

**Quartz crystal controlled oscillators of assessed quality
- Part 6: Phase jitter measurement method for quartz
crystal oscillators and SAW oscillators - Application
guidelines**

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 60679-6:2011 sisaldab Euroopa standardi EN 60679-6:2011 ingliskeelset teksti.

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**Quartz crystal controlled oscillators of assessed quality -
Part 6: Phase jitter measurement method for quartz crystal oscillators and
SAW oscillators -
Application guidelines
(IEC 60679-6:2011)**

Oscillateurs pilotés par quartz sous
assurance de la qualité -
Partie 6: Méthode de mesure de la gigue
de phase pour les oscillateurs à quartz et
les oscillateurs SAW -
Lignes directrices pour l'application
(CEI 60679-6:2011)

Quarzoszillatoren mit bewerteter Qualität -
Teil 6: Phasenjitter-Messverfahren für
Quarzoszillatoren und OFW-Oszillatoren -
Leitfaden für die Anwendung
(IEC 60679-6:2011)

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

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Foreword

The text of document 49/935/FDIS, future edition 1 of IEC 60679-6, prepared by IEC TC 49, Piezoelectric, Dielectric and Electrostatic Devices and Associated Materials for Frequency Control, Selection and Detection, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60679-6 on 2011-04-18.

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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) 2012-01-18
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2014-04-18

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60679-6:2011 was approved by CENELEC as a European Standard without any modification.

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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>
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INTRODUCTION

The study of phase jitter measurement methods was conducted in accordance with the agreement during the IEC TC 49 Berlin international meeting in 2001. At this meeting, the decision was made that Japan should assume the responsibilities of this study. Then, the technical committee of the Quartz Crystal Industry Association of Japan (QIAJ) proceeded with this study. This study was substantially conducted during the years 2002 to 2005 and can be referred to as the first stage of the study. The second stage is being continued at present.

Phase jitter has become one of the essential measurement items by digitization of electronic devices. However, theoretically, some ambiguity is still left in the phase jitter. Since no standard measurement method is proposed, suppliers and customers may be mutually exposed to a risk which could cause enormous economic losses.

To avoid this risk, this document provides a standard, based on the study results during the first stage, for each company of QIAJ members to avoid anxiety as to the measurement of the phase jitter and for the purpose of giving guidance without any mistakes.

In this standard, a recommendation to make r.m.s. jitter a measurement object is presented. The reason why this recommendation is submitted is because the oscillators resulting in ultra-low amount of jitter are targeted as the object to be measured.

Oscillators are analogue-type electronic devices. Their sine wave output signals are more favourable than the signals obtained by electronic systems. Moreover, the output is utilized as the reference clock of the measurement equipment, leading to a situation in which the amount of phase jitter is shown to be smaller than the amount of phase jitter of the measurement equipment. Accordingly, this may give the impression that the measured amount of phase jitter is not from the oscillators but rather the amount of phase jitter generated by the measurement equipment, or the measurement system. Therefore, when adopting the amount of other phase jitters as the measurement items, a recommendation is presented to select measurement equipment and a measurement system capable of being verified and confirmed sufficiently, contractually determined between suppliers and customers. Moreover, when the phase noise method is used, the random jitter values need to be discussed after defining the jitter frequency bands from start to end of integrating the phase noise.

In case of doubts related to the measurement values, refer to the application of Allan Variance [1]¹.

Frequency stability was compiled into a single work by IEEE in 1968 [2]. Then, the definition was applied to atomic oscillators, crystal oscillators, as well as electronic systems for telecommunication, information, audio-visual, and the like.

Conventional crystal oscillators and electronic systems have analogue systems and their signal waveforms are sine waves. Therefore, the short-term frequency stability as one field of the frequency stability is measured as the phase noise or Allan Variance. Recently, digitization of electronic systems is progressing. Under such circumstance, the short-term frequency stability has been measured as the phase jitter.

On the other hand, the oscillators are analogue-type electronic devices. For the oscillators, the signals having square waves or waveforms similar thereto are demanded by users to be easily fit into the electronic systems. Naturally, for the short-term frequency stability, the measurement as the phase jitter is frequently demanded by users.

For advance application in electronic information and communication technology: (e.g.: advanced satellite communications, control circuits for electric vehicle (EV) and etc.), necessity arises for the measurement method for common guidelines of phase jitter. In these

¹ Numbers in square brackets refer to the Bibliography.

days, measurement method of phase jitter also becomes more important from the electromagnetic influence (EMI) point of view.

In that sense, international standardization as IEC 60679-6 of phase jitter measurement method is significant and timely. The measurement method of phase jitter described in this document is the newest method by which quantitative measurement was made possible from the breakthrough of the measurement system technology, in the hope to get attention from not only a device engineer but also a system engineer and expected to be widely used.

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QUARTZ CRYSTAL CONTROLLED OSCILLATORS OF ASSESSED QUALITY –

Part 6: Phase jitter measurement method for quartz crystal oscillators and SAW oscillators – Application guidelines

1 Scope

This part of the IEC 60679 series applies to the phase jitter measurement of quartz crystal oscillators and SAW oscillators used for electronic devices and gives guidance for phase jitter that allows the accurate measurement of r.m.s. jitter.

In the measurement method, phase noise measurement equipment or a phase noise measurement system is used.

The measuring frequency range is from 10 MHz to 1 000 MHz.

This standard applies to quartz crystal oscillators and SAW oscillators used in electronic devices and modules that have the multiplication or division functions based on these oscillators. The type of phase jitter applied to these oscillators is the r.m.s. jitter. In the following text, these oscillators and modules will be referred to as “oscillator(s)” for simplicity.

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 60679-1:2007, *Quartz crystal controlled oscillators of assessed quality – Part 1: Generic specification*

3 Terms, definitions and general concepts

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60679-1:2007 apply.

Units, drawings, codes, and characters are also based on IEC 60679-1.

3.2 General concepts

3.2.1 Phase jitter

The phase jitter of oscillators means an electronic noise of signal waveforms in terms of time. On the other hand, the phase jitter is described as a jitter in which the frequency of signal deflection exceeds 10 Hz and as a wander in which the frequency is 10 Hz or less.

It is difficult to observe the wander of oscillators. The wander is a phenomenon which is confirmed in electronic parts such as optical cables susceptible to expansion and contraction even by a small amount of temperature changes. Therefore, the wander is generally not discussed in the oscillators. In this document also, phase jitter is targeted only to the jitter.