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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

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FOREWORD

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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 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.

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.

INFORMATION TECHNOLOGY – GENERIC CABLING FOR CUSTOMER PREMISES –

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

1 Scope

This part of ISO/IEC 11801 covers the following channel descriptions constructed from components with a nominal impedance of 100 Ω.

a) Class I: 30 m channel based on upcoming Category 8.1 components. This channel provides increased margin compared to ISO/IEC 11801, Class E_A channels, and an upper frequency limit of 1 600 MHz (2 000 MHz (ffs) (see Clause 4).

b) Class II: 30 m channel based on upcoming Category 8.2 components. This channel provides increased margin compared to ISO/IEC 11801, Class F_A channels, and an upper frequency limit of 1 600 MHz (2 000 MHz ffs) (see Clause 4).

c) Channels based on Category 6_A components of ISO/IEC 11801, length corrected to 30 m (Clause 5).

d) Channels based on Category 7_A components of ISO/IEC 11801, length corrected to 30 m (Clause 5).

e) Channels based on Category 6_A components of ISO/IEC 11801, length corrected to 30 m, characterized beyond the current upper frequency (see Annex B).

f) Channels based on Category 7_A components of ISO/IEC 11801, length corrected to 30 m, characterized beyond the current upper frequency (see Annex B).

This Technical Report offers an assessment (see Annex A) of expected capacity and reach for the channels defined in Clause 4, Clause 5 and Annex B.

All 30 m channels comprise a 2 m cord (50 % derated) attached at each end of a permanent link of 26 m length. These assumptions are for modelling only.

ISO/IEC 11801 gives the freedom to use different configurations as long as the channel values are fulfilled.

Specific component requirements are not addressed in this Technical Report. Any inferred component requirements are not intended to be normative.

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.

ISO/IEC 11801:2002, *Information technology – Generic cabling for customer premises*
Amendment 1:2008
Amendment 2:2010[1]

IEC TR 61156-1-3, *Multicore and symmetrical pair/quad cables for digital communications – Part 1-3: Electrical transmission parameters for modelling cable assemblies using symmetrical pair/quad cables*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document the terms and definitions of ISO/IEC 11801 and the following apply.

3.1.1
background noise
noise calculated from electronic background noise from transmit power and the maximum considered frequency

Note 1 to entry: Background noise is calculated in decibel (dB).

Note 2 to entry: Background noise is given in dBm/Hz.

Note 3 to entry: Transmit power (Tp) is given in dBm.

Note 4 to entry: The maximum considered frequency (fmax_system) is given in Hz.

3.1.2
cabling noise
single channel cabling noise is the power sum of return loss, power sum near end crosstalk and power sum far end crosstalk

3.1.3
connection
two mated connectors

EXAMPLE Jack and plug.

3.2 Abbreviations

For the purposes of this document the abbreviations of ISO/IEC 11801 and the following apply.

ACR	Attenuation CRosstalk
ANEXT	Alien (EXogenous) Near-End crosstalk loss
AACR	Attenuatin to Alien (exogenous) CRosstalk
BNp	Background Noise
CN	NEXT Cancellation
CF	FEXT Cancellation
CR	Return loss (Echo) Cancellation
ELTCTL	Equal Level TCTL
ffs	for further study
NEXT	Near-End crosstalk attenuation (loss)

[1] A consolidated version of this publication exists, comprising ISO/IEC 11801:2002, ISO/IEC 11801:2002/AMD 1:2008 and ISO/IEC 11801:2002/AMD 2:2010.

TCL	Transverse Conversion Loss
TCTL	Transverse Conversion Transfer Loss
fmax_system	maximum frequency considered for the calculation of capacity
PS	Power Sum
Tp	Transmit power

4 Channel requirements using components with enhanced performance and extended frequency

4.1 General

This clause specifies the transmission performance up to 1 600 MHz (2 000 MHz ffs) of 30 m channels assembled from two sets of enhanced components subject to future standardisation:

a) Class I based on upcoming Category 8.1 components

b) Class II based on upcoming Category 8.2 components

The parameters specified in this clause apply to screened channels.

