

Applicant:

ELATEC GmbH
Zeppelinstraße 1
82178 Puchheim
Germany
Tel.: +49 89 5529961-0

Test report no.:

250065-AU01+W03

for:

ELATEC GmbH
RFID reader / writer
TWN4 USB Front Reader

according to:

47 CFR Part 2
RSS-102



Deutsche
Akkreditierungsstelle
D-PL-12155-01-00

Accreditation:

FCC test firm accreditation expiration date: 2027-09-09
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 2027-03-18 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

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1 Summary of test results

1.1 FCC standard

<i>FCC standard</i>	<i>Requirement</i>	<i>Result</i>	<i>Page</i>
47 CFR Part 2, § 2.1093	SAR test exclusion, except WPT	Passed	9
47 CFR Part 2, § 2.1093	Simultaneous transmissions - SAR test exclusion, except WPT	Passed	14

1.2 IC standard

<i>IC standard</i>	<i>Requirement</i>	<i>Result</i>	<i>Page</i>
RSS-102, section 6.2.2	NS exemption limits - calculation	Passed	16
RSS-102, section 6.3	SAR test exclusion, except 3 kHz – 10 MHz	Passed	19
RSS-102, section 8.2.2.1	Simultaneous transmissions SAR test exclusion, except 3 kHz – 10 MHz	Passed	22

Straubing, December 16, 2025



Tested by
Konrad Graßl
Department Manager Radio



Approved by
Christian Kiermeier
Reviewer

2 Test regulations

2.1 FCC standards

<i>Standard</i>	<i>Title</i>
Part 1, Subpart I, Section 1.1307 October 2025	Actions that may have a significant environmental effect, for which Environmental Assessment (EAs) must be prepared.
Part 1, Subpart I, Section 1.1310 October 2025	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093 October 2025	Radiofrequency radiation exposure evaluation: portable devices.
KDB 447498 D04 v01 November 29, 2021	RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices
ANSI C63.10 September 2020	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

2.2 IC standards

<i>Standard</i>	<i>Title</i>
RSS-102 Issue 6 (December 15, 2023)	Spectrum Management and Telecommunications Radio Standards Specification Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)

3 Equipment under Test

All Information in this clause is declared by customer.

3.1 General information

Product type:	RFID reader / writer		
Model name:	TWN4 USB Front Reader		
Serial number(s):	R2025303546		
Applicant:	ELATEC GmbH		
Manufacturer:	ELATEC GmbH		
Hardware version:	A		
Software version:	B1.64/NKF4.64/STD2.04/B/BT1.07EL		
Short description:	EUT is a RFID reader / writer operating at the frequencies 125 kHz and 13.56 MHz. In addition Bluetooth low energy is integrated.		
Additional modifications:	None		
FCC ID:	WP5TWN4F34		
IC registration number:	7948A-TWN4F34		
Power supply:	DC supply		
	Nominal voltage:	5.00 V	
	Minimum voltage:	4.30 V	
	Maximum voltage:	5.50 V	
	Nominal frequency:	---	
Temperature range:	-25 °C to +65 °C (customer defined)		
Device type:	☐ Portable	☒ Mobile	☐ Fixed

3.2 Radio specifications

Radio technology 1:

System type:	RFID Reader		
Application frequency band:	n/a		
Operating frequencies:	125 kHz		
Number of RF channels	1		
Highest internal frequency:	2480 MHz (BLE)		
Modulation	ASK		
Antenna:	Type:	Air coil	
	Inductance:	490 $\mu\text{H} \pm 5\%$	
	Diameter of wire:	0.15 mm	
	Turns:	123-128 (max)	
	Connector:	☐ external ☐ temporary	☐ internal ☒ none (integral antenna)

Radio technology 2:

System type:	RFID Reader		
Application frequency band:	13.110 MHz – 14.010 MHz		
Operating frequencies:	13.56 MHz		
Number of RF channels	1		
Highest internal frequency:	2480 MHz (BLE)		
Modulation	ASK		
Antenna:	Type:	PCB antenna	
	Outer dimension:	48 x 33 mm $\pm 1\%$	
	Inductance	950 nH $\pm 5\%$	
	Diameter of wire	1 mm	
	Turns:	3	
	Connector:	☐ external ☐ temporary	☐ internal ☒ none (integral antenna)

Radio technology 3:

System type:	Digital transmission system (DTS)		
Radio technology:	Bluetooth low energy		
Application frequency band:	2400.0 MHz - 2483.5 MHz		
Number of RF channels:	40		
Nominal bandwidth:	2 MHz		
Modulation(s):	GFSK		
Antenna:	Type:	PCB antenna	
	Gain:	1.0 dBi (maximum)	
	Connector:	☐ external	☐ internal
		☐ temporary	☒ none (integral antenna)

3.3 Human exposure specifications

Exposure tier:	Body
Separation distance:	5 mm
Evaluated against exposure limits:	General public use
Simultaneous transmissions:	yes

3.4 Photographs of EUT

See Annex B of test report 250065-AU01+W02 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 4.

4.1 FCC

4.1.1 SAR test exclusion, except WPT

Requirement: Part 2, §2.1093
Reference: KDB 447498 D04 v01

Performed by:	Konrad Graßl	Date of test:	November 19, 2025
Result:	☒ Limits kept	☐ Limits not kept	

4.1.1.1 Requirements and limits for separation distance ≤ 20 cm

According to §2.1093(b):

For purposes of this section, the definitions in §1.1307(b)(2) of this chapter shall apply. A portable device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that the RF source's radiating structure(s) is/are within 20 centimeters of the body of the user.

According to §2.1093(c)(1):

Evaluation of compliance with the exposure limits in §1.1310 of this chapter, and preparation of an EA if the limits are exceeded, is necessary for portable devices having single RF sources with more than an available maximum time-averaged power of 1 mW, more than the ERP listed in Table 1 to §1.1307(b)(3)(i)(C), or more than the P_{th} in the following formula, whichever is greater. The following formula shall only be used in conjunction with portable devices not exempt by §1.1307(b)(3)(i)(C) at distances from 0.5 centimeters to 20 centimeters and frequencies from 0.3 GHz to 6 GHz.

Note:

1. According to the TCB Workshop on April 27, 2022 P_{th} can be calculated to the extended frequency range 100 kHz to 6 GHz. The formulas in the presentation of the TCB workshop beginning at slide 17 were used in addition to the KDB 447498 D04 v01.

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

Table 1: Formula for calculation P_{th}

d = the minimum separation distance (cm) in any direction from any part of the device antenna(s) or radiating structure(s) to the body of the device user.

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.

Table 2: Table 1 to §1.1307(b)(3)(i)(C)—Single RF Sources Subject to Routine Environmental Evaluation

According to §1.1307(b)(3)(i)(c):

Or using Table 1 to §1.1307 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to §1.1307 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

4.1.1.2 Process to determine RF Exposure Compliance

According to Appendix A of KDB 447498 D04 Interim General RF Exposure Guidance V01:
Generally, the sequence to apply for single portable RF sources includes the following steps:

- 1) Determination of 1 mW exemption
- 2) Determination of exemption according to Table 2
- 3) Determination of exemption according to formula in Table 1

4.1.1.3 Results

4.1.1.3.1 Radio technology 1

The following data are based on applicants document: Test report 250065-AU01+W02 of the test laboratory Element Materials Technology Straubing GmbH

Operation frequency: 125 kHz
Field strength: -7.0 dBμV/m at 300 m (Peak)

Information related to Exposure:

Tune-up tolerance (according to the manufacturer): 0 dB
Separation distance: 5 mm
Exposure: general public
Power averaging over time: not applied
Applied determination process: Step 1 of clause 4.1.1.2

<i>Separation distance (mm)</i>	<i>Channel frequency (kHz)</i>	<i>ERP + tolerance (dBm)</i>	<i>ERP + tolerance (mW)</i>	<i>Limit (mW)</i>	<i>Ratio of limit</i>	<i>Result</i>
5	125	-64.3	0.0000004	1.0000000	0.0000004	Passed

Table 3: Result of SAR test exclusion, exposure to the head and body

EIRP is calculated using the formula of ANSI C63.10-2013 clause 9.5:

$$\text{EIRP} = E + 20\log(d) - 104.7$$

Where: EIRP = equivalent isotropically radiated power in dBm
E = electric field strength in dBμV/m
d = measurement distance in meters (m)

$$\text{ERP} = \text{EIRP} - 2.15 \text{ dB}$$

4.1.1.3.2 Radio technology 2

The following data are based on applicants document: Test report 250065-AU01+W01 of the test laboratory Element Materials Technology Straubing GmbH

Operation frequency: 13.56 MHz
Field strength:: 38.9 dB μ V/m at 30 m

Information related to Exposure:

Tune-up tolerance (according to the manufacturer): 0 dB
Separation distance: 5 mm
Exposure: general public
Power averaging over time: not applied
Applied determination process: Step 1 of clause 4.1.1.2

<i>Separation distance (mm)</i>	<i>Channel frequency (MHz)</i>	<i>ERP + tolerance (dBm)</i>	<i>ERP + tolerance (mW)</i>	<i>Limit (mW)</i>	<i>Ratio of limit</i>	<i>Result</i>
5	13.56	-38.4	0.00014	1.00000	0.00014	Passed

Table 4: Result of SAR test exclusion, exposure to the head and body

EIRP is calculated using the formula of ANSI C63.10-2013 clause 9.5:

$$\text{EIRP} = E + 20\log(d) - 104.7$$

Where: EIRP = equivalent isotropically radiated power in dBm
E = electric field strength in dB μ V/m
d = measurement distance in meters (m)

$$\text{ERP} = \text{EIRP} - 2.15 \text{ dB}$$

4.1.1.3.3 Radio technology 3

The following data are based on applicants document: Test report 250065-AU01+W10 of the test laboratory Element Materials Technology Straubing GmbH

Antenna gain: 1.0 dBi
Maximum conducted output power: -37.7 dBm at 2426 MHz

Information related to Exposure:

Tune-up tolerance (according to the manufacturer): 0 dB
Separation distance: 5 mm
Exposure: general public
Power averaging over time: not applied
Applied determination process: Step 3 of clause 4.1.1.2

<i>Separation distance (mm)</i>	<i>Channel frequency (MHz)</i>	<i>ERP + tolerance (dBm)</i>	<i>ERP + tolerance (mW)</i>	<i>Limit (mW)</i>	<i>Ratio of limit</i>	<i>Result</i>
5	2426	-38.9	0.00013	2.76556	0.00005	Passed

Table 5: Result of SAR test exclusion, exposure to the head and body

EIRP is calculated using the formula of ANSI C63.10-2013 clause 9.5:

$$\text{EIRP} = E + 20\log(d) - 104.7$$

Where: EIRP = equivalent isotropically radiated power in dBm
E = electric field strength in dBμV/m
d = measurement distance in meters (m)

$$\text{ERP} = \text{EIRP} - 2.15 \text{ dB}$$

4.1.2 Simultaneous transmissions - SAR test exclusion, except WPT

Requirement: Part 2, § 2.1093
Reference: KDB 447498 D04 v01

Performed by:	Konrad Graßl	Date of test:	December 1, 2025
Result:	☒ Limits kept	☐ Limits not kept	

4.1.2.1 Requirements and limits

According to §2.1093(c)(2):

For multiple mobile or portable RF sources within a device operating in the same time averaging period, evaluation is required if the formula in §1.1307(b)(3)(ii)(B) of this chapter is applied to determine the exemption ratio and the result is greater than 1.

According to §1.1307(b)(3)(ii)(B)

in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for Pth, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

Pi = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

Pth,i = the exemption threshold power (Pth) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.

ERPj = the ERP of fixed, mobile, or portable RF source j.

ERPth,j = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$ according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

Evaluatedk = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

Exposure Limitk = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from §1.1310 of this chapter.

According to clause 4.3.2 of KDB 447498 D01 General RF Exposure Guidance:

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneously transmitting antenna. When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to the simultaneous transmission configuration.

4.1.2.2 Results

Note(s):

1. The SAR ratios are taken from clause 4.1.1.3.
2. Technologies 1 and 3 or 2 and 3 can transmit simultaneously.

Ratio of radio technology 1: 0.0000004

Ratio of radio technology 2: 0.00014

Ratio of radio technology 3: 0.00005

<i>Radio technologies</i>	<i>Addition of ratios</i>	<i>Sum</i>	<i>Limit</i>	<i>Result</i>
1 + 3	0.0000004+ 0.00005	0.0000504	≤1	Passed
2 + 3	0.00014+ 0.00005	0.00019	≤1	Passed

Table 6: Result of SAR test exclusion, simultaneous transmissions

4.2 Canada

4.2.1 NS exemption limits - calculation

Requirement: RSS-102, section 6.2.2

Reference: n/a

Performed by:	Konrad Graßl	Date of test:	November 19, 2025
Result:	☒ Limits kept	☐ Limits not kept	

4.2.1.1 NS exemption limits for inductive systems

According to RSS-102, section 6.2.2.1:

Section 6.2.2 of RSS-102 applies to inductively-coupled systems, which deliver current to a transmission coil to couple energy through the magnetic field to a receiver (e.g. for wireless power transfer).

An inductively coupled system is exempt from routine NS evaluation when the product of the number of turns, n , and RMS current, I_{RMS} (in amperes), in the transmission coil is less than or equal to the result on the right-hand side of equation (1), where x represents the separation distance in millimetres between the coil and exposed tissue.

$$nI_{RMS} \leq 24 \left(\frac{7.827}{(x+0.2786)^{0.1557}} - 3.953 \right)^{-1} \quad (1)$$

The exemption is only valid when:

the geometry of the transmission coil is circular or square

the outer dimension (diameter for circular coils or edge length for square coils) of the transmission coil is less than or equal to 100 mm

the minimum separation distance x is greater than or equal to 0.15 mm and

the maximum separation distance x is less than or equal to 50 mm

The thickness of the enclosure is permitted to be included in the separation distance x .

This equation is based on an approximation of internal E-fields resulting from general magnetic field sources determined through computational electromagnetic simulations.

Equation (1) is plotted in Figure 1. Devices with ampere-turns less than or equal to the curve are deemed exempt for the specific separation distances where this occurs. Similarly, the required separation distance for a fixed ampere-turn value corresponds to the appropriate intersection point. Note that the transmitting device might increase the current when the separation distance increases (e.g. based on feedback sent by the receiving device) as such, compliance with the exemption limit needs to be verified for all separation distances allowed in the device's instructions of use.

