

FCC Test Report (Part 1)

RF Exposure (EMF)

Test report no.:	LAB-341F (v1.0)	Date of report:	08-Dec-2021
Number of pages:	16	Project support engineer:	Oliver Flecke
Test period:	22-Sep to 08-Oct-2021		

Applicant:	Molex CVS Dabendorf GmbH, Märkische Straße 72, 15806 Zossen, Germany, Mr. Michael Schmidt
Manufacturer:	Molex CVS Dabendorf GmbH, Märkische Straße 72, 15806 Zossen, Germany
EUT identification:	Molex, WCH-304 (WCH-304a)
FCC ID:	RK7WCH-304

Testing laboratory:	Molex CVS Lab, Molex CVS Bochum GmbH, Meesmannstr.103, 44807 Bochum, Germany
Tel.:	+49 234 51668-0
e-mail:	Product.Validation.Bochum@molex.com
FCC designation no.:	DE0017
Laboratory manager:	Robert Müller

Test result:	The EUT complies with the requirements made in the referred test documents.
---------------------	---

Approver:	Robert Müller	Technical review:	Jürgen Mitterer
Title:	Laboratory Manager	Title:	Validation and Test Engineering Manager

Signature:  **Signature:** 

This test report may not be reproduced, except in full, without written permission of testing laboratory. Former issued versions of this report are declared as invalid. The test results in this test report relates only to the tested samples as received, which is mentioned in this test report. Molex CVS Bochum GmbH cannot be made responsible for any generalizations or conclusions drawn from this test report.

Contents

VERSION HISTORY	3
1. SUMMARY FOR FCC EMF TEST REPORT	4
1.1. EUT AND ACCESSORY INFORMATION	4
1.2. TECHNICAL CHARACTERISTICS	5
1.3. APPLIED STANDARDS	6
1.4. MEASUREMENT UNCERTAINTIES	7
1.5. DECISION RULE	7
1.6. RISK ASSESSMENT	7
1.7. SUMMARY OF TEST RESULTS	8
2. TEST SETUPS	9
2.1. FCC EMF TEST SETUP	9
3. RF EXPOSURE (EMF)	10
3.1. TEST METHOD AND LIMIT	10
3.2. TEST RESULTS H-FIELD	12
4. TEST EQUIPMENT	15
4.1. RF EXPOSURE	15

Version History

Report Number	Date	Comment
LAB-341F (v1.0)	08-Dec-2021	1 st approved version
-	-	-
-	-	-
-	-	-

1. Summary for FCC EMF Test Report

Date of receipt	09-Aug-2021
Testing completed	09-Nov-2021
The customer's contact person	Mr. Michael Schmidt
Test sample / setup pictures	none
HW change / difference document	none
Notes	none

1.1. EUT and accessory Information

The EUT is an inductive wireless power transfer device (wireless charger) with transmitter and load modulation operating at 127.55 kHz. The WPT device supports a maximum charging power level of 15 W.

The EUT is tested with a commercially available mobile phone (highest duty cycle of 100 %). The maximum current consumption was observed between 5 % and 25 % charging level of the mobile phone, so that measurement is done up to 25 %.

The following test samples provided by the customer were tested.

ID	Description	Manufacturer	Type	S/N	HW Version	SW Version
DAB210913E	WPT Device	Molex	WCH-304a	0000030D041C	H10	T019

The following accessories have been provided by the customer and belong to the equipment under test (EUT).

ID	Description	Manufacturer	Type	S/N	HW Version	SW Version
DAB210469E	DC power cable long	Molex	-	-	-	-
DAB200859E	Cellular RF cable with Bias-T (50 Ω, 10 kΩ)	Molex	-	-	-	-
Iphone 12	Mobile Phone (127.55 kHz)	Apple	Iphone 12	-	-	-

1.2. Technical characteristics

Power Supply [V]	Lead-acid battery (vehicle regulated) – 13.2 V DC		
Voltage Range [V]	Unom = 13.2	Umin = 11.1	Umax = 15.3
Charging cut-off Voltage [V] @ 15W	U _{cut-off} = 9.0 (wireless power transfer is stopped for U < U _{cut-off})		
Temperatures Range [°C]	-20 → +80		
Radio Type	WPT transceiver		
Product Category	Category I radio apparatus (type 3)		
Operating Frequency Range [kHz]	127.55		
Communication Frequency [kHz]	Same as operating frequency range		
Operating Channels	Not channelized		
Antenna Type	Integral inductive loop coils (no customization allowed)		
Antenna Gain [dBi]	n.a.		
Modulation Type	5 W BPP: H-field for charging is not modulated 15 W EPP: H-field for charging is digital modulated		
Modulation Technique	5 W BPP: H-field for charging is not modulated 15 W EPP: H-field for charging is FSK modulated		

Above technical information was provided by the applicant. For more details, please refer to the User's manual of the EUT.

