

## FINAL VERSION

## VERSION FINALE



**Home and building electronic systems (HBES) and building automation and control systems (BACS) –  
Part 5-1: EMC requirements, conditions and test set-up**

**Systèmes électroniques pour les foyers domestiques et les bâtiments (HBES) et systèmes de gestion technique du bâtiment (SGTB) –  
Partie 5-1: CEM Exigences générales, condition et montage d'essais**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### HOME AND BUILDING ELECTRONIC SYSTEMS (HBES) AND BUILDING AUTOMATION AND CONTROL SYSTEMS (BACS) –

#### Part 5-1: EMC requirements, conditions and test set-up

#### FOREWORD

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**IEC 63044-5-1 edition 1.1 contains the first edition (2017-01) [documents 23/736/CDV and 23/748/RVC] and its amendment 1 (2022-06) [documents 23/1001/FDIS and 23/1007/RVD].**

**This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.**

International Standard IEC 63044-5-1 has been prepared by IEC technical committee 23: Electrical accessories.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 63044 series, published under the general title *Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS)*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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## INTRODUCTION

The IEC 63044 series deals with developing and testing Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS).

The IEC 63044-5 series ensures a common level of EMC requirements for HBES/BACS devices.

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# HOME AND BUILDING ELECTRONIC SYSTEMS (HBES) AND BUILDING AUTOMATION AND CONTROL SYSTEMS (BACS) –

## Part 5-1: EMC requirements, conditions and test set-up

### 1 Scope

This product family standard specifies the EMC requirements for HBES/BACS devices.

In addition, it defines EMC requirements for the interface of equipment intended to be connected to an HBES/BACS network. It does not apply to interfaces to other networks.

NOTE An example of other networks is a dedicated ICT network covered by CISPR 32.

This document provides general performance requirements, standard test conditions and test set-ups.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current  $\leq$  16 A per phase)*

IEC 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current  $\leq$  16 A per phase and not subject to conditional connection*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3 : Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 63044-1, *General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) – Part 1: General requirements*

IEC 63044-3, *General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) – Part 3: Electrical safety requirements*

CISPR 22, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

CISPR 32, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

### 3 Terms, definitions and abbreviated terms

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 63044-1 and IEC 63044-3 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

##### 3.1.1

##### **port**

particular interface of the specified device with the external electromagnetic environment

Note 1 to entry: See Figure 1.

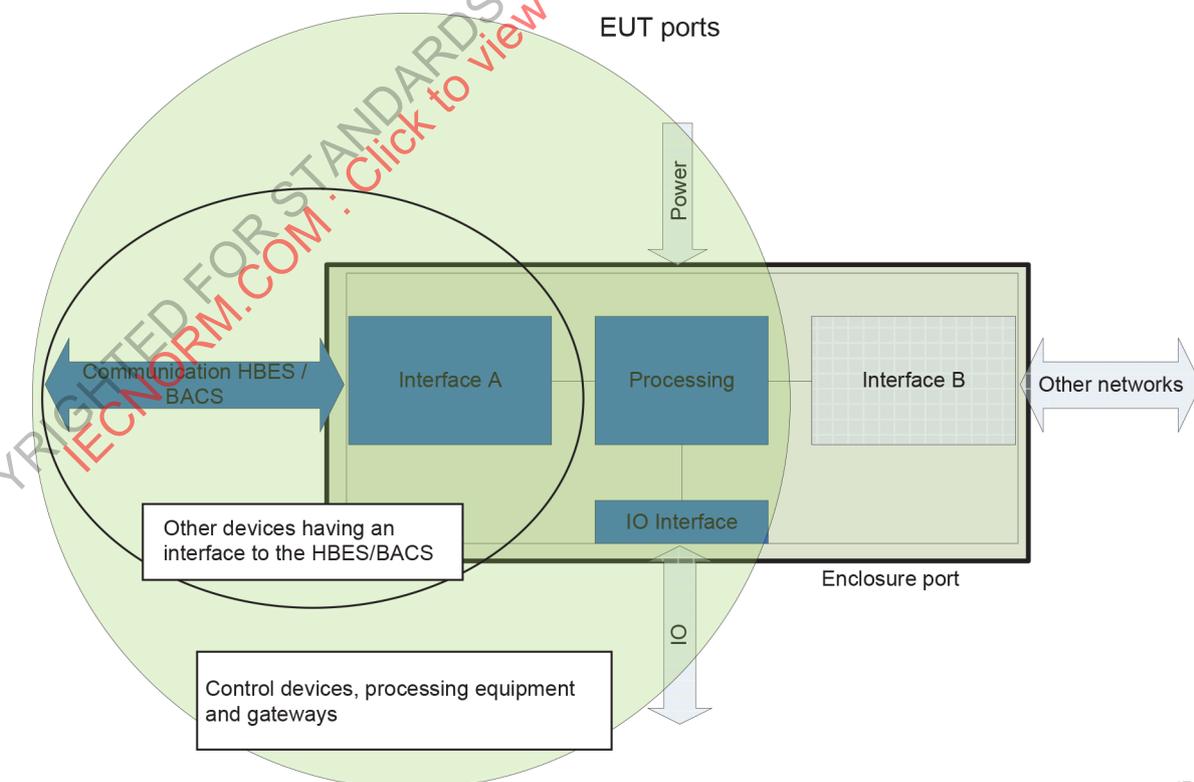


Figure 1 – EUT ports

### 3.1.2 enclosure port

physical boundary of the apparatus which electromagnetic fields may radiate through or impinge on

### 3.1.3 I/O signal port

port at which a conductor or cable intended to carry auxiliary signals, excluding network signals according to 3.1.4, is connected to the apparatus

EXAMPLES Analogue inputs, outputs and control lines.

### 3.1.4 power port

port at which a conductor or cable carrying the primary electrical power (AC or DC) needed for the operation (functioning) of an apparatus or associated apparatus is connected to the apparatus

### 3.1.5 HBES/BACS network port

port at which a conductor or cable intended to carry communication signals between the different devices of the HBES/BACS network is connected to the apparatus

Note 1 to entry: For test purposes, the HBES/BACS network port is equivalent to the telecommunications/network port according to IEC 61000-6-3.

## 3.2 Abbreviated terms

|      |                                         |
|------|-----------------------------------------|
| AE   | auxiliary equipment                     |
| BACS | building automation and control systems |
| CDN  | coupling de-coupling network            |
| EMC  | electromagnetic compatibility           |
| ESD  | electrostatic discharge                 |
| EUT  | equipment under test                    |
| HBES | home and building electronic systems    |
| HCP  | horizontal coupling plane               |
| RF   | radio-frequency                         |

## 4 General requirements

This document applies in the following way.

- If no applicable EMC product standard exists, the test set-up, test levels and performance criteria of the IEC 63044 series apply.
- If an applicable EMC product standard does not specify requirements for HBES applications, the test set-up, test levels and general performance criteria of the IEC 63044 series apply. The specific performance criteria of the product standard apply.
- If a product standard specifies requirements for HBES, the test levels and general performance criteria of the IEC 63044 series shall be adopted as the minimum level.

## 5 Performance criteria

### 5.1 General performance criteria

During and after all tests, independent of the performance criteria, the device shall not block the communication among the other HBES devices or send unintended telegrams.

A functional description and a definition of performance criteria, during or as a consequence of the EMC testing, shall be based on intended use and noted in the test report, based on the following criteria.

- Many devices operate using sophisticated protocol services which permit the recovery of data corrupted by interference or cause re-transmission of data in the event of corruption. Transmission errors caused by the application of the tests in this document and which are subsequently corrected by the protocol services are regarded as normal and the equipment is regarded as operating as intended in such circumstances;
- Changes in stored data, such as communication error logs, and which are not directly related to the intended function of the equipment shall be ignored, or recorded.

## 5.2 Specific performance criteria

### 5.2.1 Performance criterion A

In addition to the general performance criteria in 5.1, the device shall continue to operate as intended during and after the test. No unintended change of state, stored data directly related to the intended function, unintended or loss of function is allowed.

During the test, audio and/or video signals may be corrupted during the test, providing the information is kept intelligible to a qualitative evaluation.

### 5.2.2 Performance criterion B

In addition to the general performance criteria in 5.1, the device shall continue to operate as intended after the test. Unintended change of state, stored data directly related to the intended function, unintended function or loss of function is not allowed after the test.

During the test, degradation of performance is allowed as follows.

- For analogue I/O signal ports, degradation up to 10 times the tolerance specified in product documentation, with a maximum value of 50 % of full scale, is allowed.
- For digital I/O signal ports, no unexpected change of state or stored data related to the intended function is allowed.
- For HBES/BACS network port, degradation of performance is allowed. Loss of communication is allowed during the application time of the disturbance but the communication shall be restored after application of the disturbance has stopped.

### 5.2.3 Performance criterion C

In addition to the general performance criteria in 5.1, temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

## 6 Standard test conditions

### 6.1 General

EMC tests are carried out on one single device (EUT).

All tests shall be done with a minimum test configuration. A minimum test configuration is a set of devices to exercise the fundamental functions of the EUT.

The minimum test configuration adopted for the EUT shall be recorded on the test report.

Examples of test set ups are provided in Annex B.

The minimum test configuration may be different for each test.

Precautions should be taken to prevent auxiliary devices from being disturbed by tests.

In addition:

- Where a relevant International product Standard (IEC) exists, which defines suitable operating condition(s) during EMC tests, the operating condition(s) of the EUT, during the test conditioning, shall be as defined in that Standard.
- Where no relevant International product Standard (IEC) exists, the operating condition(s) of the EUT, during the test conditioning, shall include at least that (those) corresponding to the main functional mode (appropriate to the test being undertaken) of the system which it forms part of.

The configuration and mode(s) of operation during the tests shall be precisely noted in the test report.

- The use of dedicated software for testing purposes is allowed, providing that all significant functions are exercised.
- All I/O signal and HBES/BACS network ports shall be tested, with cables attached. If the EUT has more than five identical ports then at least 10 % of them, with a minimum of five, shall be tested with cables attached.

NOTE The term “identical” means same hardware and software characteristics.

- Ports (e.g. test and service ports) to which cables are normally not attached need no cables attached and need not be tested.
- Cable types (e.g. screened, unshielded, twisted pair) shall be those specified by the manufacturer. If the manufacturer does not specify the cable types in product documentation, unshielded non-twisted cables shall be used.
- Extensible cables (such as handset cable) shall not be intentionally stretched during the test. For such cables, the reference length refers to unstretched conditions.
- If the device is required to be installed in a specific case or cabinet according to manufacturer’s product documentation, all tests on the EUT shall be carried out using such an enclosure.
- If the device can be installed in different kinds of cabinets available on the market, tests shall be carried out on the EUT without the cabinet to allow repeatability.
- EUT, auxiliary equipment and cables shall be kept in fixed positions (e.g. by means of mechanical constraints) during the test.
- A description of the test set-up shall be contained in the test report.
- The cable type shall be referenced in the test report.

## 6.2 Immunity

### 6.2.1 Electrostatic discharge (ESD)

This test shall be performed according to the test set-up and test procedures defined in IEC 61000-4-2, taking into account the general standard test conditions defined in 6.1, by applying 10 positive and 10 negative discharges in the following manner:

- contact discharge to the conductive surfaces and to coupling planes;
- air discharge at insulating surfaces, if applicable.

Test points shall include hand commands (push buttons, keyboards, etc.), display, touch screen, slits.

The static electricity discharges shall be applied only to such points and surfaces of the EUT which are accessible in normal use.

A clear identification of the tested points shall be included in the test report.

Wall-mounted equipment shall be treated as table-top equipment. In order to perform the test, the wall side of the EUT is turned towards the HCP.

The cable length between the components of the minimum configuration should be 1 m unless otherwise specified by the manufacturer.

### 6.2.2 RF fields

The test shall be performed according to IEC 61000-4-3, taking into account the general standard test conditions defined in 6.1.

Wall-mounted equipment shall be treated as table-top equipment.

EUT with each side dimension below 5 cm shall be tested on front face only with vertical and horizontal polarization.

