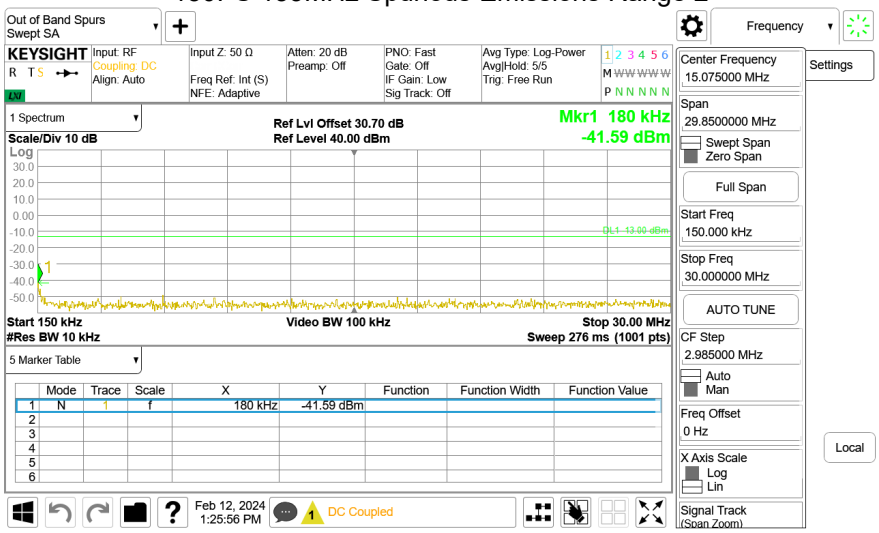
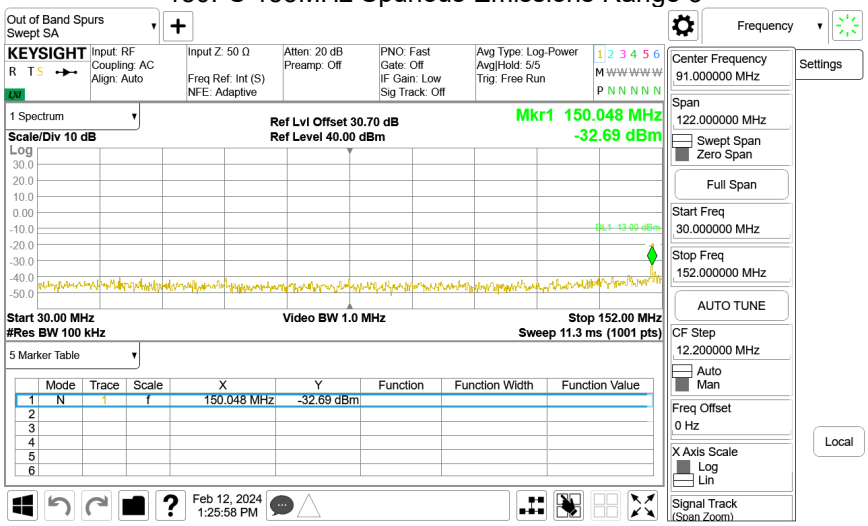
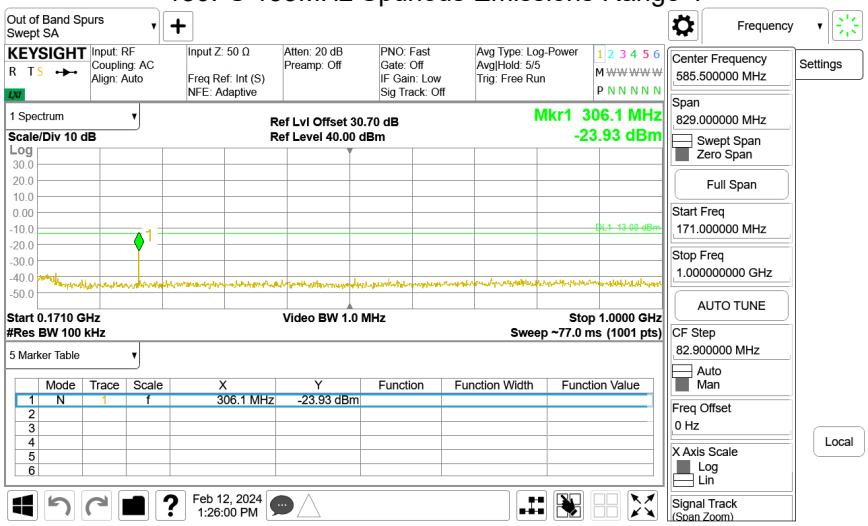
150PS 153MHz Spurious Emissions Range 2



