SLOVENSKI STANDARD
SIST EN 60444-9:2008
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Measurement of quartz crystal unit parameters - Part 9: Measurement of spurious resonances of piezoelectric crystal units (IEC 60444-9:2007)

Messung von Schwingquarz-Parametern - Teil 9: Messung der Nebenresonanzen von Schwingquarzen (IEC 60444-9:2007)

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Mesure des parametres des résonateurs a quartz - Partie 9 : Mesure des résonances parasites des quartz piézoélectriques (IEC 60444-9:2007)

Ta slovenski standard je istoveten z: **EN 60444-9:2007**

ICS:

31.140	Úa:[^|^\dã}^Á åa|^\dã}^Á a}¦æç^	Piezoelectric and dielectric devices

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60444-9

April 2007

ICS 31.140

English version

Measurement of quartz crystal unit parameters - Part 9: Measurement of spurious resonances of piezoelectric crystal units
(IEC 60444-9:2007)

Mesure des paramètres
des résonateurs à quartz -
Partie 9: Mesure des résonances
parasites des quartz piézoélectriques
(CEI 60444-9:2007)

Messung von Schwingquarz-Parametern -
Teil 9: Messung der Nebenresonanzen
von Schwingquarzen
(IEC 60444-9:2007)

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CENELEC

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

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

Ref. No. EN 60444-9:2007 E

Foreword

The text of document 49/764/FDIS, future edition 1 of IEC 60444-9, prepared by IEC TC 49, Piezoelectric and dielectric devices for frequency control and selection, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60444-9 on 2007-03-01.

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)   2007-12-01

– latest date by which the national standards conflicting
  with the EN have to be withdrawn   (dow)   2010-03-01

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Endorsement notice

The text of the International Standard IEC 60444-9:2007 was approved by CENELEC as a European Standard without any modification.

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INTERNATIONAL STANDARD

IEC
60444-9

First edition
2007-02

Measurement of quartz crystal unit parameters –

**Part 9:
Measurement of spurious resonances
of piezoelectric crystal units**

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE   **P**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MEASUREMENT OF QUARTZ CRYSTAL UNIT PARAMETERS –

Part 9: Measurement of spurious resonances of piezoelectric crystal units

FOREWORD

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International Standard IEC 60444-9 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
49/764/FDIS	49/774/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.

A list of all parts of IEC 60444 series, published under the general title *Measurement of quartz crystal unit parameters,* 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 standard may be issued at a later date.

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MEASUREMENT OF QUARTZ CRYSTAL UNIT PARAMETERS –

Part 9: Measurement of spurious resonances of piezoelectric crystal units

1 Scope

This part of IEC 60444 describes two methods for determining the spurious (unwanted) modes of piezoelectric crystal resonators. It extends the capabilities and improves the reproducibility and accuracy compared to previous methods.

The previous methods described in IEC 60283 (1968) were based on the use of a measuring bridge, which applies to non-traceable components such as variable resistors and a hybrid transformer, which are no longer commercially available.

Method A (Full parameter determination)

Full parameter determination allows the determination of the equivalent parameters of the spurious resonances and is based on the methods described in IEC 60444-5 using the same measurement equipment. It is the preferred method, which can be applied to the measurement of low and medium impedance spurious resonances up to several kΩ.
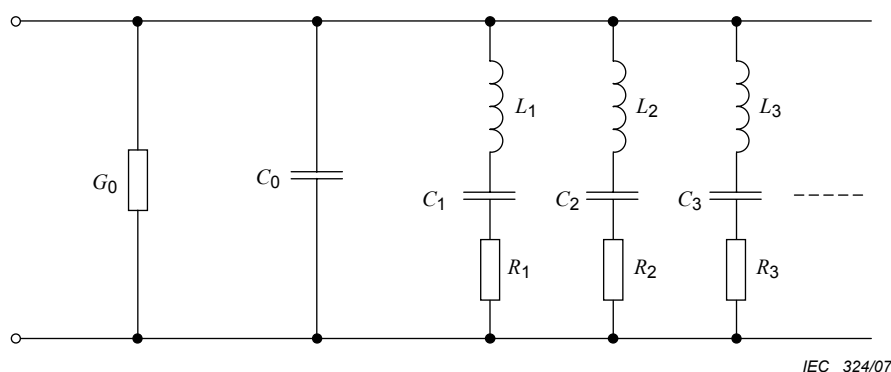
Method B (Resistance determination)

Resistance determination should be used for the determination of high impedance spurious resonances as specified, for example for certain filter crystals. It uses the same test equipment as method A in conjunction with a test fixture, which consists of commercially available microwave components such as a 180° hybrid coupler and a 10 dB attenuator, which are well-defined in a 50 Ω environment. This method is an improvement to the "reference method" of the obsolete IEC 60283.

2 Overview

Piezoelectric crystal units show multiple resonances, which can be electrically represented by a parallel connection of a number of series resonant circuits. The one-port equivalent circuit of the complete crystal unit is shown in Figure 1 (taken from IEC 60444-5).

IEC   324/07

Figure 1 – General one-port equivalent circuit for multiple resonances

The total admittance Y_{tot} of the equivalent circuit for n resonance modes is therefore

$$Y_{tot} = G_0 + j\omega C_0 + \sum_i Y_i \tag{1}$$

with

$$Y_i = G_i + jB_i = \left(R_i + j\omega L_i + \frac{1}{j\omega C_i}\right)^{-1} (i = 1,2,\ldots n) \tag{2}$$

Index i = 1 represents the main mode, while i = 2 … n represents the spurious resonance modes.

The spurious modes are regarded as uncoupled modes. Coupled modes can also be found by the described test methods, however their strong amplitude dependence does not allow for the precise determination of their parameters.

The attenuation a_{spur}^i, of a spurious mode i, is defined as the logarithmic ratio (expressed in dB) of its resistance R_i, to the resistance R_1 of the main mode:

$$a_{spur}^i = 20 \cdot \log_{10}\left(\frac{R_i}{R_1}\right) \tag{3}$$

Figure 2 shows a typical spectrum for the spurious resonances of an AT-cut quartz crystal unit as displayed on a spectrum analyzer using a π-network according to IEC 60444-1.