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60255-22-3

Third edition
Troisième édition
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Measuring relays and protection equipment –

**Part 22-3:
Electrical disturbance tests –
Radiated electromagnetic field immunity**

Relais de mesure et dispositifs de protection –

**Partie 22-3:
Essais d'influence électrique –
Immunité aux champs électromagnétiques
rayonnés**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEASURING RELAYS AND PROTECTION EQUIPMENT –**Part 22-3: Electrical disturbance tests –
Radiated electromagnetic field immunity**

FOREWORD

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International Standard IEC 60255-22-3 has been prepared by IEC technical committee 95: Measuring relays and protection equipment.

This third edition cancels and replaces the second edition published in 2000. The main change with respect to the previous edition concerns the extension of the frequency range to be tested.

The text of this standard is based on the following documents:

FDIS	Report on voting
95/209/FDIS	95/215/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 parts of 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- withdrawn,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
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MEASURING RELAYS AND PROTECTION EQUIPMENT –

Part 22-3: Electrical disturbance tests – Radiated electromagnetic field immunity

1 Scope and object

This part of IEC 60255 is based on IEC 61000-4-3, referring to that publication where applicable, and specifies the general requirements for radiated electromagnetic field immunity tests for measuring relays and protection equipment for power system protection, including the control, monitoring and process interface equipment used with those systems.

The objective of the tests is to confirm that the equipment under test (EUT) will operate correctly when energised and subjected to an electromagnetic field from a radiation source operating within the frequency range 80 MHz to 2,7 GHz.

NOTE 1 The product standard IEC 60255-22-6 (based on IEC 61000-4-6) establishes the immunity of measuring relays and protection equipment over the frequency range of 0,15 MHz to 80 MHz.

NOTE 2 The test methods defined in this standard are structured for the primary objective of establishing adequate repeatability of results at various test facilities for qualitative analysis of effects. The test methods using a portable transmitter¹ are not taken into consideration here because the EMC directive now specifies a sweep test, calibrated field strengths must be used and the portable transmitter test is not generally reproducible.

The requirements specified in this standard are applicable to measuring relays and protection equipment in a new condition, and all tests specified are type tests only.

2 Normative references

The following referenced 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 60050(161), *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 60050(446), *International Electrotechnical Vocabulary (IEV) – Chapter 446: Electrical relays*

IEC 60050(448), *International Electrotechnical Vocabulary (IEV) – Chapter 448: Power system protection*

IEC 60255-6, *Electrical relays – Part 6: Measuring relays and protection equipment*

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

¹ Specified in the first edition (1989) of this standard.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050(161), IEC 60050(446) and IEC 60050(448), and the following apply.

3.1

auxiliary equipment

equipment necessary to provide the EUT with the signals required for normal operation, and equipment used to verify the performance of the EUT

3.2

equipment under test

EUT

equipment which may be either a measuring relay or a protection equipment

3.3

port

particular interface of the EUT with electromagnetic environment

[IEV 131-12-60, modified and IEC 61000-4-12, 3.7, modified]

4 Test severity level

The field strength, prior to modulation being applied, shall be 10 V/m, measured in accordance with IEC 61000-4-3.

NOTE This level of field strength is applicable to equipment used in a severe electromagnetic radiation environment, for example levels typical of transceivers that can be operated close to the equipment, but not closer than 1 m.

5 Test equipment

The recommended test equipment is described in IEC 61000-4-3. This includes a description of the test facility and calibration of the field.

6 Test set-up

The general test set-up should be as specified in IEC 61000-4-3. Specific details for measuring relays and protection equipment are as follows.

Where possible, it is recommended that all auxiliary equipment should be located outside the boundary of the test site.

Normally, the EUT shall be individually tested, with the EUT placed on a non-conducting table 0,8 m above the ground plane. All parts of the EUT shall be at least 0,8 m from any metal surface.

Where the EUT is exclusively mounted in a cubicle, the tests may be conducted with the EUT in the cubicle. The cubicle should be placed on a non-conducting support, and for practical reasons a distance of approximately 0,1 m is recommended between the cubicle and the ground plane.

Where earth connections are required for safety purposes, they shall be connected to the ground plane. Where they are not otherwise provided or specified by the manufacturer, earth connections shall be, where practicable, 1 m long and shall run parallel to, and at a distance of not more than 0,1 m from, the auxiliary power supply connection.

