TÜV ÖSTERREICH

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Accredited Testing Laboratory,
Inspection Body,
Certification Body,
Calibration Body

Notified Body 0408

# TEST REPORT

of the accredited test laboratory

**TÜV Nr.:M/EMV-03/138**

about

the following EMC - test/- research

| | |
|---|---|
| **Applicant:** | Skidata AG<br>Untersbergstraße 40<br>A-5083 Gartenau - St. Leonhard |
| **Product:** | Keyterminal; ASx70KT |
| **Serial Number:** | D022902597 |
| **Standard:** | 47 CFR Ch. I Part 15 |

**TÜV Österreich**

Test laboratory for EMC

Deputy Supervisor of EMC-laboratory

Ing. Wilhelm Seier

Official seal

2. 4. 2003

Copy Nbr.: 01

Checked by

Ing. Michael Emminger



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

DVR 0047 333
UID ATU 37086005

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# Contents

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# 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 |

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# 2. Description of EUT

| | |
|---|---|
| EUT | Keyterminal; ASx70KT |
| Serial Number | D022902597 |
| Manufacturer | Skidata AG<br>A-5083 Gartenau - St. Leonhard; Untersbergstraße 40 |
| Description | Skidata AG provided the following configuration for the measurements:<br><br>Serial production model |
| Operating mode | The measurements were carried out at the following running states:<br><br>**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;<br>**Charging mode**, without operating transmitters |

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## 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

| Frequeny range | Limit | |
|---|---|---|
| Detector | Quasi Peak | Average |
| 0,150 - 0,5 MHz | 66 - 56 dBµV<br>decreasing with the logarithm of frequency | 56 - 46 dBµV<br>decreasing with the logarithm of frequency |
| 0,5 - 5 MHz | 56 dBµV | 46 dBµV |
| 5 - 30 MHz | 60 dBµV | 50 dBµV |
| 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 |

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## 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.

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## 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

| | Detector Quasi Peak | |
|---|---|---|
| Frequency range | 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 |

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Test result:

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

| Frequency MHz | Level dBµV/m | Limit dBµV/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 |

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## 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))

| | Detector Quasi Peak | |
|---|---|---|
| Frequency range | 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 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 |

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Test result:

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

| Frequency kHz | Level dBµV/m | Limit dBµV/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 coverd by 15.225 (a) see page 16 |

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

| Frequency MHz | Level dBµV/m | Limit dBµV/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 |

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

| Frequency MHz | Level dBµV/m | Limit dBµV/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 |

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## 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 dBµV/m) at 30 meters.

Measurement results:

