CETECOM ICT Services GmbH

Radio Satellite Communication
Untertürkheimer Straße 6–10, D-66117 Saarbrücken,
Telephone +49 (0) 681 598- 0, Fax +49 (0) 598 9075

Recognized by the
Federal Communications Commission
Anechoic chamber registration no.: 90462 (FCC)
Anechoic chamber registration no.: 3463 (IC)
TCB ID: DE 0001

Accredited by the
German Accreditation Council
DAR–Registration Number
TTI–P–G 081/94-D0

Independent ETSI
compliance test house

Accredited Bluetooth™ Test Facility (BQTF)

Test report No. :2-3679-01-02/04
Standard :Part 15.231
Applicant :KOSTAL Industrie Elektrik GmbH
Type :0545KEY
FCC–ID No :SX4KEY
IC No. :2795C-KEY

Table of contents

1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5.
The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

Test laboratory manager:

2005-01-27	RSC - 8411	Berg M.	
Date	Section	Name	Signature

Technical responsibility for area of testing:

2005-01-27	RSC - 8412	Hausknecht D.	
Date	Section	Name	Signature

1.2 Testing laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6 - 10
66117 Saarbrücken
Germany
Telephone : + 49 681 598 - 0
Telefax : + 49 681 598 - 9075
E-mail : info@ict.cetecom.de
Internet : www.cetecom-ict.de

Accredited testing laboratory
The test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025.
DAR registration number: TTI-P-G-081/94-D0
Listed by: Federal Communications Commission (FCC)
Identification/Registration No: 90462
Anechoic chamber registration no.:3463 (IC)
Accredited Bluetooth™ Test Facility (BQTF)
BLUETOOTH™ is a trademark owned by Bluetooth SIG, Inc. and licensed to CETECOM

1.3 Details of applicant

Name : KOSTAL Industrie Elektrik GmbH
Street : Hauert 11
City : D-44227 Dortmund
Country : Germany
Telephone: +49 (0)231 7588-0
Fax : +49 (0)231 7588-700
E-mail :

Contact person:
Name : Guido Werduen
Telephone : +49 (0)231 7588-546
Telex : +49 (0)231 7588-700
E-mail : g.werduen@kostsl.com

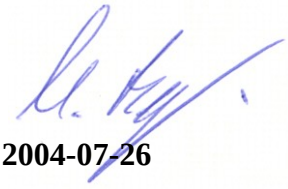
1.4 Application details

Date of receipt of test item : 2004-07-22
Date of test : 2004-07-22
Person(s) who have been present during the test : Mr. Martin Degener
: -.-

1.5 Test item

Company Number:	**2795C**
Model Number:	**KOSTAL-No. : 0545KEY**
Product Name:	**Keyless Home Entry**
Manufacturer:	KOSTAL Industrie Elektrik GmbH
Tested to Radio Standards Specification(RSS) No.:	**210 Issue 5**
Open Area Test Site Industry Canada Number:	**3463**
Frequency Range (or fixed frequency):	**Tx: 433.92 MHz Rx: 125 KHz**
R F: Power in Watts:	**0.0003 mW**
Field Strength (at what distance):	**1233.1 µV/m (61.82 dBµV/m) in 3m**
Occupied Bandwidth (99% BW):	**116.633 MHz**
Type of Modulation:	**FSK**
Emission Designator (TRC-43):	**117KF1D**
Transmitter Spurious (worst case):	**211.8 µV/m in 3m**
Receiver Spurious (worst case):	**45.7 µV/m in 3m (noise floor)**
IC no.	**2795C-KEY**
FCC ID no.	**SX4KEY**
Temperature range	**-20°C to +50°C**
Power supply	**3 V Lithium Battery**

ATTESTATION: I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all the applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

Signature: 

Date: **2004-07-26**

NAME AND TITLE (Please print or type):
Berg Michael, Project Engineer

Note: This form must be completed and provided with the submission.

1.6 Test specifications: FCC Part 15 §15.209
FCC Part 15 §15.231
CANADA RSS-210

2 Technical test

2.1 Summary of test results

FCC Part 15 Subpart B

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 20 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber.
The receiving antennas are conform with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2003 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test set-ups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received.
The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.4-2003 clause 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 Hz, wave guide horn

All measurement settings are according to FCC 15.35, 15.205, 15.209,15.231.

