INSTITUTE FOR TESTING AND CERTIFICATION, a.s.

Testing Laboratory of Electrical Products
Sokolovska 573
686 01 Uherske Hradiste
Czech Republic

L 1004.3

TESTING LABORATORY No. 1004.3
accredited by the Czech Institute for Accreditation, o. p. s
according to ČSN EN ISO/IEC 17025:2005

Test Report No: **414103548AE1**
Number of Copies: 3
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TEST REPORT

ABOUT THE ELECTROMAGNETIC COMPATIBILITY TEST

of the AC24/R

AKREDITOVANÁ ZKUŠEBNÍ LABORATOŘ č.1004.3 Institut pro testování a certifikaci, a.s.

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Test Engineer and Report Author:
Mr. Vlastimil Vaculik

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Head of Testing Laboratory:
Mr. Pavel Vavra

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Distribution List:

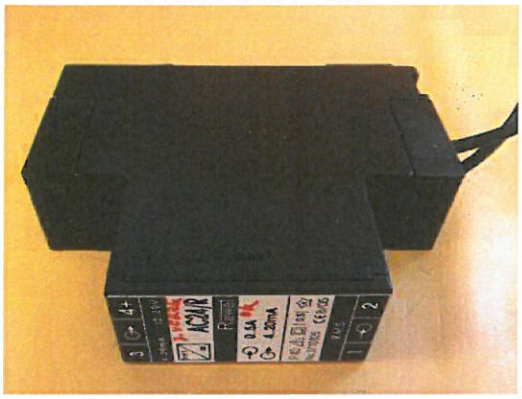
Institute for testing and certification (Copy No 1)
Applicant (Copy No 2)
Applicant (Copy No 3) - English

1. GENERAL SPECIFICATIONS

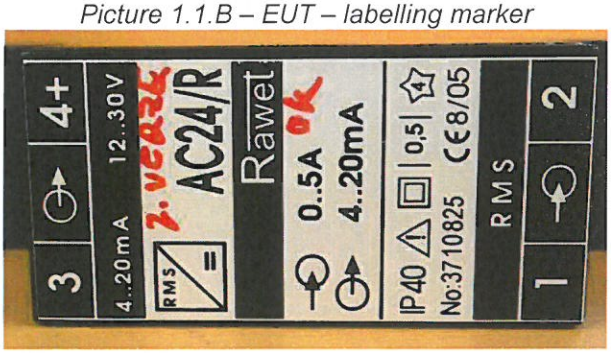
1.1. Equipment Under Test (EUT)

One sample of the AC24/R with serial number 3710825 was delivered to institute for testing and certification on 2017-08-16. ATL 1004.3 started the requested test under Job No 414103548.

Picture 1.1.A – EUT



Picture 1.1.B – EUT – labelling marker



1.2. Applicant

Rawet s.r.o.
Čapkova 22
678 01 Blansko
Czech Republic

Company ID: 47901411
VAT No.: CZ47901411

Order No.:
as of: 2017-08-16

1.3. Manufacturer

Rawet s.r.o.
Čapkova 22
678 01 Blansko
Czech Republic

1.4. Test Period

Started on: 2017-08-16
Finished on: 2017-11-06

1.5. Test Conditions

Ambient temperature:(+15 up to +35) °C / (+59 up to +95) °F
Barometric pressure: (86 up to 106) kPa
Relative humidity: (25 – 75) %

1.6. Regulations used

i	*Regulation used*	*As Czech implementation of*
1	ČSN EN 50155 ed.3:2008	EN 50155:2007
2	ČSN EN 50121-3-2 ed.3:2016	EN 50121-3-2:2015
3	ČSN EN 55016-2-1 ed.3:2015	EN 55016-2-1:2014
4	ČSN EN 55016-2-3 ed.3:2010+A1:2011	EN 55016-2-3:2010+A1:2010
5	ČSN EN 61000-4-2 ed.2:2009	EN 61000-4-2:2009
6	ČSN EN 61000-4-3 ed.3:2006+A1:2008 +A2:2011	EN 61000-4-3:2006+A1:2007+A2:2010
7	ČSN EN 61000-4-4 ed.3:2013	EN 61000-4-4:2012
8	ČSN EN 61000-4-5 ed.3:2015	EN 61000-4-5:2014
9	ČSN EN 61000-4-6 ed.4:2014	EN 61000-4-6:2014
10	AC24/R, AC24/S	

