

Refinement of IEEE 802.3an Link Segment Spec

in support of
ballot comment
on 802.3an D1.2
by Alan Flatman

Supporters:

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November Motion

17 November 2004:

Motion to generate a single worst case link segment in next draft.

M: Alan Flatman

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14Y/3N/5A

Technical

Passes

802.3an D1.2 Link Segment Spec

Subclause 55.7.3.2 specification of PS ANEXT spans 5 pages

It has PS ANEXT specs for FOUR different cabling systems

It duplicates insertion loss requirements for multiple cabling systems, which are mandatory (i.e. shalls)

It contains significant tutorial information

Undeclared assumptions in supported cabling systems

Observations

- **we should specify a single link segment, as agreed**
 - » just like IEEE 802.3 has always done
- **we should support the widest range of cabling types**
- **valuable to define supported cabling implementations, but briefly and accurately:**
 - » **Class F = Class F = Class F**
 - » **Class E = Class E = Class E**
 - » **55m Category 6 is unclear (how much cordage?)**
- **we should not unnecessarily duplicate cabling specs**
 - » IEEE 802.3 is not in the cabling business
- **we should minimise complexity and tutorial material**
- **we should simply state the minimum requirements**

Proposed Refinement

Subclause 55.7.3.2.2

$$\begin{aligned}\text{PSANEXT_constant} &= 62 - (\text{CE_IL_250MHz} - \text{SCE_IL_250MHz}) \times 15/15.6 \text{ dB} \\ &= 62 - (35.9 - \text{SCE_IL_250MHz})/1.04 \text{ dB} \\ &= (28.6 + \text{SCE_IL_250MHz})/1.04 \text{ dB}\end{aligned}$$

Subclause 55.7.3.2.1

$$\begin{aligned}\text{PSANEXT} &\geq \text{PSANEXT_constant} - 10\log_{10}(f/100) \text{ dB} && 1 \leq f \leq 100 \\ &\geq \text{PSANEXT_constant} - 15\log_{10}(f/100) \text{ dB} && 100 < f \leq 500 \\ &\geq (28.6 + \text{IL}_{(250\text{MHz})})/1.04 - 10\log_{10}(f/100) \text{ dB} && 1 \leq f \leq 100 \\ &\geq (28.6 + \text{IL}_{(250\text{MHz})})/1.04 - 15\log_{10}(f/100) \text{ dB} && 100 < f \leq 500\end{aligned}$$

where $\text{IL}_{(250\text{MHz})}$ is the link segment insertion loss at 250MHz

Supported Cabling Implementations

Channel Class	Channel Length	Horizontal Cable	Total Cordage	Total Connectors	Channel IL₍₂₅₀₎
Class F	100m	90m Cat 7	10m Cat 7 @ 50% IL	4 x Cat 7	33.8dB
Class E	100m	90m Cat 6	10m Cat 6 @ 50% IL	4 x Cat 6	35.9dB
Cat 6	55m	45m Cat 6	10m Cat 6 @ 20% IL	4 x Cat 6	20.3dB
Cat 6 Augmented	100m	90m Cat 6A	10m Cat 6A @ 20% IL	4 x Cat 6A	33.8dB

Applying the Generic Formula

Class F PSANEXT	$\geq (28.6 + 33.8)/1.04 - 10\log_{10} (f/100) \text{ dB}$	$1 \leq f \leq 100$
	$\geq (28.6 + 33.8)/1.04 - 15\log_{10} (f/100) \text{ dB}$	$100 < f \leq 500$
	$\geq 60 - 10\log_{10} (f/100) \text{ dB}$	$1 \leq f \leq 100$
	$\geq 60 - 15\log_{10} (f/100) \text{ dB}$	$100 < f \leq 500$
Class E PSANEXT	$\geq (28.6 + 35.9)/1.04 - 10\log_{10} (f/100) \text{ dB}$	$1 \leq f \leq 100$
	$\geq (28.6 + 35.9)/1.04 - 15\log_{10} (f/100) \text{ dB}$	$100 \leq f \leq 500$
	$\geq 62 - 10\log_{10} (f/100) \text{ dB}$	$1 \leq f \leq 100$
	$\geq 62 - 15\log_{10} (f/100) \text{ dB}$	$100 < f \leq 500$
55m Cat 6 PSANEXT	$\geq (28.6 + 20.3)/1.04 - 10\log_{10} (f/100) \text{ dB}$	$1 \leq f \leq 100$
	$\geq (28.6 + 20.3)/1.04 - 15\log_{10} (f/100) \text{ dB}$	$100 < f \leq 500$
	$\geq 47 - 10\log_{10} (f/100) \text{ dB}$	$1 \leq f \leq 100$
	$\geq 47 - 15\log_{10} (f/100) \text{ dB}$	$100 < f \leq 500$
Cat 6A PSANEXT	$\geq (28.6 + 33.8)/1.04 - 10\log_{10} (f/100) \text{ dB}$	$1 \leq f \leq 100$
	$\geq (28.6 + 33.8)/1.04 - 15\log_{10} (f/100) \text{ dB}$	$100 < f \leq 500$
	$\geq 60 - 10\log_{10} (f/100) \text{ dB}$	$1 \leq f \leq 100$
	$\geq 60 - 15\log_{10} (f/100) \text{ dB}$	$100 < f \leq 500$

Bottom Line

- **a single PSANEXT formula may be used for 10GBASE-T**
- **it is mathematically equivalent to the existing approach**
- **formula makes the link segment spec totally generic**
- **no need to spec AXTIR or IL for other cabling systems**
- **we simply state minimum requirements for 10GBASE-T**
- **supported cabling systems are offered as examples**
- **we leave cabling specs to the cabling standards groups**