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EMC Test Report

for the Device

" QCIOT ZSSC PMOD "

for the Customer

Renesas Electronics Europe GmbH

Jens Lerner
Michael Neikes

Administrative Summary

IMST GmbH
Dept. Test Center
Carl-Friedrich-Gauss-Strasse 2-4
D-47475 Kamp-Lintfort
Germany
Tel. +49 2842 981-0

Subject: Test of Electromagnetic Compatibility (EMC)
Device: QCIOT ZSSC PMOD
Serial No.: Prototype

Customer: Renesas Electronics Europe GmbH
Arcadiastraße 10
40472 Düsseldorf
Germany

Project No.: 6000/ 6250490/60120-2394

Chief Test Engineer: Jens Lerner
Dept. Test Center

Date: August 28, 2025

The Test Report, No. *Renesas_2394*, has the following conclusion:

The device has PASSED the tests hereunder.

Technical

Responsibility:



Jens Lerner
Test Engineer

Approved:



Michael Neikes
Quality Engineer

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Table of Contents

1	Introduction	5
2	General	5
3	Description of the Device Under Test (DUT)	6
3.1	General	6
3.2	DUT Modes of Operation	6
3.3	DUT Setup	7
3.4	Description of DUT Peripherals	8
3.5	Description of Monitoring System during the Immunity Tests	9
3.6	Equipment modifications	9
4	Applied Standards	10
4.1	Applied Generic Standards	10
4.2	Applied Product Standards	10
4.3	Applied Basic Standards	10
5	Applied Methods of Measurement	11
5.1	Electrostatic Discharge Immunity Test	11
5.1.1	Purpose of the Test	11
5.1.2	Applied Standards	11
5.1.3	Measurement Equipment Used	11
5.1.4	Measurement Setup	12
5.1.5	Test Result	13
5.2	Radiated Radio Frequency Electromagnetic Field Immunity Test	14
5.2.1	Purpose of the Test	14
5.2.2	Applied Standards	14
5.2.3	Measurement Equipment Used	14
5.2.4	Measurement Setup	15
5.2.5	Test result	16
5.3	Immunity to magnetic field (50 Hz and 60 Hz)	17
5.3.1	Purpose of the Test	17
5.3.2	Applied Standards	17
5.3.3	Measurement Equipment Used	17
5.3.4	Measurement Setup	18
5.3.5	Test result	19

5.4	Measurement of Radiated Emission	20
5.4.1	Purpose of the Measurement	20
5.4.2	Applied Standards	20
5.4.3	Measurement Equipment Used	20
5.4.4	Measurement Setup	21
5.4.5	Measurement Results	22
6	Measurement Uncertainty	23
7	Quality assurance	24
8	Interpretation of the measurement results	24

1 Introduction

The objective of the investigations was to perform EMC tests of the device QCIOT ZSSC PMOD for the customer Renesas Electronics Europe GmbH in accordance to the relevant EMC requirements.

Due to instructions given by the customer, only partial EMC tests were performed. The measurements described in this report do not cover all EMC tests necessary for the device.

The test results only relate to the items tested.

2 General

Description	Manufacturer Information	Customer Information
Company Name	Renesas Electronics Europe GmbH	Renesas Electronics Europe GmbH
Street Name, No.	Arcadiastr. 10	Arcadiastr. 10
PLZ/ZIP City	40472 Düsseldorf	40472 Düsseldorf
Country	Germany	Germany
Contact Person	Julius Kaluzevicius	Julius Kaluzevicius
Phone	+37 065520800	+37 065520800
E-Mail	julius.kaluzevicius.pz@renesas.com	julius.kaluzevicius.pz@renesas.com

Subject: Test of Electromagnetic Compatibility

Chief test engineer: Jens Lerner

Date of receipt of test item: July 24, 2025

Date of test: July 28 to August 01, 2025

Place of test: EMC laboratory at IMST GmbH, Kamp-Lintfort

Present persons during the tests:

IMST GmbH

Jens Lerner

Renesas Electronics Europe GmbH

./.

3 Description of the Device Under Test (DUT)

3.1 General

The purpose of this setup is to provide a platform for enabling the certification testing of various sensors and communication interfaces.

In this case Device under test (DUT) is a combination of following boards:

- QCIOT-USB2SERDEMOZ – USB converter to different serial interfaces
- QCIOT-DA7212EVZ – Audio codec
- US082-SSC3240EVZ – resistive sensor measurement board
- US082-SSC3224EVZ – differential sensor measurement board
- EK-RA2L1 – MCU board controlling audio codec

Features

- Sensors signal conditioning
- Interfacing different serial interfaces using USB
- Voice recognition
- Sound playback

3.2 DUT Modes of Operation

- Active mode

3.3 DUT Setup

DUT:

- QCIOT-USB2SERDEMOZ
- QCIOT-DA7212EVZ
- US082-SSC3240EVZ
- US082-SSC3224EVZ
- EK-RA2L1

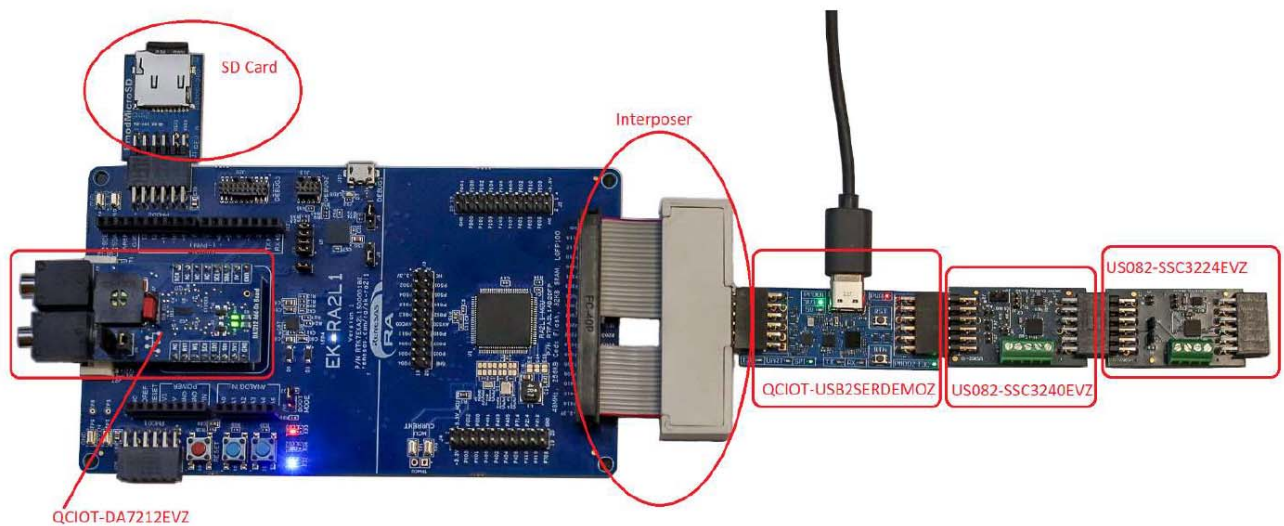


Fig. 3.3.1: QCIOT ZSSC PMODTM board setup

3.4 Description of DUT Peripherals

- USB-Power/Data connection via USB-C
- Computer for data logging / monitoring

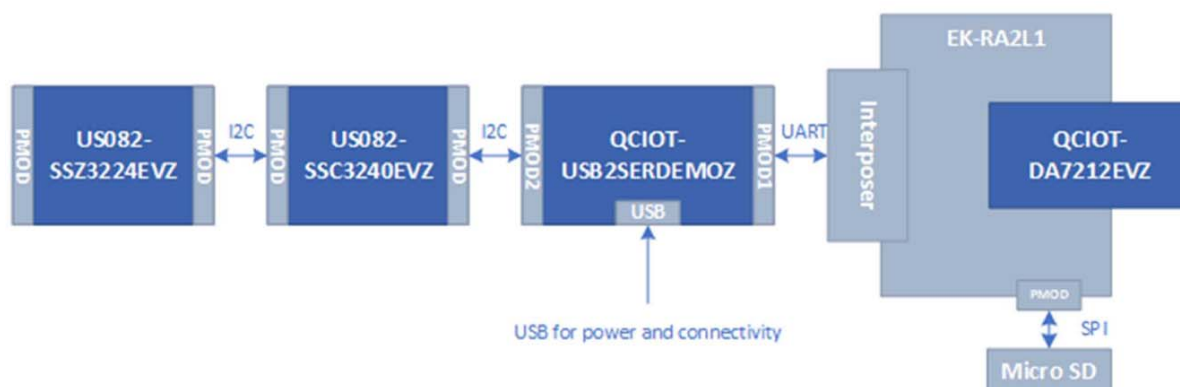


Fig. 3.4.1: Block diagram for DUT setup

```

File Edit Setup Control Window Help

*****
*      CE CERTIFICATIO TEST SETUP
*      -----
* - Boards      : QCIoT-USB2SERDEMOZ
                  QCIoT-DA7212EVZ
                  US082-SSC3240EVZ
                  US082-SSC3224EVZ
* - FSP Version : 5.8.0
* - F/W Version : 0.05 CE
* - F/W Build   : Jun 26 2025 00:09:56
*
* - Connection  : PMOD1
* - Voltage     : 3V3
* - Interface    : UART
* - Baudrate     : 9600
* - Data bits    : 8
* - Parity       : OFF
* - Stop bits    : 1
* - Flow ctrl    : none
*
*****

To get complete command list type help and press Enter
<CNT:0>,<DA7212:0><ZSSC3224:16.73><ZSSC3240:30.57><STATUS:0>
<CNT:1>,<DA7212:0><ZSSC3224:16.74><ZSSC3240:30.57><STATUS:0>
<CNT:2>,<DA7212:0><ZSSC3224:16.73><ZSSC3240:30.57><STATUS:0>
<CNT:3>,<DA7212:0><ZSSC3224:16.75><ZSSC3240:30.57><STATUS:0>

```

Fig. 3.4.1: Computer logging / monitoring via USB connection using Tera Term

3.5 Description of Monitoring System during the Immunity Tests

During all tests the device was controlled visually by USB Terminal connection. The pass criterion given by the client was that the values remained within the specified tolerance and no error messages supposed to appear.

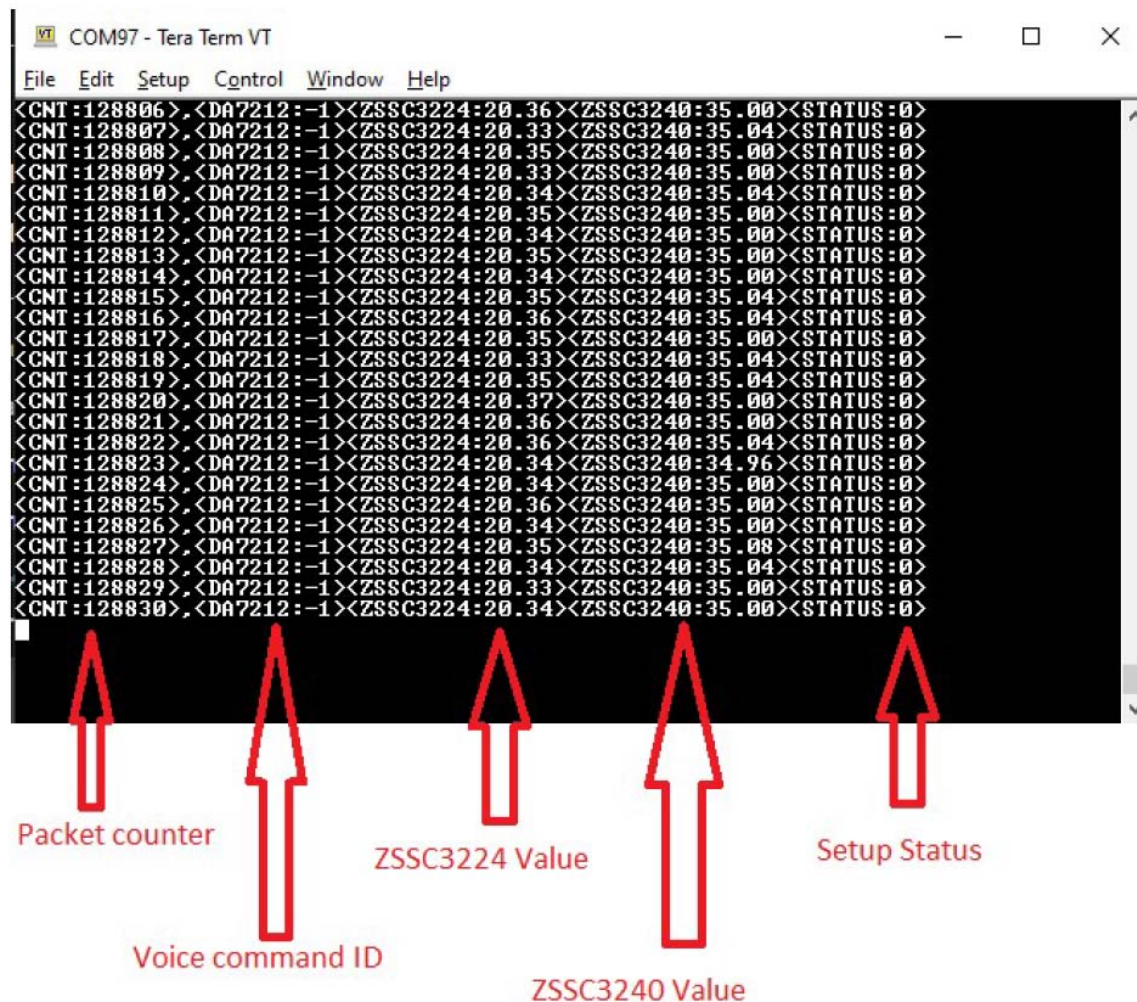


Fig. 3.5.1: Logging via Tera term

3.6 Equipment modifications

The following equipment modification was implemented by the customer:

- none

4 Applied Standards

The following standards, signed with a ☒, were applied:

4.1 Applied Generic Standards

- | | |
|---|--|
| <input checked="" type="checkbox"/> DIN EN IEC 61000-6-1:2019-11
(VDE 0839-6-1:2019-11) | Generic standards – Immunity for residential, commercial and light-industrial environments |
| <input type="checkbox"/> DIN EN IEC 61000-6-2:2019-11
(VDE 0839-6-2:2019-11) | Generic standards – Immunity for industrial environments |
| <input checked="" type="checkbox"/> DIN EN IEC 61000-6-3:2022-06
(VDE 0839-6-3:2022-06) | Generic standards – Emission standard for residential commercial and light-industrial environments |
| <input type="checkbox"/> DIN EN IEC 61000-6-4:2020-09
(VDE 0839-6-4:2020-09) | Generic standards – Emission standard for industrial environments |

4.2 Applied Product Standards

- | | |
|--|---|
| <input checked="" type="checkbox"/> DIN EN 55032:2016-02
(VDE 0878-32:2016-02) | Electromagnetic compatibility of multimedia equipment - Emission Requirements |
| <input checked="" type="checkbox"/> DIN EN 55032/A11:2021-03
(VDE 0878-32/A11:2021-03) | Electromagnetic compatibility of multimedia equipment - Emission Requirements |

4.3 Applied Basic Standards

Immunity

- | | |
|---|---|
| <input checked="" type="checkbox"/> DIN EN 61000-4-2:2009-12
(VDE 0847-4-2:2009-12) | Electrostatic discharge immunity tests (ESD) |
| <input checked="" type="checkbox"/> DIN EN IEC 61000-4-3:2021-11
(VDE 0847-4-3:2021-11) | Radiated radio frequency electromagnetic field immunity test |
| <input checked="" type="checkbox"/> DIN EN 61000-4-8:2010-11
(VDE 0847-4-8:2010-11) | Testing and measurement techniques – Power frequency magnetic field immunity test |

5 Applied Methods of Measurement

5.1 Electrostatic Discharge Immunity Test

5.1.1 Purpose of the Test

The purpose of this test is to check the immunity of the DUT to electrostatic discharge (ESD).

5.1.2 Applied Standards

The test is based on the following standard:

DIN EN 61000-4-2:2009-12
(VDE 0847-4-2:2009-12)

5.1.3 Measurement Equipment Used

The following measurement equipment was used for performing the tests. The date of the next check of the equipment (calibration or verification) can be seen in column "next Cal/Ver Date".

Equipment	Type	Ser. No.	next Cal/Ver Date
ESD3000	ESD-Simulator	103605-2421	01/2027
ESD3000M1	16 kV Aufsatz	103606-2130	01/2027

5.1.4 Measurement Setup

The measurement setup and the test conditions are in conformity with the cited standards. Fig. 5.1.1 shows a sketch of the measurement setup in principle.

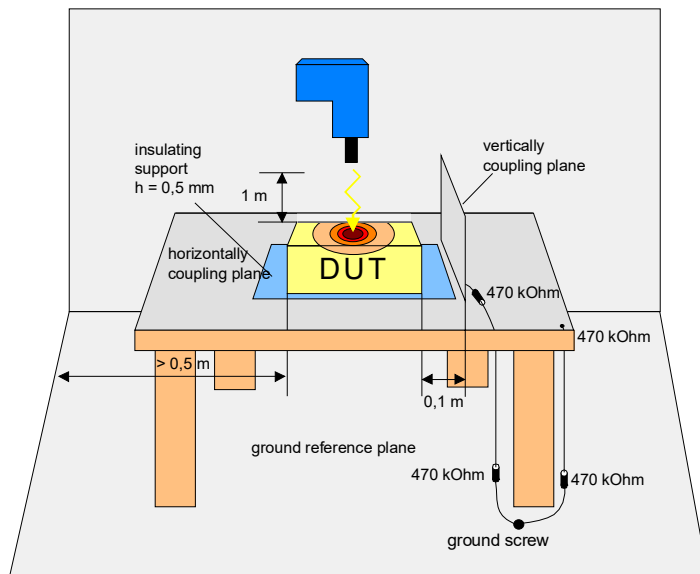


Fig. 5.1.1: Sketch of the ESD measurement setup in principle.

The real measurement setup can be seen in Fig. 5.1.2.

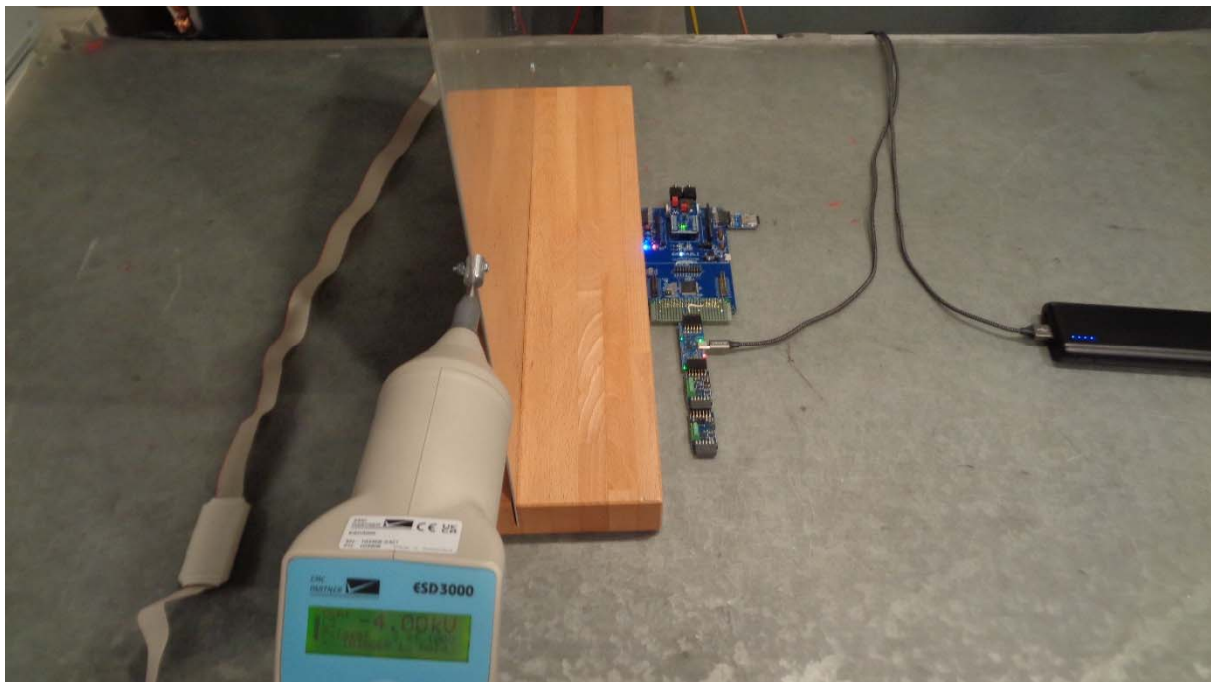


Fig. 5.1.2: Sketch of the ESD measurement indirect contact discharge.

Conditions	Value
Temperature [°C]	22.3
Air humidity [%]	44.1
Air pressure [hPa]	1013.4

5.1.5 Test Result

The following tests were performed:

- Indirect contact discharge (10 pulses each with 2 kV and 4 kV, pos./neg.) on the vertical and horizontal coupling plate onto all sides of the DUT.

Result: The device passed the test without limitations.

5.2 Radiated Radio Frequency Electromagnetic Field Immunity Test

5.2.1 Purpose of the Test

The purpose of this test is to check the immunity of the DUT to radiated radio frequency electromagnetic fields, which are coupled into the DUT by external feed lines and by the casing.

5.2.2 Applied Standards

The test is based on the following standard:

DIN EN 61000-4-3:2021-11
(VDE 0847-4-3:2021-11)

5.2.3 Measurement Equipment Used

The following measurement equipment was used for performing the tests. The date of the next check of the equipment (calibration or verification) can be seen in column "next Cal/Ver Date".

Equipment	Type	Ser. No.	next Cal/Ver Date
33120 A Hewlett Packard	Function generator	US36044329	01/2027
HI-6105 ETS Lindgren	Field probe	00167114	01/2027
AT 1080 Amplifier Research	Transmit antenna	19457	01/2027
500W1000B Amplifier Research	Amplifier	0351615	01/2027
438 A Hewlett Packard	Power meter	3513U04830	01/2027
3115 EMCO	Horn antenna	9609-4952	01/2027
100S1G6 Amplifier Research	Amplifier	0347137	01/2027
SMB 100 A Rohde & Schwarz	Signal generator	113979	01/2027

5.2.4 Measurement Setup

The measurement setup and the test conditions are in conformity with the cited standards. Fig. 5.2.1 shows a sketch of the measurement setup in principle.

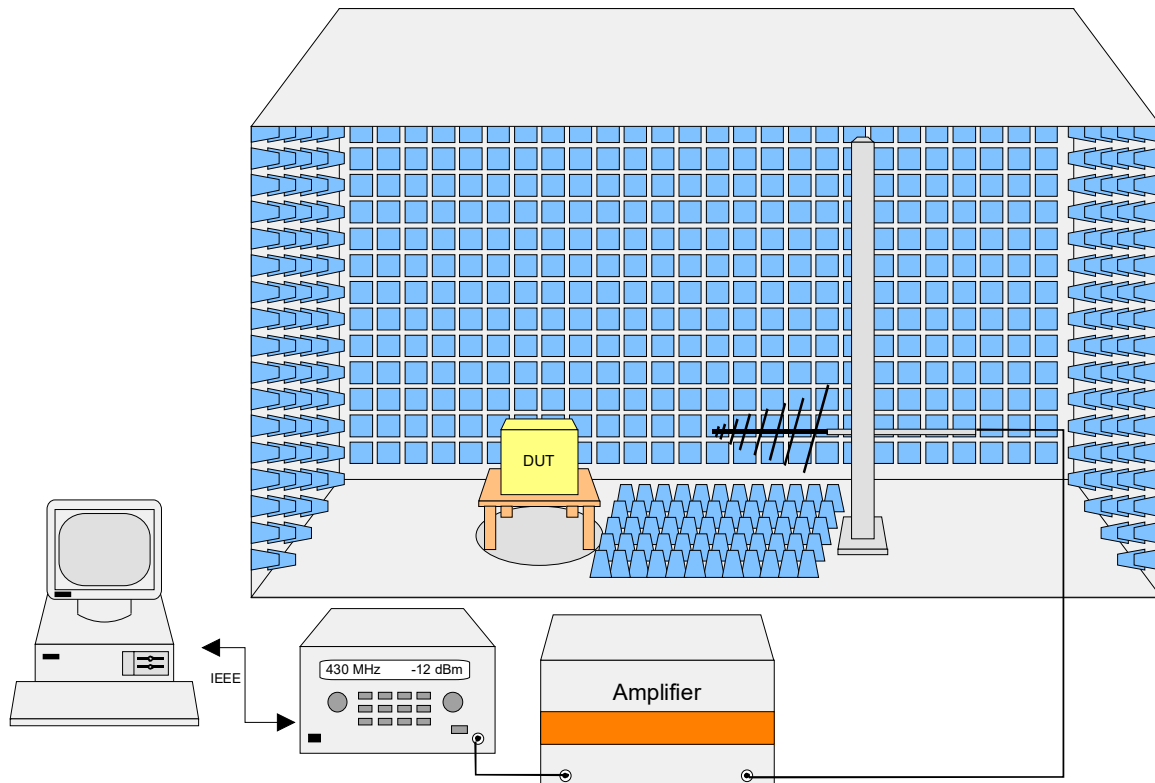


Fig. 5.2.1: Sketch of the radiated immunity measurement setup in principle.

The real measurement setup can be seen in Fig. 5.2.2.



Fig. 5.2.2: Real radiated immunity measurement setup 80 MHz to 1 GHz.

