Unretimed PHY for the 20 m MMF objective

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- Detailed specification proposal with comparisons to 100GBASE-SR4 "heavy", CAUI-4 and OIF CEI-28G-VSR
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Introduction

- This presentation builds on earlier presentations exploring unretimed links (dawe_01b_0112_NG100GOPTX, dawe_01a_0912_optx, dawe_01a_1112_optx.pdf), and Clause 91 (P802.3bj, 100GBASE-CR4) FEC always transmitted (petrilla_02a_0912_optx, P802.3bj)
- Addresses the 20 m on MMF objective
- Targets high density data centre equipment
- Leverage already paid-for data centre host features
  - FEC, FFE driver, high performance electrical receiver
- Unretimed modules for low cost high volume short links where low module power is crucial
  - Specs for a CPPI-4 function
  - Also allows retimed modules
- 20 m PHY and 100 m PHY can be interoperable over 20 m MMF
- Hosts that support unretimed modules can support retimed modules

Two MMF PHYs

- Low power, relaxed (MMF) mechanics and low test time => Low cost
- The power of the 8 CDRs in 100GBASE-SR4 "heavy" is a significant proportion of the total module power
  - On the order of half the power
- "100GBASE-UR4" or "100GBASE-SR4 lite" for the 20 m objective
  - This presentation uses "100GBASE-UR4" for convenience

Module > Host ⋁	Unre-timed	Re-timed
CPPI-4	Y	Y
CAUI-4	X	Y

	UR4	SR4
UR4	20 m	20 m
SR4	20 m	100 m
(Showing minimum reaches in objectives)		

Thermal budget

- QSFP28 could support 4-lane retimed MMF module
- But lower power than QSFP's 3.5 W max. is essential for fully populated high density cards
  - Require 1.5 W to 2 to <2.7 W per module: see sela_01a_0112 (802.3bj) and dawe_01_0312_NG100GOPTX
- See example on next slide
  - A similar analysis (slide 7 of dawe_01_0312_NG100GOPTX) for a top-of-rack switch concluded with a 3 W requirement

Core switch – modular leaf switch

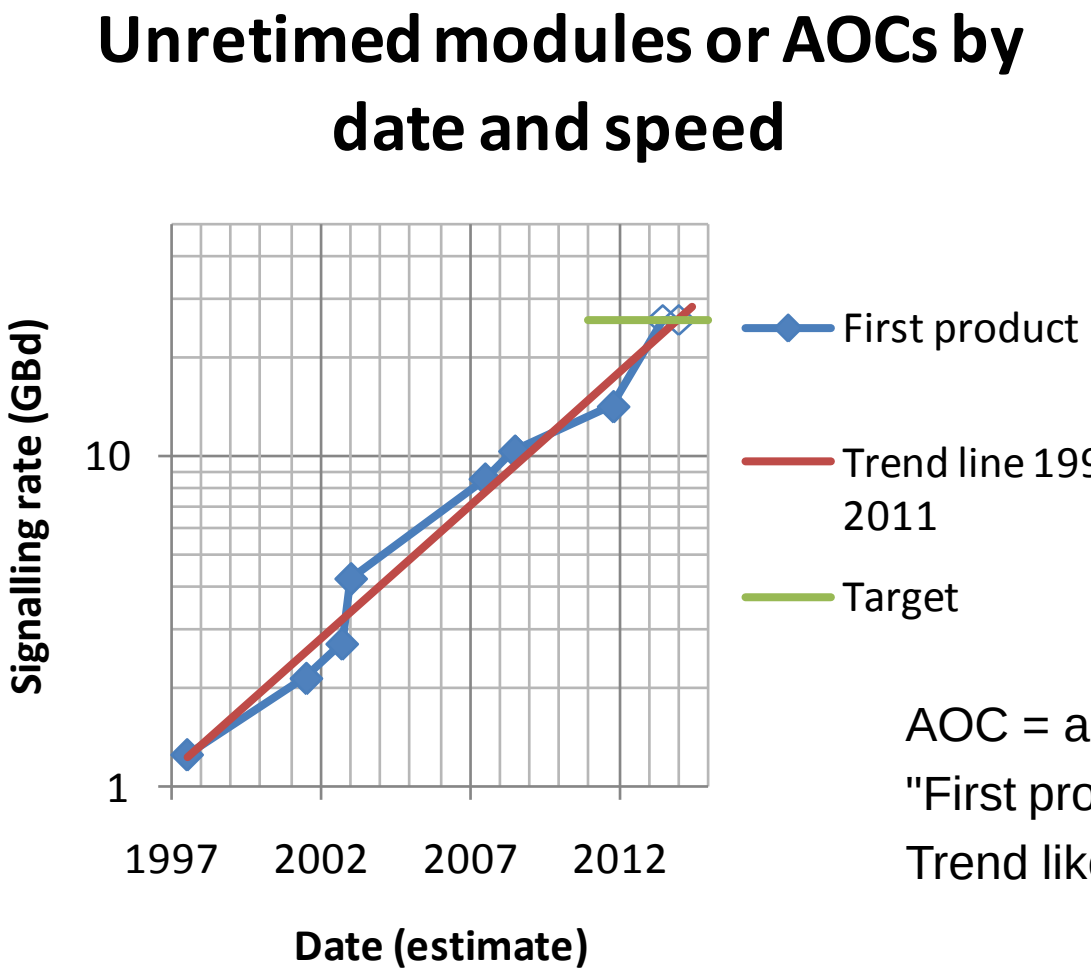
Component	40G	100G
Switch ASIC (include 18 KR4 and 18 4x25G ports)	85	85
Fans [2]	0	0
Management CPU[2]	0	0
Misc	9	9
Power supply (in)efficiency	10% or 15	10% or 15

