



**Laboratory Tests of Voice Alarm Control
and Indicating Equipment (VACIE)
According EN 54-16:2008**

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**CNBOP-PIB Standard
Fire Protection**

**Laboratory Tests of Voice Alarm Control and Indicating
Equipment (VACIE) According EN 54-16:2008**

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Revision I

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1. Information about BA laboratory

The Department-Laboratory of Fire Alarm Systems and Fire Automation (BA) operates in accordance with requirements specified in the Quality Book. The organizational structure, division of responsibility, system and research procedures, processes and resources are consistent with implemented quality system in accordance with requirements of EN 17025. The Department-Laboratory has been accredited since 07.10.1998, Accreditation Certificate of Research Laboratory No. AB 207 (see Annex 3). The scope of Department-Laboratory activities includes variety of issues connected with fire detection, activating fire alarm devices and fire alarm systems and alarm signal transmission. The Department-Laboratory tests all types of voice alarm control and indicating equipment. The procedure of the laboratory tests (please remember that below procedure includes only laboratory tests, not the whole certification process):

- Send us an order letter (see the annex 1),
- We prepare an agreement and send it to you to sign (one version by e-mail and two by post),
- Sign the agreements and send one copy back to our company,
- Pay the advance money (it is 40% percent of the total contract value),
- Deliver us the samples with complete documentation, documentation should be signed and dated,
- When we receive advance money, samples and documentation we will start testing VACIE. It takes about 2 months if more than one specimen is supplied, and about 3 months if a single specimen is supplied,
- We will inform the customer immediately and stop doing tests, if voice alarm control and indicating equipment fails any of the tests,
- If anything goes wrong, the client decide what he want to do (stop testing, continue testing or make modifications),
- If a voice alarm control and indicating equipment pass the tests, we prepare testing report in three Polish versions and two English versions,
- We inform the client that tests are over, and we send him an invoice.
- The client pay the rest of money,
- We send the test report by post,
- The contract is completed.

2. General information

The EN 54-16 standard specifies requirements, methods of test and performance criteria for voice alarm control and indicating equipment for use in fire detection and fire alarm systems installed in buildings, where the alarm signal is in the form of tone(s) or voice message(s), or both.

3. The most important functional and design requirements

The VACIE shall be supplied by power supply equipment which is complied with the requirements of EN 54-4.

The VACIE shall be capable of indicating the following functional conditions:

- Quiescent condition: a green separate discrete light emitting indicator on each cabinets,
- Voice alarm condition: at least red separate visible general voice alarm indicator and an optional audible indicator (minimum 60 dBA),
- Fault warning condition: at least yellow separate visible general fault warning indicator and an audible indicator (minimum 50 dBA),
- Disablement condition (option requirements): yellow separate visible general disablement indicator.

The VACIE shall be capable of receiving and processing alarm signals from the control and indicating equipment or from manual control on the VACIE or both. The VACIE may have provision for emergency microphone(s).

The manufacturer shall send to the laboratory declaration in writing according to p. 13.1.2 EN 54-16 (see Annex 3).

The cabinet of the VACIE shall have IP30 according to EN 60529 (IP3x – protection against solid objects over 2.5 mm (tools and wires), during this test force of 3N is used; IPx0 – no requirements).

4. Marking

The VACIE shall be marked with the following information, which shall be legible at access level 1:

- the number of the European Standard, i.e. EN 54-16,
- the name or trademark of the manufacturer or supplier,
- the type number or other designation of the VACIE.

It shall be possible to identify a code or number that identifies the production period of the VACIE, at access level 1, 2 or 3.

5. Documentation of the VACIE

The manufacturer shall prepare installation and user documentation, which shall be submitted for assessment together with the VACIE. This shall comprise at least the following:

- a general description of the VACIE, including a list of:
 - the optional functions with requirements of this European Standard,
 - the functions relating to the other parts of EN 54,
 - the ancillary functions not required by this European Standard.
- technical specifications of the inputs and outputs of the VACIE, sufficient to permit an assessment of the mechanical, electrical, and software compatibility with other components of the system (e.g. as described in EN 54-1), including where relevant:
 - the power requirements for recommended operation,
 - the maximum number of voice alarm zones,
 - information concerning the connection of emergency microphones,
 - the maximum and minimum electrical ratings for each input and output,
 - information on the communication parameters employed on each transmission path,
 - recommended cable parameters for each transmission path,
 - fuse ratings.
- specified means to limit the consequences of fault (see 13.5.2 of EN 54-16);

- d. configuring and commissioning instructions;
- e. operating instructions;
- f. maintenance information.

The manufacturer shall prepare design documentation that shall be submitted to the testing authority together with the VACIE. This documentation shall include drawings, part lists, block diagrams, circuit diagrams and a functional description to such an extent that compliance with EN 54-16 may be checked and that a general assessment of the mechanical and electrical design is made possible.

The manufacturer shall prepare the documentation that gives an overview of the software design, which shall be submitted to the testing authority together with the VACIE. This documentation shall be in sufficient detail for the design to be inspected for compliance with this EN 54-16, and shall comprise at least the following:

- a functional description, using a clear methodology appropriate to the nature of the software, e.g. graphical representations of the system design, data flows and control flows and of the main program flow, including:
 - a brief description of each module and the tasks it performs,
 - the way the modules interact,
 - the way the modules are called, including any interrupt processing,
 - the overall hierarchy of the program.
- a description of which areas of memory are used for the various purposes (e.g. the program, site specific data and running data);
- a description of how the software interacts with the hardware of the VACIE.

Where dynamic memory management is employed, a separation shall be implemented between the program, site specific data and running data and this shall be described in connection with the method of memory allocation.

The manufacturer shall prepare and maintain detailed design documentation. This need not be submitted for assessment but shall be available for inspection in a manner which respects the manufacturer's rights of confidentiality. This documentation shall comprise at least the following:

- a description of each module of the software program, as it is implemented in the source code of the program, containing:
 - the name of the module,
 - the identification of the author(s).
- the source code listing, including all global and local variables, constants and labels used, and sufficient comment for the program flow to be recognized;
- details of any software tools used in the preparation of the program (e.g. high level design tools, compilers, assemblers, etc).

Table 1. The parameter card of the voice alarm control and indicating equipment for laboratory tests according EN 54-16:2008

BASIC DATA		
1	Name of the VACIE	
2	Manufacturer (name, address)	
3	Customer (name, address)	
4	Built-in hardware (components) the VACIE	e.g. power amplifiers, emergency microphone(s), end line unit
5	The kind and the type of devices cooperating with the VACIE	e.g. control and indicating equipment, fire alarm devices, external control devices
6	Type of installation, installation method	e.g. one cabinet, several cabinets side by side or distributed within the protected premises, standing, wall mounting
7	Degree of enclosure protection IP of the EN 60529	IP30 (minimum)
8	Range of working conditions, [°C]	-5 ÷ 40 (minimum)
9	Cabinet(s) types and dimensions (length x width x height), [m]	
10	The VACIE cabinet(s) material	e.g. steel, glass
11	Applied software version	
12	Additional functions in the VACIE	e.g. background music, non-emergency messages
13	Means to limit the consequences of a short circuit or an interruption in the transmission path to the loudspeaker(s) (more information see 13.5.2 EN 54-16)	
TRANSMISSION PATHS		
14	Loudspeaker line voltage, [V]	e.g. 70, 100
15	Recommended cable parameters for each transmission path (in case of shielded cables please indicate how the shield should be terminated – one end or both ends to earth connection):	
	- primary power supply	e.g. YLY 3x1,5
	- secondary power supply	
	- loudspeaker lines	e.g. HDGSekw 2x2,5
	- transmission path to the CIE	
	- indications of fault lines	
	- indications of voice alarm condition lines	
	- transmission path to the emergency microphone	
- connection line between the VACIE cabinets		
- other		
16	Rated values of fuses, [A]	
17	Type of control loudspeaker lines	Frequency method / impedance method / addressable method
18	The maximum number of voice alarm zones	
19	The opportunity to simultaneously broadcasting more than 1 messages to more than 1 voice alarm zones	Yes / Not
POWER AMPLIFIERS		
20	Type (name) of power amplifiers	
21	Power amplifier class	e.g. A, B, D
22	Output power, [W]	
23	Minimum resistive load, [Ω]	
24	Maximum capacitive load line connected in amplifiers, [μ F]	
25	Input load simulating the microphone impedance (if provided), [k Ω] (more information see 16.4 EN 54-16)	
TRANSMISSION PATH BETWEEN DISTRIBUTED CABINETS OF THE VACIE		
26	Type of connection	Star / ring / mixed
27	Maximum number of cabinets of the VACIE, [unit]	
28	I/O interface marking (wire connection, fiber optic)	

29	Communication standard	e.g. RS485
30	Maximum permitted length of transmission line, [m]	
TRANSMISSION PATH TO THE CIE		
31	Interface type	e.g. relay
32	The conditions of cooperation, number of control inputs for CIE outputs, type of protocol, the control of connection	
POWER SUPPLY		
33	Power supply equipment has the certificate of conformity according EN 54-4/A1/A2	Yes / Not
34	Power supply equipment is included in the VACIE	Yes / Not
Primary power supply		
35	Operating voltage, [V AC]	e.g. 230 -15 +10%
36	Maximum current consumption during the quiescent condition, [A]	
37	Maximum current consumption during the voice alarm condition, [A]	
Secondary power supply		
38	Operating voltage, [V DC]	e.g. 24 -15 +10%
39	Maximum current consumption during the quiescent condition, [A]	
40	Maximum current consumption during the voice alarm condition, [A]	
OPTIONS WITH REQUIREMENTS		
41	Audible warning (7.3)	Yes / Not
42	Delays to entering the voice alarm condition (7.4)	Yes / Not
43	Phased evacuation (7.5)	Yes / Not
44	Manual silencing of the voice alarm condition (7.6.2)	Yes / Not
45	Manual reset of the voice alarm condition (7.7.2)	Yes / Not
46	Output to fire alarm devices (7.8)	Yes / Not
47	Voice alarm condition output (7.9)	Yes / Not
48	Indication of faults related to the transmission path to the CIE (8.3)	Yes / Not
49	Indication of faults related to voice alarm zones (8.4)	Yes / Not
50	Disablement condition (9)	Yes / Not
51	Voice alarm manual control (10)	Yes / Not
52	Interface to external control device(s) (11)	Yes / Not
53	Emergency microphone(s) (12)	Yes / Not
54	Redundant power amplifiers (13.14)	Yes / Not

For testing compliance with EN 54-16 the manufacturer shall provide at least 1 VACIE. The VACIE shall have at least 1 sample of every component.

The maximum dimensions of the cabinet are:

- length 90 cm,
- width 90 cm,
- height 180 cm.

If a manufacturer wants to provide a larger cabinet he should contact the laboratory.

6. Test program

Table 2. Subject matter and method of research

No.	Product characteristic tested	Test method according to PN-EN 54-16	Test apparatus and procedure according:
1.	General requirements	p. 4	NA
2.	General requirements for indications	p. 5	NA
3.	The quiescent condition	p. 6	NA
4.	The voice alarm condition	p. 7	NA
4.1	Audible warning (option with requirements)	p. 7.3	NA
4.2	Delays to entering the voice alarm condition (option with requirements)	p. 7.4	NA
4.3	Phased evacuation (option with requirements)	p. 7.5	NA

