10GBASE-T
Channel Model Proposal

March 2004
Orlando, FLA

Overview

Purpose of presentation:

- **Get agreement on a baseline channel models that will be used for evaluating PHY proposals**
  - **Channel models must be acceptable to PHY vendors**
  - **Channel models must be acceptable to cabling vendors**
  - **Will involve a balance of pain on both fronts**
  - **Format and details may differ in providing different levels of detail to each community**
- **Provide some parameter trade-off guidelines**
  - **Gives us some assurance that small changes in cable specification based on cabling industry feedback will not invalidate our analysis**

10GBASE-T Link Segment Specifications

Basis of all specification is prior motion:

IEEE P802.3an Meeting
January 14th and 15th, 2004, Vancouver, BC. Canada
Motion # 2
Description: Move to set the starting performance requirements for 10GBASE-T 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: Henriecus 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**

Channel Models

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

ANEXT limit line model:

1 MHz ≦ f ≦ 100 MHz X1 -10*Log10 (fMhz/100)

100 MHz ≦ f ≦ 625 MHz X1 -15*Log10 (fMhz/100)

ANEXT average level (of ripple) to assume in simulations

1 MHz ≦ f ≦ 100 MHz X1+2 -10*Log10 (fMhz/100)

100 MHz ≦ f ≦ 625 MHz X1+2 -15*Log10 (fMhz/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)

ADD in text short reach

Channel Configurations: Informative

Existing installed cable	Distance	Channel Model	Comment
Class F	100m	Model #1	Min. req. Objective
Class E screened	100m	Model # 3	High end of Objective
Class E UTP	55m	Model #2	Min. req. objective
Class E, with qualif. Anext	55m<L ≤ 100m	Model #4	Desirable, but requires testing L>55
Future Installations			
Class F	100m	Model #1	Min. req. Objective
Class E screened	100m	Model #3	High end of Objective
Class E augmented	100m	Model #1, Model #3	High end of Objective

- **Class E augmented specification has not be finalized therefore we have two models to cover this**
  - **Further tradeoffs are permitted provided; guidance on these numbers from ISO/IEC & TIA will be requested**
  - X1= 62-(IL(100)-proposedIL@250Mhz)*15/15.6)

Usage of Channel Models

- Any PHY proposal must provide following information
  - Link margin over Model #1, Model #2, Model #3
  - Maximum length, L, that the proposal will cover with Model #4 with 3dB margin
- Latency associated with the proposal
- Complexity measure of implementation

Motion

- **Motion # ?**

- **Description: Adopt channel models proposed for the purpose of evaluating PHY proposals**

Motion Type: Technical 75% required
Moved By: ??
Seconded By: ??
SG Voters Y: ?? N: ?? A: ??
802.3 Voters: Y: ?? N: ?? A: ??
Results: **?? %** P/F:

10GBASET Link Segment

Cabling system characteristics

- 4-connector structured 4-pair, twisted-pair copper cabling
- at least 55m to 100 m on four-pair Class E balanced copper cabling
- at least 100m on four-pair Class F balanced copper cabling
- ISO/IEC 11801:2002, with any appropriate augmentation

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

Link Transmission Parameters

Delay parameters:

- **Maximum link delay**
  - –The propagation delay of a link segment shall not exceed 570 ns at all frequencies between 2 MHz and TBD MHz.
- **Link delay skew**
  - –The difference in propagation delay, or skew, between all duplex channel pair combinations of a link segment, under all conditions, shall not exceed 50 ns at all frequencies from 2 MHz to TBD MHz. It is a further functional requirement that, once installed, the skew between any two of the four duplex channels due to environmental conditions shall not vary more than 10 ns within the above requirement.