

TEST REPORT
of the accredited test laboratory

TÜV Nr.: M/EMV-03/266

about
the following EMC - test/- research

Division Medical
Technology/
Communication
Technology/ EMC

Testing Body for
Communication
Technology/ EMC

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Applicant: AKG Acoustics USA
914 Airpark Center Drive
Nashville, TN 37217, USA

Product: HEARO 999 AUDIOSPHERE II
digital transmitter for wireless headphone set

Serial Number: ---

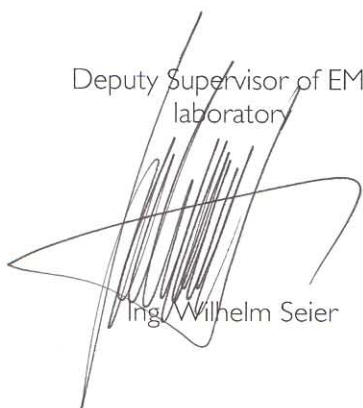
Standard: 47 CFR Ch. I Part 15

Accredited Testing
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Notified Body 0408

TÜV Österreich
Test laboratory for EMC

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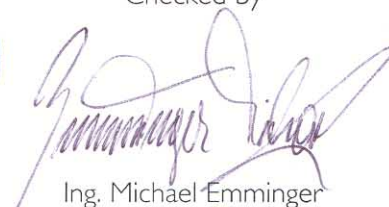

Ing. Wilhelm Seier



13.01.2004

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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.

DVR 0047 333
UID ATU 3708600

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1. Applicant

Company	AKG Acoustics USA
Department	---
Address	914 Airpark Center Drive Nashville, TN 37217, USA
Contact person	Mr. Doug MacCallum

EUT received on 17.12.2003

Tests were performed on 17.12.2003

2. Description of EUT

EUT	HEARO 999 AUDIOSPHERE II digital transmitter for wireless headphone set
Serial Number	---
Manufacturer	AKG Acoustics GmbH Lemböckgasse 21 - 25 A - 1230 Vienna
Description	AKG provided the following configuration for the measurements: HEARO 999 AUDIOSPHERE II digital transmitter for wireless headphone set
Operating mode	The measurements were carried out at the following running states: transmit

3. Standards / Final result

Name	Title	Deviation	Result
47 CFR Ch. I Part 15	Radio Frequency Devices	none	PASS
PASS EUT passed FAIL EUT failed			

4. Test results

4.1. Conducted emission

Limits according to 15.109

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
transmit	Measurement diagram 1

Test result:

4. 1.1.) Measurement with QP-Detector

Due to the large margin of the pre-measurement results, no final measurement was performed.

4. 1.2.) Measurement with AV-Detector

Due to the large margin of the pre-measurement results, no final measurement was performed.

4.2. Radiated emission

Limits according to 15.209 (15.249 (c))

$< 1 \text{ GHz} \rightarrow$ Quasi Peak Limit $> 1 \text{ GHz} \rightarrow$ Average Limit (Peak Limit 20 dB above average Limit)				
Frequency range	Limit	Bandwith	Measurement distance	Remark
0,009 – 0,150 MHz	2400 μ V / f(kHz)	200 Hz	300 m	1
0,150 – 0,490 MHz	2400 μ V / f(kHz)	9 kHz	300 m	1
0,490 – 1,705 MHz	24000 μ V / f(kHz)	9 kHz	30 m	1
1,705 - 30 MHz	30 μ V/m	9 kHz	30 m	1
30 – 88 MHz	100 μ V/m	120 kHz	3 m	---
88 – 216 MHz	150 μ V/m	120 kHz	3 m	---
216 – 960 MHz	200 μ V/m	120 kHz	3 m	---
960 MHz - 1000 MHz	500 μ V/m	120 kHz	3 m	---
Above 1000 MHz	500 μ V/m	1 MHz	3 m	2
Remark: 1) The Limit was increased for a constant measurement distance of 3m with a factor of 40 dB per Decade. 2) The Limit was increased for a constant measurement distance of 1m with a factor of 20 dB per Decade.				

Operating mode	Measuring result
transmit	Measurement diagram 1-8

Test result:

**4. 2.1.) Measurement in the frequency range 9 kHz to 200 MHz
Channel 1**

Due to the large margin of the pre-measurement results, no final measurement was performed.
(see measurement diagram 2 and 3)

**4. 2.2.) Measurement in the frequency range 9 kHz to 200 MHz
Channel 2**

Due to the large margin of the pre-measurement results, no final measurement was performed.
(see measurement diagram 2 and 4)

**4. 2.3.) Measurement in the frequency range 9 kHz to 200 MHz
Channel 3**

Due to the large margin of the pre-measurement results, no final measurement was performed.
(see measurement diagram 2 and 5)

**4. 2.4.) Measurement in the frequency range 200 MHz to 18000 MHz
Channel 1**

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB
200 to 216	< 35	43,5	---
216 to 1000	< 38	46,0	---
1831,16	51,8	63,5	11,7
2747,0	54,9	63,5	8,6
3662,63	61,8	63,5	1,7
4578,33	55,1	63,5	8,4
all other above 1 GHz	< 50	63,5	---
see measurement diagram 6 (The measuring diagram only show the frequency range up to 1 GHz.)			

**4. 2.5.) Measurement in the frequency range 200 MHz to 18000 MHz
Channel 2**

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB
200 to 216	< 35	43,5	---
216 to 1000	< 38	46,0	---
1828,94	50,6	63,5	12,9
2743,11	54,6	63,5	8,9
3657,51	61,0	63,5	2,5
4571,81	54,2	63,5	11,3
all other above 1 GHz	< 50	63,5	---
see measurement diagram 7 (The measuring diagram only show the frequency range up to 1 GHz.)			

4. 2.6.) Measurement in the frequency range 200 MHz to 18000 MHz
Channel 3

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB
200 to 216	< 35	43,5	---
864,1	37,5	46,0	8,5
All other between 216 to 1000	< 38	46,0	---
1829,89	50,7	63,5	12,8
2745,11	54,9	63,5	8,6
3660,14	60,9	63,5	2,6
4575,21	54,0	63,5	9,5
all other above 1 GHz	< 50	63,5	---
see measurement diagram 8 (The measuring diagram only show the frequency range up to 1 GHz.)			

4.3. Field strength in the frequency range 902 – 928 MHz

Limits according to 15.249 (a):

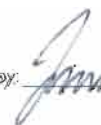
The field strength of any emissions within this band shall not exceed 50.000 microvolts/meter (94 dB μ V/m) at 3 meters.

Measurement results:

Channel 1: 90,7 dB μ V/m at 915,6 MHz

Channel 2: 90,9 dB μ V/m at 914,4 MHz

Channel 3: 91,5 dB μ V/m at 915,05 MHz



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. Antenna 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	☐	B9-DSP-IS Digital Analyzer for voltage fluctuations	NT-230
☐	Horn Antenna 500 MHz - 2900 MHz	NT-133	☐	DFT 555 - Power and harmonics analyzer	NT-231
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-134	☐	EFA-3 H-field- / E-field probe	NT-243
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-135	☐	E-field measuring instrument EMR-200; 100 kHz - 3 GHz	NT-244
☐	BiConiLog Antenna 26 MHz - 2000 MHz	NT-137	☐	E-field probe 100 kHz - 3 GHz	NT-245
☐	Conical Dipol Antenna PCD8250	NT-138	☐	Magneticfield-Sensor 300 kHz - 30 MHz	NT-246
☒	HZ-1 Antenna tripod	NT-150	☐	E-field probe 10 MHz - 18 GHz	NT-247
☐	BN 1500 Antenna tripod	NT-151	☐	H-field probe 10 MHz - 1 GHz	NT-248
☐	Ant. tripod for EN61000-4-3 Model TP1000A	NT-156	☐	ELT-400 1 Hz - 400 kHz	NT-249
☐	ESVP - Test receiver 20 - 1000 MHz	NT-201	☐	MDS 21 - Absorbing clamp 30 - 1000 MHz	NT-250

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Appendix 1 (continued)

Test equipment used

☐	FCC-2031	NT-251	☐	AS0102-65R - RF-Amplifier	NT-333
	EM Injection clamp			1 GHz - 2 GHz	
☐	FCC-2031-DCN	NT-252	☐	APA01 - RF-Amplifier	NT-334
	Ferrite decoupling network			0,5 GHz - 2,5 GHz	
☐	PR50	NT-253	☐	Preamplifier	NT-335
	Current Probe			1 GHz - 4 GHz	
☐	Model 2000	NT-261	☐	Preamplifier for GPS	NT-336
	Digital Multimeter			MKU 152 A	
☐	Fluke 97	NT-262	☐	Preamplifier	NT-337
	Digital Multimeter			100 MHz - 23 GHz	
☐	Fluke 97	NT-263	☐	DC Block 10 MHz - 18 GHz	NT-338
	Digital Multimeter			Model 8048	
☒	ESH2-Z5 Artificial mains	NT-300	☐	2-97201	NT-341
	network 4x25A			Electronic load	
☐	ESH3-Z5 Artificial mains	NT-301	☐	TSX3510P - Power supply	NT-344
	network 2x10A			0-30 V / 0 - 10 A	
☐	ESH3-Z6 Artificial mains	NT-302	☐	TSX3510P - Power supply	NT-345
	network 1x100A			0-30 V / 0 - 10 A	
☐	ESH3-Z4	NT-303	☐	VDS 200	NT-350
	T-Artificial network			Mobil-impuls-generator	
☐	PHE 4500/B	NT-304	☐	LD 200	NT-351
	Power amplifier			Mobil-impuls-generator	
☐	EZ10	NT-305	☐	MPG 200	NT-352
	T-Artificial network			Mobil-Impuls-Generators	
☐	SMG - Signal generator	NT-310	☐	EFT 200	NT-353
	0,1 - 1000 MHz			Mobil-impuls-generator	
☐	PM 5518 TXVPS	NT-311	☐	FP 16/3-1	NT-400
	Video generator			3 ph. Coupling filter (Burst)	
☐	RefRad	NT-312	☐	PHE 4500 - Mains impedance	NT-401
	Reference generator			network	
☐	SMP 02 Signal generator	NT-313	☐	FP-SURGE 32.1	NT-402
	10 MHz - 20 GHz			3 ph. Coupling filter (Surge)	
☐	40 MHz Arbitrary Generator	NT-315	☐	IP 6.2 Coupling filter for	NT-403
	T1241			data lines (Surge)	
☐	PEFT - Burst generator	NT-320	☐	ESH2-Z3 - Probe	NT-410
	up to 4 kV			9 kHz - 30 MHz	
☐	PSD - ESD generator	NT-321	☐	IP 4 - Capacitive clamp	NT-411
	up to 25 kV			(Burst)	
☐	ESD-Pistol	NT-322	☐	Highpass-Filter	NT-412
				100 MHz - 4 GHz	
☐	Vacuum-Relais	NT-323	☐	Highpass-Filter	NT-413
	up to 8 kV			600 MHz - 4 GHz	
☐	PSURGE 4.1	NT-324	☐	Highpass-Filter	NT-414
	Surge generator			1250 MHz - 4 GHz	
☐	TRANSIENT 1000	NT-325	☐	Highpass-Filter	NT-415
	Immunity test system			1800 MHz - 18 GHz	
☐	VCS 500-M6	NT-326	☐	Highpass-Filter	NT-416
	Surge-Generator			3500 MHz - 18 GHz	
☐	BTA-250 - RF-Amplifier	NT-330	☐	HV-Attenuator 54,5 dB	NT-420
	9 kHz - 220 MHz / 250 W			(Burst)	
☐	T82-50 RF-Amplifier	NT-331	☐	RF-Attenuator 20 dB	NT-421
	2 GHz - 8 GHz			0,1 - 1000 MHz / 25 W	
☒	500W1000M7 - RF-Amplifier	NT-332	☒	RF-Attenuator 10 dB	NT-422
	80 - 1000 MHz / 500 W			0,1 - 1000 MHz / 20 W	

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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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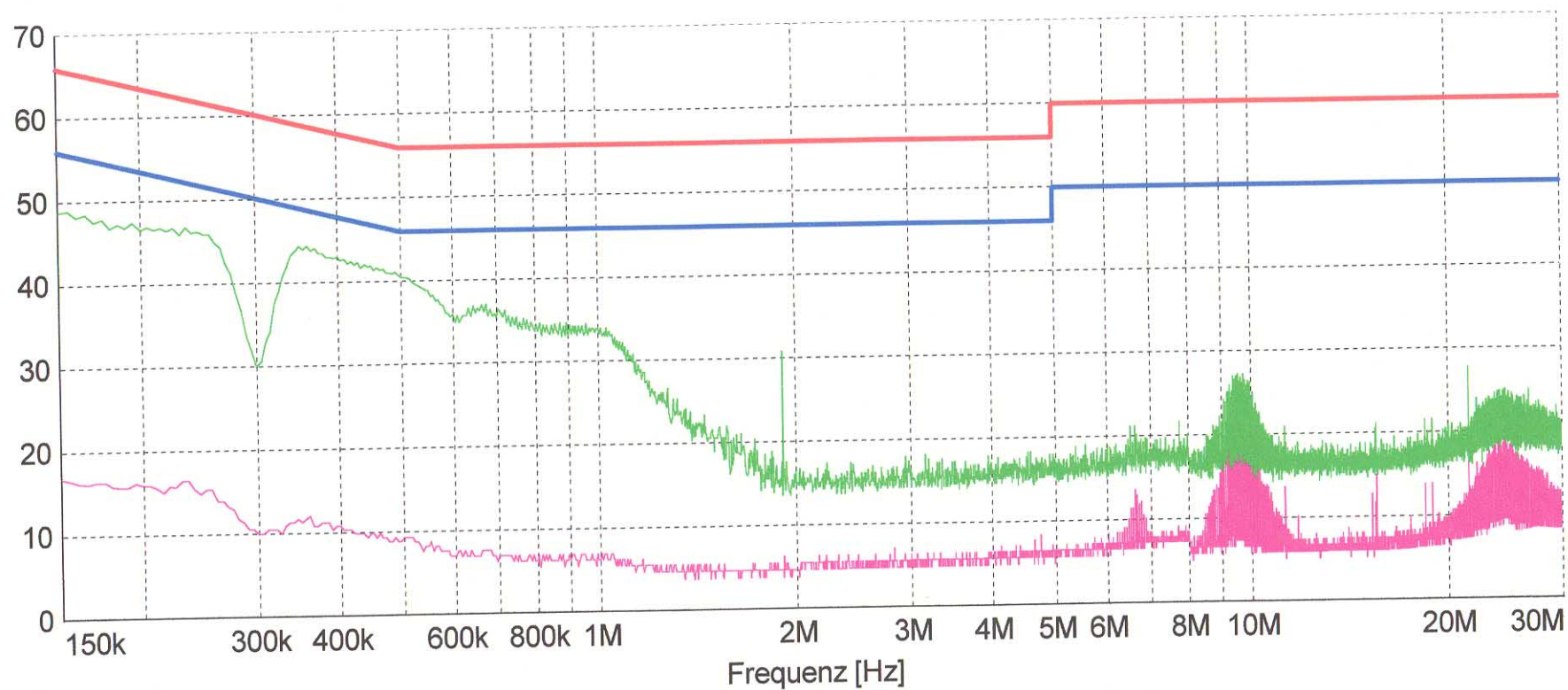
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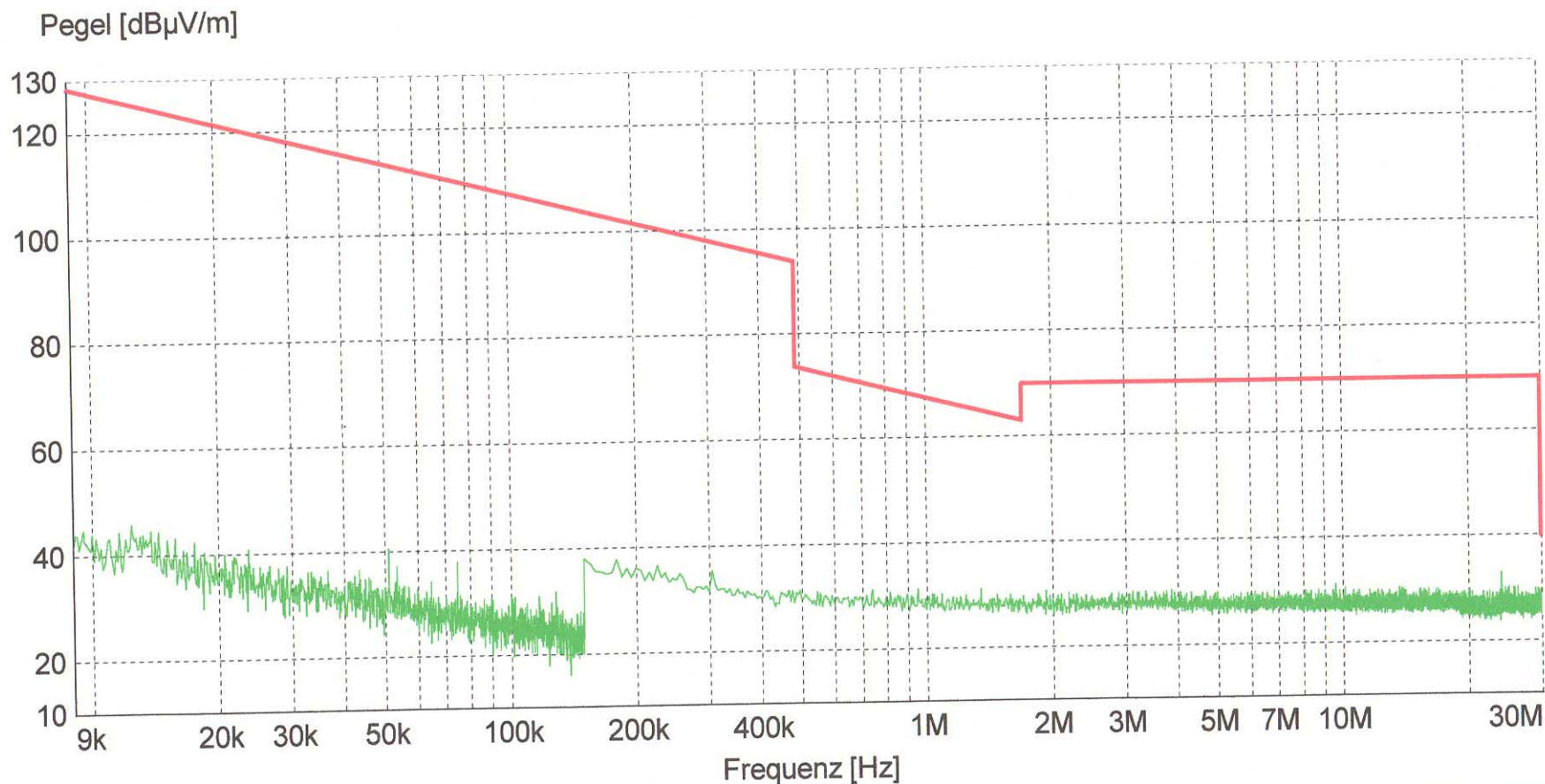
Checked by: 

