

# TEST REPORT

**Test Report Reference: R41092A Revision 1, Edition 2**

**Equipment under Test: PRM5 / SWH-2100**

**Serial Number: -**

**Applicant: deister electronic GmbH**

**Manufacturer: deister electronic GmbH**

**Test Laboratory  
(CAB)  
accredited by  
DATech e.V.  
in compliance with DIN EN ISO/IEC 17025  
under the  
Reg. No. DAT-P-105/99-21  
and listed by  
FCC 31040/SIT1300F2**

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## 1 IDENTIFICATION

### 1.1 APPLICANT

|                            |   |
|----------------------------|---|
| Name:                      | deister electronic GmbH                               |
| Address:                   | Hermann-Bahlsen-Straße 11 – 13<br>30890 Barsinghausen |
| Country:                   | Germany   |
| Name for contact purposes: | Mr. Stefan Eichler                                    |
| Tel:                       | +49 51 05 516-129                                     |
| Fax:                       | +49 51 05 516-266                                     |
| e-mail address:            | eichler@deister-gmbh.de                               |

### 1.2 MANUFACTURER

|                            |   |
|----------------------------|---|
| Name:                      | deister electronic GmbH                               |
| Address:                   | Hermann-Bahlsen-Straße 11 – 13<br>30890 Barsinghausen |
| Country:                   | Germany   |
| Name for contact purposes: | Mr. Stefan Eichler                                    |
| Tel:                       | +49 51 05 516-129                                     |
| Fax:                       | +49 51 05 516-266                                     |
| e-mail address:            | eichler@deister-gmbh.de                               |

### 1.3 DATES

|                                 |                  |
|---------------------------------|------------------|
| Date of receipt of test sample: | 01 December 2004 |
| Start of test:                  | 02 December 2004 |
| End of test:                    | 07 January 2005  |

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## 1.4 TEST LABORATORY

The tests were carried out at: **PHOENIX TESTLAB GmbH**  
**Königswinkel 10**  
**D-32825 Blomberg**                      **Phone: +49 (0) 52 35 / 95 00-0**  
**Germany**                                      **Fax: +49 (0) 52 35 / 95 00-10**

accredited by DATech e.V. in compliance with DIN EN ISO/IEC 17025 under Reg. No. DAT-P-105/99-21 and listed by FCC 31040/SIT1300F2.

|                      |                       |   |                          |
|----------------------|-----------------------|---|--------------------------|
| Test engineer:       | Thomas KÜHN<br>Name   | <br>Signature  | 07 February 2005<br>Date |
| Test report checked: | Bernd STEINER<br>Name | <br>Signature | 07 February 2005<br>Date |

**PHOENIX TESTLAB GmbH**  
**Königswinkel 10**  
**32825 Blomberg**  
**Tel. 0 52 35 / 95 00-0**  
**Fax 0 52 35 / 95 00-10**

Stamp

## 1.5 RESERVATION

This test report is only valid in its original form.

Any reproduction of its contents without written permission of the accredited test laboratory PHOENIX TESTLAB GmbH is prohibited.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT REFERENCE.

## 1.6 NORMATIVE REFERENCES

- [1] **ANSI C63.4-2003** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC 47 CFR Part 15 (November 2004)** Radio Frequency Devices

## 1.7 TEST RESULTS

The requirements of this test document are fulfilled by the equipment under test. The complete test results are presented in the following.

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## 2 TECHNICAL DATA OF EQUIPMENT

### 2.1 DEVICE UNDER TEST

|                             |                  |
|-----------------------------|------------------|
| Type of equipment:          | 13.56 MHz Reader |
| Type designation:           | PRM5 / SWH-2100  |
| Serial No.:                 | -                |
| Highest internal frequency: | 13.56 MHz        |
| Antenna type:               | Integral         |

The following external I/O cables were used:

| Cable  | Length  | Shielding | Connector              |
|--|---------|-----------|------------------------|
| Connection cable<br>(including DC supply lines and Data in/ out lines) | 2.5 m * | No        | 12 pole terminal block |
| -  | -       | -         | -                      |
| -  | -       | -         | -                      |
| -  | -       | -         | -                      |
| -  | -       | -         | -                      |

\*: Length during the test

### 2.2 PEREPHERY DEVICES

The following equipment was used as control unit and ancillary equipment:

During all measurements the EUT was reading a 13.56 MHz transponder card.

### 2.3 SPECIAL EMC MEASURES

The following EMC measures were necessary to reach the documented results:

None

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### 3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

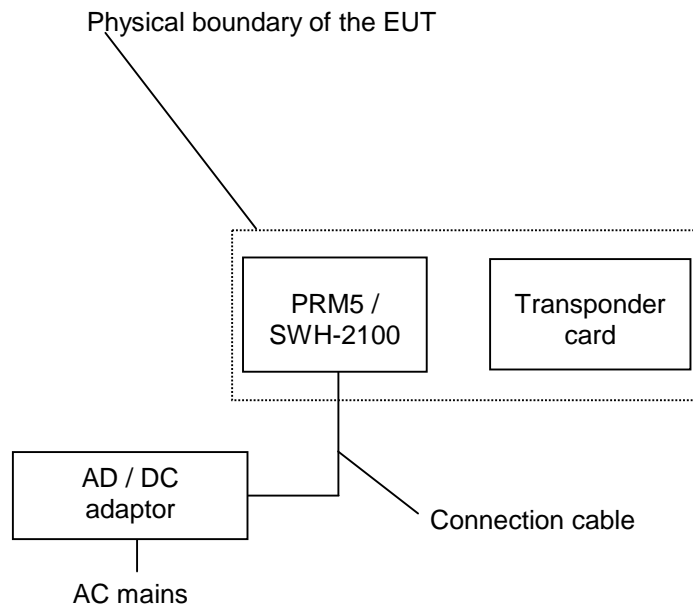
During all tests the EUT was supplied with a DC supply voltage, which was provided by an external power supply or an AC / DC adaptor type FW 2388 (used only for the conducted emissions on AC-mains). For the conducted emission measurement on AC-mains the AC / DC adaptor was supplied with 120 V AC / 60 Hz.

If a variation of the supply voltage was necessary, it was done in the range 8.0 V DC to 16 V DC. This range was declared by the applicant as extreme supply voltage range.

If not otherwise stated, the tests were carried out with the EUT in the in the following operation mode:  
Reading a passive 13.56 MHz TAG (type ISO14443, A).

For the whole frequency range a preliminary measurement in a fully anechoic chamber with a measuring distance of 3 m was carried out to determine the frequencies, which were radiated by the EUT.  
The final measurements on the detected frequencies were carried out on an outdoor test site without ground plane (for the frequency range 9 kHz to 30 MHz) and on an open area test site with ground plane (for the frequency range 30 MHz to 1 GHz).

The physical boundaries of the Equipment Under Test are shown below.



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## 4 LIST OF TEST MODULES

### 4.1 EMISSION

| Conducted emissions FCC 47 CFR Part 15 section 15.207 (a)[2]                                     |                      |  |                       |        |        |
|--|----------------------|--|-----------------------|--------|--------|
| Application  | Frequency range      | Limits   | Reference standard    | Remark | Status |
| On AC supply line  | 0.15 to 0.5 MHz      | 66 to 56 dB $\mu$ V (QP) *<br>56 to 46 dB $\mu$ V (AV) * | ANSI C63.4<br>(2003)  | -      | Passed |
|  | 0.5 to 5 MHz         | 56 dB $\mu$ V (QP)<br>46 dB $\mu$ V (AV)                 |                       |        |        |
|  | 5 to 30 MHz          | 60 dB $\mu$ V (QP)<br>50 dB $\mu$ V (AV)                 |                       |        |        |
| *: Decreases with the logarithm of the frequency   |                      |  |                       |        |        |
| Radiated emissions FCC 47 CFR Part 15 section 15.209 [2]   |                      |  |                       |        |        |
| Application  | Frequency range      | Limits<br>(microvolts/meter)                             | Reference standard    | Remark | Status |
| Intentional radiator   | 0.009 to 0.49 MHz    | 2400/f(kHz) at 300 m                                     | ANSI C63.4<br>(2003); | -      | Passed |
|  | 0.490 to 1.705 MHz   | 24000/f(kHz) at 30 m                                     |                       |        |        |
|  | 1.705 to 30.0 MHz    | 30.0 dB $\mu$ V/m at 30 m                                |                       |        |        |
|  | 30 to 88 MHz         | 40.0 dB $\mu$ V/m at 3 m                                 |                       |        |        |
|  | 88 to 216 MHz        | 43.5 dB $\mu$ V/m at 3 m                                 |                       |        |        |
|  | 216 to 960 MHz       | 46.0 dB $\mu$ V/m at 3 m                                 |                       |        |        |
|  | 960 to 1000 MHz      | 54.0 dB $\mu$ V/m at 3 m                                 |                       |        |        |
| Radiated emissions FCC 47 CFR Part 15 section 15.225 (a)[2]                                      |                      |  |                       |        |        |
|  | Frequency range      | Limits<br>(microvolts/meter)                             | Reference standard    | Remark | Status |
| Operation with in the band<br>13.553 – 13.567 MHz  | 13.553 to 13.567 MHz | 15,848 at 30 m   | ANSI C63.4<br>(2003); | -      | Passed |
| Frequency tolerance over temperature and supply voltage FCC 47 CFR Part 15 section 15.225 (e)[2] |                      |  |                       |        |        |
| Application  |                      | Limits   | Reference standard    | Remark | Status |
| Temperature range -20°C to +50°C and<br>supply voltage 85 to 115 % or new battery                |                      | 0.01 %   | ANSI C63.4<br>(2003); | -      | Passed |

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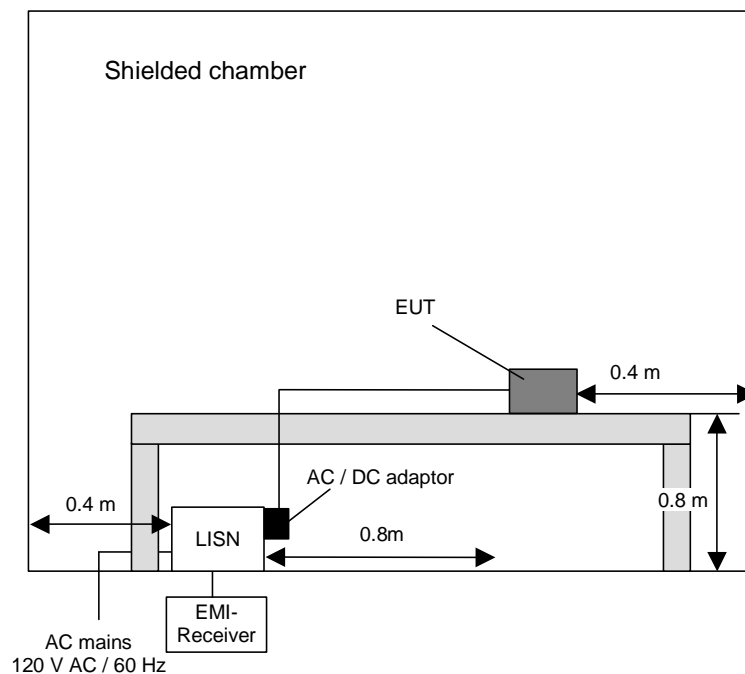
## 5 METHOD OF MEASUREMENT

### 5.1 CONDUCTED EMISSIONS ON POWER SUPPLY LINES (150 kHz to 30 MHz)

This test will be carried out in a shielded chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriate limit, this emission will be measured with the average and quasi-peak detector on all lines.

| Frequency range   | Resolution bandwidth |
|-------------------|----------------------|
| 150 kHz to 30 MHz | 9 kHz                |





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## 5.2 RADIATED EMISSIONS 9 kHz to 30 MHz

The radiated emission measurement is divided into two stages.

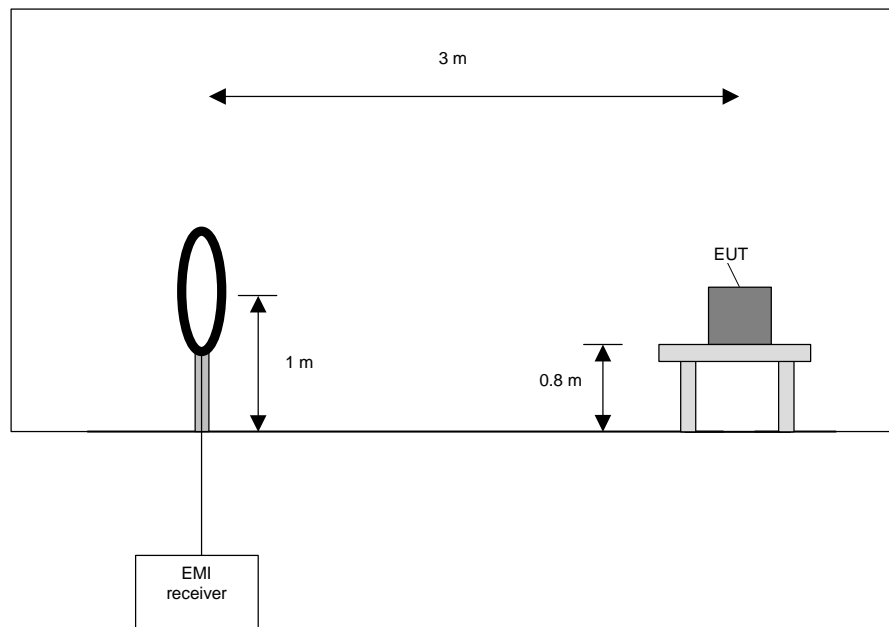
### Preliminary measurement:

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to found the maximum emissions.

The resolution bandwidth of the spectrum analyser will be set to the following values:

| Frequency range   | Resolution bandwidth |
|-------------------|----------------------|
| 9 kHz to 150 kHz  | 200 Hz               |
| 150 kHz to 30 MHz | 10 kHz               |



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Preliminary measurement procedure:

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
- 2) Manipulate the system cables within the range to produce the maximum level of emission.
- 3) Rotate the EUT by 360 ° to maximize the detected signals.
- 4) Make a hardcopy of the spectrum.
- 5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 6) Repeat steps 1) to 4) with the other orthogonal axes of the EUT.
- 7) Rotate the measuring antenna and repeat steps 1) to 5).

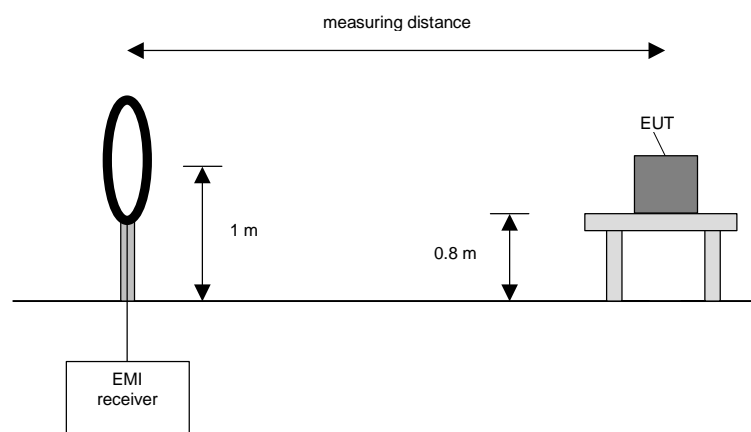
Final measurement:

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in a measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances are required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with a EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the during the preliminary measurement detected frequencies the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

The resolution bandwidth of the EMI Receiver will be set to the following values:

| Frequency range   | Resolution bandwidth |
|-------------------|----------------------|
| 9 kHz to 150 kHz  | 200 Hz               |
| 150 kHz to 30 MHz | 9 kHz                |



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Final measurement procedure:

The following procedure will be used:

- 1) Monitor the frequency range with the measuring antenna at vertical orientation parallel to the EUT at an azimuth of 0 °.
- 2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
- 3) Rotate the measuring antenna to find the maximum and note the value.
- 4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
- 5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT if applicable (handheld equipment).

