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TECHNICAL REPORT

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Electromagnetic compatibility (EMC) – Part 4-40: Testing and measurement techniques – Digital methods for the measurement of power quantities of modulated or distorted signals



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ELECTROMAGNETIC COMPATIBILITY (EMC) –

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FOREWORD

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The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 61000-4-40, which is a Technical Report, has been prepared by subcommittee SC77A: EMC – Low frequency phenomena, of IEC technical committee TC 77: Electromagnetic compatibility.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
77A/1055/DTR	77A/1065/RVC

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

IEC 61000 is published in separate parts, according to the following structure:

Part 1: General

General considerations (introduction, fundamental principles)

Definitions, terminology

Part 2: Environment

Description levels

Classification of the environment

Compatibility levels

Part 3: Limits

Emission limits

Immunity limits (in so far as they do not fall under the responsibility of the product committees)

Part 4: Testing and measurement techniques

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines

Installation guidelines

Mitigation methods and devices

Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into several parts, published either as International Standards, Technical Specifications or Technical Reports, some of which have already been published as sections. Others are and will be published with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

This document gives the rationale for the assessment of electrical power quantities (RMS voltage, RMS current and active power) under non-stationary conditions. It explains and compares two digital methods that can be used in digital measurement instrumentation to either average or filter the signals when measuring fluctuating loads, and algorithms for the realization of both methods. The examples relate to 50 Hz or 60 Hz power systems because power quantity assessments are predominantly required for these systems.

The digital averaging or integration algorithm is evaluated for fluctuating, or non-stationary, conditions, as is a digital filtering algorithm that emulates the traditional analogue power meter.

This document aims to illustrate the application of the two measurement algorithms given above to characterize existing, and commonly found, non-stationary loads, which have been selected to help interpret the measurement results obtained using both algorithms.

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

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1 Scope

This part of IEC 61000, which is a Technical Report, deals with the assessment of electrical power quantities (RMS voltage, RMS current and active power). It explains and compares two digital algorithms suitable for power quantity measurements in fluctuating or non-periodic loads. The examples are from 50 Hz or 60 Hz power systems.

This document does not attempt to cover all possible digital implementations of the algorithms used for power quantity assessment in fluctuating loads, for example in the context of the EMC assessment described in several IEC documents. Rather, it compares averaging with one of the filtering algorithms. This document aims to highlight some examples of applications that illustrate how the presented algorithms work. Further, guidance is given for quantifying the accuracy of each approach.

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 cited edition applies. For undated references, the latest edition of the referenced document applies, including any amendments.

IEC TR 61000-1-7:2016, *Electromagnetic compatibility (EMC) – Part 1-7: General – Power factor in single phase systems under non-sinusoidal conditions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TR 61000-1-7 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 General

IEC TR 61000-1-7:2016, 3.1, defines the root-mean square (RMS) value of a time-dependent quantity as a positive square root of the mean value of the square of the quantity taken over a given time interval.

IEC TR 61000-1-7:2016, 5.1.4, further states that the RMS value of the voltage U (current I) is defined as the positive square root of the mean value of the square of the voltage $u(t)$ (current $i(t)$) taken over an integer number of periods kT of the AC power supply system: