
D1.0 Clause 55 Link Segment Specifications

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802.3an

Background: 10GBASE-T Cabling Objectives

- Support operation over 4-connector structured 4-pair, twisted-pair copper cabling for all supported distances and classes
- Define a single 10 Gbit/s PHY that would supports links of:
 - at least 100m on four-pair Class F balanced copper cabling
 - at least 55m to 100m on four-pair Class E balanced copper cabling
- Support star-wired local area networks using point-to-point links and structured cabling topologies
- Select copper media from ISO/IEC 11801:2002, with any appropriate augmentation to be developed through work of 802.3 in conjunction with ISO/IEC SC25 WG3
- Meet CISPR/FCC Class A EMC limits
- Support a BER of 10^{-12} on all supported distances and classes

Editorial Strategy:

- To create a D1.0 10GBASE-T link segment specification based on the task force agreement to:
 - utilize 1000BASE-T as specification template
 - Set the starting performance requirements to:
ISO/IEC 11801-2002 Class E specifications extrapolated by using the formulas in that standard up to 625 MHz
 - Set the ANEXT specifications to the approved channel models
 - Set the Class F insertion loss specifications to the approved channel models
 - Set the 55 meter Class E insertion loss to the approved channel models

Basis of the link segment specification motion(s):

IEEE P802.3an Meeting

January 14th and 15th, 2004, Vancouver, BC. Canada

Motion:

Description: Move to set the starting performance requirements for 10GBASET

cabling to: ISO/IEC 11801-2002 Class E specifications extrapolated by using the formulas in this standard up to 625 MHz.

Motion Type: Technical 75% required

Moved By: Henricus Koeman

Seconded By: Luc

SG Voters Y: 38 N: 0 A: 14

802.3 Voters: Y: 17 N: 0 A: 8

Results: 100 % P/F: Passed

Basis of the link segment specification motion(s):

**IEEE P802.3an Meeting
March, 2004, Orlando, FLA**

Motion:

Description: Adopt channel models proposed on slide #3 for the purpose of evaluating PHY proposals and adopt as the baseline for link segment model for draft D1.0

Motion Type: Technical 75% required

Moved By: Sanjay Kasturia

Seconded By: Luc Adriaenssens

TF Voters Y: 50 N: 0 A: 2

Clause 55.x Link Segment Characteristics:

- **Set the starting performance requirements to:
ISO/IEC 11801-2002 Class E specifications extrapolated
by using the formulas in that standard up to 625 MHz**
 - **Insertion Loss**
 - **Return Loss**
 - **Pair-to-pair NEXT**
 - **Power sum NEXT**
 - **Pair-to-pair ELFEXT**
 - **Power sum ELFEXT**
 - **Delay**
 - **Delay skew**

Channel models (kasturia_2_0304.pdf)

Model #	Insertion loss	ANEXT Intercept (X1)	ANEXT margin (dB)
1	100m of Class F	60	2.5
2	55m of Class E	47	2.5
3	100m of Class E	62	2.5
4	55m to 100m of Class E	Given by formula	2.5

ANEXT limit line model:

$$1 \text{ MHz} \leq f \leq 100 \text{ MHz} \quad X1 - 10 * \text{Log}_{10} (f\text{Mhz}/100)$$

$$100 \text{ MHz} \leq f \leq 625 \text{ MHz} \quad X1 - 15 * \text{Log}_{10} (f\text{Mhz}/100)$$

ANEXT average level (of ripple) to assume in simulations

$$1 \text{ MHz} \leq f \leq 100 \text{ MHz} \quad X1 + 2.5 - 10 * \text{Log}_{10} (f\text{Mhz}/100)$$

$$100 \text{ MHz} \leq f \leq 625 \text{ MHz} \quad X1 + 2.5 - 15 * \text{Log}_{10} (f\text{Mhz}/100)$$

ANEXT intercept X1 as a function of cable length, L

- IL(L) is Class E insertion loss for length L in meters at freq. 250MHz
- Use following formula for ANEXT:

$$X1 = 62 - ((IL(100) - IL(L)) * 15 / 15.6)$$

Clause 55.x Link Segment Characteristics:

- **Insertion Loss Class F**
- **Insertion Loss of a Category 6 channel of 55 meters**
- **PS ANEXT for a Class E Channel**
- **PS ANEXT for a Class F Channel**
- **PS ANEXT for a Category 6 channel of 55 meters**
- **PS AFEXT for a Category 6 channel of 55 meters (ffs)**