

TEST REPORT
of the accredited test laboratory

TÜV Nr.: M/EMV-03/138

about
the following EMC - test/- research

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

Product: Keyterminal; ASx70KT

Serial Number: D022902597

Standard: 47 CFR Ch. I Part 15

Division Medical
Technology/
Communication
Technology/ EMC

Testing Body for
Communication
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2. 4. 2003

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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)	6-8
4.2.	Radiated emission (15.109)	9-11
4.3.	Radiated emission (15.209)	12-15
4.4.	Field strength at 13,56 MHz (15.225 (a))	16
4.5.	Frequency variation at extreme test conditions (15.225 (c))	17
Appendix	Designation	pages
1	Test equipment used	3
2	Photodocumentation	17
3	Measurement diagrams	6

1. Applicant

Company Skidata AG

Department

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

Contact person Mr. Christoph Sonderegger

EUT received on 12th December 2002

Tests were performed on 12th March 2003

2. Description of EUT

EUT	Keyterminal; ASx70KT
Serial Number	D022902597
Manufacturer	Skidata AG A-5083 Gartenau - St. Leonhard; Untersbergstraße 40
Description	Skidata AG provided the following configuration for the measurements: Serial production model
Operating mode	The measurements were carried out at the following running states: Transmit mode without charging and data cable, because the transmitters shall not be able to be operated, when the cable is connected, this must be ensured in the serial production; Charging mode , without operating transmitters

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	
	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
Charging mode	Measurement diagram 1

Test result:

4. 1.1.) Measurement with QP-Detector

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

4. 1.2.) Measurement with AV-Detector

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

4. 2. Radiated emission

Limits according to 15.109

Frequency range	Detector Quasi Peak	
	Limit	Measurement distance
30 – 88 MHz	100	3 m
88 – 216 MHz	150	3 m
216 – 960 MHz	200	3 m
Above 960 MHz	500	3 m

Operating mode	Measuring result
Charging mode	Measurement diagram 2-3

Test result:

4. 2.1.) Measurement in the frequency range 30 MHz to 200 MHz

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed- Mark	Height cm	Azimuth deg	Polarization
32,75	38,4	40,0	1,6		131	226	VERTICAL
49,70	34,6	40,0	5,4		131	191	VERTICAL
113,50	31,4	43,5	12,1		180	298	HORIZONTAL

4. 2.2.) Measurement in the frequency range 200 MHz to 1000 MHz

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

4.3. Radiated emission

Limits according to 15.209 (15.225 (b))

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 20 dB per Decade.		

Operating mode	Measuring result
Transmit mode pulse modulated on both frequencies 122,63 kHz and 13,562 MHz (like normal operation)	Measurement diagram 4-6

Test result:

4. 3.1.) Measurement in the frequency range 9 kHz to 30 MHz

Frequency kHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed- Mark
122,9	39,8	65,8	26,0	
13562	45,9	49,5	3,6	This part of emission is covered by 15.225 (a) see page 16

4. 3.2.) Measurement in the frequency range 30 MHz to 200 MHz

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed- Mark	Height cm	Azimuth deg	Polarization
40,70	38,6	40,0	1,4		100	90	VERTICAL
54,25	33,6	40,0	6,4		100	90	VERTICAL
67,80	30,2	40,0	9,8		100	90	VERTICAL

4. 3.3.) Measurement in the frequency range 200 MHz to 1000 MHz

Frequency MHz	Level dB μ V/m	Limit dB μ V/m	Margin dB	Exceed- Mark	Height cm	Azimuth deg	Polarization
528,95	39,7	46,0	6,3		110	128	VERTICAL
596,75	40,4	46,0	5,6		100	104	VERTICAL
745,95	42,5	46,0	3,5		142	252	VERTICAL
773,05	39,5	46,0	6,5		100	0	VERTICAL
786,60	39,8	46,0	6,2		100	5	VERTICAL
813,75	40,6	46,0	5,4		100	237	VERTICAL

4.4. Field strength at 13,56 MHz

Limits according to 15.225 (a):

The field strength of any emissions within this band shall not exceed 10.000 microvolts/meter (80 dB μ V/m) at 30 meters.

Measurement results:

The field strength at 3m distance was measured as 45,9 dB μ V/m. Extrapolated with 20 dB per decade to 30 meters distance it would be 25,9 dB μ V/m or 19,72 μ V/m.

4.5. Frequency variation at extreme test voltages and extreme temperatures

Limits according to 15.225 (c):

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
		$F_{nom} = 13,562$ MHz
$T_{nom} (20)^{\circ}C$	$V_{min} (3,15) V$	13,56226
$T_{nom} (20)^{\circ}C$	$V_{nom} (4,25) V$	13,56226
$T_{min} (-20)^{\circ}C$	$V_{nom} (3,7) V$	13,56248
$T_{max} (50)^{\circ}C$	$V_{nom} (3,7) V$	13,56251
Maximum deviation from nominal frequency under extreme test conditions (%)		0,0038
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	☐	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
☐	ESVP - Test receiver 20 - 1000 MHz	NT-201	☐	MDS 21 - Absorbing clamp 30 - 1000 MHz	NT-250
☐	Switchbox	NT-202	☐	FCC-203I EM Injection clamp	NT-251

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Department: EMV

Test report number:
M/EMV-03/138

Page: 1 of 3

Date: 2. 4. 2003

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Appendix 1 (continued)

Test equipment used

☐ FCC-203I-DCN	NT-252	☐ 500W1000M7 - RF-Amplifier	NT-332
Ferrite decoupling network		80 - 1000 MHz / 500 W	
☐ PR50	NT-253	☐ AS0102-65R - RF-Amplifier	NT-333
Current Probe		1 GHz - 2 GHz	
☐ Model 2000	NT-261	☐ APA01 - RF-Amplifier	NT-334
Digital Multimeter		0,5 GHz - 2,5 GHz	
☐ Fluke 97	NT-262	☐ Preamplifier	NT-335
Digital Multimeter		1 GHz - 4 GHz	
☐ Fluke 97	NT-263	☐ 2-97201	NT-341
Digital Multimeter		Electronic load	
☒ ESH2-Z5 Artificial mains	NT-300	☐ TSX3510P - Power supply	NT-344
network 4x25A		0-30 V / 0 - 10 A	
☐ ESH3-Z5 Artificial mains	NT-301	☐ TSX3510P - Power supply	NT-345
network 2x10A		0-30 V / 0 - 10 A	
☐ ESH3-Z6 Artificial mains	NT-302	☐ VDS 200	NT-350
network 1x100A		Mobil-impuls-generator	
☐ ESH3-Z4	NT-303	☐ LD 200	NT-351
T-Artificial network		Mobil-impuls-generator	
☐ PHE 4500/B	NT-304	☐ MPG 200	NT-352
Power amplifier		Mobil-Impuls-Generators	
☐ EZ10	NT-305	☐ EFT 200	NT-353
T-Artificial network		Mobil-impuls-generator	
☐ MidiStar	NT-306	☐ FP 16/3-1	NT-400
Telephone exchange		3 ph. Coupling filter (Burst)	
☐ SMG - Signal generator	NT-310	☐ PHE 4500 - Mains impedance	NT-401
0,1 - 1000 MHz		network	
☐ PM 5518 TXVPS	NT-311	☐ FP-SURGE 32.1	NT-402
Video generator		3 ph. Coupling filter (Surge)	
☐ RefRad	NT-312	☐ IP 6.2 Coupling filter for	NT-403
Reference generator		data lines (Surge)	
☐ SMP 02 Signal generator	NT-313	☐ ESH2-Z3 - Probe	NT-410
10 MHz - 20 GHz		9 kHz - 30 MHz	
☐ 40 MHz Arbitrary Generator	NT-315	☐ IP 4 - Capacitive clamp	NT-411
T1241		(Burst)	
☐ PEFT - Burst generator	NT-320	☐ HV-Attenuator 54,5 dB	NT-420
up to 4 kV		(Burst)	
☐ PSD - ESD generator	NT-321	☐ RF-Attenuator 20 dB	NT-421
up to 25 kV		0,1 - 1000 MHz / 25 W	
☐ ESD-Pistol	NT-322	☐ RF-Attenuator 10 dB	NT-422
		0,1 - 1000 MHz / 20 W	
☐ Vacuum-Relais	NT-323	☐ RF-Attenuator 30 dB	NT-423
up to 8 kV		0,1 - 1000 MHz / 1 W	
☐ PSURGE 4.1	NT-324	☐ RF-Attenuator	NT-424
Surge generator		30 dB	
☐ TRANSIENT 1000	NT-325	☐ RF-Attenuator 6 dB	NT-425
Immunity test system		0,1 - 1000 MHz / 1 W	
☐ VCS 500-M6	NT-326	☐ RF-Attenuator 6 dB	NT-426
Surge-Generator		0,1 - 1000 MHz / 1 W	
☐ BTA-250 - RF-Amplifier	NT-330	☐ Voltage-divider	NT-427
9 kHz - 220 MHz / 250 W		1:100	

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Department: EMV

Test report number:
M/EMV-03/138

Page: 2 of 3

Date: 2. 4. 2003

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Appendix 1 (continued)

Test equipment used

☐ RF-Attenuator 6 dB	NT-428	☐ BSR-V1 - Video transmission system (optical fiber link)	NT-512
☐ RF-Attenuator 0 dB - 81 dB	NT-429	☒ ES-K1 Test software	NT-520
☐ WRU 27 - Band blocking 27 MHz	NT-430	☐ ESPC-K1 Test software	NT-521
☐ WHJ450C9 AA - High pass 450 MHz	NT-431	☐ SPS_PHE - Test software voltage fluctuations/harmonics	NT-525
☐ WHJ250C9 AA - High pass 250 MHz	NT-432	☐ SPS_EM - Test software for PHE 4500/B	NT-527
☐ RF-Load 150 W	NT-433	☐ Noise power test apparatus according to EN 55014	NT-530
☐ Impedance transducer 50 Ohm - 800 Ohm	NT-435	☐ Vertical coupling plane (ESD)	NT-531
☐ I+P 7780 Directional coupler 100 - 2000 MHz	NT-440	☐ Equipment for ESD-pulse verification.	NT-532
☒ ESH3-Z2 - Pulse limiter 9 kHz - 30 MHz	NT-441	☐ TEM-Zelle	NT-533
☐ Power Divider 6 dB/1 W/50 Ohm	NT-443	☐ ESV-24 Plotter adapter	NT-540
☐ Directional coupler 0,1 MHz - 70 MHz	NT-444	☒ Test cables	NT-550
☐ Directional coupler 0,1 MHz - 70 MHz	NT-445	☐ Test cable #4 for EN 61000-4-6	NT-553
☐ Tube imitations according to EN 55015	NT-450	☒ Test cable #3 for conducted emission	NT-554
☐ FCC-801-M5-25 Coupling decoupling network	NT-460	☐ Test cable #5 ESD-cable (2x470k)	NT-555
☐ FCC-801-AF10 Coupling decoupling network	NT-461	☐ Test cable #6 ESD-cable (2x470k)	NT-556
☐ FCC-801-S25 Coupling decoupling network	NT-462	☐ Serial data - fiber optic link	NT-557
☐ FCC-801-T4 Coupling decoupling network	NT-463	☐ Test cable #8 Sucoflex 104EA	NT-559
☐ FCC-801-C1 Coupling decoupling network	NT-464	☐ Test cable #9 (for outdoor measurements)	NT-580
☐ F-16A - Current probe 1kHz - 70MHz	NT-465	☐ Test cable #10 (for outdoor measurements)	NT-581
☒ PC P450 - Test computer	NT-500	☐ Test cable #13 PBA-33PBC-10	NT-584
☐ SE 284 GPIB - Plotter	NT 502	☐ Shield chamber	NT-600
☐ PC P133 Test computer #2	NT-504	☐ Climatic chamber -55°C to +180°C	M-512
☐ PC P4 1700 MHz Notebook	NT-505	☐ Control and simulation equipment for EUT	---
☐ PC PIII 933 MHz Notebook	NT-506		
☐ 7110 - Controlling device for E-Field probe	NT-510		
☐ Monitoring camera with Monitor	NT-511		

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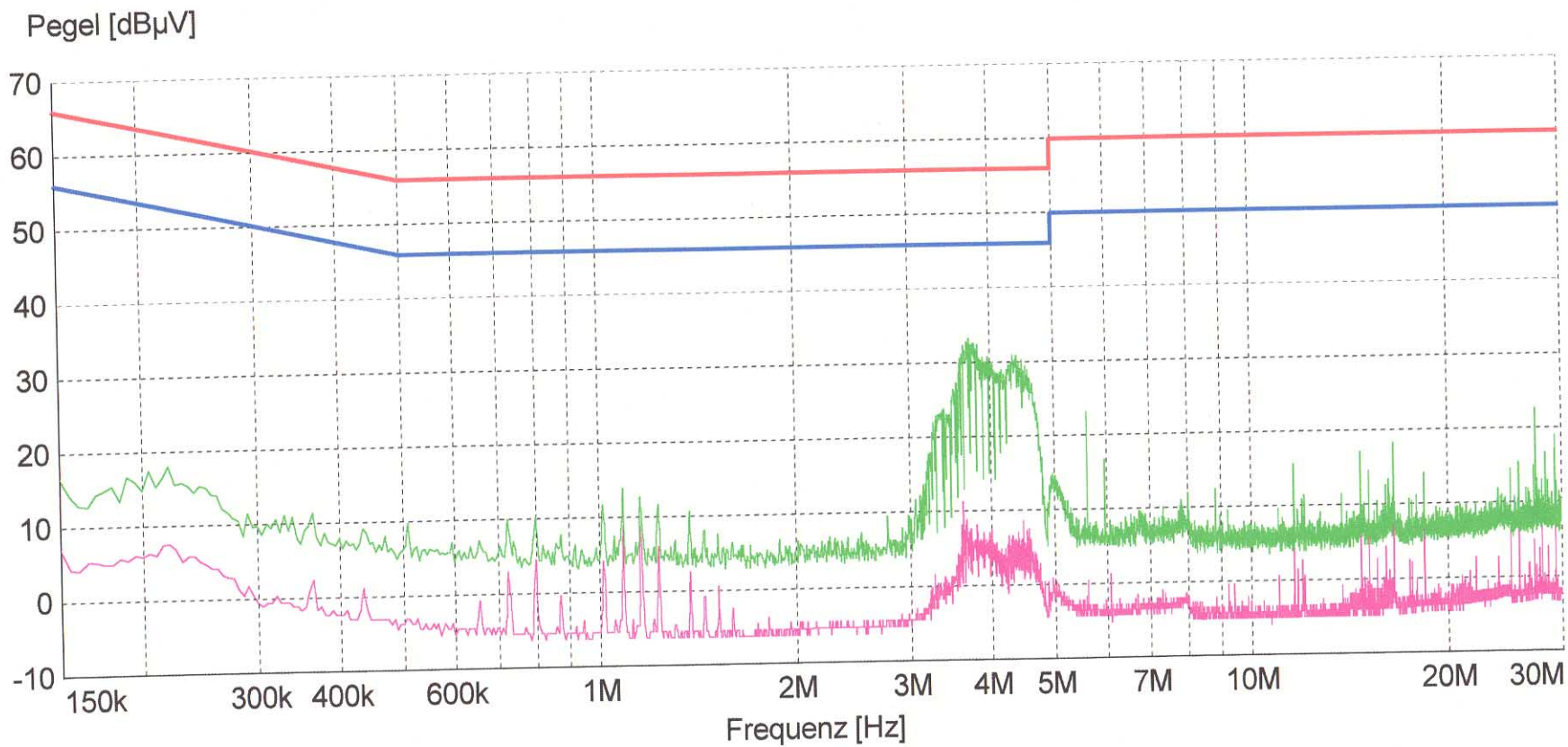
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Test report number:
M/EMV-03/138

Page: 3 of 3

Date: 2. 4. 2003

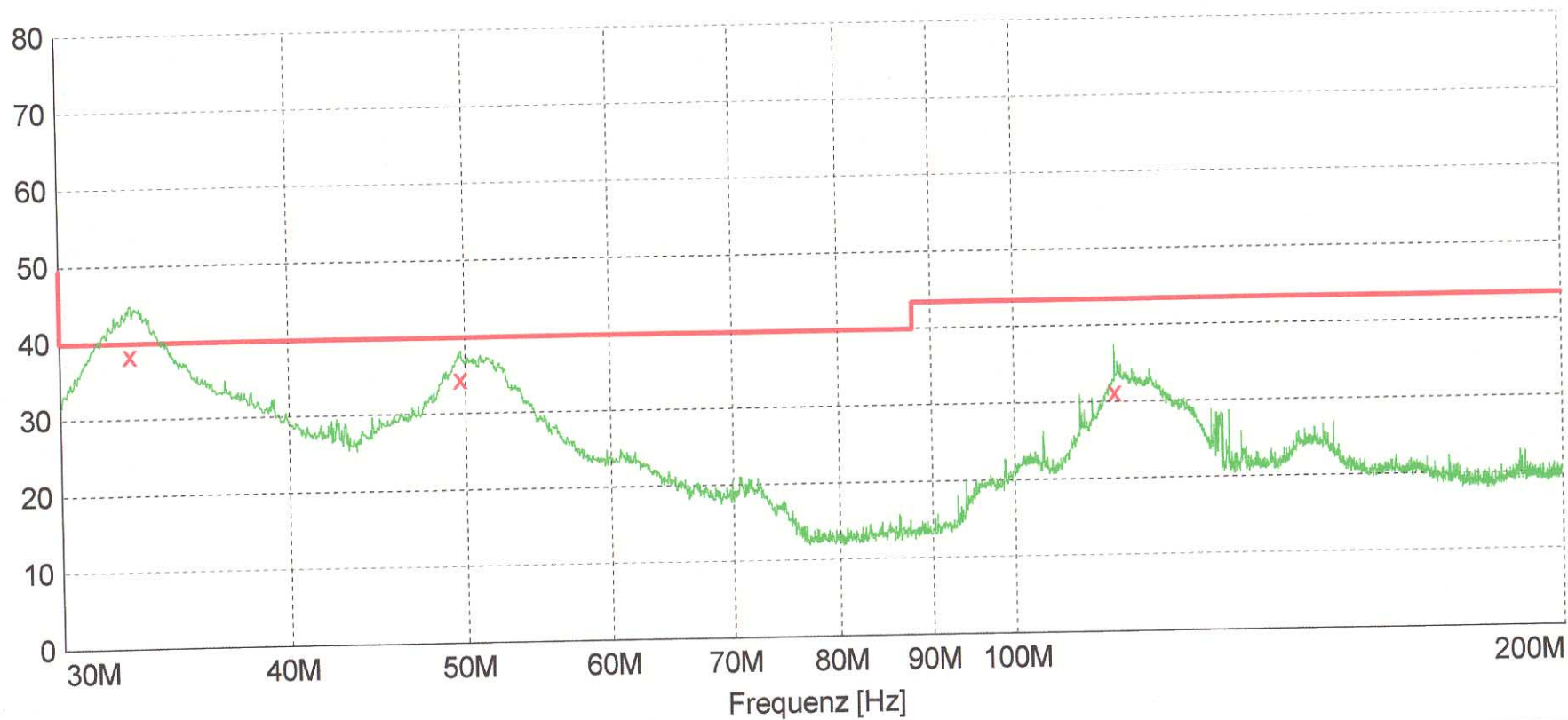
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— MES Keyterm_V1_pre PK
— MES Keyterm_V1_pre AV
— LIM EN 55022 V QP
— LIM EN 55022 V AV

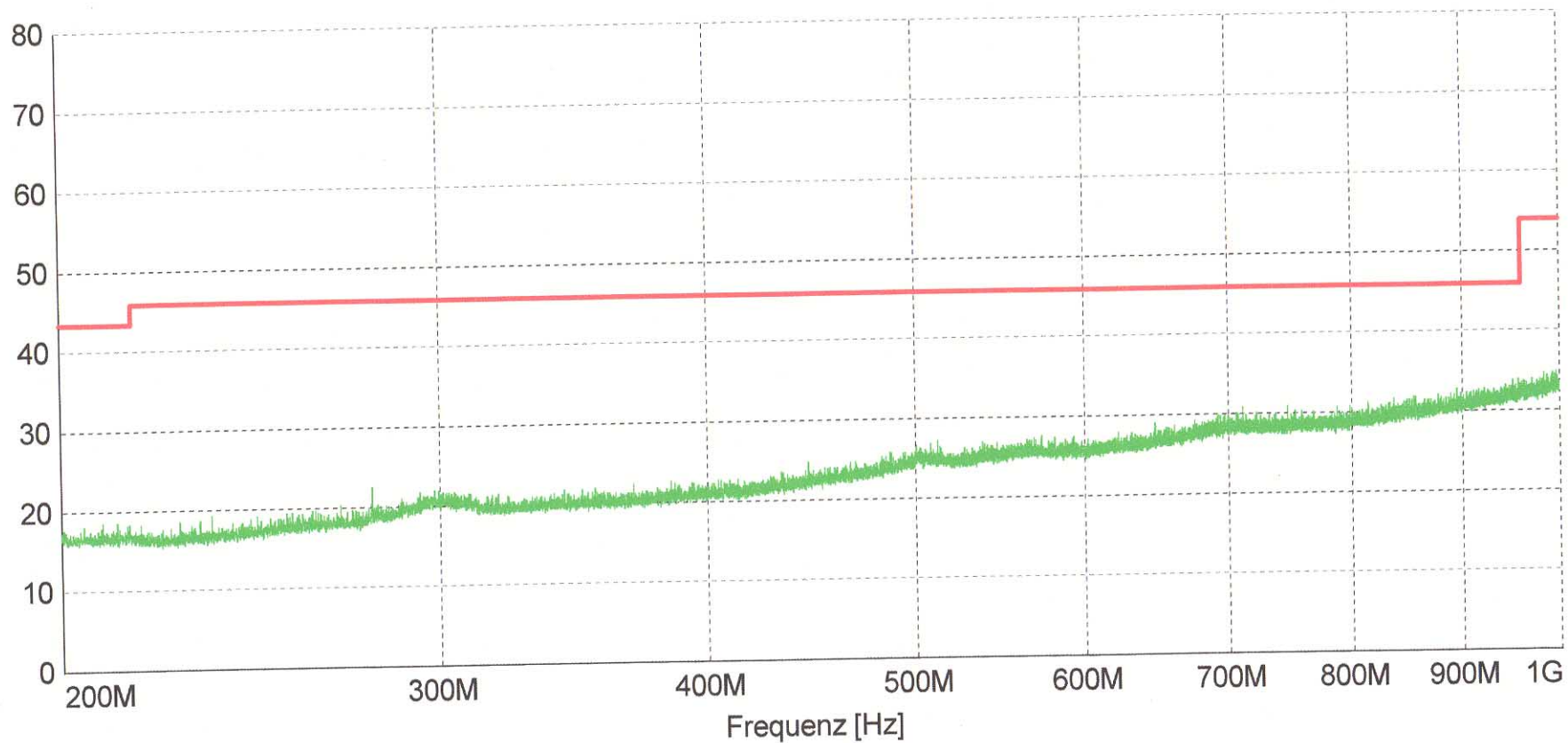
EN 55022 V QP
EN 55022 V AV

Pegel [dB μ V/m]



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 — MES Keyterm_F2R_pre PK
 — LIM FCC ClassB F QP/AV

