



TEST REPORT

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



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing Laboratory

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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.

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1 Table of contents

1	Table of contents.....	2
2	General information	3
2.1	Notes and disclaimer	3
2.2	Application details	3
2.3	Statement of compliance	3
2.4	Technical details	4
2.5	Auxiliary equipment	4
3	Test standard/s:.....	5
3.1	RF exposure limits	5
4	Summary of Measurement Results	6
5	Test Environment	6
6	Test Set-up.....	7
6.1	Measurement system.....	7
6.1.1	Broadband Electromagnetic Field Test system.....	7
6.1.2	Test equipment list	8
6.1.3	Averaging.....	8
6.1.4	Uncertainties.....	9
6.1.4.1	Typical uncertainty of EHP-50F	9
6.1.5	Validation procedure.....	9
6.1.6	Definition of test position and distances	10
6.1.7	Anisotrophical probe behaviour management.....	10
6.1.8	Measurement distances with EHP probes	10
6.2	Test results	11
6.2.1	Setup 1: Tablet + Demo fixture (60W).....	11
6.2.2	Setup 2: Tablet-Housing, Shield Metal + Demo fixture (60W)	12
6.3	Final verdict	13
Annex A:	Photo documentation	13
Annex B:	Document History	13
Annex C:	Further Information	13

2 General information

2.1 Notes and disclaimer

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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	0.05 μ T to < 100 μ T	2.3	3.0 ⁽²⁾
	100 μ T to < 3000 μ T	2.6	3.8 ⁽³⁾
Frequency from 5 to 40 Hz	0.05 μ T to < 10 μ T	5.3	5.7 ⁽²⁾
Frequency from 40 to 100kHz	0.05 μ T to < 10 μ T	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 μ T	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.

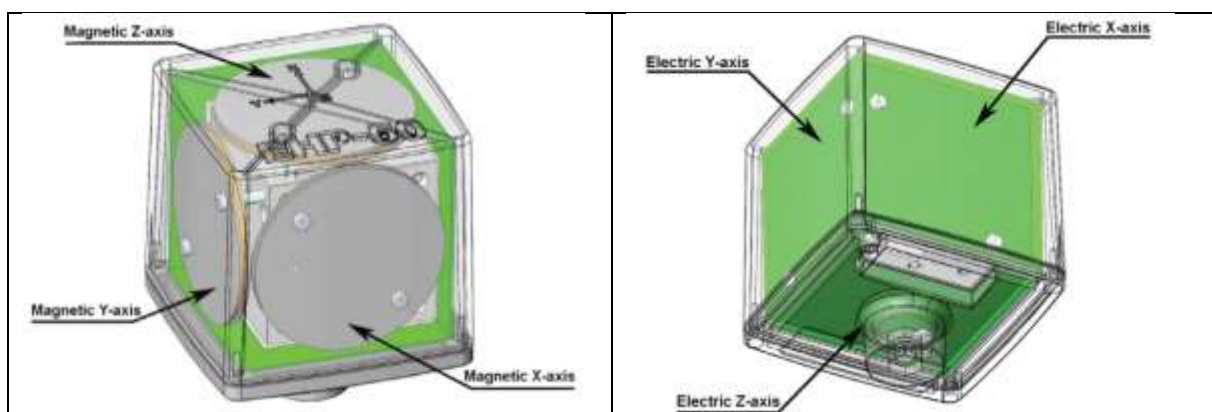
Step 1: Finding the position of the highest radiated field source with a basic probe orientation.

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