Pegel [dB μ V]



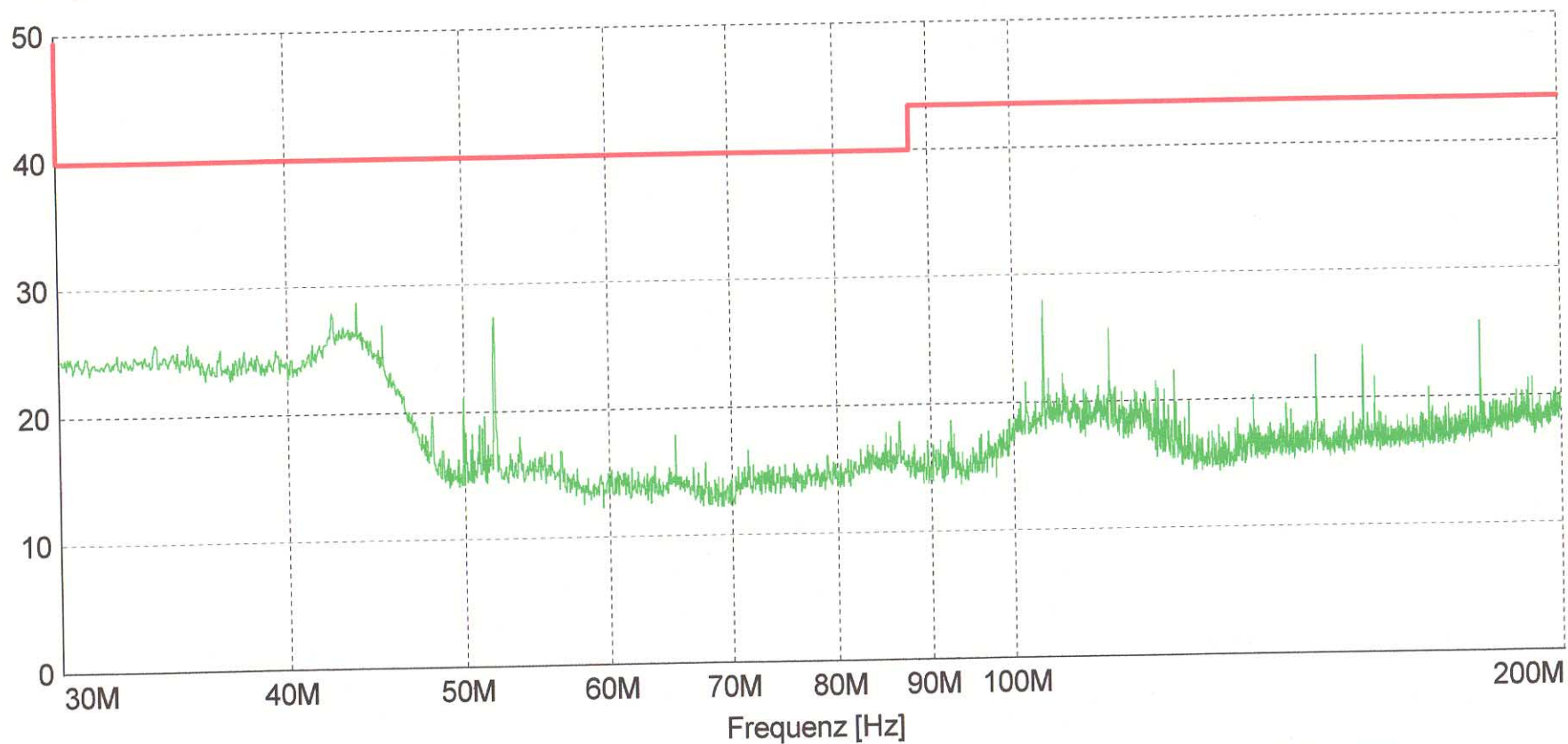
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 — MES TX999_VAC_pre AV
 — LIM EN 55022 V QP
 — LIM EN 55022 V AV

