

TEST REPORT
of the accredited test laboratory

TÜV Nr.: M/EMV-04/120

about
the following EMC - test/- research

Division Medical
Technology/
Communication
Technology/ EMC

Testing Body for
Communication
Technology/ EMC

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

Product: AS x70i DUO/KEY

Serial Number: ---

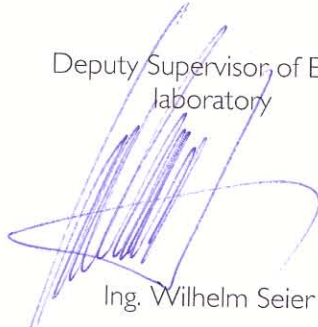
Standard: 47 CFR Ch. I Part 15
RSS-210 Issue 5

Accredited Testing
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Notified Body 0408
Canada: IC4413

TÜV Österreich
Test laboratory for EMC

Deputy Supervisor of EMC-
laboratory


Ing. Wilhelm Seier



25.02.2004

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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 09.02.2004

Tests were performed on 09.02. – 11.02.2004

2. Description of EUT

EUT	AS x70i DUO/KEY
Serial Number	---
Manufacturer	SKIDATA AG A-5083 Gartenau – St. Leonhard; Untersbergstraße 40
Description	SKIDATA AG provided the following configuration for the measurements: Serial production
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. Conducted emission

Limits according to 15.109 and 6.6.

Frequency range	Limit	
Detector	Quasi Peak	Average
0,150 - 0,5 MHz	66 - 56 dB μ V decreasing with the logarithm of frequency	56 - 46 dB μ V decreasing with the logarithm of frequency
0,5 - 5 MHz	56 dB μ V	46 dB μ V
5 - 30 MHz	60 dB μ V	50 dB μ V
Remark: Quasi Peak and Average limits must be both met		

Measuring apparatus parameters:

Parameter	Preview measurement	Final measurement	Parameter	Preview measurement	Final measurement
Start frequency	150 kHz	150 kHz	Detector	MP/AV	QP/AV
Stop frequency	30 MHz	30 MHz	Measuring time	10 ms	1 s
Stepsize	5 kHz	5 kHz	RF-attenuation	0dB	0dB
IF- Bandwidth	9 kHz	9 kHz	Preamplifier	0 dB	0 dB

Operating mode	Measuring result
Normal use	Measurement diagram 1

Test result:

4. 1.1.) Measurement with QP-Detector

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed- Mark	Phase	PE
13,546	59,8	60	0,2		L	GND
13,574	59,7	60	0,3		N	GND
13,505	51,8	60	8,2		L	GND
13,595	49,1	60	10,9		L	GND
13,630	47,7	60	12,3		N	GND
13,715	42,0	60	18,0		L	GND

4. 1.2.) Measurement with AV-Detector

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed- Mark	Phase	PE
13,546	33,8	50	16,2		L	GND
13,574	36,7	50	13,3		L	GND

4. 2. Radiated emission

Limits according to 15.209 and 6.2.1.

Detector Quasi Peak		
Frequency range	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,	Measurement diagram 2-4
continuous and modulated carrier at 13,56 MHz	Measurement diagram 5-7

Test result:

4. 2.1.) Measurement in the frequency range 9 kHz to 30 MHz

continuous and modulated carrier at 122,9 kHz

Frequency kHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed- Mark
122,9	103,7	105,8	2,1	

4. 2.2.) Measurement in the frequency range 30 MHz to 1000 MHz

continuous and modulated carrier at 122,9 kHz

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

4. 2.3.) Measurement in the frequency range 9 kHz to 30 MHz

continuous and modulated carrier at 13,56 MHz

Frequency kHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed- Mark
13560	101,8	69,5	32,3	This part of emission is covered by 15.225 (a) and 6.2.2.(e) see page 11

4. 2.4.) Measurement in the frequency range 200 MHz to 1000 MHz

continuous and modulated carrier at 13,56 MHz

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

4.3. 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:

The field strength at 3m distance was measured as 101,8 dB μ V/m. Extrapolated with 40 dB per decade to 30 meters distance it would be 61,8 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:

The field strength at 3m distance was measured as 101,8 dB μ V/m. Extrapolated with 40 dB per decade to 30 meters distance it would be 61,8 dB μ V/m.

