

# INTERNATIONAL STANDARD



**Metallic ~~communication~~ 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**

Document Preview

[IEC 62153-4-15:2021](https://standards.iteh.ai/catalog/standards/iec/c8374e71-4b72-45c4-a3d0-19c68ec28741/iec-62153-4-15-2021)

<https://standards.iteh.ai/catalog/standards/iec/c8374e71-4b72-45c4-a3d0-19c68ec28741/iec-62153-4-15-2021>



**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2021 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, 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 either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

**About the IEC**

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

**About IEC publications**

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

**IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)**

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

**IEC online collection - [oc.iec.ch](http://oc.iec.ch)**

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

**IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)**

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

**Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

**IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)**

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

International Standards  
standards.iteh.ai  
Document Preview

[IEC 62153-4-15:2021](https://standards.iteh.ai/catalog/standards/iec/c8374e71-4b72-45c4-a3d0-19c68ec28741/iec-62153-4-15-2021)

<https://standards.iteh.ai/catalog/standards/iec/c8374e71-4b72-45c4-a3d0-19c68ec28741/iec-62153-4-15-2021>



IEC 62153-4-15

Edition 2.0 2021-08  
REDLINE VERSION

# INTERNATIONAL STANDARD



**Metallic communication 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**

Document Preview

[IEC 62153-4-15:2021](https://standards.iteh.ai/catalog/standards/iec/c8374e71-4b72-45c4-a3d0-19c68ec28741/iec-62153-4-15-2021)

<https://standards.iteh.ai/catalog/standards/iec/c8374e71-4b72-45c4-a3d0-19c68ec28741/iec-62153-4-15-2021>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 33.100.10; 33.120.10

ISBN 978-2-8322-5214-7

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

## 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 .....	13
5.4 Coupling attenuation .....	13
5.5 Tube-in-tube method .....	13
6 Test procedures .....	14
6.1 General.....	14
6.2 Triaxial cell .....	14
6.3 Cut-off frequencies, higher-order modes .....	14
6.4 Test equipment .....	14
6.5 Calibration procedure .....	16
6.6 Test leads and connecting cables to the DUT .....	17
7 Sample preparation .....	17
7.1 Coaxial connector or assembly or quasi-coaxial component .....	17
7.2 Balanced or multipin connectors or components.....	17
7.3 Cable assemblies.....	19
7.4 Other screened devices.....	19
8 Transfer impedance (short-matched).....	20
8.1 General.....	20
8.2 Principle block diagram of transfer impedance .....	20
8.3 Measuring procedure.....	20
8.4 Evaluation of test results .....	21
8.5 Test report .....	21
9 Screening attenuation .....	21
9.1 General.....	21
9.2 Impedance matching .....	21
9.3 Measuring with matched conditions .....	22
9.3.1 Procedure .....	22
9.3.2 Evaluation of test results .....	22
9.4 Measuring with mismatch .....	23
9.4.1 General .....	23
9.4.2 Evaluation of test results .....	23
9.5 Test report .....	24
10 Coupling attenuation.....	24
10.1 General.....	24
10.2 Procedure .....	24
10.2.1 Coupling attenuation with balun.....	24
10.2.2 Balunless coupling attenuation .....	25
10.3 Expression of results .....	25

