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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

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IEC TC 95 : MEASURING RELAYS AND PROTECTION EQUIPMENT	
SECRETARIAT: France	SECRETARY: Mr Thierry BARDOU
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 14, TC 17, TC 38, TC 77, TC 115, TC 122	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☒ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

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TITLE:

Measuring relays and protection equipment – Part 26: Electromagnetic compatibility requirements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEASURING RELAYS AND PROTECTION EQUIPMENT –**Part 26: Electromagnetic compatibility requirements**

FOREWORD

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International Standard IEC 60255-26 has been prepared by IEC technical committee 95: Measuring relays and protection equipment.

This fourth edition cancels and replaces the third edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) expansion of the frequency range on radiated radio-frequency immunity test up to 6 GHz;
- b) addition of updated requirements on electrostatic discharge tests;
- c) addition of higher immunity requirements on power frequency magnetic field tests;
- d) update of the spot frequency test and a new annex with background information;
- e) addition of details and further guidance on the relay settings;
- f) introduction of a wired network port;

- g) update of product standards and basic EMC standards;
- h) addition of an annex about EMC risk assessments
- i) addition of an annex on radio interfaces

The text of this International Standard is based on the following documents:

FDIS	Report on voting
95/xxx/FDIS	95/xxx/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

A list of all the parts in the IEC 60255 series, published under the general title *Measuring relays and protection equipment*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<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.

A bilingual version of this publication may be issued at a later date.

MEASURING RELAYS AND PROTECTION EQUIPMENT –

Part 26: Electromagnetic compatibility requirements

1 Scope

1.1 General

This part of the IEC 60255 series specifies the requirements for electromagnetic compatibility for measuring relays and protection equipment. It is applicable to measuring relays and protection equipment and combinations of devices to form schemes for power system protection including the control, monitoring, communication and process interface equipment used with those systems.

Tests specified in this document are not required for equipment not incorporating electronic circuits, for example electromechanical relays.

The requirements specified in this document are applicable to measuring relays and protection equipment in a condition representative of how new equipment is provided by the manufacturer. All tests specified are type tests only.

1.2 Emission

This document specifies limits and test methods, for measuring relays and protection equipment in relation to electromagnetic emissions which might cause interference in other equipment.

These emission limits represent electromagnetic compatibility requirements and have been selected to ensure that the disturbances generated by measuring relays and protection equipment, operated normally in substations and power plants, do not exceed a specified level which could prevent other equipment from operating as intended.

Test requirements are specified for the enclosure, auxiliary power supply ports, input/output ports, signal/control ports and wired network ports.

1.3 Immunity

This document specifies the immunity test requirements for measuring relays and protection equipment in relation to continuous and transient, conducted and radiated disturbances, including electrostatic discharges.

These test requirements represent the electromagnetic compatibility immunity requirements and have been selected so as to ensure an adequate level of immunity for measuring relays and protection equipment, operated normally in substations and power plants.

NOTE 1 Product safety considerations are not covered in this document.

NOTE 2 In special cases, situations will arise where the levels of disturbance could exceed the levels specified in this document, for example where a hand-held transmitter or a mobile telephone is used close to measuring relays and protection equipment. In these instances, special precautions and procedures could have to be employed.

2 Normative references

The following documents are indispensable for the application 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 60255-1:2020, *Measuring relays and protection equipment – Part 1: Common requirements*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006/AMD1:2007/AMD2:2010, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014/AMD1:2017, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11:2004/AMD1:2017, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-16:2015, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*

IEC 61000-4-17:1999/AMD1:2001/AMD2:2008, *Electromagnetic compatibility (EMC) – Part 4-17: Testing and measurement techniques – Ripple on d.c. input power port immunity test*

IEC 61000-4-18:2019, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-4-29:2000, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

CISPR 11:2015/AMD1:2016, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CISPR 32:2019, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions 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 auxiliary equipment

AE

equipment necessary to provide the equipment under test (EUT) with the signals required for normal operation and to verify the performance of the EUT

3.1.2 auxiliary power supply port

AC or DC auxiliary energizing input of the EUT

NOTE Some modern relays have a single auxiliary power supply port that can be energized with both AC and/or DC.

