Report on the FCC Exposure Testing of

Continental Automotive GmbH
Wireless Power Charger with NFC,

Model: WCA NFC 2.0

In accordance with FCC CFR 47 Part 18

Add value.
Inspire trust.

Prepared for: 7Layers GmbH
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40880
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COMMERCIAL-IN-CONFIDENCE

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SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matthew Russell	RF Team Leader	Authorised Signatory	18 December 2020

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC CFR 47 Part 18: 2019.

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Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	18 December 2020

Table 1

1.2 Introduction

Applicant	7Layers GmbH
Manufacturer	Continental Automotive GmbH
Model Number(s)	WCA NFC 2.0
Serial Number(s)	ID:08
Hardware Version(s)	C2
Software Version(s)	009_001_004
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 18 (2019) Industrial, Scientific, and Medical Equipment
Order Number Date	PMDE20C026 02-December 2020
Date of Receipt of EUT	08-December 2020
Start of Test	14-December 2020
Finish of Test	14-December 2020
Name of Engineer(s)	Stephen Dodd
Related Document(s)	KDB 680106 D01 V03 RF exposure considerations for low power consumer wireless power transfer applications. FCC CFR 47 Part 1.1310 Radiofrequency radiation exposure limits.

1.3 Brief

Summary of Results

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 18 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Qi Wireless Power Transfer – 126.6 kHz:				
2.1	KDB 680106 D01 v03 Clause 3 c	Measurement of Electric and Magnetic field exposure	Pass	KDB 680106 FCC CFR 47 Part 1.1310

Table 2

1.4 Product Information

1.4.1 Technical Description

Wireless power charger for mobile phones, with NFC communication, integrated into cars.

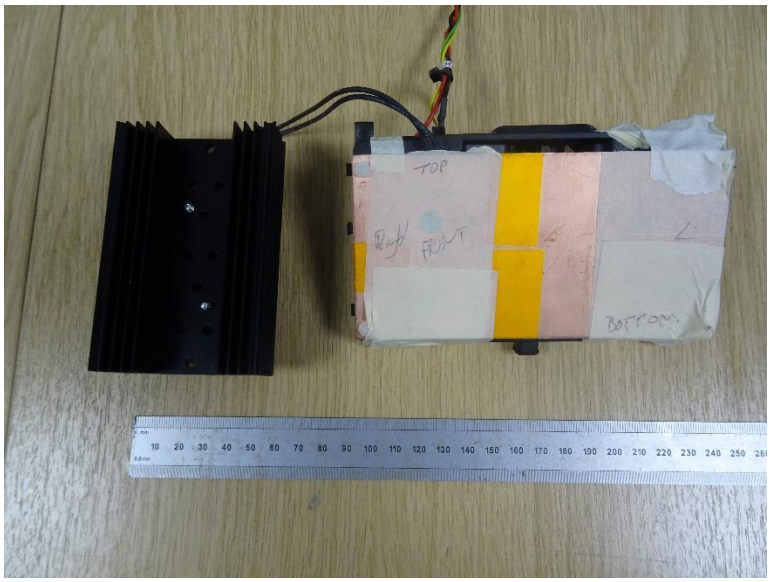

Figure 1 – General View – Front – Charging Mode Test Sample.

140 x 70 mm x 2mm Copper Shielding is fitted to the charging mode test sample, simulating a handset.

Figure 2 – General View – Rear – Charging Mode Test Sample.

1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.7 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Qi Wireless Power Transfer – 126.6 kHz		
RF Exposure Electric and Magnetic Field	Stephen Dodd	Not Accredited

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 RF Exposure Electric and Magnetic Fields

2.1.1 Specification Reference

FCC CFR 47 Part 18, Clause 3 c): Desktop applications
KDB 680106, Clause 3: RF Exposure Requirements

2.1.2 Equipment Under Test and Modification State

WCA NFC 2.0 - ID:08 - Modification State 0

2.1.3 Date of Test

14 December 2020

2.1.4 Test Method

For devices designed for typical desktop applications, such a wireless charging pads, RF exposure evaluation should be conducted assuming a user separation distance of 15 cm.

