

Test report

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EMC test report

190222-AU01+W04



Industry
Canada

Elatec GmbH

RFID Reader / Writer

TWN4 Slim

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Accreditation:



FCC test firm accreditation expiration date: 2021-05-30
MRA US-EU, FCC designation number: DE0010
BnetA-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

Location of Testing:

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94315 Straubing

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



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1 Test regulations

<i>Standard</i>	<i>Title</i>
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
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.
KDB 865664 D01	SAR Measurement Requirements for 100 MHz to 6 GHz, August 7, 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

2 Summary of test results

FCC

Standard and clause	Test	Page	Result	Note
Part 1, Subpart 2, Section 2.1091	Evaluation for separation distance > 20 cm, except WPT	8	Passed	1
Part 1, Subpart 2, Section 2.1091	Multiple transmitters capable of simultaneous transmission		Not applicable	1

Note 1: Frequency 1(125 kHz) and frequency 2 (13.56 MHz) are categorically excluded from routine environmental evaluation for RF exposure.

Canada

Standard and clause	Test	Page	Result	Note
RSS-102 Issue 5, clause 4	For transmitters operating between 3 kHz and 10 MHz	11	Passed	
RSS-102 Issue 5, clause 2.5.2	Evaluation for separation distance > 20 cm, except 3 kHz – 10 MHz	14	Passed	
RSS-102 Issue 5, clause 2.5.2	Multiple transmitters capable of simultaneous transmission	16	Passed	

Straubing, October 14, 2019



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Elatec GmbH
RFID Reader Writer
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3 Equipment under test (EUT)

Product type: RFID Reader / Writer
Model Name: TWN4 Slim
HVIN: EL1901
Manufacturer: Elatec GmbH
Serial number: 2019103472
Short description: The EUT is a RFID Reader operating on the frequencies 125 kHz and 13.56 MHz with a certified BLE module.
FCC ID: WP5TWN4F9
IC certification number: 7948A-TWN4F9
FCC-ID of BLE-module: QOQ11
IC registration number of BLE-module: 5123A-11
Operating frequencies: Frequency 1: 125 kHz
Frequency 2: 13.56 MHz
Frequency 3: 2402 – 2480 MHz (BLE)
Multiple transmissions: Yes
Antenna types: PCB antenna
 detachable not detachable
Power supply: DC supply
nominal voltage: 5.0 V
Type of device: Body-supported device
 Body-worn (or body-mount) radio
 Limb-Worn device
 other
Separation distance: ≤ 20 cm
 > 20 cm
Evaluated against exposure limits: General public use
 Controlled use

4 Photographs of EUT

See 190222-AU01+W01 Annex B 125 kHz and 190222-AU01+W03 Annex B 13.56 MHz.

5 Test results

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

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

<i>Ambient temperature</i>	<i>Ambient humidity</i>	<i>Ambient pressure</i>
15°C to 35°C	30 % to 75 %	86 kPa to 106 kPa

5.1 FCC

5.1.1 Evaluation for separation distance > 20 cm, except WPT

Reference: Part 1, Subpart 2, Section 2.1091

Basic standard: n/a

Performed by: Konrad Graßl Date of test: September 24, 2019

Result: Limits kept Limits not kept

5.1.1.1 Data of equipment under test (EUT)

Note: The data for the Frequency 3 is taken out of the Test report 285803-1 of the test laboratory SGS.

Frequency 3:

Antenna connector: none

Antenna detachable: No

Maximum peak conducted output power: 8.32 dBm at 2402 MHz

Antenna Gain: 2.14 dBi

Tune-up tolerance: ± 1 dB

Applicable duty cycle: As worst case not applied

Separation distance: 20 cm

5.1.1.2 Requirements and limits for separation distance > 20 cm

This estimation follows the general guidelines for RF Exposure according to KDB 447498.

As noted in §2.1091(b) a mobile 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 a **separation distance of at least 20 centimeters** is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.”

According to §2.1091(c) the limits to be used for evaluation are defined in §1.1310.

As specified in §1.1310(d)(2) at operating frequencies less than or equal to 6 GHz, the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 of §1.1310(e) may be used.

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 - 1500			f/300	6
1500 - 100000			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 - 1500			f/1500	30
1500 - 100000			1.0	30

Table 1: Limits for maximum permissible exposure (MPE) according to table 1 of §1.1310(e)

Notes:

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

5.1.1.3 Results

Frequency 3

<i>Channel Frequency (MHz)</i>	<i>EIRP + tuneup tolerance (dBm)</i>	<i>Power density (mW/cm²)</i>	<i>Limit Power density (mW/cm²)</i>	<i>Fraction of limit (%)</i>	<i>Result</i>
2402	11.46	0.0028	1	0.28	Passed

Table 2: Result of MPE

5.2 Canada

5.2.1 Frequency range 3 kHz up to 10 MHz

Reference: RSS-102, clause 4

Basic standard: n/a

Performed by:	Jennifer Riedel	Date of test:	August 23, 2019
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Result:	<input checked="" type="checkbox"/> Limits kept	<input type="checkbox"/> Limits not kept
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5.2.1.1 Data of equipment under test (EUT)

