



BSI Standards Publication

Metallic cables and other passive components test methods

Part 4-15: Electromagnetic compatibility (EMC) related test method for measuring transfer impedance and screening attenuation or coupling attenuation with triaxial cell

National foreword

This British Standard is the UK implementation of EN IEC 62153-4-15:2021+A1:2024. It is identical to IEC 62153-4-15:2021, incorporating amendment 1:2024. It supersedes BS EN IEC 62153-4-15:2021, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee EPL/46, Cables, wires and waveguides, radio frequency connectors and accessories for communication and signalling.

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 2024
Published by BSI Standards Limited 2024

ISBN 978 0 539 30896 9
ICS 33.100.01; 33.100.10; 33.120.10

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 30 September 2021.

Amendments/corrigenda issued since publication

Date	Text affected
30 June 2024	Implementation of IEC amendment 1:2024 with CENELEC endorsement A1:2024

English Version

**Metallic cables and other passive components test methods -
Part 4-15: Electromagnetic compatibility (EMC) - Test method for
measuring transfer impedance and screening attenuation - or
coupling attenuation with triaxial cell
(IEC 62153-4-15:2021)**

Méthodes d'essais des câbles métalliques et autres
composants passifs - Partie 4-15 : Compatibilité
électromagnétique (CEM) - Méthode d'essai pour le
mesurage de l'impédance de transfert et de
l'affaiblissement d'écran - ou de l'affaiblissement de
couplage avec cellule triaxiale
(IEC 62153-4-15:2021)

Prüfverfahren für metallische Kommunikationskabel - Teil 4-
15: Elektromagnetische Verträglichkeit (EMV) -
Prüfverfahren zur Messung des Kopplungswiderstandes
und der Schirmdämpfung oder der Kopplungsdämpfung mit
der Triaxialen Zelle
(IEC 62153-4-15:2021)

This European Standard was approved by CENELEC on 2021-09-07. 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, 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

European foreword

The text of document 46/814/FDIS, future edition 2 of IEC 62153-4-15, prepared by IEC/TC 46 "Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62153-4-15:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2022-06-07 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2024-09-07 document have to be withdrawn

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.

Endorsement notice

The text of the International Standard IEC 62153-4-15:2021 was approved by CENELEC as a European Standard without any modification.

European foreword to amendment A1

The text of document 46/992/FDIS, future IEC 62153-4-15/AMD1, prepared by IEC/TC 46 "Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62153-4-15:2021/A1:2024.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2025-03-05 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2027-06-05 document have to be withdrawn

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.

Endorsement notice

The text of the International Standard IEC 62153-4-15:2021/AMD1:2024 was approved by CENELEC as a European Standard without any modification.

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>	<u>EN/HD</u>	<u>Year</u>
IEC 61196-1	-	Coaxial communication cables - Part 1:- Generic specification - General, definitions and requirements		-
IEC TS 62153-4-1	2014	Metallic communication cable test methods- - Part 4-1: Electromagnetic compatibility (EMC) - Introduction to electromagnetic screening measurements		-
IEC 62153-4-3	-	Metallic communication cable test methods- - Part 4-3: Electromagnetic compatibility (EMC) - Surface transfer impedance - Triaxial method		-
IEC 62153-4-4	2015	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 62153-4-7	-	Metallic cables and other passive components - Test methods - Part 4-7: Electromagnetic compatibility (EMC) -Test method for measuring of transfer impedance Z_T and screening attenuation a_s or coupling attenuation a_C of connectors and assemblies - Triaxial tube in tube method	EN IEC 62153-4-7	-
IEC 62153-4-8	-	Metallic cables and other passive- components - Test methods - Part 4-8: Electromagnetic compatibility (EMC) - Capacitive coupling admittance		-
IEC 62153-4-9	2018	Metallic communication cable test methods - Part 4-9: Coupling attenuation of screened balanced cables, triaxial method		-

EN IEC 62153-4-15:2021+A1:2024 (E)

