

### SLOVENSKI STANDARD SIST EN IEC 55025:2022

01-maj-2022

Nadomešča:

SIST EN 55025:2017

SIST EN 55025:2017/AC:2018

Vozila, plovila in naprave z motorji z notranjim zgorevanjem - Karakteristike občutljivosti za radijske motnje - Mejne vrednosti in metode merjenja za zaščito sprejemnikov na krovu

Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of on-board receivers

### PREVIEW

Fahrzeuge, Boote und von Verbrennungsmotoren angetriebene Geräte -Funkstöreigenschaften - Grenzwerte und Messverfahren für den Schutz von an Bord befindlichen Empfängern

#### SIST EN IEC 55025:2022

Véhicules, bateaux et moteurs à dombustion interne d'Caractéristiques des pertubations radioélectriques - Limités et méthodes de mesure pour la protection des récepteurs embarqués

Ta slovenski standard je istoveten z: EN IEC 55025:2022

ICS:

33.060.20 Sprejemna in oddajna Receiving and transmitting

oprema equipment

33.100.99 Drugi vidiki v zvezi z EMC Other aspects related to

**EMC** 

SIST EN IEC 55025:2022 en

**SIST EN IEC 55025:2022** 

### iTeh STANDARD **PREVIEW** (standards.iteh.ai)

SIST EN IEC 55025:2022 https://standards.iteh.ai/catalog/standards/sist/d8f0fd2e-7c51-46c9-975e-f713ee881c10/sist-en-iec-55025-2022

**EUROPEAN STANDARD** 

**EN IEC 55025** 

NORME EUROPÉENNE

**EUROPÄISCHE NORM** 

February 2022

ICS 33.100.10; 33.100.20

Supersedes EN 55025:2017 and all of its amendments and corrigenda (if any)

#### **English Version**

Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of on-board receivers (CISPR 25:2021)

Véhicules, bateaux et moteurs à combustion interne -Caractéristiques des pertubations radioélectriques - Limites et méthodes de mesure pour la protection des récepteurs embarqués (CISPR 25:2021) Fahrzeuge, Boote und von Verbrennungsmotoren angetriebene Geräte - Funkstöreigenschaften - Grenzwerte und Messverfahren für den Schutz von an Bord befindlichen Empfängern (CISPR 25:2021)

This European Standard was approved by CENELEC on 2022-01-20. 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.

SIST EN IEC 55025:2022

#### https://standards.iteh.ai/catalog/standards/sist/d8f0fd2e-

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, 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

**EN IEC 55025:2022 (E)** 

#### **European foreword**

The text of document CIS/D/477/FDIS, future edition 5 of CISPR 25, prepared by CISPR SC D "Electromagnetic disturbances related to electric/electronic equipment on vehicles and internal combustion engine powered devices" of CISPR "International special committee on radio interference" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 55025:2022.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2022–10–20 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2025–01–20 document have to be withdrawn

This document supersedes EN 55025:2017 and all of its amendments and corrigenda (if any).

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.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

### PREVIEW

(staEndorsement notice ai)

The text of the International Standard CISPR 25:2021 was approved by CENELEC as a European Standard without any modification ards.iteh.ai/catalog/standards/sist/d810fd2e-7c51-46c9-975e-f713ee881c10/sist-en-iec-55025-2022

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

CISPR 12:2007 NOTE Harmonized as EN 55012:2007 (not modified)

CISPR 16-2-3:2016 NOTE Harmonized as EN 55016-2-3:2017 (not modified)

IEC 62196-1:2014 NOTE Harmonized as EN 62196-1:2014 (modified)

CISPR 16-2-1:2014 NOTE Harmonized as EN 55016-2-1:2014 (not modified)

CISPR 32:2015 NOTE Harmonized as EN 55032:2015 (not modified) +A11:2020

CISPR 16-4-2:2011 NOTE Harmonized as EN 55016-4-2:2011 (not modified)

