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# TEST REPORT
# no.: 240500150/3/EMC

**Test name** : Electromagnetic compatibility tests

**Test subject** : Household equipment

**Product name** : Thermostat for electric floor heating

**Model** : TR-01

**Manufacturer** : Trivolt s.r.o.
Diaľničná cesta 22B
903 01 Senec
Slovak Republic

**Applicant** : COCV TSÚ Piešťany
Krajinská cesta 2929/9
921 01 Piešťany
Slovak Republic

**Testing location** : Testing laboratory TSÚ Piešťany, a. s.
Krajinská cesta 2929/9
921 01 Piešťany
Slovak Republic

**Order no.** : 240500150

**Test procedure** : see chapter 2

**Date of test** : see chapter 2

**Distribution** : Copy no.1 – manufacturer
Copy no.2 – TSÚ Piešťany

**Date of issue** : 25.09.2024

TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, a. s.
Krajinská cesta 2929/9
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-213-

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# 1 TESTS REGULATIONS AND TESTS RESULTS

Used test methods according to MPS 01/5.10 Measurement of electromagnetic compatibility and standards mentioned below:

| EMISSION | | | | |
|---|---|---|---|---|
| Test | **Standard** | Performance criterion | Test result | Note |
| Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission | **EN IEC 55014-1:2021** | ------ | PASS | |
| Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <=16 A per phase) | **EN IEC 61000-3-2:2019/ A1:2021** (idt IEC 61000-3-2:2018/ Amd 1:2020) | ------ | PASS | |
| Electromagnetic compatibility (EMC). Part 3-3: Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection | **EN 61000-3-3:2013/ A1:2019/A2:2021/ AC Jan.:2022** (idt IEC 61000-3-3:2013/ AMD2:2021/COR1:2022) | ------ | PASS | |

| SUSCEPTIBILITY | | | | |
|---|---|---|---|---|
| Test | **Standard** | Performance criterion | Test result | Note |
| Electromagnetic compatibility. Requirements for household appliances, electric tools and similar apparatus. Part 2: Immunity. Product family standard | **EN IEC 55014-2:2021** | cat. V | PASS | 1 |
| Electromagnetic compatibility (EMC) - Part 4-2: Electrostatic discharge immunity test | **EN 61000-4-2:2009** (idt IEC 61000-4-2:2008) | B | PASS | |
| Electromagnetic compatibility (EMC). Part 4-3: Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test | **EN IEC 61000-4-3:2020** (idt IEC 61000-4-3:2020) | A | PASS | |
| Electromagnetic compatibility (EMC) - Part 4-4: Electrical fast transient/burst immunity test | **EN 61000-4-4:2012** (idt IEC 61000-4-4:2012) | B | PASS | |
| Electromagnetic compatibility (EMC) – Part 4-5: Surge immunity test | **EN 61000-4-5:2014/ A1:2017** (idt IEC 61000-4-5:2014/ AMD1:2017) | B | PASS | |
| Electromagnetic compatibility (EMC). Part 4-6: Testing and measurement techniques Immunity to conducted disturbances, induced by radio-frequency fields | **EN IEC 61000-4-6:2023** (idt IEC 61000-4-6:2023) | A | PASS | |
| Electromagnetic compatibility (EMC) Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests | **EN IEC 61000-4-11:2020/ AC Jun.:2020/AC:2022** (idt IEC 61000-4-11:2020/ COR1:2020/COR2:2022) | C | PASS | |

Notes:
1. Category of apparatus selected according to standard EN IEC 55014-2:2021 (idt CISPR 14-2:2020) chapter 4.

## 1.1 Criteria of performance for susceptibility tests

According to EN IEC 55014-2:2021 (idt CISPR 14-2:2020) criteria of performance shall be:

| Criterion of performance | Requirements |
|---|---|
| A | The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended. |
| B | The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation and from what the user may reasonably expect from the apparatus if used as intended. |
| C | Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use. |

# 2 GENERAL INFORMATION

EMC emissions and immunity tests were performed on the equipment under test (EUT) in the testing laboratory of Technický skúšobný ústav Piešťany, a. s., Piešťany, Slovak Republic, accredited by the SNAS.

All tests were conducted in an environment which ensured that the measurable influence or interference (background noise) not generated by EUT, was below the threshold limits defined in the standards.

## 2.1 Measurement uncertainties

The uncertainties are based on a 95% confidence level (based on the coverage factor k = 2) and calculated according to CISPR 16-4 and internal document MP 01/317/2018 of Technický skúšobný ústav Piešťany, a. s.

The recorded values of measurement uncertainty are, for each measurement result, equal to or lower than the values required by the test-related standard.

| **Uncertainty** | | |
|---|---|---|
| Conducted RF emissions | < 3,36 dB | |
| Radiated RF emissions | < 5,71 dB | |
| Harmonic current emissions EN 61000-3-2 | < 5 % | |
| Voltage fluctuations and flicker EN 61000-3-3 | < 8 % | |
| Electrostatic discharge EN 61000-4-2 | < 0,3 kV for ± 4 kV<br>< 0,4 kV for ± 8 kV<br>< 0,6 kV for ± 15 kV | |
| Radio frequency electromagnetic field EN 61000-4-3 | < 1,67 dB | |
| Electrical fast transients and bursts EN 61000-4-4 | Pulse rise time | < 6,2 % |
| | Peak voltage level | 8,64 % (related to 3,75 kV) |
| | Pulse width | < 5,9 % |
| Surges EN 61000-4-5 | Pulse rise time | < 13,3 % |
| | Peak voltage level | 8,63 % (related to 3,85 kV) |
| | Pulse width | < 5,9 % |
| Radio frequency conducted disturbance EN 61000-4-6 | < 1,25 dB | |
| Voltage dips and interruptions EN 61000-4-11 | < 3 dB | |

If there are some measured values of the tested parameters in the measurement uncertainty band with their respective limits, there is the possibility that this sample or similar, selected out of production, may not meet the required limit if tested by another laboratory.

## 3 EQUIPMENT UNDER TEST

| | | |
|---|---|---|
| Manufacturer (name & address) | : | Trivolt s.r.o.<br>Diaľničná cesta 22B<br>903 01 Senec<br>Slovak Republic |
| Product name | : | Thermostat for electric floor heating |
| Model | : | TR-01 |
| Serial number | : | --- (not stated on the samples) |
| Number of supplied samples | : | 2 pcs. |
| Place and date of taking samples | : | The samples were delivered to TSÚ Piešťany, a. s. on 04.06.2024 and recorded under the registration number 240500150/213/5536/3. |
| Description | : | TR-01 is an electronic thermostat designed for electric floor heating. The thermostat allows you to set a comfortable temperature in the room and at the same time using the floor sensor to check and manage the maximum floor temperature. The air sensor is built right on the bottom side of the thermostat and an external NTC floor sensor is supplied as a standard accessory and is included in the thermostat package. |
| Tested sample description | : | Power rating: 230 V AC, 50 Hz, <1,5 W<br>Output: 230 V AC, 16 A max. load<br><br>Max. internal clock frequency: unknown (higher than 108 MHz)<br><br>EUT functional temperature range: 0 to +45 °C |

The EUT was tested with ancillary equipment (AE) as follows:
AE1: Heating mat, model: TR-2P-10, manufacturer: Trivolt s.r.o, Slovak Republic (provided by manufacturer for testing)

The EUT was tested according to the requirements for category V devices defined in EN IEC 55014-2.

The EUT was tested in the following modes:
Emission tests – load connected (heating), load disconnected
Immunity tests – load connected

## 4 ENVIRONMENTAL CONDITIONS

| Environmental conditions | Required values | Actual values |
|---|---|---|
| Temperature: | 15°C ÷ 35 °C | 21 - 24 °C |
| Humidity: | 30 % ÷ 75 % | 34 - 38 % |
| Pressure: | 860 kPa ÷ 1060 hPa | 1001 - 1025 hPa |

Note: Actual values are valid for all tests. Exact actual values during ESD test are provided in chapter 7.1.

| | | |
|---|---|---|
| Place of the testing | : | ☒ EMC testing laboratory TSÚ Piešťany<br>☐ Laboratory Pobedim TSÚ Piešťany<br>☐ on-site: |
| Start of test | : | 27.06.2024 |
| End of test | : | 16.08.2024 |
| Test procedure deviation | : | Nothing |
| Test conditions | : | See chapter 6 and chapter 7 - Test conditions and results |

# 5 USED TEST EQUIPMENT

| Measurement of emission | | | | | | |
|---|---|---|---|---|---|---|
| Used eq. | Name | Manufacturer | Type | S/N | Registration no. | Date of calibration validity |
| ☒ | EMI test receiver | Rohde & Schwarz | ESR7 | 1316.30003K07 | 540-316-022 | 23.06.2025 |
| ☒ | LISN type V | PMM Italy | PMM L3-32 | 122WT50407 | 540-316-018 | 24.04.2025 |
| ☐ | LISN type V | Hameg | HM6050-2 | 025880024 | 540-316-026 | 02.03.2025 |
| ☐ | BiConiLog Antenna | A.H. Systems | SAS-521F-2 | 272 | 540-317-097 | 24.08.2025 |
| ☒ | BiConiLog Antenna | ETS Lindgren | 3143B | 00157570 | 540-316-017 | 23.11.2024 |
| ☐ | Horn Antenna | ETS Lindgren | 3119 | 00157903 | 540-316-016 | 16.12.2024 |
| ☐ | Three-phase network analyzer | Fluke | Fluke 435 | DM9631006 | 130-316-85 | 17.05.2025 |
| ☐ | Harmonic current analyzer | Spitzenberger | B10 | G80588 | 540-316-025 | 11.11.2024 |
| ☐ | LISN - 16A | Spitzenberger | Line - 16A | A2793 07/0 0701 | 540-316-023 | 11.11.2024 |
| ☐ | AC/ DC Power source | Spitzenberger | PAS 5000 | A2793 01/0 0701 | 540-316-024 | 11.11.2024 |
| ☒ | Antenna mast | ETS Lindgren | 2175 | --- | --- | --- |
| ☒ | Turntable | ETS Lindgren | 2188 | --- | --- | --- |
| ☒ | Anechoic chamber | ETS Lindgren | FACT 3 | --- | --- | --- |
| ☒ | Atmosphere recorder | Comet System | C4130 | 13900371 | 412-316-001 | 04.04.2025 |

