

FCC Test Report (Part 1)

RF Exposure (EMF)

Test Report no.:	EMC_BO_002204 (v2.0)	Date of issue:	10-APR-2019
Number of pages:	14	Project support engineer:	Oliver Flecke
Test period:	04.02.-06.02.2019		

Applicant:	Molex CVS Grand Blanc, LLC, 8100 Industrial Park Drive, Grand Blanc, MI 48439, USA, Mrs. Rhonda Turner		
Manufacturer:	Molex CVS Shanghai Limited, No.150 Cailun Road, Zhangjiang Hi-Tech Park, Pudong New Area, Shanghai, PRC201203		
EUT identification:	Molex, WCH-210		
FCC ID:	2APE3WCH-210	ISED ID:	23771-WCH210

Testing laboratory:	Molex CVS Lab, Molex CVS Bochum GmbH, Meesmannstr.103, 44807 Bochum, Germany		
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	e-mail:	Product.Validation.Bochum@molex.com	
	FCC designation no.:	DE0017	ISED recognition no.: DE0015
	Laboratory manager:	Jürgen Mitterer	

Test result	The EUT complies with the requirements made in the referred test documents.
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Approver:	Jürgen Mitterer	Technical Review:	Frank Wittmann
Title:	Laboratory Manager	Title:	Senior Test Engineer EMC

Signature:		Signature:	
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1. Summary for FCC Part 1 EMF test report

Date of receipt	04-Feb-2019
Testing completed	06-Feb-2019
The customer's contact person	Michael Schmidt
Notes	none

1.1. EUT and accessory information

The EUT is an inductive wireless power transfer device (wireless charger) with load modulation operating at 111 kHz. The highest output power is available at 111 kHz. The EUT is tested with a commercial available mobile phone with highest duty cycle of 100%. Same current consumption was observed between 5% and 95% charging level of the mobile phone, so that measurement was done at around 50%.

Product	Type	SN	HW	MV	SW	DUT
Wireless Charger Unit	WCH-210	9740271190040086	A0	-	52.0.2.0(RC16)	GRA190135E
Power Cable	--	--	--	--	--	GRA190139E
Mobile Phone	Galaxy S7	IMEI: 357810085825140	--	--	--	MPS7

1.2. Applied standards

Standard, Rule Part	Version	Year
CFR 47, FCC Part 2	-	Jan-2019
CFR 47, FCC Part 1	-	Jan-2019
KDB 680106 D01	v03	Apr-2018
ISED RSS-216	Issue 2	Jan-2016
ISED RSS-102	Issue 5	Mar-2015
SPR-002	Issue 1	Sep-2016
Safety Code 6	Issue 3	Mar-2015

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

1.3. Summary of test results

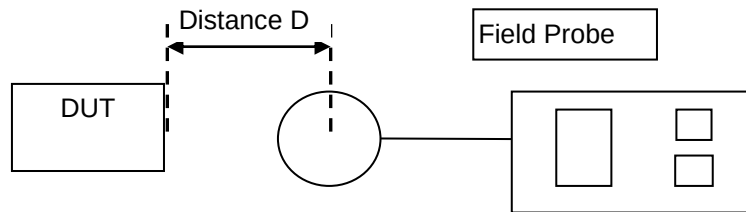
Section	Section in CFR 47	Section in RSS-102 / SC6	Name of the test	Result
3.2	1.1307(b), 1.1310	4 / 2.2.1	RF Exposure (H-field)	PASSED
3.3	1.1307(b), 1.1310	4 / 2.2.1	RF Exposure (E-field)	PASSED

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.

1.4. Measurement uncertainties

Parameter	Worst Case Uncertainty	Max. Uncertainty
H-field probe 100 cm ²	3.33 %	< 30 %
H-field probe 3 cm ²	4.17 %	
H-field level tester	12.60 %	
E-field probe + level tester	20 %	

2. EMF Test setup



3. RF Exposure (EMF)

EUT with DUT number	GRA190135E
Accessories with DUT numbers	MPS7 (mobile phone), GRA190139E (power cable)
Operation Voltage [V] / [Hz]	12 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	20 / 27
Date of measurements	04-Feb-2019 to 06-Feb-2019
Measured by	Ralf Lange

3.1. Test method and limit

The DUT is working on the operating frequency (111 kHz) with the highest output power (worst case). Measurement was performed at all sides of the DUT in 5 cm steps between 10 and 20 cm and in 1 cm steps between 1 and 10 cm, if possible.