### 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	EN/HD	<u>Year</u>
IEC 61851-1	2017	Electric vehicle conductive charging system - Part 1: General requirements	EN IEC 61851-1	2019
CISPR 16-1-1	2019 1	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1–1: Radio disturbance and immunity measuring apparatus - Measuring apparatus	EN IEC 55016-1-1	2019
CISPR 16-1-2	2014 https://stan	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1–2: Radio disturbance and immunity measuring apparatus - Coupling devices for conducted disturbance measurements	EN 55016-1-2	2014
AMD1		-975e-f713ee881c10/sist-en-iec-55025		2018
CISPR 16-1-6	2014	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1–6: Radio disturbance and immunity measuring apparatus - EMC antenna calibration	EN 55016-1-6	2015
AMD1	2017		A1	2017
ISO 7637-3	2016	Road vehicles - Electrical disturbances from conduction and coupling - Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines	-	-
ISO 11452-4	2020	Road vehicles - Component test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 4: Harness excitation methods	-	-
SAE ARP 958.1 Rev D	2003– 02	Electromagnetic Interference Measurement Antennas; Standard Calibration Method	-	-

**SIST EN IEC 55025:2022** 

### iTeh STANDARD **PREVIEW** (standards.iteh.ai)

SIST EN IEC 55025:2022 https://standards.iteh.ai/catalog/standards/sist/d8f0fd2e-7c51-46c9-975e-f713ee881c10/sist-en-iec-55025-2022



### CISPR 25

Edition 5.0 2021-12

### INTERNATIONAL STANDARD

### NORME INTERNATIONALE



INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

### iTeh STANDARD

Vehicles, boats and internal combustion engines – Radio disturbance characteristics – Limits and methods of measurement for the protection of on-board receivers

(standards.iteh.ai)

Véhicules, bateaux et moteurs à combustion interne – Caractéristiques des perturbations radioélectriques <u>Fimites et méthodes</u> de mesure pour la protection des récepteurs embarques talog/standards/sist/d8f0fd2e-7c51-46c9-975e-f713ee881c10/sist-en-iec-55025-2022

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 33.100.10: 33.100.20 ISBN 978-2-8322-1061-6

Warning! Make sure that you obtained this publication from an authorized distributor.

Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

### CONTENTS

F	OREWORD.		9
IN	ITRODUCTI	ON	11
1	Scope		12
2	Normativ	e references	12
3	Terms ar	nd definitions	13
4		nents common to vehicle and component/module emissions measurement	
•	•	neral test requirements	
	4.1.1	Categories of disturbance sources (as defined in the test plan)	
	4.1.2	Test plan	
	4.1.3	Determination of conformance of equipment under test (EUT) with limits	
	4.1.4	Operating conditions	
	4.1.5	Test report	
	4.2 Shi	elded enclosure	
	4.3 Abs	sorber-lined shielded enclosure (ALSE)	21
	4.3.1	General	
	4.3.2	Size	21
	4.3.3	Objects in ALSE	21
	4.3.4	Objects in ALSE performance validation	22
	4.4 Me	asuring instrument	22
	4.4.1		
	4.4.2	Spectrum analyser parameters	22
	4.4.3	Scanning receiver parameters	25
	4.5 Pov	ver supply	27
	4.5.1	General SIST EN IEC 55025:2022	27
	4.5.2	Internal combustions itch ai catalog standards of the off the	
	4.5.3	Internal combustion engine vehicle – engine running	
	4.5.4	Plug-in hybrid electric or electric vehicle in charging mode	
	4.5.5	Hybrid electric or electric vehicle in running mode	
	4.5.6	Component/module tests	
5	Measure	ment of emissions received by an antenna on the same vehicle	29
		neral	
		enna measuring system	
	5.2.1	Type of antenna	
	5.2.2	Measuring system requirements	
		thod of measurement	
		st setup for vehicle in charging mode	
	5.4.1	General	32
	5.4.2	Vehicle in charging mode 1 or mode 2 (AC power charging without communication)	33
	5.4.3	Vehicle in charging mode 3 (AC power charging with communication) or mode 4 (DC power charging with communication)	35
	5.5 Exa	amples of limits for vehicle radiated disturbances	
6		ment of components and modules	
	6.1 Ge	neral	46
		st equipment	
	6.2.1	Reference ground plane	46
	6.2.2	Power supply and AN	47

