

Test Report

Report Number:

F222097E4

Equipment under Test (EUT):

Passive entry car key

MS6

Applicant:

Marquardt GmbH

Manufacturer:

Marquardt GmbH



Deutsche
Akkreditierungsstelle
D-PL-17186-01-00

References

- [1] **ANSI C63.4:2014** 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 2:** General Rules and Regulations
- [3] **FCC 47 CFR Part 15:** Radio Frequency Devices (Subpart B)
- [4] **ICES-003 Issue 7: (October 2020)** Spectrum Management and Telecommunications. Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus) —Limits and Methods of Measurement

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test. The complete test results are presented in the following.
“Passed” indicates that the equipment under test conforms with the relevant limits of the testing standard without taking any measurement uncertainty into account as stated in clause 10.2.8.2 of ANSI C63.4 (2014). However, the measurement uncertainty is calculated and shown in this test report.

Tested and written
by:

Signature

Reviewed and
approved by:

Signature

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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 NUMBER.

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1 Identification

1.1 Applicant

| | |
|--|--|
| Name: | Marquardt GmbH |
| Address: | Schloßstraße 16 78604 Rietheim-Weilheim |
| Country: | Germany |
| Name for contact purposes: | Mr. Gerd SIEGEL |
| Phone: | +49 74 24 99-15 89 |
| eMail address: | gerd.siegel@marquardt.de |
| Applicant represented during the test by the following person: | |

1.2 Manufacturer

| | |
|---|--|
| Name: | Marquardt GmbH |
| Address: | Schloßstraße 16 78604 Rietheim-Weilheim |
| Country: | Germany |
| Name for contact purposes: | Mr. Gerd SIEGEL |
| Phone: | +49 74 24 99-15 89 |
| eMail address: | gerd.siegel@marquardt.de |
| Manufacturer represented during the test by the following person: | |

1.3 Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

Accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-05 and D-PL-17186-01-06, FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

| | |
|----------------------------|-----------------------|
| Test object: * | Passive entry car key |
| Model name: * | MS6 |
| Serial number: * | #12 |
| PCB identifier: * | 243.677.011 |
| Hardware version: * | 23/19/00 |
| Software version: * | 23/19.00 |
| FCC ID: * | IYZMS6 |
| IC certification number: * | 2701A-MS6 |
| PMN: * | MS6 |
| HVIN: * | MS6 |
| FVIN: * | N/A |

* Declared by the applicant

One EUT was used for all tests.

Note: PHOENIX TESTLAB GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

| General | | | |
|--|--------------------------------|--------------------------------|--------------------------------|
| Power supply EUT: * | Lithium battery CR2032 | | |
| Supply voltage EUT: * | $U_{nom} = 3.0 \text{ V}_{DC}$ | $U_{min} = 2.4 \text{ V}_{DC}$ | $U_{max} = 3.3 \text{ V}_{DC}$ |
| Temperature range: * | -20 °C to +65 °C | | |
| Lowest / highest internal frequency: * | 21.845 kHz / 434.37 MHz | | |

* Declared by the applicant

| RF part: | |
|--------------------------|--------------------------------------|
| Duty cycle class :* | Manual triggered device |
| Channel spacing: * | 450 kHz (three channel operation) |
| Operating Frequencies: * | 433.47 MHz / 433.92 MHz / 434.37 MHz |
| Transmitter power: * | -16 dBm |
| Modulation: * | BFSK |
| Frequency deviation: * | ± 10 kHz |
| Data rate: * | 10kBit/s |
| Antenna: * | Integrated PCB-Loop antenna |
| LF receiver | |
| Operating frequency: * | 21.85 kHz |
| Number of channels: * | 1 |
| Type of modulation: * | BPSK |
| Data rate: * | 5.4 kBit/s |
| Antenna type: * | 3D-Axis-Coil, Rx at all axis |

* Declared by the applicant

| Ports / Connectors | | | | |
|--------------------|---------------------------------|-----------|--------------------|----------------------|
| Identification | Connector | | Length during test | Shielding (Yes / No) |
| | EUT | Ancillary | | |
| - | - | - | - | - |
| - | No lines connectable to the EUT | | - | - |
| - | - | - | - | - |

1.6 Dates

| | |
|---------------------------------|------------|
| Date of receipt of test sample: | 23.06.2023 |
| Start of test: | 27.06.2023 |
| End of test: | 04.07.2023 |

2 Operational States

Description of function of the EUT:

The MS6 is a passive entry car key and is part of a driving authorisation system for a car. The complete driver authorisation system consists of the MS6, the BODY CONTROL UNIT and an external antenna module. The BODY CONTROL UNIT sends an LF signal to the MS6 to wake it up. The MS6 responds using the RF part. The components exchange encrypted data for car access, to start the engine and to locate the key.

Optional the car can be accessed without handling the key. In this case RF signals are exchanged bidirectional when touching the door handle.

In case the battery is low, car access is possible by means of an integrated mechanic emergency key. The MS6 is then to be placed into a dedicated slot inside the vehicles centre console to be powered wireless by means of a magnetic field.

Because the EUT is a handheld device, the radiated emission measurements were carried out in three orthogonal directions. The positions were defined as follows:

Position 1: EUT lying on the table, buttons showing upwards.

Position 2: EUT standing on its long housing side, buttons showing right hand side.

Position 3: EUT standing on its short housing side, buttons showing right hand side.

For details of the three positions, refer also the photographs in annex A of this test report.

All measurements were carried out by using new batteries.

Test modes:

In test mode the EUT is transmitting or receiving continuously with a duty cycle of 100%.

| Button pressed | Button 1 Open | Button 2 Close | Button 3 Trunk |
|----------------|--|--|--|
| Shortly | Continuous receiving at 433.47 MHz (operation mode 4) | Continuous receiving at 434.37 MHz (operation mode 5) | Continuous receiving at 433.92 MHz (operation mode 6) |
| Long | Continuous transmitting at 433.47 MHz (operation mode 1) | Continuous transmitting at 434.37 MHz (operation mode 2) | Continuous transmitting at 433.92 MHz (operation mode 3) |

3 Additional Information

The EUT was not labeled.

The results of the measurements of the transmitter part of the EUT are documented under PHOENIX TESTLAB GmbH test report reference F222097E2.

Because the housing of the EUT is friction welded, the internal photographs are supplied by the applicant to keep the tested sample operational.

4 Overview

| Conducted emissions FCC 47 CFR Part 15 section 15.107 (a), (b) [3] ICES-003 Issue 7 section 3.2.1[4] | | | | |
|---|-----------------|--|--------------------|-------------------|
| Application | Frequency range | Limits | Reference standard | Status |
| AC supply line Class B | 0.15 to 0.5 MHz | 66 to 56 dB(μ V) QP* 56 to 46 dB(μ V) AV* | ANSI C63.4 | Not applicable ** |
| | 0.5 to 5 MHz | 56 dB(μ V) QP 46 dB(μ V) AV | | |
| | 5 to 30 MHz | 60 dB(μ V) QP 50 dB(μ V) AV | | |
| *: Decreases with the logarithm of the frequency **: Not applicable, because the EUT is supplied by a non-rechargeable battery only. | | | | |

| Radiated emissions FCC 47 CFR Part 15 section 15.109 (a), (b) [3] | | | | |
|---|-----------------|---|--------------------|--------|
| Application | Frequency range | Limits | Reference standard | Status |
| Radiated Emission Class B | 30 to 88 MHz | 40.0 dB(μ V/m) QP at 3 m | ANSI C63.4 | Passed |
| | 88 to 216 MHz | 43.5 dB(μ V/m) QP at 3 m | | |
| | 216 to 960 MHz | 46.0 dB(μ V/m) QP at 3 m | | |
| | 960 to 1000 MHz | 54.0 dB(μ V/m) QP at 3 m | | |
| | above 1000 MHz | 54.0 dB(μ V/m) AV at 3 m and 74.0 dB(μ V/m) PK at 3 m | | |

| Radiated emissions ICES-003 Issue 7 section 3.2.2 [4] | | | | |
|---|-----------------|---|--------------------|--------|
| Application | Frequency range | Limits | Reference standard | Status |
| Radiated Emission Class B | 30 to 88 MHz | 40.0 dB(μ V/m) QP at 3 m | ANSI C63.4 | Passed |
| | 88 to 216 MHz | 43.5 dB(μ V/m) QP at 3 m | | |
| | 216 to 230 MHz | 46.0 dB(μ V/m) QP at 3 m | | |
| | 230 to 960 MHz | 47.0 dB(μ V/m) QP at 3 m | | |
| | 960 to 1000 MHz | 54.0 dB(μ V/m) QP at 3 m | | |
| | above 1000 MHz | 54 dB(μ V/m) AV at 3 m and 74 dB(μ V/m) PK at 3 m | | |

Remark: As declared by the applicant the highest internal clock frequency is < 500 MHz.
Therefore, the radiated emission measurement must be carried out up to 2 GHz.

The EUT was classified by the applicant as CLASS B equipment.

5 Results

5.1 Test setups

5.1.1 Radiated: 30 MHz to 1 GHz

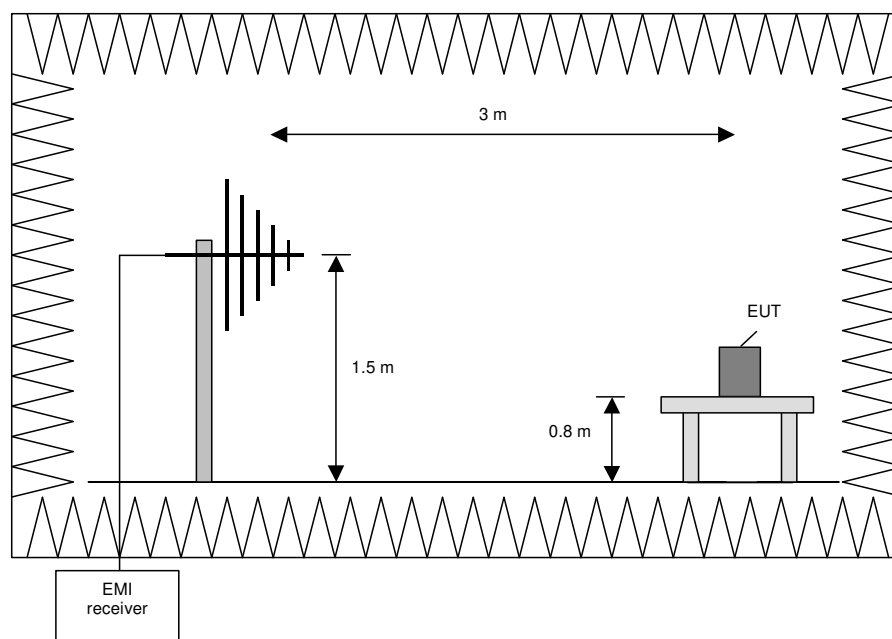
5.1.1.1 Preliminary and final measurement 30 MHz to 1 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber with a metal ground plane at a measuring distance of 3 meters. Table-top devices are 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 are placed directly on the turntable / ground plane. The setup of the equipment under test is in accordance with [1].

