
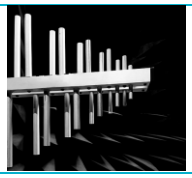
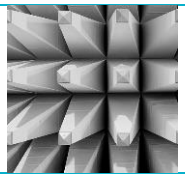

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test Report No.: 1-5652/17-01-77

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-03

Testing Laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken/Germany
Phone: + 49 681 5 98 - 0
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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-12076-01-03

Applicant

Bury GmbH & Co. KG
Robert-Koch-Str. 1-7
32584 Löhne/GERMANY
Phone: +49 5732 9706-100
Contact: Johann Dshus
e-mail: dshus@bury.com
Phone: -/-

Manufacturer

Bury Sp. Z o.o
ul. Wojska Polskiego4
39-300 Mielec / Poland

Test Standard/s

47 CFR - § 1.1310	Limits for Maximum permissible Exposure (MPE)

Test Item

Kind of test item:	Wireless charger / NFC reader	
Device type:	mobile device	
Model name:	**Koppelantenne Gen. 3**	
S/N serial number:	15 S (NFC) / NR.1a (Wireless charging)	
FCC-ID:	QZ9-KA3	
Sample number:	**15S**	**NR.1a**
Hardware status:	H09	H09
Software status:	0050	0050
Frequency:	**13.56 MHz**	**111 kHz**
Antenna:	integrated antenna	
Battery option:	12 V	
Accessories:	Key Card / representative mobile phones	
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:

Thomas Vogler
DN: cn=Thomas Vogler, o=CTC advanced GmbH, ou=VOG-161125, email=thomas.vogler@ctcadvanced.com, c=DE
Datum: 2019.02.27 15:24:02 +01'00'

Thomas Vogler
Lab Manager
Radio Communications & EMC

Test performed:

Marco Scigliano
cn=Marco Scigliano, o=CTC advanced GmbH, ou=SCI-161125, email=marco.scigliano@ctcadvanced.com, c=DE
2019.02.27 15:23:20 +01'00'

Marco Scigliano
Testing Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CTC advanced GmbH.
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2.2 Application details

Date of receipt of order:	2018-06-20
Date of receipt of test item:	2018-10-23
Start of test:	2018-10-24
End of test:	2019-01-17
Person(s) present during the test:	Mr Dshus

2.3 Statement of compliance

The EMF values found for the Koppelantenne Gen. 3 Wireless charger / NFC reader are below the maximum allowed levels according to the standards listed in section 3 at a minimum distance of **4 cm for NFC** and **5cm for wireless charging**.

2.4 RF exposure limits

According to **FCC KDB 680106 D01 Paragraph 3 RF Exposure Requirements clause 3** the Emission-Limits in the frequency range from 100 to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of **CFR 47 – Section 1.310** as following (measurement distance shall be 15cm from all sides).
KDB inquiry is not required with less than 50% of the MPE limit at 20cm from the center of the probe to the top side and 15cm from the center of the probe to the edge of the device):

	E-field	H-field	B-field
Frequency	V / m	A/m	µT
0.3 – 3.0 MHz	**614**	**1.63**	2.0
3.0 – 30 MHz	**824/f** ($=60.7_{13.56MHz}$)	**2.19/f** ($=0.161_{13.56MHz}$)	--

3 Summary of Measurement Results

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

The following minimum safety distances from the human body to the antenna is required for bystanders when the device is used for wireless charging or RFID scanning:

Technologies	**Safety distance [cm]**
Wireless Charging (111 kHz)	5
RFID / NFC (13.56 MHz)	4

4 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

5 Test Set-up

5.1 Measurement system

5.1.1 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

5.1.2 Test equipment list

	Manufacturer	Device	Type	Serial number	Last Calibration
☒	Narda	Electric and Magnetic Field Meter	NBM-550	F-0319	2017-01-18
☐	Narda	Electric and Magnetic Field Meter	NBM-520	D-1234	2017-05-08
☐	Narda	Electric Field Probe (100 kHz - 6 GHz)	EF 0691	G-0027	2017-01-18
☐	Narda	Electric Field Probe (100 MHz - 60 GHz)	EF 6092	A-0071	2017-05-08
☐	Narda	Magnetic Field Probe (300 kHz to 30 MHz)	HF 3061	D-0404	2017-01-18
☐	Narda	Electric and Magnetic Field Analyser (5 Hz – 100 kHz)	EHP-50D	230WX50108	2017-02-21
☒	Narda	Electric and Magnetic Field Analyser (5 Hz – 400 kHz)	EHP-50F	000WX60907	2016-08-25

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

5.1.3 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.

5.1.4 Uncertainties

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

5.1.4.1 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 10kHz	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%

5.1.4.2 Typical uncertainty of HF3061

Flatness of frequency response(a) Calibration uncertainty not included	0/-1 dB (500 to 800 kHz) +0.1/ -0.5 dB (800 kHz to 30 MHz)	
Calibration uncertainty(b) @ 0.59 mW/cm² (0.125 A/m)	1.3 dB	
Linearity Referred to 0.59 mW/cm² (0.125 A/m)	±3 dB (0.017 to 0.033 A/m) ±1 dB (0.033 to 0.068 A/m) ±0.5 dB (0.068 to 3 A/m) ±1 dB (3 to 16 A/m)	±3 dB (10 to 40 µW/cm²) ±1 dB (40 to 175 µW/cm²) ±0.5 dB (175 µW/cm² to 340 mW/cm²) ±1 dB (0.34 to 10 W/cm²)
Isotropic response(C)	±1 dB	
Temperature response	+0.2/ -0.8 dB (±0.025 dB/K @ 10 to 50 °C)	

(a) Frequency response can be compensated for by the use of correction factors stored in the probe memory
(b) Accuracy of the fields generated to calibrate the probes
(c) Uncertainty due to varying polarization (verified by type approval test for meter with probe). Ellipse ratio included and calibrated for each probe

5.1.5 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	
HF 3061	300 kHz – 30 MHz	0.0016	--	

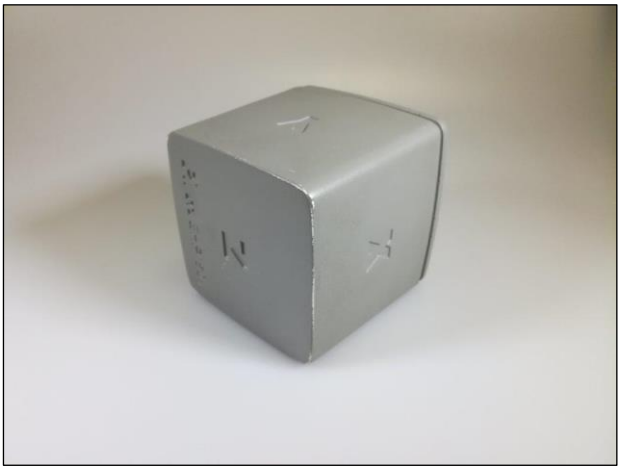
5.1.6 Definition of test position and distances

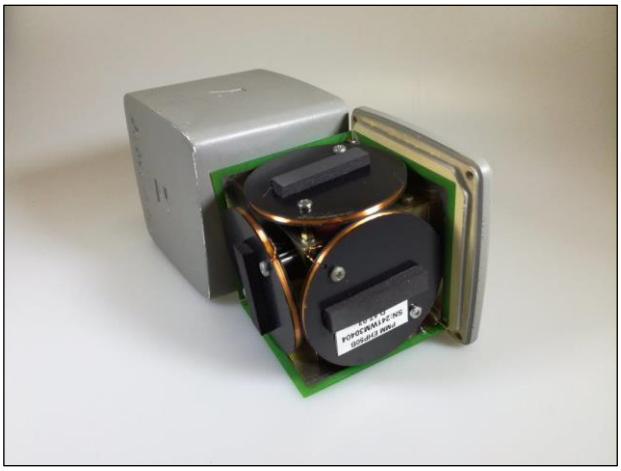
In absence of an equipment specific regulation with given test distances, all not further noted test positions were measured in “touched” mode, the probe radome touching the DUT at the defined test position.
Due to the mechanical concept of the used probe a distance between DUT surface and electrical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

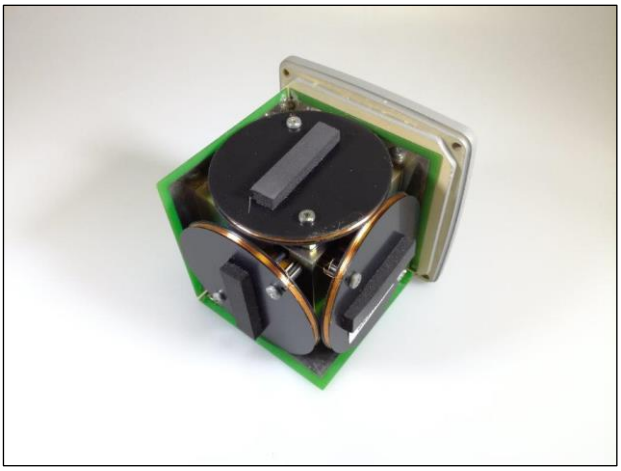
Probe type	Maximum distance (cm)	
	Magnetic Field	Electrical Field
HF 3061	5.5	--

With the z-axis of the EHP-50 probe pointing towards the EUT the z-axis coil has a dominant share of the measured magnetic field compared to the x- and y-coils.
Measurement results show that z-axis field strength is minimum 90% of the resultant field.
This effect has been taken into account when defining the measurement distance between EUT and probe center. The pictures below show the predecessor EHP-50B with cover removed to make this effect more transparent.

Probe type	Axis:	Maximum distance (cm)	
		Magnetic Field	Electrical Field
EHP-50F	z	1.5	8
	y	4	4
	x	4	4







5.2 Test results

Three different representative mobile phones where charged whilst the power consumption and field strengths where monitored to be consistent with 5 WATT power consumption and 0.8A current flow to provide equal field distributions. The differences in the measurements therefore resulted from the quality of the coupling between the mobile device and the reflections and deformations of the field because of the individual device.

Test positions see photo documentation (Annex A).
The distance has been measured between the edge of the device and the probe centre (determined by the position of the z-axis coil).

During the measurements the DUT was switched on in normal operating mode.

The nominal test distance has been determined to be 5 cm on customer request.
The test distance of 15 cm (according to KDB 680106) has been tested completely for the worst case out of 3 representative smart phones.
The KDB inquiry exclusion condition (20 cm from top and 15 cm from sides with less than 50% of the MPE limit) has been measured for all 3 test samples.

