

CTC advanced
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# TEST REPORT

**Test Report No.: 1-9990/20-01-06-C**

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

## Testing Laboratory


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**Accredited Test Laboratory:**
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

## Applicant


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## Manufacturer


**etatronix GmbH**
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## Test Standard/s

| | |
|---|---|
| FCC - Title 47 CFR Chapter I - Subchapter I §1.1310 | Radiofrequency radiation exposure limits. |
| FCC KDB 680106 D01 Exposure Wireless Charging Apps v03 | RF Exposure Considerations for Low Power Consumer Wireless Power Transfer Applications |

For further applied test standards please refer to section 3 of this test report.

## Test Item

| | |
|---|---|
| Kind of test item: | wireless charger |
| Device type: | mobile device |
| **Model name:** | **Tablet including receiver (81909002) + demo fixture including transmitter (81909001)** |
| FCC-ID: | 2AOR81909002 |
| Frequency: | 111 - 149 kHz |
| Antenna: | Integrated antenna |
| DC supply: | 24V |
| Auxiliary equipment: | USB Power Delivery - Tester PM110 (load) |
| Test sample status: | identical prototype |
| Exposure category: | general population / uncontrolled environment |

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## Test Report authorised:

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# 1 Table of contents

# 2 General information

## 2.1 Notes and disclaimer

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In no case this test report can be considered as a Letter of Approval.

## 2.2 Application details

| | |
|---|---|
| Date of receipt of order: | 2020-02-05 |
| Date of receipt of test item: | 2020-02-26 |
| Start of test: | 2020-02-26 |
| End of test: | 2020-02-26 |
| Person(s) present during the test: | Mr. Huwig |
| | Mr. Saulheimer |

## 2.3 Statement of compliance

The EMF values found for the Tablet including receiver (81909002) + demo fixture including transmitter (81909001) wireless charger are below the maximum allowed levels according to the standards listed in section 3.

## 2.4 Technical details

**Test Setup 1: (Setup including Tablet + Demo fixture)**

Tablet with plastic housing including:

- Receiver model name 81909002
- Tablet:
  Type: 20L4-S02P00
  S/N: P2-03X972
  P/N: SL10Q92914

Demo fixture including the wireless charging module:

- Transmitter model name 81909001

| | |
|---|---|
| Frequency: | 111 - 149 kHz |
| Output power: | 60W |
| Distance between Tx and Rx: | 1cm |
| Input voltage: | 24V |

**Test Setup 2: (Tablet Housing, Metal Shield +Fixture)**

Tablet housing including:

- Receiver model name 81909002

Shield Metal: 182x182x0.3mm aluminium sheet
(See appendix to test report 1-9990/20-01-03 Photo documentation)

Demo fixture including the wireless charging module:

- Transmitter model name 81909001

| | |
|---|---|
| Frequency: | 111 - 149 kHz |
| Output power: | 60W |
| Distance between Tx and Rx: | 1cm |
| Input voltage: | 24V |

## 2.5 Auxiliary equipment

USB Power Delivery Tester
www.passmark.com
Model: PM110
(Hardware Revision 001)

# 3 Test standard/s:

| Test Standard | Version | Test Standard Description |
|---|---|---|
| FCC - Title 47 CFR Chapter I - Subchapter I §1.1310 | 04.06.2013 | Radiofrequency radiation exposure limits. |
| FCC KDB 680106 D01 Exposure Wireless Charging Apps v03 | 04.09.2018 | RF Exposure Considerations for Low Power Consumer Wireless Power Transfer Applications |

## 3.1 RF exposure limits

Reference levels for general public (uncontrolled environment) exposure to time-varying electric and magnetic fields.

In accordance with the PAG inquiry that was conducted for this project, the following limits were established. Minimum distance to the DUT is 0 mm.

| | E-field | H-field | B-field |
|---|---|---|---|
| Frequency | V / m | A/m | µT |
| 0.3 – 3.0 MHz | **614** | **1.63** | 2.0 |

## 4 Summary of Measurement Results

| | |
|---|---|
| ☒ | **No deviations from the technical specifications ascertained** |
| ☐ | Deviations from the technical specifications ascertained |

Both variants were measured with the probe in touch position using the worst case orientation as described in chapter 6.1.7 (Anisotrophical probe behaviour management) and 6.1.8 (Measurement distances with EHP probes).
The equipment complies with the limits following FCC guidance provided via KDB PAG enquiry and stated above.

## 5 Test Environment

| | |
|---|---|
| Ambient temperature: | 20 – 24 °C |
| Relative humidity content: | 40 – 50 % |
| Air pressure: | not relevant for this kind of testing |
| Power supply: | 230 V / 50 Hz |

# 6 Test Set-up

## 6.1 Measurement system

### 6.1.1 Broadband Electromagnetic Field Test system


A state of the art Broadband Electromagnetic Field Test system was used. The probes of the system are fitted with three sensors which measure the field strength of the X, Y and Z plane directions separately. The field strength is calculated by the instrument's processor by summing the squares of the three measured values.