During the tests the EUT is rotated in the range of 0 ° to 360 °, the measuring antenna is set to horizontal and vertical polarization 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 is set to the following values:

| Test | Frequency range | Step-size | Resolution bandwidth | Measuring time | Detector |
|-------------------------|-----------------|-----------|----------------------|----------------|--------------|
| Preliminary measurement | 30 MHz to 1 GHz | 30 kHz | 120 kHz | - | Peak Average |
| Frequency peak search | ± 120 kHz | 10 kHz | 120 kHz | 1 s | Peak |
| Final measurement | 30 MHz to 1 GHz | - | 120 kHz | 1 s | QuasiPeak |



Procedure preliminary measurement:

The following procedure is used:

- 1) Set the measuring antenna to 1 m height.
- 2) Monitor the frequency range at horizontal polarization of the measuring antenna and an EUT / turntable azimuth of 0 °.
- 3) Rotate the EUT by 360° to maximize the detected signals.
- 4) Repeat steps 2 to 3 with the vertical polarization of the measuring antenna.
- 5) Increase the height of the measuring antenna for 0.5 m and repeat steps 2 to 4 until the final height of 4 m is reached.
- 6) The highest values for each frequency are saved by the software, including the measuring antenna height and polarization and the turntable azimuth for that value.

Procedure final measurement:

The following procedure is used:

- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced step size of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case EUT orientation (x,y,z) for the final test.
- 4) The worst-case measuring antenna height is found via varying the height by +/- 0.5 m from the value obtained in the preliminary measurement while monitoring the emission level.
- 5) The worst-case turntable position is found via varying the turntable azimuth by +/- 30° from the value obtained in the preliminary measurement while monitoring the emission level.
- 6) The final measurement is performed at the worst-case measuring antenna height and the worst-case turntable azimuth.
- 7) Steps 2 to 6 are repeated for each frequency peak selected in step 1.

5.1.2 Radiated: 1 GHz to 40 GHz

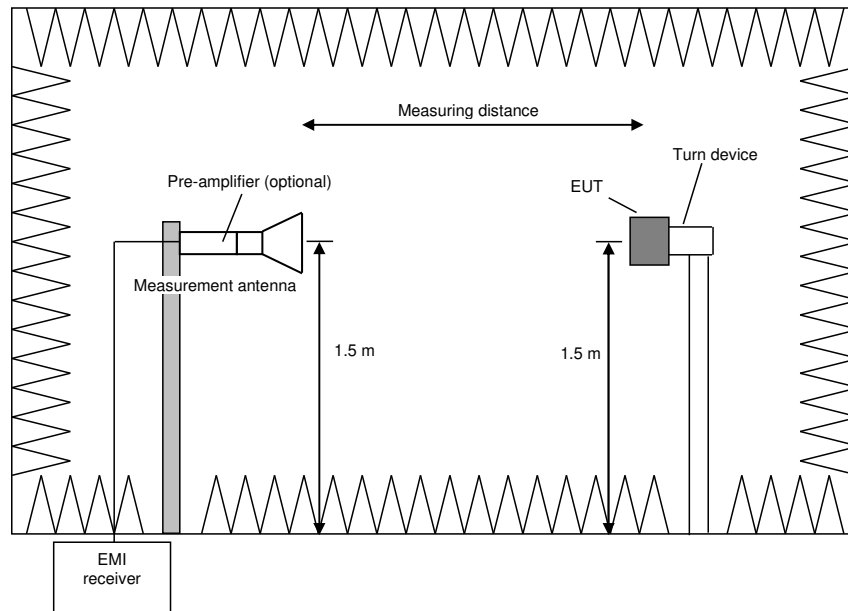
5.1.2.1 Preliminary and final measurement 1 to 40 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber at a measuring distance of 3 meters, with floor absorbers between EUT and measuring antenna. Table-top devices are 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 are placed directly on the turntable / ground plane. The setup of the equipment under test is in accordance with [1].

During the tests the EUT is rotated in the range of 0 ° to 360 °, the measuring antenna is set to horizontal and vertical polarization and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions. While changing the height, the measuring antenna gets tilted so that it is always aiming at the EUT.

