# Discussion on TBDs in Annex 120G

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**For IEEE 802.3ck Ad-Hoc**

# Supporters

# Outlines

- Background
- Target Transition Time Analysis
- Summary Table of C2M Test Specifications – Including C2M 50GAUI-1 & 100GAUI-1

# Background

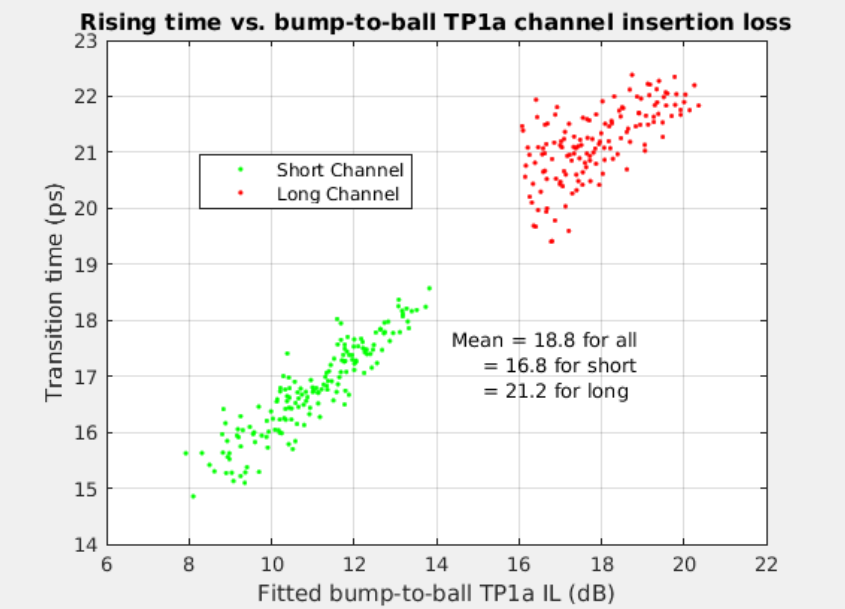
- There are still a lot of TBDs in Annex 120G
  - It requires to fill in those TBDs for technical completeness before D2.0
- Target transition time of Host/Module input stress test
  - Give some directions from experiments on IEEE C2M channels
- Collect specifications of C2M 50GAUI-1 & 100GAUI-1 (in D1.4) & compare
- Purpose: facilitate the discussion & consensus

# Channel and Analysis

- Channel (crosstalk included)
  - TP1a analysis for total nineteen IEEE C2M host-to-module channels
    - Sweep host package trace length, z_p1(TX)
      - z_p1(TX) = [5:0.5:10 11:1:20 22:2:36]
    - Total 19 * 29 = 551 CH+PKG test cases
- COM parameter settings [details in appendix]
  - COM 3.1
  - TP1a: TX Device/PKG + H2M Channels
    - Set ‘zero’ to related RX PKG & on-die settings
- Analysis
  - Take TP0 to TP1a through channel
    - Good channel only with VEC <= 12 dB & VEO >= 8 mV
  - Calculate 20% ~ 80% transition time (rising & falling times) at TP1a
    - By optimized TX FIR settings
    - Based on 802.3ck D1p4 & Annex 120E

# Simulation Results & Target Transition Time

- Show ONLY passed channels here
- Transition time strongly depends on bump-to-ball TP1a insertion loss
- The purpose of 'target transition time' spec is to reflect the "real" transition time it may be under input stressed test
  - Taking the average of the transition time of "good" passed channels as "target"
- Due to their different channel IL ranges, short and long channels split into two groups
  - Mean of "short channel" = 16.8 ps
  - Mean of "long channel" = 21.2 ps
- Proposal: adopt 19 ps for target transition time in 120G.3.3.2.1