Note: The data for the Frequency 1 is taken out of the Test report 190222-AU01+W01 of the test laboratory EMV Testhaus GmbH

Frequency 1:

Antenna connector: none

Antenna detachable: No

Maximum field strength: 55.67 dB μ V/m at 3 m

Operation frequency: 125 kHz

Tune-up tolerance: ± 1 dB

5.2.1.2 Limits

According to 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 can be found in table 3 and table 4 of Safety Code 6, section 2.2:

<i>Electric Field Strength Reference Levels</i>				
<i>Frequency Range (MHz)</i>	<i>Reference Level Basis</i>	<i>Reference Level (E_{RL}), (V/m, RMS)</i>		<i>Reference Period (minutes)</i>
		<i>Uncontrolled Environment</i>	<i>Controlled Environment</i>	
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 3: Electric field strength reference levels (see table 3 of Safety Code 6)

<i>Magnetic Field Strength Reference Levels</i>				
<i>Frequency Range (MHz)</i>	<i>Reference Level Basis</i>	<i>Reference Level (H_{RL}), (A/m, RMS)</i>		<i>Reference Period (minutes)</i>
		<i>Uncontrolled Environment</i>	<i>Controlled Environment</i>	
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 4: Magnetic field strength reference levels (see table 4 of Safety Code 6)

5.2.1.3 Test configuration

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 distance as noted in Table 5 and Table 6 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”.

5.2.1.4 Test results

<i>Channel Frequency (MHz)</i>	<i>Measured electric field strength (V/m) at 20 cm + tune-up tolerance</i>	<i>Limit (V/m)</i>	<i>Fraction of limit (%)</i>	<i>Result</i>
0.125	1.29	83	1.56	Passed

Table 5: Result of electric field strength

<i>Channel Frequency (MHz)</i>	<i>Measured magnetic field strength (A/m) at 20 cm + tune-up tolerance</i>	<i>Limit (A/m)</i>	<i>Fraction of limit (%)</i>	<i>Result</i>
0.125	1.01	90	1.12	Passed

Table 6: Result of magnetic field strength

5.2.2 Evaluation for separation distance > 20 cm, except 3 kHz – 10 MHz

Reference: RSS 102 clause 2.5.2

Basic standard: n/a

Performed by: Jennifer Riedel Date of test: August 23, 2019

Result: Limits kept Limits not kept

5.2.2.1 Data of equipment under test (EUT)

Note: The data for the Frequency 2 is taken out of the Test report 190222-AU01+W03 of the test laboratory EMV Testhaus GmbH

Frequency 2:

Antenna connector: none
Antenna detachable: No
Maximum field strength 67.95 dB μ V/m at 3 m
Operation frequency: 13.56 MHz
Tune-up tolerance: \pm 1 dB
Applicable duty cycle: As worst case not applied

Note: The data for the Frequency 3 is taken out of the Test report 285803-1 of the test laboratory SGS.

Frequency 3:

Antenna connector: none
Antenna detachable: No
Maximum peak conducted output power: 8.32 dBm at 2402 MHz
Antenna Gain: 2.14 dBi
Tune-up tolerance: \pm 1 dB
Applicable duty cycle: As worst case not applied

5.2.2.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

According to RSS 102 Clause 2.5.2:

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

5.2.2.3 Results

Frequency 2

Channel Frequency (MHz)	ERP + tuneup tolerance (dBm)	P (W)	Limit (W)	Fraction of limit (%)	Result
13.56	-26.25	0.000002	1	0.0002	Passed

Table 7: Result of exemption for routine evaluation

Frequency 3

Channel Frequency (MHz)	EIRP + tuneup tolerance (dBm)	P (W)	Limit (W)	Fraction of limit (%)	Result
2402	11.46	0.011	2.68	0.41	Passed

Table 8: Result of exemption for routine evaluation



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5.2.3 Multiple transmitters capable of simultaneous transmission

Reference: RSS 102

Basic standard: n/a

Performed by: Konrad Graßl

Date of test: October 14, 2019

Result: Limits kept

Limits not kept

5.2.3.1 Requirements and limit

According to RSS 102 Clause 2.5.2:

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

5.2.3.2 Results

Frequency 1 and frequency 2 can not work simultaneously. Frequency 1 and frequency 3 or frequency 2 and frequency 3 can work simultaneously. (see clause 5.2.1 and 5.2.2).

Worst case : Frequency 1 works simultaneously with frequency 3.

<i>Fraction of limit frequency 1 (%)</i>	<i>Fraction of limit frequency 3 (%)</i>	<i>Sum of fractions (%)</i>	<i>Limit (%)</i>	<i>Result</i>
1.56	0.41	1.97	100	passed

6 Revision history

<i>Revision</i>	<i>Date</i>	<i>Issued by</i>	<i>Description of modifications</i>
0	2019-10-14	Konrad Graßl	First edition