The resolution bandwidth of the EMI receiver is set to the following values:

| Test | Frequency range | Step-size | Resolution bandwidth | Measuring time | Detector |
|-------------------------|-----------------|-----------|----------------------|----------------|--------------|
| Preliminary measurement | 1 - 40 GHz | 250 kHz | 1 MHz | - | Peak Average |
| Frequency peak search | + / - 1 MHz | 50 kHz | 1 MHz | 100 ms | Peak |
| Final measurement | 1 - 40 GHz | - | 1 MHz | 100 ms | Peak Average |



Procedure preliminary measurement:

The following procedure is used:

- 1) Monitor the frequency range at horizontal polarisation of the measuring antenna and an EUT / turntable azimuth of 0 °.
- 2) Rotate the EUT by 360° to maximize the detected signals.
- 3) Repeat steps 1 to 2 with the vertical polarisation of the measuring antenna.
- 4) Repeat steps 1 to 3 with the EUT reorientated by an angle of 30° (60°, 90°, 120° and 150°), according to 6.6.5.4 in [1].
- 5) The highest values for each frequency are saved by the software, including the measuring antenna polarization, the turntable azimuth and the turn device elevation for that value.

Procedure final measurement:

The following procedure is used:

- 1) Set the turntable and the turn device to the position which leads to the highest emission for the first frequency identified in the preliminary measurements.
- 2) Set the measurement antenna to the polarisation which leads to the highest emission for the first frequency identified in the preliminary measurements.
- 3) Set the spectrum analyser to EMI mode with Peak and Average detector activated.
- 4) The worst-case turntable position is found via varying the turntable azimuth by +/- 30° from the value obtained in the preliminary measurement while monitoring the emission level.
- 5) The final measurement is performed at the worst-case turntable azimuth.
- 6) Repeat steps 1 to 5 for each frequency detected during the preliminary measurements.

5.2 Radiated emissions

5.2.1 Test setup (Maximum unwanted emissions)

| Test setup (Maximum unwanted emissions) | | | |
|---|---|----------------|---------|
| Used | Setup | See sub-clause | Comment |
| <input checked="" type="checkbox"/> | Radiated: 30 MHz to 1 GHz / 1 GHz to 40 GHz | 5.1.1 / 5.1.2 | - |

5.2.2 Test method (Maximum unwanted emissions)

Test method (radiated) see sub-clause 5.1.1 / 5.1.2 as described herein

5.2.3 Test results (Maximum unwanted emissions)

5.2.3.1 Test results (30 MHz – 1 GHz)

| | |
|----------------------|-------|
| Ambient temperature: | 22 °C |
| Relative humidity: | 47 % |

| | |
|------------|-------------|
| Date: | 04.07.2023 |
| Tested by: | Thomas KÜHN |

Position of EUT: For tests for f between 30 MHz to 1 GHz, the EUT was set-up on a table with a height of 80 cm. The distance between EUT and antenna was 3 m.

Cable guide: For detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Test record: Plots for each frequency range are submitted below.

Remark: All 3 orthogonal planes were tested separately

Calculations:

Result [dBμV/m] = Reading [dBμV] + Correction [dB/m]

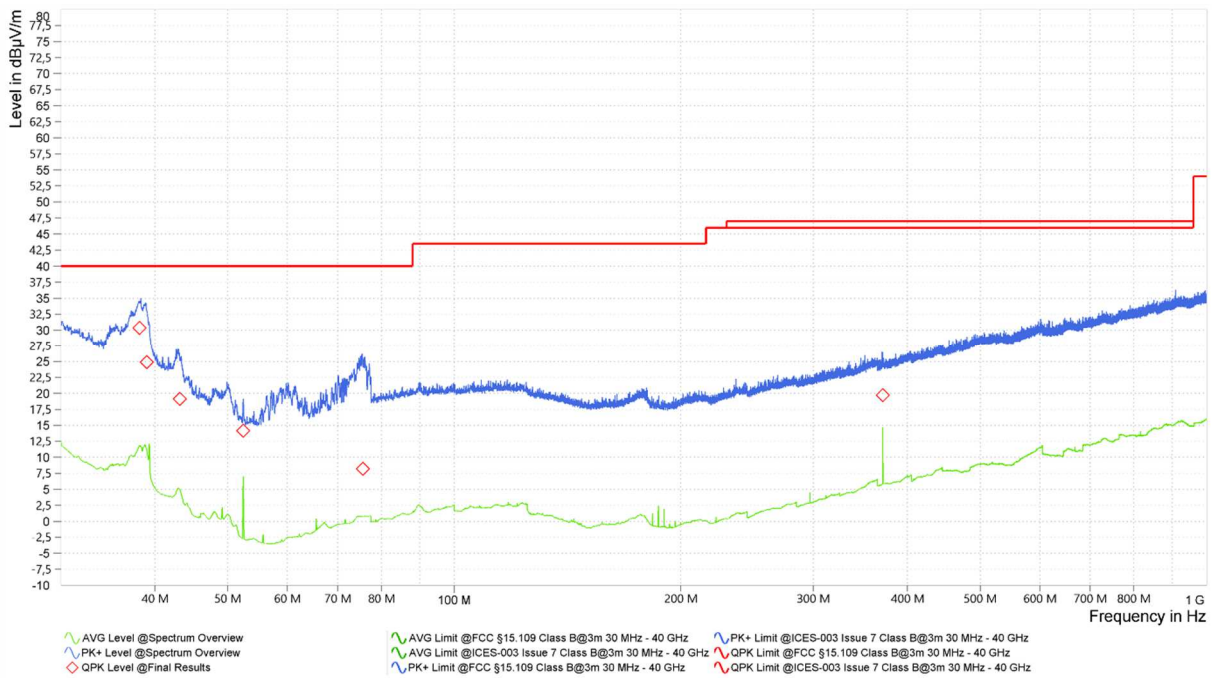
Correction [dB/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]