# C2M Test Specs Summary – (Exc. ERL) 50GAUI-1 & 100GAUI-1 (1/2)

| | | Diff. p2p output voltage (mV, max.) | | Slew time (target) or Transition time (min.) | |
|---|---|---|---|---|---|
| | | 50GAUI-1 | 100GAUI-1 | 50GAUI-1 | 100GAUI-1 |
| Host output | Spec @ TP1a (max. volt.) | 880 | 870 | 10 ps | 7.5 ps (min.) |
| | Xtalk cal. @ TP4 (target) | 900 | ~~TBD~~ → 900 | 12 ps (+/- 0.27 V) | ~~TBD ps (+/- TBD V)~~ → ? ps (+/- 0.27 V) |
| Module output | Spec @ TP4 (max. volt.) | 900 | 900 | 9.5 ps | 7.5 ps (min.) |
| | Xtalk cal. @ TP1a (target) | 880 | ~~TBD~~ → 870 | 19 ps | ~~TBD ps~~ → 19 ps (20% ~ 80%) |
| Host input | In Spec @ TP4a | - | - | - | - |
| | Sig. cal. @ TP4 (min.) | 900 | 900 | - | - |
| | Xtalk cal. @ TP1a (target) | 880 | ~~TBD~~ → 870 | 19 ps (20% ~ 80%) | ~~TBD ps~~ → 19 ps (20% ~ 80%) |
| Module input | In Spec @ TP1 | - | - | 10.5 ps (20% ~ 80%) | 9 ps (20% ~ 80%) (min.) |
| | Sig. cal. @ TP1a (min.) | 900 | 900 | - | - |
| | Xtalk cal. @ TP4 (target) | 900 | ~~TBD~~ → 900 | 12 ps (+/- 0.27 V) | ~~TBD ps (+/- TBD V)~~ → ? ps (+/- 0.27 V) |

PS: The values in RED are the proposed values.

# C2M Test Specs Summary – (Exc. ERL) 50GAUI-1 & 100GAUI-1 (2/2)

| | | EH (min) | | VEC (max) | |
|---|---|---|---|---|---|
| | | 50GAUI-1 | 100GAUI-1 | 50GAUI-1 | 100GAUI-1 |
| Host out | Out Spec @ TP1a | 32 mV | ~~15 mV~~ → 8 mV *2 | 12 dB | ~~9 dB~~ → 12 dB *2 |
| Module out | Out Spec @ TP4 | Near-end: 70 mV<br>Far-end: 30 mV | ~~24 mV~~ → ?? mV *3 | - | ~~7.5 dB~~ → ?? dB *3 |
| Host in | Sig. cal. @ TP4 | Near-end: -<br>Far-end: 30 mV | ~~24 mV~~ → ?? mV *3 | - | ~~7.5 dB~~ → ?? dB *3 |
| Module in | Sig. cal. @ TP1a | 32 mV | ~~15 mV~~ → 8 mV *2 | 12 dB | ~~9.0 ~ 9.5 dB~~ *1 → 12 ~ 12.5 dB *2 |

PS: The values in RED are the proposed values.

1* This spec had been proposed by Mike Dudek by #10062 against D1.1 & adopted in D1.2. Due to VEC at TP1a is more critical for end to end performance than just the eye opening. Add VEC (max) & VEC (min) in the table.

2* The detailed analysis can be found in wu_3ck_01_0121.pdf

3* We may apply the similar analysis to derive the EH & VEC for module output & host input

# Summary

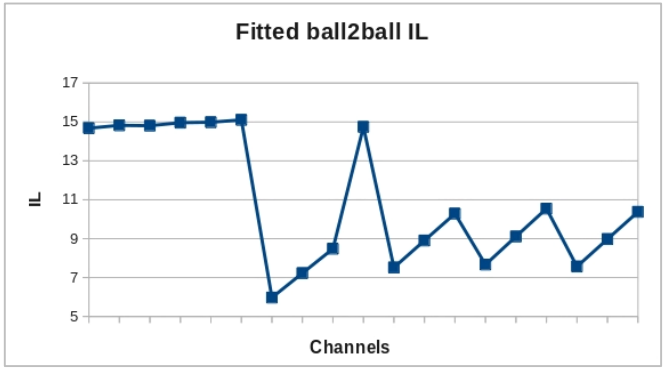
- Propose to adopt slides 7 & 8 to modify 120G

