

INTERNATIONAL STANDARD

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

**Méthode au résonateur à disque circulaire de type symétrique pour mesurer la
permittivité complexe des substrats diélectriques à faible perte**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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

FDIS	Report on voting
46F/523/FDIS	46F/531/RVD

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

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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 a 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 is 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 on the following condition:
 - frequency: $10 \text{ GHz} \leq f \leq 110 \text{ GHz}$;
 - relative permittivity: $1 \leq \epsilon_r' \leq 10$;
 - loss tangent: $10^{-4} \leq \tan\delta \leq 10^{-2}$

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61338-1-3:1999, *Waveguide type dielectric resonators – Part 1-3: General information and test conditions – Measurement method of complex relative permittivity for dielectric resonator materials at microwave frequency*

IEC 62810:2015, *Cylindrical cavity method to measure the complex permittivity of low-loss dielectric rods*

3 Terms and definitions

No terms and definitions are listed in this document.

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