No.	Product characteristic tested	Test method according to PN-EN 54-16	Test apparatus and procedure according:
4.4	Manual silencing of the voice alarm condition (option with requirements)	p. 7.6.2	NA
4.5	Manual reset of the voice alarm condition (option with requirements)	p. 7.7.2	NA
4.6	Output to fire alarm devices (option with requirements)	p. 7.8	NA
4.7	Voice alarm condition output (option with requirements)	p. 7.9	NA
5.	Fault warning condition	p. 8	NA
5.1	Indication of faults related to the transmission path to the CIE (option with requirements)	p. 8.3	NA
5.2	Indication of faults related to voice alarm zones (option with requirements)	p. 8.4	NA
6.	Disablement condition (option with requirements)	p. 9	NA
7.	Voice alarm manual control (option with requirements)	p. 10	NA
8.	Interface to external control device(s) (option with the requirements)	p. 11	NA
9.	Emergency microphone(s) (option with the requirements)	p. 12	NA
10.	Design requirements	p. 13	NA
10.1	Redundant power amplifiers (option with requirements)	p. 13.14	NA
11.	Additional design requirements for software controlled VACIE	p. 14	NA
12.	Marking	p. 15	NA
13.	Functional test	p. 16.2	NA
14.	Output power	p.16.4	NA
15.	Signal-to-noise ratio	p.16.5	NA
16.	Frequency response of VACIE without microphone(s)	p.16.6	NA
17.	Frequency response of VACIE with microphone(s)	p.16.7	NA
18.	Cold (operational)	p.16.8	EN 60068-2-1
19.	Damp heat, steady state (operational)	p.16.9	EN 60068-2-78
20.	Damp heat, steady state (endurance)	p.16.10	EN 60068-2-78
21.	Impact (operational)	p.16.11	EN 60068-2-75
22.	Vibration, sinusoidal (operational)	p.16.12	EN 60068-2-6
23.	Vibration, sinusoidal (endurance)	p.16.13	EN 60068-2-6
24.	Supply voltage variation (operational)	p.16.14	NA
25.	Main supply voltage variations	p.16.15.1a	EN 50130-4
26.	Main supply voltage dips and interruptions	p.16.15.1b	EN 50130-4 EN 61000-4-11
27.	Electrostatic discharge	p.16.15.1c	EN 50130-4 EN 61000-4-2
28.	Radiated electromagnetic fields	p.16.15.1d	EN 50130-4 EN 61000-4-3
29.	Conducted disturbance induced by magnetic fields	p.16.15.1e	EN 50130-4 EN 61000-4-6
30.	Fast transient burst	p.16.15.1f	EN 50130-4 EN 61000-4-4
31.	Slow high energy voltage surges	p.16.15.1g	EN 50130-4 EN 61000-4-5

7. Tests

7.1 Output power

The VACIE output power shall be as declared by the manufacturer.

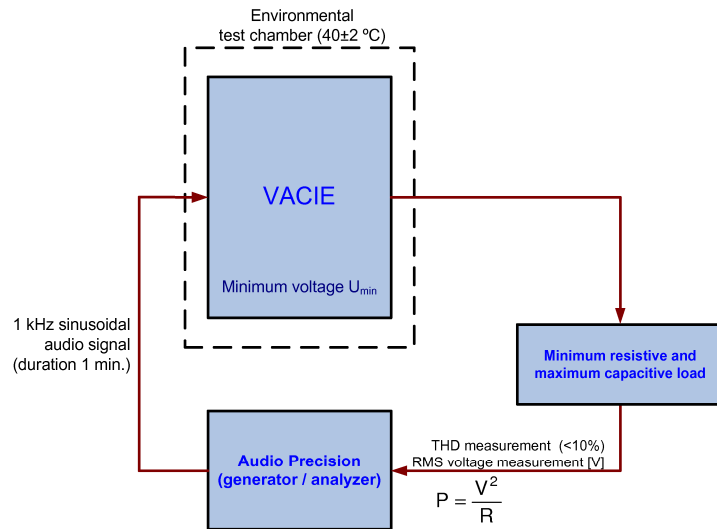


Fig. 1. Testing arrangement for output power

7.2 Signal-to-noise ratio

The VACIE shall have an A-weighted signal-to-noise ratio of at least 45 dB.

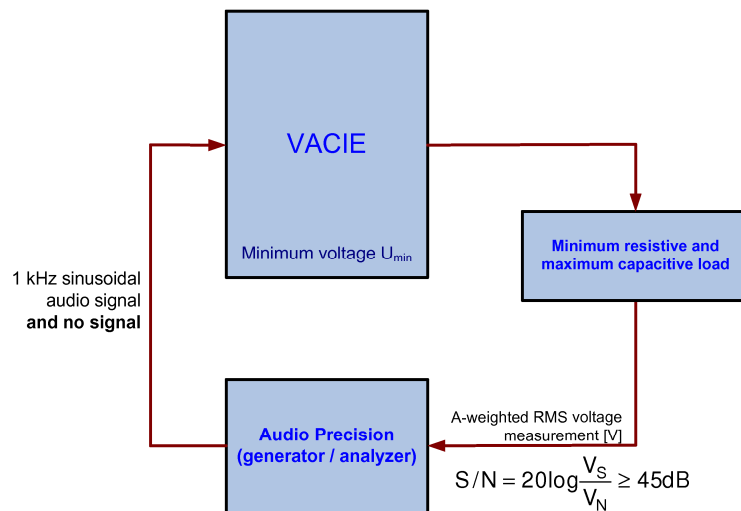


Fig. 2. Testing arrangement for signal-to-noise ratio

7.3 Frequency response

The frequency response of the VACIE shall fit within the non-shaded area in Fig. 4. VACIE frequency response limits without microphone(s) for sound sources without microphone(s) (e.g. message store) and Fig. 6. VACIE frequency response limits with microphone(s) for sound sources with microphone(s).

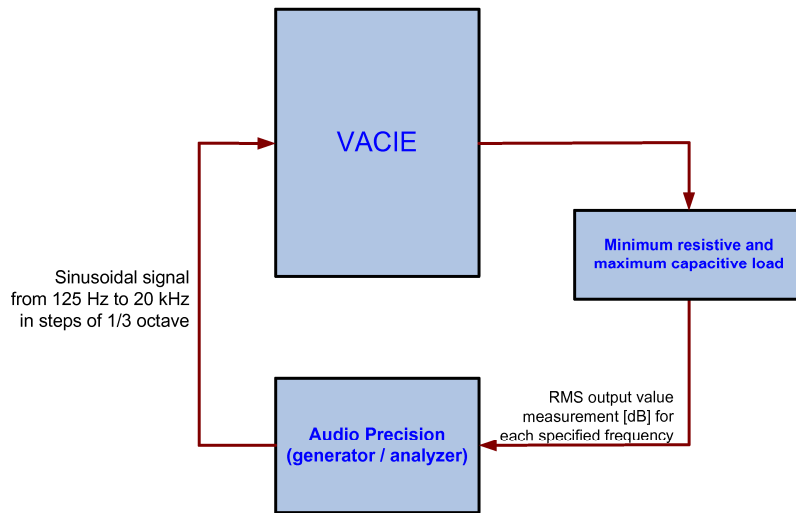


Fig. 3. Testing arrangement for frequency response without microphone(s)

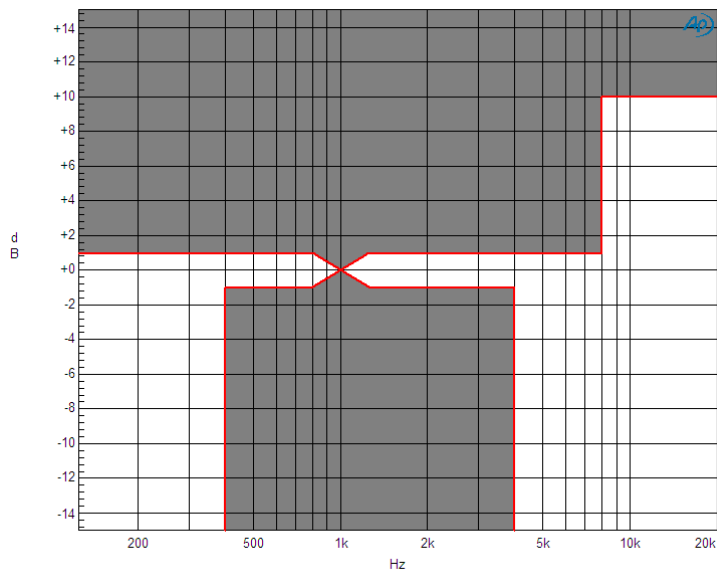


Fig. 4. VACIE frequency response limits without microphone(s)

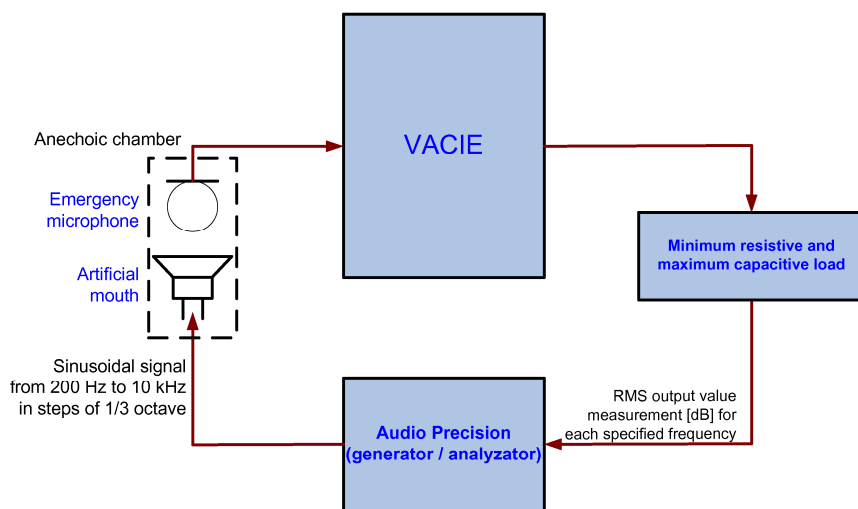


Fig. 5. Testing arrangement for frequency response with microphone(s)

