This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

Edition 1.0 2014-10

TECHNICAL REPORT

colour inside

Information technology – Generic cabling for customer premises – Part 9901: Guidance for balanced cabling in support of at least 40 Gbit/s data transmission

ISO/IEC TR 11801-9901:2014-10(en)

This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 ISO/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 ISO/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 Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

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 It also gives information on projects, replaced and withdrawn publications.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 Just Published - webstore.iec.ch/justpublished

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

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - 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: csc@iec.ch.

This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

Edition 1.0 2014-10

TECHNICAL REPORT

colour inside

Information technology – Generic cabling for customer premises – Part 9901: Guidance for balanced cabling in support of at least 40 Gbit/s data transmission

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE F

ICS 35.200

ISBN 978-2-8322-1858-7

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

This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

CONTENTS

FOREWORD 6
INTRODUCTION 8
1 Scope 9
2 Normative references 9
3 Terms, definitions and abbreviations 10
3.1 Terms and definitions 10
3.2 Abbreviations 10
4 Channel requirements using components with enhanced performance and extended frequency 11
4.1 General 11
4.2 Return loss 11
4.3 Insertion loss 13
4.4 Near-end crosstalk loss (NEXT) 14
4.4.1 Pair-to-pair NEXT 14
4.4.2 Power sum NEXT (PS NEXT) 15
4.5 Attenuation to crosstalk loss ratio near-end (ACR-N) 16
4.5.1 Pair-to-pair ACR-N 16
4.5.2 Power sum ACR-N (PS ACR-N) 16
4.6 Attenuation to crosstalk ratio far-end (ACR-F) 16
4.6.1 Pair-to-pair ACR-F 16
4.6.2 Power sum ACR-F (PS ACR-F) 17
4.7 Alien (Exogenous) crosstalk 18
4.7.1 PS ANEXT 18
4.7.2 PS AACR-F 19
4.8 DC loop resistance 20
4.9 Propagation delay 20
4.10 Delay skew 21
4.11 Unbalance attenuation near end (TCL), far end (ELTCTL) and coupling attenuation 21
4.11.1 General 21
4.11.2 Unbalance attenuation, near end 21
4.11.3 Unbalance attenuation far end (ELTCTL) 22
4.11.4 Coupling attenuation 23
5 Channel requirements for Category 6_A and Category 7_A components 23
5.1 General 23
5.2 Return loss 23
5.3 Insertion loss 24
5.4 Near-end crosstalk loss (NEXT) 25
5.4.1 Pair-to-pair NEXT 25
5.4.2 Power sum NEXT (PS NEXT) 26
5.5 Attenuation to crosstalk loss ratio near-end (ACR-N) 27
5.5.1 Pair-to-pair ACR-N 27
5.5.2 Power sum ACR-N (PS ACR-N) 27
5.6 Attenuation to crosstalk loss ratio far-end (ACR-F) 27
5.6.1 Pair-to-pair ACR-F 27
5.6.2 Power sum ACR-F (PS ACR-F) 28
5.7 Alien (Exogenous) crosstalk 29

This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

5.8 DC loop resistance 29
5.9 Propagation delay 29
5.10 Delay skew 30
5.11 Transverse conversion loss (TCL) 30
5.12 Equal level transverse conversion loss (ELTCTL) 30
5.13 Coupling attenuation 30
Annex A (informative) Assessment of cabling capacity for 40 Gbit/s 31
A.1 Overview 31
A.2 Channels Class I and Class II (Clause 4) 32
A.2.1 General 32
A.2.2 Results 32
A.2.3 Case 1 33
A.2.4 Case 2 36
A.2.5 Case 3: alien crosstalk included 38
A.3 Channel requirement for Category 6_A and Category 7_A components (Clause 5) 42
A.3.1 Category 6_A Case 2 42
A.3.2 Category 7_A Case 2 43
A.4 Characterisation of channels using standardised components with extended frequency (Annex B) 44
A.4.1 General 44
A.4.2 CHε using the same cancellation as in A.2.4.2 44
A.4.3 CHγ using the same cancellation as in A.2.4.3 44
A.5 Excerpt of definitions and formulae used in this annex 45
A.5.1 Shannon capacity 45
A.5.2 Margin 45
A.5.3 Transmit power 45
A.5.4 Cancellation 45
A.5.5 Background noise 45
A.5.6 Bandwidth 45
A.5.7 Electronic noise 45
A.5.8 Cabling noise 46
A.5.9 Signal 46
A.5.10 Noise 46
Annex B (informative) Characterisation of a channel using standardised components with extended frequency 47
B.1 General 47
B.2 Return loss 47
B.3 Insertion loss 48
B.4 Near-end crosstalk loss (NEXT) 48
B.4.1 Pair-to-pair NEXT 48
B.4.2 Power sum NEXT (PS NEXT) 49
B.5 Attenuation to crosstalk loss ratio near-end (ACR-N) 50
B.5.1 Pair-to-pair ACR-N 50
B.5.2 Power sum ACR-N (PS ACR-N) 50
B.6 Attenuation to crosstalk ratio far-end (ACR-F) 51
B.6.1 Pair-to-pair ACR-F 51
B.6.2 Power sum ACR-F (PS ACR-F) 51
B.7 Alien (Exogenous) crosstalk 52

This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

B.7.1 PS ANEXT 52
B.7.2 PS AACR-F 53
B.8 DC loop resistance 54
B.9 Propagation delay 54
B.10 Delay skew 55
B.11 Transverse conversion loss (TCL) 55
B.12 Unbalance attenuation far end (ELTCTL) 56
B.13 Coupling attenuation 56

Figure A.1 – Channel Shannon capacity and margin for Class I 34
Figure A.2 – Channel Shannon capacity and margin for Class II 35
Figure A.3 – Channel Shannon capacity and margin for Class I 37
Figure A.4 – Channel Shannon capacity and margin for Class II 38
Figure A.5 – Influence of the PS AACR-F reference length on noise level on a 30 m channel 39
Figure A.6 – Influence of the PS AACR-F reference length on noise level on a 3 m channel 40
Figure A.7 – Influence of PS AACR-F on Shannon capacity and margin 41
Figure A.8 – Channel Shannon capacity and margin for Category 6_A 42
Figure A.9 – Channel Shannon capacity and margin for Category 7_A 43

Table 1 – Formulae for return loss limits for a channel 11
Table 2 – Return loss limits for a channel at key frequencies 12
Table 3 – Formulae for insertion loss limits for a channel 13
Table 4 – Insertion loss limits for a channel at key frequencies 14
Table 5 – Formulae for pair-to-pair NEXT limits for a channel 14
Table 6 – Pair-to-pair NEXT limits for a channel at key frequencies 15
Table 7 – Formulae for PS NEXT limits for a channel 15
Table 8 – PS NEXT limits for a channel at key frequencies 16
Table 9 – Formulae for ACR-F limits for a channel 17
Table 10 – ACR-F limits for a channel at key frequencies 17
Table 11 – Formulae for PS ACR-F limits for a channel 18
Table 12 – PS ACR-F limits for a channel at key frequencies 18
Table 13 – Formulae for PS ANEXT limits for a channel 19
Table 14 – PS ANEXT limits for a channel at key frequencies 19
Table 15 – Formulae for PS AACR-F limits for a channel 19
Table 16 – PS AACR-F limits for a channel at key frequencies 20
Table 17 – Formulae for propagation delay limits for a 30 m channel 20
Table 18 – Propagation delay limits for a channel at key frequencies 20
Table 19 – Delay skew limits for a 30 m channel 21
Table 20 – TCL for a channel 21
Table 21 – TCL limits for a channel at key frequencies 22
Table 22 – ELTCTL for a channel 22
Table 23 – ELTCTL limits for a channel at key frequencies 22
Table 24 – Coupling attenuation for a channel 23

This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

Table 25 – Coupling attenuation limits for a channel at key frequencies 23
Table 26 – Formulae for return loss limits for a channel 24
Table 27 – Return loss limits for a channel at key frequencies 24
Table 28 – Formulae for insertion loss limits for a channel 24
Table 29 – Insertion loss limits for a channel at key frequencies 25
Table 30 – Formulae for NEXT limits for a channel 25
Table 31 – NEXT limits for a channel at key frequencies 25
Table 32 – Formulae for PS NEXT limits for a channel 26
Table 33 – PS NEXT limits for a channel at key frequencies 26
Table 34 – Formulae for ACR-F limits for a channel 27
Table 35 – ACR-F limits for a channel at key frequencies 28
Table 36 – Formulae for PS ACR-F limits for a channel 28
Table 37 – PS ACR-F limits for a channel at key frequencies 29
Table 38 – Formulae for propagation delay limits for a channel 29
Table 39 – Propagation delay limits for a channel at key frequencies 29
Table 40 – Delay skew limits for a channel 30
Table A.1 – Cancellation levels at 30 m channel length, Case 1: Fixed cancellation values 32
Table A.2 – Cancellation levels at 30 m channel length Case 2: cabling noise cancelled below background noise 32
Table B.1 – Formulae for return loss limits for a channel 47
Table B.2 – Return loss limits for a channel at key frequencies 47
Table B.3 – Formulae for insertion loss limits for a channel 48
Table B.4 – Insertion loss limits for a channel at key frequencies 48
Table B.5 – Formulae for pair-to-pair NEXT limits for a channel 49
Table B.6 – Pair-to-pair NEXT limits for a channel at key frequencies (informative) 49
Table B.7 – Formulae for PS NEXT limits for a channel 50
Table B.8 – PS NEXT limits for a channel at key frequencies 50
Table B.9 – Formulae for ACR-F limits for a channel 51
Table B.10 – ACR-F limits for a channel at key frequencies 51
Table B.11 – Formulae for PS ACR-F limits for a channel 52
Table B.12 – PS ACR-F limits for a channel at key frequencies 52
Table B.13 – Formulae for PS ANEXT limits for a channel 53
Table B.14 – PS ANEXT limits for a channel at key frequencies 53
Table B.15 – Formulae for PS AACR-F limits for a channel 53
Table B.16 – PS AACR-F limits for a channel at key frequencies 54
Table B.17 – Formulae for propagation delay limits for a 30 m channel 54
Table B.18 – Propagation delay limits for a channel at key frequencies 54
Table B.19 – Delay skew limits for a 30 m channel 55
Table B.20 – Formulae for TCL limits for an unscreened channel 55
Table B.21 – TCL limits for an unscreened channel at key frequencies 55
Table B.22 – ELTCTL for channel for an unscreened channel 56
Table B.23 – Formulae for coupling attenuation limits for a screened channel 56
Table B.24 – Coupling attenuation limits for a screened channel at key frequencies 56

This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

INFORMATION TECHNOLOGY – GENERIC CABLING FOR CUSTOMER PREMISES –

Part 9901: Guidance for balanced cabling in support of at least 40 Gbit/s data transmission

FOREWORD

1) ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

2) The formal decisions or agreements of IEC and ISO 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 and ISO member bodies.

3) IEC, ISO and ISO/IEC publications have the form of recommendations for international use and are accepted by IEC National Committees and ISO member bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC, ISO and ISO/IEC publications is accurate, IEC or ISO 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 and ISO member bodies undertake to apply IEC, ISO and ISO/IEC publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any ISO, IEC or ISO/IEC publication and the corresponding national or regional publication should be clearly indicated in the latter.

5) ISO and IEC do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. ISO or IEC are 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 ISO or its directors, employees, servants or agents including individual experts and members of their technical committees and IEC National Committees or ISO member bodies 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 of, use of, or reliance upon, this ISO/IEC publication or any other IEC, ISO or ISO/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 ISO/IEC publication may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

ISO/IEC TR 11801-9901, which is a technical report, has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 11801 series, under the general title *Information technology – Generic cabling for customer premises*, can be found on the IEC web site.

This Technical Report has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

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

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 publication using a colour printer.

This is a preview of "ISO/IEC TR 11801-990...". Click here to purchase the full version from the ANSI store.

INTRODUCTION

This Technical Report provides guidance for balanced cabling in support of at least 40 Gbit/s data transmission. The guidance proposes of two new channel specifications, namely Class I and Class II, with two connections able to support future 40GBASE-T up to at least 30 m.

In addition, this Technical Report contains the description of channels with two connections based on existing Category 6_A and Category 7_A components with and without characterization beyond the current upper frequency and length up to at least 30 m.

In order to evaluate the different channel approaches this Technical Report offers a preliminary assessment of Shannon capacity and reach using the channel transmission performance data described in this report. This assessment is not a definition of 40GBASE-T.