[2] Fans are powered from the Chassis, CPU management is done for the chassis of the core switch

- 18 port leaf switch
  - Fully non-blocking – 18 internal ports to spine
- Total Power Budget 150 W to 160 W
  - Thermal limitations
  - Other limitations may reduce this towards 140 W
- Analysis based on 40GigE modular leaf switch
  - Some component's power may increase for 100GigE
  - No external memory for switch – more power
  - No external PHY for the backplane – more power
- For 160 W budget-
  - Power consumption excluding the optics is 110 W
  - Max power for optics < (160-110)/18 = **2.7 W or less, e.g. 2 W depending on power supply**
- **Module power determines number of ports, hence cost**

Updated slide 9 of dawe_01_0312_NG100GOPTX.pdf

Progress of unretimed interfaces



Unretimed modules or AOCs by date and speed: first product (estimates)

GBIC	1997?	1.25
FC 2G SFP	2001	2.125
POP4	2002	2.7
FC 4G SFP	2002-3	4.25
FC 8G SFP/SFP+	2007	8.5
10GE SFP+	2008	10.3125
10G QSFP+, CXP IB QDR	2008	10.3125
IB FDR	2011	14.0625
IB EDR	2013-14?	25.78125
100GE 4-wide	2013-14?	25.78125

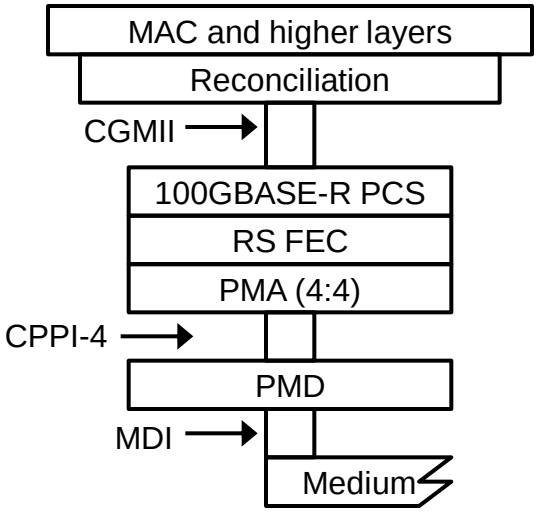
AOC = active optical cable

"First product" dates are estimates

Trend likely to slow down in future

Updated from slide 5 of dawe_01_0911_NG100GOPTX.pdf

Architecture diagram



Part of

Figure x–1—100GBASE-UR4 PMD relationship to the ISO/IEC Open Systems Interconnection (OSI) reference model and IEEE 802.3 CSMA/CD LAN model

Strategy for proposed chip-module specs for unretimed MMF PHY

1. VSR does not use host's FFE, eye can be closed at connector/TP1a. nPPI has open eye at connector/TP1a

- Proposal follows nPPI, using host's FFE. Host knows its channel loss, eye is open at connector/TP1a

2. VSR does not plan for mix of copper and optical ports. nPPI did, somewhat. IB FDR went further, with much lower signal swings. Also reduces power.

- Proposal follows IB FDR

3. nPPI does not assume any equalisation ability in host Rx – "leaves performance on the table". VSR assumes a CTLE but sets a very narrow range for module's electrical output state of emphasis

- Proposal builds on VSR or XFP, allows a wider range for module's electrical output state of emphasis, expects host will adapt to it. Use software equaliser or equivalent for spec at TP4. Using FEC, don't need VSR's extrapolation.