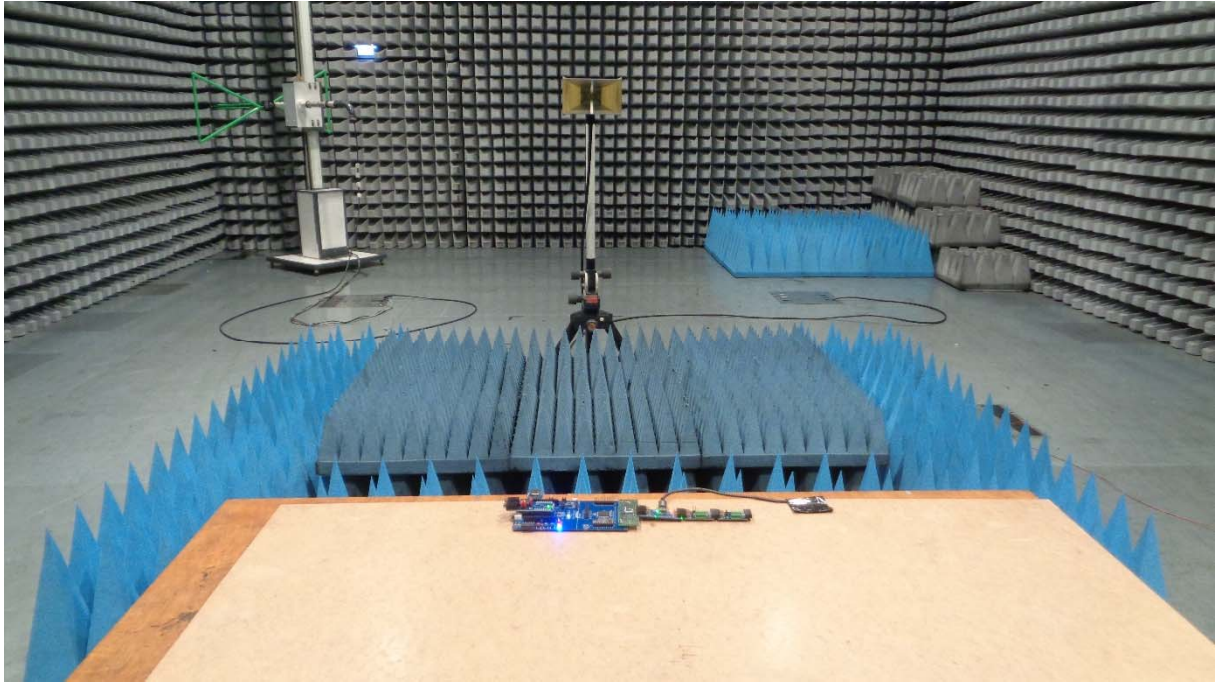


Fig. 5.2.3: Real radiated immunity measurement setup 1 GHz to 6 GHz.

5.2.5 Test result

The following tests were performed:

The test field strength was 3 V/m (80 MHz – 6 GHz), modulated with 80 % AM 1 kHz, 1 % step size). The dwell time was 2 s.

The DUT was placed on a wooden table 100 cm above the ground plane, see Fig. 5.2.2. The transmit antenna was mounted in 2.4 m measurement distance.

All sides of the DUT were exposed to a horizontally as well as vertically polarized electric field.

Result: The device passed the test without limitations.

5.3 Immunity to magnetic field (50 Hz and 60 Hz)

5.3.1 Purpose of the Test

The purpose of this test is to check the immunity of the DUT to magnetic field with power frequency.

5.3.2 Applied Standards

The test is based on the following standard:

DIN EN 61000-4-8:2010-11
(VDE 0847-4-8:2010-11)

5.3.3 Measurement Equipment Used

The following measurement equipment was used for performing the tests. The date of the next check of the equipment (calibration or verification) can be seen in column "next Cal/Ver Date".

Equipment	Type	Ser. No.	next Cal/Ver Date
33120 A Hewlett Packard	Function Generator	US36044329	01/2027
ELT 400 Narda	Fieldmeter	M-0407	01/2027
2300/90.10 Narda	Sonde	M-0421	01/2027
A-105 Pioneer	Audio Amplifier		Not necessary
Loopantenna IMST	1 m Diameter		Not necessary

5.3.4 Measurement Setup

The measurement setup and the test conditions are in conformity with the cited standards. Fig. 5.3.1 shows a sketch of the measurement setup in principle.

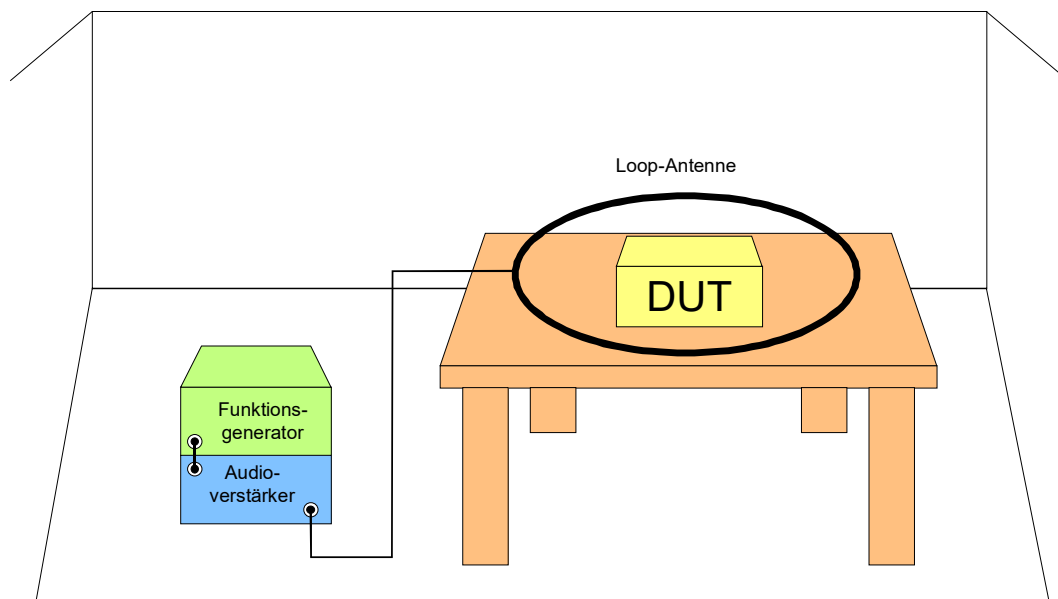


Fig. 5.3.1: Sketch of the conducted immunity measurement setup in principle.

The real measurement setup can be seen in Fig. 5.3.2.

