

# 200 Gb/s per lane KR Backplane Objective Proposal – Status Report

Richard Mellitz, Samtec

Brandon Gore, Samtec

Kent Lusted, Intel

Jim Weaver, Arista

Sam Kocsis, Amphenol

Howard Heck, Intel

Mike Li, Intel

Tom Palkert, Samtec

Nathan Tracy, TE Connectivity

Priyank Shukla, Synopsys

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# Contributors

- ❑ Adam Healey, Broadcom
- ❑ Henry Wong, Alphawave
- ❑ Megha Shanbhag, TE Connectivity
- ❑ Jason Chan, Arista
- ❑ Tony Chan Carusone, Alphawave
- ❑ Dave Cassan, Alphawave

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# Presentation Goal

MOTIONS\_3DFDJ\_2303

- Propose a value for “X” in straw poll #1 (motions\_3dfdj\_2303)

## Straw Poll #1

I would support a one-lane 200 GbE, a two-lane 400 GbE, a four-lane 800 GbE, and an eight-lane 1.6 TbE backplane objective of the form:

“Define a physical layer specification that supports [n\*200] Gb/s operation over [n] lanes over electrical backplanes supporting a die-to-die insertion loss  $\leq X$  dB at 53.125 GHz”

Results (all) Y: 56 , N: 11 , A: 14

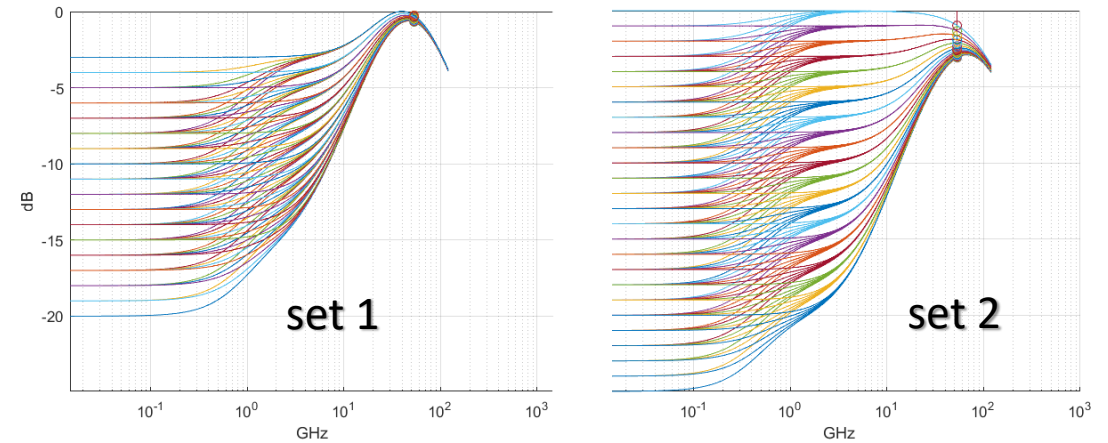
**X = 40**

# Example parameters sets which suggest > 3 dB COM feasibility for “X” = 40 dB

THIS IS NOT A PARAMETER PROPOSAL

parameter	Used for this work set 1	Used for this work set 2
$\eta_0$ [V <sup>2</sup> /GHz]	4e-9	5e-9
SNR_Tx	33	33
$t_r$ [ps]	4	4
$f_r$	0.58	0.5
$b_{\max}$	0.75	0.85
DFE equivalent [Taps]	1	1
Tx FFE Pre/Post	4/1	4/1
Rx FFE pre/post cursor	6/60	6/24
FFE floating groups/ floating taps per group*	NA	4/5
DER <sub>0</sub>	1e-4	1e-4
MLSE used	yes	yes

\* RX FFE floating taps estimated in COM 4.0 with RX DFE floating taps in the presentation



parameter	Used for this work set 1	Used for this work Set 2
fz	fb/4.223	fb/2.5
fp1	fb/2.6562	fb/2.5
fp2	Fb/1.8973	Fb
fLF	Fb/80	Fb/160
Gdc	-15 to 0-3 (step 1)	-20 to 0 (step 1)
Gdc2	-5 to 0 (step 1)	-6 to 0 (step 1)

