CISPR TR 16-3

Edition 3.0 2015-09

TECHNICAL REPORT

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

AMENDMENT 2

Specification for radio disturbance and immunity measuring apparatus and methods –
Part 3: CISPR technical reports

CISPR TR 16-3:2010-08/AMD2:2015-09(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
More than 60 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

CISPR TR 16-3

Edition 3.0 2015-09

TECHNICAL REPORT

colour inside

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

AMENDMENT 2

Specification for radio disturbance and immunity measuring apparatus and methods –
Part 3: CISPR technical reports

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 33.100.10; 33.100.20

ISBN 978-2-8322-2884-5

FOREWORD

This amendment has been prepared by subcommittee A: Radio-interference measurements and statistical methods, of IEC technical committee CISPR: International special committee on radio interference.

The text of this amendment is based on the following documents:

DTR	Report on voting
CISPR/A/1102/DTR	CISPR/A/1109/RVC

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

3.2 Abbreviations

Add, to the existing list of abbreviations, the following new abbreviations:

CDN	Coupling decoupling network
CDNE	CDN for emission measurement
CM	Common mode
DM	Differential mode
RRT	Round robin test

Add, after the existing subclause 4.11.2 added by Amendment 1, the following new subclause:

4.12 Background on CDNE equipment and measurement method

4.12.1 General

The CDN measurement method was originally developed for assessment of radiated disturbances of lighting equipment from 30 MHz to 300 MHz. In October 2006 the CDN method was adopted by a first amendment of Edition 7 of CISPR 15, published in 2006 [91].

A CISPR joint Task Force between CISPR SC/A and CISPR SC/F on the 'CDN measurement method of radio frequency disturbances for lighting equipment in the frequency range 30 MHz to 300 MHz' (CDNE JTF A/F) was established in 2008, and tasked with transferring the CDN method of emission measurement in the frequency range 30 MHz to 300 MHz to the CISPR 16 series. This was to give the method a more generic status and enable use for other types of equipment. An additional aim was to improve the CDN method uncertainties.

The CDNE JTF developed specifications and measurement methods for a CDNE, which is the CDN for emission measurement. Between 2008 and 2014 the CDNE specification, the associated measurement method, the measurement instrumentation uncertainties and the correlation with the classical radiated measurement method were implemented in respectively CISPR 16-1-2 [95], CISPR 16-2-1 [8], CISPR 16-4-2 [96] and CISPR 16-4-5 [97].

The following subclauses give background information and rationales on the CDN and the CDNE equipment and measurement method.

4.12.2 Historical overview

4.12.2.1 Situation around 1996

Before the first amendment to Edition 7, lighting products were subject to conducted and radiated RF disturbance measurements according to CISPR 15 [98] in the frequency range below 30 MHz. Radiated disturbance measurements above 30 MHz according to CISPR 22 [99] were carried out on a voluntary basis to assure quality and to avoid complaints in specific environments. Generally the emission levels of lighting products with bipolar circuit technology were negligible for frequencies above 30 MHz.

In 1996, within the EMC group of Philips Research in Eindhoven, the Netherlands, an investigation was started on possible workbench methods as an alternative for the radiated tests in the frequency range 30 MHz to 300 MHz. The CDN, which is known from RF immunity tests in the range of 150 kHz to 80 MHz according to IEC 61000-4-6 [15], seemed a suitable candidate for application to measurement of RF disturbances as well. Therefore, a method using the CDN for disturbance measurements was developed and investigated. Especially the

relationship with the established radiated disturbance measurement method in a SAC was explored.

It is generally accepted that correlation between two test methods only makes sense when both methods have good reproducibility and low uncertainty. The established radiated RF disturbance measurement method has a fairly large compliance uncertainty (7 dB) due to variability in cable layout and termination, while the CDN method has a moderate compliance uncertainty (4 dB) provided that the EUT is small and the cable length between the CDN and EUT is limited. Still, a reasonable correlation between the CDN method and the 3-m and 10-m radiated method was demonstrated for luminaires of different sizes.

4.12.2.2 CDN concept for disturbance measurements introduced in 1999

The feasibility and concept of the CDN method was presented in a paper at the 1999 Zurich EMC conference by Stef Worm [93]. In that paper, the radiated disturbance measurement method in a 3 m SAC and the CDN method (refer to Figure 200) are compared. It is demonstrated by modelling that the CM current in a cable (single wire – see NOTE 1) connected to the EUT is a good metric for the E-field measured using the 3 m SAC/OATS method.

NOTE 1 The single wire and its impedance is the model of a cable with one or more wires including the protective earth wire. The CM impedance mentioned in the report represents the "total" CM impedance of the cable.

NOTE 2 At the time of this investigation the 3 m SAC/OATS was used as reference. Later it was agreed more formally (see CISPR 16-4-5 [97]) that the 10 m SAC/OATS is the reference, called the established test method.

Note that the cable does not necessarily need to be a mains cable and is not connected to a network. The E-field/CM-current ratio depends on the termination impedance. Measurement results [92] have shown (see Figure 201) that the response is reasonably flat if the termination impedance of the cable (single wire) equals 150 Ω. Also the impact of cable layout and set-up of the EUT and CDN has been investigated. The 150-Ω impedance also provides a good match with the disturbance source, which prevents standing waves. Different options for the 150-Ω impedance have been compared in [93], where it was concluded that the best candidate for the 150-Ω termination impedance was the existing CDN used for immunity tests.

So, in the original and basic concept of the CDN method, the purpose of the CM impedance of 150 Ω is to enable a good match (no standing waves) with the disturbance source. With this property, a relatively simple relation between the E-field limit and the limit applicable for the CDN method could be derived and implemented in Table B.1 of CISPR 15:2013 [98]. It has not been the intention that the CDN emulates the CM impedance and LCL − or whatever other property of the network to which the (mains) cable could be connected.

The CDNE method is an alternative method to assess radiated disturbance of a product in the frequency range of 30 MHz to 300 MHz, under specific limitations of the product characteristics. Hence it addresses the radiation coming from the enclosure port of the EUT. Another example of a radiated disturbance assessment method is the absorbing clamp method in the frequency range between 30 MHz and 1 000 MHz.