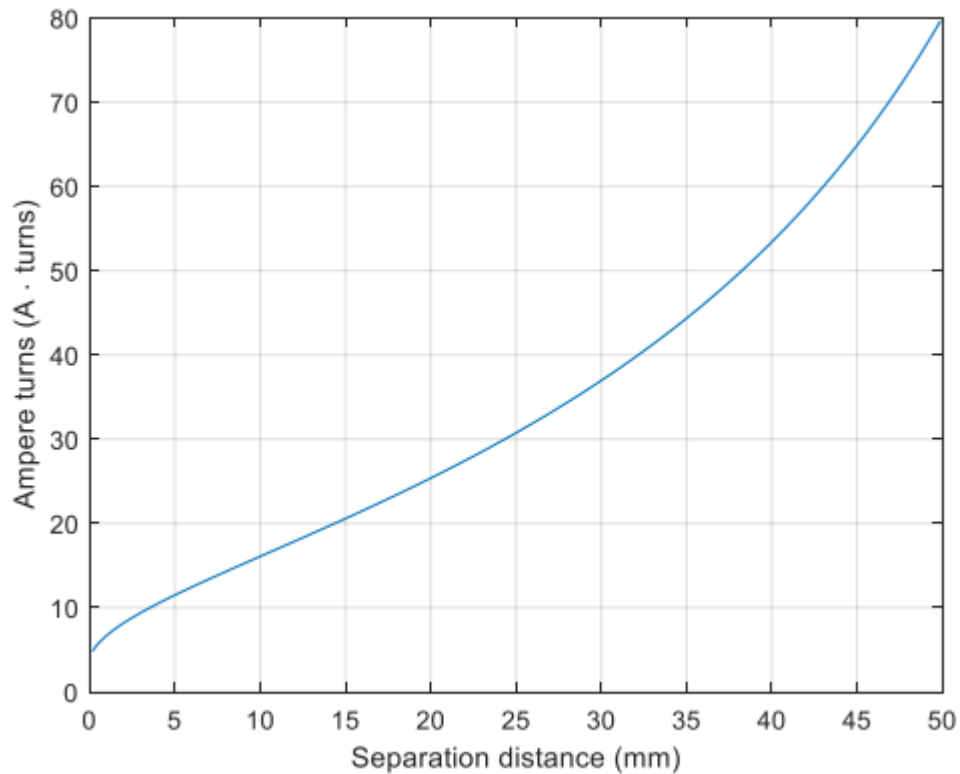


Figure 1: Ampere-turns versus separation for NS exemption limits

The applicable exemption limits for the maximum allowable ampere-turns at specific separation distances are summarized in Table 7.

Separation distance (mm)	0.15	5	10	15	20	25	30	35	40	45	50
Maximum ampere-turns (A turns)	4.8	11.4	16.0	20.5	25.3	30.7	36.9	44.3	53.4	64.8	80.0

Table 7: NS evaluation exemption limits for routine evaluation

According to Notice 2025-DRS0001:

The coil shapes in the categories listed below are applicable to NS exemption limits:

- Planar shapes (e.g. square, rectangular, hexagonal, elliptical etc.)
- Stacked rounded shapes (e.g. rectangular, cylindrical etc.)
- Surface Mount Technology (SMT) Coil Inductors

The coil shapes in the categories listed below are not applicable to NS exemption limits:

- 3-Axis SMT Coil (Not exempt from NS testing)
- Double D Coil (Not exempt from NS testing)

4.2.1.2 Results

4.2.1.2.1 Radio technology 1

The following data are based on applicants information:

Transmission coil: rectangular
Outer dimension: 43.4 x 28.4 mm
Number of turns n : 123 - 128
RMS current I_{RMS} : 44 mA
Separation distance x : 5 mm

Geometry	Outer dimension (mm)	Number of turns n	RMS current I_{RMS} (mA)	Separation distance x (mm)	Ampere-turns $n I_{RMS}$ (A)	Limit for $n I_{RMS}$ (A)	Result
rectangular	43.4 x 28.4	128	44.0	5	5.632	11.495	Limit kept

Table 8: Result of application of NS exemption limits

Note:

The calculation was performed assuming that 128 turns represent the worst case.

4.2.2 SAR test exclusion, except 3 kHz – 10 MHz

Requirement: RSS-102, section 6.3

Reference: n/a

Performed by:	Konrad Graßl	Date of test:	November 19, 2025
Result:	☒ Limits kept	☐ Limits not kept	

4.2.2.1 Exemption Limits for Routine Evaluation – SAR Evaluation

According RSS 102, section 6.3:

Devices operating at or below the applicable output power levels (adjusted for tune-up tolerance) specified in Table 9, based on the separation distance, are exempt from SAR evaluation. The separation distance, defined as the distance between the user and/or bystander and the antenna and/or radiating element of the device or the outer surface of the device, shall be less than or equal to 20 cm for these exemption limits to apply.

Frequency (MHz)	≤ 5 mm (mW)	10 mm (mW)	15 mm (mW)	20 mm (mW)	25 mm (mW)	30 mm (mW)	35 mm (mW)	40 mm (mW)	45 mm (mW)	>50 mm (mW)
≤ 300	45	116	139	163	189	216	246	280	319	362
450	32	71	87	104	124	147	175	208	248	296
835	21	32	41	54	72	96	129	172	228	298
1900	6	10	18	33	57	92	138	194	257	323
2450	3	7	16	32	56	89	128	170	209	245
3500	2	6	15	29	50	72	94	114	134	158
5800	1	5	13	23	32	41	54	74	102	128

Table 9: Power limits for exemption from routine SAR evaluation based on the separation distance

The exemption limits in Table 9 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 50 mm from a flat phantom, which provides a SAR value of approximately 0.4 W/kg for 1 g of tissue.