### 5.3 RADIATED EMISSIONS 30 MHz to 1 GHz

The radiated emission measurement is divided into two stages.

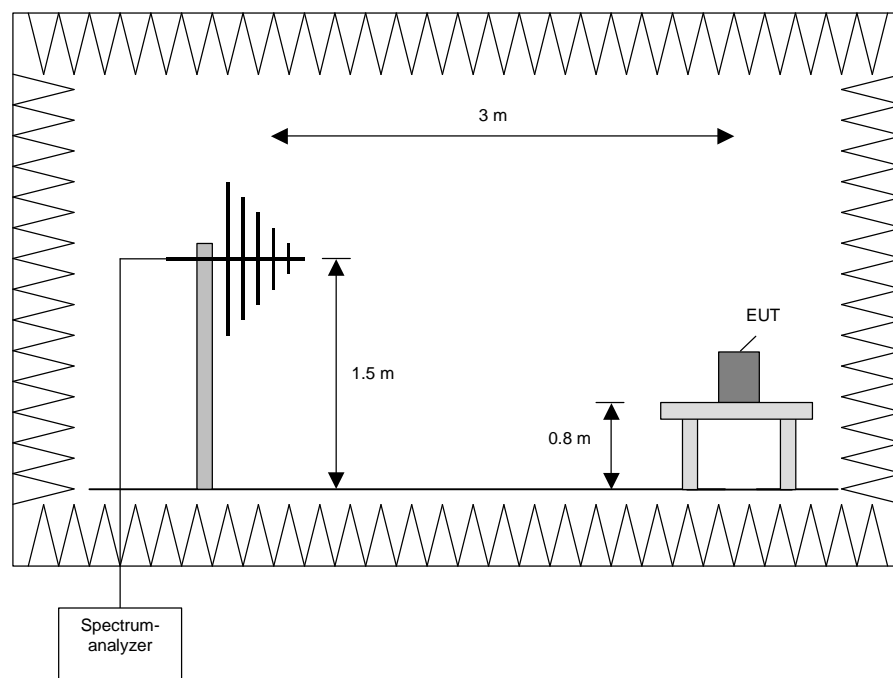
**Preliminary measurement:**

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

| Frequency range | Resolution bandwidth |
|-----------------|----------------------|
| 30 MHz to 1 GHz | 100 kHz              |



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**Procedure preliminary measurement:**

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.  
The following procedure will be used:

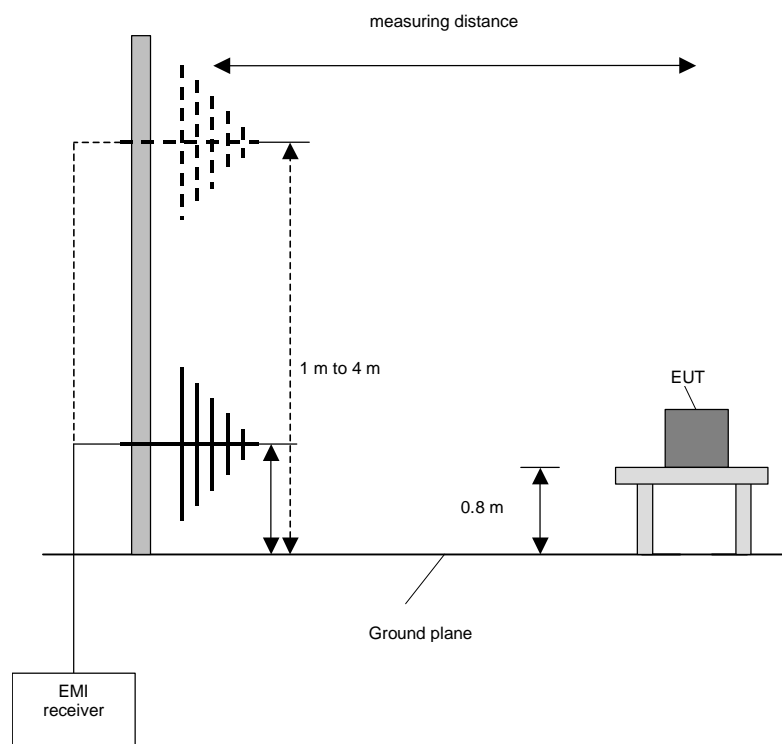
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of 3 highest detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat steps 1) to 4) with the other orthogonal axes of the EUT.
7. Repeat steps 1) to 5) with the vertical polarisation of the measuring antenna.

**Final Measurement:**

In the second stage a final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

| Frequency range | Resolution bandwidth |
|-----------------|----------------------|
| 30 MHz to 1 GHz | 120 kHz              |



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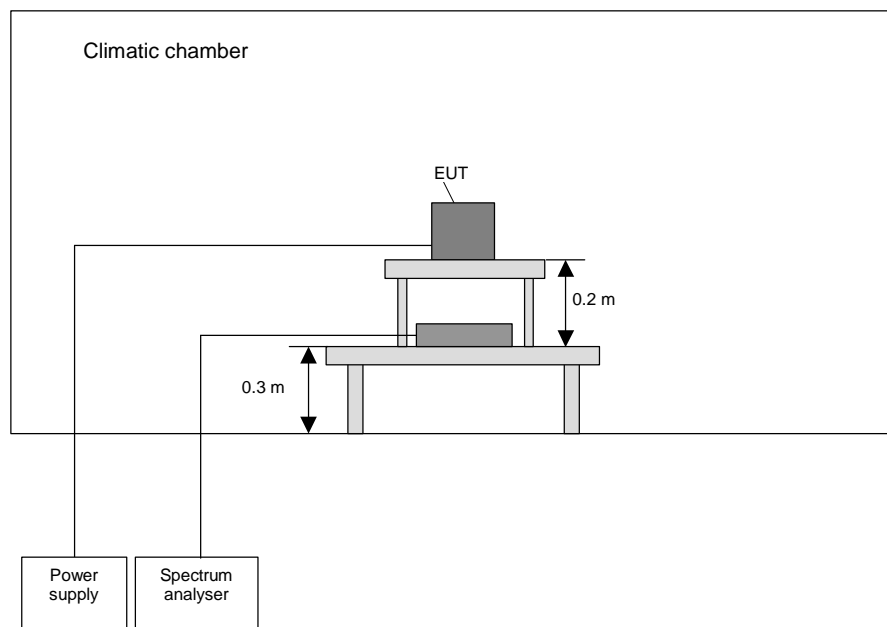
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Procedure final measurement:

The following procedure will be used:

- 1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
- 4) Repeat 1) to 3) for the other orthogonal antenna polarization.
- 5) Move the antenna and the turntable to the position where the maximum value is detected.
- 6) Measure while moving the antenna slowly +/- 1 m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable +/- 45 °.
- 9) Set the turntable to the azimuth where the maximum value is found.
- 10) Measure with Final detector (QP or AV) and note the value.
- 11) Repeat 5) to 10) for each frequency.
- 12) Repeat 1) to 11) for each orthogonal axes of the EUT if handheld equipment.