Margin [dB] = Limit [dBμV/m] - Result [dBμV/m]

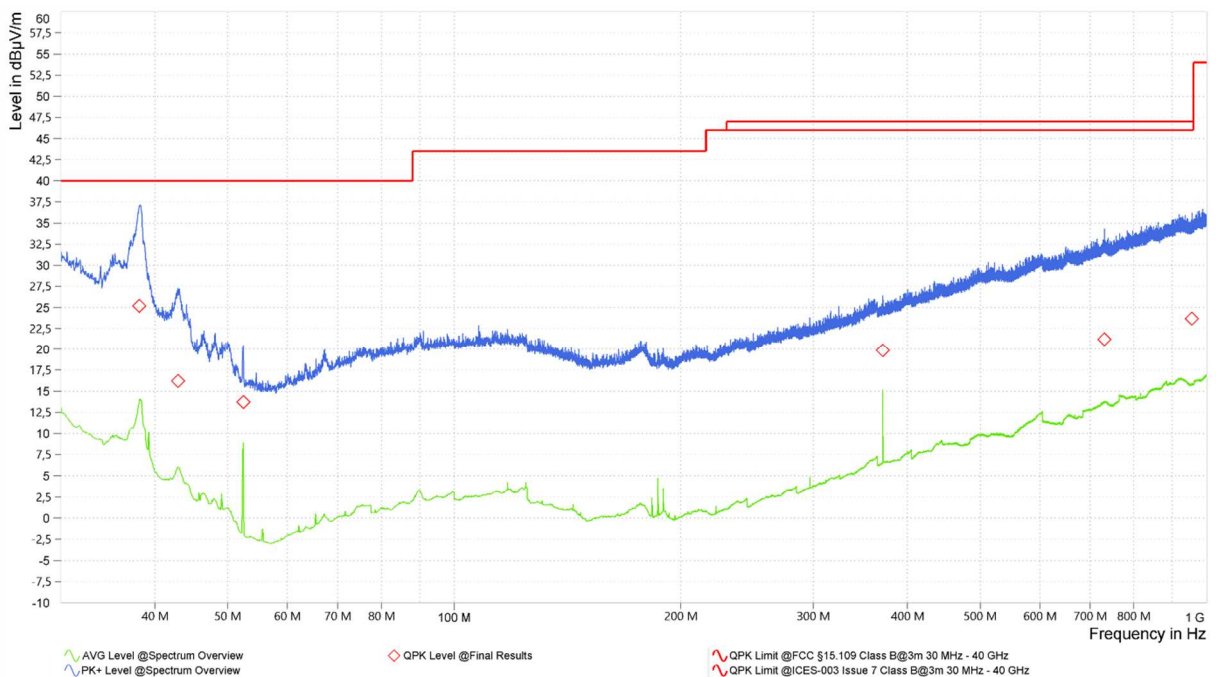
The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with "♦" are the measured results of the standard subsequent measurement in a semi-anechoic chamber.

Worst case plots:

Spurious emissions from 30 MHz to 1 GHz (operation mode 4 – position 3):



Spurious emissions from 30 MHz to 1 GHz (operation mode 5 – position 1):



Result tables:

Results according to FCC 47 CFR Part 15 section 15.109 (a), (b) [3]

