

Applicant:

DESKO GmbH Gottlieb-Keim-Str. 56 95448 Bayreuth Germany

Tel.: +49 921 79279-0

Test report no.:

230423-AU04+W01

for:

DESKO GmbH RFID reader module RFID Reader Module

> according to: 47 CFR Part 1 RSS-102





Accreditation:



FCC test firm accreditation expiration date: 2025-09-19 MRA US-EU, FCC designation number: DE0010 Test firm registration number: 997268 FCC Registration Number (FRN): 0032245045 BNetzA-CAB-02/21-02/7 Valid until 2028-11-26

Recognized until 2025-03-16 by the
Department of Innovation, Science and Economic Development Canada (ISED)
as a recognized testing laboratory
CAB identifier: DE0011
Company number: 3472A

Location of Testing:

Element Materials Technology Straubing GmbH

Tel.: +49 9421 56868-0 Fax: +49 9421 56868-100

Email: info.straubing@element.com

Gustav-Hertz-Straße 35 94315 Straubing, Germany

The technical accuracy is guaranteed through the quality management of Element Materials Technology Straubing GmbH.



Table of contents

1	Sur	nmary of test results	5
	1.1	FCC standard	
	1.2	IC standard	5
2	Tes	t regulations	
	2.1	FCC standards	
	2.2	IC standards	
3	Equ	ipment under Test	
	3.1	General information	7
	3.2	Radio specifications	
	3.3	Human exposure specifications	
	3.4	Photographs of EUT	
4	Tes	t results	
	4.1	FCC	10
	4.2	Canada	16
5	Equ	ipment calibration status	24
6	Mea	asurement uncertainty	25
7	Rev	vision history	26
Pi Pi Pi Pi Pi Pi Pi Pi	cture 2 cture 5 cture 6 cture 6 cture 1 cture 2 cture 3 cture 4 cture 5	List of pictures I: Setup of magnetic field test at a measurement distance of 20 cm, without RFID tag	12 13 13 14 17 18 19 19
		List of tables	
Ta Po Ta Ta Ta Ta Ta	able 2: able 3: opulation able 4: able 5: able 6: able 7: able 8: able 9:	EUT used for testing	10 14 15 15 16 16 20
Ta	able 11	: Result of magnetic field strength	21
Τa	able 12	2: Result of power density	21



Table 13:	Result of electric field strength	22
	Result of magnetic field strength	
	Result of power density	
	Result of electric field strength	
	Result of magnetic field strength	
	Result of power density	
	Test results for electric, magnetic and electromagnetic fields	
	Test results for electric, magnetic and electromagnetic fields	
Table 21:	Test results for electric, magnetic and electromagnetic fields	23



1 Summary of test results

1.1 FCC standard

FCC standard	Requirement	Result	Page
Part 1, §1.1310(e)(1):	Maximum permissible exposure, except WPT, calculation	Passed	10

1.2 IC standard

IC standard	Requirement	Result	Page
	Evaluation for separation distance > 20 cm, except 3 kHz – 10 MHz	Passed	16

Straubing, June 20, 2024

Tested by
Konrad Graßl
Department Manager Radio

Approved by Christian Kiermeier Reviewer



2 Test regulations

2.1 FCC standards

Standard	Title
Part 1, Subpart I, Section 1.1310 October 2023	Radiofrequency radiation exposure limits

2.2 IC standards

Standard	Title
RSS-102 Issue 5 (March 19, 2015) Amendment 1 (February 2, 2021)	Spectrum Management and Telecommunications Radio Standards Specification Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)
SPR-002 Issue 2 (October 2022) Spectrum Management and Telecommunications	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



3 Equipment under Test

3.1 General information

Product type: RFID reader module

Model name: RFID Reader Module

Serial number(s): n/a

Applicant: DESKO GmbH
Manufacturer: DESKO GmbH

Hardware version: Rev 1.1

Software version: 0805010A.00000090

Additional modifications: None

FCC ID: WTM-NFCREADER2
IC registration number: 7998A-NFCREADER2

Designation of emissions: 98H0K1D

Power supply: DC supply

Nominal voltage: 5 V Minimum voltage: 4.75 V Maximum voltage: 5.25 V

Temperature range: -25 °C to +50 °C (customer defined)

Device type: \square Portable \square Mobile \boxtimes Fixed



3.2 **Radio specifications**

System type: RFID reader

Application frequency

band:

Operating frequency: 13.56 MHz

Short description: The EUT is a RFID reader module operating at the frequency 13.56 MHz.

13.110 MHz - 14.010 MHz

Number of RF channels

Highest internal frequency: 27.12 MHz

Modulation ASK

Antenna: Type: PCB antenna

> Type designation: 2063518:7215 Manufacturer: DESKO GmbH

Connector: □ internal

> ☐ temporary □ none (integral

antenna)

3.3 **Human exposure specifications**

Separation distance: > 20 cm

Evaluated against exposure limits: General public use

Simultaneous transmissions: no

3.4 **Photographs of EUT**

See Annex B of test report 230423-AU01+W01 of test laboratory Element Materials Technology Straubing GmbH.



4 Test results

This clause gives details about the test results as collected in the summary of test results on page 5.

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



4.1 FCC

4.1.1 Maximum permissible exposure, except WPT, measurement

 Requirement:
 Part 1, §1.1310(e)(1):

 Performed by:
 Konrad Graßl
 Date of test:
 June 18, 2024

 Result:
 ☑ Limits kept
 ☐ Limits not kept

4.1.1.1 Test configuration

Device	Type designation	Serial or inventory no.	Manufacturer	
RFID reader module	RFID Reader Module		DESKO GmbH	
PCB antenna	Penta (0190050012)	n/a	DESKO GmbH	

Table 1: EUT used for testing

Device	Type designation	Serial or inventory no.	Manufacturer
RFID-tag	13.56 MHz		
Evaluation board	RFID Reader Module Adapter	0190048105	DESKO GmbH
Laptop Desko	ThinkPad T460	W01538	Lenovo
Power supply for laptop	AC adapter	ADLX90NCC3A	Lenovo

Table 2: Support equipment used for testing

4.1.1.2 Mode of operation

- The RFID reader module was in continuous interrogation mode at 13.56 MHz.
- The RFID reader module was mounted on an evaluation board, which is only used for testing purposes and is no part of product.
- The device was powered by a laptop via USB.
- Mode 1: The RFID reader module was in continuous interrogation mode at 13.56 MHz. There is not any tag in the EUT's antenna
- Mode 2: RFID tag is in the position 1 of the EUT's antenna
- Mode 3: RFID tag is in the position 2 of the EUT's antenna



4.1.1.3 Test equipment

Туре	Designation	Manufacturer	Inventory no.
Broadband field meter	NBM-550	Narda Safety Test Solutions GmbH	E00900
Magnetic field probe	HF3061	Narda Safety Test Solutions GmbH	E00901
Electric field probe	EF0691	Narda Safety Test Solutions GmbH	E00902

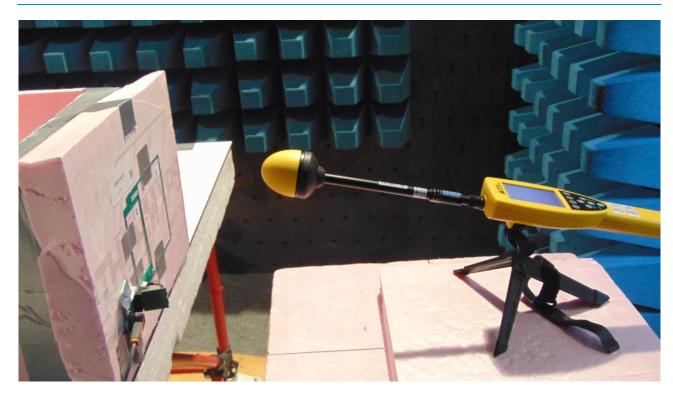
4.1.1.4 Test setup

Mode 1.