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

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## 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 ± 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 |
|---|---|---|
| | | $F_{nom}$ = 13,562 MHz |
| $T_{nom}$ ( 20 )°C | $V_{min}$ ( 3,15 )V | 13,56226 |
| $T_{nom}$ ( 20 )°C | $V_{nom}$ ( 4,25 )V | 13,56226 |
| $T_{min}$ ( -20 )°C | $V_{nom}$ ( 3,7 )V | 13,56248 |
| $T_{max}$ ( 50 )°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 |
| ☒ | MA 240 - Antenna mast 1 - 4 m height | NT-110 |
| ☒ | DS 412 - Turntable 0 - 400 ° Azimuth | NT-111 |
| ☒ | HD 100 Controller Mast+Turntable | NT-112 |
| ☐ | HUF-Z2 - Bicon. Antennna 20 - 300 MHz | NT-120 |
| ☐ | HUF-Z3 - Log. Per. Antenna 200 - 1000 MHz | NT-121 |
| ☒ | HFH-Z2 - Loop Antenna. 9 kHz - 30 MHz | NT-122 |
| ☐ | HFH-Z6 - Rod Antenna 9 kHz - 30 MHz | NT-123 |
| ☐ | 3121C - Dipole Antenna 28 - 1000 MHz | NT-124 |
| ☐ | 3115 - Horn Antenna 1 - 18 GHz | NT-125 |
| ☐ | 3116 - Horn Antenna 18 - 40 GHz | NT-126 |
| ☐ | SAS-200/543 - Bicon. Ant. 20 MHz - 300 MHz | NT-127 |
| ☐ | AT-1080 - Log. Per. Ant. 80 - 1000 MHz | NT-128 |
| ☒ | HK-116 - bicon. Ant. 20 MHz - 300 MHz | NT-129 |
| ☐ | HK-116 - bicon. Ant. 20 MHz - 300 MHz | NT-130 |
| ☒ | 3146 - Log. Per. Ant. 200 - 1000MHz | NT-131 |
| ☐ | Loop Antenna H-Field | NT-132 |
| ☐ | Horn Antenna 500 MHz - 2900 MHz | NT-133 |
| ☐ | Log. per. Antenna 800 MHz - 2500 MHz | NT-134 |
| ☐ | Log. per. Antenna 800 MHz - 2500 MHz | NT-135 |
| ☐ | BiConiLog Antenna 26 MHz – 2000 MHz | NT-137 |
| ☐ | Conical Dipol Antenna PCD8250 | NT-138 |
| ☐ | HZ-1 Antenna tripod | NT-150 |
| ☐ | BN 1500 Antenna tripod | NT-151 |
| ☐ | ESVP - Test receiver 20 - 1000 MHz | NT-201 |
| ☐ | Switchbox | NT-202 |
| ☐ | ESPC - Test receiver 9 kHz - 2,5 GHz | NT-203 |
| ☒ | ESI26 – Test receiver 20 Hz – 26,5 GHz | NT-207 |
| ☐ | Digital Radio Tester CTS55 | NT-208 |
| ☐ | Noise-gen., ITU-R 559-2 20 Hz – 20 kHz | NT-209 |
| ☐ | CMTA - Radiocommunication analyzer ; 0,1 - 1000 MHz | NT-210 |
| ☐ | 3271 - Spectrum analyzer 100 Hz - 26,5 GHz | NT-211 |
| ☐ | Radiocommunicationanalyzer Marconi 2945A | NT-212 |
| ☐ | 2855S - Communication analyzer | NT-213 |
| ☐ | Mixer M28HW 26,5 GHz - 40 GHz | NT-214 |
| ☐ | Diode Detector 0,01 GHz - 26,5 GHz | NT-215 |
| ☐ | 3160-10 Horn Antenna 26,5 GHz - 40 GHz | NT-216 |
| ☐ | Radiocommunicationanalyzer SWR 1180 MD | NT-217 |
| ☐ | Mixer M19HWD 40 GHz – 60 GHz | NT-218 |
| ☐ | Mixer M12HWD 60 GHz – 90 GHz | NT-219 |
| ☐ | TDS - 540 DSO Digital scope | NT-220 |
| ☐ | PM97 Scopemeter | NT-221 |
| ☐ | B9-DSP-IS Digital Analyzer for voltage fluctuations | NT-230 |
| ☐ | DFT 555 - Power and harmonics analyzer | NT-231 |
| ☐ | EFA-3 H-field- / E-field probe | NT-243 |
| ☐ | E-field measuring instrument EMR-200; 100 kHz – 3 GHz | NT-244 |
| ☐ | E-field probe 100 kHz – 3 GHz | NT-245 |
| ☐ | Magneticfield-Sensor 300 kHz – 30 MHz | NT-246 |
| ☐ | E-field probe 10 MHz – 18 GHz | NT-247 |
| ☐ | H-field probe 10 MHz – 1 GHz | NT-248 |
| ☐ | MDS 21 - Absorbing clamp 30 - 1000 MHz | NT-250 |
| ☐ | FCC-203I EM Injection clamp | NT-251 |

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# Appendix 1 (continued)
# Test equipment used

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

# Appendix 1 (continued)
# Test equipment used

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

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Department: EMV

Test report number:
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Date: 2. 4. 2003