10.4	Test report .....	25
<del>11 Coupling transfer function .....</del>		
Annex A	(informative) Principle of the triaxial test procedure .....	28
A.1	General .....	28
A.2	Transfer impedance .....	29
A.3	Screening attenuation .....	29
A.4	Coupling attenuation .....	30
Annex B	(informative) Triaxial cell .....	33
<del>Annex C (informative) Cut off frequencies, higher order modes .....</del>		
<del>Annex D (informative) Coupling transfer function .....</del>		
<del>Annex E (informative) Attenuation versus scattering parameter <math>S_{21}</math> .....</del>		
Annex C	(normative) Triaxial absorber cell .....	42
C.1	Cut-off frequencies, higher order modes .....	42
C.2	Absorber .....	43
C.3	Influence of absorber .....	45
Annex D	(informative) Application of a moveable shorting plane .....	46
D.1	Coupling transfer function .....	46
D.2	Effect of the measurement length on the measurement cut-off frequency .....	47
D.3	Details of the movable shorting plane .....	47
D.4	Measurement results .....	49
Annex E	(informative) Correction in the case that the receiver input impedance $R$ is higher than the characteristic impedance of the outer circuit $Z_2$ .....	52
E.1	Impedance $Z_2$ lower than the input impedance of the receiver .....	52
E.2	Correction .....	54
Annex F	(informative) Test adapter .....	55
Annex G	(informative) Attenuation versus scattering parameter $S_{21}$ .....	56
Bibliography	.....	58
Figure 1	– Definition of $Z_T$ .....	8
Figure 2	– Principle depiction of the triaxial <del>cell</del> 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 .....	12
Figure 4	– Rectangular waveguide .....	15
Figure 5	– Preparation of balanced or multipin connectors for transfer impedance and screening attenuation .....	18
Figure 6	– Preparation of balanced or multipin connectors for coupling attenuation measurement .....	19
Figure 7	– Test setup (principle) for transfer impedance measurement in accordance with test method B of IEC 62153-4-3 .....	20
Figure 8	– Principle test setup for balunless coupling attenuation measurement according to IEC 62153-4-9 .....	25
Figure A.1	– Principle test setup to measure transfer impedance and screening attenuation .....	28
Figure A.2	– Equivalent circuit of the principle of the test setup in Figure A.1 .....	29
Figure A.3	– Coupling attenuation, principle of test setup with balun and standard tube .....	31

Figure A.4 – Coupling attenuation, principle of setup with multiport VNA and standard head.....	31
Figure B.1 – Principle depiction of the triaxial cell to measure transfer impedance and screening attenuation <del>at HV-assemblies</del> on a connector with tube-in-tube according to IEC 62153-4-7 .....	33
Figure B.2 – Examples of different designs of triaxial cells.....	34
<del>Figure C.1 – Comparison of the measurements with tube and with triaxial cell of a RG 11 cable with single braid construction, linear scale.....</del>	<del>35</del>
<del>Figure C.2 – Comparison of the measurements with tube and with triaxial cell of a cable RG 11 with single braid construction, log scale.....</del>	<del>36</del>
<del>Figure D.1 – Measured coupling transfer function of a braided screen vs. frequency with the triaxial cell.....</del>	<del>37</del>
<del>Figure E.1 – Measurement with HP8753D of <math>S_{21}</math> of a 3dB attenuator.....</del>	<del>38</del>
<del>Figure E.2 – Measurement with ZVRE of <math>S_{21}</math> of a 3dB attenuator.....</del>	<del>39</del>
Figure C.1 – Cavity or rectangular waveguide.....	42
Figure C.2 – Comparison of the measurements of a RG 214 cable with 40 mm tube and triaxial cells.....	43
Figure C.3 – Principle of the triaxial cell with tube in tube and ferrite tiles as absorber .....	43
Figure C.4 – Comparison of the measurements of an RG 214 with 40 mm tube and triaxial cells with magnetic absorber .....	44
Figure C.5 – Examples of magnetic flat absorber.....	44
Figure C.6 – Setup for correction measurement.....	45
Figure C.7 – Correction measurement.....	45
Figure D.1 – Measured coupling transfer function of a braided screen versus frequency with the triaxial cell.....	46
Figure D.2 – Cross-section of triaxial cell with movable shorting plane .....	48
Figure D.3 – Crosscut of plane shortening housing and tube-in-tube .....	48
Figure D.4 – Detail H of Figure D.3: contact between plane and housing.....	49
Figure D.5 – Detail G of Figure D.3: contact between plane and tube-in-tube .....	49
Figure D.6 – Compilation of transfer impedance test results with different shorting plane distances .....	50
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 $\Omega$ .....	53
Figure E.2 – DUT with uniform cylindrical shape in the centre of the cell .....	54
Figure F.1 – Principle of the test setup to measure transfer impedance and screening or coupling attenuation of connectors .....	55
Figure F.2 – Principle of the test setup to measure transfer impedance and screening attenuation on a cable assembly .....	55
Figure G.1 – Measurement with HP8753D of $S_{21}$ of a 3 dB attenuator.....	56
Figure G.2 – Measurement with ZVRE of $S_{21}$ of a 3 dB attenuator .....	57
Table 1 – IEC 62153-4 series, Metallic communication cable test methods – Test procedures with triaxial test setup .....	10
<del>Table C.1 – Resonance frequencies of different triaxial cells.....</del>	<del>11</del>

