

# INTERNATIONAL STANDARD

**IEC**  
**62153-4-4**

First edition  
2006-05

---

---

**Metallic communication cable test methods –**

**Part 4-4:**

**Electromagnetic compatibility (EMC) –  
Shielded screening attenuation, test method  
for measuring of the screening attenuation  $a_s$   
up to and above 3 GHz**



Reference number  
IEC 62153-4-4:2006(E)

## Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

## Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

## Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** ([www.iec.ch](http://www.iec.ch))

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site ([www.iec.ch/searchpub](http://www.iec.ch/searchpub)) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications ([www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: [custserv@iec.ch](mailto:custserv@iec.ch)  
Tel: +41 22 919 02 11  
Fax: +41 22 919 03 00

# INTERNATIONAL STANDARD

**IEC**  
**62153-4-4**

First edition  
2006-05

---

---

## **Metallic communication cable test methods –**

### **Part 4-4:**

### **Electromagnetic compatibility (EMC) – Shielded screening attenuation, test method for measuring of the screening attenuation $a_s$ up to and above 3 GHz**

© IEC 2006 — Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland  
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: [inmail@iec.ch](mailto:inmail@iec.ch) Web: [www.iec.ch](http://www.iec.ch)



Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

PRICE CODE

**P**

*For price, see current catalogue*

## CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references.....	5
3 Symbols and theoretical background.....	5
3.1 Electrical symbols.....	5
3.2 Theoretical background .....	6
3.3 Screening attenuation .....	6
3.4 Relationship between length and the surface transfer impedance $Z_T$ .....	7
4 Principles of the measuring method .....	10
5 Measurement.....	11
5.1 Equipment .....	11
5.2 Cable under test .....	11
5.3 Procedure.....	14
5.4 Expression of results .....	14
6 Requirement.....	15
Figure 1 – Relationship of $U_2/U_1$ on a log (f) scale for a single braided cable .....	8
Figure 2 – Relationship of $U_2/U_1$ on a linear (f) scale and screening attenuation $a_s$ on a linear (f) scale for a single braided cable .....	9
Figure 3 – Measured screening attenuation $a_s$ formed by the maximum envelope curve to the measured coupling voltage ratio $U_2/U_1$ of a single braided cable .....	9
Figure 4 – Triaxial measuring set-up .....	10
Figure 5 – Triaxial measuring set-up connected to the network analyser .....	10
Figure 6 – Preparation of test sample (symmetrical and multi-conductor cables) .....	11
Figure 7 – Impedance matching for $Z_1 < 50 \Omega$ .....	13
Figure 8 – Impedance matching for $Z_1 > 50 \Omega$ .....	13

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## METALLIC COMMUNICATION CABLE TEST METHODS –

**Part 4-4: Electromagnetic compatibility (EMC) –  
Shielded screening attenuation, test method for measuring of  
the screening attenuation  $a_s$  up to and above 3 GHz**

## 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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 62153-4-4 has been prepared by subcommittee 46A: Coaxial cables, of IEC technical committee 46: Cables, wires, waveguides, r.f. connectors, r.f. and microwave passive components and accessories.

The text of this standard is based on the following documents:

FDIS	Report on voting
46A/799/FDIS	46A/816/RVD

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

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

IEC 62153 consists of the following parts under the general title *Metallic communication cable test methods*:

- Part 1-1: Electrical – Measurement of the pulse/step return loss in the frequency domain using the Inverse Discrete Fourier Transformation (IDFT)
- Part 1-2: Reflection measurement correction<sup>1</sup>
- Part 4-0: Electromagnetic Compatibility (EMC) – Relationship between Surface transfer impedance and Screening attenuation, recommended limits<sup>1</sup>
- Part 4-1: Electromagnetic Compatibility (EMC) – Introduction to electromagnetic (EMC) screening measurements<sup>1</sup>
- Part 4-2: Electromagnetic compatibility (EMC) – Screening and coupling attenuation – Injection clamp method
- Part 4-3: Electromagnetic Compatibility (EMC) – Surface transfer impedance – Triaxial method
- Part 4-4: Electromagnetic Compatibility (EMC) – Shielded screening attenuation, test method for measuring of the screening attenuation "as " up to and above 3 GHz
- Part 4-5: Electromagnetic Compatibility (EMC) – Coupling or screening attenuation – absorbing clamp method
- Part 4-6: Electromagnetic Compatibility (EMC) – Surface transfer impedance – line injection method
- Part 4-7: Electromagnetic Compatibility (EMC) – Shielded screening attenuation, test method for measuring the Transfer impedance ZT, the screening attenuation as and the coupling attenuation ac of RF Connectors up to and above 3 GHz; Tube in Tube method
- Part 4-8: Electromagnetic Compatibility (EMC) – Capacitive Coupling Admittance <sup>1</sup>

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

<sup>1</sup> Under consideration.

## METALLIC COMMUNICATION CABLE TEST METHODS –

### Part 4-4: Electromagnetic compatibility (EMC) – Shielded screening attenuation, test method for measuring of the screening attenuation $a_s$ up to and above 3 GHz

#### 1 Scope

This part of IEC 62153 determines the screening attenuation  $a_s$  of metallic communication cable screens. Due to the concentric outer tube, measurements are independent of irregularities on the circumference and outer electromagnetic field.

A wide dynamic and frequency range can be applied to test even super-screened cables with normal instrumentation from low frequencies up to the limit of defined transversal waves in the outer circuit at approximately 4 GHz.

#### 2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 61917:1998, *Cables, cable assemblies and connectors – Introduction to electromagnetic (EMC) screening measurements* <sup>2</sup>

#### 3 Symbols and theoretical background

##### 3.1 Electrical symbols

$Z_1$	characteristic impedance of the primary circuit (cable under test)
$Z_2$	characteristic impedance of the secondary circuit
$Z_S$	normalized value of the characteristic impedance of the environment of the cable under test (150 $\Omega$ outer circuit impedance $Z_2$ )
$R$	input impedance of the receiver
$Z_T$	transfer impedance of the cable under test in $\Omega/m$
$Z_F = Z_1 \times Z_2 \times j\omega \times C_T$	capacitive coupling impedance of the cable under test in $\Omega/m$
$f$	frequency in Hz
$C_T$	through capacitance of the outer conductor per unit length in F/m
$\epsilon_{r1}$	relative dielectric permittivity of the cable under test
$\epsilon_{r2}$	relative dielectric permittivity of the secondary circuit
$\epsilon_{r2,n}$	normalized value of the relative dielectric permittivity of the environment of the cable
$l$	effective coupling length

<sup>2</sup> This is under revision and will be replaced by IEC 62153-4-1.