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Department: EMC

Test report reference: M/EMV-03/138

Measurement diagram: 1 of 6

Date: 2. 4. 2003

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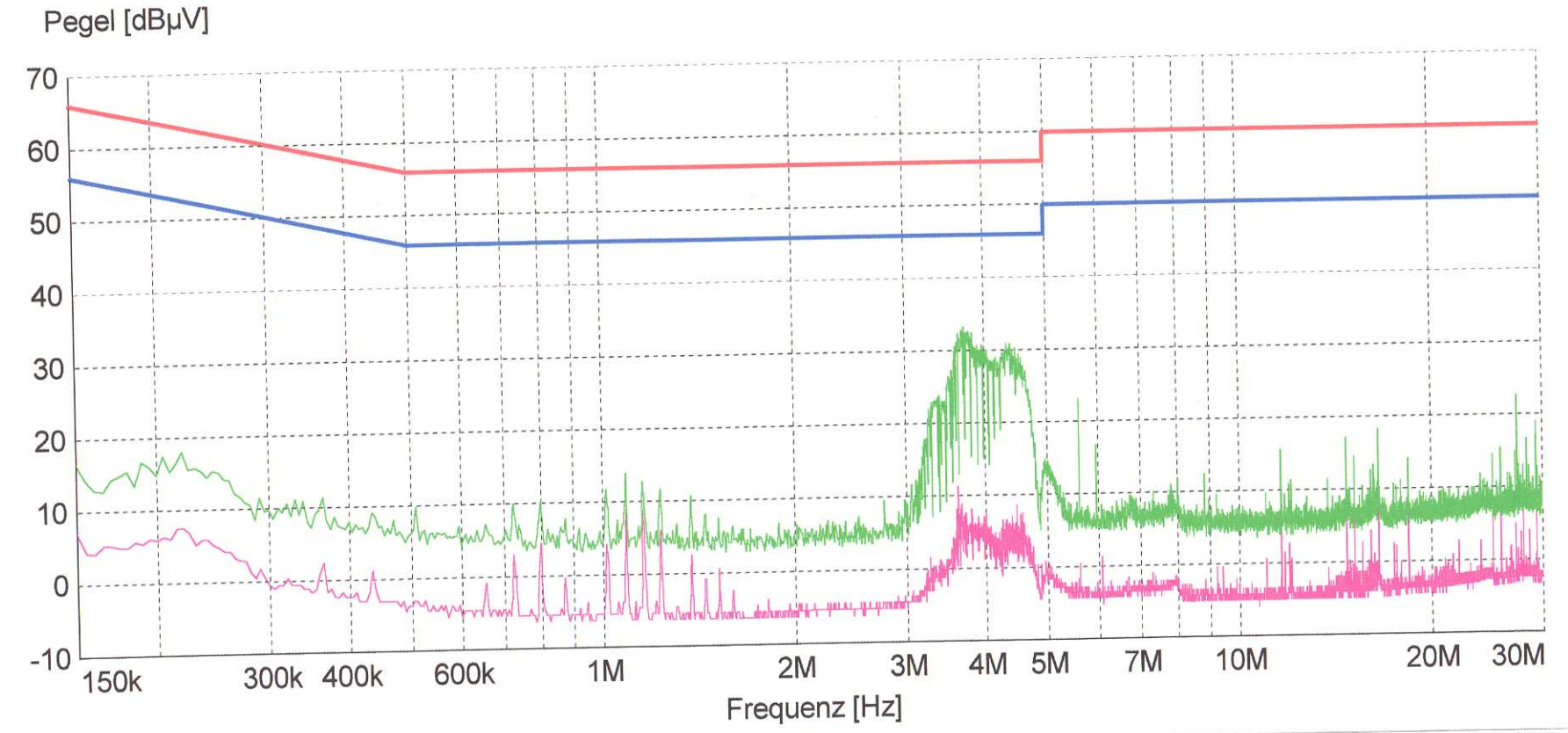