6.2.3	Load simulator	47
6.3 C	onducted emissions from components/modules – Voltage method	47
6.3.1	General	47
6.3.2	Test setup	47
6.3.3	Test procedure	48
6.3.4	Limits for conducted disturbances from components/modules – Voltage method	54
6.4 C	onducted emissions from components/modules – current probe method	54
6.4.1	General	54
6.4.2	Test setup	54
6.4.3	Test procedure	55
6.4.4	Limits for conducted disturbances from components/modules – Current probe method	57
6.5 R	adiated emissions from components/modules – ALSE method	57
6.5.1	General	
6.5.2	Test setup	58
6.5.3	Test procedure	60
6.5.4	Limits for radiated disturbances from components/modules – ALSE method	65
6.6 R	adiated emissions from components/modules – Stripline method	
Annex A (inf	ormative) Flow chart for checking the applicability of CISPR 25 to vehicles	
Annay D /na	PREVIEW	73
`	rmative) Antenna matching unit – Vehicle test	
B.1 A	ntenna matching unit parameters (150 kHz to 6,2 MHz)	74
	ntenna matching unit – verification	
B.2.1	General SIST EN IEC 55025-2022	74
B.2.2	Gain measurement SIST EN IEC 33023.2022	74
B.2.3	Gain measurement SIST EN IEC 55025:2022  Test procedure dards.iteh.ai/catalog/standards/sist/d8f0fd2e-  rest procedure dards.iteh.ai/catalog/standards/sist/d8f0fd2e-  rest procedure dards.iteh.ai/catalog/standards/sist/d8f0fd2e-  rest procedure dards.iteh.ai/catalog/standards/sist-d8f0fd2e-  rest procedure dards.iteh.ai/catalog/standards/sist-en-iec-55025-2022	74
•	formative) Sheath-current suppressor	
	eneral information	
	uppressor construction	76
	formative) Guidance for the determination of the noise floor of active	77
Direct Curre	rmative) Artificial Network (AN), High Voltage Artificial Network (HV-AN), nt charging Artificial Network (DC-charging-AN), Artificial Mains Network	
	Asymmetric Artificial Network (AAN)	
	eneral	
	tificial networks (AN)	
E.2.1	Component powered by LV	
E.2.2	Component powered by HV	
E.2.3	Direct Current charging Artificial Networks (DC-charging-AN)	
	tificial Mains Networks (AMN)	
	symmetric Artificial Network (AAN)	
E.4.1	General	
E.4.2	Signal/control port with symmetric lines	
E.4.3	Wired network port with PLC on power lines	
E.4.4	Signal/control port with PLC (technology) on control pilot line	
E.4.5	Signal/control port with control pilot line	89

	informative) Radiated emissions from components/modules – Stripfine	91
F.1	General	
F.2	Test setup.	
F.2.1	·	
F.2.2	Stripline impedance matching	92
F.2.3		
F.2.4		
F.2.5		
F.3	Test procedure	
F.4	Limits for radiated emissions from components/modules – Stripline method	
F.5	Stripline design	
	(informative) Interference to mobile radio communication in the presence of noise – Methods of judging degradation	99
G.1	General	99
G.2	Survey of methods of judging degradation to radio channel	99
G.2.	General	99
G.2.2	Subjective tests	99
G.2.3		101
G.2.4	Conclusions relating to judgement of degradation	101
Annex H	(normative) Test methods for power supply systems for high voltages in	
electric a	nd hybrid vehicles	102
H.1	General	102
H.2	Test equipment (standards.iteh.ai)	102
H.2.1	Reference ground plane	102
H.2.2	Power supply, AN, HV-AN, AMN and AAN	103
H.2.3	B Load simulator SIST EN ILC 55025.2022  Load simulator SIST EN ILC 55025.2022	103
H.3	Load simulator https://standards.iteh.ai/catalog/standards/sist/d8f0fd2e- Conducted emission from components/modules on HV power lines – Voltage method	103
H.3.1	General	103
H.3.2	2 Test setup	104
H.3.3	B Limits for conducted emission – Voltage method	110
H.4	Conducted emission from components/modules on HV power lines – current probe method	111
H.4.1	•	
п.4. Н.4.2		
H.4.3	·	
H.5	Radiated emissions from components/modules – ALSE method	
H.5.1	·	
H.5.2		
H.5.3	·	
H.6	Coupling between HV and LV systems	
H.6.1		
H.6.2		
H.6.3	·	
	nformative) ALSE performance validation 150 kHz to 1 GHz	
I.1	General	
1. 1 1.2	Validation method	
ı.∠ I.2.1	Overview	
1.2.1	Overview	133

1.2.2	Equipment	135
1.2.3	Procedure	138
1.2.4	Requirements	147
	informative) Measurement instrumentation uncertainty – measurement of sreceived by an antenna on the same vehicle	148
J.1	General	148
J.2	Uncertainty sources	148
J.3	Measurand	150
J.4	Input quantities to be considered	150
J.4.1	General	150
J.4.2	AM band with OEM passive vehicle antenna (high impedance)	150
J.4.3	AM band with OEM active vehicle antenna ("matched 50 $\Omega$ " impedance)	150
J.4.4	Others bands (e.g FM, DAB III,) with OEM active vehicle antenna ("matched 50 $\Omega$ " impedance)	150
J.4.5	Others bands with reference antenna	151
	(informative) Uncertainty budgets for measurement of emissions received by na on the same vehicle	156
K.1	General	156
K.2	Typical CISPR 25 uncertainty budgets	
K.3	Receiver's frequency step	163
Annex L (	informative) Measurement instrumentation uncertainty – Emissions from	
componei	nts/modules – Test methods II. II. II. III. III. III. III. III.	164
L.1	General	104
L.2	Uncertainty sources tandards itch ai	164
L.3	Measurand	168
L.4	Input quantities to be considered	168
Annex M	(informative) Uncertainty budgets for emissions from components/modules https://standards.iteh.ai/catalog/standards/sist/d8f0fd2e-	175
M.1	nttps://standards.iten.ai/catalog/standards/sist/d8101d2e- General7c51-46c9-975e-1713ee881c10/sist-en-iec-55025-2022	175
M.2	Typical uncertainty budgets	175
Annex N	(informative) Items under consideration	181
N.1	General	181
N.2	Measurement techniques and limits	
N.3	ALSE performance validation method above 1 GHz	
N.4	Reconsideration of the scope of the document	
N.5	Reorganizing the document into separate parts similar to CISPR-16 document series	
N.6	Inclusion of test setups for WPT charging	181
Bibliograp	phy	182
Figure 1 -	- Method of determination of conformance for all frequency bands	20
Figure 2 -	- Example of gain curve	30
Figure 3 -	- Example of test setup – Vehicle-radiated emissions (front view with antenna)	32
Figure 4 -	- Example of test setup for vehicle with the inlet located on vehicle side mode 1 or 2, AC powered, without communication)	
Figure 5 -	- Example of test setup for vehicle with the inlet located front / rear of vehicle mode 1 or 2, AC powered, without communication	
	- Example of test setup for vehicle with the inlet located on vehicle side	
	mode 3 or mode 4, with communication)	38