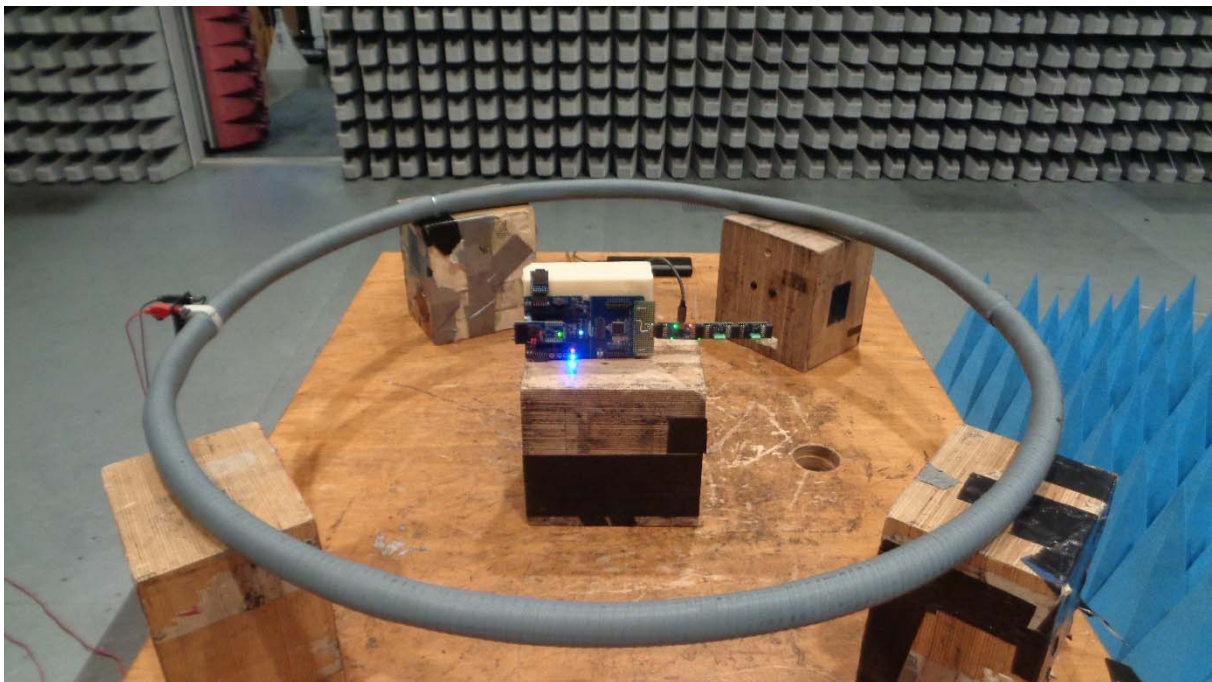


Fig. 5.3.2: Real conducted immunity measurement setup used during the tests.

5.3.5 Test result

The following tests were performed

The test field strength was 3 A/m (50 Hz / 60 Hz). The dwell time was 1 min.

The DUT was placed on a table, see Fig. 5.3.2. The induction coil was placed around the DUT.

The induction coil was turned around ($2 \times 90^\circ$) to test in different orthogonal directions

Result: The device passed the test without limitations.

5.4 Measurement of Radiated Emission

5.4.1 Purpose of the Measurement

The purpose of this test is to measure the DUT radiated emissions in the frequency range 30 MHz to 1 GHz.

5.4.2 Applied Standards

The measurement is based on the following standard:

DIN EN 55032:2016-02
(VDE 0878-32:2016-02)

DIN EN 55032/A11:2021-03
(VDE 0878-32/A11:2021-03)

5.4.3 Measurement Equipment Used

The following measurement equipment was used for performing the tests. The date of the next check of the equipment (calibration or verification) can be seen in column "next Cal/Ver Date".

Equipment	Type	Ser. No.	next Cal/Ver Date
8546 A Hewlett Packard	EMI receiver	3448A00318	01/2027
85460 A Hewlett Packard	RF filter section	3625A00345	01/2027
HD 100 Deisel	Controller	100/432/96	01/2027
MA 240 Deisel	Antenna tower	240/393/96	01/2027
DS 420 Deisel	Turn table	420/418/96	01/2027
6112 B Chase	Bilog Antenne	2426	01/2027
BBHA 9120 Schwarzbeck	Horn antenna	139	01/2027

5.4.4 Measurement Setup

The measurement setup and the test conditions are in conformity with the cited standards. Fig. 5.4.1 shows a sketch of the measurement setup in principle.

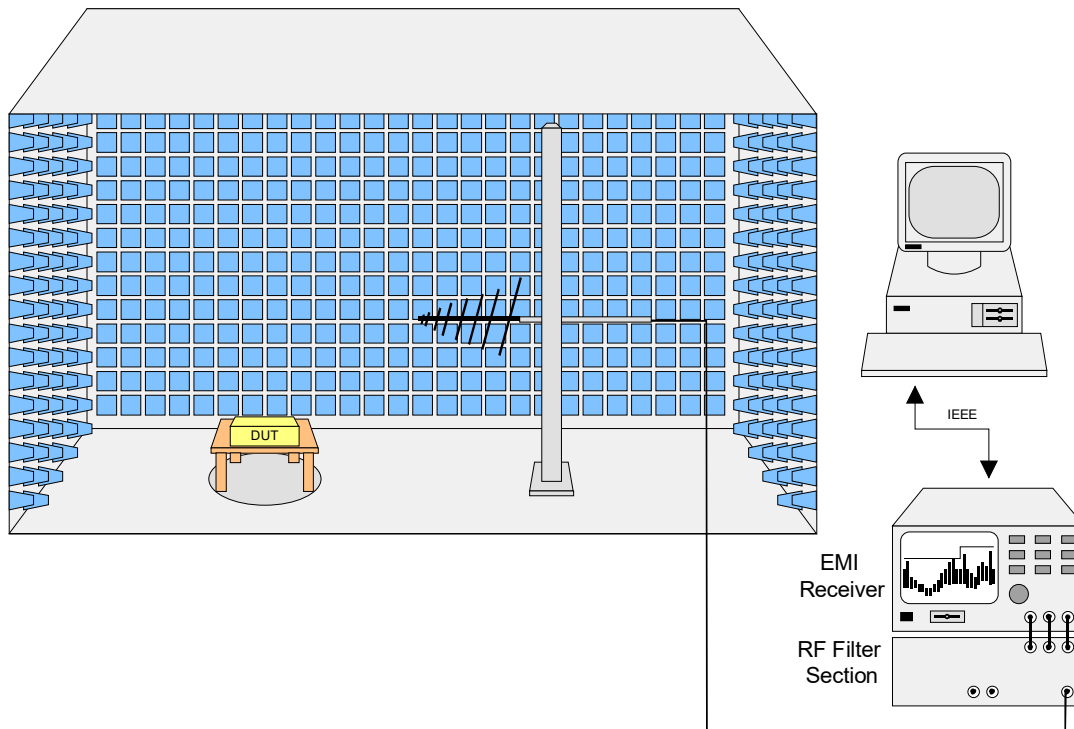


Fig. 5.4.1: Sketch of the radiated emission measurement setup in principle (30 MHz-1 GHz).