The product fulfills also the requirements for CANADA RSS-210

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

2.2 Test report

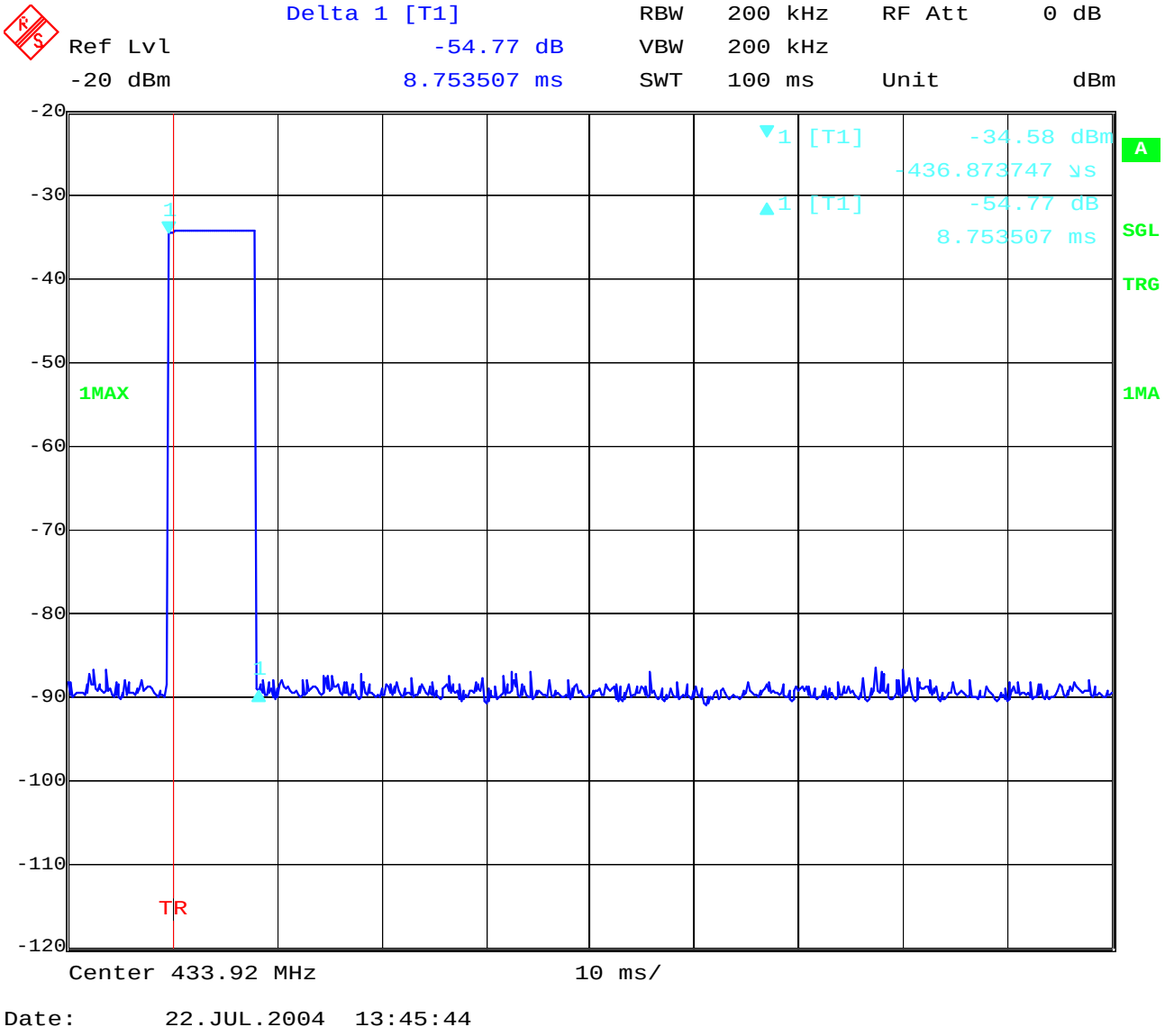
TEST REPORT

Test report no. : 2-3679-01-02/04

TEST REPORT REFERENCE

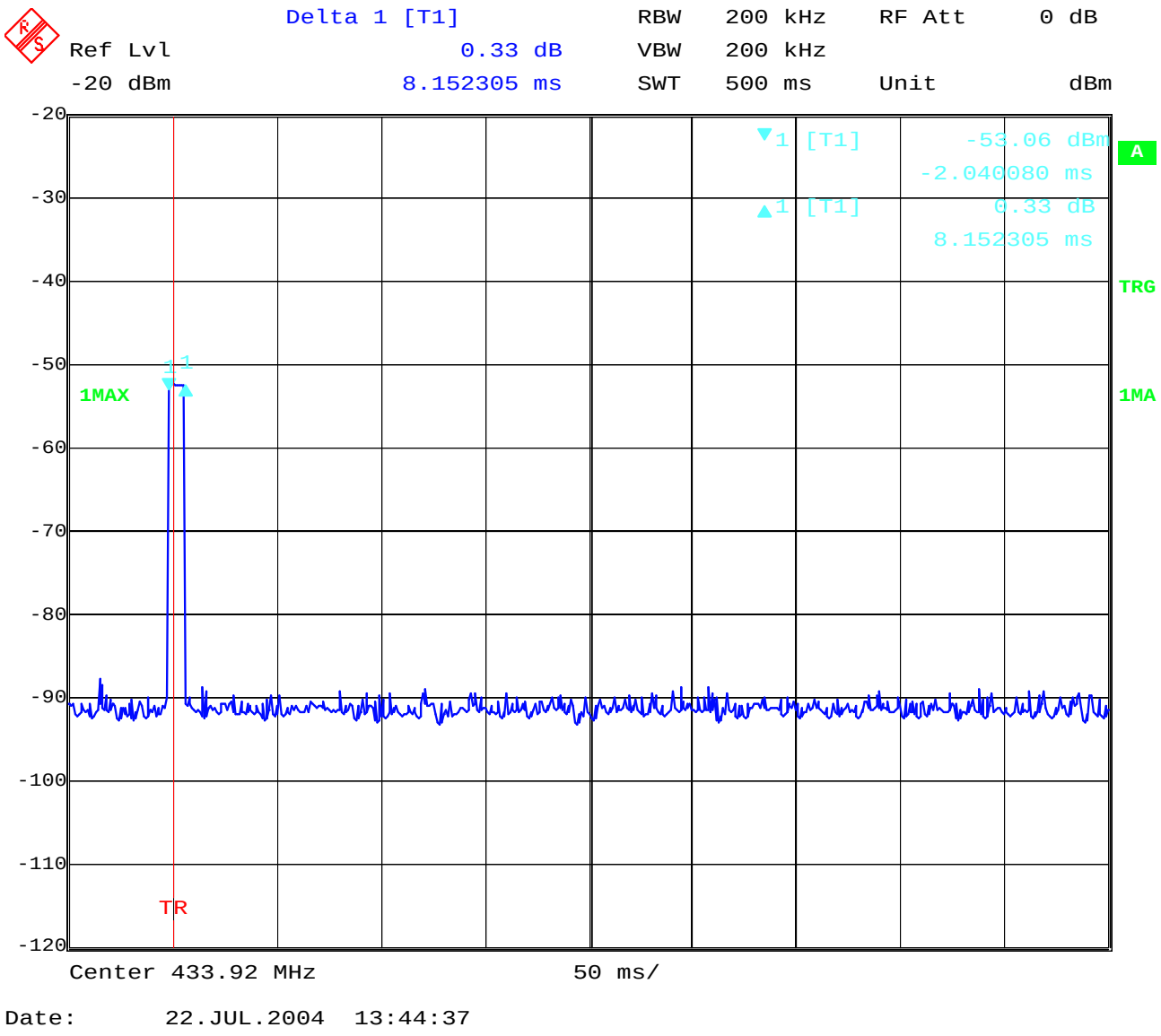
LIST OF MEASUREMENTS

Timing of the transmitter **SUBCLAUSE § 15.231 (a) (1)**



The pulse train length is 8.57 ms.

Timing of the transmitter **SUBCLAUSE § 15.231 (a) (1)**



The transmitter is automatically activated by a 125 kHz RF signal from the wall mounted reader unit. Only 1 pulse train (8.57 ms) will be send.

So the product complies with the FCC requirements.

Timing of the transmitter **SUBCLAUSE § 15.231 (a)**

Duty Cycle:
Regarding to 100 ms, we have a TX-On time of 8.75 ms
The TX-Off time is > 100 ms
So we have an average correction factor of 10 log (8.75ms / 100 ms) = -10.58 dB

Radiated output power is max. 72.4 dBµV/m at 3m distance PEAK .
The calculated AVERAGE is 72.4 dBµV/m – 10.58 dB = 61.82 dBµV/m at 3m distance.
The limit for 433.92 MHz according to FCC15.231 is 80.8 dBµV/m.

So the product complies with the FCC requirements.

FIELDSTRENGTH OF THE FUNDAMENTAL **SUBCLAUSE § 15.231 (a)**
MAXIMUM PEAK OUTPUT POWER
(RADIATED)

TEST CONDITIONS		MAXIMUM AVERAGE OUTPUT POWER (µV/m)		
Frequency 433.92 MHz		05 45 10 31	05 45 10 30	
T_{nom}(23)°C	V_{nom}(3.0)V	1233.1 µV/m (61.82 dBµV/m)	1025.7 µV/m (60.22 dBµV/m)	
Maximum deviation from output power under extreme test conditions (dBc)		not applicable	not applicable	
Measurement uncertainty		±3dB		

RBW/VBW : 1 MHz

Limit for 433,92 MHz : 10997 µV/m (80.8 dBµV/m)

Limits **SUBCLAUSE § 15. 231 (b)**

Frequency (MHz)	Field strength (µV/m)	Field strength of Spurious emissions (µV/m)
40.66-407	2250	225
70-130	1250	125
130-174	1250 to 3750 **	125 to 375 **
174-260	3750	375
260-470	2750 to 12500 **	375 to 1250 **
Above 470	12500	1250
** linear interpolations		

SPURIOUS EMISSION (radiated) **§ 15.231 (b)**

EMISSION LIMITATIONS					
f (MHz)		amplitude of emission (dBµV/m) Average/QP	limit max. allowed emmision power	actual attenuation below frequency of operation (dB)	results
05 45 10 31					
433,92		61.82 / AV	80.8 dBµV/m Average		Operating frequency
867.86		-	20 dBc / 46 dBµV/m		
1301.76		31.72 AV	54 dBµV/m	30.1	Complies
1735.68		46.52 AV		15.3	Complies
2169.6		35.52 AV		26.3	Complies
2603.52		28.22 AV		33.6	Complies
3037.44		18.72 AV		43.1	Complies
05 45 10 30					
433.92		60.22 /AV	80.8 dBµV/m Average		Operating frequency
867.86		23.12	20 dBc / 46 dBµV/m	37.1	Complies
1301.79		35.92	54 dBµV/m	24.3	Complies
1735.68		35.22		25.0	Complies
2169.65		36.82		23.4	Complies
2603.52		28.22		32.0	Complies
3037.44		19.62		40.6	Complies
Measurement uncertainty		± 3dB			

So the product complies with the FCC requirements.

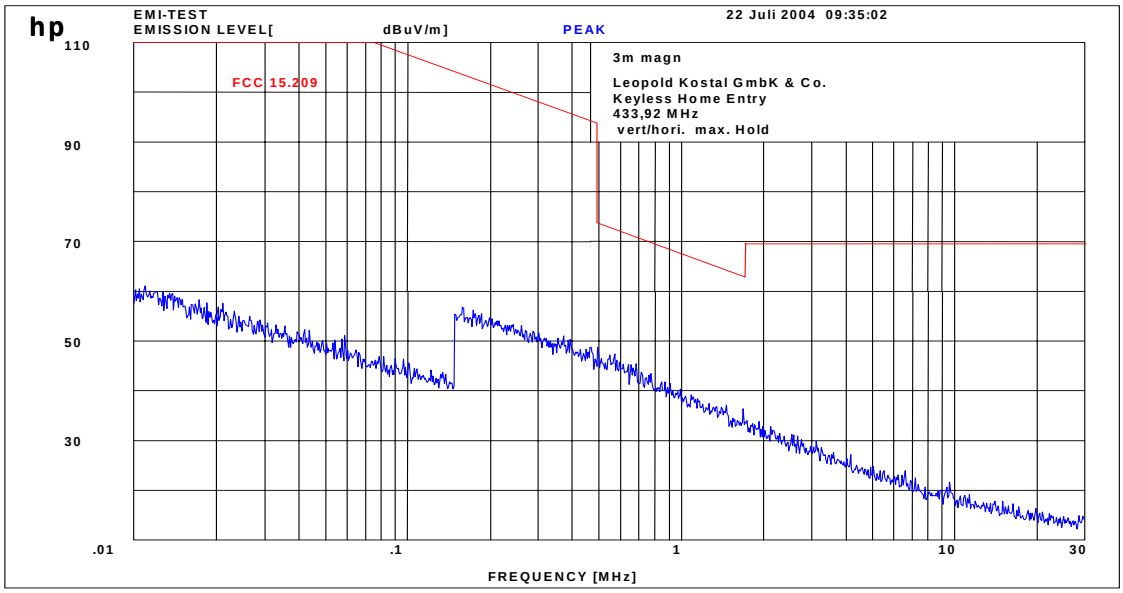
Limits **SUBCLAUSE § 15. 231 (b)**

Frequency (MHz)	Field strength (µV/m) of the fundamental	Field strength of Spurious emissions (µV/m)
40.66-407	2250 / 67 dBµV/m	225 / 47 dBµV/m
70-130	1250 / 62 dBµV/m	125 / 42 dBµV/m
130-174	1250 to 3750 ** 62 – 71.5 dBµV/m	125 to 375 ** 42 – 51.5 dBµV/m
174-260	3750 / 71.5 dBµV/m	375
260-470	2750 to 12500 ** 71.5 – 82 dBµV/m	375 to 1250 ** 51.5 – 62 dBµV/m
Above 470	12500 / 82 dBµV/m	1250 / 62 dBµV/m
** linear interpolations		

