TEST REPORT
No.: 18-1-0070201T07

According to:
FCC Regulations
§1.1310, §1.1307 (b)
§ 2.1091 & 2.1093

for

Laird Technologies, Inc.

Wireless Charging Unit WCH-209

FCC ID: 2APE3WCH-209

Laboratory Accreditation and Listings		
ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-00000-00-00 Accredited EMC-Test Laboratory	Industry Canada Reg. No.: 3462D-1 Reg. No.: 3462D-2 Reg. No.: 3462D-3	VCCI Voluntary Controls for Electromagnetic Emissions Reg. No.: R-4452, C-20009, T-20006, G-20013
Wi Fi ALLIANCE AUTHORIZED RF LABORATORY	ctia Authorized™ Test Lab Lab Code: 20011130-00	FCC MRA US-EU 0003
accredited according to DIN EN ISO/IEC 17025		

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Table of contents

1. Summary of test results

The test results apply exclusively to the test samples as presented in this Report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests.

The Equipment Under Test (in this report, hereinafter referred as EUT) is a wireless Mobile charger.
The wireless charger is operated at Frequency 111kHz.

TEST OVERVIEW

No. of Diagram group	Test Cases	Port	References, Standards & Limits		EUT set-up	EUT op-mode	Measured values	Result
			FCC	Limits				
1.1	Electric field strength	4cm – 15cm distance to EUT	§1.1310 §1.1307 (b) §2.1091 §2.1093	614 (V/m)	1	1	all values are below the regulatory limits	passed
1.2	Magnetic field strength	1,6cm -20cm distance to EUT	§1.1310 §1.1307 (b) §2.1091 §2.1093	1.63 (A/m)	1	1	all values are below the regulatory limits	passed

Remark:
Following tests have been performed to show compliance with applicable Standards:
FCC §1.1310, §1.1307 (b), §2.1091 §2.1093
OET Bulletin 65 Supplement C
KDB 680106 D01 V03.

Digital unterschrieben von Niels Jeß
DN: cn=Niels Jeß, o=CETECOM GmbH, ou=Branch Duesseldorf, email=niels.jess@cetecom.com, c=DE
Datum: 2018.10.05 15:35:06 +02'00'

Digital signiert von: Wolfgang Markus
Name: CN = Wolfgang Markus email = wolfgang.markus@cetecom.com C = DE O = CETECOM GmbH OU = RCEMC
Datum: 2018.10.05 13:55:50 +01'00'

.....
Dipl.-Ing. Niels Jeß
Responsible for test section

.....
W. Markus
Responsible for test report

2. Administrative Data

2.1. Identification of the testing laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Dipl.-Ing. Niels Jeß

2.2. Test location

2.2.1. Test laboratory "CTC"

Company name:	see chapter 2.1. Identification of the testing laboratory

2.3. Organizational items

Responsible for test report :	W. Markus
Receipt of EUT:	2018-08-31
Date(s) of test:	2018-09-23
Date of report:	2018-10-01
Version of template: 12.11	

2.4. Applicant's details

Applicant's name:	Laird Technologies, Inc.
Address:	8100 Industrial Park Dr. Grand Blanc, MI, 48439 USA
Contact person:	Ms. Rhonda Turner

2.5. Manufacturer's details

Manufacturer's name:	Laird Wireless Shanghai Ltd.
Address:	398 Lane 3088 Hua'ning Road Shanghai 201108 China

3. Equipment under test (EUT)

3.1. Technical data of main EUT declared by applicant

Main function	☒ Wireless Power Transfer		
Type	WCH-209b		
Frequency range	Fixed frequency 111kHz for wireless charging		
Antenna Type	☒ Integrated (coil type) ☐ External, no RF- connector ☐ External, separate RF-connector		
Power supply	☒ 12V DC		
Special EMI components	--		
EUT sample type	☒ Production	☐ Pre-Production	☐ Engineering
FCC label attached	☐ yes	☒ no	

3.2. EUT: Type, S/N etc. and short descriptions used in this test report

Short descrip-tion*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	Wireless Charging Unit	Wireless Power Transfer Device WCH-209b	711822802000 0003	4.0	RC11

*) EUT short description is used to simplify the identification of the EUT in this test report.
Remark: The type WCH-209 has two variants, WCH-209a and WCH-209b. All tests are performed with only one variant, WCH-209b. The customer has declared a "Declaration of Similarity" for it.

3.3. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

AE short descrip-tion *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	Samsung Mobile Phone	Samsung Galaxy S7	R58J46PML VK	--	--

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

3.4. EUT set-ups

EUT set-up no.*)	Combination of EUT and AE	Remarks
Set. 1	EUT A + AE 1	--

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

3.5. EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	Wireless charging	Wireless charging was activated The EUT is transferring power to AE1

*) EUT operating mode no. is used to simplify the test report.