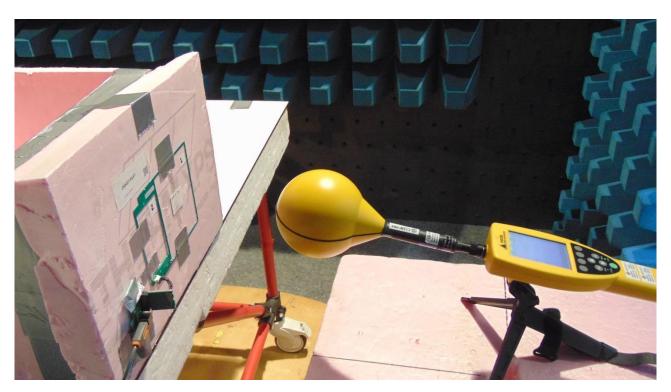
Picture 1: Setup of magnetic field test at a measurement distance of 20 cm, without RFID tag





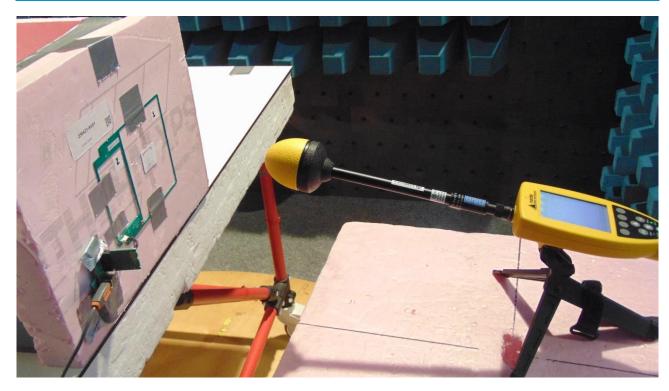
Picture 2: Setup of electric field test at a measurement distance of 20 cm, without RFID tag

Mode 2.



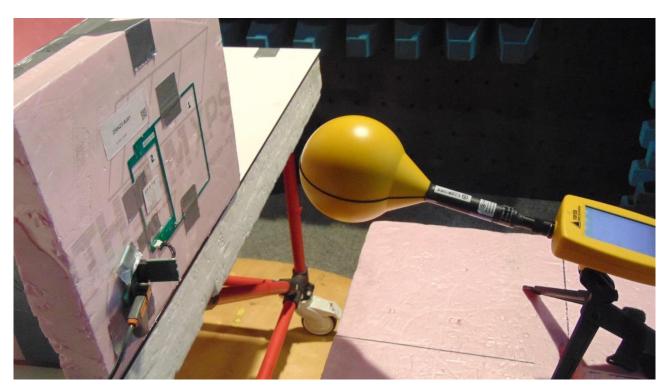
Picture 3: Setup of magnetic field test at a measurement distance of 20 cm, with RFID tag in Position 1





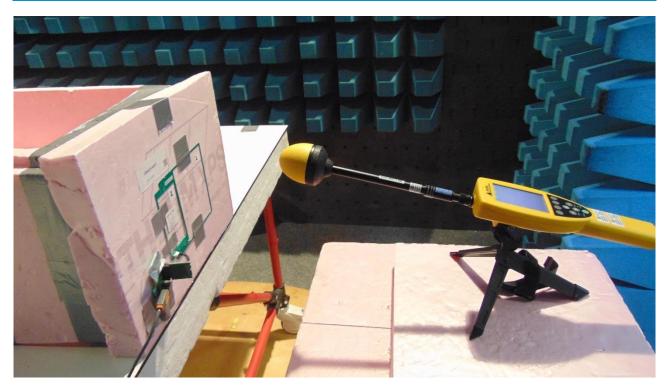
Picture 4: Setup of electric field test at a measurement distance of 20 cm, with RFID tag in Position 1

Mode 3.



Picture 5: Setup of magnetic field test at a measurement distance of 20 cm, with RFID tag in Position 2





Picture 6: Setup of electric field test at a measurement distance of 20 cm, with RFID tag in Position 2

4.1.1.5 Requirements and limits maximum permissible exposure

According to §1.1310(e)(1):

Table 1 to § 1.1310(e)(1) sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

Frequency	Electric field	Magnetic field	Power	Averaging
range (MHz)	strength (V/m)	strength (A/m)	densitiy (mW/cm²)	time (minutes)
1.34-30	824/f	2.19/f	180/f ² (see note 2)	<30

Table 3: Table 1 to §1.1310(e)(1) Limits for Maximum Permissible Exposure (MPE) for General Population/Uncontrolled Exposure

Notes:

- 1. F = frequency in MHz
- 2. Plane-wave equivalent power density

4.1.1.6 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 of 20 cm, while observing the display of the field meter. At the worst case position, the final value is measured and recorded.

The test distance is measured from the center of the probe(s) to the edge of the device.



4.1.1.7 Results

Application: RFID

Operation frequency: 13.56 MHz

Information related to Exposure:

Tuneup tolerance: 0 dB Separation distance: 20 cm

Exposure: general public

Averaging time over 6 minutes applied Yes

Mode 1

Type of measurement	Measured average value	Limit	Ratio of limit	Result
E-Field	0.760 V/m	60.767 V/m	0.013	Passed
H-Field	0.030 A/m	0.162 A/m	0.185	Passed
Power density	0.002 mW/cm ²	0.979 mW/cm ²	0.002	Passed

Table 4: Test results for electric, magnetic and electromagnetic fields

Mode 2

Type of measurement	Measured average value	Limit	Ratio of limit	Result
E-Field	1.120 V/m	60.767 V/m	0.018	Passed
H-Field	0.049 A/m	0.162 A/m	0.303	Passed
Power density	0.005 mW/cm ²	0.979 mW/cm ²	0.006	Passed

Table 5: Test results for electric, magnetic and electromagnetic fields

Mode 3

Type of measurement	Measured average value	Limit	Ratio of limit	Result
E-Field	1.250 V/m	60.767 V/m	0.021	Passed
H-Field	0.051 A/m	0.162 A/m	0.318	Passed
Power density	0.006 mW/cm ²	0.979 mW/cm ²	0.007	Passed

Table 6: Test results for electric, magnetic and electromagnetic fields



4.2 Canada

4.2.1 Evaluation for separation distance > 20 cm, except 3 kHz - 10 MHz

Requirement: RSS-102 Issue 5, section 3.3

Reference: n/a

Performed by:	Konrad Graßl	Date of test:	June 18, 2024
Result:	□ Limits kept	☐ Limits not kept	

4.2.1.1 Test configuration

Device	Type designation	Serial or inventory no.	Manufacturer
RFID reader module	RFID Reader Module		DESKO GmbH
PCB antenna	Penta (0190050012)	n/a	DESKO GmbH

Table 7: EUT used for testing

Device	Type designation	Serial or inventory no.	Manufacturer
RFID-tag	13.56 MHz		
Evaluation board	RFID Reader Module Adapter	0190048105	DESKO GmbH
Laptop Desko	ThinkPad T460	W01538	Lenovo
Power supply for laptop	AC adapter	ADLX90NCC3A	Lenovo

Table 8: Support equipment used for testing

4.2.1.2 Mode of operation

- The RFID reader module was in continuous interrogation mode at 13.56 MHz.
- The RFID reader module was mounted on an evaluation board, which is only used for testing purposes and is no part of product.
- The device was powered by a laptop via USB.
- Mode 1: The RFID reader module was in continuous interrogation mode at 13.56 MHz. There is not any tag in the EUT's antenna
- Mode 2: RFID tag is in the position 1 of the EUT's antenna
- Mode 3: RFID tag is in the position 2 of the EUT's antenna

