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**Merilne metode za odbojnost absorberjev milimetrskih elektromagnetnih valov  
(IEC 62431:2008)**

Reflectivity of electromagnetic wave absorbers in millimetre wave frequency -  
Measurement methods (IEC 62431:2008)

Verfahren zur Messung des Reflexionsvermögens von Absorbern für elektromagnetische  
Wellen im Millimeterwellen-Frequenzbereich (IEC 62431:2008)

Réflexivité des absorbeurs d'ondes électromagnétiques dans la plage des fréquences  
millimétriques - Méthodes de mesure (CEI 62431:2008)

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**Reflectivity of electromagnetic wave absorbers  
in millimetre wave frequency -  
Measurement methods  
(IEC 62431:2008)**

Réflectivité des absorbeurs d'ondes  
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im Millimeterwellen-Frequenzbereich  
(IEC 62431:2008)

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 46F/65/CDV, future edition 1 of IEC 62431, prepared by SC 46F, R.F. and microwave passive components, of IEC TC 46, Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories, was submitted to the IEC-CENELEC Parallel Unique Acceptance Procedure and was approved by CENELEC as EN 62431 on 2008-11-01.

The following dates were fixed:

- |  |       |            |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2009-08-01 |
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Annex ZA has been added by CENELEC.

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## Endorsement notice

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**Annex ZA**  
(normative)**Normative references to international publications  
with their corresponding European publications**

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

| <u>Publication</u> | <u>Year</u>     | <u>Title</u>  | <u>EN/HD</u>     | <u>Year</u>        |
|--------------------|-----------------|---|------------------|--------------------|
| ISO/IEC 17025      | - <sup>1)</sup> | General requirements for the competence of testing and calibration laboratories | EN ISO/IEC 17025 | 2005 <sup>2)</sup> |

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<sup>1)</sup> Undated reference.

<sup>2)</sup> Valid edition at date of issue.

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# INTERNATIONAL STANDARD

Reflectivity of electromagnetic wave absorbers in millimetre wave frequency –  
Measurement methods

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

# REFLECTIVITY OF ELECTROMAGNETIC WAVE ABSORBERS IN MILLIMETRE WAVE FREQUENCY – MEASUREMENT METHODS

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62431 has been prepared by subcommittee SC46F: RF and microwave passive components, of IEC technical committee 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories.

IEC 62431 replaces and cancels IEC/PAS 62431 with corrections of obvious errors as noted in 46F/29A/RVN.

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

| CDV        | Report on voting |
|------------|------------------|
| 46F/65/CDV | 46F/72/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.

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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# REFLECTIVITY OF ELECTROMAGNETIC WAVE ABSORBERS IN MILLIMETRE WAVE FREQUENCY – MEASUREMENT METHODS

## 1 Scope

This International Standard specifies the measurement methods for the reflectivity of electromagnetic wave absorbers (EMA) for the normal incident, oblique incident and each polarized wave in the millimetre-wave range. In addition, these methods are also equally effective for the reflectivity measurement of other materials:

- measurement frequency range: 30 GHz to 300 GHz;
- reflectivity: 0 dB to –50 dB;
- incident angle: 0° to 80°.

NOTE This standard is applicable not only to those EMA which are widely used as counter-measures against communication faults, radio interference etc. , but also to those used in an anechoic chamber in some cases. EMAs may be any kind of material, and may have any arbitrary shape, configuration, or layered structure as pointed out below.

Material: Conductive material, dielectric material, magnetic material.

Shape: planar-, pyramidal-, wedge-type, or other specific shapes.

Layer structure: single layer, multi layers, or graded-index material.

## 2 Normative references

[SIST EN 62431:2009](#)

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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.

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

## 3 Terms, definitions and acronyms

For the purposes of this document, the following terms and definitions apply.

### 3.1 Terms and definitions

#### 3.1.1

##### **ambient level**

the value of radiation power or noise which exists when no measurement is being carried out at the experiment site

#### 3.1.2

##### **associated equipment**

an apparatus or product connected for convenience or operation of the equipment

#### 3.1.3

##### **beam diameter**

the diameter where the electric field strength decreases by 3 dB from the centre of the focused beam

**3.1.4****beam waist**

the portion at which the diameter of the focused beam becomes minimum when the electromagnetic waves radiated from a transmit antenna are converged using a dielectric lens

**3.1.5****beam waist diameter**

beam diameter at the beam waist

**3.1.6****bistatic measurement**

measurement where the incident and reflection angle are equal

**3.1.7****dielectric lens**

electromagnetic wave lens that is composed of dielectric material

Usually, it is used by mounting in front of a pyramidal or conical horn.

**3.1.8****directional gain**

ratio of the radiated power density in a particular direction to the average power density that would be radiated in all directions

**3.1.9****dynamic range**

difference in decibels between the receiving level from the reference metal plate and the receiving level measured when the metal plate is removed

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**3.1.10****electromagnetic wave absorber**

material ingredient which absorbs the electromagnetic wave energy and dissipates it thermally

**3.1.11****focal distance**

distance between the centre of the dielectric lens and the focal point

**3.1.12****focal point**

centre of the beam waist when the electromagnetic waves are converged using a dielectric lens

**3.1.13****focused beam**

focused electromagnetic wave converged by the dielectric lens mounted in front of the horn antenna

The focused beam diameter is a few times the wavelength or more at the beam waist, which depends on the focal distance of the lens.

**3.1.14****fraunhofer region**

region where the angular radiation pattern of an aperture antenna is nearly independent of the distance

**3.1.15****free-space method**

measurement method that employs a single or pair of horn antennas where the specimen and the antennas are put in free space

**3.1.16****fresnel region**

region where the angular radiation pattern of an aperture antenna depends on the distance except for the region extremely near to the aperture

**3.1.17****horn antenna**

aperture antenna where impedance matching is taken gradually from the waveguide aperture to free space

**3.1.18****monostatic measurement**

measurement where the incident and reflected waves follow the same direction and which lie at an arbitrary angle with respect to normal to the specimen surface

**3.1.19****normal incidence**

the incidence for which an electromagnetic wave strikes to the specimen surface normally

The reflectivity in normal incidence is usually measured in the configuration where the incident angle of a transmitting antenna and that of a receiving antenna are within 0° to 5° with respect to the normal direction of the specimen surface.

**3.1.20****oblique incidence**

the incidence for which an electromagnetic wave strikes to the specimen surface at an oblique angle

The reflectivity in oblique incidence is usually measured with a transmitting and receiving antenna set up so that the incident and reflected angle of EM wave may be equal.

**3.1.21****parallel beam**

EM wave, which has a nearly flat phase front on the surface normal to the antenna axis, and which is formed using a dielectric lens set-up in front of a horn antenna

**3.1.22****reference metal plate**

metal plate with the same shape and an equal surface projected area in normal to the specimen

**3.1.23****reflectivity**

the ratio between reflected EM wave voltage received by the receiving antenna when a specimen is irradiated by the EM wave, and the voltage of the EM wave reflected from a metal plate with equal size and with the same projection shape in normal to the specimen surface expressed in decibel by

$$\text{reflectivity} = 20 \log_{10} \left| \frac{V_S}{V_m} \right| = 20 \log_{10} |V_S| - 20 \log_{10} |V_m| \text{ [dB]} \quad (1)$$

where  $V_S$  is the reflected EM wave voltage received by the receiving antenna when a specimen is irradiated by the EM wave, and  $V_m$  is the voltage of the EM wave reflected from a