

C2M ERL_{min} Proposal

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ToC

- ❑ Experiment with Rich Set of Cases
- ❑ Keys for Parameters, Scatter Plots, and Histograms
- ❑ Pass-fail Definitions
- ❑ Data Culling Process
- ❑ Recommendations

Experiment with Rich Set of Cases

Use posted channels to create a rich set of “pass/fail” cases using transmitter length swept between 11 mm and 32 mm in steps of 1 mm

There are 1408 cases considered here

Using COM configurations in sun_3ck_02_1119

“Pass” will be considered a COM > 3 dB using in the module die

Called this “COM full system”

COM run without crosstalk to sensitize experiment to reflections.

Measure at Tp1a

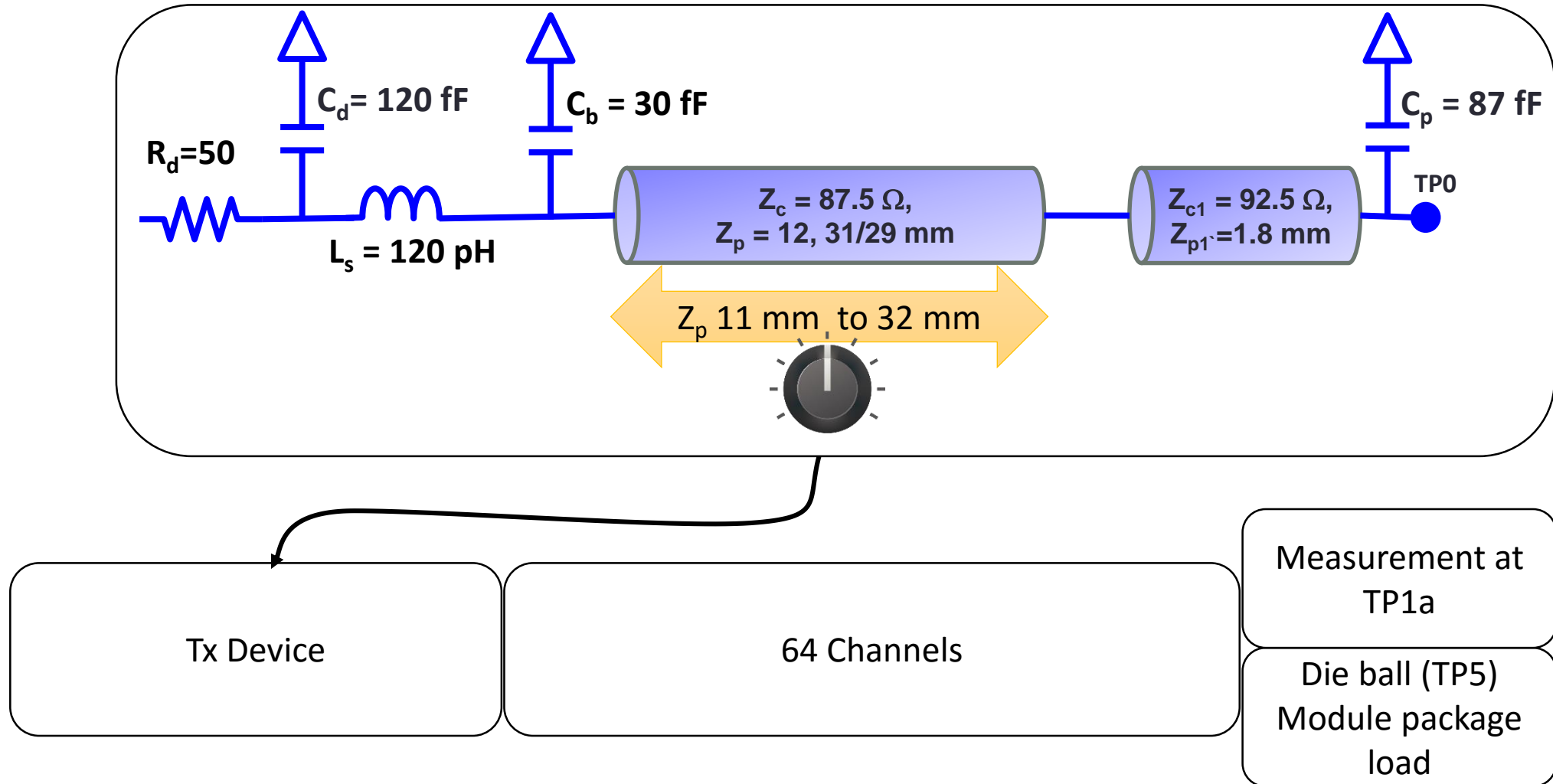
EVEC (sun_3ck_02_1119)

P_{\max}/v_f using $N_p=200$ (mellitz_3ck_01a_0919)

EH (mV)

ERL with ($N_{bx}=4$)