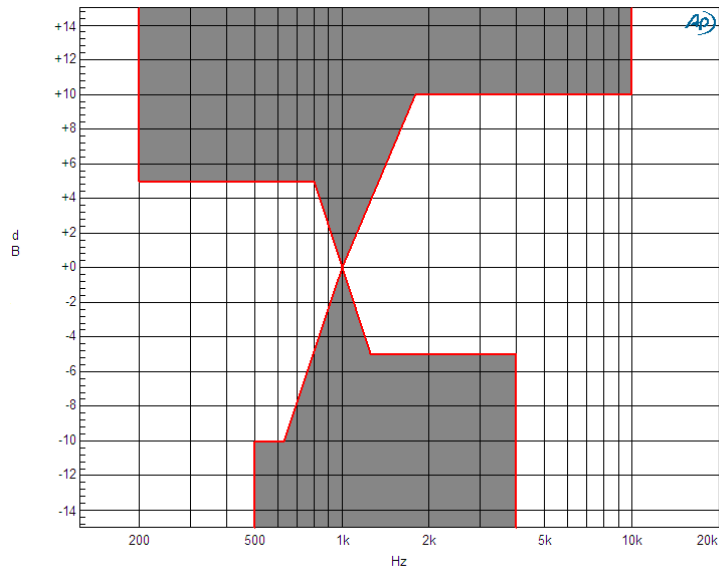


Fig. 6. VACIE frequency response limits with microphone(s)

7.4 Cold (operational)

To demonstrate the ability to function correctly at low temperatures.

The severity of conditioning:

- Temperature: -5 ± 3 °C,
- Duration: 16 h.

7.5 Damp heat, steady state (operational)

To demonstrate the ability to function correctly at high relative humidity (without condensation).

The severity of conditioning:

- Temperature: 40 ± 2 °C,
- Relative humidity: $93 +2 -3$ %,
- Duration: 4 days.

7.6 Damp heat, steady state (endurance)

To demonstrate the ability to withstand the long-term effects of humidity.

The severity of conditioning:

- Temperature: 40 ± 2 °C,
- Relative humidity: $93 +2 -3$ %,
- Duration: 21 days.

The specimen is not supplied with power during the conditioning.



Fig. 7. The view of the climatic test chamber

7.7 Impact (operational)

To demonstrate the immunity to mechanical impacts upon its surface.

The severity of conditioning:

- Impact energy: $0,5 \pm 0,04$ J,
- Number of impacts per point: 3.



Fig. 8. The view of the hammer

7.8 Vibration, sinusoidal (operational)

To demonstrate the immunity to vibrations at levels considered appropriate to the service environment.

The severity of conditioning:

- Frequency range: 10÷150 Hz,
- Acceleration amplitude: 0,1 g,
- Number of axes: 3,
- Number of sweep cycles per axis: 1.

7.9 Vibration, sinusoidal (endurance)

To demonstrate the ability to withstand the long-term effects of vibration.

The severity of conditioning:

- Frequency range: 10÷150 Hz,
- Acceleration amplitude: 0,5 g,
- Number of axes: 3,
- Number of sweep cycles per axis: 20.

The specimen is not supplied with power during the conditioning. The sample after the most of the tests should be functional tested and inspected visually for mechanical damage both externally and internally.



Fig. 9. The view of the shaker

7.10 Supply voltage variation

To demonstrate the ability to function correctly over the anticipated range of supply voltage conditions.

The severity of conditioning:

- Supply voltage max (U_{max}): $U_{nom} + 10\%$,
- Supply voltage min (U_{min}): $U_{nom} - 15\%$.