The frequency range 5 Hz to 60 GHz is covered.
Depending on the used probe type Electric and Magnetic Field or Electric Field only is detectable.

- EHP-50D 5 Hz to 100 kHz Electric and Magnetic Field
- EHP-50F 5 Hz to 400 kHz Electric and Magnetic Field
- HF 3061 300 kHz to 30 MHz Magnetic Field
- EF 0691 100 kHz to 6 GHz Electric Field
- EF 6092 100 MHz to 60 GHz Electric Field

### 6.1.2 Test equipment list

| | Manufacturer | Device | Type | Serial number | Last Calibration |
|---|---|---|---|---|---|
| ☐ | Narda | Electric and Magnetic Field Meter | NBM-550 | F-0319 | 2019-02-06 |
| ☐ | Narda | Electric and Magnetic Field Meter | NBM-520 | D-1234 | 2019-05-15 |
| ☐ | Narda | Electric Field Probe (100 kHz - 6 GHz) | EF 0691 | G-0027 | 2019-02-06 |
| ☐ | Narda | Electric Field Probe (100 MHz - 60 GHz) | EF 6092 | A-0071 | 2019-05-15 |
| ☐ | Narda | Magnetic Field Probe (300 kHz to 30 MHz) | HF 3061 | D-0404 | 2019-02-06 |
| ☐ | Narda | Electric and Magnetic Field Analyser (5 Hz – 100 kHz) | EHP-50D | 230WX50108 | 2019-02-12 |
| ☒ | Narda | Electric and Magnetic Field Analyser (5 Hz – 400 kHz) | EHP-50F | 000WX60907 | 2018-09-04 |

☒ Devices used during the test ☐ Devices not used during the test

### 6.1.3 Averaging

For time efficient testing an average of 8 seconds was used. With some spot checks was verified, that caused by the time structure of the measured responses, the results did not change with a 6-minute-averaging.

### 6.1.4 Uncertainties

The probe uncertainties stated by the manufacturer are considered to be the main relevant and dominant issues.

#### 6.1.4.1 Typical uncertainty of EHP-50F

The uncertainties stated in this document have been determined according to EA-4/2 [4].
They were estimated as expanded uncertainty obtained multiplying the standard by the coverage factor k=2, corresponding to a confidence level of about 95%.
The total uncertainty of the probe derived from typical contributions of linearity, anisotropy, frequency response, temperature, relative humidity and with/without contribution of uncertainty of calibration.

| Magnetic probe (1) | Magnetic flux density | Total expanded uncertainty (k=2) | |
|---|---|---|---|
| | | Without contribution of uncertainty of calibration $U_{EHP50F}$ (%) | With contribution of uncertainty of calibration $U_T$ (%) |
| Frequency at 50Hz | 0.05µT to < 100µT | 2.3 | 3.0 (2) |
| | 100µT to < 3000µT | 2.6 | 3.8 (3) |
| Frequency from 5 to 40 Hz | 0.05µT to < 10µT | 5.3 | 5.7 (2) |
| Frequency from 40 to 100kHz | 0.05µT to < 10µT | 4.9 | 5.3 (2) |

(1) This uncertainty budget is for an ambient temperature of (23 +/- 4) °C, and relative humidity of (50 +/- 5) %
The expanded uncertainty for magnetic flux density for values close to 50 nT is calculated with negligible contribution of noise level.
(2) The uncertainty of calibration used is 2.0%
(3) The uncertainty of calibration used is 2.8%

| Electric probe (4) | Electric field range | Total expanded uncertainty (k=2) | |
|---|---|---|---|
| | | Without contribution of uncertainty of calibration $U_{EHP50F}$ (%) | With contribution of uncertainty of calibration $U_T$ (%) |
| Frequency at 50Hz | 1 V/m to 1000 V/m | 7.1 | 7.4 (5) |
| | 1 V/m to < 100 kV/m | 7.8 | 8.2 (6) |
| Frequency from 5 Hz to 100 kHz | 1 V/m to <1000 V/m | 8.8 | 9.2 (6) |

(4) This uncertainty budget is for an ambient temperature of (23 +/- 4) °C, and relative humidity of (50 +/- 5) %
(5) The uncertainty of calibration used is 2.0%
(6) The uncertainty of calibration used is 2.5%

### 6.1.5 Validation procedure

Before performing the tests the empty test chamber was checked for system immanent frequency responses. The following background signal level was detected. All levels are small enough to allow accurate proof of the limits to be considered.