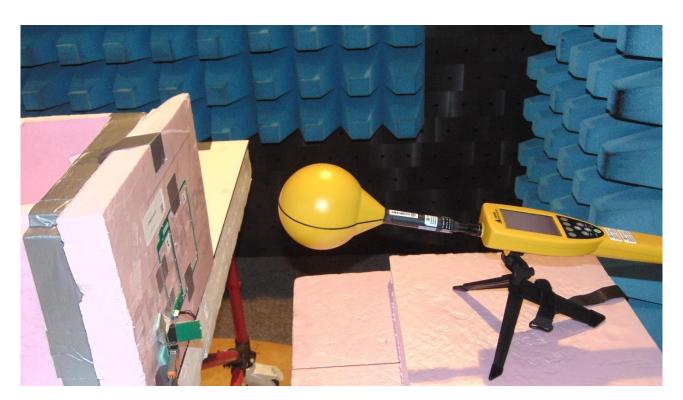


4.2.1.3 Test equipment

Туре	Designation	Manufacturer	Inventory no.
Broadband field meter	NBM-550	Narda Safety Test Solutions GmbH	E00900
Magnetic field probe	HF3061	Narda Safety Test Solutions GmbH	E00901
Electric field probe	EF0691	Narda Safety Test Solutions GmbH	E00902

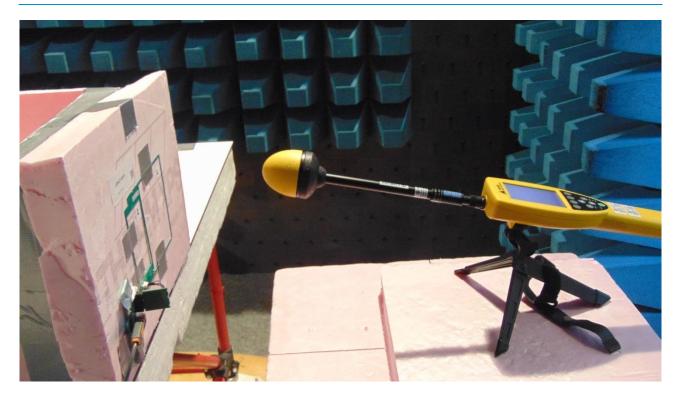
4.2.1.4 Test setup

Mode 1.



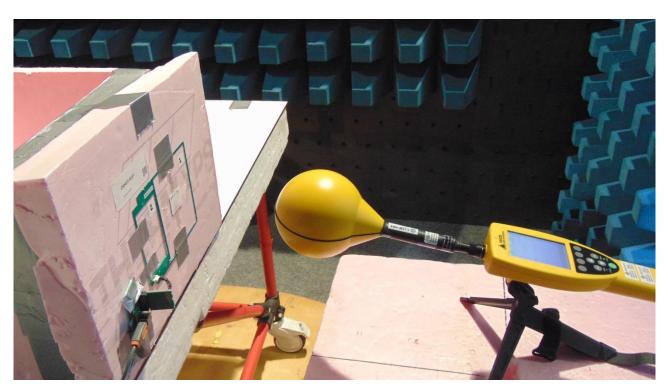
Picture 7: Setup of magnetic field test at a measurement distance of 20 cm, without RFID tag





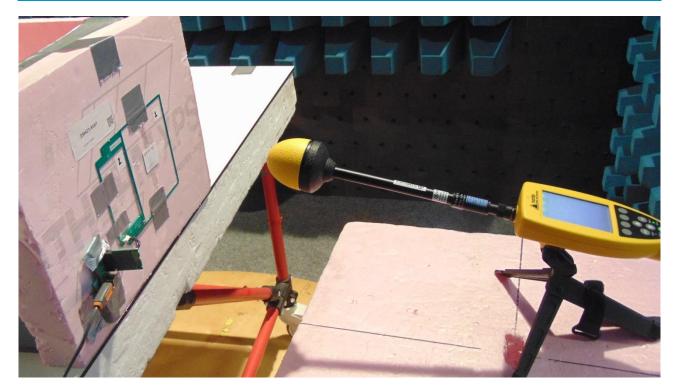
Picture 8: Setup of electric field test at a measurement distance of 20 cm, without RFID tag

Mode 2.



