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Responsible committee: GEL/210/11 EMC - Standards Committee

Interested committees:

Title: BS EN IEC 61000-6-3 Amendment 1 - Fragment 2 - Electromagnetic compatibility (EMC)

Part 6-3: Generic standards - Emission standard for equipment in residential environments

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

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Responsible Committee Secretary: **Mrs Geraldine D Salt (BSI)**
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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



CIS/H/440/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 61000-6-3/AMD1/FRAG2 ED3

DATE OF CIRCULATION:

2021-09-24

CLOSING DATE FOR COMMENTS:

2021-11-19

SUPERSEDES DOCUMENTS:

CI/H/439/RR

IEC CIS/H : LIMITS FOR THE PROTECTION OF RADIO SERVICES	
SECRETARIAT: Korea, Republic of	SECRETARY: Mr Jong-Hwa Kwon
OF INTEREST TO THE FOLLOWING COMMITTEES: SC 77A,CIS/A,CIS/B,CIS/D,CIS/F,CIS/I	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☒ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Amendment 1/Fragment 2: Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for equipment in residential environments

NOTE FROM TC/SC OFFICERS:

Fragment 2 "Conducted Emission Requirements in the frequency Range 9 kHz - 150 kHz" of a total of 4 fragments, which make up maintenance to amendment 1 as explained in CIS/H/439/RR

INTRODUCTION

This introduction is for information of the National Committees only and will not be part of the final standard.

The project for this amendment to IEC 61000-6-3 is based on the following documents:

CIS/H/342/Q, CIS/H/369/RQ_on_CIS/H/342/Q, 77A/991/Q, 77A/995/RQ_on_77A/991/Q.

As a result of these questionnaires a Joint Working Group (CIS/H/JWG-6) between CISPR SC/H and IEC SC/77A has been set up, with CIS SC/H as leading committee and the following Terms of Reference:

- Developing equipment emission limits in the frequency range 9 kHz – 150 kHz to accommodate the latest amendments to IEC 61000-2-2 “Electromagnetic compatibility (EMC) - Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low voltage power supply systems - Basic EMC publication” for this frequency range.
- Developing the methodology for emission measurements against the newly developed limits, possibly using measuring equipment and methods from the CISPR 16 series for both differential mode and common mode disturbances. The suitability of the methodology shall be shown.
- Preparing appropriate implementation in standards, i.e. proposing an amendment to the generic standard – which has a pilot function for the product standards– and preparing the implementation into Product/Product Family standards.

JWG-6 had a number of meetings: Frankfurt 2018, Busan 2019, Saclay 2019, Vienna 2019, Erlangen 2019, Catania 2020 (replaced by a WebCon), WebCon Oct. 2020, WebCon Jan. 2021, WebCon Feb. 2021, WebCon Mar. 2021.
Additional work has been done in a TF1.

This CD is based on CIS/H/428/DC, the identical 77A/1100/DC, the comments of the NC's, published in CIS/H/431/INF and 77A/1105/INF, the discussion of these comments in JWG-6 during its web-meeting July 2021 and the combined observations of JWG-6, published as CIS/H/433/INF and 77A/1111/INF.

After long, intensive and controversial discussions JWG-6 reached consensus on proposing the following amendment to IEC 61000-6-3, which contains the following main parts:

- To add normative requirements on the conducted emissions, Low voltage AC mains port in the frequency range 9 kHz – 150 kHz
- To add an informative annex (numbered XX in this DC) with background information about the newly proposed normative limits containing the following subclauses:
 - XX-1 Background information about the derivation of the normative limits
 - XX-2 Radio Protection Analysis for common mode disturbance injections
 - XX-3 Radio Protection Analysis for differential mode disturbance injections
- To add an informative annex (numbered YY in this DC) with recommendations to limit the spectral density of non-intentional emissions (NIE), containing the following subclauses:
 - YY-1 Abbreviations
 - YY-2 Introduction of Integral Voltage Levels (IVL) for the limitation of the spectral density of NIE
 - YY-3 Recommended maximum IVL for NIE
 - YY-4 Reasoning for the recommendation of additional limitations on the spectral density of NIE
- To add the mentioned references to clause 2 (normative references) and to the bibliography

TEXT OF THE AMENDMENT

Add the following abbreviation:

CM common mode

DM differential mode

NEC2 Numerical Electromagnetics Code 2

Add the following normative references in clause 2

IEC 61800-3:2017 Adjustable speed electrical power drive systems - Part 3:
EMC requirements and specific test methods

IEC 62040-2:2016 Uninterruptible power systems (UPS) - Part 2:
Electromagnetic compatibility (EMC) requirements

Replace in Clause 11 "Emission test details", Table 4 "Requirements for conducted emissions, Low voltage AC mains port" line 4.3 by the following new line with added requirements in the frequency range 9 kHz to 150 kHz and add footnote ^a within Table 4 at the end:

Table Clause	Measurement Network	Frequency range MHz	Limits dB(μV)	Measurement Specifications	Limitations and restrictions
			Detector		
...					
4.1	V-AMN	0,009 – 0,05	120,5 – 110 Quasi-peak	Instrumentation, CISPR 16-1-1, Clauses 4 & 6 Networks, CISPR 16-1-2, Clause 4 Method, CISPR 16-2-1, Clause 7 Set-up, CISPR 16-2-1, Clause 7	Impulse noise (clicks) shall be measured and assessed in the frequency range 150 kHz to 30 MHz according to CISPR 14-1.
			104 – 80 ^a Quasi-peak		
		0,15 – 0,5	66 - 56 Quasi-peak		
			56 - 46 Average		
		0,5 – 5	56 Quasi-peak		
			46 Average		
		5 – 30	60 Quasi-peak		
			50 Average		

^a To equipment that is within the scope of the following standards:

- IEC 61800-3:2017
- IEC 62040-2:2016

and apparatus which incorporates equipment (or part of) defined in the above standards the following limits apply: 110 dB(μV) to 82,5 dB(μV).

This relaxation of the limits does not apply, if all of such equipment is used by more than 5% of the customers connected to the same medium voltage / low voltage transformer in the public low voltage network.

Add the following note below Table 4:

NOTE See also Annex XX for background information about the normative limits in the frequency range 9 kHz – 150 kHz and Annex YY for recommendations to improve compatibility with mains communicating equipment.

Add the following new informative Annex XX

Annex XX (informative)

Background information to the normative limits in the frequency range 9 kHz – 150 kHz

XX.1 Background information about the derivation of the normative limits

Starting point for the derivation of limits in the frequency range 9 kHz – 150 kHz in the generic emission standard for residential environment was a new amendment to IEC 61000-2-2 “Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems”, which has been accepted by the National Committees and published in 2018.

Compatibility levels up to 150 kHz have been defined, after long controversial discussions in IEC SC77A/WG8, under direct supervision of ACEC, to improve EMC for equipment such as mains communicating systems, electricity meters, clocks or filter capacitors supplied by public low voltage power supply systems against disturbances generated by equipment such as switching power converters, switch mode power supplies, photovoltaic inverters, etc..

As explained in Annex D of IEC 61000-2-2, the defined compatibility level curve represents the best currently achievable compromise supported by all stakeholders and has been defined for voltage distortion in differential mode.

The task to derive emission limits from these compatibility levels has been given to a Joint Working Group between CISPR SC/H and IEC SC77A, CIS/H/JWG-6.

The terms of reference of this CIS/H/JWG-6, as agreed by the National Committees in CISPR SC/H as well as in IEC SC77A, are as follows:

- Developing equipment emission limits in the frequency range 9 kHz – 150 kHz to accommodate the latest amendments to IEC 61000-2-2 “Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low voltage power supply systems – Basic EMC publication” for this frequency range.
- Developing the methodology for emission measurements against the newly developed limits, possibly using measuring equipment and methods from the CISPR 16 series for both differential mode and common mode disturbances. The suitability of the methodology shall be shown.
- Preparing appropriate implementation in standards, i.e. proposing an amendment to the generic standard – which has a pilot function for the product standards – and preparing the implementation into Product/Product Family standards.

One of the first decisions of this JWG was, that limits for the unsymmetrical voltage shall be developed, using the quasi peak detector, defined in CISPR 16-1-1 and the existing measuring methods in the CISPR 16 series. This way, existing measuring equipment could lead to results which can be used to evaluate the compatibility with mains communicating systems as well as the suitability for the protection of radio services.