E and H field strength measurements shall be used to demonstrate compliance.

Measurements should be made from all sides and the top of the primary/client pair, with the 15 cm measured from the center of the probe(s) to the edge of the device.

For the assessment of thermal exposure, the electromagnetic fields are time-averaged over a period of 30 minutes.

2.1.5 Limits

FCC CFR 47 Part 1.1310 Table 1 (B); General Population/Uncontrolled Exposure.

Emissions between 100 kHz to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of Section 1.1310: 614 V/m and 1.63 A/m.

A KDB inquiry is required to determine the applicable exposure limits below 100 kHz.

2.1.6 Environmental Conditions

Ambient Temperature	22.2 °C
Relative Humidity	43.5 %
Ambient Electric Field	0.98 V/m
Ambient Magnetic Field	0.03 µT

2.1.7 Validation Check Result

Validation Source	Demagnetizer coil at 20 cm	
	Electric Field V/m	Magnetic Field µT
Measured level	4.6	7.7

Table 5 – Validation Check

2.1.8 Test Results

Measurement Result

Field Type	Measurement position	Field Strength Result rms	MPE Limit *	Units	Test Separation Distance (mm)	Compliance (Yes/No)
Electric field	Front	1.32	614	V/m	150	Yes
	Top	1.11	614	V/m	150	Yes
Electric field	Bottom	1.08	614	V/m	150	Yes
Electric field	LHS	1.12	614	V/m	150	Yes
Electric field	RHS	1.11	614	V/m	150	Yes

Table 6 – Electric Field (Time Average)

Field Type	Measurement position	Field Strength Result rms	MPE Limit *	Units	Test Separation Distance (mm)	Compliance (Yes/No)
Magnetic field	Front	0.34	1.63	A/m	150	Yes
Magnetic field	Top	0.15	1.63	A/m	150	Yes
Magnetic field	Bottom	0.12	1.63	A/m	150	Yes
Magnetic field	LHS	0.14	1.63	A/m	150	Yes
Magnetic field	RHS	0.13	1.63	A/m	150	Yes

Table 7 – Magnetic Field (Time Average)

* Table 1 of Section 1.1310: 614 V/m and 1.63 A/m

Measurement Result Frequency Spectrum

The frequency spectrum was viewed using the RF Field Meter FFT function to confirm the presence of the 126.6 kHz transmissions.