MES Keyterm_V1_pre PK
MES Keyterm_V1_pre AV
LIM EN 55022 V QP
LIM EN 55022 V AV

EN 55022 V QP
EN 55022 V AV

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Date: 2. 4. 2003

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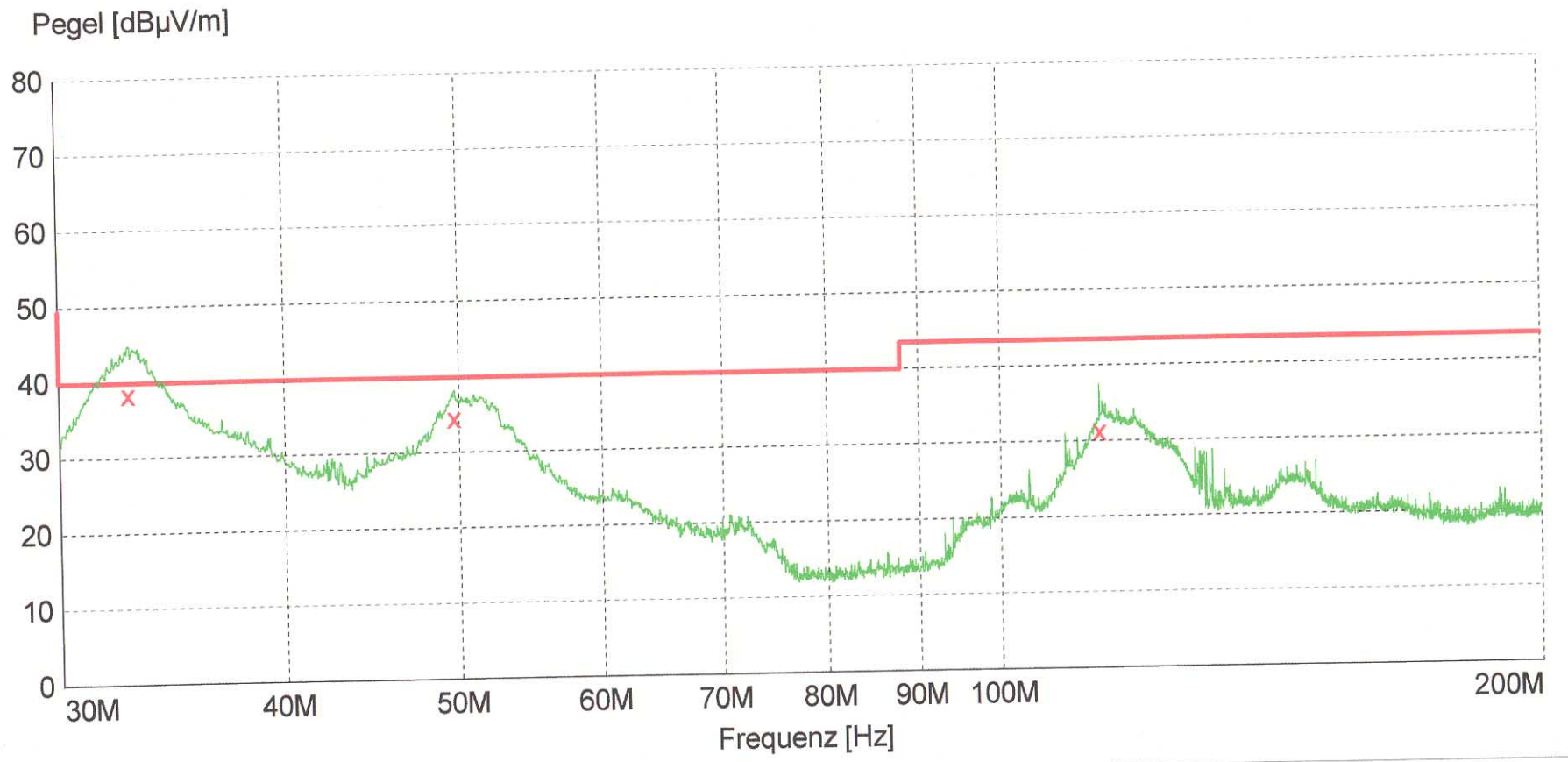