| Operation mode 4 | | | | | | | | | |
|------------------|----------------------------|----------------------|-------------|-----------------------|-------------------|-------------|---------------|-------|------------|
| Frequency [MHz] | Result (QP) [dB μ V/m] | Limit [dB μ V/m] | Margin [dB] | Readings [dB μ V] | Correction [dB/m] | Height [cm] | Azimuth [deg] | Pol. | Position # |
| 38.160 | 30.4 | 40.0 | 9.6 | 9.2 | 21.2 | 113 | 48 | Hor. | 3 |
| 39.330 | 25.5 | 40.0 | 14.5 | 5.0 | 20.5 | 102 | 211 | Hor. | 2 |
| 42.990 | 20.1 | 40.0 | 19.9 | 1.9 | 18.2 | 110 | 45 | Vert. | 1 |
| 52.440 | 15.4 | 40.0 | 24.6 | 2.7 | 12.7 | 219 | 14 | Vert. | 2 |
| 75.600 | 8.2 | 40.0 | 31.8 | -7.6 | 15.8 | 205 | 25 | Vert. | 3 |
| 183.510 | 8.2 | 43.5 | 35.3 | -7.3 | 15.5 | 215 | 62 | Vert. | 1 |
| 186.750 | 9.9 | 43.5 | 33.6 | -5.3 | 15.2 | 100 | 177 | Vert. | 2 |
| 371.280 | 19.7 | 46.0 | 26.3 | -1.5 | 21.2 | 208 | 17 | Vert. | 3 |
| Operation mode 5 | | | | | | | | | |
| Frequency [MHz] | Result (QP) [dB μ V/m] | Limit [dB μ V/m] | Margin [dB] | Readings [dB μ V] | Correction [dB/m] | Height [cm] | Azimuth [deg] | Pol. | Position # |
| 38.160 | 26.3 | 40.0 | 13.7 | 5.2 | 21.2 | 127 | -0.21 | Vert. | 2 |
| 39.330 | 22.1 | 40.0 | 17.9 | 1.6 | 20.5 | 100 | 247 | Hor. | 2 |
| 42.990 | 20.3 | 40.0 | 19.7 | 2.1 | 18.2 | 113 | 87 | Vert. | 3 |
| 52.440 | 13.7 | 40.0 | 26.3 | 1.0 | 12.7 | 219 | 25 | Vert. | 1 |
| 371.280 | 19.9 | 46.0 | 26.2 | -1.3 | 21.2 | 243 | 237 | Vert. | 1 |
| 731.460 | 21.2 | 46.0 | 24.8 | -6.9 | 28.2 | 100 | 87 | Hor. | 1 |
| 956.070 | 23.7 | 46.0 | 22.3 | -6.6 | 30.3 | 132 | 80 | Vert. | 1 |

Results according to ICES-003 Issue 7 section 3.2.2 [4]

| Operation mode 4 | | | | | | | | | |
|------------------|----------------------------|----------------------|-------------|-----------------------|-------------------|-------------|---------------|-------|------------|
| Frequency [MHz] | Result (QP) [dB μ V/m] | Limit [dB μ V/m] | Margin [dB] | Readings [dB μ V] | Correction [dB/m] | Height [cm] | Azimuth [deg] | Pol. | Position # |
| 38.160 | 30.4 | 40.0 | 9.6 | 9.2 | 21.2 | 113 | 48 | Hor. | 3 |
| 39.330 | 25.5 | 40.0 | 14.5 | 5.0 | 20.5 | 102 | 211 | Hor. | 2 |
| 42.990 | 20.1 | 40.0 | 19.9 | 1.9 | 18.2 | 110 | 45 | Vert. | 1 |
| 52.440 | 15.4 | 40.0 | 24.6 | 2.7 | 12.7 | 219 | 14 | Vert. | 2 |
| 75.600 | 8.2 | 40.0 | 31.8 | -7.6 | 15.8 | 205 | 25 | Vert. | 3 |
| 183.510 | 8.2 | 43.5 | 35.3 | -7.3 | 15.5 | 215 | 62 | Vert. | 1 |
| 186.750 | 9.9 | 43.5 | 33.6 | -5.3 | 15.2 | 100 | 177 | Vert. | 2 |
| 371.280 | 19.7 | 47.0 | 27.3 | -1.5 | 21.2 | 208 | 17 | Vert. | 3 |
| Operation mode 5 | | | | | | | | | |
| Frequency [MHz] | Result (QP) [dB μ V/m] | Limit [dB μ V/m] | Margin [dB] | Readings [dB μ V] | Correction [dB/m] | Height [cm] | Azimuth [deg] | Pol. | Position # |
| 38.160 | 26.3 | 40.0 | 13.7 | 5.2 | 21.2 | 127 | -0.21 | Vert. | 2 |
| 39.330 | 22.1 | 40.0 | 17.9 | 1.6 | 20.5 | 100 | 247 | Hor. | 2 |
| 42.990 | 20.3 | 40.0 | 19.7 | 2.1 | 18.2 | 113 | 87 | Vert. | 3 |
| 52.440 | 13.7 | 40.0 | 26.3 | 1.0 | 12.7 | 219 | 25 | Vert. | 1 |
| 371.280 | 19.9 | 47.0 | 27.2 | -1.3 | 21.2 | 243 | 237 | Vert. | 1 |
| 731.460 | 21.2 | 47.0 | 25.8 | -6.9 | 28.2 | 100 | 87 | Hor. | 1 |
| 956.070 | 23.7 | 47.0 | 23.3 | -6.6 | 30.3 | 132 | 80 | Vert. | 1 |

Test result: Passed

| |
|--|
| Test equipment (please refer to chapter 7 for details) |
| 1 – 9 |

5.2.3.2 Test results (radiated 1 to 2 GHz)

| | |
|----------------------|-------|
| Ambient temperature: | 21 °C |
| Relative humidity: | 54 % |

| | |
|------------|-------------|
| Date: | 27.06.2023 |
| Tested by: | Thomas KÜHN |

Position of EUT: For tests for f between 1 GHz and the 5th harmonic, the EUT was set-up on a position device with a height of 150 cm. The distance between EUT and antenna was 3 m.

Cable guide: For detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Test record: Plots for each frequency range are submitted below.

Remark: The plots below showing the worst case of all positons.