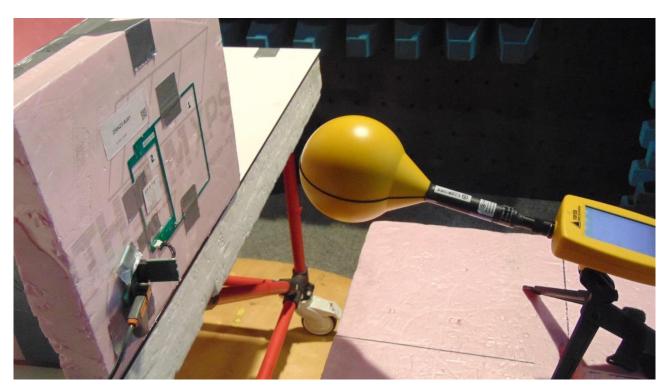
Picture 9: Setup of magnetic field test at a measurement distance of 20 cm, with RFID tag in Position 1





Picture 10: Setup of electric field test at a measurement distance of 20 cm, with RFID tag in Position 1

Mode 3.



Picture 11: Setup of magnetic field test at a measurement distance of 20 cm, with RFID tag in Position 2





Picture 12: Setup of electric field test at a measurement distance of 20 cm, with RFID tag in Position 2

4.2.1.5 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

According to RSS 102 Clause 5 table 7:

Frequency range	Electric field	Magnetic field	Power density	Reference Period		
	strength	strength				
(MHz)	(V/m)	(A/m)	(W/m²)	(minutes)		
10 - 20 27.46 0.0728			2	6		
Note: f = frequency in MHz.						

Table 9: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)



4.2.1.6 Results

System type: RFID reader

Application frequency

band:

13.110 MHz - 14.010 MHz

Operating frequency: 13.56 MHz

Short description: The EUT is a RFID reader module operating at the frequency 13.56 MHz.

Number of RF channels 1

Highest internal frequency: 27.12 MHz

Modulation ASK

Antenna: Type: PCB antenna

Type designation: 2063518:7215 Manufacturer: DESKO GmbH

 \square temporary \square none (integral

antenna)

Information related to Exposure:

Tune-up tolerance (according to the

manufacturer):

0 dB

Separation distance: 20 cm

Exposure tier: general public

Power averaging over time: not applied

Mode 1

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	E (V/m)	Limit (V/m)	Ratio of limit	Result
13.56		0.7600	27.4600	0.0277	Passed

Table 10: Result of electric field strength

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	H (A/m)	Limit (A/m)	Ratio of limit	Result
13.56		0.0299	0.0728	0.4107	Passed

Table 11: Result of magnetic field strength

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	S (W/m²)	Limit (W/m²)	Ratio of limit	Result
13.56		0.0227	2.0000	0.0114	Passed

Table 12: Result of power density



Mode 2

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	E (V/m)	Limit (V/m)	Ratio of limit	Result
13.56		1.1200	27.4600	0.0408	Passed

Table 13: Result of electric field strength

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	H (A/m)	Limit (A/m)	Ratio of limit	Result
13.56		0.0489	0.0728	0.6717	Passed

Table 14: Result of magnetic field strength

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	S (W/m²)	Limit (W/m²)	Ratio of limit	Result
13.56		0.0548	2.0000	0.0274	Passed

Table 15: Result of power density

Mode 3

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	E (V/m)	Limit (V/m)	Ratio of limit	Result
13.56		1.2500	27.4600	0.0455	Passed

Table 16: Result of electric field strength

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	H (A/m)	Limit (A/m)	Ratio of limit	Result
13.56		0.0514	0.0728	0.7060	Passed

Table 17: Result of magnetic field strength

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	S (W/m²)	Limit (W/m²)	Ratio of limit	Result
13.56		0.0643	2.0000	0.0321	Passed

Table 18: Result of power density

Application: RFID

Operation frequency: 13.56 MHz



Information related to Exposure:

Tuneup tolerance: 0 dB Separation distance: 20 cm

Exposure: general public

Averaging time over 6 minutes applied Yes

Mode 1

į.	Type of measurement	Measured average value	Limit	Ratio of limit	Result
Ī	E-Field	0.7600 V/m	27.4600 V/m	0.0277	Passed
Ī	H-Field	0.0299 A/m	0.0728 A/m	0.4107	Passed
Ī	Power density	0.0227 W/m ²	2.0000 W/m ²	0.0114	Passed

Table 19: Test results for electric, magnetic and electromagnetic fields

Mode 2

Type of measurement	Measured average value	Limit	Ratio of limit	Result
E-Field	1.1200 V/m	27.4600 V/m	0.0408	Passed
H-Field	0.0489 A/m	0.0728 A/m	0.6717	Passed
Power density	0.0548 W/m ²	2.0000 W/m ²	0.0274	Passed

