Test report

Applicant:

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Test report no.:

200136-AU02+W04

for:

Elatec GmbH
RFID reader / writer module
TWN4 MultiTech 3 M LEGIC

Industry Canada

according to:

RSS 102

EMV TESTHAUS

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

Accreditation:

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

2 Summary of test results

Standard	*Result*	*Remark*
RSS-102 Issue 5	Passed	---

Straubing, July 29, 2020

Andreas Menacher
Test engineer
EMV **TESTHAUS** GmbH

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

3 Equipment under test (EUT)

Product type:	RFID reader / writer module	
Model Name:	TWN4 MultiTech 3 M LEGIC	
Manufacturer:	Elatec GmbH	
Serial number:	2020182927	
Version:	Hardware:	B
	Software:	B1.09/NKB3.22/STD2.03/B/BT1.07EL
Short description:	EUT is a RFID reader / writer module operating at the frequencies 125 kHz and 13.56 MHz.	
FCC ID:	WP5TWN4F14	
IC certification number:	7948A-TWN4F14	
RF technology 1:	RFID	
RF technology 2:	RFID	
Application frequency band 1:	N/A	
Application frequency band 2:	13.110 MHz – 14.010 MHz	
Operating frequency 1:	125 kHz	
Operating frequency 2:	13.56 MHz	
Modulation RF technology 1:	ASK	
Modulation RF technology 2:	ASK	
Antenna type 1:	Loop antenna ☐ detachable	☒ not detachable
Antenna type 2:	PCB antenna ☐ detachable	☒ not detachable
Power supply:	DC supply nominal voltage: 5.00 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 of test report 200136-AU01+W04 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 Canada

5.1.1 Frequency range 3 kHz up to 10 MHz

Reference: RSS-102

Basic standard: SPR-002
IEEE C95.3

Performed by:	Andreas Menacher	Date of test:	July 15, 2020
Result:	☒ Limits kept	☐ Limits not kept	

5.1.1.1 Test configuration

EUT			
Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
RFID reader / writer module	TWN4 MultiTech 3 M LEGIC	2020182927	Elatec GmbH
Peripheral devices			
Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
RFID tag	Keyfob 125 KHz	---	---
Laptop	Lifebook U772	O00632	FUJITSU
Power supply unit for laptop	AC adapter	O00632	FUJITSU

Table 1: Devices used for testing

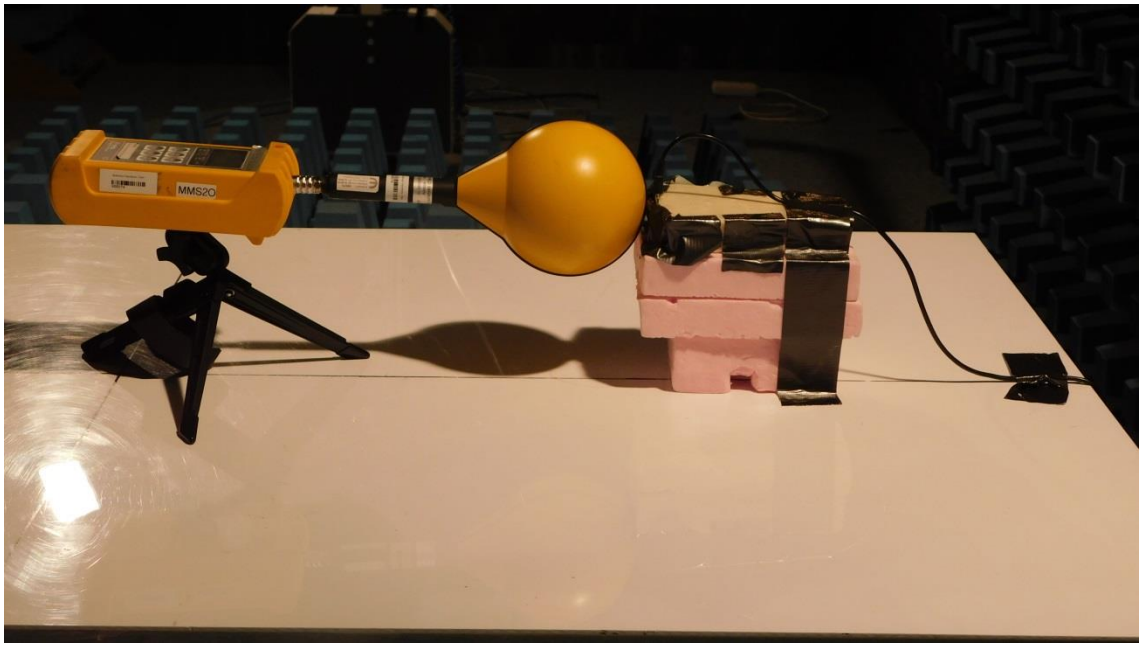
5.1.1.2 Mode of operation

The EUT was powered and controlled via USB-port.
Test software “TWN4_xKx401_STD204_Multi_Keyboard_Standard.bix” was used to force the EUT to send a modulated carrier signal at the operating frequency 125 kHz.