- No Auto-Negotiation, no need for a Training phase
  - Unlike 100GBASE-CR4, host Rx knows loss between source of electrical signal and itself

Proposed specifications follow

- These are as shown in September (dawe_01a_0912_optx) and November (dawe_01b_1112_optx.pdf) with additional material from recent presentations including the 100 m MMF reach objective baseline proposal king_02_0113_optx.pdf

Block diagram – like 40GBASE-SR4

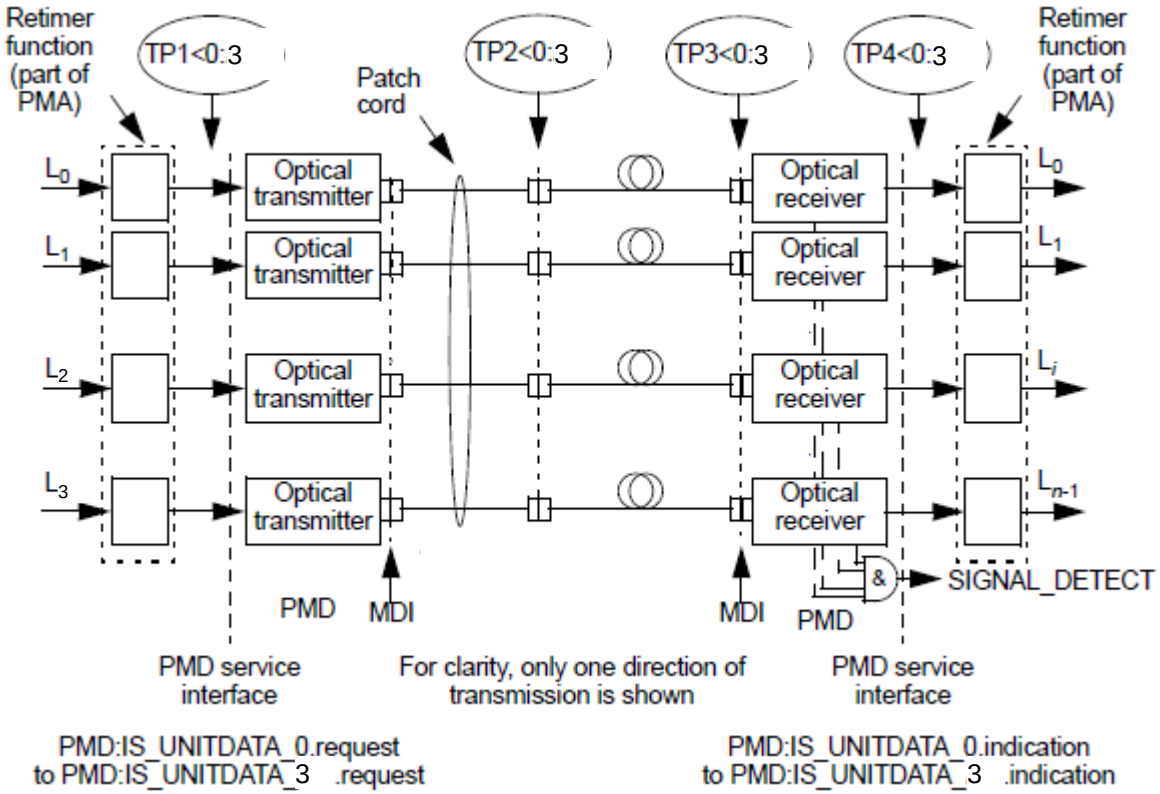


Figure x–2—Block diagram for 100GBASE–UR4 transmit/receive paths

Optical specs at a glance

Transmitter	Type	Unit	100GBASE-SR4 proposed	100GBASE-UR4 proposed
Center wavelength	Range	nm	840 to 860	840 to 860
RMS spectral width	Max	nm	0.6	0.65
Average launch power	Max	dBm	2.4	2.4
Average launch power	Min	dBm	-9.1 (tbc)*	-7.6
Optical Modulation Amplitude (OMA)	Max	dBm	3	3
OMA	Min	dBm	-7.1 (tbc)*	-5.6
Difference in launch power between any two lanes (OMA)	Max	dB	ffs (4 or greater)	4
Peak power, each lane	Max	dBm		4
OMA at max TDP	Min	dBm	-3	
Launch power in OMA minus TDP	Min	dBm	-8 (tbc)*	TBD
Transmitter & dispersion penalty (TDP) at target BER before FEC	Max	dB	5 (tbc)*	TBD
Extinction ratio	Min	dB	3	3
Optical return loss tolerance	Max	dB	12	12
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}, 5×10–5 hits/sample	Spec values		For further study	Around 0.25, 0.36, 0.45, 0.27, 0.35, 0.4
Average launch power of OFF transmitter	Max	dBm	-30	–30
Receiver	**Type**	**Unit**		
Center wavelength	Range	nm	840 to 860	840 to 860
Damage threshold	Min	dB	3.4	3.4
Average power at receiver	Max	dBm	2.4	2.4
Average power at receiver	Min	dBm	-11.0 (tbc)*	-9.2
Optical Modulation Amplitude (OMA)	Max	dBm	3	3
Stressed receiver sensitivity in OMA	Max	dBm	ffs	TBD
Peak power, each lane	Max	dBm		4
SRS test conditions:			ffs	
Vertical eye closure penalty (VECP)		dB		2.7?
Stressed eye J2 Jitter		UI		0.34?
Stressed eye J4 Jitter		UI		0.44?
Receiver reflectance	Max	dB	-12	-12

