

Test Report

Report Number:

F241817E2

Equipment under Test (EUT):

OPT/s NFC Reader /TMC1,5m

Applicant:

Fronius International GmbH

Manufacturer:

Fronius International GmbH



Deutsche
Akkreditierungsstelle
D-PL-17186-01-00

References

- [1] **ANSI C63.10: 2020** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- [2] **FCC CFR 47 Part 15** Radio Frequency Devices
- [3] **RSS-210 Issue 11 (June 2024)**
Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
- [4] **RSS-Gen, Issue 5 Amendment 2 (2021-02)**
General Requirements for Compliance of Radio Apparatus

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 1.4 of ANSI C63.10 (2020). 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: | Fronius International GmbH |
| Address: | Günter-Fronius-Straße 1, 4600 Wels-Thalheim |
| Country: | Austria |
| Name for contact purposes: | Mr. Jan HERNDLER |
| Phone: | +43-7242-241-0 |
| eMail address: | herndler.jan@fronius.com |
| Applicant represented during the test by the following person: | None |

1.2 Manufacturer

| | |
|---|---|
| Name: | Fronius International GmbH |
| Address: | Günter-Fronius-Straße 1, 4600 Wels-Thalheim |
| Country: | Austria |
| Name for contact purposes: | Mr. Jan HERNDLER |
| Phone: | +43-7242-241-0 |
| eMail address: | herndler.jan@fronius.com |
| Manufacturer represented during the test by the following person: | None |

1.3 Test Laboratory

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

accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) according to DIN EN ISO/IEC 17025:2018. The accreditation is only valid for the scope of accreditation listed in the annex of the certificate D-PL-17186-01-00. 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: * | NFCTMC1 |
| Model name: * | OPT/s NFC Reader /TMC1,5m |
| Model number: * | 4,101,434 |
| Order number: * | N/A |
| FCC ID: * | QKWNFCTMC1 |
| IC certification number: * | 12270A-NFCTMC1 |
| PMN: * | OPT/s NFC Reader / TMC 1,5m |
| HVIN: * | V0.3A |
| FVIN: * | V1.2.2 |

| | EUT number | |
|---------------------|------------|---|
| | 1 | 2 |
| Serial number: * | N/A | - |
| PCB identifier: * | 4,071,832 | - |
| Hardware version: * | V0.3A | - |
| Software version: * | V1.2.2 | - |

* 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: * | 24 V _{DC} | | |
| Supply voltage EUT: * | U _{nom} = 24 V _{DC} | U _{min} = 24 V _{DC} | U _{max} = 24 V _{DC} |
| Temperature range: * | -20 °C to +65 °C | | |
| Lowest / Highest internal frequency: * | 20 kHz / 13.56 MHz | | |

* Declared by the applicant

| RFID part | |
|------------------------|-------------|
| Operating frequency: * | 13.56 MHz |
| Number of channels: * | 1 |
| Type of modulation: * | ASK |
| Data rate: * | 848 kbps |
| Duty cycle: * | 100 % |
| Antenna type: * | PCB antenna |
| Antenna connector: * | - |

* Declared by the applicant

| Ports / Connectors | | | | |
|-----------------------|-----------|---------------------|--------------------|----------------------|
| Identification | Connector | | Length during test | Shielding (Yes / No) |
| | EUT | Ancillary | | |
| Power supply and data | Fixed | TIG-Multi Connector | 1.5 m | No |
| - | - | - | - | - |
| - | - | - | - | - |

| Equipment used for testing | |
|---------------------------------|---------|
| NFC sample card: * ¹ | NTAG213 |
| - | - |
| - | - |

*¹ Provided by the applicant

*² Provided by the laboratory

| Ancillary equipment | |
|----------------------------------|--------------------|
| AC power adapter: * ¹ | UE36LCP1-240150SPA |
| - | - |
| - | - |

*¹ Provided by the applicant

1.6 Dates

| | |
|---------------------------------|------------|
| Date of receipt of test sample: | 02.12.2024 |
| Start of test: | 02.12.2024 |
| End of test: | 10.12.2024 |

2 Operational States

Description of function of the EUT:

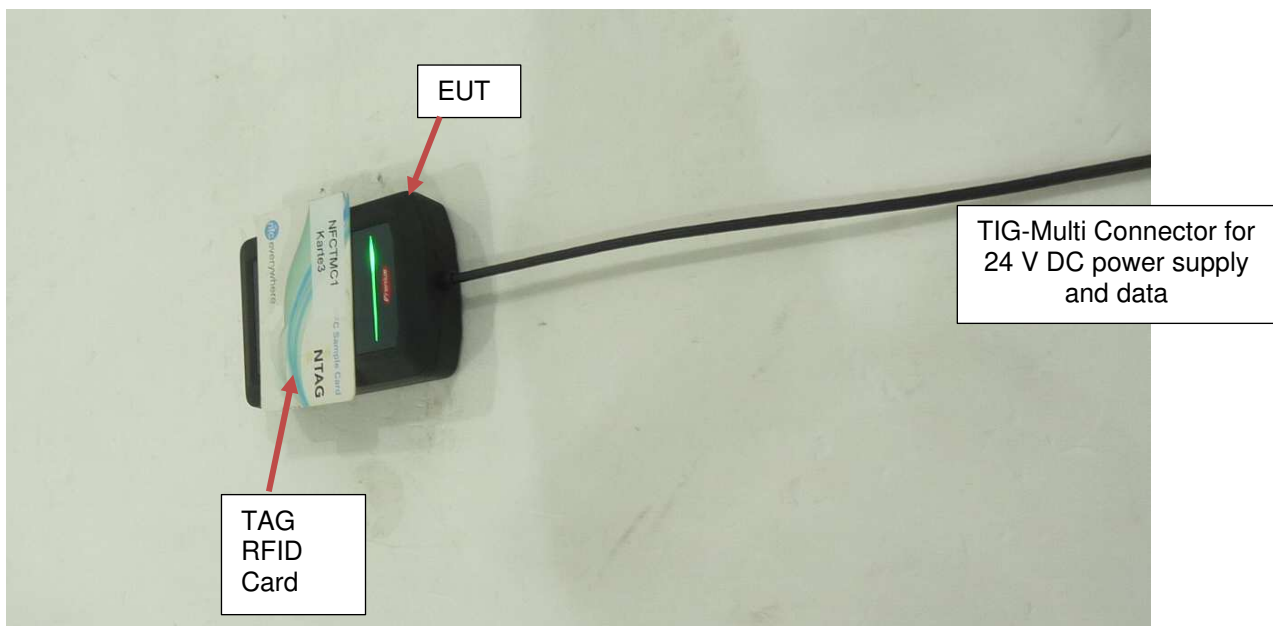
The EUT is an RFID reader running in normal operation mode.