| Probe | Frequency Range | Magnetic Flux Density (B) in µT | Electrical Field Strength in V/m | Remark |
|---|---|---|---|---|
| EHP-50F | 5 – 1000 Hz | 0.006 | 0.50 | |
| EHP-50F | 4 – 400 kHz | 0.004 | 0.235 | |

### 6.1.6 Definition of test position and distances

In absence of an equipment specific regulation with given test distances, all not further noted test positions were measured in “touched” mode, the probe radome touching the DUT at the defined test position.
Due to the mechanical concept of the used probe a distance between DUT surface and electrical centre of the probe antennas remains.

| Probe type | Maximum distance (cm) | |
|---|---|---|
| | Magnetic Field | Electrical Field |
| EHP-50F | 4 | 4 |

### 6.1.7 Anisotrophical probe behaviour management

As EMF measurements for safety and health aspects are often performed in the nearfield of a radiation source it is important to be aware of the not ideal isotropic performance of a typical probe and how to reproduce reliable results.

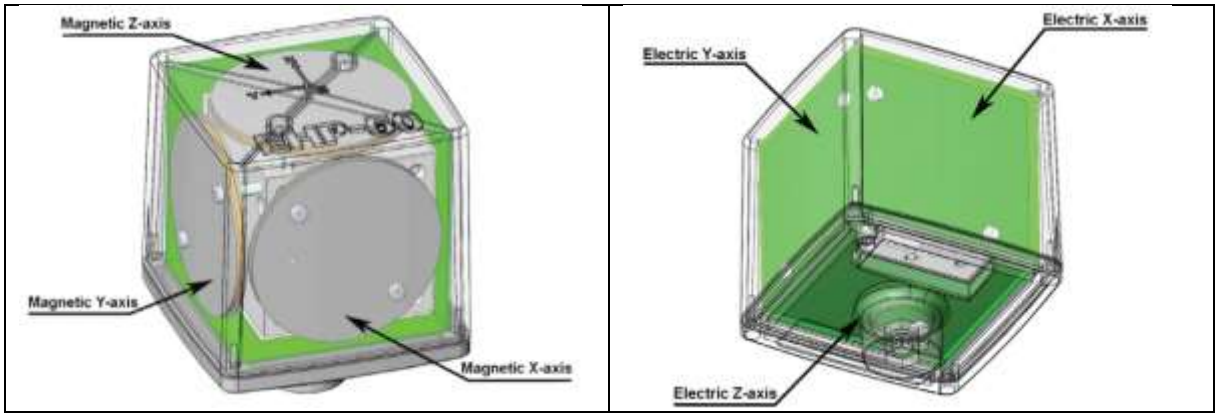
During measurements the following steps are performed to get always the highest possible field strength result and validate that the measured results are always the worst case scenario with the highest energy emitted by the source.

Step 1: Finding the position of the highest radiated field source with a basic probe orientation.
Step2: Turning the probe to all possible orientations to find the orientation that delivers the maximum field strength.

### 6.1.8 Measurement distances with EHP probes

In lack of better possibilities to measure in the nearfield at very low frequencies, the touch position of the probe towards the source in the orientation that delivers the largest field is considered as 0cm between source and probe.

The following pictures show the position of the axis




Probe dimensions: 8 x 8 x 8 cm
Electrical center: 4 cm
Distance of probes to the outer housing: according to manufacturer (0.9cm)

## 6.2 Test results

**The testing has been performed following FCC guidance provided via KDB enquiry by the grantee.**
The following chapter shows the test results for different setups, which are referenced inside the external photo documentation as well as in the final verdict section.

Detailed pictures can be found in:
**Appendix to test report no. 1-9990/20-01-06-C Photo documentation**

### 6.2.1 Setup 1: Tablet + Demo fixture (60W)

For considering worst-case conditions all measurements were performed at smallest possible distance from the device under test. Limits shown in the tables below are the lowest ones within the wideband frequency ranges of the field probes applied.

During the measurements the DUT (Transmitter and Receiver) were positioned to a distance of 1cm to have a defined charging situation. The device was charged wireless during the measurements.

The measurements were performed for different output powers.
The E-Field was only measured in the power scenario that produced the greatest H-field.

| H-Field [A/m] | | | | | | | |
|---|---|---|---|---|---|---|---|
| Side | Distance* [cm] | Output Power | | | | | Limit (A/m) |
| | | 60W (100%) | 54W (90%) | 30W (50%) | 13.5W (22.5%) | 6W (10%) | |
| Top | 0 | 0.58 | 0.57 | 0.6 | 0.65 | 0.64 | **1.63** |
| Side 1 | 0 | 0.59 | 0.61 | 0.64 | 0.67 | 0.63 | **1.63** |
| Side 2 | 0 | 0.64 | 0.63 | 0.66 | 0.71 | 0.70 | **1.63** |
| Side 3 | 0 | 0.15 | 0.14 | 0.17 | 0.22 | 0.21 | **1.63** |
| Side 4 | 0 | 0.51 | 0.50 | 0.53 | 0.58 | 0.57 | **1.63** |