Electrical specs at a glance

	nPPI		CEI-28G-VSR		CAUI-4		CPPI-4			
Parameter description	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Unit**	**Conditions**
TP1a										
BER	n/a			1E-15		TBD	n/a			
Output transition time, 20% to 80%	28	—	10		10	—	~10 TBD	—	ps	
J2 Jitter output	—	0.17					—	0.19	UI	
Jx jitter output	J9	0.29					J4	0.23	UI	
Data Dependent Pulse Width Shrinkage (DDPWS)	—	0.07					—	0.1	UI	
Equalized J2 Jitter output						TBD	—	0.1	UI	
Equalized Jx jitter output			1-EW15 (note 1)	0.54			J4	0.14	UI	
Equalized DDPWS							—	0.05	UI	
Eye height at 10-x probability (EHx)[1]			95	at 10^-15					mV	
Vpk-pk				900					mV	
	Specification values						**pecification value**			
Eye mask coordinates: X1, X2	0.11, 0.31					TBD	0.13, 0.33		UI	Hit ratio = 5
Y1, Y2	95, 350						95, 350		mV	× 10–5
1.Open eye is generated through the use of a reference Continuous Time Linear Equalizer (CTLE)										
TP4	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Unit**	**Conditions**
BER	n/a			1E-15		TBD		5.E-5		
Output transition time, 20% to 80%	28	—	9.5		9.5		~ 8 to 10 TBD		ps	
J2 Jitter output	—	0.42					—	0.6	UI	
Jx jitter output	J9	0.65							UI	
Equalized J2 Jitter output						TBD	—	0.5	UI	
Equalized Jx jitter output			1-EW15	0.43			—	0.64	UI	
Eye height at 10-x probability (EHx)			228	at 1e-15					mV	
Vpk-pk				900					mV	
	Specification values						pecification value			
Eye mask coordinates: X1, X2	0.29, 0.5					TBD	~ 0.45, 0.5		UI	Hit ratio = 5
Y1, Y2	150, 425						40, 250		mV	× 10–5
Vertical Eye Closure				6.5					dB	

Table xA-1 CPPI-4 host electrical output specifications at TP1a

	nPPI				CEI-28G-VSR		CAUI-4		CPPI-4		
Parameter description	**Min**	**Max**	**Unit**	**Conditions**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Comments**
BER	n/a					1.E-15		TBD	n/a		
Single ended output voltage	–0.3	4	V	Referred to signal common					–0.3	4	
Common Mode Voltage common mode voltage is generated by host			V		-0.3	2.8	-0.3	2.8			
Differential peak-to-peak output voltage (max) with Tx disabled			mV					35			
AC common-mode output voltage	—	15	mV	RMS		17.5		18	—	20	Not as important as we feared
Differential termination resistance mismatch	—	5	%	1 MHz		10		10	*(n/a)*		Use Sdc22 spec which controls
Differential output return loss	See 86A.4.1.1	—	dB			Eqn. 1-2	Eqn. A-1	—	Eqn. A-1	—	skew-induced conversion as well as R matching
Common-mode output return loss	See 86A.4.1.2	—	dB			-2 *			Eqn. A-2	—	Unwisely deleted from 802.3-2012
Common-mode to differential output return loss						Eqn 1-3	Eqn. A-3	—	Eqn. A-3	—	Sdc22 (see equations for f ranges
Output transition time, 20% to 80%	28	—	ps		10		10	—	~10 TBD	—	
J2 Jitter output	—	0.2	UI						—	0.2	
J4 Jitter output			UI						0	0.23	
J9 Jitter output	—	0.3	UI						(no need)		
Data Dependent Pulse Width Shrinkage (DDPWS)	—	0.1	UI						—	0.10	
Equalized J2 Jitter output			UI				TBD		—	0.10	With fixed CTLE or similar
Equalized J4 Jitter output			UI						—	0.14	These three items estimate the
Equalized DDPWS			UI						—	0.05	"unequalizable jitter"
Eye width at 10-15 probability (EW15)1			UI		0.5	at 10^-15				see J9	
Eye height at 10-15 probability (EH15)1			mV		95	at 10^-15					
Q_{sq} for 4 lanes	45	—	V/V						45	—	
	Specification values				**Target value**				**Specification v**		
Eye mask coordinates: X1, X2 Y1, Y2	0.11, 0.31 95, 350		UI mV	Hit ratio = 5 × 10–5	-, -, -, 450		-, -, -, 450		0.13, 0.33 95, 350		
Crosstalk source, each input lane	700 VMA		mV	At TP4	900 pk-pk				500 pk-pk		Same as module output
Crosstalk source transition times, 20% to 80%	34		ps	At TP4	9.5				ound 8 to 10 TE		Ditto