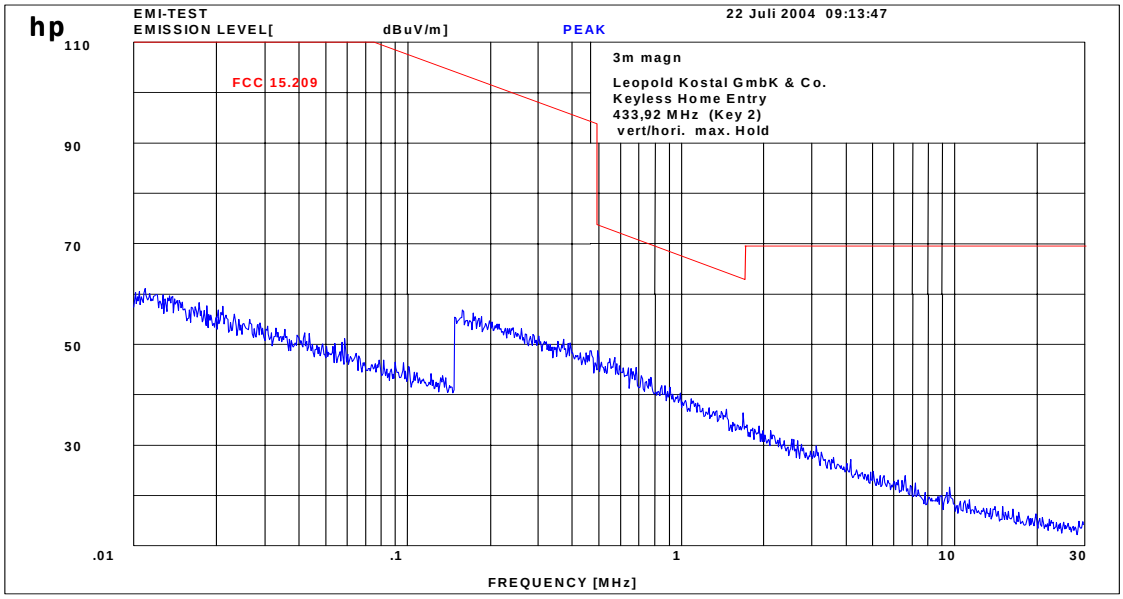
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED : 17 - 24
(for reference numbers see test equipment listing)

Part 15.109 Magnetics

KOSTAL No.: 05 45 10 31



KOSTAL No.: 05 45 10 30

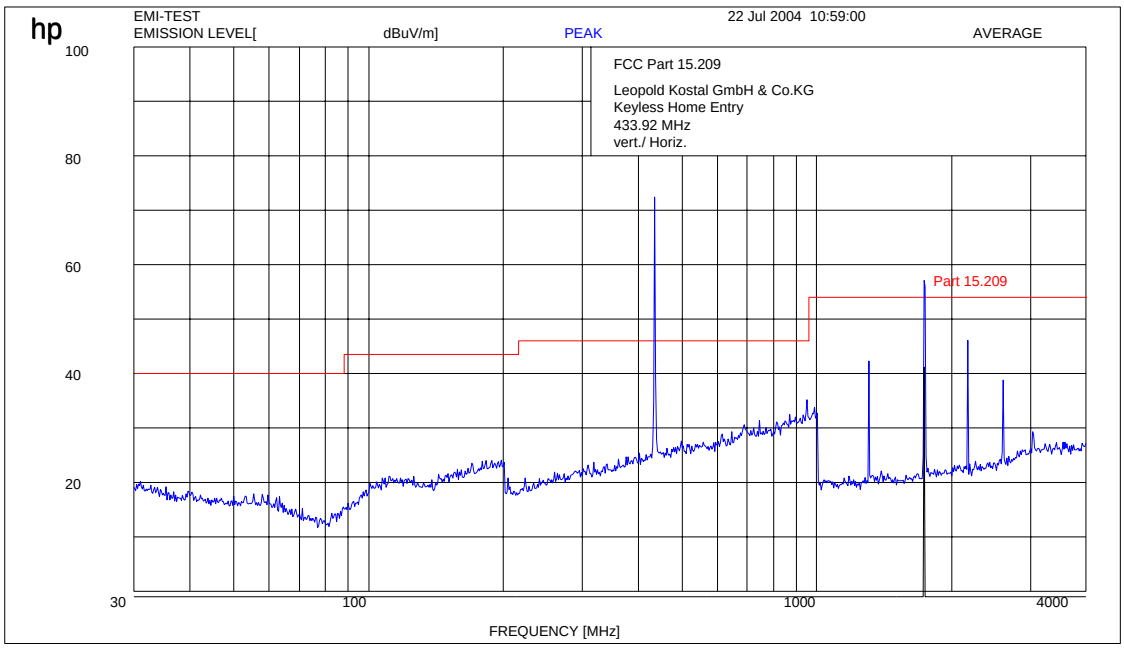


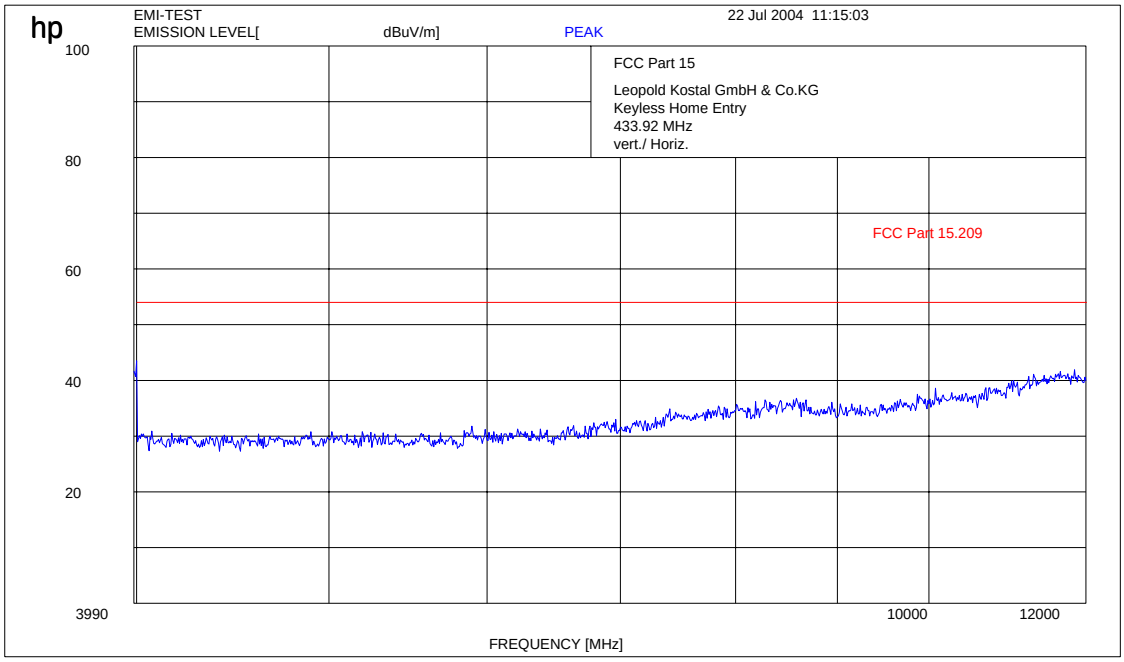
(to convert the measuring distance from 3m to 30m and 30 to 300m a correction factor from 40 dB/decade was used.)