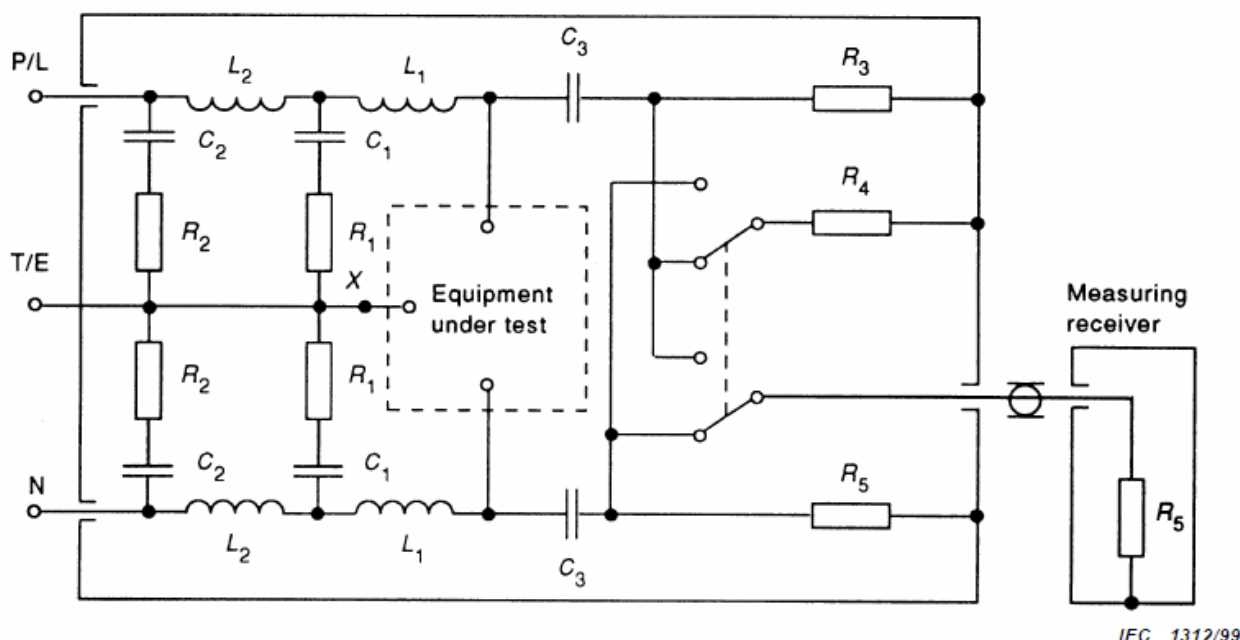
111 The limit levels for the unsymmetrical voltage have been defined, considering in a first step a minimum
 112 margin of 3 dB between compatibility levels and emission limits, as explained in IEC 61000-2-2, sub-
 113 clause 4.11, NOTE 2:

114 NOTE 2 Based on the following assumptions, an emission margin equal to or higher than 3 dB between the
 115 equipment emission limits in differential mode for non-intentional emissions and the corresponding
 116 compatibility levels is sufficient:

- 117 – for each bandwidth of 200 Hz, the probability that the compatibility level is exceeded is lower than
 118 5 %;
- 119 – at a given location, the disturbance level in a same bandwidth of 200 Hz does not result from more
 120 than two pieces of equipment generating non-intentional emissions close to the emission limit at
 121 the same time;
- 122 – non-intentional emissions from different equipment are generated independently from each other.

123 In addition the emission limits need to be lower than the compatibility levels by another 6 dB, due to
 124 the chosen measuring method. The compatibility levels have been defined for a differential mode
 125 voltage, but the CISPR 16 measuring method calls for a measurements of the unsymmetrical voltage
 126 on the neutral and line conductors, using a typical artificial mains network, as has been defined in
 127 CISPR 16-1-2, see Figure XX 1.

128



129
 130 **Figure XX 1**
 131 **Example of an Artificial Mains Network**
 132 **according to CISPR 16-1-2, Figure 5**

133

134 The measured unsymmetrical voltage according to this method depends on both differential mode
 135 and common mode disturbance voltages, produced by the EUT. Assuming the EUT produces only
 136 differential mode disturbance voltage (proportion of 100 % differential mode voltage and 0 % common
 137 mode voltage), a 6 dB lower unsymmetrical voltage is measured with the used measuring method.
 138 This 6 dB difference is based on a worst case assumption. In reality the proportion of differential
 139 mode voltage produced by the EUT is lower than 100 %, which gives de-facto another margin for the
 140 protection of mains communicating systems.