Cables shall run either vertically or horizontally in the field uniform area, for at least 1 m. Connection with AE outside the chamber shall be released through a bypass filter with no effects on signal transmission.

### 6.2.3 Fast transients (bursts)

This test shall be performed according to IEC 61000-4-4, taking into account the general standard test conditions defined in 6.1.

Additional information on test set up is given in Annex A

For tests with the EMC coupling clamp, multi-conductor cables shall be tested as a single cable.

### 6.2.4 Surge

This test shall be performed according to IEC 61000-4-5, taking into account the general standard test conditions defined in 6.1.

Number of pulses: 2 positive + 2 negative at each of the following angles: 0°, 90°, 180°, 270°.

Time between pulses: 1 min or less.

For communication systems with floating (not connected to ground) devices of small sizes, it is important to consider the return path for the surge current to the test equipment.

In order to specify a reproducible return path to ground, an impedance  $Z$  ( $R = 50 \Omega$ ,  $C = 0,47 \mu\text{F}$ ) or that specified by the manufacturer shall be connected from ground to each wire of a communication cable. For devices with only point-to-point communication (i.e. only direct communication between two units), this impedance can be omitted during the test. The impedance used shall be recorded in the test report.

#### **6.2.5 RF voltage**

This test shall be performed according to IEC 61000-4-6, taking into account the general standard test conditions defined in 6.1.

For tests with the EMC coupling clamp, multiconductor cables shall be tested as a single cable.

#### **6.2.6 Power frequency magnetic fields**

This test shall be performed according to IEC 61000-4-8, taking into account the general standard test conditions defined in 6.1.

#### **6.2.7 Voltage dips and interruptions**

This test shall be performed according to IEC 61000-4-11, taking into account the general standard test conditions defined in 6.1.

The test shall be done both with a minimum configuration and a fully loaded EUT from the power supply point of view.

### **6.3 Emission**

#### **6.3.1 General**

The configuration of the test sample shall be varied to maximize the emission consistent with the typical applications.

The EUT shall be tested after the thermal steady-state condition is reached.

#### **6.3.2 Conducted emission**

This test shall be performed according to CISPR 32, taking into account the general standard test conditions defined in 6.1.

The EUT shall be tested after the thermal steady-state condition is reached.

#### **6.3.3 Radiated emission**

This test shall be performed according to CISPR 32, taking into account the general standard test conditions defined in 6.1.

Cables shall run vertically for at least 1 m. Connection with AE outside the chamber shall be released through a bypass filter with no effects on signal transmission.

## **Annex A** (informative)

### **Additional information for fast transients (burst) test set-up**

For communication systems with floating devices of small sizes (e.g. sensors or push-buttons) without connection to earth and supplied via the communication wires or by batteries, it is important to consider the return path for the burst current to ground plane of the test equipment.

The basic standard IEC 61000-4-4 specifies the EUT to be placed 10 cm over the ground plane. However, when mounting the device direct on a wall, this capacity to ground can be increased because of the smaller coupling distance. This can influence the immunity to the burst impact. Therefore, an additional test shall be done with the EUT placed directly on the ground plane.

In cases where the EUT has an accessible metal surface or shielding, the test shall be done with and without connection of this metal surface or shielding to earth.

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## **Annex B** (informative)

### **Test set-ups**

#### **B.1 General**

Annex B gives examples of test set-ups for EMC tests. Real test set-ups should be created accordingly and described in the test report (see 6.1). These test set-ups are based on twisted-pair cabled systems. To create test set-ups for power line system and wireless system, make reference to the relevant product standards.

#### **B.2 Test set-up for conducted immunity tests**

The following test set-up is applicable to

- fast transients/burst (IEC 61000-4-4),
- surge (IEC 61000-4-5),
- RF conducted disturbances (IEC 61000-4-6).

The separation between the EUT and the rest of the system (minimum test configuration, according to 6.1) is normally obtained with a minimum cable length of 3 m. The cable may be twisted to save space.

To improve separation, a CDN or filter may be used, providing it will not affect the system communication. If required, this device is connected as reported in Figure B.1,  $l_4$  being the total length of the cable and the device.