Measurement distance 3m
This measurement was done in 3 polarisation's, the plot shows the worst case

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

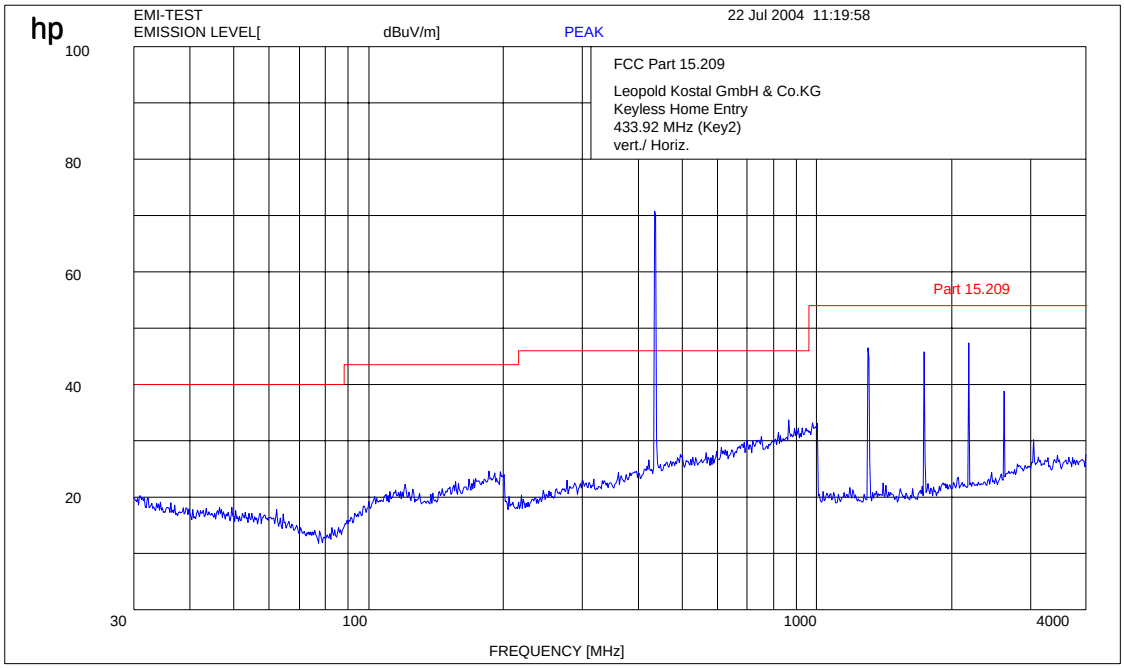
SPURIOUS EMISSION (radiated) § 15.231 (b)
KOSTAL No.: 05 45 10 31

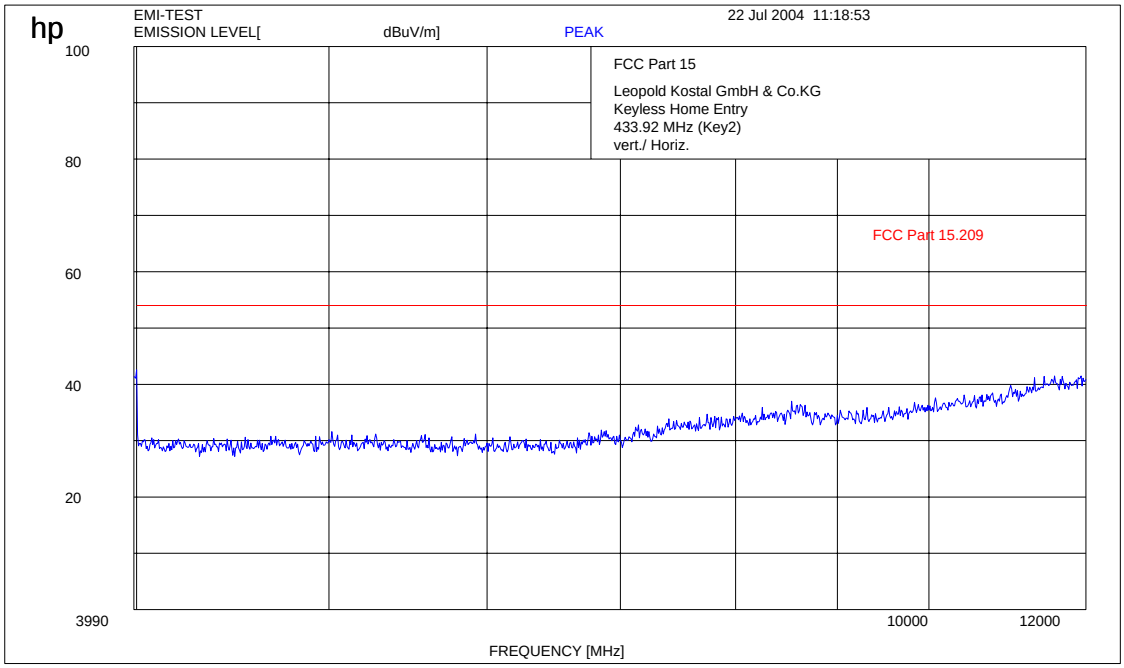




REFERENCE NUMBER(S) OF TEST EQUIPMENT USED : 17 - 24
(for reference numbers see test equipment listing)