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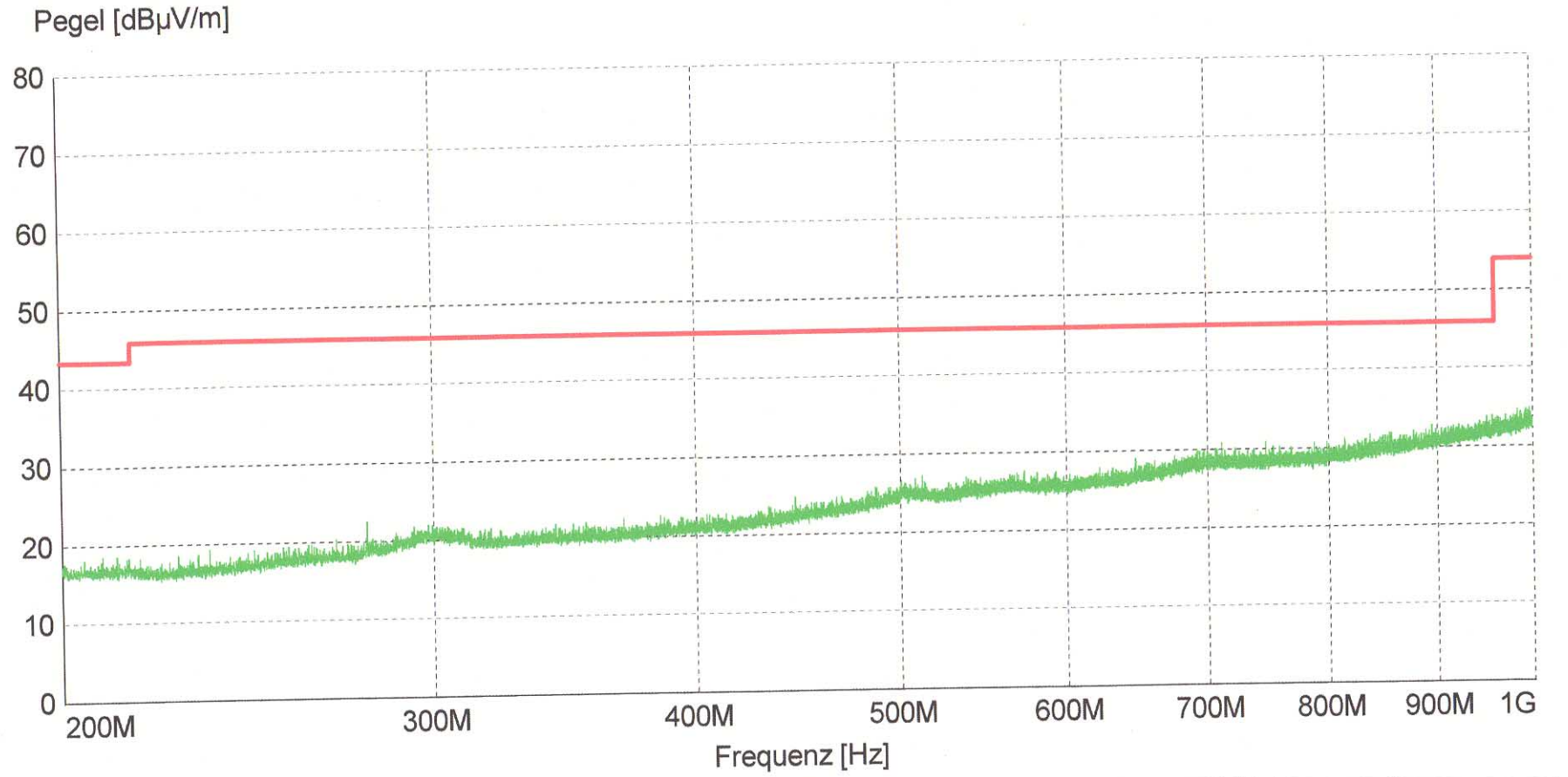
