

TEST REPORT
of the accredited test laboratory

TÜV Nr.:M/EMV-04/133

about
the following EMC - test/- research

Applicant: SKIDATA AG
Untersbergstraße 40
A-5083 Gartenau - St. Leonhard

Product: KeyD 232 DUO

Serial Number: ---

Standard: 47 CFR Ch. I Part 15
RSS-210 Issue 5

Division Medical
Technology/
Communication
Technology/ EMC

Testing Body for
Communication
Technology/ EMC

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Canada: IC4413

TÜV Österreich
Test laboratory for EMC

Deputy Supervisor of EMC-
laboratory



Ing. Wilhelm Seier



Checked by



Ing. Michael Emminger

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The results of this test report only refer to the provided equipment.

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1. Applicant

Company SKIDATA AG

Department

Address A-5083 Gartenau – St. Leonhard; Untersbergstraße 40

Contact person Mr. Sonderegger

EUT received on 21.01.2004

Tests were performed on 21.01. – 23.01.2004

2. Description of EUT

EUT	KeyD 232 DUO
Serial Number	---
Manufacturer	SKIDATA AG A-5083 Gartenau – St. Leonhard; Untersbergstraße 40
Description	SKIDATA AG provided the following configuration for the measurements: Serial production External antenna: KeyD ANT DUO
Operating mode	The measurements were carried out at the following running states: normal use

3. Standards / Final result

Name	Title	Deviation	Result
47 CFR Ch. I Part 15	Radio Frequency Devices	none	PASS
RSS-210 Issue 5	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)	none	PASS
PASS EUT passed FAIL EUT failed			

4. Test results

4.1. Radiated emission

Limits according to 15.209 and 6.2.1.

Frequency range	Detector Quasi Peak	
	Limit	Measurement distance
0,009 – 0,490 MHz	2400 μ V / f(kHz)	300 m
0,490 – 1,705 MHz	24000 μ V / f(kHz)	30 m
1,705 - 30 MHz	30	30 m
30 – 88 MHz	100	3 m
88 – 216 MHz	150	3 m
216 – 960 MHz	200	3 m
Above 960 MHz	500	3 m
Remark: The Limit was increased for a constant measurement distance of 3m with a factor of 40 dB per Decade.		

Operating mode	Measuring result
continuous and modulated carrier at 122,9 kHz, internal antenna	Measurement diagram 1-3
continuous and modulated carrier at 122,9 kHz, external antenna	Measurement diagram 4-6
continuous and modulated carrier at 13,56 MHz internal antenna	Measurement diagram 7-9
continuous and modulated carrier at 13,56 MHz External antenna	Measurement diagram 10-12

Test result:

4. 1.1.) Measurement in the frequency range 9 kHz to 1000 MHz
(continuous and modulated carrier at 122,9 kHz → internal and external antenna)

Due to the large margin to the limit, no final measurement was performed.

4. 1.2.) Measurement in the frequency range 9 kHz to 1000 MHz
(continuous and modulated carrier at 13,56 MHz → internal antenna)

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed-Mark
13,560	66,1	69,5	3,4	This part of emission is covered by 15.225 (a) and 6.2.2.(e) see page 8
81,35	39,1	40,0	0,9	
94,9	43,3	43,5	0,2	
135,6	43,1	43,5	0,4	
149,15	40,6	43,5	2,9	

4. 1.3.) Measurement in the frequency range 9 kHz to 1000 MHz
(continuous and modulated carrier at 13,56 MHz → external antenna)

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed-Mark
13,560	72,3	69,5	-2,8	This part of emission is covered by 15.225 (a) and 6.2.2.(e) see page 8
81,35	37,2	40,0	2,8	
94,9	39,8	43,5	3,7	
122,05	37,7	43,5	5,8	
149,15	43,4	43,5	0,1	
162,7	40,7	43,5	2,8	
176,25	41,8	43,5	1,7	

4.2. 15.225 Operation within the band 13,110 – 14,010 MHz
RSS-210 6.2.2.(e) 13,553 – 13,567 MHz

15.225 (a):

The field strength of any emissions within this band shall not exceed 15.848 microvolts/meter (84 dB μ V/m) at 30 meters.

Measurement results:

Internal antenna:

The field strength at 3m distance was measured a 66,1 dB μ V/m. Extrapolated with 40 dB per decade to 30 meters distance it would be 26,1 dB μ V/m.

External antenna:

The field strength at 3m distance was measured as 72,3 dB μ V/m. Extrapolated with 40 dB per decade to 30 meters distance it would be 32,3 dB μ V/m.

6.2.2.(e)

The field strength of any emissions within this band shall not exceed 15.500 microvolts/meter (84 dB μ V/m) at 30 meters.

Measurement results:

Internal antenna:

The field strength at 3m distance was measured as 66,1 dB μ V/m. Extrapolated with 40 dB per decade to 30 meters distance it would be 26,1 dB μ V/m.

External antenna:

The field strength at 3m distance was measured as 72,3 dB μ V/m. Extrapolated with 40 dB per decade to 30 meters distance it would be 32,3 dB μ V/m.

15.225 (b) and 6.2.2.(e): internal and external antenna

Frequency range MHz	Level dB μ V/m	Limit dB μ V/m
13,410 – 13,553	< 70	90,5
13,567 – 13,710	< 70	90,5

The Limit was increased for a constant measurement distance of 3m with a factor of 40 dB per Decade.

15.225 (c) and 6.2.2.(e): internal and external antenna

Frequency range MHz	Level dB μ V/m	Limit dB μ V/m
13,110 – 13,410	< 50	80,5
13,710 – 14,010	< 50	80,5
The Limit was increased for a constant measurement distance of 3m with a factor of 40 dB per Decade.		

15.225 (d):

See measurement diagram.

15.225 (e) and 6.2.2.(e):

The frequency tolerance of the carrier signal shall be maintained within $\pm 0,01$ % of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation of the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Measurement results:

Test conditions		Transmitter frequency
		13,56 MHz
T _{nom} (20)°C	V _{min} (93,5)V	13,56121
T _{nom} (20)°C	V _{nom} (126,5)V	13,56124
T _{min} (-20)°C	V _{nom} (110)V	13,56125
T _{max} (50)°C	V _{nom} (110)V	13,56123
Maximum deviation from nominal frequency under extreme test conditions (%)		0,00922
Measurement uncertainty		± 10 Hz