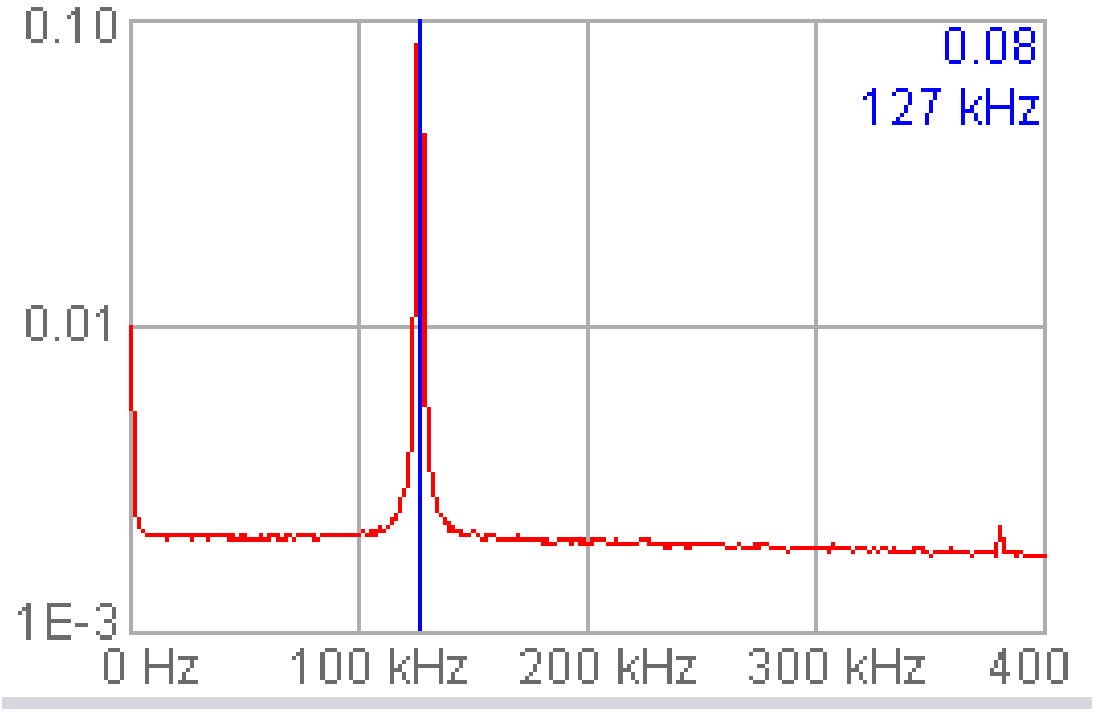

Figure 3 - Frequency Spectrum 126.6kHz

2.2 Test Set-up Photographs

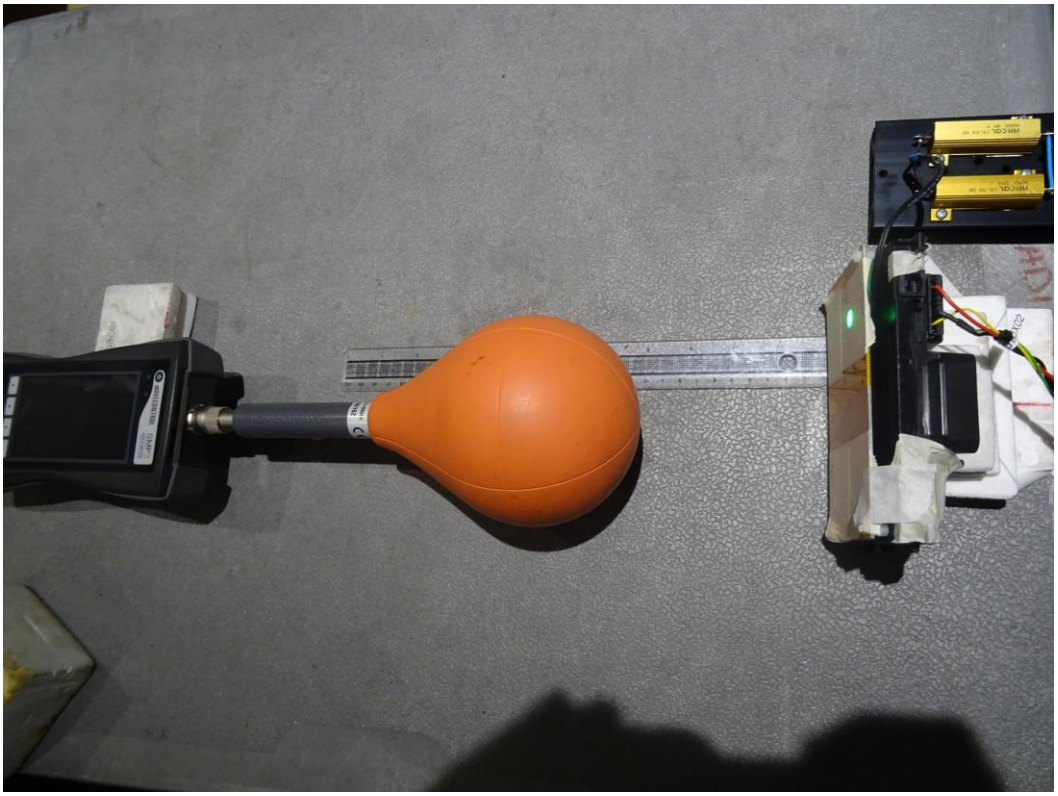

Figure 4 - General Test Set-Up (Front - 15cm to Probe Centre)