The real measurement setup can be seen in the following figure.

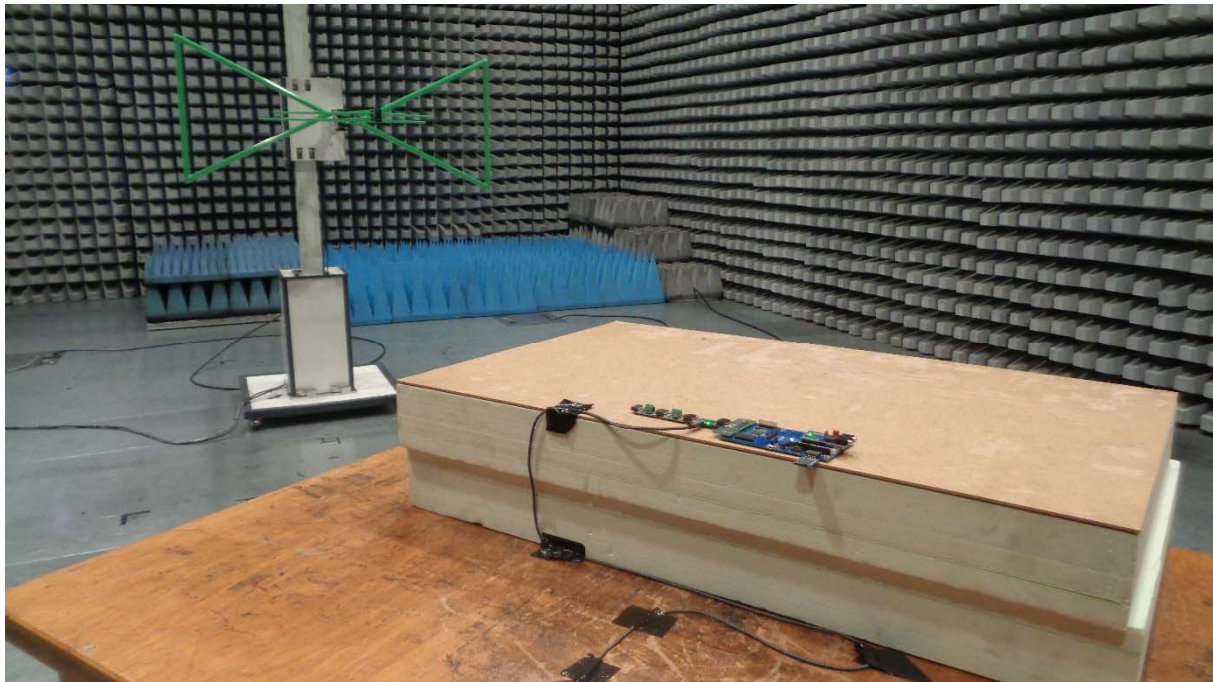
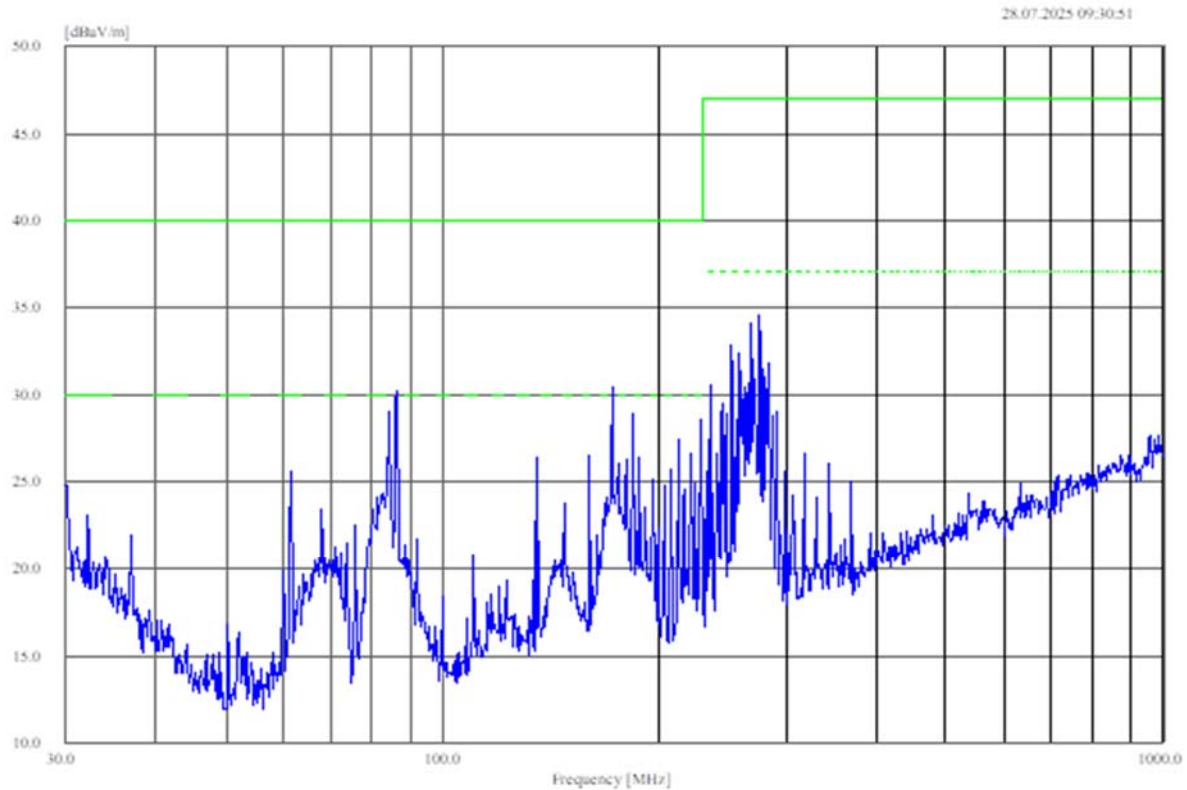


Fig. 5.4.2: Real radiated emission measurement setup used during the tests.

5.4.5 Measurement Results

Emission spectrum of prescan, 3 m measurement distance, 30 MHz – 1 GHz
(antenna heights 1 m – 4 m, turntable angles 45°, 135°, 225°, 315°).