15.225 (b) and 6.2.2.(e):

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):

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

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

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Appendix 1 (continued)

Test equipment used

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

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Appendix 1 (continued)

Test equipment used

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

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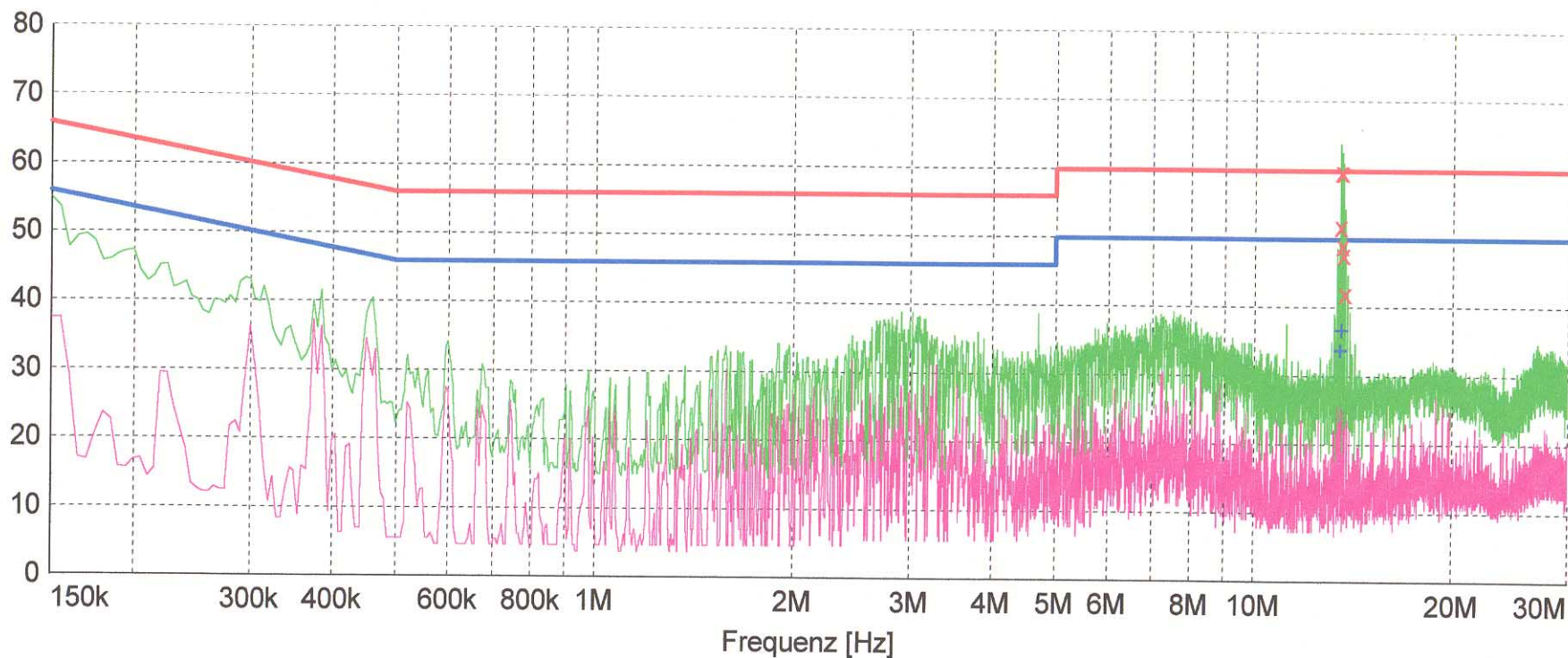
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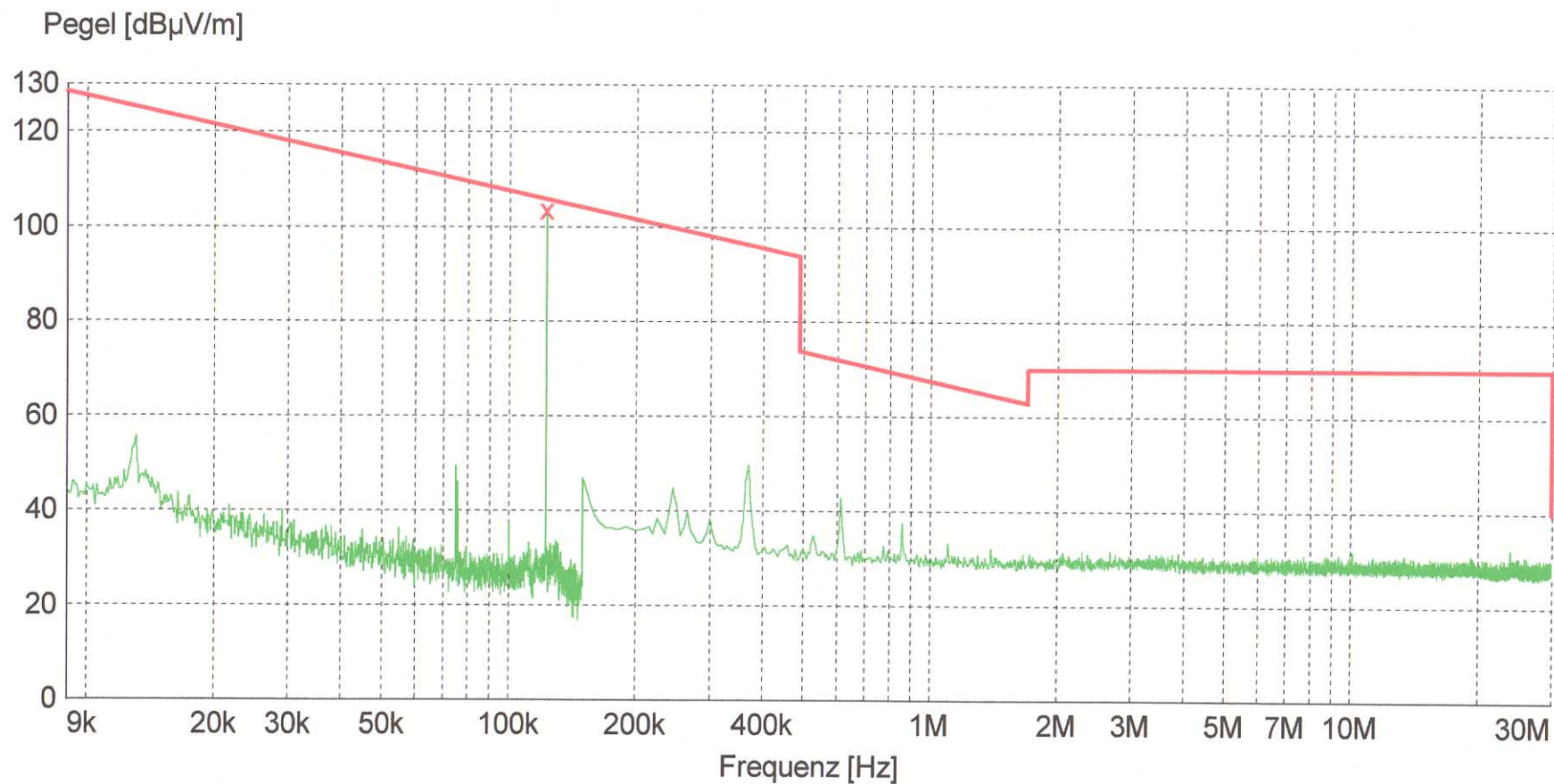
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Pegel [dB μ V]