# Example 200 Gb/s KR COM configuration set 1

Packages were adjusted to achieve around 40 dB die to die loss

Table 93A-1 parameters				I/O control			Table 93A-3 parameters			
Parameter	Setting	Units	Information				Parameter	Setting	Units	Information
f_b	106.25	GBd		DIAGNOSTICS	1	logical	package_tl_gamma0_a1_a2	[0 0.0008455 0.000340225]		
f_min	0.05	GHz		DISPLAY_WINDOW	1	logical	package_tl_tau	0.00644805	ns/mm	
Delta_f	0.01	GHz		CSV_REPORT	0	logical	package_Z_c	[92 92 ; 70 70; 80 80; 100 100]	Ohm	
C_d	[0.4e-4 0.9e-4 1.1e-4 ; 0.4e-4 0.9e-4 1.1e-4]	nF	[TX RX]	RESULT_DIR	results\CACR_set1_{date}\		z_p_select	[1:10]		[test cases to run]
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	nH	[TX RX]	SAVE_FIGURES	0	logical	z_p (TX)	[ 6 31 ; 1 1; 1 1 ; 0.5 0.5 ]	mm	[test cases]
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]	Port Order	[ 1 3 2 4 ]		z_p (NEXT)	[ 8 29 ; 1 1; 1 1 ; 0.5 0.5 ]	mm	[test cases]
R_0	50	Ohm		RUNTAG	KR_se1_eval_		z_p (FEXT)	[ 6 31 ; 1 1; 1 1 ; 0.5 0.5 ]	mm	[test cases]
R_d	[ 45 45]	Ohm	[TX RX]	COM_CONTRIBUTION	1	logical	z_p (RX)	[ 8 29 ; 1 1; 1 1 ; 0.5 0.5 ]	mm	[test cases]
A_v	0.386	V	vp/vf=	Operational			C_p	[0.5e-4 0.5e-4]	nF	[TX RX]
A_fe	0.386	V	vp/vf=	ERL Pass threshold	10	dB	Floating Tap Control			
A_ne	0.6	V		COM Pass threshold	3	db	N_bg	0	0 1 2 or 3 groups	
L	4			DER_0	1.00E-04		N_bf	3	taps per group	
M	32			T_r	0.00400	ns	N_f	80	UI span for floating taps	
filter and Eq				FORCE_TR	1	logical	bmaxg	0.2	max DFE value for floating taps	
f_r	0.58	*fb		PMD_type	C2C		B_float_RSS_MAX	0.1	rss tail tap limit	
c(0)	0.55		min	EW	1		N_tail_start	25	(UI) start of tail taps limit	
c(-1)	[ -0.4:0.02:0 ]		[min:step:max]	MLSE	1	logical	Filter: Rx FFE			
c(-2)	[ 0:.02:0.1 ]		[min:step:max]	TDR and ERL options			ffe_pre_tap_len	6	UI	
c(-3)	0		[min:step:max]	TDR	1	logical	ffe_post_tap_len	60	UI	
c(-4)	0		[min:step:max]	ERL	1	logical	ffe_tap_step_size	0		
c(1)	[ -0.2:0.05:0 ]		[min:step:max]	ERL_ONLY	0	ns	ffe_main_cursor_min	1		
N_b	1	UI		TR_TDR	0.01		ffe_pre_tap1_max	1		
b_max(1)	0.75		As/dffe1	N	1000	logical	ffe_post_tap1_max	1		
b_max(2..N_b)	0.15		As/dfe2..N_b	TDR_Butterworth	1		ffe_tapn_max	1		
b_min(1)	0		As/dffe1	beta_x	0		ffe_backoff	0		
b_min(2..N_b)	-0.15	S	As/dfe2..N_b	rho_x	0.618					
g_DC	[-15:1:-3]	dB	[min:step:max]	TDR_W_TXPKG	0	UI				
f_z	25.16	GHz		N_bx	20					
f_p1	40.00	GHz		fixture delay time	[ 0 0 ]					
f_p2	56.00	GHz		Tukey_Window	1					
g_DC_HP	[-5:1:0]		[min:step:max]	Noise, jitter						
f_HP_PZ	1.328125	GHz		sigma_RJ	0.01	UI				
Butterworth	1	logical	include in fr	A_DD	0.02	V^2/GHz				
				eta_0	4.00E-09	dB				
				SNR_TX	33					
				R_LM	0.95					

# Example 200 Gb/s KR COM configuration set 2

Packages were adjusted to achieve around 40 dB die to die loss

Table 93A-1 parameters			
Parameter	Setting	Units	Information
f_b	106.25	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[0.4e-4 0.9e-4 1.1e-4 ; 0.4e-4 0.9e-4 1.1e-4 ]	nF	[TX RX]
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14 ]	nH	[TX RX]
C_b	[0.3e-4 0.3e-4 ]	nF	[TX RX]
A_v	0.413	V	vp/vf=
A_fe	0.413	V	vp/vf=
A_ne	0.608	V	
L	4		
M	32		
filter and Eq			
f_r	0.5	*fb	
c(0)	0.54		min
c(-1)	[-0.4:0.02:0]		[min:step:max]
c(-2)	[0:.02:0.16]		[min:step:max]
c(-3)	[-0.1:0.02:0]		[min:step:max]
c(-4)	[0:.02:0.1]		[min:step:max]
c(1)	[-0.2:0.02:0]		[min:step:max]
N_b	1	UI	
b_max(1)	0.85		As/dffe1
b_max(2..N_b)	[0.3 0.2*ones(1,22)]		As/dfe2..N_b
b_min(1)	0		As/dffe1
b_min(2..N_b)	[-0.3 -0.2*ones(1,22)]	S	As/dfe2..N_b
g_DC	[-20:1:0]	dB	[min:step:max]
f_z	42.50	GHz	
f_p1	42.50	GHz	
f_p2	106.25	GHz	
g_DC_HP	[-6:1:0]		[min:step:max]
f_HP_PZ	0.6640625	GHz	

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	1	logical
CSV_REPORT	0	logical
RESULT_DIR	.\results\CAKR_set2_{date}\	
SAVE_FIGURES	0	logical
Port Order	[ 1 3 2 4 ]	
RUNTAG	KR_set2_eval_	
COM_CONTRIBUTION	1	logical
Operational		
ERL Pass threshold	10	dB
COM Pass threshold	3	db
DER_0	1.00E-04	
T_r	0.004	ns
FORCE_TR	1	logical
PMD_type	C2C	
EW	1	
MLSE	1	logical
TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	ns
TR_TDR	0.01	
N	3500	logical
TDR_Butterworth	1	
beta_x	0	
rho_x	0.618	
TDR_W_TXPKG	0	UI
N_bx	21	
fixture delay time	[ 0 0 ]	
Tukey_Window	1	
Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	V^2/GHz
eta_0	5.00E-09	dB
SNR_TX	33	
R_LM	0.95	

Table 93A-3 parameters			
Parameter	Setting	Units	Information
package_tl_gamma0_a1_a2	[0.0005 0.00089 0.0002]		
package_tl_tau	0.006141	ns/mm	
package_Z_c	[87.5 87.5 ; 92.5 92.5 ]	Ohm	
z_p select	[ 1 2 ]		[test cases to run]
z_p (TX)	[12 42; 1.8 1.8 ]	mm	[test cases]
z_p (NEXT)	[12 40; 1.8 1.8 ]	mm	[test cases]
z_p (FEXT)	[12 42; 1.8 1.8 ]	mm	[test cases]
z_p (RX)	[12 40; 1.8 1.8 ]	mm	[test cases]
C_p	[0.4e-4 0.4e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[ 46.25 46.25]	Ohm	[TX RX]
Floating Tap Control			
N_bg	4		0 1 2 or 3 groups
N_bf	5		taps per group
N_f	60		UI span for floating taps
bmaxg	0.05		max DFE value for floating taps
B_float_RSS_MAX	0.02		rss tail tap limit
N_tail_start	50		(UI) start of tail taps limit
Filter: Rx FFE			
ffe_pre_tap_len	6	UI	
ffe_post_tap_len	24	UI	
ffe_tap_step_size	0		
ffe_main_cursor_min	0.7		
ffe_pre_tap1_max	0.7		
ffe_post_tap1_max	0.7		
ffe_tapn_max	0.7		
ffe_backoff	0		

# Channels which reached X of 40 dB with 7 dB loss packages

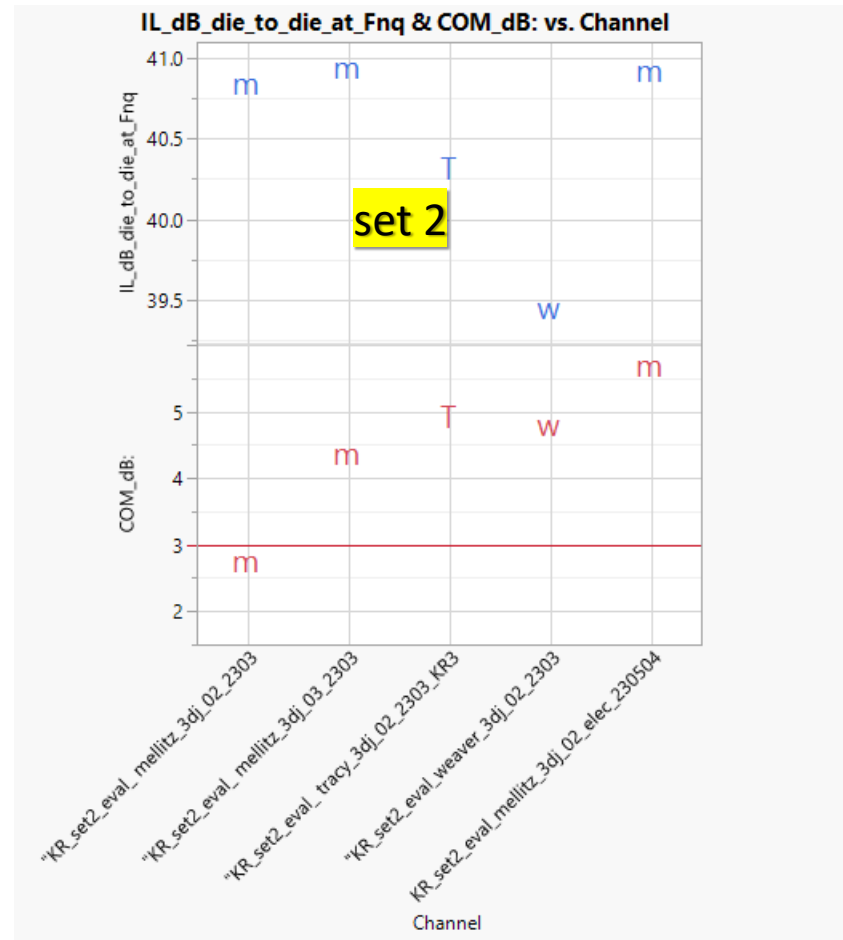
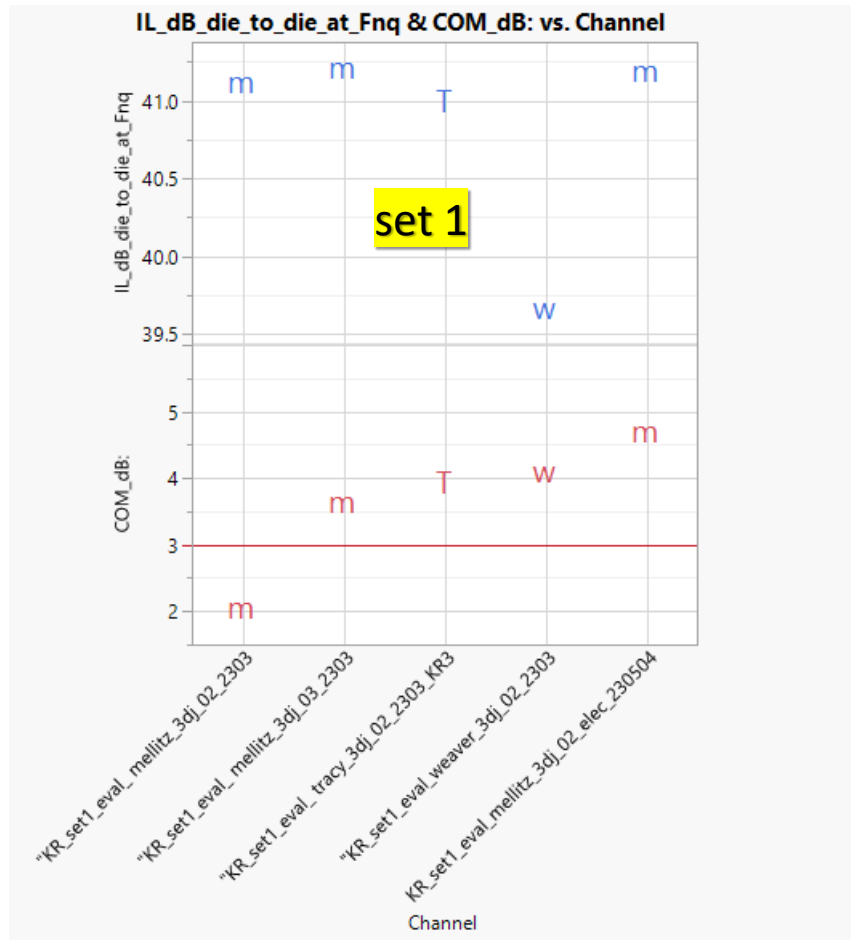
## □ Channels in this presentation (with key)