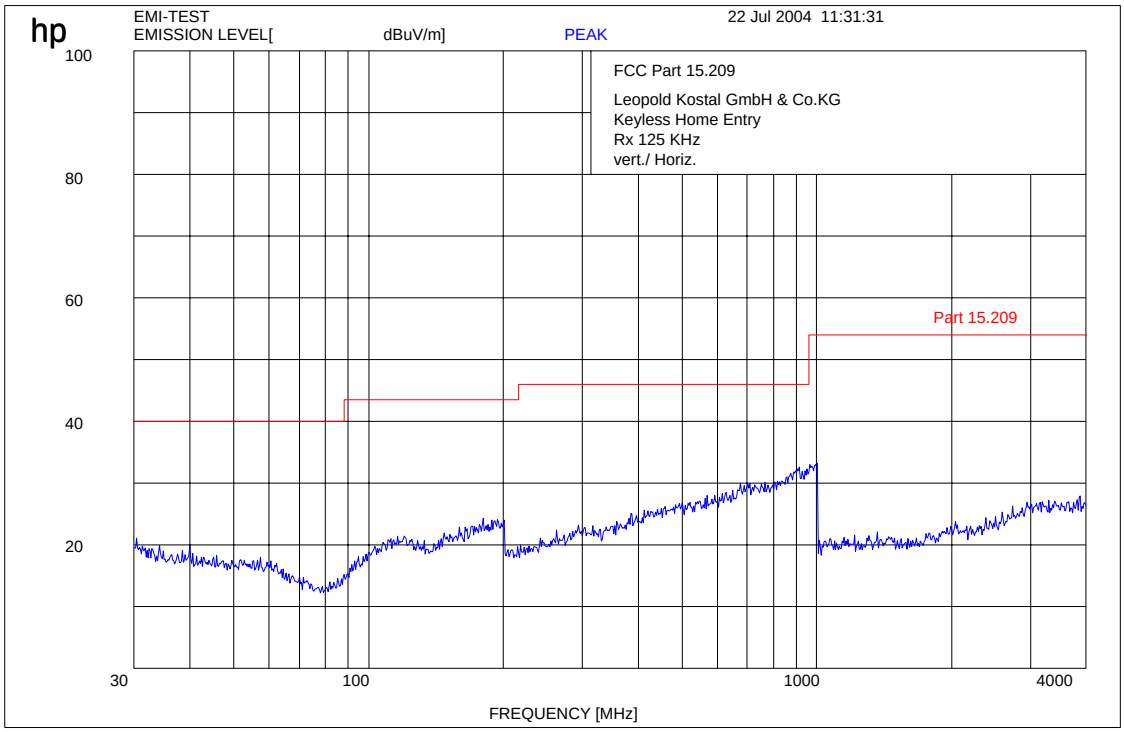
SPURIOUS EMISSION (radiated) § 15.231 (b)
KOSTAL No.: 05 45 10 30





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

RECEIVER SPURIOUS EMISSION (radiated) § 15.109



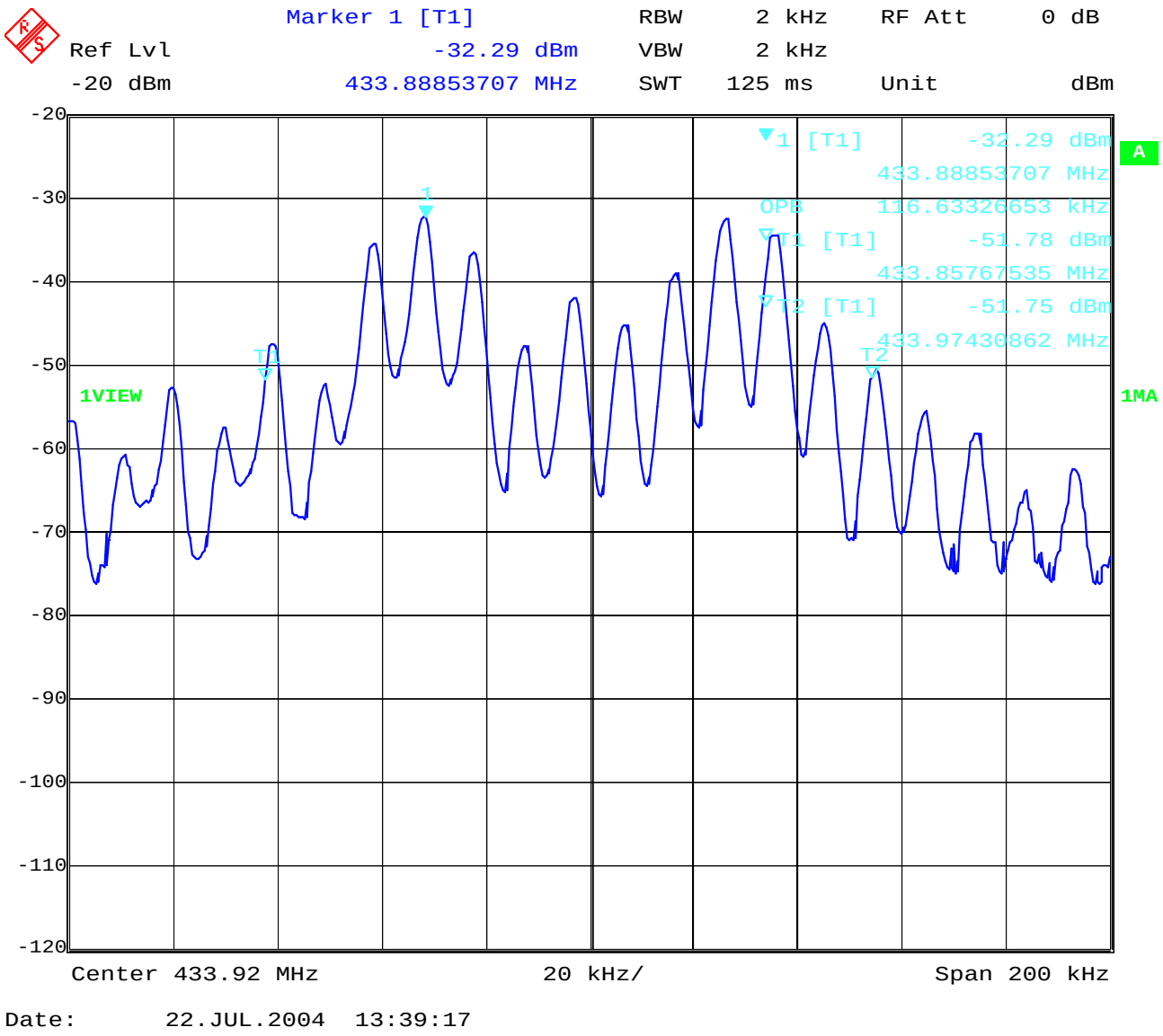
no traceable peak found

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 : 17 - 24
(for reference numbers see test equipment listing)