IEC 62153-4-10	-	Metallic communication cable test methods- - Part 4-10: Electromagnetic compatibility (EMC) - Transfer impedance and screening attenuation of feed-throughs and electromagnetic gaskets - Double coaxial test method	-
IEC 62153-4-16	-	Metallic cables and other passive-components test methods - Part 4-16: Electromagnetic compatibility (EMC) - Extension of the frequency range to higher frequencies for transfer impedance and to lower frequencies for screening attenuation measurements using the triaxial set-up	-

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Physical background.....	10
5 Principle of the test methods	10
5.1 General.....	10
5.2 Transfer impedance	12
5.3 Screening attenuation	12
5.4 Coupling attenuation	12
5.5 Tube-in-tube method.....	12
6 Test procedures	12
6.1 General.....	12
6.2 Triaxial cell	12
6.3 Cut-off frequencies, higher-order modes	13
6.4 Test equipment	14
6.5 Calibration procedure.....	14
6.6 Test leads and connecting cables to the DUT	15
7 Sample preparation	15
7.1 Coaxial connector or assembly or quasi-coaxial component.....	15
7.2 Balanced or multipin connectors or components	15
7.3 Cable assemblies.....	16
7.4 Other screened devices	17
8 Transfer impedance (short-matched)	17
8.1 General.....	17
8.2 Principle block diagram of transfer impedance	17
8.3 Measuring procedure	18
8.4 Evaluation of test results.....	18
8.5 Test report	18
9 Screening attenuation.....	19
9.1 General.....	19
9.2 Impedance matching.....	19
9.3 Measuring with matched conditions.....	19
9.3.1 Procedure.....	19
9.3.2 Evaluation of test results	19
9.4 Measuring with mismatch	20
9.4.1 General	20
9.4.2 Evaluaton of test results	20
9.5 Test report	21
10 Coupling attenuation.....	21
10.1 General.....	21
10.2 Procedure	21
10.2.1 Coupling attenuation with balun	21
10.2.2 Balunless coupling attenuation	22
10.3 Expression of results	22
10.4 Test report	23

Annex A (informative) Principle of the triaxial test procedure	24
A.1 General.....	24
A.2 Transfer impedance	25
A.3 Screening attenuation	25
A.4 Coupling attenuation	26
Annex B (informative) Triaxial cell.....	28
Annex C (normative) Triaxial absorber cell.....	30
C.1 Cut-off frequencies, higher order modes	30
C.2 Absorber	31
C.3 Influence of absorber	33
Annex D (informative) Application of a moveable shorting plane	34
D.1 Coupling transfer function	34
D.2 Effect of the measurement length on the measurement cut-off frequency	35
D.3 Details of the movable shorting plane	35
D.4 Measurement results.....	37
Annex E (informative) Correction in the case that the receiver input impedance R is higher than the characteristic impedance of the outer circuit Z_2	39
E.1 Impedance Z_2 lower than the input impedance of the receiver	39
E.2 Correction	40
Annex F (informative) Test adapter	41
Annex G (informative) Attenuation versus scattering parameter S_{21}	42
Annex H (normative) Coupling attenuation expressed by mixed mode scattering parameter and an envelope line	44
H.1 General.....	44
H.2 Coupling attenuation expressed by mixed mode scattering parameter.....	44
H.3 Envelope line of coupling attenuation	44
Bibliography.....	46
Figure 1 – Definition of Z_T	8
Figure 2 – Principle depiction of the triaxial test setup (tube) to measure transfer impedance and screening attenuation with tube in tube in accordance with IEC 62153-4-7	11
Figure 3 – Principle depiction of the triaxial cell to measure transfer impedance and screening attenuation of connectors or assemblies with tube in tube in accordance with IEC 62153-4-7	11
Figure 4 – Rectangular waveguide	13
Figure 5 – Preparation of balanced or multipin connectors for transfer impedance and screening attenuation	16
Figure 6 – Preparation of balanced or multipin connectors for coupling attenuation measurement.....	16
Figure 7 – Test setup (principle) for transfer impedance measurement in accordance with test method B of IEC 62153-4-3.....	17
Figure 8 – Principle test setup for balunless coupling attenuation measurement according to IEC 62153-4-9	22
Figure A.1 – Principle test setup to measure transfer impedance and screening attenuation.....	24
Figure A.2 – Equivalent circuit of the principle of the test setup in Figure A.1.....	25
Figure A.3 – Coupling attenuation, principle of test setup with balun and standard tube.....	26