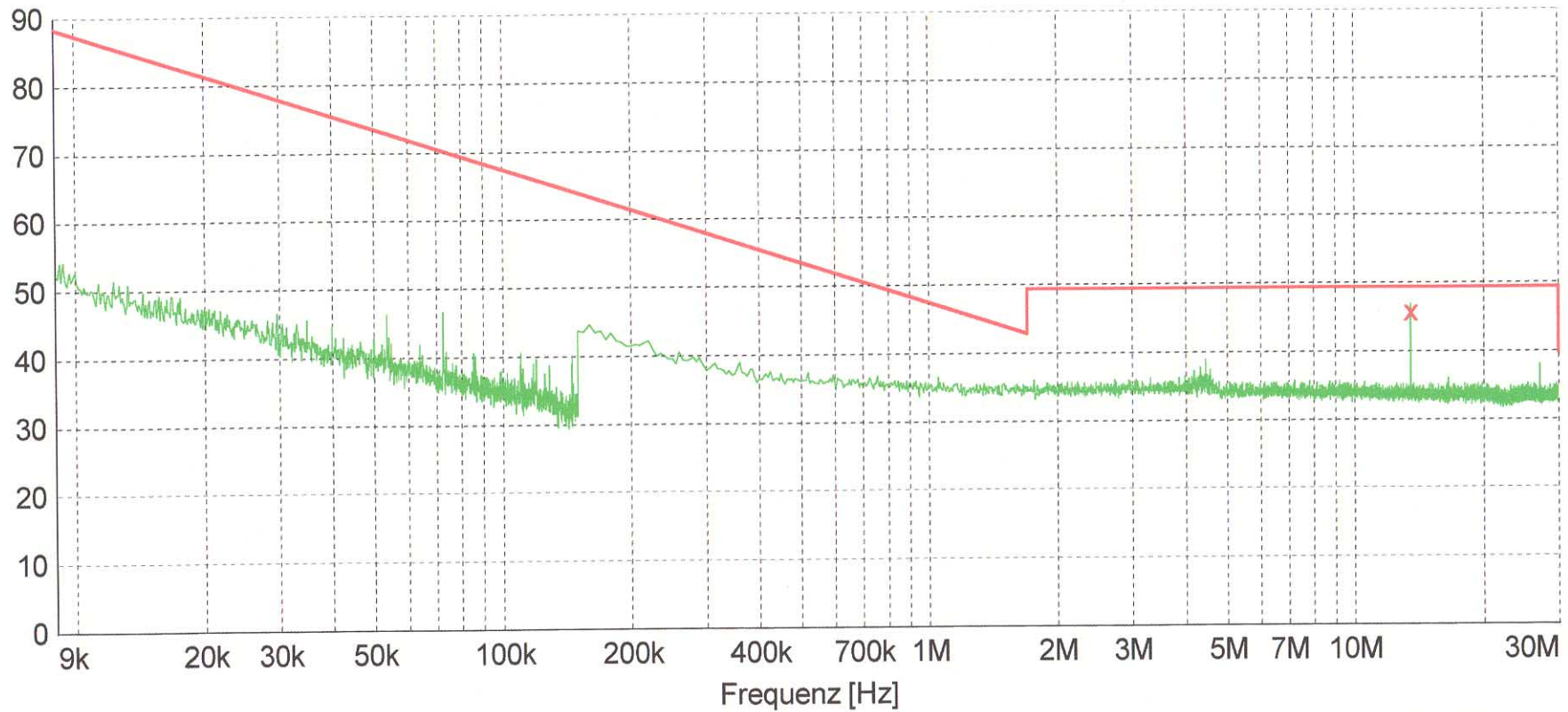
FCC ClassB, field strength 3m

Pegel [dB μ V/m]

MES Keyterm_F3R_pre PK
LIM FCC ClassB F QP/AV

FCC ClassB, field strength 3m

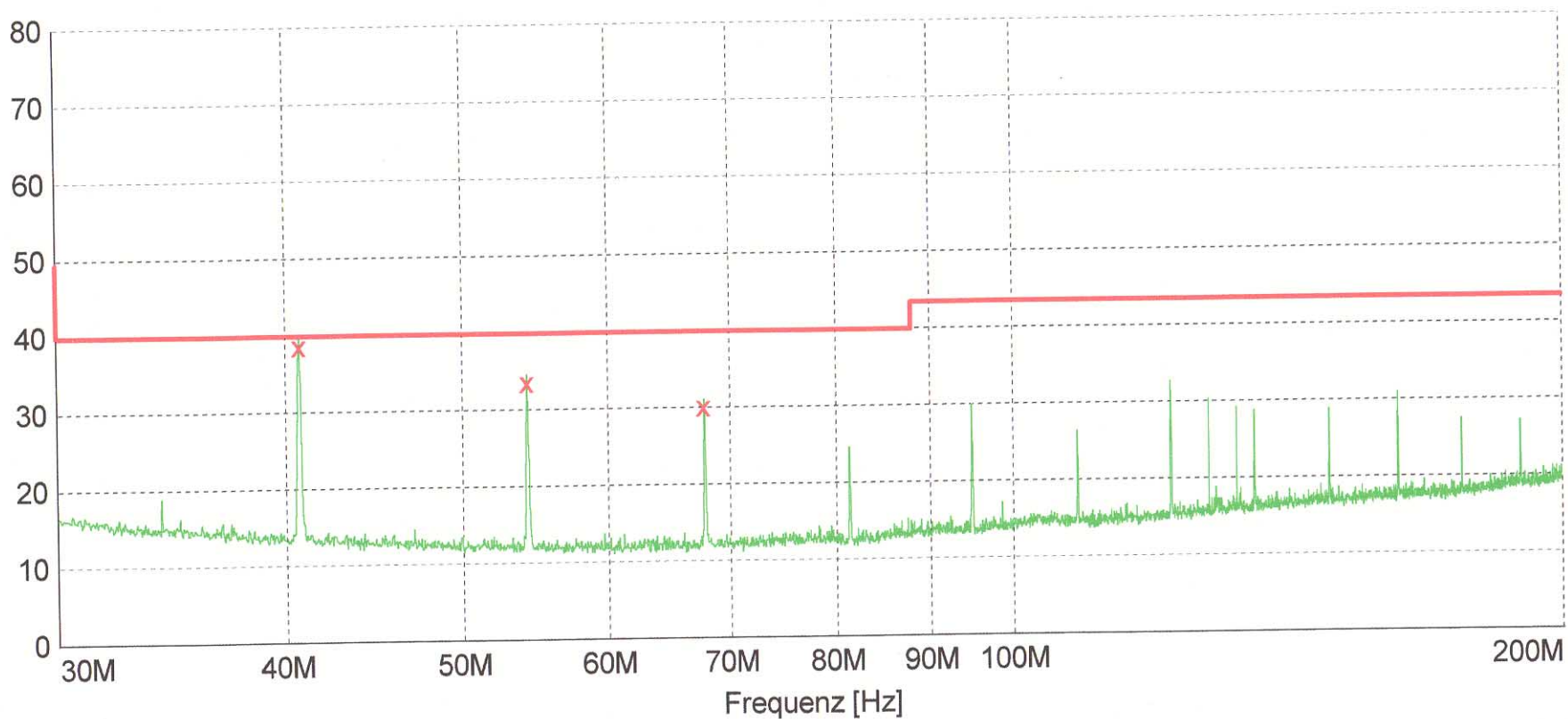
Pegel [dB μ V/m]



x x : MES Keyterm_F1U_fin QP
 — MES Keyterm_F1U_pre PK
 — LIM FCC ClassB F QP/AV

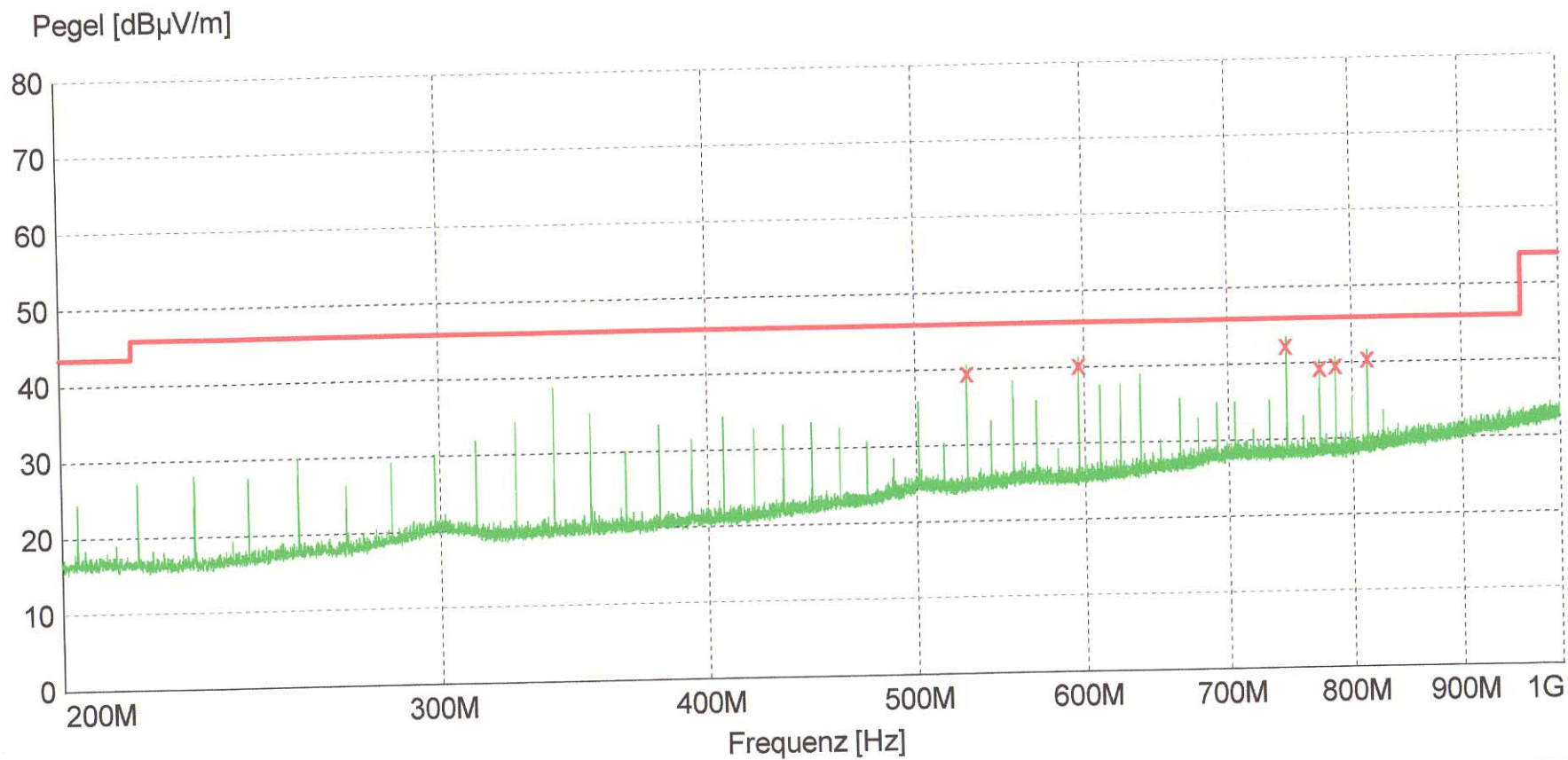
FCC ClassB, field strength 3m

Pegel [dB μ V/m]



x x : MES Keyterm_F2U_fin QP
 — MES Keyterm_F2U_pre PK
 — LIM FCC ClassB F QP/AV

FCC ClassB, field strength 3m



x x : MES Keyterm_F3U_fin QP
 — MES Keyterm_F3U_pre PK
 — LIM FCC ClassB F QP/AV

FCC ClassB, field strength 3m