| Measurement of susceptibility | | | | | | |
|---|---|---|---|---|---|---|
| Used eq. | Name | Manufacturer | Type | S/N | Registration no. | Date of calibration validity |
| ☐ | Multifunctional test generator for transients | EM test | UCS500 N5 | 07430/06 | 540-323-77 | 07.07.2025 |
| ☒ | Compact NX Generator | AMETEK CTS | NX5 | 1824221146 | 540-317-091 | 13.03.2026 |
| ☐ | ESD Simulator | Schaffner | NSG 432 | 1450 | 540-316-019 | 17.08.2025 |
| ☒ | Generator - ESD NX 30.1 | emtest | ESD NX 30.1 | 11944 | 540-317-098 | 05.03.2026 |
| ☒ | Compact simulator conducted immunity | EM test | CWS500 N1 | P1315117094 | 540-316-001 | 08.08.2025 |
| ☐ | Coupling and Decoupling network | EM test | CDN M1-32A | P1326119725 | 540-316-002 | --- |
| ☒ | Coupling and Decoupling network | EM test | CDN M2/M3 | P1343125199 | 540-316-003 | --- |
| ☐ | Coupling and Decoupling network | EM test | CDN M5-32A | P1317117980 | 540-316-004 | --- |
| ☐ | Coupling and Decoupling network | EM test | CDN S4 USB | P1315117419 | 540-316-005 | --- |
| ☐ | Coupling and Decoupling network | EM test | CDN AF3 | P1315117307 | 540-316-006 | --- |
| ☐ | Coupling and Decoupling network | EM test | CDN AF5 | P1316117719 | 540-316-007 | --- |
| ☐ | Coupling and Decoupling network | EM test | CDN AF8 | P1318118482 | 540-316-008 | --- |
| ☐ | Coupling and Decoupling network | EM test | CDN T4 RJ45 | P1344125509 | 540-316-009 | --- |
| ☐ | Coupling and Decoupling network | EM test | CDN S19 HDMI | P1529161237 | 540-316-020 | --- |
| ☐ | Coupling and Decoupling network | EM test | CDN T8 RJ45 | P1510151693 | 540-316-021 | --- |
| ☐ | Coupling and Decoupling network | Schaffner | CDN 117 | 17395 | 540-323-83 | --- |
| ☐ | Coupling and Decoupling network | AMETEK CTS | CNI 508N2 | P1907226998 | 540-317-090 | 27.02.2025 |
| ☒ | RF Amplifier | Prana | MT-200 | --- | 1312-1464 | --- |
| ☒ | RF Amplifier | Prana | SV-40DC | --- | 1312-1465 | --- |
| ☒ | RF Amplifier | Prana | UX-30DC | --- | 1312-1466 | --- |
| ☒ | Attenuator 6dB | EM test | ATT 6 / 75 | P1306112990 | 540-316-010 | 21.11.2024 |
| ☒ | Adapter - R100N | EM test | R100N | P1324119059 | 540-316-011 | 21.11.2024 |
| ☒ | Field Probe | PMM Italy | EP 601 | 511WX30645 | 540-316-014 | 05.12.2024 |
| ☒ | Signal Generator | Rohde&Schwarz | SMB100A03 | 180253 | 540-316-027 | 02.05.2025 |
| ☐ | AC/ DC Power source | Spitzenberger | PAS 5000 | A2793 01/0 0701 | 540-316-024 | 11.11.2024 |
| ☐ | Set for testing of immunity to the magnetic field | TSU Piešťany, a. s. | 9.15 | 201501 | 540-317-084 | --- |
| ☐ | Set for testing of immunity to the transients and surges in the vehicular environment. | TSU Piešťany, a. s. | 11.19 | 201901 | 540-317-101 | --- |
| ☐ | BiConiLog Antenna | A.H. Systems | SAS-521F-2 | 272 | 540-317-097 | 24.08.2025 |
| ☒ | BiConiLog Antenna | ETS Lindgreen | 3143B | 00157570 | 540-316-017 | 23.11.2024 |
| ☐ | Horn Antenna | ETS Lindgreen | 3119 | 00157903 | 540-316-016 | 16.12.2024 |
| ☒ | Antenna mast | ETS Lindgreen | 2175 | --- | --- | --- |
| ☒ | Turntable | ETS Lindgreen | 2188 | --- | --- | --- |
| ☒ | Anechoic chamber | ETS Lindgreen | FACT 3 | --- | --- | --- |
| ☒ | Atmosphere recorder | Comet System | C4130 | 13900371 | 412-316-001 | 04.04.2025 |

# 6 TEST CONDITIONS AND EMISSION TEST RESULTS

The tests according to:

1. **EN IEC 55014-1:2021** (idt CISPR 14-1:2020)
   Electromagnetic compatibility. Requirements for household appliances, electric tools and similar apparatus Part 1: Emission

2. **EN IEC 61000-3-2:2019/A1:2021** (idt IEC 61000-3-2:2018/Amd1:2020)
   Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A per phase)

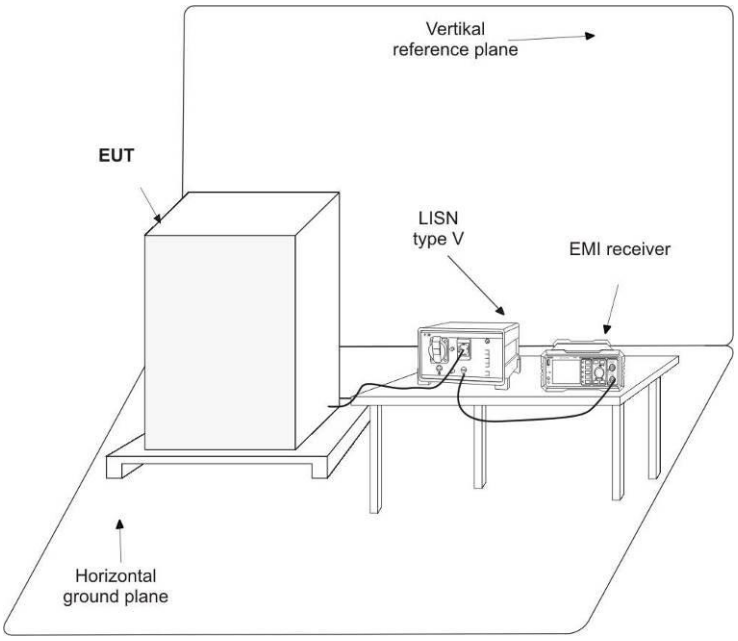
3. **EN 61000-3-3:2013/A1:2019/A2:2021/AC Jan.:2022** (idt IEC 61000-3-3:2013/AMD2:2021/ COR1:2022)
   Electromagnetic compatibility (EMC). Part 3-3: Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection

## 6.1 Radio noise voltage measured on mains terminals emitting from EUT

Conducted disturbance (0,15-30 MHz) The measurement was carried out according to the EN IEC 55014-1:2021 (idt CISPR 14-1:2020).

**Typical test setup:**

Block diagram of test set up according to standard EN IEC 55014-1:2021 (idt CISPR 14-1:2020):




**Test limits:**

The conducted emissions shall comply with limits according to the standard EN IEC 55014-1:2020 (idt CISPR 14-1:2020):

| Frequency range (MHz) | Quasi peak dB (µV) | Average dB (µV) |
|---|---|---|
| 0,15 – 0,5 | 66 ÷ 56 | 56 ÷ 46 |
| 0,5 – 5 | 56 | 46 |
| 5 - 30 | 60 | 50 |

**Measurement data:**

Phase: **L**

**Scan Table**

| | |
|---|---|
| Scan Start | 150.000000000 kHz |
| Scan Stop | 30.000000000 MHz |
| Scan Type | TD Scan |
| Transducer | 1 1,PMM L3-32 L1(16).TDF |

Detector Trace 1: Quasi Peak Trace 2: CISPR AV

| Start Frequency | Stop Frequency | Step Size | RBW | RF Atten | Preamp | Input |
|---|---|---|---|---|---|---|
| 150.000 kHz | 30.000 MHz | 2.250 kHz | 9.0 kHz | 15.0 dB | 20.0 dB | INPUT1 |

**Peak List**

Margin 35.0 dB
Peaks 25

| Trace | Frequency | Level (dBµV) | Phase | Detector | Delta Limit/dB |
|---|---|---|---|---|---|
| 2 | 217.500000000 kHz | 34.96 | | CISPR AV | -20.03 |
| 1 | 219.750000000 kHz | 45.18 | | Quasi Peak | -17.65 |
| 1 | 352.500000000 kHz | 50.80 | | Quasi Peak | -8.10 |
| 2 | 359.250000000 kHz | 41.36 | | CISPR AV | -8.21 |
| 2 | 390.750000000 kHz | 48.57 | | CISPR AV | -0.09 |
| 1 | 395.250000000 kHz | 56.22 | | Quasi Peak | -1.73 |
| 1 | 764.250000000 kHz | 46.87 | | Quasi Peak | -9.13 |
| 2 | 782.250000000 kHz | 38.16 | | CISPR AV | -7.84 |
| 2 | 1.000500000 MHz | 36.27 | | CISPR AV | -9.73 |
| 1 | 1.117500000 MHz | 44.14 | | Quasi Peak | -11.86 |
| 2 | 1.500000000 MHz | 35.25 | | CISPR AV | -10.75 |
| 1 | 1.504500000 MHz | 43.69 | | Quasi Peak | -12.31 |
| 1 | 2.501250000 MHz | 44.52 | | Quasi Peak | -11.48 |
| 2 | 2.501250000 MHz | 40.92 | | CISPR AV | -5.08 |
| 1 | 4.195500000 MHz | 42.29 | | Quasi Peak | -13.71 |
| 2 | 4.195500000 MHz | 35.06 | | CISPR AV | -10.94 |
| 1 | 5.136000000 MHz | 31.73 | | Quasi Peak | -28.27 |
| 2 | 5.473500000 MHz | 24.26 | | CISPR AV | -25.74 |
| 1 | 7.995750000 MHz | 31.80 | | Quasi Peak | -28.20 |
| 2 | 7.995750000 MHz | 28.08 | | CISPR AV | -21.92 |
| 1 | 13.575750000 MHz | 26.54 | | Quasi Peak | -33.46 |
| 2 | 13.596000000 MHz | 18.76 | | CISPR AV | -31.24 |
| 2 | 22.015500000 MHz | 16.46 | | CISPR AV | -33.54 |
| 1 | 22.017750000 MHz | 25.31 | | Quasi Peak | -34.69 |

## Scan Diagram


**Result of test: PASS**

Neutral: **N**

**Scan Table**

| | |
|---|---|
| Scan Start | 150.000000000 kHz |
| Scan Stop | 30.000000000 MHz |
| Scan Type | TD Scan |
| Transducer | PMM L3-32<br>N(16).TDF |

Detector Trace 1: Quasi Peak Trace 2: CISPR AV

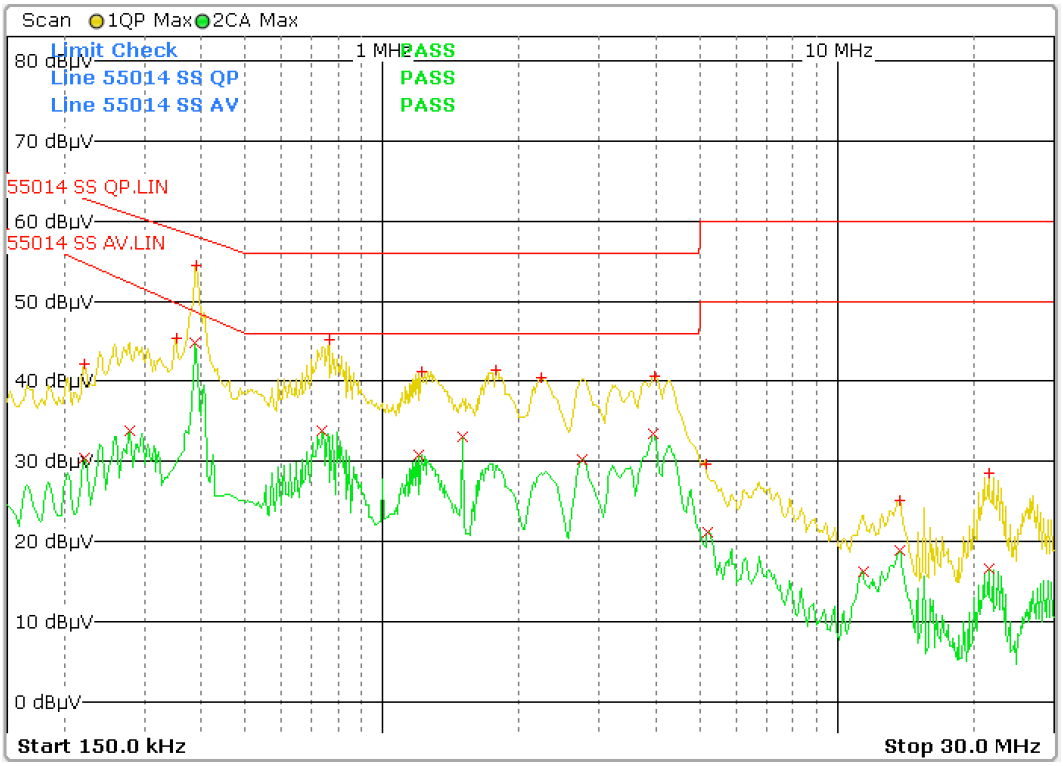
| Start Frequency | Stop Frequency | Step Size | RBW | RF Atten | Preamp | Input |
|---|---|---|---|---|---|---|
| 150.000 kHz | 30.000 MHz | 2.250 kHz | 9.0 kHz | 10.0 dB | 20.0 dB | INPUT1 |

