Test report

Applicant:

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Test report no.:

190706-AU03+W01

for:

Continental Automotive GmbH
Regensburg
Immobilizer

A2C95937800

according to:

Part 2

RSS 102

EMV TESTHAUS

DAkkS Deutsche Akkreditierungsstelle D-PL-12155-01-04

DAkkS Deutsche Akkreditierungsstelle D-PL-12155-01-03

Accreditation:

FCC test firm accreditation expiration date: 2021-05-30
MRA US-EU, FCC designation number: DE0010
FCC registration number: 97268
BnetzA-CAB-02/21-02/5 Valid until 2023-11-26

Recognized on March 14th, 2019 by the
Department of Innovation, Science and Economic Development (ISED) Canada
as a wireless testing laboratory
CAB identifier: DE0011
ISED#: 3472A

Location of Testing:

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The technical accuracy is guaranteed through the quality management of the EMV **TESTHAUS** GmbH.

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1 Test regulations

Standard	*Title*
RSS-102 Issue 5 March 2015	Spectrum Management and Telecommunications Radio Standards Specification Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)
SPR-002 Issue 1 September 2016	Spectrum Management and Telecommunications Supplementary Procedure Supplementary Procedure for Assessing Compliance with RSS-102 Nerve Stimulation Exposure Limits
Safety Code 6 (2015)	Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz
IEEE C95.3-2002 (R2008) Approved December 11, 2002 Reaffirmed June 12, 2008	IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz
KDB 680106 D01 May 31, 2013 (published by the Federal Communications Commission FCC)	RF Exposure Considerations for Low Power Consumer Wireless Power Transfer Applications
OET Bulletin 65, 65A, 65B Edition 97-01, August 1997	Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields
Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1091	Radiofrequency radiation exposure evaluation: mobile devices.
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device
KDB 447498 D01 v06	Mobile and portable devices RF Exposure procedures and equipment authorisation policies, October 23, 2015.
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
ANSI C63.10 June 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

2 Summary of test results

Standard	*Result*	*Remark*
Part 2.1091 (d) (4)	Passed	---
RSS-102 Issue 5	Passed	---

Straubing, August 31, 2020

Andreas Menacher
Test engineer
EMV **TESTHAUS** GmbH

Konrad Graßl
Head of Radio department
EMV **TESTHAUS** GmbH

3 Equipment under test (EUT)

Product type:	Immobilizer	
Model Name:	A2C95937800	
HVIN:	A2C95937800	
Manufacturer:	Continental Automotive GmbH	
Serial number:	---	
Version:	Hardware:	---
	Software:	---
Short description:	EUT is a Wireless power transfer system which operates at the frequency 125 kHz.	
FCC ID:	KR5A2C95937800	
IC certification number:	7812-A2C95937800	
Application frequency band:	N/A	
Operating frequency:	125 kHz	
Number of RF channels:	1	
Modulation:	ASK	
Antenna types:	Loop antenna ☐ detachable ☒ not detachable	
Power supply:	Battery supply nominal voltage: 12.00 V	
Exposure to:	☒	Head
	☒	Body
	☐	Limbs
	☐	other
Separation distance:	☒	≤ 20 cm
	☐	> 20 cm
Evaluated against exposure limits:	☒	General public use
	☐	Controlled use

4 Photographs of EUT

See Annex B and C of test reports 190706-AU03+W02 or 190706-AU03+W03 of test laboratory EMV Testhaus GmbH.

5 Test results

This clause gives details about the test results as collected on page 6.

The climatic conditions are recorded during the tests. It is ensured that the climatic conditions are within the following ranges:

Ambient temperature	*Ambient humidity*	*Ambient pressure*
15°C to 35°C	30 % to 75 %	86 kPa to 106 kPa

5.1 FCC

5.1.1 Wireless power transfer

Reference: KDB 680106 D01
Basic standard: IEEE C95.3

Performed by:	Andreas Menacher	Date of test:	August 26, 2020
Result:	☒ Limits kept	☐ Limits not kept	

5.1.1.1 Test configuration

EUT			
Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
Immobilizer	A2C95937800	---	Continental Automotive GmbH
Peripheral devices			
Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
Trigger tool	Homologation box	---	Continental Automotive GmbH
Vehicle key	Ford	BATT. EMPTY	Continental Automotive GmbH
Vehicle key	Ford	BATT. EMPTY	Continental Automotive GmbH
Power supply	3231.1	E01235	Statron

Table 1: Devices used for testing

5.1.1.2 Mode of operation

As soon as the EUT was powered via the homologation box, it was sending a permanent carrier at the operating frequency 125 kHz.

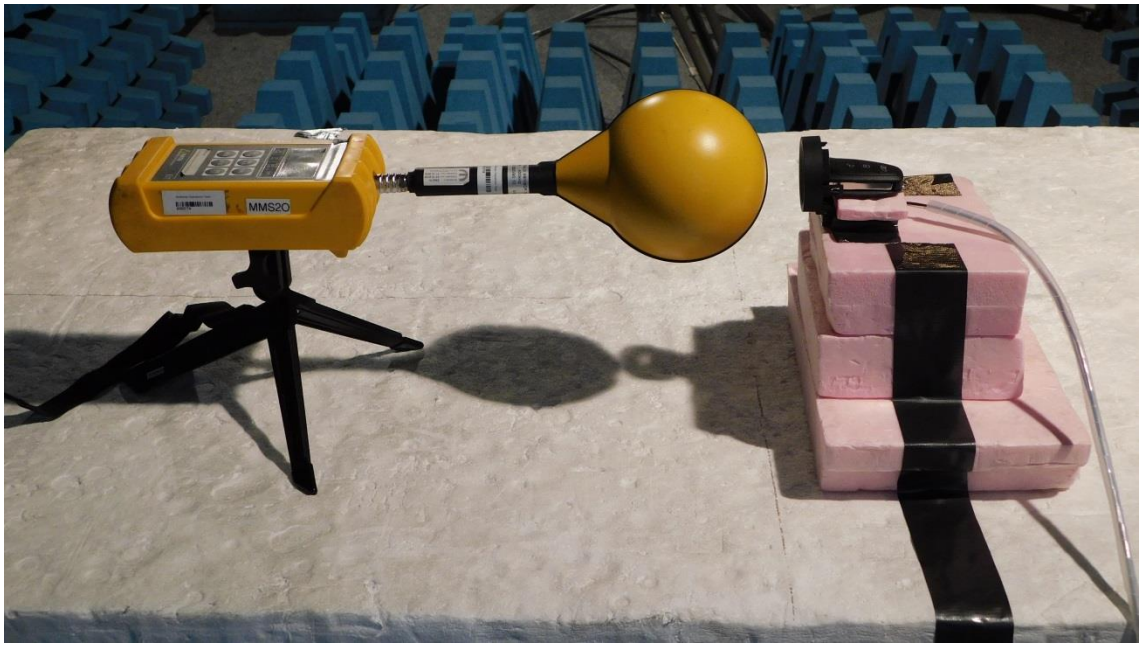
Measurements were performed in the following modes:

Mode 1: Without vehicle key
Mode 2: With empty battery of vehicle key
Mode 3: With fully charged battery of vehicle key