Appendix 1

Test equipment used

<input checked="" type="checkbox"/>	Anechoic Chamber with 3m measurement distance	NT-100	<input type="checkbox"/>	ESPC - Test receiver 9 kHz - 2,5 GHz	NT-203
<input checked="" type="checkbox"/>	MA 240 - Antenna mast 1 - 4 m height	NT-110	<input checked="" type="checkbox"/>	ESI26 - Test receiver 20 Hz - 26,5 GHz	NT-207
<input checked="" type="checkbox"/>	DS 412 - Turntable 0 - 400 ° Azimuth	NT-111	<input type="checkbox"/>	Digital Radio Tester CTS55	NT-208
<input checked="" type="checkbox"/>	HD 100 Controller Mast+Turntable	NT-112	<input type="checkbox"/>	Noise-gen., ITU-R 559-2 20 Hz - 20 kHz	NT-209
<input type="checkbox"/>	HUF-Z2 - Bicon. Antenna 20 - 300 MHz	NT-120	<input type="checkbox"/>	CMTA - Radiocommunication analyzer ; 0,1 - 1000 MHz	NT-210
<input type="checkbox"/>	HUF-Z3 - Log. Per. Antenna 200 - 1000 MHz	NT-121	<input checked="" type="checkbox"/>	3271 - Spectrum analyzer 100 Hz - 26,5 GHz	NT-211
<input checked="" type="checkbox"/>	HFH-Z2 - Loop Antenna. 9 kHz - 30 MHz	NT-122	<input type="checkbox"/>	Radiocommunicationanalyzer Marconi 2945A	NT-212
<input type="checkbox"/>	HFH-Z6 - Rod Antenna 9 kHz - 30 MHz	NT-123	<input type="checkbox"/>	2855S - Communication analyzer	NT-213
<input type="checkbox"/>	3121C - Dipole Antenna 28 - 1000 MHz	NT-124	<input type="checkbox"/>	Mixer M28HW 26,5 GHz - 40 GHz	NT-214
<input type="checkbox"/>	3115 - Horn Antenna 1 - 18 GHz	NT-125	<input type="checkbox"/>	Diode Detector 0,01 GHz - 26,5 GHz	NT-215
<input type="checkbox"/>	3116 - Horn Antenna 18 - 40 GHz	NT-126	<input type="checkbox"/>	3160-10 Horn Antenna 26,5 GHz - 40 GHz	NT-216
<input type="checkbox"/>	SAS-200/543 - Bicon. Ant. 20 MHz - 300 MHz	NT-127	<input type="checkbox"/>	Radiocommunicationanalyzer SWR 1180 MD	NT-217
<input type="checkbox"/>	AT-1080 - Log. Per. Ant. 80 - 1000 MHz	NT-128	<input type="checkbox"/>	Mixer M19HWD 40 GHz - 60 GHz	NT-218
<input checked="" type="checkbox"/>	HK-116 - bicon. Ant. 20 MHz - 300 MHz	NT-129	<input type="checkbox"/>	Mixer M12HWD 60 GHz - 90 GHz	NT-219
<input type="checkbox"/>	HK-116 - bicon. Ant. 20 MHz - 300 MHz	NT-130	<input type="checkbox"/>	TDS - 540 DSO Digital scope	NT-220
<input checked="" type="checkbox"/>	3146 - Log. Per. Ant. 200 - 1000MHz	NT-131	<input type="checkbox"/>	PM97 Scopemeter	NT-221
<input type="checkbox"/>	Loop Antenna H-Field	NT-132	<input type="checkbox"/>	B10 - Harmonics and flicker analyzer	NT-231
<input type="checkbox"/>	Horn Antenna 500 MHz - 2900 MHz	NT-133	<input type="checkbox"/>	EFA-3 H-field- / E-field probe	NT-243
<input type="checkbox"/>	Log. per. Antenna 800 MHz - 2500 MHz	NT-134	<input type="checkbox"/>	E-field measuring instrument EMR-200; 100 kHz - 3 GHz	NT-244
<input type="checkbox"/>	Log. per. Antenna 800 MHz - 2500 MHz	NT-135	<input type="checkbox"/>	E-field probe 100 kHz - 3 GHz	NT-245
<input type="checkbox"/>	BiConiLog Antenna 26 MHz - 2000 MHz	NT-137	<input type="checkbox"/>	Magneticfield-Sensor 300 kHz - 30 MHz	NT-246
<input type="checkbox"/>	Conical Dipol Antenna PCD8250	NT-138	<input type="checkbox"/>	E-field probe 10 MHz - 18 GHz	NT-247
<input type="checkbox"/>	HZ-1 Antenna tripod	NT-150	<input type="checkbox"/>	H-field probe 10 MHz - 1 GHz	NT-248
<input checked="" type="checkbox"/>	BN 1500 Antenna tripod	NT-151	<input type="checkbox"/>	ELT-400 1 Hz - 400 kHz	NT-249
<input type="checkbox"/>	Ant. tripod for EN61000-4-3 Model TP1000A	NT-156	<input type="checkbox"/>	MDS 21 - Absorbing clamp 30 - 1000 MHz	NT-250
<input type="checkbox"/>	ESVP - Test receiver 20 - 1000 MHz	NT-201			

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Appendix 1 (continued)

Test equipment used

<input type="checkbox"/>	FCC-203I EM Injection clamp	NT-251	<input type="checkbox"/>	AS0102-65R - RF-Amplifier 1 GHz - 2 GHz	NT-333
<input type="checkbox"/>	FCC-203I-DCN Ferrite decoupling network	NT-252	<input type="checkbox"/>	APA01 – RF-Amplifier 0,5 GHz – 2,5 GHz	NT-334
<input type="checkbox"/>	PR50 Current Probe	NT-253	<input type="checkbox"/>	Preamplifier 1 GHz - 4 GHz	NT-335
<input type="checkbox"/>	PR630 Current Probe	NT-254	<input type="checkbox"/>	Preamplifier for GPS MKU 152 A	NT-336
<input type="checkbox"/>	Model 2000 Digital Multimeter	NT-261	<input type="checkbox"/>	Preamplifier 100 MHz – 23 GHz	NT-337
<input type="checkbox"/>	Fluke 97 Digital Multimeter	NT-262	<input type="checkbox"/>	DC Block 10 MHz – 18 GHz Model 8048	NT-338
<input type="checkbox"/>	Fluke 97 Digital Multimeter	NT-263	<input type="checkbox"/>	2-97201 Electronic load	NT-341
<input type="checkbox"/>	ESH2-Z5 Artificial mains network 4x25A	NT-300	<input type="checkbox"/>	TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-344
<input type="checkbox"/>	ESH3-Z5 Artificial mains network 2x10A	NT-301	<input type="checkbox"/>	TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-345
<input type="checkbox"/>	ESH3-Z6 Artificial mains network 1x100A	NT-302	<input type="checkbox"/>	VDS 200 Mobil-impuls-generator	NT-350
<input type="checkbox"/>	ESH3-Z4 T-Artificial network	NT-303	<input type="checkbox"/>	LD 200 Mobil-impuls-generator	NT-351
<input type="checkbox"/>	PHE 4500/B Power amplifier	NT-304	<input type="checkbox"/>	MPG 200 Mobil-Impuls-Generators	NT-352
<input type="checkbox"/>	EZ10 T-Artificial network	NT-305	<input type="checkbox"/>	EFT 200 Mobil-impuls-generator	NT-353
<input type="checkbox"/>	SMG - Signal generator 0,1 - 1000 MHz	NT-310	<input type="checkbox"/>	FP 16/3-1 3 ph. Coupling filter (Burst)	NT-400
<input type="checkbox"/>	PM 5518 TXVPS Video generator	NT-311	<input type="checkbox"/>	PHE 4500 - Mains impedance network	NT-401
<input type="checkbox"/>	RefRad Reference generator	NT-312	<input type="checkbox"/>	IP 6.2 Coupling filter for data lines (Surge)	NT-403
<input type="checkbox"/>	SMP 02 Signal generator 10 MHz - 20 GHz	NT-313	<input type="checkbox"/>	ESH2-Z3 - Probe 9 kHz - 30 MHz	NT-410
<input type="checkbox"/>	40 MHz Arbitrary Generator T1241	NT-315	<input type="checkbox"/>	IP 4 - Capacitive clamp (Burst)	NT-411
<input type="checkbox"/>	PEFT - Burst generator up to 4 kV	NT-320	<input type="checkbox"/>	Highpass-Filter 100 MHz – 4 GHz	NT-412
<input type="checkbox"/>	ESD 30 System up to 25 kV	NT-321	<input type="checkbox"/>	Highpass-Filter 600 MHz – 4 GHz	NT-413
<input type="checkbox"/>	PSURGE 4.1 Surge generator	NT-324	<input type="checkbox"/>	Highpass-Filter 1250 MHz – 4 GHz	NT-414
<input type="checkbox"/>	TRANSIENT 1000 Immunity test system	NT-325	<input type="checkbox"/>	Highpass-Filter 1800 MHz – 18 GHz	NT-415
<input type="checkbox"/>	VCS 500-M6 Surge-Generator	NT-326	<input type="checkbox"/>	Highpass-Filter 3500 MHz – 18 GHz	NT-416
<input type="checkbox"/>	BTA-250 - RF-Amplifier 9 kHz - 220 MHz / 250 W	NT-330	<input type="checkbox"/>	HV-Attenuator 54,5 dB (Burst)	NT-420
<input type="checkbox"/>	T82-50 RF-Amplifier 2 GHz – 8 GHz	NT-331	<input type="checkbox"/>	RF-Attenuator 20 dB 0,1 - 1000 MHz / 25 W	NT-421
<input type="checkbox"/>	500W1000M7 - RF-Amplifier 80 - 1000 MHz / 500 W	NT-332	<input type="checkbox"/>	RF-Attenuator 10 dB 0,1 - 1000 MHz / 20 W	NT-422

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Test equipment used

<input type="checkbox"/>	RF-Attenuator 30 dB 0,1 - 1000 MHz / 1 W	NT-423	<input type="checkbox"/>	FCC-801-C1 Coupling decoupling network	NT-464
<input type="checkbox"/>	RF-Attenuator 30 dB	NT-424	<input type="checkbox"/>	F-16A - Current probe 1kHz - 70MHz	NT-465
<input type="checkbox"/>	RF-Attenuator 6 dB 0,1 - 1000 MHz / 1 W	NT-425	<input checked="" type="checkbox"/>	PC P450 - Test computer	NT-500
<input type="checkbox"/>	RF-Attenuator 6 dB 0,1 - 1000 MHz / 1 W	NT-426	<input type="checkbox"/>	PC P4 1700 MHz Notebook	NT-505
<input type="checkbox"/>	Voltage-divider 1:100	NT-427	<input type="checkbox"/>	PC PIII 933 MHz Notebook	NT-506
<input type="checkbox"/>	RF-Attenuator 6 dB	NT-428	<input type="checkbox"/>	Monitoring camera with Monitor	NT-511
<input type="checkbox"/>	RF-Attenuator 0 dB - 81 dB	NT-429	<input checked="" type="checkbox"/>	ES-K1 Test software	NT-520
<input type="checkbox"/>	WRU 27 - Band blocking 27 MHz	NT-430	<input type="checkbox"/>	SPS_PHE - Test software voltage fluctuations/harmonics	NT-525
<input type="checkbox"/>	WHJ450C9 AA - High pass 450 MHz	NT-431	<input type="checkbox"/>	SPS_EM - Test software for PHE 4500/B	NT-527
<input type="checkbox"/>	WHJ250C9 AA - High pass 250 MHz	NT-432	<input type="checkbox"/>	Noise power test apparatus according to EN 55014	NT-530
<input type="checkbox"/>	RF-Load 150 W	NT-433	<input type="checkbox"/>	Vertical coupling plane (ESD)	NT-531
<input type="checkbox"/>	Impedance transducer 50 Ohm – 800 Ohm	NT-435	<input type="checkbox"/>	TEM-Zelle	NT-533
<input type="checkbox"/>	RF-Attenuator DC – 18 GHz 6 dB	NT-436	<input type="checkbox"/>	Test cable #4 for EN 61000-4-6	NT-553
<input type="checkbox"/>	RF-Attenuator DC – 18 GHz 6 dB	NT-437	<input type="checkbox"/>	Test cable #3 for conducted emission	NT-554
<input type="checkbox"/>	RF-Attenuator DC – 18 GHz 10 dB	NT-438	<input type="checkbox"/>	Test cable #5 ESD-cable (2x470k)	NT-555
<input type="checkbox"/>	RF-Attenuator DC – 18 GHz 20 dB	NT-439	<input type="checkbox"/>	Test cable #6 ESD-cable (2x470k)	NT-556
<input type="checkbox"/>	I+P 7780 Directional coupler 100 - 2000 MHz	NT-440	<input type="checkbox"/>	Test cable #8 Sucoflex 104EA	NT-559
<input type="checkbox"/>	ESH3-Z2 - Pulse limiter 9 kHz - 30 MHz	NT-441	<input type="checkbox"/>	Test cable #9 (for outdoor measurements)	NT-580
<input type="checkbox"/>	Power Divider 6 dB/1 W/50 Ohm	NT-443	<input type="checkbox"/>	Test cable #10 (for outdoor measurements)	NT-581
<input type="checkbox"/>	Directional coupler 0,1 MHz – 70 MHz	NT-444	<input type="checkbox"/>	Test cable #13 Sucoflex 104PE	NT-584
<input type="checkbox"/>	Directional coupler 0,1 MHz – 70 MHz	NT-445	<input type="checkbox"/>	Shield chamber	NT-600
<input type="checkbox"/>	Tube imitations according to EN 55015	NT-450	<input checked="" type="checkbox"/>	Climatic chamber -55°C to +180°C	M-512
<input type="checkbox"/>	FCC-801-M2-50A Coupling decoupling network	NT-459	<input type="checkbox"/>	Control and simulation equipment for EUT	---
<input type="checkbox"/>	FCC-801-M5-25 Coupling decoupling network	NT-460			
<input type="checkbox"/>	FCC-801-AF10 Coupling decoupling network	NT-461			
<input type="checkbox"/>	FCC-801-S25 Coupling decoupling network	NT-462			
<input type="checkbox"/>	FCC-801-T4 Coupling decoupling network	NT-463			

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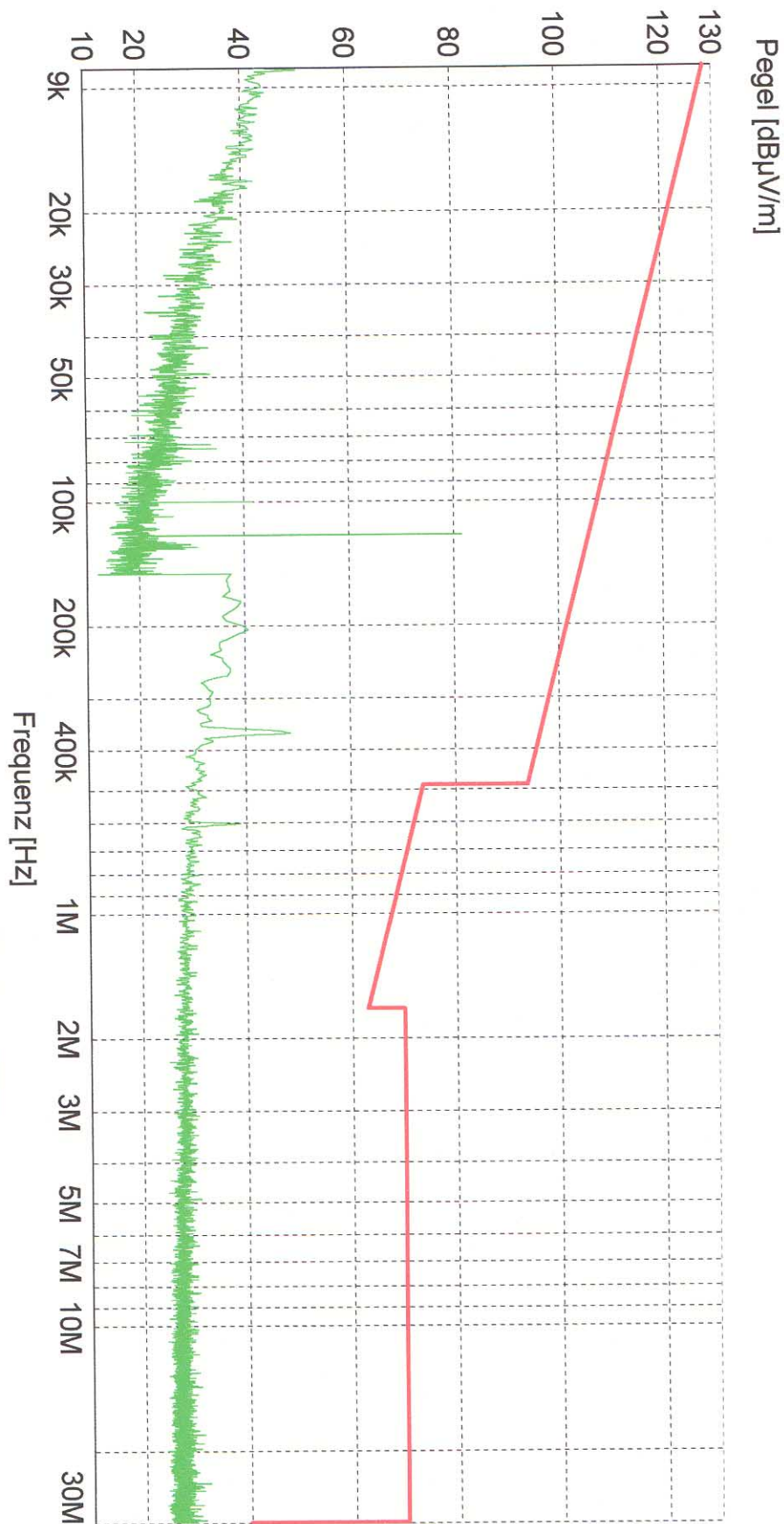
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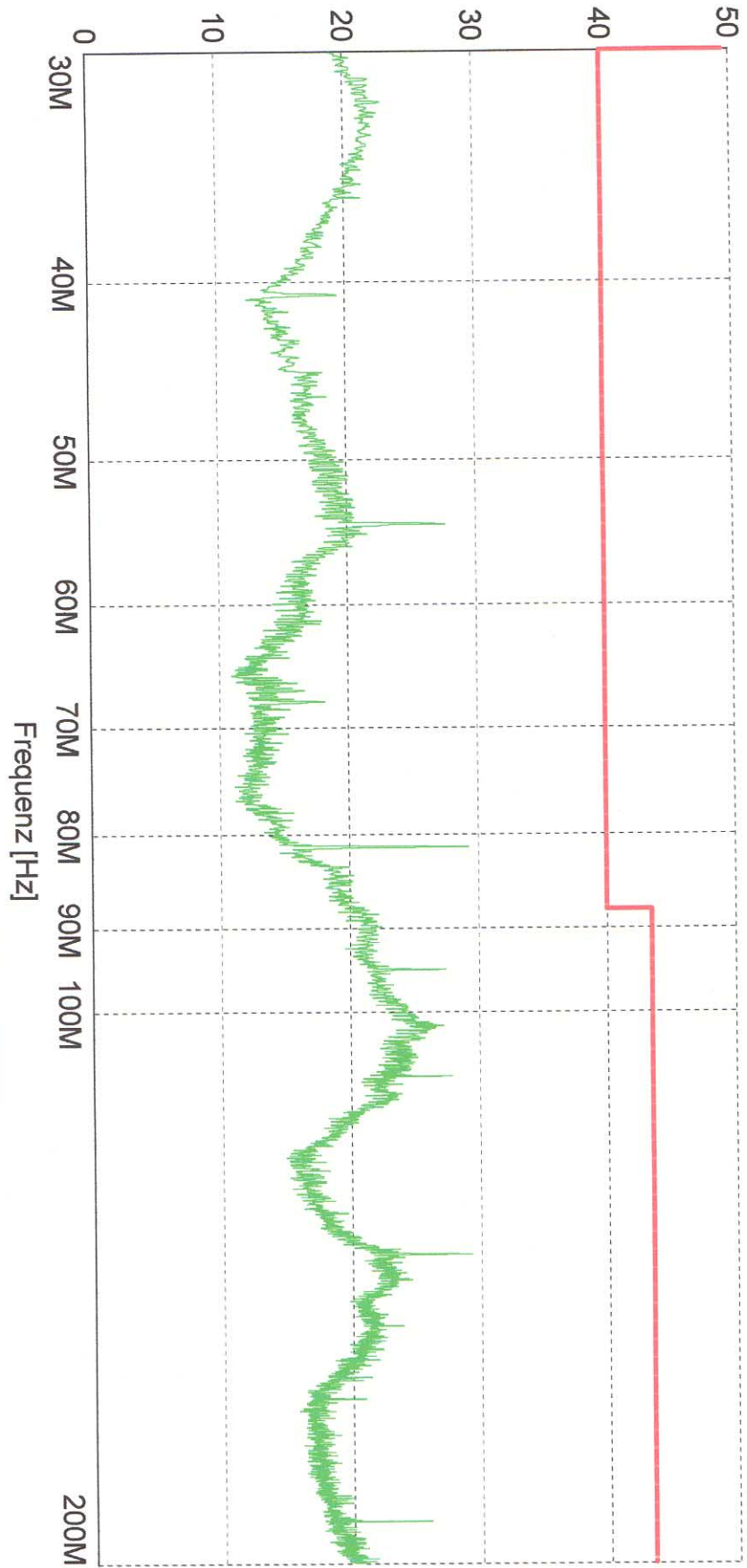
Date: 09.03.2004

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MES KeyDuo_F00F_pre PK
 LIM FCC ClassB_QP_40dB FCC ClassB, field strength 3m

Pegel [dBµV/m]



MES KeyDuo_F01f_pre PK
LIM FCC ClassB_F_QP/AV FCC ClassB, field strength 3m

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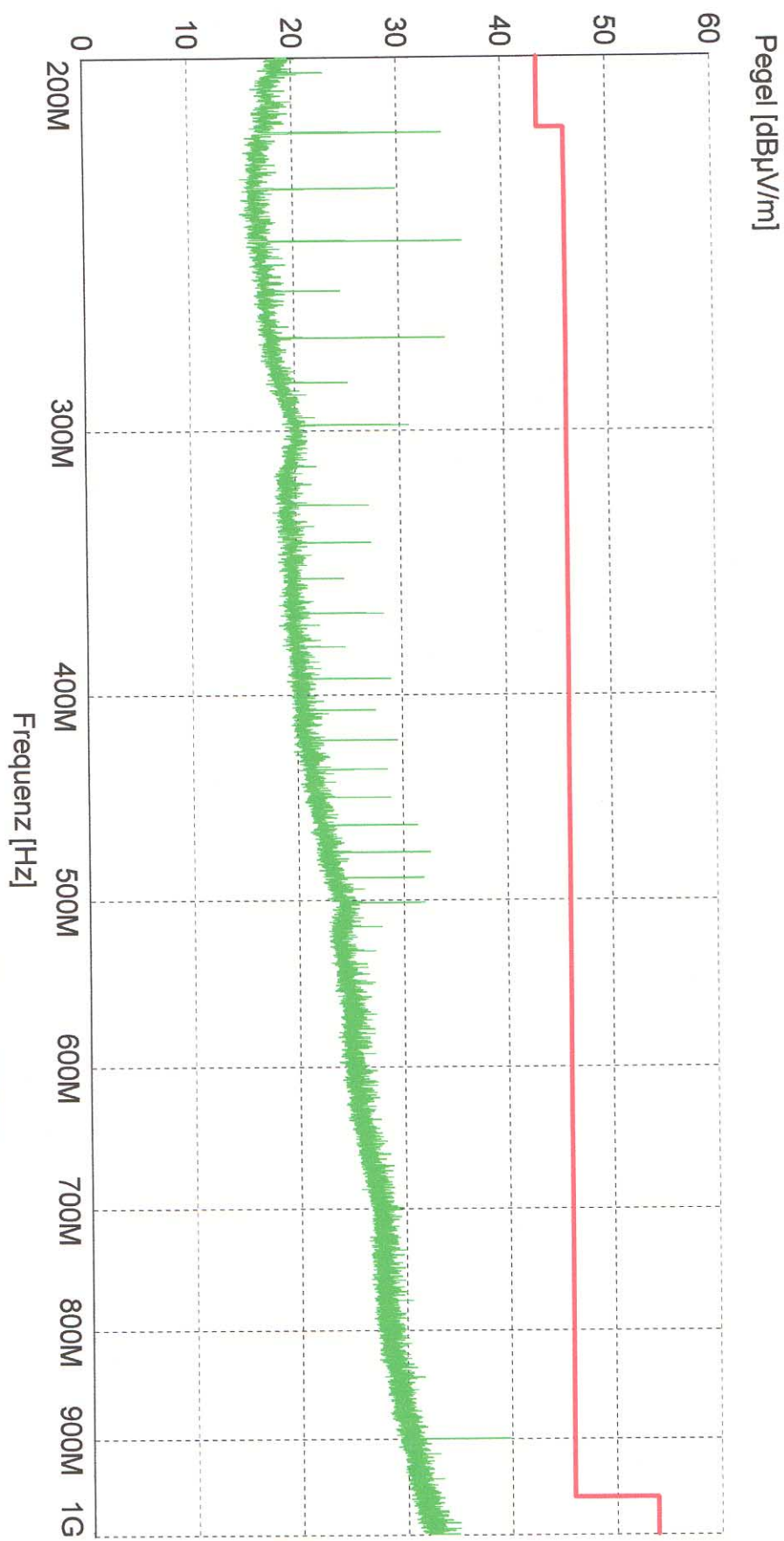
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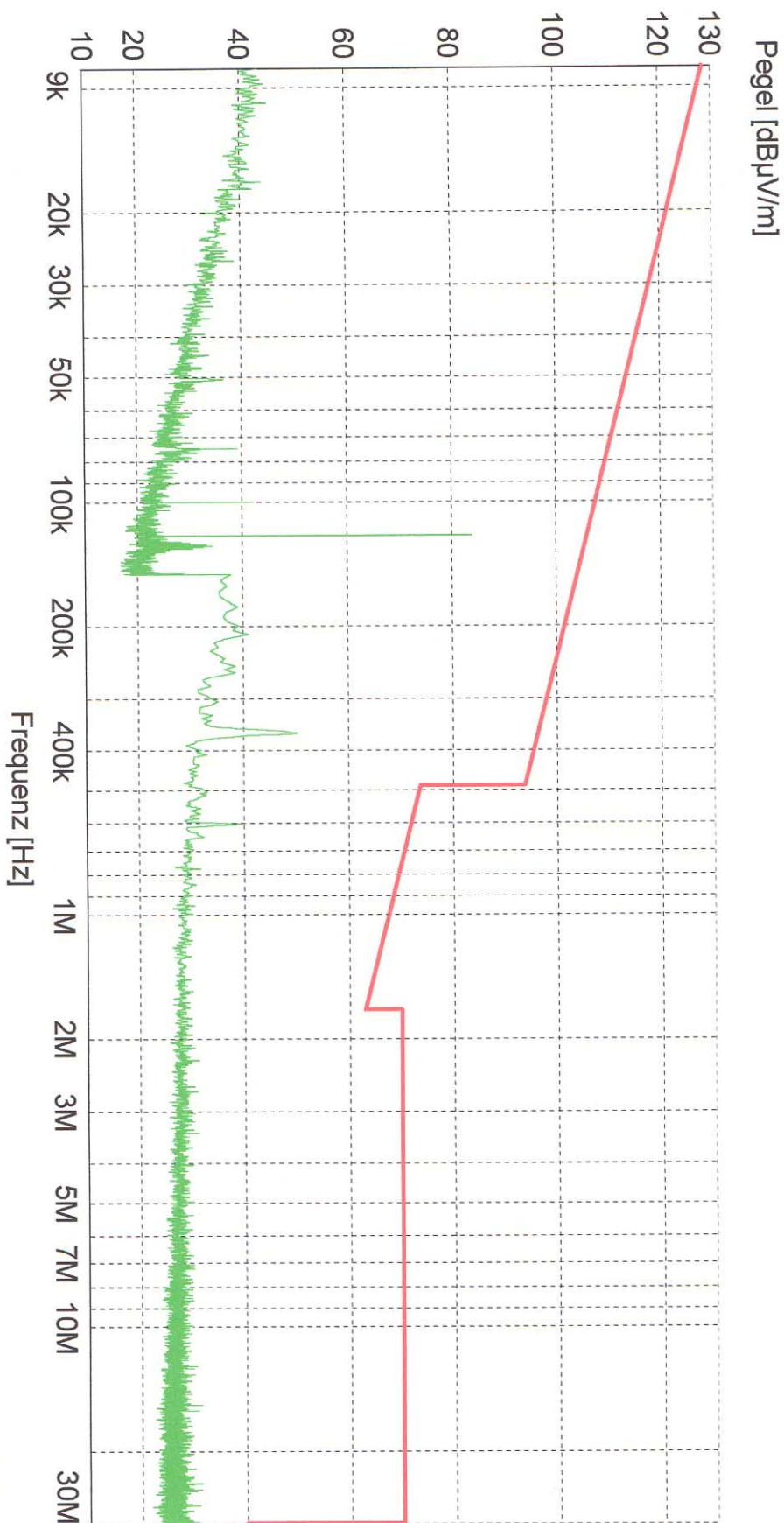
Measurement diagram: 3 of 12

Date: 09.03.2004

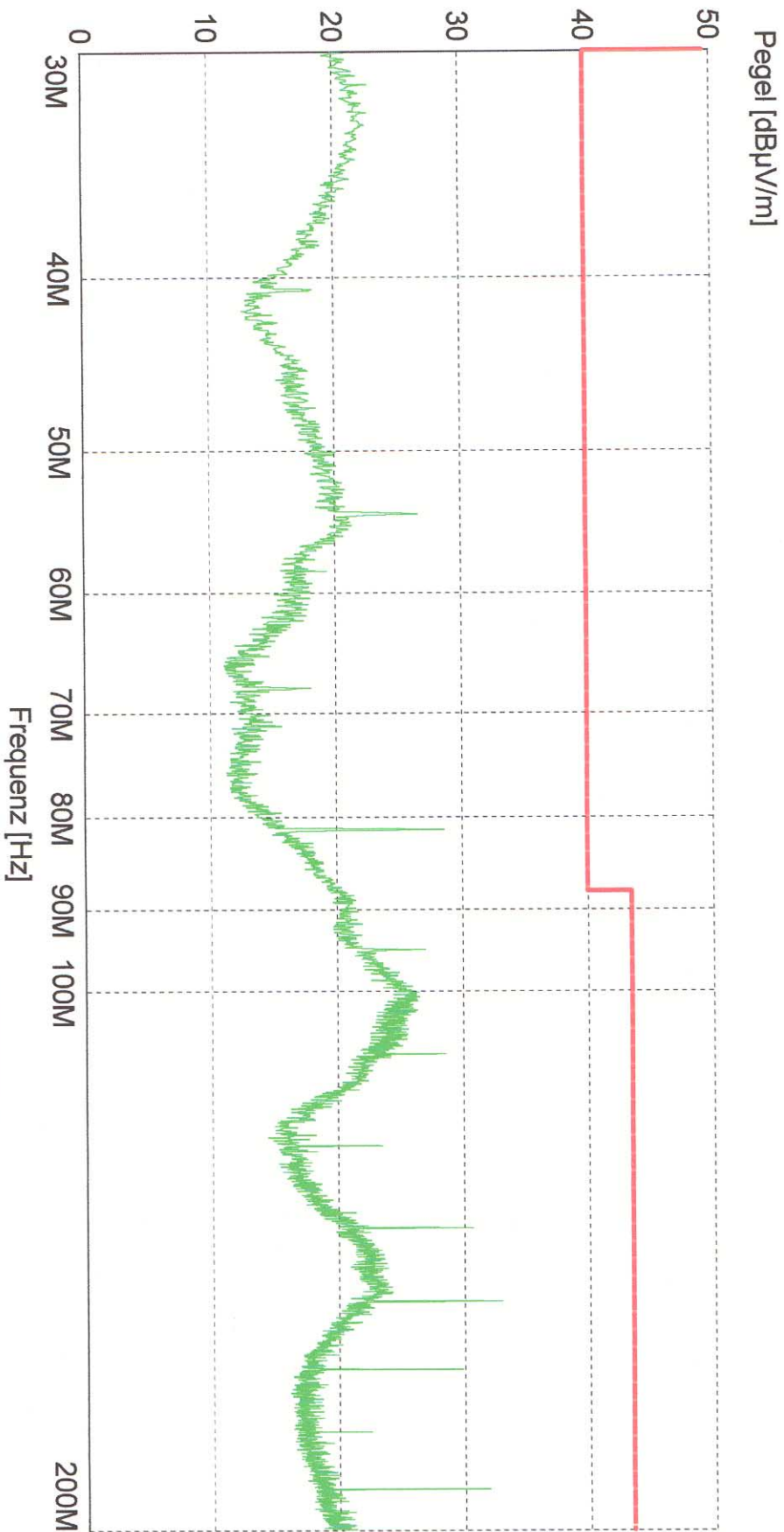
checked by: *J. Müller*



MES KeyDuo_F02F_pre PK
LIM FCC ClassB_F_QP/AV FCC ClassB, field strength 3m



MES KeyDuo_F10F_pre PK
 LIM FCC ClassB_F_QP_40dB FCC ClassB, field strength 3m



MES KeyDuo_F11f_pre_PK
LIM FCC ClassB F_QP/AV

FCC ClassB, field strength 3m

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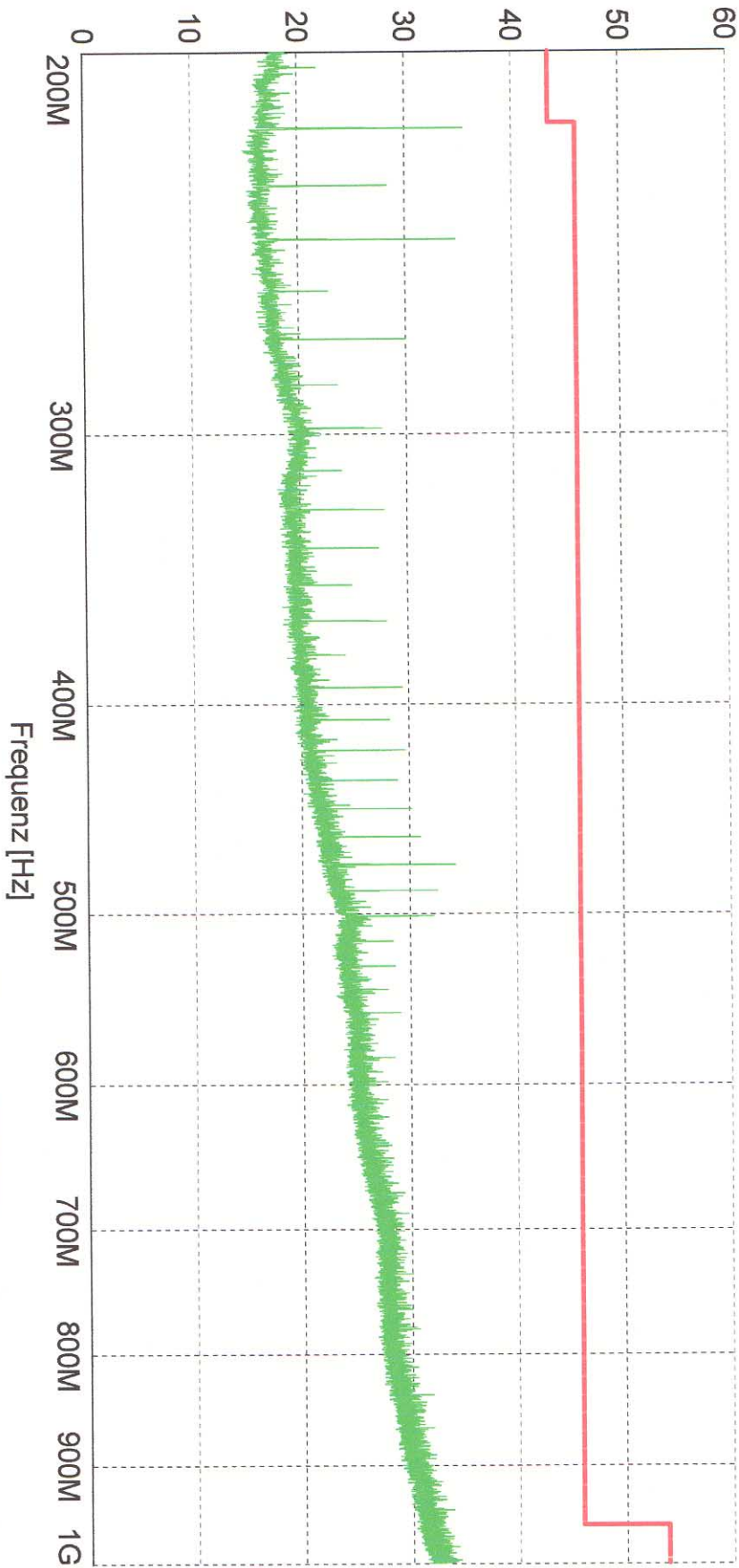
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Date: 09.03.2004

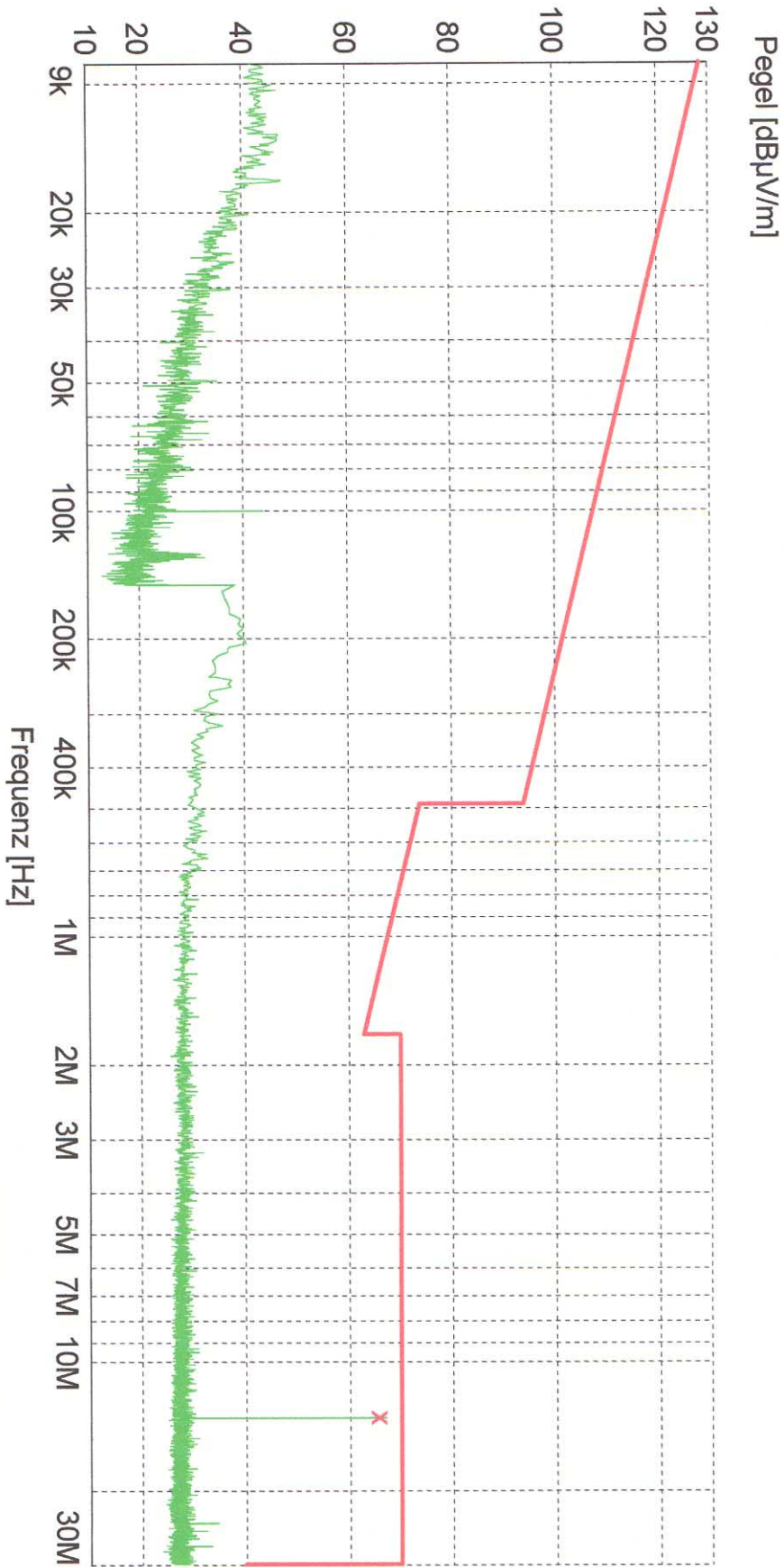
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Pegel [dBµV/m]



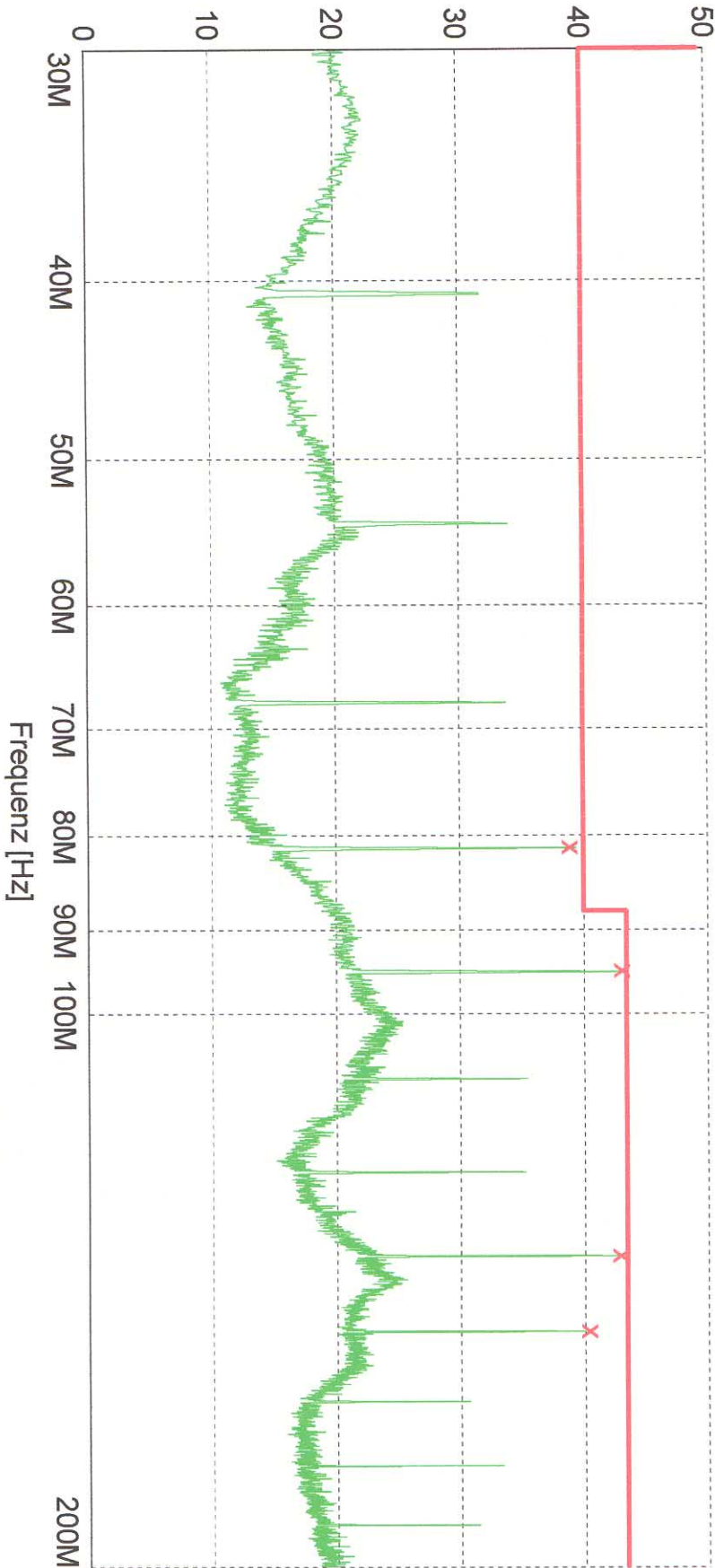
MES KeyDuo_F12F_pre_PK
LIM FCC ClassB_F_QP/AV