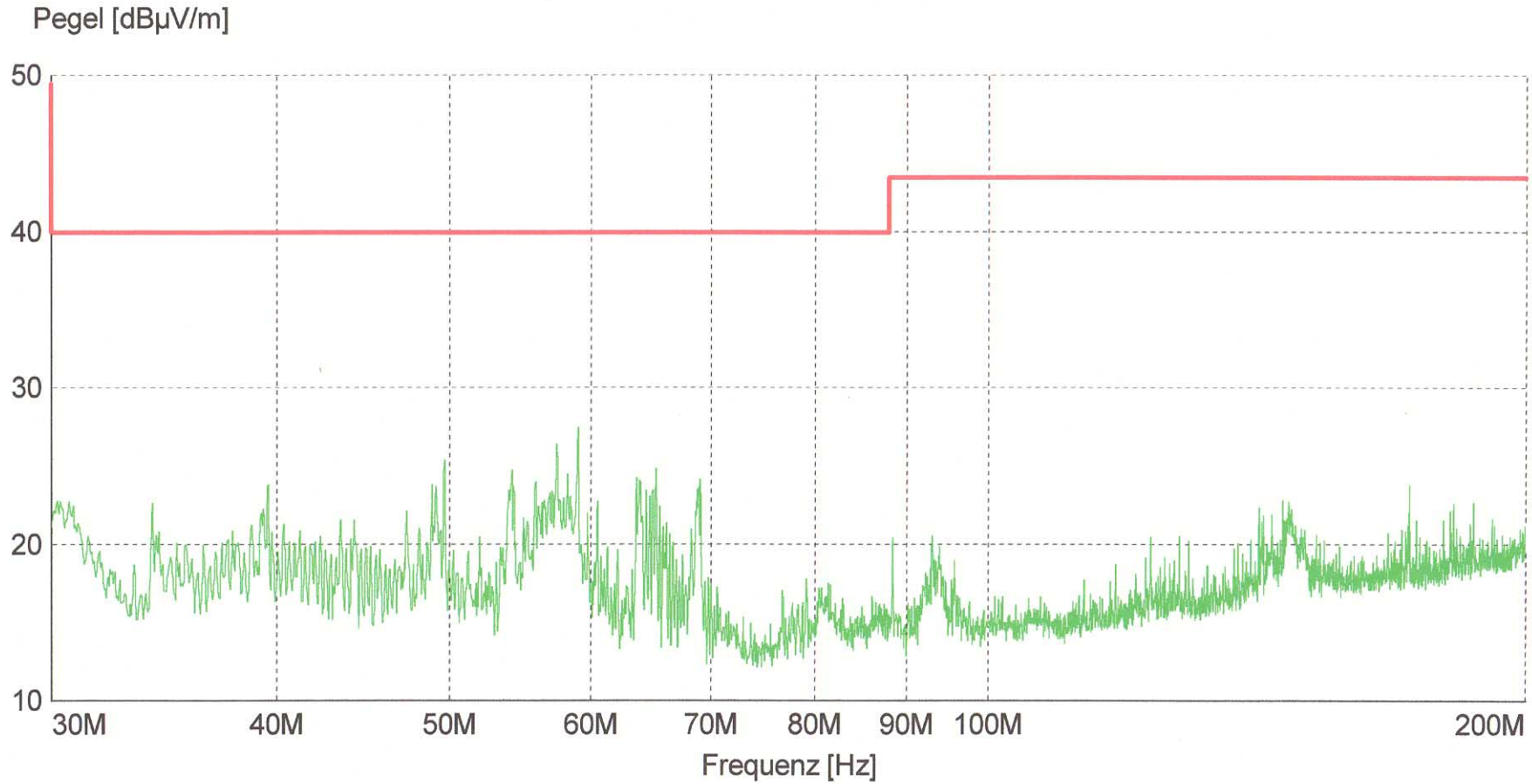


x x > MES Key_AS_VAC_fin QP
+ + - MES Key_AS_VAC_fin AV
— MES Key_AS_VAC_pre PK
— MES Key_AS_VAC_pre AV
— LIM EN 55022 V QP
— LIM EN 55022 V AV