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### **METALLIC ~~COMMUNICATION~~ 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.

**This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62153-4-15:2015. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.**

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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://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](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.**



## METALLIC ~~COMMUNICATION~~ 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 ~~(in accordance with the scope of IEC technical committee 46).~~

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 62153-4-15:2021](https://standards.iteh.ai/catalog/standards/iec/c8374e71-4b72-45c4-a3d0-19c68ec28741/iec-62153-4-15-2021)

<https://standards.iteh.ai/catalog/standards/iec/c8374e71-4b72-45c4-a3d0-19c68ec28741/iec-62153-4-15-2021>

IEC TS 62153-4-1:20132014, *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, 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 ~~communication~~ cables and other passive components – Test methods – Part 4-8: Electromagnetic compatibility (EMC) – Capacitive coupling admittance*

IEC 62153-4-9:20092018, *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) – ~~Shielded screening attenuation test method for measuring the screening effectiveness~~ Transfer impedance and screening attenuation of feed-throughs and electromagnetic gaskets – Double coaxial test method*

IEC ~~IS~~ 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 [ $\Omega$ ] (see Figure 1)

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

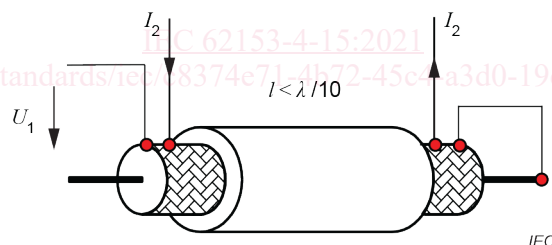


Figure 1 – Definition of  $Z_T$

$$Z_T = \frac{U_1}{I_2} \tag{1}$$

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

#### 3.3 effective transfer impedance

$Z_{TE}$

impedance defined as:

$$Z_{TE} = \max |Z_F \pm Z_T| \tag{3}$$

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

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

where

~~Env is the minimum envelope curve of the measured values in dB~~

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  $\Omega$  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

IEC 62153-4-15:2021

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

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

or electrically long, if

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

where

$L$  is the effective coupling length, in m;

$\lambda_0$  is the free space wavelength, in m;

$\varepsilon_{r1}$  is the resulting relative permittivity of the dielectric of the cable;

$\varepsilon_{r2}$  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.

