Test report

Applicant:

Elatec GmbH

Zeppelinstraße 1

82178 Puchheim

Tel.: +49 49 89 5529961-0

Fax: +49 89 5529961-129

Test report no.:

200302-AU01+W04

for:

Elatec GmbH

RFID reader / writer module

TWN4 MultiTech 2 M LF

Industry Canada

according to:

RSS 102

EMV TESTHAUS

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

Accreditation:

Deutsche Akkreditierungsstelle D-PL-12155-01-03

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:

EMV **TESTHAUS** GmbH
Tel.: +49 9421 56868-0
Fax: +49 9421 56868-100
Email: info@emv-testhaus.com
Gustav-Hertz-Straße 35
94315 Straubing, Germany

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

Table of contents

List of pictures

List of tables

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

2 Summary of test results

Standard	*Result*	*Remark*
RSS-102 Issue 5 *for transmitters operating between 3 kHz and 10 MHz*	Passed	---

Straubing, June 9, 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 2 M LF
HVIN:	EL20203
Manufacturer:	Elatec GmbH
Serial number:	2020158947
Short description:	EUT is a RFID reader / writer module which operates at the frequency 125 kHz.
IC certification number:	7948A-TWN4F13
Operating frequency:	125 kHz
Number of RF channels:	1
Modulation:	ASK
Antenna types:	PCB antenna ☐ detachable ☒ not detachable
Power supply:	DC supply nominal voltage: 5.00 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 Annex B of test report 200302-AU01+W03 of test laboratory EMV Testhaus GmbH.

5 Test results

This clause gives details about the test results as collected on page 4.

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 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:	June 9, 2020
Result:	☒ Limits kept	☐ Limits not kept	

5.1.1 Test configuration

EUT			
Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
RFID reader / writer	TWN4 MultiTech 2 M LF	2020158947	Elatec
Peripheral devices			
Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
RFID tag 13.56 MHz	Keyfob 13.56 MHz	---	---
Laptop (AM)	Lifebook U772	O00632	FUJITSU
Power supply for laptop	AC adapter	O00632	FUJITSU

Table 1: Devices used for testing

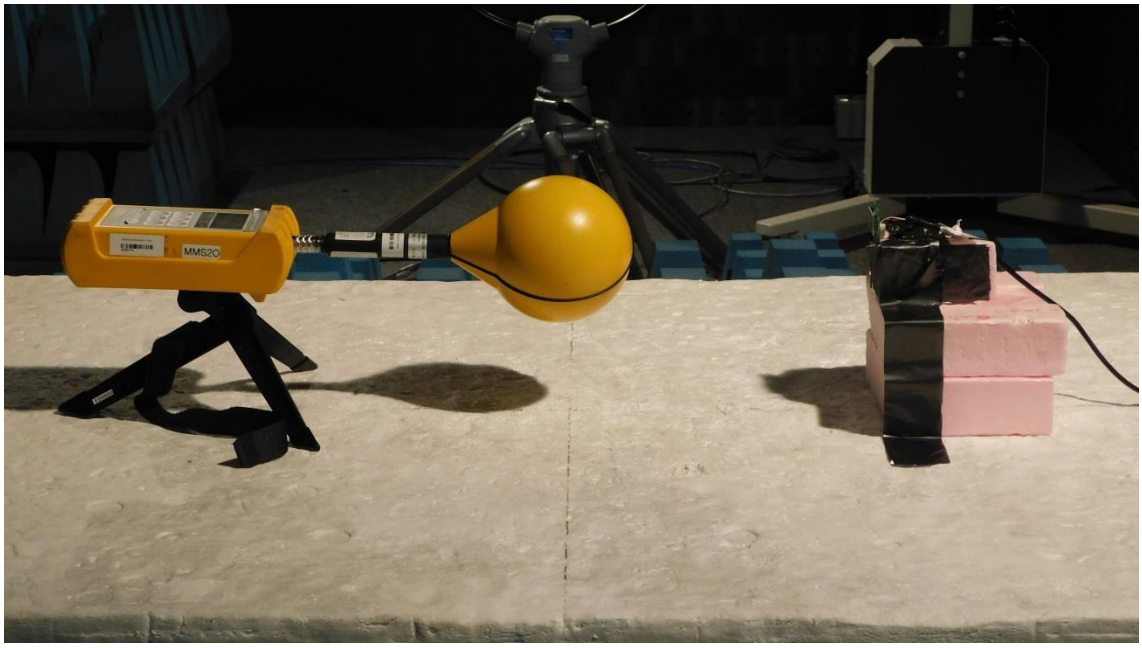
5.1.2 Mode of operation

EUT was forced via test software “TWN4_NKx322_CONT108_Continuous_Mode4_125kHz.bix” to send a modulated carrier signal at the operating frequency 125 kHz.

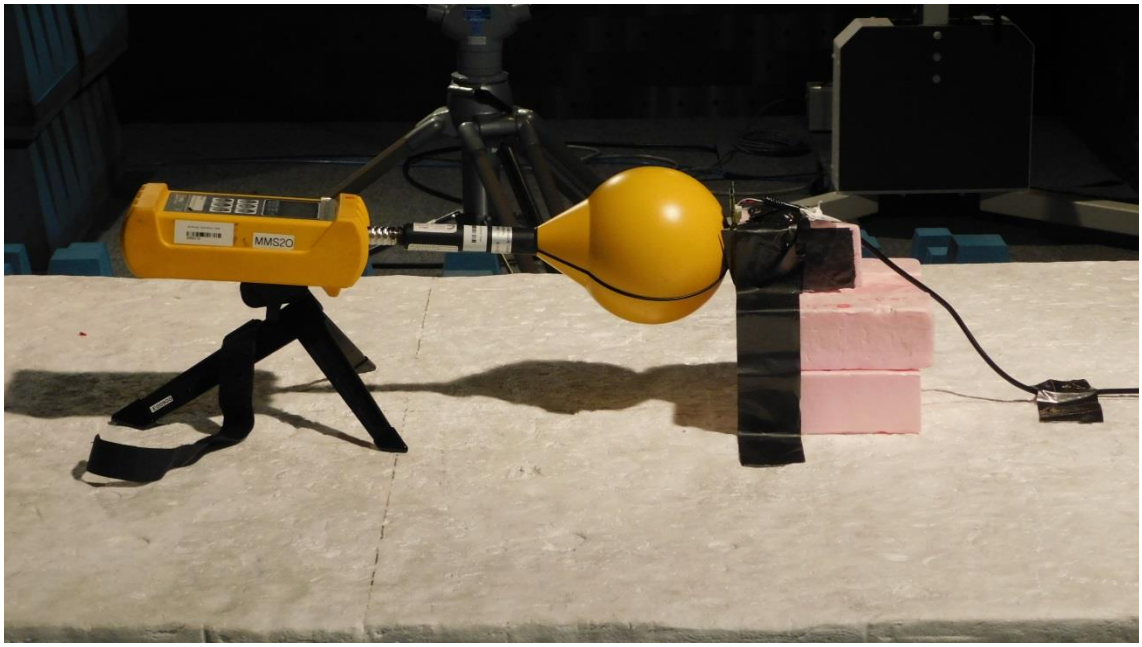
5.1.3 Test equipment

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

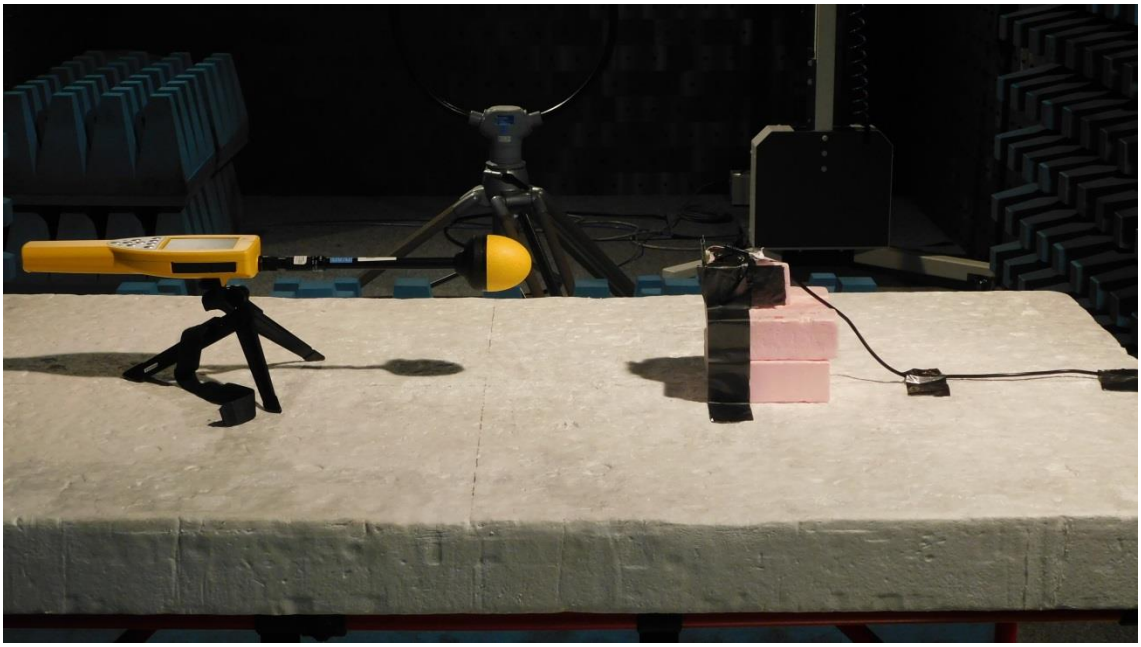
5.1.4 Test setup



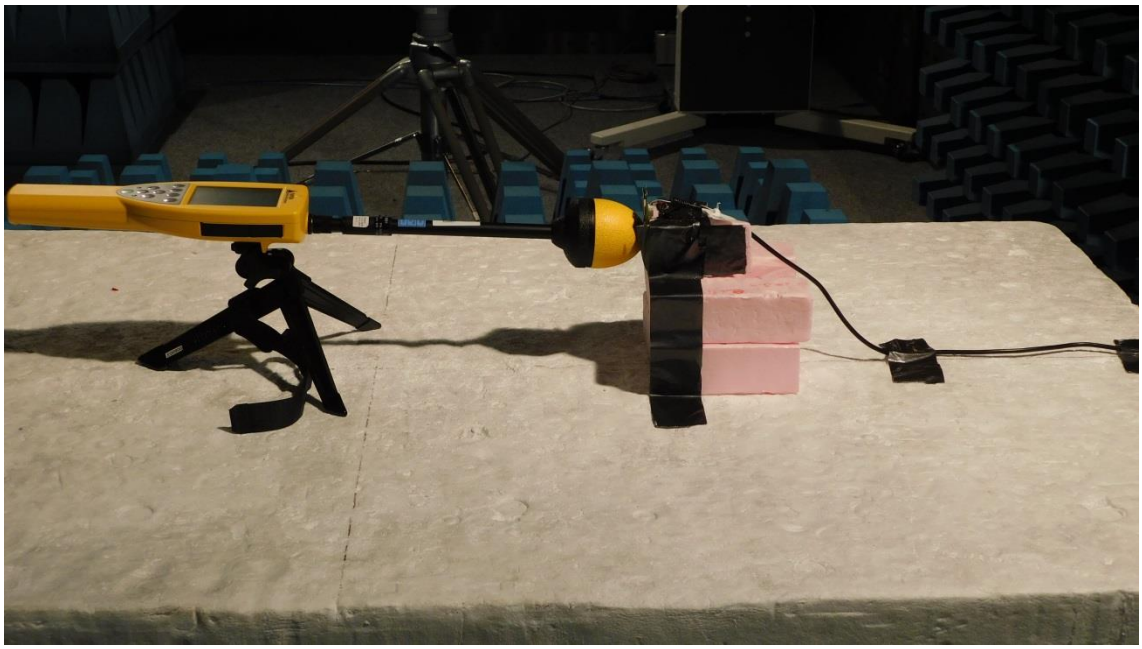
Picture 1: Setup of magnetic field test at a measurement distance of 20 cm