Occupied bandwidth **FCC 15.231 (c)**



The occupied bandwidth (20 dB / 99%) is 116.633 kHz .

So the product complies with the FCC requirements.

Limit	**SUBCLAUSE § 15.231(c)**
< 0.25% of the centre frequency, here 1.08 MHz	

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED : 65
(for reference numbers see test equipment listing)

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

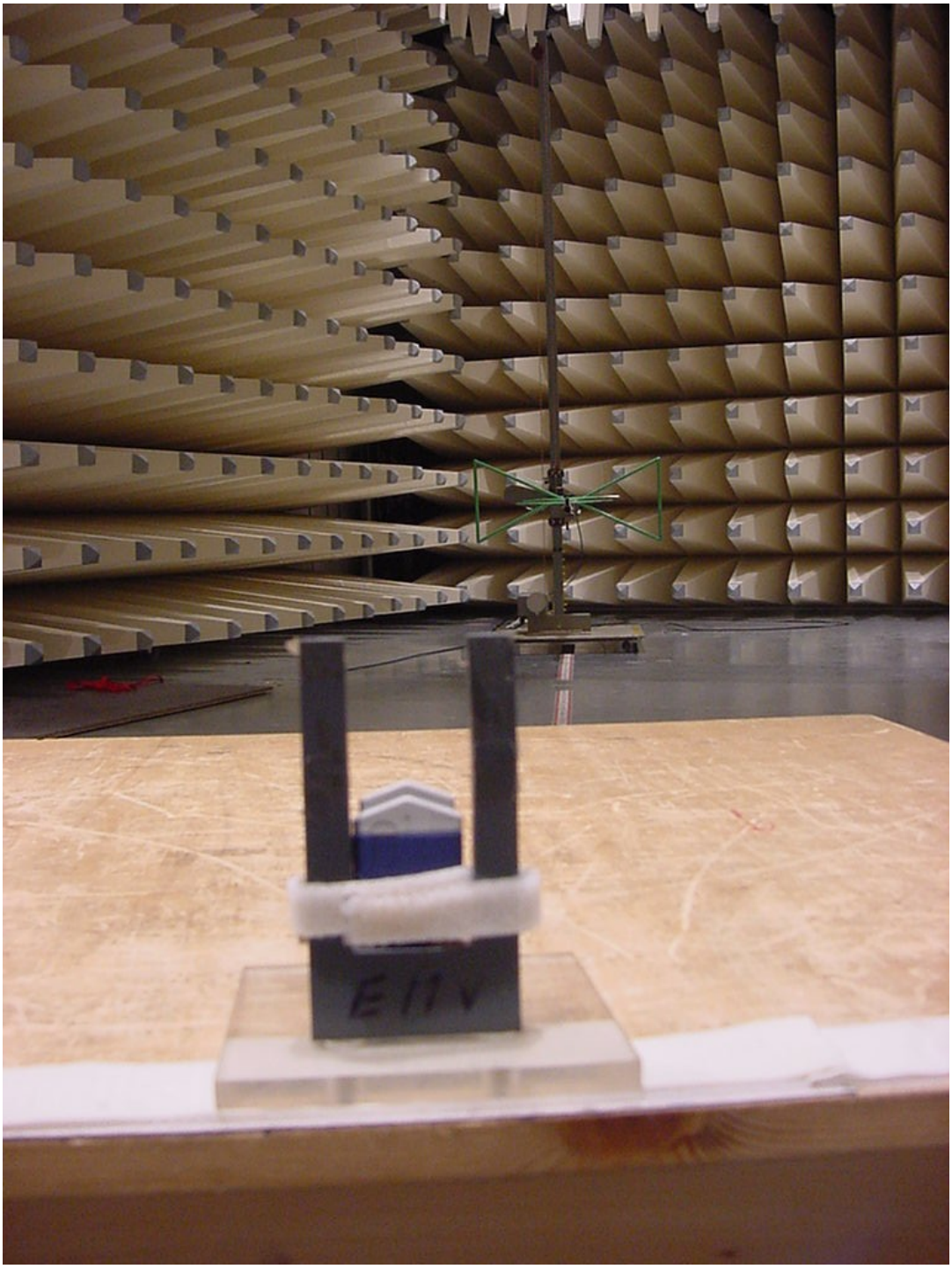
To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

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 Communication 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	Function Generator	AFGU	Rohde & Schwarz	862 480/032
09	Regulating Transformer	MPL	Erfi	91350
10	LISN	NNLA 8120	Schwarzbeck	8120331
11	Relay-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	Modulation Meter	9008	Racal-Dana	2647
16	Frequency Counter	5340 A	Hewlett-Packard	1532A03899
17	Anechoic Chamber	---	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 Antenna	3104	Emco	3758
23	Log. Per. Antenna	3146	Emco	2130
24	Double Ridged 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 Antenna	HK 116	Rohde & Schwarz	888 945/013
28	Log. Per. Antenna	HL 223	Rohde & Schwarz	825 584/002
29	Relay-Switch-Unit	RSU	Rohde & Schwarz	375 339/002
30	Highpass	HM985955	FSY Microwave	001
31	Amplifier	P42-GA29	Tron-Tech	B 23602
32	Anechoic Chamber		Frankonia	
33	Control Computer	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