For a balanced cabling installation to perform in accordance with this Technical Report:

1) the channel performance should meet the specifications of this clause;

2) the interfaces to the cabling shall conform to the requirements of ISO/IEC 11801:2002, with its amendments 1:2008 and 2:2010, Clause 10, with respect to mating interfaces;

3) local regulations concerning safety and EMC shall be met as applicable to the location of the installation.

4.2 Return loss

The return loss for each pair of a channel shall not exceed the limits computed, to one decimal place, using the formulae of Table 1. The limits shown in Table 2 are derived from the formulae at key frequencies.

The return loss requirement shall be met at both ends of the cabling.

Return loss values at frequencies where the insertion loss is below 3 dB (ffs) are for information only (see Table 2).

Table 1 – Formulae for return loss limits for a channel

Frequency MHz	Minimum return loss Class I and Class II dB
$1 \le f \le 10$	19,0
$10 < f \le 100$	24 – 5 lg(f)
$100 < f \le 1\,000$	26 – 6 lg(f)
$1\,000 < f \le 1600$	8,0
$1\,600 < f \le 2\,000$	8,0 ffs

Table 2 – Return loss limits for a channel at key frequencies

Frequency MHz	Minimum return loss Class I and Class II dB
1,0	19,0
16,0	18,0
100,0	14,0
250,0	11,6
500,0	9,8
600,0	9,3
1 000,0	8,0
1 600,0	8,0
2 000,0 ffs	8,0 ffs

4.3 Insertion loss

The insertion loss for each pair of a channel shall not exceed the limits computed, to one decimal place, using the formulae of Table 3. The limits shown in Table 4 are derived from the formulae at key frequencies. Table 4 is given for information only.

Table 3 – Formulae for insertion loss limits for a channel

	Frequency MHz	**Maximum insertion loss** dB
Class I	$1 < f \le 250$	$0,32\left(1,8\sqrt{f}+0,005f+0,25/\sqrt{f}\right)+0,0324\sqrt{f}$ $+2\left(0,016835\sqrt{f}-10\lg\left[1-10^{\frac{32-20\lg(f/100)}{-10}}\right]-10\lg\left[1-10^{\frac{51-20\lg(f/100)}{-10}}\right]\right)$
	$250 < f \le 500$	$0,32\left(1,8\sqrt{f}+0,005f+0,25/\sqrt{f}\right)+0,0324\sqrt{f}$ $+2\left(0,016835\sqrt{f}-10\lg\left[1-10^{\frac{32-20\lg(f/100)}{-10}}\right]-10\lg\left[1-10^{\frac{43,04-30\lg(f/250)}{-10}}\right]\right)$
	$500 < f \le 1\,000$	$0,32\left(1,8\sqrt{f}+0,005f+0,25/\sqrt{f}\right)+0,0324\sqrt{f}$ $+2\left(0,016835\sqrt{f}-10\lg\left[1-10^{\frac{32-20\lg(f/100)}{-10}}\right]-10\lg\left[1-10^{\frac{34-40\lg(f/500)}{-10}}\right]\right)$
	$1\,000 < f \le 1\,600$ $1\,600 < f \le 2\,000$ ffs	$0,32\left(1,8\sqrt{f}+0,005f+0,25/\sqrt{f}\right)+0,0324\sqrt{f}$ $+2\left(0,016835\sqrt{f}+0,283-10\lg\left[1-10^{\frac{34-40\lg(f/500)}{-10}}\right]\right)$
NOTE The term $0,032\,4\sqrt{f}$ is ffs.		
Class II	$1 < f \le 1\,600$ $1\,600 < f \le 2\,000$ ffs	$0,32\left(1,8\sqrt{f}+0,005f+0,25/\sqrt{f}\right)+2\times 0,02\sqrt{f}$
For measurements the values below 4,0 dB revert to 4,0 dB (ffs).		