

TECHNICAL REPORT

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

Specification for radio disturbance and immunity measuring apparatus and methods –

Part 2-5: In situ measurements of disturbing emissions produced by physically large equipment

CISPR TR 16-2-5:2008

<https://standards.iteh.ai/catalog/standards/sist/7f9d1500-2173-47db-85c4-f4862c708a6f/cispr-tr-16-2-5-2008>



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

P

ICS 33.100.10

ISBN 2-8318-9894-3

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INTERNATIONAL ELECTROTECHNICAL COMMISSION
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**SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY
MEASURING APPARATUS AND METHODS –**

**Part 2-5: *In situ* measurements of disturbing emissions
produced by physically large equipment**

FOREWORD

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CISPR 16-2-5, which is a technical report, has been prepared by CISPR subcommittee H: Limits for the protection of radio services.

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

Enquiry draft	Report on voting
CISPR/H/161/DTR	CISPR/H/172/RVC

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 the CISPR 16 series, published under the general title *Specification for radio disturbance and immunity measuring apparatus and methods*, 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- withdrawn,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.

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SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

Part 2-5: *In situ* measurements of disturbing emissions produced by physically large equipment

1 Scope

This part of CISPR 16 deals with *in situ* electromagnetic disturbance measurements in any environment from physically large equipment and systems excluding networks.

It covers both radiated and conducted emission phenomena, and does not deal with immunity tests.

This technical report is intended to be applied primarily to such physically large equipment which are not under the scope of any existing emission standards (as for example CISPR 11 and CISPR 22). It serves only as a guideline on how to deal with emissions of that equipment at the particular location of installation. It does not establish any emission requirements.

NOTE 1 Although this technical report is intended to be applied to equipment which is not under the scope of any existing emission standards, it may be used also in such cases in order to serve as additional information for carrying out *in situ* measurements for any type of large equipment.

NOTE 2 Examples of large equipment are: production machines, conveyors, large displays, aircraft simulators, traffic control equipment, etc.

Due to the severe impact of the conditions existing at a particular location of operation and the use of the respective large equipment, however it is not intended to use the measurements in the frame of type testing.

NOTE 3 In general, type testing on large equipment is only possible at standardized test sites in a controlled environment. The assessment results obtained under *in situ* conditions are only valid for the respective individual large equipment actually measured at its particular place of installation. These results cannot be transposed to other equipment of the same type, but installed at other locations.

Reference *in-situ* measurement distances will be given. This allows comparison of the measurement results with limits from existing relevant standards.

The frequency range under consideration is from 9 kHz to 18 GHz.

Dealing with biological effects on living matter is excluded from this document.

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.

CISPR 16-1-1, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 16-1-2, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Conducted disturbances*

CISPR 16-1-4, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Radiated disturbances*

CISPR 16-2-1, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements*

CISPR 16-2-3, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

NOTE See also the Bibliography

3 Terms and definitions

For the purposes of this document, the terms and definitions contained in IEC 60050-161 as well as the following terms and definitions apply.

NOTE See particularly electromagnetic disturbance (IEV 161-01-05) and electromagnetic interference (IEV 161-01-06).

3.1 boundary

for physically large equipment: imaginary straight line periphery describing a simple geometric configuration encompassing the equipment or system under consideration. All interconnecting cables inside the physically large equipment should be included within this boundary

3.2 antenna reference point

the reference point referred to in the antenna calibration procedure, which is used to determine the measurement distance between the equipment under test and the antenna

3.3 characterised interference

interference with an origin from an identified electromagnetic phenomenon, and for which the disturbance level at a given point is characterised by a collection of technical data, for example the spectrum

3.4 deviation from intended use regarding EMC

installation and/or operation of a device, equipment or system, deviating from the instructions of the manufacturer given in the user's manual

NOTE The installation refers to both the defined environment and electrical conditions including cabling.

3.5 distribution point

point on a data and communication network inside a system or an installation, electrically nearest to a particular communication equipment or terminal, at which other equipment or terminals are, or could be, connected

3.6 in-plant point of coupling IPC

point on a network inside a system or an installation, electrically nearest to a particular load, at which other loads are, or could be, connected

NOTE The IPC is usually the point for which electromagnetic compatibility is to be considered.

[IEC 61000-2-4, definition 3.1.7]

3.7

point of common coupling

PCC

point on a public power supply network, electrically nearest to a particular load, at which other loads are, or could be, connected

[IEC 61000-2-4, definition 3.1.6]

3.8

reference point (for *in situ* measurement)

point at which *in situ* measurement is performed

NOTE 1 In case of radiated measurements, it is measured along a perpendicular line from the boundary to the antenna reference point.

NOTE 2 Different reference points might be defined according to the frequency range.

NOTE 3 The boundary to be taken into account for measurement depends on the actual *in situ* conditions

3.9

physically large equipment

a group of items of equipment functionally connected to form a commercially specified physically large equipment considered in a defined context as a whole and separated from their environment

NOTE 1 An equipment can be considered as physically large when it has a total dimension exceeding that which is practical for testing on a conventional 10 m test site.

NOTE 2 The physically large equipment is considered to be separated from the environment and from the other external systems by an imaginary surface, which cuts the links between them and the physically large equipment.

NOTE 3 For the purpose of this document, the elements of the physically large equipment are objects such as devices, items of equipment or sub-systems. They are interrelated for achieving an objective which is the performance of a function or a set of functions.

3.10

victim equipment

interfered equipment having caused a complaint

3.11

equipment under test

EUT

the equipment (devices, appliances and systems) subjected to tests

4 Methodology

4.1 Structure of each measurement

The investigated EUT shall be checked and measured at each type of port for which EMC requirements are defined. In case of interference complaints this may be restricted to those ports which cause the interference situation. Each measurement may be separated according to the following steps.

- A preliminary measurement of the investigated port is carried out to detect the frequencies with the highest emissions by a measurement method which may deviate from the measurement method on the standardized test site as described in the relevant part of CISPR 16-2.
- Frequently appearing operating modes of the EUT have to be checked in order to find the mode with the highest disturbance emission (see 4.3).
- For each investigation the reference point has to be selected at the EUT and has to be used for the final measurements (see also 4.3).

- The measurement quantity has to be identified under environmental conditions for the final measurement. This value may have to be transferred to the standard conditions if necessary. In case of interference complaint, the value of the measurement quantity needs only be determined in the direction in which compatibility is required. This value may have to be transferred to the standard conditions if necessary.

4.2 Preliminary measurements and selection of measurement method

It is useful to apply different approaches for the detection of the frequencies with the highest emissions. One approach could be to check the technical documentation of the EUT with respect to such emissions; another approach could involve checking the highest emission at a closer distance to the EUT than that used for the final measurements.

The measurement method depends on the frequency range and EUT port under consideration.

Radiated emissions should be assessed by measurements of the electromagnetic field strength only, see CISPR 16-2-3.

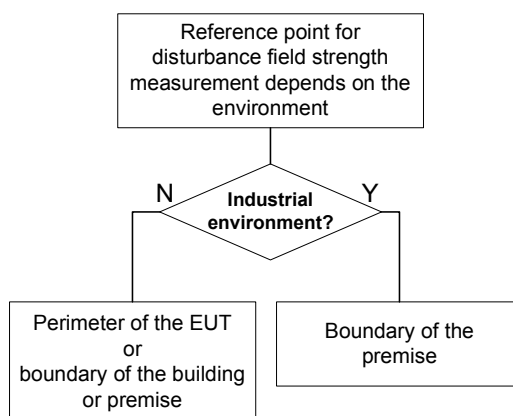
Four measurement procedures are taken into account for telecommunication ports and AC mains ports as follows:

- measurement with the voltage probe according to CISPR 16-1-2;
- measurement with the capacitive voltage probe (CVP) according to CISPR 16-1-2;
- measurement with the current probe according to CISPR 16-1-2;
- measurement with a high impedance voltage probe via an *in-situ* produced capacity for the measurement of the asymmetrical voltage according to CISPR 16-1-2.

4.3 Selection of the EUT mode of operation and the reference point depending on the environment

CISPR 16-2-3 requires the mode with the highest emission for the measurements. If it is possible to select this mode from different modes, this shall be done.

The selection of the reference point for the measurements is different for the ports and depends on the environments. Figure 1 shows the different approaches.



IEC 1188/08

NOTE It is recommended to choose the appropriate requirements (for example limits to be met) with respect to the characteristics of the interference victim.

Figure 1 – Enclosure port

4.4 Assessment of measurement results

It should be understood that measurement results obtained *in situ* are not comparable with any other results which are obtained on standardized test sites. For the results of *in situ* measurements it must be taken into account that they are only valid for the place of installation of the individual large equipment actually assessed. These results do not have any validity for similar large equipment installed at other places.

In most cases such results will only be obtained if an interference case has occurred. The question how much lower the emission has to be in order not to cause interference definitely depends on the source and the victim again. Considering both sides (source and victim), it may be possible to consult standards which are applicable to these products for further assessment.

Also it is understood that in most cases it is not possible to measure in a standardized measurement distance.

Two approaches are possible for normalization of obtained measured data to the standardized test distance.

The first possibility is the calculation as described in CISPR 16-2-3 for an EUT inside of buildings or premises.

The second possibility (in case there are no obstacles between the antenna and the EUT) is to use the distance between measurement antenna and interference source, and to convert the measured field strength to the value referring to a standardized measurement distance. In this case the following equation is recommended.

$$E_{\text{std}} [\text{dB}\mu\text{V/m}] = E_{\text{mea}} [\text{dB}\mu\text{V/m}] + 20 \log \frac{d_{\text{mea}}}{d_{\text{std}}} \quad (1)$$

where d_{mea} is the actual measurement distance and d_{std} is a standardized measurement distance (both in meters) and where E_{mea} is the field strength at an actual measurement distance and E_{std} is the field strength at a standardized measurement distance.

NOTE Equation (1) should not be applied if frequencies below 30 MHz and if distances smaller than 30 m are used for the assessments.

5 Method of *in situ* measurement of conducted disturbance

5.1 General

In situ measurements might be performed because of two reasons: for the investigation of an interference problem at a particular location or for the evaluation of compliance with the relevant technical requirements. Depending on the actual reason, some of the conditions to be considered for the measurements might be different.

The method of measurement for *in situ* conducted emission at any mains and telecommunication/signal ports of physically large equipment is proposed as follows.

Testing should be performed at the points of measurement indicated below. Excluded from *in situ* measurements of conducted emissions are internal ports of large equipment such as internal mains or internal telecommunication ports or mains connections above 1 kV.

Both the large equipment and its location are considered as the equipment under test (EUT). The emission results are unique to the site because site containment properties affect the measurement.