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Applicant:

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Test report no.:

240514-AU02+W04

for:

ELATEC GmbH
RFID reader / writer
TWN4 Secustos SG30

according to:

47 CFR Part 2
RSS-102

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12155-01-00

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 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:

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

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1 Summary of test results

1.1 FCC standard

FCC standard	*Requirement*	*Result*	*Page*
47 CFR Part 2, § 2.1093	SAR test exclusion, except WPT	Passed	11

1.2 IC standard

IC standard	*Requirement*	*Result*	*Page*
RSS-102 Issue 6, section 6.2.2	NS exemption limits - calculation	Passed	16
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Straubing, April 30, 2025

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 1.1307 October 2024	Actions that may have a significant environmental effect, for which Environmental Assessment (EAs) must be prepared.
Part 1, Subpart I, Section 1.1310 October 2024	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093 October 2024	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

Standard	*Title*
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 Secustos SG30		
Serial number(s):	R2025125683		
Applicant:	ELATEC GmbH		
Manufacturer:	ELATEC GmbH		
Hardware version:	PRODA		
Software version:	CONT1.26, Mode 4 (125 kHz)		
Firmware version:	4.70		
Short description:	EUT is a RFID reader / writer operating at the frequencies 125 kHz and 13.56 MHz. BLE is additionally integrated.		
FCC ID:	WP5TWN4F31		
IC registration number:	7948A-TWN4F31		
Temperature range:	-20 °C to +60 °C (customer defined)		
Device type:	☐ Portable	☐ Mobile	☒ Fixed

3.2 Power supply

USB:

Power input characteristics:	
Input power type:	DC
Nominal voltage:	5 V
Voltage range:	4.7 V – 5.8 V

RS-485:

Power input characteristics:	
Input power type:	DC
Nominal voltage:	12 V
Voltage range:	6 V – 28 V

Wiegand:

Power input characteristics:	
Input power type:	DC
Nominal voltage:	12 V
Voltage range:	6 V – 28 V

3.3 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:	Magnetic loop	
	Inductance:	490 µH ± 5%	
	Diameter of wire:	0.11 mmm	
	Turns:	135, max 140	
		Coil is fixed by using backed wire	
		Leadfree and RoHS conform	
	Connector:	☐ external	☐ internal
		☐ temporary	☒ 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, 2 Layers	
	Outer dimension:	65.00 x 41.35 mm ± 1%	
	Inductance	875 nH ± 5%	
	Width of wire	0.6 mm	
	Turns:	3	
	Connector:	☐ external	☐ internal
		☐ temporary	☒ none (integral antenna)

Radio technology 3:

System type (Note 1):	Digital transmission system (DTS)		
Application frequency band:	2400.0 MHz - 2483.5 MHz		
Number of RF channels:	40		
Nominal bandwidth:	2 MHz		
Modulation(s):	GFSK		
Antenna:	Type:	2.4GHz Mini Antenna, SMT	
	Peak gain:	0.5 dBi	
	Model:	2450AT18A100	
	Manufacturer:	Johanson Technology Inc.	
	Connector:	☐ external	☐ internal
		☐ temporary	☒ none (integral antenna)

Note(s):
1. "DTS" is the equipment class for digital transmission systems, "DSS" for all other Part 15 spread spectrum transmitters as used for equipment authorization system form 731.

3.4 Human exposure specifications

Exposure tier:	Body
Separation distance:	< 5 mm
Evaluated against exposure limits:	General public use
Simultaneous transmissions:	no

3.5 Photographs of EUT

See Annex B of test report 240514-AU02+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 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:	April 30, 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.

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

Where

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

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

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^2f.
1,500-100,000	19.2R^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 λ/2π, 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 λ/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

Note:
1. As worst case the exposure limit to the head and body was applied.