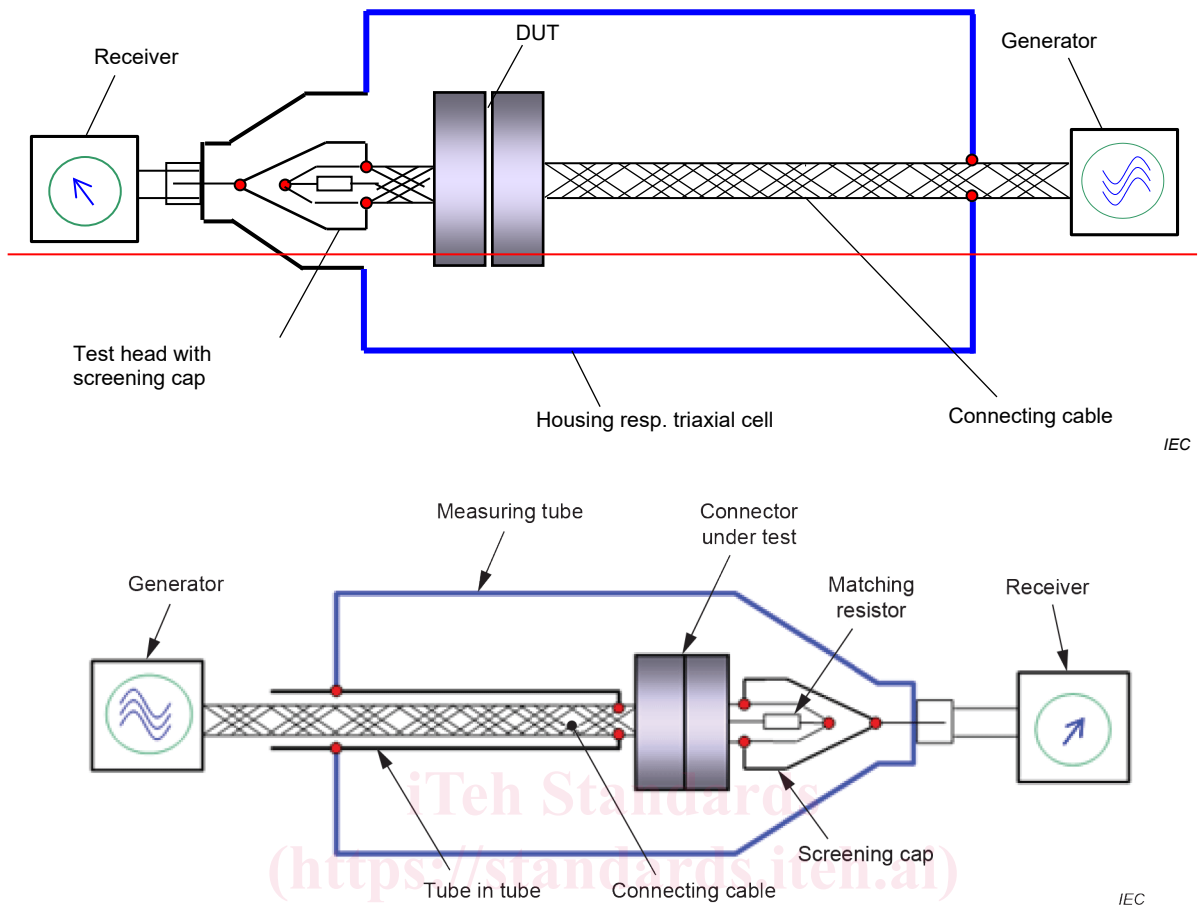
Table 1 gives an overview of the test procedures of the IEC 62153-4 series carried out with the triaxial test setup.

**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 <del>TS</del> 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