1.Open eye is generated through the use of a reference Continuous Time Linear Equalizer (CTLE)

- See backup for reflection equations
- Module input table to be consistent with this table (see dawe_01a_0912_optx.pdf)

Table x-6 100GBASE–SR4 or 100GBASE–UR4 optical transmit characteristics

Table x-6 100GBASE–SR4 or 100GBASE–UR4 optical transmit characteristics							
		40GBASE-SR4 or 100GBASE-SR10	100GBASE–SR4 (proposed)				
Description	**Type**	**Value**		**100GBASE–UR4**	**Unit**		
Center wavelength	Range	840 to 860	840 to 860	840 to 860	nm		
RMS spectral width[a]	Max	0.65	0.6	0.65	nm		
Average launch power, each lane	Max	2.4	2.4	2.4	dBm		
Average launch power, each lane	Min	-7.6	-9.1 TBC	-7.6	dBm		
Optical Modulation Amplitude (OMA), each lane	Max	3	3	3	dBm		
Optical Modulation Amplitude (OMA), each lane	Min	–5.6[b]	–7.1[b]	–5.6[b]	dBm		
Difference in launch power between any two lanes (OMA)	Max	4	ffs (>=4)	4	dB		
Peak power, each lane	Max	4		4	dBm		
Launch power in OMA minus TDP, each lane	Min	–6.5	-8 TBC	TBD	dBm		
Transmitter and dispersion penalty (TDP), each lane	Max	3.5	5 TBC	TBD	dB		
Extinction ratio	Min	3	3	3	dB		
Optical return loss tolerance	Max	12	12	12	dB		
Encircled flux[c]		>= 86% at 19 µm, <= 30% at 4.5 µm	>= 86% at 19 µm, <= 30% at 4.5 µm	>= 86% at 19 µm, <= 30% at 4.5 µm			
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} Hit ratio 5×10–5 hits per sample	Spec values	0.23, 0.34, 0.43, 0.27, 0.35, 0.4	For further study	Around 0.25, 0.36, 0.45, 0.27, 0.35, 0.4		SR contains Tx CDR, UR need not	
Average launch power of OFF transmitter, each lane	Max	–30	–30	–30	dBm		
a RMS spectral width is the standard deviation of the spectrum.				a [same]			
b Even if the TDP < 0.9 dB, the OMA (min) must exceed this value.			b [same]	b Even if the TDP < TBD dB, the OMA (min) must exceed this value.			
c If measured into type A1a.2 or type A1a.3 50 µm fiber in accordance with IEC 61280-1-4.				c [same]			

Table x–5—SIGNAL_DETECT value definition

Receive conditions	SIGNAL_DETECT value
For any lane; Average optical power at TP3 <= –30 dBm	FAIL
For all lanes; [(Optical power at TP3 >= Minimum OMA, each lane, in Table x–z) and (compliant 100GBASE–SR4 or 100GBASE–UR4 signal input as appropriate)]	OK
All other conditions	Unspecified

Just as Clause 86

Table x-7 Characteristics of signal within, and at the receiving end of, a compliant optical channel

	40GBASE-SR4 and 100GBASE-SR10						
Description	**Minimum**		**Max**	**Minimum**		**Max**	**Unit**
Fiber type	OM3	OM4		**SR4**	**UR4**	**SR4 and UR4**	
Total average power for 40GBASE–SR4	–3.5	–3.1	+8.4	-4.9	-3.3	+8.4	dBm
Total average power for 100GBASE–SR10	+0.5	+0.9	+12.4	*(n/a)*			dBm
Average power, each lane	–9.5	–9.1	+2.4	-10.9	-9.3	+2.4	dBm
Optical Modulation Amplitude (OMA), each lane	–7.5	–7.1	+3	-9.0	-7.3	+3.0	dBm