**Peak List**

| | |
|---|---|
| Margin | 35.0 dB |
| Peaks | 25 |

| Trace | Frequency | Level (dBµV) | Phase | Detector | Delta Limit/dB |
|---|---|---|---|---|---|
| 1 | 222.000000000 kHz | 42.17 | | Quasi Peak | -20.57 |
| 2 | 222.000000000 kHz | 30.42 | | CISPR AV | -24.35 |
| 2 | 278.250000000 kHz | 33.78 | | CISPR AV | -18.55 |
| 1 | 352.500000000 kHz | 45.45 | | Quasi Peak | -13.45 |
| 2 | 388.500000000 kHz | 44.83 | | CISPR AV | -3.89 |
| 1 | 390.750000000 kHz | 54.52 | | Quasi Peak | -3.53 |
| 2 | 739.500000000 kHz | 33.77 | | CISPR AV | -12.23 |
| 1 | 764.250000000 kHz | 45.21 | | Quasi Peak | -10.79 |
| 2 | 1.200750000 MHz | 30.83 | | CISPR AV | -15.17 |
| 1 | 1.218750000 MHz | 41.23 | | Quasi Peak | -14.77 |
| 2 | 1.502250000 MHz | 33.10 | | CISPR AV | -12.90 |
| 1 | 1.774500000 MHz | 41.32 | | Quasi Peak | -14.68 |
| 1 | 2.235750000 MHz | 40.41 | | Quasi Peak | -15.59 |
| 2 | 2.753250000 MHz | 30.16 | | CISPR AV | -15.84 |
| 2 | 3.954750000 MHz | 33.49 | | CISPR AV | -12.51 |
| 1 | 3.988500000 MHz | 40.73 | | Quasi Peak | -15.27 |
| 1 | 5.142750000 MHz | 29.66 | | Quasi Peak | -30.34 |
| 2 | 5.210250000 MHz | 21.26 | | CISPR AV | -28.74 |
| 2 | 11.404500000 MHz | 16.34 | | CISPR AV | -33.66 |
| 1 | 13.715250000 MHz | 25.18 | | Quasi Peak | -34.82 |
| 2 | 13.715250000 MHz | 18.95 | | CISPR AV | -31.05 |
| 1 | 21.522750000 MHz | 28.61 | | Quasi Peak | -31.39 |
| 2 | 21.525000000 MHz | 16.68 | | CISPR AV | -33.32 |

## Scan Diagram

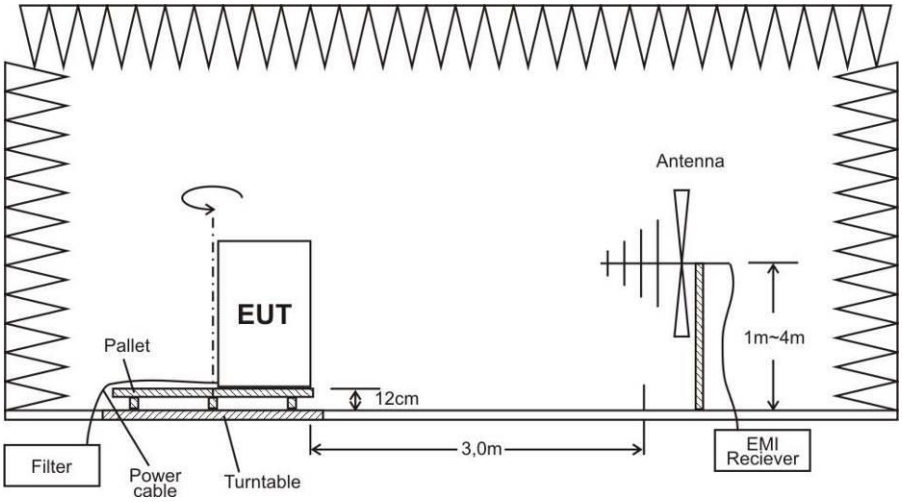



**Result of test: PASS**

## 6.2 Radio disturbance emission – frequency range from 30 MHz to 1000 MHz

Limits of radio disturbance emissions in frequency range from 30 MHz to 1000 MHz according to standard EN IEC 55014-1:2021 (idt CISPR 14-1:2020).

**Typical test setup:**




**Test limits:**

The radiated emissions shall comply with limits according to the standard EN IEC 55014-1:2020 (idt CISPR 14-1:2020):

Radiated disturbance: OATS or SAC, measurement distance: 3 m

| Frequency range (MHz) | Quasi peak dB (µV) |
|---|---|
| 30 – 230 | 40 |
| 230 - 1000 | 47 |

**Measurement data:**
Measurement method: **Radiated disturbance in SAC**
Polarization of antenna: **Vertical**

## Scan Table

| | |
|---|---|
| Scan Start | 30.000000000 MHz |
| Scan Stop | 1.000000000 GHz |
| Scan Type | TD Scan |
| Transducer | Antenna 3143B new cal + cable |

Detector Trace 1: Quasi Peak

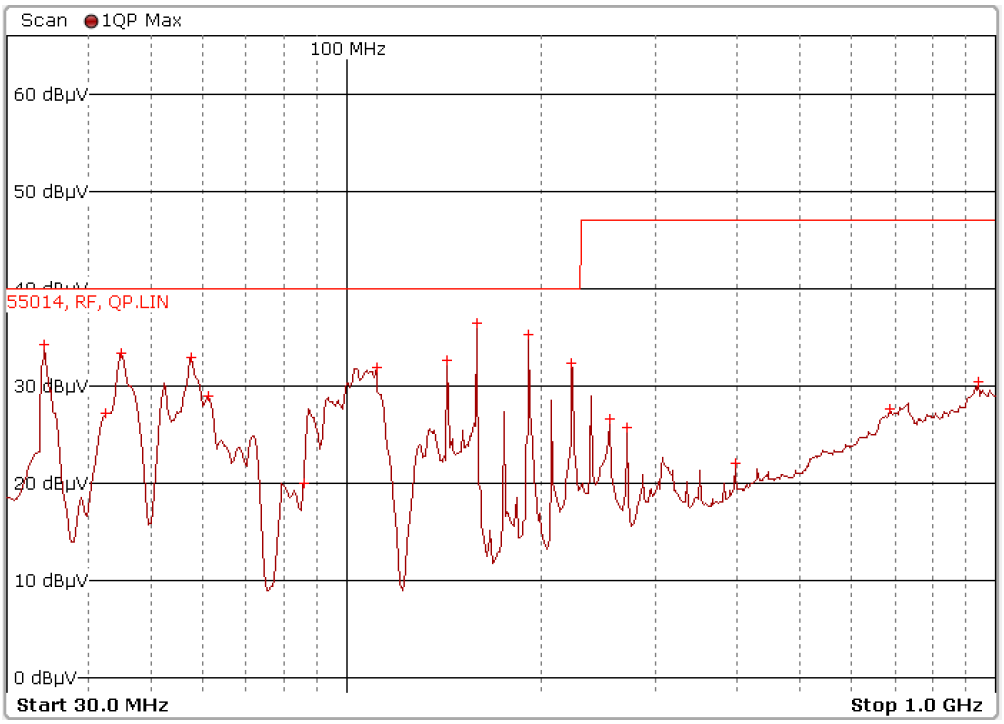
| Start Frequency | Stop Frequency | Step Size | RBW | RF Atten | Preamp | Input |
|---|---|---|---|---|---|---|
| 30.000 MHz | 1.000 GHz | 30.000 kHz | 120.0 kHz | 10.0 dB | 20.0 dB | INPUT1 |

## Peak List

| | |
|---|---|
| Margin | 30.0 dB |
| Peaks | 25 |

| Trace | Frequency | Level (dBµV) | Phase | Detector | Delta Limit/dB |
|---|---|---|---|---|---|
| 1 | 34.230000000 MHz | 34.19 | | Quasi Peak | -5.81 |
| 1 | 42.570000000 MHz | 27.18 | | Quasi Peak | -12.82 |
| 1 | 44.970000000 MHz | 33.38 | | Quasi Peak | -6.62 |
| 1 | 57.540000000 MHz | 32.97 | | Quasi Peak | -7.03 |
| 1 | 61.230000000 MHz | 28.94 | | Quasi Peak | -11.06 |
| 1 | 85.890000000 MHz | 20.02 | | Quasi Peak | -19.98 |
| 1 | 111.330000000 MHz | 31.88 | | Quasi Peak | -8.12 |
| 1 | 143.160000000 MHz | 32.62 | | Quasi Peak | -7.38 |
| 1 | 158.850000000 MHz | 36.45 | | Quasi Peak | -3.55 |
| 1 | 190.770000000 MHz | 35.27 | | Quasi Peak | -4.73 |
| 1 | 222.330000000 MHz | 32.39 | | Quasi Peak | -7.61 |
| 1 | 254.520000000 MHz | 26.58 | | Quasi Peak | -20.42 |
| 1 | 270.240000000 MHz | 25.77 | | Quasi Peak | -21.23 |
| 1 | 397.410000000 MHz | 21.97 | | Quasi Peak | -25.03 |
| 1 | 686.880000000 MHz | 27.55 | | Quasi Peak | -19.45 |
| 1 | 939.420000000 MHz | 30.43 | | Quasi Peak | -16.57 |

## Scan Diagram




**Result of test: PASS**

Polarization of antenna: **Horizontal**

## Scan Table

| | |
|---|---|
| Scan Start | 30.000000000 MHz |
| Scan Stop | 1.000000000 GHz |
| Scan Type | TD Scan |
| Transducer | Antenna 3143B new cal + cable |