- [tracy\\_3dj\\_02\\_2303 \(T\)](#)
  - TE\_KR3\_2p7dBPCB\_10in30AWG\_Conn\_1m26AWG\_Conn\_10in30AWG\_2p7dBPCB\_THRU
- [weaver\\_3dj\\_02\\_2303 \(w\)](#)
  - KR\_ch\_3in\_PCB\_NPC\_300mm\_29AWG\_BP\_800mm\_27AWG\_thru
- [mellitz\\_3dj\\_02\\_2303 \(m\)](#)
  - KRCA\_wXTALK\_25\_PCB-25-25\_mm\_FO-300-300\_mm\_CA-1000\_mm\_thru
- [mellitz\\_3dj\\_03\\_2303 \(m\)](#)
  - KRCA\_wXTALK\_LD\_25\_PCB-25-25\_mm\_FO-300-300\_mm\_CA-1000\_mm\_thru
- [mellitz\\_3dj\\_02\\_elec\\_230504 \(m\)](#)
  - KRCA\_wXTALK\_MX\_4\_PCB-25-25\_mm\_FO-200-200\_mm\_CA-200\_mm\_thru



# Landing zone channels for X=40 dB

Both sets of COM parameter can achieve 3 dB of COM



# Proposed IEEE P802.3dj Objectives

- Define a physical layer specification that supports 200 Gb/s operation over 1 lane over electrical backplanes supporting a die-to-die insertion loss  $\leq 40$  dB at 53.125 GHz
- Define a physical layer specification that supports 400 Gb/s operation over 2 lanes over electrical backplanes supporting a die-to-die insertion loss  $\leq 40$  dB at 53.125 GHz
- Define a physical layer specification that supports 800 Gb/s operation over 4 lanes over electrical backplanes supporting a die-to-die insertion loss  $\leq 40$  dB at 53.125 GHz
- Define a physical layer specification that supports 1.6 Tb/s operation over 8 lanes over electrical backplanes supporting a die-to-die insertion loss  $\leq 40$  dB at 53.125 GHz

# Summary

- ❑ 3 dB COM demonstrated for channels with 40 dB die to die loss
- ❑ Replace X with 40 dB in straw poll #1 of motions\_3dfdj\_2303
  - Technical feasibility illustrated with 3 KR channels from different sources and different COM parameters,
- ❑ Propose: Add 200GBASE-KR1, 400GBASE-KR2, 800GBASE-KR4, and 1.6TBASE-KR8 objectives to IEEE P802.3dj as on slide 9

# Thank You!