EN 55022 V QP
 EN 55022 V AV



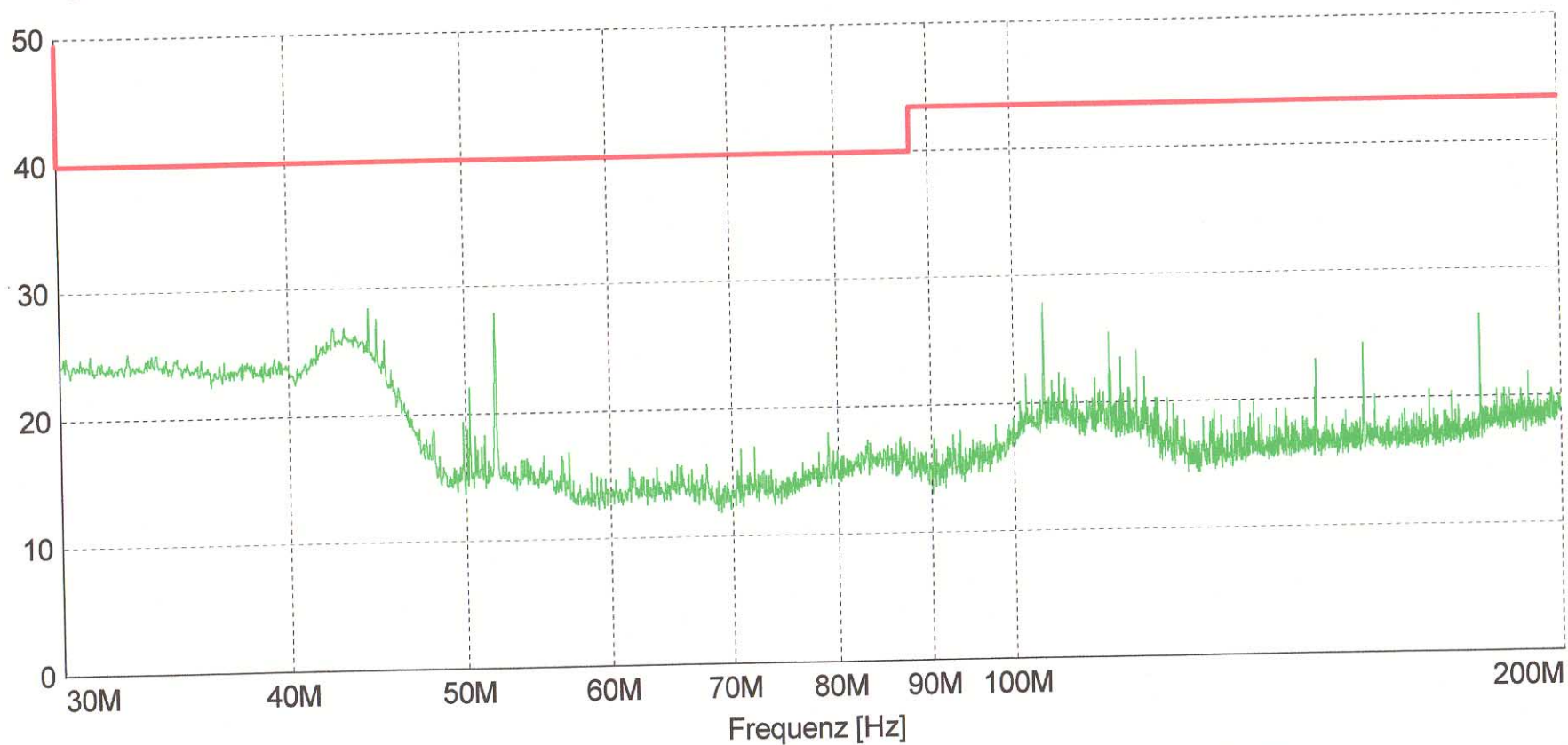
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Pegel [dB μ V/m]



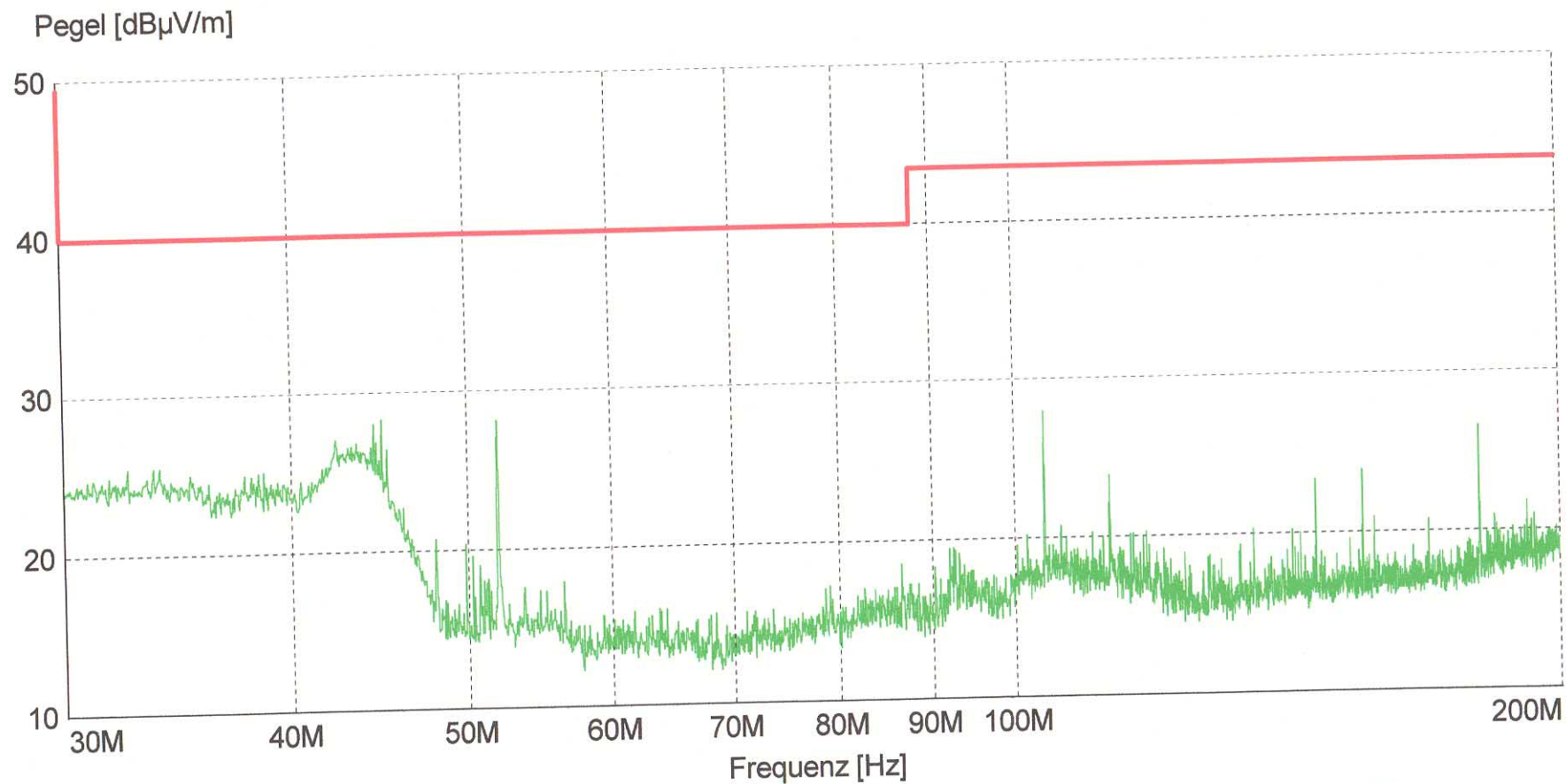
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 LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m

Pegel [dB μ V/m]



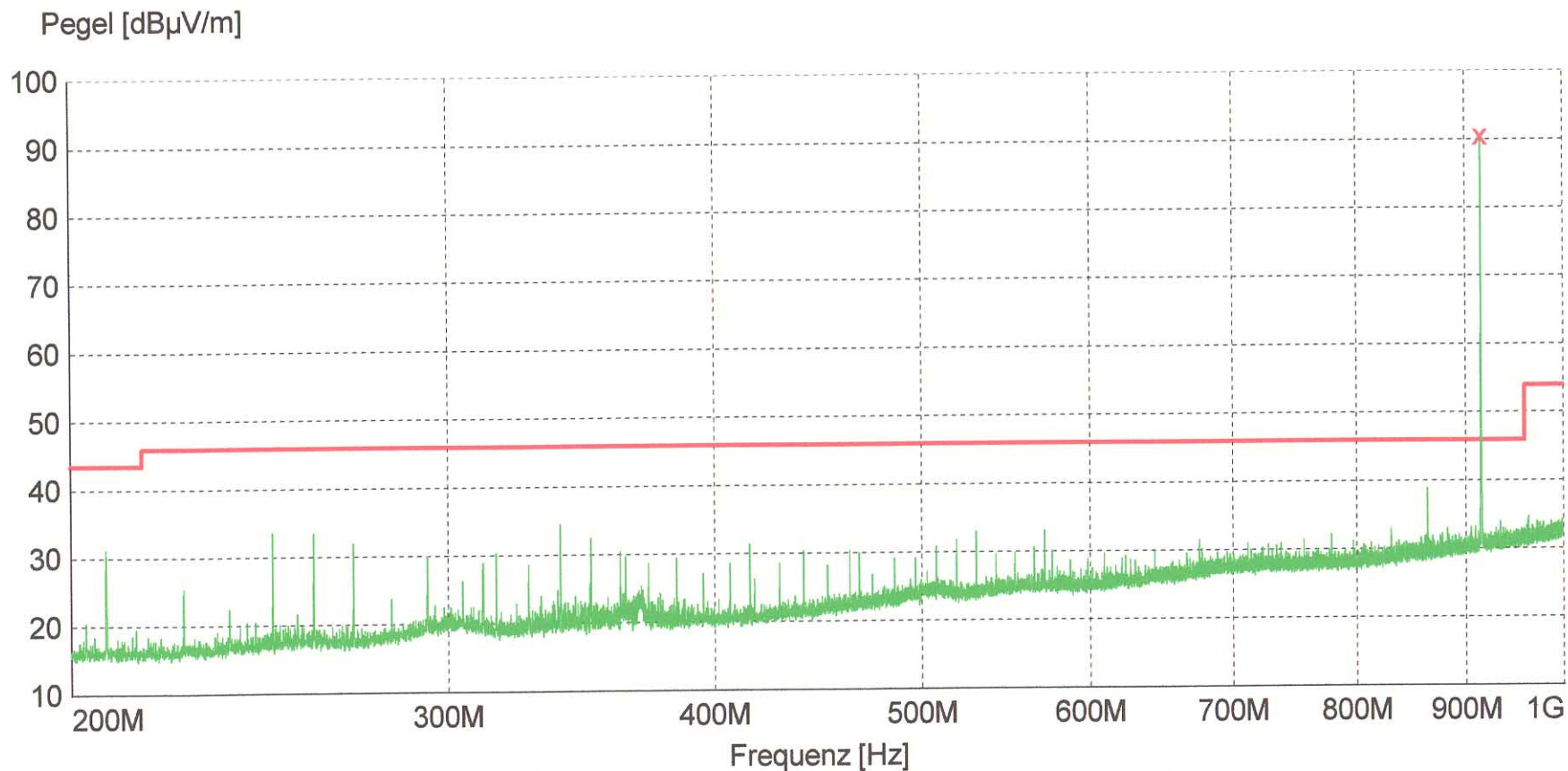
MES TX999_F12 pre PK
LIM FCC ClassB F QP/AV

