

TECHNICAL REPORT

CISPR 16-4-5

First edition
2006-10

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

Specification for radio disturbance and immunity measuring apparatus and methods –

Part 4-5:

Uncertainties, statistics and limit modelling – Conditions for the use of alternative test methods

© IEC 2006 — Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

X

For price, see current catalogue

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Symbols and abbreviated terms.....	7
5 Introduction	8
6 Procedure to derive limits for an alternative test method.....	9
6.1 Overview	9
6.2 Select the reference quantity X	12
6.3 Describe the test methods and measurands	12
6.4 Determine the deviations of the measured quantities from the reference quantity	13
6.5 Determine the average values of the deviations	13
6.6 Estimate the standard uncertainties of the test methods	14
6.7 Estimate the expanded uncertainties of the test methods	15
6.8 Calculate the average conversion factor.....	16
6.9 Verify the calculated values.....	17
6.10 Apply the conversion	17
Annex A (informative) Remarks on EUT modelling	18
Annex B (informative) Examples of application of the test method comparison procedure	19
Bibliography.....	49
Figure 1 – Overview of quantities to estimate for use in conversion procedure.....	10
Figure 2 – Overview of limit conversion procedure using estimated quantities.....	11
Figure B.1 – Example reference quantity	19
Figure B.2 – EUT and antenna set-up for fully anechoic room emission measurement	20
Figure B.3 – EUT and antenna set-up for open-area test site measurement.....	20
Figure B.4 – Radiation characteristics of elementary radiator (left), and scheme of EUT-model (right)	21
Figure B.5 – Maximum average deviations for 3 m FAR (top) and 10 m OATS (bottom)	24
Figure B.6 – Sample cumulative distribution function	26
Figure B.7 – Uncertainties due to the unknown EUT characteristic for 3 m FAR (top) and 10 m OATS (bottom)	28
Figure B.8 – Expanded uncertainties ($k = 2$) of alternative (3 m FAR, top) and established (10 m OATS, bottom) test methods	32
Figure B.9 – Maximum average conversion factors for different volumes	33
Figure B.10 – Photo (left) and cut-view of simulation model (right) of the specimen EUT	35
Figure B.11 – Deviations of the specimen EUT: 3 m fully anechoic room (top) and 10 m open area test site (bottom).....	36
Figure B.12 – Sample FAR measurement	37
Figure B.13 – OATS 10 m limit line converted to FAR 3 m conditions.....	37

Figure B.14 – Expanded uncertainties.....	37
Figure B.15 – Comparison of the measured values with the corrected converted limit.....	38
Figure B.16 – EUT and antenna set-up of 3 m open area test site measurement.....	39
Figure B.17 – Maximum average deviations for 3 m OATS.....	40
Figure B.18 – Uncertainties due to the unknown EUT characteristic for 3 m OATS.....	41
Figure B.19 – Expanded uncertainties ($k = 2$) of alternative test method [OATS (3 m)].....	43
Figure B.20 – Maximum average conversion factors	44
Figure B.21 – Deviations of the specimen EUT: Open area test site (3 m).....	46
Figure B.22 – Sample OATS (3 m) measurement.....	47
Figure B.23 – OATS (10 m) limit line converted to OATS (3 m) conditions	47
Figure B.24 – Expanded uncertainties.....	48
Figure B.25 – Comparison of the corrected values with the converted limit	48
Table 1 – Summary of steps in conversion procedure	9
Table 2 – Overview of quantities and defining equations for conversion process.....	12
Table B.1 – Instrumentation uncertainty of the 3 m fully anechoic chamber test method	25
Table B.2 – Uncertainties in dB due to the unknown EUT characteristic for 3 m FAR	30
Table B.3 – Uncertainties in dB due to the unknown EUT characteristic for 10 m OATS.....	31
Table B.4 – Maximum average conversion factors in dB between 10 m OATS and 3 m FAR	34
Table B.5 – Uncertainties in dB due to the unknown EUT characteristic for 3 m OATS.....	42
Table B.6 – Maximum average conversion factors in dB between 10 m and 3 m OATS.....	45

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

Part 4-5: Uncertainties, statistics and limit modelling – Conditions for the use of alternative test methods

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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".

CISPR 16-4-5, which is a technical report, has been prepared by CISPR subcommittee A: Radio-interference measurements and statistical methods.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
CISPR/A/665/DTR	CISPR/A/685/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 publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the CISPR 16-4 series, published under the general title *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainties, statistics and limit modelling*, 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 publication may be issued at a later date.

SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

Part 4-5: Uncertainties, statistics and limit modelling – Conditions for the use of alternative test methods

1 Scope

This part of CISPR 16-4 specifies a method to enable product committees to develop limits for alternative test methods, using conversions from established limits. This method is generally applicable for all kinds of disturbance measurements, but focuses on radiated disturbance measurements (i.e. field strength), for which several alternative methods are presently specified. These limits development methods are intended for use by product committees and other groups responsible for defining emissions limits in situations where it is decided to use alternative test methods and the associated limits in product standards.

2 Normative references

IEC 60050-161, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

CISPR 16-4-1:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-1: Uncertainties, statistics and limit modelling – Uncertainty in standardized EMC tests*

CISPR 16-4-2:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements*