KEYSIGHT

C2M Host/Module Output Test Measurements

Rev 5.0-R1.0
January 2024
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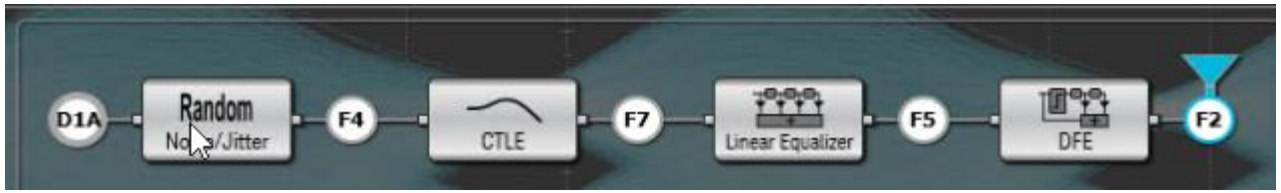
Feasibility of C2M Host/Module output test procedures at TP1a/TP4

Current assumption for C2M channel (https://www.ieee802.org/3/dj/public/23_11/diminico_3dj_01_2311.pdf)

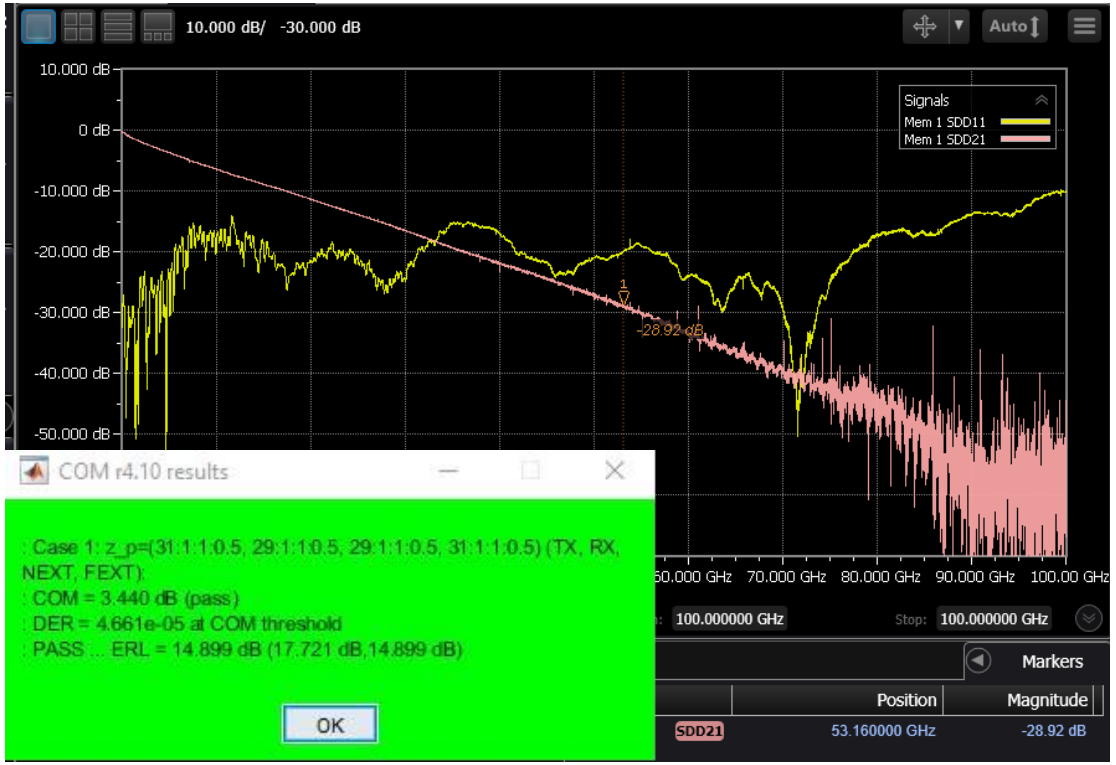
- Up to 33dB IL
- Ref Rx: 80GHz 4th order Bessel + input referred noise + 2-gain stage CTLE + 60Tap FFE + 1-tap DFE



Initial measurement for C2M host output test reported in(https://www.ieee802.org/3/dj/public/adhoc/electrical/24_0104/calvin_3dj_elec_01a_240104.pdf)

- Feasibly of C2M test channel demonstrated in using 1mm based MTF and ISI board (COM >30dB)
- EH/VEC not possible @1e-5 probability while COM reported 6dB VEC → concerns reported by the WG about the equalizer employed (lack of CTLE) for measurement.

