

TEST REPORT
of the accredited test laboratory

TÜV Nr.:M/EMV-05/104

about
the following EMC - test/- research

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

Product: Keycard Return Machine
KC 370i AUT2

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

Prüfzentrum Wien
A-1230 Wien
Deutschstraße 10

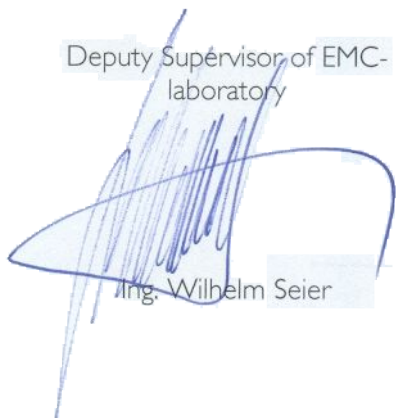
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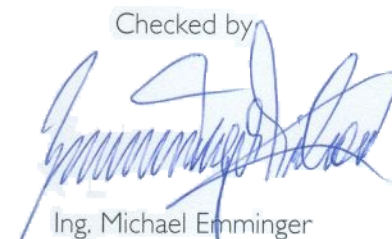
TÜV Österreich
Test laboratory for EMC

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.

DVR 0047 333
UID ATU 37086005

Contents

	Designation	page
1.	Applicant	3
2.	Description of EUT	4
3.	Standards / Final result	5
4.	Test results	
4.1.	Conducted emission (15.109); (6.6.)	6-8
4.2.	Radiated emission (15.209); (6.2.1.)	9-11
4.3.	Operation within the band 13,110 – 14,010 MHz 15.225 (a+b+c+d+e); 6.2.2. (e)	12-13
Appendix	Designation	pages
1	Test equipment used	3
2	Photodocumentation	21
3	Measurement diagrams	10

1. Applicant

Company SKIDATA AG

Department

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

Contact person Mr. Sonderegger

EUT received on 14.09.2004

Tests were performed on 14.09. – 17.09.2004

2. Description of EUT

EUT	Keycard Return Machine KC 370i AUT2
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
continuous and modulated carrier at 13,56 MHz	Measurement diagram 1
continuous and modulated carrier at 122,9 kHz	Measurement diagram 2

Test result:

4. 1.1.) Measurement with QP-Detector

continuous and modulated carrier at 13,56 MHz

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed- Mark	Phase	PE
0,65	45,9	56	10,1		L	GND
0,975	46,5	56	9,5		N	GND
13,56	57,7	60	2,3		L	GND

4. 1.2.) Measurement with AV-Detector

continuous and modulated carrier at 13,56 MHz

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed- Mark	Phase	PE
0,18	51,7	54,5	2,8		L	GND
0,52	43	46	3		L	GND
0,65	43,9	46	2,1		L	GND
0,715	42,9	46	3,1		L	GND
0,78	42,6	46	3,4		L	GND
0,935	41,1	46	4,9		N	GND
0,975	42	46	4		L	GND
1,17	42	46	4		N	GND
13,56	56,8	50	-6,8	**	L	GND
25,81	46,2	50	3,8		L	GND

** This part of emission is covered by 15.225 (a) and 6.2.2.(e)

4. 1.3.) Measurement with QP-Detector

continuous and modulated carrier at 122,9 kHz

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Exceed- Mark	Phase	PE
0,525	45		11		L	GND
0,655	46,6		9,4		L	GND
0,72	45,9		10,1		L	GND
0,935	45,7		10,3		N	GND
0,975	45,4		10,6		L	GND
1,18	45,2		10,8		L	GND

4. 1.4.) Measurement with AV-Detector

continuous and modulated carrier at 122,9 kHz

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Exceed- Mark	Phase	PE
0,18	52,5	54,5	2		L	GND
0,525	43,1	46	2,9		L	GND
0,655	44,8	46	1,2		L	GND
0,72	44	46	2		L	GND
0,785	43,4	46	2,6		L	GND
0,935	45,3	46	0,7		L	GND
0,975	44,9	46	1,1		L	GND
1,015	41,2	46	4,8		N	GND
1,18	42,3	46	3,7		L	GND
1,245	41,6	46	4,4		N	GND

4. 2. Radiated emission

Limits according to 15.209 and 6.2.1.

Frequency range	Detector Quasi Peak	
	Limit	Measurement distance
0,009 – 0,490 MHz	2400µV / f(kHz)	300 m
0,490 – 1,705 MHz	24000µV / 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 3-6
continuous and modulated carrier at 13,56 MHz	Measurement diagram 7-10

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 dBµV/m	Limit dBµV/m	Margin dB	Exceed- Mark	Height cm	Azimuth deg	Polarization
122,9	44,8	105,8	61		100	0	Vertical

4. 2.2.) Measurement in the frequency range 30 MHz to 18000 MHz

continuous and modulated carrier at 122,9 kHz

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Exceed- Mark	Height cm	Azimuth deg	Polarization
66,6	31,6	40	8,4		111	332	vertical
100,55	32,9	43,5	10,6		100	197	vertical
149,85	37,9	43,5	5,6		177	48	horizontal
172,05	33,4	43,5	10,1		175	87	horizontal
174,8	33,4	43,5	10,1		119	105	horizontal
221,2	41,1	46	4,9		110	255	horizontal
299,65	40,3	46	5,7		100	358	horizontal
349,6	40,8	46	5,2		109	3	vertical
399,55	40,8	46	5,2		100	344	vertical
501,35	37,5	46	8,5		108	358	vertical
699,1	37,6	46	8,4		156	358	vertical

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

continuous and modulated carrier at 13,56 MHz

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

4. 2.4.) Measurement in the frequency range 30 MHz to 18000 MHz

continuous and modulated carrier at 13,56 MHz

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed- Mark	Height cm	Azimuth deg	Polarization
67	32,2	40	7,8		100	358	vertical
100,55	31,3	43,5	12,2		100	197	vertical
149,85	35,6	43,5	7,9		135	44	horizontal
221,2	42,1	46	3,9		106	238	horizontal
299,65	38,1	46	7,9		100	358	horizontal
349,6	38,8	46	7,2		115	8	vertical
399,55	37,7	46	8,3		100	348	vertical
442,4	36,9	46	9,1		389	267	horizontal
501,35	38,5	46	7,5		112	357	vertical

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 39,9 dB μ V/m. Extrapolated with 40 dB per decade to 30 meters distance it would be -0,1 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 39,9 dB μ V/m. Extrapolated with 40 dB per decade to 30 meters distance it would be -0,1 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	< 45	90,5
13,567 – 13,710	< 45	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	< 45	80,5
13,710 – 14,010	< 45	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 ov -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	☐	ESVP - Test receiver 20 - 1000 MHz	NT-201
☒	MA 240 - Antenna mast 1 - 4 m height	NT-110	☐	ESPC - Test receiver 9 kHz - 2,5 GHz	NT-203
☒	DS 412 - Turntable 0 - 400 ° Azimuth	NT-111	☒	ESI26 - Test receiver 20 Hz - 26,5 GHz	NT-207
☒	HD 100 Controller Mast+Turntable	NT-112	☐	Digital Radio Tester CTS55	NT-208
☐	HUF-Z2 - Bicon. Antennna 20 - 300 MHz	NT-120	☐	Noise-gen., ITU-R 559-2 20 Hz - 20 kHz	NT-209
☐	HUF-Z3 - Log. Per. Antenna 200 - 1000 MHz	NT-121	☐	CMTA - Radiocommunication analyzer ; 0,1 - 1000 MHz	NT-210
☐	HFH-Z2 - Loop Antenna. 9 kHz - 30 MHz	NT-122	☐	3271 - Spectrum analyzer 100 Hz - 26,5 GHz	NT-211
☐	HFH-Z6 - Rod Antenna 9 kHz - 30 MHz	NT-123	☐	Radiocommunicationanalyzer Marconi 2945A	NT-212
☐	3121C - Dipole Antenna 28 - 1000 MHz	NT-124	☐	2855S - Communication analyzer	NT-213
☒	3115 - Horn Antenna 1 - 18 GHz	NT-125	☐	Mixer M28HW 26,5 GHz - 40 GHz	NT-214
☐	3116 - Horn Antenna 18 - 40 GHz	NT-126	☐	Diode Detector 0,01 GHz - 26,5 GHz	NT-215
☐	SAS-200/543 - Bicon. Ant. 20 MHz - 300 MHz	NT-127	☐	RubiSource T&M Timing reference	NT-216
☐	AT-1080 - Log. Per. Ant. 80 - 1000 MHz	NT-128	☐	Radiocommunicationanalyzer SWR 1180 MD	NT-217
☒	HK-116 - bicon. Ant. 20 MHz - 300 MHz	NT-129	☐	Mixer M19HWD 40 GHz - 60 GHz	NT-218
☐	HK-116 - bicon. Ant. 20 MHz - 300 MHz	NT-130	☐	Mixer M12HWD 60 GHz - 90 GHz	NT-219
☒	3146 - Log. Per. Ant. 200 - 1000MHz	NT-131	☐	TDS - 540 DSO Digital scope	NT-220
☒	Loop Antenna H-Field	NT-132	☐	PM97 Scopemeter	NT-221
☐	Horn Antenna 500 MHz - 2900 MHz	NT-133	☐	TPS 2014 Digital scope	NT-222
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-134	☐	B10 - Harmonics and flicker analyzer	NT-231
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-135	☐	EFA-3 H-field- / E-field probe	NT-243
☐	BiConiLog Antenna 26 MHz - 2000 MHz	NT-137	☐	E-field measuring instrument EMR-200; 100 kHz - 3 GHz	NT-244
☐	Conical Dipol Antenna PCD8250	NT-138	☐	E-field probe 100 kHz - 3 GHz	NT-245
☐	HZ-1 Antenna tripod	NT-150	☐	Magneticfield-Sensor 300 kHz - 30 MHz	NT-246
☒	BN 1500 Antenna tripod	NT-151	☐	E-field probe 10 MHz - 18 GHz	NT-247
☐	Ant. tripod for EN61000-4-3 Model TP1000A	NT-156	☐	H-field probe 10 MHz - 1 GHz	NT-248
☒	Spectrumanalyzer - FSP7 9 kHz - 7 GHz	NT-200	☐	ELT-400 1 Hz - 400 kHz	NT-249

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Department: EMV

Test report number:
M/EMV-05/104

Page: 1 of 3

Date: 13.01.2005

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Appendix 1 (continued)

Test equipment used

- ☐ IDS 21 - Absorbing clamp
10 - 1000 MHz
- ☐ CC-203I
IM Injection clamp
- ☐ CC-203I-DCN
Ferrite decoupling network
- ☐ PR50
Current Probe
- ☐ PR630
Current Probe
- ☐ Model 2000
Digital Multimeter
- ☐ Fluke 97
Digital Multimeter
- ☐ Fluke 97
Digital Multimeter
- ☒ SH2-Z5 Artificial mains
network 4x25A
SH3-Z5 Artificial mains
network 2x10A
SH3-Z6 Artificial mains
network 1x100A
SH3-Z4
Γ-Artificial network
PHE 4500/B
Power amplifier
EZ10
Γ-Artificial network
iMG - Signal generator
0,1 - 1000 MHz
PM 5518 TXVPS
Video generator
RefRad
Reference generator
iMP 02 Signal generator
10 MHz - 20 GHz
10 MHz Arbitrary Generator
11241
PEFT - Burst generator
up to 4 kV
iSD 30 System
up to 25 kV
SURGE 4.1
Surge generator
TRANSIENT 1000
Immunity test system
CS 500-M6
Surge-Generator
TA-250 - RF-Amplifier
kHz - 220 MHz / 250 W
82-50 RF-Amplifier
GHz - 8 GHz

- 500W1000M7 - RF-Amplifier
80 - 1000 MHz / 500 W
- AS0102-65R - RF-Amplifier
1 GHz - 2 GHz
- APA01 - RF-Amplifier
0,5 GHz - 2,5 GHz
- Preamplifier
1 GHz - 4 GHz
- Preamplifier for GPS
MKU 152 A
- Preamplifier
100 MHz - 23 GHz
- DC Block 10 MHz - 18 GHz
Model 8048
- 2-97201
Electronic load
- TSX3510P - Power supply
0-30 V / 0 - 10 A
- TSX3510P - Power supply
0-30 V / 0 - 10 A
- VDS 200
Mobil-impuls-generator
- LD 200
Mobil-impuls-generator
- MPG 200
Mobil-Impuls-Generators
- EFT 200
Mobil-impuls-generator
- FP 16/3-1
3 ph. Coupling filter (Burst)
- PHE 4500 - Mains impedance
network
- IP 6.2 Coupling filter for
data lines (Surge)
- ESH2-Z3 - Probe
9 kHz - 30 MHz
- IP 4 - Capacitive clamp
(Burst)
- Highpass-Filter
100 MHz - 4 GHz
- Highpass-Filter
600 MHz - 4 GHz
- Highpass-Filter
1250 MHz - 4 GHz
- Highpass-Filter
1800 MHz - 18 GHz
- Highpass-Filter
3500 MHz - 18 GHz
- HV-Attenuator 54,5 dB
(Burst)
- RF-Attenuator 20 dB
0,1 - 1000 MHz / 25 W