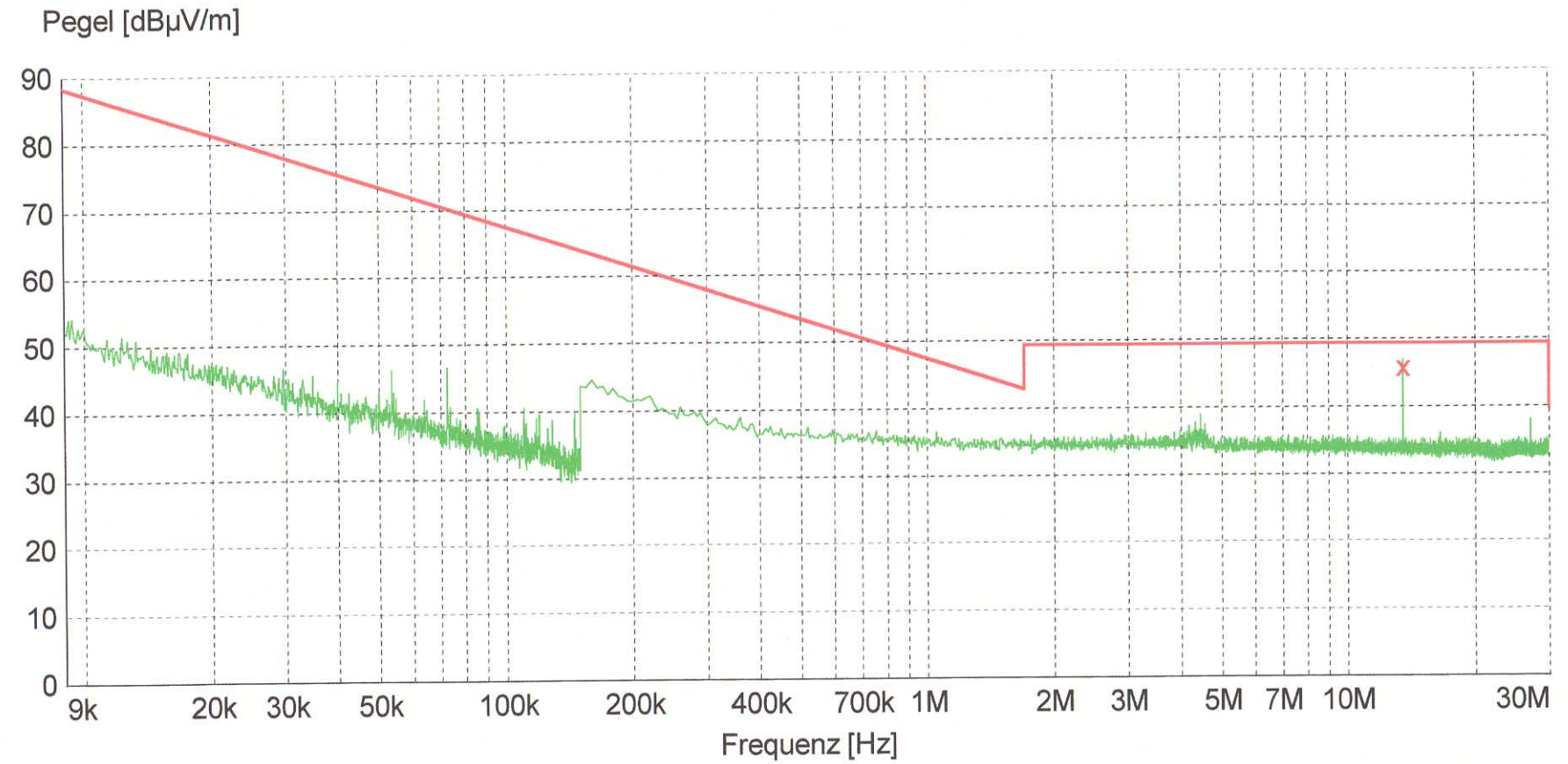
MES Keyterm_F2R_pre PK
LIM FCC ClassB F QP/AV

FCC ClassB, field strength 3m


Pegel [dBµV/m]
80
70
60
50
40
30
20
10
0
200M
300M
400M
500M
600M
700M
800M
900M
1G
Frequenz [Hz]
MES Keyterm_F3R_pre PK
LIM FCC ClassB F QP/AV
FCC ClassB, field strength 3m




x x :MES Keyterm_F1U_fin QP
MES Keyterm_F1U_pre PK
LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m

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Department: EMC

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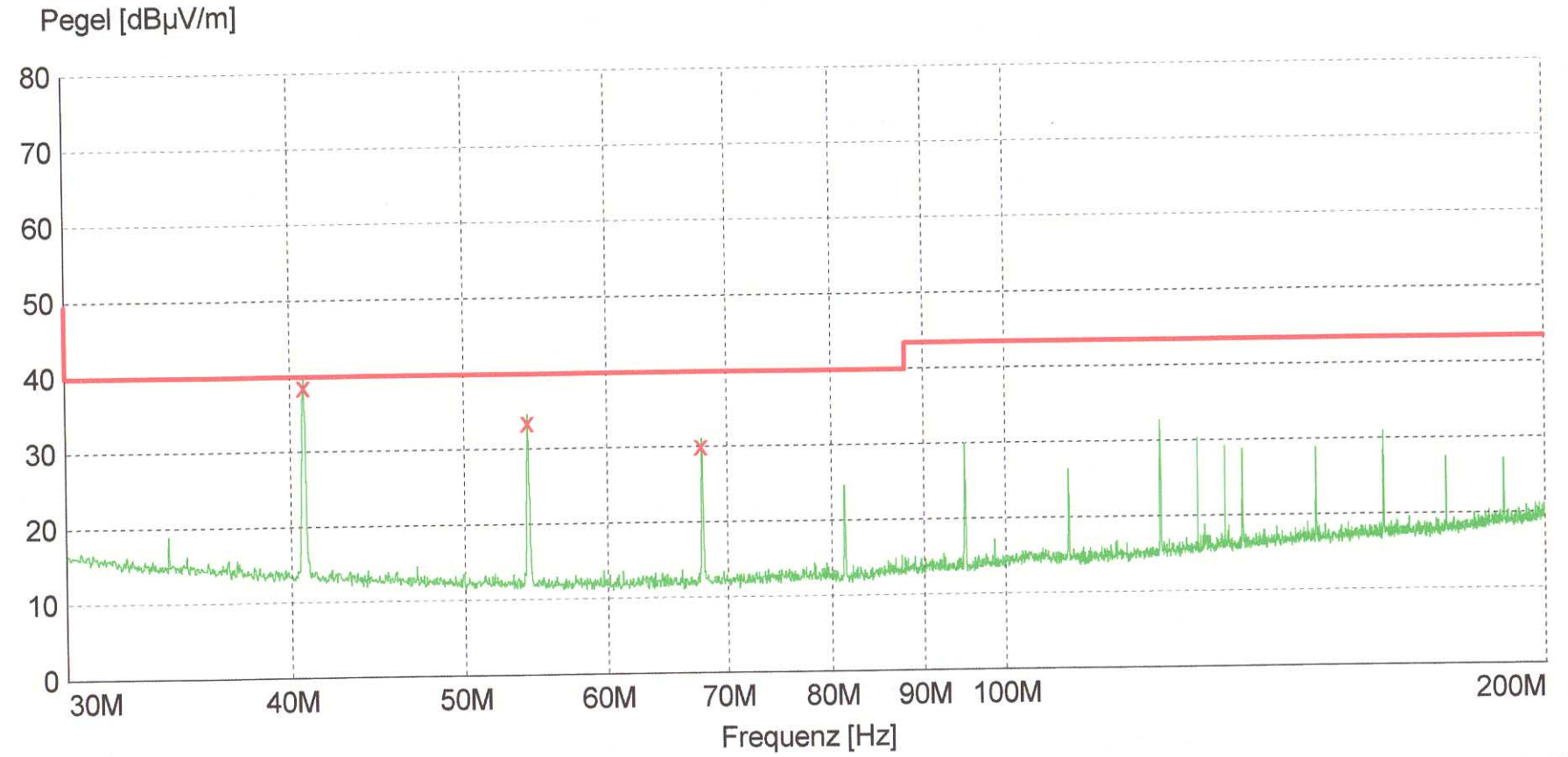
Measurement diagram: 5 of 6

