst case)



LIMITS

SUBCLAUSE § 15.231

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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(for reference numbers see test equipment listing)

Equipment under test : HS(M) 4

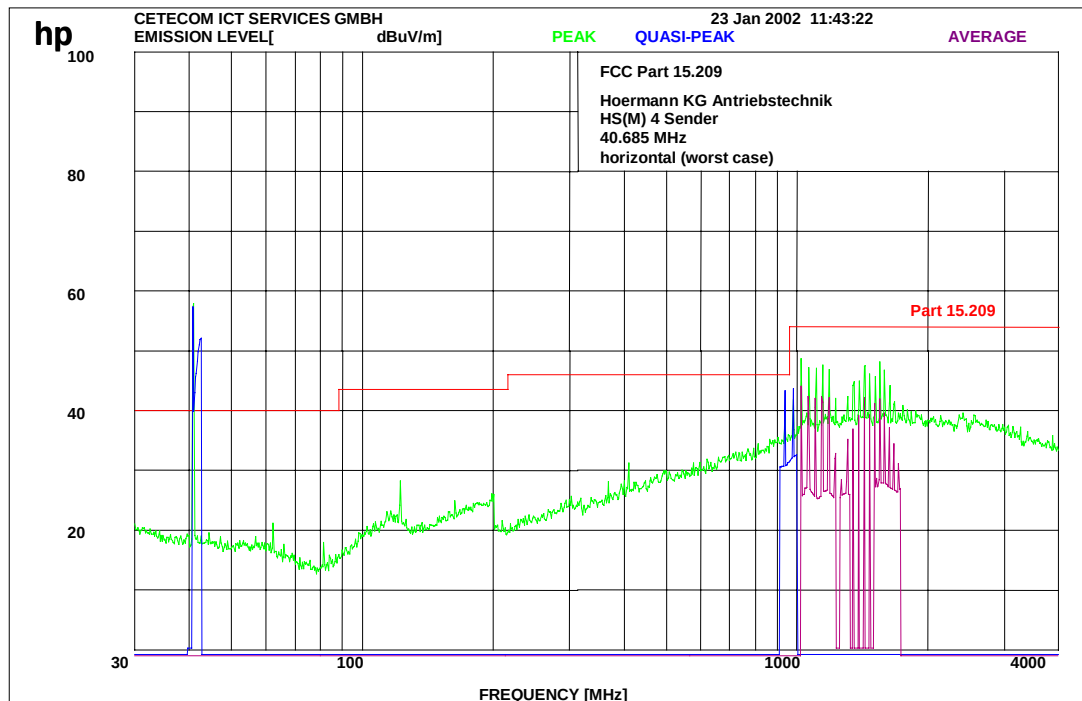
Ambient temperature : 23,4°C

Relative humidity : 33 %

EMISSION LIMITATIONS RADIATED (40,685 MHz)

§15.231(b)

Horizontal (worst case)



LIMITS

SUBCLAUSE § 15.231

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : HS(M) 2/4

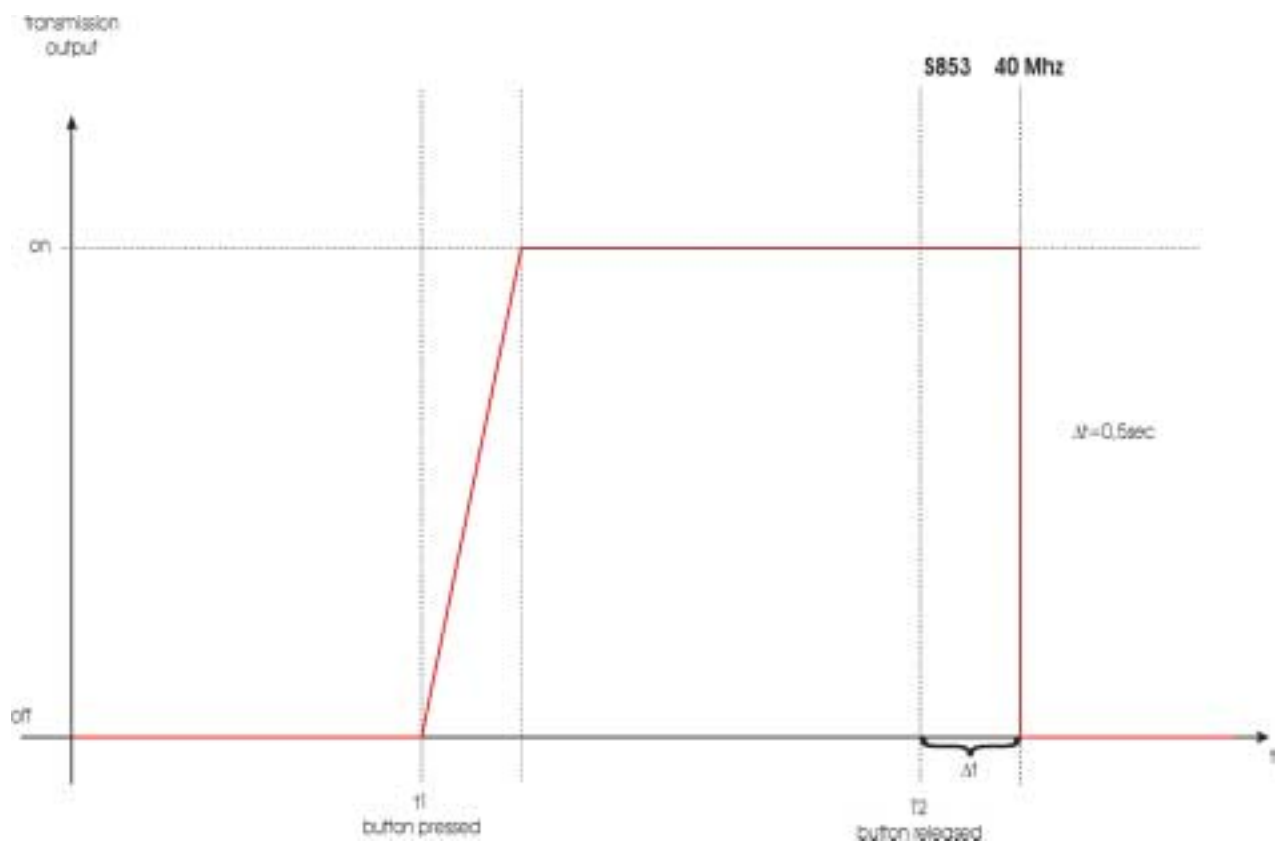
Ambient temperature : 23,4°C

Relative humidity : 33 %

AUTOMATIC DEACTIVATION

SUBCLAUSE § 15.231 (a)

The transmitter is automatically deactivated within 5 seconds of being released.



Equipment under test : HS(M) 2/4

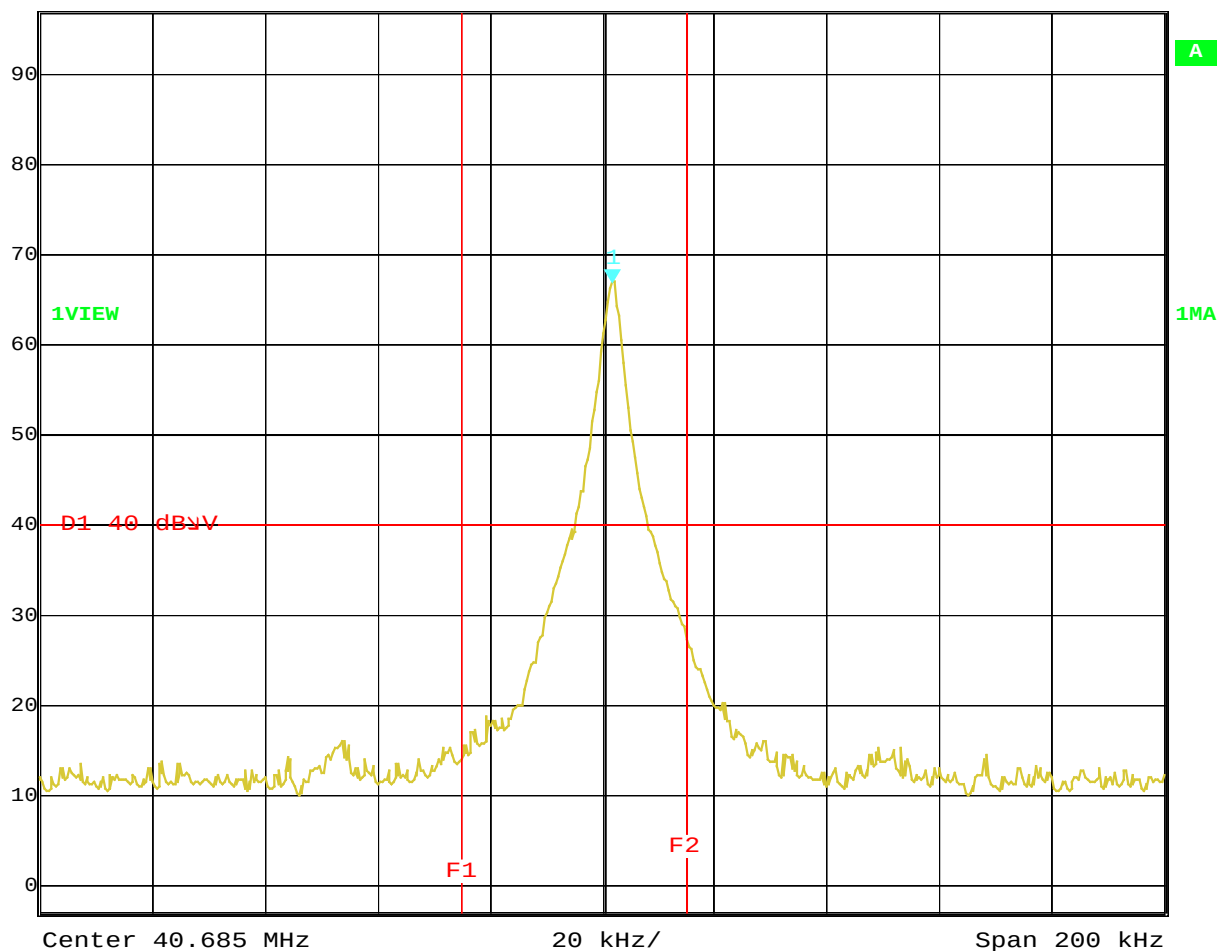
Ambient temperature : 23,4°C

Relative humidity : 33 %

Bandwidth of emissions

SUBCLAUSE § 15.231 (d)

	Ref Lvl	Marker 1 [T1]	RBW	2 kHz	RF Att	20 dB
	97 dBµV	66.85 dBµV	VBW	2 kHz		
		40.68680361 MHz	SWT	125 ms	Unit	dBµV



Date: 22.NOV.2001 14:35:28

LIMITS:

§15.231(d)

Under all test conditions	The bandwidth of the emission shall be conform within the band edges
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REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : HS(M) 2/4

Ambient temperature : 23,4°C

Relative humidity : 33 %

AFC FREQ ERROR vs. VOLTAGE

SUBCLAUSE § 15.231 (d)

nom. Voltage	nom. Voltage	Voltage [V]	Frequency error [Hz]	Frequency [MHz]	Error in %	Error in ppm
0,85	12	10,20	1270	40,685	0,00312154	31,2154
0,87	12	10,44	1290	40,685	0,00317070	31,7070
0,90	12	10,80	1350	40,685	0,00331818	33,1818
0,92	12	11,04	1310	40,685	0,00321986	32,1986
0,95	12	11,40	1350	40,685	0,00331818	33,1818
0,97	12	11,64	1360	40,685	0,00334276	33,4276
1,00	12	12,00	1360	40,685	0,00334276	33,4276
1,02	12	12,24	1360	40,685	0,00334276	33,4276
1,05	12	12,60	1340	40,685	0,00329360	32,9360
1,07	12	12,84	1340	40,685	0,00329360	32,9360
1,10	12	13,20	1310	40,685	0,00321986	32,1986

AFC FREQ ERROR vs. TEMPERATURE

Temperature [° C]	Frequency error [Hz]	Frequency [MHz]	Error in %	Error in ppm
-20°	1650	40,685	0,00040555	40,5555
-10°	1610	40,685	0,00039572	39,5723
0,0°	1560	40,685	0,00038343	38,3434
+10°	1430	40,685	0,00035148	35,1481
+20°	1340	40,685	0,00032936	32,9360
+30°	1230	40,685	0,00030232	30,2323
+40°	1120	40,685	0,00027529	27,5286
+50°	1160	40,685	0,00028512	28,5117

LIMITS:

§15.231 (d)

Under all test conditions	± 0.01 %
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REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

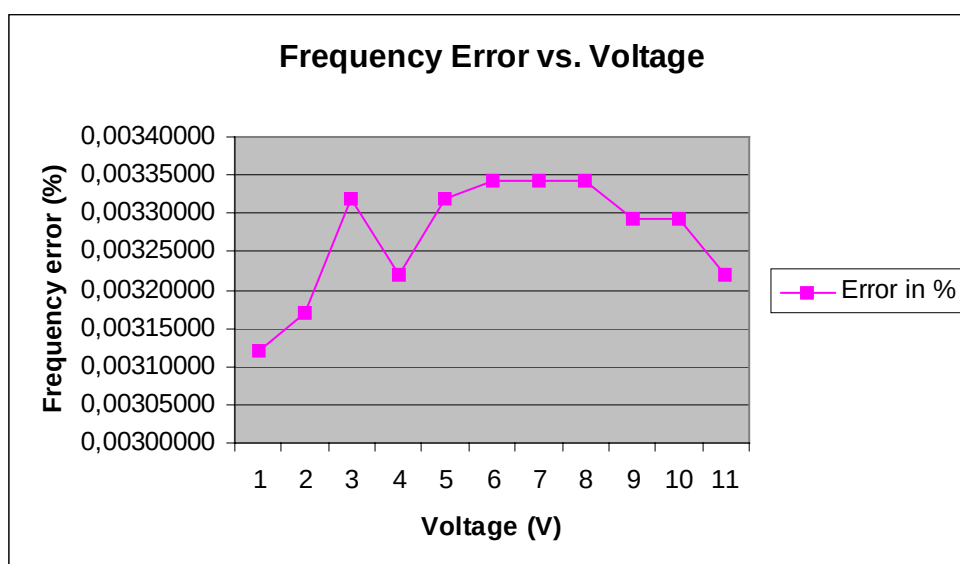
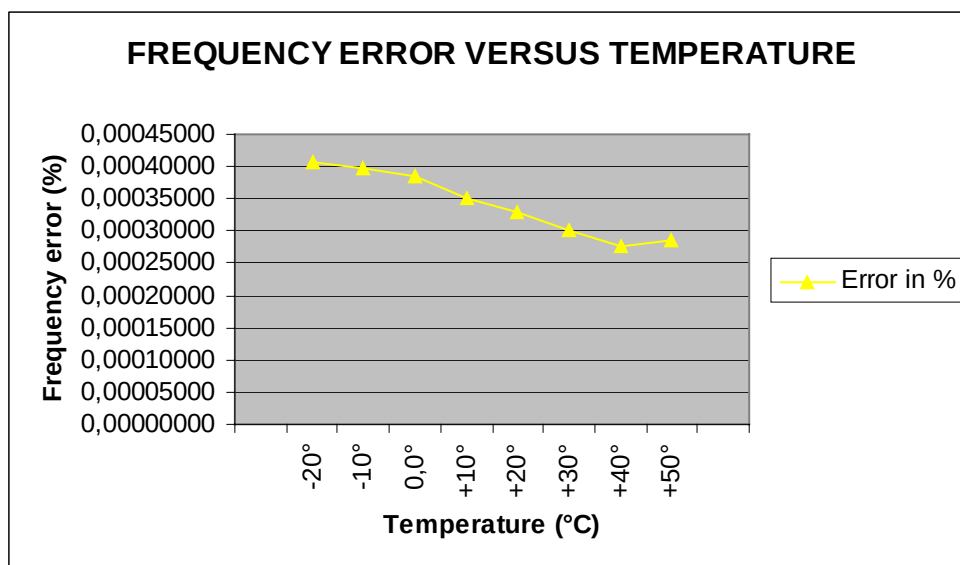
(for reference numbers see test equipment listing)

01, 05

Equipment under test : HS(M) 2/4

Ambient temperature : 23,4°C

Relative humidity : 33 %



REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

01, 05

Equipment under test : HER1
 Ambient temperature : 23,4°C
 Relative humidity : 33 %

RECEIVER SPURIOUS RADIATION Radiated

§ 15.109

SPURIOUS EMISSIONS LEVEL (µV/m)								
HER1			HE 1/2					
f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)
no	peak	found	no	peak	found			
Measurement uncertainty			±3 dB					

f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Measurement distance see table

Limits

SUBCLAUSE § 15.109

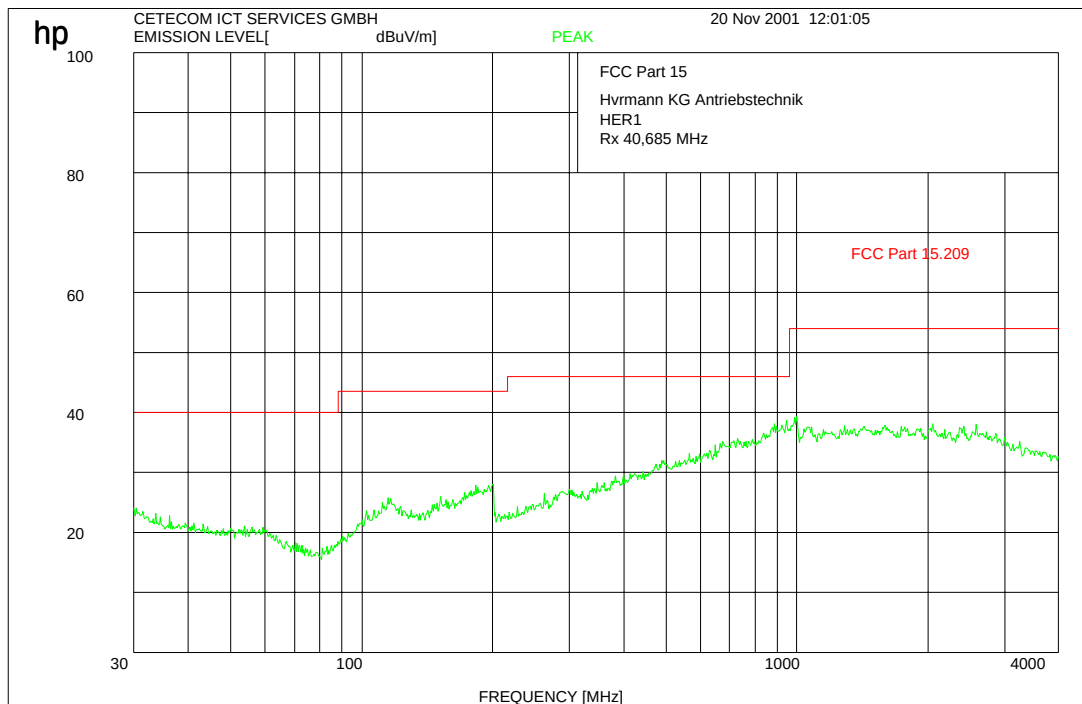
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)
 17 - 24

Equipment under test : HER1
 Ambient temperature : 23,4°C
 Relative humidity : 33 %

RECEIVER SPURIOUS RADIATION

§ 15.109



Limits

SUBCLAUSE § 15.109

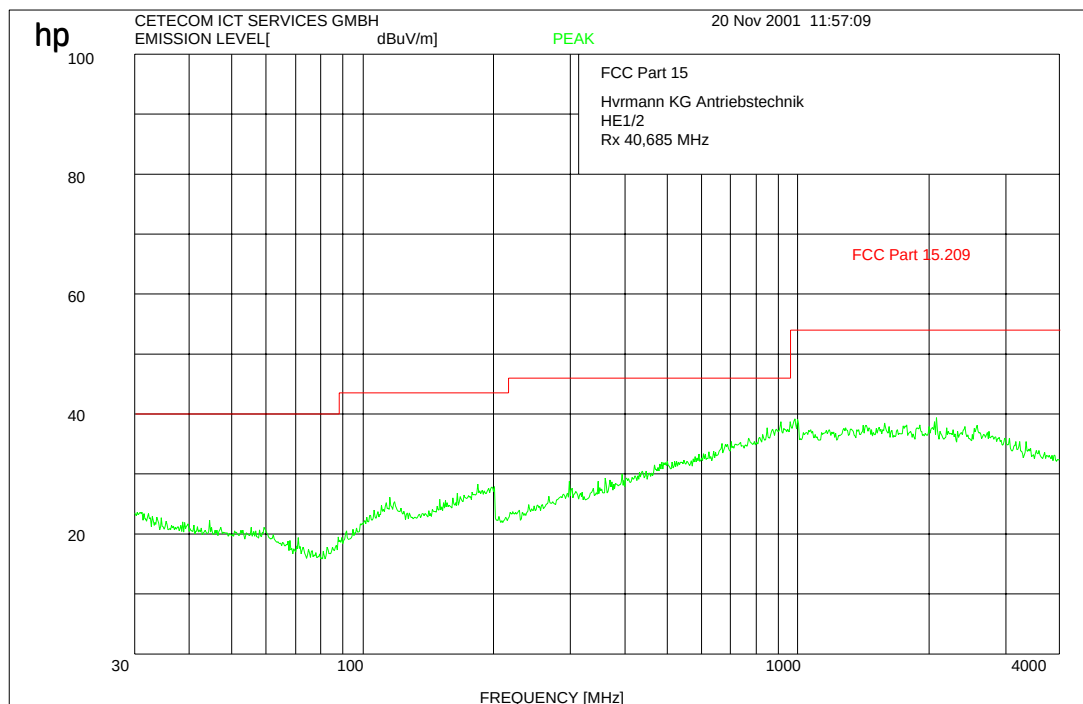
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)
 17 - 24

Equipment under test : HER1
 Ambient temperature : 23,4°C
 Relative humidity : 33 %

RECEIVER SPURIOUS RADIATION Radiated

§ 15.109



Limits

SUBCLAUSE § 15.109

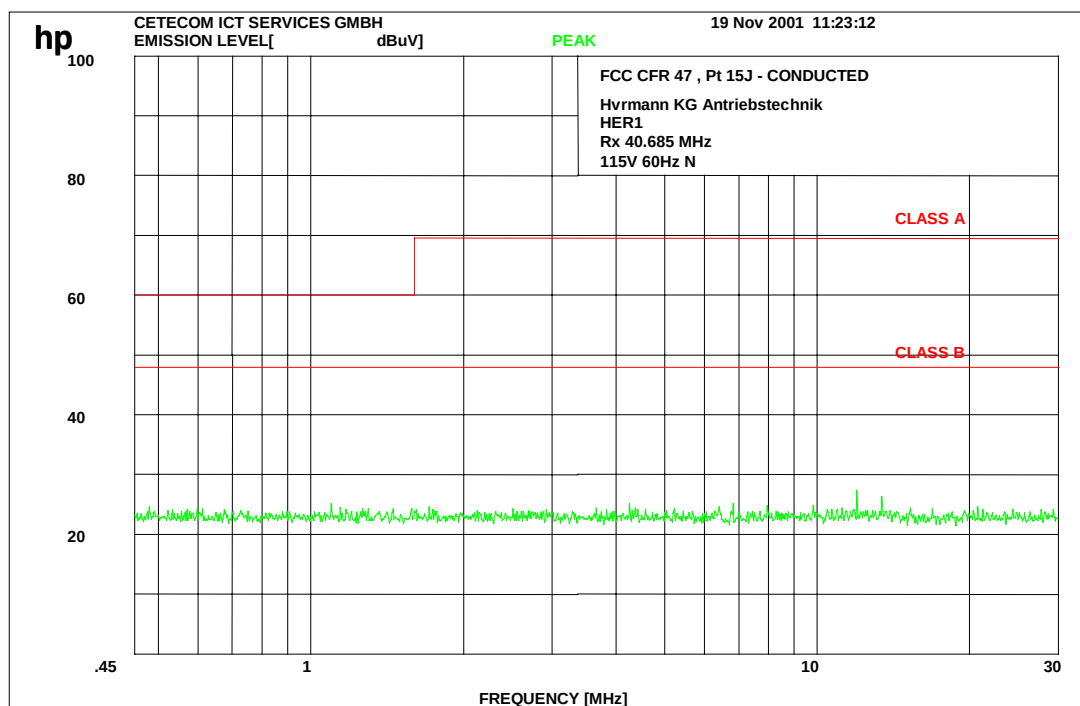
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)
 17 - 24

Equipment under test : HER1
Ambient temperature : 23,4°C
Relative humidity : 33 %

Conducted emissions

§ 15.107/207



Limits

SUBCLAUSE § 15.107 / 207

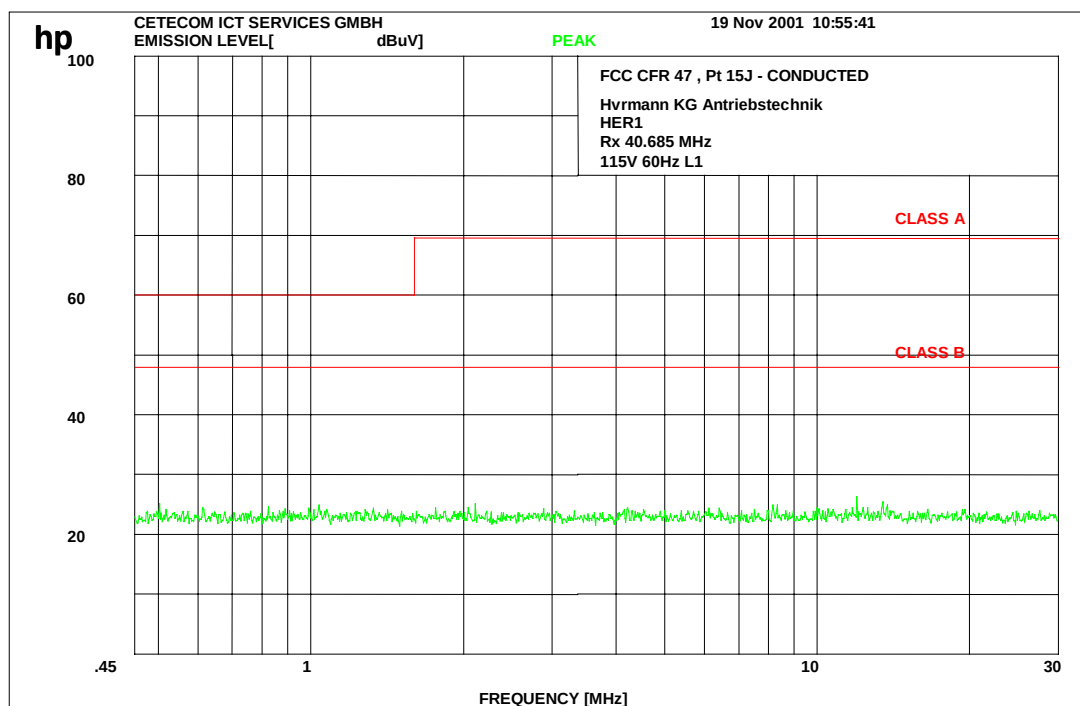
Frequency (MHz)	Conducted Limits (µV)
0.45 – 1.705	1000 / 60 dBµV (Class A)
1.705 – 30.0	3000 / 69.5 dBµV (Class A)
0.45 – 30.0	250 / 48 dBµV (Class B)

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)

Equipment under test : HER1
 Ambient temperature : 23,4°C
 Relative humidity : 33 %

Conducted emissions

§ 15.107/207



Limits

SUBCLAUSE § 15.107 / 207

Frequency (MHz)	Conducted Limits (µV)
0.45 – 1.705	1000 / 60 dBµV (Class A)
1.705 – 30.0	3000 / 69.5 dBµV (Class A)
0.45 – 30.0	250 / 48 dBµV (Class B)

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

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, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	8566 A	Hewlett-Packard	1925A00257
02	Analyzer Display	8566 A	Hewlett-Packard	1925A00860
03	Oscilloscope	7633	Tektronix	230054
04	Radio Analyzer	CMTA 54	Rohde & Schwarz	894 043/010
05	System Power Supply	6038 A	Hewlett-Packard	2848A07027
06	Signal Generator	8111 A	Hewlett-Packard	2215G00867
07	Signal Generator	8662 A	Hewlett-Packard	2224A01012
08	Funktionsgenerator	AFGU	Rohde & Schwarz	862 480/032
09	Regeltrenntrafo	MPL	Erfi	91350
10	Netznachbildung	NNLA 8120	Schwarzbeck	8120331
11	Relais-Matrix	PSU	Rohde & Schwarz	893 285/020
12	Power-Meter	436 A	Hewlett-Packard	2101A12378
13	Power-Sensor	8484 A	Hewlett-Packard	2237A10156
14	Power-Sensor	8482 A	Hewlett-Packard	2237A00616
15	Modulationsmeter	9008	Racal-Dana	2647
16	Frequenzzähler	5340 A	Hewlett-Packard	1532A03899
17	Absorber Schirmkabine	---	MWB	87400/002
18	Spectrum Analyzer	85660 B	Hewlett-Packard	2747A05306
19	Analyzer Display	85662 A	Hewlett-Packard	2816A16541
20	Quasi Peak Adapter	85650 A	Hewlett-Packard	2811A01131
21	RF-Preselector	85685 A	Hewlett-Packard	2833A00768
22	Biconical Antenne	3104	Emco	3758
23	Log. Per. Antenne	3146	Emco	2130
24	Double Ridge Horn	3115	Emco	3088
25	EMI-Testreceiver	ESAI	Rohde & Schwarz	863 180/013
26	EMI-Analyzer-Display	ESAI-D	Rohde & Schwarz	862 771/008
27	Biconical Antenne	HK 116	Rohde & Schwarz	888 945/013
28	Log. Per. Antenne	HL 223	Rohde & Schwarz	825 584/002
29	Relais-Switch-Unit	RSU	Rohde & Schwarz	375 339/002
30	Highpass	HM985955	FSY Microwave	001
31	Amplifier	P42-GA29	Tron-Tech	B 23602
32	Absorber Schirmkabine		Frankonia	
33	Steuerrechner	PSM 7	Rohde & Schwarz	834 621/004
34	EMI Test Receiver	ESMI	Rohde & Schwarz	827 063/010
35	EMI Test Receiver	Display	Rohde & Schwarz	829 808/010

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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, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
36	Controler	HD 100	Deisel	100/322/93
37	Relais Matrix	PSN	Rohde & Schwarz	829 065/003
38	Control Unit	GB 016 A2	Rohde & Schwarz	344 122/008
39	Relais Switch Unit	RSU	Rohde & Schwarz	316 790/001
40	Power Supply	6032A	Hewlett Packard	2846A04063
41	Spektrum Monitor	EZM	Rohde & Schwarz	883 720/006
42	Meßempfänger	ESH 3	Rohde & Schwarz	890 174/002
43	Meßempfänger	ESVP	Rohde & Schwarz	891 752/005
44	Biconi Ant. 20-300MHz	HK 116	Rohde & Schwarz	833 162/011
45	Logper Ant. 0.3-1 GHz	HL 223	Rohde & Schwarz	832 914/010
46	Amplifier 0.1-4 GHz	AFS4	Miteq Inc.	206461
47	Logper Ant. 1-18 GHz	HL 024 A2	Rohde & Schwarz	342 662/002
48	Polarisationsnetzwerk	HL 024 Z1	Rohde & Schwarz	341 570/002
49	Double Ridge G Horn Antenne 1-26.5 GHz	3115	EMCO	9107-3696
50	Microw. Sys. Amplifier 0.5- 26.5 GHz	8317A	Hewlett Packard	3123A00105
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PHOTOGRAPHS OF THE EQUIPMENT

TX – HS 2

Photograph no.: 1



PHOTOGRAPHS OF THE EQUIPMENT

TX – HS 2

Photograph no.: 2



PHOTOGRAPHS OF THE EQUIPMENT

TX – HS 2

Photograph no.: 3



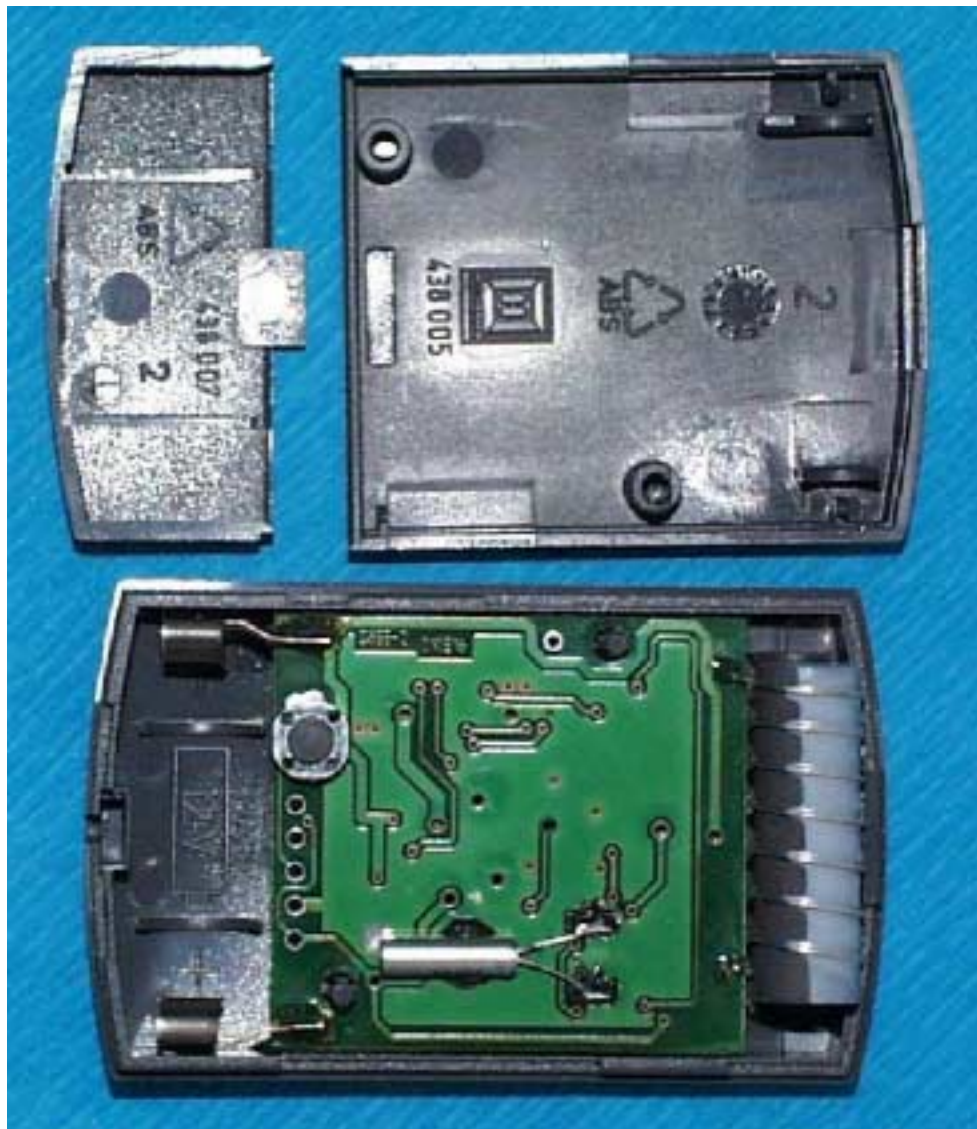
PHOTOGRAPHS OF THE EQUIPMENT**TX – HS 2**

Photograph no.: 4



PHOTOGRAPHS OF THE EQUIPMENT**TX – HS 2**

Photograph no.: 5



PHOTOGRAPHS OF THE EQUIPMENT

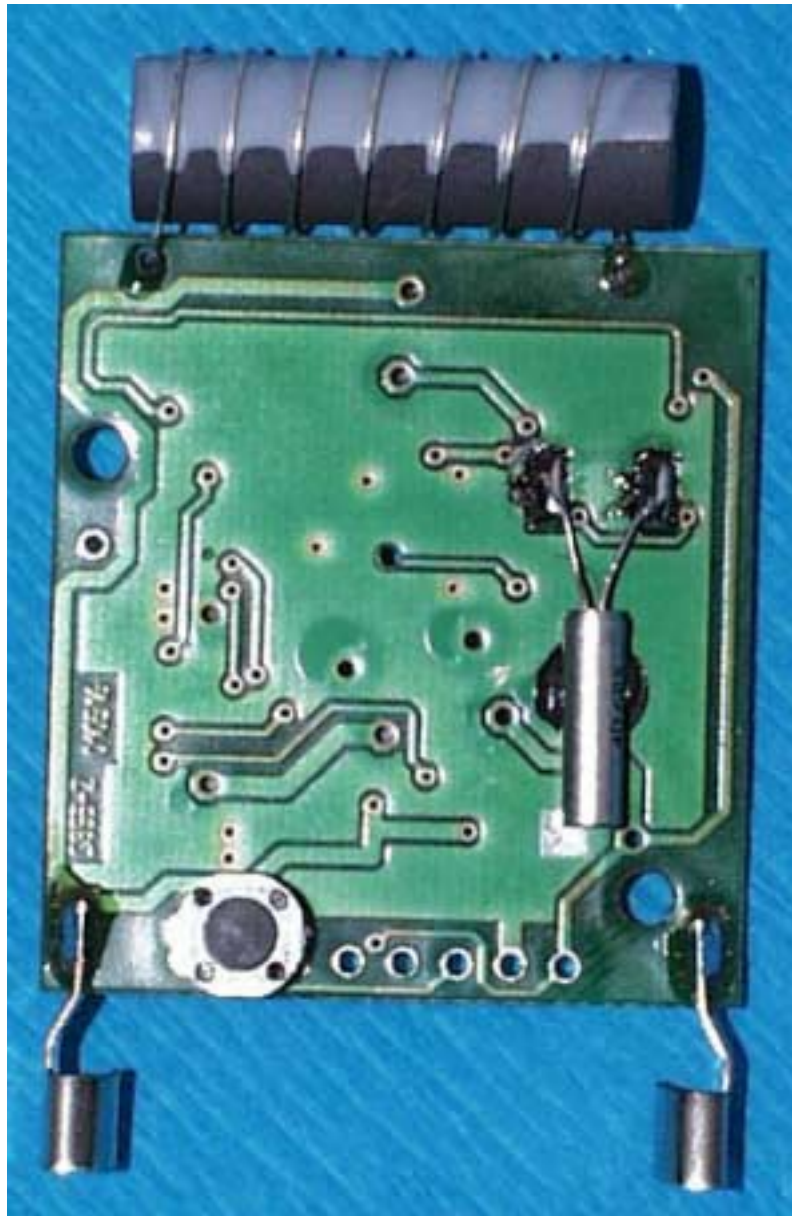
TX – HS 2

Photograph no.: 6



PHOTOGRAPHS OF THE EQUIPMENT**TX – HS 2**

Photograph no.: 7



PHOTOGRAPHS OF THE EQUIPMENT

TX – HS 4

Photograph no.: 8



PHOTOGRAPHS OF THE EQUIPMENT

TX – HS 4

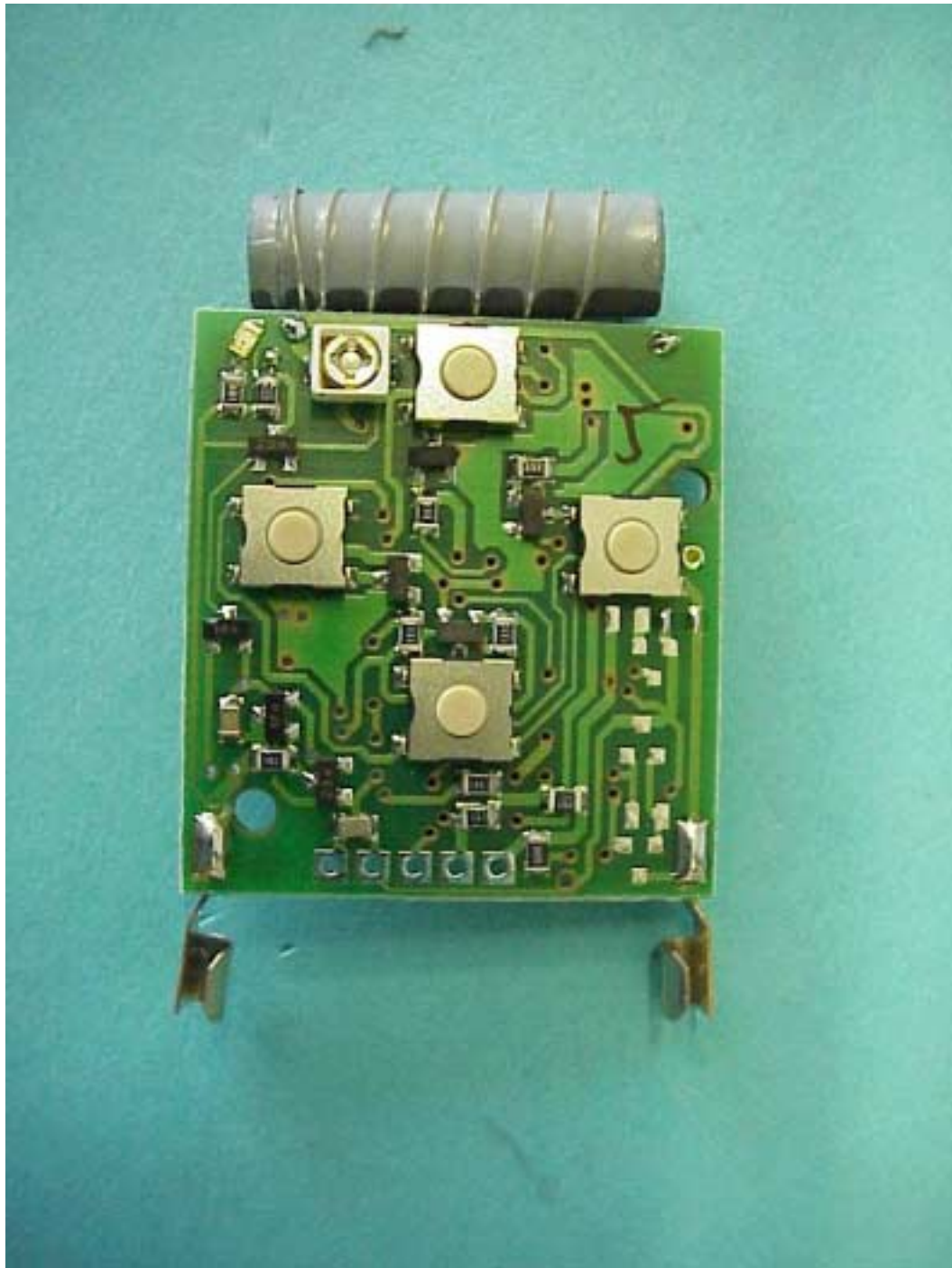
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PHOTOGRAPHS OF THE EQUIPMENT

TX – HS 4

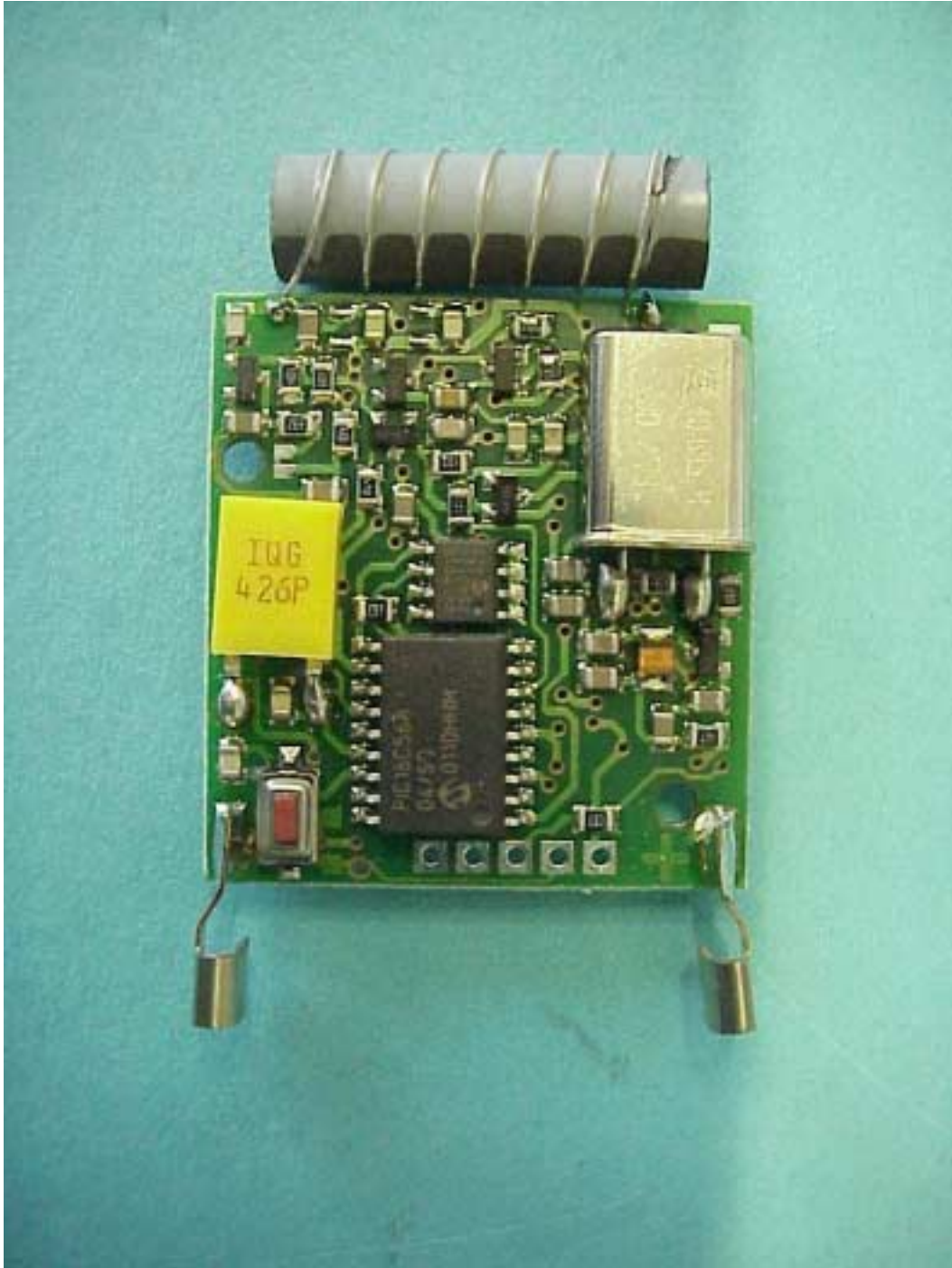
Photograph no.: 10



PHOTOGRAPHS OF THE EQUIPMENT

TX – HS 4

Photograph no.: 11



PHOTOGRAPHS OF THE EQUIPMENT

RX – HE1/2

Photograph no.: 12



PHOTOGRAPHS OF THE EQUIPMENT

RX – HE1/2

Photograph no.: 13



PHOTOGRAPHS OF THE EQUIPMENT

RX – HE1/2

Photograph no.: 14



PHOTOGRAPHS OF THE EQUIPMENT**RX – HE1/2**

Photograph no.: 15



PHOTOGRAPHS OF THE EQUIPMENT

RX – HER 1

Photograph no.: 16



PHOTOGRAPHS OF THE EQUIPMENT

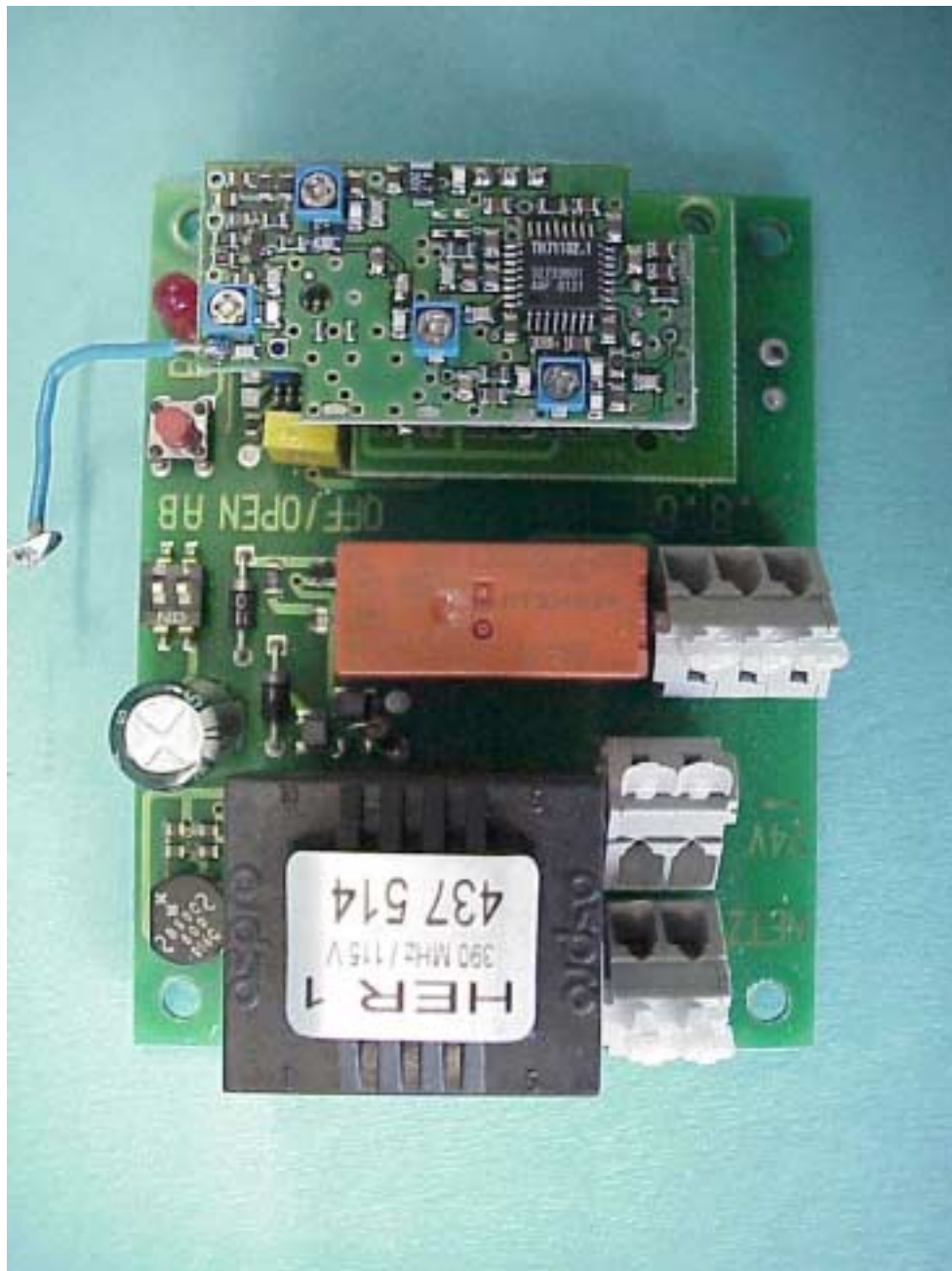
RX – HER 1

Photograph no.: 17



PHOTOGRAPHS OF THE EQUIPMENT**RX – HER 1**

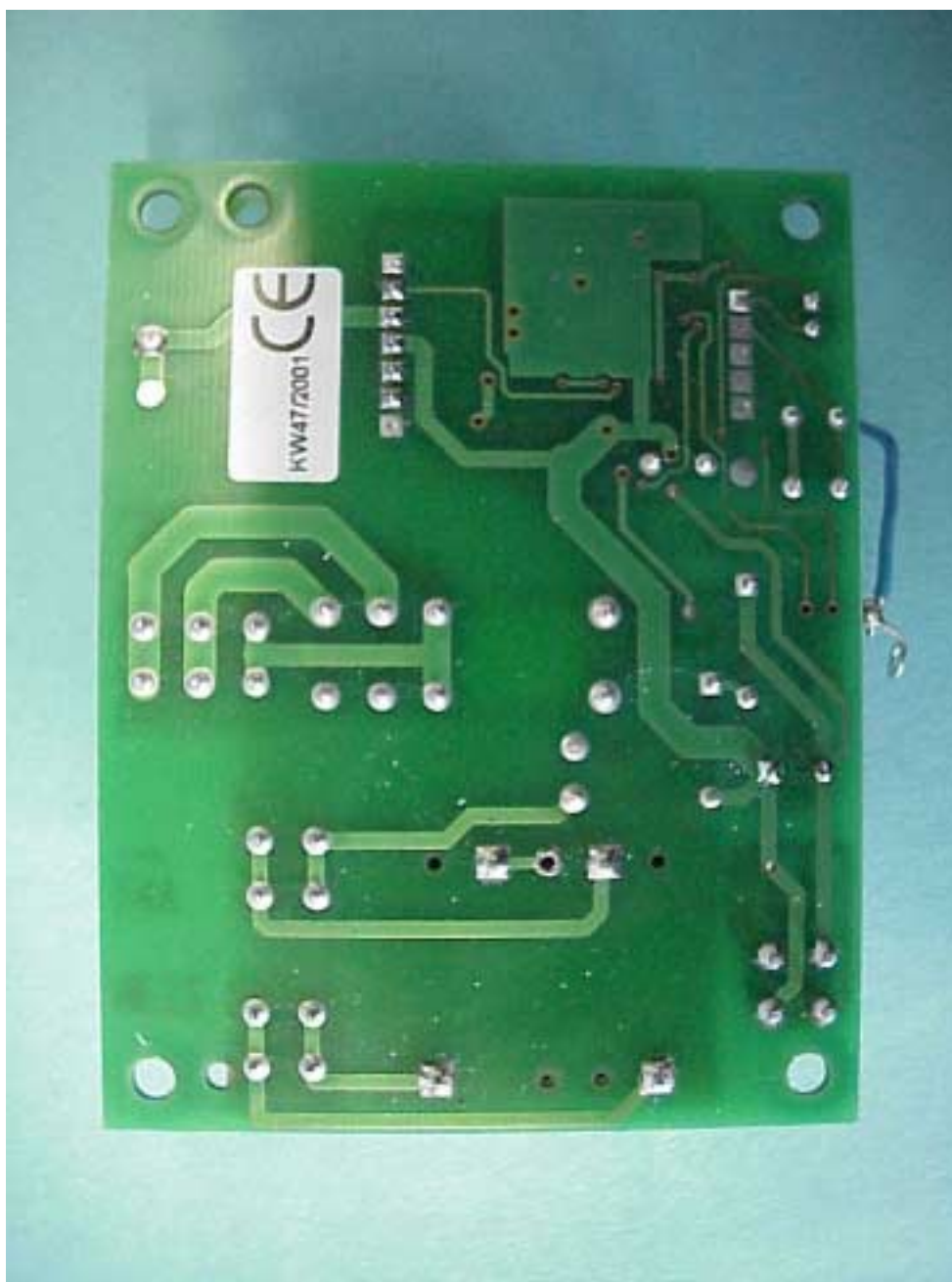
Photograph no.: 18



PHOTOGRAPHS OF THE EQUIPMENT

RX – HER 1

Photograph no.: 19



PHOTOGRAPHS OF THE EQUIPMENT

Testsite

Photograph no.: 20



PHOTOGRAPHS OF THE EQUIPMENT

Testsite

Photograph no.: 21

