Considerations for 802.3by Sponsor ballot open issues

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25 Gb/s Ethernet

Within the 802.3by draft specification we know there are 2 areas of interest for potential change or simplification.

Purpose of this presentation is to highlight them and propose justification for addressing them.

- Twinax Cable: 802.3by currently advertises two cable type with a 3m reach
- PHY designation: There has been a proposal to change from the current 25GBASE-CR-S and 25GBASE-CR PHY designations to a single hybrid 25GBASE-CR

3m cables

We have two cables defined for 802.3by both with an advertised reach of 3m. There are 3 potential options that have been discussed.

1. Do nothing, keep CA-25G-N and CA-25G-S @ 3m
2. Use the CA-25G-N methodology to increase loss/reach of CA-25G-S to ~4m/~19dB.
3. Remove CA-25G-S cable type and revert to only just the CA-25G-N for 3m cables.

   3b) Perhaps make it an informative annex…

Twin-ax cables

Table 110–9—Cable assembly characteristics summary

Description	Reference	CA-25G-L	CA-25G-S	CA-25G-N	Unit
Maximum insertion loss at 12.8906 GHz	110.10.2	22.48	16.48	15.5	dB
Minimum insertion loss at 12.8906 GHz	110.10.2	8			dB
Minimum differential return loss at 12.8906 GHz	110.10.3	6			dB
Differential to common-mode return loss	110.10.4	Equation (92–28)			dB
Differential to common-mode conversion loss	110.10.5	Equation (92–29)			dB
Common-mode to common-mode return loss	110.10.6	Equation (92–30)			dB

Twin-ax cables

Table 110–10—COM parameter values

Parameter	Symbol	CA-25G-N	CA-25G-S	CA-25G-L[a]	Units
Signaling rate	f_b	25.78125			GBd
Maximum start frequency	f_{min}	0.05			GHz
Maximum frequency step[b]	Δf	0.01			GHz
Device package model					
Single-ended device capacitance	C_d	2.5×10^{-4}			nF
Transmission line length, Test 1	z_p	12			mm
Transmission line length, Test 2	z_p	30			mm
Single-ended package capacitance at package-to-board interface	C_p	1.8×10^{-4}			nF
Single-ended reference resistance	R_0	50			Ω
Single-ended termination resistance	R_d	55			Ω
Receiver 3 dB bandwidth	f_r	$0.75 \times f_b$			GHz
Transmitter equalizer, minimum cursor coefficient	$c(0)$	0.62			
Transmitter equalizer, pre-cursor coefficient	$c(-1)$				
Minimum value		−0.18			
Maximum value		0			
Step size		0.02			
Transmitter equalizer, post-cursor coefficient	$c(1)$				
Minimum value		−0.38			
Maximum value		0			
Step size		0.02			
Continuous time filter, DC gain	g_{DC}				
Minimum value		−16	−12	−12	dB
Maximum value		0	0	0	dB
Step size		1	1	1	dB
Continuous time filter, zero frequency	f_z	$f_b / 4$			GHz

Table 110–10—COM parameter values

Parameter	Symbol	CA-25G-N	CA-25G-S	CA-25G-L[a]	Units
Continuous time filter, pole frequencies	f_{p1}	$f_b / 4$			GHz
	f_{p2}	f_b			
Transmitter differential peak output voltage					
Victim	A_v	0.4			V
Far-end aggressor	A_{fe}	0.6			V
Near-end aggressor	A_{ne}	0.6			V
Number of signal levels	L	2			
Level separation mismatch ratio	R_{LM}	1			
Transmitter signal-to-noise ratio	SNR_{TX}	28.4	27	27	dB
Number of samples per unit interval	M	32			
Decision feedback equalizer (DFE) length	N_b	14			
Normalized DFE coefficient magnitude limit, for $n = 1$ to N_b	$b_{max}(n)$	0.35	0.5	1	—
Random jitter, RMS	σ_{RJ}	0.01			UI
Dual-Dirac jitter, peak	A_{DD}	0.05			UI
One-sided noise spectral density	η_0	5.2×10^{-8}			V^2/GHz
Target detector error ratio	DER_0	10^{-12}	10^{-8}	10^{-5}	—
Channel Operating Margin (min.)	COM	3[c]	3	3	dB

[a]The parameters for CA-25G-L are the same as those for 100GBASE-CR4 (Table 93–8), except for A_{fe}.
[b]For cable lengths greater than 4 m, a frequency step (Δf) no larger than 5 MHz is recommended.
[c]For CA-25G-N cable assemblies with insertion loss at 12.89 GHz greater than 12 dB, the minimum COM is relaxed to 2.2 dB.

3m cable considerations

Option 1) "Keep as-is"

- Two cables with same advertised reach can be justified if there is a tangible cost difference between CA-25G-N and CA-25G-S
  - low latency (higher cost) cable
  - Higher loss (lower cost) cable
- Preliminary questions indicating that CA-25G-N could be 20-35% higher cost vs. CA-25G-S

3m cable considerations

Option 2) "Increase reach/loss of CA-25G-S"

- Not addressing any 802.3by objective
- Lowest level of support in Oct meeting straw poll

  Straw Poll #1.

  Choose one of the following to implement in D2.2:

  A. Leave CA-25G-S specification as is.

  B. "Increase" CA-25G-S specifications (e.g., dudek_100715_25ge_adhoc)

  C. Eliminate CA-25G-S cable type.

  Pick one. A: 10 B: 6 C: 14

3m cable considerations

Option 3) "Remove (or become informative) CA-25G-S"

- Cost difference of CA-25G-N and CA-25G-S means removal of CA-25G-S would burden all users with higher cost solutions
- Without CA-25G-S, opens questions on need for BASE-R FEC
- Unclear how an informative annex would really be handled by industry users

3m cable recommendations

- CA-25G-N cables addresses a specific latency sensitive application consistent with early adopters
- As 25GE adoption broadens, latency sensitive applications may not be the dominant market need, and industry may regret being limited to only a higher cost cable

Recommend keeping 802.3by D3.0 cable definition as-is going forward.

PHY designation

There seems to be interest in changing the PHY designation definitions. Two options:

1. Leave everything as-is with both 25GBASE-CR-S PHY (*defining No-FEC and BASE-R FEC operation for operation over 3m*) and 25GBASE-CR PHY (*defining No-FEC and BASE_R FEC operation for operation over 3m and RS-FEC operation for operation over 5m*)

2. Converge into one PHY (to be named 25GBASE-CR) which includes definition of all the FEC modes but makes the No-FEC and RS-FEC optional. This was Y. Hidaka's proposal (detailed here: http://www.ieee802.org/3/by/public/adhoc/architecture/hidaka_100715_25GE_adhoc.pdf)

Background

Current PHY designation approach was thoroughly debated leading up to March 2015 meeting. Concluding motion was:

Motion #5: 2 PHY types

Move to:

– adopt the PHY type approach outlined on page 5 of dudek_3by_01b_0315.pdf. This defines both 25GBASE-CR and 25GBASE-CR-S PHY types.

– create an informal communication to the SFF committee to inform them of our decision

- *Y/N/A: 35/2/7*

Discussion

- A single 25GBASE-CR PHY designation has some simplicity to it
- Key concern for this approach is the requirement for the user to understand what is implemented within the silicon to ensure interoperability
  - E.g. 5m cable operation, both ends designated 25GBASE-CR but only one end has implemented RS-FEC.

PHY designations recommendations

Recommend keeping 802.3by D3.0 PHY designations as-is going forward.