KEYSIGHT

# Validation of C2M and CR physical layer test-points real world -vs- COM Version 1.2

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**Based on draft release of IEEE 802.3dj™/D1.0**

**Abstract: A measurement science review of 802.3dj big-ticket-items related to CR/KR/AUI-C2M/AUIC2C/AUI C2M transmitter parametric values which are currently classified as TBD.**

**This contribution compiles efforts to bridge the physics of actual TP0v (Table 178–6), TP2 (Table 179-7) and C2M TP1a (Table 176E-1) operations with an emphasis on J3u, VEC, EH and EW as compared to what COM reports under identical conditions (Using TDMODE). It's an advancement of a similar contribution done in January with the objective of offering an existence proof that certain Jitter, VEC and EH targets are attainable in a real-world validation setting.**

## Supporters/Collaborators

Ray Schmeltzer (Wilder Technologies)
Richard Mellitz (Samtec)
Geoff Zhang (AMD)
Michael Dudek (Marvell)
Karl Muth (Broadcom)
Chris Lyon (Amphenol)
Piers Dawe (Nvidia)
Ali Ghiasi (Ghiasi Quantum)
Adee Ran (Cisco)
Karen Liu (Nubis)

## Forward

In review of this contribution with multiple sources of technical feedback, a disclaimer is needed. This analysis was absent FEXT/NEXT sources, which will have a significant impact on most measurements shown here.

# Equipment used in this contribution

- M8042A PG
  - Light 5 tap Tx de-emphasis
- M8067A-005-Trace
  - 22.3dB @53.125GHZ – Trace 1 + Wilder 1mm OSFP MTF
  - 30.76dB @53.125GHz – Trace 1+ Trace 2
  - 2X pair of 1mm 8” phase matched cables (1.2dB each)
  - Net TP1a test channel loss 33.15dB
- N1000A+N1046A Sampling scope
  - Prototype Clock Recovery
  - SIRC: 60GHz 4$^{th}$ order Butterworth
  - Input referred noise 2e-9V²/GHz
- UXR0802B Real-Time scope
  - DSP/SW Clock Recovery
  - ~SIRC: 60GHz 4$^{th}$ order Butterworth rolling off to -9dB @ 80GHZ
- COM Version: com_ieee8023_93a_450beta3
  - TDMODE (PR imported from instruments, spreadsheet in supporting material)

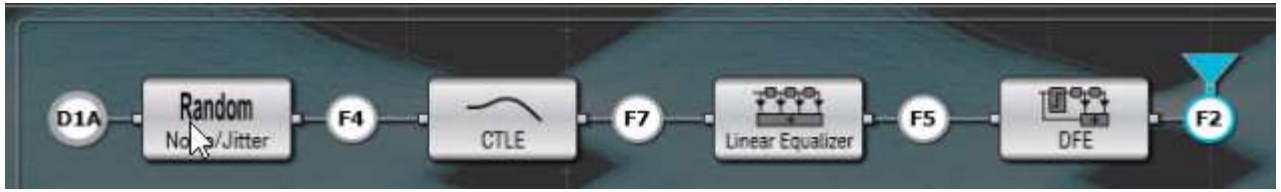
# Overview

The draft 1.0 P802.3dj has several TBD categories in areas of key parametric measurements, due to a combination of inconclusive modeling or inability to physically make measurements due to instrument limitations.

This contribution pairs up physical channel losses to approximate current worst case loss conditions.

C2M TP1a channel assumptions (https://www.ieee802.org/3/dj/public/23_11/lusted_3dj_04_2311.pdf)

- Up to 32dB IL (M8067A-005 Trace 1 + Trace 2)
- Ref Rx: 60GHz 4th order Butterworth + input referred noise + 2-gain stage CTLE + 24 Tap FFE + 1-tap DFE (all parameters tuned directly with COM)




CR TP2 channel assumptions (https://www.ieee802.org/3/dj/public/23_11/diminico_3dj_01_2311.pdf )

- Up to 23dB IL (Wilder OSFP 1mm fixture + M8067A-005 Trace 1)
- Ref Rx: 60GHz 4th order Bessel + 5 Tap TX FFE lightly tuned for TP0V optimization. No Rx EQ, No Rx De-Embed

# Channel configurations used in this study:

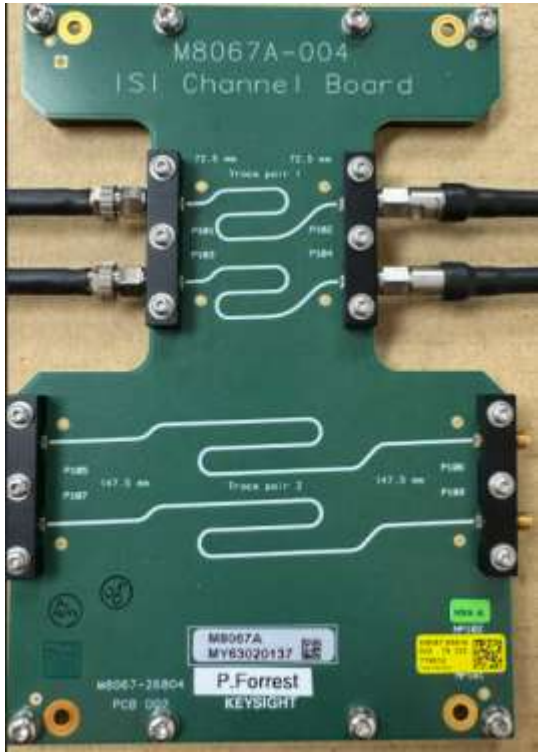
Closest attainable physical proxies for:

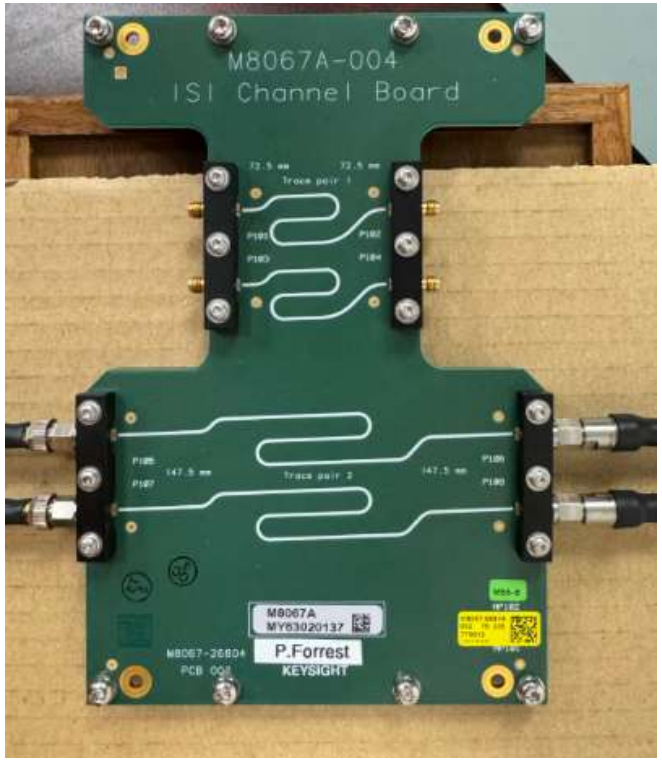
CR/TP2 targeting (HH-HL) 22.35dB

C2M/TP1a targeting (HL-HL) ~33dB

Reference : https://www.ieee802.org/3/dj/public/23_11/diminico_3dj_01_2311.pdf pg 9

https://www.ieee802.org/3/dj/public/23_11/lusted_3dj_04_2311.pdf pg 7



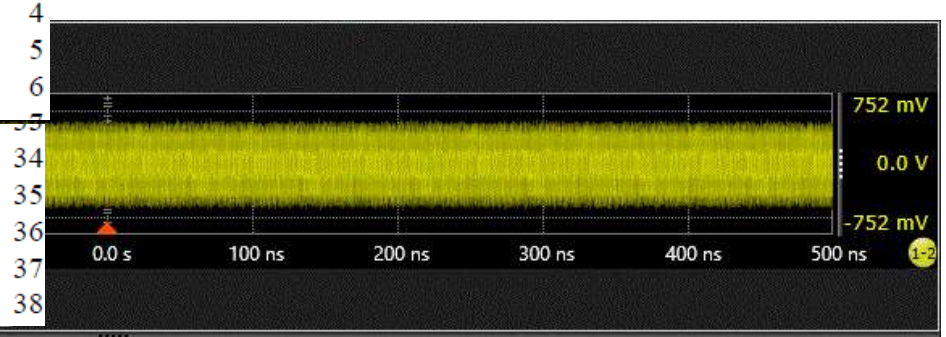
# Table 178–6 Output Jitter (Max) : TBD (TP0V)



Consider a TP0V J3u of 115mUI identical to clause 162.9.2 Tx Characteristics. Real Silicon will be better than instrumentation.

**Table 178–6—Summary of transmitter specifications at TP0v**

| Parameter | Reference | Value | Units |
|---|---|---|---|
| Signal-to-noise-and-distortion ratio, SNDR (min) | 179.9.4.6 | 32.5 | dB |
| Signal-to-residual-intersymbol-interference ratio, $SNR_{ISI}$ (min) | 179.9.4.3 | 28 | dB |
| Output jitter (max) TBD | 179.9.4.7 | TBD | UI |




The starting point for this setup is TP0d amplitude calibration and jitter evaluation. Signal amplitude of 750mV PtP was the initial setup.

*Experimentation at 600mV failed for C2M and required 800mV PtP to lock clock recovery's after 33dB of channel loss.*

PAM4 Jitter

Channel 1 - 2 | Various | Composite Histogram

Ch 1-2 J3u Table (15504 Patterns)

| From | To L0 | To L1 | To L2 | To L3 |
|---|---|---|---|---|
| All | 119.741 mUI | | | |
| L3 | 41.0620 mUI | 57.8868 mUI | 121.493 mUI | |
| L2 | 65.7422 mUI | 122.210 mUI | | 151.604 mUI |
| L1 | 113.347 mUI | | 103.292 mUI | 60.5345 mUI |
| L0 | | 109.696 mUI | 66.4268 mUI | 47.5761 mUI |

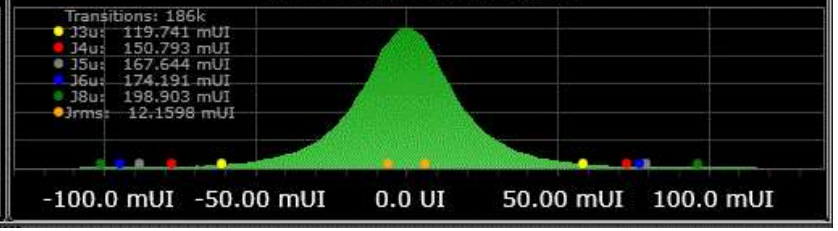
Ch 1-2 EOJ Table (15504 Patterns)

| From | To L0 | To L1 | To L2 | To L3 |
|---|---|---|---|---|
| All | 12.1337 mUI | | | |
| L3 | 1.28278 mUI | 1.74717 mUI | 12.1337 mUI | |
| L2 | 3.78663 mUI | 7.24101 mUI | | 5.47836 mUI |
| L1 | 1.28278 mUI | | 2.95316 mUI | 6.88528 mUI |
| L0 | | 7.75554 mUI | 3.78663 mUI | 7.24101 mUI |

Ch 1-2 Jrms Table (15504 Patterns)

| From | To L0 | To L1 | To L2 | To L3 |
|---|---|---|---|---|
| All | 12.1598 mUI | | | |
| L3 | 5.46268 mUI | 7.20194 mUI | 16.2837 mUI | |
| L2 | 8.95168 mUI | 15.2301 mUI | | 20.2807 mUI |
| L1 | 13.3824 mUI | | 12.0190 mUI | 8.01082 mUI |
| L0 | | 13.6593 mUI | 9.22503 mUI | 6.68577 mUI |

Ch 1-2 Composite Histogram

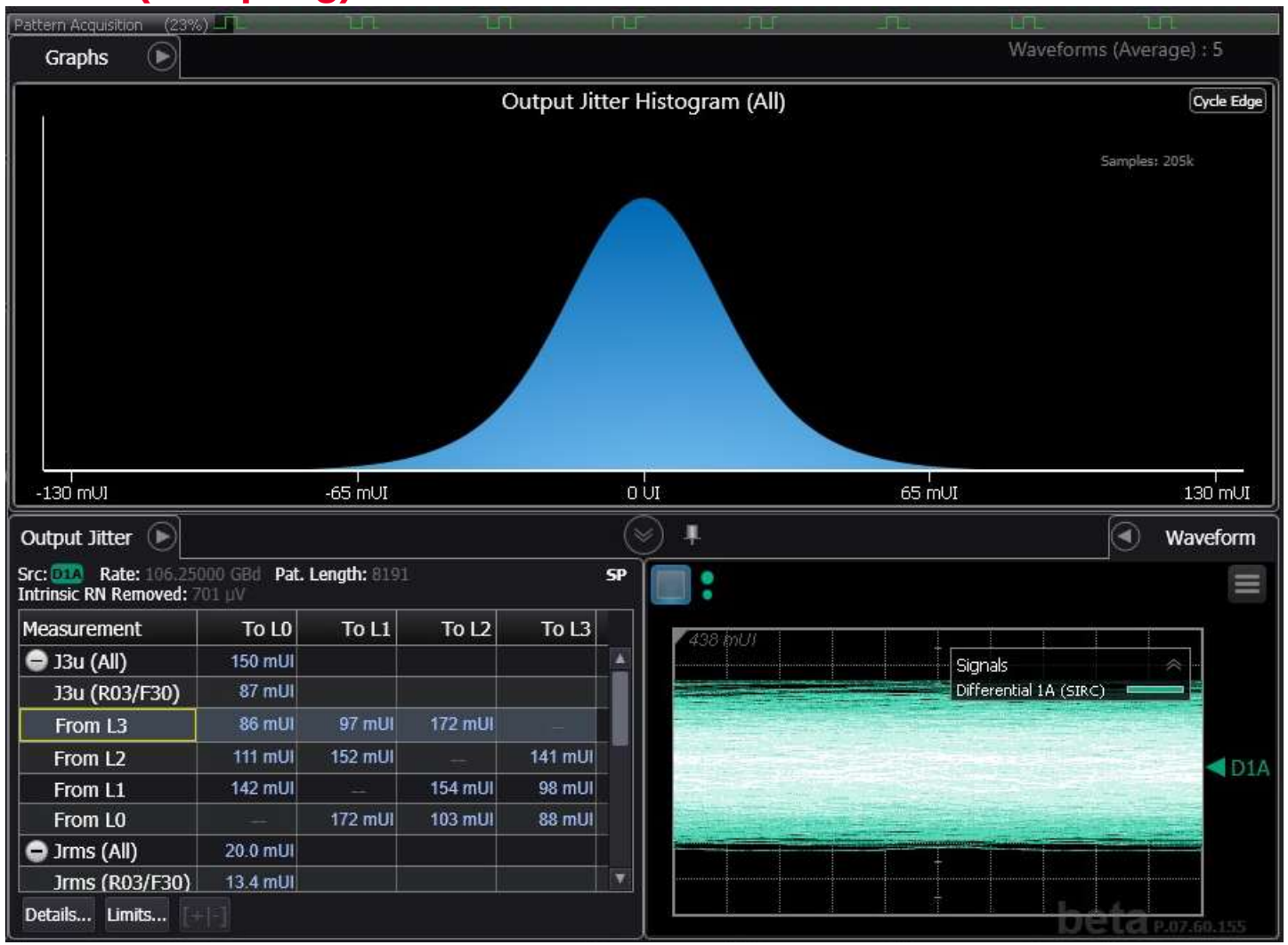


# Table 179–7— transmitter specifications at TP2 (Sampling)



**Table 179–7—Summary of transmitter specifications at TP2 *(continued)***

| Parameter | Subclause reference | Value | Units |
|---|---|---|---|
| Transmitter steady-state voltage, $v_f$ (min)<br>Host designation Host-Low<br>Host designation Host-Nominal<br>Host designation Host-High | 179.9.4.1.2 | <br>TBD<br>TBD<br>TBD | <br>V<br>V<br>V |
| Transmitter steady-state voltage, $v_f$ (max) | 179.9.4.1.2 | 0.6 | V |
| Linear fit pulse peak ratio, $R_{peak}$ (min)<br>Host designation Host-Low<br>Host designation Host-Nominal<br>Host designation Host-High | 179.9.4.1.2 | <br>TBD<br>TBD<br>TBD | <br>—<br>—<br>— |
| Level separation mismatch ratio $R_{LM}$ (min) | 179.9.4.2 | 0.95 | — |
| Transmitter output waveform<br>absolute value of step size for all taps (min)<br>absolute value of step size for all taps (max)<br>value at minimum state for $c(-3)$ (max)<br>value at maximum state for $c(-2)$ (min)<br>value at minimum state for $c(-1)$ (max)<br>value at minimum state for $c(0)$ (max)<br>value at minimum state for $c(1)$ (max) | <br>179.9.4.1.4<br>179.9.4.1.4<br>179.9.4.1.5<br>179.9.4.1.5<br>179.9.4.1.5<br>179.9.4.1.5<br>179.9.4.1.5 | <br>0.005<br>0.025<br>−0.06<br>0.12<br>−0.34<br>0.5<br>−0.2 | <br>—<br>—<br>—<br>—<br>—<br>—<br>— |
| Signal-to-noise-and-distortion ratio, SNDR (min) | 179.9.4.6 | 31.5 | dB |
| Signal-to-residual-intersymbol-interference ratio, $SNR_{ISI}$ (min) | 179.9.4.3 | 26.7 | dB |
| Output jitter (max)<br>TBD | 179.9.4.7 | TBD | UI |




23dB Channel Loss

775mV PtP Launch Amplitude (TP0d)

60GHz 4’th order Bessel Reference Receiver. No tuning apart from light TX 5 tap FFE EQ. (Eye is very closed)

J3u could be further reduced by using COM to tune the TX FFE.

# Table 179–7— transmitter specifications at TP2 (Real-Time)



**Table 179–7—Summary of transmitter specifications at TP2 *(continued)***

| Parameter | Subclause reference | Value | Units |
|---|---|---|---|
| Transmitter steady-state voltage, $v_f$ (min)<br>Host designation Host-Low<br>Host designation Host-Nominal<br>Host designation Host-High | 179.9.4.1.2 | <br>TBD<br>TBD<br>TBD | <br>V<br>V<br>V |
| Transmitter steady-state voltage, $v_f$ (max) | 179.9.4.1.2 | 0.6 | V |
| Linear fit pulse peak ratio, $R_{peak}$ (min)<br>Host designation Host-Low<br>Host designation Host-Nominal<br>Host designation Host-High | 179.9.4.1.2 | <br>TBD<br>TBD<br>TBD | <br>—<br>—<br>— |
| Level separation mismatch ratio $R_{LM}$ (min) | 179.9.4.2 | 0.95 | — |
| Transmitter output waveform<br>absolute value of step size for all taps (min)<br>absolute value of step size for all taps (max)<br>value at minimum state for $c(-3)$ (max)<br>value at maximum state for $c(-2)$ (min)<br>value at minimum state for $c(-1)$ (max)<br>value at minimum state for $c(0)$ (max)<br>value at minimum state for $c(1)$ (max) | <br>179.9.4.1.4<br>179.9.4.1.4<br>179.9.4.1.5<br>179.9.4.1.5<br>179.9.4.1.5<br>179.9.4.1.5<br>179.9.4.1.5 | <br>0.005<br>0.025<br>−0.06<br>0.12<br>−0.34<br>0.5<br>−0.2 | <br>—<br>—<br>—<br>—<br>—<br>—<br>— |
| Signal-to-noise-and-distortion ratio, SNDR (min) | 179.9.4.6 | 31.5 | dB |
| Signal-to-residual-intersymbol-interference ratio, $SNR_{ISI}$ (min) | 179.9.4.3 | 26.7 | dB |
| Output jitter (max)<br>TBD | 179.9.4.7 | TBD | UI |


775mV PtP Launch Amplitude

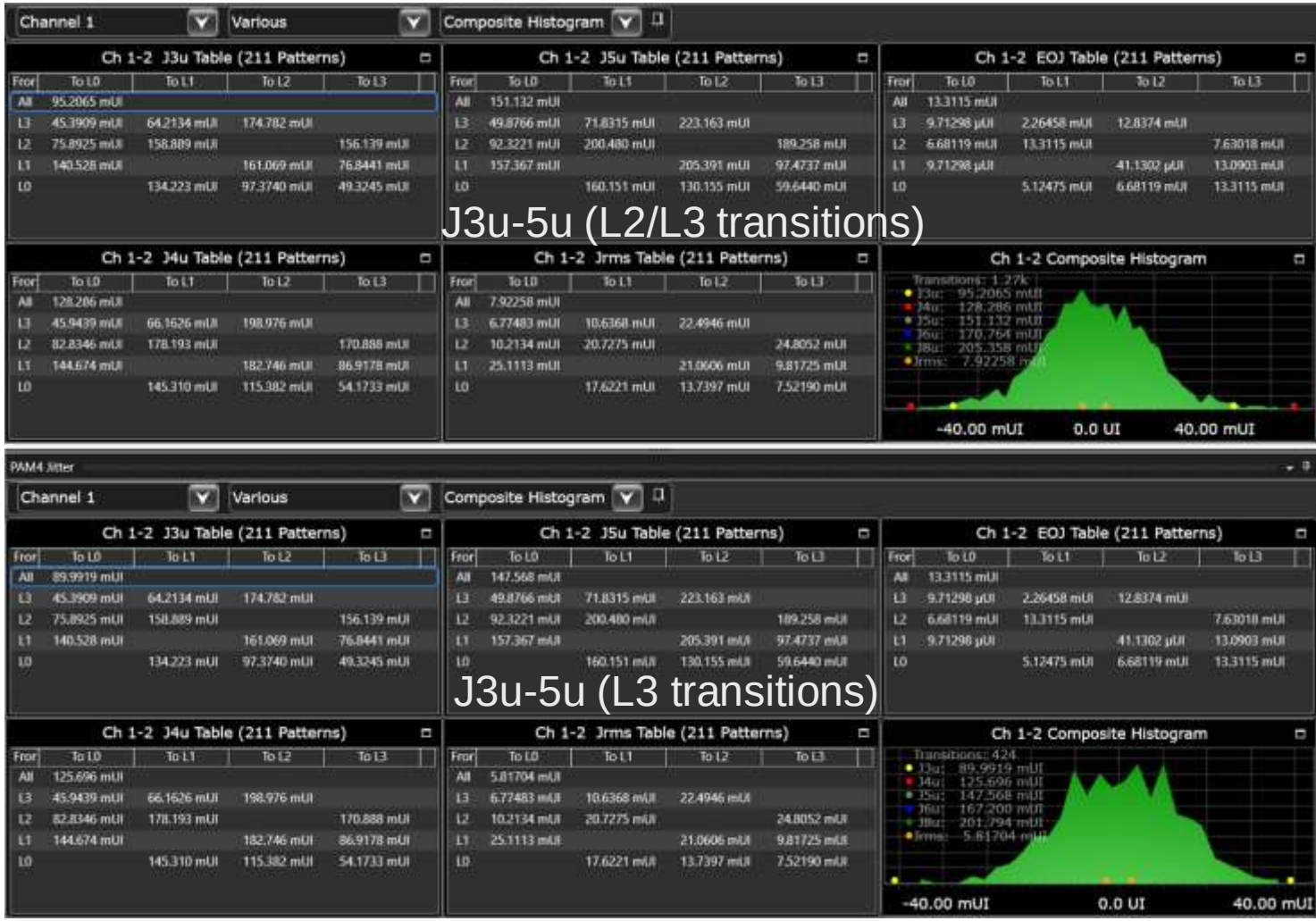
60GHz 4’th order Bessel Reference Receiver. No tuning apart from light TX 5 tap FFE EQ.