Figure A.4 – Coupling attenuation, principle of setup with multiport VNA and standard head	27
Figure B.1 – Principle depiction of the triaxial cell to measure transfer impedance and screening attenuation on a connector with tube-in-tube according to IEC 62153-4-7	28
Figure B.2 – Examples of different designs of triaxial cells	29
Figure C.1 – Cavity or rectangular waveguide	30
Figure C.2 – Comparison of the measurements of a RG 214 cable with 40 mm tube and triaxial cells	31
Figure C.3 – Principle of the triaxial cell with tube in tube and ferrite tiles as absorber	31
Figure C.4 – Comparison of the measurements of an RG 214 with 40 mm tube and triaxial cells with magnetic absorber	32
Figure C.5 – Examples of magnetic flat absorber	32
Figure C.6 – Setup for correction measurement	33
Figure C.7 – Correction measurement	33
Figure D.1 – Measured coupling transfer function of a braided screen versus frequency with the triaxial cell	34
Figure D.2 – Cross-section of triaxial cell with movable shorting plane	36
Figure D.3 – Crosscut of plane shortening housing and tube-in-tube	36
Figure D.4 – Detail H of Figure D.3: contact between plane and housing	37
Figure D.5 – Detail G of Figure D.3: contact between plane and tube-in-tube	37
Figure D.6 – Compilation of transfer impedance test results with different shorting plane distances	38
Figure E.1 – Example of forward transfer scattering parameter S_{21} for different impedances in the outer circuit where the receiver input impedance is 50 Ω	39
Figure E.2 – DUT with uniform cylindrical shape in the centre of the cell	40
Figure F.1 – Principle of the test setup to measure transfer impedance and screening or coupling attenuation of connectors	41
Figure F.2 – Principle of the test setup to measure transfer impedance and screening attenuation on a cable assembly	41
Figure G.1 – Measurement with HP8753D of S_{21} of a 3 dB attenuator	42
Figure G.2 – Measurement with ZVRE of S_{21} of a 3 dB attenuator	43
Figure H.1 – Example of coupling attenuation with envelope line	45
Table 1 – IEC 62153-4 series, Metallic communication cable test methods – Test procedures with triaxial test setup	10

INTERNATIONAL ELECTROTECHNICAL COMMISSION

METALLIC CABLES AND OTHER PASSIVE COMPONENTS TEST METHODS –

Part 4-15: Electromagnetic compatibility (EMC) – Test method for measuring transfer impedance and screening attenuation – or coupling attenuation with triaxial cell

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 62153-4-15 has been prepared by IEC technical committee 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories.

This second edition cancels and replaces the first edition published in 2015. This edition constitutes a technical revision.

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

- a) measurement of coupling attenuation of balanced connectors, assemblies and components with balun and balunless added;
- b) application of a test adapter was added;
- c) application of a moveable shorting plane;

- d) application of the triaxial "absorber" cell;
- e) correction of test results in the case that the receiver input impedance R is higher than the characteristic impedance of the outer circuit Z_2 .

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

FDIS	Report on voting
46/814/FDIS	46/822/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all the parts in the IEC 62153-4 series, published under the general title *Metallic communication cable test methods – Electromagnetic compatibility (EMC)*, 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 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.

METALLIC CABLES AND OTHER PASSIVE COMPONENTS TEST METHODS –

Part 4-15: Electromagnetic compatibility (EMC) – Test method for measuring transfer impedance and screening attenuation – or coupling attenuation with triaxial cell

1 Scope

This part of IEC 62153 specifies the procedures for measuring with triaxial cell the transfer impedance, screening attenuation or the coupling attenuation of connectors, cable assemblies and components, for example accessories for analogue and digital transmission systems, and equipment for communication networks and cabling.

Measurements can be achieved by applying the device under test directly to the triaxial cell or with the tube-in-tube method in accordance with IEC 62153-4-7.

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.

IEC 61196-1, *Coaxial communication cables – Part 1: Generic specification – General, definitions and requirements*

IEC TS 62153-4-1:2014, *Metallic communication cable test methods – Part 4-1: Electromagnetic Compatibility (EMC) – Introduction to electromagnetic screening measurements*

IEC 62153-4-3, *Metallic communication cable test methods – Part 4-3: Electromagnetic compatibility (EMC) – Surface transfer impedance – Triaxial method*

IEC 62153-4-4:2015, *Metallic communication cable test methods – Part 4-4: Electromagnetic compatibility (EMC) – Test method for measuring of the screening attenuation a_S up to and above 3 GHz, triaxial method*

IEC 62153-4-7, *Metallic communication cable test methods – Part 4-7: Electromagnetic compatibility (EMC) – Test method for measuring the transfer impedance Z_T and the screening attenuation a_s or coupling attenuation a_c of connectors and assemblies up to and above 3 GHz – Triaxial Tube in tube method*

IEC 62153-4-8, *Metallic cables and other passive components – Test methods – Part 4-8: Electromagnetic compatibility (EMC) – Capacitive coupling admittance*

IEC 62153-4-9:2018, *Metallic communication cable test methods – Part 4-9: Electromagnetic compatibility (EMC) – Coupling attenuation of screened balanced cables, triaxial method*

IEC 62153-4-10, *Metallic communication cable test methods – Part 4-10: Electromagnetic compatibility (EMC) – Transfer impedance and screening attenuation of feed-throughs and electromagnetic gaskets – Double coaxial test method*

IEC 62153-4-16, *Metallic communication cable test methods – Part 4-16: Electromagnetic compatibility (EMC) – Extension of the frequency range to higher frequencies for transfer impedance and to lower frequencies for screening attenuation measurements using the triaxial set-up*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61196-1 and the following apply.

3.1

triaxial cell

rectangular housing in analogy to the principles of the triaxial test procedure, consisting of a non-ferromagnetic metallic material

Note 1 to entry: The triaxial test procedure is described in IEC 62153-4-3 and IEC 62153-4-4.

3.2

surface transfer impedance

Z_T

for an electrically short screen, quotient of the longitudinal voltage U_1 induced to the inner circuit by the current I_2 fed into the outer circuit or vice versa [Ω] (see Figure 1)

Note 1 to entry: The value Z_T of an electrically short screen is expressed in ohms [Ω] or decibels in relation to 1 Ω .

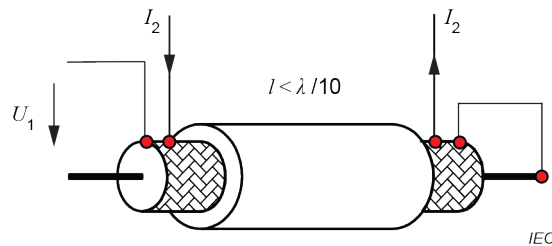


Figure 1 – Definition of Z_T

$$Z_T = \frac{U_1}{I_2} \quad (1)$$

$$Z_T \text{ dB}(\Omega) = 20 \cdot \lg \left(\frac{|Z_T|}{1\Omega} \right) \quad (2)$$

3.3

effective transfer impedance

Z_{TE}

impedance defined as:

$$Z_{TE} = \max |Z_F \pm Z_T| \quad (3)$$

where Z_F is the capacitive coupling impedance

3.4 screening attenuation

a_s

for electrically long devices, i.e. above the cut-off frequency, logarithmic ratio of the feeding power P_1 and the periodic maximum values of the coupled power $P_{r,max}$ in the outer circuit

$$a_s = 10 \cdot \lg \left(\text{Env} \left| \frac{P_1}{P_{r,max}} \right| \right) \quad (4)$$

Note 1 to entry: The screening attenuation of an electrically short device is defined as:

$$a_s = 20 \cdot \lg \frac{150 \Omega}{Z_{TE}} \quad (5)$$

where

150 Ω is the standardised impedance of the outer circuit.