Date: 2. 4. 2003

checked by:

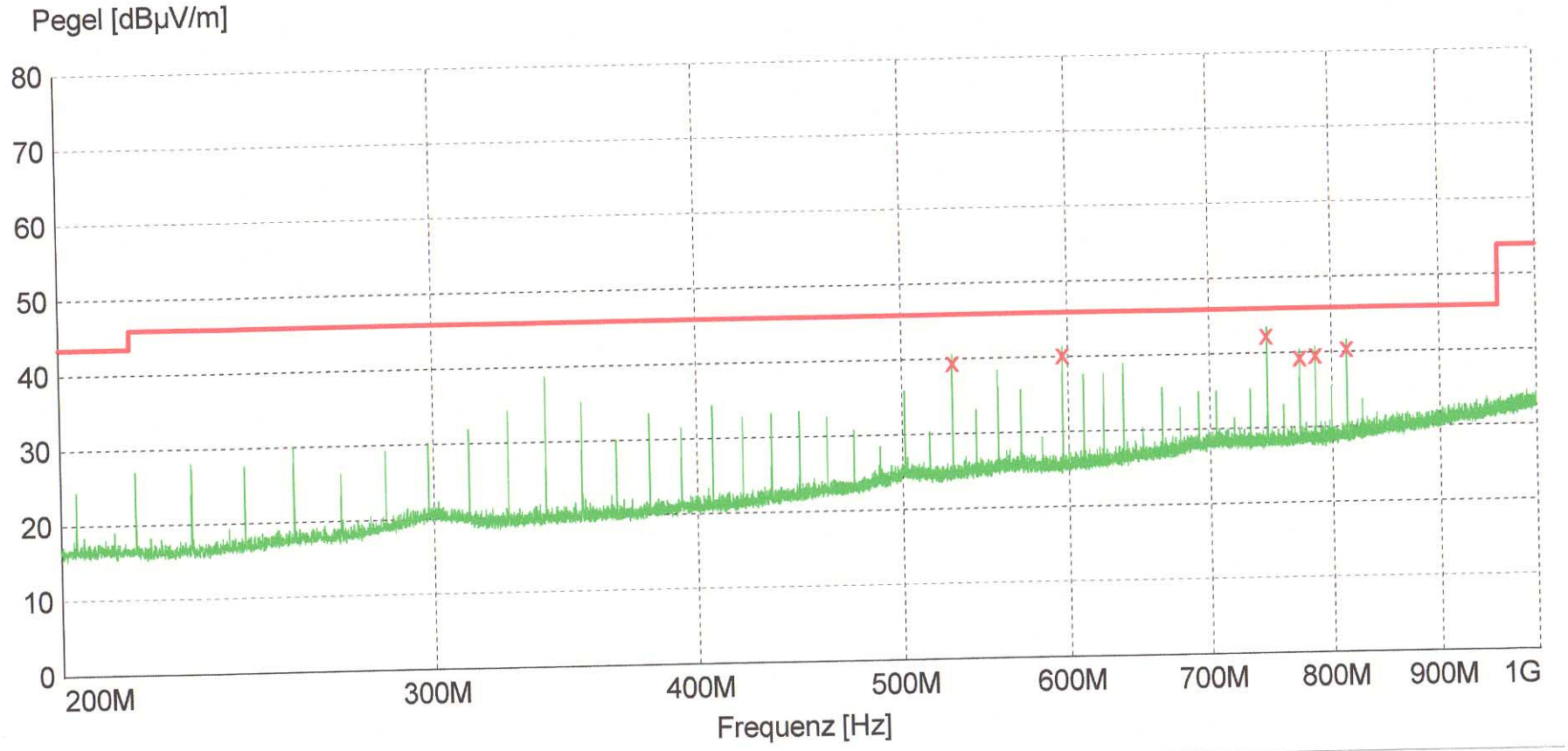



x x : MES Keyterm_F2U_fin QP

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