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
36	Control Computer	HD 100	Deisel	100/322/93
37	Relay Matrix	PSN	Rohde & Schwarz	829 065/003
38	Control Unit	GB 016 A2	Rohde & Schwarz	344 122/008
39	Relay Switch Unit	RSU	Rohde & Schwarz	316 790/001
40	Power Supply	6032A	Hewlett Packard	2846A04063
41	Spectrum Monitor	EZM	Rohde & Schwarz	883 720/006
42	Measuring Receiver	ESH 3	Rohde & Schwarz	890 174/002
43	Measuring Receiver	ESVP	Rohde & Schwarz	891 752/005
44	Bicon 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	Polarisation Network	HL 024 Z1	Rohde & Schwarz	341 570/002
49	Double Ridged Horn Antenna 1-26.5 GHz	3115	EMCO	9107-3696
50	Microw. Sys. Amplifier 0.5- 26.5 GHz	8317A	Hewlett Packard	3123A00105
51	Audio Analyzer	UPD	Rohde & Schwarz	1030.7500.04
52	Controler	PSM 7	Rohde & Schwarz	883 086/026
53	DC V-Network	ESH3-Z6	Rohde & Schwarz	861 406/005
54	DC V-Network	ESH3-Z6	Rohde & Schwarz	893 689/012
55	AC 2 Phase V-Network	ESH3-Z5	Rohde & Schwarz	861 189/014
56	AC 2 Phase V-Network	ESH3-Z5	Rohde & Schwarz	894 981/019
57	AC-3 Phase V-Network	ESH2-Z5	Rohde & Schwarz	882 394/007
58	Power Supply	6032A	Rohde & Schwarz	2933A05441
59	RF-Test Receiver	ESVP.52	Rohde & Schwarz	881 487/021
60	Spectrum Monitor	EZM	Rohde & Schwarz	883 086/026
61	RF-Test Receiver	ESH3	Rohde & Schwarz	881 515/002
62	Relay Matrix	PSU	Rohde & Schwarz	882 943/029
63	Relay Matrix	PSU	Rohde & Schwarz	828 628/007
64	Spectrum Analyzer	FSIQ 26	Rohde & Schwarz	119.6001.27
65	Spectrum Analyzer	HP 8565E	Hewlett Packard	3473A00773
66				
67				
68				

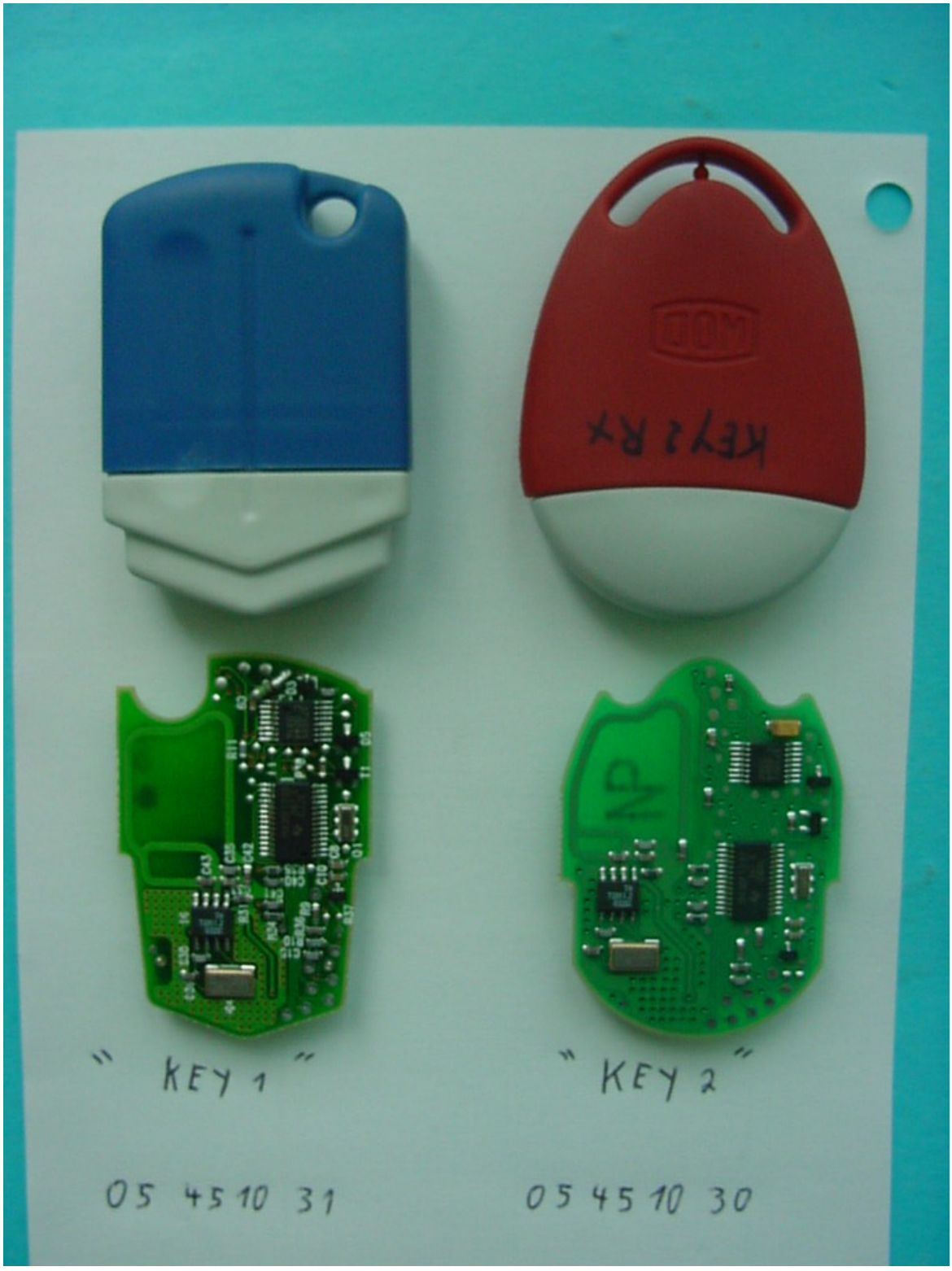
Test site

Test site



Photographs of the equipment

Photograph no.: 1



Photographs of the equipment

Photograph no.: 2