3.5 coupling attenuation

a_c

for a screened balanced device, sum of the unbalance attenuation a_u of the symmetric pair and the screening attenuation a_s of the screen of the device under test

Note 1 to entry: For electrically long devices, i.e. above the cut-off frequency, the coupling attenuation a_c is defined as the logarithmic ratio of the feeding power P_1 and the periodic maximum values of the coupled power $P_{r,max}$ in the outer circuit.

3.6 coupling length

length of cable that is inside the test jig, i.e. the length of the screen under test

Note 1 to entry: The coupling length is electrically short, if

$$\frac{\lambda_0}{L} > 10 \cdot \sqrt{\epsilon_{r1}} \quad \text{or} \quad f < \frac{c_0}{10 \cdot L \cdot \sqrt{\epsilon_{r1}}} \quad (6)$$

or electrically long, if

$$\frac{\lambda_0}{L} \leq 2 \cdot \left| \sqrt{\epsilon_{r1}} - \sqrt{\epsilon_{r2}} \right| \quad \text{or} \quad f > \frac{c_0}{2 \cdot L \cdot \left| \sqrt{\epsilon_{r1}} - \sqrt{\epsilon_{r2}} \right|} \quad (7)$$

where

L is the effective coupling length, in m;

λ_0 is the free space wavelength, in m;

ϵ_{r1} is the resulting relative permittivity of the dielectric of the cable;

ϵ_{r2} is the resulting relative permittivity of the dielectric of the secondary circuit;

f is the frequency, in Hz;

c_0 is the velocity of light in free space, in m/s.

3.7 device under test DUT

connector with mating connector and attached connecting cables or cable assembly consisting of the assembly with their attached mated connectors and with connecting cables

4 Physical background

See IEC TS 62153-4-1, IEC 62153-4-3, IEC 62153-4-4, and Annex A to Annex F.

5 Principle of the test methods

5.1 General

The IEC 62153-4 series describes different test procedures to measure screening effectiveness on communication cables, connectors and components.

Table 1 gives an overview of the test procedures of the IEC 62153-4 series carried out with the triaxial test setup.

**Table 1 – IEC 62153-4 series, Metallic communication cable test methods –
Test procedures with triaxial test setup**

IEC 62153-4 series	Metallic communication cable test methods – Electromagnetic compatibility (EMC)
IEC TS 62153-4-1	Introduction to electromagnetic screening measurements
IEC 62153-4-3	Surface transfer impedance – Triaxial method
IEC 62153-4-4	Shielded screening attenuation, test method for measuring of the screening attenuation a_S up to and above 3 GHz
IEC 62153-4-7	Shielded screening attenuation test method for measuring the Transfer impedance Z_T and the screening attenuation a_S or the coupling attenuation a_C of RF-connectors and assemblies up to and above 3 GHz, tube in tube method
IEC 62153-4-9	Coupling attenuation of screened balanced cables, triaxial method
IEC 62153-4-10	Shielded screening attenuation test method for measuring the screening effectiveness of feedtroughs and electromagnetic gaskets double coaxial method
IEC 62153-4-15	Test method for measuring transfer impedance and screening attenuation – or coupling attenuation with triaxial cell
IEC 62153-4-16	Extension of the frequency range to higher frequencies for transfer impedance and to lower frequencies for screening attenuation measurements using the triaxial setup

Larger connectors, cable assemblies, and components do not fit into the commercially available test rigs (tubes) of the triaxial test procedures of IEC 62153-4-3, IEC 62153-4-4, and IEC 62153-4-7, respectively, which were designed originally to measure transfer impedance and screening attenuation on communication cables, connectors, and assemblies.

Since rectangular housings with RF-tight caps are easier to manufacture than tubes, the "triaxial cell" was designed to test larger devices, such as connectors, assemblies and components. The principles of the triaxial test procedures in accordance with IEC 62153-4-3, IEC 62153-4-4 and IEC 62153-4-7 can be transferred to rectangular housings. Tubes and rectangular housings may be operated in combination in one test setup (see Figure 2 and Figure 3).