Radio technology 1:

The following data are based on applicants document: Test report 240514-AU02+W01 of the test laboratory Element Materials Technology Straubing GmbH

Operation frequency:	125 kHz
Maximum field strength:	-18.2 dBµV/m at 300 m
Calculated EIRP:	-73.4 dBm
Calculated ERP:	-75.5 dBm

Information related to Exposure:

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

Separation distance (mm)	*Channel frequency (kHz)*	*ERP + tolerance (dBm)*	*ERP + tolerance (mW)*	*Limit (mW)*	*Ratio of limit*	*Result*
< 5	125	-75.5	0.00000003	629542.36285785	4.76537E-14	Passed

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

EIRP is calculated using the formula of ANSI C63.10, clause 11.12.2.2:

EIRP = E + 20log(d) - 104.8

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

According to annex G.4 of ANSI C63.10:

ERP = EIRP – 2.15 dB

Radio technology 2:

The following data are based on applicants document: Test report 240514-AU02+W02 of the test laboratory Element Materials Technology Straubing GmbH

Operation frequency:	13.56 MHz
Maximum field strength:	34.6 dBµV/m at 30
Calculated EIRP:	-40.6
Calculated ERP:	-42.7

Information related to Exposure:

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

Separation distance (mm)	*Channel frequency (MHz)*	*ERP + tolerance (dBm)*	*ERP + tolerance (mW)*	*Limit (mW)*	*Ratio of limit*	*Result*
< 5	13.56	-42.7	0.000054	2997.207390	1.80168E-08	Passed

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

EIRP is calculated using the formula of ANSI C63.10, clause 11.12.2.2:

EIRP = E + 20log(d) - 104.8

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

According to annex G.4 of ANSI C63.10:

ERP = EIRP – 2.15 dB

Radio technology 3:

The following data are based on applicants document: Test report 240514-AU02+W03 of the test laboratory Element Materials Technology Straubing GmbH

Antenna gain:	0.5 dBi
Maximum conducted output power:	-0.6 dBm at 2402 MHz

Information related to Exposure:

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

Notes:
1. According to clause 2.1.3 of KDB 447498 D04 Interim the conducted output power was used for calculation as worst case.

Separation distance (mm)	*Channel frequency (MHz)*	*Conducted power + tolerance (dBm)*	*Conducted power + tolerance (mW)*	*Limit (mW)*	*Ratio of limit*	*Result*
< 5	2402	-0.6	0.9	2.8	0.32	Passed

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

4.2 Canada

4.2.1 NS exemption limits - calculation

Requirement:	RSS-102 Issue 6, section 6.2.2
Reference:	n/a

Performed by:	Konrad Graßl	Date of test:	April 1, 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, IRMS (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.