#### 5.4 FREQUENCY STABILITY WITH RESPECT TO AMBIENT TEMPERATURE AND SUPPLY VOLTAGE



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The following procedure will be used:

- 1) Place the EUT in the climatic chamber.
- 2) Switch on the EUT and check the correct function and the settings of the spectrum analyser.
- 3) Switch off the EUT and tune the climatic chamber to a temperature of 20 °C. Wait until the thermal balance is obtained.
- 4) Switch the EUT on and record the frequency 10 minutes after powering on.
- 5) Repeat 4) with the minimum and the maximum of the supply voltage.
- 6) Switch off the EUT and tune the climatic chamber to a temperature of 50 °C. Wait until the thermal balance is obtained.
- 7) Switch the EUT on and record the frequencies at start-up and 2, 5 and 10 minutes after powering on.
- 8) Repeat 7) with the minimum and the maximum of the supply voltage.
- 9) Switch off the EUT and tune the climatic chamber to a temperature of -20 °C. Wait until the thermal balance is obtained.
- 10) Switch the EUT on and record the frequencies at start-up and 2, 5 and 10 minutes after powering on.
- 11) Repeat 10) with the minimum and the maximum of the supply voltage.

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## 6 TEST RESULTS EMISSION TEST

### 6.1 CONDUCTED EMISSION MEASUREMENT ON AC MAINS (150 kHz to 30 MHz)

|                      |       |                    |      |
|----------------------|-------|--------------------|------|
| Ambient temperature: | 19 °C | Relative humidity: | 35 % |
|----------------------|-------|--------------------|------|

Position of EUT: The EUT was set-up on a wooden table of a height of 0.8 m.

Cable guide: All cables of the EUT were fixed on the wooden table. For further information of the cable guide refer to the pictures in annex C of this test report.

Test record: The test was carried out in normal operation mode of the EUT (reading a TAG). All results are shown in the following.

Power supply: During this test the EUT was powered by an AC / DC adaptor type FW3288.

Title: AC Powerline Conducted Emission Test with protective ground conductor simulating network

EUT: PRM5 / SWH-2100

Manufacturer: deister electronic GmbH

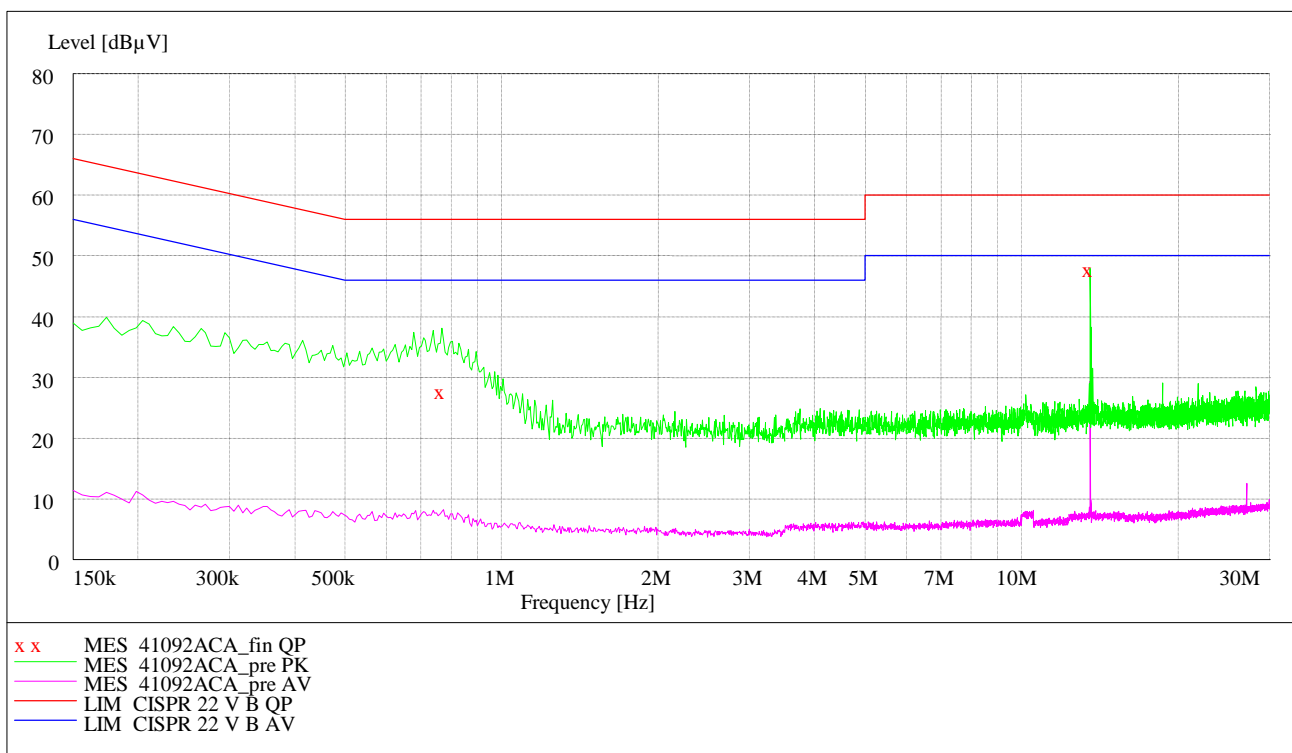
Operating Condition: Reading TAG, external DC-power supply

Test site: PHOENIX TEST-LAB Blomberg M4

Operator: Th. KÜHN

Test Specification:

Comment:



Data record name: 41092ACA

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**Result measured with the quasi-peak detector:**  
(These values are marked in the above diagram by x)

| Frequency<br>MHz | Level<br>dB $\mu$ V | Transducer<br>dB | Limit<br>dB $\mu$ V | Margin<br>dB | Line | PE  |
|------------------|---------------------|------------------|---------------------|--------------|------|-----|
| 0.768480         | 28.00               | 0.8              | 56.0                | 28.0         | L1   | FLO |
| 13.558200        | 48.20               | 1.8              | 60.0                | 11.8         | L1   | FLO |

Data record name: 41092ACA\_fin QP

Test: Passed

TEST EQUIPMENT USED:

1 - 3, 5, 6



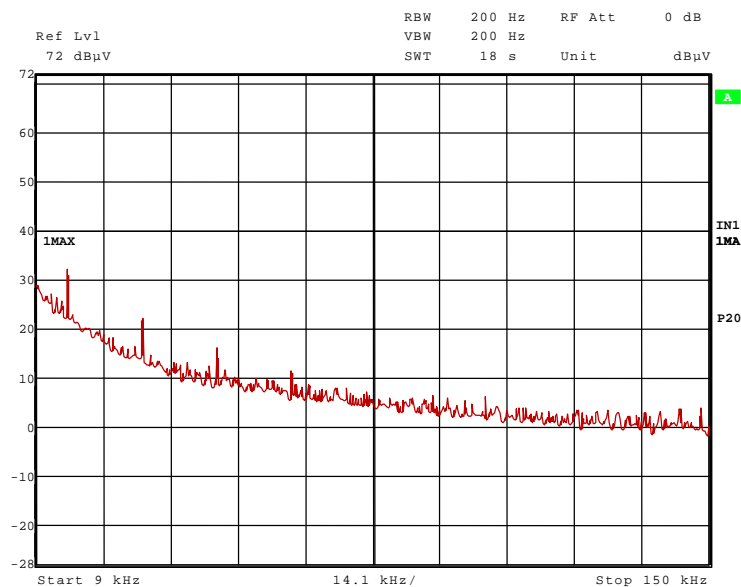
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## 6.2 PRELIMINARY RADIATED EMISSION TEST (9 kHz to 30 MHz)

|                      |       |                    |      |
|----------------------|-------|--------------------|------|
| Ambient temperature: | 21 °C | Relative humidity: | 33 % |
|----------------------|-------|--------------------|------|

- Position of EUT:** The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide:** The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record:** The test was carried out in normal operation mode of the EUT (reading TAG). All results are shown in the following.
- Remark:** The emissions found at 15.5 kHz, 31 kHz, 47.9 kHz and 62.5 kHz caused by the measuring system and not by the EUT.