1.3. Applied standards

Standard / Rule Part	Version	Year
CFR 47, FCC Part 2	-	Dec-2021
CFR 47, FCC Part 1	-	Dec-2021
KDB 680106 D01	v03r01	Jan-2021

Deviations or clarifications to these standards are noted in the related test result under “test method and limit”.

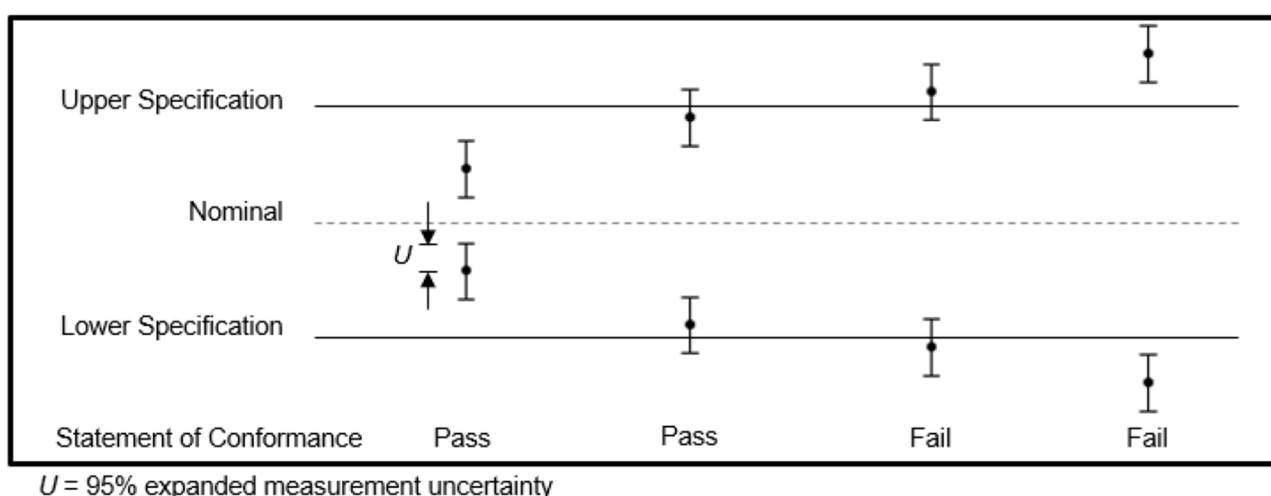
1.4. Measurement uncertainties

Parameter	Measurement Uncertainty	Maximum Uncertainty
H-field probe 100 cm ²	3.33 %	< 30 %
H-field probe 3 cm ²	4.17 %	
H-field level tester	12.60 %	

These uncertainties represent an expanded uncertainty expressed approximately at the 95% confidence level using a coverage factor of k=2

1.5. Decision rule

Unless it is inherent in the requested customer specification or test standard, the “Binary Statement for Simple Acceptance” as defined in ILAC G8:2019 clause 4.2.1 is applied as decision rule for the conformity statement. Therefore, the measured values are compared directly with the limit values without taking the measurement uncertainty into account.



1.6. Risk Assessment

Following the guidance of ILAC G8:2019 clause 5.2, the level of specific risk of False Accept or False Reject considering different decision rules and respectively expanded measurement uncertainties can be expressed as follows.

Decision Rule	Distance of Measurement Value to Limit	Probability of wrong Conformity Statement
6 Sigma	3 x Measurement Uncertainty	< 1 ppm
3 Sigma	1.5 x Measurement Uncertainty	< 0.16 %
ILAC G8:2009 Rule	1 x Measurement Uncertainty	< 2.5 %
ISO 14253.1:2017	0.83 x Measurement Uncertainty	< 5 %
Simple Acceptance, ILAC G8:2009 4.2.1	Measurement Value on Limit Line	50 % “worst case” scenario

1.7. Summary of test results

Section	Section in CFR 47	Name of the test	Result
3.2	1.1307(b), 1.1310	RF Exposure (H-field)	PASSED *
-	1.1307(b), 1.1310	RF Exposure (E-field)	NA

PASSED: The EUT complies with the essential requirements in the standard.