141 In summary the normative limits in the frequency range 9 kHz – 150 kHz have been set 9 dB lower
 142 than the compatibility levels for this frequency range, as suggested in IEC 61000-2-2.

143

144

For some equipment the relaxation in Table 4, footnote ^a has been agreed:

^a To equipment that is within the scope of the following standards:

- IEC 61800-3
- IEC 62040-2

and apparatus which incorporates equipment (or part of) defined in the above standards the following limits apply: 110 dB(μV) to 82,5 dB(μV).

This relaxation of the limits does not apply, if all of such equipment is used by more than 5 % of the customers connected to the same medium voltage / low voltage transformer in the public low voltage network.

The rationale for this relaxation is, that in typical residential locations, this type of equipment is expected not to be installed in more than 5 % of residential premises. In addition, equipment from different manufacturers usually emit a different spectrum. Both issues are expected to remain valid for the future. Consequently, cumulative effects from this type of equipment are less pronounced.

Furthermore, such equipment has been developed in accordance with the requirements defined in IEC TS 62578 and been used in residential locations for many years with very few reported cases of disturbance in the frequency range from 9 kHz to 150 kHz.

XX.2 Radio Protection Analysis for CM disturbance injections

XX.2.1 Derivation of coupling factor by simulation

For the case at hand a conducted limit line needs to be derived based on the protection requirements of the radio services given in field strength values in the requested protection distance (which for residential environments is a distance of 10 m). At first a representative radiation model needs to be defined. In a residential environment any electronic or electrical device is connected to some wire in the house and will via connection to the installation topology around the house (including all possible directions) finally terminate in the breaker box. From the viewpoint of which cable topology would possibly have the maximum radiation efficiency, a vertical wire (i.e. a vertical antenna) would represent the worst case of a possible common mode radiator. With respect to the length of such a wire, a length of 30 m is estimated as worst case in typical residential environments. Therefore, the coupling factor for a 30 m long vertical antenna (see figure 1) was chosen to represent the worst possible coupling situation for common mode injection. Any real installation, where the low voltage line would take a respective path around the house connecting power outlets, switches, lamps and other appliances, would radiate less than the scenario chosen.

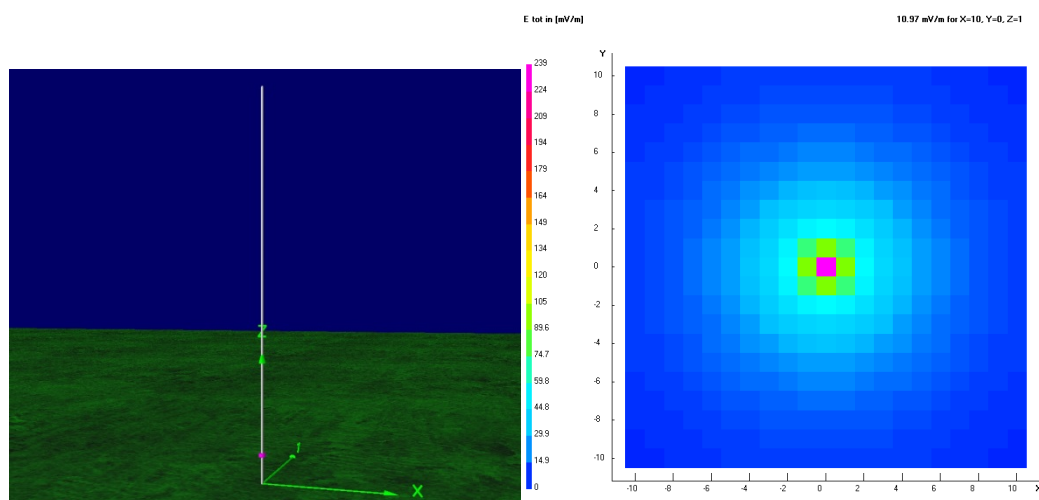


Figure 1 - left) Simple vertical wire fed with 1 V CM voltage at the pink dot
right) the electrical field strength distribution in 1 m height

A simulation with a finite momentum solver (NEC2) for the several frequencies and a feed of 1 V of CM voltage at the bottom of the structure results in the coupling factor values shown in Table 1.