1.7. Test Instruments and Equipment

i	*Instrument / Equipment*	*Serial No*
1	Test Receiver Rohde & Schwarz ESIB 7	100318
2	Artificial Network RWMO US4 25-50	000422
3	Log-periodic antenna Frankonia BTA-H	97061002
4	Horn antenna Rohde & Schwarz HF 906	359287/003
5	Signal generator Rohde & Schwarz SMH	862490/007
6	Signal generator Rohde & Schwarz SME03	834617/007
7	RF amplifier AR 10W1000B	21532
8	RF amplifier MILMEGA AS0840-30-17	10140028
9	Probe electromagnetic field PMM EP408	000WX10305
10	Burst generator Haefely PEFT-Junior	583333-82
11	Capacitive clamp 093.506.1	808 184-1
12	Surge generator Haefely PSURGE 4010	080888/07
13	Coupling network IP 6.2	145348
14	Coupling network DEC1A	145312
15	EM clamp KEMZ 801	14299
16	Current meter ML10	428178
17	Horn antenna ETS Lindgren 3117	104521
18	Signal generator Rohde & Schwarz SMR 40	101987
19	RF amplifier MILMEGA AS1860-100	1040909

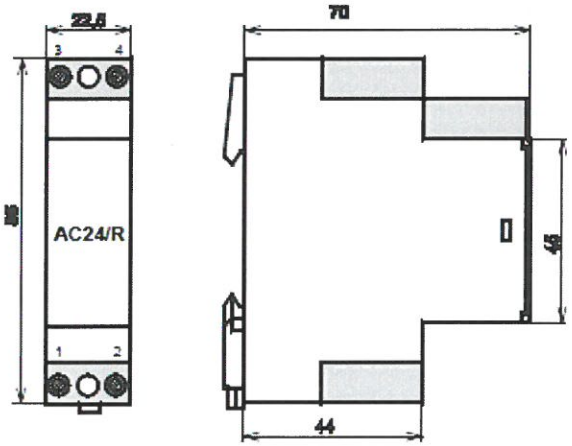
All listed equipment subjected calibration has been duly calibrated and they passed a regular metrological inspection.

1.8. EUT Installation

EUT was supplied from DC mains 24V using 2-wire cable length of 4 m. The current meter was installed in the power circuit. The input of the EUT was connected to the testing transformer which one was connected to the 230V/50Hz.

Picture 1.8.A – Block diagram

AC24,AC/S
1,2...vstup měřeného signálu
3,4...výstup 4-20mA (napájení
výstupní smyčky 4 je +)



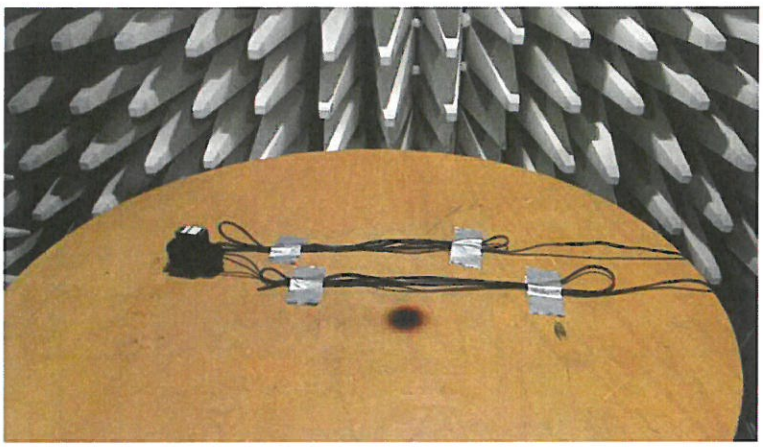
1, 2 – input for measured signal

3(-), 4(+) – output current circle 4-20mA

2. EMC TESTS OF RADIATED INTERFERENCE

EUT was powered by DC stabilised voltage source 24V. EUT was connected according to clause 1.8.

Picture 2.A – EUT during the test



2.1. Measurement of Terminal Spurious Voltage

Requirement in	**ČSN EN 50121-3-2, clause 7, table 2, ČSN EN 50155 čl. 12.2.8.2**
Testing method	**ČSN EN 55016-2-1, clause 7.4.1**
Test specification	Measuring of the levels of spurious terminal voltages, radiated by the EUT into the leads on frequency band of 0.15 up to 30 MHz. The EUT was placed on the wooden table 80 cm above the ground reference plane in a shielded anechoic chamber. The EUT was in the operation mode during the test. The spurious voltage levels were measured on the supply terminals of the positive lead (+24V) and negative lead (GND) supply conductors of the EUT using the Selective Micro-voltmeter with a quasi-peak and detector.
Measurement uncertainty	U = ± 3.5 dB (specified for the coverage coefficient k = 2 and the confidence probability of 95 %)
Results	**PASSED**