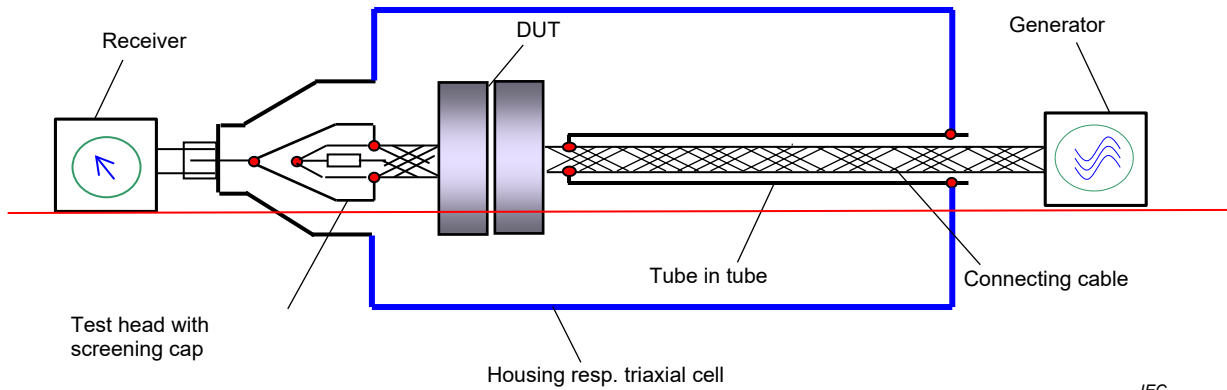
Larger connectors, cable assemblies, and components do not fit into the commercially available test rigs (tubes) of the triaxial test procedures of ~~IEC 62153-4-x series according to Table 1~~ IEC 62153-4-3, IEC 62153-4-4, and IEC 62153-4-7, respectively, which were designed originally to measure transfer 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 ~~components~~ devices, such as connectors, assemblies and components. The principles of the triaxial test procedures in accordance with ~~IEC 62153-4-x series~~ IEC 62153-4-3, IEC 62153-4-4 and IEC 62153-4-7 can be transferred to rectangular housings. Tubes and rectangular housings ~~can~~ may be operated in combination in one test setup (see Figure 2 and Figure 3).

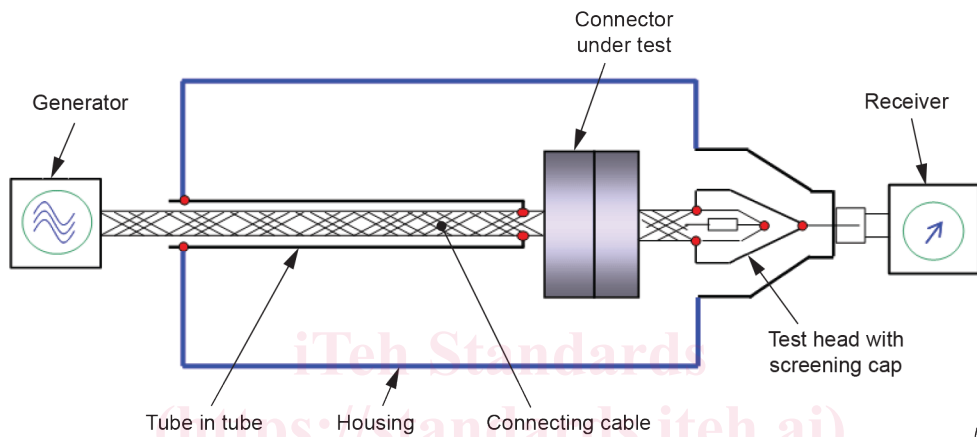


**Figure 2 – Principle depiction of the triaxial-cell test setup (tube) to measure transfer impedance and screening attenuation with tube in tube in accordance with IEC 62153-4-7**

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.



IEC



IEC

**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**

<https://standards.iteh.ai/catalog/standards/iec/c8374e71-4b72-45c4-a3d0-19c68ec28741/iec-62153-4-15-2021>

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.

## 5.2 Transfer impedance

The test determines the screening effectiveness of a shielded device by applying a well-defined current and voltage to the screen of the cable, the assembly or the device under test and measuring the induced voltage in the secondary circuit in order to determine the surface transfer impedance. This test measures only the galvanic and magnetic components of the transfer impedance. To measure the electrostatic component (the capacitance coupling impedance), the method described in IEC 62153-4-8 ~~should~~ shall be used.

The triaxial method for the measurement of the transfer impedance is in general suitable in the frequency range up to 30 MHz for a 1 m sample length and 100 MHz for a 0,3 m sample length, which corresponds to an electrical length less than 1/6 of the wavelength in the sample. A detailed description ~~could~~ can be found in Clause 9 of IEC TS 62153-4-1:2013 ~~2014~~ as well as in IEC 62153-4-3.