



BSI Standards Publication

Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy

Part 5: Reverberation chamber

National foreword

This British Standard is the UK implementation of ISO 11451-5:2023.

The UK participation in its preparation was entrusted to Technical Committee AUE/32, Electrical and electronic components and general system aspects (Road vehicles).

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2023
Published by BSI Standards Limited 2023

ISBN 978 0 539 04275 7

ICS 19.060; 19.080; 33.100.20; 43.040.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2023.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

INTERNATIONAL
STANDARD

ISO
11451-5

First edition
2023-05

**Road vehicles — Vehicle test methods
for electrical disturbances from
narrowband radiated electromagnetic
energy —**

**Part 5:
Reverberation chamber**

*Véhicules routiers — Méthodes d'essai d'un véhicule soumis
à des perturbations électriques par rayonnement d'énergie
électromagnétique en bande étroite —*

Partie 5: Chambre réverbérante



Reference number
ISO 11451-5:2023(E)



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Test conditions	6
5 Test location	6
5.1 Reverberation chamber description.....	6
5.2 Working volume.....	7
6 Test instrumentation	7
6.1 General.....	7
6.2 Field generating device.....	8
6.3 Field probes.....	8
6.4 Stimulation and monitoring of the device under test (DUT).....	8
6.5 Optional: receiving antenna(s) and spectrum analyser.....	8
6.6 Optional: vector network analyser.....	9
7 Test set-up	9
7.1 Vehicle placement.....	10
7.2 Field generating device location – Antenna constraints.....	10
7.3 Vehicle test configurations.....	10
7.3.1 Vehicle not connected to the power grid.....	10
7.3.2 Vehicle in charging mode 1 or mode 2 (AC powered, without communication).....	10
7.3.3 Vehicle in charging mode 3 or mode 4 (AC or DC powered, with communication).....	13
7.3.4 Vehicle in charging mode through wireless power transmission (WPT).....	17
8 Test procedure	19
8.1 General.....	19
8.2 Stirring configurations.....	20
8.3 Test plan.....	20
8.4 Test methods.....	20
8.5 Reverb method with substitution method power control.....	23
8.5.1 Reverb reference points.....	23
8.5.2 Substitution method with empty chamber calibration.....	25
8.5.3 Substitution method with calibration including the vehicle.....	29
8.6 Test report.....	31
Annex A (informative) Function performance status classification	32
Annex B (normative) Test level definition	33
Annex C (normative) Reverberation chamber characteristics	36
Annex D (informative) Tuned mode and stirred mode	44
Annex E (informative) TLS method	48
Annex F (informative) Cavity mode method	55
Annex G (informative) Reverb method with closed-loop power control	59
Annex H (informative) Chamber time constant method	61
Annex I (informative) VNA method	67
Annex J (informative) Measurement of total antenna efficiency η	74
Annex K (informative) Measurement of diffuse field correction factor F_{df}	77

Annex L (informative) Measurement of τ, Q, and ACS	80
Annex M (normative) Additional AAN(s)	85
Bibliography	86

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

A list of all parts in the ISO 11451 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy —

Part 5: Reverberation chamber

1 Scope

This document specifies methods for testing the immunity of passenger cars and commercial vehicles to electromagnetic disturbances, regardless of the vehicle propulsion system (e.g. spark ignition engine, diesel engine, electric motor) using a reverberation chamber.

The electromagnetic disturbances considered are limited to narrowband electromagnetic fields.

While this document refers specifically to passenger cars and commercial vehicles, generalized as “vehicle(s)”, it can readily be applied to other types of vehicles.

ISO 11451-1 specifies general test conditions, definitions, practical use, and basic principles of the test procedure.

Function performance status classification guidelines for immunity to electromagnetic radiation from an off-vehicle radiation source are given in [Annex A](#).

2 Normative references

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.

ISO 11451-1:2015, *Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 1: General principles and terminology*

IEC 61000-4-21, *Electromagnetic compatibility (EMC) – Part 4-21: Testing and measurement techniques – Reverberation chamber test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11451-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>