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Department: EMV

Test report number:
M/EMV-05/104

Page: 2 of 3

Date: 13.01.2005

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Appendix 1 (continued)

Test equipment used

☐	RF-Attenuator 10 dB 0,1 - 1000 MHz / 20 W	NT-422	☐	FCC-801-T4 Coupling decoupling network	NT-463
☐	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 P4 3 GHz 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 Intel Centrino 1600 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 Version 1.71 Test software	NT-520
☐	WRU 27 - Band blocking 27 MHz	NT-430	☐	SPS-PHE Test software V2.32 voltage fluctuations/harmonics	NT-525
☐	WHJ450C9 AA - High pass 450 MHz	NT-431	☐	SPS-EM Test software V2.32 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 104PF	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 +130°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			

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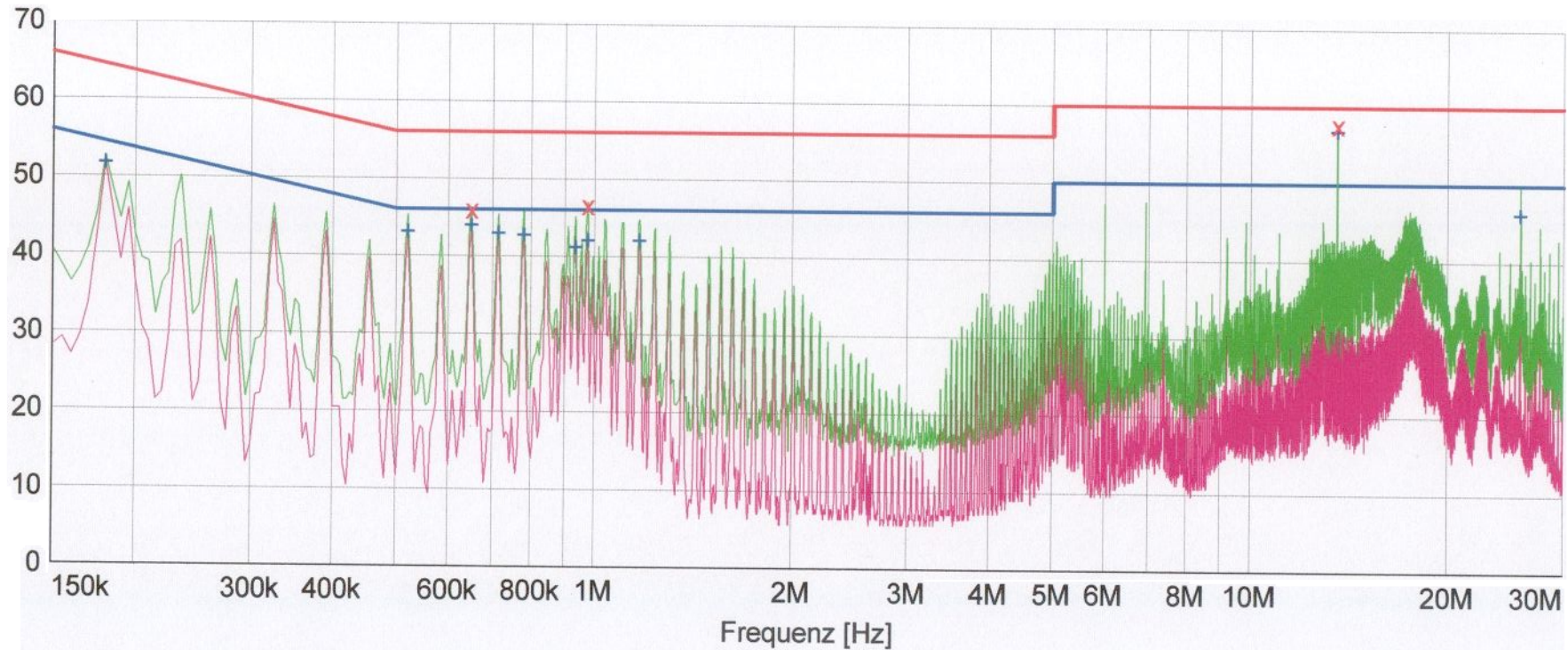
Test report number:
M/EMV-05/104

Page: 3 of 3

Date: 13.01.2005

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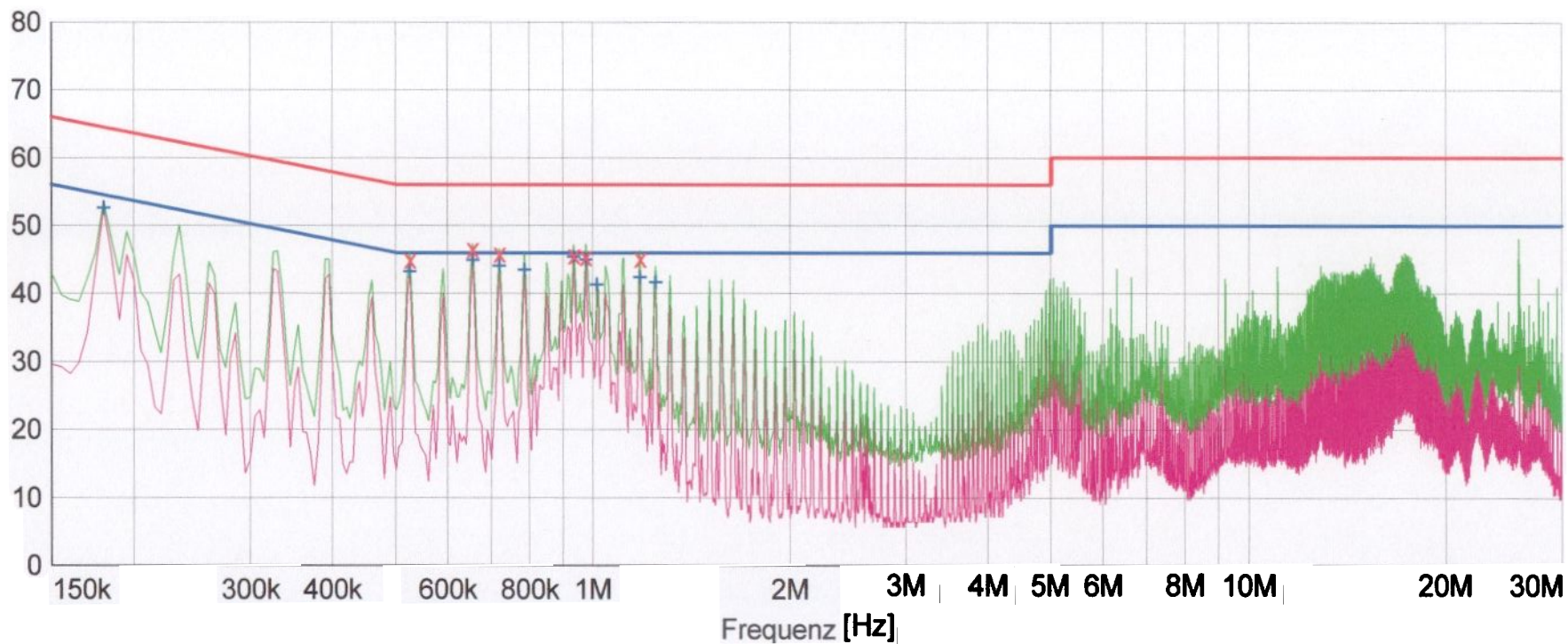
Pegel [dBµV]