For limb-worn devices where the 10 gram of tissue applies, the exemption limits for routine evaluation in Table 9 are multiplied by a factor of 2.5.

For controlled-use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 9 are multiplied by a factor of 5.

When the operating frequency of the device is between two frequencies located in Table 9, linear interpolation shall be applied for the applicable separation distance. If the separation distance of the device is between two distances located in Table 9, linear interpolation may be applied for the applicable frequency. Alternatively, the limit corresponding to the smaller distance may be employed. For example, in case of a 7 mm separation distance, either use the exception value for a 5 mm separation distance or interpolate between the limits corresponding to 5 mm and 10 mm separation distances.

For implanted medical devices, the exemption limit for routine SAR evaluation is set at an output power of 1 mW, regardless of frequency.

The SAR levels from exempted transmitters shall be included in the compliance assessment and the determination of the TER. Detailed guidance is included in sections 7.1.8 and 8.2.2.1 of RSS-102.

4.2.2.2 Results

4.2.2.2.1 Radio technology 2

The following data are based on applicants document: Test report 250065-AU01+W01 of the test laboratory Element Materials Technology Straubing GmbH

Operation frequency: 13.56 MHz
Field strength:: 38.9 dBμV/m at 30 m

Information related to Exposure:

Tune-up tolerance 0 dB
(according to the manufacturer):
Separation distance: 5 mm
Exposure: general public
Power averaging over time: not applied

<i>Separation distance (mm)</i>	<i>Channel frequency (MHz)</i>	<i>ERP + tolerance (dBm)</i>	<i>ERP + tolerance (mW)</i>	<i>Limit 1-g SAR (mW)</i>	<i>Ratio of limit</i>	<i>Result</i>
5	13.56	-38.4	0.0001	45.0000	0.000003	passed

Table 10: Result of SAR test exclusion, exposure to the head and body

EIRP is calculated using the formula of ANSI C63.10-2013 clause 9.5:

$$\text{EIRP} = E + 20\log(d) - 104.7$$

Where: EIRP = equivalent isotropically radiated power in dBm
E = electric field strength in dBμV/m
d = measurement distance in meters (m)

$$\text{ERP} = \text{EIRP} - 2.15 \text{ dB}$$

4.2.2.2.2 Radio technology 3

The following data are based on applicants document: Test report 250065-AU01+W10 of the test laboratory Element Materials Technology Straubing GmbH

Antenna gain: 1.0 dBi
Maximum conducted output power: -37.7 dBm at 2426 MHz

Information related to Exposure:

Tune-up tolerance (according to the manufacturer): 0 dB
Separation distance: 5 mm
Exposure: general public
Power averaging over time: not applied

<i>Separation distance (mm)</i>	<i>Channel frequency (MHz)</i>	<i>EIRP + tolerance (dBm)</i>	<i>EIRP + tolerance (mW)</i>	<i>Limit 1-g SAR (mW)</i>	<i>Ratio of limit</i>	<i>Result</i>
5	2426	-36.7	0.0002	3.0000	0.0001	passed

Table 11: Result of SAR test exclusion, exposure to the head and body

4.2.3 Simultaneous transmissions SAR test exclusion, except 3 kHz – 10 MHz

Requirement: RSS-102, section 8.2.2.1

Reference: n/a

Performed by:	Konrad Graßl	Date of test:	December 1, 2025
Result:	☒ Limits kept	☐ Limits not kept	

4.2.3.1 Requirements and limit

According to RSS-102, section 8.2.2.1:

The various $ER_{therm \leq 10MHz}$ and $ER_{therm < 10MHz}$ from each of the different transmitters and different exposure metrics can be combined to determine the TER for all transmitters (TER_{therm}) using equation (16):

$$\begin{aligned}
 TER_{therm} = & ER_{therm \leq 10MHz} \\
 & + \sum_{t=1}^T ER_{therm > 10MHz,t} + \sum_{u=1}^U ER_{therm > 10MHz,u} \\
 & + \sum_{v=1}^V ER_{therm > 10MHz,v} + \sum_{w=1}^W ER_{therm > 10MHz,w} \\
 & + \sum_{x=1}^X ER_{therm > 10MHz,x} + \sum_{y=1}^Y ER_{therm > 10MHz,y} \\
 & + \sum_{z=1}^Z ER_{exempted_{1mW,z}}
 \end{aligned} \tag{16}$$

where:

- T is the number of simultaneously operating transmitters for which an assessment against the basic restriction for SAR may have been performed (refer to section 8.2.2.1 of RSS-102)
- U is the number of simultaneously operating exempted transmitters for which an estimate against the basic restriction for SAR may have been performed (refer to section 8.2.2.1 of RSS-102)
- V is the number of simultaneously operating transmitters for which an assessment against the basic restriction for APD may have been performed (refer to section 8.2.2.2 of RSS-102)
- W is the number of simultaneously operating exempted transmitters for which an estimate against the basic restriction for APD may have been performed (refer to section 8.2.2.2 of RSS-102)
- X is the number of simultaneously operating transmitters (operating between 6 GHz and 30 GHz) for which an assessment against the IPD level may have been performed (refer to section 8.2.2.3 of RSS-102)
- Y is the number of simultaneously operating transmitters (operating between 30 GHz and 300 GHz) for which an assessment against the IPD level may have been performed (refer to section 8.2.2.3 of RSS-102) and
- Z is the number of simultaneously operating transmitters for which the 1 mW exemption as outlined in section 6.5 applies (refer to section 8.2.2.4 of RSS-102)

Compliance with the SAR-PD-based RF exposure limits is achieved if $TER_{therm} \leq 1$.

According to RSS-102, section 7.1.8:

SAR values from exempted transmitters shall be included in the total exposure assessment. A SAR value of 0.4 W/kg for 1 g, 1 W/kg for 10 g, or an estimated SAR value based on the ratio of the power level and the power exemption limit may be used to determine the standalone SAR value for test configurations that do not require a SAR evaluation based on test reductions or on the exemption limits outlined in section 6.3. The estimated SAR value, $SAR_{estimated}$ is calculated using equation (2):

$$SAR_{estimated} = \frac{P_{max}}{P_{max,exemption}} \times 0.25 \times SAR_{limit} W/kg \quad (2)$$

where:

- P_{max} is the maximum power level including tune-up tolerance for the exempted transmitter
- $P_{max,exemption}$ is the maximum power level of exemption at the same frequency and distance for the exempted transmitter
- SAR_{limit} is the applicable SAR limit (e.g. 1.6 W/kg for 1 g or 4 W/kg for 10 g)

For example, transmitter A has a maximum output power of 2 mW and the power exemption threshold is 3 mW at that specific frequency and distance (i.e. 2.45 GHz with a separation distance of 5 mm). The estimated SAR = (2 mW / 3 mW) * 0.4 W/kg = 0.27 W/kg.

The SAR levels from exempted transmitters shall be included in the total exposure ratio assessment. Detailed guidance is included in section 8.2.2.1 of RSS-102.

<i>Exposure tier</i>	<i>Region of body</i>	<i>SAR exemption limit (W/kg)</i>
General public	Head and trunk	0.4
General public	Limbs	1.0
Occupational	Head and trunk	2.0
Occupational	Limbs	5.0

Table 12: SAR exemption limits

4.2.3.2 Results

Note(s):

1. The ratios are taken from clause 4.2.2.2.
2. The radio technologies 2 and 3 can transmit simultaneously in the frequency range > 10 MHz.
3. There are no simultaneous transmissions below 10 MHz (nerve stimulation).

Ratio of radio technology 2: 0.000003

Ratio of radio technology 3: 0.0001

<i>Radio technologies</i>	<i>Addition of ratios</i>	<i>Sum</i>	<i>Limit</i>	<i>Result</i>
2 + 3	0.000003+ 0.0001	0.000103	≤1	Passed

Table 13: Result of SAR exemption, simultaneous transmissions

5 Revision history

<i>Revision</i>	<i>Date</i>	<i>Issued by</i>	<i>Description of modifications</i>
0	2025-12-16	Konrad Graßl	First edition

Template: RF_FCC_IC_Human Exposure_V1.10