FAILED: The EUT does not comply with the essential requirements in the standard.

NP: The test was not performed.

NA: The test was not applicable.

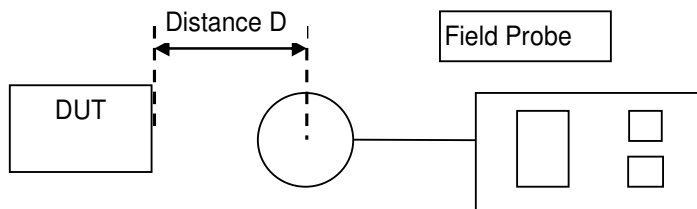
* The table below shows the worst-case minimum distances where the FCC limit is just reached.

FCC Limit [A/m]	Pos A Distance [cm]	Pos B Distance [cm]	Pos C Distance [cm]	Pos D Distance [cm]	Pos Top C Distance [cm]	Result
1.63	7.25	7.25	7.25	8.00	7.50	PASSED

The EUT must maintain the minimum distances in the respective positions to pass the FCC limit requirement.

2. Test setups

2.1. FCC EMF test setup



H-Field Probe: Narda ELT-400 + ELT Probe 100 cm² (3 cm² for D < 6 cm) (1 Hz – 400 kHz)

3. RF Exposure (EMF)

EUT with DUT number	DAB210913E
Accessories with DUT numbers	DAB210469E, DAB200859E, OnePlus 9, Iphone 12
Operation Voltage [V] / [Hz]	13.2 V / DC
Result	PASSED
Remarks	none
Temp [°C] / Humidity [%RH]	20.1 °C / 40.0 %
Date of measurement	23-Sep to 08-Nov-2021
Test Responsible	Oliver Flecke
Test system SW version	n.a.

3.1. Test method and limit

The mobile phone is placed above the charging area of each coil (coil 1, coil 2, coil 3) with minimum distance between the primary coil in the DUT and the secondary coil in the mobile phone (best coupling).

The DUT is working on the operating frequency 127.55 kHz with maximum power of 15 Watt.

The measurement was performed at sides A, B, C, D and TOP at ranges of 2 cm, 4 cm, 6 cm, 8 cm, 10cm.

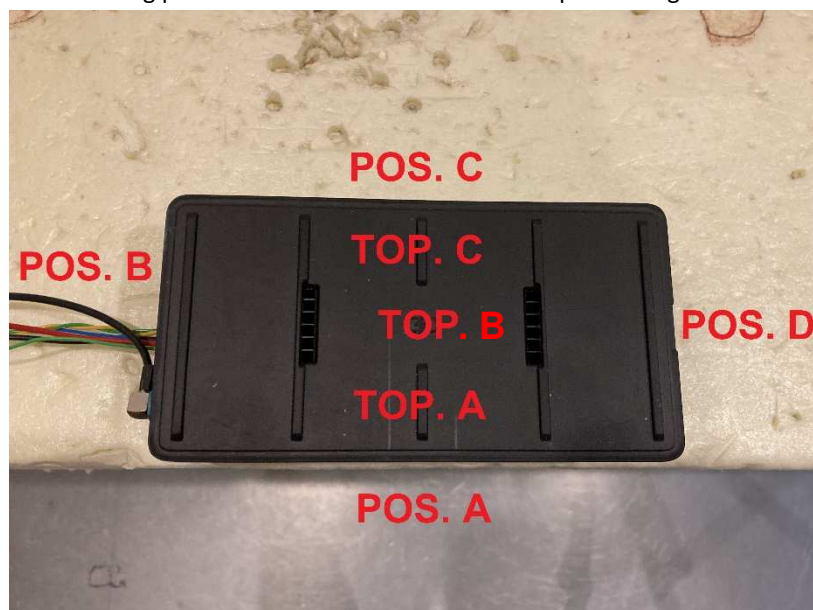
Because the TOP field revealed a structure where the magnetic field flux drops at the centre of the coil the TOP Position was divided into TOP A, TOP B and Top C.

Measurements for distances > 6 cm were performed with 100 cm² H-field probe and measurements for distances ≤ 6 cm were performed with 3 cm² H-field probe.