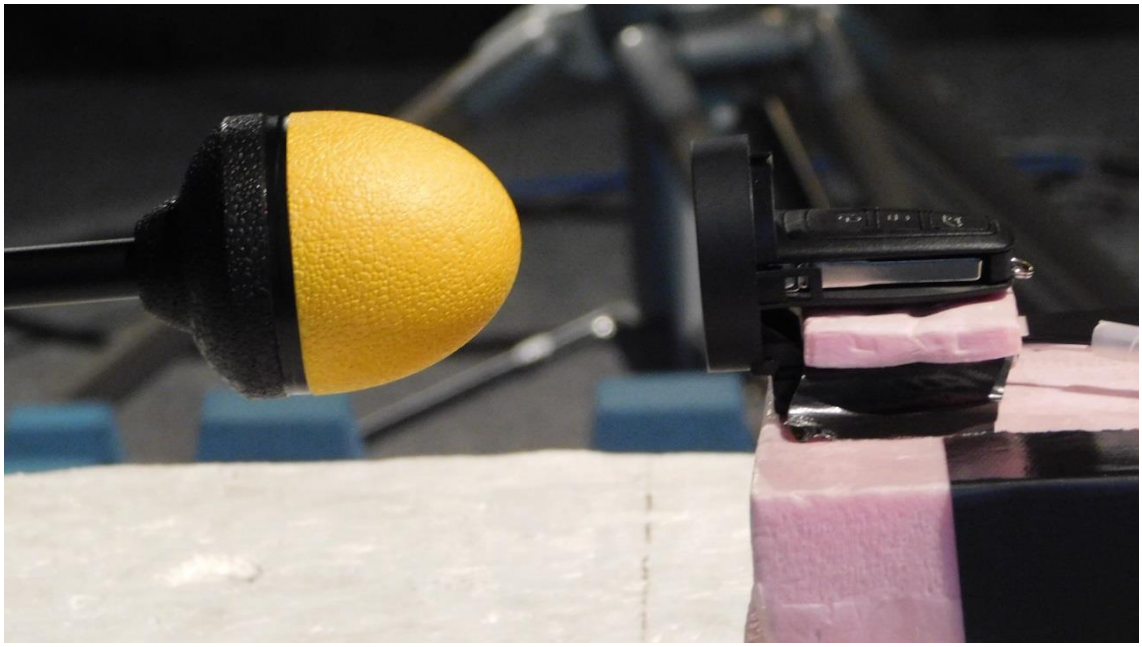
5.1.1.3 Test equipment

Type	*Designation*	*Manufacturer*	*Inventory no.*
Exposure level tester with magnetic field probe 100 cm^2	ELT-400 with BN 2300/90.10	Narda Safety Test Solutions GmbH	E00276
Broadband field meter	NBM-550	Narda Safety Test Solutions GmbH	E00900
Electric field probe	EF0691	Narda Safety Test Solutions GmbH	E00902

5.1.1.4 Test setup



Picture 1: Setup of magnetic field test at a measurement distance of 8 cm, mode 2



Picture 2: Setup of electric field test at a measurement distance of 8 cm, mode 2

5.1.1.5 Limits

According to section 3, paragraph 2) of KDB 680106 D01, based on the design and implementation of the power transfer application, it must be clearly identified if mobile or portable RF exposure conditions apply. Devices that are installed to provide separation of at least 20 cm from users and bystanders may qualify for mobile exposure conditions. For some conditions where users and bystanders may be exposed at closer than 20 cm, Section 2.1091(d)(4) of the rules may apply.

According to section 2.1091(d)(4) in some cases e.g., modular or desktop transmitters, the potential conditions of use of a device may not allow easy classification of that device as either mobile or portable(also see §2.1093). In such cases, applicants are responsible for determining minimum distances for compliance for the intended use and installation of the device based on evaluation of either specific absorption rate (SAR), field strength or power density, whichever is most appropriate.

According to section 3, paragraph c) of KDB 680106 D01 for emissions between 100 kHz and 300 kHz the limts at 300 kHz in table 1 of section 1.1310: 614 V/m and 1.63 A/m shall be applied.

Frequency range (MHz)	*Electric field strength (V/m)*	*Magnetic field strength (A/m)*	*Power density (mW/cm^2)*	*Averaging time (minutes)*
(A) Limits for Occupational/Controlled Exposure				
0.3 - 3.0	614	1.63	*100	6
3.0 - 30	1842/f	4.89/f	*900/f^2	6
30 - 300	61.4	0.163	1.0	6
300 - 1,500			f/300	6
1,500-100,000			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 - 1,500			f/1500	30
1,500 - 100,000			1.0	30
f = frequency in MHz * = Plane-wave equivalent power density				

Table 2: Limits for Maximum Permissible Exposure (MPE) to RF electromagnetic fields

5.1.1.6 Test procedure

The RF exposure test is performed by the direct measurement method using a Broadband probe.

To find the worst case emissions, the field probe is moved over all sides of the EUT at the separation distance named in table 3, while observing the display of the field meter. At the worst case position, the final value is measured and recorded.

According to section 3 of KDB 680106 D01, the test distance is measured from the center of the probe(s) to the edge of the device.

5.1.1.7 Test results

Electric field strength at a test distance of 8 cm					
Reference level frequency range	*Frequency*	*Operation mode*	*Measured value V/m*	*Limit V/m*	*Result*
100 kHz - 300 kHz	125 kHz	Mode 2	14.85	614	Passed
Magnetic field strength at a test distance of 8 cm					
Reference level frequency range	*Frequency*	*Operation mode*	*Measured value A/m*	*Limit A/m*	*Result*
100 kHz - 300 kHz	125 kHz	Mode 2	1.30	1.63	Passed

Table 3: RF exposure test results at measurement distance 8 cm

5.1.1.8 Measurement uncertainty

The relative uncertainty is defined as the expanded uncertainty using a confidence interval of 95 % (k = 2). For evaluation of compliance, the measured value is compared directly to the applicable limit without any reduction.