3.6. Additional declaration and description of EUT

Set up 1	☐ table-top ☐ floor-standing ☐ wall-mounted ☒ not defined	typical use ☐ portable use ☐ fixed use ☒ vehicular use
Place of use	☐ Residential, commercial and light industry ☐ Industrial environment ☒ vehicular use	
Highest internal frequency generated by EUT	☒ 111kHz	
typical operating cycle of EUT	☒ < 0,5 sec. ☐ :	
Power line: ☐ AC ☐ 120V, ☐ 230V, ☐ 400V ☐ PE, ☐ N, ☐ L1, ☐ L2 ☐ L3 ☐ ___Hz ☒ DC ☐ 5V, ☒ 12.0V ☐ 24V	EUT-grounding: ☒ none ☐ with power supply ☐ additional: (in case of deviation during tests the single details are described on chapter 4)	

Other Ports (description of interconnecting cables) Description	Connector	possible total cable length	shielding	connected during test
1. Main	Multi pin	☒ < 3m ☐> 3m ☐ : other	☐ screened ☒ unscreened	☒ yes ☐ no
Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrodynamics microphones, etc.?				☐ yes ☒ no
Is mounting position / usual operating position defined?				☐ yes ☒ no

Remark

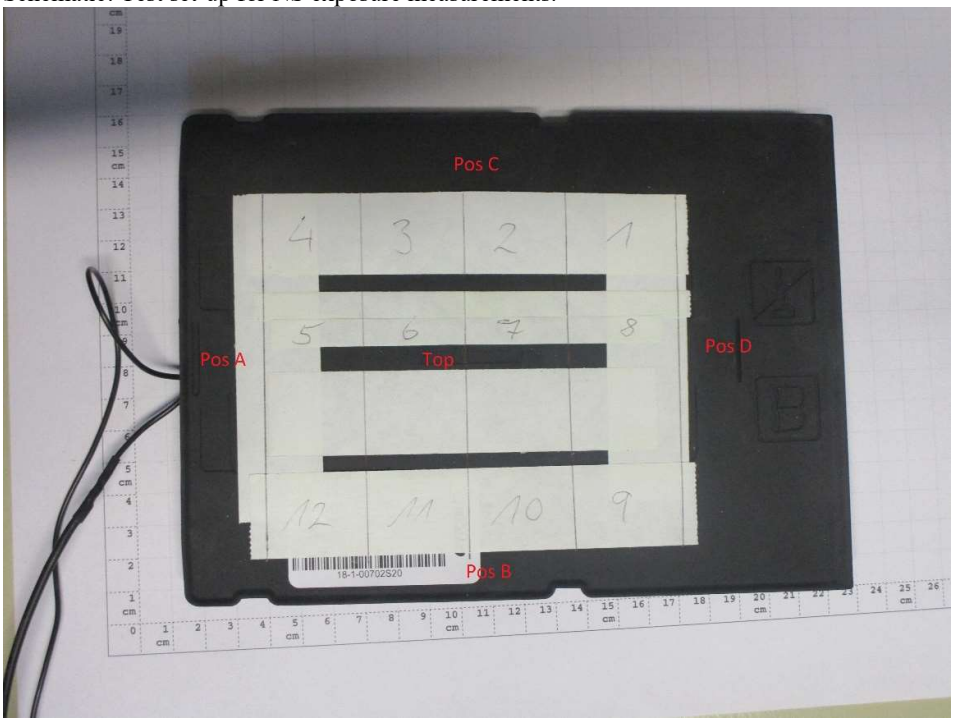
4. DESCRIPTION OF TEST SET-UP's

4.1. Test Set-up for configuration

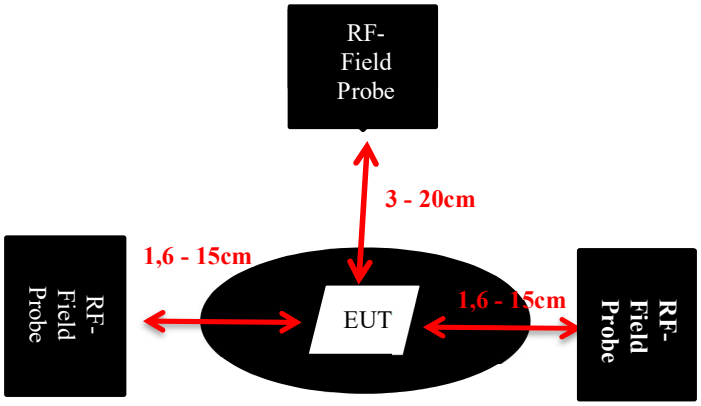
The RF exposure test is performed in shielded room.