Limits:

- Quasi peak limit in dBµV class B, distance 3 m, DIN EN 55032:2021
- - - Margin 10 dB below the quasi peak limit

Result: The device passed the test without limitations.

6 Measurement Uncertainty

The following information about the calculation and estimation of measurement uncertainty are based upon DIN EN 55016-4-2:11-2014: Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-2: Uncertainties, statistics and limit modelling - Measurement instrumentation uncertainty (CISPR 16-4-2:2011 + A1:2014); German version EN 55016-4-2:2011 + A1:2014. Here, budgets for measurement uncertainty are defined for conducted as well as radiated emission measurements. Furthermore, also the "ISO Guide to the Expression of Uncertainty in Measurement" is taken into account. The ISO guide is understood here as state of the art.

The determination of overall measurement uncertainty has been performed according to the so called determination method B. The necessary detailed calculations and estimations for this are part of a separate document, which can be examined in the IMST EMC laboratory.

The measurement uncertainties for the described measurements are as follows:

Immunity

Measurement method	Overall measurement uncertainty / tolerance
ESD	$\pm 10\%$ (0.8 dB) for first discharge current peak, $\pm 30\%$ (2.3 dB) for current values after 30 and 60 ns, *)
Burst	$\pm 10\%$ (0.8 dB) for open circuit output test voltage, *)
Surge	$\pm 10\%$ (0.8 dB) for open circ. voltage a. short circ. current, *)
Voltage dips, interruptions ...	$\pm 10\%$ (0.8 dB) for test generator voltage at $I < 16\text{ A}$, *)
Radiated Immunity	$\pm 3.7\text{ dB}$, **)
Conducted Immunity	$\pm 1.7\text{ dB}$, **)

*) In addition allowed tolerances concerning the wave form of the test impulses does exist

**) In addition to the tolerances of the real output immunity signal from the normative reference signal, the influences associated with the configuration of the DUT and with the monitoring of possible failures are included too

It is assumed, that the DUT has passed the test, if it fulfills the given test criterion at the defined or a higher immunity test level. The measurement uncertainty has been taken into account in the calibration methods, described in the relevant basic standards. The measurement equipment used fulfills the normative demands concerning the allowed tolerances. This is checked and assured by permanent calibrations and verifications.

Emission

Measurement method	Overall measurement uncertainty / tolerance
Radiated emissions 30 MHz-1GHz	± 5 dB
Radiated emissions 1 GHz-6 GHz	± 4 dB
Conducted emissions	± 3.6 dB
Harmonic current emissions	± 5 % of limits or 0.2 % of rated current
Flicker	± 8 % (0.7 dB)
Radio noise power	± 4.45 dB
Clicks	estimation of measurement uncertainty makes no sense

The values shown are smaller/equal than the maximal allowed measurement uncertainty of

- ± 5.2 dB for radiated emission measurements, and
- ± 3.6 dB for conducted emission measurements, and
- ± 4.5 dB for radio noise power measurements, resp.,

Defined in DIN EN 55016-4-2:11-2014: Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-2: Uncertainties, statistics and limit modelling - Measurement instrumentation uncertainty (CISPR 16-4-2:2011 + A1:2014); German version EN 55016-4-2:2011 + A1:2014. According to the concept of DIN EN 55016-4-2, at compliance testing the specific limits defined in the relevant standards are applicable directly without additional safety factors. Corresponding to this the DUT has passed the test, if its emission is smaller or equal to the limit.

7 Quality assurance

The responsible Test engineer states that the all measurements and evaluations have been performed under the guidelines of the valid quality assurance plan according to DIN EN ISO IEC 17025-2017.

8 Interpretation of the measurement results

The interpretation of the test results (decision rule) is carried out on the basis of ILAC-G8:09/2019, chap. 4.2.1 according to the decision rule "Simple Acceptance" - as far as this is not contradicted by other normative requirements.

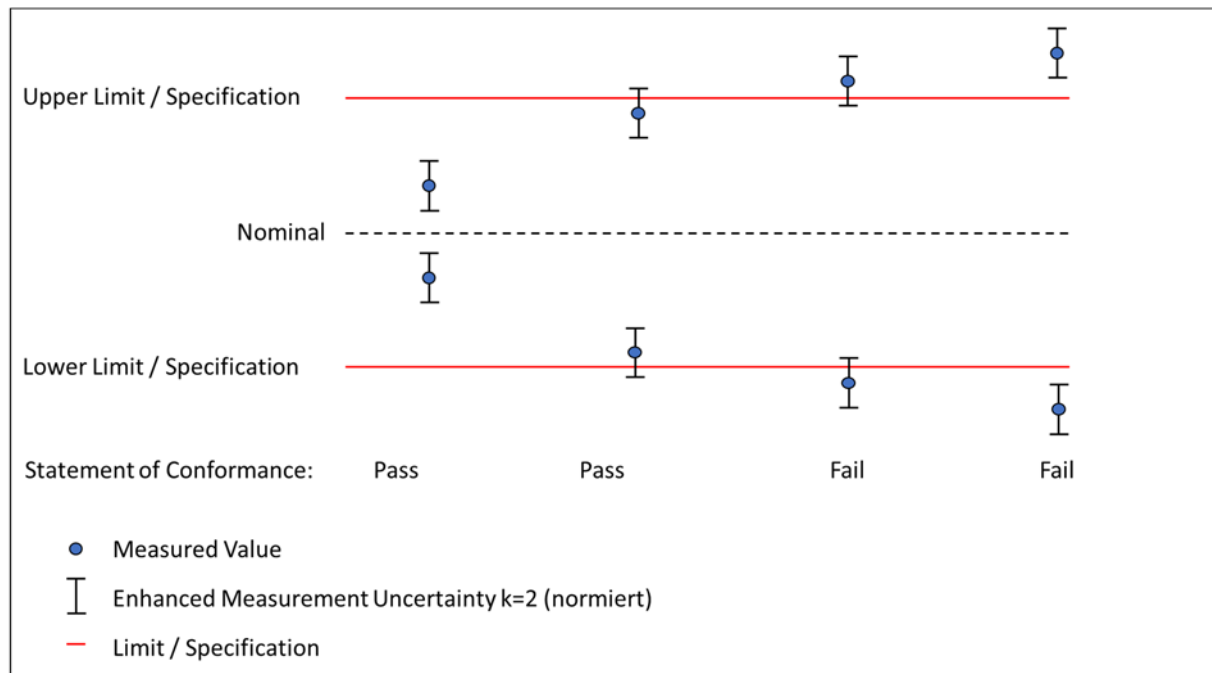


Fig. 1: Decision rules acc. ILAC-G8:09/2019, Chapter 4.1 „Simple Acceptance “

- end of report -