# Thank You

# C2M Host-to-Module Channels for Analysis

- Short Channel
- Long Channel

| Contribution | Zip files | Channel | SxP Files |
|---|---|---|---|
| lim_3ck_01a_0319 | lim_3ck_01_0319_c2m.zip | Tx7_L10 | 112G_16dB_(QSFPDD+module card)_TX7_L10 |
| | | Tx7_L23 | 112G_16dB_(QSFPDD+module card)_TX7_L23 |
| | | Tx3_L10 | 112G_16dB_(QSFPDD+module card)_TX3_L10 |
| | | Tx3_L23 | 112G_16dB_(QSFPDD+module card)_TX3_L23 |
| | | Tx7_Asic | 112G_16dB_(QSFPDD+module card)_TX7_Asic |
| | | Tx3_Asic | 112G_16dB_(QSFPDD+module card)_TX3_Asic |
| lim_3ck_adhoc_01_ | 073119 lim_3ck_adhoc_02_073119.zip | Ch5a_2" | Channel5a_Smaller_Pad_2inch_trace |
| | | Ch5b_3" | Channel5b_Smaller_Pad_3inch_trace |
| | | Ch5c_4" | Channel5c_Smaller_Pad_4inch_trace |
| | | Ch5d_9" | Channel5d_Smaller_Pad_9inch_trace |
| akinwale_3ck_adhoc_01a_08282019 | akinwale_3ck_C2M_channels_TP0a_100ohms_08222019.zip | 2''100Ohm | C2M_2p0in_100Ohm_thru1.s4p |
| | | 3''100Ohm | C2M_3p0in_100Ohm_thru1.s4p |
| | | 4''100Ohm | C2M_4p0in_100Ohm_thru1.s4p |
| | akinwale_3ck_C2M_channels_TP0a_85ohms_08222019.zip | 2''85Ohm | C2M_2p0in_85Ohm_thru1.s4p |
| | | 3''85Ohm | C2M_3p0in_85Ohm_thru1.s4p |
| | | 4''85Ohm | C2M_4p0in_85Ohm_thru1.s4p |
| | akinwale_3ck_C2M_channels_TP0a_93Ohms_08222019.zip | 2''93Ohm | C2M_2p0in_93Ohm_thru1.s4p |
| | | 3''93Ohm | C2M_3p0in_93Ohm_thru1.s4p |
| | | 4''93Ohm | C2M_4p0in_93Ohm_thru1.s4p |



# COM Settings – TP1a

| Table 93A-1 parameters | | | | |
|---|---|---|---|---|
| **Parameter** | **Setting** | **Units** | **Information** | |
| f_b | 53.125 | GBd | | |
| f_min | 0.05 | GHz | | |
| Delta_f | 0.01 | GHz | | |
| C_d | [1.2e-4 0] | nF | [TX RX] | |
| L_s | [0.12 0] | nH | [TX RX] | |
| C_b | [0.3e-4 0] | nF | [TX RX] | |
| z_p select | [ 1 2 ] | | [test cases to run] | |
| z_p (TX) | [12 16; 18 18 ] | mm | [test cases] | |
| z_p (NEXT) | [ 0 0 ; 0 0 ] | mm | [test cases] | |
| z_p (FEXT) | [12 16; 18 18 ] | mm | [test cases] | |
| z_p (RX) | [ 0 0 ; 0 0 ] | mm | [test cases] | |
| C_p | [0.87e-4 0] | nF | [TX RX] | |
| R_0 | 50 | Ohm | | |
| R_d | [50 50] | Ohm | [TX RX] | |
| A_v | 0.415 | V | vp/vf=.694 | |
| A_fe | 0.415 | V | vp/vf=.694 | |
| A_ne | 0.608 | V | | |
| L | 4 | | | |
| M | 32 | Samp/UI | | |
| samples_for_C2M | 100 | Samp/UI | | |
| T_O | 50 | mUI | | |
| AC_CM_RMS | 0 | V | [test cases] | [ 0.0235 0.0256] |
| **filter and Eq** | | | | |
| f_r | 0.75 | *fb | | |
| c(0) | 0.54 | | min | |
| c(-1) | [-0.2:0.02:0] | | [min:step:max] | |
| c(-2) | [0:0.02:0.1] | | [min:step:max] | |
| c(-3) | [ 0 ] | | [min:step:max] | |
| c(1) | [-0.1:0.02:0] | | [min:step:max] | |
| N_b | 4 | UI | | |
| b_max(1) | 0.4 | | As/dffe1 | |
| b_max(2..N_b) | [ 0.15 **0.10** 0.1 ] | | As/dfe2..N_b | |
| b_min(1) | 0.1 | | As/dffe1 | |
| b_min(2..N_b) | [ -0.15 – **0.05** – 0.05 ] | | As/dfe2..N_b | |
| g_DC | [-13:1:-0] | dB | [min:step:max] | |
| f_z | 12.58 | GHz | | |
| f_p1 | 20 | GHz | | |
| f_p2 | 28 | GHz | | |
| g_DC_HP | [-3:0.5:0] | | [min:step:max] | |
| f_HP_PZ | 1.328125 | GHz | | |
| G_Qual | [-2-9 ;-2-12; -4-12; -6-13] | dB | ranges | |
| G2_Qual | [ 0 -1 -2 -3 ] | dB | ranges | |