The EUT was placed on a table.
The measurement probe was moved at a distance of 1,6-20cm (H-Field) and 4-15cm (E-Field) from the EUT at 12 different points

Schematic: Test set-up for NS exposure measurements:



Position of E-Field and H-Field probe



Schematic: Test set-up for Rf exposure measurements

5. Maximum Permissible RF Exposure

5.1.FCC References & Limits

FCC Rules: §1.1310, § 2.1093

The criteria used for the evaluation of human exposure to radio frequency radiation is listed in table 1 according FCC §1.1307(b, except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this.

Note 1 to table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provide those persons are fully aware for a exposure and can control over their exposure. Limits for occupational/controlled exposures also apply in situations when an individual is transient through a location where occupational/controlled apply provided he or she is made aware of the potential for exposure.

Note 2 to table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz

So applicable limits in this case are as follows:

§1.1310 LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)
Table 1(B) Limits for General Population/Uncontrolled Exposure

0.3–1,34 MHz: Electric field: 614 V/m

0.3–1,34 MHz: Magnetic field: 1.63 A/m

5.2. E-Field Results

5.2.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	☒ CETECOM Essen (Chapter 2.2.1)		☐ Please see Chapter 2.2.2		☐ Please see Chapter 2.2.3	
equipment	☒ 686 EHP-200A	☒ ELT 400 NARDA	☐	☐	☐	☐
signaling	☐ 017 CMD 65	☐ 323 CMD 55	☐ 340 CMD 55			
signaling	☐ 298 CMU	☐ 460 CMU	☐ 295 RACAL	☐ 392 MT8820A		
line voltage	☒ 12V DC					

5.2.2. Test condition and test set-up

link to test system (if used):	☐ air link	☐ cable connection	
EUT-grounding (if different to chapter 3.5)	☐ none	☐ with power supply	☐ additional connection
Equipment set up	-		-
Climatic conditions	Temperature: 24 °C		Rel. humidity: 31 %

5.2.3. Results

Left coil

EUT Type and S/N or EUT set-up no.		EUT set-up 1						
EUT operating mode or operating mode no.		EUT operating mode 1						
Frequency Range (kHz)	Distance between EUT and Field probe (m)	E-field (V/m)					E-field Limit (V/m)	Result
		A	B	C	D	Top		
111	0.02	NP	NP	NP	NP	NP	614	passed
111	0.03	NP	NP	NP	NP	NP	614	passed
111	0.04	0,79	1,22	2,01	0,59	**3,69**	614	passed
111	0.05	0,71	1,12	1,69	0,51	2,39	614	passed
111	0.06	0,61	1,01	1,42	0,45	1,84	614	passed
111	0.07	0,55	0,81	1,20	0,40	1,63	614	passed
111	0.08	0,41	0,69	1,07	0,38	1,54	614	passed
111	0.09	0,38	0,52	0,90	0,35	1,41	614	passed
111	0.10	0,30	0,41	0,69	0,30	1,12	614	passed
111	0.15	0,21	0,31	0,48	0,22	0,93	614	passed
111	0.20	0,12	0,20	0,31	0,10	0,78	614	passed
111	0.30	0,07	0,13	0,14	0,02	0,57	614	passed
111	0.50	--	--	--	--	0,12	614	passed
NP = not performed								

Remark: measured on all 12 postions shown in the schematic picture. Only the max value was recorded and noted
Measurement values were transformed from µT toA/m, where 1 A/m = 1.256 µT

middle coil

EUT Type and S/N or EUT set-up no.		EUT set-up 1						
EUT operating mode or operating mode no.		EUT operating mode 1						
Frequency Range (kHz)	Distance between EUT and Field probe (m)	E-field (V/m)					E-field Limit (V/m)	Result
		A	B	C	D	Top		
111	0.02	NP	NP	NP	NP	NP	614	passed
111	0.03	NP	NP	NP	NP	NP	614	passed
111	0.04	0,72	0,95	1,71	0,55	**2,12**	614	passed
111	0.05	0,61	0,81	1,21	0,51	1,78	614	passed
111	0.06	0,52	0,72	1,03	0,48	1,52	614	passed
111	0.07	0,46	0,60	0,95	0,40	1,31	614	passed
111	0.08	0,31	0,51	0,69	0,36	1,22	614	passed
111	0.09	0,30	0,42	0,59	0,30	0,95	614	passed
111	0.10	0,27	0,36	0,45	0,28	0,79	614	passed
111	0.15	0,20	0,31	0,38	0,19	0,68	614	passed
111	0.20	0,13	0,19	0,22	0,11	0,53	614	passed
111	0.30	0,02	0,11	0,13	0,02	0,42	614	passed
111	0.50	--	--	--	--	0,19	614	passed
NP = not performed								

Remark: measured on all 12 postions shown in the schematic picture. Only the max value was recorded and noted
Measurement values were transformed from µT toA/m, where 1 A/m = 1.256 µT

right coil

EUT Type and S/N or EUT set-up no.		EUT set-up 1						
EUT operating mode or operating mode no.		EUT operating mode 1						
Frequency Range (kHz)	Distance between EUT and Field probe (m)	E-field (V/m)					E-field Limit (V/m)	Result
		A	B	C	D	Top		
111	0.02	NP	NP	NP	NP	NP	614	passed
111	0.03	NP	NP	NP	NP	NP	614	passed
111	0.04	0,71	0,96	2,23	0,80	**3,30**	614	passed
111	0.05	0,65	0,82	2,02	0,69	2,97	614	passed
111	0.06	0,50	0,71	1,73	0,52	2,52	614	passed
111	0.07	0,42	0,59	1,55	0,41	2,21	614	passed
111	0.08	0,36	0,43	1,32	0,35	2,01	614	passed
111	0.09	0,35	0,39	1,01	0,31	1,63	614	passed
111	0.10	0,33	0,37	0,83	0,30	1,41	614	passed
111	0.15	0,21	0,29	0,68	0,21	1,28	614	passed
111	0.20	0,13	0,21	0,49	0,14	1,03	614	passed
111	0.30	0,04	0,12	0,17	0,03	0,85	614	passed
111	0.50	--	--	--	--	0,48	614	passed
NP = not performed								

Remark: measured on all 12 postions shown in the schematic picture. Only the max value was recorded and noted
Measurement values were transformed from µT toA/m, where 1 A/m = 1.256 µT

5.3. H-Field Results

5.3.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	☒ CETECOM Essen (Chapter 2.2.1)		☐ Please see Chapter 2.2.2		☐ Please see Chapter 2.2.3	
equipment	☒ 686 EHP-200A	☒ ELT 400 NARDA	☐	☐	☐	☐
signaling	☐ 017 CMD 65	☐ 323 CMD 55	☐ 340 CMD 55			
signaling	☐ 298 CMU	☐ 460 CMU	☐ 295 RACAL	☐ 392 MT8820A		
line voltage	☒ 12V DC					

5.3.2. Test condition and test set-up

link to test system (if used):	☐ air link	☐ cable connection	
EUT-grounding (if different to chapter 3.5)	☐ none	☐ with power supply	☐ additional connection
Equipment set up	-		-
Climatic conditions	Temperature: 24 °C		Rel. humidity: 31 %

left coil

EUT Type and S/N or EUT set-up no.		EUT set-up 1						
EUT operating mode or operating mode no.		EUT operating mode 1						
Frequency Range (kHz)	Distance between EUT and Field probe (m)	E-field (V/m)					H-field Limit (A/m)	Result
		A	B	C	D	Top		
111	0,016	0,72	0,70	1,57	0,56	NP	1,63	passed
111	0,02	0,61	0,63	1,49	0,51	NP	1,63	passed
111	0,03	0,46	0,47	1,11	0,44	NP	1,63	passed
111	0.04	0,35	0,38	0,81	0,39	**1,62**	1,63	passed
111	0.05	0,31	0,33	0,62	0,32	1,37	1,63	passed
111	0.06	0,19	0,18	0,41	0,19	1,01	1,63	passed
111	0.07	0,13	0,15	0,38	0,12	0,79	1,63	passed
111	0.08	0,09	0,12	0,29	0,10	0,71	1,63	passed
111	0.09	0,06	0,09	0,21	0,08	0,52	1,63	passed
111	0.10	0,05	0,07	0,10	0,06	0,40	1,63	passed
111	0.15	0,03	0,04	0,04	0,04	0,03	1,63	passed
111	0.20	--	--	--	--	0,07	1,63	passed
111	0.50	--	--	--	--	--	1,63	passed
NP = not performed								

Remark: measured on all 12 postions shown in the schematic picture. Only the max value was recorded and noted