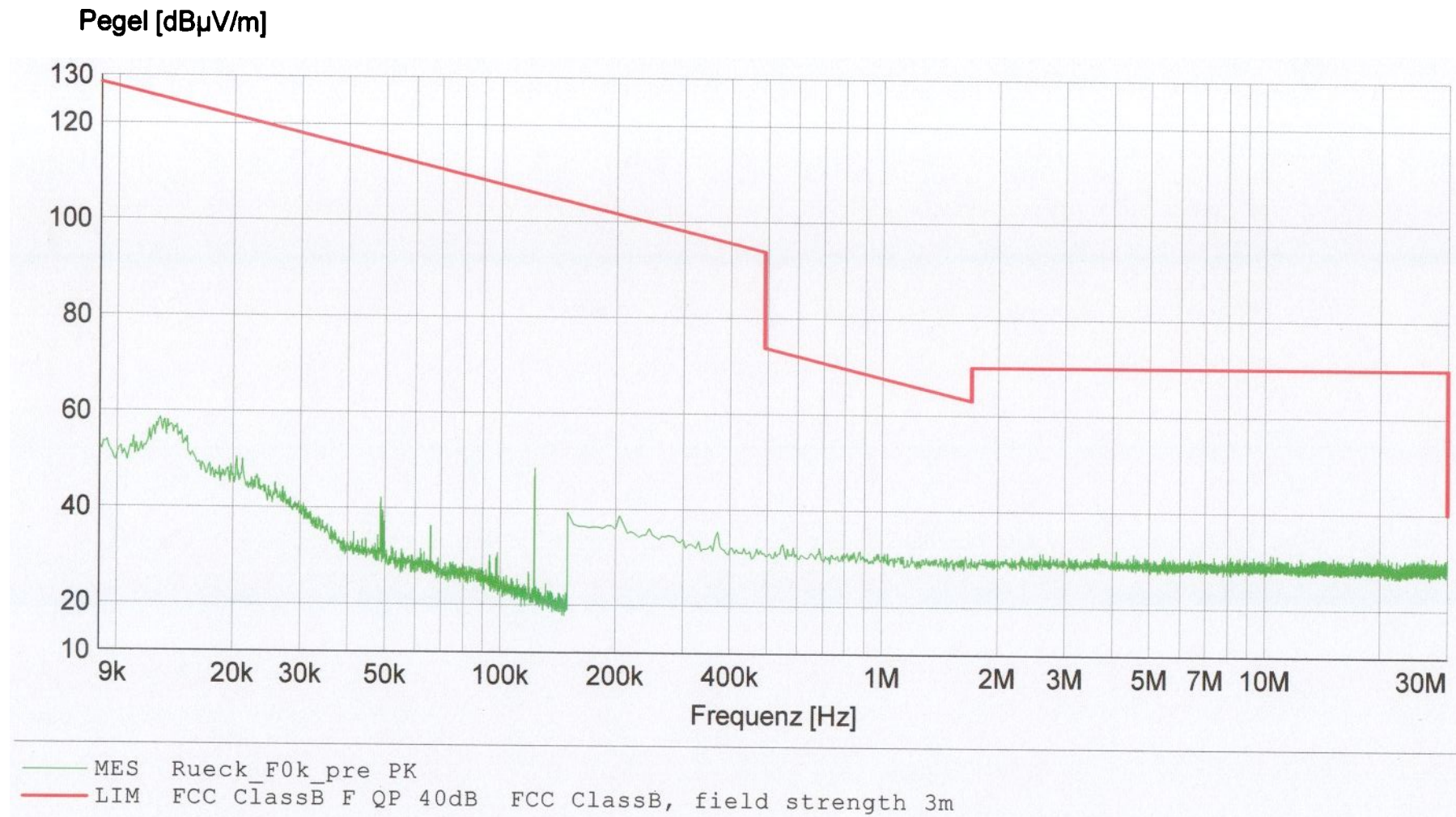
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+	+	+	MES	Rueck_AC1_fin	AV
			MES	Rueck_AC1_pre	PK
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			LIM	EN 55022 V	QP
			LIM	EN 55022 V	AV