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



Picture 3: Setup of electric field test at a measurement distance of 20 cm



Picture 4: Setup of electric field test at a measurement distance of 0 cm

5.1.5 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.

5.1.6 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 5 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”.

5.1.7 Test results

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:

Test no.	*Exposure condition*	*Distance*	*Relaxation factor*
1	Hand within induced field	0 cm	5.0
2	Trunk of the body within induced field	20 cm	1.0

Table 5: Tests to be performed

	Electric field strength at a distance of 0 cm						
Reference level frequency range	*Reference level basis*	*Frequency*	*Measured value*	*Relaxation factor*	*Limit*	*Fraction of limit*	*Result*
3 kHz - 10 MHz	NS	125 kHz	12.03 V/m	5.0	415 V/m	2.90 %	Passed
	Magnetic field strength at a distance of 0 cm						
Reference level frequency range	*Reference level basis*	*Frequency*	*Measured value*	*Relaxation factor*	*Limit*	*Fraction of limit*	*Result*
3 kHz - 10 MHz	NS	125 kHz	4.35 A/m	5.0	450 A/m	0.97 %	Passed
100 kHz - 10 MHz	SAR	125 kHz	4.35 A/m	5.0	29.2 A/m	14.90 %	Passed

Table 6: RF exposure test results according to RSS-102 at a distance of 0 cm

Remark: The worst case emission occurred without tag.

Note: The measurement values at 0 cm separation distance are peak values measured during a period of 10 seconds. This is assumed as the worst-case duration to identify a user at the reader.

	Electric field strength at a distance of 20 cm						
Reference level frequency range	*Reference level basis*	*Frequency*	*Measured value*	*Relaxation factor*	*Limit*	*Fraction of limit*	*Result*
3 kHz - 10 MHz	NS	125 kHz	0.59 V/m	1.0	83 V/m	0.71 %	Passed
	Magnetic field strength at a distance of 20 cm						
Reference level frequency range	*Reference level basis*	*Frequency*	*Measured value*	*Relaxation factor*	*Limit*	*Fraction of limit*	*Result*
3 kHz - 10 MHz	NS	125 kHz	2.17 A/m	1.0	90 A/m	2.41 %	Passed
100 kHz - 10 MHz	SAR	125 kHz	2.17 A/m	1.0	5.84 A/m	37.16 %	Passed

Table 7: RF exposure test results according to RSS-102 at a distance of 20 cm

Remark: The worst case emission occurred without tag.

Note: The measurement values at 0 cm separation distance are peak values.

5.1.7.1.1 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 8: Measurement uncertainties

5.1.7.1.2 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 cm^2	ELT-400 with BN 2300/90.10	B-0087 B-0102	E00276	2018-20	2020-08
Broadband field meter with magnetic field probe	NBM-550 with HF3061	H-0015 D-0595	E00900 E00901	2019-01	2021-01
Broadband field meter with electric field probe	NBM-550 with EF0691	H-0015 H-0318	E00900 E00902	2019-03	2021-03

Table 9: Equipment calibration status

6 Revision history

Revision	*Date*	*Issued by*	*Description of modifications*
0	2020-06-09	Andreas Menacher	First edition