Table 1: Test results H-field @111 - 149kHz

*) All results were measured with the probe in touch position using the worst case orientation as described in chapter 6.1.7 Anisotrophical probe behaviour management and 6.1.8 Measurement distances with EHP probes.

| E-Field [V/m] | | | |
|---|---|---|---|
| Side | Distance* [cm] | Output Power | Limit (V/m) |
| | | 13.5W (worst case from H-Field) | |
| Top | 0 | 0.9 | **614** |
| Side 1 | 0 | 0.9 | **614** |
| Side 2 | 0 | 0.8 | **614** |
| Side 3 | 0 | 0.6 | **614** |
| Side 4 | 0 | 0.7 | **614** |

Table 2: Test results E-field @111 - 149kHz

*) All results were measured with the probe in touch position using the worst case orientation as described in chapter 6.1.7 Anisotrophical probe behaviour management and 6.1.8 Measurement distances with EHP probes.

### 6.2.2 Setup 2: Tablet-Housing, Shield Metal + Demo fixture (60W)

For considering worst-case conditions all measurements were performed at smallest possible distance from the device under test. Limits shown in the tables below are the lowest ones within the wideband frequency ranges of the field probes applied.

During the measurements the DUT (Transmitter and Receiver) were positioned to a distance of 1cm to have a defined charging situation. The device was charged wireless during the measurements.

The measurements were performed for different output powers.
The E-Field was only measured in the power scenario that produced the greatest H-field.

| H-Field [A/m] | | | | | | | |
|---|---|---|---|---|---|---|---|
| Side | Distance* [cm] | Output Power | | | | | Limit (A/m) |
| | | 60W (100%) | 54W (90%) | 30W (50%) | 13.5W (22.5%) | 6W (10%) | |
| Top | 0 | 0.20 | 0.19 | 0.19 | 0.20 | 0.19 | **1.63** |
| Side 1 | 0 | 1.00 | 0.98 | 0.99 | 1.00 | 0.98 | **1.63** |
| Side 2 | 0 | 1.05 | 0.98 | 1.03 | 1.20 | 1.17 | **1.63** |
| Side 3 | 0 | 0.90 | 0.96 | 1.01 | 1.20 | 1.14 | **1.63** |
| Side 4 | 0 | 0.60 | 0.58 | 0.74 | 0.80 | 0.76 | **1.63** |

Table 3: Test results H-field @111 - 149kHz

*) All results were measured with the probe in touch position using the worst case orientation as described in chapter 6.1.7 Anisotrophical probe behaviour management and 6.1.8 Measurement distances with EHP probes.

| E-Field [V/m] | | | |
|---|---|---|---|
| Side | Distance* [cm] | Output Power | Limit (V/m) |
| | | 13.5W (worst case from H-Field) | |
| Top | 0 | 1.6 | **614** |
| Side 1 | 0 | 1.5 | **614** |
| Side 2 | 0 | 1.3 | **614** |
| Side 3 | 0 | 0.9 | **614** |
| Side 4 | 0 | 1.0 | **614** |

Table 4: Test results E-field @111 - 149kHz

*) All results were measured with the probe in touch position using the worst case orientation as described in chapter 6.1.7 Anisotrophical probe behaviour management and 6.1.8 Measurement distances with EHP probes.

## 6.3 Final verdict

Both variants were measured with the probe in touch position using the worst case orientation as described in chapter 6.1.7 (Anisotrophical probe behaviour management) and 6.1.8 (Measurement distances with EHP probes).
The equipment complies with the limits following FCC guidance provided via KDB PAG enquiry and stated above.

## Annex A: Photo documentation

Photo documentation is described in the additional document:

# Appendix to test report no. 1-9990/20-01-06-C Photo documentation

## Annex B: Document History

| Version | Applied Changes | Date of Release |
|---|---|---|
| | Initial Release | 2020-03-09 |
| -A | Added tablet information on page 4. | 2020-03-23 |
| -B | Corrected FCC-ID on page 1. | 2020-08-12 |
| -C | Corrected Section 3.1 / 4 / 6.2 / 6.3 | 2020-08-28 |

## Annex C: Further Information

**Glossary**

| | | |
|---|---|---|
| DUT | - | Device under Test |
| EUT | - | Equipment under Test |
| FCC | - | Federal Communication Commission |
| FCC ID | - | Company Identifier at FCC |
| HW | - | Hardware |
| Inv. No. | - | Inventory number |
| N/A | - | not applicable |
| S/N | - | Serial Number |
| SW | - | Software |