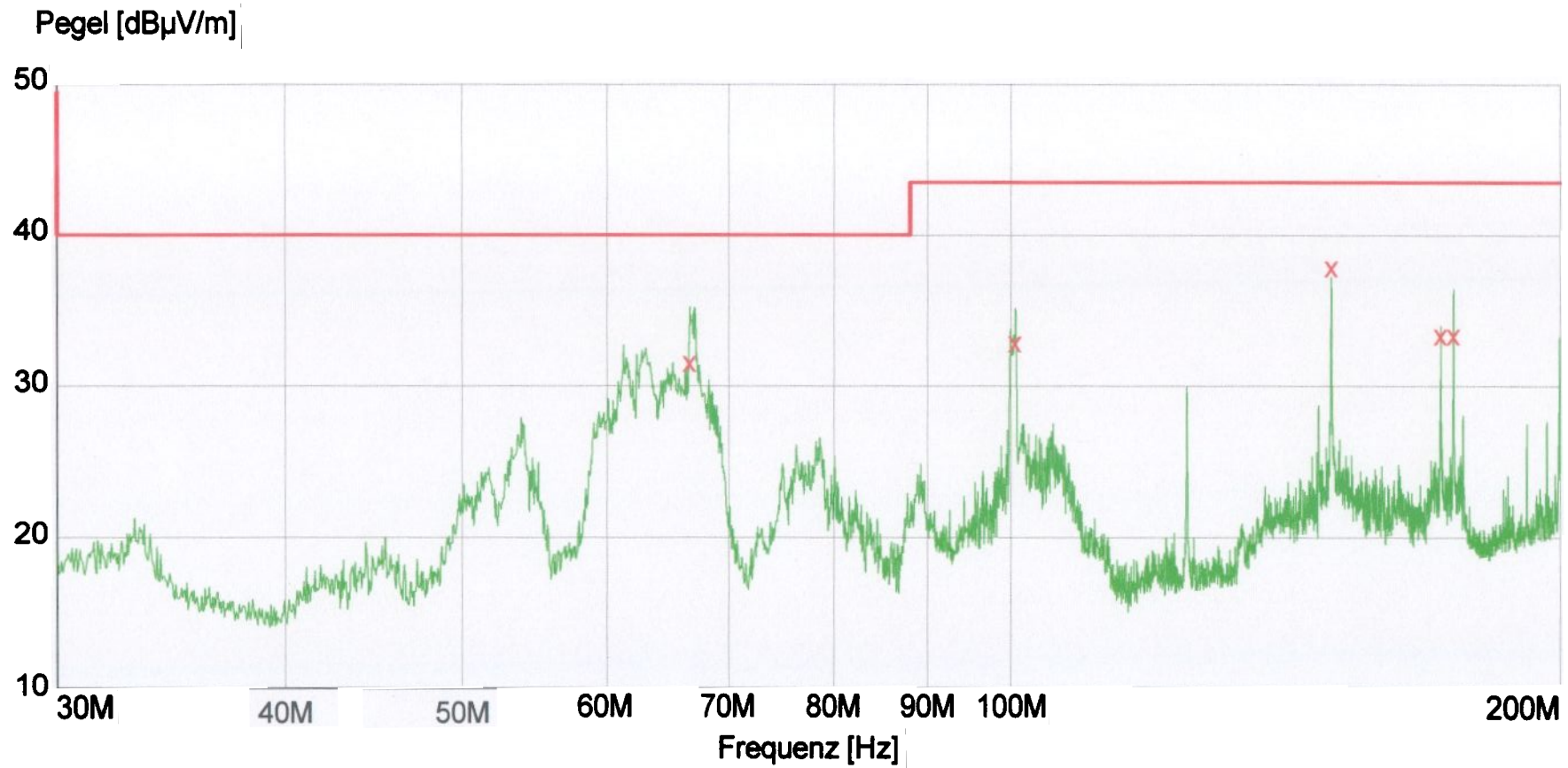
EN 55022 V QP
 EN 55022 V AV

Pegel [dB μ V]



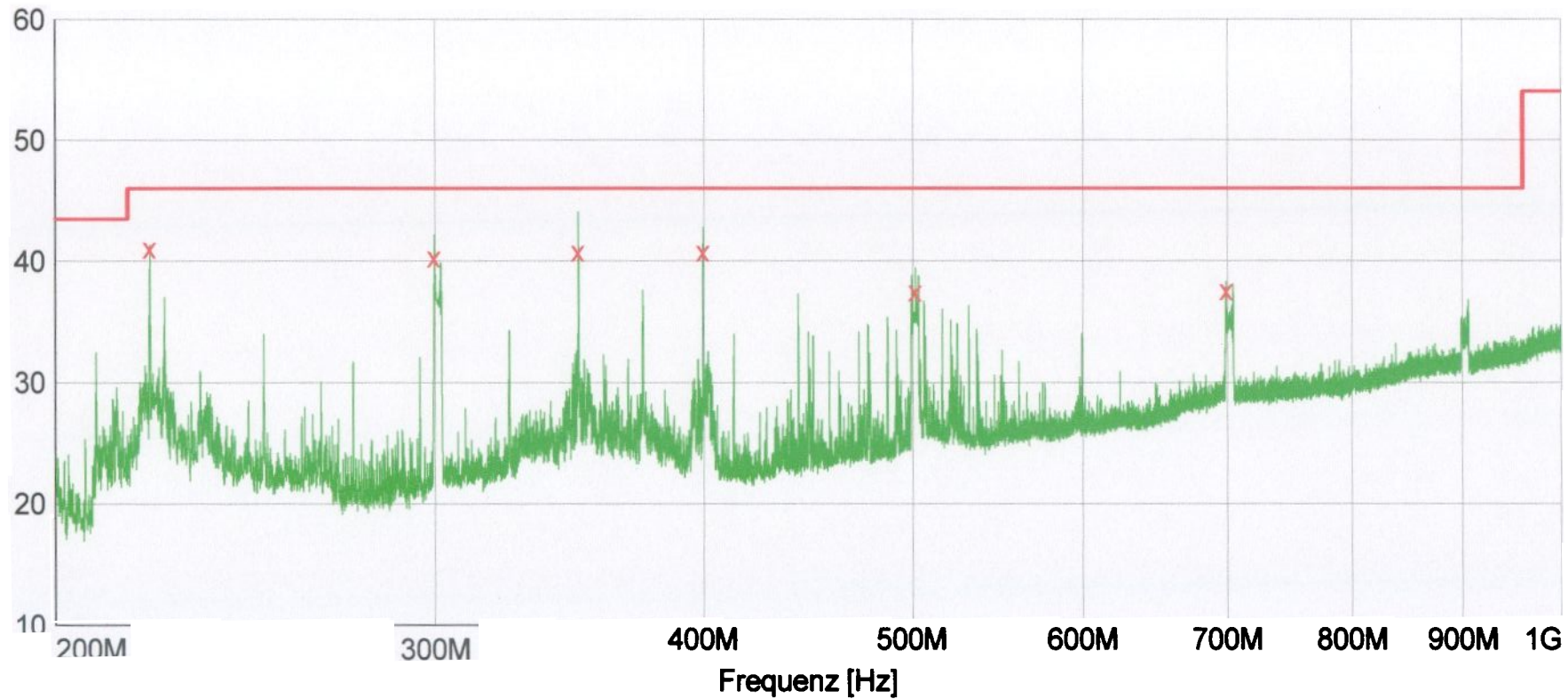
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+ + +	MES	Rueck_AC2_fin	AV	
— —	MES	Rueck_AC2_pre	PK	
— —	MES	Rueck_AC2_pre	AV	
— —	LIM	EN 55022 V	QP	EN 55022 V QP
— —	LIM	EN 55022 V	AV	EN 55022 V AV