FCC ClassB, field strength 3m



x x : MES KeyDuo F00F3 fin QP
 MES KeyDuo_F00F3_pre PK
 LIM FCC ClassB F_QP 40dB FCC ClassB, field strength 3m

Pegel [dBµV/m]



x x : MES KeyDuo_F01F3_fin_QP
 MES KeyDuo_F01F3_pre_PK
 LIM FCC ClassB_F_QP/AV

FCC ClassB, Field strength 3m


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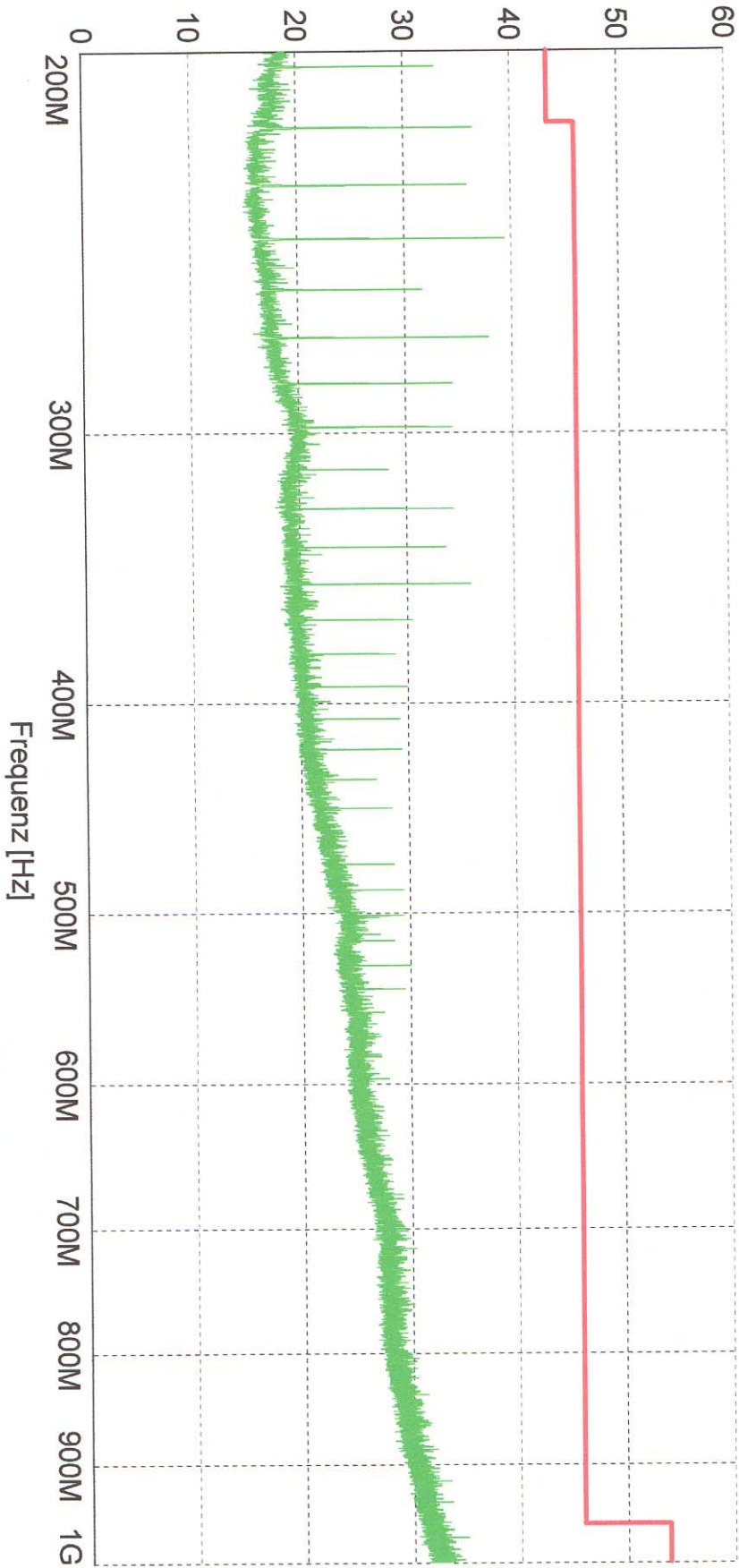
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Measurement diagram: 9 of 12

Date: 09.03.2004

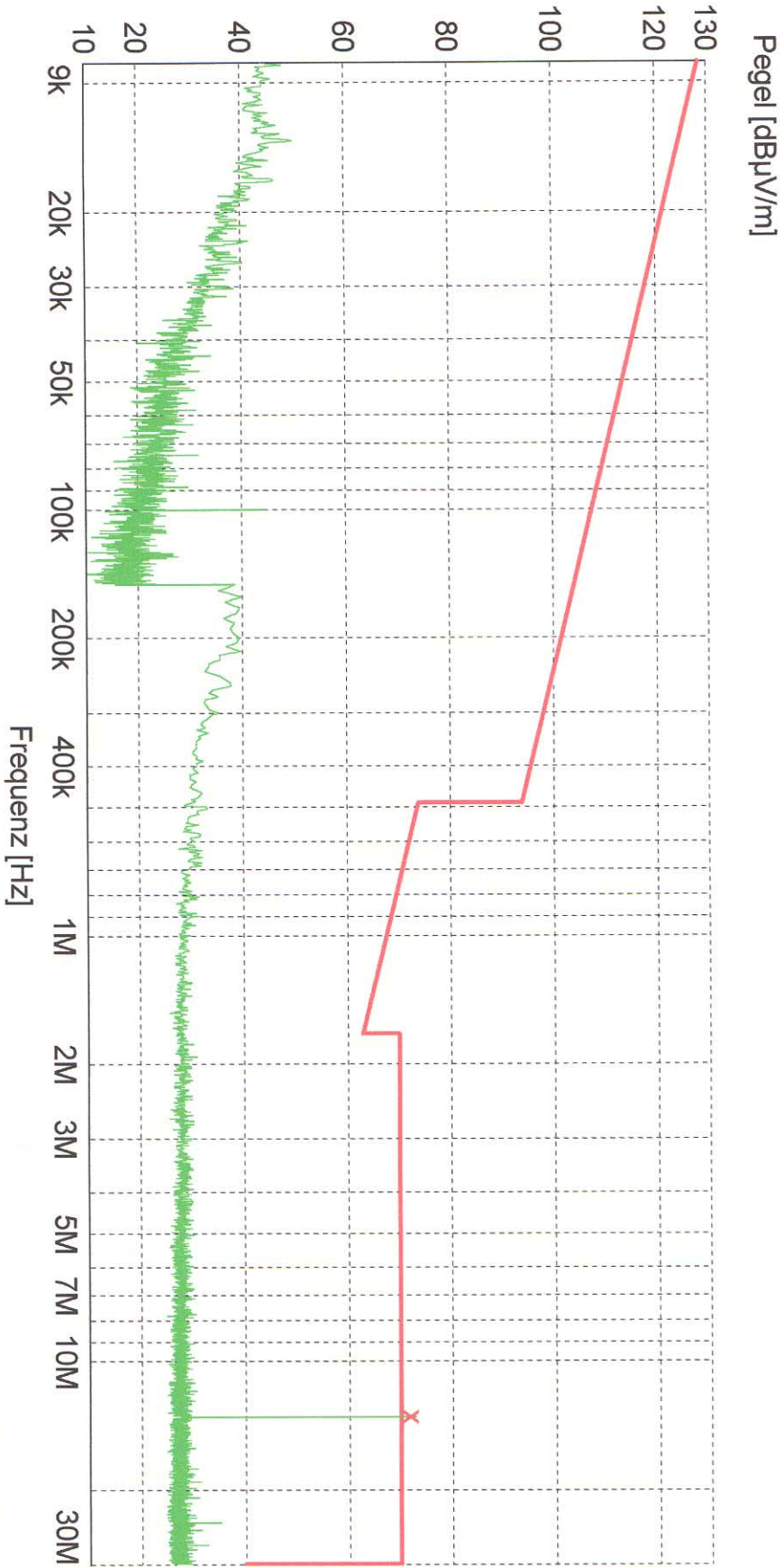
checked by: 

