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Test Report

Report Number:

F241683E1

Equipment under Test (EUT):

WLAN / Bluetooth Module on radio PCB

Radio PCB M-PCB-WFB002V2

Applicant:

Alltek Marine Electronics Corporation

Manufacturer:

Alltek Marine Electronics Corporation



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-247 Issue 3 (August 2023)**
Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
- [4] **RSS-Gen, Issue 5 Amendment 2 (February 2021)**
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: | Alltek Marine Electronics Corporation |
| Address: | 14F-2, No. 237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City, 22161 |
| Country: | Taiwan |
| Name for contact purposes: | Mr. H.A. CHEN |
| Phone: | +886-2-8691-8568 |
| eMail address: | ch@alltekmarine.com |
| Applicant represented during the test by the following person: | - |

1.2 Manufacturer

| | |
|---|--|
| Name: | Alltek Marine Electronics Corporation |
| Address: | 14F-2, No. 237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City, 22161 |
| Country: | Taiwan |
| Name for contact purposes: | Mr. H.A. CHEN |
| Phone: | +886-2-8691-8568 |
| eMail address: | ch@alltekmarine.com |
| Manufacturer represented during the test by the following person: | - |

1.3 Test Laboratory

The tests were carried out by:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) 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: * | WLAN / Bluetooth Module on Radio PCB |
| Model name: * | Radio PCB M-PCB-WFB002V2 |
| Model number: * | - |
| Order number: * | - |

| | EUT number | | |
|---------------------|----------------|---|---|
| | 1 | 2 | 3 |
| Serial number: * | - | - | - |
| PCB identifier: * | M-PCB-WFB002V2 | - | - |
| Hardware version: * | V2 | - | - |
| Software version: * | NA | - | - |

* 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 WLAN module (W151)

| | |
|----------------------------|-------------------------|
| Test object: * | WLAN / Bluetooth Module |
| Model name: * | W151 |
| FCC ID: * | WZ7-W151 |
| IC certification number: * | 9547A-W151 |
| HMN: * | - |
| PMN: * | W151 |
| HVIN: * | W151 |
| FVIN: * | - |

1.6 Technical Data of Equipment

| General | | | | |
|--|---|--|---|--|
| Power supply EUT: * | DC | | | |
| Supply voltage EUT: * | $U_{\text{nom}} = 12 \text{ V}_{\text{DC}}$ | $U_{\text{min}} = 9.6 \text{ V}_{\text{DC}}$ | $U_{\text{max}} = 31.2 \text{ V}_{\text{DC}}$ | |
| Temperature range: * | -25 °C to +55 °C | | | |
| Lowest / highest internal frequency: * | 40 MHz / 2462 MHz | | | |

* Declared by the applicant

| WLAN part | | | | |
|-------------------------------|---|--|--|--|
| Fulfils WLAN specification: * | IEEE 802.11™ (b/g/n) | | | |
| Operating frequency range: * | 2412 to 2462 MHz | | | |
| Number of channels: * | 11 | | | |
| Type of modulation: * | IEEE 802.11 b: DSSS (1Mbps DBPSK, 2Mbps DQPSK, 5.5/11Mbps CCK) IEEE 802.11 g: OFDM (6/9Mbps BPSK, 12/18Mbps QPSK, 24/36Mbps 16-QAM, 48/54Mbps 64-QAM) IEEE 802.11n (HT20): OFDM (BPSK, QPSK, 16-QAM, 64-QAM) | | | |
| Supply voltage WLAN module: * | $U_{\text{nom}} = 3.3 \text{ V}_{\text{DC}}$ | $U_{\text{min}} = 3.0 \text{ V}_{\text{DC}}$ | $U_{\text{max}} = 3.6 \text{ V}_{\text{DC}}$ | |
| Antenna type: * | Dipole | | | |
| Antenna name: * | GY196HT695-001 by WIESON TECHNOLOGIES CO., LTD. | | | |
| Antenna gain: * | 2.94 dBi | | | |
| Antenna connector: * | U.FL on carrier PCB (Wi-Fi board) | | | |

* Declared by the applicant

| Ports / Connectors | | | | |
|--------------------|---------------|-----------------|--------------------|----------------------|
| Identification | Connector | | Length during test | Shielding (Yes / No) |
| | EUT | Ancillary | | |
| Antenna port | U.FL | Antenna | 10 cm | Yes |
| DC supply + UART | JST connector | Converter board | ~15 cm | No |
| - | - | - | - | - |

| Equipment used for testing | | | | |
|-------------------------------|--|--|--|--|
| Laptop computer* ² | Lifebook U748 by Fujitsu Limited | | | |
| Converter board* ¹ | RS232-RS422-USB Adapter (Hardware: M-PCB-NU81MBV1) | | | |
| - | - | | | |

*¹ Provided by the applicant

*² Provided by the laboratory

1.7 Dates

| | |
|---------------------------------|------------|
| Date of receipt of test sample: | 11.11.2024 |
| Start of test: | 14.11.2024 |
| End of test: | 02.12.2024 |

2 Operational States

Description of function of the EUT:

The EUT is a radio PCB intended for integration into various hosts. The radio PCB contains a W151 WLAN / Bluetooth module including a trace design and an U.FL antenna connector.

The following states were defined as the operating conditions:

The EUT was supplied by 12 V DC during all tests.