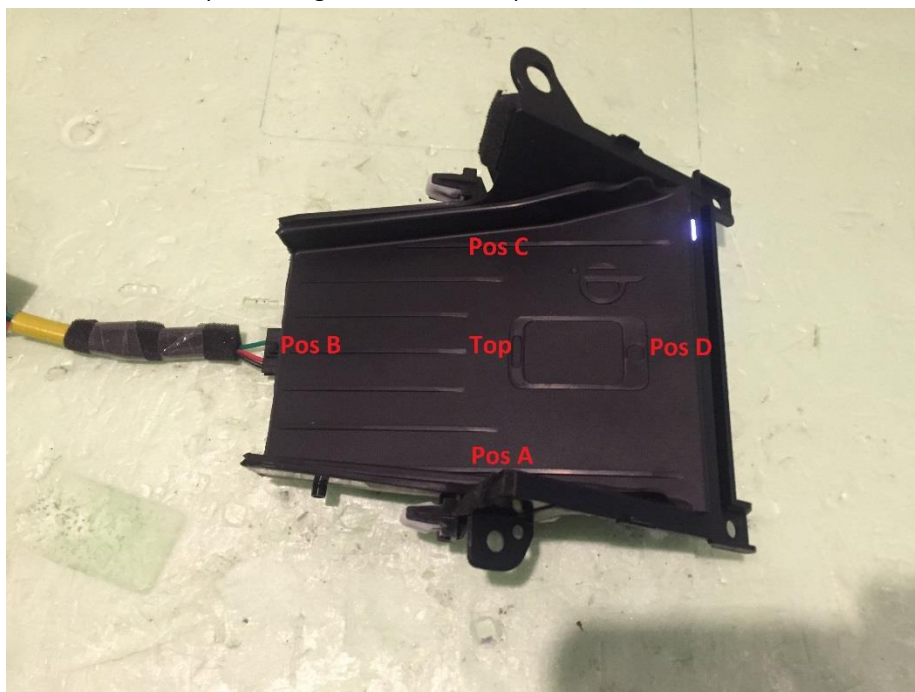
The mobile phone was placed in the center of the charging area of each coil (left, middle, right), one after another.

Minimum distance between the primary coil in the DUT and the secondary coil in the mobile phone (best coupling).

Different probes were used for E- and H-field measurement.

The highest emission level was recorded.

Side definition for positioning of E- and H-field probe



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

Note1: According to DUT operating frequency and installation definition, the limit in bold letters (300 kHz) was applied.

ISED limits for maximum permissible exposure

Frequency range [MHz]	Electric Field Strength Limit [V/m]	Magnetic Field Strength Limit [A/m]	Power Density [W/m ²]	Average Time [minutes]
RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
0.003 – 10	83	90	-	Instantaneous
0.1 – 10	-	0.73 / $f_{\text{[MHz]}}$	-	6
1.1 – 10	87 / $f_{\text{[MHz]}}^{0.5}$	-	-	6
10 – 20	27.46	0.0728	-2	6
20 – 48	58.07 / $f_{\text{[MHz]}}^{0.25}$	0.1540 / $f_{\text{[MHz]}}^{0.25}$	8.944 / $f_{\text{[MHz]}}^{0.5}$	6
48 – 300	22.06	0.05852	1.291	6
300 – 6000	3.142 $f_{\text{[MHz]}}^{0.3417}$	0.008335 $f_{\text{[MHz]}}^{0.3417}$	0.02619 $f_{\text{[MHz]}}^{0.6834}$	6
6000 – 15000	61.4	0.163	10	6
15000 – 150000	61.4	0.163	10	616000 / $f_{\text{[MHz]}}^{1.2}$
150000 – 300000	0.158 $f_{\text{[MHz]}}^{0.5}$	4.21 x 10 ⁻⁴ $f_{\text{[MHz]}}^{0.5}$	6.67 x 10 ⁻⁵ $f_{\text{[MHz]}}$	616000 / $f_{\text{[MHz]}}^{1.2}$

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

3.2. Test results H-field (FCC, ISED)

3.2.1 H-field (left coil)

Detector: RMS, Mode: 320 μ T, Range: normal, Low Cut: 10 Hz

Distance [cm]	Level Pos A [A/m]	Level Pos B [A/m]	Level Pos C [A/m]	Level Pos D [A/m]	Level Top [A/m]	Level Bottom [A/m]	FCC Limit [A/m]	ISED Limit [A/m]	Result
20	-	-	-	-	0.26	-	1.63	90 / 6.58	PASSED
15	0.29	0.27	0.29	0.26	-	-	1.63	90 / 6.58	PASSED
10	0.31	0.29	0.31	0.28	0.29	0.32	1.63	90 / 6.58	PASSED
9	0.33	0.29	0.33	0.29	0.47	0.33	1.63	90 / 6.58	PASSED
8	0.35	0.30	0.37	0.29	0.56	0.37	1.63	90 / 6.58	PASSED
7	0.37	0.31	0.40	0.30	0.71	0.41	1.63	90 / 6.58	PASSED
6	0.43	0.46	0.47	0.33	0.91	0.49	1.63	90 / 6.58	PASSED
5	0.58	0.59	0.58	0.35	1.21	0.62	1.63	90 / 6.58	PASSED
4	0.85	0.80	0.78	0.42	1.63	0.81	1.63	90 / 6.58	PASSED
3	1.27	1.15	1.14	0.52	NP	1.13	1.63	90 / 6.58	PASSED
2.5	1.63	1.30	NP	0.57	NP	NP	1.63	90 / 6.58	PASSED
2	NP	NP	1.63	NP	NP	1.54	1.63	90 / 6.58	PASSED
1.6	NP	NP	NP	NP	NP	NP	1.63	90 / 6.58	PASSED

Note1: Measurement values were transformed from μ T to A/m, where 1 A/m = 1.256 μ T

Note2: Measurements for distances ≥ 6 cm were performed with 100 cm² H-field probe

Note3: Measurements for distances < 6 cm were performed with 3 cm² H-field probe

Note4: Result declaration relates only to the columns with measured values within each row

Note5: NP = Not Performed

Worst-case position H-field probe (left coil, Top, 4 cm)



3.2.2 H-field (mid coil)

Detector: RMS, Mode: 320 μ T, Range: normal, Low Cut: 10 Hz

Distance [cm]	Level Pos A [A/m]	Level Pos B [A/m]	Level Pos C [A/m]	Level Pos D [A/m]	Level Top [A/m]	Level Bottom [A/m]	FCC Limit [A/m]	ISED Limit [A/m]	Result
20	-	-	-	-	0.29	-	1.63	90 / 6.58	PASSED
15	0.28	0.28	0.29	0.27	-	-	1.63	90 / 6.58	PASSED
10	0.30	0.29	0.32	0.29	0.46	0.33	1.63	90 / 6.58	PASSED
9	0.32	0.30	0.33	0.29	0.54	0.34	1.63	90 / 6.58	PASSED
8	0.35	0.32	0.39	0.29	0.65	0.39	1.63	90 / 6.58	PASSED
7	0.41	0.33	0.45	0.30	0.83	0.45	1.63	90 / 6.58	PASSED
6	0.53	0.34	0.61	0.31	1.09	0.55	1.63	90 / 6.58	PASSED
5	0.78	0.40	0.85	0.33	1.50	0.69	1.63	90 / 6.58	PASSED
4.5	NP	NP	NP	NP	1.63	NP	1.63	90 / 6.58	PASSED
4	1.14	0.80	1.22	0.37	NP	0.92	1.63	90 / 6.58	PASSED
3.0	NP	1.18	NP	0.45	NP	1.27	1.63	90 / 6.58	PASSED
2.5	NP	1.63	NP	NP	NP	NP	1.63	90 / 6.58	PASSED
2	NP	NP	NP	0.57	NP	1.63	1.63	90 / 6.58	PASSED
1.6	NP	NP	NP	0.61	NP	NP	1.63	90 / 6.58	PASSED

Note1: Measurement values were transformed from μ T to A/m. where 1 A/m = 1.256 μ T

Note2: Measurements for distances ≥ 6 cm were performed with 100 cm² H-field probe

Note3: Measurements for distances < 6 cm were performed with 3 cm² H-field probe

Note4: Result declaration relates only to the columns with measured values within each row

Note5: NP = Not Performed

Worst-case position H-field probe (mid coil, Top, 4.5 cm)



3.2.3 H-field (right coil)

Detector: RMS. Mode: 320 μ T. Range: normal. Low Cut: 10 Hz

Distance [cm]	Level Pos A [A/m]	Level Pos B [A/m]	Level Pos C [A/m]	Level Pos D [A/m]	Level Top [A/m]	Level Bottom [A/m]	FCC Limit [A/m]	ISED Limit [A/m]	Result
20	-	-	-	-	0.31	-	1.63	90 / 6.58	PASSED
15	0.31	0.32	0.31	0.31	-	-	1.63	90 / 6.58	PASSED
10	0.44	0.43	0.37	0.37	0.69	0.43	1.63	90 / 6.58	PASSED
9	0.49	0.48	0.40	0.41	0.82	0.49	1.63	90 / 6.58	PASSED
8	0.60	0.56	0.45	0.46	0.98	0.59	1.63	90 / 6.58	PASSED
7	0.73	0.68	0.55	0.55	1.17	0.72	1.63	90 / 6.58	PASSED
6	0.92	0.85	0.66	0.65	1.38	0.92	1.63	90 / 6.58	PASSED
5	1.25	1.13	0.84	0.84	1.54	1.19	1.63	90 / 6.58	PASSED
4	1.63	1.48	1.08	1.15	1.63	1.47	1.63	90 / 6.58	PASSED
3.5	NP	1.63	NP	NP	NP	1.63	1.63	90 / 6.58	PASSED
3	NP	NP	1.36	1.63	NP	NP	1.63	90 / 6.58	PASSED
2	NP	NP	NP	NP	NP	NP	1.63	90 / 6.58	PASSED
1.6	NP	NP	NP	NP	NP	NP	1.63	90 / 6.58	PASSED

Note1: Measurement values were transformed from μ T to A/m. where 1 A/m = 1.256 μ T

Note2: Measurements for distances ≥ 6 cm were performed with 100 cm² H-field probe

Note3: Measurements for distances < 6 cm were performed with 3 cm² H-field probe

Note4: Result declaration relates only to the columns with measured values within each row

Note5: NP = Not Performed

Worst case position H-field probe (right coil, Pos A and Top, 4 cm)



3.3. Test results E-field (FCC, ISED)

3.3.1 E-field (left coil)

Detector: AVRG. Mode: V/m

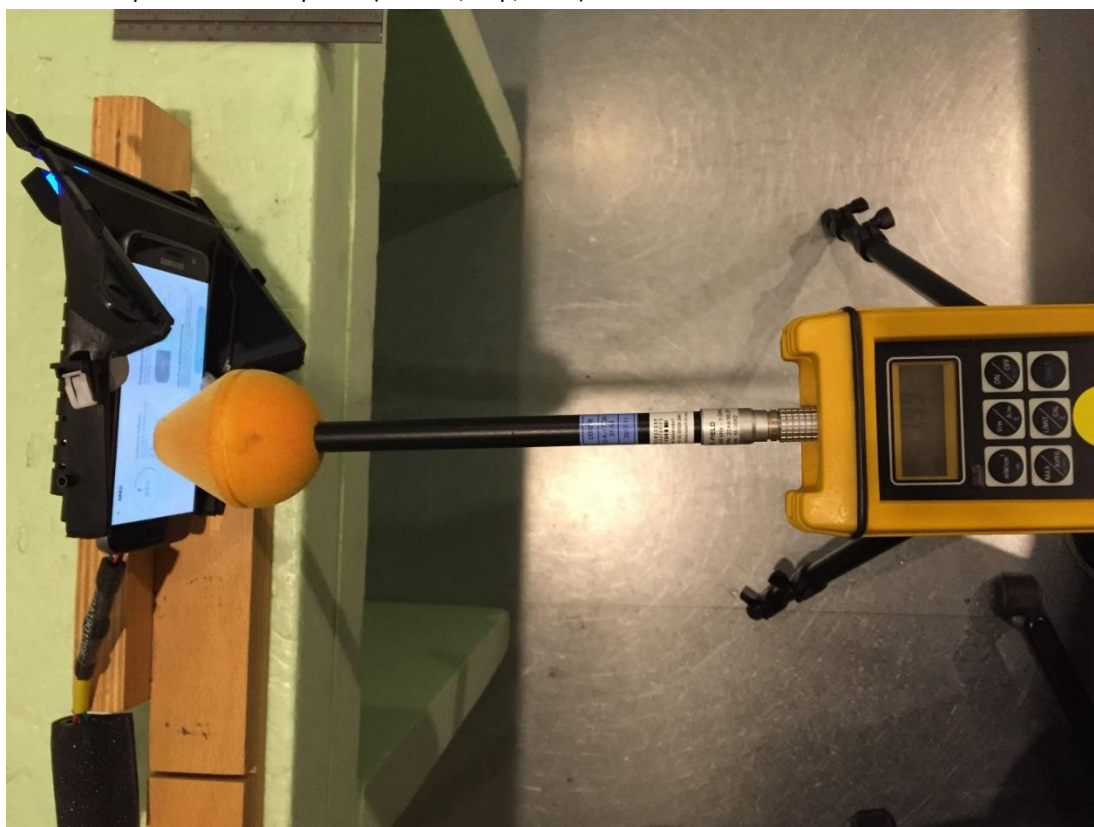
Frequency [kHz]	Distance [cm]	Level Pos A [V/m]	Level Pos B [V/m]	Level Pos C [V/m]	Level Pos D [V/m]	Level Top [V/m]	FCC Limit [V/m]	ISED Limit [V/m]	Result
111	10	0.47	0.44	0.39	0.53	0.60	614	83	PASSED
111	9	0.53	0.48	0.41	0.64	0.72	614	83	PASSED
111	8	0.66	0.55	0.49	0.74	0.84	614	83	PASSED
111	7	0.77	0.62	0.56	0.82	1.07	614	83	PASSED
111	6	0.87	0.75	0.71	0.88	1.29	614	83	PASSED
111	5	1.05	0.94	0.83	NP	1.63	614	83	PASSED
111	4	NP	1.34	NP	NP	1.99	614	83	PASSED

Note1: Measurements for distances ≥ 4 cm were performed with the E-field probe

Note2: Result declaration relates only to the columns with measured values within each row

Note3: NP = Not Performed

Worst case position E-field probe (left coil, Top, 4 cm)



3.3.2 E-field (mid coil)

Detector: AVR9. Mode: V/m

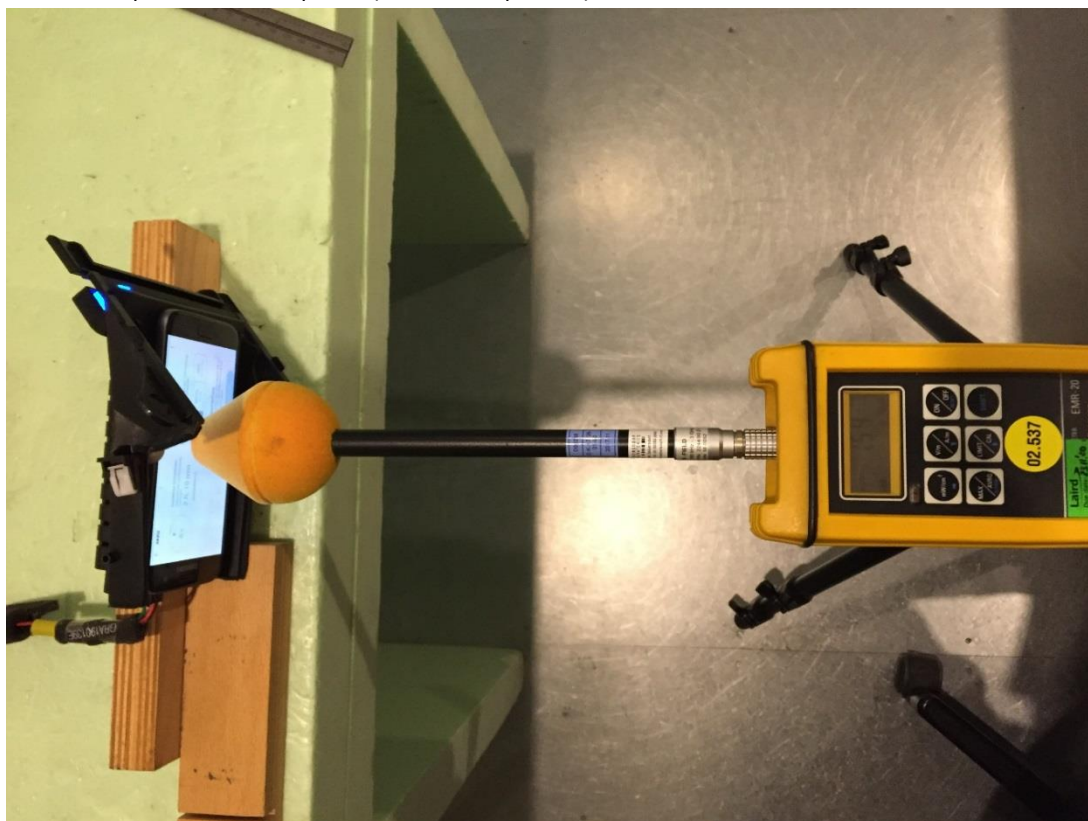
Frequency [kHz]	Distance [cm]	Level Pos A [V/m]	Level Pos B [V/m]	Level Pos C [V/m]	Level Pos D [V/m]	Level Top [V/m]	FCC Limit [V/m]	ISED Limit [V/m]	Result
111	10	0.51	0.37	0.76	0.38	0.63	614	83	PASSED
111	9	0.57	0.41	0.88	0.41	0.71	614	83	PASSED
111	8	0.65	0.59	1.07	0.46	0.80	614	83	PASSED
111	7	0.70	0.63	1.41	0.50	0.89	614	83	PASSED
111	6	0.76	0.72	1.81	0.78	1.14	614	83	PASSED
111	5	NP	0.93	NP	1.03	1.37	614	83	PASSED
111	4	NP	1.21	NP	1.13	1.54	614	83	PASSED

Note1: Measurements for distances ≥ 4 cm were performed with the E-field probe

Note2: Result declaration relates only to the columns with measured values within each row

Note3: NP = Not Performed

Worst case position E-field probe (mid coil, Top, 4 cm)



3.3.3 E-field (right coil)

Detector: AVR9. Mode: V/m

Frequency [kHz]	Distance [cm]	Level Pos A [V/m]	Level Pos B [V/m]	Level Pos C [V/m]	Level Pos D [V/m]	Level Top [V/m]	FCC Limit [V/m]	ISED Limit [V/m]	Result
111	10	0.56	0.30	0.61	0.47	0.81	614	83	PASSED
111	9	0.63	0.42	0.73	0.51	0.95	614	83	PASSED
111	8	0.77	0.49	0.88	0.55	1.11	614	83	PASSED
111	7	0.86	0.58	1.06	0.62	1.29	614	83	PASSED
111	6	1.02	0.70	2.12	0.78	1.52	614	83	PASSED
111	5	1.30	0.88	NP	0.91	1.76	614	83	PASSED
111	4	NP	1.12	NP	1.22	2.13	614	83	PASSED

Note1: Measurements for distances ≥ 4 cm were performed with the E-field probe

Note2: Result declaration relates only to the columns with measured values within each row

Note3: NP = Not Performed

Worst case position E-field probe (right coil, Top, 4 cm)



4. Test Equipment

Equipment	Manufacturer	Type	Serial No.	Actual Calibration	Next Calibration
Exposure Level Tester	Narda Safety Test Solutions GmbH	ELT-400	N-0385	07.12.2017	07.12.2020
H-field Probe 3 cm ²	Narda Safety Test Solutions GmbH	2300/90.20	C-0150	23.04.2018	23.04.2021
H-Field Probe 100 cm ²	Narda Safety Test Solutions GmbH	Probe	M-0823	07.12.2017	07.12.2020
Field Analyzer	Wandel & Goltermann	EMR20	P-0030	23.11.2017	23.11.2020
Isotropic Electric Field Probe	Wandel & Goltermann	Type 8	M-0082	23.11.2017	23.11.2020