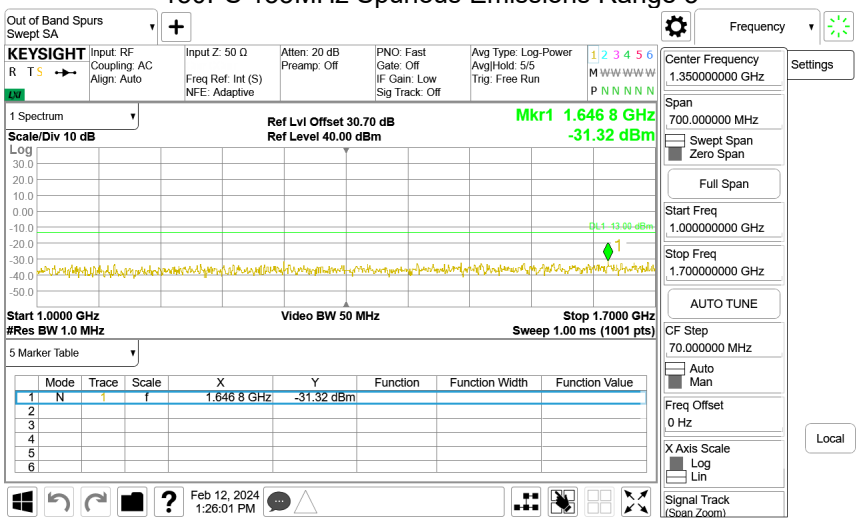

150PS 153MHz Spurious Emissions Range 3



150PS 153MHz Spurious Emissions Range 4




150PS 153MHz Spurious Emissions Range 5



## 3.7 Noise Figure

| | | | |
|---|---|---|---|
| Governing Doc | FCC Part 90.219 | Room Temperature (°C) | 20.5 |
| Test Procedure | ANSI/TIA-603- E; FCC KDB 935210 D05, v01r03 | Relative Humidity (%) | 38.6 |
| Test Location | Richmond | Barometric Pressure (kPa) | 101.8 |
| Test Engineer | Zara Vali | Date | February 12, 2024 |
| EUT Voltage | ☒ +48VDC | ☐ 120VAC @ 60Hz | |

| Test Equipment Used | Manufacturer | Model | Serial Number | Calibration date | Calibration due |
|---|---|---|---|---|---|
| Signal Generator | Keysight | N5172B | MY53050270 | Dec 12, 2023 | Dec 12, 2026 |
| Spectrum Analyzer | Keysight | N9020B | MY62153079 | Oct 25, 2023 | Aug 1, 2025 |

| | |
|---|---|
| Frequency Range: | ☒ 2 times of the passband on each band |
| Detector: | ☒ Average |
| RBW: | ☒910 kHz |
| Type of Facility: | ☒ Tabletop |
| Distance: | ☒ Direct |

Noise Figure on each band is less than the 9 dB required.

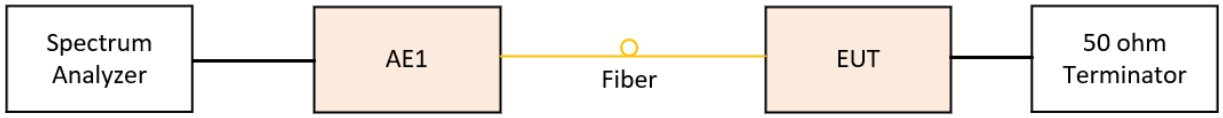
Compliant ☒ Non-Compliant ☐ Not Applicable ☐

### Test setup

Based on FCC KDB 935210 D05 Indus Booster Basic Meas v01r03: 2019, the system maximum gain and the noise density is measured.Measurements were performed within the EUT's passband.

The noise figure is then calculated by NF = NP – Gain + KTB Noise; where NP is in band noise power per Herz, Gain is measured at the maximum noise frequence with -55 dBm input signal in UL. KTB Noise is 174dB/Hz.

The EUT was set to **Operation Mode #1 with configuration Mode #1.**



## Results

| Test Band | Gain (dB) | kTB (dBm/Hz) | Measured Value (dBm/Hz) | Noise Figure (dB) |
|---|---|---|---|---|
| UHF PS | 57.3 | -174 | -108.4 | 8.29 |
| VHF PS | 58.4 | -174 | -110.2 | 5.43 |

## 3.8 Frequency Stability

The DMU and RU37 are sychronized to the same reference clock. Therefore there is no frequency error after down and up frequency conversion are performed.

The frequency stability check is not applicable to the EUT.