### 41092A\_1: Spurious emissions from 9 kHz to 150 kHz:

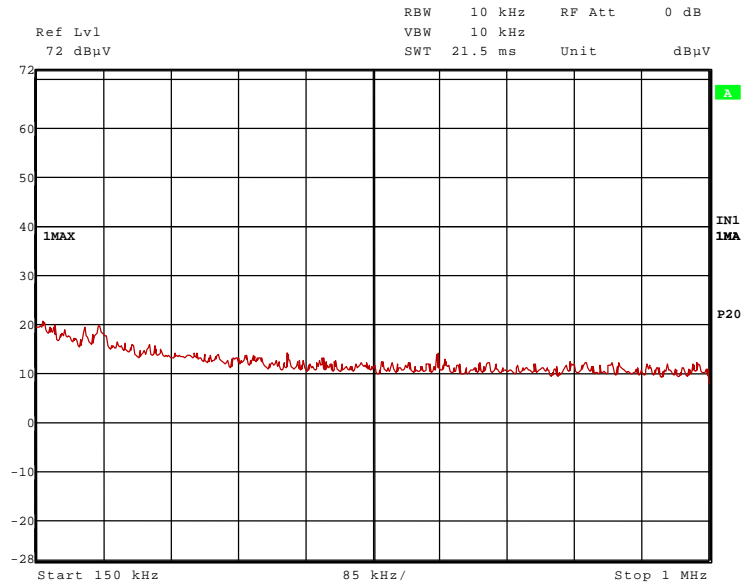


### TEST EQUIPMENT USED THE TEST:

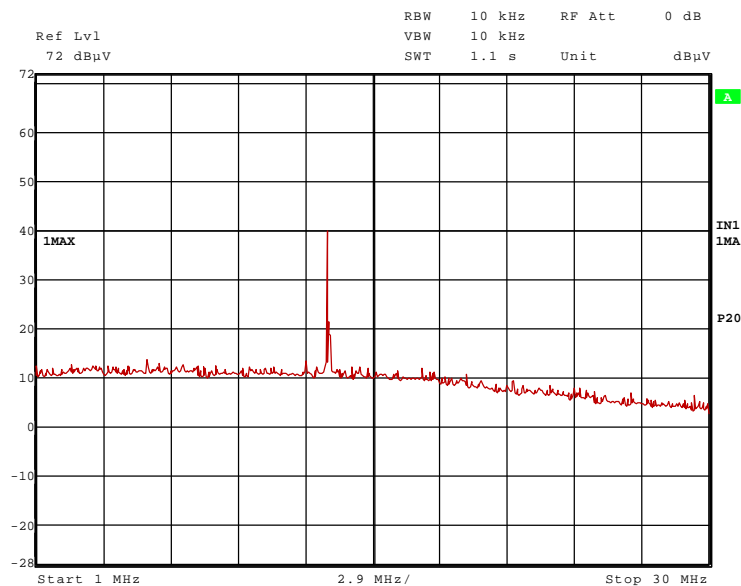
|                     |
|---------------------|
| 29, 31 – 33, 54, 56 |
|---------------------|

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41092A\_2.wmf: Spurious emissions from 150 kHz to 1 MHz:



41092A\_3.wmf: Spurious emissions from 1 MHz to 30 MHz:



No emissions found in and outside the restricted bands.

The following frequency was found inside the 13.533 to 13.567 MHz band according to FCC 47 CFR Part 15 section 15.225 [2]:

13.561 MHz.

This frequency has to be measured on the outdoor test site. The result of this final measurement is shown in subclause 6.4 of this test report.

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### 6.3 PRELIMINARY RADIATED EMISSION TEST (30 MHz to 1 GHz)

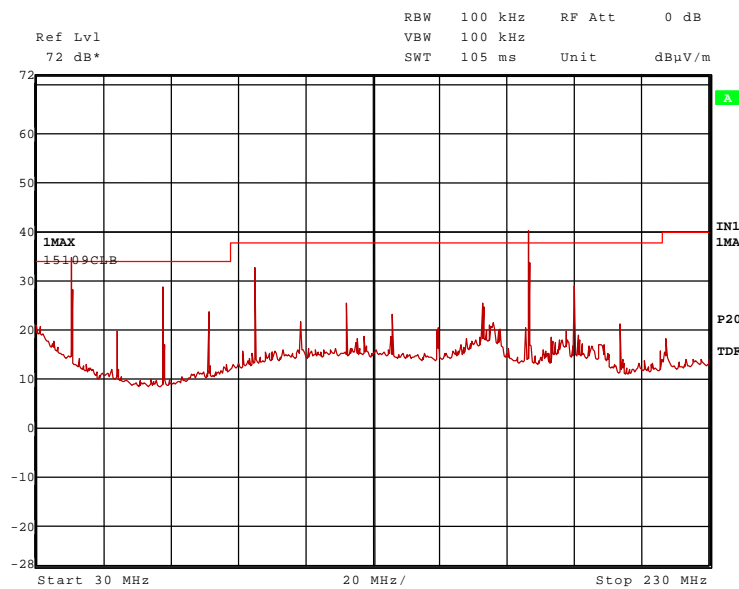
|                      |       |                    |      |
|----------------------|-------|--------------------|------|
| Ambient temperature: | 21 °C | Relative humidity: | 33 % |
|----------------------|-------|--------------------|------|

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

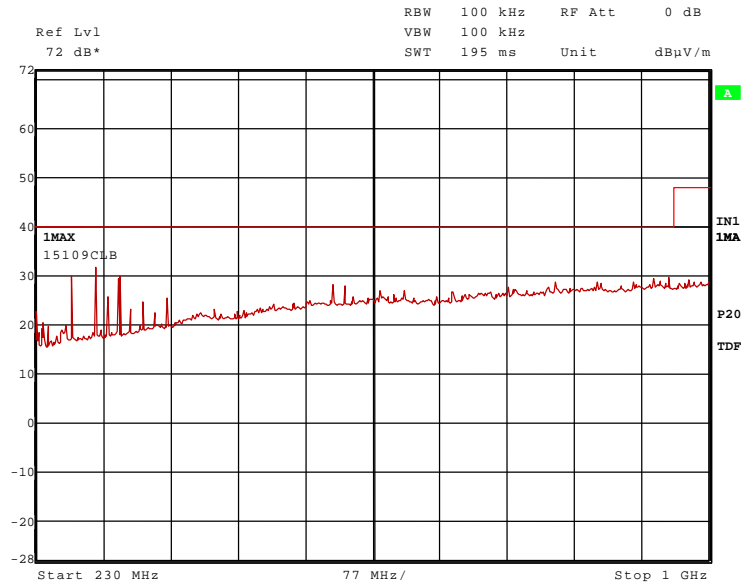
Test record: The test was carried out in normal operation mode of the EUT (reading TAG). All results are shown in the following.

#### 41092A\_4.wmf: Spurious emissions from 30 MHz to 230 MHz:



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41092A\_5.wmf: Spurious emissions from 230 MHz to 1 GHz:



The following frequencies were found during the preliminary radiated emission test:

- 40.685 MHz,
- 67.808 MHz,
- 94.931 MHz,
- 176.296MHz,
- 189.885 MHz,
- 298.344MHz,
- and 311.904 MHz.

The following frequencies were found inside the restricted bands according to FCC 47 CFR Part 15 section 15.205 [2].

- 162.734MHz,
- 271.223MHz
- and 325.464 MHz.

These frequencies have to be measured on the open area test site. The results of this final measurement are shown in subclause 6.5 of this test report.