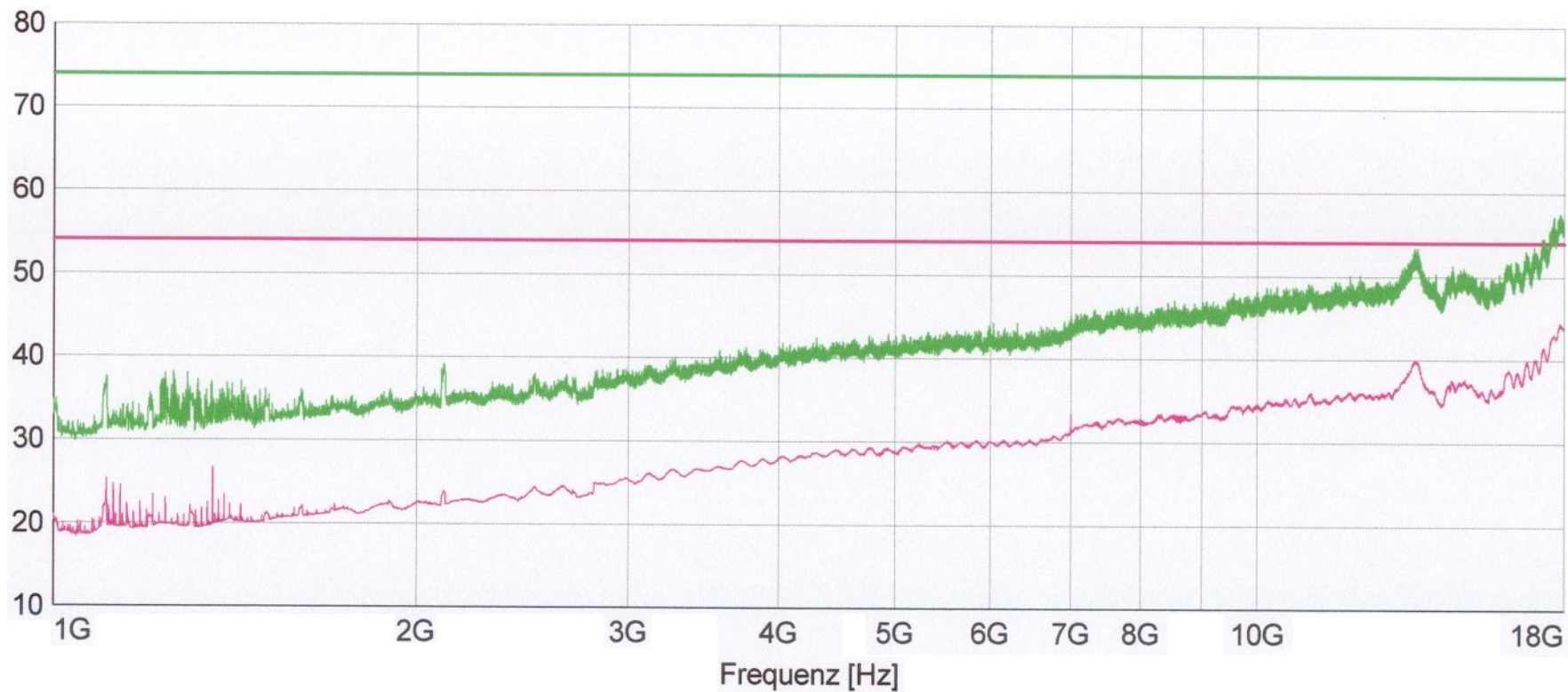
x x :MES Rueck_Flk_fin QP
 - - - - - MES Rueck_Flk_pre PK
 ——— LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m

Pegel [dB μ V/m]

