INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CISPR 15

Edition 9.0 2018-05
Amendment 1 2024-07

Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by subcommittee CISPR F: Interference relating to household appliances, electric tools, electrical lighting equipment, and similar apparatus, of IEC technical committee CISPR: International special committee on radio interference.

The text of this interpretation sheet is based on the following documents:

DISH	Report on voting
CIS/F/926/DISH	CIS/F/932/RVDISH

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

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CISPR 15 interpretation sheet on the use of the current probe on wires with high differential currents

INTRODUCTION

This document is an interpretation sheet to CISPR 15:2018 and CISPR 15:2018/AMD1:2024. It answers the question how to avoid the measurement of false common mode disturbance currents in CISPR 15 with the current probe.

This interpretation sheet is an interim solution that will not automatically be included into future CISPR 15 amendments and editions. A permanent solution will be based on a future amendment of CISPR 16-2-1.

The proposed measurement procedure is based on investigations and measurements done in Japan (JLMA), Germany (Bundesnetzagentur BNetzA) and by Manufacturers of electronic LED drivers. Based on these investigations and discussions within CISPR/F the proposal for an interpretation sheet has been created.

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When measuring conducted disturbances according to Clause B.3 (local wired ports), it has been observed that reproducibility of common mode disturbance measurements performed with a current probe (see B.3.5 and Table 3, Table 6 for the limits) is under special circumstances low. This low reproducibility has been observed when measuring the common mode current with a current clamp on the wires from the electronic control gear or halogen converter (EuT = Equipment under Test) to the load (LED or halogen lamp).

Various measurements have been done to find out the reason for this low reproducibility.

As a result of these measurements, it has been found that there is a significant impact on the reading at the receiver depending on the spatial position and orientation of the local wired port cable within the current probe. The measurement results are showing that the variations in the readings are large if there are high differential mode currents flowing in these wires (several amperes).

The typical LED control-gear generates a high (pulse-width-modulated) differential mode output current.

The reason for this variation in the measurement results seems to be the non-ideal behaviour of the current probe. An ideal current probe will suppress the differential mode perfectly, no matter where the two wires of the cable – carrying the differential and common mode current – are located within the current probe.

However, even according to CISPR 16-1-2:2014, 5.1.3, a current probe is allowed to have an “influence of orientation” of up to 1 dB up to 30 MHz and 2,5 dB from 30 MHz to 1 000 MHz.

A calculation has been done showing that even this “low” value of 1 dB influence by the orientation of the wire within the probe hole can cause significant change of readings in a receiver if high differential mode currents are present (see Figure 1).

Calculation of the influence of orientation in case of strong differential currents in a CISPR current								
Differential current:	1,0	A		1,0	A		0,01	A
Differential current in dBµA:	120	dBµA		120,0	dBµA		80	dBµA
Influence of orientation Value (Difference between the two conductors)	1	dB		0,01	dB		0,1	dB
Conductor 1 Current reading:	120	dBµA		120,0	dBµA		80	dBµA
Conductor 2 Current reading:	119	dBµA		120,0	dBµA		79,9	dBµA
Conductor 1 Current reading:	1,000 0	A		1,000 0	A		0,010 0	A
Conductor 2 Current reading:	0,891 3	A		0,998 8	A		0,009 9	A
Delta (Conductor 1 minus Conductor 2)	0,108 7	A		0,001 2	A		0,000 1	A
Receiver reading ("Artificial" Signal/false common mode):	**100,7**	**dBµA**		**61,2**	**dBµA**		**41,2**	**dBµA**

IEC

Table 1 – Calculation of the false common mode current in case of high differential currents

For the common mode current measured, the 1 dB influence of the orientation is not critical because the maximum change in the reading at the receiver is only 1 dB. But for the differential mode current the 1 dB will lead to significant changes in the reading. The calculations in Figure 1 are showing that even with a 0,01 dB influence of variation, which is very low compared to 1 dB, which is currently allowed by CISPR 16-1-2, a reading of 61 dBµA false common mode current at the receiver input will come up. This is much higher than the limit (Table 3 of CISPR 15:2018) of 40 dBµA at 150 kHz! Thus, a very limited differential mode rejection of the typical current probes becomes obvious. Also, one can see that a “better” current probe (e.g., having only 0,01 dB influence of orientation) would not solve the problem.

The various measurements which have been done by Japan, Germany and various manufacturers of LED drivers are showing that significant improvements can be achieved when a twisted pair cable or a coaxial cable are used as local wired port cable at the position where the load cable goes through the current probe. It is the assumption that the twisting or the coaxial current distribution through the current probe will lead to a much better suppression of the differential current, thus improving the stability of the readings performed with the current probe.

The reason to choose the twisted pair cable instead or beside of the coaxial cable in this interpretation sheet is, that the coaxial cable has an unsymmetrical behaviour in the high frequency range. As a result of the asymmetric transition between a two wire cable and a coaxial cable, the potential for a “differential to common mode conversion” is much higher when a coaxial cable segment is used.