# Table 179–7— transmitter specifications at TP2 (Real-Time)



**Table 179–7—Summary of transmitter specifications at TP2 *(continued)***

| Parameter | Subclause reference | Value | Units |
|---|---|---|---|
| Transmitter steady-state voltage, $v_f$ (min)<br>Host designation Host-Low<br>Host designation Host-Nominal<br>Host designation Host-High | 179.9.4.1.2 | <br>TBD<br>TBD<br>TBD | <br>V<br>V<br>V |
| Transmitter steady-state voltage, $v_f$ (max) | 179.9.4.1.2 | 0.6 | V |
| Linear fit pulse peak ratio, $R_{peak}$ (min)<br>Host designation Host-Low<br>Host designation Host-Nominal<br>Host designation Host-High | 179.9.4.1.2 | <br>TBD<br>TBD<br>TBD | <br>—<br>—<br>— |
| Level separation mismatch ratio $R_{LM}$ (min) | 179.9.4.2 | 0.95 | — |
| Transmitter output waveform<br>absolute value of step size for all taps (min)<br>absolute value of step size for all taps (max)<br>value at minimum state for $c(-3)$ (max)<br>value at maximum state for $c(-2)$ (min)<br>value at minimum state for $c(-1)$ (max)<br>value at minimum state for $c(0)$ (max)<br>value at minimum state for $c(1)$ (max) | <br>179.9.4.1.4<br>179.9.4.1.4<br>179.9.4.1.5<br>179.9.4.1.5<br>179.9.4.1.5<br>179.9.4.1.5<br>179.9.4.1.5 | <br>0.005<br>0.025<br>−0.06<br>0.12<br>−0.34<br>0.5<br>−0.2 | <br>—<br>—<br>—<br>—<br>—<br>—<br>— |
| Signal-to-noise-and-distortion ratio, SNDR (min) | 179.9.4.6 | 31.5 | dB |
| Signal-to-residual-intersymbol-interference ratio, $SNR_{ISI}$ (min) | 179.9.4.3 | 26.7 | dB |
| Output jitter (max)<br>TBD | 179.9.4.7 | TBD | UI |




Performing L3(0->3/3->0) level) and L2/L3 Jnu decomposition at TP2 is entirely feasible and repeatable measurement. L1's are problematic at 23dB of loss but very consistent between the two instrument types used here.

# Table 17E-1— transmitter specifications at TP1a (Sampling)

**Table 176E–1—Host output characteristics at TP1a**

| Parameter | Reference | Value | Units |
|---|---|---|---|
| Signaling rate, each lane (range) | | 106.25 ± 50 ppm[a] | GBd |
| DC common-mode output voltage (max) | 176E.5.1 | 2.8 | V |
| DC common-mode output voltage (min) | 176E.5.1 | –0.3 | V |
| Single-ended output voltage (max) | 176E.5.1 | 3.3 | V |
| Single-ended output voltage (min) | 176E.5.1 | –0.4 | V |
| Peak-to-peak AC common-mode voltage (max)<br>Low-frequency, $VCM_{LF}$<br>Full-band, $VCM_{FB}$ | 176E.5.1 | <br>32<br>80 | mV |
| Differential peak-to-peak output voltage (max)<br>Transmitter disabled<br>Transmitter enabled | 176E.5.1 | <br>35<br>750 | mV |
| Steady-state voltage, $v_f$ (max) | 176E.5.3 | TBD | mV |
| Eye height (min) | 176E.3.3.1 | TBD | mV |
| Vertical eye closure, VEC (max) | 176E.3.3.1 | TBD | dB |
| Common-mode to differential-mode return loss, *RLdc* (min) | 176E.3.3.2 | Equation (176E–1) | dB |
| Effective return loss, ERL (min) | 176E.3.3.3 | TBD | dB |
| Differential termination mismatch (max) | 176E.3.3.4 | 10 | % |
| Transition time (min) | 176E.3.3.5 | TBD | ps |

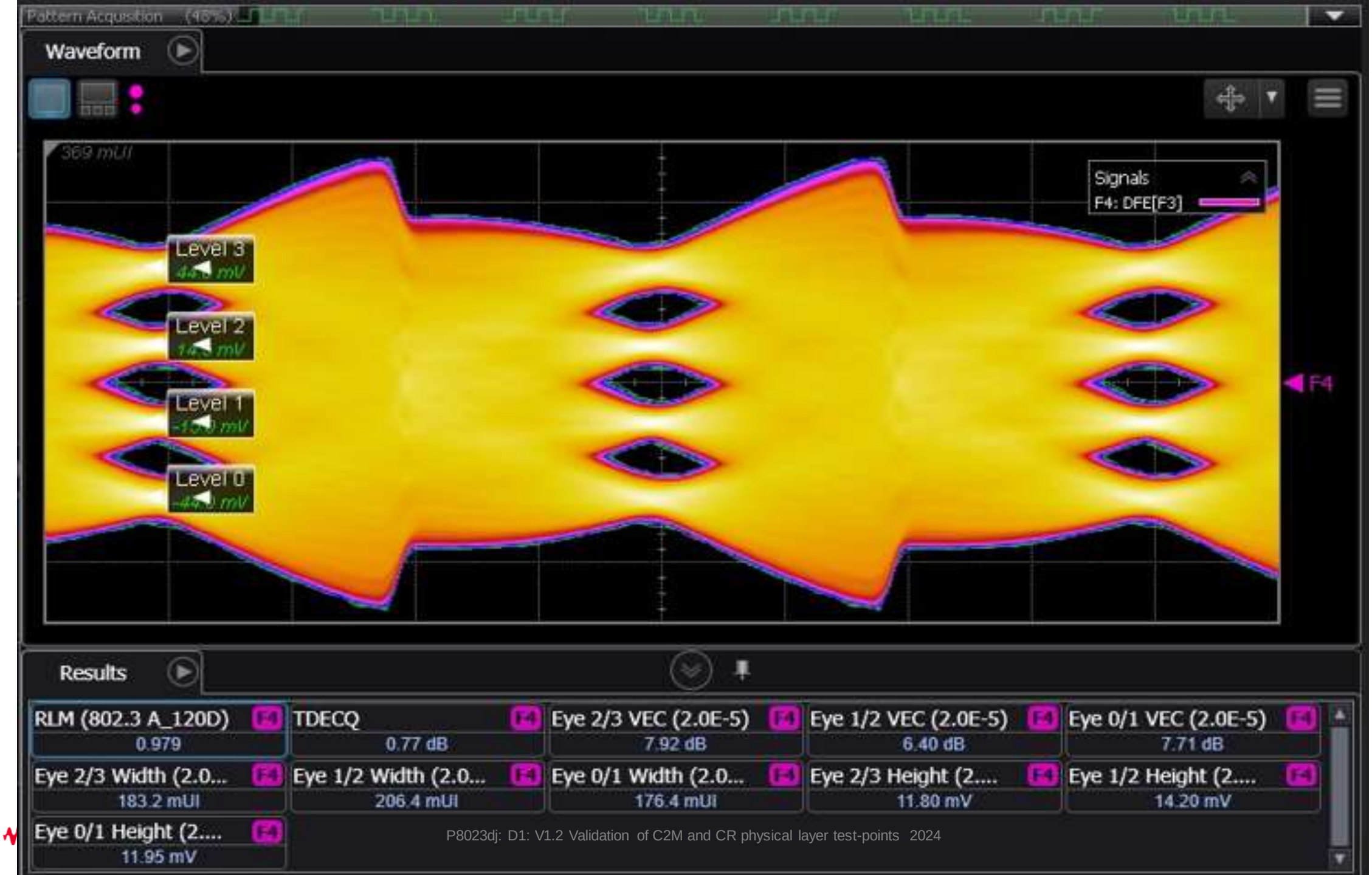
800mV Launch Amplitude

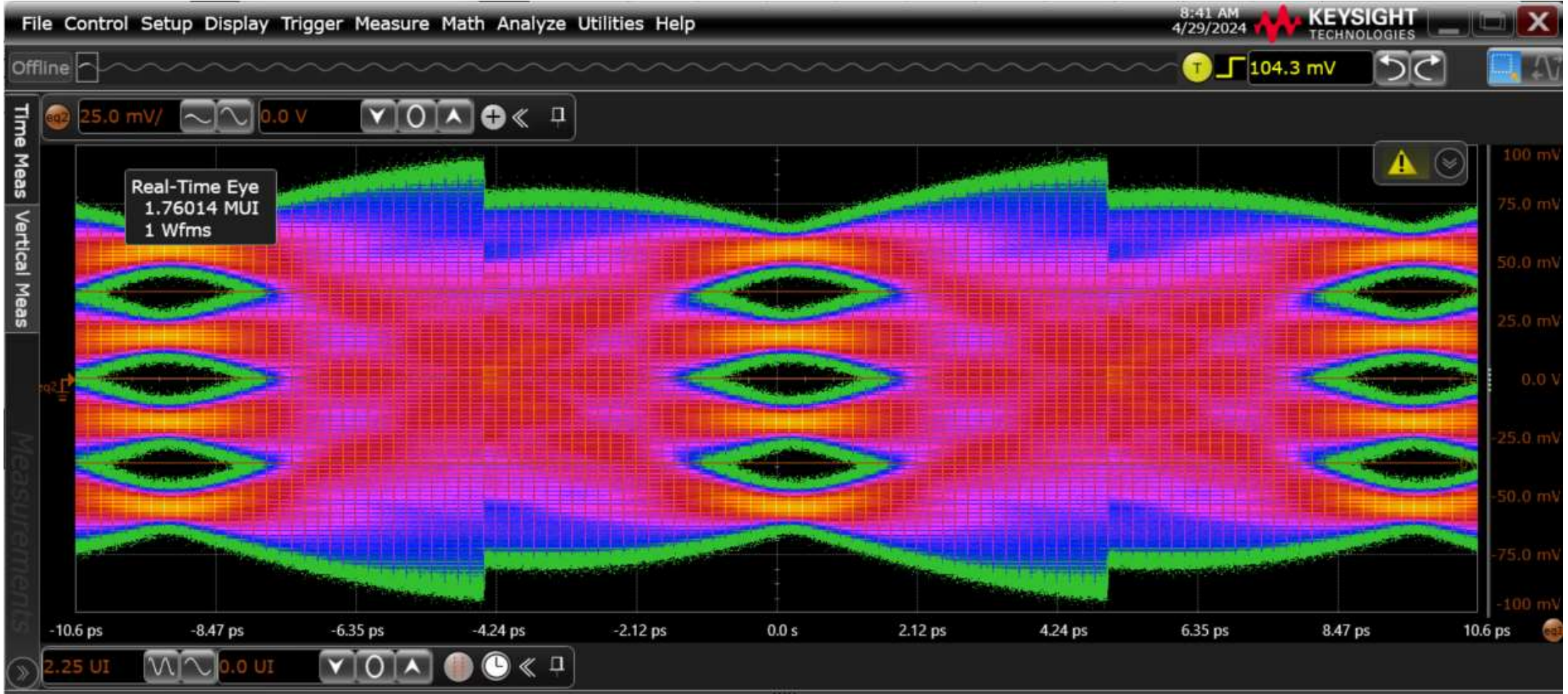
60GHz 4’th order Butterworth Reference Receiver. Tuned with COM TDMODE

This is NOT an official IEEE document.
Revision: 4.50beta3 This is a computation example for exploring COM and ERL
for projects like IEEE P802.3bj/b/bs/cd/ck with some exploratory extensions and is not normative or official
TXFFE coefficients: 1
SNR ISI: 34 dB
CTLE DC gain: -9 dB
CTF peaking gain: -3.4 dB
Symbol Available signal: 0.0061807
Die to die loss = dB
run time = 0.412117 min
WC All cases PASS ... VEC = 7.494 dB
WC All cases PASS ... EH = 5.112 mV

# COM 4.50b3 Output

| | |
|---|---|
| SNR_ISI_XTK_normalized_1_sigma | 22.5571 |
| SNR_ISI_est | 34.3572 |
| Pmax_by_Vf_est | 0.6402 |
| Tr_measured_from_step_ps | 9.1176 |
| CTLE_zero_poles | [4.2500e+10,1.06... |
| CTLE_DC_gain_dB | -9 |
| g_DC_HP | -2 |
| HP_poles_zero | 1.3281e+09 |
| TXLE_taps | 1 |
| Pre2Pmax | *[ ]* |
| DFE_taps | 0.5944 |
| floating_tap_locations | *[ ]* |
| RxFFE | *19x1 double* |
| RxFFEgain | 0 |
| itick | -15 |
| error_propagation_probability | *[ ]* |
| burst_probabilities | *[ ]* |
| sgm_Ani__isi_xt_noise | 8.7403e-04 |
| sgm_isi_xt | 4.8674e-04 |
| sgm_noise__gaussian_noise_p_DD | 7.2596e-04 |
| sgm_p_DD | 4.1651e-04 |
| sgm_gaussian_noise | 5.9459e-04 |
| sgm_G | 5.9459e-04 |
| sgm_rjit | 2.0833e-04 |
| sgm_N | 2.7970e-04 |


Pattern Acquisition (46%)
Waveform
369 mUI
Signals
F4: DFE[F3]
Level 3
Level 2
Level 1
Level 0
F4
Results
RLM (802.3 A_120D)
0.979
TDECQ
0.77 dB
Eye 2/3 VEC (2.0E-5)
7.92 dB
Eye 1/2 VEC (2.0E-5)
6.40 dB
Eye 0/1 VEC (2.0E-5)
7.71 dB
Eye 2/3 Width (2.0...
183.2 mUI
Eye 1/2 Width (2.0...
206.4 mUI
Eye 0/1 Width (2.0...
176.4 mUI
Eye 2/3 Height (2....
11.80 mV
Eye 1/2 Height (2....
14.20 mV
Eye 0/1 Height (2....
11.95 mV




Results (Measure All Edges)

Measurements

| Measurement | Current | Mean | Min | Max | Range (Max-Min) | Std Dev | Count |
|---|---|---|---|---|---|---|---|
| Eye 2/3 Width(eq2) | 189.8 mUI | 189.8 mUI | 189.8 mUI | 189.8 mUI | 0.0 UI | 0.0 UI | 1 |
| Eye 1/2 Width(eq2) | 203.9 mUI | 203.9 mUI | 203.9 mUI | 203.9 mUI | 0.0 UI | 0.0 UI | 1 |
| Eye 0/1 Width(eq2) | 172.3 mUI | 172.3 mUI | 172.3 mUI | 172.3 mUI | 0.0 UI | 0.0 UI | 1 |
| Eye 2/3 Height(eq2) | 12.9 mV | 12.9 mV | 12.9 mV | 12.9 mV | 0.0 V | 0.0 V | 1 |
| Eye 1/2 Height(eq2) | 12.3 mV | 12.3 mV | 12.3 mV | 12.3 mV | 0.0 V | 0.0 V | 1 |
| Eye 0/1 Height(eq2) | 11.5 mV | 11.5 mV | 11.5 mV | 11.5 mV | 0.0 V | 0.0 V | 1 |
| VEC(eq2) | 10.01 dB | 10.01 dB | 10.01 dB | 10.01 dB | 0.0 dB | 0.0 dB | 1 |
| SER, cumulative(eq2) | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 176013( |

Color Grade

- 1 - 60
- 61 - 121
- 122 - 243
- 244 - 487
- 488 - 974
- 975 - 1949
- 1950 - 3899

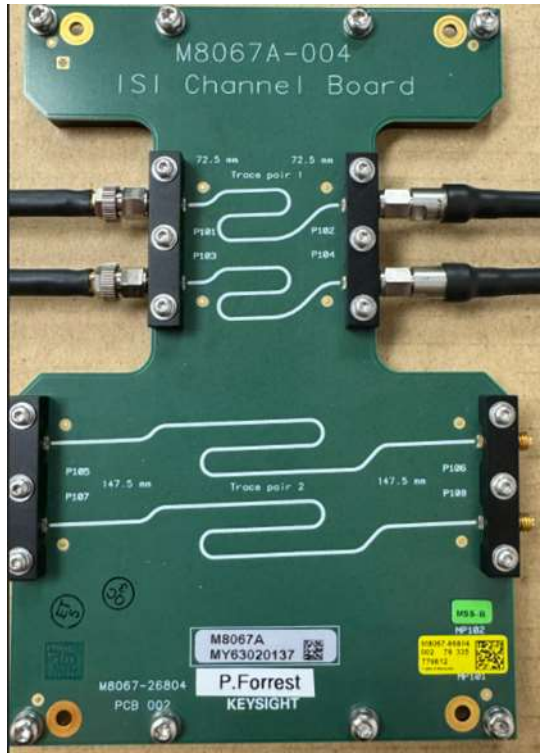
# Summary

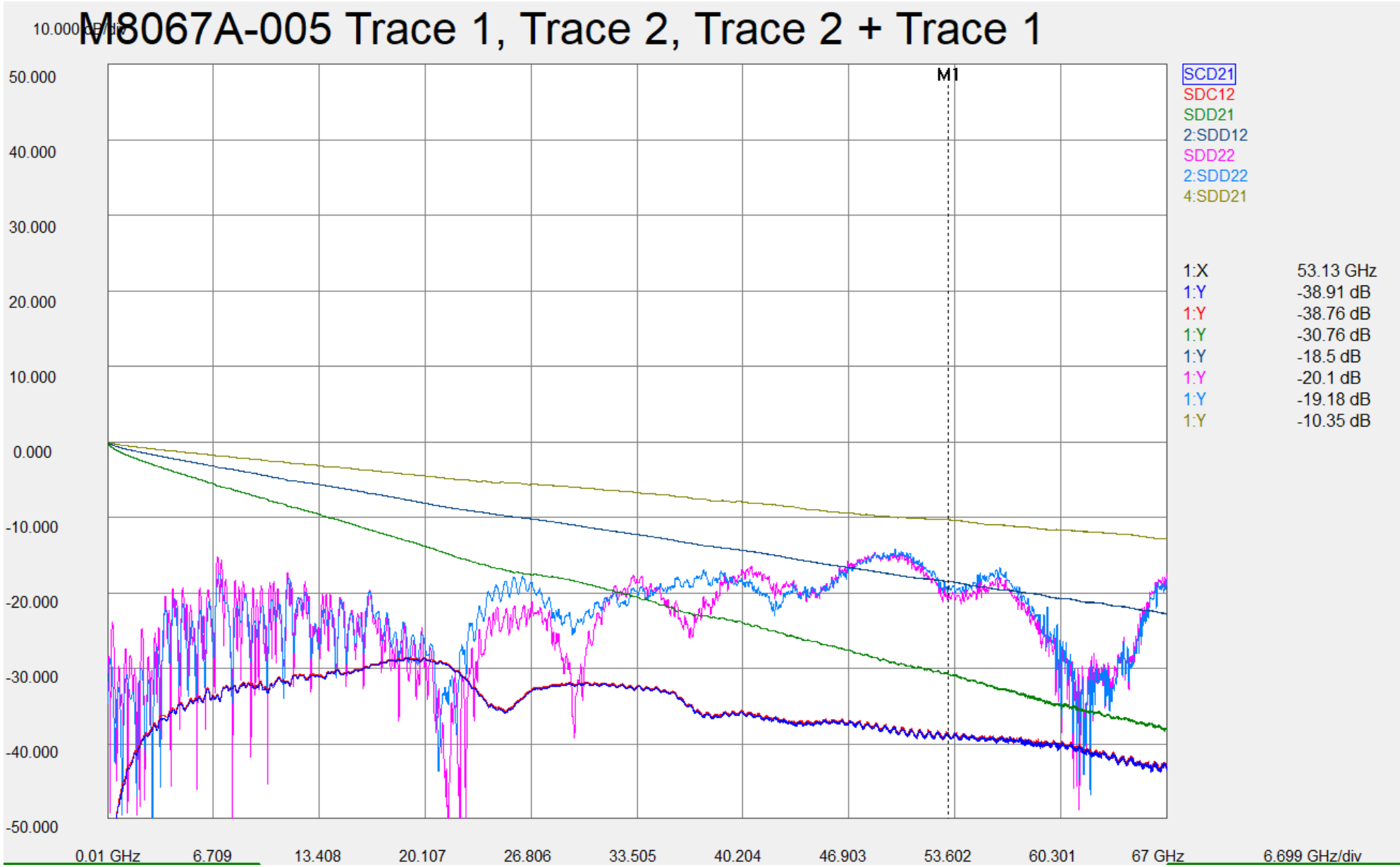
- Efforts to test TP1a with a minimum allowable signal amplitude of 600mV PtP exceed the sensitivity of contemporary test equipment. 800mV PtP (TP0d) of signal amplitude was the minimum measurable after 33dB.
  - At 800mV PtP launch, with Rx CTLE, Rx 20 tap FFE and 1 tap DFE we get 1. an open eye! 2. VEC , EW and EH values. The output of the DFE with this high a gain is a bit suspect as we correlate well on VEC but not well on EH. (DFE's are non-linear, can we really believe the EH?)
- CR's signal amplitude of 775mV PtP works fine in a TP2 worst case setting of 23dB.
  - Jitter Decomposition may want to focus on L3 or L2/L3 combinations if clause 162.9.4 limits are retained.
  - More aggressive TX FIR with 7'tap EQ tuned with COM would bring current J3u Jitter closer but will not match clause 162.9.4 allowable limits of 125mUI. Either remove the single level transitions (which have the highest measurement error) or increase the J3u limit to 150mUI (from 125mUI).
- Two distinct classes of instrumentation were demonstrated in this contribution with reasonable result correlation at TP1a and TP2, TP0v. There are still some curious post high gain DFE eye height results but the use of COM as a tuning agent to extract proper "system level tuning" was a success.

# Thank you

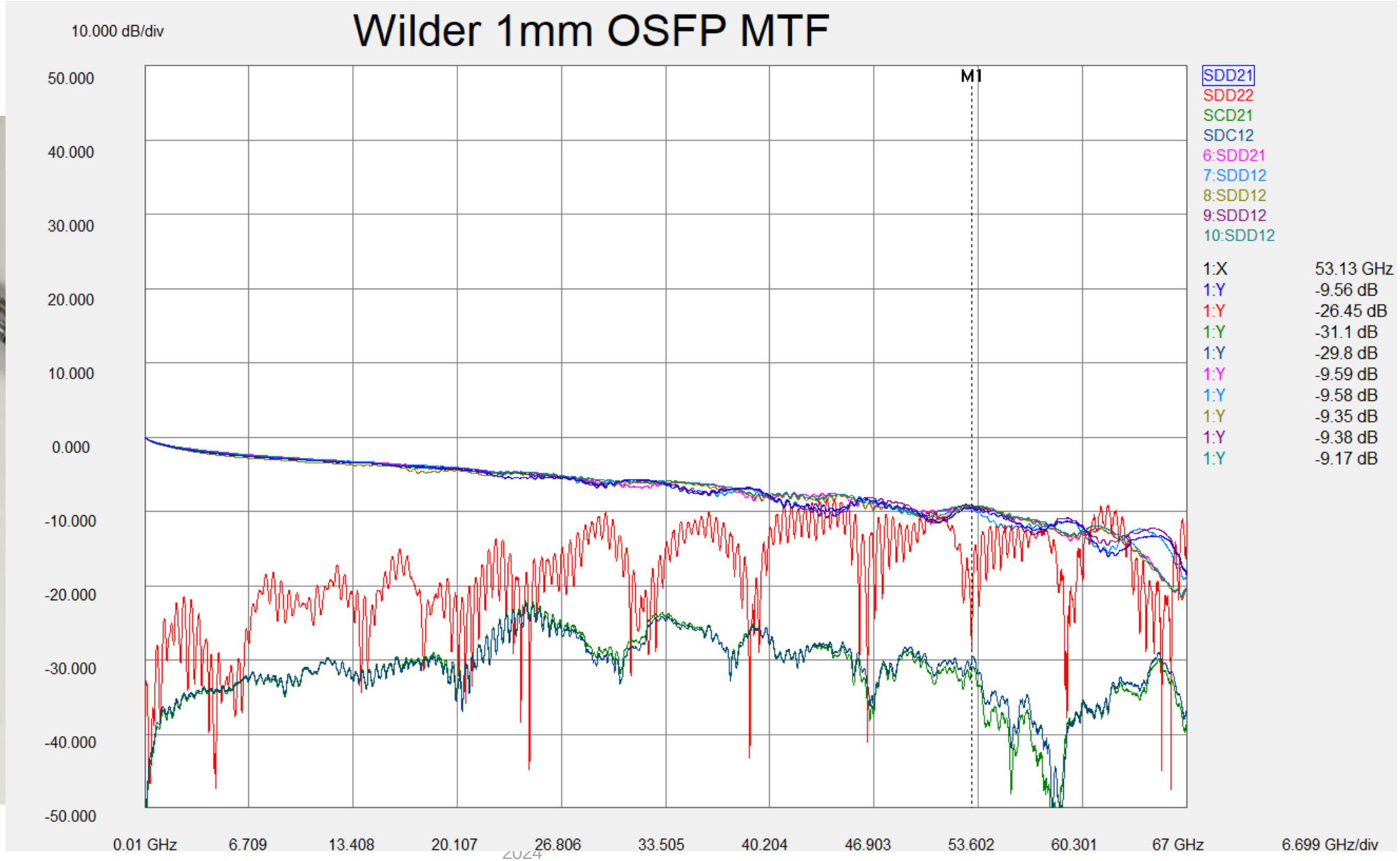
# Backup

- M8067A-005 ISI trace Performance



# Wilder 1mm OSFP MTF



# TP1a COM Table

| 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] |
| R_0 | 50 | Ohm | |
| R_d | [ 50 50] | Ohm | [TX RX] |
| A_v | 0.413 | V | vp/vf= |
| A_fe | 0.413 | V | vp/vf= |
| A_ne | 0.45 | V | |
| L | 4 | | |
| M | 32 | | |
| **filter and Eq** | | | |
| f_r | 0.58 | *fb | |
| c(0) | 1 | | min |
| c(-1) | 0 | | [min:step:max] |
| c(-2) | 0 | | [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) | 0.85 | | 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 | [-10:1:0] | dB | [min:step:max] |
| f_z | 42.50 | GHz | 10E10/Off |
| f_p1 | 42.50 | GHz | |
| f_p2 | 106.25 | 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 | CRKR_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 | UI |
| eta_0 | 2.00E-09 | V^2/GHz |
| SNR_TX | 30.5 | dB |
| R_LM | 0.98 | |
| 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 | 1 | UI | |
| ffe_post_tap_len | 17 | 25 | |
| 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 | 2.00E-05 | | |
| T_r | 0.00450 | ns | |
| FORCE_TR | 1 | logical | |
| PMD_type | C2M | | |
| EW | 0 | | |
| MLSE | 0 | logical | |
| ts_anchor | 1 | | |
| sample_adjustment | [ -16 16] | | |
| Local Search | 0 | | |
| TDMODE | 1 | time domain pulse response | |
| VEC Pass threshold | 12 | | |
| num_ui_RXFF_noise | 1024 | | |

| SAVE_CONFIG2MAT | 1 | |
|---|---|---|
| **Receiver testing** | | |
| RX_CALIBRATION | 0 | logical |
| Sigma BBN step | 5.00E-03 | V |
| **ICN parameters** | | |
| f_v | 0.278 | Fb |
| f_f | 0.278 | Fb |
| f_n | 0.278 | Fb |
| f_2 | 61.625 | GHz |
| A_ft | 0.450 | V |
| **A_nt** | 0.450 | V |

| **Parameter** | **Setting** | |
|---|---|---|
| board_tl_gamma0_a1_a2 | *6.44084e-4 3.6036e-0* | 1.4 db/in @ 53.125G |
| board_tl_tau | *5.790E-03* | ns/mm |
| board_Z_c | 100 | Ohm |
| z_bp (TX) | *32* | mm |
| z_bp (NEXT) | *32* | mm |
| z_bp (FEXT) | *32* | mm |
| z_bp (RX) | *32* | mm |
| C_0 | [0.2e-4 0] | nF |
| C_1 | [0.2e-4 0] | nF |
| **Include PCB** | **0** | **logical** |
| **Seletions (rectangle, gaussian,dual_rayleigh,triangle** | | |
| Histogram_Window_Weight | gaussian | selection |
| Qr | *0.02* | UI |
| **Floating Tap Control** | | |
| N_bg | 0 | 0 1 2 or 3 groups |
| N_bf | 4 | taps per group |
| N_f | 20 | UI span for floating taps |
| bmaxg | 0.2 | max DFE value for floating taps |
| B_float_RSS_MAX | 0.2 | rss tail tap limit |
| N_tail_start | 18 | (UI) start of tail taps limit |
| BREAD_CRUMBS | 1 | |