3.1.3 battery monitor port

a port that monitors the station battery voltage

3.1.4 common mode

CM

mode between each active conductor and a specified reference, usually earth or ground reference plane

3.1.5 cabinet

free-standing and self-supporting enclosure for housing electrical and/or electronic equipment

Note – A cabinet is usually fitted with doors and/or side panels, which may or may not be removable.

[SOURCE: IEC 60050-581:2008, 581-25-02]

3.1.6 coupling network

electrical circuit for the purpose of transferring energy from one circuit to another

3.1.7 decoupling network

electrical circuit for the purpose of preventing test voltages applied to the EUT from affecting other devices, equipment, or systems which are not under test

3.1.8 differential mode

DM

mode between any two of a specified set of active conductors

3.1.9 earth port

point where a cable intended for connection to earth for functional or safety purposes can be connected

Note 1 to entry: Multiple earth ports should be tested separately.

3.1.10 enclosure port

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

[SOURCE: IEC 60050-445:2010, 445-07-4, modified – “relay” has been replaced by “EUT” and “can” has been replaced by “may”.]

3.1.11 equipment under test**EUT**

equipment submitted to a test, including any accessories, unless otherwise specified

3.1.12 highest internal frequency**F_x**

highest fundamental frequency generated or used within the EUT or highest frequency at which it operates

Note 1 to entry: This includes frequencies which are solely used within an integrated circuit.

3.1.13 nominal value

value of a quantity used to designate and identify a component, device, equipment, or system

NOTE The nominal value is generally a rounded value.

[SOURCE: IEC 60050-151:2001, 151-16-09]

3.1.14 input port

port through which the EUT is energized or controlled in order to perform its function(s)

EXAMPLES Analog current transformer (LPCT/CT) input, analog voltage transformer (LPVT/VT) input, binary input, battery monitor input etc.

3.1.15 low power instrument transformer**LPIT**

arrangement, consisting of one or more current or voltage transformer(s) which may be

connected to transmitting systems and secondary converters, all intended to transmit a low-power analogue or digital output signal to measuring instruments, meters and protective or control devices or similar apparatus.

EXAMPLE An arrangement consisting of three current sensors, three voltage sensors connected to one merging unit delivering one digital output is considered an LPIT.

Note 1 to entry: LPITs are commonly called non-conventional instrument transformers (NCIT).

Note 2 to entry: The output power produced by these devices is typically lower or equal to 1 VA.

[SOURCE: IEC 61869-6:2016]

3.1.16 low-power current transformer**LPCT**

low-power instrument transformer for current measurement

[SOURCE: IEC 61869-6:2016]

3.1.17 low-power voltage transformer**LPVT**

low-power instrument transformer for voltage measurement

[SOURCE: IEC 61869-6:2016]

3.1.18 output port

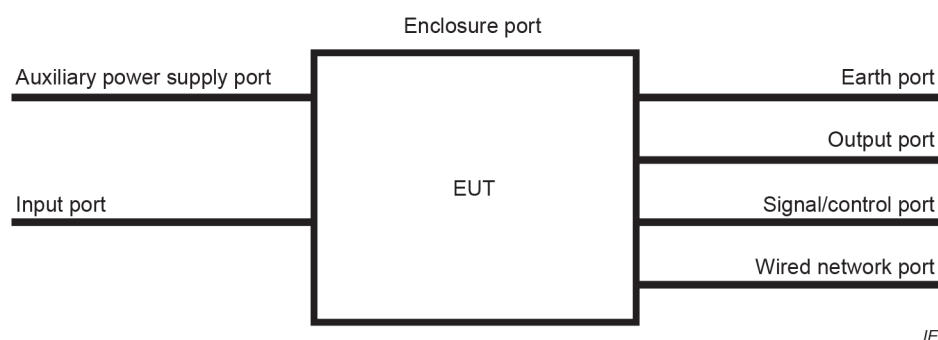
port through which the EUT produces predetermined changes

EXAMPLE Contacts, analogue output, etc.

3.1.19 port

particular interface of the specified EUT with the external electromagnetic environment

See Figure 1.



IEC

Figure 1 – Ports for measuring relays and protection equipment

3.1.20 rated value

value of a quantity used for specification purposes, established for a specified set of operating conditions of a component, device, equipment, or system

[SOURCE: IEC 60050-151:2001, 151-16-08]

3.1.21 signal/control port

port intended for the interconnection of components of an EUT, or between an EUT and local AE and used in accordance with relevant functional specifications (for example, for the maximum length of cable connected to it)

Note 1 to entry: Examples include EIA-232, Universal Serial Bus (USB), High-Definition Multimedia Interface (HDMI), IEEE Standard 1394 ("Fire Wire"), IRIG-B Interface.

3.1.22 small equipment

equipment, either positioned on a tabletop or standing on the floor which, including its cables, fits in a cylindrical test volume of 1,2 m in diameter and 1,5 m above the ground plane

Note: For small equipment, emission testing at distances under 10 m is accepted.

3.1.23 wired network port

port for the connection of voice, data and signaling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network

Note 1 to entry: Examples of these include CATV, PSTN, ISDN, xDSL, LAN and similar networks.

Note 2 to entry: These ports may support screened or unscreened cables and may also carry AC or DC power (e.g. PoE) where this is an integral part of the telecommunication specification.

NOTE 3 A port generally intended for interconnection of components of a system under test (e.g. EIA-232, IEEE Standard 1284 (parallel printer), Universal Serial Bus (USB), IEEE Standard 1394 ("Fire Wire"), etc.) and used in accordance with its functional specifications (e.g. for the maximum length of cable connected to it), is not considered to be a wired network port.

Note 4 Fiber optic interfaces shall be considered as a wired network port. They shall be activated during all EMC testing even when they are not tested directly.

3.2 Abbreviations

AAN	Asymmetric Artificial Network
AE	Auxiliary Equipment
AIS	Air Insulated Switchgear
AMN	Artificial Mains Network
CATV	Communal (Broadcasting) Antenna
CDN	Coupling/Decoupling Network
CVP	Capacitive Voltage Probe
EMC	Electro Magnetic Compatibility
ESD	Electro Static Discharge
EUT	Equipment Under Test
FDOW	Fast Damped Oscillatory Wave
GIS	Gas Insulated Switchgear
IED	Intelligent Electronic Device
ISDN	Integrated Services Digital Network
LAN	Local Area Network
LPCT	Low Power Current Transformer
LPIT	Low Power Instrument Transformer
LPVT	Low Power Voltage Transformer
PCBA	Printed Circuit Board Assembly
PCB	Printed Circuit Board
PSTN	Public Switched Telephone Network
RF	Radio Frequency
UFA	Uniform Field Area
USB	Universal Serial Bus
xDSL	Generic term for all types of DSL (Digital Subscriber Line) technology

4 Electromagnetic environmental levels

4.1 General

The environmental levels shall be selected in accordance with the most realistic installation and environmental conditions in which the EUT is expected to operate.

Based on common installation practices, the recommended selection of test levels are given in 4.2 and 4.3.

4.2 Zone A, severe electromagnetic environment

The installation is characterized by the following attributes:

- no suppression of electrical fast transients/bursts in the power supply and control and power circuits which are switched by relays and contactors;
- no separation of the industrial circuits from other circuits associated with environments of higher severity levels;
- no separation between power supply, control, signal and communication cables;
- use of common multi-core cables for control and signal lines.
- Interconnections that are running as outdoor cables along with power cables, even to the high voltage equipment; A special case of this environment is when the electronic equipment is connected to the telecommunication network within a densely populated area. There is no systematically constructed grounding network outside the electronic equipment, and the grounding system consists only of pipes, cables, etc.

The outdoor area of industrial process equipment, power stations, open-air HV substation switchyards and gas insulated switchgear may be representative of this environment.

4.3 Zone B, typical electromagnetic environment

The installation is characterized by the following attributes:

- no suppression of electrical fast transients/bursts in the power supply and control circuits which are switched by relays (no contactors);
- poor separation of the industrial circuits from other circuits associated with environments of higher severity levels;
- dedicated cables for power supply, control, signal and communication lines;
- poor separation between power supply, control, signal and communication cables;
- The interconnection cables can be partly outdoor cables, but close to the grounding network;
- availability of earthing system represented by conductive pipes, ground conductors in the cable trays (connected to the protective earth system) and by a ground mesh.

The area of industrial process equipment, the power plants and the relay room of open-air HV substations may be representative of this environment.