Sweep package length between 12 mm and 32 mm to produce ERL device variability

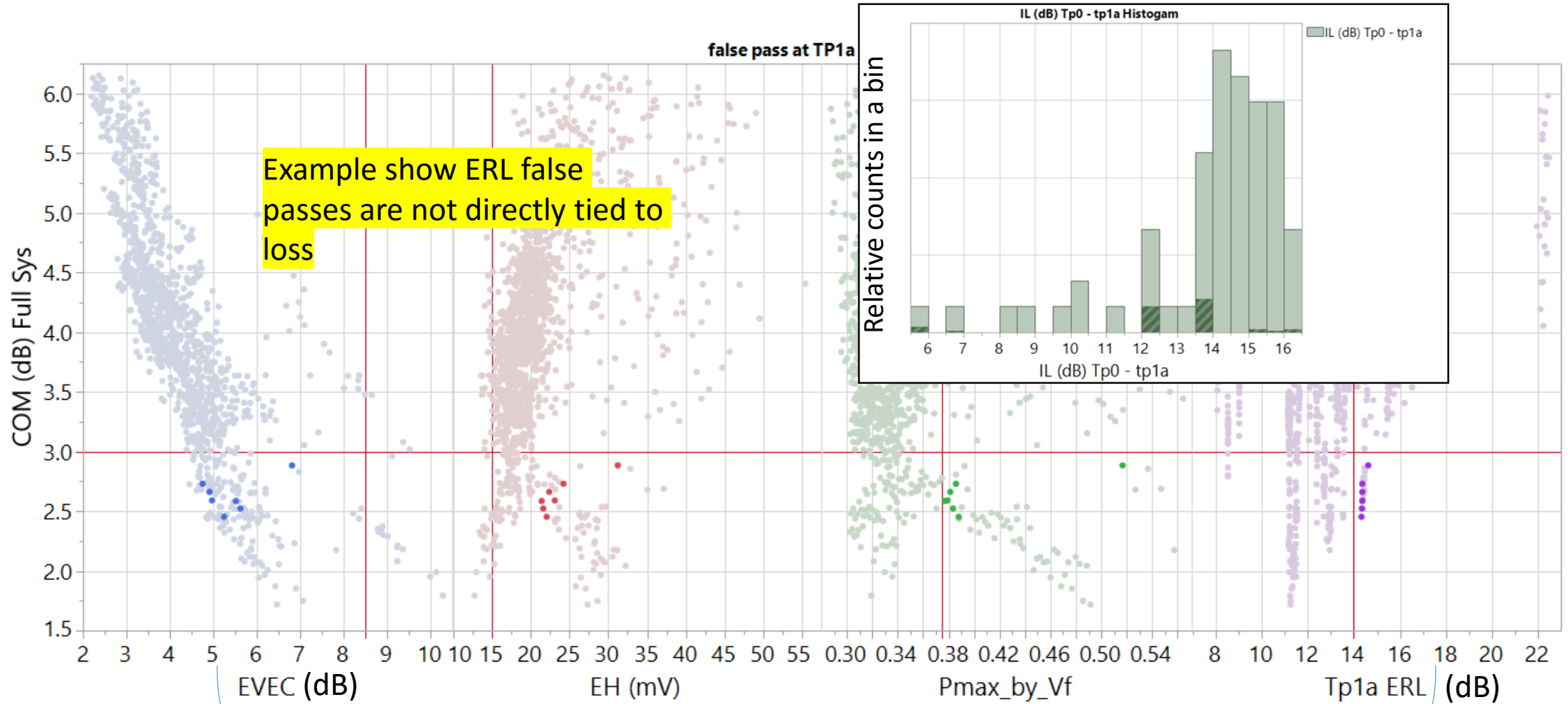


Parameter Key

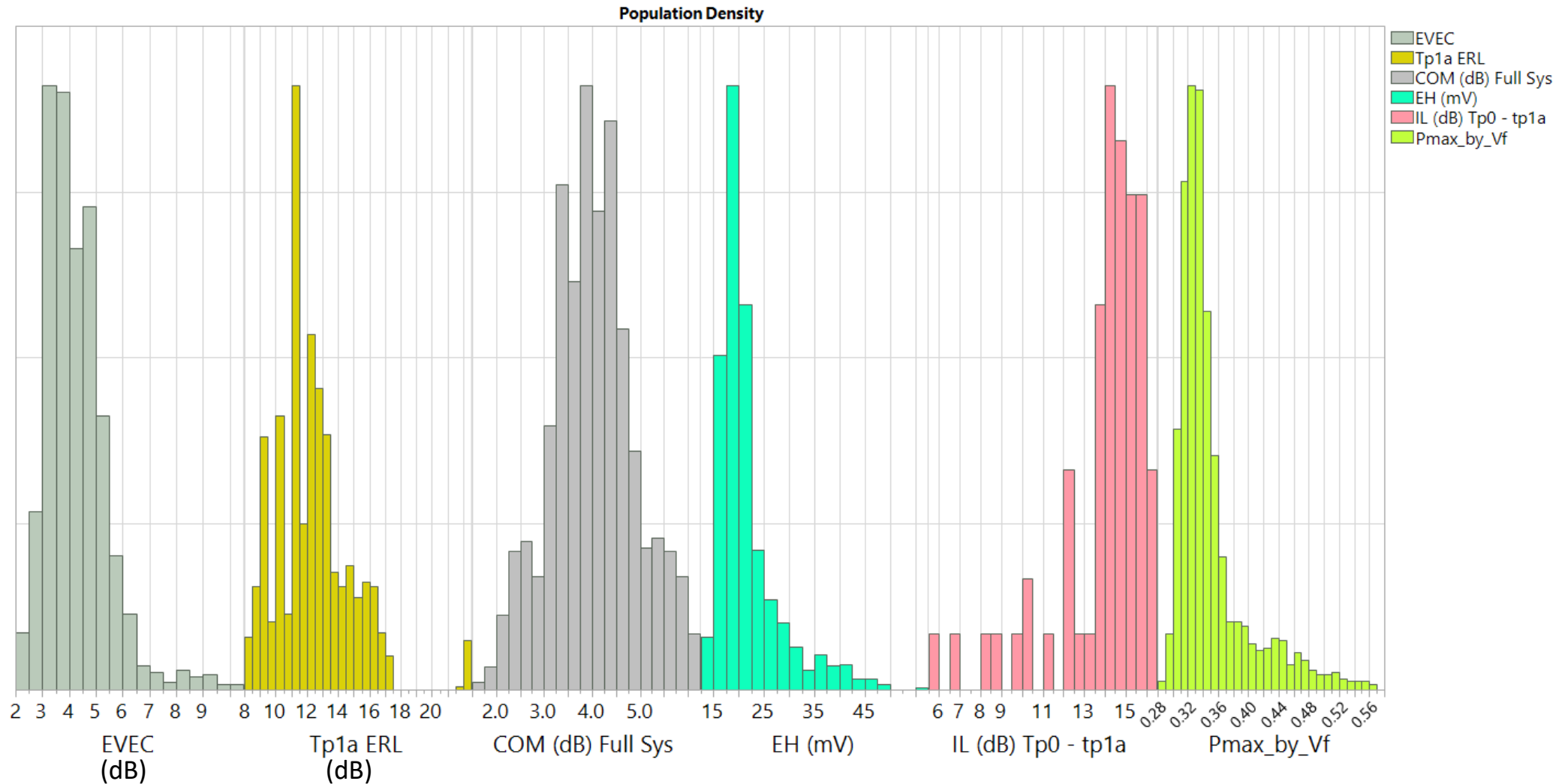
- ❑ *EVEC* (dB): from sun_3ck_02_1119
- ❑ *Pmax_by_Vf* (mv): from mellitz_3ck_01a_0919
 - $N_p=200$
- ❑ *Tp1a ERL* (dB): Annex 93A.5
 - T_{fx} adjusted per channel evaluated
- ❑ *COM* (dB): Annex 93A.1
- ❑ *EH* (mV): VEO from healey_3bs_01a_0317

Key for scatter plots and histograms