## 3.9 Radiated Emissions – Enclosure 30 MHz – 1 GHz

| | | |
|---|---|---|
| Standard | FCC Part 15 Subpart B (§ 15.109)<br>FCC Part 90 (§ 90.219 and § 90.210) | |
| Basic Standard(s) | ANSI C63.4: 2014, CISPR 16-2-1<br>ANSI C63.26-2015<br>KDB 935210 D05 v01r04 | |
| Tested by | Zara Vali | |
| Test date | February 12, 2024 | |
| Test location | Richmond lab, stand #2 | |
| Applied limit | **Radiated Emission FCC Class B Limit at 3 Meters**<br>**Frequency (MHz)** / **Quasi-peak (dB µV/m)**<br>30 – 88 / 40<br>88 – 216 / 43.5<br>216 - 960 / 46<br>960 – 1000 / 54<br>Note 1. The lower limit shall apply at the transition frequency<br>Note 2. Additional provisions may be required for cases where interference occurs<br><br>Since the Class B limit is more stringent than the other limits, the other limits have not been presented. | |
| Test set-up description | ☒ | Equipment on a table of 80 cm height |
| | ☐ | Equipment on the floor (insulated from ground plane) |
| | ☐ | Other: |
| Test method applied | ☒ | SAC with measurement distance [m]: ☒3 ☐10 |
| | ☐ | FAR CISPR 16-2-3 with measurement distance [m]: 3 |
| | ☐ | FAR IEC 61000-4-22 with measurement distance [m]: 3 |
| | ☐ | TEM Waveguide according to IEC 61000-4-20 |
| Supplementary test set-up | ☒ | Measurements were made in semi-anechoic chamber that complies to CISPR 16. Preliminary (peak) measurements. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak detector below 1GHz and average detector above 1GHz) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. |
| VERDICT: PASS | | |

## Test Method

This test measures the radiating levels from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified by positioning a broadband receive antenna three meter from the EUT.

A scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7! with the receiver in the peak mode. The receiver IF bandwidth was 120 kHz and scan step was less than 30kHz. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters and rotated to produce horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. Measurements were then made using CISPR quasi peak when the peak readings were within 10dB of the limit line. The numerical results are included herein to demonstrate compliance.

## Test Setup

The EUT was placed on a 0.8 m non-conducting table above a Turn table in SAC.

The EUT was set to **Operation Mode #1 with configuration Mode #1.**

## Test Result

Graphical Representation for Emission - Radiated 30MHz to 1GHz

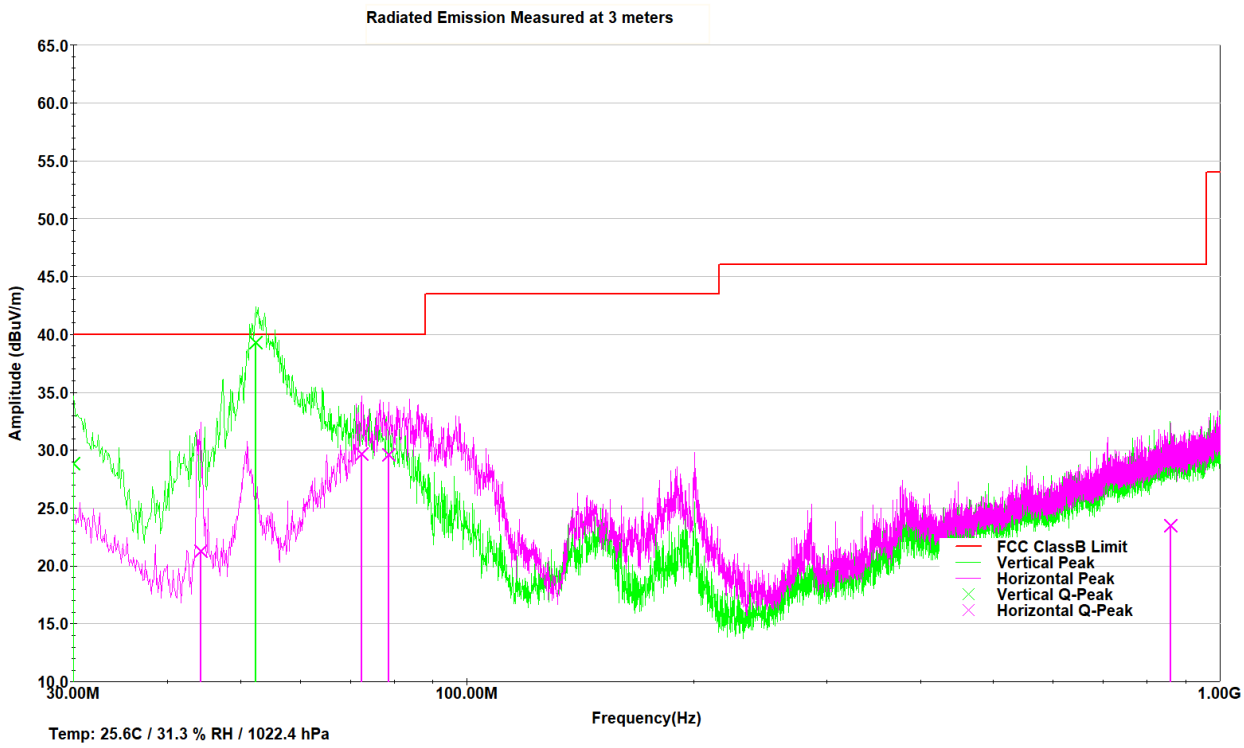


Table Representation for Emission - Radiated 30MHz to 1GHz

| Frequency | Ant. Pol. | Raw_QPeak | AF | System_dB | Q_Peak | Margin | FCC Limit |
|---|---|---|---|---|---|---|---|
| MHz | V/H | dBuV | dB/m | dB | dBuV/m | dB | dBuV/m |
| **44.34234** | H | 5.8 | 14.9 | 0.5 | 21.2 | 18.8 | 40 |
| 72.45471 | H | 16.6 | 12.3 | 0.7 | 29.7 | 10.3 | 40 |
| 78.70921 | H | 17.1 | 11.7 | 0.8 | 29.6 | 10.4 | 40 |
| 859.796 | H | -5.5 | 26 | 3 | 23.5 | 22.5 | 46 |

| Frequency | Ant. Pol. | Raw_QPeak | AF | System_dB | Q_peak | Margin | FCC Limit |
|---|---|---|---|---|---|---|---|
| MHz | V/H | dBuV | dB/m | dB | dBuV/m | dB | dBuV/m |
| **30.00525** | V | 3.3 | 25.1 | 0.4 | 28.8 | 11.2 | 40 |
| 52.40768 | V | 27.1 | 11.5 | 0.6 | 39.3 | 0.7 | 40 |

Note (1) Quasi-peak (dBuV/m) = Raw Quasi-peak (dBuV) + Antenna Factor (dB/m) + System_dB
System_dB = Cable loss(dB)

## 3.10 Radiated Emissions above 1 GHz

<table>
<tr><td>Standard</td><td colspan="2">FCC Part 15 Subpart B (§ 15.109)<br>FCC Part 90 (§ 90.219 and § 90.210)</td></tr>
<tr><td>Test Method</td><td colspan="2">ANSI C63.4: 2014, CISPR 16-2-1<br>ANSI C63.26-2015<br>KDB 935210 D05 v01r04</td></tr>
<tr><td>Tested by</td><td colspan="2">Zara Vali</td></tr>
<tr><td>Test date</td><td colspan="2">February 12, 2024</td></tr>
<tr><td>Test location</td><td colspan="2">Richmond, Stand #3</td></tr>
<tr><td>Applied limit</td><td colspan="2">
<table>
<tr><th colspan="3">Radiated Emission FCC/ Class B Limit at 3 Meters</th></tr>
<tr><th>Frequency (GHz)</th><th>Average (dBμV/m)</th><th>Peak (dBμV/m)</th></tr>
<tr><td>> 1</td><td>54</td><td>74</td></tr>
</table>
Since the Class B limit is more stringent than the other limits, the other limits have not been presented.
</td></tr>
<tr><td rowspan="3">Test set-up description</td><td>☒</td><td>Equipment on a table of 80 cm height</td></tr>
<tr><td>☐</td><td>Equipment on the floor (insulated from ground plane)</td></tr>
<tr><td>☐</td><td>Other:</td></tr>
<tr><td>Operating modes of EUT</td><td colspan="2">The EUT is configured as “Dive Mode”, the wireless charger is powered by 120V/60Hz or 230V/50Hz.</td></tr>
<tr><td rowspan="4">Test method applied</td><td>☐</td><td>OATS or SAC with measurement distance [m]: ☒3 ☐10</td></tr>
<tr><td>☒</td><td>FAR CISPR 16-2-3 with measurement distance [m]: 3</td></tr>
<tr><td>☐</td><td>FAR IEC 61000-4-22 with measurement distance [m]: 3</td></tr>
<tr><td>☐</td><td>TEM Waveguide according to IEC 61000-4-20</td></tr>
<tr><td>Supplementary test set-up</td><td>☒</td><td>Measurements were made in FAR chamber that complies to CISPR 16. Preliminary (peak) measurements. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak detector below 1GHz and average detector above 1GHz) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.</td></tr>
<tr><td colspan="3">VERDICT: PASS</td></tr>
</table>

## Test Method

This test measures the radiating levels from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standards referenced in the test summary section of this report. The EUT was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified by positioning a broadband receive antenna three meter from the EUT. A scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7 with the receiver in the peak mode. The receiver IF bandwidth was 1MHz and scan step was about 0.5 MHz. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters and rotated to produce horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. Measurements were then made using CISPR averaging when the peak readings were within 10 dB of the peak limit line. The numerical results are included herein to demonstrate compliance.

Emission level is presented according to the below formula:
Emission level (dBuV/m) = Detected level (dBuV) +Cable Loss (dB) + Antenna Factor (dB/m) + Pre-Amplifier Gain (dB)

## Test Setup

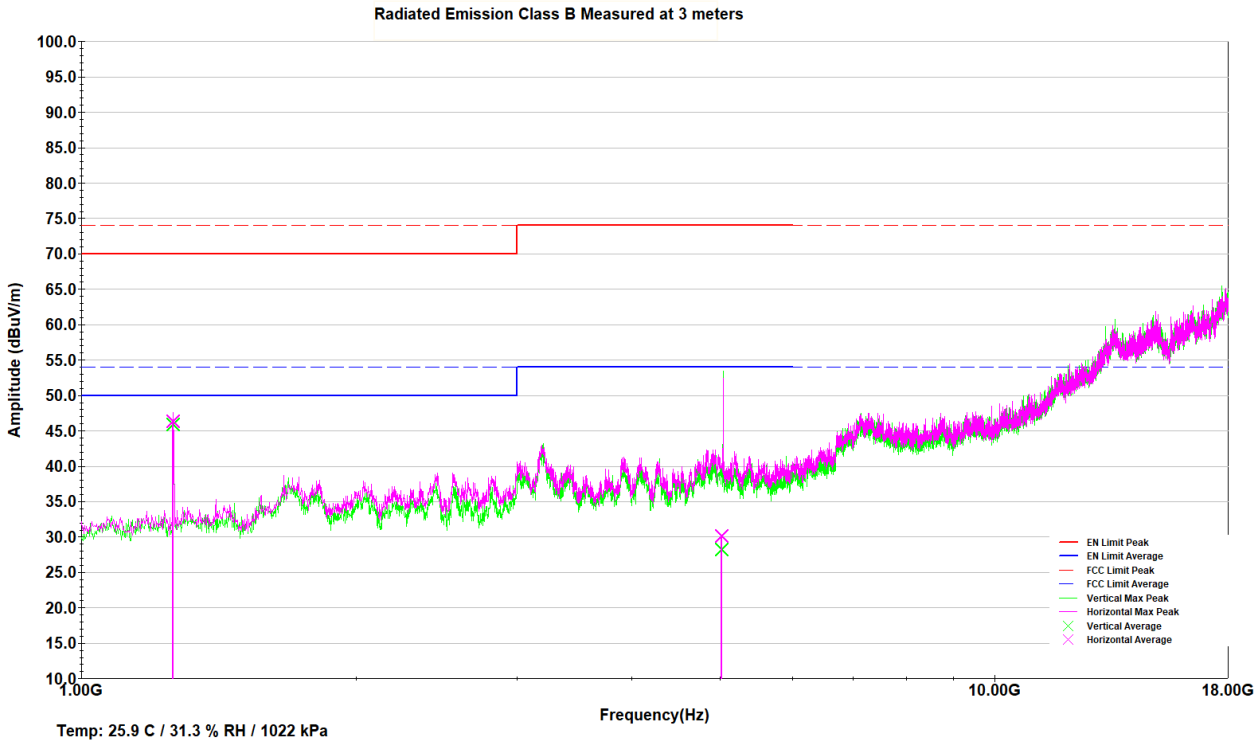
Description of test set-up:

The EUT was placed on a 0.8 m non-conducting table above a Turn table in SAC.

The EUT was set to **Operation Mode #1 with configuration Mode #1.**

## Test Result

Graphical Representation for Emission - Radiated 1 to 18GHz




| Frequency | AntFac | Sys_dB | Peaks | Peak Margin | AVG | AVG Margin |
|---|---|---|---|---|---|---|
| MHz | dB | dB | dBuV/m | dB | dBuV/m | dB |
| **1259.964** | 24.73 | -29.71 | 47.43 | 26.573 | 46.277 | 7.723 |
| 5022.356 | 33.95 | -22.32 | 41.73 | 32.273 | 30.09 | 23.91 |

Note (1) Quasi-peak (dBuV/m) = Raw Quasi-peak (dBuV) + Antenna Factor (dB/m) + Sys_dB (dB)
Sys_dB (dB) = Cable loss(dB) + Preamp Gain(dB)
Note (2) Average measurement around 18 GHz were below the average limit line.

## 3.11 Conducted Emissions at AC Power Port

| | |
|---|---|
| Standard | FCC Part 15 Subpart B (§ 15.107) |
| Test Methods | ANSI C63.4:2014, CISPR 16-2-1 |
| Tested by | Zara Vali |
| Test date | February 12, 2024 |
| Test location | Richmond Lab, Stand #1 |

**Applied limit**

| AC Port Conducted Emission Class B Limit | | |
|---|---|---|
| Frequency (MHz) | Quasi-Peak (dBμV) | Average (dBμV) |
| 0.15 - 0.50 | 66 to 56 | 56 to 46 |
| 0.50 – 5 | 56 | 46 |
| 5-30 | 60 | 50 |

Note 1. The lower limit shall apply at the transition frequencies.
Note 2. The limit decreases linearly with the logarithm of the frequency in the 0.15 to 0.50 MHz

**Test set-up description**

| | |
|---|---|
| ☒ | Set-up Type A (40 cm distance to vertical ground plane, 80 cm over ground plane) |
| ☐ | Set-up Type B (40 cm distance to horizontal ground plane) |
| ☐ | Floor standing equipment set-up (10 cm over ground plane) |
| ☐ | Other: |

| | |
|---|---|
| Operating modes of EUT | The EUT is configured as “Dive Mode”, the wireless charger is powered by 120V/60Hz or 230V/50Hz. |

**Test method applied**

| | |
|---|---|
| ☒ | Artificial mains network (AMN) |
| ☐ | Voltage Probe |

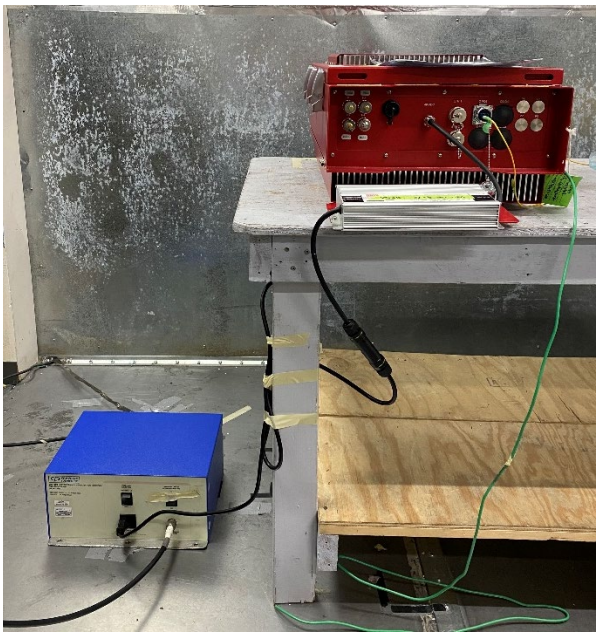
VERDICT: PASS

### Test Method

This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially a scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7!, from 150 kHz to 30 MHz on each phase with the receiver in the peak mode. The measuring bandwidth was set up to 9 kHz. Measurements were then made using CISPR16-1 quasi peak and averaging detectors when the peak readings were within 10dB of the Quasi-peak limit line.

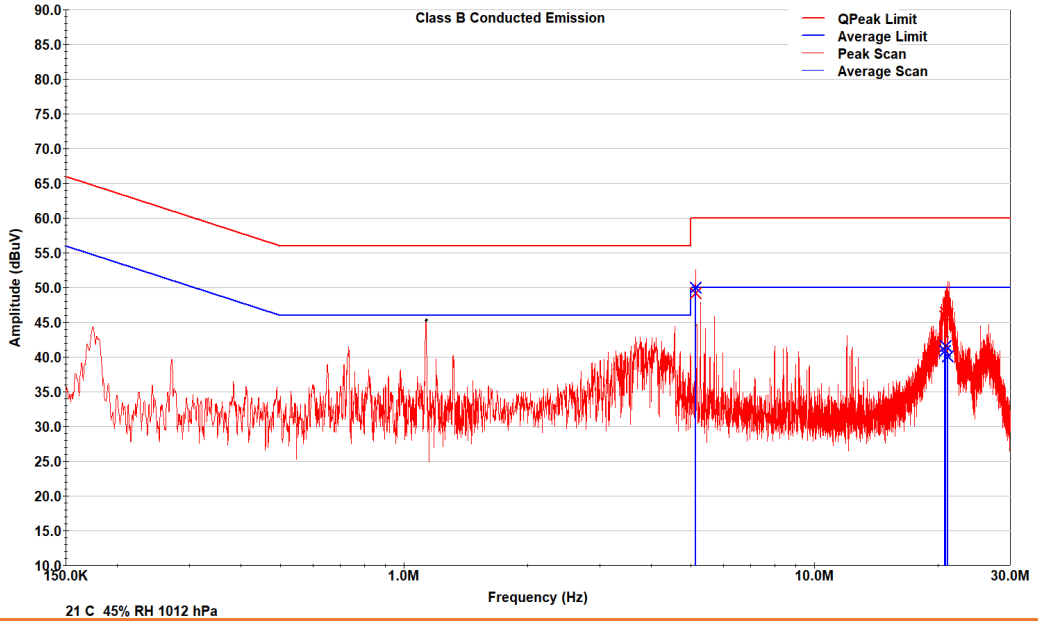
## Test Setup

The EUT was placed on a 0.8m non-conducting table above GRP.



## Test Results

Conducted Emission 150 kHz - 30MHz Class B, 120V/60Hz AC Main L1



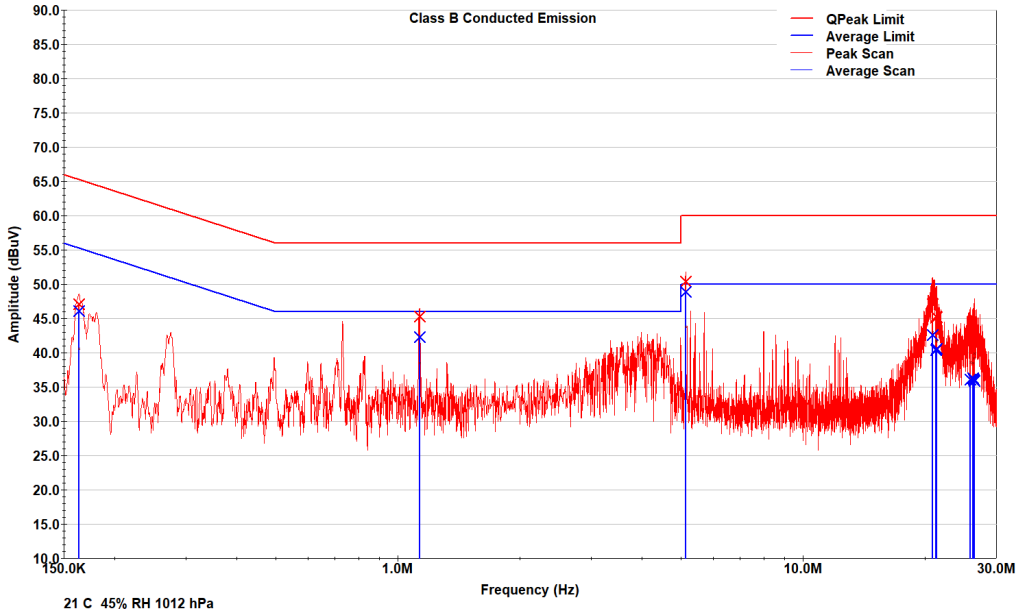
| Frequency | Correction Factor | QPeak | QPeak Margin | QPeak Limit | Average | Average Margin | Average Limit |
|---|---|---|---|---|---|---|---|
| MHz | dB | dBuV | dB | dBuV | dBuV | dB | dBuV |
| **5.135** | 28.66 | 49.21 | 10.79 | 60 | 49.971 | 0.03 | 50 |
| 20.798 | 29.08 | 45.88 | 14.12 | 60 | 40.874 | 9.13 | 50 |
| 20.921 | 29.097 | 46.45 | 13.55 | 60 | 41.559 | 8.44 | 50 |
| 21.09 | 29.124 | 46.16 | 13.84 | 60 | 40.121 | 9.88 | 50 |

Note (1) All other frequencies were not measured because either they were ambient background noise, or their peak pre-measurement was at least 20 dB below the limit line.