7.11 Main supply voltage dips and interruptions

To demonstrate the immunity to the short duration dips (reductions) and interruptions in the AC mains voltage.

The severity of conditioning:

- Voltage reduction 20, 30, 60, 100 %,
- Number of reductions at each duration: 3,
- Interval between reductions: ≥ 10 s.



Fig. 10. Testing arrangement for supply voltage variation

7.12 Electrostatic discharge

To demonstrate the immunity to the electrostatic discharges.

The severity of conditioning:

- Test voltages: air discharges 2, 4, 8 kV, contact discharges 2, 4, 6 kV,
- Polarity: + and –,
- Number of discharges per point for each voltage and polarity: 10,
- Interval between discharges: ≥ 1 s.

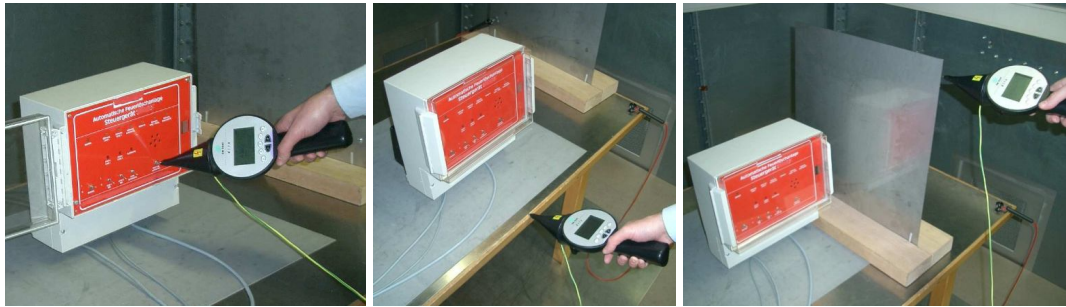


Fig. 11. Testing arrangement for the electrostatic discharge

7.13 Radiated electromagnetic fields

To demonstrate the immunity to the electromagnetic fields.

The severity of conditioning:

- Frequency range: 80 ÷ 2000 MHz,
- Field strength: 10 V/m,
- Modulation: AM, PM.

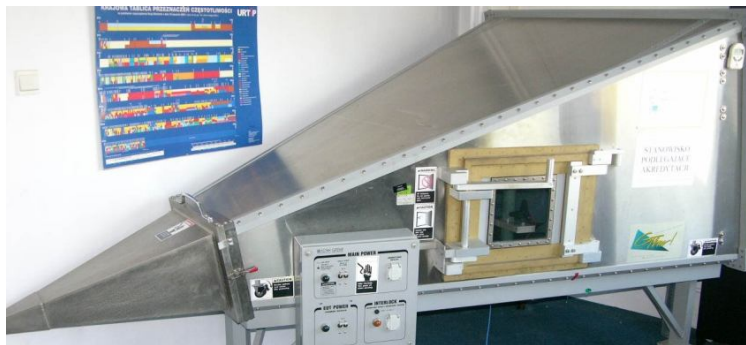


Fig. 12. Testing arrangement for the radiated electromagnetic fields

7.14 Conducted disturbance induced by magnetic fields

To demonstrate the immunity to the conducted disturbances induced by electromagnetic fields onto the field wiring.

The severity of conditioning:

- Frequency range: 0,15 ÷ 100 MHz,
- Voltage level: 10 V,
- Modulation: AM, PM.



Fig. 13. Testing arrangement for the conducted disturbance induced by magnetic fields

7.15 Fast transient burst

To demonstrate the immunity to the bursts of fast low energy transients.

The severity of conditioning:

- Test voltage: AC mains supply lines 2 kV, other 1 kV,
- Polarity: + and –,
- Number of applications for each polarity: 1,
- Duration per application: 1 +0,2 - 0 min.



Fig. 14. Testing arrangement for fast transient burst

7.16 Slow high energy voltage surges

To demonstrate the immunity to the relatively slow high energy transients.

The severity of conditioning:

- Test voltage: AC mains supply lines 0,5; 1 kV (line to line), 0,5; 1; 2 kV (line to ground), other line to ground 0,5; 1 kV,
- Polarity: + and –,
- Minimum number of surges at each polarity, voltage coupling mode and line: AC mains supply lines 20, other 5.