Test	*Equipment used*	*Expanded uncertainty*	*k*
Magnetic field (H and B) 1 Hz – 400 kHz	ELT-400 with BN 2300/90.10	-28.07 % +28.07%	2
Electric field (E) 100 kHz to 6 GHz	NBM-550 with EF0691	-27.75 % +31.11 %	2

Table 4: Measurement uncertainties

5.1.1.9 Equipment calibration status

Description	Modell number(s)	Serial number(s)	Inventory number(s)	Last calibration	Next calibration
Exposure level tester with magnetic field probe 100 cm^2	ELT-400 with BN 2300/90.10	B-0087 B-0102	E00276	2018-10	2020-10
Broadband field meter with magnetic field probe	NBM-550 with HF3061	H-0015 D-0595	E00900 E00901	2019-03	2021-03
Broadband field meter with electric field probe	NBM-550 with EF0691	H-0015 H-0318	E00900 E00902	2019-03	2021-03

Table 5: Equipment calibration status

5.2 Canada

5.2.1 Frequency range 3 kHz up to 10 MHz

Reference: RSS-102

Basic standard: SPR-002
IEEE C95.3

Performed by:	Konrad Graßl	Date of test:	August 26, 2020
Result:	☒ Limits kept	☐ Limits not kept	

5.2.1.1 Test configuration

EUT			
Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
Immobilizer	A2C95937800	---	Continental Automotive GmbH
Peripheral devices			
Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
Trigger tool	Homologation box	---	Continental Automotive GmbH
Vehicle key	Ford	BATT. EMPTY	Continental Automotive GmbH
Vehicle key	Ford	BATT. EMPTY	Continental Automotive GmbH
Power supply	3231.1	E01235	Statron

Table 6: Devices used for testing

5.2.1.2 Mode of operation

As soon as the EUT was powered via the homologation box, it was sending a permanent carrier at the operating frequency 125 kHz.

Measurements were performed in the following modes:

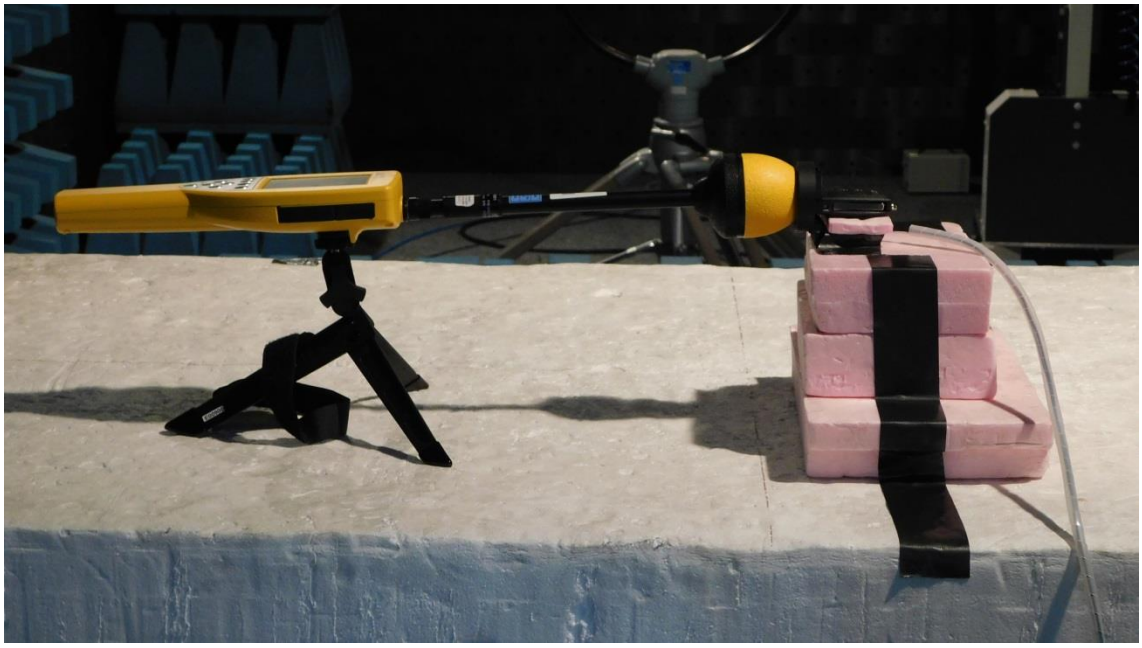
Mode 1: Without vehicle key
Mode 2: With empty battery of vehicle key
Mode 3: With fully charged battery of vehicle key

5.2.1.3 Test equipment

Type	*Designation*	*Manufacturer*	*Inventory no.*
Exposure level tester with magnetic field probe 100 cm^2	ELT-400 with BN 2300/90.10	Narda Safety Test Solutions GmbH	E00276
Broadband field meter	NBM-550	Narda Safety Test Solutions GmbH	E00900
Electric field probe	EF0691	Narda Safety Test Solutions GmbH	E00902

5.2.1.4 Test setup

Picture 3: Setup of magnetic field test at a measurement distance of 0 cm



Picture 4: Setup of electric field test at a measurement distance of 0 cm, mode 2

5.2.1.5 Limits

According to note 5 in section 2.5.1 of RSS-102, transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in section 4 of RSS-102. **Therefore, these limits apply irrespective of the separation distance between the user or bystanders and the device.**

The exposure limits in section 4 of RSS-102 are adopted from Health Canada's Safety Code 6. According to section 2.1 of Safety Code 6, limits for internal electric field strength are intended to prevent the occurrence of nerve stimulation (NS). At frequencies between 3 kHz and 10 MHz, basic restrictions for internal electric field strength in excitable tissues as shown in table 1 of Safety Code 6 (i.e. table 2 of RSS-102) shall not be exceeded. For conditions where the determination of internal electric field strength is not possible or practical (e.g. by measurement or modelling), external unperturbed field strength assessment shall be carried out and the reference levels outlined in section 2.2 of Safety Code 6 shall be respected.

For transmitters operating between 3 kHz and 10 MHz, the requirements of table 4 and table 6 in section 4 of RSS-102 apply which are adopted from table 3 and table 4 of Safety Code 6, section 2.2:

Electric Field Strength Reference Levels				
Frequency Range (MHz)	*Reference Level Basis*	*Reference Level (E_{RL}), (V/m, RMS)*		*Reference Period (minutes)*
		Uncontrolled Environment	*Controlled Environment*	
0.003 – 10	NS	83	170	Instantaneous*
1.1 – 1.29	SAR	$87 / f^{0.5}$	---	6**
1.29 – 10	SAR	$87 / f^{0.5}$	$193 / f^{0.5}$	6**
Note: Frequency, f, is in MHz.				

Table 7: Electric field strength reference levels

Magnetic Field Strength Reference Levels				
Frequency Range (MHz)	*Reference Level Basis*	*Reference Level (H_{RL}), (A/m, RMS)*		*Reference Period (minutes)*
		Uncontrolled Environment	*Controlled Environment*	
0.003 – 10	NS	90	180	Instantaneous*
0.1 – 10	SAR	$0.73 / f$	$1.6 / f$	6**
Note: Frequency, f, is in MHz.				

Table 8: Magnetic field strength reference levels

Notes:

1 * At no point in time shall the RMS values for electric- and magnetic-fields exceed the reference levels with an instantaneous reference period in table 7 and table 8. In the case of RF fields with amplitude modulation, the RMS value during the maximum of the modulation envelope shall be compared to the reference level.

2 ** For exposures shorter than the reference period, field strengths may exceed the reference levels, provided that the time average of the squared value of the electric or magnetic field strength over any time period equal to the reference period shall not exceed E_{RL}^2 or H_{RL}^2, respectively. For exposures longer than the reference period, including indefinite exposures, the time average of the squared value of the electric or magnetic field strength over any time period equal to the reference period shall not exceed E_{RL}^2 or H_{RL}^2, respectively.

3 Where external electric (at all applicable frequencies) or magnetic (at frequencies at or above 100 kHz) field strengths are spatially non-uniform, comparison to the reference levels shall be made after spatially averaging the field strengths over the vertical extent of the human body. Where comparison is to be made to the reference levels based on NS in table 7 and table 8, spatial averaging is with respect to the sample values of the field strengths. Where comparison is to be made to the reference levels based on SAR in table 7 and table 8, spatial averaging is with respect to the square of the sample values of the field strengths.

4 Where external magnetic field strengths are spatially non-uniform and are below 100 kHz, the spatial peak magnetic field strength over the vertical extent of the human body shall be compared to the reference levels in table 8 (i.e. magnetic field strengths shall not be spatially-averaged at frequencies below 100 kHz).