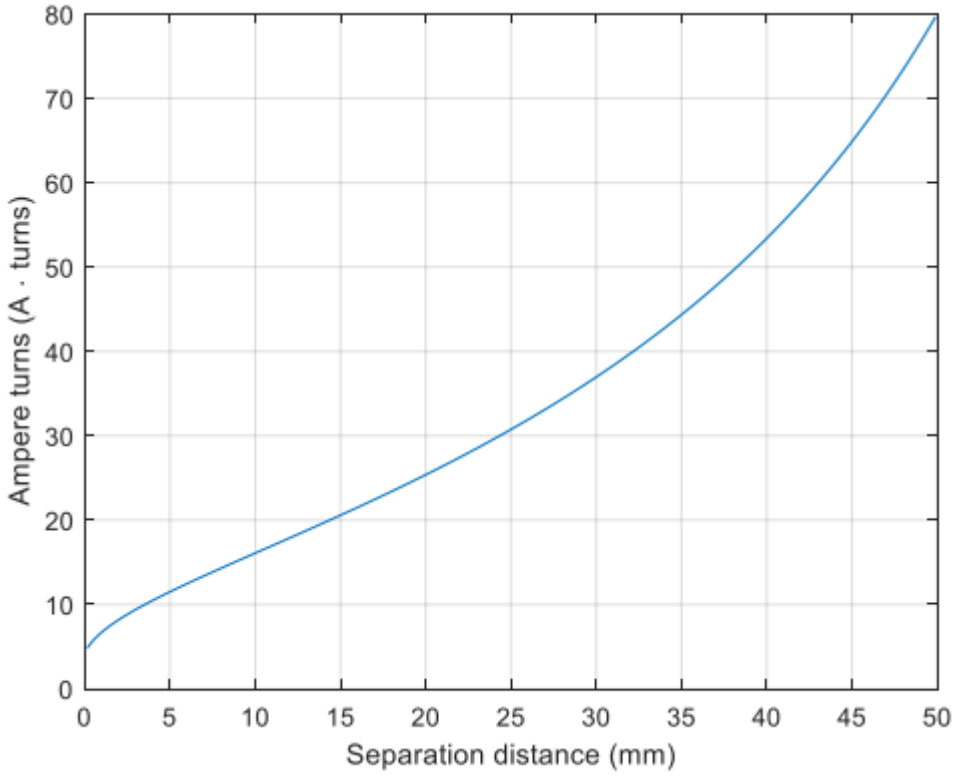

Figure 1: Ampere-turns versus separation for NS exemption limits

The applicable exemption limits for the maximum allowable ampere-turns at specific separation distances are summarized in Table 6.

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 6: NS evaluation exemption limits for routine evaluation

4.2.1.2 Results

Radio technology 1:

The following data are based on applicants information:

Transmission coil:	circular
Outer dimension:	17.0 mm
Number of turns n:	typ. 135, max 140
RMS current I_{RMS}:	52.2 mA
Separation distance x (see note 1):	2.1 mm

Note:
1. "x" is the shortest distance between the antenna and the touchable surface of the device.

Geometry	Outer dimension (mm)	Number of turns *n*	RMS current I_{RMS} (mA)	Separation distance x (mm)	Ampere-turns $n \cdot I_{RMS}$ (A)	Limit for $n \cdot I_{RMS}$ (A)	Result
circular	17	140	52.2	2.1	7.308	8.316	Limit kept

Table 7: Result of application of NS exemption limits

4.2.2 SAR test exclusion, except 3 kHz – 10 MHz

Requirement:	RSS-102 Issue 6, section 6.3
Reference:	n/a

Performed by:	Konrad Graßl	Date of test:	April 30, 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 8, 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 8: Power limits for exemption from routine SAR evaluation based on the separation distance

The exemption limits in Table 8 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 8 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 8 are multiplied by a factor of 5.

When the operating frequency of the device is between two frequencies located in Table 8, linear interpolation shall be applied for the applicable separation distance. If the separation distance of the device is between two distances located in Table 8, 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

Radio technology 2:

The following data are based on applicants document: Test report 240514-AU02+W02 of the test laboratory Element Materials Technology Straubing GmbH

Operation frequency:	13.56 MHz
Maximum field strength:	34.6 dBµV/m at 30
Calculated EIRP:	-40.6

Information related to Exposure:

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

Separation distance (mm)	*Channel frequency (MHz)*	*EIRP + tolerance (dBm)*	*EIRP + tolerance (mW)*	*Limit 1-g SAR (mW)*	*Ratio of limit*	*Result*
< 5	13.56	-40.6	0.00009	45.00000	0.000002	passed

Table 9: Result of SAR test exclusion, exposure to the head and body

EIRP is calculated using the formula of ANSI C63.10, clause 11.12.2.2:

EIRP = E + 20log(d) - 104.8

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

Radio technology 3:

The following data are based on applicants document: Test report 240514-AU02+W03 of the test laboratory Element Materials Technology Straubing GmbH

Antenna gain:	0.5 dBi
Maximum conducted output power:	-0.6 dBm at 2402 MHz

Information related to Exposure:

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

Separation distance (mm)	*Channel frequency (MHz)*	*Output power + tolerance (dBm)*	*Output power + tolerance (mW)*	*Limit (mW)*	*Ratio of limit*	*Result*
< 5	2402	-0.6	0.9	3.3	0.27	passed

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

5 Revision history

Revision	*Date*	*Issued by*	*Description of modifications*
0	2025-04-30	Konrad Graßl	First edition

Template: RF_FCC_IC_Human Exposure_V1.10