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

middle coil

EUT Type and S/N or EUT set-up no.		EUT set-up 1						
EUT operating mode or operating mode no.		EUT operating mode 1						
Frequency Range (kHz)	Distance between EUT and Field probe (m)	E-field (V/m)					H-field Limit (A/m)	Result
		A	B	C	D	Top		
111	0,016	0,75	0,59	0,84	0,41	NP	1,63	passed
111	0,02	0,68	0,51	0,76	0,36	NP	1,63	passed
111	0,03	0,53	0,43	0,61	0,35	NP	1,63	passed
111	0.04	0,38	0,31	0,41	0,30	**1,68**	1,63	passed
111	0.05	0,38	0,31	0,41	0,30	1,36	1,63	passed
111	0.06	0,31	0,28	0,39	0,21	1,21	1,63	passed
111	0.07	0,24	0,21	0,32	0,18	1,16	1,63	passed
111	0.08	0,18	0,16	0,21	0,16	1,12	1,63	passed
111	0.09	0,11	0,09	0,11	0,12	1,09	1,63	passed
111	0.10	0,09	0,07	0,07	0,10	0,82	1,63	passed
111	0.15	0,06	0,04	0,04	0,03	0,61	1,63	passed
111	0.20	--	--	--	--	0,22	1,63	passed
111	0.50	--	--	--	--	--	1,63	passed
NP = not performed								

Remark: measured on all 12 postions shown in the schematic picture. Only the max value was recorded and noted
Measurement values were transformed from µT toA/m, where 1 A/m = 1.256 µT

right coil

EUT Type and S/N or EUT set-up no.		EUT set-up 1						
EUT operating mode or operating mode no.		EUT operating mode 1						
Frequency Range (kHz)	Distance between EUT and Field probe (m)	E-field (V/m)					H-field Limit (A/m)	Result
		A	B	C	D	Top		
111	0,016	0,98	1,47	1,56	0,41	NP	1,63	passed
111	0,02	0,90	1,31	1,41	0,39	NP	1,63	passed
111	0,03	0,67	1,12	1,18	0,30	1,60	1,63	passed
111	0.04	0,41	0,86	0,62	0,28	**1,55**	1,63	passed
111	0.05	0,32	0,59	0,35	0,25	11,1	1,63	passed
111	0.06	0,26	0,42	0,23	0,13	0,98	1,63	passed
111	0.07	0,17	0,36	0,18	0,09	0,81	1,63	passed
111	0.08	0,15	0,25	0,15	0,08	0,69	1,63	passed
111	0.09	0,12	0,21	0,13	0,08	0,55	1,63	passed
111	0.10	0,10	0,18	0,10	0,07	0,26	1,63	passed
111	0.15	0,03	0,13	0,05	0,05	0,19	1,63	passed
111	0.20	--	--	--	--	0,09	1,63	passed
111	0.50	--	--	--	--	--	1,63	passed
NP = not performed								

Remark: measured on all 12 postions shown in the schematic picture. Only the max value was recorded and noted
Measurement values were transformed from µT toA/m, where 1 A/m = 1.256 µT

6. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved.
For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it's contribution to the overall uncertainty according it's statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

RF-Measurement	Frequency range	Calculated uncertainty based on a confidence level of 95%	Remarks:
Power Output conducted	9 kHz .. 20 GHz	1.0 dB	--
Power Output radiated	30 MHz .. 4 GHz	3.17 dB	Substitution method
Conducted emissions on antenna ports	9 kHz .. 20 GHz	1.0 dB	--
Radiated emissions enclosure	9 kHz .. 30 MHz	5.0 dB	Magnetic field
	9 MHz .. 1 GHz	5.0 dB	E-Field
	30 MHz .. 1 GHz	4.2 dB	E-Field
	1 GHz .. 20 GHz	3.17 dB	Substitution method
Occupied bandwidth	9 kHz .. 4 GHz	0.1272 ppm (Delta Marker)	Frequency error
		1.0 dB	Power
Emission bandwidth	9 kHz .. 4 GHz	0.1272 ppm (Delta Marker)	Frequency error
		1.0 dB	Power
Frequency stability	9 kHz .. 20 GHz	0.0636 ppm	--
Conducted emissions on AC-mains port (U_{CISPR})	9 kHz .. 150 kHz	4.0 dB	--
	150 kHz .. 30 MHz	3.6 dB	

Table: measurement uncertainties, valid for conducted/radiated measurements

7. Accreditation details of CETECOM's laboratories and test sites

Ref.-No.	Accreditation Certificate	Valid for laboratory area or test site	Accreditation Body
-	D-PL-12047-01-01	All laboratories and test sites of CETECOM GmbH, Essen	DAkkS, Deutsche Akkreditierungsstelle GmbH
337 487 558 348 348	MRA US-EU 0003	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem.	FCC, Federal Communications Commission Laboratory Division, USA (MRA US-EU 0003)
337 487 550 558	3462D-1 3462D-2 3462D-2 3462D-3	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR)	IC, Industry Canada Certification and Engineering Bureau
337 487 550 348	R-20013 G-20013 C-20009 T-20006	Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem.	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan
OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room			

8. Instruments and Ancillary

The “Ref.-No” in the left column of the following tables allows the clear identification of the laboratory equipment.