Calculation:

Max Peak [dBμV/m] = Reading [dBμV] + Correction [dB/m]

Average [dBμV/m] = Reading [dBμV] + Correction [dB/m]

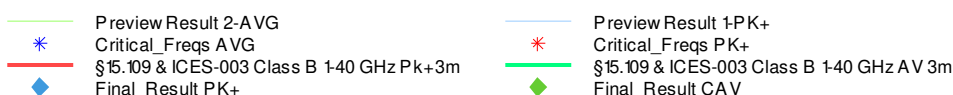
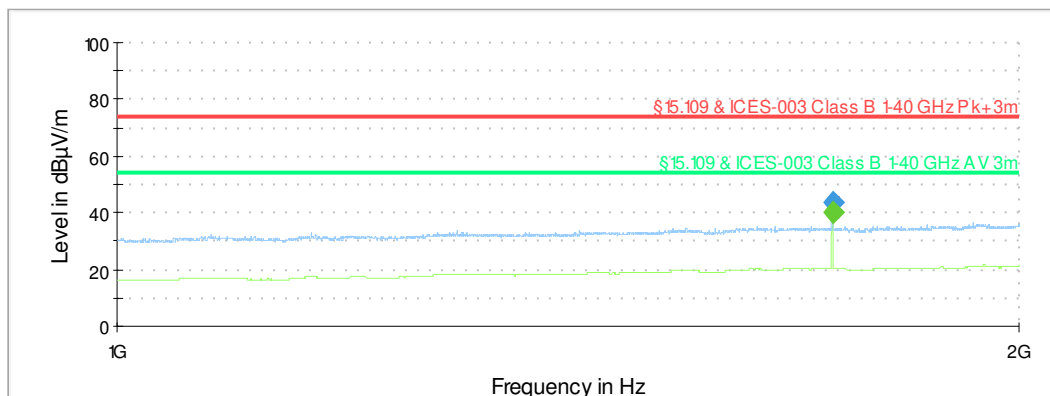
Correction [dB/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]+DCCF* [dB]
* (if applicable – only for Average values, that are fundamental related)

Margin [dB] = Limit [dBμV/m] – Max Peak | Average [dBμV/m]

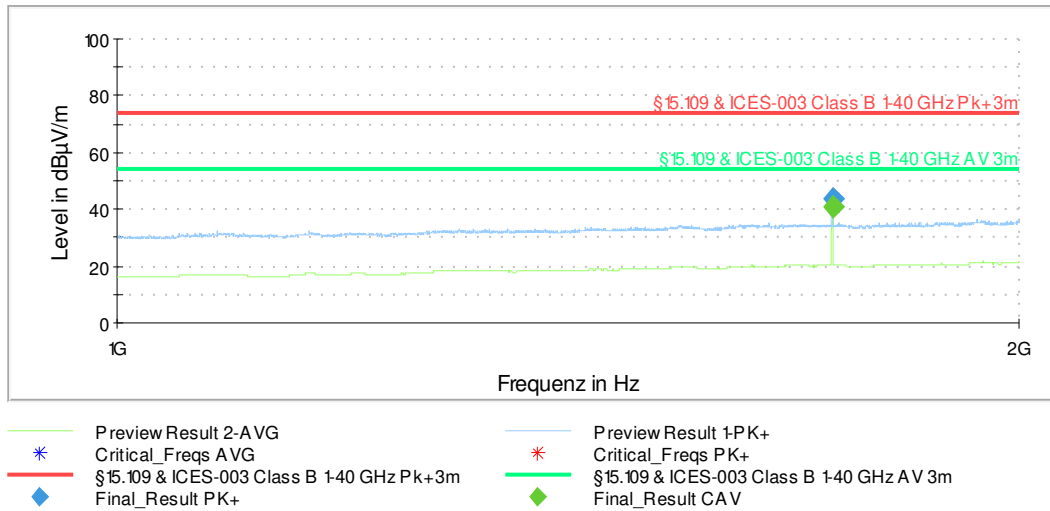
The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with various EUT and antenna positions.

The top measured curve represents the peak measurement. The measured points marked with "◆" are frequency points for the final peak detector measurement. These values are indicated in the following table. The bottom measured curve represents the average measurement. The measured points marked with "◆" are frequency points for the final average detector measurement.

Spurious emissions from 1 GHz to 2 GHz (operation mode 4):



Spurious emissions from 1 GHz to 2 GHz (operation mode 5):



Result tables:

| Operation mode 4 | | | | | | | | | |
|------------------|--------------------|--------------------|------------------|-------------------|-------|-------------|---------------|-----------------|------------|
| Frequency [MHz] | MaxPeak [dB(µV/m)] | Average [dB(µV/m)] | Limit [dB(µV/m)] | Margin [dB(µV/m)] | Pol | Height [cm] | Azimuth [deg] | Elevation [deg] | Corr. [dB] |
| 1733.000 | --- | 40.3 | 54.0 | 13.7 | Vert. | 150 | 186 | 90 | -13.0 |
| | 43.3 | --- | 74.0 | 30.7 | | | | | |
| Operation mode 5 | | | | | | | | | |
| Frequency [MHz] | MaxPeak [dB(µV/m)] | Average [dB(µV/m)] | Limit [dB(µV/m)] | Margin [dB(µV/m)] | Pol | Height [cm] | Azimuth [deg] | Elevation [deg] | Corr. [dB] |
| 1733.000 | --- | 40.7 | 54.0 | 13.4 | Vert. | 150 | 190 | 90 | -13.0 |
| | 43.6 | --- | 74.0 | 30.4 | | | | | |

Test result: Passed

| |
|--|
| Test equipment (please refer to chapter 7 for details) |
| 10 – 19 |

6 Measurement Uncertainties

| Radiated measurements | | |
|--|--------------|--------|
| Radiated field strength M276 | | |
| R&S HL562E @ 3 m 30 MHz – 1 GHz | CISPR 16-4-2 | 4.8 dB |
| R&S HL050 @ 3 m | - | |
| 1 – 6 GHz | CISPR 16-4-2 | 5.1 dB |
| 6 – 18 GHz | CISPR 16-4-2 | 5.4 dB |
| Flann Standard Gain Horns 18 – 40 GHz | - | 5.9 dB |
| Radiated field strength M20 | | |
| CBL6112B @ 3 m 30 MHz – 1 GHz | CISPR 16-4-2 | 5.3 dB |
| R&S HL050 @ 3 m | | |
| 1 – 6 GHz | CISPR 16-4-2 | 5.1 dB |
| 6 – 18 GHz | CISPR 16-4-2 | 5.4 dB |
| Flann Standard Gain Horns 18 – 40 GHz | - | 5.9 dB |

7 Test Equipment used for Tests

| No. | Test equipment | Type | Manufacturer | Serial No. | PM. No. | Cal. Date | Cal Due |
|-----|-------------------------------|--------------------------|--------------------|--------------------------|---------|---------------------------|---------|
| 1 | Attenuator 6 dB | WA2-6 | Weinschel | | 482793 | Calibration not necessary | |
| 2 | Ultralog Antenna | HL562E | Rohde & Schwarz | 101079 | 482978 | 18.03.2021 | 03.2024 |
| 3 | RF Switch Matrix | OSP220 | Rohde & Schwarz | | 482976 | Calibration not necessary | |
| 4 | Turntable | TT3.0-3t | Maturo | 825/2612/.01 | 483224 | Calibration not necessary | |
| 5 | Antenna support | BAM 4.5-P-10kg | Maturo | 222/2612.01 | 483225 | Calibration not necessary | |
| 6 | Controller | NCD | Maturo | 474/2612.01 | 483226 | Calibration not necessary | |
| 7 | Semi Anechoic Chamber M276 | SAC5-2 | Albatross Projects | C62128-A540-A138-10-0006 | 483227 | Calibration not necessary | |
| 8 | Test software M276 | EMC32 V11.30 | Rohde & Schwarz | 100970 | 482972 | Calibration not necessary | |
| 9 | EMI Testreceiver | ESW44 | Rohde & Schwarz | 101828 | 482979 | 08.12.2021 | 12.2023 |
| 10 | Fully anechoic chamber M20 | B83117-E2439-T232 | Albatross Projects | 103 | 480303 | Calibration not necessary | |
| 11 | Turntable | DS420 HE | Deisel | 420/620/00 | 480315 | Calibration not necessary | |
| 12 | Antenna support | AS620P | Deisel | 620/375 | 480325 | Calibration not necessary | |
| 13 | Multiple Control Unit | MCU | Maturo GmbH | MCU/043/971107 | 480832 | Calibration not necessary | |
| 14 | Antenna (Log.Per.) | HL050 | Rohde & Schwarz | 100438 | 481170 | Calibration not necessary | |
| 15 | Software | EMC32 V10.60.20 | Rohde & Schwarz | | 483261 | Calibration not necessary | |
| 16 | Preamplifier 100 MHz - 16 GHz | AFS6-00101600-23-10P-6-R | Narda MITEQ | 2011215 | 482333 | 17.02.2022 | 02.2024 |

| No. | Test equipment | Type | Manufacturer | Serial No. | PM. No. | Cal. Date | Cal Due |
|-----|----------------------------------|---------------|-----------------|--------------------|---------|---------------------------|---------|
| 17 | RF-cable No.38 | Sucoflex 106B | Suhner | 0709/6B / Kabel 38 | 481328 | Calibration not necessary | |
| 18 | Positioner | TDF 1.5- 10Kg | Maturo | 15920215 | 482034 | Calibration not necessary | |
| 19 | EMI Receiver / Spectrum Analyser | ESW44 | Rohde & Schwarz | 101635 | 482467 | 22.02.2022 | 02.2024 |

8 Test site Verification

| Test equipment | PM. No. | Frequency range | Type of validation | According to | Val. Date | Val Due |
|----------------------------|---------|-----------------|--------------------|---|------------|------------|
| Semi anechoic chamber M276 | 483227 | 30 – 1000 MHz | NSA/RSM | CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017 | 01.03.2023 | 28.02.2026 |
| Fully anechoic chamber M20 | 480303 | 1 -18 GHz | SVSWR | CISPR 16-1-4 Amd. 1 | 17.08.2022 | 16.08.2024 |

9 Report History

| Report Number | Date | Comment |
|---------------|------------|---------------------|
| F222097E4 | 02.08.2023 | Initial Test Report |
| - | - | - |
| - | - | - |

10 List of Annexes

Annex A Test Setup Photos

8 pages