Pegel [dBµV/m]



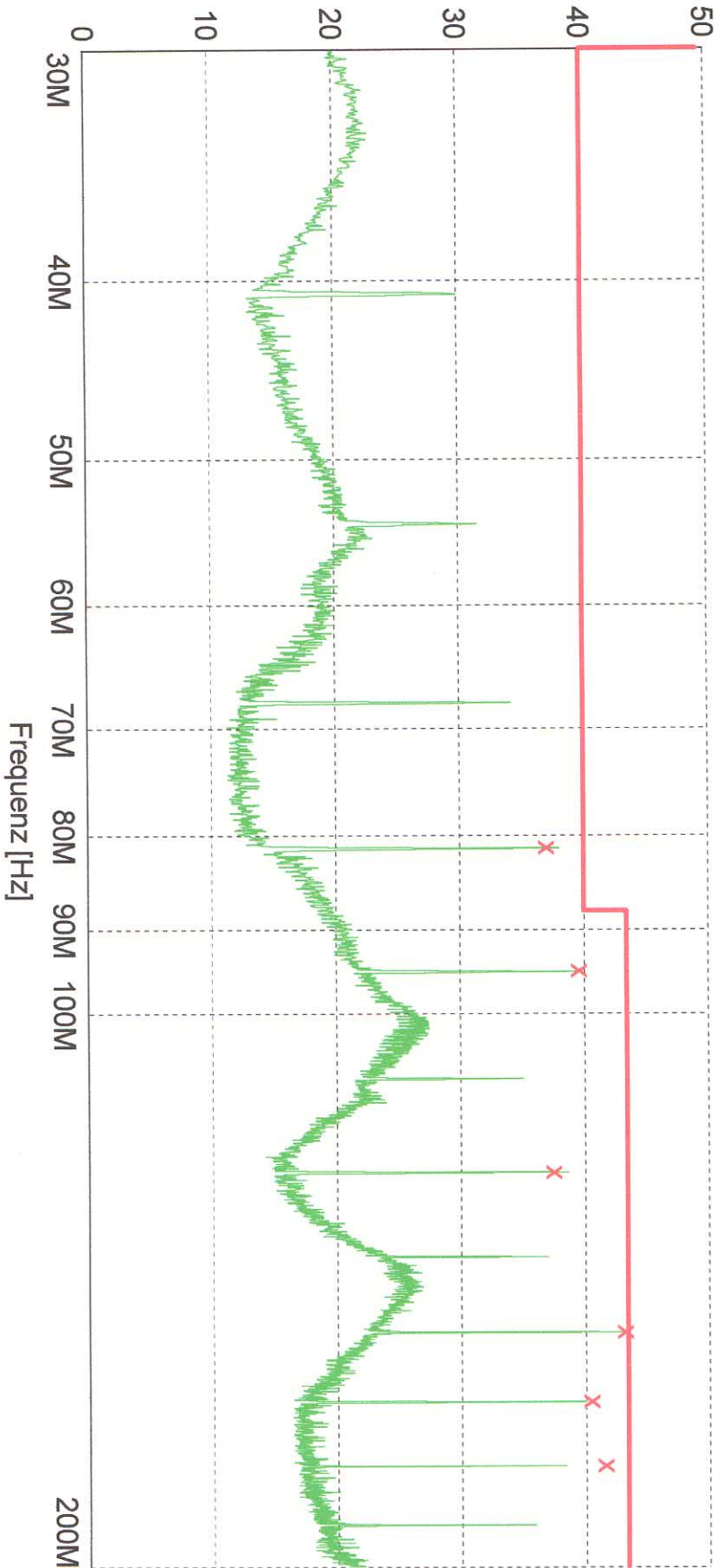
MES KeyDuo_F02f3_pre PK
LIM FCC ClassB_F_QP/AV

FCC ClassB, field strength 3m



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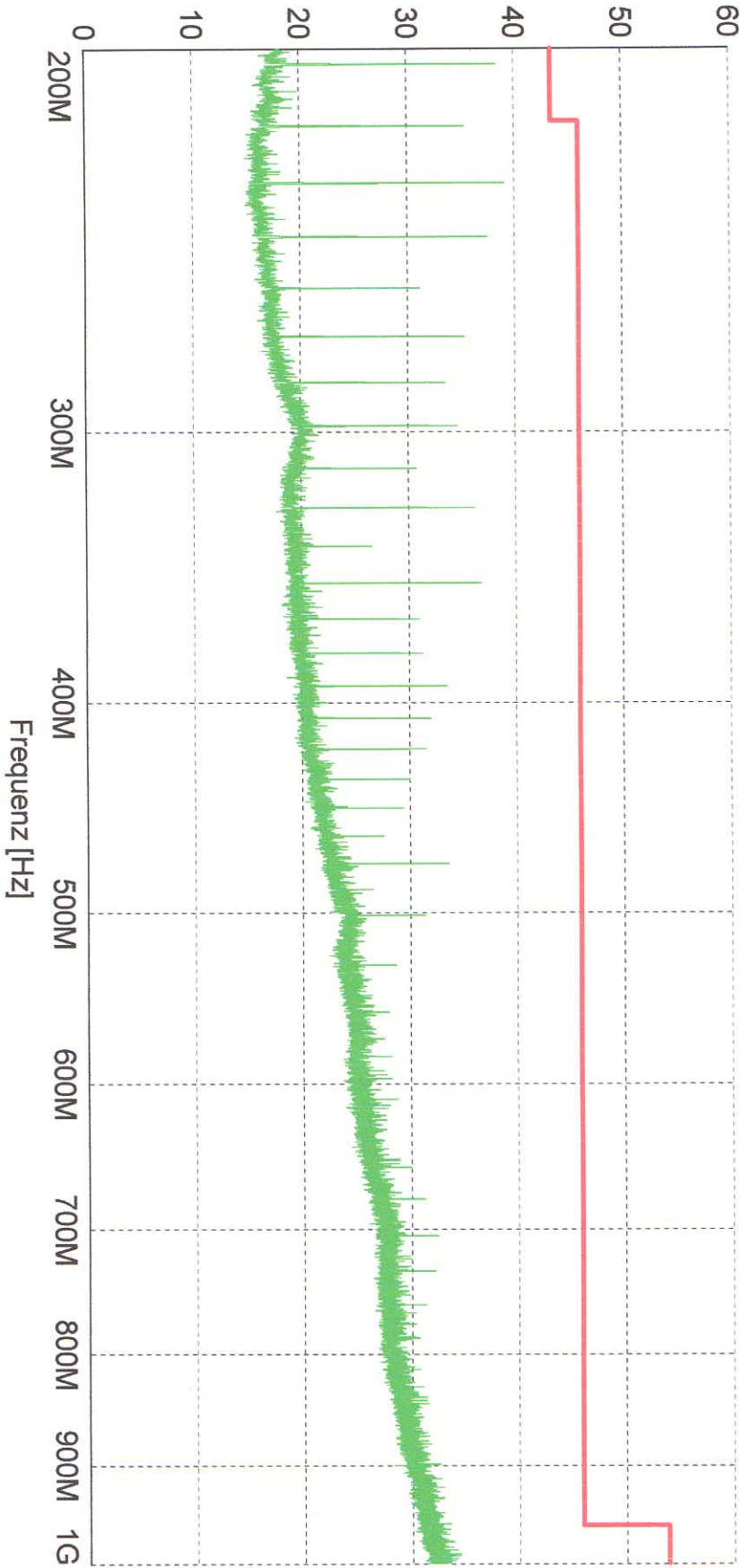
Pegel [dBµV/m]



x x : MES KeyDuo F11f3 fin QP
 MES KeyDuo F11f3_pre PK
 LIM FCC ClassB F QP/AV

FCC ClassB, field strength 3m

Pegel [dBµV/m]



MES KeyDuo_F12F3_pre PK
LIM FCC ClassB_QP/AV

FCC ClassB, field strength 3m