EN 55022 V QP
EN 55022 V AV

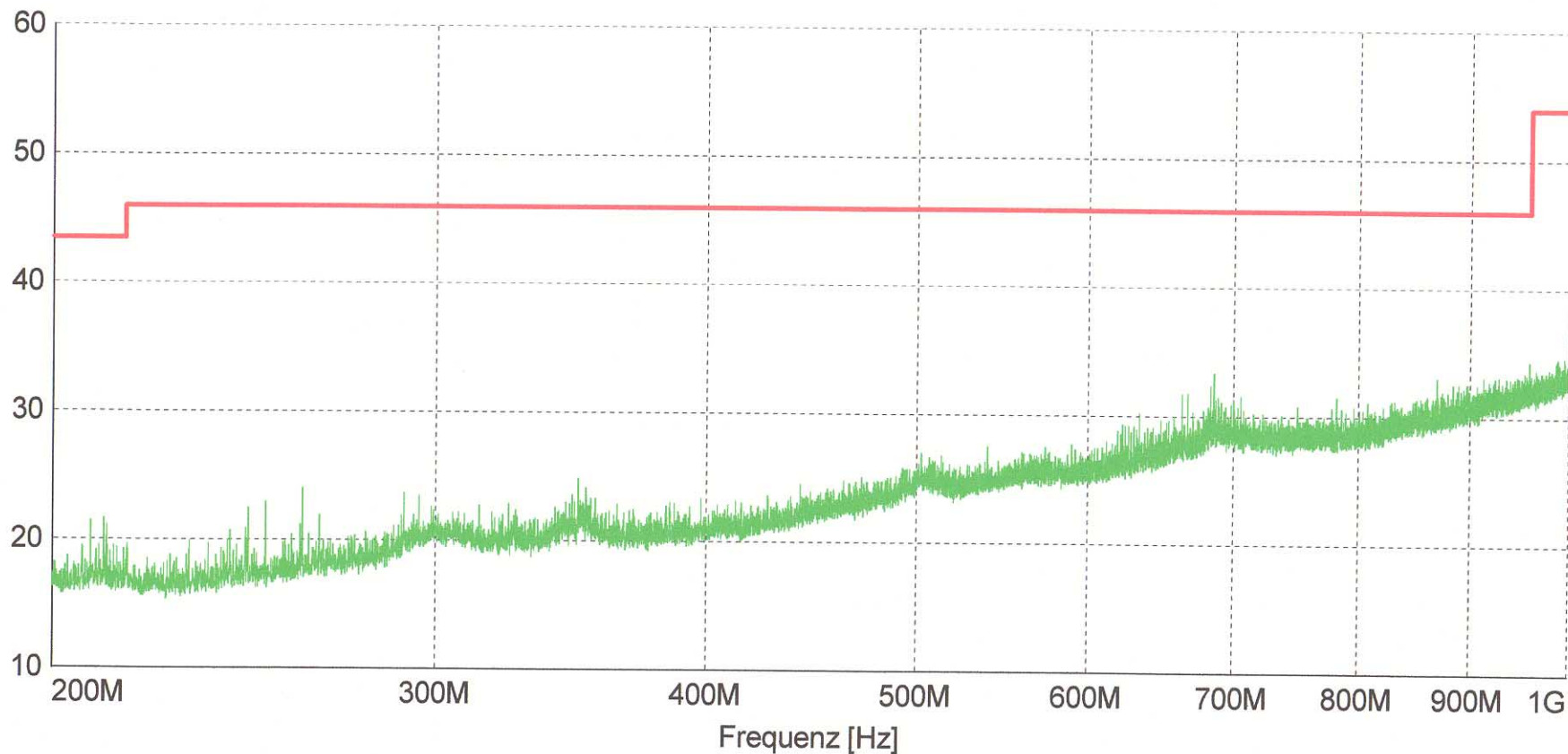


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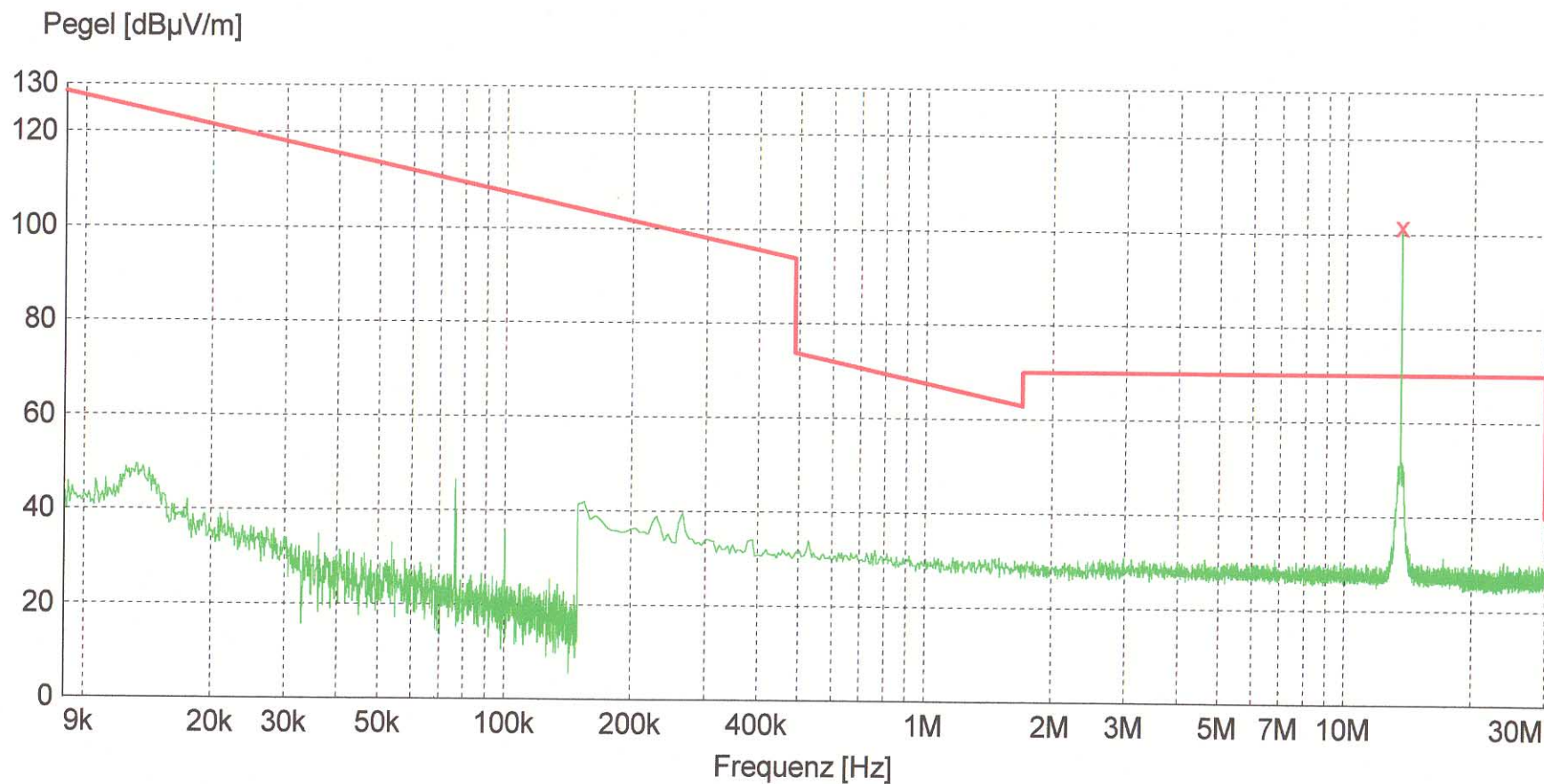


— MES Key_AS_F2_pre PK
 — LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m