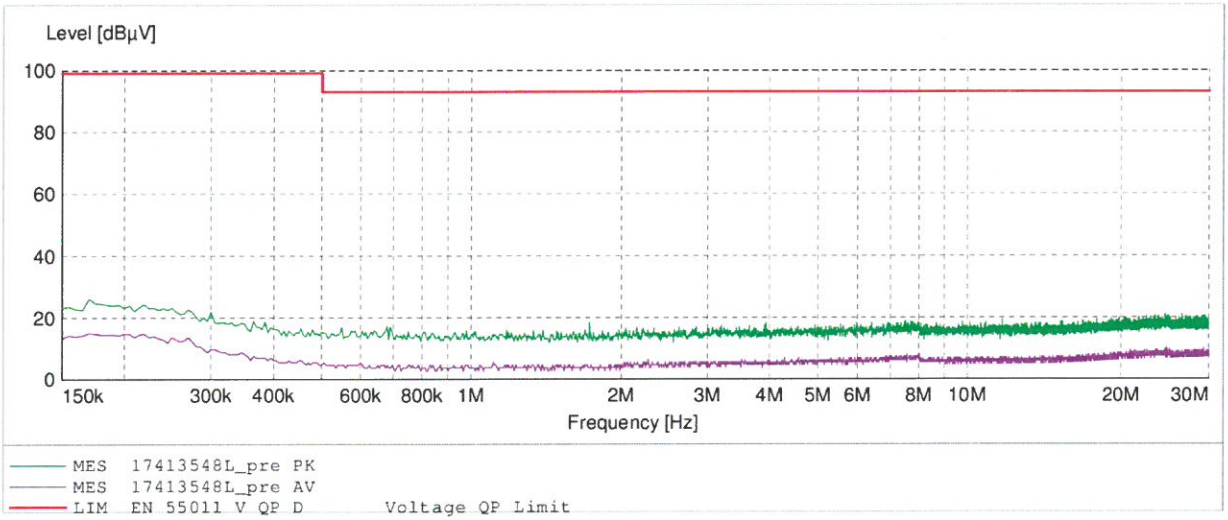
Limits of the conducted spurious voltage according to ČSN EN 50121-3-2, clause 7, table 2

Frequency band (MHz)	Limits dB (μV)
	Quasi-Peak values
0,15 up to 0,50	99
0,5 up to 30	93
NOTE 1 – The lower limit is valid for the frequency on boundary.	

Graph 2.1.A – Conducted terminal voltage ČSN EN 50121-3-2, quasi-peak, terminal +

Voltage on Mains

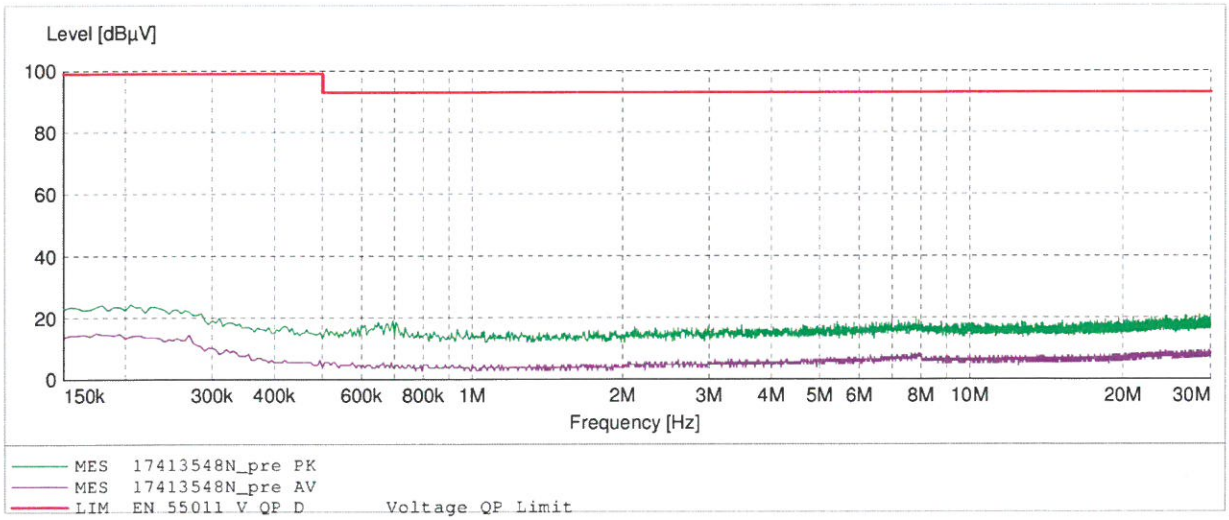
```
EUT:                AC24/R
Manufacturer:       Rawet s.r.o.
Operating Condition:
Test Site:
Operator:           V.Vaculík
Test Specification: +24V
Comment:
Start of Test:      31.10.2017 / 13:43:21
```



