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10G Link Segment Performance Specification

Primary Parameters

Supporters

- *Henriekus Koeman, Fluke Networks*
- *Shadi Abughazaleh, Hubbell Premise Wiring*
- *Brian Ensign, Leviton*
- *Bernie Hammond, KRONE*
- *Valerie Rybinski The Siemon Co.*
- *Olindo Savi, The Siemon Co.*
- *Bryan Sparrowhawk, Leviton*
- *George Zimmerman, Solarflare*
- *Stuart Reeves, KRONE inc.*
- *Michel Bohbot, NORDX-CDT*
- *Joe Dupuis, Ortronics*
- *Rehan Mahmood, Hubbell*
- *Paul Vanderlaan, Belden*
- *Alan Flatman, LAN Technologies*

Basic principles

- *10GBASE-T is designed to operate over ISO/IEC 11801 Class E or Class F 4-Pair balanced cabling that meets the additional requirements specified in clause 55.X*
- *The cabling system used to support 10GBASE-T requires 4 pairs of ISO/IEC 11801 Class E or Class F balanced cabling with a nominal impedance of 100 Ohms.*
- *The link segment transmission parameters of insertion loss, NEXT loss, ELFEXT loss, and return loss specified in 55.X are ISO/IEC 11801 Class E specifications extended by extrapolating the formulas to a frequency up to (TBD 625) MHz. With the exception of the parameters of NEXT and MDNEXT, which are further specified in subclauses 55.x.2 and 55.x.3. In addition, link segment requirements are specified in subclause 55.x.4 for alien crosstalk.*

Near-End Crosstalk (NEXT)

The NEXT loss between any two duplex channels of a link segment shall be at least

$$20\log\left(10^{\frac{-74.3+15\log(f)}{20}}+2\cdot10^{\frac{-94+20\log(f)}{20}}\right)$$

where f is the frequency over the range of 1 MHz to 330 MHz, and

$$-31+50\log(f/330)$$

where f is the frequency over the range of 330 MHz to (TBD $\leq$ 625) MHz.

Multiple Disturber Near-End Crosstalk (MDNEXT) loss

The Power Sum loss between a duplex channel and the three adjacent disturbers shall be greater than

$$20\log\left(10^{\frac{-72.3+15\log(f)}{20}} + 2\cdot 10^{\frac{-90+20\log(f)}{20}}\right)$$

where f is the frequency over the range of 1 MHz to 330 MHz, and:

$$-28 + 42\log(f/330)$$

where f is the frequency over the range of 330 MHz to (TBD $\leq$ 625) MHz.

Rationale NEXT, MDNEXT

- *A more detailed (magnitude based) mathematical model has been studied and compared against worst case channel measurements with excellent results.*
- *Due to known and well defined connector pin-pair constraints within the connector, a relaxation of the extrapolated limit is required at high frequencies. This phenomenon is observed most prominintly in short channel configurations, but appears in long (100m) channel response as well (Abughazaleh_1_0503.pdf pp. 5-8, abughazaleh_1_0304.pdf Vaden_2_0504.pdf)*
- *Predicted response is better than extrapolated limit below 330 MHz and worse above that frequency.*
- *Worst case occurs typically in the shortest channel configurations where SNR is highest.*

TIA 42.7 resolution, Baltimore

- *The following items were established in order to further the development of 10 Gigabit related component development.*
- *The following assumptions should be used as worst case conditions for modeling.*
  - » *1. Min Channel Lengths*
  - » *1 meter patch – 1meter patch –10 meters horizontal –1 meter patch-1 meter patch (as used in a Data center)*
  - » *2. WC Channel Topology for Modeling*
  - » *Channels: 4 connector channel*
  - » *3. NEXT extended frequency limits.*
  - » *$1 \le f < 330$ MHz: Extrapolate C6 limit lines.*
  - » *$330 \le f \le 625$ MHz: NEXT $\ge 31 - 50\log(f/330)$ dB*
  - » *4. PSNEXT extended frequency limits*
  - » *$1 \le f < 330$ MHz: Extrapolate C6 limit lines.*
  - » *$330 \le f \le 625$ MHz: NEXT $\ge 28 - 50\log(f/330)$ dB*

Insertion Loss, Return Loss, ELFEXT, MDELFEXT,

- *No change from ISO/Class E, TIA Cat 6 requirements extrapolated to higher frequencies.*

- *There seem to be some measurement related artifacts of FEXT/ELFEXT at high frequencies where the actual FEXT measurement is so low that it becomes obscured by measurement noise. This causes a perceived rapid increase in ELFEXT magnitude at high frequencies, where insertion loss is high and FEXT loss is actually quite low. It is the author's opinion that this is not a significant problem.*

Motion 1

- *Adopt the following BASELINE values for extended frequency channel NEXT*

The NEXT loss between any two duplex channels of a link segment shall be at least

$$20\log\left(10^{\frac{-74.3+15\log(f)}{20}}+2\cdot 10^{\frac{-94+20\log(f)}{20}}\right)$$

where f is the frequency over the range of 1 MHz to 330 MHz, and

$$-31+50\log(f/330)$$

where f is the frequency over the range of 330 MHz to (TBD ≤ 625) MHz.

Motion by:
Second:

Vote	(P802.3an)	Y: N: A:
	(802.3 Voters)	Y: N: A:

Motion 2

- *Adopt the following BASELINE values for extended frequency channel MDNEXT*

The NEXT loss between any two duplex channels of a link segment shall be at least

$$20\log\left(10^{\frac{-72.3+15\log(f)}{20}}+2\cdot 10^{\frac{-90+20\log(f)}{20}}\right)$$

where f is the frequency over the range of 1 MHz to 330 MHz, and

$$-28+42\log(f/330)$$

where f is the frequency over the range of 330 MHz to (TBD ≤ 625) MHz.

Motion by:		
Second:		
Vote	(P802.3an)	Y: N: A:
	(802.3 Voters)	Y: N: A:

Motion 3

Communicate to cabling groups that a relaxation of NEXT, and MDNEXT requirements for 10G as described in Vaden_2_0504 is feasable and that the P802.3an Task Force is interested in receiving accurate (though perhaps more complex) models of expected performance.

Motion by:
Second:

Vote	(P802.3an)	Y: N: A:
	(802.3 Voters)	Y: N: A:

Motion 4

Communicate to cabling standards groups that IL and ANEXT, MDANEXT are critical parameters with some flexibility in the ratio as indicated in Kasturia_2_0304, where the resulting relationships should be the focus of their work.

Motion by:		
Second:		
Vote	(P802.3an)	Y: N: A:
	(802.3 Voters)	Y: N: A: