BS EN 60603-7-81:2016

BSI Standards Publication

Connectors for electronic equipment

Part 7-81: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 2 000 MHz

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National foreword

This British Standard is the UK implementation of EN 60603-7-81:2016. It is identical to IEC 60603-7-81:2015.

The UK participation in its preparation was entrusted to Technical Committee EPL/48, Electromechanical components and mechanical structures for electronic equipment.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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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 April 2016.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60603-7-81

April 2016

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English Version

Connectors for electronic equipment - Part 7-81: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 2 000 MHz (IEC 60603-7-81:2015)

Connecteurs pour équipements électroniques - Partie 7-81: Spécification particulière pour les fiches et les embases blindées à 8 voies pour la transmission de données à des fréquences jusqu'à 2 000 MHz (IEC 60603-7-81:2015)

Steckverbinder für elektronische Einrichtungen - Teil 7-81: Bauartspezifikation für geschirmte freie und feste Steckverbinder, 8polig, für Datenübertragungen bis 2 000 MHz (IEC 60603-7-81:2015)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 48B/2451/FDIS, future edition 1 of IEC 60603-7-81, prepared by SC 48B “Electrical connectors” of IEC/TC 48 “Electrical connectors and mechanical structures for electrical and electronic equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60603-7-81:2016.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2016-10-20
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2019-01-20

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Endorsement notice

The text of the International Standard IEC 60603-7-81:2015 was approved by CENELEC as a European Standard without any modification.

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

IEC 60603-7-2:2010	NOTE	Harmonized as EN 60603-7-2:2010 (not modified).
IEC 60603-7-3:2010	NOTE	Harmonized as EN 60603-7-3:2010 (not modified).
IEC 60603-7-4:2010	NOTE	Harmonized as EN 60603-7-4:2010 (not modified).
IEC 60603-7-41:2010	NOTE	Harmonized as EN 60603-7-41:2010 (not modified).
IEC 60603-7-51:2010	NOTE	Harmonized as EN 60603-7-51:2010 (not modified).
IEC 60603-7-7:2010	NOTE	Harmonized as EN 60603-7-7:2010 (not modified).
IEC 60603-71:2010	NOTE	Harmonized as EN 60603-71:2010 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When 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

Publication	Year	Title	EN/HD	Year
IEC 60512-2-1	-	Connectors for electronic equipment - Tests and measurements - Part 2-1: Electrical continuity and contact resistance tests - Test 2a: Contact resistance - Millivolt level method	EN 60512-2-1	-
IEC 60512-25-9	-	Connectors for electronic equipment - Tests and measurements - Part 25-9: Signal integrity tests - Test 25i: Alien crosstalk	EN 60512-25-9	-
IEC 60512-26-100	-	Connectors for electronic equipment - Tests and measurements - Part 26-100: Measurement setup, test and reference arrangements and measurements for connectors according to IEC 60603-7 - Tests 26a to 26g	EN 60512-26-100	-
IEC 60512-28-100	-	Connectors for electronic equipment - Tests and measurements - Part 28-100: Signal integrity tests up to 1 000 MHz on IEC 60603-7 and IEC 61076-3 series connectors - Tests 28a to 28g	EN 60512-28-100	-
IEC 60603-7	2008	Connectors for electronic equipment - Part 7: Detail specification for 8-way, unshielded, free and fixed connectors	EN 60603-7	2009
IEC 60603-7-1	2011	Connectors for electronic equipment - Part 7-1: Detail specification for 8-way, shielded, free and fixed connectors	EN 60603-7-1	2011
IEC 61156	Series	Multicore and symmetrical pair/quad cables for digital communications	-	-
IEC 62153-4-15	2015	Metallic communication cable test methods - Part 4-15: Electromagnetic compatibility (EMC) - Test method for measuring transfer impedance and screening attenuation - or coupling attenuation with triaxial cell	-	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CONNECTORS FOR ELECTRONIC EQUIPMENT –

Part 7-81: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 2 000 MHz

FOREWORD

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International Standard IEC 60603-7-81 has been prepared by subcommittee 48B: Electrical connectors, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

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

FDIS	Report on voting
48B/2451/FDIS	48B/2464/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.

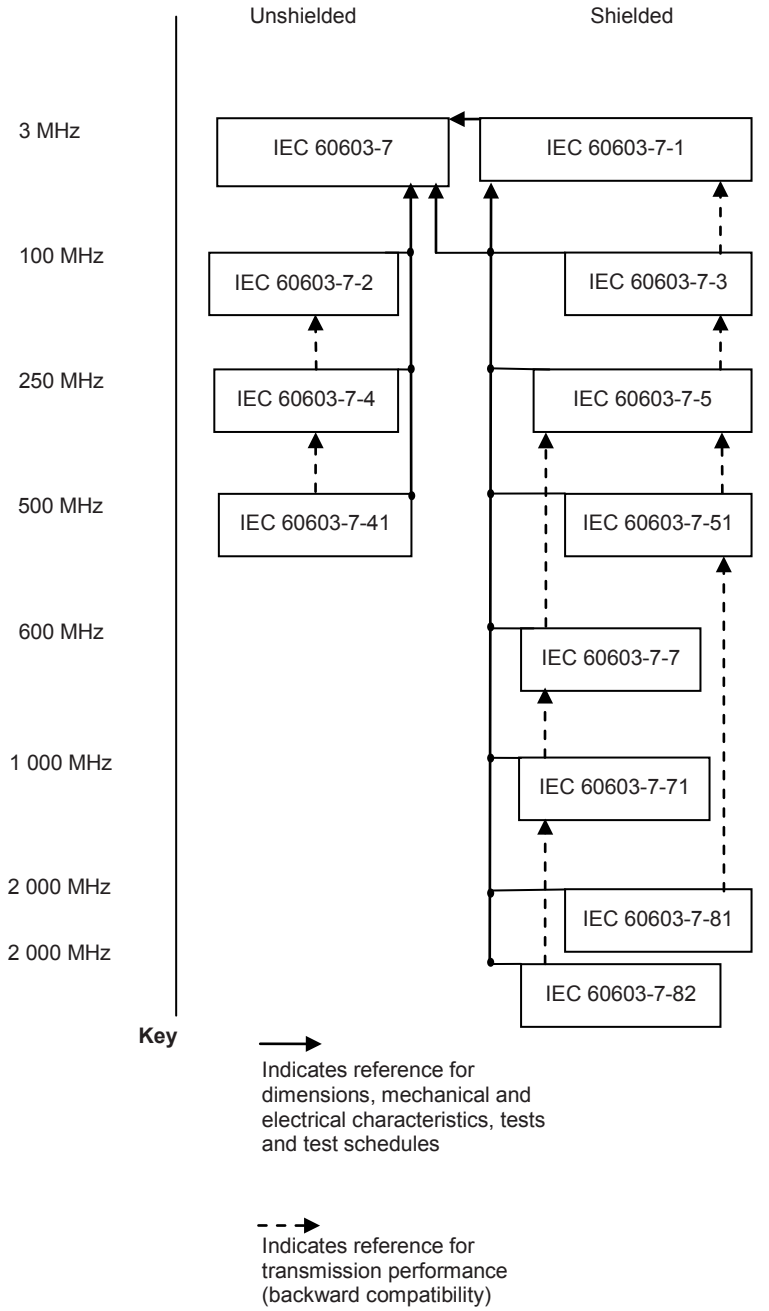
A list of all parts in the IEC 60603 series, published under the general title *Connectors for electronic equipment*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

INTRODUCTION

IEC 60603-7 is the base specification of the whole series. Subsequent specifications do not duplicate information given in the base document, but list only additional requirements. For complete specification regarding a component of a higher number document all lower numbered documents shall be considered as well. The following diagram shows the interrelation of the documents:



The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning transmission characteristics given in 6.2.

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ISO (www.iso.org/patents) and IEC (http://patents.iec.ch) maintain on-line data bases of patents relevant to their standards. Users are encouraged to consult the data bases for the most up to date information concerning patents.

CONNECTORS FOR ELECTRONIC EQUIPMENT –

Part 7-81: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 2 000 MHz

1 Scope

This part of IEC 60603 covers 8-way, shielded, free and fixed connectors, references dimensional, mechanical, electrical and environmental characteristics and tests in IEC 60603-7, and specifies electrical transmission requirements, including power sum alien (exogenous) crosstalk, for frequencies up to 2 000 MHz.

These connectors are typically used as “category 8.1” connectors in “class I” cabling systems specified in ISO/IEC 11801.

These connectors are intermateable and interoperable with other IEC 60603-7 series connectors as defined in Clause 2 of IEC 60603-7.

These connectors are backward compatible with other IEC 60603-7 series connectors, except IEC 60603-7-7 and IEC 60603-7-71 connectors.

NOTE Transmission performance categories: in this IEC standard, the term “category”, when used in reference to transmission performance, refers to those categories defined by ISO/IEC 11801.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60512-2-1, *Connectors for electronic equipment – Tests and measurements – Part 2-1: Electrical continuity and contact resistance tests – Test 2a: Contact resistance – Millivolt level method*

IEC 60512-25-9, *Connectors for electronic equipment – Tests and measurements – Part 25-9: Signal integrity tests – Test 25i: Alien crosstalk*

IEC 60512-26-100, *Connectors for electronic equipment – Tests and measurements – Part 26-100: Measurement setup, test and reference arrangements and measurements for connectors according to IEC 60603-7 – Tests 26a to 26g*

IEC 60512-28-100: (2nd edition under consideration) *Connectors for electronic equipment – Tests and measurements – Part 28-100: Signal integrity tests up to 2 000 MHz on IEC 60603-7 and IEC 61076-3 series connectors –Tests 28a to 28g*

IEC 60603-7:2008, *Connectors for electronic equipment – Part 7: Detail specification for 8-way, unshielded, free and fixed connectors*

IEC 60603-7-1:2011, *Connectors for electronic equipment – Part 7-1: Detail specification for 8-way, shielded, free and fixed connectors*

IEC 61156 (all parts), *Multicore and symmetrical pair/quad cables for digital communications*

IEC 62153-4-15: *Metallic communication cable test methods – Part 4-15: Electromagnetic compatibility (EMC) – Test method for measuring transfer impedance and screening attenuation or coupling attenuation with triaxial cell*[1]

3 Terms and definitions

For the purposes of this document, the terms and definitions of Clause 2 of IEC 60603-7, apply as well as the following.

3.1
backward compatibility
a set of requirements ensuring that a free or fixed connector which is in compliance with this standard, mated with a fixed or free connector in compliance with any lower frequency IEC 60603-7 series connector, fully complies with the requirements of the lower frequency IEC 60603-7 series connector, except 60603-7-7 and 60603-7-71

Note 1 to entry: The complete specification of the categories and the backward compatibility system for the IEC 60603-7 series connectors, when used in standard ISO/IEC 11801-1 balanced cabling systems, is specified in referenced ISO/IEC 11801-1.

See Clause 3 of IEC 60603-7-1:2011 for dimensions, views and requirements.

4 Cable terminations and internal connections – Fixed and free connectors

See Clause 4 of IEC 60603-7-1:2011 for cable termination and internal connections types.

5 Gauge

The gauge as defined by Clause 5 of IEC 60603-7-1:2011 shall apply.

6 Characteristics

6.1 General

6.1.1 Overview

Connectors according to this standard shall meet all relevant requirements specified by IEC 60603-7-1.

6.1.2 Pin and pair grouping assignment

The pin and pair grouping assignment of Figure 9 of 6.2 of IEC 60603-7:2008 applies.

6.1.3 Classification into climatic category

Connectors according to this standard are classified in the same climatic categories as defined by IEC 60603-7.

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1 To be published.

6.2 Electrical characteristics

6.2.1 General

Connectors according to this standard shall meet the electrical characteristics specified by IEC 60603-7-1.

In the following clauses/subclauses, f is the frequency expressed in MHz.

6.2.2 Transfer impedance

In addition to 6.2.1, the transfer impedance of connectors conforming to this standard shall meet the following requirements.

Conditions:

When tested according to IEC 60512-26-100, Test 26e, mated connectors, terminated with each cable type (e.g. F/UTP, S/FTP) intended to be used for these connectors shall not show higher magnitude of transfer impedance as given by formula:

All types: $\leq 0{,}05 f^{0{,}3}\ \Omega$ from 1 MHz to 10 MHz

$\leq 0{,}01 f\ \Omega$ from 10 MHz to 80 MHz.

6.3 Transmission characteristics

6.3.1 General

Compliance to this standard in respect to transmission characteristics, is determined according to specific test methods described in test group EP, see Table 1. The interoperability of connectors compliant to this standard shall be demonstrated by testing the fixed connectors with the full range of free connectors according to IEC 60512-28-100.

Compliance to this standard in respect to the alien (exogenous) crosstalk is determined according to specific test methods described in IEC 60512-25-9.

All transmission performance requirements apply between the reference planes specified in 2nd edition of IEC 60512-28-100.

NOTE At the date of issue of this standard, the test method was under consideration. 1st edition of IEC 60512-28-100 will be updated to 2 000 MHz as 2nd edition.

6.3.2 Insertion loss

Conditions:

IEC 60512, test 28a.

Mated connectors.

All pairs: $\leq 0{,}02\sqrt{f}$ dB, from 1 MHz to 500 MHz.

All pairs: $\leq 0{,}00649\sqrt{f} + 0{,}000605 f$ dB, from 500 MHz to 2 000 MH.

Whenever the formula results in a value less than 0,1 dB, the requirement shall revert to 0,1 dB.

6.3.3 Return loss

Conditions.

IEC 60512, test 28 b.

Mated connectors.

All pairs: ≥ 72-20 log (*f*) dB from 1 MHz to 2 000 MHz.

Whenever the formula results in a value greater than 30 dB, the requirement shall revert to 30 dB.

Whenever the formula results in a value less than 12 dB, the requirement shall revert to 12 dB.

6.3.4 Propagation delay

All pairs: ≤ 2,5 ns.

The propagation delay test does not need to be performed, since it is assumed that connectors comply by design.

6.3.5 Delay skew

All pair combinations: ≤ 1,25 ns.

This characteristic is calculated from the individual propagation delay measurements and, as with propagation delay (6.3.4), it is assumed that connectors comply by design.

6.3.6 NEXT loss

Conditions.

IEC 60512, test 28c.

Mated connectors.

All pair combinations: ≥ 94-20 log (*f*) dB from 1 MHz to 250 MHz.

(unless limits are specified by IEC 60512-28-100 ED 2)

All pair combinations: ≥ 46,04 -30 log(*f/250*) dB from 250 MHz to 500 MHz.

(unless limits are specified by IEC 60512-28-100 ED 2)

All pair combinations: ≥ 37,0-40 log(*f/500)* dB from 500 MHz to 2 000 MHz.

(unless limits are specified by IEC 60512-28-100 ED 2)

Whenever the formula results in a value greater than 80 dB, the requirement shall revert to 80 dB.

6.3.7 Power sum NEXT loss

This characteristic is given for information only.

Conditions:

Mated connectors.

$$PS\ \ NEXT_k = -10\log \sum_{i=1, i\neq k}^{n} 10^{\frac{-NEXT_{ik}}{10}}$$

All pairs: ≥ 90-2 log (*f*) dB from 1 MHz to 250 MHz.

All pairs: ≥ 42,04-30 log (*f/250*) dB from 250 MHz to 500 MHz.

All pairs: ≥ 33,0-40 log (*f/500*) dB from 500 MHz to 2 000 MHz.

This characteristic is calculated from the individual FEXT loss measurements and connector compliance is achieved by compliance to the FEXT loss requirements (6.3.8).

6.3.8 FEXT Loss

Conditions:

IEC 60512, test 28 d.

Mated connectors.

All pair combinations: ≥ 83,1-20 log (*f*) dB from 1 MHz to 2 000 MHz.

Whenever the formula results in a value greater than 80 dB, the requirement shall revert to 80 dB.

6.3.9 Power sum FEXT loss

This characteristic is given for information only.

Conditions:

Mated connectors.

$$PS\quad FEXT_k = -10\log\sum_{i=1,i\neq k}^{n} 10^{\frac{-FEXT_{ik}}{10}}$$

All pairs: ≥ 80,1-20 log (*f*) dB from 1 MHz to 2 000 MHz.

This characteristic is calculated from the individual FEXT loss measurements and connector compliance is achieved by compliance to the FEXT loss requirements (6.3.8).

6.3.10 Transverse conversion loss

Conditions:

IEC 60512, test 28 f.

Mated connectors

All pairs: ≥ 74-20 log (*f*) dB from 1 MHz to 2 000 MHz.

Whenever the formula results in a value greater than 40 dB, the requirement shall revert to 40 dB.

6.3.11 Transverse conversion transfer loss

Conditions:

IEC 60512, test 28 g.

Mated connectors.

All pairs: ≥ 78-20 log (*f*) dB from 1 MHz to 2 000 MHz.

Whenever the formula results in a value greater than 40 dB, the requirement shall revert to 40 dB.

6.3.12 Coupling attenuation

Conditions:

IEC 62153-4-15 for coupling attenuation with triaxial cell.

Mated connectors, terminated with each cable construction type intended to be allowed for these connectors.

All types: ≥ 85–20log (*f*/100) dB, from 30 MHz to 2 000 MHz.

Whenever the formula results in a value greater than 85 dB, the requirement shall revert to 85 dB.

The coupling attenuation requirement is assumed to be fulfilled when the transfer impedance and unbalance attenuation (transverse conversion loss and transverse conversion transfer loss) requirements are met on the full bandwidth.

6.3.13 Power sum alien (exogenous) NEXT

Conditions:

IEC 60512, test 25i.

Mated connectors.

$$PS\quad ANEXT_k = -10\log\left[\sum_{j=1}^{N}\ \sum_{i=1}^{4} 10^{\frac{-ANEXT_{kij}}{10}}\right]$$

All pairs: ≥ 135,5-20log(*f*) dB from 1 MHz to 2 000 MHz.

Whenever the formula results in a value greater than 84 dB, the requirement shall revert to 84 dB.

The coupling attenuation requirement is assumed to be fulfilled when the transfer impedance and unbalance attenuation (transverse conversion loss and transverse conversion transfer loss) requirements are met on the full bandwidth.

6.3.14 Power sum alien (exogenous) FEXT

Conditions:

IEC 60512, test 25i.

Mated connectors.

$$PS\quad AFEXT_k = -10\log\left[\sum_{j=1}^{N}\ \sum_{i=1}^{4} 10^{\frac{-AFEXT_{kij}}{10}}\right]$$

All pairs: ≥ 131-20log(*f*) dB from 1 MHz to 2 000 MHz.

Whenever the formula results in a value greater than 84 dB, the requirement shall revert to 84 dB.

The PS AFEXT requirements are fulfilled when the coupling attenuation is verified and it is 10 dB better than the PS ANEXT and the PS AACR-F minimum requirements.

6.3.15 Mechanical

Connectors according to this standard shall conform to the mechanical characteristics specified by IEC 60603-7-1.

6.3.16 Pin assignment

The pin and pair grouping assignment of Figure 9 of 6.2 of IEC 60603-7:2008 applies.

7 Tests and test schedule

7.1 General

See 7.1 of IEC 60603-7:2008, and the introduction to this standard.

7.2 Arrangement for contact resistance test

See also 7.2 of IEC 60603-7:2008.

7.3 Arrangement for vibration test

See also 7.3 of IEC 60603-7:2008.

7.4 Test procedures and measuring methods

See 7.4 of IEC 60603-7:2008.

7.5 Preconditioning

See 7.5 of IEC 60603-7:2008.

7.6 Wiring and mounting of specimens

7.6.1 Wiring

Wiring of these connectors shall take into account the wire and cable diameter of the cables defined in the IEC 61156 series as given in the manufacturer's specification.

7.6.2 Mounting

Shall be in accordance with 7.6.2 of IEC 60603-7:2008.

8 Test schedules

8.1 General

The test conditions required shall not be less than those listed in Clause 6.

8.2 Basic (minimum) test schedule

Not applicable.

8.3 Full test schedule

8.3.1 General

In addition to the test schedule of IEC 60603-7-1, one further group of two sets of mated connectors is required for group EP, which is shown in Table 1. The free connectors for group EP shall additionally meet the requirements of IEC 60512-28-100 and IEC 60512-25-9.

Additional sets of connectors are required for the alien (exogenous) NEXT and FEXT (EP10 and EP11) measurements according to IEC 60512-25-9.

8.3.2 Test group P preliminary

All the test group specimens shall be subjected to the preliminary group P of IEC 60603-7 and the preliminary group P of IEC 60603-7-1.

8.3.3 Test group AP

See 7.7.2.3 of IEC 60603-7:2008 and 7.7.2.3 of IEC 60603-7-1:2011.

8.3.4 Test group BP

See 7.7.2.4 of IEC 60603-7:2008 and 7.7.2.4 of IEC 60603-7-1:2011.

8.3.5 Test group CP

See 7.7.2.5 of IEC 60603-7:2008 and 7.7.2.5 of IEC 60603-7-1:2011.

8.3.6 Test group DP

See 7.7.2.6 of IEC 60603-7:2008 and 7.7.2.6 of IEC 60603-7-1:2011.

8.3.7 Test group EP

Table 1 – Test Group EP

	Test			Measurement to be performed		
	Title	**IEC 60512 Test No.**	**Severity or condition of test**	**Title**	**IEC 60512 Test No.**	**Requirements**
EP1			All pairs, one direction	Insertion loss	Test 28a	Per 6.3.2
EP2			All pairs, both directions, (pair to pair)	NEXT loss	Test 28c	Per 6.3.6
EP3			All pairs, both directions	Return loss	Test 28b	Per 6.3.3
EP4			All pairs, both directions, (pair to pair)	FEXT loss	Test 28d	Per 6.3.8
EP5			All pairs, both directions	TCL	Test 28f	Per 6.3.10
EP6			All pairs, both directions	TCTL	Test 28g	Per 6.3.11
EP7	Input to output resistance		Measurement points as defined in 6.4.5 of IEC 60603-7:2008 All input/output connector paths	Millivolt level method	Test 2a	6.4.5 of IEC 60603-7:2008
EP8	Resistance unbalance		Measurement points as defined in 6.4.6 of IEC 60603-7:2008 All input/output connector path combinations	Millivolt level method	Test 2a	6.4.6 of IEC 60603-7:2008
EP9			All pairs, both directions	PS ANEXT	Test 25i	Per 6.3.13
EP10			All pairs, both directions	PS AFEXT	Test 25i	Per 6.3.14
EP11			All pairs	Transfer Impedance	Test 26e	Per 6.2.2

8.3.8 Test group FP

See 7.7.2.8 of IEC 60603-7:2008.

8.3.9 Test group GP

See 7.7.2.9 of IEC 60603-7-1:2011.

Bibliography

IEC 60603-7-2:2010, *Connectors for electronic equipment – Part 7-2: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 100 MHz*

IEC 60603-7-3:2010, *Connectors for electronic equipment – Part 7-3: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 100 MHz*

IEC 60603-7-4:2010, *Connectors for electronic equipment – Part 7-4: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

IEC 60603-7-41:2010, *Connectors for electronic equipment – Part 7-41: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz*

IEC 60603-7-51:2010, *Connectors for electronic equipment – Part 7-51: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz*

IEC 60603-7-7:2010, *Connectors for electronic equipment – Part 7-7: Detail specification for 8-way, shielded, free and fixed connectors for data transmission with frequencies up to 600 MHz*

IEC 60603-7-71:2010, *Connectors for electronic equipment – Part 7-71: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 1 000 MHz*

IEC 62153-4-12, *Metallic communication cable test methods – Part 4-12: Electromagnetic Compatibility (EMC) – Coupling attenuation or screening attenuation of connecting hardware – Absorbing clamp method*

NOTE The above document is defined up to 1 GHz. IEC TC46/WG5 is requested to revise it to 2 GHz.

ISO/IEC TR 11801-9901, *Information technology – Generic cabling for customer premises – Part 9901: Guidance for balanced cabling in support of at least 40 Gbit/s data transmission*

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