Graph 2.1.B – Conducted terminal voltage ČSN EN 50121-3-2, quasi-peak, terminal -

Voltage on Mains

```
EUT:                AC24/R
Manufacturer:       Rawet s.r.o.
Operating Condition:
Test Site:
Operator:           V.Vaculík
Test Specification: GND
Comment:
Start of Test:      31.10.2017 / 13:46:14
```



2.2. Measurement of Radiated Field

Requirement in	**ČSN EN 50121-3-2, clause 7, ČSN EN 50155 čl. 12.2.8.2**
Testing method	**ČSN EN 55016-2-3, clause 7.2**
Test specification	The field strength levels, radiated by the EUT into environment on frequencies 30 up to 1,000 MHz. The EUT was situated on the wooden table 80 cm above ground reference plane in the shielded anechoic chamber. The EUT was in the operational mode during the test. The measurement was carried out in the anechoic chamber at the distance of 3 m / 9.8 ft and recalculated for the distance of 10 m / 32.8 ft. The Selective Micro-voltmeter with a quasi-peak type detector was connected to the measuring antenna. The values of radiated electromagnetic field were subsequently measured at horizontal as well as vertical polarization of the measuring antenna. The maximum of emission was searched for horizontal and for vertical polarization by rotation of device and by turning the high of antenna.
Measurement uncertainty	U = ± 5.2 dB (specified for the coverage coefficient k = 2 and the confidence probability of 95 %)
Results	**PASSED**

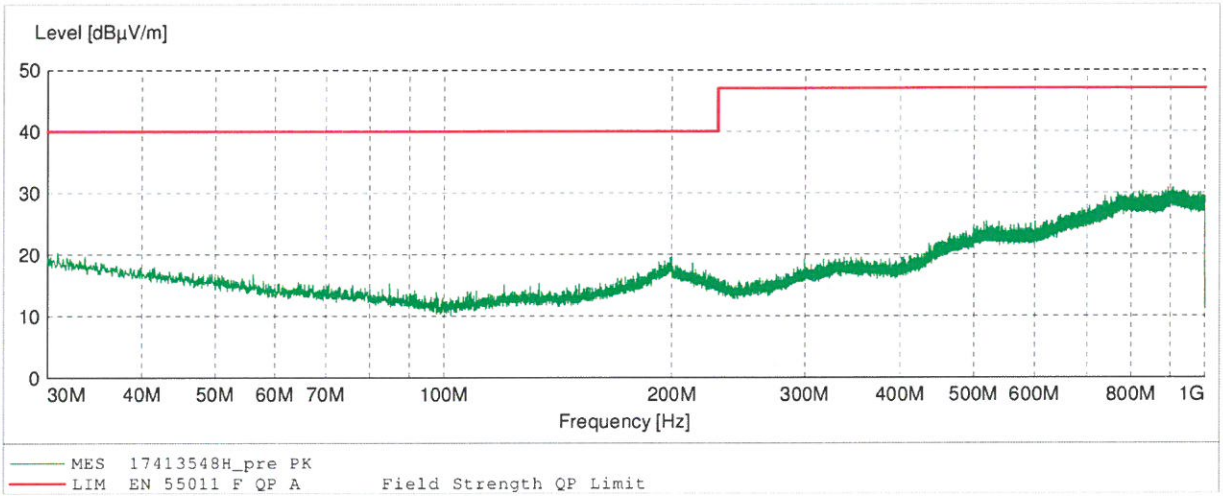
Limits of the radiated emissions (measuring distance 10 m) according to ČSN EN 50121-3-2, Table 3

Frequency range (MHz)	Quasi-Peak limits dB (μV/m)
30 up to 230	40
230 up to 1000	47
NOTE 1 – The lower limit is valid for the frequencies on the boundaries of bands.	

Graph 2.2.A – radiated emissions according to ČSN EN 50121-3-2, horizontal

Electric Field Strength

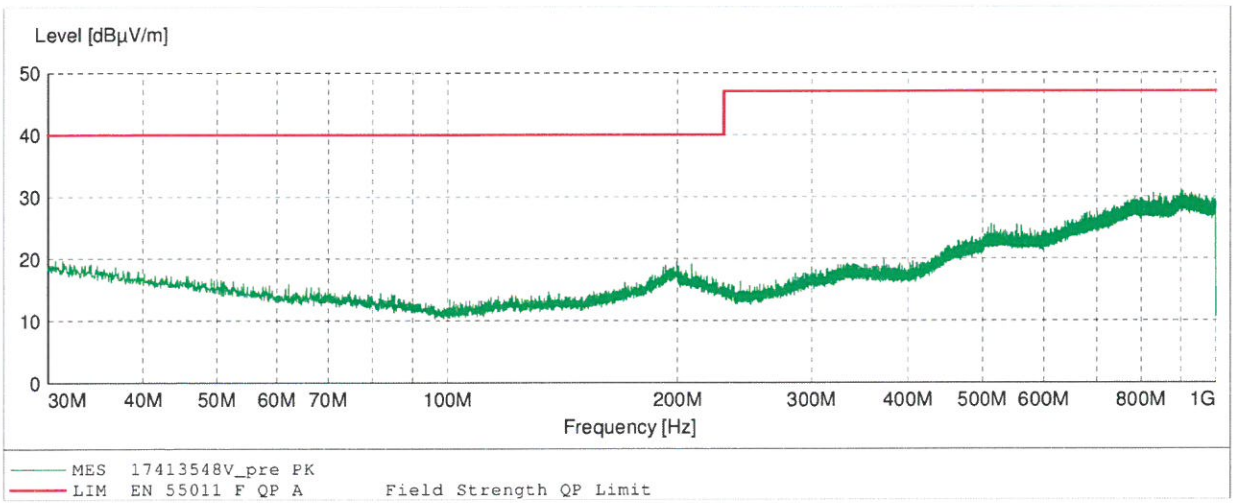
```
EUT:                AC24/R
Manufacturer:       Rawet s.r.o.
Operating Condition:
Test Site:
Operator:           V.Vaculík
Test Specification: Horizontal
Comment:
Start of Test:      31.10.2017 / 13:48:55
```



Graph 2.2.B – radiated emissions according to ČSN EN 50121-3-2, vertical

Electric Field Strength

```
EUT:                AC24/R
Manufacturer:       Rawet s.r.o.
Operating Condition:
Test Site:
Operator:           V.Vaculík
Test Specification: Vertical
Comment:
Start of Test:      31.10.2017 / 13:56:19
```



3. EMC IMMUNITY

The EUT was placed on the table for required test. The EUT was in the operation mode during the test. The EUT was connected according to clause 1.8.

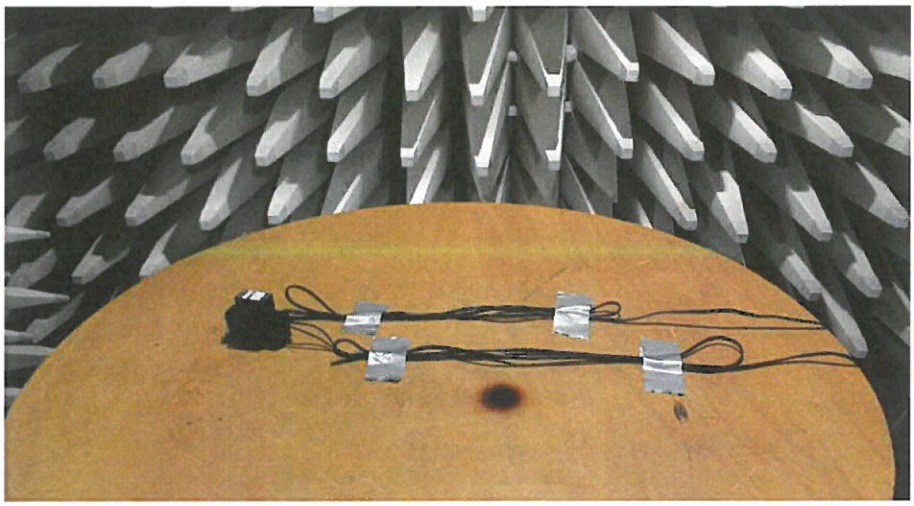
For criterion A - EUT function must not be influenced or reset. The measured values during test immunity have to be in the tolerance of the manufacturer.

3.1. Electrostatic Discharge Immunity

Requirement in	**ČSN EN 50121-3-2, clause 8, table 6, item 6.3** **ČSN EN 50155, clause 12.2.7.2**
Testing method	**ČSN EN 61000-4-2**
Test specification	The test is applied to equipment accessible to passengers and operators. The test does not apply if the device is only accessible for maintenance.
Results	**PASSED, EUT available only for maintenance**

3.2. Field Immunity

Picture 3.2.A – EUT during the field immunity test



Requirement in	**ČSN EN 50121-3-2, clause 8, table 6, items 6.1, 6.2** **ČSN EN 50155, clause 12.2.8.1**
Testing method	**ČSN EN 61000-4-3**
Test specification	The EUT was placed in the shielded anechoic chamber on the wooden table 80 cm above the reference grounding surface. The frequency band 5,1GHz – 6GHz was tested in the laboratory VTUPV Vyskov. The test report from VTUPV is attached to this test report. EUT was in the operation mode during the test.
Results	**PASSED, Performance Criterion A**

Table 3.2.A – field immunity test parameters

Maximal change frequency	1% logarithmic step
Time step	2s

Table 3.2.B – Field immunity test parameters and performance

Frequencies	*AM*	*Mod. frequency*	*Polarization*	*Severity level [V/m]*	*Performance*
80 MHz – 1 GHz	80%	1 kHz	Horizontal	20	A
1,4 GHz – 2,0 GHz	80%	1 kHz	Horizontal	10	A
2,0 GHz – 2,7 GHz	80%	1 kHz	Horizontal	5	A
5,1 GHz – 6 GHZ	80%	1 kHz	Horizontal	3	A
80 MHz – 1 GHz	80%	1 kHz	Vertical	20	A
1,4 GHz – 2,0 GHz	80%	1 kHz	Vertical	10	A
2,0 GHz – 2,7 GHz	80%	1 kHz	Vertical	5	A
5,1 GHz – 6 GHZ	80%	1 kHz	Vertical	3	A

A ... Performance Criterion A (no function of the EUT was affected)

3.3. Electrical Fast Transients/Burst Immunity

Requirement in	**ČSN EN 50121-3-2, clause 8, table 4, item 4.2, table 5, item 5.2** **ČSN EN 50155, clause 12.2.7.3**
Testing method	**ČSN EN 61000-4-4**
Test specification	The pulse groups were injected to the interconnecting cables using the capacitive way. The EUT was placed 0.1 m / 0.33 ft above the reference grounding surface on a wooden table. The minimum distance from any metallic objects was more than 0.6 m / 1.97 ft. from the EUT. EUT was in the operation mode during the test.
Results	**PASSED, Performance Criterion A**

Table 3.3.A – fast transients/burst immunity test parameters

Pulse group width	15 ms
Pulse group period	300 ms
Repeating frequency of the pulse groups	5 kHz
Duration positive / negative pulses:	1 minute for each conductor

Table 3.3.B – Performances of the EUT on the fast transients/burst immunity tests

Amplitude	+1 kV	- 1 kV	+2 kV	- 2 kV
Power cable (current circuit)(capacitive way)	-	-	A	A
Input cable	-	-	A	A

A ... Performance Criterion A (no function of the EUT was affected)

3.4. Surge Immunity

Requirement in	**ČSN EN 50121-3-2 clause 8, table 4, item 4.3** **ČSN EN 50155, clause 12.2.7.1**
Testing method	**ČSN EN 61000-4-5**
Test specification	The EUT was placed on the reference ground planer. The surges were applied directly between the: • + and - power supply cables EUT was in the operation mode during the test.
Results	**PASSED, Performance Criterion B**

Table 3.4.A – surge immunity test parameters

Shape of pulses	1.2/50 μs open-circuit voltage, 8/20 μs short-circuit current
Phase of injected signal with reference to the mains	0°, 90°, 180°, 270°
Number of surges	5
Interval between surges	10 s
Source impedance	42 Ω
Coupling capacitance	0,5μF

Table 3.4.B – Performances of the EUT - surge immunity test

Amplitude	+1 kV	- 1 kV	+ 2 kV	- 2 kV
Power supply cable + and power supply cable -	B	B	-	-

B ... Performance Criterion B (impaired function of the EUT, function of the EUT was restored after the test) – measured values out of the tolerance of the manufacturer

3.5. Immunity to Conducted Disturbances Induced by RF Fields

Requirement in	**ČSN EN 50121-3-2 clause 8, table 4, item 4.1, table 5, item 5.1** **ČSN EN 50155, clause 12.2.8.1**
Testing method	**ČSN EN 61000-4-6**
Test specification	The conducted spurious signal was injected into the power conductors and interconnecting cable using EM clamp. The EUT was placed on the wooden table 0.1 m / 0.33 ft above the reference grounding surface.
Results	**PASSED, Performance Criterion A**

Table 3.5.A – field immunity test parameters

Maximal change frequency	1% logarithmic step
Time step	2s

Table 3.5.B – Field immunity test parameters and performances

	Frequencies	*AM*	*Mod. frequency*	*Severity level [V]*	*Performance*
Power cable	150 kHz – 80 MHz	80%	1 kHz	10	A
Input cable	150 kHz – 80 MHz	80%	1 kHz	10	A

A ... Performance Criterion A (no function of the EUT was affected)

4. CONCLUSIONS

The equipment AC24/R complies with requirements of the following regulations in the range of performed tests.

- **EN 50155:2007**
- **EN 50121-3-2:2015**
- **EN 61000-4-2:2009**
- **EN 61000-4-3:2006 criterion A**
- **EN 61000-4-4:2012 criterion A**
- **EN 61000-4-5:2014 criterion B**
- **EN 61000-4-6:2014 criterion A**

END OF THE REPORT

Vojenský technický ústav, s.p.

The certified quality system according to ČSN EN ISO 9001

Equipment Testing Centre – Testing Laboratory No. 1103
accredited by CAI according to ČSN EN ISO/IEC 17025
EMC TESTING LABORATORY

L 1103

Target / Order No.:	**17-19-5-93-3074/257**
Report No.:	**194300-527/2017**
Copy No.:	**1**
Pages:	**4**
Annex/pages:	–

TEST REPORT

electromagnetic compatibility – immunity

Applican tname and address:	**Institut pro testování a certifikaci a.s.** **třída Tomáše Bati 299, Louky, 763 02 Zlín, Czech Republic**
Identification of EUT:	**AC24/R**
Serial No.:	3710825
Manufacturer:	Rawet s.r.o. Čapkova 22, 678 01 Blansko, Czech Republic
Technical documentation:	Not delivered

Test method[1]:

ČSN EN 50121-3-2 ed.3:2016 chap. 8, tab. 6.2 (band 5,1 GHz to 6,0 GHz)

Sample received: **6. 11. 2017**	Test leader: **Ing. Jan Šot**
Date and place of test: **6. 11. 2017** **EMS test room, VTÚPV**	Test carried out by: **Ing. Jan Šot**
Date of Issue: **23. 11. 2017**	Authorized by technical manager: **Ing. Milan Rýdel**

Zkušební laboratoř č.1103 akreditovaná NAO ČR podle ČSN EN ISO/IEC 17025
ÚSEK ZKOUŠENÍ TECHNIKY
Vojenský technický ústav, s.p.
odštěpný závod VTÚPV
Víta Nejedlého 691
682 01 Vyškov
- 1 -

Test Results:

Test results are on next pages of the test report.

The expanded measurement uncertainty is a product of standard measurement uncertainty and extension factorof K = 2, which corresponds to a coverage probability of approximately 95 % for anormal distribution.

Address: **Vojenský technický ústav, s.p.**
odštěpný závod VTÚPV
Equipment Testing Centre
Víta Nejedlého 691
682 01 Vyškov, CZ

Tel.: **+420 910 105 619**
E-mail: **Jan.Sot@vtusp.cz**

Notes:
This test report istranslationof Czech versionof test report No. 194300-527/2017. In thecaseof diference isvalid Czech versionofthis test report.

[1] This standard is the Czech version of the standard EN 50121-3-2:2015

1 LIST OF THE TEST INSTRUMENTS

Tab. 1 List ofthe test instruments

Inventory No.	Instrument Name	Calibration Validity
104521	Antenna ETS Lindgren 3117	exempt from calibration
41k-61044	Generator vf R&S SMR 40	06-2019
41a-61252	Electric field intensity sensor EP 602	11-2018
1040909	Amplifier Milmega AS1860-100	exempt from calibration

2 CLIMATIC CONDITIONS DURING THE TESTS

- atmospheric pressure: (98,0 ± 0,2) kPa
- ambient temperature: (20 ± 2) °C
- relative humidity: (42 ± 8) %

3 TESTED EQUIPMENT

3.1 Name and Type

- AC24/R
- serialnumber: 3710825

3.2 Activity mode

- operation mode

3.3 Arrangement

- The EUT is powered by a 24V 2-wire unshielded cable. The milliammeter was connected to the power current loop circuit. The EUT input was connected to a test transformer that was connected to 230V / 50Hz.

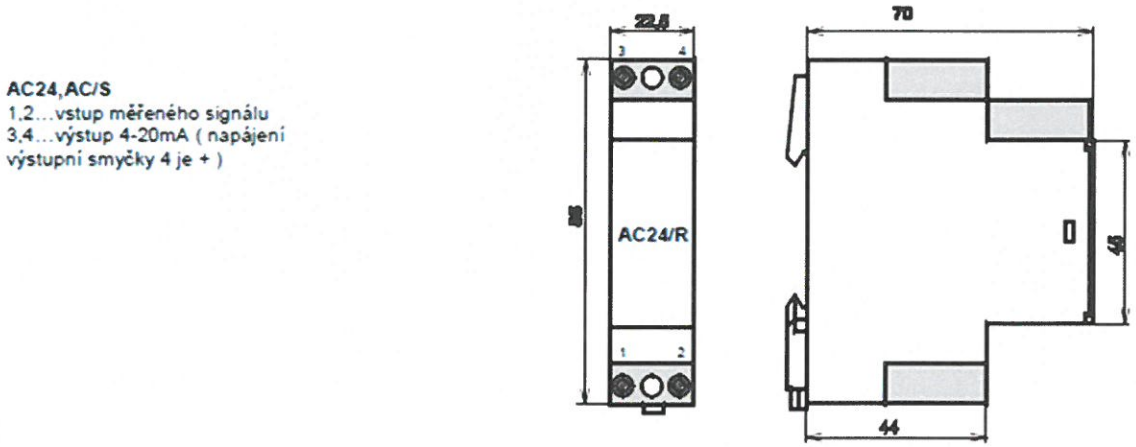


Fig.1 Block diagram of the EUT

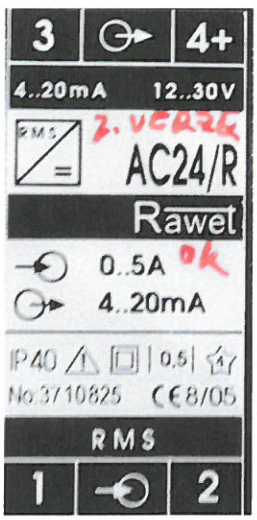


Fig.2 Serial label of the EUT

4 TEST RESULTS

4.1 Immunity to HF electromagnetic fields ČSN EN 50121-3-2 ed.3:2016 chap. 8, tab. 6.2 (band 5,1 GHz to 6,0 GHz); basic standard ČSN EN 61000-4-3 ed. 3:2006 + A1:2008 + Z1:2010 + A2:2011

Standard ČSN EN 61000-4-3 specifies immunity of electric and electronic equipments to radiated energy, test levels and test method.

4.1.1 Parameters of the test signal

Tab. 2 Parameters of test signal

Frequency band	E_{rms} [V/m]	Modulation	Tuning velocity	Accuracy of calibrated field
5,1 GHz – 6,0 GHz	3	80 % AM 1 kHz	1 % f / 3 s	0 to + 6 dB

E_{rms} – effective value of electric field intensity for unmodulated signal
f – signal frequency

4.1.2 Course of the test and response of the EUT

Tab. 3 Test results

Direction of the effects of electromagnetic field to EUT[1)]	Frequency band	E_{rms} [V/m]	Polarization[2)]	Test result
From the front	5,1 GHz – 6,0 GHz	3	H / V	A / A

[1)] – distance between antenna and EUT: 1 m (5,1 GHz – 6,0 GHz)

[2)] – polarization: H - horizontal; V - vertical

A – normal performance within the specification limits defined by manufacturer, test applicant or customer

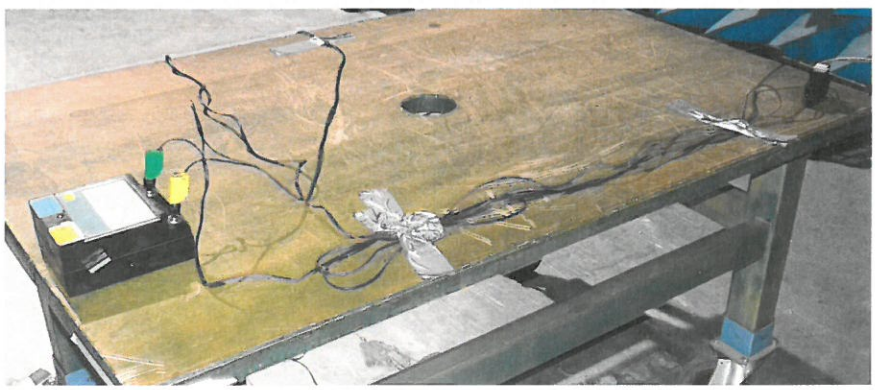


Fig.3 Arrangement of the EUT during the test according to EN 61000-4-3

END OF THE TEST REPORT

Vojenský technický ústav, s. p.

Number of sheets: 1

TECHNICAL COMMENTARY

on test results - test report No. 194300-527/2017

Testedequipment: **AC24/R.**

Serialnumber: **3710825.**

COMPLIED

withrequirementsof standard:

ČSN EN 50121-3-2 ed.3:2016 chap. 8, tab. 6.2 (band 5,1 GHz to 6,0 GHz)

Technical commentary on tests results has an information character and is beyond scope of testing centre accreditation.

In Vyškov 23. 11. 2017

Responsible person: Ing. Jan Šot

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signature