



TECHNICAL SPECIFICATION

**Electromagnetic compatibility (EMC) -
Part 1-6: General - Guidelines for the evaluation of measurement uncertainty in
EMC testing**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Electromagnetic compatibility (EMC) -
Part 1-6: General - Guidelines for the evaluation of measurement
uncertainty in EMC testing**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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IEC TS 61000-1-6 has been prepared by IEC technical committee 77: Electromagnetic compatibility in cooperation with CISPR (International Special Committee on Radio Interference). It is a Technical Specification.

This first edition cancels and replaces the first edition of IEC TR 61000-1-6 published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) purpose of and responsibilities in measurement uncertainty evaluation by testing and calibration laboratories, technical committees dealing with EMC requirements have been introduced;
- b) classification of measurement uncertainty contributions (measurement uncertainty, measurement instrumentation uncertainty, intrinsic uncertainty of the measurand) has been revised;
- c) new clauses devoted to measurement uncertainty in emission test methods and measurement uncertainty in immunity test methods and in calibration have been added;
- d) methods of measurement uncertainty calculation have been enriched by introducing the GUM Supplement 1 (GUMS1) numerical approach based on Monte Carlo method;
- e) measurement uncertainty budget development has been revised to include the basic steps to follow in case of application of the GUM method or of the GUMS1 method;
- f) a clause specifically devoted to the measurement model function has been added to emphasize the importance of the measurement model and to provide guidance when the measurement model is unknown;
- g) the clause on probability density functions has been revised to include the Student-t probability density function;
- h) the clause on Type A and Type B evaluations of uncertainty has been revised to improve readability;
- i) the clause on the conversion from linear quantities to decibel and vice versa has been revised to improve readability and make some corrections;
- j) the clause on the applicability of measurement uncertainty has been modified to improve readability and to remove statements conflicting with conformity assessments standards;
- k) [Annex A](#) and [Annex B](#) have been revised by including results of GUMS1 application;
- l) new annexes have been introduced, namely [Annex C](#) (on metrological confirmation of measurement equipment), [Annex D](#) (on sampling statistics, moved from the main text to this annex to improve readability of the whole document), [Annex E](#) (on robust statistics for processing interlaboratory comparison data, with example), [Annex F](#) (including an example of application of MU for the assessment of the risk of an out of tolerance of measurement equipment) and [Annex G](#) (including an example of application of MU for the evaluation of in-tolerance probability as a function of tolerance to uncertainty ratio – TUR).

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

Draft	Report on voting
77/637/DTS	77/640/RVDTS

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

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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 of the environment
- 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 or as technical specifications or technical reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

Further reading:

- European Telecommunications Standards Institute (ETSI) [1]
- European Accreditation (EA) [2]
- UK Accreditation Service (UKAS) [3]
- M. Kendall and A. Stuart [4]
- I. A. Harris and F. L. Warner [5]
- C.F.M. Carobbi [6]

1 Scope

This part of IEC 61000 provides methods and background information for the evaluation of measurement uncertainty in electromagnetic compatibility (EMC) tests and calibrations. It gives guidance to cover general measurement uncertainty considerations within the IEC 61000 series [7].

The objective of this document is to give advice to EMC technical committees dealing with EMC tests, testing laboratories and calibration laboratories on the development of measurement uncertainty budgets; to allow uniform development and comparability of these budgets between laboratories; and to align the treatment of measurement uncertainty across the technical committees of the IEC dealing with EMC tests.

Any contributing factor to measurement uncertainty that is mentioned within this document will be treated as an example: the EMC committee responsible for the preparation of a basic immunity or emission standard is responsible for identifying the factors that contribute to the measurement uncertainty of the relevant test method.

This document provides:

- methods for the evaluation of measurement uncertainty (MU),
- mathematical formulae for probability density functions and their interpretation,
- examples of MU calculations,
- examples of MU applications,
- MU reporting information.

This document is not intended to summarize all measurement uncertainty influence quantities, nor is it intended to specify how measurement uncertainty will be taken into account in determining compliance with an EMC requirement.

NOTE Some of the examples given in this document are based on IEC publications (for example CISPR 16-4 series [8]) other than the IEC 61000 series [7] that have already implemented the evaluation procedure presented here. These examples are used to illustrate the principles.

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 60050-161:1990, *International Electrotechnical Vocabulary (IEV) - Part 161: Electromagnetic compatibility*

CISPR 16-1-1, *Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus*

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