8.0.1. Single instruments and test systems

Ref .Nr	Equipment	Type	Serial Nr.	Manufacturer	Calibration	Next Calibration
686	Field Analyzer	EHP-200A	160WX30702	Narda Safety Test Solutions	29.03.2017	29.03.2019
--	Exposure Level Tester	ELT 400	N-0385	Narda Safety Test Solutions	07.12.2017	07.12.2020
--	H-Field Probe 3cm^2	Probe	M-0823	Narda Safety Test Solutions	20.05.2015	20.05.2018

9. Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2018-10-01

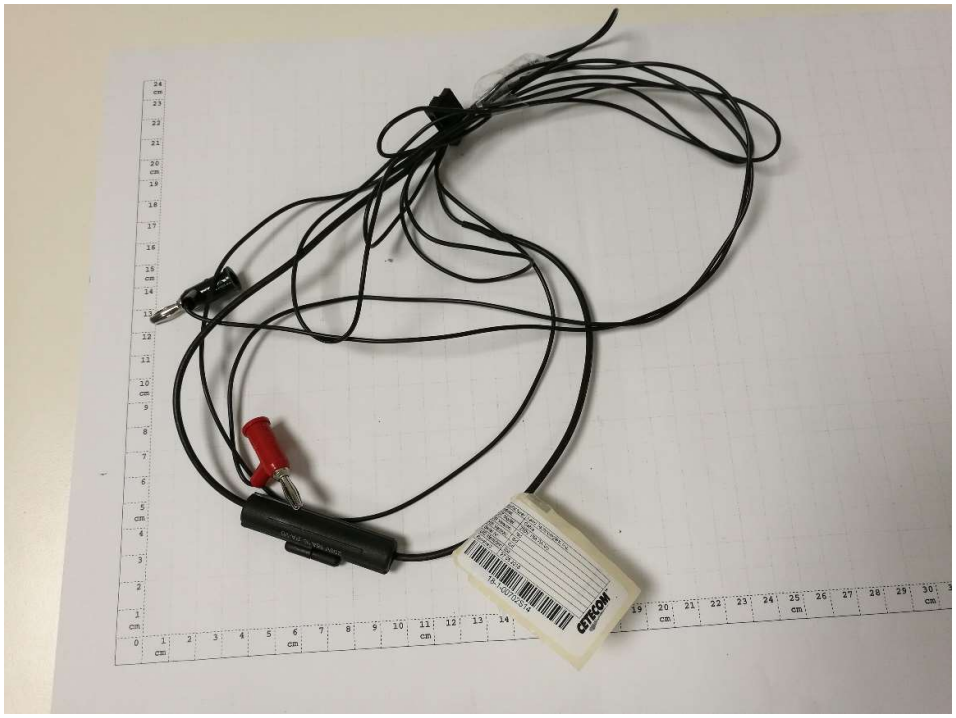
10. External photographs

10.1. Device under test (EUT/DUT)

Photograph 1: EUT A – Top Side

Photograph 2: EUT A – Rear Side

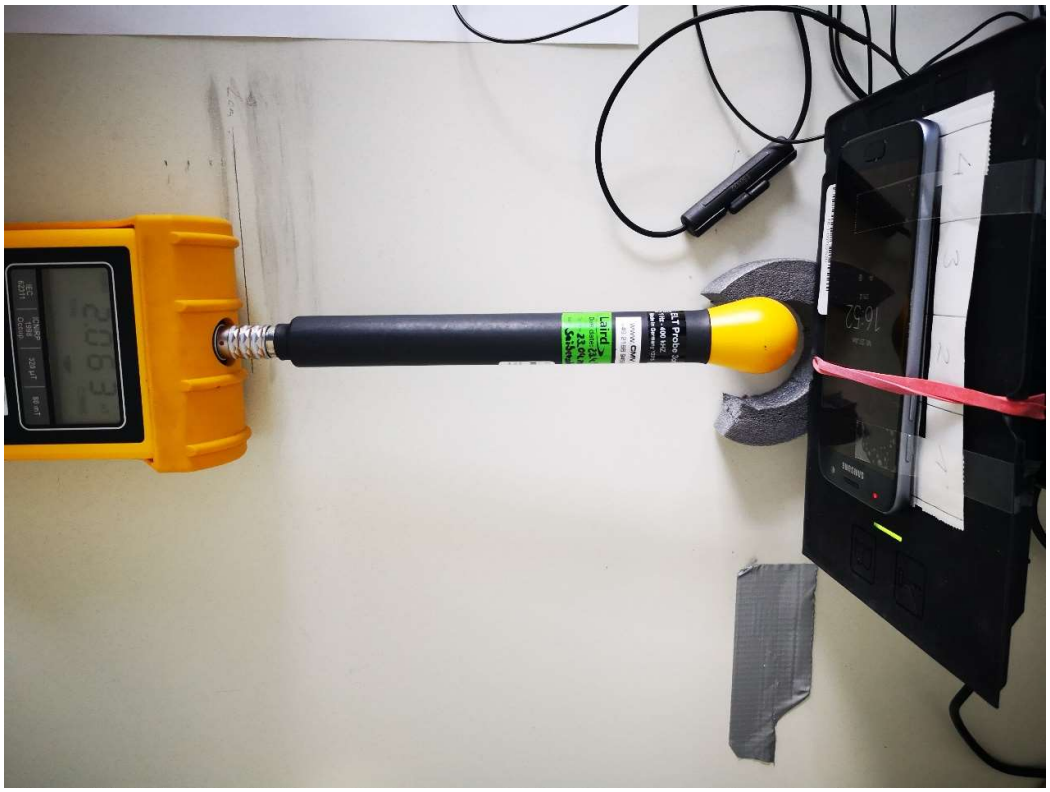
Photograph 3: EUT A – right side



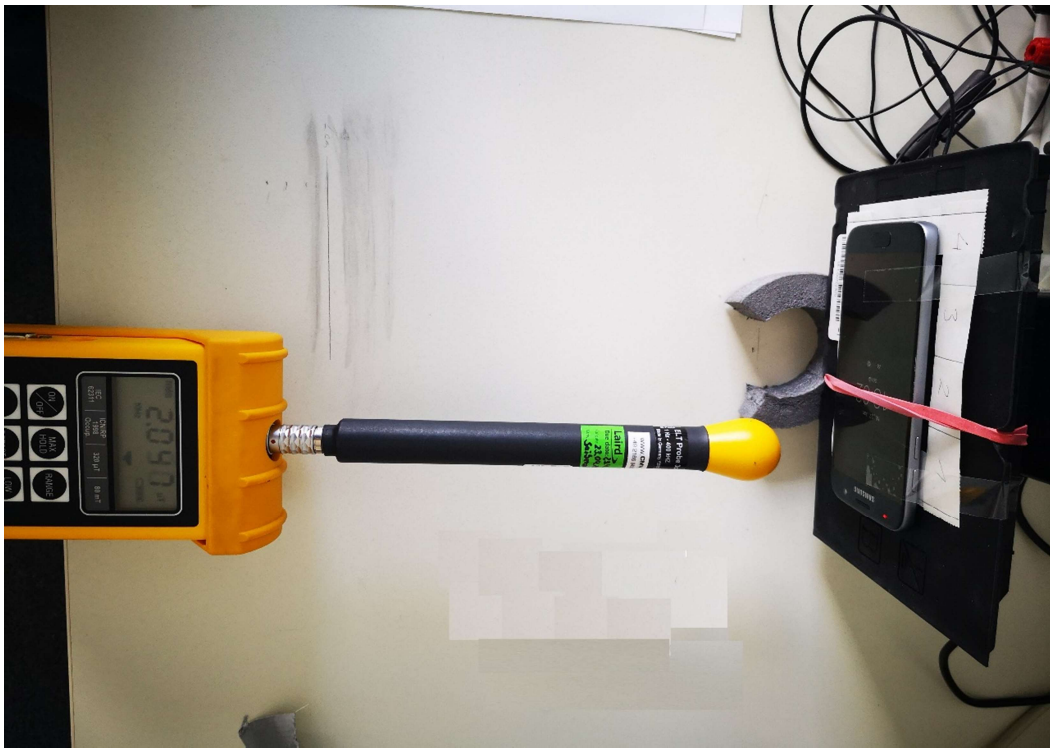
Photograph 4: EUT B

11. RF-exposure measurements

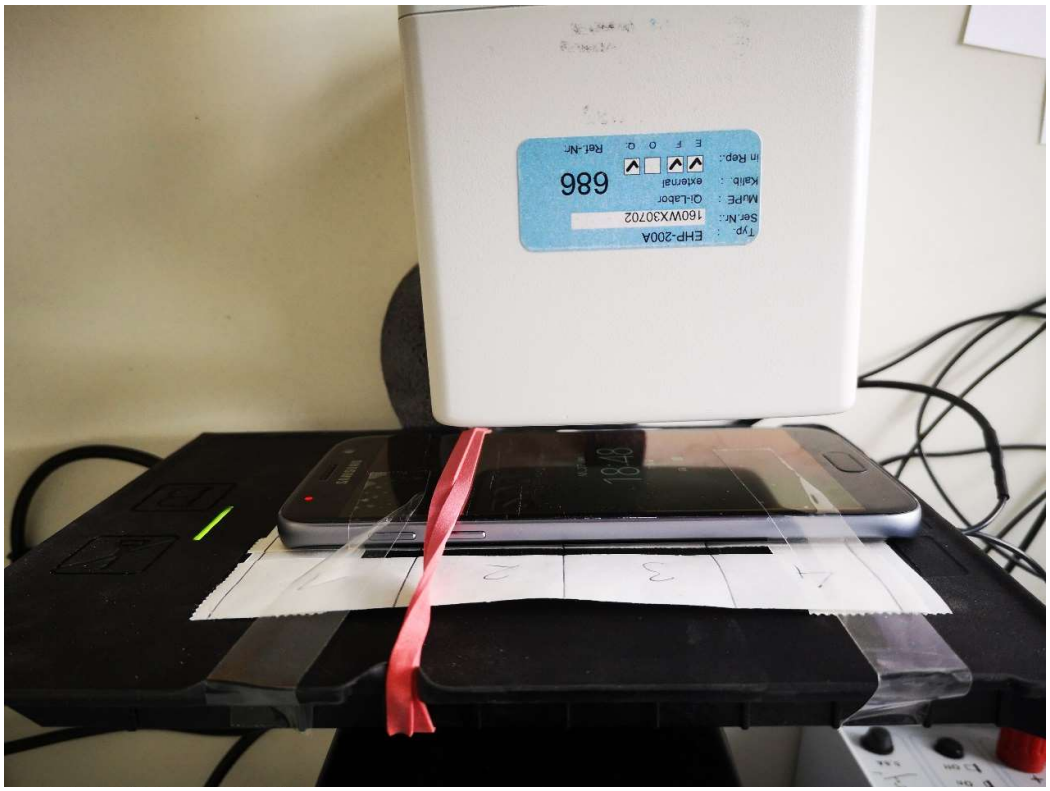
H-Field, worst case position, left coil, 4cm



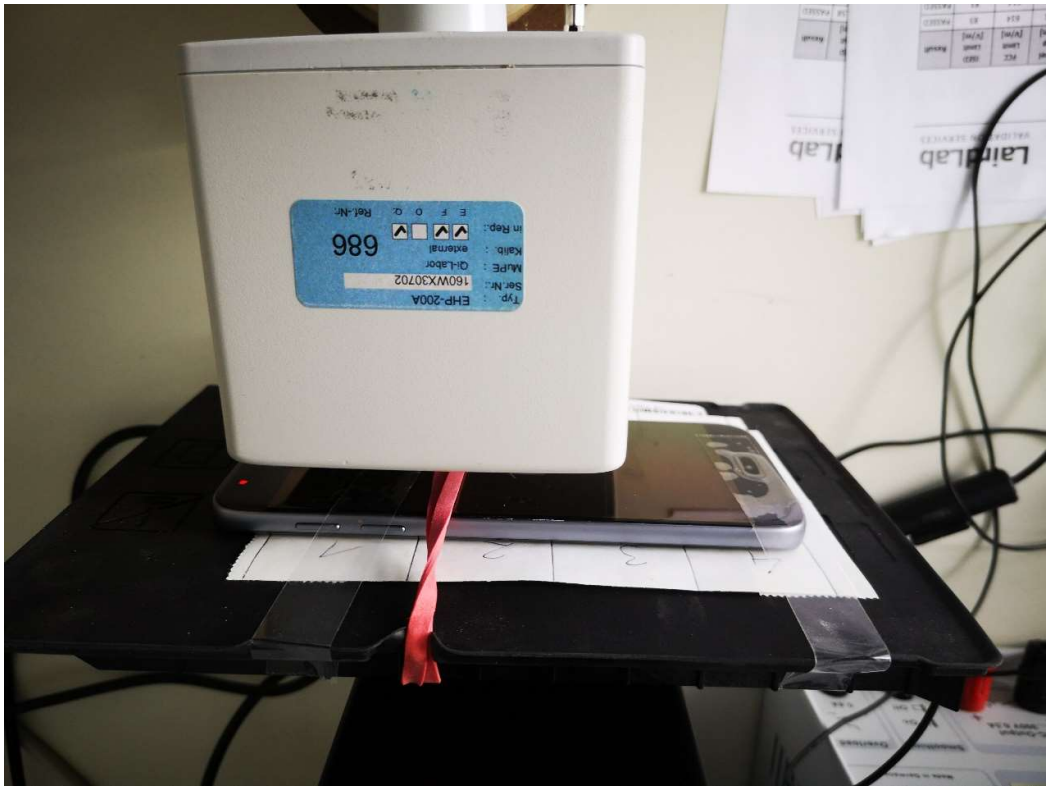
H-Field, worst case position, middle coil, 4cm



H-Field, worst case position, right coil, 4cm



E-Field, worst case position, left coil, 4cm



E-Field, worst case position, middle coil, 4cm

E-Field, worst case position, right coil, 4cm