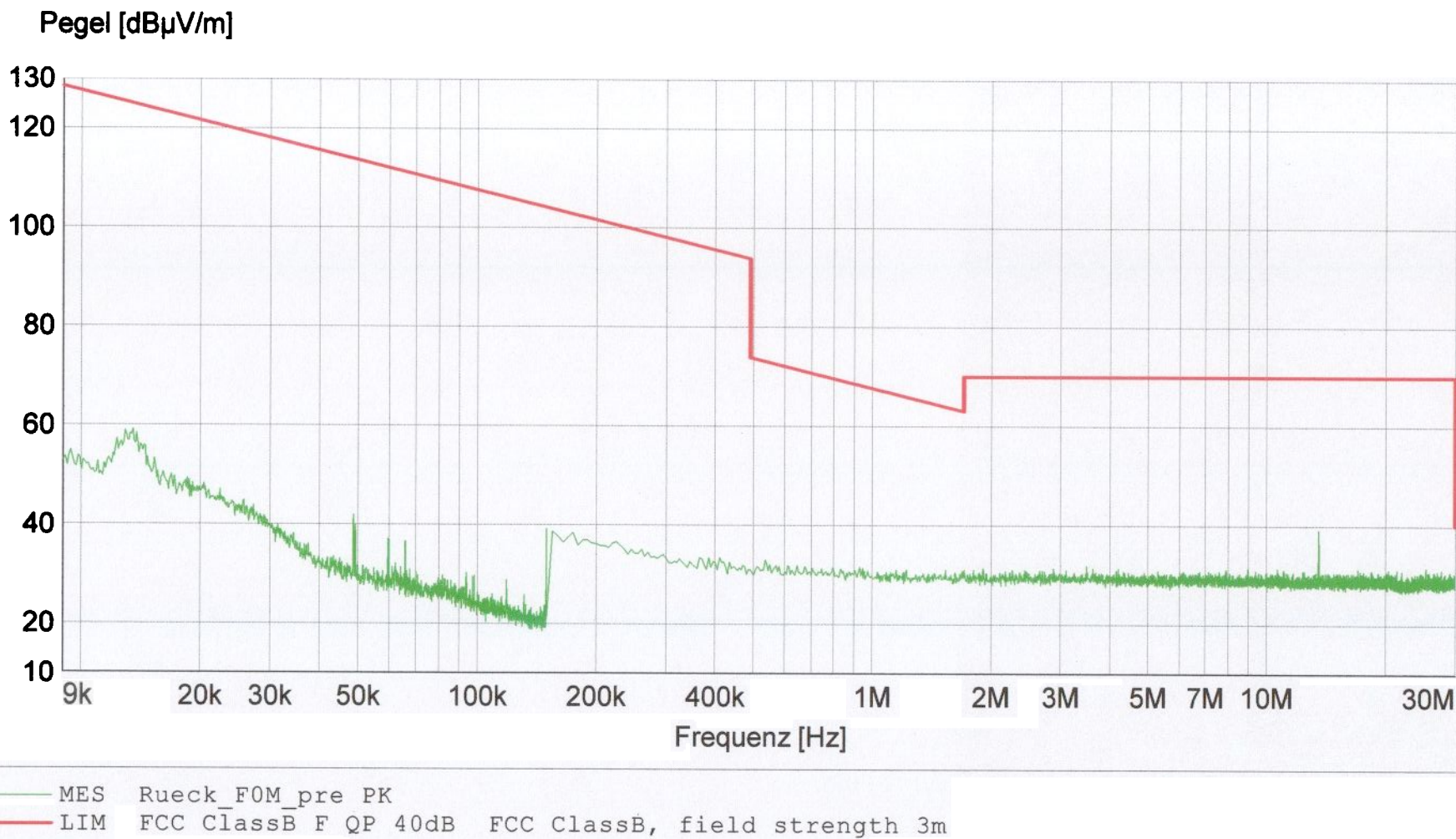


x x :MES Rueck_F2k_fin QP
 — MES Rueck_F2k_pre PK
 — LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m

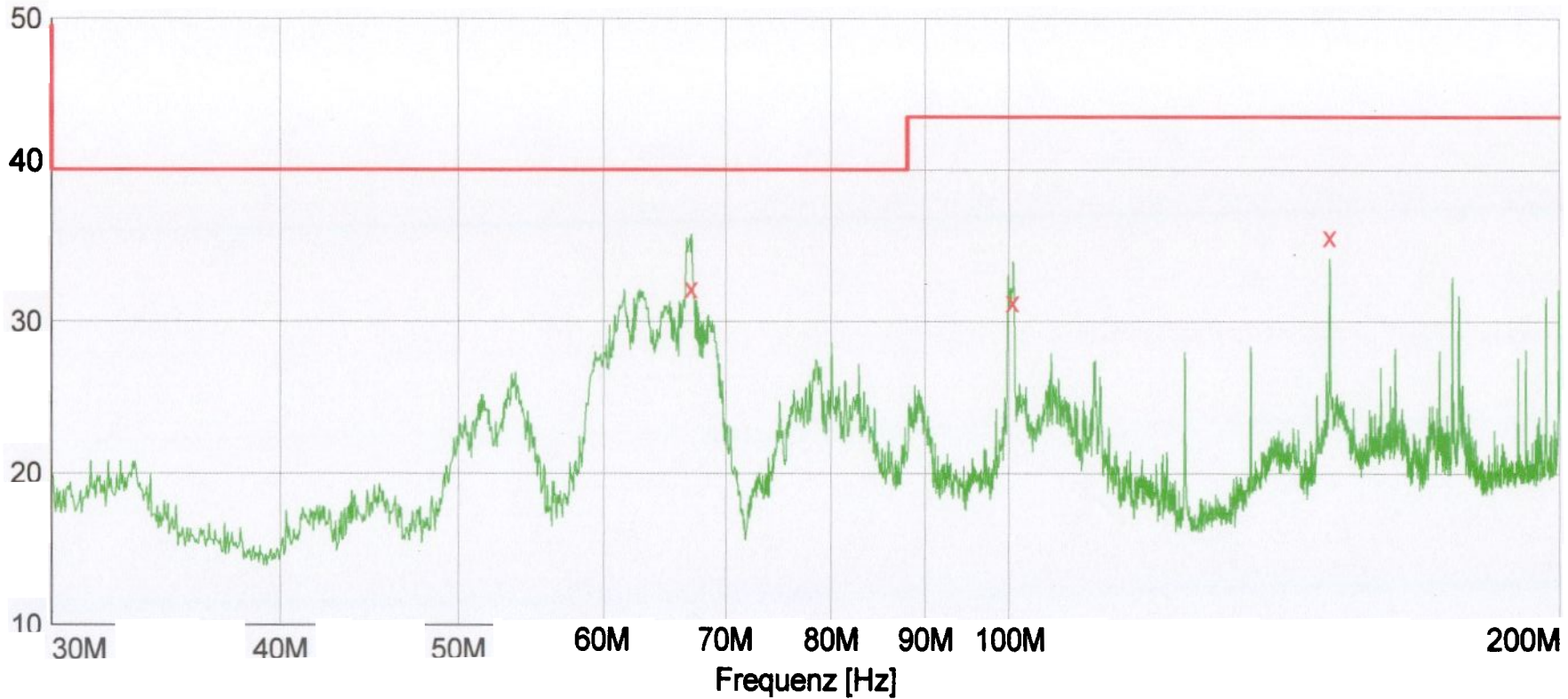
Pegel [dB μ V/m]



—	MES	Rueck_F3k_pre PK	
—	MES	Rueck_F3k_pre AV	
—	LIM	FCC ClassB F QP/AV	FCC ClassB, field strength 3m
—	LIM	FCC ClassB F PK	FCC ClassB, field strength 3m



Pegel [dB μ V/m]