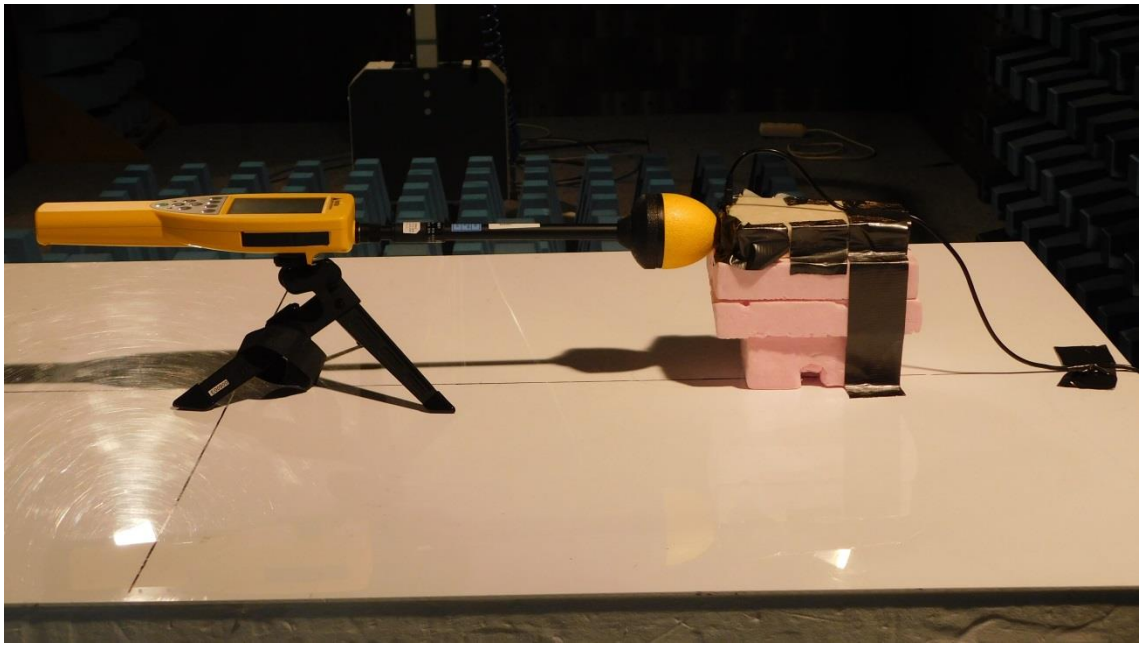
5.1.1.3 Test equipment

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 0 cm



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

5.1.1.5 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 2: 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 3: 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 2 and table 3. 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 2 and table 3, 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 2 and table 3, 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 3 (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.

5.1.1.6 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 8 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”.

5.1.1.7 Test results

Results for Frequency 1:

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 4: Limb exposure limit relaxation

However, a second exposure evaluation must be taken at the distance at which the trunk of the body would rest in relation to the device under test. Therefore, measurements are performed in two distances:

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	9.18	1.0	83	11.06 %	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	3.43	1.0	90	3.81 %	Passed
100 kHz - 10 MHz	SAR	125 kHz	3.43	1.0	5.84	58.73 %	Passed

Table 5: RF exposure test results according to RSS-102 at a distance of 0 cm

Remark: The worst case emission occurred without tag.

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 6: 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 cm2	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 7: Equipment calibration status

5.1.2 Evaluation for separation distance ≤ 20 cm, except 3 kHz -10 MHz

Reference: RSS 102 clause 2.5.1

Basic standard: n/a

Performed by:	Andreas Menacher	Date of test:	July 15, 2020
Result:	☒ Limits kept	☐ Limits not kept	

5.1.2.1 Data of equipment under test (EUT)

Note: The data for the RF technology 2 is declared by the customer.

RF technology 2:

Application:	RFID
Operation frequency:	13.56 MHz
Antenna model	PCB
Antenna connector:	none
Antenna type:	internal
	not detachable
Maximum output power of RFID chip inclusive tune-up tolerance:	11.4 dBm

5.1.2.2 Exemption Limits for Routine Evaluation – SAR Evaluation

According RSS 102 clause 2.5.1:
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

[4] The exemption limits in Table 1 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

[5] Transmitters operating between 0.003-10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in Section 4.

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.
For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

5.1.2.3 Results

RF technology 2:

Information related to Exposure:

Antenna model	PCB antenna
Separation distance:	0 mm
Exposure tier:	general public
Power averaging over time:	Not applied

Exposure to the head

Separation distance (mm)	*Channel Frequency (MHz)*	*EIRP + tolerance (dBm)*	*EIRP + tolerance (mW)*	*Limit 1-g SAR (mW)*	*Fraction of limit (%)*
0	13.56	11.40	13.80	71.00	19.44

6 Revision history

Revision	*Date*	*Issued by*	*Description of modifications*
0	2020-07-29	Andreas Menacher	First edition