This contribution: Attempt to reconcile COM predictions and lab measurements



212.5 Gb/s Measurement with 29dB channel

"C2M channel condition" with a new channel

- ❑ M8042A PG
  - ❑ no Tx de-emphasis
- ❑ M8067A-005-Trace 2
  - ❑ 29dB @53.125GHz
- ❑ N1000A+N1046A Sampling scope
  - ❑ Explicit Clock
  - ❑ SIRC: 80GHz 4th order Bessel
  - ❑ Input referred noise 6e-9V²/GHz

C2M measurement with 29dB channel

15 taps FFE

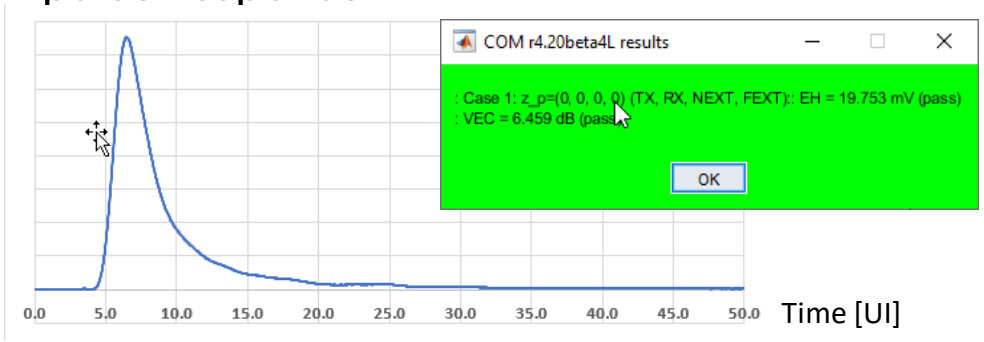
- large noise enhancement (no Tx de-emphasis)

- Eyes still closed at 1e-5 probability but VEC/EH measurement possible at 1e-4 probability
- DDJ/ISI-J main contributor to TJ Jitter
  - 850mUI TJ (1e-4) → 760mUI DDJ

C2M measurement with 29dB channel

2-Gain stage CTLE + 15 taps FFE + 1-tap DFE

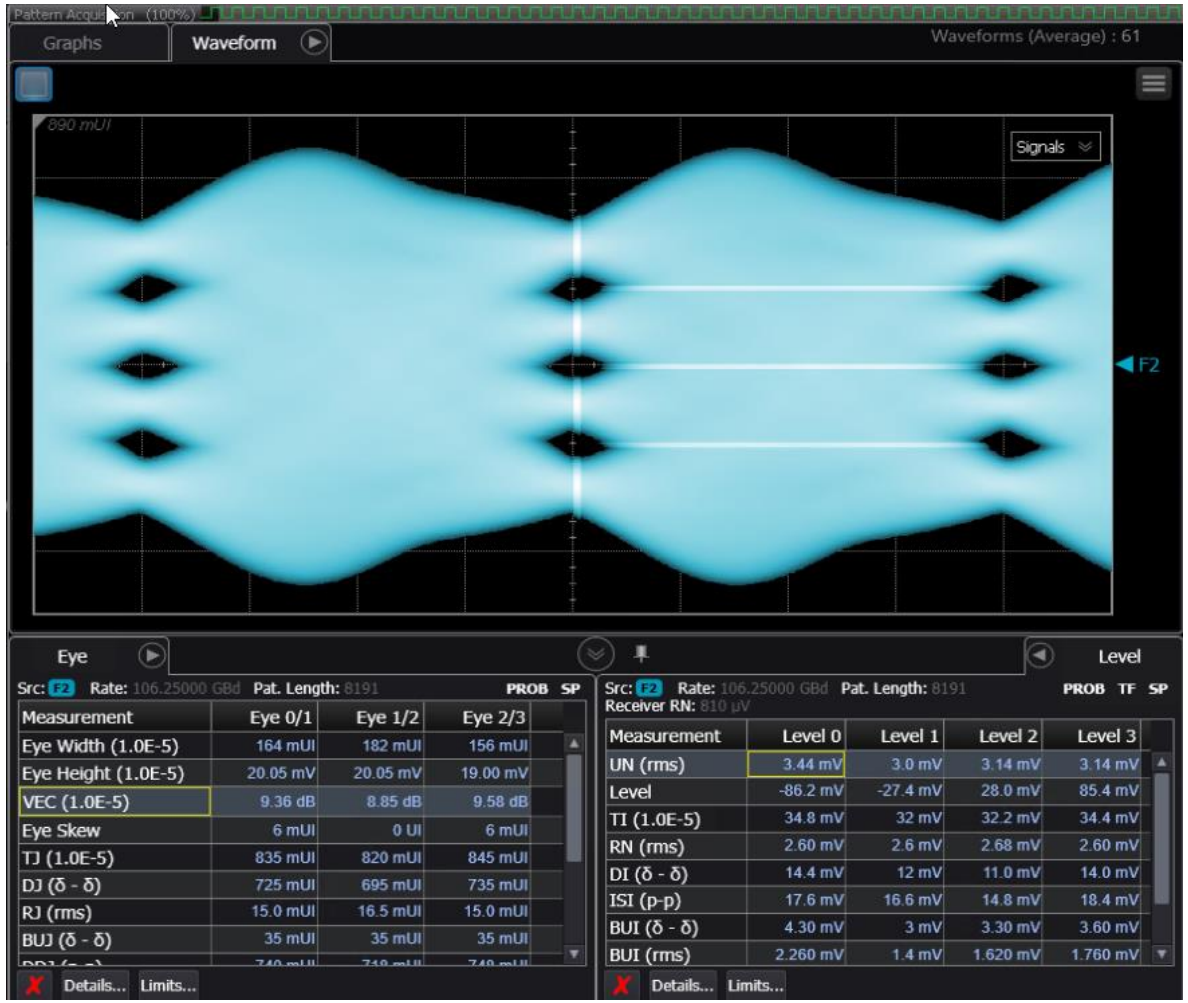
- Use COM tool using the measured system pulse response



- Use COM CTLE & FFE settings in Scope

	COM tool	Scope
VEC [dB]	6.45	9.6
EH [mV]	19.75	19.0
DFE	0.44	0.26

- DDJ/ISI-J *still* main contributor to TJ Jitter



Summary

- Report host output measurements @ TP1a with 29dB channel
- Compare EH/VEC predicted by COM and measured by scope
  - Better agreement between COM tool and scope → Different DFE values indicate COM CTLE/FFE values are not optimal for the exp. setup
  - EH/VEC measurement is extremely sensitive to Rx equalizer settings
  - Note: COM rev 4.10 cannot handle pulse response (defect) → COM rev 4.20 beta provided by Richard Mellitz

- Open issues
  - Discrepancies between COM prediction and measurements are still significant (3dB VEC)
  - How to adapt the measurement procedure in case MLSD adopted for C2M ref Rx?

COM C2M prediction with Pulse Response

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	0.9e-4 1.1e-4 ;0.4e-4 0.9e-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]
R_0	50	Ohm	
R_d	[50 50]	Ohm	[TX RX]
A_v	0.1	V	vp/vf=
A_fe	0	V	vp/vf=
A_ne	0	V	
L	4		
M	32		
filter and Eq			
f_r	0.58	*fb	
c(0)	0.54		min
c(-1)	[-0.4:0.02:0]		[min:step:max]
c(-2)	[0:.02:0.1]		[min:step:max]
c(-3)	0		[min:step:max]
c(-4)	0		[min:step:max]
c(1)	0		[min:step:max]
N_b	1	UI	
b_max(1)	0.75		As/dffe1
b_max(2..N_b)	0.3		As/dfe2..N_b
b_min(1)	0		As/dffe1
b_min(2..N_b)	-0.15	S	As/dfe2..N_b
g_DC	[-15:1:-3]	dB	[min:step:max]
f_z	25.16	GHz	
f_p1	40.00	GHz	
f_p2	56.00	GHz	
g_DC_HP	[-5:1:0]		[min:step:max]
f_HP_PZ	1.328125	GHz	