Detector Trace 1: Quasi Peak

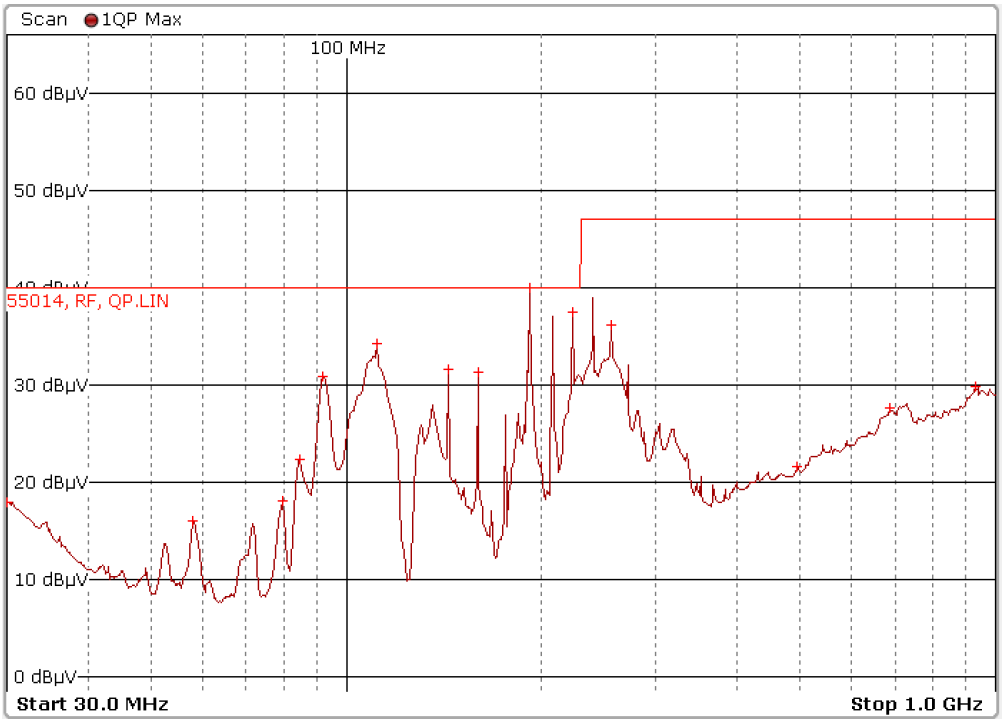
| Start Frequency | Stop Frequency | Step Size | RBW | RF Atten | Preamp | Input |
|---|---|---|---|---|---|---|
| 30.000 MHz | 1.000 GHz | 30.000 kHz | 120.0 kHz | 10.0 dB | 20.0 dB | INPUT1 |

## Peak List

| | |
|---|---|
| Margin | 30.0 dB |
| Peaks | 25 |

| Trace | Frequency | Level (dBµV) | Phase | Detector | Delta Limit/dB |
|---|---|---|---|---|---|
| 1 | 30.000000000 MHz | 17.92 | | Quasi Peak | -22.08 |
| 1 | 58.080000000 MHz | 16.02 | | Quasi Peak | -23.98 |
| 1 | 79.770000000 MHz | 18.02 | | Quasi Peak | -21.98 |
| 1 | 84.720000000 MHz | 22.34 | | Quasi Peak | -17.66 |
| 1 | 92.040000000 MHz | 30.85 | | Quasi Peak | -9.15 |
| 1 | 111.720000000 MHz | 34.30 | | Quasi Peak | -5.70 |
| 1 | 143.670000000 MHz | 31.61 | | Quasi Peak | -8.39 |
| 1 | 159.600000000 MHz | 31.34 | | Quasi Peak | -8.66 |
| 1 | 191.580000000 MHz | 39.91 | | Quasi Peak | -0.09 |
| 1 | 223.560000000 MHz | 37.43 | | Quasi Peak | -2.57 |
| 1 | 255.510000000 MHz | 36.13 | | Quasi Peak | -10.87 |
| 1 | 495.030000000 MHz | 21.55 | | Quasi Peak | -25.45 |
| 1 | 686.370000000 MHz | 27.56 | | Quasi Peak | -19.44 |
| 1 | 929.910000000 MHz | 29.80 | | Quasi Peak | -17.20 |

## Scan Diagram

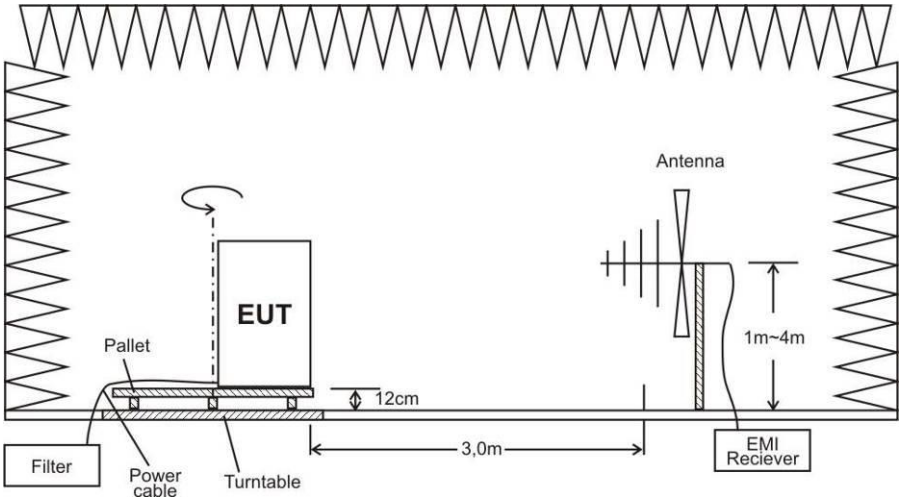



**Result of test: PASS**

## 6.3 Radio disturbance emission – frequency range from 1 GHz to 6 GHz

Limits of radio disturbance emissions in frequency range from 1 GHz to 6 GHz according to standard EN IEC 55014-1:2021 (idt CISPR 14-1:2020).

**Typical test setup:**




A facility validated against the FSOATS requirements shall be used for measurements above 1 GHz.
An FSOATS may be a SAC/OATS with RF absorber on the RGP or a FAR.

**Test limits:**

The radiated emissions shall comply with limits according to the standard EN IEC 55014-1:2020 (idt CISPR 14-1:2020).

Testing method: FSOATS* or FAR, measurement distance: 3 m

| Frequency range (MHz) | Peak detector dB(µV/m) | Average detector dB(µV/m) |
|---|---|---|
| 1000 – 3000 | 70 | 50 |
| 3000 - 6000 | 74 | 54 |

* A FSOATS may be a SAC/OATS with RF absorbers on the RGP.

**Measurement data:**

Measurement method: **Radiated disturbance in FAR**
Polarization of antenna: **Vertical**

## Scan Table

| | |
|---|---|
| Scan Start | 1.000000000 GHz |
| Scan Stop | 6.000000000 GHz |
| Scan Type | TD Scan |
| Transducer | Antenna 3119 + cable |

Detector Trace 1: Max Peak Trace 2: CISPR AV

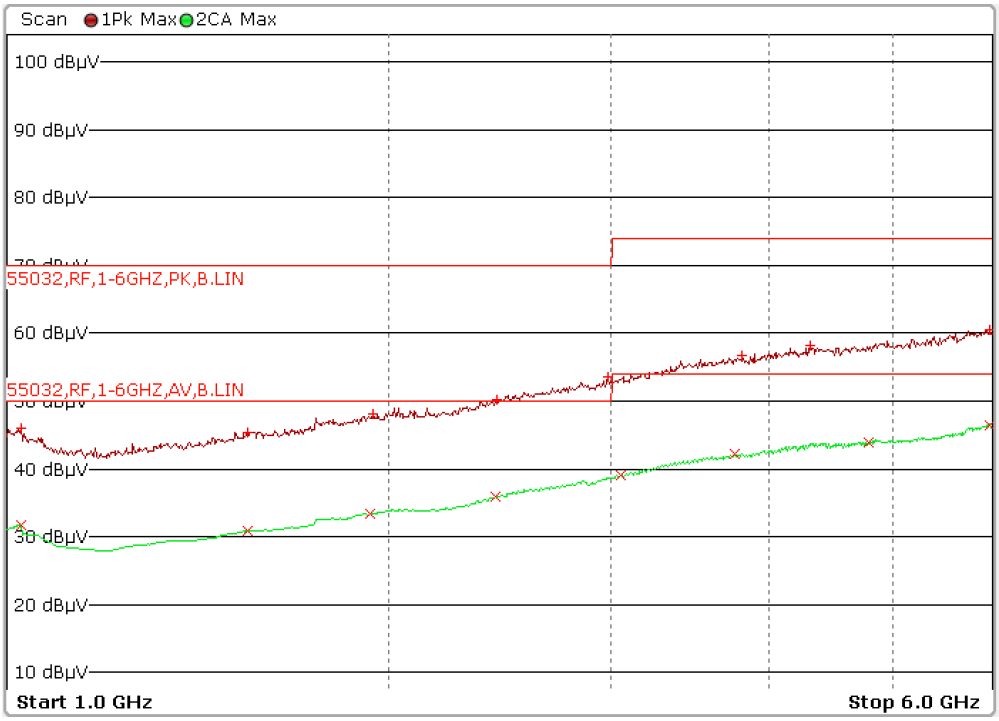
| Start Frequency | Stop Frequency | Step Size | RBW | Meas Time | RF Atten | Preamp | Input |
|---|---|---|---|---|---|---|---|
| 1.000 GHz | 6.000 GHz | 250.000 kHz | 1.0 MHz | 100.0 µs | 10.0 dB | 20.0 dB | INPUT1 |

## Peak List

| | |
|---|---|
| Margin | 27.0 dB |
| Peaks | 5 |

| Trace | Frequency | Level (dBµV) | Phase | Detector | Delta Limit/dB |
|---|---|---|---|---|---|
| 1 | 1.025250000 GHz | 46.03 | | Positive Peak | -23.97 |
| 2 | 1.025750000 GHz | 31.82 | | CISPR AV | -18.18 |
| 1 | 1.547500000 GHz | 45.39 | | Positive Peak | -24.61 |
| 2 | 1.547750000 GHz | 30.98 | | CISPR AV | -19.02 |
| 2 | 1.937250000 GHz | 33.51 | | CISPR AV | -16.49 |
| 1 | 1.944000000 GHz | 48.04 | | Positive Peak | -21.96 |
| 2 | 2.431250000 GHz | 35.96 | | CISPR AV | -14.04 |
| 1 | 2.437750000 GHz | 50.31 | | Positive Peak | -19.69 |
| 1 | 2.978500000 GHz | 53.56 | | Positive Peak | -16.44 |
| 2 | 3.054500000 GHz | 39.16 | | CISPR AV | -14.84 |
| 2 | 3.756500000 GHz | 42.17 | | CISPR AV | -11.83 |
| 1 | 3.808000000 GHz | 56.68 | | Positive Peak | -17.32 |
| 1 | 4.303750000 GHz | 58.23 | | Positive Peak | -15.77 |
| 2 | 4.796000000 GHz | 44.01 | | CISPR AV | -9.99 |
| 1 | 5.962500000 GHz | 60.59 | | Positive Peak | -13.41 |
| 2 | 5.966500000 GHz | 46.54 | | CISPR AV | -7.46 |

## Scan Diagram




**Result of test: PASS**

Polarization of antenna: **Vertical**

## Scan Table

| | |
|---|---|
| Scan Start | 1.000000000 GHz |
| Scan Stop | 6.000000000 GHz |
| Scan Type | TD Scan |
| Transducer | Antenna 3119 + cable |