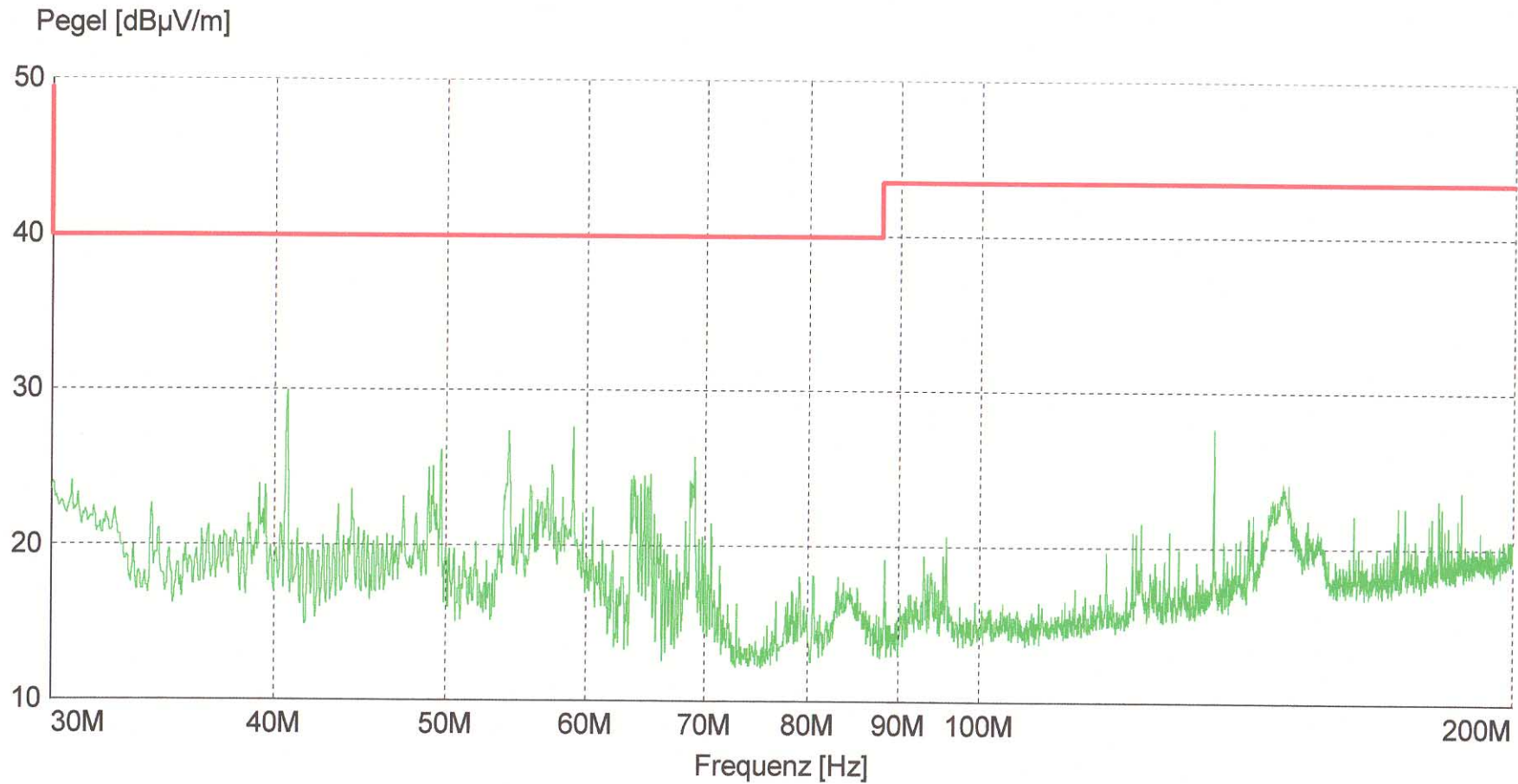
Pegel [dB μ V/m]



