ICS 33.120.30 SLOVENSKÁ TECHNICKÁ NORMA August 2025

STN

Meranie komplexnej permitivity nízkostratových dielektrických podložiek metódou symetrického kruhového diskového rezonátora

STN
EN IEC 63185

35 3815

Measurement of the complex permittivity for low-loss dielectric substrates balanced-type circular disk resonator method

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 07/25

Obsahuje: EN IEC 63185:2025, IEC 63185:2025

Oznámením tejto normy sa od 31.05.2028 ruší
STN EN IEC 63185 (35 3815) z júna 2021

obsahuje
farebné
strany

140827

Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, 2025

Slovenská technická norma a technická normalizačná informácia je chránená zákonom č. 60/2018 Z. z. o technickej normalizácii v znení neskorších predpisov.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN IEC 63185

May 2025

ICS 33.120.30

Supersedes EN IEC 63185:2021

English Version

Measurement of the complex permittivity for low-loss dielectric substrates balanced-type circular disk resonator method (IEC 63185:2025)

Méthode du résonateur symétrique à disque circulaire pour mesurer la permittivité complexe des substrats diélectriques à faible perte
(IEC 63185:2025)

Messung der komplexen Dielektrizitätskonstante für verlustarme dielektrische Substrate nach dem symmetrischen Kreisscheibenresonatorverfahren
(IEC 63185:2025)

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Ref. No. EN IEC 63185:2025 E

European foreword

The text of document 46F/699/FDIS, future edition 2 of IEC 63185, prepared by SC 46F "RF and microwave passive components" of IEC/TC 46 "Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 63185:2025.

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• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2026-05-31
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IEC 61338-1-3:1999	NOTE Approved as EN 61338-1-3:2000 (not modified)
IEC 62810:2015	NOTE Approved as EN 62810:2015 (not modified)

IEC 63185

Edition 2.0 2025-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Measurement of the complex permittivity for low-loss dielectric substrates balanced-type circular disk resonator method

Méthode du résonateur symétrique à disque circulaire pour mesurer la permittivité complexe des substrats diélectriques à faible perte

IEC 63185:2025-03(en-fr)

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IEC 63185

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INTERNATIONAL STANDARD

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ICS 33.120.30

ISBN 978-2-8327-0311-3

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MEASUREMENT OF THE COMPLEX PERMITTIVITY FOR LOW-LOSS DIELECTRIC SUBSTRATES BALANCED-TYPE CIRCULAR DISK RESONATOR METHOD

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IEC 63185 has been prepared by subcommittee 46F: RF and microwave passive components, of IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories. It is an International Standard.

This second edition cancels and replaces the first edition published in 2020. This edition constitutes a technical revision.

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

a) the upper limit of the applicable frequency range has been extended from 110 GHz to 170 GHz;

b) circular disk resonators used for the measurements now include one with waveguide interfaces;

c) in calculating the complex permittivity from the measured resonant properties, the fringing fields are now accurately taken into account based on the mode-matching analysis.

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

Draft	Report on voting
46F/699/FDIS	46F/702/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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MEASUREMENT OF THE COMPLEX PERMITTIVITY FOR LOW-LOSS DIELECTRIC SUBSTRATES BALANCED-TYPE CIRCULAR DISK RESONATOR METHOD

1 Scope

This document relates to a measurement method for complex permittivity of dielectric substrates at microwave and millimeter-wave frequencies. This method has been developed to evaluate the dielectric properties of low-loss materials used in microwave and millimeter-wave circuits and devices. It uses higher-order modes of a balanced-type circular disk resonator and provides broadband measurements of dielectric substrates by using one resonator, where the effect of excitation holes and that of fringing fields are taken into account accurately on the basis of the mode-matching analysis.

In comparison with the conventional method described in IEC 62810 and IEC 61338-1-3, this method has the following characteristics:

- the values of the relative permittivity ε_r' and loss tangent $\tan\delta$ normal to dielectric plate samples can be measured accurately and non-destructively;
- this method presents broadband measurements by using higher-order modes by one resonator;
- this method is applicable for the measurements under the following conditions:
  - frequency: $10\ \text{GHz} \le f \le 170\ \text{GHz}$;
  - relative permittivity: $1 \le \varepsilon_r' \le 10$;
  - loss tangent: $10^{-4} \le \tan\delta \le 10^{-2}$.

2 Normative references

There are no normative references in this document.

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