During all tests, software named S-center 7.0.1 (delivered by the applicant) was used to activate the test-mode of the EUT. The laptop computer with the test software was connected to the EUT via an USB cable and a converter board, which were also provided by the applicant.

The Bluetooth functionality of WLAN / Bluetooth module was deactivated by the applicant and therefore is not tested.

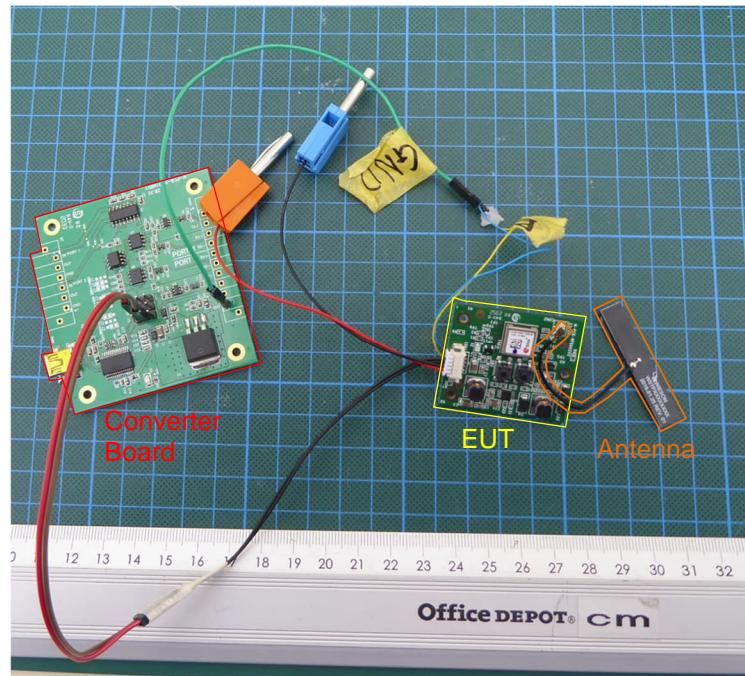
The worst-case modes and power settings from the original FCC report of the NINA-W151 were used (F170297E6 by PHOENIX TESTLAB GmbH).

2.1.1 Operation modes*

| Operation mode # | Radio technology | Frequency [MHz] | Channel | Modulation / Mode | Data rate | Power setting |
|------------------|-----------------------|-----------------|---------|-------------------|-----------|---------------|
| 1 | IEEE 802.11, g-mode | 2412 | 6 | OFDM | 6 Mbit/s | 22 |
| 2 | IEEE 802.11, g-mode | 2437 | 6 | OFDM | 6 Mbit/s | 8 |
| 3 | IEEE 802.11, g-mode | 2462 | 6 | OFDM | 6 Mbit/s | 24 |
| 4 | IEEE 802.11, n20-mode | 2437 | 6 | ODFM | MCS7 | 0 |
| 5 | IEEE 802.11, n40-mode | 2422 | 3 | ODFM | MCS5 | 20 |
| 6 | IEEE 802.11, b-mode | 2437 | 6 | OFDM | 1 Mbit/s | 24 |
| 7 | IEEE 802.11, b-mode | 2412 | 1 | OFDM | 1 Mbit/s | 34 |

* Only the worst-case spurious emissions from the original test report "F170297E6" by "PHOENIX TESTLAB GmbH".

The system was setup as follows:



3 Additional Information

All tests were performed using an unmodified EUT.

4 Overview

| Application | Frequency range [MHz] | FCC 47 CFR Part 15 section [2] | RSS-247 [4] RSS-Gen [5] | Tested EUT | Status |
|-------------------------------------|-----------------------|--|-----------------------------|------------|----------|
| Maximum peak conducted output power | 2400.0 - 2483.5 | 15.247 (b) (3), (4) | 5.4 (d) [4] | -*2 | - |
| Maximum conducted output power | 2400.0 - 2483.5 | 15.247 (b) (3), (4) | 5.4 (d) [4] | 1 | Passed*3 |
| DTS Bandwidth / 99% Bandwidth | 2400.0 - 2483.5 | 15.247 (a) (2) | 5.2 (a) [4] | -*2 | - |
| Peak Power Spectral Density | 2400.0 - 2483.5 | 15.247 (e) | 5.2 (b) [4] | -*2 | - |
| Average Power Spectral Density | 2400.0 - 2483.5 | 15.247 (e) | 5.2 (b) [4] | -*2 | - |
| Band edge compliance | 2400.0 - 2483.5 | 15.247 (d) 15.205 (a) 15.209 (a) | 5.5 [4] | -*2 | - |
| Maximum unwanted emissions*4 | 0.009 – 26,500*1 | 15.247 (d) 15.205 (a) 15.209 (a) | 8.9 [5] | 1 | Passed*4 |
| Antenna Requirement | - | 15.203 15.247 (b) | 6.8 [5] 5.4 (f) (ii) [4] | 1 | Passed |
| Conducted emissions on supply line | 0.15 – 30 | 15.207 (a) | 8.8 [5] | -*2 | - |

*1: As declared by the applicant the highest radio clock frequency is 2.462 GHz for WLAN in 2.4 GHz mode. Therefore, the radiated emission measurement must be carried out up to 10th of the highest radio clock frequency in this case 26.5 GHz.

*2 Not tested, because not ordered by the applicant.

*3 Power verification of the worst-case output power from the original radio report.

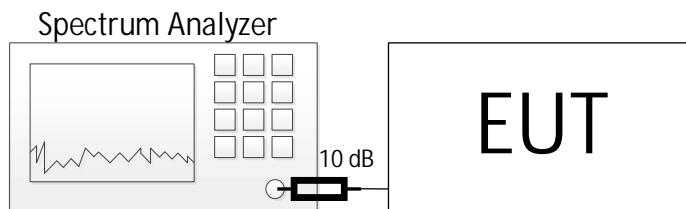
*4 Retest of the worst-case emission of the original test report.

5 Results

5.1 Test setups

5.1.1 Conducted: Antenna port

| Test setup (conducted) | | |
|-------------------------------------|-----------------------------|------------------------------|
| Used | Antenna connector | Comment |
| <input type="checkbox"/> | Temporary antenna connector | As provided by the applicant |
| <input checked="" type="checkbox"/> | Normal antenna connector | - |



The 10 dB external attenuation are considered in all relevant plots

5.1.2 Radiated: 30 MHz to 1 GHz

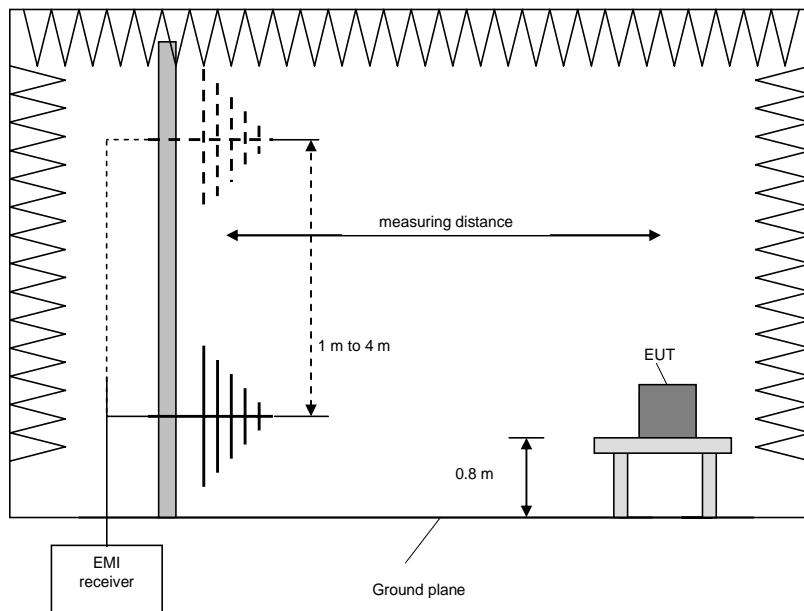
5.1.2.1 Preliminary and final measurement 30 MHz to 1 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber with a metal ground plane at a measuring distance of 3 meters. Table-top devices are set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices are placed directly on the turntable / ground plane. The setup of the equipment under test is in accordance with [1].

During the tests the EUT is rotated in the range of 0 ° to 360 °, the measuring antenna is set to horizontal and vertical polarization and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

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

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



Procedure preliminary measurement:

The following procedure is used:

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

Procedure final measurement:

The following procedure is used:

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

5.1.3 Radiated: 1 GHz to 40 GHz

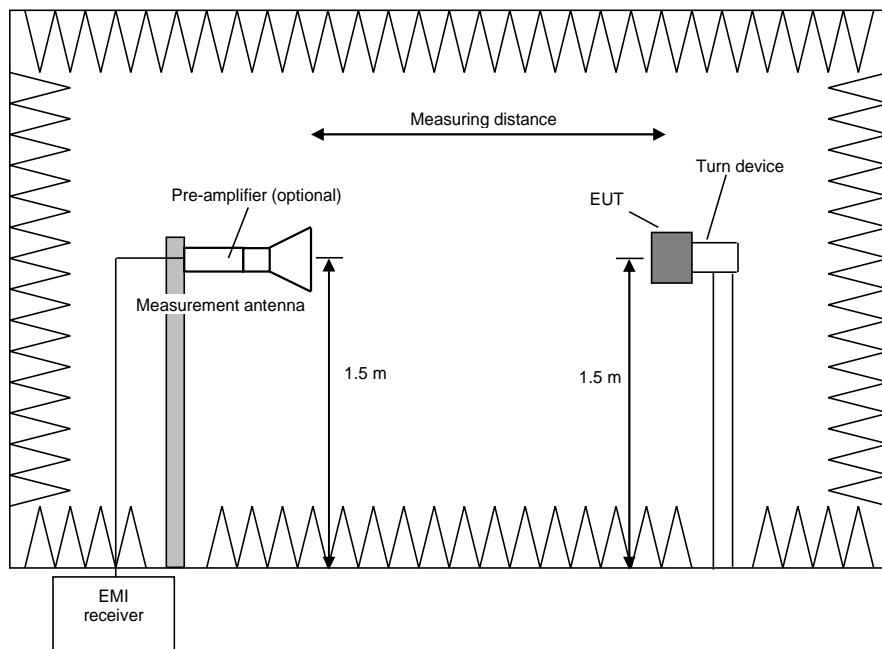
5.1.3.1 Preliminary and final measurement 1 GHz to 40 GHz

The preliminary and final measurements from 1 GHz to 4 GHz are performed in a semi-anechoic chamber with ground absorbers, the other measurements are performed in a fully anechoic chamber. All measurements were done at a measuring distance of 3 meters. Table-top devices are set up on a non-conducting turn device at the height of 1.5 m. 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 ° and the measuring antenna is set to horizontal and vertical polarization to find the maximum level of emissions. After these steps, the measurement is repeated after reorientating the EUT in 30 ° steps.

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

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



Procedure preliminary measurement:

The following procedure is used:

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

Procedure final measurement:

The following procedure is used:

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

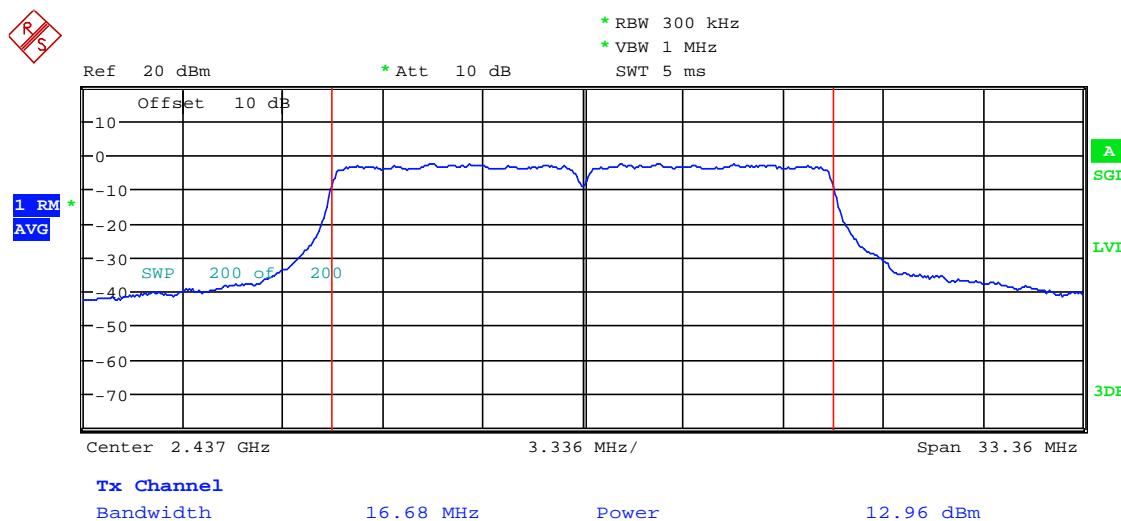
5.1.4 Test results (DTS fundamental emission output power)

| | |
|----------------------|-------|
| Ambient temperature: | 23 °C |
| Relative humidity: | 30 % |

| | |
|------------|------------|
| Date: | 02.12.2024 |
| Tested by: | P. Neufeld |

5.1.4.1 Maximum conducted (average) output power

Worst case plot (operation mode 2):



| Operation mode | Reading [dBm] | Corr. Fact. [dB] | DCCF [dB] | Result [dBm] | Result Orig. Report [dBm] | EIRP* [dBm] | Limit conducted [dBm] | Limit EIRP [dBm] |
|----------------|---------------|------------------|-----------|--------------|---------------------------|-------------|-----------------------|------------------|
| 1 | 10.3 | 0.5 | 1.0 | 11.8 | 12.5 | 14.74 | 30 | 36 |
| 2 | 13.0 | 0.5 | 1.0 | 14.5 | 15.6 | 17.44 | 30 | 36 |
| 3 | 7.2 | 0.5 | 1.0 | 8.7 | 11.6 | 11.64 | 30 | 36 |

* EIRP [dBm] = Result [dBm] + Antenna gain [dBi]. The antenna gain of the EUTs antenna is 2.94 dBi, see 1.6 for details.

Test result: Passed

| |
|--|
| Test equipment (please refer to chapter 7 for details) |
| 29 |

5.1.4.2 Test results (30 MHz – 1 GHz)

| | |
|----------------------|-------|
| Ambient temperature: | 22 °C |
| Relative humidity: | 32 % |

| | |
|------------|------------|
| Date: | 25.11.2024 |
| Tested by: | P. Neufeld |

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: Only the worst-case position from the original test report was tested.

Remark: Only the worst-case orthogonal plane from the original test report was tested.

Calculations:

Result [dB μ V/m] = Reading [dB μ V] + Correction [dB/m]

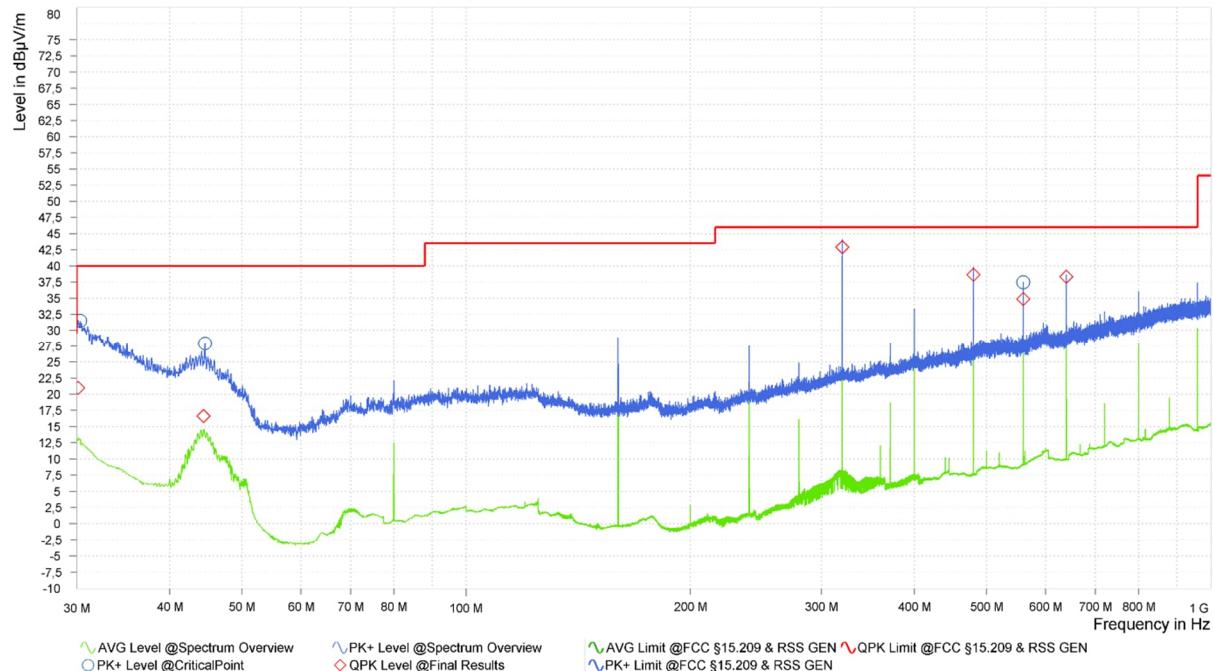
Correction [dB/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]

Margin [dB] = Limit [dB μ V/m] - Result [dB μ V/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:

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



Result tables:

(Operation mode 4):

| Frequency [MHz] | Result (QP) [dB μ V/m] | Limit [dB μ V/m] | Margin [dB] | Readings [dB μ V] | Correction [dB/m] | Pol. (H/V) | Azimuth [deg] | Height [m] | Position # |
|--------------------|----------------------------------|-------------------------|----------------|--------------------------|----------------------|---------------|------------------|---------------|---------------|
| 30.150 | 21.0 | 40.0 | 19.0 | -5.6 | 26.6 | H | 55 | 1.2 | 1 |
| 44.430 | 16.6 | 40.0 | 23.4 | -0.6 | 17.2 | V | 22 | 1.1 | 1 |
| 320.010 | 42.9 | 46.0 | 3.1 | 23.4 | 19.5 | H | 128 | 1.0 | 1 |
| 480.000 | 38.7 | 46.0 | 7.4 | 15.0 | 23.6 | H | 311 | 1.9 | 1 |
| 559.980 | 34.9 | 46.0 | 11.1 | 9.9 | 25.0 | H | 205 | 1.6 | 1 |
| 639.990 | 38.3 | 46.0 | 7.7 | 12.1 | 26.2 | H | 198 | 1.3 | 1 |

Test result: Passed

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

5.1.4.3 Test results (radiated 1 to 40 GHz)

| | | | |
|----------------------|-------------|------------|------------------------|
| Ambient temperature: | 22 °C | Date: | 14.11.2024, 25.11.2024 |
| Relative humidity: | 32 % - 44 % | Tested by: | P. Neufeld |

Position of EUT: For tests for f between 1 GHz and the 10th harmonic, the EUT was set-up on a positioner device with a height of 150 cm. The distance between EUT and antenna was 3 m.

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

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

Remark: -

Calculation:

Max Peak [dB μ V/m] = Reading [dB μ V] + Correction [dB/m]

Average [dB μ V/m] = Reading [dB μ V] + Correction [dB/m]

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

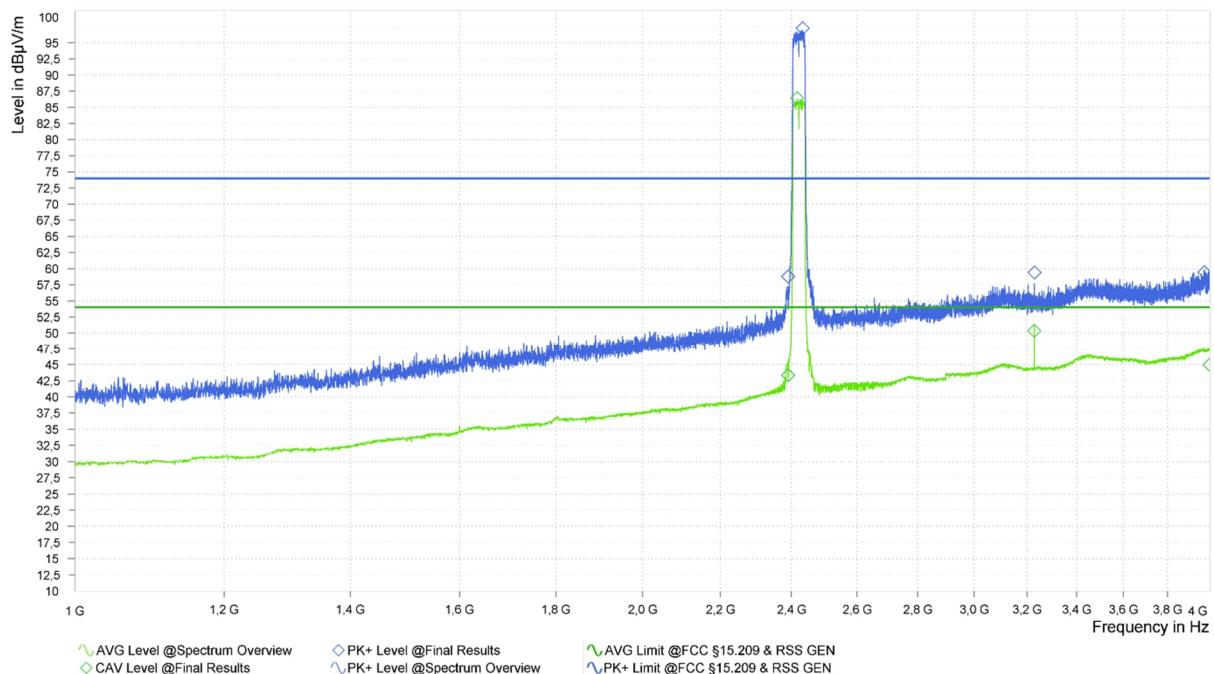
Margin [dB] = Limit [dB μ V/m] – Max Peak | Average [dB μ V/m]

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

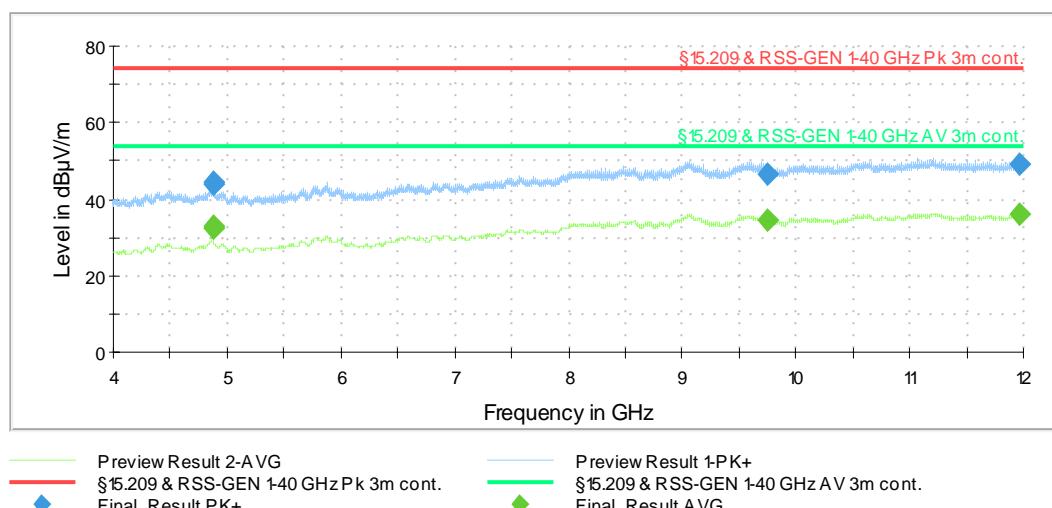
The top measured curve represents the peak measurement. The measured points marked with "◆" or "◇" are frequency points for the final peak detector measurement. These values are indicated in the following table. The bottom measured curve represents the average measurement. The measured points marked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

Worst case plots:

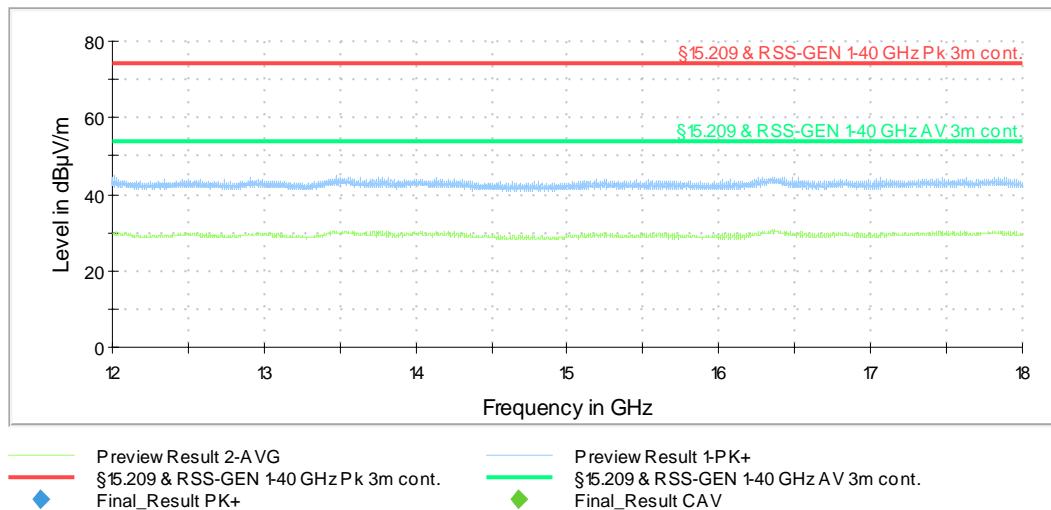
Spurious emissions from 1 GHz to 4 GHz (operation mode 5):



