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Waveguide type dielectric resonators –

Part 1-4:

General information and test conditions – Measurement method of complex relative permittivity for dielectric resonator materials at millimetre-wave frequency

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CONTENTS

FOREWORD.....	4
1 Scope and object.....	6
2 Normative references.....	6
3 Measurement parameter.....	7
4 Dielectric rod resonator method excited by NRD-guide	8
4.1 Measurement equipment and apparatus	8
4.2 Theory and calculation equations.....	11
4.3 Measurement procedure	16
4.4 Example of measurement result.....	19
5 Cut-off waveguide method excited by coaxial cables with small loops	21
5.1 Measurement equipment and apparatus	21
5.2 Theory and calculation equations.....	23
5.3 Measurement procedure	28
Annex A (informative) Errors on ε_r caused by air gap between dielectric specimen and upper conducting plate	30
Annex B (informative) Derivation of equation (15) for σ_r	31
Bibliography.....	33
Figure 1 – Schematic diagram of measurement equipment	8
Figure 2 – Measurement apparatus of dielectric rod resonator method excited by NRD-guide.....	9
Figure 3 – Waveguide transducer from NRD-guide to waveguide.....	11
Figure 4 – Configuration of a cylindrical dielectric rod resonator short-circuited at both ends by two parallel conducting plates.....	12
Figure 5 –Calculations of u^2 and W as a function of v^2 for TE_{011} , TE_{021} and TE_{031} resonance modes.....	13
Figure 6 –Configuration of reference dielectric resonator for measurement of σ_r of conducting plates	15
Figure 7 – Diameter d of TE_{011} , TE_{021} and TE_{031} mode resonators with resonance frequency of 60 GHz.....	18
Figure 8 – Diameter d of TE_{011} , TE_{021} and TE_{031} mode resonators with resonance frequency of 77 GHz.....	19
Figure 9 – Example of TE_{021} mode resonant peak	20
Figure 10 – Measurement result of temperature dependence of f_0 and ε' of sapphire.....	21
Figure 11 – Measurement apparatus for cut-off waveguide method.....	22
Figure 12 – Frequency response for the empty cavity with dimensions of $d = 7$ mm and $h = 31$ mm	24
Figure 13 – Correction term $\Delta\varepsilon/\varepsilon_a$	26
Figure 14 – Correction terms $\Delta A/A$ and $\Delta B/B$	27

Figure 15 – Measurement apparatus for temperature coefficient of relative permittivity	28
Figure 16 – Mode chart of TE_{011} and TE_{013} modes for an empty cavity	29
Figure A.1 – Error on ε' caused by air gap between dielectric specimen and upper conducting plates	30
Table 1 – Diameter of conducting plate	10
Table 2 – Dimension of dielectric strip of NRD-guide	10
Table 3 – Dimensions of waveguide transducer	10
Table 4 – Dimensions of reference sapphire resonators and their partial electric energy filling factor P_e and geometric factor G	15
Table 5 – Diameter d of test specimens for 60 and 77 GHz measurement. Height h is fixed to 2,25 mm and 1,80 mm for 60 GHz and 77 GHz measurement, respectively	17
Table 6 – Measurement results of σ_r of conducting plates	20
Table 7 – Measurement results of ε' and $\tan \delta$ of sapphire and PTFE specimen	20
Table 8 – Recommended dimensions for conducting cylinder	23

INTERNATIONAL ELECTROTECHNICAL COMMISSION

WAVEGUIDE TYPE DIELECTRIC RESONATORS –

**Part 1-4: General information and test conditions –
Measurement method of complex relative permittivity for
dielectric resonator materials at millimetre-wave frequency**

FOREWORD

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International Standard IEC 61338-1-4 has been prepared by IEC Technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

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

FDIS	Report on voting
49/748/FDIS	49/751/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.

IEC 61338 consists of the following parts, under the general title *Waveguide type dielectric resonators*:

- Part 1: Generic specification
- Part 1-3: General information and test conditions – Measurement method of complex relative permittivity for dielectric resonator materials at microwave frequency
- Part 1-4: General information and test conditions – Measurement method of complex relative permittivity for dielectric resonator materials at millimetre-wave frequency
- Part 2: Guidelines for oscillator and filter applications
- Part 4: Sectional specification
- Part 4-1: Blank detail specification

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.

WAVEGUIDE TYPE DIELECTRIC RESONATORS –

Part 1-4: General information and test conditions – Measurement method of complex relative permittivity for dielectric resonator materials at millimetre-wave frequency

1 Scope and object

This part of IEC 61338 describes the measurement method of dielectric properties for dielectric resonator materials at millimetre-wave frequency.

This standard consists of two measurement methods: a) the dielectric rod resonator method excited by NRD-guide (Non-Radiative Dielectric waveguide) and b) the cut-off waveguide method excited by coaxial cables with small loops.

- a) The dielectric rod resonator method excited by NRD-guide is similar to the dielectric rod resonator method given in IEC 61338-1-3. This method has the following characteristics:
- a complete and exact mathematical solution of complex permittivity is given by computer software;
 - the measurement error is less than 0,3 % for ε' and less than $0,05 \times 10^{-4}$ for $\tan \delta$;
 - the applicable measuring ranges of complex permittivity for this method are as follows:

frequency:	$30 \text{ GHz} < f < 100 \text{ GHz}$;
relative permittivity:	$2 < \varepsilon' < 30$;
loss factor:	$10^{-6} < \tan \delta < 10^{-2}$.
- b) The cut-off waveguide method excited by coaxial cables with small loops uses a dielectric plate sample placed in a circular cylinder of the TE_{011} mode. This method has the following characteristics:
- fringe effect is corrected using the correction charts on the basis of rigorous analysis;
 - the measurement error is less than 0,5 % for ε' and less than $0,05 \times 10^{-4}$ for $\tan \delta$;
 - the *TCF* is measured with high accuracy;
 - the applicable measuring ranges of dielectric properties for this method are as follows:

frequency:	$30 \text{ GHz} < f < 100 \text{ GHz}$;
relative permittivity:	$2 < \varepsilon' < 30$;
loss factor:	$10^{-6} < \tan \delta < 10^{-2}$.

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 61338-1-3, *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*