The following states were defined as the operating conditions:

The EUT was supplied by 24 V DC / 120 V 60 Hz AC during all tests.
During all tests, a TAG was placed in front of the RFID reader. The TAG was read continuously by the EUT.
As pretests has shown the worst-case emission were noticed with reading a TAG so all tests were carried with reading a TAG continuously.

As defined by the applicant the EUTs normal position is lying.

The system was setup as follows:



3 Additional Information

The EUT was not labeled as required by FCC / IC.

4 Overview

| Application | Frequency range [MHz] | FCC 47 CFR Part 15 section [2] | RSS-Gen, Issue 5 [4] and RSS-210, Issue 11 [3] | Tested EUT | Status |
|------------------------------------|-----------------------|--------------------------------|--|------------|----------|
| Conducted emissions on supply line | 0.15 – 30 | 15.207 (a) | 8.8 [4] | 1 | Passed |
| Radiated emissions | 0.009 – 1000 ** | 15.205 (a) 15.209 (a) | 8.9 and 8.10 [4] 8.1 and 8.3 [3] | 1 | Passed |
| 99 % bandwidth | 13.56 | - | 6.7 [4] | 1 | Passed |
| Antenna requirement | - | 15.203 [2] | 6.8 [4] | - | Passed * |

*: Integrated antenna only, requirement fulfilled.

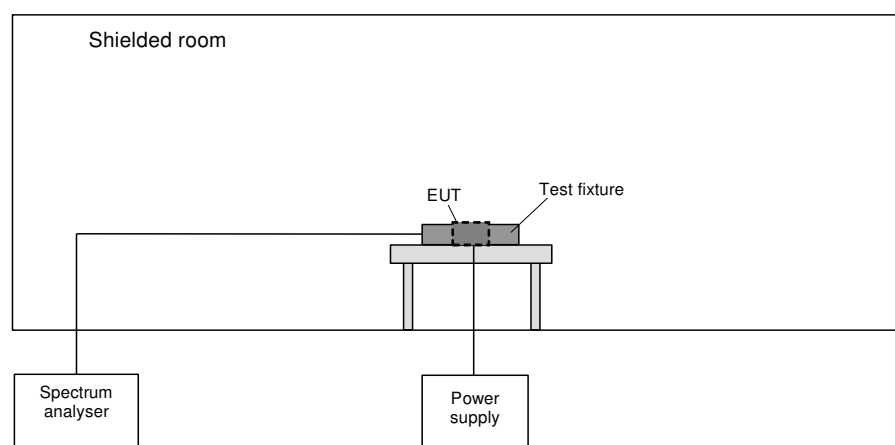
**: As declared by the applicant the highest clock frequency is 13.56 MHz.
Therefore the radiated emission measurement must be carried out up to 10th of the highest clock frequency or 1 GHz, whichever is the highest [2]. In this case the measurement must be carried out up to 1 GHz.

5 Results

5.1 Test setups

5.1.1 Radiated: Test fixture

The test is carried out in a shielded chamber. Table-top devices are set up on a table and the spectrum analyser is connected to a test fixture / loop antenna, which is placed around / on top of the EUT.



5.1.2 Radiated: 9 kHz to 30 MHz

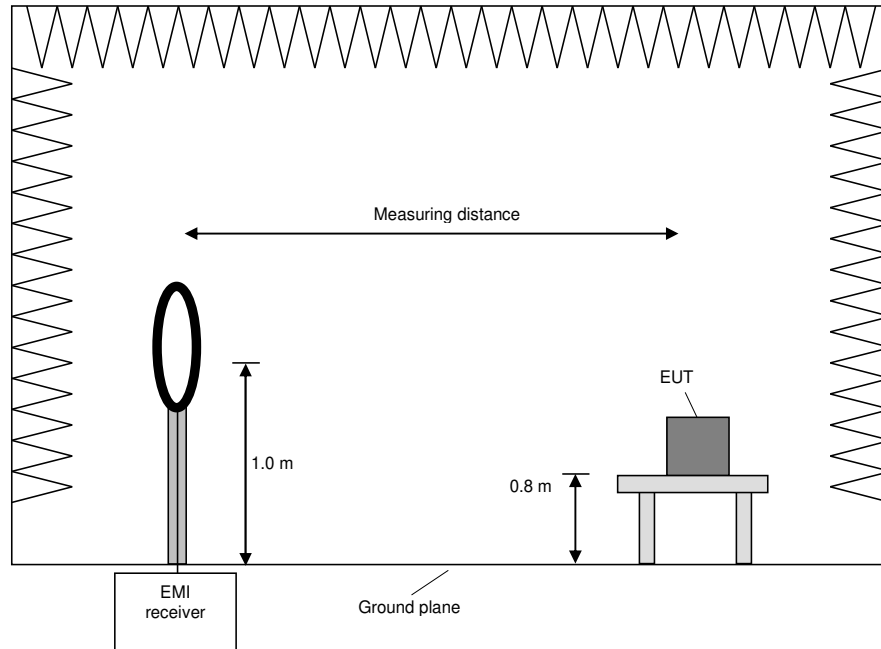
5.1.2.1 Preliminary measurement 9 kHz to 30 MHz

In the first stage a preliminary measurement is performed in a semi-anechoic chamber 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].

The frequency range 9 kHz to 30 MHz is monitored with an EMI receiver while the system and its cables are manipulated to find out the configuration with the maximum emission levels if applicable. The EMI receiver is set to MAX hold mode. The EUT and the measuring antenna are rotated around their vertical axis to find the maximum emission levels.

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

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



Procedure preliminary measurement:

Pre-scans are performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure is used:

- 1) Monitor the frequency range with the measuring antenna facing the EUT and an EUT / turntable azimuth of 0°.
- 2) Manipulate the system cables to produce the maximum levels of emissions.
- 3) Rotate the EUT by 360° to maximize the detected signals.
- 4) Measure the frequencies of the highest detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency values.
- 5) If the EUT is portable or ceiling mounted, repeat steps 1 to 4 with other orientations (x, y, z) of the EUT.
- 6) Rotate the measuring antenna and repeat steps 1 to 5.

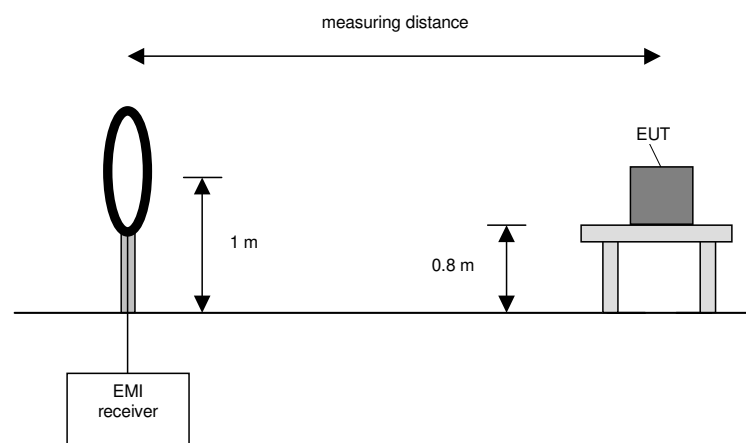
5.1.2.2 Final measurement 9 kHz to 30 MHz

In the second stage a final measurement is performed on an open area test site with no conducting ground plane at a measuring distance of 3 m, 10 m, or 30 m. If the standard requires larger measuring distances for a given frequency, the results are extrapolated according to section 15.31 (f) (2) [2]. The final measurement is performed with an EMI receiver set to Quasi-Peak detector, except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an Average detector is used according to section 15.209 (d) [2].

At the frequencies, which were detected during the preliminary measurements, the final measurement is performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum level value is found.

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

| Frequency range | Resolution bandwidth | Measuring time |
|-------------------|----------------------|----------------|
| 9 kHz to 150 kHz | 200 Hz | 1 s |
| 150 kHz to 30 MHz | 9 kHz | 1 s |



Procedure final measurement:

The following procedure is used:

- 1) Monitor the selected frequencies from the preliminary measurement with the measuring antenna facing the EUT and an EUT azimuth of 0 °.
- 2) Rotate the EUT by 360 ° to maximize the detected signals.
- 3) Rotate the measuring antenna and repeat steps 1 to 2 until the maximum value is found and note it.
- 4) If the EUT is portable or ceiling mounted, repeat steps 1 to 3 with other orientations (x, y, z) of the EUT.

5.1.3 Radiated: 30 MHz to 1 GHz

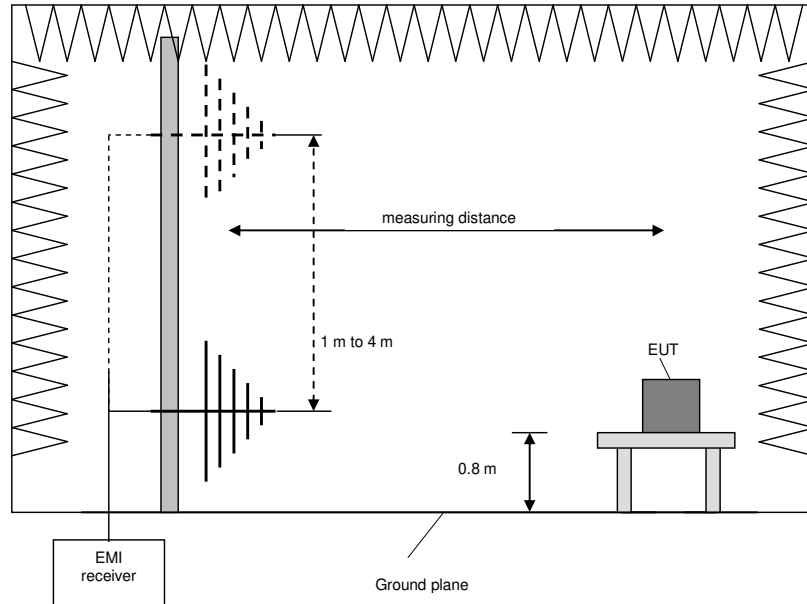
5.1.3.1 Preliminary and final measurement 30 MHz to 1 GHz