Detector Trace 1: Max Peak Trace 2: CISPR AV

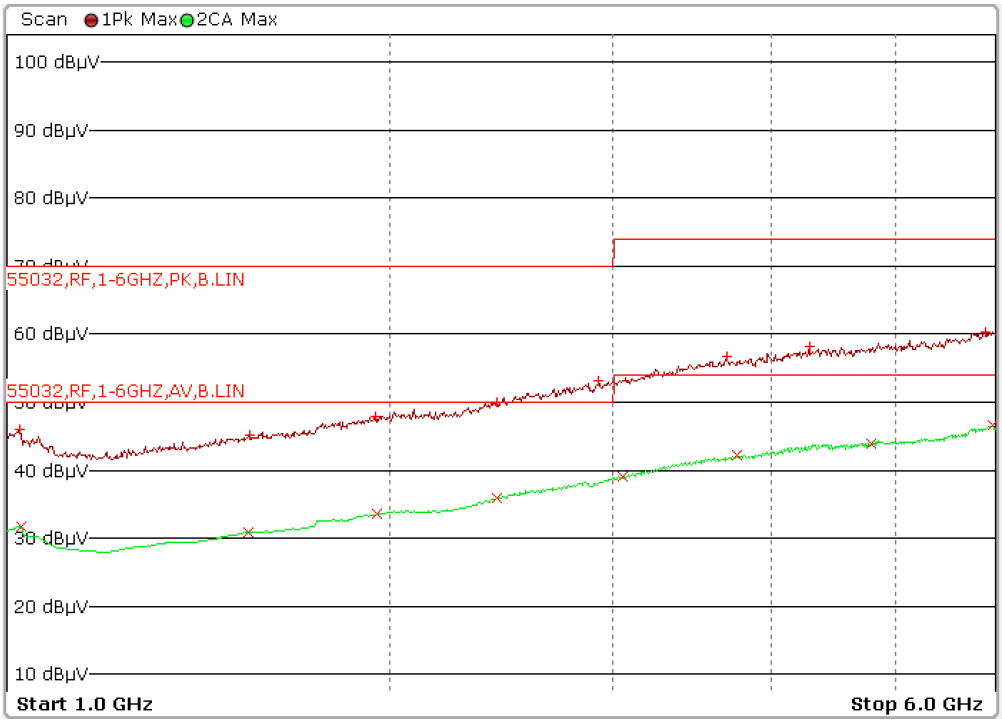
| Start Frequency | Stop Frequency | Step Size | RBW | RF Atten | Preamp | Input |
|---|---|---|---|---|---|---|
| 1.000 GHz | 6.000 GHz | 250.000 kHz | 1.0 MHz | 10.0 dB | 20.0 dB | INPUT1 |

## Peak List

| | |
|---|---|
| Margin | 27.0 dB |
| Peaks | 5 |

| Trace | Frequency | Level (dBµV) | Phase | Detector | Delta Limit/dB |
|---|---|---|---|---|---|
| 1 | 1.023000000 GHz | 46.09 | | Positive Peak | -23.91 |
| 2 | 1.025750000 GHz | 31.83 | | CISPR AV | -18.17 |
| 2 | 1.547000000 GHz | 30.98 | | CISPR AV | -19.02 |
| 1 | 1.552000000 GHz | 45.22 | | Positive Peak | -24.78 |
| 1 | 1.948000000 GHz | 47.96 | | Positive Peak | -22.04 |
| 2 | 1.957750000 GHz | 33.52 | | CISPR AV | -16.48 |
| 1 | 2.430750000 GHz | 50.04 | | Positive Peak | -19.96 |
| 2 | 2.431000000 GHz | 35.97 | | CISPR AV | -14.03 |
| 1 | 2.924000000 GHz | 53.19 | | Positive Peak | -16.81 |
| 2 | 3.054750000 GHz | 39.17 | | CISPR AV | -14.83 |
| 1 | 3.683750000 GHz | 56.63 | | Positive Peak | -17.37 |
| 2 | 3.756500000 GHz | 42.17 | | CISPR AV | -11.83 |
| 1 | 4.279750000 GHz | 58.13 | | Positive Peak | -15.87 |
| 2 | 4.796000000 GHz | 44.01 | | CISPR AV | -9.99 |
| 1 | 5.890000000 GHz | 60.30 | | Positive Peak | -13.70 |
| 2 | 5.966500000 GHz | 46.57 | | CISPR AV | -7.43 |

## Scan Diagram




**Result of test: PASS**

## 6.4 Measurement of harmonic current emissions

The tests according to

EN IEC 61000-3-2:2019/A1:2021 (idt IEC 61000-3-2:2018/Amd1:2020) Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current < 16 A per phase)

**Limits for harmonic current measurement:**

| Limits for Class A equipment | |
|---|---|
| Harmonics order no. | Max. permissible harmonics current (A) |
| **Odd harmonics** | |
| 3 | 2,30 |
| 5 | 1,14 |
| 7 | 0,77 |
| 9 | 0,4 |
| 11 | 0,33 |
| 13 | 0,21 |
| 15<=n<=39 | 0,15x15/n |
| **Even harmonics** | |
| 2 | 1,08 |
| 4 | 0,43 |
| 6 | 0,30 |
| 8<=n<=40 | 0,23x8/n |

Limits for Class B equipment: For Class B equipment, the harmonics of the input current shall not exceed the values given in Table 1 multiplied by a factor of 1,5.

Note*:*
Class A and Class D are classified according to item section 5 of EN IEC 61000-3-2:2019/A1:2021 (idt IEC 61000-3-2:2018/Amd1:2020)

**Measurement data:**
Tabular overview:

Spitzenberger & Spies GmbH & Co. KG
Viechtach

| | | | |
|---|---|---|---|
| Name: | | Serial no: | |
| Department: | 317 | Operating modes: | normal |
| Company: | TSU | Comment1: | -- |
| Test report no: | 1 | Comment2: | -- |
| Device: | | Comment3: | -- |
| Specimen: | | Comment4: | -- |
| Manufacturer: | | Date: | 22.07.2024 |
| Type: | | Test date: | 22.07.2024 |

Maximum RMS current and corresponding values in timewindow 1:

| | | | | | | |
|---|---|---|---|---|---|---|
| Voltage: | 230.86 Vrms | | THD=0.00 % | THV=0.011 V | POHV=0.006 V | PWHD=0.01 % |
| Current: | 0.740 Arms | 1.107 Apk | THD=1.32 % | THC=0.010 A | POHC=0.004 A | PWHD=3.69 % |
| Power: | 170.7 W | P1=170.7 W | 170.8 VA | | | |
| Power factor: | 1.000 | CosPhi1: 1.000 | | | | |

Test conditions: EN 61000-3-2:2014, f=50 Hz, Phase=L1, Range=4.00 A
Time window=10/12 (200ms), Grouping (>2nd harm.)=on
No Ztest selected
harmonic currents < 0.6 % of I or < 5 mA are disregard for calc. of THD, THC, POHC, PWHD

HARMONIC ANALYSIS: Test PASS
Tobs = entire measurement; POHC: avg=0.00 A, limits=0.38 A
Iavg=0.737 Arms

| Ha | Entire measurement (2.5 min = 750 time windows) | | | | | | Worst 2.5 min | | Average | | PASS | FAIL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum | Window | EN61000-3-2 Class B | Margin in MaxWin | 100 to 150% | Ex-ceeded | 100 to 150% | Ex-ceeded | Value | Ex-ceeded | | |
| DC | 0.0110 A | 739 | -.- - - - | - - - . - | 0 | 0 | n.e. | n.e. | 0.0105 A | 0 | -- | |
| 1 | 0.7395 A | 1 | -.- - - - | - - - . - | 0 | 0 | n.e. | n.e. | 0.7365 A | 0 | X | |
| 2 | 0.0008 A | 93 | 1.6200 A | -99.9 % | 0 | 0 | n.e. | n.e. | 0.0005 A | 0 | X | |
| 3 | 0.0036 A | 278 | 3.4500 A | -99.9 % | 0 | 0 | n.e. | n.e. | 0.0035 A | 0 | X | |
| 4 | 0.0004 A | 557 | 0.6450 A | -99.9 % | 0 | 0 | n.e. | n.e. | 0.0004 A | 0 | X | |
| 5 | 0.0034 A | 28 | 1.7100 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0033 A | 0 | X | |
| 6 | 0.0002 A | 93 | 0.4500 A | -100.0 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 7 | 0.0033 A | 135 | 1.1550 A | -99.7 % | 0 | 0 | n.e. | n.e. | 0.0032 A | 0 | X | |
| 8 | 0.0003 A | 592 | 0.3450 A | -99.9 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 9 | 0.0032 A | 65 | 0.6000 A | -99.5 % | 0 | 0 | n.e. | n.e. | 0.0031 A | 0 | X | |
| 10 | 0.0003 A | 86 | 0.2760 A | -99.9 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 11 | 0.0030 A | 105 | 0.4950 A | -99.4 % | 0 | 0 | n.e. | n.e. | 0.0029 A | 0 | X | |
| 12 | 0.0002 A | 1 | 0.2300 A | -99.9 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 13 | 0.0029 A | 1 | 0.3150 A | -99.1 % | 0 | 0 | n.e. | n.e. | 0.0028 A | 0 | X | |
| 14 | 0.0002 A | 276 | 0.1971 A | -99.9 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 15 | 0.0027 A | 96 | 0.2250 A | -98.8 % | 0 | 0 | n.e. | n.e. | 0.0026 A | 0 | X | |
| 16 | 0.0002 A | 90 | 0.1725 A | -99.9 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 17 | 0.0025 A | 9 | 0.1985 A | -98.7 % | 0 | 0 | n.e. | n.e. | 0.0024 A | 0 | X | |
| 18 | 0.0002 A | 1 | 0.1533 A | -99.9 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 19 | 0.0023 A | 81 | 0.1776 A | -98.7 % | 0 | 0 | n.e. | n.e. | 0.0023 A | 0 | X | |
| 20 | 0.0002 A | 617 | 0.1380 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 21 | 0.0021 A | 487 | 0.1607 A | -98.7 % | 0 | 0 | n.e. | n.e. | 0.0021 A | 0 | X | |
| 22 | 0.0002 A | 151 | 0.1255 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 23 | 0.0019 A | 1 | 0.1467 A | -98.7 % | 0 | 0 | n.e. | n.e. | 0.0019 A | 0 | X | |
| 24 | 0.0002 A | 571 | 0.1150 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 25 | 0.0017 A | 23 | 0.1350 A | -98.8 % | 0 | 0 | n.e. | n.e. | 0.0016 A | 0 | X | |
| 26 | 0.0002 A | 597 | 0.1062 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 27 | 0.0015 A | 321 | 0.1250 A | -98.8 % | 0 | 0 | n.e. | n.e. | 0.0014 A | 0 | X | |
| 28 | 0.0002 A | 85 | 0.0986 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 29 | 0.0013 A | 28 | 0.1164 A | -98.9 % | 0 | 0 | n.e. | n.e. | 0.0012 A | 0 | X | |
| 30 | 0.0002 A | 324 | 0.0920 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 31 | 0.0011 A | 1 | 0.1089 A | -99.0 % | 0 | 0 | n.e. | n.e. | 0.0010 A | 0 | X | |
| 32 | 0.0002 A | 1 | 0.0862 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 33 | 0.0009 A | 1 | 0.1023 A | -99.1 % | 0 | 0 | n.e. | n.e. | 0.0009 A | 0 | X | |
| 34 | 0.0002 A | 178 | 0.0812 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 35 | 0.0007 A | 198 | 0.0964 A | -99.3 % | 0 | 0 | n.e. | n.e. | 0.0007 A | 0 | X | |
| 36 | 0.0002 A | 1 | 0.0767 A | -99.7 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 37 | 0.0006 A | 338 | 0.0912 A | -99.4 % | 0 | 0 | n.e. | n.e. | 0.0005 A | 0 | X | |
| 38 | 0.0002 A | 330 | 0.0726 A | -99.8 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |
| 39 | 0.0004 A | 746 | 0.0865 A | -99.5 % | 0 | 0 | n.e. | n.e. | 0.0004 A | 0 | X | |
| 40 | 0.0002 A | 34 | 0.0690 A | -99.7 % | 0 | 0 | n.e. | n.e. | 0.0002 A | 0 | X | |

average value < 0.6 % of Iavg or < 5 mA  n.e. = not evaluated

Graphical overview:

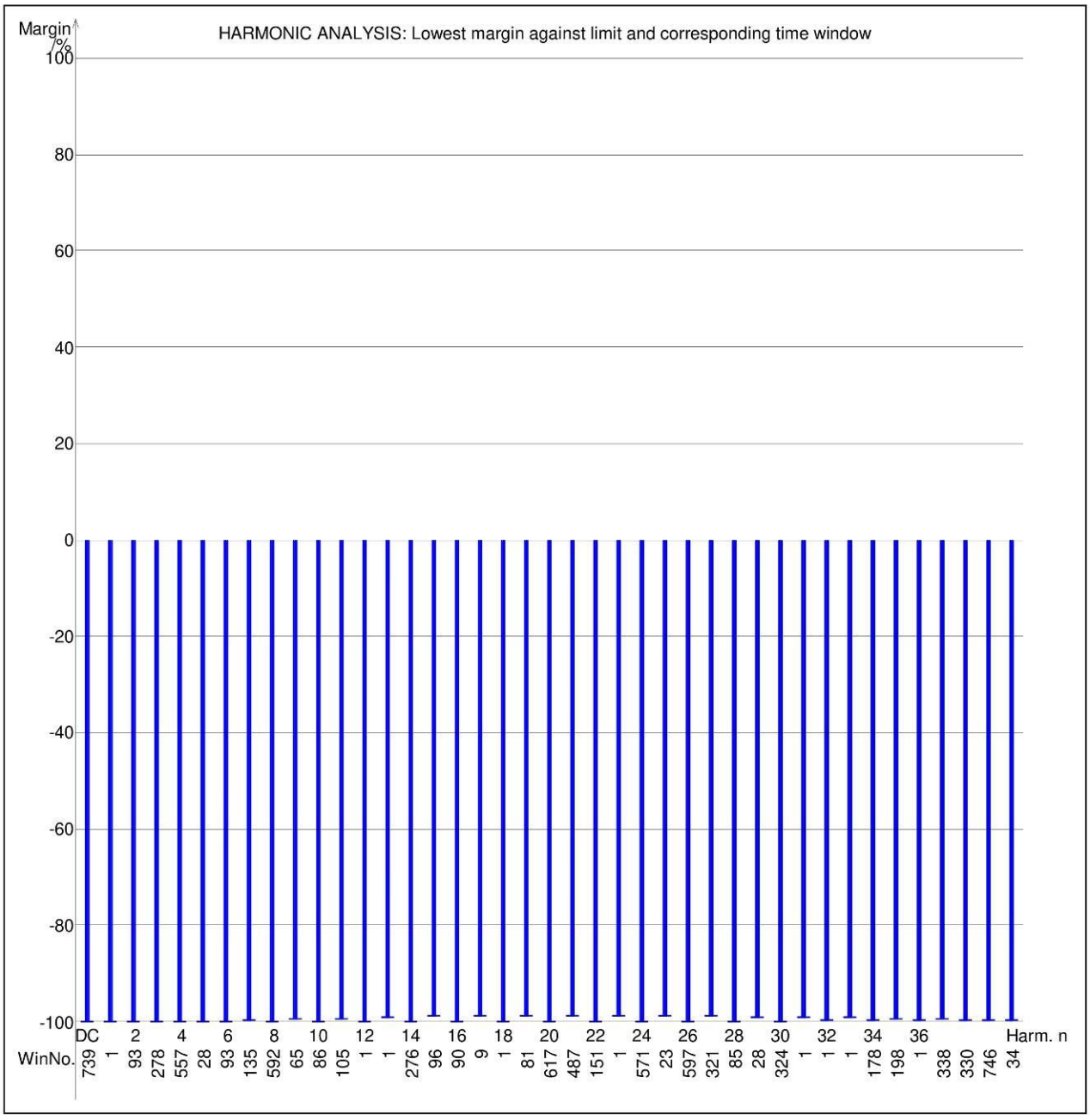
Spitzenberger & Spies GmbH & Co. KG
Viechtach

| | | | |
|---|---|---|---|
| Name: | | Serial no: | |
| Department: | 317 | Operating modes: | normal |
| Company: | TSU | Comment1: | -- |
| Test report no: | 1 | Comment2: | -- |
| Device: | | Comment3: | -- |
| Specimen: | | Comment4: | -- |
| Manufacturer: | | Date: | 22.07.2024 |
| Type: | | Test date: | 22.07.2024 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Voltage: | 230.86 Vrms | | THD=0.00 % | THV=0.011 V | POHV=0.006 V | PWHD=0.01 % |
| Current: | 0.740 Arms | 1.107 Apk | THD=1.32 % | THC=0.010 A | POHC=0.004 A | PWHD=3.69 % |
| Power: | 170.7 W | P1=170.7 W | 170.8 VA | | | |
| Power factor: | 1.000 | CosPhi1: 1.000 | | | | |

Test conditions: EN 61000-3-2:2014, f=50 Hz, Phase=L1, Range=4.00 A
Time window=10/12 (200ms), Grouping (>2nd harm.)=on
No Ztest selected
harmonic currents < 0.6 % of I or < 5 mA are disregard for calc. of THD, THC, POHC, PWHD

Graphical Harmonic Overview - EN61000-3-2 Class B




**Result of test: PASS**

## 6.5 Measurement of voltage changes, voltage fluctuations and flicker

The tests according to

EN 61000-3-3:2013/A1:2019/A2:2021/AC Jan.:2022 (idt IEC 61000-3-3:2013/AMD2:2021/COR1:2022) Electromagnetic compatibility (EMC). Part 3-3: Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection

**Measurement data:**

Spitzenberger & Spies GmbH & Co. KG
Viechtach

| | | | |
|---|---|---|---|
| Name: | | Serial no: | |
| Department: | 317 | Operating modes: | normal |
| Company: | TSU | Comment1: | -- |
| Test report no: | 1 | Comment2: | -- |
| Device: | | Comment3: | -- |
| Specimen: | | Comment4: | -- |
| Manufacturer: | | Date: | 22.07.2024 |
| Type: | | Test date: | 22.07.2024 |

Test conditions: EN 61000-3-3:2013 / 230 V / 50 Hz / Phase L1
EN 61000-4-15:2011 / Obs 12 x 1 min / Ztest (0.400+j0.250) Ohm
Ra+jXa (0.2400+j0.1500) Ohm / Rn+jXn (0.1600+j0.1000) Ohm

FLICKER: Test PASS!

| Time | Pmax | Pst | Sliding Plt | Tmax [s] | dmax [%] | dc [%] | PASS | FAIL |
|---|---|---|---|---|---|---|---|---|
| 10:34:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:35:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:36:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:37:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:38:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:39:07 | 0.000 | 0.0020 | 0.0020 | 0.000 | +0.000 | - . - - - | X | |
| 10:40:07 | 0.000 | 0.0020 | 0.0020 | 0.000 | +0.000 | - . - - - | X | |
| 10:41:07 | 0.000 | 0.0020 | 0.0020 | 0.000 | +0.000 | - . - - - | X | |
| 10:42:07 | 0.000 | 0.0020 | 0.0020 | 0.000 | +0.000 | - . - - - | X | |
| 10:43:07 | 0.000 | 0.0020 | 0.0020 | 0.000 | +0.000 | - . - - - | X | |
| 10:44:07 | 0.000 | 0.0020 | 0.0020 | 0.000 | +0.000 | - . - - - | X | |
| 10:45:07 | 0.000 | 0.0020 | 0.0020 | 0.000 | +0.000 | - . - - - | X | |
| Limits: | | 1.000 | 0.650 | 0.500 | 7.000 | 3.300 | | |
| Plt: 0.002000 (calculated over 12 periods) | | | | | | | X | |
| Evaluated: PST, PLT, Sliding PLT, dc, dmax, Tmax | | | | | | | | |

FLICKER: Source test PASS!

| Time | Pmax | Pst | Sliding Plt | Tmax [s] | dmax [%] | dc [%] | PASS | FAIL |
|---|---|---|---|---|---|---|---|---|
| 10:34:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:35:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:36:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:37:07 | 0.000 | 0.0010 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:38:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:39:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:40:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:41:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:42:07 | 0.000 | 0.0020 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:43:07 | 0.000 | 0.0010 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:44:07 | 0.000 | 0.0010 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| 10:45:07 | 0.000 | 0.0010 | - . - - - - | 0.000 | +0.000 | - . - - - | X | |
| Plt: 0.001783 (calculated over 12 periods) | | | | | | | | |
| Evaluated: PST <= 0.4 dmax < 20 % dmax1 | | | | | | | | |

**Result of test: PASS**

# 7 TEST CONDITIONS AND SUSCEPTIBILITY TEST RESULTS

The tests according to:

**EN IEC 55014-2:2021** (idt CISPR 14-2:2020) Electromagnetic compatibility. Requirements for household appliances, electric tools and similar apparatus Part 1: Emission

and following standards

1. **EN 61000-4-2:2009** (idt IEC 61000-4-2:2008)
   Electromagnetic compatibility. Part 4: Testing and measurement techniques. Section 2: Electrostatic discharge – immunity test

2. **EN IEC 61000-4-3:2020** (idt IEC 61000-4-3:2020)
   Electromagnetic compatibility (EMC). Part 4-3: Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test

3. **EN 61000-4-4:2012** (idt IEC 61000-4-4:2012)
   Electromagnetic compatibility (EMC) - Part 4-4: Electrical fast transient/burst immunity test

4. **EN 61000-4-5:2014/A1:2017** (idt IEC 61000-4-5:2014/AMD1:2017)
   Electromagnetic compatibility (EMC) – Part 4-5: Surge immunity test

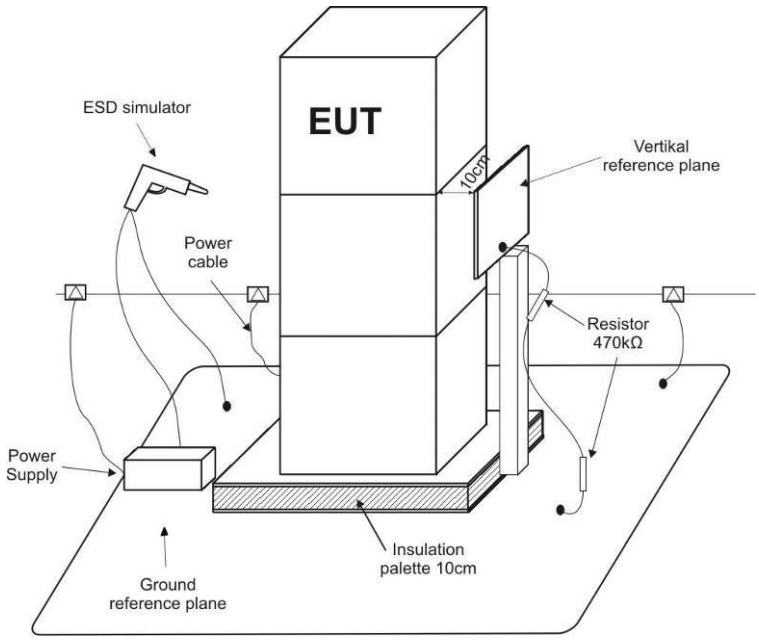
5. **EN IEC 61000-4-6:2023** (idt IEC 61000-4-6:2023)
   Electromagnetic compatiblity (EMC). Part 4-6: Testing and measurement techniques Immunity to conducted disturbances, induced by radio-frequency fields

6. **EN IEC 61000-4-11:2020/AC Jun.:2020/AC:2022** (idt IEC 61000-4-11:2020/COR1:2020/COR2:2022)
   Electromagnetic compatibility (EMC) Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests

## 7.1 Electrostatic discharge immunity test

Testing provided according to EN 61000-4-2:2009 (idt IEC 61000-4-2:2008). This standard determines the requirements for immunity of EUT for electrostatic discharge. Servility levels for the electrostatic discharge immunity test defined according to standard EN 55014-2:2015 (idt CISPR 14-2:2015). Based on this standard, the category of EUT was classified as Category III.

**Typical test setup:**




**Test severity levels:**

| Contact discharge | | Air discharge | |
|---|---|---|---|
| Level | Test voltage (kV) | Level | Test voltage (kV) |
| **1** | ±2 | **1** | ±2 |
| **2** | ±4 | **2** | ±4 |
| **3** | ±6 | **3** | ±8 |
| **4** | ±8 | **4** | ±15 |
| **x** | Specified | **x** | Specified |

NOTE:

- x is an open class. This level can be specified in the product specification.

**Test conditions*:***

| Environmental conditions | Required value | Actual value |
|---|---|---|
| Temperature: | 15°C ÷ 35 °C | 22,7 °C |
| Humidity: | 30 % ÷ 75 % | 36,5 % |
| Pressure: | 860 hPa ÷ 1060 hPa | 1013 hPa |

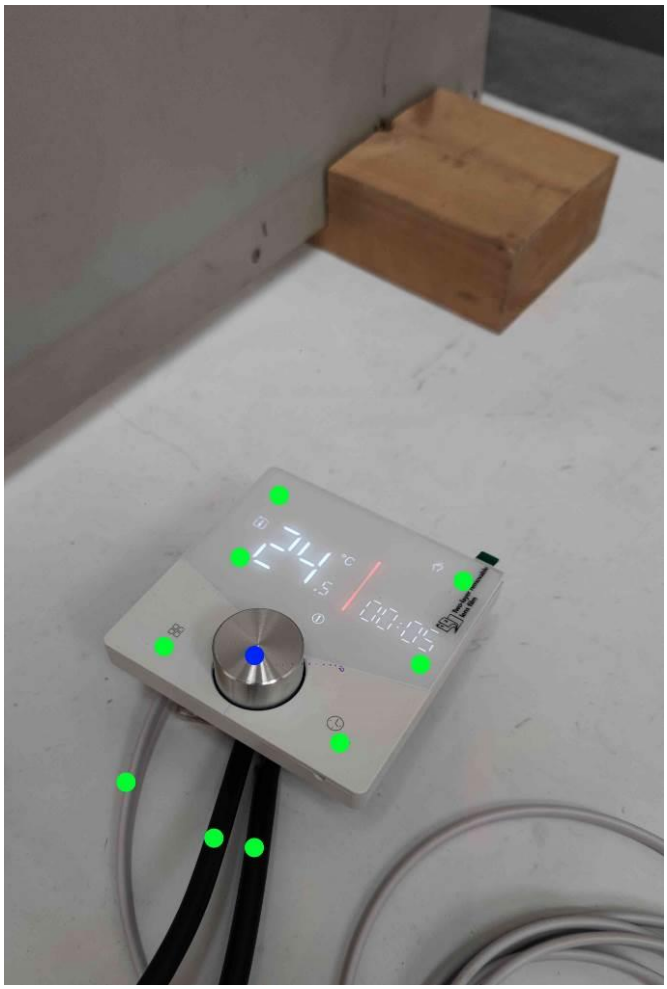
**Measurement data:**

| Test voltage | Number of discharges per location for each polarity (number of locations) | Required criteria | Result |
|---|---|---|---|
| **+ 4 kV Contact discharge** | 10 (1) | B | PASS |
| **- 4 kV Contact discharge** | 10 (1) | B | PASS |
| **+ 2; 4; 8 Air discharge** | 10 (9) | B | PASS |
| **- 2; 4; 8 Air discharge** | 10 (9) | B | PASS |

Each kind of the discharge (with positive and negative polarity) and voltage was applied ten times to the accessible parts of the sample. Duration between application of the discharges was >5 seconds.

**Points of ESD Test:**

Air discharge
Contact discharge



Remarks: No failure according to the performance criteria in the used standard was observed during or after the test.

**Result of test: PASS**

## 7.2 Radiated, radio-frequency, electromagnetic field immunity test

Testing provided according to standard EN IEC 61000-4-3:2020 (idt IEC 61000-4-3:2020) Electromagnetic compatibility (EMC). Part 4-3: Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test.

**Test severity levels:**

| Level | Field strength |
|---|---|
| **1** | 1 V/m |
| **2** | 3 V/m |
| **3** | 10 V/m |
| **x** | Specified |

NOTE:

- x is an open class. This level can be specified in the product specification.

**Measurement data:**

Modulation: AM 80%, 1kHz sine wave, Dwell time: 1000ms
Frequency step size: 1% of preceding frequency value
Test location: Anechoic chamber, Distance of antenna – EUT: 3,0m

| Frequency (MHz) | Antenna polarization | Face | Field strength | Required criteria | Result |
|---|---|---|---|---|---|
| 80 ÷ 1000 | Vertical | Front | 3 V/m | A | PASS |
| 80 ÷ 1000 | Vertical | Rear | 3 V/m | A | PASS |
| 80 ÷ 1000 | Horizontal | Front | 3 V/m | A | PASS |
| 80 ÷ 1000 | Horizontal | Rear | 3 V/m | A | PASS |
| 1000 ÷ 6000 | Vertical | Front | 3 V/m | A | PASS |
| 1000 ÷ 6000 | Vertical | Rear | 3 V/m | A | PASS |
| 1000 ÷ 6000 | Horizontal | Front | 3 V/m | A | PASS |
| 1000 ÷ 6000 | Horizontal | Rear | 3 V/m | A | PASS |

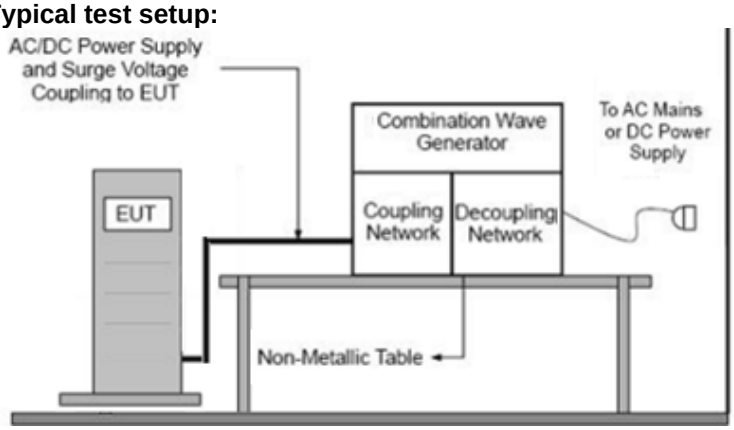
Remarks: No failure according to the performance criteria in the used standard was observed during or after the test.

**Result of test: PASS**

## 7.3 Electrical fast transient/burst – immunity test

Testing provided according to standard EN 61000-4-4:2012 (idt IEC 61000-4-4:2012).
Electromagnetic compatibility (EMC) - Part 4-4: Electrical fast transient/burst immunity test.

**Typical test setup:**




**Test severity levels:**

The following test severity levels are recommended for the fast transient/burst test:

| Open circuit output test voltage ± 10% | | |
|---|---|---|
| Level | On power supply | On I/O signal, data and control line |
| **1** | 0,50 kV | 0,25 kV |
| **2** | 1,0 kV | 0,50 kV |
| **3** | 2,0 kV | 1,0 kV |
| **4** | 4,0 kV | 2,0 kV |
| **x** | Specified | Specified |

NOTE:
- x is an open class. This level can be specified in the product specification.

**Measurement data:**

Direct coupling with a Coupling/Decoupling Network

| Impulse | Level | Coupling | Required criteria | Test result |
|---|---|---|---|---|
| 5/50 ns | ±1,0 kV | L1 | B | PASS |
| 5/50 ns | ±1,0 kV | N | B | PASS |
| 5/50 ns | ±1,0 kV | L1+N | B | PASS |

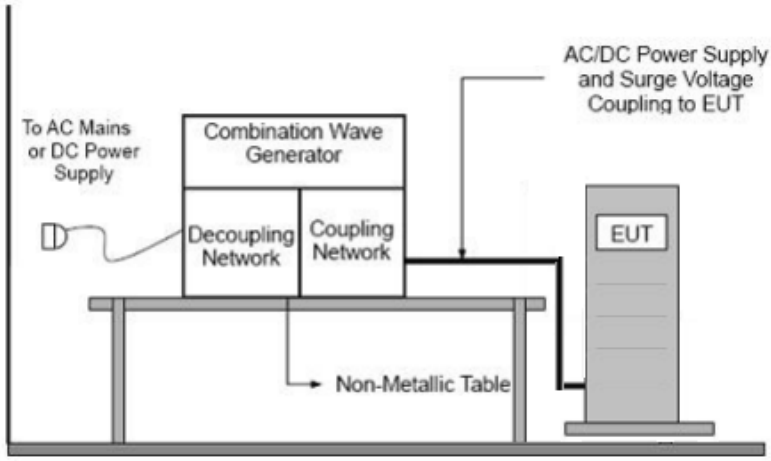
Remarks: No failure according to the performance criteria in the used standard was observed during or after the test.

**Result of test: PASS**

## 7.4 Surge – immunity test

Testing provided according to standard EN 61000-4-5:2014/A1:2017 (idt IEC 61000-4-5:2014/AMD1:2017) Electromagnetic compatibility (EMC) – Part 4-5: Surge immunity test.

**Typical test setup:**




**Test severity levels:**

The following test severity levels are recommended for the surge immunity test:

| Level | Open circuit output test voltage ± 10% |
|---|---|
| **1** | 0,5 kV |
| **2** | 1,0 kV |
| **3** | 2,0 kV |
| **4** | 4,0 kV |
| **x** | Specified |

NOTE:

- x is an open class. This level can be specified in the product specification.

**Measurement data:**

AC power port:

| Pulse | Voltage | Coupling | Required criteria | Test results - polarity | | | |
|---|---|---|---|---|---|---|---|
| | | | | 0° | 90° | 180° | 270° |
| 1,2/50 µs | ±1,0 kV | L1-N | B | PASS | PASS | PASS | PASS |

Remarks: No failure according to the performance criteria in the used standard was observed during or after the test.

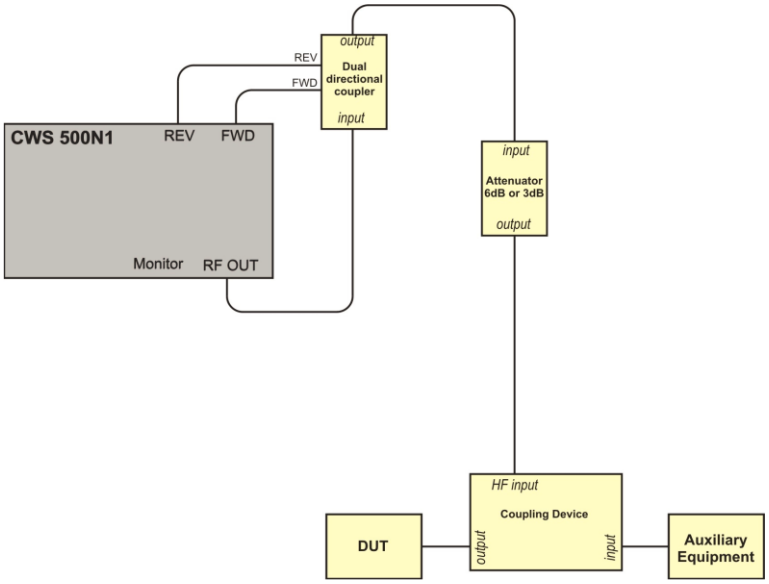
**Result of test: PASS**

## 7.5 Immunity to conducted disturbances, induced by radio-frequency fields

Testing provided according to standard EN IEC 61000-4-6:2023 (idt IEC 61000-4-6:2023)

Electromagnetic compatibility (EMC). Part 4-6: Testing and measurement techniques Immunity to conducted disturbances, induced by radio-frequency fields.

**Typical test setup:**




**Test severity levels:**

| Level | Voltage level |
|---|---|
| **1** | 1 V |
| **2** | 3 V |
| **3** | 10 V |
| **x** | Specified |

NOTE:

- x is an open class. This level can be specified in the product specification.

**Measurement data:**

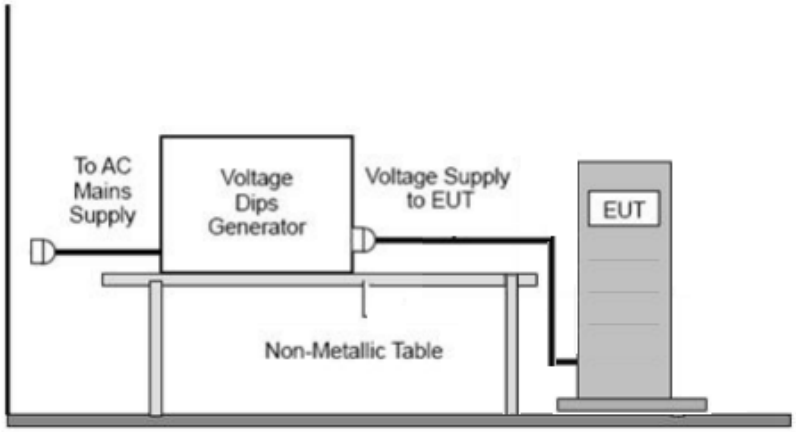
| **Test no.1 Specifications: Input port** | | |
|---|---|---|
| Test Level and limits defined according to standard EN IEC 55014-1 – **AC power port** | | |
| Frequency - range | : | 0,15 MHz - 230 MHz |
| Voltage level (EMF) | : | ☐ 1V ☒ 3V ☐ 10V ☐ x |
| Modulation | : | AM: 80 % / sine 1000Hz |
| Frequency step | : | 1 % |
| Dwell time | : | 3 s |
| Cable description | : | AC power line 230 V AC |
| Test specification | : | Coupling with Coupling/Decoupling Network (CDN) or Electromagnetic Injection Clamp |
| Coupling via | : | CDN M2/M3 |
| Screening | : | Unscreened |
| Status | : | Active |
| Signal transmission | : | Analog |
| **Test result** | | |
| The requirements are | : | FULFILLED |
| Performance required criterion | | A |
| Performance observed criterion | : | A |
| Remarks: | : | No failure according to the performance criteria in the used standard was observed during or after the test. |

**Result of test: PASS**

## 7.6 Voltage dips, short interruptions and voltage variations immunity tests

Testing provided according to standard EN IEC 61000-4-11:2020/ AC Jun.:2020/AC:2022 (idt IEC 61000-4-11:2020/COR1:2020/COR2:2022). Electromagnetic compatibility (EMC) Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests.

**Typical test setup:**




**Measurement data:**

| Supply voltage | Frequency | Time of dips | Test level (% of rated voltage) | Required criteria | Test result |
|---|---|---|---|---|---|
| 230 V | 50 Hz | 10 ms | 0 % | C | PASS |
| 230 V | 50 Hz | 200 ms | 40 % | C | PASS |
| 230 V | 50 Hz | 500 ms | 70 % | C | PASS |

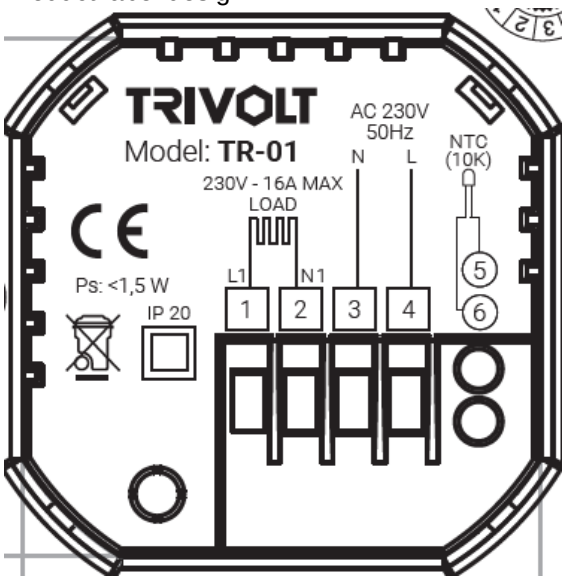
Remarks: No failure according to the performance criteria in the used standard was observed during or after the test.

**Result of test: PASS**

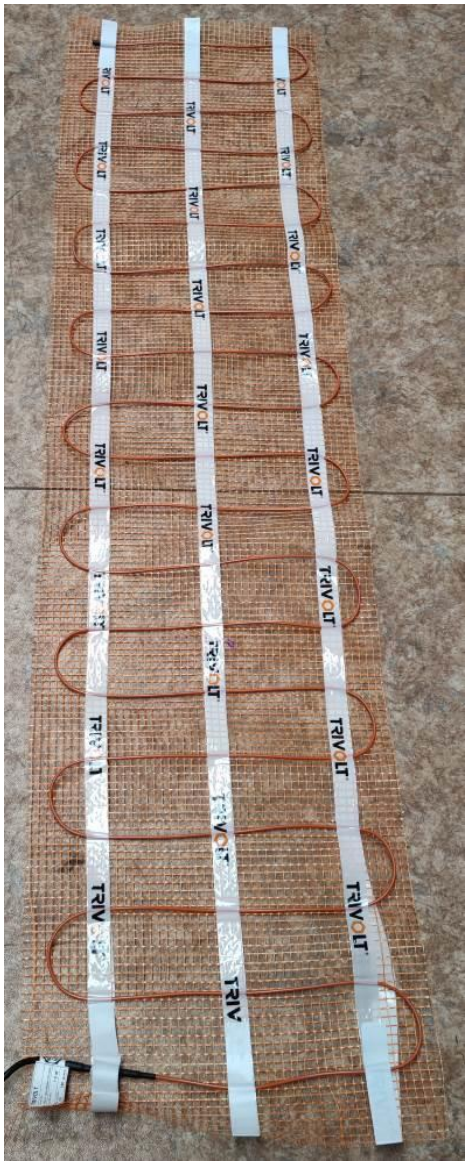
## 8 PHOTOGRAPHS OF EQUIPMENT UNDER TEST

EUT:

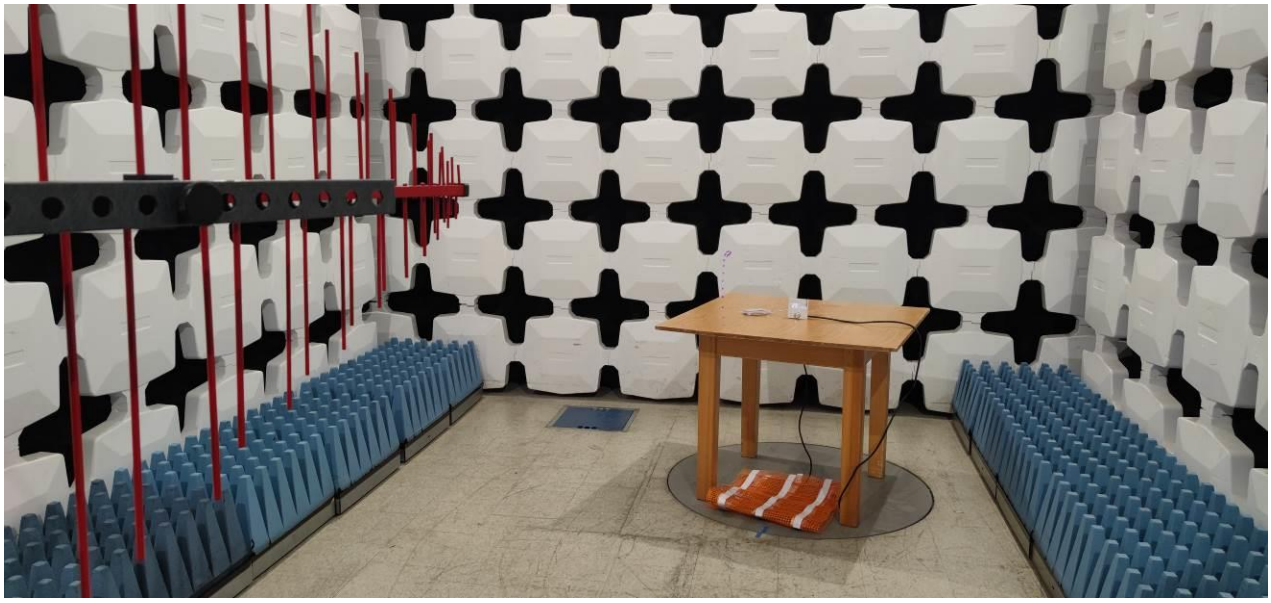

Product label design:

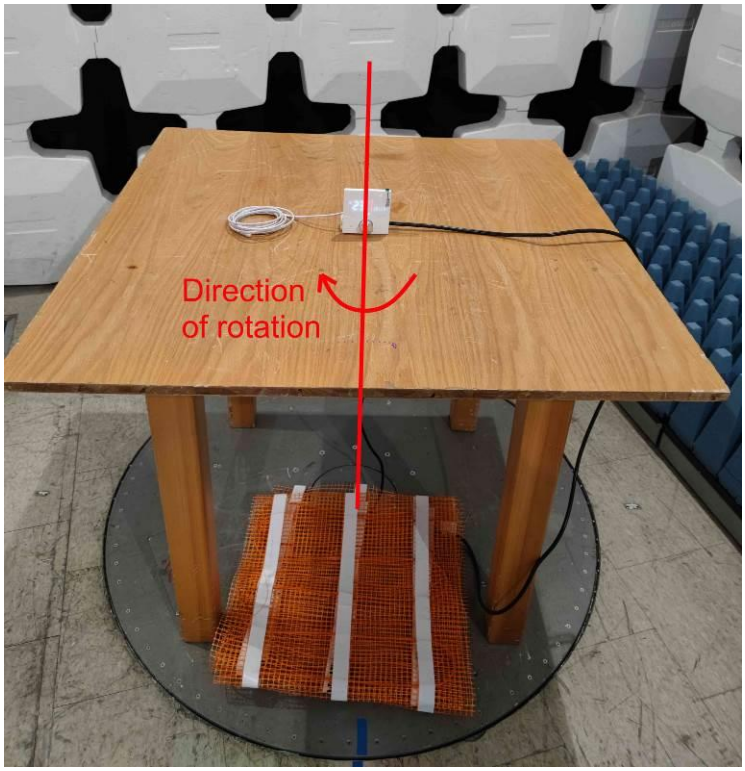



AE1:




EUT in semi-anechoic room:






End of test report