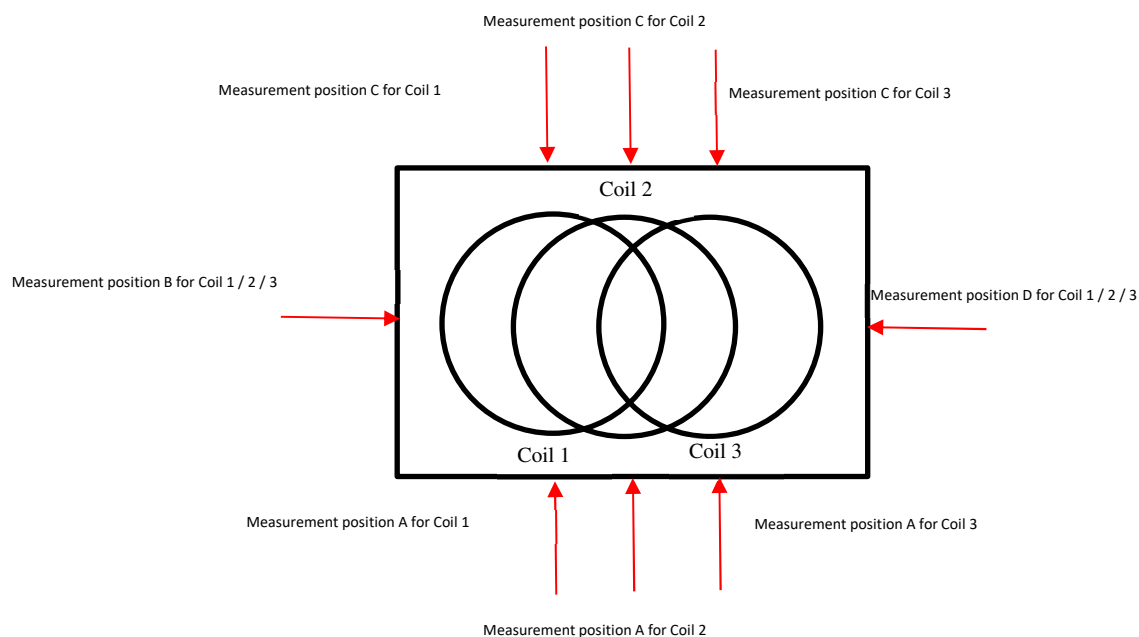
The following settings were used: Detector: RMS, Mode: 320 µT, Range: normal, Low Cut: 10 Hz

Measurement values were transformed from µT to A/m, where 1 A/m = 1.256 µT.

The following picture shows the side definition for positioning of the H-field probe.



The following figure shows the measuring positions of the three coils.



FCC limits for maximum permissible exposure

Frequency range [MHz]	Electric Field Strength Limit [V/m]	Magnetic Field Strength Limit [A/m]	Power Density [mW/cm ²]	Average Time [minutes]
(B) Limits for General Population / Uncontrolled Exposures				
0.3 – 1.34	614	1.63	100	30
1.34 – 30	824 / $f_{\text{[MHz]}}$	2.19 / $f_{\text{[MHz]}}$	180 / $f_{\text{[MHz]}}^2$	30
30 – 300	27.5	0.073	0.2	30
300 – 1500			$f_{\text{[MHz]}} / 1500$	30
1500 – 100000			1.0	30

Note: According to DUT operating frequency and installation definition, the limit in bold letters (300 kHz) was applied.

- ⇒ FCC limit calculation for $f \leq 300$ kHz:
- H-field: 1.63 A/m

3.2. Test results H-field

3.2.1 Mobile phone (Coil 1)

Distance [cm]	Level Pos A [A/m]	Level Pos B [A/m]	Level Pos C [A/m]	Level Pos D [A/m]	FCC Limit [A/m]	Result
20	0.15	0.19	0.16	0.22	1.63	PASSED
15	0.34	0.41	0.31	0.35	1.63	PASSED
10	0.56	0.80	0.59	0.62	1.63	PASSED
8	0.80	1.10	0.90	0.91	1.63	PASSED
6	2.1	2.15	2.15	1.62	1.63	FAILED
4	4.17	4.13	4.30	2.88	1.63	FAILED
2	11.28	10.37	11.46	5.77	1.63	FAILED

Distance [cm]	Level Top A [A/m]	Level Top B [A/m]	Level Top C [A/m]	FCC Limit [A/m]	Result
20	0.17	0.17	0.17	1.63	PASSED
15	0.37	0.37	0.37	1.63	PASSED
10	1.00	1.00	0.95	1.63	PASSED
8	1.28	1.42	1.48	1.63	PASSED
6	2.17	2.24	2.70	1.63	FAILED
4	3.43	2.79	4.60	1.63	FAILED
2	9.50	4.68	12.71	1.63	FAILED

The table below shows the worst-case minimum distances where the FCC limit is just reached.