Table 20: Test results for electric, magnetic and electromagnetic fields

Mode 3

Type of measurement	Measured average value	Limit	Ratio of limit	Result
E-Field	1.2500 V/m	27.4600 V/m	0.0455	Passed
H-Field	0.0514 A/m	0.0728 A/m	0.7060	Passed
Power density	0.0643 W/m ²	2.0000 W/m ²	0.0321	Passed

Table 21: Test results for electric, magnetic and electromagnetic fields



5 Equipment calibration status

Description	Modell number(s)	Serial number(s)	Inventory number(s)	Last calibration	Next calibration
Broadband field meter with magnetic field probe	NBM-550 with HF3061	H-0015 D-0595	E00900 E00901	2023-09	2025-09
Broadband field meter with electric field probe	NBM-550 with EF0691	H-0015 H-0318	E00900 E00902	2023-09	2025-09



6 Measurement uncertainty

Test	Frequency range	Equipment used	Expanded uncertainty	U _{Limit}	k=
Magnetic field	1 Hz – 10 kHz	ELT 400 + probe	± 28.147 %	+58.% / -37 %	2
Magnetic field	10 kHz – 400 kHz	ELT 400 + probe	± 28.147 %	+41.% / -30 %	2
H-field	300 kHz – 800 kHz	NBM 550 + HF3061	± 25.602 %	+41.% / -30 %	2
H-field	800 kHz – 1 MHz	NBM 550 + HF3061	± 25.245 %	+41.% / -30 %	2
H-field	1 MHz – 30 MHz	NBM 550 + HF3061	± 25.245 %	+41.% / -30 %	2
E-field	100 kHz – 1 MHz	NBM 550 + EF0691	± 28.467 %	+41.% / -30 %	2
E-field	1 MHz – 30 MHz	NBM 550 + EF0691	± 27.324 %	+41.% / -30 %	2
E-field	30 MHz – 1 GHz	NBM 550 + EF0691	± 27.324 %	+100.% / -50 %	2
E-field	1 GHz – 4 GHz	NBM 550 + EF0691	± 30.244 %	+100.% / -50 %	2
E-field	4 GHz – 6 GHz	NBM 550 + EF0691	± 32.150 %	+100.% / -50 %	2
Contact current	0 Hz – 110 MHz	EZ 17	+41.25 % / -29.21.%	+100.% / -50 %	2

Note(s):

- 1 The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. For a confidence level of 95 % the coverage factor k is 2.
- 2 The values of the measurement uncertainty as listed above are calculated according to
 - a) ETSI TR 100 028-1 V1.4.1 and ETSI TR 100 028-2 V1.4.1
 - b) CISPR 16-4-2:2011-06 + A1:2014-02 + A2:2018-08
- 3 The limits for the measurement uncertainty as listed above are
 - a) derived from ETSI EN 300 328 V2.1.1
 - b) equal to U_{CISPR} taken from CISPR 16-4-2:2011-06 + A1:2014-02 + A2:2018-08
 - c) defined by the test laboratory
- 4 Simple acceptance is applied as the decision rule while keeping the specified limits (*U*_{Limit}) for the expanded measurement uncertainty (i.e. Test Uncertainty Ratio TUR ≥ 1:1). That means, compliance is based on the recorded level by the lab irrespective of the expanded measurement uncertainty value but with a limitation to it. For details on simple acceptance and the level of risk (such as false accept, false reject and false statistical assumptions) associated with this decision rule see ISO/IEC Guide 98-4:2012 and ILAC G8:09/2019 "Guidelines on Decision Rules and Statements of Conformity" ("Binary Statement for Simple Acceptance Rule" according to clause 4.2.1).
- 5 All used test instruments as well as the test accessories are calibrated at regular intervals.



7 Revision history

Revision	Date	Issued by	Description of modifications
0	2024-06-18	Konrad Graßl	First edition

Template: RF_FCC_IC_Human Exposure_V1.8