Figure 7 – Example of test setup for vehicle with the inlet located front /rear of vehicle (charging mode 3 or mode 4, with communication)	39
Figure 8 – Details of average limits for GPS, BDS,B1I and GLONASS bands – Complete vehicle	45
Figure 9 – Conducted emissions – Example of test setup for EUT with power return line remotely grounded	50
Figure 10 – Conducted emissions – Example of test setup for EUT with power return line locally grounded	51
Figure 11 – Conducted emissions – Example of test setup for alternators and generators	52
Figure 12 – Conducted emissions – Example of test setup for ignition system components	53
Figure 13 – Conducted emissions – Example of test setup for current probe measurements	56
Figure 14 – Test harness bending requirements	59
Figure 15 – Example of test setup – rod antenna	61
Figure 16 – Example of test setup – biconical antenna	62
Figure 17 – Example of test setup – log-periodic antenna	63
Figure 18 – Example of test setup – above 1 GHz – Horn antenna	64
Figure 19 – Details of average limit for GPS, BDS, B1I and GLONASS bands – Components	
Figure A.1 – Flow chart for checking the applicability of this document	73
Figure B.1 – Verification setup	75
Figure C.1 – Characteristic S <sub>21</sub> of the sheath-current suppressor	76
Figure D.1 – Example of vehicle test setup for equipment noise	78
Figure D.2 – Example of vehicle test setup for antenna noise measurement	79
Figure E.1 – Example of 5 ut) AN schematics 1.0/sist-en-icc-55025-2022	
Figure E.2 – Characteristics of the AN impedance Z <sub>PB</sub>	81
Figure E.3 – Example of 5 µH HV-AN schematic	83
Figure E.4 – Example of 5 µH HV-AN combination in a single shielded box	84
Figure E.5 – Impedance matching network attached between HV-ANs and EUT	85
Figure E.6 – Example of 5 µH DC-charging-AN schematic	86
Figure E.7 – Example of an AAN for signal/control port with symmetric lines (e.g. CAN)	87
Figure E.8 – Example of AAN with wired network port with PLC on AC or DC power lines	88
Figure E.9 – Example of AAN circuit for signal/control port with PLC on control pilot	89
Figure E.10 – Example of AAN circuit for pilot line	90
Figure F.1 – Example of a basic stripline test setup in a shielded enclosure	93
Figure F.2 – Example for a 50 Ω stripline	97
Figure F.3 – Example for a 90 Ω stripline	
1 igure 1 .5 - Example for a 90 ½ surpline	98
Figure H.1 – Conducted emission – example for test setup for EUTs with shielded power supply systems	
Figure H.1 – Conducted emission – example for test setup for EUTs with shielded	106
Figure H.1 – Conducted emission – example for test setup for EUTs with shielded power supply systems	106

Figure H.4 – Conducted emission – Example of test setup for EUTs with shielded power supply systems and charger device	109
Figure H.5 – Conducted emission – Example of test setup current probe measurement on HV lines for EUTs with shielded power supply systems	113
Figure H.6 – Conducted emission – Example of test setup current probe measurement on HV lines for EUTs with shielded power supply systems with electric motor attached to the bench	114
Figure H.7 – Conducted emission – Example of test setup current probe measurement on HV lines for EUTs with shielded power supply systems and inverter	115
Figure H.8 – Conducted emission – Example of test setup current probe measurement on HV lines for EUTs with shielded power supply systems and charger device	116
Figure H.9 – Radiated emission – Example of test setup measurement with biconical antenna for EUTs with shielded power supply systems and with LV lines facing the antenna	119
Figure H.10 – Radiated emission – Example of test setup measurement with biconical antenna for EUTs with shielded power supply systems with electric motor attached to the bench and with LV lines facing the antenna	120
Figure H.11 – Radiated emission – Example of test setup measurement with biconical antenna for EUTs with shielded power supply systems and inverter and with LV lines facing the antenna	121
Figure H.12 – Radiated emission – Example of test setup measurement with biconical antenna for EUTs with shielded power supply systems and charger device and with LV lines facing the antenna	122
Figure H.13 – Test setup for calibration of the test signal	124
Figure H.14 – Example of test setup for conducted emissions – voltage method – measurement on LV ports with injection on HV supply ports	125
Figure H.15 – Example of test setup for conducted emissions – current probe method – measurement on LV ports with injection on HV supply ports.	127
Figure H.16 – Example of test setup for radiated emissions ALSE method – measurement with biconical antenna with injection on HV supply ports 2022	129
Figure H.17 – Test setup for EUT $S_{21}$ measurements	131
Figure H.18 – Examples of requirements for coupling attenuation, $a_{\rm c}$	132
Figure I.1 – Examples of typical ALSE influence parameters over the 10 MHz to 100 MHz frequency range	134
Figure I.2 – Visual representation of ALSE performance validation process	135
Figure I.3 – Metallic sheet angles used as support for the rod	137
Figure I.4 – Radiator side view 50 $\Omega$ terminations	137
Figure I.5 – Photo of the radiator mounted on the ground reference plane	137
Figure I.6 – Example VSWR measured from four radiation sources (without 10 dB attenuator)	138
Figure I.7 – Example setup for ALSE equivalent field strength measurement (rod antenna shown for the frequency range from 150 kHz to 30 MHz)	140
Figure I.8 – MoM-Model for the frequency range 30 MHz to 200 MHz	142
Figure J.1 – Sources of measurement instrumentation uncertainty	149
Figure K.1 – Example of measurement for frequency step uncertainty evaluation	163
Figure L.1 – Sources of measurement instrumentation uncertainty – conducted emissions from components/modules – Voltage method	165
Figure L.2 – Sources of measurement instrumentation uncertainty – conducted emissions from components/modules – Current probe method	166

Figure L.3 – Sources of measurement instrumentation uncertainty – radiated emissions from components/modules – ALSE method	167
Table 1 – Spectrum analyser parameters	24
Table 2 – Scanning receiver parameters	26
Table 3 – Antenna types	29
Table 4 – Example for limits of disturbance – Complete vehicle – General	40
${\sf Table}\ 5-{\sf Example}\ {\sf for}\ {\sf limits}\ {\sf of}\ {\sf disturbance}-{\sf Complete}\ {\sf vehicle}-{\sf Digital}\ {\sf mobile}\ {\sf phone}$	42
Table 6 – Examples of limits for conducted disturbances – Voltage method	54
Table 7 – Examples of limits for conducted disturbances – Current probe method	57
Table 8 – Examples of limits for radiated disturbances – ALSE method – General	65
Table 9 – Examples of limits for radiated disturbances – ALSE method – Digital mobile phone	67
Table E.1 – Magnitude of the AN impedance Z <sub>PB</sub>	82
Table F.1 – Examples of limits for radiated disturbances – Stripline method	94
Table H.1 – Example for HV limits for conducted voltage measurements at shielded power supply devices (HV-LV coupling attenuation class A1)	110
Table H.2 – Example of configurations for equipment without negative LV line	131
Table H.3 – Example of configurations for equipment with negative LV line	131
Table H.4 – Examples of requirements for minimum coupling attenuation, $a_{\mathbb{C}}$	132
Table I.1 – Reference data to be used for chamber validation	142
Table J.1 – Input quantities to be considered for voltage at antenna terminal	151
measurements	151
Table K.1 – Typical uncertainty budget <u>EVoltage at antenna</u> terminal – AM band with OEM passive vehicle antenna (high impedance) og/standards/sist/d8f0fd2e	156
Table K.2 – Typical uncertainty budget 13 Voltage at antenna terminal 2 AM band with OEM active vehicle antenna ("matched 50 Ω" impedance)	159
Table K.3 – Typical uncertainty budget – Voltage at antenna terminal – Others bands with reference antenna	161
Table L.1 – Input quantities to be considered for emissions from components/modules $\dots$	169
Table M.1 – Typical uncertainty budget – Conducted emissions from components/modules – Voltage method and current probe method	175
Table M.2 – Typical uncertainty budget – Radiated emissions from components/modules – ALSE method	177

**-9-**

# INTERNATIONAL ELECTROTECHNICAL COMMISSION INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

# VEHICLES, BOATS AND INTERNAL COMBUSTION ENGINES – RADIO DISTURBANCE CHARACTERISTICS – LIMITS AND METHODS OF MEASUREMENT FOR THE PROTECTION OF ON-BOARD RECEIVERS

#### **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.

CISPR 25 has been prepared by CISPR subcommittee D: Electromagnetic disturbances related to electric/electronic equipment on vehicles and internal combustion engine powered devices. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) inclusion of new frequency bands,
- b) deletion of the annex on TEM cells,
- c) inclusion of annexes on measurement uncertainty,
- d) overall improvement.