Darker colors are associated selected data



Just Information: Population density of parameters for 1408 channels simulations suggest a reasonable population



Pass-fail definitions for ERL specification

❑ False ERL pass (due to ERL only)

- COM full system fail
- EVEC pass
- EH pass
- ERL pass
 - Explore P_{\max}/v_f dependence
 - Called Pmax_by Vf in the slides

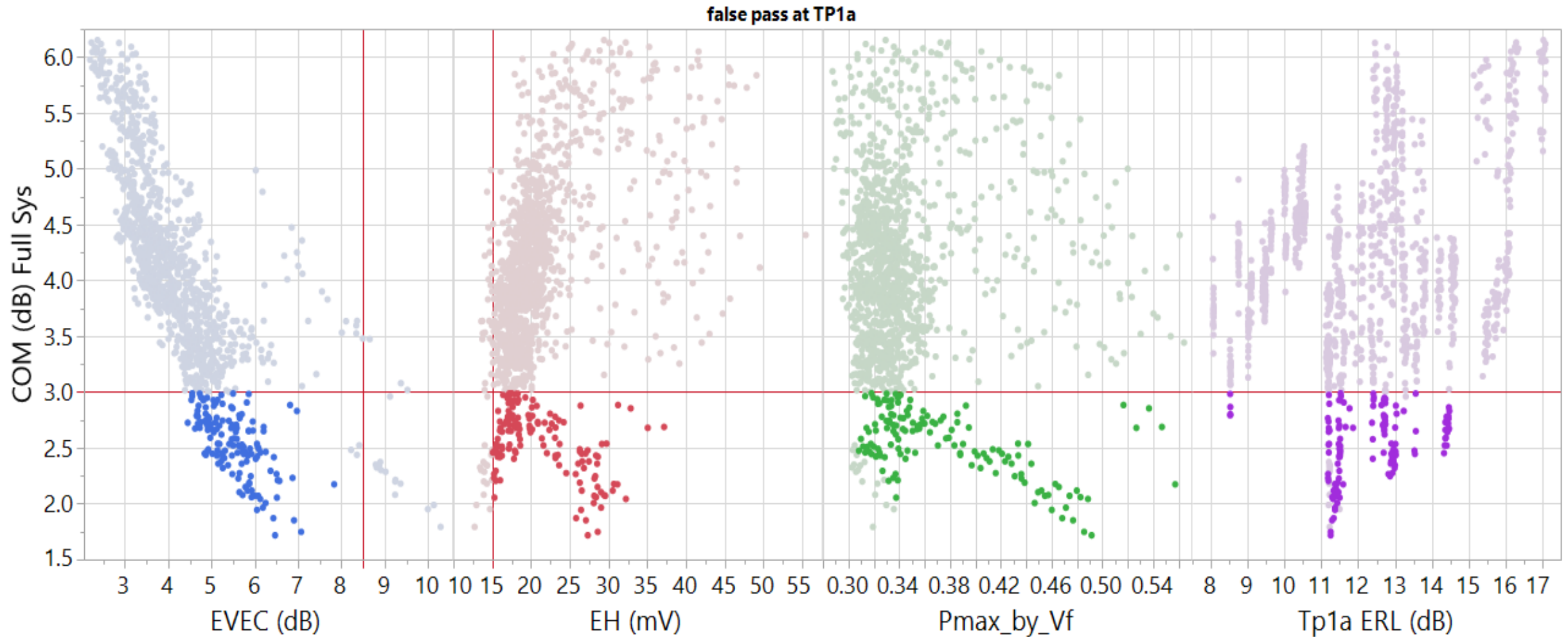
❑ False ERL fail (due to ERL only)