Note (2) Emission level is presented according to the below formula:

Conducted Emission (dBuV) = Measured Emission (dBuV) + Correction Factor (dB)
Correction Factor (dB) = LISN Transduce Factor (dB) + Cable loss(dB) + 20 dB limiter(dB)

Conducted Emission 150 kHz - 30MHz Class B, 120V/60Hz AC Main L2



| Frequency | Correction Factor | QPeak | QPeak Margin | QPeak Limit | Average | Average Margin | Average Limit |
|---|---|---|---|---|---|---|---|
| MHz | dB | dBuV | dB | dBuV | dBuV | dB | dBuV |
| **0.163** | 28.627 | 47.05 | 18.25 | 65.3 | 46.11 | 9.19 | 55.3 |
| **1.131** | 28.573 | 45.27 | 10.73 | 56 | 42.336 | 3.66 | 46 |
| **5.132** | 28.66 | 50.43 | 9.57 | 60 | 48.953 | 1.05 | 50 |
| **20.925** | 29.098 | 47.07 | 12.93 | 60 | 42.6 | 7.4 | 50 |
| **21.326** | 29.116 | 45.33 | 14.67 | 60 | 40.411 | 9.59 | 50 |
| **21.364** | 29.112 | 45.19 | 14.81 | 60 | 40.561 | 9.44 | 50 |
| **25.901** | 29.164 | 41.98 | 18.02 | 60 | 36.078 | 13.92 | 50 |
| **26.254** | 29.2 | 42.07 | 17.93 | 60 | 36.265 | 13.73 | 50 |
| **26.336** | 29.201 | 42.02 | 17.98 | 60 | 36.127 | 13.87 | 50 |
| **26.509** | 29.2 | 41.91 | 18.09 | 60 | 35.917 | 14.08 | 50 |

Note (1) All other frequencies were not measured because either they were ambient background noise, or their peak pre-measurement was at least 20 dB below the limit line.

Note (2) Emission level is presented according to the below formula:

Conducted Emission (dBuV) = Measured Emission (dBuV) + Correction Factor (dB)
Correction Factor (dB) = LISN Transduce Factor (dB) + Cable loss(dB) + 20 dB limiter(dB)

## List of test equipment

| Test Stand #1 | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Labtest ID** | **Last calibration** | **Calibration due*** |
| EMC Analyzer | Agilent Technologies | E7405A | 272 | 27 September, 2023 | 27 September, 2024 |
| LISN | Com-Power | LIN-120C | 920 | 23 July, 2023 | 23 July, 2024 |
| RF Cable | MRO | n/a | n/a | IHC[2] | IHC[1] |
| AC Power Source | Pacific Power Source | 360AMXT-UPC32 | 955 | IHC[3] | IHC[1] |
| Used Software | Tile! 7 v7.3.0.6 | | | | |
| **Test Stand #2** | | | | | |
| EMC Analyzer | Agilent Technologies | E7405A | 272 | 27 September, 2023 | 27 September, 2024 |
| Broadband Antenna | Sunol | JB1 | 371 | 24 October, 2022 | 24 October, 2024 |
| Motion Controller | Sunol | SC104V | 235A | IHC[1] | IHC[1] |
| Antenna Tower | Sunol | TWR95-4 | 235B | IHC[1] | IHC[1] |
| Turn Table | Sunol | SM46C | 235C | IHC[1] | IHC[1] |
| EMC Shielded Enclosure | USC | USC-26 | 374 | IHC[1] | IHC[1] |
| RF Cable | MRO | n/a | n/a | IHC[2] | IHC[1] |
| Used Software | Tile! 7 v7.3.0.6 | | | | |
| **Test Stand #3** | | | | | |
| Horn Antenna | A.H Systems | SAS-571 | 227C | 13-Sept-2022 | 13-Sept-2024 |
| EMC Analyzer | Agilent Technologies | E7405A | 272 | 07-Sept-2023 | 07-Sept-2024 |
| Motion Controller | Sunol | SC104V | 235A | IHC[1] | IHC[1] |
| Antenna Tower | Sunol | TWR95-4 | 235B | IHC[1] | IHC[1] |
| Turn Table | Sunol | SM46C | 235C | IHC[1] | IHC[1] |
| EMC Shielded Enclosure | USC | USC-26 | 374 | IHC[1] | IHC[1] |
| RF Cable | A.H. Systems | SAC-26G-3 | 227D | IHC[2] | IHC[1] |
| RF Preamplifier | Agilent | 8449B | 273 | IHC[2] | IHC[1] |
| Used Software | Tile! 7 v7.3.0.6 | | | | |

Note 1) IHC = In House Calibration
Calibration interval extended based on enough calibration data and experience of use (see IECEE OD-5011:2015 clause 8.3)

# Annex

## Annex 1 - ISO 17025 ACCREDITATION CERTIFICATE

For complete scope of certification use

https://labtestcert.com/wp-content/uploads/2024/04/LabTest-Certification-Inc-Cert-and-Scope-File-03-12-2024_1710259791.pdf

**END OF REPORT**