

EMC IC modelling - Part 1: General modelling  
framework

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 62433-1:2019 sisaldab Euroopa standardi EN IEC 62433-1:2019 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 62433-1:2019 consists of the English text of the European standard EN IEC 62433-1:2019.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 26.04.2019.	Date of Availability of the European standard is 26.04.2019.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 31.200

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:  
Koduleht [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage [www.evs.ee](http://www.evs.ee); phone +372 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

ICS 31.200

English Version

**EMC IC modelling - Part 1: General modelling framework  
(IEC 62433-1:2019)**

Modèles de circuits intégrés pour la CEM - Partie 1: Cadre  
de modèle général  
(IEC 62433-1:2019)

EMV-IC-Modellierung - Teil 1: Allgemeine  
Modellierungsstruktur  
(IEC 62433-1:2019)

This European Standard was approved by CENELEC on 2019-04-12. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## European foreword

The text of document 47A/1042/CDV, future edition 1 of IEC 62433-1, prepared by SC 47A "Integrated circuits" of IEC/TC 47 "Semiconductor devices" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62433-1:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2020-01-12
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-04-12

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

## Endorsement notice

The text of the International Standard IEC 62433-1:2019 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

CISPR 17      NOTE      Harmonized as EN 55017

## Annex ZA

(normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62433	series	EMC IC modelling	EN 62433	series
ISO 8879	-	Information processing - Text and office systems - Standard Generalized Markup Language (SGML)	-	-
ANSI INCITS 4	1986	Information Systems - Coded Character Sets - 7-Bit American National Standard Code for Information Interchange (7-Bit ASCII)	-	-

## CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references .....	7
3 Terms, definitions, abbreviated terms and conventions.....	7
3.1 Terms and definitions.....	7
3.2 Abbreviated terms.....	10
3.3 Conventions.....	11
4 Definition of models.....	11
4.1 General.....	11
4.2 Conducted emission model .....	11
4.3 Radiated emission model .....	11
4.4 Conducted immunity model .....	12
4.5 Radiated immunity model.....	12
4.6 Conducted pulse immunity model.....	12
5 Modelling approaches.....	12
5.1 General.....	12
5.2 Black box modelling approach.....	13
5.3 Equivalent circuit modelling approach .....	13
5.4 Other modelling approaches .....	14
5.4.1 General .....	14
5.4.2 Electromagnetic modelling approach .....	14
5.4.3 Statistical modelling approach .....	14
6 Requirements of model description.....	14
7 Model data exchange format.....	14
7.1 General.....	14
7.2 IC EMCML structure.....	15
7.3 IC EMCML components.....	16
7.3.1 Root element .....	16
7.3.2 Global element .....	16
7.3.3 Header section .....	16
7.3.4 Lead element.....	17
7.3.5 Lead_definitions section .....	17
7.3.6 Macromodels section .....	17
7.3.7 Frequency section .....	18
7.3.8 Validity section .....	19
7.3.9 Pdn section .....	20
7.3.10 Nlb section .....	21
7.3.11 lbc section .....	21
7.3.12 Ia section.....	21
7.3.13 Ib section.....	22
7.3.14 Fb section.....	22
7.3.15 Voltage, Current and Power sections .....	23
7.3.16 Table section.....	23
7.3.17 Coordinate_system section.....	24
7.3.18 Reference section.....	24
Annex A (normative) Requirements for EMC IC models .....	25

Annex B (normative) Preliminary definitions for XML representation .....	26
B.1 XML basics .....	26
B.1.1 XML declaration.....	26
B.1.2 Basic elements .....	26
B.1.3 Root element .....	26
B.1.4 Comments .....	26
B.1.5 Line terminations .....	27
B.1.6 Element hierarchy.....	27
B.1.7 Element attributes .....	27
B.2 Keyword requirements .....	27
B.2.1 General .....	27
B.2.2 Keyword characters .....	27
B.2.3 Keyword syntax .....	28
B.2.4 File structure .....	28
B.2.5 Values .....	30
Annex C (normative) IC_EMCML valid keywords and usage .....	32
C.1 Root element keywords.....	32
C.2 Global keywords .....	33
C.3 File header keywords.....	33
C.4 <i>Lead</i> keyword attributes .....	35
C.5 <i>Submodel</i> element attributes.....	36
C.6 <i>Vector</i> element keywords .....	36
C.7 <i>Lead_definitions</i> section attributes.....	37
C.7.1 General .....	37
C.7.2 <i>Lead</i> element attributes .....	38
C.8 <i>Validity</i> section keywords.....	38
C.9 <i>Subckt</i> section attributes.....	38
C.10 <i>Netlist</i> section keywords .....	39
C.11 <i>Pdn</i> and <i>lbc</i> section keywords.....	39
C.11.1 General .....	39
C.11.2 <i>Lead</i> element attributes in the <i>Pdn</i> section .....	40
C.11.3 <i>Lead</i> element attributes in the <i>lbc</i> section.....	42
C.12 <i>Ia</i> section keywords .....	44
C.12.1 General .....	44
C.12.2 <i>Lead</i> element attributes .....	44
C.12.3 <i>Voltage</i> section keywords .....	45
C.12.4 <i>Current</i> section keywords .....	46
C.12.5 <i>Pulse</i> element keywords .....	48
C.13 <i>Ib</i> section keywords .....	50
C.13.1 <i>Lead</i> element keywords .....	50
C.13.2 <i>Max_power_level</i> section keywords .....	51
C.13.3 <i>Voltage</i> section keywords .....	51
C.13.4 <i>Current</i> section keywords .....	52
C.13.5 <i>Power</i> section keywords .....	53
C.13.6 <i>Test_criteria</i> section keywords.....	54
C.14 <i>Nlb</i> section keywords .....	55
C.15 <i>Fb</i> section keywords .....	56
C.15.1 <i>Lead</i> element keywords .....	56
C.15.2 Table element keywords .....	57