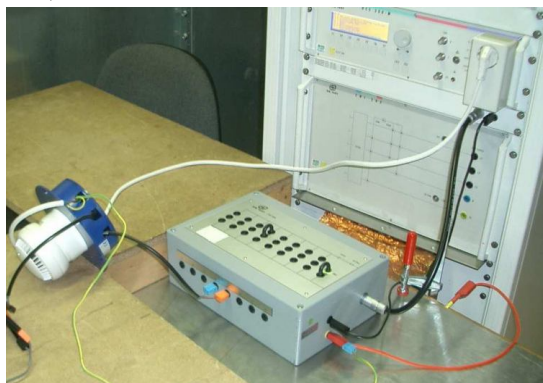


Fig. 15. Testing arrangement for fast transient burst

8. Contact

If you have any questions regarding laboratory tests please feel free to contact us:

M. Eng. Tomasz Popielarczyk
phone: +48 22 769 32 09
e-mail: tpopielarczyk@cnbop.pl

M. Eng. Tomasz Sowa
phone: +48 22 769 32 09
e-mail: tsowa@cnbop.pl

The order letter¹

.....
(place and date)²

To
Department Laboratory of Fire Alarm Systems
and Fire Automation
CNBOP-PIB
ul. Nadwislanska 213
05-420 Jozefow/k.Otwocka
Poland
fax: 0-22 769 33 56
pstepien@cnbop.pl
tpocielarczyk@cnbop.pl

Our company would like to make qualification tests of *(name of device) type (type of device)* according to:

- The European Standard EN 54-16,
- Attached test program *(please write on the attached document: "I accept above test program" and sign it)*.*

Please prepare all necessary documents and send to the address given below.

Name of the company:

Address of the company:

Mailing address (if another than company address):

VAT number:

Contact person:

With kind regards

* cross out if not applicable

¹ The order letter can be sent by e-mail, mail or fax.

² After filling the form all the notations in italics should be removed

Declaration of compliance

Name of the voice alarm control and indicating equipment (VACIE):

.....

Manufacturer:

Address:

.....

Hereby declare that, in accordance with EN 54-16 p. 13.1.2:

- the design has been carried out in accordance with the quality management system which incorporates a set of rules for the design of all elements of the VACIE and
- the components of the VACIE have been selected for the intended purpose and are expected to operate within their specifications when the environmental conditions outside the cabinet of the VACIE comply with Class 3k5 of EN 60721-3-3.

Place, date:

Stamp and signature:

The accreditation certificate of testing laboratory

POLSKIE CENTRUM AKREDYTACJI
POLISH CENTRE FOR ACCREDITATION

 Sygnatariusz EA MLA
EA MLA Signatory

CERTYFIKAT AKREDYTACJI
LABORATORIUM BADAWCZEGO
ACCREDITATION CERTIFICATE OF TESTING LABORATORY
Nr AB 207

Potwierdza się, że: / This is to confirm that:

**CENTRUM NAUKOWO-BADAWCZE OCHRONY
PRZECIWPOŻAROWEJ im. Józefa Tuliszkowskiego
- PAŃSTWOWY INSTYTUT BADAWCZY
ZESPÓŁ LABORATORIÓW SYGNALIZACJI ALARMU POŻARU
I AUTOMATYKI POŻARNICZEJ BA
ul. Nadwiślańska 213, 05-420 Józefów k/Otwocka**

spełnia wymagania normy PN-EN ISO/IEC 17025:2005
meets requirements of the PN-EN ISO/IEC 17025:2005 standard

Akredytowana działalność jest określona w Zakresie Akredytacji Nr AB 207
Accredited activity is defined in the Scope of Accreditation No AB 207

Akredytacja pozostaje w mocy pod warunkiem przestrzegania
wymagań jednostki akredytującej określonych w kontrakcie Nr AB 207
This accreditation remains in force provided the Laboratory observes
the requirements of Accreditation Body defined in the Contract No AB 207

Certyfikat akredytacji ważny do dnia 11.10.2017 r.
The certificate of accreditation is valid until 11.10.2017

Akredytacji udzielono dnia 07.10.1998 r.
Accreditation was granted on 07.10.1998

 ZASTĘPCA DYREKTORA
POLSKIEGO CENTRUM AKREDYTACJI

LUCYNA OLBORSKA

Warszawa, dnia 27 września 2013 roku