The representative devices were (left to right):

- Samsung Galaxy Note9
- Apple iPhone XR
- LG G7 ThinQ – LMG710EM

Detailed Device information:

Device:	Serial number:	Type:
Samsung Galaxy Note9	RFSK934MPDP	SM-N960F/DS
I Phone XR	n/a	n/a
LG – LMG710EM	B1100879	TELLG-0057

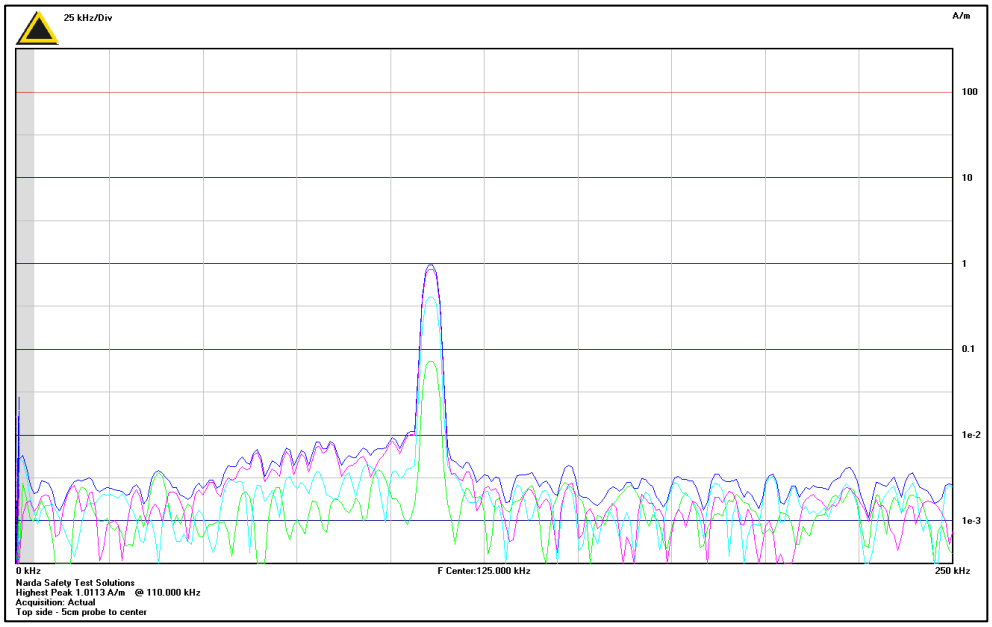
5.2.1 Wireless Charging 111kHz

Field strengths monitored during wireless charging for Samsung Galaxy Note9:

Wireless Charging 111 kHz averaged field strengths				
test position	distance (cm)	H (A/m)	Limit (A/m)	Probe
Top	5	**1.011**	**1.63**	EHP-50F
	20*	0.095	**1.63** [50% = 0.815]	
Left side	5	0.880	**1.63**	
	15*	0.180	**1.63** [50% = 0.815]	
Right side	5	0.621	**1.63**	
Front side	5	0.782	**1.63**	
Rear (cable) side	5	0.655	**1.63**	
bottom	5	0.463	**1.63**	
Charged device: Samsung Galaxy Note 9				

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

*) the measured field strength is below 50% off the applicate limit (0.815 A/m)

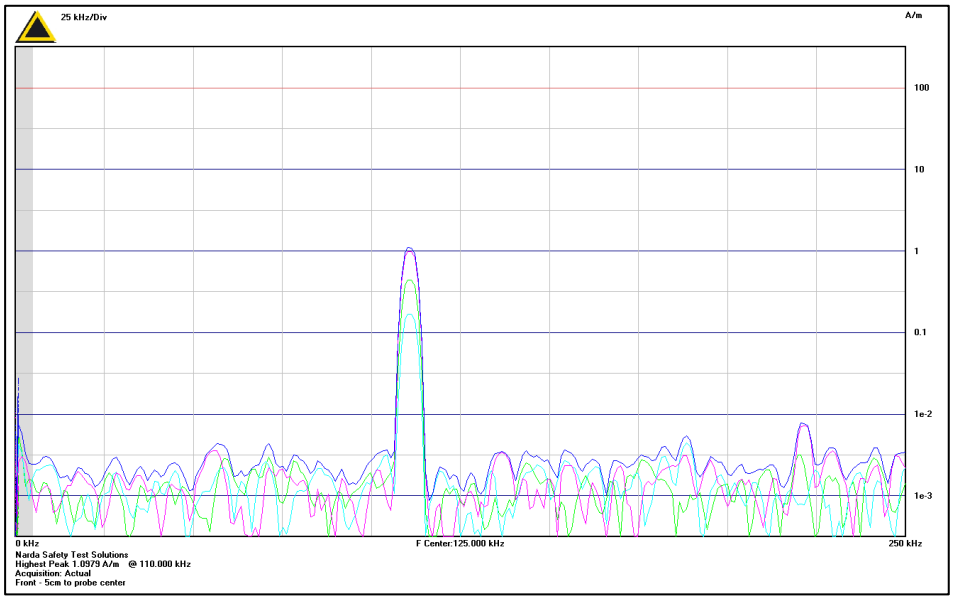


Field strengths monitored during wireless charging for I Phone XR:

Wireless Charging 111 kHz averaged field strengths				
test position	distance (cm)	H (A/m)	Limit (A/m)	Probe
Top	5	0.623	**1.63**	EHP-50F
	20*	0.025	**1.63**	
Left side	5	0.446	**1.63**	
Right side	5	0.527	**1.63**	
Front side	5	**1.110**	**1.63**	
	15*	0.068	**1.63**	
Rear (cable) side	5	0.221	**1.63**	
bottom	5	0.069	**1.63**	
Charged device: I Phone XR				

Table 2: Test results for H-field@111kHz

*) the measured field strength is below 50% off the applicate limit (0.815 A/m)

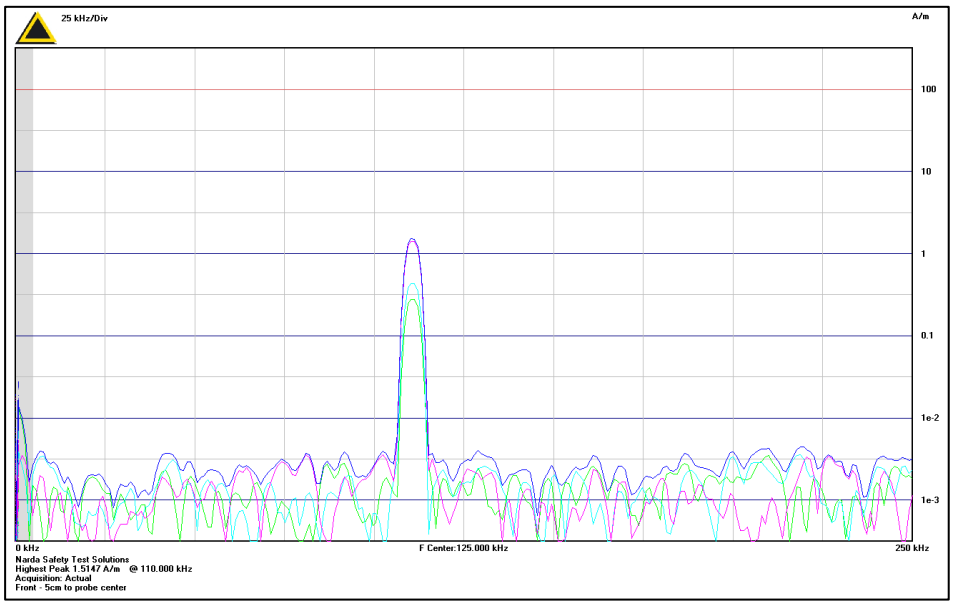


Field strengths monitored during wireless charging for LG – LMG710EM:

Wireless Charging 111 kHz averaged field strengths				
test position	distance (cm)	H (A/m)	Limit (A/m)	Probe
Top	5	1.277	**1.63**	EHP-50F
	20*	0.029	**1.63**	
Left side	5	0.771	**1.63**	
	15*	0.072	**1.63**	
Right side	5	0.712	**1.63**	
	15*	0.106	**1.63**	
Front side	5	**1.515**	**1.63**	
	15*	0.162	**1.63**	
Rear (cable) side	5	0.621	**1.63**	
	15*	0.048	**1.63**	
bottom	5	0.317	**1.63**	
	15*	0.027	**1.63**	
Charged device: LG - LMG710EM				

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

*) the measured field strength is below 50% off the applicate limit (0.815 A/m)



5.2.2 NFC / RFID 13.56 MHz

NFC 13.56 MHz averaged field strengths				
test position	distance (cm)	H (A/m)	Limit (A/m)	Probe
top	0	0.210	**0.161**	HF3061
	4	**0.055**	**0.161**	
side	0	0.020	**0.161**	

Table 4: Test results H-field@13.56MHz, peak values (max hold) divided by 2.

NOTE: The DUT has a duty cycle of 1 sec. ON and 1 sec. OFF, for NFC communication, thus for all AVG values were Peak measured and divided by 2.

5.3 Final verdict

The following minimum safety distances from the human body to the antenna is required for bystanders when the device is used for wireless charging or RFID scanning:

Technologies	Safety distance [cm]
Wireless Charging (111 kHz)	5
RFID / NFC (13.56 MHz)	4