Table x–8 100GBASE–SR4 or 100GBASE–UR4 optical receiver characteristics

	40GBASE-SR4 or 100GBASE-SR10		100GBASE–SR4		Unit
Description	**Type**	**Value**		**100GBASE–UR4**	
Center wavelength, each lane	Range	840 to 860		840 to 860	nm
Damage threshold[a]	Min	3.4	3.4	3.4	dBm
Average power at receiver input, each lane	Max	2.4	2.4	2.4	dBm
	Min	–9.5	-11 TBC	-9.2	dBm
Receiver reflectance	Max	–12	-12	-12	dB
Optical Modulation Amplitude (OMA), each lane	Max	3	3	3	dBm
Stressed receiver sensitivity in OMA, each lane[b]	Max	–5.4	FFS	TBD	dBm
Peak power, each lane	Max	4		4	dBm
Conditions of stressed receiver sensitivity test:					
Vertical eye closure penalty (VECP)[c], each lane	—	1.9	FFS	2.7?	dB
Stressed eye J2 Jitter[c], each lane	—	0.3		0.34?	UI
Stressed eye J4 Jitter[c], each lane				0.44?	UI
Stressed eye J9 Jitter[c], each lane	—	0.47			UI
OMA of each aggressor lane	—	–0.4		–0.4	dBm
Receiver jitter tolerance in OMA, each lane[d]	Max	–5.4		*As SRS*	dBm
Conditions of receiver jitter tolerance test:					
Jitter frequency and peak-to-peak amplitude	—	(75, 5)		(187.5, 5)	(kHz, UI)
Jitter frequency and peak-to-peak amplitude	—	375, 1		(937.5, 1)	(kHz, UI)
OMA of each aggressor lane	—	–0.4		–0.4	dBm

a The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.

a [same]

b Measured with conformance test signal at TP3 (see 86.8.4.7).

b Measured with conformance test signal at TP3 (see x.y.z).

c Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver. The apparent discrepancy between VECP and TDP is because VECP is defined at eye center while TDP is defined with ±0.15 UI offsets of the sampling instant.

c [same]

d This is a test of the optical receiver's ability to track low-frequency jitter and is inappropriate for any subsystem that does not include a CRU.

d [same]

Table x-9 100GBASE–SR4 and 100GBASE–UR4 illustrative link power budgets

	40GBASE-SR4 or 100GBASE-SR10		100GBASE–SR4		100GBASE–UR4		Unit
Parameter	**OM3**	**OM4**	**OM3**	**OM4**	**OM3**	**OM4**	
Effective modal bandwidth at 850 nm[a]	2000	4700	2000	4700	2000	4700	MHz•km
Power budget (for maximum TDP)	8.3		8.2	8.2	?	?	dB
Operating distance	0.5 to 100	0.5 to 150	0.5 to ?	0.5 to 106	0.5 to ?	0.5 to 20	m
Channel insertion loss[b]	1.9	1.5	FFS	1.9	1.6	1.6	dB
Allocation for penalties (for maximum TDP)[c]	6.4	6.5	FFS	6.3?	#VALUE!	#VALUE!	dB
Unallocated margin	0	0.3[d]	FFS	0?	#VALUE!	#VALUE!	dB
Additional insertion loss allowed	0		FFS	0?	0?		dB

a Per IEC 60793-2-10.

b The channel insertion loss is calculated using the maximum distances specified in Table 86–2 and cabled optical fiber attenuation of 3.5 dB/km at 850 nm plus an allocation for connection and splice loss given in x.y.z.

c Link penalties are used for link budget calculations. They are not requirements and are not meant to be tested.

d This unallocated margin is not available for use.

Table x-13 Fiber optic cabling (channel) characteristics at 850 nm

		40GBASE-SR4 or 100GBASE-SR10		100GBASE–SR4		100GBASE–UR4		Unit
Description	**Type**	**OM3**	**OM4**	**OM3**	**OM4**	**OM3**	**OM4**	
Operating distance	Max	100	150	?	106	?	20	m
Cabling Skew	Max	79						ns
Cabling Skew Variation[a]	Max	2.5						ns
Channel insertion loss	Min	0				0		dB
Channel insertion loss[b]	Max	1.9[c]	1.5[d]	#####	1.9	#####	1.6	dB

a An additional 300 ps of Skew Variation could be caused by wavelength changes, which are attributable to the transmitter not the channel.

b These channel insertion loss values include cable, connectors, and splices.

c 1.5 dB allocated for connection and splice loss.

d 1 dB allocated for connection and splice loss.

Use notes a, b only

Table x-14 Optical fiber and cable characteristics

Description	OM3[a]	OM4[b]	Unit
Nominal core diameter	50		µm
Nominal fiber specification wavelength	850		nm
Effective modal bandwidth (min)c	2000	4700	MHz•km
Cabled optical fiber attenuation (max)	3.5		dB/km
Zero dispersion wavelength (λ0)	1295 <= λ0 <= 1340		nm
Chromatic dispersion slope (max) (S0)	0.105 for 1295 <= λ0 <= 1310 and 0.000375×(1590 – λ0) for 1310 <= λ0 <= 1340		ps/nm^2 km

a IEC 60793-2-10 type A1a.2

b IEC 60793-2-10 type A1a.3

c When measured with the launch conditions specified in Table x-6.

Just as Clause 86

Table xA–3 CPPI-4 module electrical output specifications at TP4

	nPPI				CEI-28G-VSR		CAUI-4		CPPI-4		
Parameter description	**Min**	**Max**	**Unit**	**Conditions**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Comments**
BER	n/a					1.E-15		TBD	n/a		
Single ended output voltage tolerance	–0.3	4	V	Referred to signal common					–0.3	4	
Common Mode Voltage common mode voltage is generated by host					-0.3	2.8					
AC common-mode output voltage (RMS)	—	7.5	mV			17.5	—	18	—	18	
Differential termination resistance mismatch	—	5	%	1 MHz		10		10%	*(n/a)*		Use Sdc22 spec which controls
Differential output return loss	See 86A.4.2.1	—	dB	10 MHz to 11.1 GHz		Eqn 1-2	Eqn. A-1	—	Eqn. A-1	—	skew-induced conversion as well as R matching
Common-mode output return loss	See 86A.4.2.2	—	dB	10 MHz to 11.1 GHz		-2 *	Eqn. A-2	—	Eqn. A-2	—	Unwisely deleted from 802.3-2012
Common-mode to differential output return loss						Eqn 1-x	Eqn. A-3	—	Eqn. A-3	—	
Output transition time, 20% to 80%	28	—	ps		9.5		9.5		Around 8 to 10		TBD
J2 Jitter output	—	0.4	UI						—	0.6	
J9 Jitter output	—	0.7	UI						*(n/a)*		
Equalized J2 Jitter output									—	0.5	With adjustable CTLE or similar
Equalized J4 Jitter output									—	0.64	Ditto
	Specification va				**Target value**				**Specification values**		
Eye mask coordinates: X1, X2 Y1, Y2	0.29, 0.5 150, 425		UI mV	Hit ratio = 5 × 10–5	-, -, -, 450		-, -, -, 450		Around 0.45, 0.5		
Eye width at 10-x probability (EWx)			UI		0.6	at 1e-	TBD	at			
Eye height at 10-x probability (EHx)			mV		228	15	TBD	TBD			
Vertical Eye Closure			dB			6.5		TBD			
Crosstalk source VMA, each lane	700 VMA		mV	At TP1a	900 pk-pk				700 pk-pk		Same as host output
Crosstalk source transition times, 20% to 80%	37		ps	At TP1a	10				Around 10 TBD		Ditto
					Eqn 1-x						
					min(-22+0.5f,-15) 50 MHz to 30 GHz						

- Host input table to be consistent with this table (see dawe_01a_0912_optx.pdf)

Conclusions

- Leverage already paid-for data centre host features
  - FEC, FFE driver, high performance electrical receiver
    - FEC is always transmitted, like 100GBASE-CR4
    - Unretimed module with FEC offer lowest module power and reduced test time vs. non-FEC
      - Hence cost
    - Use host FFE to open the eye at TP1
    - Assume host Rx is adaptive
- Power in the module is a cost
  - Specify for unretimed for high volume short links
- Retimed and unretimed can be interoperable
  - Can be connected over UR4 (short) MMF
  - Retimed module can work in non-retimed host

References

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- Oren Sela et al., Power Considerations for 100GBASE-KR4 PHY, http://ieee802.org/3/bj/public/jan12/sela_01a_0112.pdf
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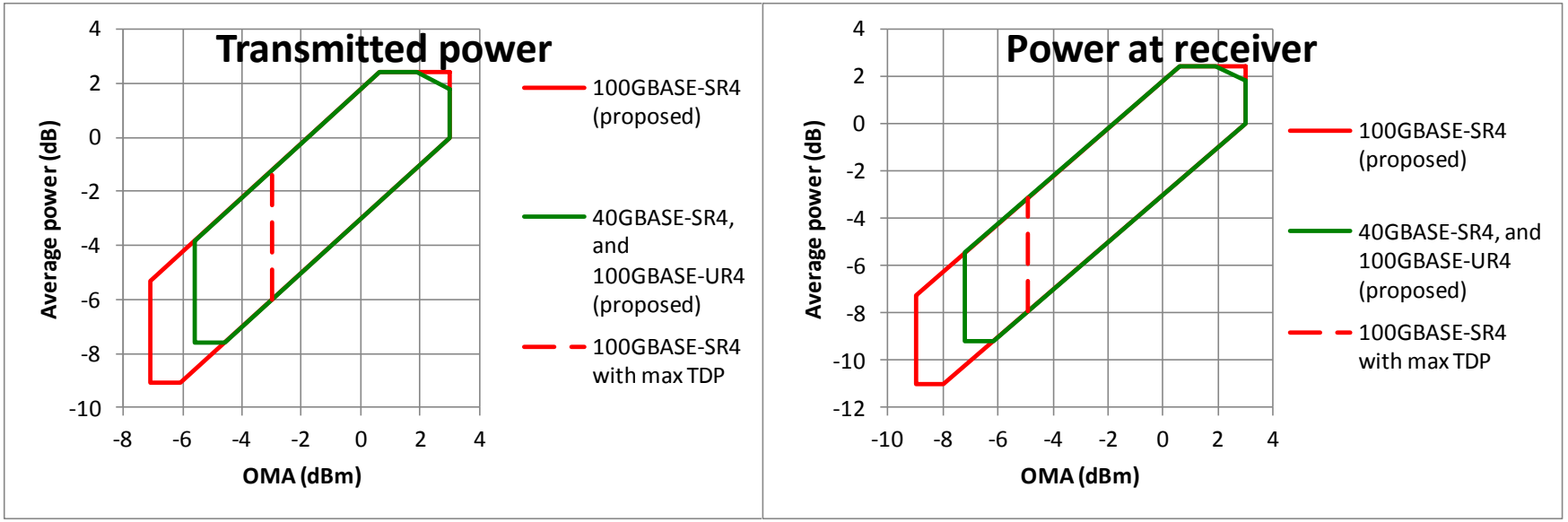
- Piers Dawe, Low power 100G MMF PHY and electrical specs, http://ieee802.org/3/bm/public/nov12/dawe_01a_1112_optx.pdf
- OIF CEI-28G-VSR Draft 9.0, January 2013
- Jonathan King, 100m MMF reach objective baseline proposal, http://ieee802.org/3/bm/public/jan13/king_02_0113_optx.pdf

Backup slides

OMA – average power maps



Reflection specifications

nPPI	CEI-28G-VSR	CAUI-4	CPPI-4
Eqn. 86A-1 (in S-parameter form for comparison with other specs)	Eqn 1-2	Eqn. A-1	Eqn. xA-1
Sddxx <= -12+2sqrt(f) 0.01 <= f < 4.11 -6.3+13log10(f/5.5) 4.11 <= f <= 11.1	SDD22 < -11 for 0.05<f<fb/7, < -6.0 + 9.2*log(2f/fb) for fb/7<f<fb	SDD22>= 12-0.5f for 0.01<=f<=8, >= 5.65-9.71log10(f/14) for 8<f<= 25	Sddxx <= -12+fn(f) TBD 0.05 <= f <= 25.79
Eqn. 86A-2 (in 802.3ba)	* 250 MHz to30 GHz		Eqn. xA-2
Sccxx <= -7 +1.6f 0.01 ≤ f < 2.5 -3 2.5 ≤ f ≤ 11.1			Sccxx <= -2 0.2 ≤ f ≤ 5 -1 -f/10 5 ≤ f ≤ 25.79
	Eqn 1-3	Eqn. A-3	Eqn. xA-3
	SDC22 < -25 + 20*(f/fb) for 0.05<f<fb/2, < -15 for fb/2<f<fb	SDC22 < -25 + 20*(f/25.78) for 0.05<f<12.89, SDC22 < -15 for 12.89<f<25.78	Sdcxx <= -15+0.5f or similar, 0.05 <= f <= 25.79

xA.6 Recommended electrical channel

- Host electrical performance is under active study in P802.3bj
- Host reflections are very significant
  - The estimates below, from September 2012, assume a clean host channel (low reflections and ILD)
  - Expect that a host channel suitable for 100GBASE-CR4 will be suitable for 100GBASE-UR4

between the PMA IC (TP0 or TP5) and TP1a or TP4a

Sdd21 >= -0.5 $0.01 \le f < 0.11$

-0.114 - 0.8914sqrt(f) - 0.846f $0.11 \le f < 7$

35.91 - 6. 3 291f $7 \le f < 8$

-14.72 $8 \le f \le 11.1$

Sdd21 <= 0.22 -0.46f $0.01 \le f \le 7$

3 $7 \le f \le 11.1$

Sdd21 >= -0.5 $0.01 \le f <$ 0.?

-? - ?sqrt(f) - ?f 0.? $\le f <$ 13

? -?f 13 $\le f <$ 25.79

Ratio of about 2.5 to 3, as for nPPI

Sdd21 <= 0.22 -?f $0.01 \le f \le$ 25.79

Add: recommended max ILDrms

The recommended maximum loss of the host PCB only (without connector or HCB) at 5.15625 GHz is 4.4 dB.

The recommended maximum loss of the host PCB only (without connector or HCB) at 12.890625 GHz is 6.8? dB.

Revision history: Version a

- New slide 14
- J9 replaced by J4
- Slide 25, OMA – average power maps, corrected and enhanced
- Layout corrections on slide 13
- Corrected reference on slide 11