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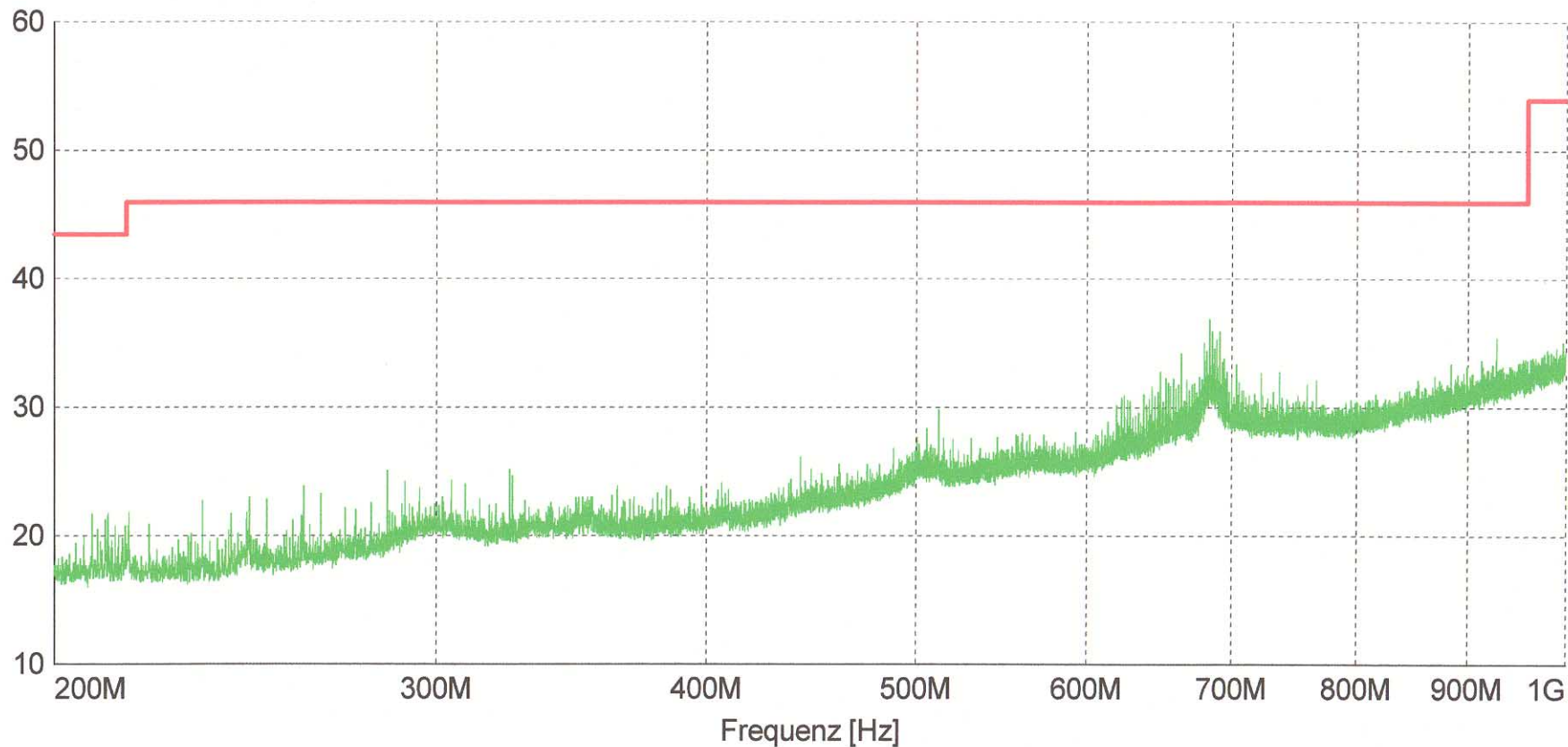
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— LIM FCC ClassB F QP 40dB FCC ClassB, field strength 3m



MES Key_AS_F5_pre PK

LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m

Pegel [dB μ V/m]



MES Key_AS_F6_pre PK
 LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m