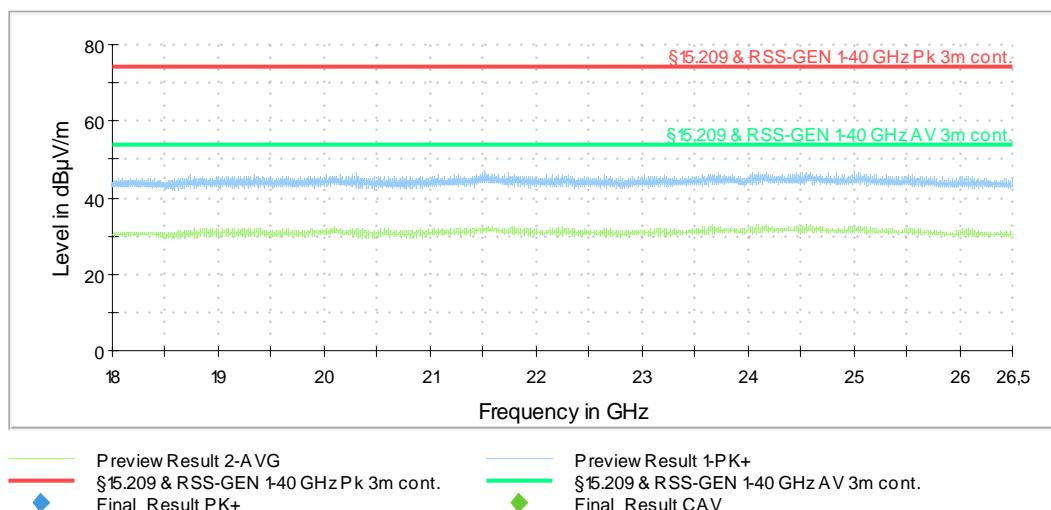
Spurious emissions from 4 GHz to 12 GHz (operation mode 6):



Spurious emissions from 12 GHz to 18 GHz (operation mode 7):



Spurious emissions from 18 GHz to 26.5 GHz (operation mode 7):



Result tables:

Operation mode 5:

| Frequency [MHz] | MaxPeak [dB(µV/m)] | MaxPeak limit [dB(µV/m)] | MaxPeak margin [dB] | Average [dB(µV/m)] | Average limit [dB(µV/m)] | Average margin [dB] | Corr. [dB/m] | Pol [H/V] | Azimuth [deg] | Elevation [deg] |
|--------------------|-----------------------|--------------------------------|---------------------------|-----------------------|--------------------------------|---------------------------|-----------------|--------------|------------------|--------------------|
| 2390.000 | 58.8 | 74.0 | 15.2 | - | - | - | 34.4 | H | 120 | 124 |
| 2390.250 | - | - | - | 43.3 | 54.0 | 10.7 | 34.4 | H | 120 | 128 |
| 2417.000 | - | - | - | 86.4 | Fund. | - | 34.5 | H | 90 | 95 |
| 2433.000 | 97.3 | Fund. | - | - | - | - | 34.6 | H | 90 | 94 |
| 3229.250 | - | - | - | 50.3 | 54.0 | 3.7 | 37.7 | H | 150 | 309 |
| 3229.500 | 59.4 | 74.0 | 14.6 | - | - | - | 37.7 | H | 90 | 272 |
| 3974.000 | 59.4 | 74.0 | 14.6 | - | - | - | 40.0 | H | 120 | 160 |
| 3999.500 | - | - | - | 45.0 | 54.0 | 9.0 | 40.1 | H | 120 | 273 |

Operation mode 6:

| Frequency [MHz] | MaxPeak [dB(µV/m)] | Average [dB(µV/m)] | Limit [dB(µV/m)] | Margin [dB] | Pol [H/V] | Azimuth [deg] | Elevation [deg] | Corr. [dB/m] |
|--------------------|-----------------------|-----------------------|---------------------|----------------|--------------|------------------|--------------------|-----------------|
| 4873.250 | 43.8 | --- | 74.0 | 30.2 | H | 55 | 60 | -1.6 |
| 4873.250 | --- | 32.7 | 54.0 | 21.3 | H | 55 | 60 | -1.6 |
| 4874.750 | 44.6 | --- | 74.0 | 29.4 | H | 62 | 60 | -1.6 |
| 4874.750 | --- | 32.6 | 54.0 | 21.4 | H | 62 | 60 | -1.6 |
| 9748.000 | 46.6 | --- | 74.0 | 27.4 | H | 353 | 90 | 6.4 |
| 9748.000 | --- | 34.7 | 54.0 | 19.3 | H | 353 | 90 | 6.4 |
| 11962.750 | 49.3 | --- | 74.0 | 24.7 | H | 66 | 60 | 6.4 |
| 11962.750 | --- | 36.1 | 54.0 | 17.9 | H | 66 | 60 | 6.4 |

Test result: Passed

| |
|--|
| Test equipment (please refer to chapter 7 for details) |
| 3 - 28 |

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 | Attenuator 6 dB | WA2-6 | Weinschel | 8254 | 410119 | Calibration not necessary | |
| 2 | Ultralog Antenna | HL562E | Rohde & Schwarz | 101079 | 482978 | 24.04.2024 | 04.2027 |
| 3 | EMC test software | Elektra V5.05.00 | Rohde & Schwarz | --- | 483755 | Calibration not necessary | |
| 4 | RF Switch Matrix | OSP220 | Rohde & Schwarz | 101391 | 482976 | Calibration not necessary | |
| 5 | Turntable | TT3.0-3t | Maturo | 825/2612/.01 | 483224 | Calibration not necessary | |
| 6 | Antennasupport | BAM 4.5-P-10kg | Maturo | 222/2612.01 | 483225 | Calibration not necessary | |
| 7 | Controller | NCD | Maturo | 474/2612.01 | 483226 | Calibration not necessary | |
| 8 | Semi Anechoic Chamber M276 | SAC5-2 | Albatross Projects | C62128-A540-A138-10-0006 | 483227 | Calibration not necessary | |
| 9 | EMI Testreceiver | ESW44 | Rohde & Schwarz | 101828 | 482979 | 21.02.2024 | 02.2026 |
| 10 | Low Noise Amplifier 100 MHz - 18 GHz | LNA-30-00101800-25-10P | Narda-Miteq | 2110917 | 482967 | 20.02.2024 | 02.2026 |
| 11 | Log.-Per. antenna | HL050 | Rohde & Schwarz | 100908 | 482977 | 22.09.2022 | 09.2025 |
| 12 | Standard gain horn 12 GHz - 18 GHz | 18240-20 | Flann | 483 | 480294 | Calibration not necessary | |
| 13 | Standard gain horn 18 GHz - 26 GHz | 20240-20 | Flann | 411 | 480297 | Calibration not necessary | |
| 14 | Microwave cable 2m | Insulated Wire Inc. | Insulated Wire | KPS-1533-800-KPS | 480302 | Calibration not necessary | |
| 15 | Fully anechoic chamber M20 | B83117-E2439-T232 | Albatross Projects | 103 | 480303 | Calibration not necessary | |
| 16 | Turntable | DS420 HE | Deisel | 420/620/00 | 480315 | Calibration not necessary | |
| 17 | Antenna support | AS620P | Deisel | 620/375 | 480325 | Calibration not necessary | |
| 18 | Low Noise Amplifier 100 MHz - 18 GHz | LNA-30-00101800-25-10P | Narda-Miteq | 2110917 | 482967 | 20.02.2024 | 02.2026 |
| 19 | Preamplifier 18 GHz - 26 GHz | JS4-18002600-20-5A | MITEQ Hauppauge N.Y. | 658697 | 480342 | 19.02.2024 | 02.2026 |
| 20 | Preamplifier 12 GHz - 18 GHz | JS3-12001800-16-5A | MITEQ Hauppauge N.Y. | 571667 | 480343 | 19.02.2024 | 02.2026 |
| 21 | RF Kabel 38 | SF106B/11N/11 N/4500.0 | Huber & Suhner | 500218/6B | 482415 | Calibration not necessary | |
| 22 | Multiple Control Unit | MCU | Maturo GmbH | MCU/043/97110 7 | 480832 | Calibration not necessary | |
| 23 | Antenna (Log.Per.) | HL050 | Rohde & Schwarz | 100977 | 483511 | 25.04.2024 | 04.2026 |
| 25 | Software | EMC32 V10.60.20 | Rohde & Schwarz | --- | 483261 | Calibration not necessary | |

| No. | Test equipment | Type | Manufacturer | Serial No. | PM. No. | Cal. Date | Cal Due |
|-----|----------------------------------|-----------------|-----------------|-----------------|---------|---------------------------|---------|
| 26 | High-pass filter | WHKX4.0/18G-8SS | Wainwright | 1 | 480587 | Calibration not necessary | |
| 27 | Positioner | TDF 1.5- 10Kg | Maturo | 15920215 | 482034 | Calibration not necessary | |
| 28 | EMI Receiver / Spectrum Analyser | ESW44 | Rohde & Schwarz | 101635 | 482467 | 27.02.2024 | 02.2026 |
| 29 | Signal & spectrum analyzer | FSW43 | Rohde & Schwarz | 100586 & 100926 | 481720 | 07.05.2024 | 05.2026 |

8 Test site Verification

| Test equipment | PM. No. | Frequency range | Type of validation | According to | Val. Date | Val Due |
|----------------------------|---------|-----------------|--------------------|---|------------|------------|
| Semi anechoic chamber M276 | 483227 | 30 – 1000 MHz | NSA | ANSI C63.4-2014 ANSI C63.4a-2017 | 01.03.2023 | 28.02.2026 |
| Semi anechoic chamber M276 | 483227 | 1 -18 GHz | SVSWR | CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017 | 28.02.2023 | 27.02.2026 |
| Fully anechoic chamber M20 | 480303 | 1 -18 GHz | SVSWR | CISPR 16-1-4 Amd. 1 | 17.08.2022 | 16.08.2025 |

9 Report History

| Report Number | Date | Comment |
|---------------|------------|---------------------|
| F241683E1 | 14.07.2025 | Initial Test Report |
| - | - | - |
| - | - | - |

10 List of Annexes

| | | |
|---------|-------------------|---------|
| Annex A | Test Setup Photos | 8 pages |
| Annex B | EUT Photos | 2 pages |

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