Measuring relays and protection equipment shall meet Class A emission limits for both environmental conditions (Zone A and Zone B).

5 Emission

5.1 Radiated emission

Table 1 – Radiated emission tests – Enclosure port

Item	Environmental phenomena	Frequency range	Limits	Reference standard	Test procedure
1.1	Radiated emission (below 1 GHz) ^a	30 MHz to 230 MHz	40 dB(μV/m) quasi-peak at 10 m 50 dB(μV/m) quasi-peak at 3 m	CISPR 11	See 7.2.2
		230 MHz to 1 000 MHz	47 dB(μV/m) quasi-peak at 10 m 57 dB(μV/m) quasi-peak at 3 m		
1.2	Radiated emission (above 1 GHz)	1 GHz to 3 GHz	56 dB(μV/m) average at 3 m 76 dB(μV/m) peak at 3 m	CISPR 32	See 7.2.2
		3 GHz to 6 GHz	60 dB(μV/m) average at 3 m 80 dB(μV/m) peak at 3 m		

^a Measuring relays and protection equipment are apparatus which satisfy the class A limits. Limits can be measured at a nominal distance of 3 m or 10 m or 30 m. A measuring distance less than 10 m is allowed only for equipment which complies with the definition given in 3.1.22. In case of measurements at a separation distance of 30 m, an inverse proportionality factor of 20 dB per decade shall be used to normalize the measured data to the specified distance for determining compliance.

NOTE At the transition frequency, the more stringent limit shall apply.

The following table shows the highest frequency up to which radiated emission measurements shall be performed.

Table 2 – Required highest frequency for radiated measurement

Highest internal frequency F_x	Highest measured frequency
$F_x \leq 108 \text{ MHz}$	1 GHz
$108 \text{ MHz} < F_x \leq 500 \text{ MHz}$	2 GHz
$500 \text{ MHz} < F_x \leq 1 \text{ GHz}$	5 GHz
$F_x > 1 \text{ GHz}$	$5 \times F_x$ up to a maximum of 6 GHz
NOTE Where the highest internal frequency is unknown, the measurement shall be made up to 6 GHz.	

5.2 Conducted emission

Table 3 – Conducted emission tests – AC and DC auxiliary power supply port

Item	Environmental phenomena	Frequency range	Limits ^a	Reference standard	Test procedure
3.1	Conducted emission	0,15 MHz to 0,50 MHz	79 dB(μV) quasi-peak 66 dB(μV) average	CISPR 32	See 7.2.3
		0,50 MHz to 30 MHz	73 dB(μV) quasi-peak 60 dB(μV) average		
^a These limits apply to class A equipment measured with an AMN (Artificial Mains Network) as per CISPR 32. NOTE At the transition frequency, the more stringent limit shall apply.					

Table 4 – Conducted emission tests – Wired network port

Item	Environmental phenomena	Frequency range	Limits	Reference standard	Test procedure
4.1	Conducted emission ^a	0,15 MHz to 0,50 MHz	97 dB(μV) to 87 dB(μV) quasi-peak	CISPR 32	See 7.2.3
			84 dB(μV) to 74 dB(μV) average		
		0,50 MHz to 30 MHz	87 dB(μV) quasi-peak		
			74 dB(μV) average		
4.2	Conducted emission ^b	0,15 MHz to 0,50 MHz	97 dB(μV) to 87 dB(μV) to 53 dB(μA) to 43 dB(μA) quasi-peak	CISPR 32	See 7.2.3
			84 dB(μV) to 74 dB(μV) to 40 dB(μA) to 30 dB(μA) average		
		0,50 MHz to 30 MHz	87 dB(μV) to 43 dB(μA) quasi-peak		
			74 dB(μV) to 30 dB(μA) average		

^a These limits apply to class A equipment measured with an AAN (Asymmetric Artificial Network) as per CISPR 32.

^b These limits apply to class A equipment of CISPR 32 measured with a capacitive voltage probe (CVP) and current probe as per CISPR 32.

NOTE 1 Depending on the measurement method used, it shall be sufficient to test only item 4.1 or item 4.2. The choice of the method depends on the operation of a wired network port when an AAN is applied. When the AAN affects the normal operation of it, the CVP and current probe measurement method shall be used.

NOTE 2 At the transition frequency, the more stringent limit shall apply.