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:

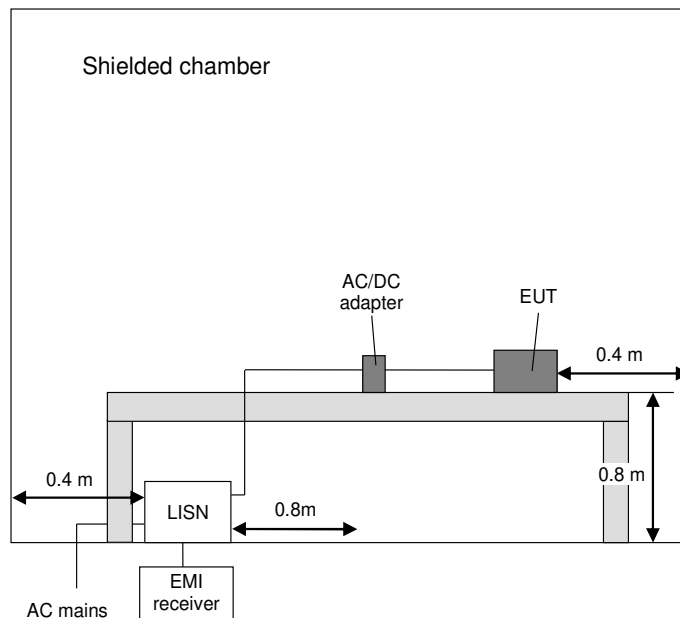
- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced step size of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case 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 $\pm 30^\circ$ 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.

5.1.4 Conducted: AC power line

The test is carried out in a shielded chamber. 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 above the ground plane. Floor-standing devices are placed directly on the ground plane. In case of DC powered equipment, which is not exclusively powered by a battery, it is connected to the LISN via a suitable AC/DC adaptor. The setup of the equipment under test is in accordance with [1].

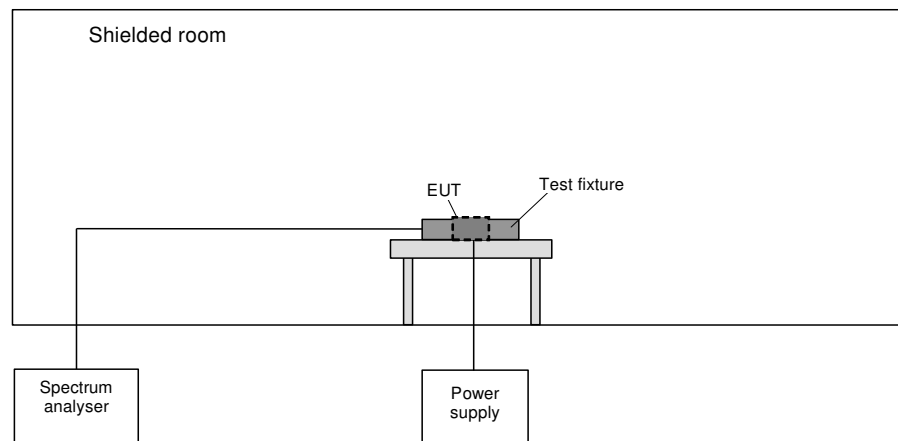
The frequency range 150 kHz to 30 MHz is measured with an EMI receiver set to MAX hold mode with Peak and Average detectors and a resolution bandwidth of 9 kHz. A scan is carried out on the phase and neutral line of the AC mains network. If emissions less than 10 dB below the appropriate limit are detected, these emissions are measured with an Average and Quasi-Peak detector on all lines.

| Frequency range | Resolution bandwidth | Measuring time |
|-------------------|----------------------|----------------|
| 150 kHz to 30 MHz | 9 kHz | 5 s |



5.1.5 Method 99 % bandwidth

The test is carried out in a shielded chamber. Table-top devices are set up on a table and the spectrum analyser is connected to a test fixture / loop antenna, which is placed around / on top of the EUT.



The following procedure will be used for the occupied bandwidth measurement according to [1]:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. The following procedure shall be used for measuring 99 % power bandwidth:

- a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 % to 5 % of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level. Specific guidance is given in 4.1.5.2.
- d) Step a) through step c) might require iteration to adjust within the specified range.

5.2 99 % bandwidth

5.2.1 Test setup (99 % bandwidth)

| Test setup (99 % bandwidth) | | | |
|-------------------------------------|-------------------------------------|----------------|---------|
| Used | Setup | See sub-clause | Comment |
| <input checked="" type="checkbox"/> | Radiated: Test fixture | 5.1.1 | - |
| <input type="checkbox"/> | Test setup (antenna port conducted) | - | - |

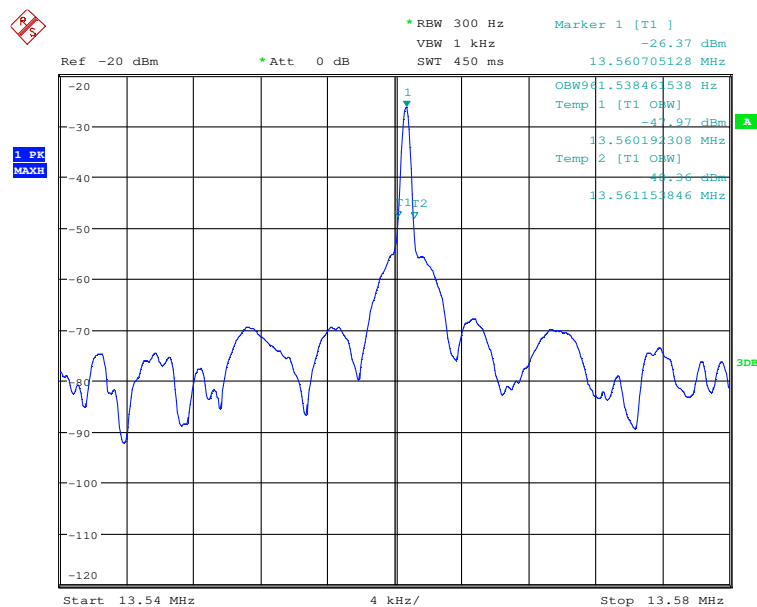
5.2.2 Test method (99 % bandwidth)

| Test method (99 % bandwidth) | | | | |
|-------------------------------------|----------------|--|---------------|---------|
| Used | Sub-Clause [1] | Name of method | Applicability | Comment |
| <input checked="" type="checkbox"/> | 6.9.3 | Occupied bandwidth – power bandwidth (99%) measurement procedure | - | - |

5.2.3 Test results (99 % bandwidth)

| | |
|----------------------|-------|
| Ambient temperature: | 22 °C |
| Relative humidity: | 29 % |

| | |
|------------|------------|
| Date: | 10.12.2024 |
| Tested by: | S. KREHS |



| F_L | F_U | BW ($F_U - F_L$) |
|---------------|---------------|--------------------|
| 13.560192 MHz | 13.561154 MHz | 0.962 kHz |

Test result: Passed

| |
|--|
| Test equipment (please refer to chapter 7 for details) |
| 1 - 4 |

5.3 Radiated emissions

5.3.1 Test setup (Maximum unwanted emissions)

| Test setup (Maximum unwanted emissions) | | | |
|---|---|----------------|---------|
| Used | Setup | See sub-clause | Comment |
| <input checked="" type="checkbox"/> | Radiated: 9 kHz to 30 MHz / 30 MHz to 1 GHz | 5.1.2 / 5.1.3 | - |

5.3.2 Test method (Maximum unwanted emissions)

☒ Test method (radiated) see sub-clause 5.1.2 / 5.1.3 as described herein

5.3.3 Test results (Maximum unwanted emissions)

5.3.3.1 Test results preliminary measurement 9 kHz to 30 MHz

| | | | |
|----------------------|-------|------------|------------|
| Ambient temperature: | 21 °C | Date: | 02.12.2024 |
| Relative humidity: | 23 % | Tested by: | M. DINTER |

Position of EUT: For tests for f between 9 kHz to 30 MHz, 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: The measurement value was already corrected by 40 dB/decade as described in 47 CFR 15.31(f)(2) regarding to the measurement distance as requested in 47 CFR 15.209(a)

Remark: EUT was tested in normal position lying on the table.

Calculations:

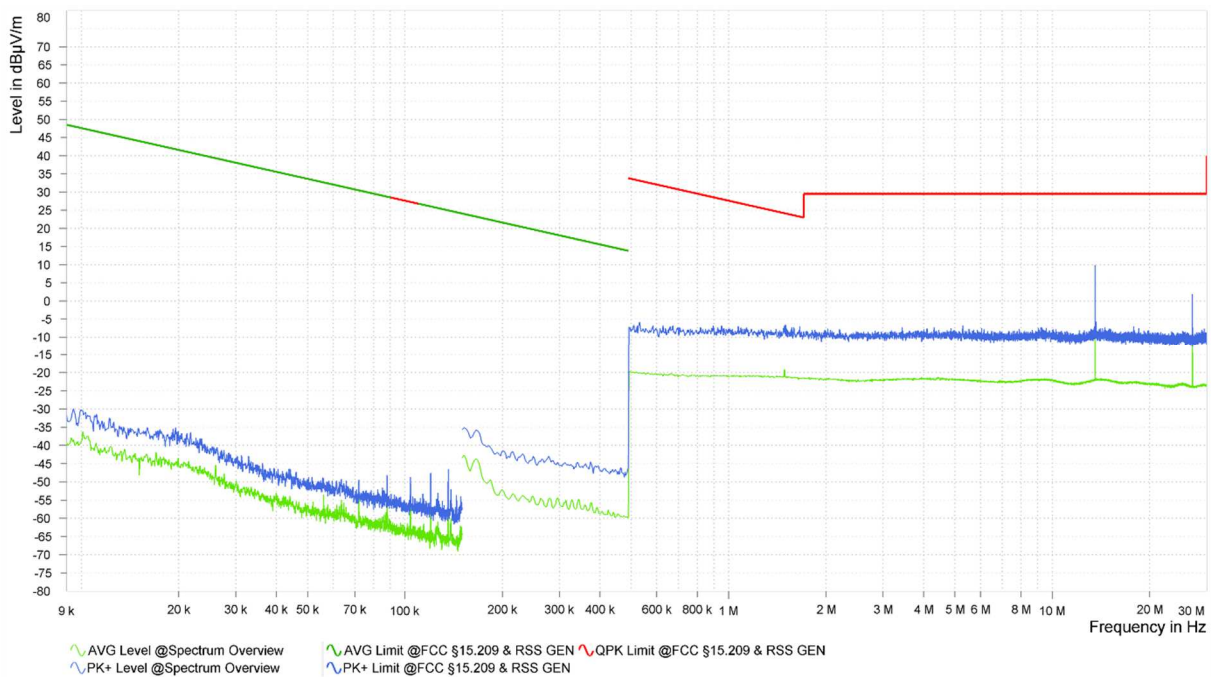
Result @ norm. dist. [dBμV/m] = Reading [dBμV] + AF [dB/m] - Distance corr. fact. [dBμV/m]

Result @ norm. dist. [dBμA/m] = Result @ norm. dist. [dBμV/m] – 20 x log₁₀ (377 Ω)

Margin [dB] = Limit [dB(μV|μA)/m] - Result [dB(μV|μA)/m]

Worst case plot (continuous reading TAG):

Spurious emissions from 9 kHz to 30 MHz:



The following frequencies were found in the frequency range 30 MHz to 960 MHz:
-13.56 MHz and 27.12 MHz

These frequencies have to be measured within a final measurement.

Remark: No further emissions close than 20 dB to the limit.

5.3.3.2 Test results final measurement 9 kHz to 30 MHz

| | |
|----------------------|------|
| Ambient temperature: | 3 °C |
| Relative humidity: | 84 % |

| | |
|------------|------------|
| Date: | 05.12.2024 |
| Tested by: | S. KREHS |

The results of the standard subsequent measurement on the outdoor test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while taking account of the specified requirements for a 30 measuring distance.

| Results 9 kHz - 30 MHz | | | | | | | | | | | | |
|------------------------|--|---|---|------------------------------------|--|----------------|----------|-----------------------------|------------------------------|------------------------------|--|---------------|
| Frequency [MHz] | Reading @ measuring distance [dB(μV)] | Result @ norm. distance [dB(μV/m)] | Result @ norm. distance [dB(μA/m)] | Limit acc. 15.209 [dB(μV/m)] | Limit acc. RSS-Gen Table 6 [dB(μA/m)] | Margin [dB] | Detector | Antenna factor [dB/m] | Measuring distance [m] | Normative distance [m] | Distance correction factor [dB] | Position # |
| 13.562 | 28.8 | 9.0 | -42.5 | 29.5 | -22.0 | 20.5 | QP | 20.2 | 3 | 30 | 40.0 | 1 |
| 27.122 | 21.5 | 1.7 | -49.8 | 29.5 | -22.0 | 27.8 | QP | 20.2 | 3 | 30 | 40.0 | 1 |

Remark:

The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ω. For example, the measurement frequency X kHz resulted in the level of Y dBμV/m, which is equivalent to Y - 51.5 = Z dBμA/m, which was the same margin, W dB, to the corresponding RSS-GEN Table 6 as it has to the 15.209(a) limit.

Remark: At 10m measuring distance the signal of the EUT was below the sensitivity of the measuring system.

Test result: Passed

| |
|--|
| Test equipment (please refer to chapter 7 for details) |
| 5 - 11 |

5.3.3.3 Test results (30 MHz – 1 GHz)

| | |
|----------------------|-------|
| Ambient temperature: | 21 °C |
| Relative humidity: | 23 % |

| | |
|------------|------------|
| Date: | 02.12.2024 |
| Tested by: | M.DINTER |

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: EUT was tested in normal position lying on the table.

Calculations:

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

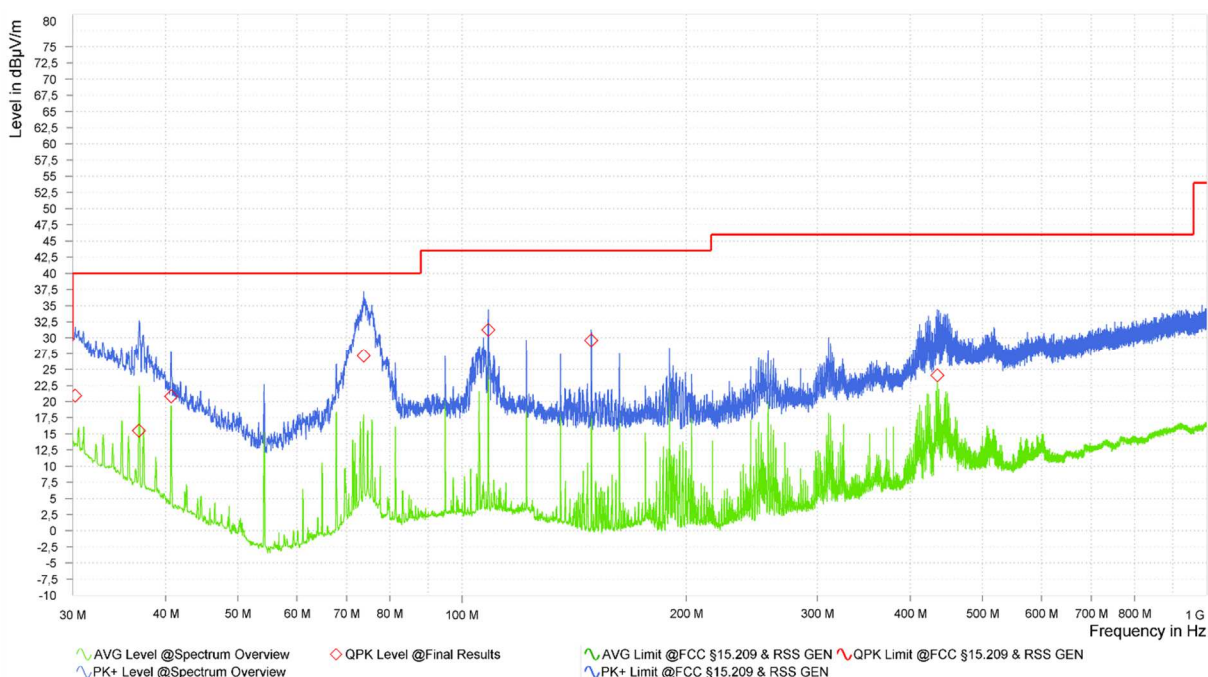
Correction [dBμV/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]

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 plot (continuous reding TAG):

Spurious emissions from 30 MHz to 1 GHz :



Result tables:

(Operation mode 1):

| Frequency [MHz] | Result (QP) [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Readings [dBμV] | Correction [dB/m] | Height [cm] | Azimuth [deg] | Pol. (H/V) | Position # |
|--------------------|----------------------------|-------------------|----------------|--------------------|----------------------|----------------|------------------|---------------|---------------|
| 30.230 | 20.9 | 40.0 | 19.1 | -5.6 | 26.5 | 1.08 | 125 | H | 1 |
| 36.830 | 15.5 | 40.0 | 24.5 | -6.9 | 22.4 | 1.11 | 66 | H | 1 |
| 40.680 | 20.8 | 40.0 | 19.2 | 0.9 | 19.9 | 1.00 | 9 | V | 1 |
| 73.780 | 27.1 | 40.0 | 12.9 | 11.8 | 15.3 | 1.34 | 226 | V | 1 |
| 108.490 | 31.3 | 43.5 | 12.2 | 13.6 | 17.7 | 2.70 | 279 | H | 1 |
| 149.170 | 29.6 | 43.5 | 13.9 | 14.2 | 15.4 | 2.04 | 257 | H | 1 |
| 434.980 | 24.1 | 46.0 | 21.9 | 1.7 | 22.4 | 1.00 | 162 | V | 1 |

Test result: Passed

| |
|--|
| Test equipment (please refer to chapter 7 for details) |
| 6 - 14 |

5.4 AC power-line conducted emissions

5.4.1 Test setup (Conducted emissions on power supply lines)

| Test setup (Conducted emissions on power supply lines) | | | |
|--|-----------------------------|----------------|---------|
| Used | Setup | See sub-clause | Comment |
| <input checked="" type="checkbox"/> | Conducted: AC power line | 5.1.4 | - |
| <input type="checkbox"/> | Not applicable, because ... | - | - |

5.4.2 Test method (Conducted emissions on power supply lines)

| Test setup (Conducted emissions on power supply lines) | | | | |
|--|------------|----------------------------------|------------|-------------------------------------|
| Used | Clause [1] | Name of method | Sub-clause | Comment |
| <input checked="" type="checkbox"/> | 6.2 | Tabletop equipment testing | 5.1.4 | Provided AC switching power adaptor |
| <input type="checkbox"/> | 6.2 | Floor-standing equipment testing | - | - |

The AC power adaptor provided by the applicant was used for the tests:
UE Switching Power adaptor, Model: UE36LCP1-240150SPA

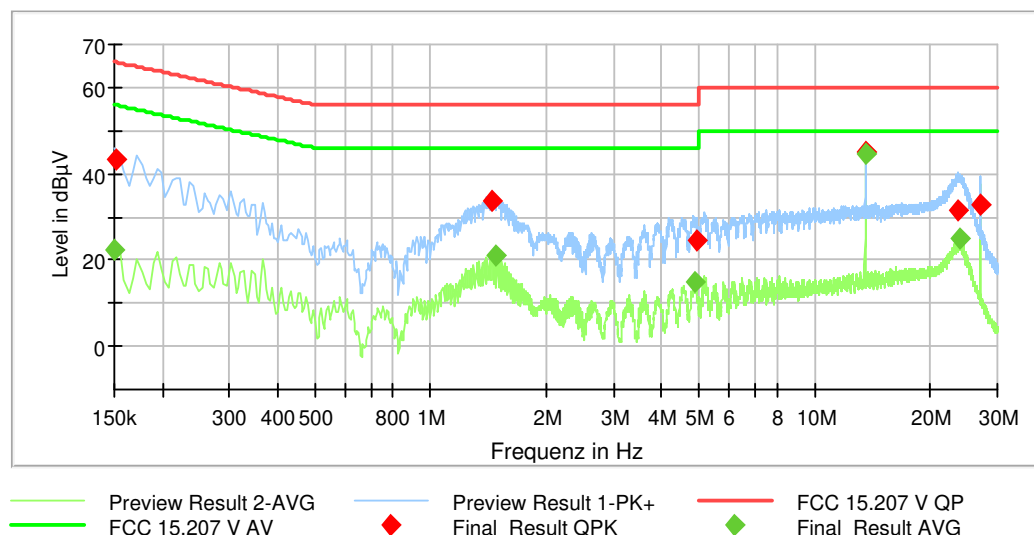
The power adaptor itself was supplied by 120V_{AC} 60Hz.

5.4.3 Test results (Conducted emissions on power supply lines)

| | |
|----------------------|-------|
| Ambient temperature: | 22 °C |
| Relative humidity: | 33 % |

| | |
|------------|------------|
| Date: | 02.12.2024 |
| Tested by: | M. DINTER |

The curves in the diagrams below only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by ◆ and the average measured points by ◆.



| Frequency [MHz] | QuasiPeak [dB(μV)] | Average [dB(μV)] | Limit [dB(μV)] | Margin [dB] | Line | PE | Corr. [dB] |
|--------------------|-----------------------|---------------------|-------------------|----------------|------|-----|---------------|
| 0.150000 | --- | 22.4 | 56.0 | 33.6 | N | GND | 9.8 |
| 0.150900 | 43.2 | --- | 66.0 | 22.8 | N | GND | 9.8 |
| 1.452300 | 33.7 | --- | 56.0 | 22.3 | N | GND | 9.9 |
| 1.471200 | --- | 21.0 | 46.0 | 25.0 | N | GND | 9.9 |
| 4.866000 | --- | 15.1 | 46.0 | 30.9 | L1 | GND | 10.3 |
| 4.940700 | 24.6 | --- | 56.0 | 31.4 | L1 | GND | 10.3 |
| 13.560900 | --- | 44.6 | 50.0 | 5.4 | L1 | GND | 10.7 |
| 13.560900 | 45.3 | --- | 60.0 | 14.7 | L1 | GND | 10.7 |
| 23.694000 | 31.6 | --- | 60.0 | 28.4 | L1 | GND | 11.0 |
| 23.998200 | --- | 24.8 | 50.0 | 25.2 | L1 | GND | 11.0 |
| 27.122100 | 32.7 | --- | 60.0 | 27.3 | N | GND | 11.2 |

Test result: Passed

Test equipment (please refer to chapter 7 for details)

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6 Measurement Uncertainties

| Conducted measurements | | |
|--|---|---|
| Measurement method | Standard used for calculating measurement uncertainty | Expanded measurement uncertainty (95 %) U_{lab} |
| Frequency error | ETSI TR 100 028 | 4.5×10^{-8} |
| Bandwidth measurements | - | 9.0×10^{-8} |
| Conducted emissions from 150 kHz to 30 MHz with LISN | CISPR 16-4-2 | 2.8 dB |

| Radiated measurements | | |
|---|-----------------|----------------------|
| Frequency error | | |
| (Semi-) Anechoic chamber | ETSI TR 100 028 | 4.5×10^{-8} |
| OATS | ETSI TR 100 028 | 4.5×10^{-8} |
| Test fixture | ETSI TR 100 028 | 4.5×10^{-8} |
| Bandwidth measurements | | |
| (Semi-) Anechoic chamber | - | 9.0×10^{-8} |
| OATS | - | 9.0×10^{-8} |
| Test fixture | - | 9.1×10^{-8} |
| 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 |
| 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 |
| OATS | | |
| Field strength measurements below 30 MHz on OATS without ground plane | - | 4.4 dB |

7 Test Equipment used for Tests

| No. | Test equipment | Type | Manufacturer | Serial No. | PM. No. | Cal. Date | Cal Due |
|-----|----------------------------------|------------------|--------------------|--------------------------|---------|---------------------------|---------|
| 1 | Loop antenna | 22.5 cm | PHOENIX TESTLAB | - | 410085 | Calibration not necessary | |
| 2 | Power Supply | TOE8852 (DC) | Toellner | 51712 | 480233 | Calibration not necessary | |
| 3 | Multimeter | 971A | Hewlett Packard | JP40010640 | 480724 | 02.04.2024 | 04.2026 |
| 4 | Spectrum Analyser | FSU46 | Rohde & Schwarz | 200125 | 480956 | 20.02.2024 | 02.2025 |
| 5 | Loop antenna | HFH2-Z2 | Rohde & Schwarz | 832609/014 | 480059 | 21.02.2024 | 02.2026 |
| 6 | EMC test software | Elektra V5.05.00 | Rohde & Schwarz | | 483755 | Calibration not necessary | |
| 7 | RF Switch Matrix | OSP220 | Rohde & Schwarz | 101391 | 482976 | Calibration not necessary | |
| 8 | Turntable | TT3.0-3t | Maturo | 825/2612/.01 | 483224 | Calibration not necessary | |
| 9 | Controller | NCD | Maturo | 474/2612.01 | 483226 | Calibration not necessary | |
| 10 | Semi Anechoic Chamber M276 | SAC5-2 | Albatross Projects | C62128-A540-A138-10-0006 | 483227 | Calibration not necessary | |
| 11 | EMI Receiver / Spectrum analyser | ESW44 | Rohde & Schwarz | 101828 | 482979 | 21.02.2024 | 02.2026 |
| 12 | Attenuator 6 dB | WA2-6 | Weinschel | 8254 | 410119 | Calibration not necessary | |
| 13 | Ultralog Antenna | HL562E | Rohde & Schwarz | 101079 | 482978 | 24.04.2024 | 04.2027 |
| 14 | Antenna support | BAM 4.5-P-10kg | Maturo | 222/2612.01 | 483225 | Calibration not necessary | |
| 15 | Software | EMC32 | Rohde & Schwarz | 100061 | 481022 | Calibration not necessary | |
| 16 | Shielded chamber M4 | B83117-S1-X158 | Siemens | 190075 | 480088 | Calibration not necessary | |
| 17 | EMI Receiver / Spectrum analyser | ESIB 26 | Rohde & Schwarz | 100292 | 481182 | 22.02.2024 | 02.2026 |
| 18 | Transient Filter Limiter | CFL 9206A | Teseq | 38268 | 481982 | 28.03.2024 | 03.2026 |
| 19 | LISN | NSLK8128 | Schwarzbeck | 8128155 | 480058 | 28.02.2024 | 02.2026 |
| 20 | AC power supply | AC6803A | Keysight | JPVJ002509 | 482350 | Calibration not necessary | |

8 Test site Verification

| Test equipment | PM. No. | Frequency range | Type of validation | According to | Val. Date | Val Due |
|----------------------------|---------|-----------------|--------------------|-------------------------------------|------------|------------|
| Shielded chamber M4 | 480088 | 9 kHz – 30 MHz | GND-Plane | ANSI C63.4-2014 | 08.11.2022 | 07.11.2025 |
| OATS Outdoor | 480293 | 9 kHz – 30 MHz | - | ANSI C63.4-2014 | - | - |
| Semi anechoic chamber M276 | 483227 | 30 – 1000 MHz | NSA | ANSI C63.4-2014 ANSI C63.4a-2017 | 01.03.2023 | 28.02.2026 |

9 Report History

| Report Number | Date | Comment |
|---------------|------------|---------------------|
| F241817E2 | 24.04.2025 | Initial Test Report |
| - | - | - |
| - | - | - |

10 List of Annexes

Annex A Test Setup Photos

6 pages

----- end of test report -----