FCC ClassB, field strength 3m

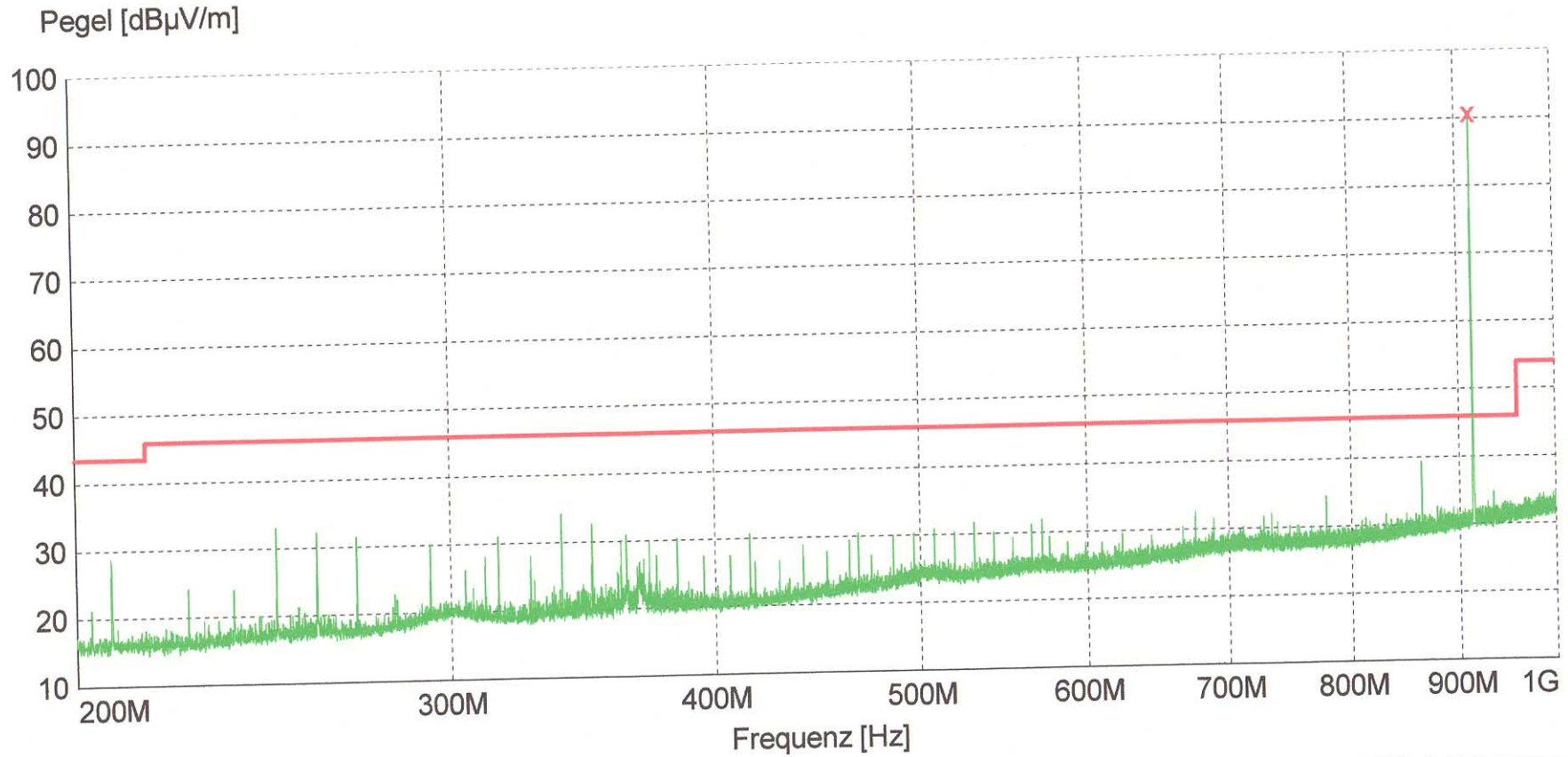


MES TX999_F13_pre PK
LIM FCC ClassB F QP/AV

FCC ClassB, field strength 3m

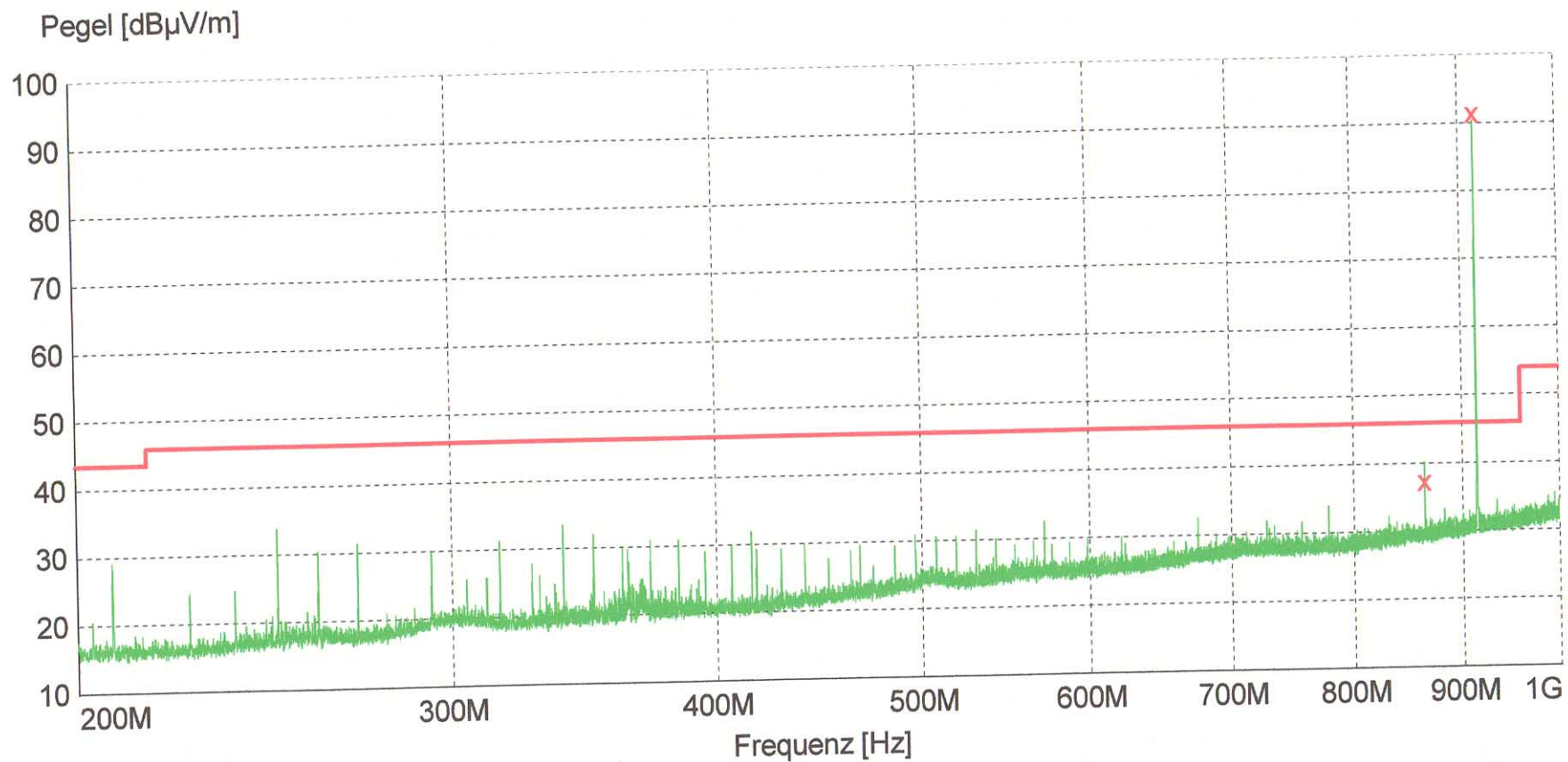


x x : MES TX999_F2_fin QP
 — MES TX999_F2_pre PK
 — LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m



x x : MES TX999_F22_fin QP
 — MES TX999_F22_pre PK
 — LIM FCC ClassB F QP/AV

FCC ClassB, field strength 3m



x x : MES TX999_F23_fin QP
 — MES TX999_F23_pre PK
 — LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m