C.15.3 Test_characteristics element attributes .....	58
Bibliography.....	59
Figure B.1 – Multiple XML files .....	29
Figure B.2 – XML files with data files (*.dat) .....	29
Figure B.3 – XML files with additional files .....	30
Figure C.1 – Pulse signal as defined using the Pulse element.....	50
Table 1 – Attributes of <i>Lead</i> keyword in the <i>Lead_definitions</i> section .....	17
Table 2 – General definition of the <i>Subckt</i> attributes .....	18
Table 3 – Definition of the <i>Validity</i> section .....	19
Table A.1 – Requirements for model description .....	25
Table B.1 – Valid logarithmic units .....	31
Table C.1 – <i>Root</i> element keywords.....	32
Table C.2 – Global keywords .....	33
Table C.3 – <i>Header</i> element keywords.....	34
Table C.4 – <i>Lead</i> element keywords .....	35
Table C.5 – <i>Submodel</i> element keywords .....	36
Table C.6 – <i>Vector</i> element keywords.....	37
Table C.7 – Valid elements in the <i>Lead_definitions</i> section .....	37
Table C.8 – Attributes of the <i>Lead</i> element in the <i>Lead_definitions</i> section .....	38
Table C.9 – <i>Validity</i> element keywords.....	38
Table C.10 – <i>Subckt</i> element keywords .....	39
Table C.11 – <i>Netlist</i> element keywords .....	39
Table C.12 – <i>Pdn</i> element keywords .....	40
Table C.13 – Attributes of the <i>Lead</i> element in the <i>Pdn</i> section .....	41
Table C.14 – Attributes of the <i>Lead</i> element in the <i>Ibc</i> section .....	43
Table C.15 – Valid keywords in the <i>Ia</i> section.....	44
Table C.16 – Attributes of the <i>Lead</i> element in the <i>Ia</i> section.....	44
Table C.17 – <i>Voltage</i> element keywords .....	45
Table C.18 – <i>Current</i> element keywords .....	47
Table C.19 – Attributes of the <i>Pulse</i> element .....	48
Table C.20 – <i>Lead</i> element keywords in the <i>Ib</i> section.....	50
Table C.21 – <i>Max_power_level</i> section keywords .....	51
Table C.22 – <i>Voltage</i> section keywords .....	52
Table C.23 – <i>Current</i> section keywords.....	53
Table C.24 – <i>Power</i> section keywords.....	54
Table C.25 – <i>Test_criteria</i> section keywords .....	55
Table C.26 – <i>Lead</i> element keywords in the <i>Nlb</i> section .....	55
Table C.27 – <i>Lead</i> element keywords in the <i>Fb</i> section.....	56
Table C.28 – <i>Table</i> element keywords in the <i>Fb</i> section.....	57
Table C.29 – <i>Test_charactetistics</i> element keywords in the <i>Fb</i> section .....	58



## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**EMC IC MODELLING –****Part 1: General modelling framework****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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 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.

International Standard IEC 62433-1 has been prepared by subcommittee 47A: Integrated circuits, of IEC technical committee 47: Semiconductor devices.

IEC 62433-1 cancels and replaces IEC TS 62433-1 published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC TS 62433 1:2011:

Incorporation of a data exchange format for an integrated circuit's model representation.

The text of this International Standard is based on the following documents:

CDV	Report on voting
47A/1042/CDV	47A/1055/RVC

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 62433 series, under the general title *EMC IC modelling*, 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 "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

**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.**