Annex A: Photo documentation

Photo 1: DUT - Top side view

Photo 2: DUT - Bottom side view

Photo 3: DUT - Label (NFC) Test Sample

Photo 4: DUT - Label (NFC) Test Sample

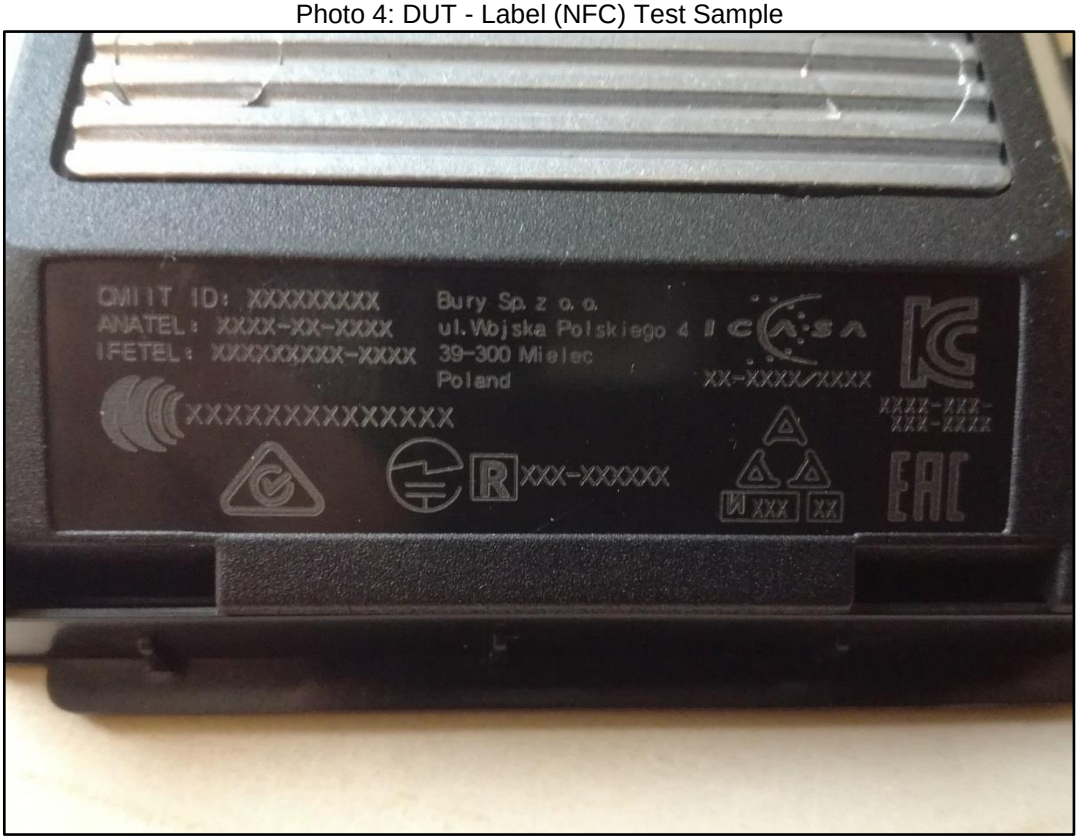


Photo 5: DUT - Label (NFC) Test Sample

Photo 6: DUT - Label (NFC) Test Sample

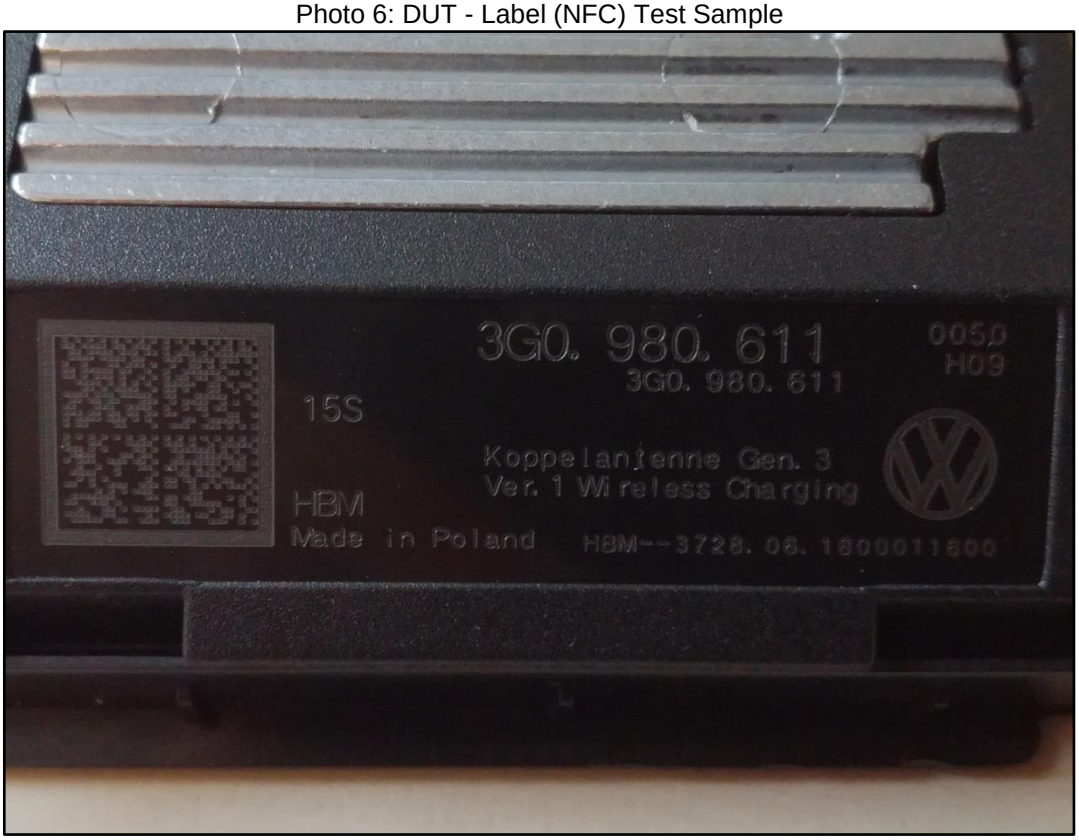


Photo 7: DUT - Label - Wireless charging Test Sample