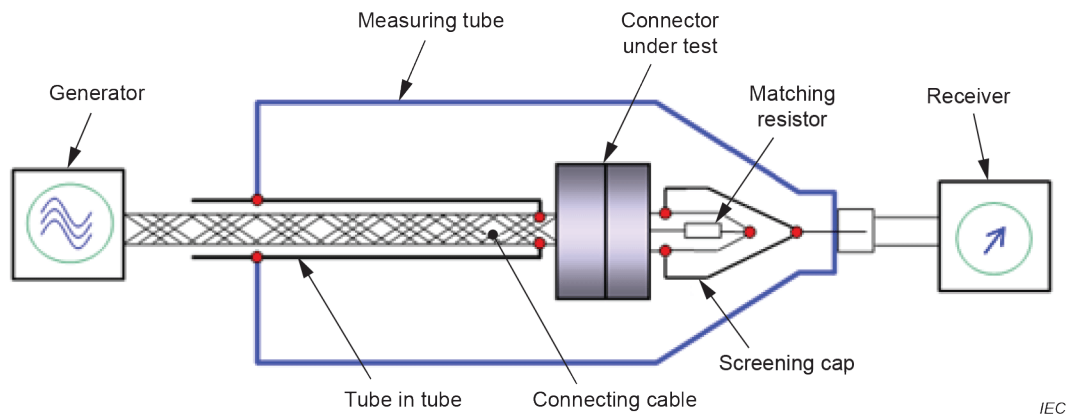


Figure 2 – Principle depiction of the triaxial test setup (tube) to measure transfer impedance and screening attenuation with tube in tube in accordance with IEC 62153-4-7

In principle, the triaxial cell can be used in accordance with all triaxial procedures of Table 1, where originally a cylindrical tube is used. The screening effectiveness of connectors, assemblies or other components can be measured, in principle, in the tube as well as in the triaxial cell. Test results of measurements with tubes and with triaxial cells correspond well.

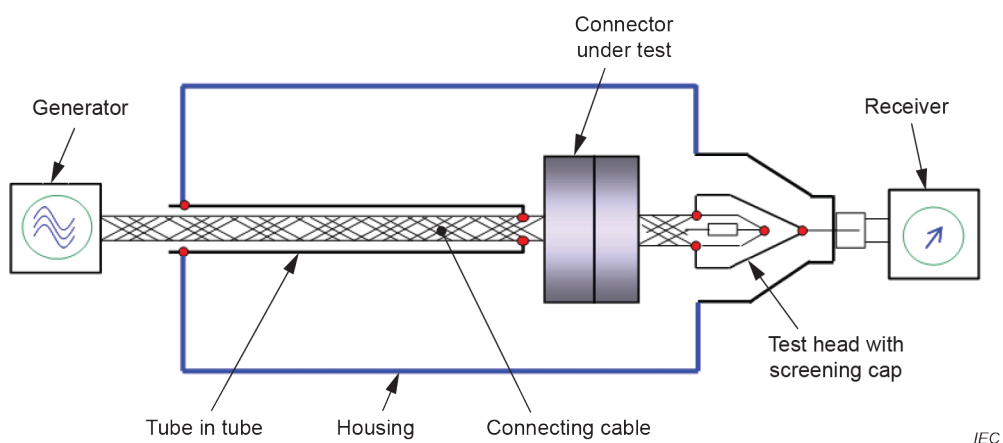


Figure 3 – Principle depiction of the triaxial cell to measure transfer impedance and screening attenuation of connectors or assemblies with tube in tube in accordance with IEC 62153-4-7

The triaxial cell test setup is based on the triaxial system in accordance with IEC 62153-4-3 and IEC 62153-4-4, consisting of the DUT, a solid metallic housing and an RF-tight extension tube (optional). The matched device under test (DUT), which is fed by a generator via a connecting cable, forms the disturbing circuit, which may also be designated as the inner or the primary circuit.

The disturbed circuit, which may also be designated as the outer or the second circuit, is formed by the outer conductor of the device under test, connected to the connecting cable (or the tube in tube, if applicable) and a solid metallic housing or cell having the DUT in its axis.