Earth connections for functional purposes (e.g. for EMC) either specified or supplied by the manufacturer for connection to the same terminal as the safety earth connection shall also be connected to the ground plane. The length of these connections shall be as short as possible.

Interconnecting cables shall be as follows:

- the manufacturer's specified wiring types and connectors shall be used;
- if the manufacturer's specification requires a wiring length of less than or equal to 3 m, then the specified length shall be used;
- if the specified length is greater than 3 m, or is not specified, then the length exposed to the electromagnetic field shall be 1 m. The remainder is decoupled, for instance via lossy radio frequency ferrite tubes or low-inductive bundling of the cable. The decoupling method shall not impair the operation of the EUT.

The length of exposed wiring is run in a configuration which essentially simulates normal wiring, i.e. the wiring is run to the side of the EUT and then either up or down.

Typical EUT set-ups for measuring relays and protection equipment are shown in Figures 1 and 2, which are based on the equivalent figures of IEC 61000-4-3.

7 Test procedure

The tests shall be carried out under the reference conditions given in IEC 60255-6.

The tests shall be performed with the antenna facing each side of the EUT. When technically justified, the EUT can be tested by exposing fewer sides to the generating antenna. The polarisation of the field generated by the antenna necessitates testing each side twice, once with the antenna positioned vertically, and once with the antenna positioned horizontally.

For practical reasons, the effect of this disturbance on the relay in its transitional or operate state is only considered at certain spot frequencies as specified in 7.2.

The following tests are to be performed to confirm that

- a) the EUT will have normal performance within the specification limits when energised and subjected to an electromagnetic field from a radiation source operating within the swept frequency ranges 80 MHz to 1 GHz and 1,4 GHz to 2,7 GHz;
- b) the EUT is capable of correct operation and reset in the presence of an electromagnetic field from a radiation source at given spot frequencies within the range 80 MHz to 2,7 GHz.

7.1 Frequency sweep

Time delay settings of the EUT shall be set to their minimum practical values as defined by their intended application.

The tests shall be carried out with auxiliary energising quantities applied to the appropriate circuits, using input energising quantities equal to rated values. The values of the input energising quantities shall be within twice the assigned error of the transitional state.

If the rated conditions of the EUT mean that the input energising quantity is much lower than the relay operate value, the tests shall be performed at the continuous thermal withstand value.

The frequency range is swept from 80 MHz to 1 GHz and 1,4 GHz to 2,7 GHz, with the signal 80 % amplitude-modulated with a 1 kHz sinewave, pausing to adjust the radio frequency signal level or to switch oscillators and antennas as necessary. The rate of sweep shall not exceed $1,5 \times 10^{-3}$ decades per second.

Where the frequency range is swept incrementally, the step size shall not exceed 1 % of fundamental, with linear interpolation between calibrated points. The dwell time at each frequency shall be 0,5 s. In those cases where the EUT operate time is greater than 0,5 s, the dwell time shall be increased until operation of the EUT is possible.

NOTE The expression “not exceed 1 % of fundamental” means that the frequency of each step is less than, or equal to, the frequency of the previous step after multiplication by a factor of 1,01 (for a 1 % step size).

7.2 Spot frequencies

The tests shall be carried out with auxiliary energising quantities applied to the appropriate circuits with values equal to rated conditions.

Table 1 specifies the spot frequencies which shall be used.

Table 1 – Spot frequencies

Test	Spot frequency MHz	Tolerance	Modulation (1 kHz sinewave)	Duty cycle
1	80	±0,5 %	80 %	100 %
2	160	±0,5 %	80 %	100 %
3	380	±0,5 %	80 %	100 %
4	450	±0,5 %	80 %	100 %
5	900	±5 MHz	80 %	100 %
6	1 850	±5 MHz	80 %	100 %
7	2 150	±5 MHz	80 %	100 %

During each spot frequency test, the input energising quantities shall be adjusted to cause the EUT to change from the normal energised state to the operated state, and held until the EUT operates correctly. The input energising quantities shall then be re-adjusted to cause the EUT to reset.

The testing time at each spot frequency should be not less than 10 s.

8 Criteria for acceptance

The test result is positive if the EUT shows its immunity throughout the entire period of the application of the tests.

Table 2 lists the important functions which could apply to a measuring relay or protection equipment. These should be monitored during both sweep and spot frequency testing.