Photo 8: DUT - Label - Wireless charging Test Sample

Photo 9: DUT - Label - Wireless charging Test Sample

Photo 10: DUT - Label - Wireless charging Test Sample

Photo 11: DUT - Label - Wireless charging Test Sample

Photo 12: AUXILARY - Key Card

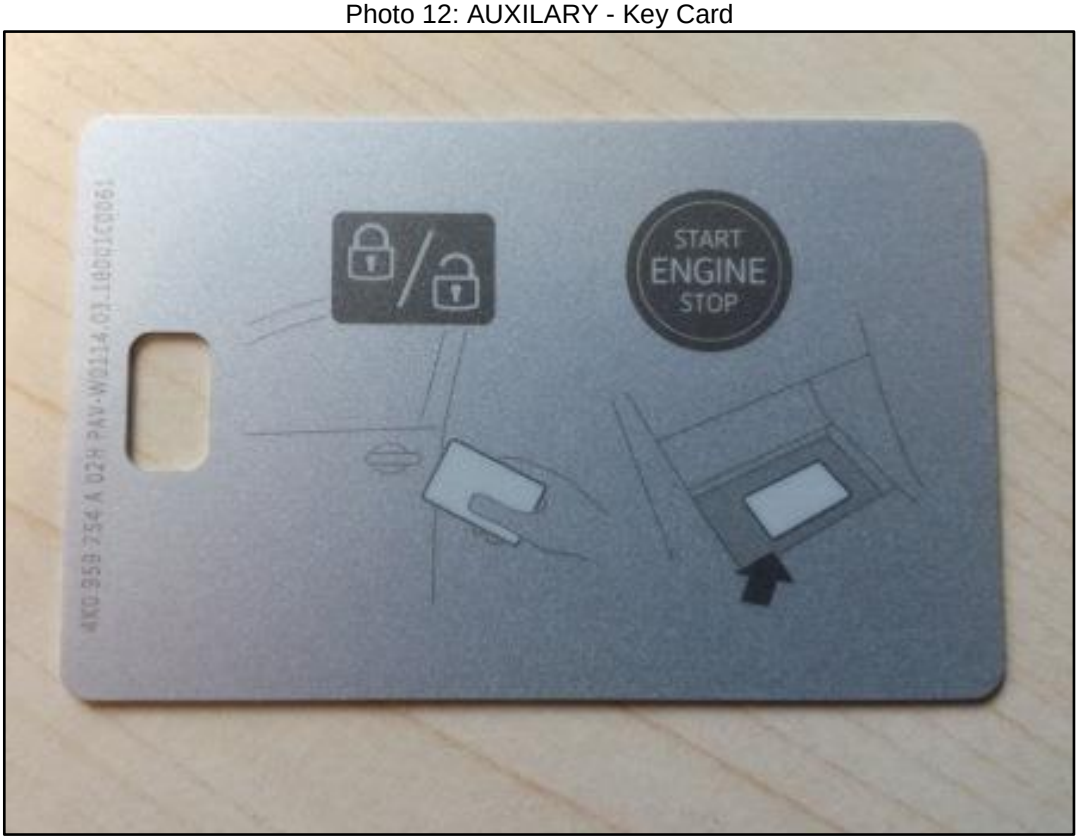


Photo 13: AUXILARY - Key Card

Photo 14: Test position - NFC with HF3061 probe (0mm distance)