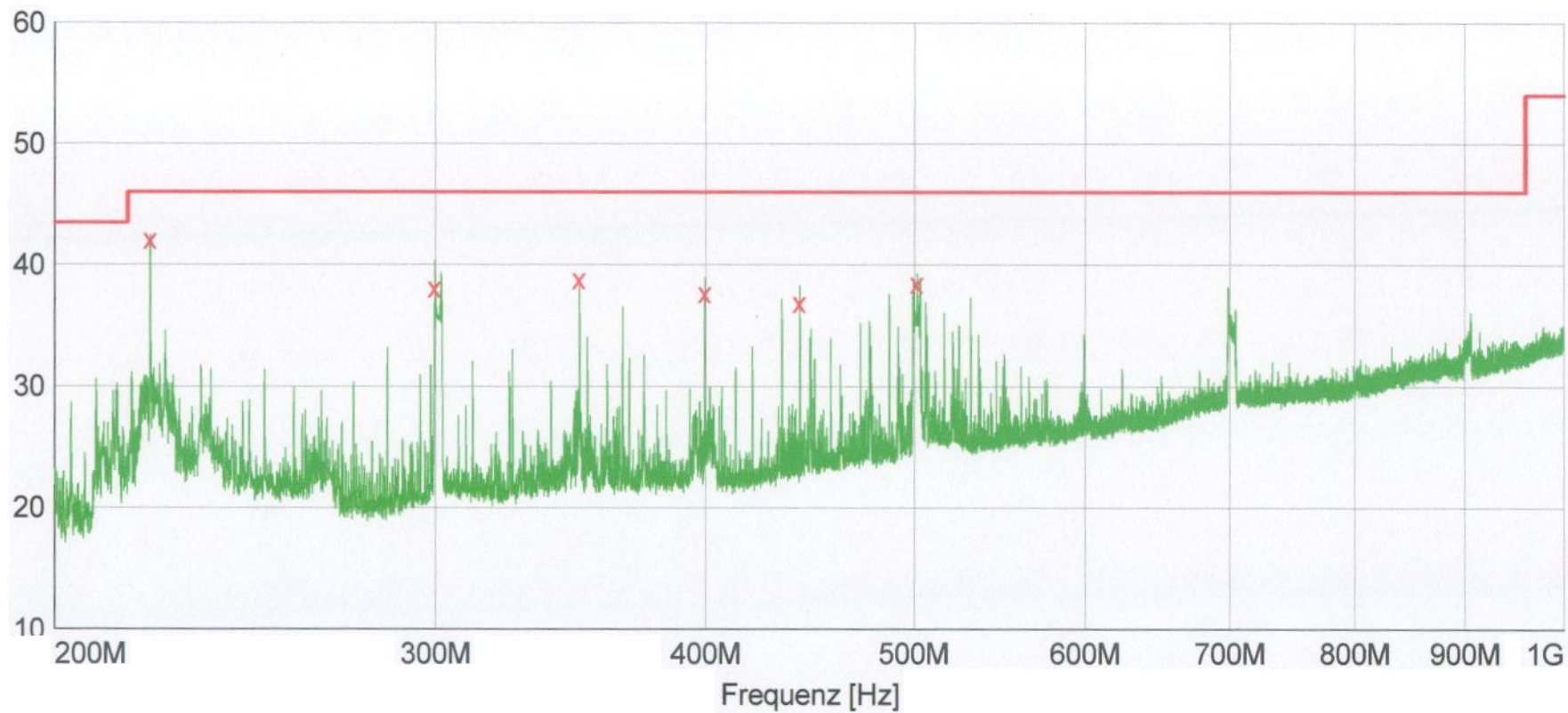


x x :MES Rueck_FlM_fin QP

— MES Rueck_FlM_pre PK

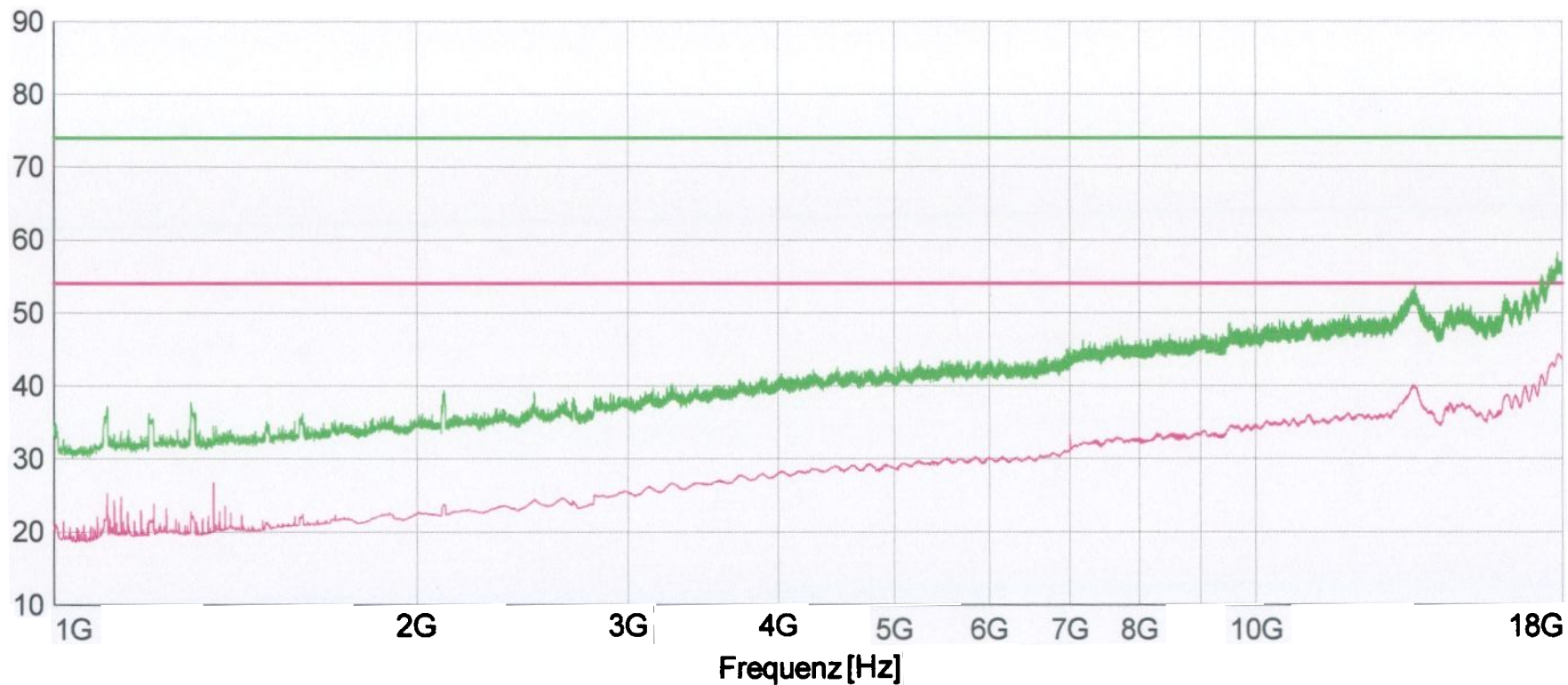
— LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m

Pegel [dB μ V/m]



x x :MES Rueck_F2M_fin QP
 — MES Rueck_F2M_pre PK
 — LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m

Pegel [dB μ V/m]



—	MES	Rueck_F3M_pre PK	
—	MES	Rueck_F3M_pre AV	
—	LIM	FCC ClassB F QP/AV	FCC ClassB, field strength 3m
—	LIM	FCC ClassB F PK	FCC ClassB, field strength 3m