FCC Limit [A/m]	Pos A Distance [cm]	Pos B Distance [cm]	Pos C Distance [cm]	Pos D Distance [cm]	Pos Top C Distance [cm]	Result
1.63	7.0	7.25	7.00	5.75	6.75	PASSED

3.2.2 Mobile phone (Coil 2)

Distance [cm]	Level Pos A [A/m]	Level Pos B [A/m]	Level Pos C [A/m]	Level Pos D [A/m]	FCC Limit [A/m]	Result
20	0.067	0.047	0.067	0.047	1.63	PASSED
15	0.13	0.071	0.135	0.071	1.63	PASSED
10	0.27	0.11	0.27	0.13	1.63	PASSED
8	0.48	0.15	0.47	0.19	1.63	PASSED
6	1.20	0.43	1.11	0.43	1.63	PASSED
4	2.87	0.65	2.81	0.66	1.63	FAILED
2	10.37	1.18	10.40	1.12	1.63	FAILED

Distance [cm]	Level Top A [A/m]	Level Top B [A/m]	Level Top C [A/m]	FCC Limit [A/m]	Result
20	0.11	0.11	0.11	1.63	PASSED
15	0.23	0.23	0.23	1.63	PASSED
10	0.32	0.36	0.40	1.63	PASSED
8	0.44	0.54	0.60	1.63	PASSED
6	1.63	1.63	1.67	1.63	FAILED
4	2.83	2.50	3.50	1.63	FAILED
2	10.45	5.90	10.80	1.63	FAILED

The table below shows the worst-case minimum distances where the FCC limit is just reached.

FCC Limit [A/m]	Pos A Distance [cm]	Pos B Distance [cm]	Pos C Distance [cm]	Pos D Distance [cm]	Pos Top C Distance [cm]	Result
1.63	5.0	2.00	5.00	2.00	6.25	PASSED

3.2.3 Mobile phone (Coil 3)

Distance [cm]	Level Pos A [A/m]	Level Pos B [A/m]	Level Pos C [A/m]	Level Pos D [A/m]	FCC Limit [A/m]	Result
20	0.19	0.21	0.18	0.27	1.63	PASSED
15	0.33	0.38	0.33	0.48	1.63	PASSED
10	0.60	0.62	0.60	0.80	1.63	PASSED
8	0.95	0.88	0.94	1.63	1.63	PASSED
6	2.90	1.63	2.30	2.52	1.63	FAILED
4	4.43	2.66	4.47	4.77	1.63	FAILED
2	11.60	4.74	11.80	11.7	1.63	FAILED

Distance [cm]	Level Top A [A/m]	Level Top B [A/m]	Level Top C [A/m]	FCC Limit [A/m]	Result
20	0.21	0.21	0.21	1.63	PASSED
15	0.45	0.45	0.45	1.63	PASSED
10	0.87	0.84	0.80	1.63	PASSED
8	1.27	1.20	1.11	1.63	PASSED
6	2.00	2.15	2.23	1.63	FAILED
4	3.90	3.60	4.18	1.63	FAILED
2	13.36	6.50	13.47	1.63	FAILED

The table below shows the worst-case minimum distances where the FCC limit is just reached.

FCC Limit [A/m]	Pos A Distance [cm]	Pos B Distance [cm]	Pos C Distance [cm]	Pos D Distance [cm]	Pos Top C Distance [cm]	Result
1.63	7.25	6.00	7.25	8.00	7.50	PASSED

4. Test Equipment

4.1. RF Exposure

Equipment	Manufacturer	Type	Serial No.	Actual Calibration	Next Calibration
Exposure Level Tester	Narda Safety Test Solutions GmbH	ELT-400	N-0385	12.11.2020	12.11.2023
H-field Probe 3 cm ²	Narda Safety Test Solutions GmbH	2300/90.20	C-0150	16.04.2021	16.04.2024
H-Field Probe 100 cm ²	Narda Safety Test Solutions GmbH	Probe	M-0823	12.11.2020	12.11.2023

END OF REPORT