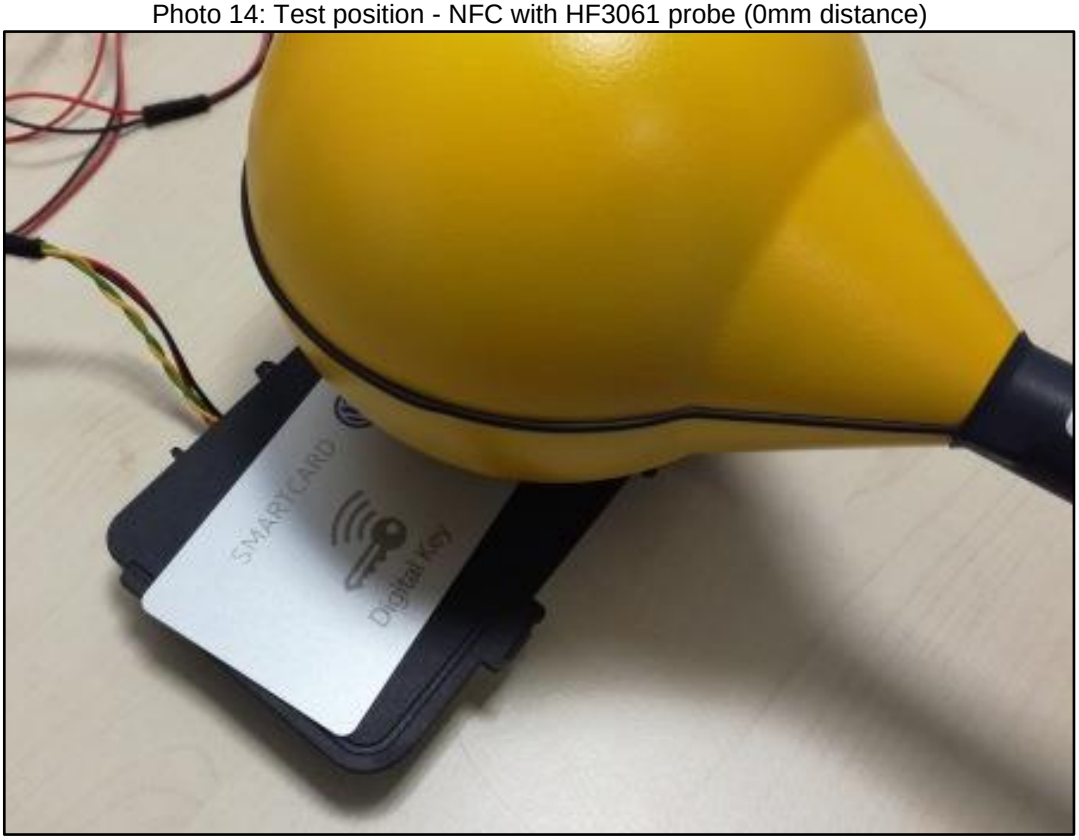


Photo 15: Test position - NFC with EF0691 probe (0mm distance)

Photo 16: Test Sample Orientations (with middle console holder)

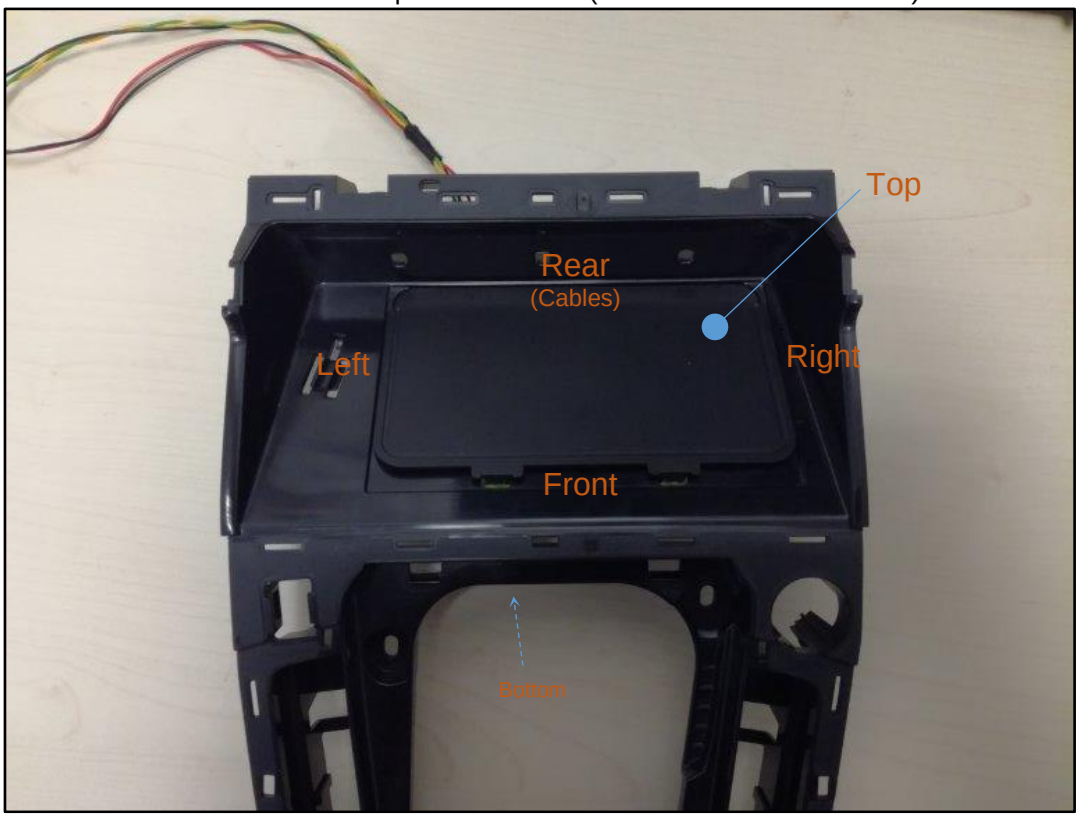


Photo 17: Test position – front side – Wireless charging with EHP50F probe
(LG – LMG710EM / 5cm distance)

Photo 18: Test position – top side – Wireless charging with EHP50F probe
(Samsung Galaxy Note9 / 5cm distance)

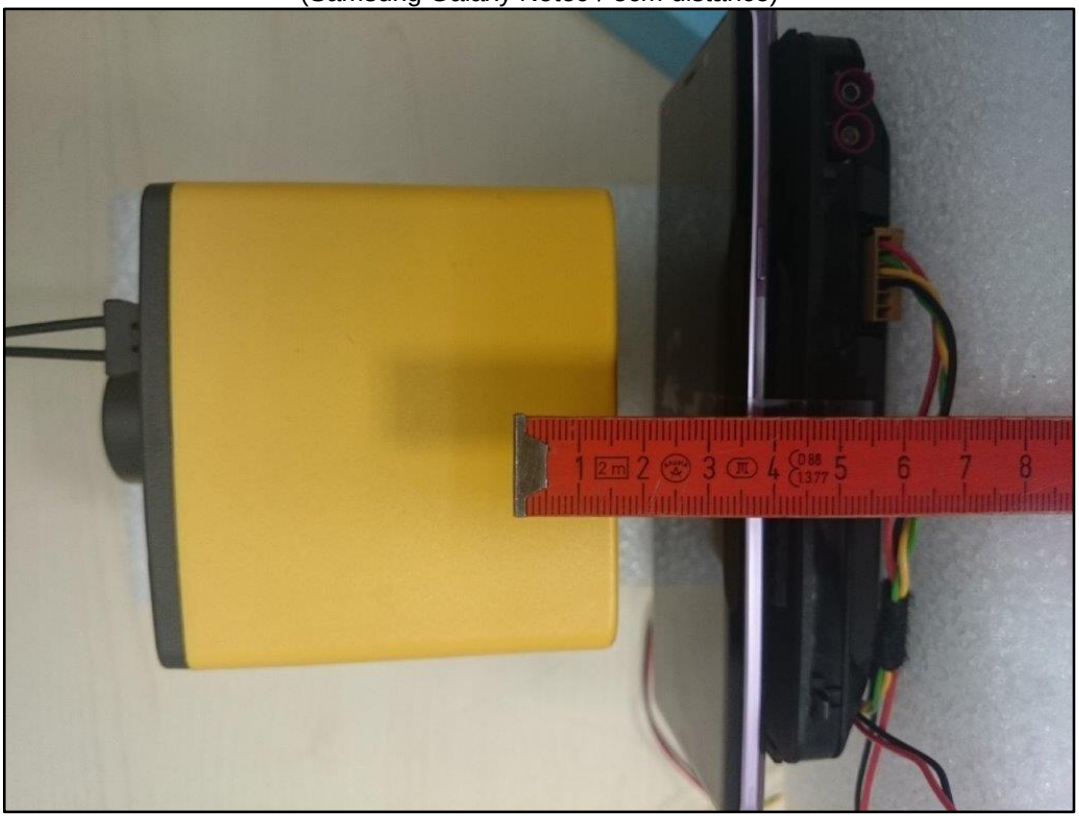
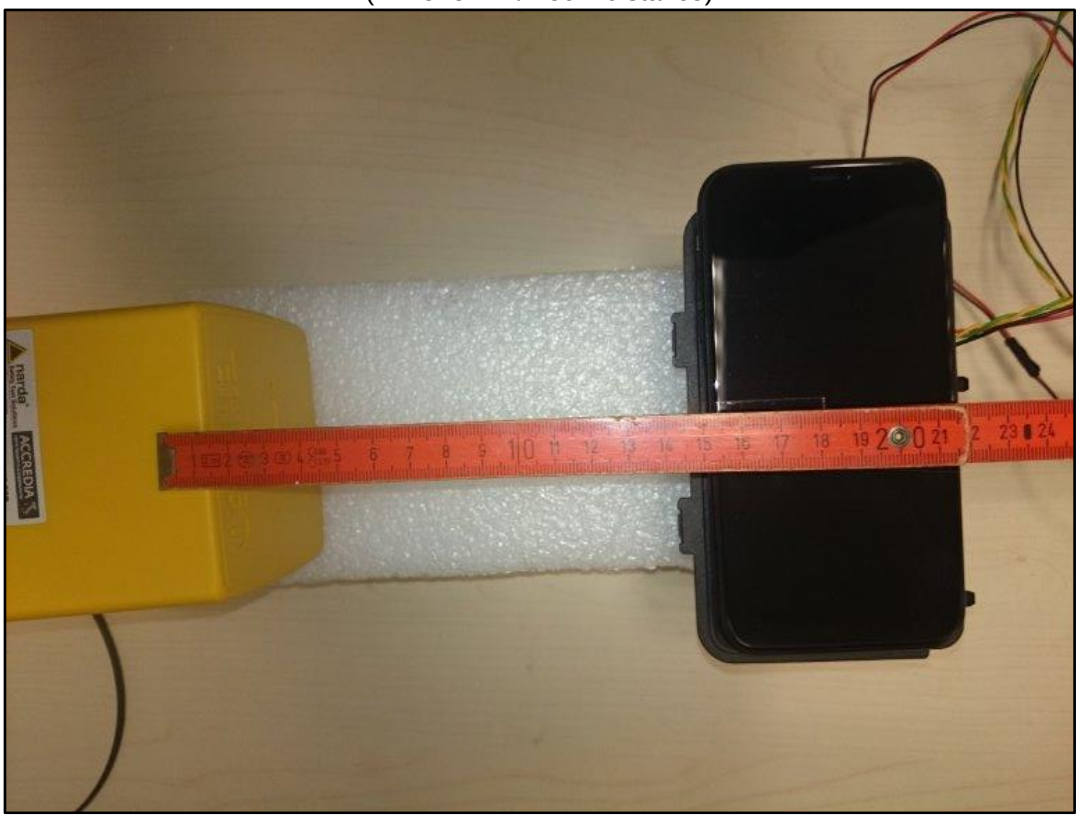


Photo 19: Test position – front side – Wireless charging with EHP50F probe
(I Phone XR / 15cm distance)



Annex B: Document History

Version	Applied Changes	Date of Release
	Initial Release	2019-01-24

Annex C: Further Information

Glossary

BW	-	Bandwidth
DTS	-	Distributed Transmission System
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
PCE	-	Personal Consumption Expenditure
OET	-	Office of Engineering and Technology
S/N	-	Serial Number
SW	-	Software