5 For simultaneous exposure to multiple frequencies and where comparison is to be made to the reference level based on NS, each of the field strength frequency component amplitudes shall be divided by the corresponding field strength reference level for that frequency, and the sum of all these ratios shall not exceed unity. This may be expressed as $\Sigma (Ei/E_{RL}) \leq 1$ for electric field strength or $\Sigma (Hi/H_{RL}) \leq 1$ for magnetic field strength.

6 For simultaneous exposure to multiple frequencies and where comparison is to be made to the reference level based on SAR, each of the squares of the field strength frequency component amplitudes shall be divided by the square of the corresponding field strength reference level for that frequency, and the sum of all these ratios shall not exceed unity. This may be expressed as $\Sigma (Ei/E_{RL})^2 \leq 1$ for electric field strength or $\Sigma (Hi/H_{RL})^2 \leq 1$ for magnetic field strength.

7 For localized exposure of the limbs, the reference levels for magnetic field strength may be exceeded provided that the basic restrictions in table 1 of Safety Code 6 are respected within the limbs.

5.2.1.6 Test procedure

The RF exposure test is performed by the direct measurement method using a Broadband probe as described in clause 6.6.1.1 of the supplementary procedure SPR-002.

To find the worst case emissions, the field probe is moved over all sides of the EUT at the separation distances as noted in table 10 while observing the display of the field meter. At the worst case position, the final value is measured and recorded.

According to section 3.2 of RSS-102, RF exposure evaluation of devices shall be made in accordance with the latest version of IEEE C95.3. Definition 3.95 in clause 3 of IEEE C95.3 specifies the separation distance applied to the measurement of electric and magnetic fields as the “distance between a source and the nearest point on the probe sensing elements”.

5.2.1.7 Test results

For the test result, the maximum field strength value of all probe positions is recorded and used to proof compliance. As the device is intended for general public use, the limits for uncontrolled environment apply.

Due to the limb exposure considerations as described in clause 6.5 of SPR-002, a limb exposure limit relaxation factor applies if the limb exposure is the primary exposed condition.

Exposure condition	*Relaxation factor*
Whole Body / Torso / Head	1.0
Leg	1.5
Arm	2.5
Hand / foot	5.0

Table 9: Limb exposure limit relaxation

Note: Premeasurements were performed to determine the worst case which is documented below.

Electric field strength at a distance of 0 cm							
Reference level frequency range	*Reference level basis*	*Frequency*	*Measured value V/m*	*Relaxation factor*	*Limit V/m*	*Fraction of limit*	*Result*
3 kHz - 10 MHz	NS	125 kHz	49.67	1.0	83	59.84 %	Passed
Magnetic field strength at a distance of 0 cm							
Reference level frequency range	*Reference level basis*	*Frequency*	*Measured value A/m*	*Relaxation factor*	*Limit A/m*	*Fraction of limit*	*Result*
3 kHz - 10 MHz	NS	125 kHz	3.47	1.0	90	3.86 %	Passed
100 kHz - 10 MHz	SAR	125 kHz	3.47	1.0	5.84	59.42 %	Passed

Table 10: RF exposure test results according to RSS-102 at a distance of 0 cm, mode 2

5.2.1.8 Measurement uncertainty

The relative uncertainty is defined as the expanded uncertainty using a confidence interval of 95 % (k = 2). For evaluation of compliance, the measured value is compared directly to the applicable limit without any reduction.

Test	*Equipment used*	*Expanded uncertainty*	*k*
Magnetic field (H and B) 1 Hz – 400 kHz	ELT-400 with BN 2300/90.10	-28.07 % +28.07%	2
Electric field (E) 100 kHz to 6 GHz	NBM-550 with EF0691	-27.75 % +31.11 %	2

Table 11: Measurement uncertainties

5.2.1.9 Equipment calibration status

Description	Modell number(s)	Serial number(s)	Inventory number(s)	Last calibration	Next calibration
Exposure level tester with magnetic field probe 100 cm^2	ELT-400 with BN 2300/90.10	B-0087 B-0102	E00276	2018-10	2020-10
Broadband field meter with magnetic field probe	NBM-550 with HF3061	H-0015 D-0595	E00900 E00901	2019-03	2021-03
Broadband field meter with electric field probe	NBM-550 with EF0691	H-0015 H-0318	E00900 E00902	2019-03	2021-03

Table 12: Equipment calibration status

6 Revision history

Revision	*Date*	*Issued by*	*Description of modifications*
0	2020-08-31	Andreas Menacher	First edition

Template: Part 2_RSS-102_V1.00