| I/O control | | |
|---|---|---|
| DIAGNOSTICS | 1 | logical |
| DISPLAY_WINDOW | 0 | logical |
| CSV_REPORT | 0 | logical |
| RESULT_DIR | .\results\100GEL_C2M_host_{date | |
| SAVE_FIGURES | 0 | logical |
| Port Order | [1 3 2 4] | |
| RUNTAG | C2M_eval_ | |
| COM_CONTRIBUTIOI | 0 | logical |
| Local Search | 2 | |
| **Operational** | | |
| VEC Pass threshold | 9 | db |
| EH_min | 15 | mV |
| ERL Pass threshold | 7.3 | dB |
| DER_0 | 0.00001 | |
| T_r | 0.0075 | ns |
| FORCE_TR | 1 | 5 |
| PMD_type | C2M | |
| BREAD_CRUMBS | 0 | logical |
| SAVE_CONFIG2MAT | 1 | logical |
| PLOT_CM | 0 | logical |
| **TDR and ERL options** | | |
| TDR | 1 | logical |
| ERL | 1 | logical |
| ERL_ONLY | 0 | logical |
| TR_TDR | 0.01 | ns |
| N | 800 | |
| beta_x | 0 | |
| rho_x | 0.618 | |
| fixture delay time | [ 0 0.2e-9 ] | [ port1 port2] |
| TDR_W_TXPKG | 1 | |
| N_bx | 0 | UI |
| Tukey_Window | 1 | |
| **Receiver testing** | | |
| RX_CALIBRATION | 0 | logical |
| Sigma BBN step | 5.00E-03 | V |
| **Noise, jitter** | | |
| sigma_RJ | 0.01 | UI |
| A_DD | 0.02 | UI |
| eta_0 | 4.10E-08 | V^2/GHz |
| SNR_TX | 32.5 | dB |
| R_LM | 0.95 | |

| Table 93A–3 parameters | | |
|---|---|---|
| **Parameter** | **Setting** | **Units** |
| package_tl_gamma0_a1_a2 | [0 0.0009909 0.0002772] | |
| package_tl_tau | 6.141E-03 | ns/mm |
| package_Z_c | [87.5 87.5 ; 92.5 92.5 ] | Ohm |
| ICN & ROM_ILD parameters | | |
| f_v | 0.594 | *Fb |
| f_f | 0.594 | GHz f_r specified in first column |
| f_n | 0.594 | GHz |
| f_2 | 40 | GHz |
| A_ft | 0.600 | V |
| A_nt | 0.600 | V |
| new | | |
| upodated for D1.4 | | |

| Floating Tap Control | | | |
|---|---|---|---|
| N_bg | 0 | 0:12 or 3 groups | |
| N_bf | 3 | taps per group | |
| N_f | 40 | span for floating taps | |
| bmaxg | 0.2 | FE value for floating taps | |
| for TP4--> | [1.2e-4 0] | nF | [TX RX] |
| | [0.12 0] | nH | [TX RX] |
| | [0.3e-4 0] | nF | [TX RX] |
| | [ 1 2 3 ] | | [test cases to run] |
| | [ 2 7 8 ] | mm | [test cases] |
| | [ 0 0 0 ] | mm | [test cases] |
| | [ 2 7 8 ] | mm | [test cases] |
| | [ 0 0 0 ] | mm | [test cases] |
| | [0 0.87e-4] | nF | [TX RX] |

| Table 92–12 parameters | | |
|---|---|---|
| **Parameter** | **Setting** | |
| board_tl_gamma0_a1_a2 | [0 3.8206e-04 9.5909e-05] | |
| board_tl_tau | 0.00579 | ns/mm |
| board_Z_c | 100 | Ohm |
| z_bp (TX) | 407 | mm |
| z_bp (NEXT) | 407 | mm |
| z_bp (FEXT) | 407 | mm |
| z_bp (RX) | 407 | mm |
| C_0 | 0 | nF |
| C_1 | 0 | nF |
| Include PCB | 0 | logical |