- COM full system pass
- EVEC pass
- EH pass
- ERL fail
 - Explore P_{\max}/v_f dependence
 - Called Pmax_by Vf in the slides

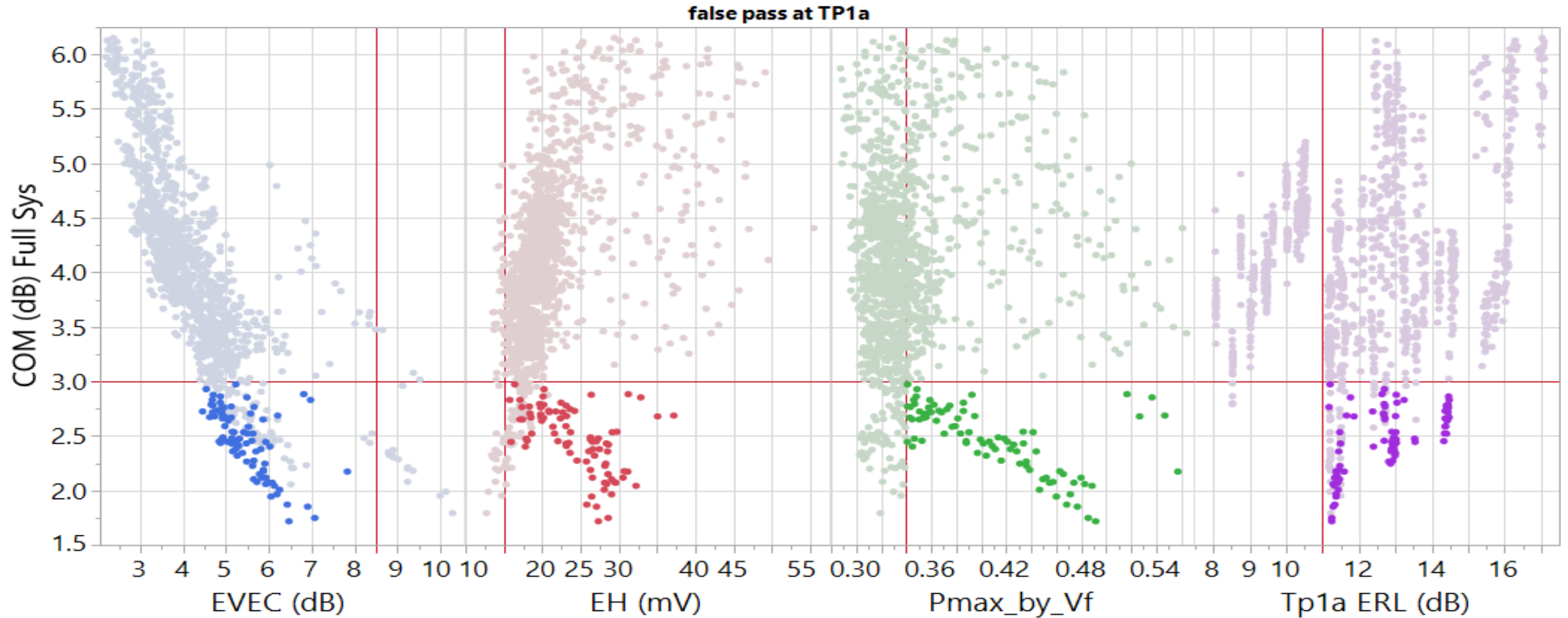
Example: Data Culling Process Follows

- ❑ The data culling process is extensive
- ❑ Only one path is shown as an example

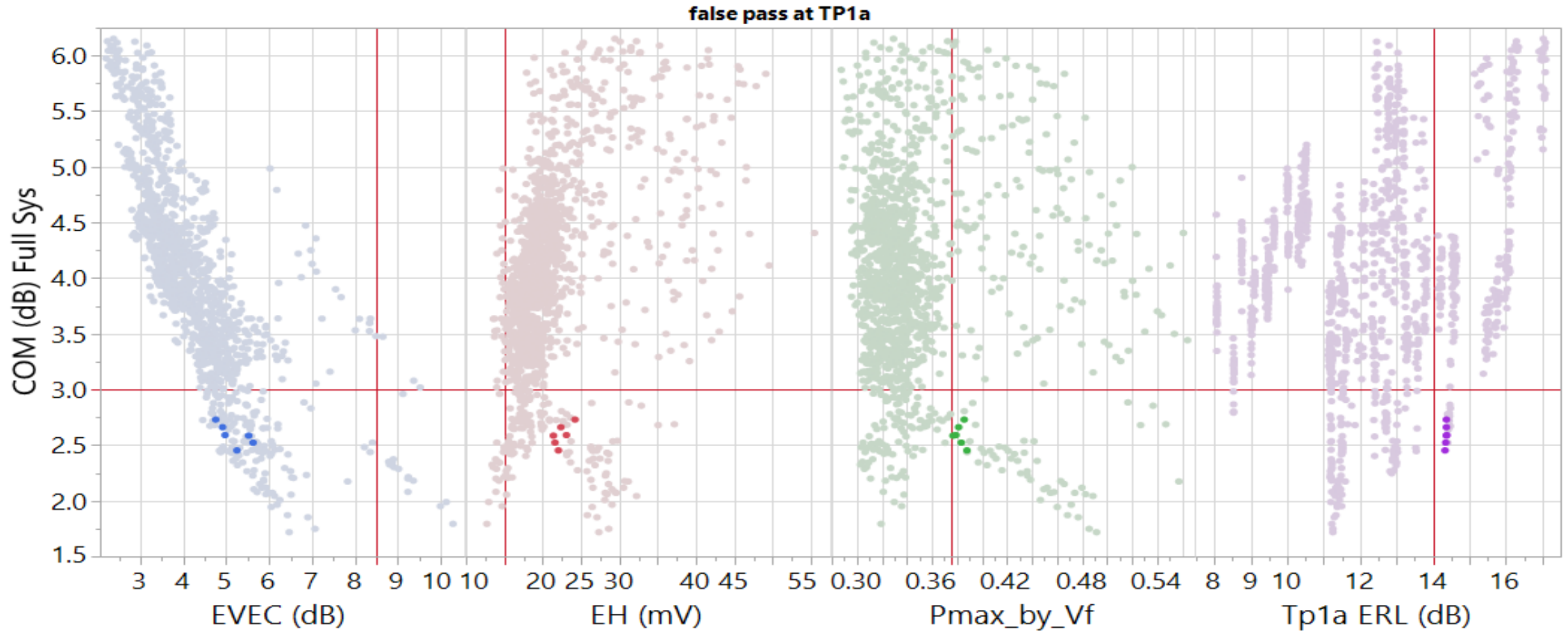
Example: False Pass using VEC and EH criteria (red lines)



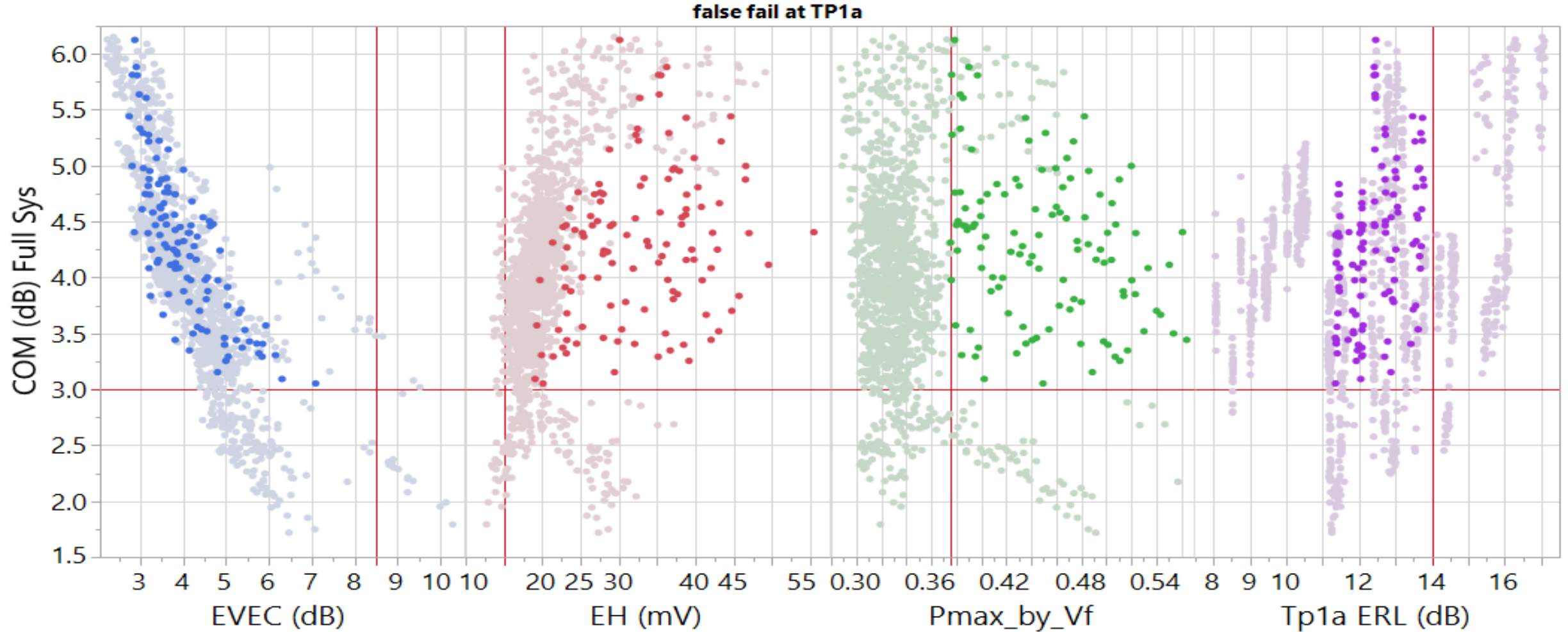
Example: False Pass using VEC and EH but adding Pmax_by Vf min (0.34) and ERL (11 dB)



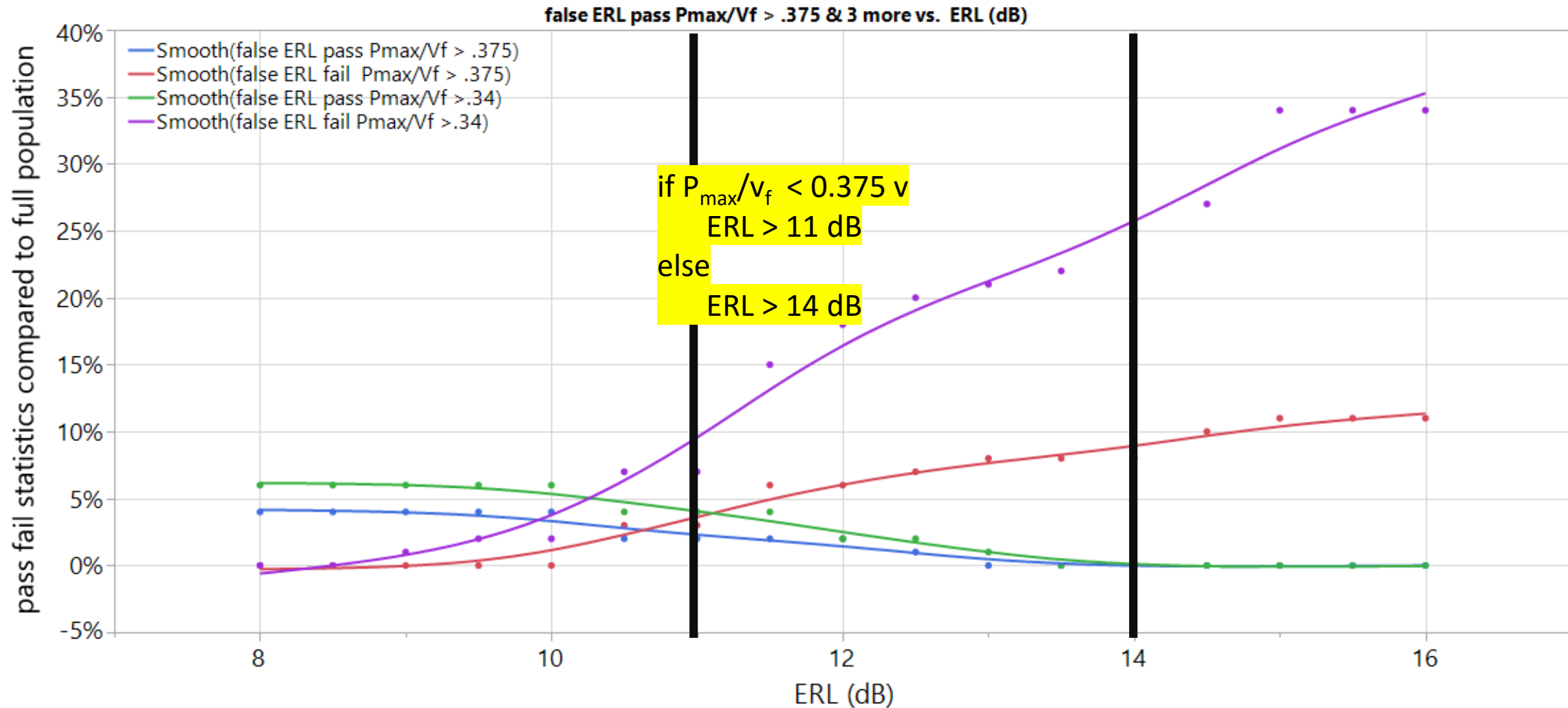
False Pass with VEC and EH Pmax_by Vf min (0.375 v) and ERL_{min} (14 dB)



Example: False fail (pass COM, EH, EVEEC) fail ERL
and Pmax/Vf min 0.375



PASS Fail Charts for ERL



ERL and Parameter recommendations for C2M

Host

- ☐ $\rho_x = 0.30$
- ☐ $\beta_x = 2.34$ GHz
- ☐ $T_r = 10$ ps
- ☐ $N = 1000$
- ☐ $N_{bx} = 4$
- ☐ $ERL_{min} = 11$ dB for host input
- ☐ ERL_{min} host output
 - $ERL_{min} = 11$ dB if $P_{max}/v_f < 0.375$
 - $ERL_{min} = 14$ dB if $P_{max}/v_f > 0.375$

Module

- ☐ $\rho_x = 0.30$
- ☐ $\beta_x = 2.34$ GHz
- ☐ $T_r = 10$ ps
- ☐ $N = 200$
- ☐ $N_{bx} = 4$
- ☐ $ERL_{min} = 11$ dB
- ☐ $V_f min = 0.68$

Thank You!

Backup data COM parameters

TP1a COM Spread Sheet from sun_3ck_02_1119

| Table 93A-1 parameters | | | | I/O control | | | | Table 93A-3 parameters | | | |
|------------------------|------------------|-------|---------------------------------|---------------------|-------------------------|-----------|--|-------------------------|--------------------------|-------|--|
| Parameter | Setting | Units | Information | | | | | Parameter | Setting | Units | |
| f_b | 53.125 | GBd | | DIAGNOSTICS | 1 | logical | | package_tl_gamma0_a1_a2 | [0 0.0009909 0.0002772] | | |
| f_min | 0.05 | GHz | | DISPLAY_WINDOW | 1 | logical | | package_tl_tau | 6.141E-03 | ns/mm | |
| Delta_f | 0.01 | GHz | | CSV_REPORT | 1 | logical | | package_Z_c | [87.5 87.5 ; 92.5 92.5] | Ohm | |
| C_d | [1.2e-4 , 0] | nF | [TX RX] | RESULT_DIR | .\TestCaseFloatingBank\ | | | | | | |
| L_s | [0.12, 0] | nH | [TX RX] | SAVE_FIGURES | 0 | logical | | | | | |
| C_b | [0.3e-4 0] | nF | [TX RX] | Port Order | [1 3 2 4] | | | | | | |
| z_p select | [1] | | [test cases to run] | RUNTAG | C2M TP1a | | | | | | |
| z_p (TX) | [13 30; 1.8 1.8] | mm | [test cases] | COM_CONTRIBUTION | 0 | logical | | | | | |
| z_p (NEXT) | [0 0; 0 0] | mm | [test cases] | Operational | | | | | | | |
| z_p (FEXT) | [13 30; 1.8 1.8] | mm | [test cases] | COM Pass threshold | 3 | dB | | | | | |
| z_p (RX) | [0 0; 0 0] | mm | [test cases] | ERL Pass threshold | 10.5 | dB | | | | | |
| C_p | [0.87e-4 0] | nF | [TX RX] | DER_0 | 1.00E-05 | | | | | | |
| R_0 | 50 | Ohm | | T_r | 6.16E-03 | ns | | | | | |
| R_d | [45, 50] | Ohm | [TX RX] | FORCE_TR | 1 | logical | | | | | |
| A_v | 0.391 | V | vp/vf=.694 | Include PCB | 0 | logical | | | | | |
| A_fe | 0.391 | V | vp/vf=.694 | TDR and ERL options | | | | | | | |
| A_ne | 0.489 | V | | TDR | 1 | logical | | | | | |
| L | 4 | | | ERL | 1 | logical | | | | | |
| M | 32 | | | ERL_ONLY | 0 | logical | | | | | |
| filter and Eq | | | | TR_TDR | 0.01 | ns | | | | | |
| f_r | 0.75 | *fb | | N | 400 | | | | | | |
| c(0) | 0.6 | | min | TDR_Butterworth | 1 | logical | | | | | |
| c(-1) | [-0.3:0.02:0] | | [min:step:max] | beta_x | 0.00E+00 | | | | | | |
| | | | | rho_x | 0.32 | | | | | | |
| c(-2) | [0:.02:0.1] | | [min:step:max] | fixture delay time | 0 | enter sec | | | | | |
| c(-3) | [-0.04:.02:0.0] | | [min:step:max] | TDR_W_TXPKG | 1 | | | | | | |
| c(1) | [-0.1:0.05:0] | | [min:step:max] | N_bx | 4 | UI | | | | | |
| N_b | 4 | UI | | Receiver testing | | | | | | | |
| b_max(1) | 0.5 | | | RX_CALIBRATION | 0 | logical | | | | | |
| b_max(2..N_b) | 0.2 | | | Sigma BBN step | 5.00E-03 | V | | | | | |
| g_DC | [-14:1:-3] | dB | [min:step:max] | Noise, jitter | | | | | | | |
| f_z | 12.58 | GHz | | sigma_RJ | 0.01 | UI | | | | | |
| f_p1 | 20 | GHz | | A_DD | 0.02 | UI | | | | | |
| f_p2 | 28 | GHz | | eta_0 | 8.20E-09 | V^2/GHz | | | | | |
| g_DC_HP | [-3:1:0] | | [min:step:max] | SNR_TX | 33 | dB | | | | | |
| f_HP_PZ | 1.328125 | GHz | | R_LM | 0.95 | | | | | | |
| ffe_pre_tap_len | 0 | UI | | | | | | | | | |
| ffe_post_tap_len | 0 | UI | | | | | | | | | |
| ffe_tap_step_size | 0 | | | | | | | | | | |
| ffe_main_cursor_min | 0.7 | | | | | | | | | | |
| ffe_pre_tap1_max | 0.3 | | | | | | | | | | |
| ffe_post_tap1_max | 0.3 | | | | | | | | | | |
| ffe_tapn_max | 0.125 | | | | | | | | | | |
| ffe_backoff | 0 | | | | | | | | | | |
| Floating Tap Control | | | | | | | | | | | |
| N_bg | 0 | | 0 1 2 or 3 groups | | | | | | | | |
| N_bf | 0 | | taps per group | | | | | | | | |
| N_f | 40 | | UI span for floating taps | | | | | | | | |
| bmaxg | 0.05 | | max DFE value for floating taps | | | | | | | | |

Whole-link COM Spread Sheet from sun_3ck_02_1119

| Table 93A-1 parameters | | | | I/O control | | | | Table 93A-3 parameters | | | |
|------------------------|--------------------|-------|---------------------------------|---------------------|-------------------------|-----------|--|-------------------------|---------------------------|-------|--|
| Parameter | Setting | Units | Information | DIAGNOSTICS | 0 | logical | | Parameter | Setting | Units | |
| f_b | 53.125 | GBd | | DISPLAY_WINDOW | 0 | logical | | package_tl_gamma0_a1_a2 | [0 0.0009909 0.0002772] | | |
| f_min | 0.05 | GHz | | CSV_REPORT | 1 | logical | | package_tl_tau | 6.141E-03 | ns/mm | |
| Delta_f | 0.01 | GHz | | RESULT_DIR | .\TestCaseFloatingBank\ | | | package_Z_c | [87.5 87.5 ; 92.5 92.5] | Ohm | |
| C_d | [1.2e-4 , 0.85e-4] | nF | [TX RX] | SAVE_FIGURES | 0 | logical | | Table 92-12 parameters | | | |
| L_s | [0.12, 0.12] | nH | [TX RX] | Port Order | [1 3 2 4] | | | Parameter | Setting | | |
| C_b | [0.3e-4 0.3e-4] | nF | [TX RX] | RUNTAG | C2M end-to-end | | | board_tl_gamma0_a1_a2 | [0 3.8206e-04 9.5909e-05] | | |
| z_p select | [1] | | [test cases to run] | COM_CONTRIBUTION | 0 | logical | | board_tl_tau | 5.790E-03 | ns/mm | |
| z_p (TX) | [13 30; 1.8 1.8] | mm | [test cases] | Operational | | | | board_Z_c | 90 | Ohm | |
| z_p (NEXT) | [6 2; 0 0] | mm | [test cases] | COM Pass threshold | 3 | dB | | z_bp (TX) | 119 | mm | |
| z_p (FEXT) | [13 30; 1.8 1.8] | mm | [test cases] | ERL Pass threshold | 10.5 | dB | | z_bp (NEXT) | 119 | mm | |
| z_p (RX) | [6 2; 0 0] | mm | [test cases] | DER_0 | 1.00E-05 | | | z_bp (FEXT) | 119 | mm | |
| C_p | [0.87e-4 0.75e-4] | nF | [TX RX] | T_r | 6.16E-03 | ns | | z_bp (RX) | 119 | mm | |
| R_0 | 50 | Ohm | | FORCE_TR | 1 | logical | | | | | |
| R_d | [45, 50] | Ohm | [TX RX] | Include PCB | 0 | logical | | | | | |
| A_v | 0.391 | V | vp/vf=.694 | TDR and ERL options | | | | | | | |
| A_fe | 0.391 | V | vp/vf=.694 | TDR | 1 | logical | | | | | |
| A_ne | 0.489 | V | | ERL | 1 | logical | | | | | |
| L | 4 | | | ERL_ONLY | 0 | logical | | | | | |
| M | 32 | | | TR_TDR | 0.01 | ns | | | | | |
| filter and Eq | | | | N | 400 | | | | | | |
| f_r | 0.75 | *fb | | TDR_Butterworth | 1 | logical | | | | | |
| c(0) | 0.6 | | min | beta_x | 0.00E+00 | | | | | | |
| c(-1) | [-0.3:0.02:0] | | [min:step:max] | rho_x | 0.32 | | | | | | |
| c(-2) | [0:.02:0.1] | | [min:step:max] | fixture delay time | 0 | enter sec | | | | | |
| c(-3) | [-0.04:.02:0.0] | | [min:step:max] | TDR_W_TXPKG | 1 | | | | | | |
| c(1) | [-0.1:0.05:0] | | [min:step:max] | N_bx | 4 | UI | | | | | |
| N_b | 4 | UI | | Receiver testing | | | | | | | |
| b_max(1) | 0.5 | | | RX_CALIBRATION | 0 | logical | | | | | |
| b_max(2..N_b) | 0.2 | | | Sigma BBN step | 5.00E-03 | V | | | | | |
| g_DC | [-14:1:-3] | dB | [min:step:max] | Noise, jitter | | | | | | | |
| f_z | 12.58 | GHz | | sigma_RJ | 0.01 | UI | | | | | |
| f_p1 | 20 | GHz | | A_DD | 0.02 | UI | | | | | |
| f_p2 | 28 | GHz | | eta_0 | 8.20E-09 | V^2/GHz | | | | | |
| g_DC_HP | [-3:1:0] | | [min:step:max] | SNR_TX | 33 | dB | | | | | |
| f_HP_PZ | 1.328125 | GHz | | R_LM | 0.95 | | | | | | |
| ffe_pre_tap_len | 0 | UI | | | | | | | | | |
| ffe_post_tap_len | 0 | UI | | | | | | | | | |
| ffe_tap_step_size | 0 | | | | | | | | | | |
| ffe_main_cursor_min | 0.7 | | | | | | | | | | |
| ffe_pre_tap1_max | 0.3 | | | | | | | | | | |
| ffe_post_tap1_max | 0.3 | | | | | | | | | | |
| ffe_tapn_max | 0.125 | | | | | | | | | | |
| ffe_backoff | 0 | | | | | | | | | | |
| Floating Tap Control | | | | | | | | | | | |
| N_bg | 0 | | 0 1 2 or 3 groups | | | | | | | | |
| N_bf | 4 | | taps per group | | | | | | | | |
| N_f | 40 | | UI span for floating taps | | | | | | | | |
| bmaxg | 0.05 | | max DFE value for floating taps | | | | | | | | |