2.3 Test Location and Test Equipment Used

This test was carried out in Chamber 10.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EM Field Meter	Wavecontrol	SMP2	15SN0086	24	15-Jan-2021
Field Meter Probe	Wavecontrol	WP400	16WP100162	24	15-Jan-2021
Thermohygrometer	Rotronic	Hygropalm	2404	12	08-Jun-2021

Table 8

2.4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Electric field strength V/m	± 1.3 dB
Magnetic field strength A/m	± 1.1 dB

Table 9

Measurement Uncertainty

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2007, clause 4.4.3 and 4.5.1.

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SAR EXCLUSION DOCUMENT

Document 75950622-06 Issue 01

13.56 MHz Transmitter:

FCC Standalone SAR Test Exclusion Considerations (KDB 447498 D01) Section 4.3.1 c)

<100 MHz – Separation Distance ≤50 mm or Separation Distance >50 mm and <200 mm

The 1g head or body SAR test exclusion thresholds for <100 MHz are determined by the following steps:

Step a) Threshold result from Formula in Section 4.3.1 a):

[(max power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1g SAR.

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison
- When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied.

Step b) requires formula to be re-arranged to give power allowed at numeric threshold at 50 mm test separation distance and Step c) requires $f_{(GHz)}$ to be set to 100 MHz (0.1 GHz) giving:

Step a) Power threshold = (3 * 50) / ($\sqrt{0.1}$) = 474.3 mW

Step b) Threshold result from Formula in Section 4.3.1 b) 1);

{[Power allowed at numeric threshold for 50 mm {Formula Step A})] + [(test separation distance – 50 mm)·($f_{(MHz)}$/150)]} mW

- f_{MHz} is the RF channel transmit frequency in MHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison

Power threshold = 474.3 mW + [(test separation distance – 50 mm)·($f_{(MHz)}$/150)]} mW

Step c) requires $f_{(MHz)}$ to be set to 100 MHz giving:

Step b) Power threshold = 474.3 mW + [(test separation distance – 50 mm)·(100)/150)] mW

Approved by ..... **Date** 18 December 2020

Matt Russell
Authorised Signatory

Step c) 1) Threshold result from Formula in Section 4.3.1 c) 1); >50 mm and <200 mm

Threshold result from Formula in Section 4.3.1 b) 1) is multiplied by [1+log(100/f_{MHz})]

Power threshold = [474.3 mW + (test separation distance – 50 mm)· (100)/150)] * [1+log(100/f_{MHz})] mW

- f_{MHz} is the RF channel transmit frequency in MHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison

SAR Exclusion Result (1 g Head or Body)

Frequency (MHz)	Power Output mW	Duty Cycle %	Maximum Power (Tune up Value) * (mW)	Test Separation Distance (mm)	SAR Exclusion Power Threshold Section 4.3.1 c) (mW)	SAR Test Exclusion (Yes/No)
13.56	1	100	1	200	1071.5	Yes

*Maximum power including tolerance of the time averaged declared conducted output power of the device. derived from FCC Determination of the Equivalent Isotropically Radiated Power (EIRP) given in the measurement and calculations overleaf>.

The SAR exclusion threshold has been evaluated using the formula described above from information supplied by the manufacturer below. Based on the calculation above, the EUT is categorically excluded from SAR testing

FCC Determination of the Equivalent Isotropically Radiated Power (EIRP) of an RF Transmitting System (KDB 412172)

Section 2.2 Direct calculation from the DUT power measured in a radiated test configuration

Section 2.2. states: When the DUT power is measured using a radiated test configuration, the eirp can be directly determined using the field strength (linear) approach by applying Equation:

$eirp = p_t \times g_t = (E \times d)^2/30$

- Eirp is the equivalent isotropically radiated power in watts.
- p_t transmitter output power in watts (not required)
- g_t numeric gain of the transmitting antenna (unitless) (not required)
- E electric field strength in V/m
- D measurement distance in meters (m)

Measure the electric field strength E at test distance d m.

If magnetic field strength is measured, convert to electric field strength in accordance with the antenna manufacturers' conversion factors.

Calculate the eirp using the equation above. Increase the eirp to include any declared tune-up tolerance value to give the maximum output power.

The result is the Maximum Power (Tune up Value) required in the SAR exclusion assessment.

Frequency MHz	Magnetic Field Strength [1] (dBµA/m)	Conversion Factor H to E Field [2] (dB)	Electric Field Strength (dBµV/m)	Electric Field Strength (V/m)	Test Distance (m)	Eirp (W)	Eirp (mW)	Tune-up Tolerance (%)	Maximum Power (Tune up Value) (mW)
13.56	4	51.5	55.5	0.0005957	10	0.000000118	0.00118	0	<0.001

Note 1: Maximum magnetic field strength measured at 10 m from Manufacturers Declaration.
Note 2: Since Electric and magnetic fields are related by their wave impedance:
E/H=377 ohms; E (dBµV/m) = H (dBµA/m) + 51.5 (dB)
377 ohms assumes worst case plane wave conditions for an inductive loop antenna, actual wave impedance would be lower giving lower result.

Manufacturer's Declaration of Product information:

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment)*	Wireless power charger for mobile phones, with NFC communication, integrated into cars
Manufacturer:	Continental Automotive GmbH
Model:	**WCA NFC 2.0**
Part Number:	

If more than one frequency band is supported, please confirm which combinations of bands are capable of Simultaneous Transmit.	Yes, 126.6**kHz** Wireless Power Charging (WPC) and **13.56MHz** Near-Field Communication (NFC) but no simultaneous transmition is possible.

Frequency Band 1: Please detail (one entry for each band), e.g GSM 900 / WCDMA FDD I etc .

Antenna Model:	: internal (litz coil - MPA21 triple coil according to Qi standard): Gain: -108.4 dBi	
Antenna length:		cm
Bottom frequency:	126.6kHz /- 6 kHz	MHz
Middle frequency:	126.6kHz	KHz
Top frequency:	126.6kHz /+ 6 kHz	MHz

Maximum power (input to the antenna including a tolerance):	15	W
Antenna gain (or maximum gain allowed):		dBi

Or

Field Strength Measurement:	7.3 dBµA/m @10m for (WPC)	dBµA/M
Measurement Distance:		cm

Separation distance from antenna to the user/bystander	20	cm
Transmitter Duty Cycle:		%

Frequency Band 2: Please detail (one entry for each band), e.g GSM 900 / WCDMA FDD I etc

Antenna Model:	several internal antennas (planar printed coil on PCB): • main antenna gain: -51.38 dBi • side 1 antenna gain: -58.58 dBi • side 2 antenna gain: -57.07 dBi Only one NFC antenna is fed at a given time.	
Antenna length:	5.9	cm
Bottom frequency:		MHz
Middle frequency:	**13.56MHz**	MHz
Top frequency:		MHz

Maximum power (input to the antenna including a tolerance):	0.7µW = -31.5 dBm EIRP	W

Antenna gain (or maximum gain allowed):	-57.07	dBi

Or

Field Strength Measurement:	4 dBµA/m @10m for (NFC)	dBµA/M
Measurement Distance:		cm

Separation distance from antenna to the user/bystander	20	cm
Transmitter Duty Cycle:		%

I hereby declare that the information supplied is correct and complete.

Name: Adyl Mssalak
Position held: Project manager
Date: 08 Dec 2020