TEST EQUIPMENT USED FOR THE TEST:

29, 31 - 35, 43, 54

TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

## 6.4 FINAL RADIATED EMISSION TEST (9 kHz to 30 MHz)

|                      |       |                    |      |
|----------------------|-------|--------------------|------|
| Ambient temperature: | 12 °C | Relative humidity: | 54 % |
|----------------------|-------|--------------------|------|

- Position of EUT:** The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 30 m.
- Cable guide:** The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record:** The test was carried out in normal operation mode of the EUT (reading TAG). All results are shown in the following.
- Supply voltage:** The EUT was supplied with 12 V DC via suitable AC/DC adaptors, and no difference was noticeable with supply voltages from 8 V DC to 16 V DC.
- Test results:** The test results were calculated with the following formula:  

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{antenna factor [dB/m]}$$

| Results with measuring distance of 10 m |                     |                    |           |          |                     |                       |
|---|---------------------|--------------------|-----------|----------|---------------------|-----------------------|
| Frequency MHz                           | Result dB $\mu$ V/m | Limit dB $\mu$ V/m | Margin dB | Detector | Readings dB $\mu$ V | Antenna factor * dB/m |
| 13.561                                  | 48.0                | 104.0              | 56.0      | QP       | 28.0                | 20.0                  |
| Results with measuring distance of 30 m |                     |                    |           |          |                     |                       |
| Frequency MHz                           | Result dB $\mu$ V/m | Limit dB $\mu$ V/m | Margin dB | Detector | Readings dB $\mu$ V | Antenna factor * dB/m |
| 13.561                                  | 37.1                | 84.0               | 46.9      | QP       | 17.1                | 20.0                  |

\*: Cable loss included

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

|         |
|---------|
| 54 – 57 |
|---------|

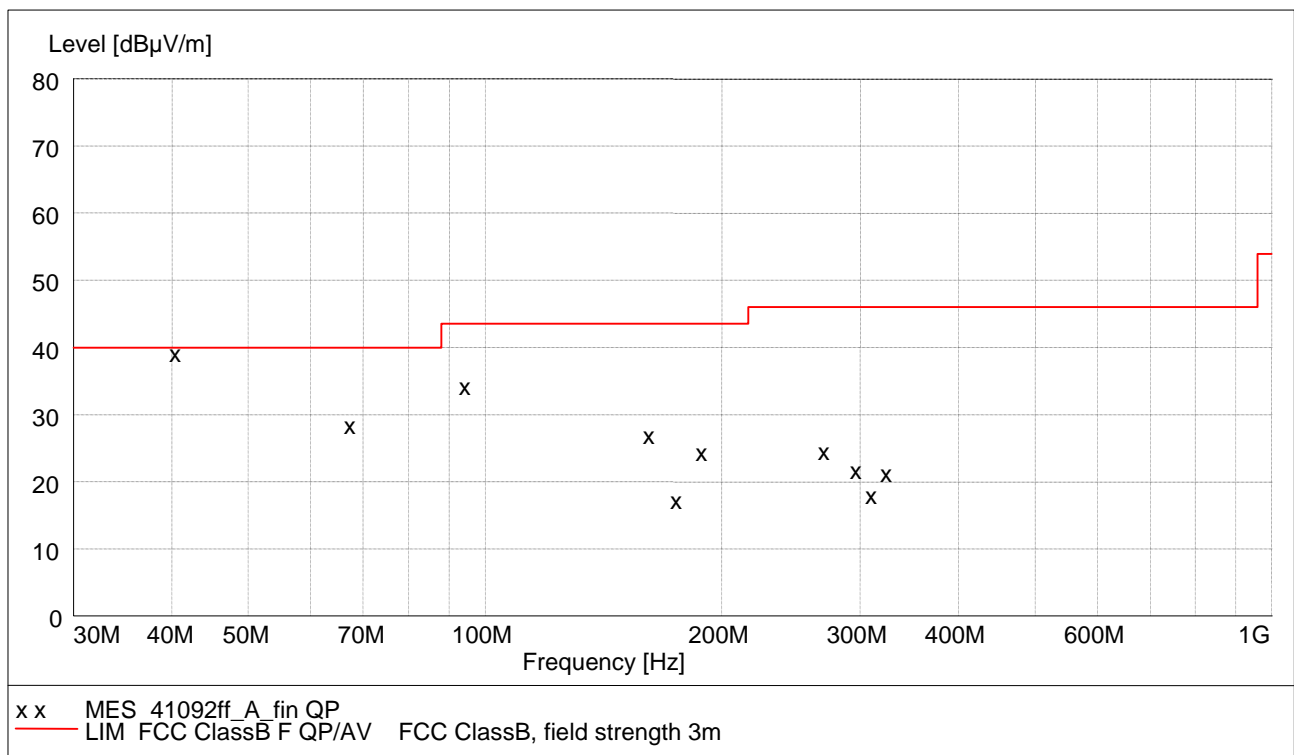
TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

### 6.5 FINAL RADIATED EMISSION TEST (30 MHz to 1 GHz)

|                      |       |                    |      |
|----------------------|-------|--------------------|------|
| Ambient temperature: | 18 °C | Relative humidity: | 43 % |
|----------------------|-------|--------------------|------|

- Position of EUT:** The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide:** The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record:** The test was carried out in normal operation mode of the EUT (reading TAG). All results are shown in the following.
- Supply voltage:** The EUT was supplied with 12 V DC via suitable AC/DC adaptors, and no difference was noticeable with supply voltages from 8 V DC to 16 V DC.
- Test results:** The test results were calculated with the following formula:
- $$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with x are the measured results of the standard final measurement on the open area test site.



Data record name: 41092ff\_A

TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

The results of the standard final measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

The measurement time with the quasi-peak measuring detector is 1 second.

| Spurious emissions outside restricted bands |                        |                       |              |                        |                        |                  |              |                |       |
|---|------------------------|-----------------------|--------------|------------------------|------------------------|------------------|--------------|----------------|-------|
| Frequency<br>MHz                            | Result<br>dB $\mu$ V/m | Limit<br>dB $\mu$ V/m | Margin<br>dB | Readings<br>dB $\mu$ V | Antenna factor<br>dB/m | Cable loss<br>dB | Height<br>cm | Azimuth<br>deg | Pol.  |
| 40.685                                      | 39.4                   | 40.0                  | 0.6          | 24.4                   | 14.6                   | 0.4              | 124.0        | 289.0          | Vert. |
| 67.808                                      | 28.7                   | 40.0                  | 11.3         | 22.0                   | 6.2                    | 0.5              | 112.0        | 0.0            | Vert. |
| 94.931                                      | 34.6                   | 43.5                  | 8.9          | 23.5                   | 10.5                   | 0.6              | 325.0        | 96.0           | Hor.  |
| 176.296                                     | 17.6                   | 43.5                  | 25.9         | 7.0                    | 9.8                    | 0.8              | 351.0        | 92.0           | Hor.  |
| 189.885                                     | 24.7                   | 43.5                  | 18.8         | 14.9                   | 9.0                    | 0.8              | 113.0        | 292.0          | Vert. |
| 298.344                                     | 22.0                   | 46.0                  | 24.0         | 7.9                    | 13.0                   | 1.1              | 125.0        | 237.0          | Vert. |
| 311.904                                     | 18.3                   | 46.0                  | 27.7         | 4.3                    | 12.9                   | 1.1              | 100.0        | 130.0          | Hor.  |
| Spurious emissions in restricted bands      |                        |                       |              |                        |                        |                  |              |                |       |
| Frequency<br>MHz                            | Result<br>dB $\mu$ V/m | Limit<br>dB $\mu$ V/m | Margin<br>dB | Readings<br>dB $\mu$ V | Antenna factor<br>dB/m | Cable loss<br>dB | Height<br>cm | Azimuth<br>deg | Pol.  |
| 162.734                                     | 27.3                   | 43.5                  | 16.2         | 15.5                   | 11.0                   | 0.8              | 174.0        | 292.0          | Hor.  |
| 271.223                                     | 24.9                   | 46.0                  | 21.1         | 11.6                   | 12.3                   | 1.0              | 107.0        | 39.0           | Hor.  |
| 325.464                                     | 21.6                   | 46.0                  | 24.4         | 7.0                    | 13.5                   | 1.1              | 117.0        | 334.0          | Hor.  |

The test results were calculated with the following formula:

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 - 20

TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

## 6.6 OCCUPIED BANDWIDTH

|                      |       |                    |      |
|----------------------|-------|--------------------|------|
| Ambient temperature: | 20 °C | Relative humidity: | 32 % |
|----------------------|-------|--------------------|------|

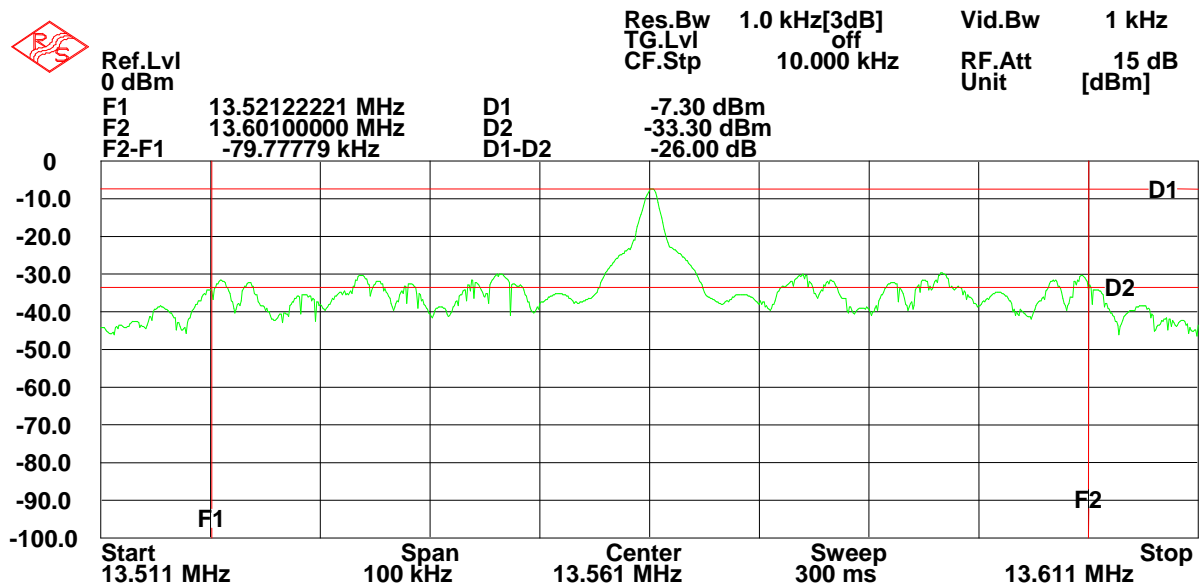
Test set-up: For this test the test set-up from the preliminary emission measurement test set-up was used.

Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report, because the same test set-up as for the frequency error was used.

Supply voltage: The EUT was supplied with 12 V DC by an external power supply.

Test record: The test was carried out in normal operation mode of the EUT (transmit mode without reading a TAG). All results are shown in the following.

41092\_5.hgl: Occupied bandwidth:



| $F_L$         | $F_U$         | BW ( $F_U - F_L$ ) |
|---------------|---------------|--------------------|
| 13.521222 MHz | 13.601000 MHz | 79.778 kHz         |

TEST EQUIPMENT USED THE TEST:

|                |
|----------------|
| 22, 54, 58, 59 |
|----------------|



TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

## 6.7 FREQUENCY TOLLERANCE

|                     |       |                   |      |
|---------------------|-------|-------------------|------|
| Ambient temperature | 20 °C | Relative humidity | 32 % |
|---------------------|-------|-------------------|------|

Test set-up: For this test the test set-up from the preliminary emission measurement test set-up was used.

Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Supply voltage: 8.0 V DC

| Temperature: | Minutes after switch on | Frequency:    | Allowed tolerance: | Measured tolerance: | Result:   |
|--------------|-------------------------|---------------|--------------------|---------------------|-----------|
| 20 ° C       | 10                      | 13.560990 MHz | -                  | -                   | Reference |
| 50 ° C       | 0                       | 13.560926 MHz | ± 1.356 kHz        | -64 Hz              | Passed    |
|              | 2                       | 13.560924 MHz | ± 1.356 kHz        | -66 Hz              | Passed    |
|              | 5                       | 13.560925 MHz | ± 1.356 kHz        | -65 Hz              | Passed    |
|              | 10                      | 13.560925 MHz | ± 1.356 kHz        | -65 Hz              | Passed    |
| - 20 ° C     | 0                       | 13.560912 MHz | ± 1.356 kHz        | -68 Hz              | Passed    |
|              | 2                       | 13.560930 MHz | ± 1.356 kHz        | -60 Hz              | Passed    |
|              | 5                       | 13.560926 MHz | ± 1.356 kHz        | -64 Hz              | Passed    |
|              | 10                      | 13.560927 MHz | ± 1.356 kHz        | -63 Hz              | Passed    |

Supply voltage: 16.0 V DC

| Temperature: | Minutes after switch on | Frequency:    | Allowed tolerance: | Measured tolerance: | Result:   |
|--------------|-------------------------|---------------|--------------------|---------------------|-----------|
| 20 ° C       | 10                      | 13.560990 MHz | -                  | -                   | Reference |
| 50 ° C       | 0                       | 13.560924 MHz | ± 1.356 kHz        | -66 Hz              | Passed    |
|              | 2                       | 13.560924 MHz | ± 1.356 kHz        | -66 Hz              | Passed    |
|              | 5                       | 13.560925 MHz | ± 1.356 kHz        | -65 Hz              | Passed    |
|              | 10                      | 13.560925 MHz | ± 1.356 kHz        | -65 Hz              | Passed    |
| - 20 ° C     | 0                       | 13.560921 MHz | ± 1.356 kHz        | -69 Hz              | Passed    |
|              | 2                       | 13.560928 MHz | ± 1.356 kHz        | -62 Hz              | Passed    |
|              | 5                       | 13.560927 MHz | ± 1.356 kHz        | -63 Hz              | Passed    |
|              | 10                      | 13.560924 MHz | ± 1.356 kHz        | -66 Hz              | Passed    |

Test result: Passed

TEST EQUIPMENT USED FOR THE TEST:

|                    |
|--------------------|
| 22, 54, 58, 59, 61 |
|--------------------|

TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

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## **7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS**

TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

| Emission measurement at AC mains and DC in / out ports at M4 |                     |               |                 |                          |                  |
|--|---------------------|---------------|-----------------|--------------------------|------------------|
| No.  | Test equipment      | Type          | Manufacturer    | Serial No.               | PM-No            |
| 1  | Shielded chamber M4 | -             | Siemens         | B83117S1-X158            | 480088           |
| 2  | Measuring receiver  | ESAI          | Rohde & Schwarz | 831953/001<br>833181/018 | 480025<br>480026 |
| 3  | LISN                | NSLK8128      | Schwarzbeck     | 8128155                  | 480058           |
| 4  | LISN                | NSLK 8128-    | Schwarzbeck     | 8128161                  | 480138           |
| 5  | AC-filter           | B84299-D87-E3 | Siemens         | 930262292                | 480097           |
| 6  | EMI-Software        | ES-K1         | Rohde & Schwarz | -                        | 480111           |

| Radiated emission measurement at M5 |                           |          |                 |                |        |
|-------------------------------------|---------------------------|----------|-----------------|----------------|--------|
| No.                                 | Test equipment            | Type     | Manufacturer    | Serial No.     | PM-No  |
| 7                                   | Fully anechoic chamber M5 | -        | Siemens         | B83177-S1-X156 | 480073 |
| 8                                   | Measuring receiver        | ESVS30   | Rohde & Schwarz | 829673/012     | 480024 |
| 9                                   | Controller                | HD100    | Deisel          | 100/324        | 480067 |
| 10                                  | Antenna support           | MA240    | Deisel          | 228/314        | 480069 |
| 11                                  | Turntable                 | DS412    | Deisel          | 412/317        | 480070 |
| 12                                  | Antenna                   | CBL6112C | Chase           | 2689           | 480327 |
| 13                                  | EMI Software              | ES-K1    | Rohde & Schwarz | -              | 480111 |

| Radiated emission measurement at M6 |                     |           |                  |            |        |
|-------------------------------------|---------------------|-----------|------------------|------------|--------|
| No.                                 | Test equipment      | Type      | Manufacturer     | Serial No. | PM-No  |
| 14                                  | Open area test site | -         | Phoenix Test-Lab | -          | 480085 |
| 15                                  | Measuring receiver  | ESVS30    | Rohde & Schwarz  | 829673/012 | 480024 |
| 16                                  | Controller          | HD100     | Deisel           | 100/670    | 480139 |
| 17                                  | Turntable           | DS420HE   | Deisel           | 420/620/80 | 480087 |
| 18                                  | Antenna support     | AS615P    | Deisel           | 615/310    | 480086 |
| 19                                  | Antenna             | CBL6111 A | Chase            | 1643       | 480147 |
| 20                                  | EMI Software        | ES-K1     | Rohde & Schwarz  | -          | 480111 |

TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

| Radiated emission measurement at M8 |                           |           |                 |                          |                  |
|-------------------------------------|---------------------------|-----------|-----------------|--------------------------|------------------|
| No.                                 | Test equipment            | Type      | Manufacturer    | Serial No.               | PM-No            |
| 21                                  | Fully anechoic chamber M8 | -         | Siemens         | B83117-E7019-T231        | 480190           |
| 22                                  | Measuring receiver        | ESMI      | Rohde & Schwarz | 843977/001<br>843530/018 | 480179<br>480180 |
| 23                                  | Measuring receiver        | ESCS 30   | Rohde & Schwarz | 828985/014               | 480270           |
| 24                                  | Controller                | HD100     | Deisel          | 100/427                  | 480181           |
| 25                                  | Turntable                 | DS420     | Deisel          | 420/435/97               | 480186           |
| 26                                  | Antenna support           | AS615P    | Deisel          | 615/310                  | 480187           |
| 27                                  | Antenna                   | CBL6112 A | Chase           | 2034                     | 480185           |
| 28                                  | EMI Software              | ES-K1     | Rohde & Schwarz | -                        | 480111           |

| Radiated emission measurement at M20 |   |           |                    |                          |                  |
|--------------------------------------|---|-----------|--------------------|--------------------------|------------------|
| No.                                  | Test equipment                          | Type      | Manufacturer       | Serial No.               | PM-No            |
| 29                                   | Fully anechoic chamber M20              | -         | Albatross Projects | B83107-E2439-T232        | 480303           |
| 30                                   | Measuring receiver                      | ESMI      | Rohde & Schwarz    | 843977/001<br>843530/018 | 480179<br>480180 |
| 31                                   | Measuring receiver                      | ESI 40    | Rohde & Schwarz    | 100064                   | 480355           |
| 32                                   | Controller                              | HD100     | Deisel             | 100/670                  | 480326           |
| 33                                   | Turntable                               | DS420HE   | Deisel             | 420/620/80               | 480315           |
| 34                                   | Antenna support                         | AS615P    | Deisel             | 615/310                  | 480187           |
| 35                                   | Antenna                                 | CBL6112 B | Chase              | 2688                     | 480328           |
| 36                                   | Antenna                                 | 3115 A    | EMCO               | 9609-4918                | 480183           |
| 37                                   | Standard Gain Horn<br>11.9GHZ – 18GHZ   | 18240-20  | Flann Microwave    | 483                      | 480294           |
| 38                                   | Standard Gain Horn<br>11.9GHZ – 18GHZ   | 18240-20  | Flann Microwave    | 482                      | 480295           |
| 39                                   | Standard Gain Horn<br>17.9GHZ – 26.7GHZ | 20240-20  | Flann Microwave    | 411                      | 480297           |
| 40                                   | Standard Gain Horn<br>17.9GHZ – 26.7GHZ | 20240-20  | Flann Microwave    | 410                      | 480296           |
| 41                                   | Standard Gain Horn<br>26.4GHZ – 40.1GHZ | 22240-20  | Flann Microwave    | 469                      | 480299           |

TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

| No. | Test equipment                          | Type                       | Manufacturer    | Serial No. | PM-No  |
|-----|---|----------------------------|-----------------|------------|--------|
| 42  | Standard Gain Horn<br>26.4GHZ – 40.1GHZ | 22240-20                   | Flann Microwave | 468        | 480298 |
| 43  | RF-cable No. 30                         | RTK 081                    | Rosenberger     | -          | 410141 |
| 44  | RF-cable No. 31                         | RTK 081                    | Rosenberger     | -          | 410142 |
| 45  | RF-cable 1m                             | KPS-1533-<br>400-KPS       | Insulated Wire  | -          | 480300 |
| 46  | RF-cable 1m                             | KPS-1533-<br>400-KPS       | Insulated Wire  | -          | 480301 |
| 47  | RF-cable 2m                             | KPS-1533-<br>400-KPS       | Insulated Wire  | -          | 480302 |
| 48  | RF-cable No. 5                          | RTK 081                    | Rosenberger     |            | 410097 |
| 49  | Preamplifier                            | JS3-<br>00101200-<br>23-5A | Miteq           | 681851     | 480337 |
| 50  | Preamplifier                            | JS3-<br>12001800-<br>16-5A | Miteq           | 571667     | 480343 |
| 51  | Preamplifier                            | JS3-<br>18002600-<br>20-5A | Miteq           | 658697     | 480342 |
| 52  | Preamplifier                            | JS3-<br>26004000-<br>25-5A | Miteq           | 563593     | 480344 |
| 53  | EMI Software                            | ES-K1                      | Rohde & Schwarz | -          | 480111 |

| Ancillary equipment used for testing |                            |           |                  |             |        |
|--------------------------------------|----------------------------|-----------|------------------|-------------|--------|
| No.                                  | Test equipment             | Type      | Manufacturer     | Serial No.  | PM-No  |
| 54                                   | Power supply               | TOE 8852  | Toellner         | 51712       | 480233 |
| 55                                   | Outdoor test site          | -         | Phoenix Test-Lab | -           | 480293 |
| 56                                   | Loop antenna               | HFH2-Z2   | Rohde & Schwarz  | 832609/014  | 480059 |
| 57                                   | EMI test receiver          | ESPC      | Rohde & Schwarz  | 843756/006  | 480150 |
| 58                                   | Test fixture               | -         | Phoenix Test-Lab | -           | 410160 |
| 59                                   | RF-cable No. 10            | RG223     | Phoenix-Test-Lab | -           | 410102 |
| 60                                   | AC power source / analyser | 6813A     | Hewlett Packard  | 3524A-00484 | 480155 |
| 61                                   | Climatic chamber           | GTS500.40 | GTS              | 1660        | 490073 |

All used measurement equipment was calibrated (if necessary). The calibration intervals and the calibration history will be given out on request.

TEST REPORT REFERENCE: R41092A Revision 1, Edition 2

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## 8 LIST OF ANNEXES

|                |   |                |
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|                | PRM5 / SWH-2100, test set-up shielded chamber       | 41092A_2.jpg   |
|                | PRM5 / SWH-2100, test set-up fully anechoic chamber | 41092A_12.jpg  |
|                | PRM5 / SWH-2100, test set-up fully anechoic chamber | 41092A_10.jpg  |
|                | PRM5 / SWH-2100, test set-up outdoor test site      | 41092A_6.jpg   |
|                | PRM5 / SWH-2100, test set-up open area test site    | 41092A_8.jpg   |
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| <b>ANNEX B</b> | <b>INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:</b>     | <b>5 pages</b> |
|                | PRM5 / SWH-2100, rear view                          | 41092A_d.jpg   |
|                | PRM5 / SWH-2100, main PCB, top view                 | 41092A_c.jpg   |
|                | PRM5 / SWH-2100, main PCB, bottom view              | 41092A_b.jpg   |
|                | PRM5 / SWH-2100, antenna PCB, top view              | 41092A_f.jpg   |
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| <b>ANNEX C</b> | <b>EXTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:</b>     | <b>1 page</b>  |
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