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	1	logical
CSV_REPORT	1	logical
RESULT_DIR	results\KRCR_1_{date}\	
SAVE_FIGURES	0	logical
Port Order	[1 3 2 4]	
RUNTAG	C2M_eval_	
COM_CONTRIBUTION	0	logical
TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	ns
TR_TDR	0.01	
N	100	logical
TDR_Butterworth	1	
beta_x	0	
rho_x	0.618	
TDR_W_TXPKG	0	UI
N_bx	20	
fixture delay time	[0 0]	
Tukey_Window	1	
Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	V^2/GHz
eta_0	6.00E-09	dB
SNR_TX	30.5	
R_LM	0.97	
benartsi_3df_01a_2211	2.4 dB, 5.8 dB, 7 dB, 9.1 dB	
mli_3df_02_220316		
healey_3dj_01_2309	slide 6 rounded up	
lim_3dj_04_2309		

Table 93A–3 parameters			
Parameter	**Setting**	**Units**	Information
package_tl_gamma0_a1_a2	[0 0.0008455 0.000340225]		
package_tl_tau	0.00644805	ns/mm	
package_Z_c	[50]	Ohm	
z_p select	[1]		[test cases to run]
z_p (TX)	0	mm	[test cases]
z_p (NEXT)	0	mm	[test cases]
z_p (FEXT)	0	mm	[test cases]
z_p (RX)	0	mm	[test cases]
C_p	[0.5e-4 0.5e-4]	nF	[TX RX]
Filter: Rx FFE			
ffe_pre_tap_len	6	UI	
ffe_post_tap_len	15	UI	
ffe_tap_step_size	0		
ffe_main_cursor_min	1		
ffe_pre_tap1_max	1		
ffe_post_tap1_max	1		
ffe_tapn_max	1		
Operational			
ERL Pass threshold	10	dB	
COM Pass threshold	3	db	
DER_0	1.00E-05		
T_r	0.00450	ns	
FORCE_TR	1	logical	
PMD_type	C2M		
EW	0		
MLSE	0	logical	
ts_anchor	1		
sample_adjustment	[-2 12]		
Local Search	2		
TDMODE	1	time domain pulse response	
VEC Pass threshold	12		

SAVE_CONFIG2MAT	1	
Receiver testing		
RX_CALIBRATION	0	
Sigma BBN step	5.00E-03	
ICN parameters		
f_v	0.278	
f_f	0.278	
f_n	0.278	
f_2	61.625	
A_ft	0.350	
A_nt	0.350	
Parameter	**Setting**	
board_tl_gamma0_a1_a2	*6.44084e-4 3.6036e-0*	1.4
board_tl_tau	*5.790E-03*	
board_Z_c	100	
z_bp (TX)	*0*	
z_bp (NEXT)	*32*	
z_bp (FEXT)	*32*	
z_bp (RX)	*0*	
C_0	[0.2e-4 0]	
C_1	[0.2e-4 0]	
Include PCB	**0**	
Seletions (rectangle, gaussian,dual_rayleigh,tr		
Histogram_Window_Weight	gaussian	
Qr	*0.02*	
Floating Tap Control		
N_bg	0	0 1 2 or 3
N_bf	4	taps per
N_f	20	UI span f
bmaxg	0.2	max DFE
B_float_RSS_MAX	0.2	rss tail t
N_tail_start	16	(UI) start

Relevant COM spreadsheet update

- remove Tx & Rx traces
- DER: 1e-4 → 1e-5
- TDMODE=1 (for pulse response)