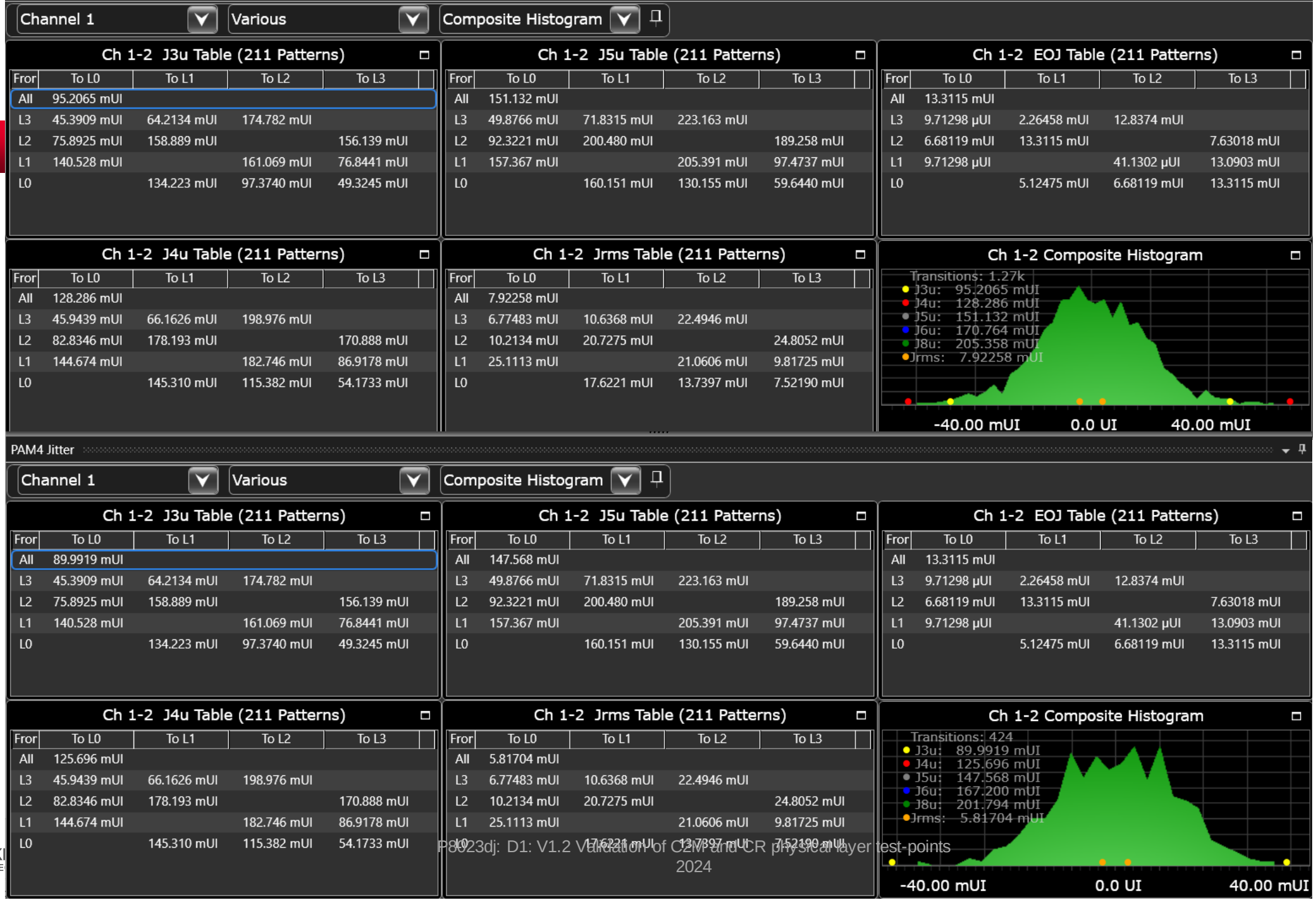

| Fror | To L0 | To L1 | To L2 | To L3 |
|---|---|---|---|---|
| All | 185.199 mUI | | | |
| L3 | 45.3909 mUI | 64.2134 mUI | 174.782 mUI | |
| L2 | 75.8925 mUI | 158.889 mUI | | 156.139 mUI |
| L1 | 140.528 mUI | | 161.069 mUI | 76.8441 mUI |
| L0 | | 134.223 mUI | 97.3740 mUI | 49.3245 mUI |

| Fror | To L0 | To L1 | To L2 | To L3 |
|---|---|---|---|---|
| All | 198.403 mUI | | | |
| L3 | 49.8766 mUI | 71.8315 mUI | 223.163 mUI | |
| L2 | 92.3221 mUI | 200.480 mUI | | 189.258 mUI |
| L1 | 157.367 mUI | | 205.391 mUI | 97.4737 mUI |
| L0 | | 160.151 mUI | 130.155 mUI | 59.6440 mUI |

| Fror | To L0 | To L1 | To L2 | To L3 |
|---|---|---|---|---|
| All | 13.3115 mUI | | | |
| L3 | 9.71298 µUI | 2.26458 mUI | 12.8374 mUI | |
| L2 | 6.68119 mUI | 13.3115 mUI | | 7.63018 mUI |
| L1 | 9.71298 µUI | | 41.1302 µUI | 13.0903 mUI |
| L0 | | 5.12475 mUI | 6.68119 mUI | 13.3115 mUI |

| Fror | To L0 | To L1 | To L2 | To L3 |
|---|---|---|---|---|
| All | 185.199 mUI | | | |
| L3 | 45.9439 mUI | 66.1626 mUI | 198.976 mUI | |
| L2 | 82.8346 mUI | 178.193 mUI | | 170.888 mUI |
| L1 | 144.674 mUI | | 182.746 mUI | 86.9178 mUI |
| L0 | | 145.310 mUI | 115.382 mUI | 54.1733 mUI |

| Fror | To L0 | To L1 | To L2 | To L3 |
|---|---|---|---|---|
| All | 17.1604 mUI | | | |
| L3 | 6.77483 mUI | 10.6368 mUI | 22.4946 mUI | |
| L2 | 10.2134 mUI | 20.7275 mUI | | 24.8052 mUI |
| L1 | 25.1113 mUI | | 21.0606 mUI | 9.81725 mUI |
| L0 | | 17.6221 mUI | 13.7397 mUI | 7.52190 mUI |


Channel 1
Various
Composite Histogram
Ch 1-2 J3u Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 95.2065 mUI
L3 45.3909 mUI 64.2134 mUI 174.782 mUI
L2 75.8925 mUI 158.889 mUI 156.139 mUI
L1 140.528 mUI 161.069 mUI 76.8441 mUI
L0 134.223 mUI 97.3740 mUI 49.3245 mUI
Ch 1-2 J5u Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 151.132 mUI
L3 49.8766 mUI 71.8315 mUI 223.163 mUI
L2 92.3221 mUI 200.480 mUI 189.258 mUI
L1 157.367 mUI 205.391 mUI 97.4737 mUI
L0 160.151 mUI 130.155 mUI 59.6440 mUI
Ch 1-2 EOJ Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 13.3115 mUI
L3 9.71298 µUI 2.26458 mUI 12.8374 mUI
L2 6.68119 mUI 13.3115 mUI 7.63018 mUI
L1 9.71298 µUI 41.1302 µUI 13.0903 mUI
L0 5.12475 mUI 6.68119 mUI 13.3115 mUI
Ch 1-2 J4u Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 128.286 mUI
L3 45.9439 mUI 66.1626 mUI 198.976 mUI
L2 82.8346 mUI 178.193 mUI 170.888 mUI
L1 144.674 mUI 182.746 mUI 86.9178 mUI
L0 145.310 mUI 115.382 mUI 54.1733 mUI
Ch 1-2 Jrms Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 7.92258 mUI
L3 6.77483 mUI 10.6368 mUI 22.4946 mUI
L2 10.2134 mUI 20.7275 mUI 24.8052 mUI
L1 25.1113 mUI 21.0606 mUI 9.81725 mUI
L0 17.6221 mUI 13.7397 mUI 7.52190 mUI
Ch 1-2 Composite Histogram
Transitions: 1.27k
J3u: 95.2065 mUI
J4u: 128.286 mUI
J5u: 151.132 mUI
J6u: 170.764 mUI
J8u: 205.358 mUI
Jrms: 7.92258 mUI
-40.00 mUI
0.0 UI
40.00 mUI
PAM4 Jitter
Channel 1
Various
Composite Histogram
Ch 1-2 J3u Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 89.9919 mUI
L3 45.3909 mUI 64.2134 mUI 174.782 mUI
L2 75.8925 mUI 158.889 mUI 156.139 mUI
L1 140.528 mUI 161.069 mUI 76.8441 mUI
L0 134.223 mUI 97.3740 mUI 49.3245 mUI
Ch 1-2 J5u Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 147.568 mUI
L3 49.8766 mUI 71.8315 mUI 223.163 mUI
L2 92.3221 mUI 200.480 mUI 189.258 mUI
L1 157.367 mUI 205.391 mUI 97.4737 mUI
L0 160.151 mUI 130.155 mUI 59.6440 mUI
Ch 1-2 EOJ Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 13.3115 mUI
L3 9.71298 µUI 2.26458 mUI 12.8374 mUI
L2 6.68119 mUI 13.3115 mUI 7.63018 mUI
L1 9.71298 µUI 41.1302 µUI 13.0903 mUI
L0 5.12475 mUI 6.68119 mUI 13.3115 mUI
Ch 1-2 J4u Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 125.696 mUI
L3 45.9439 mUI 66.1626 mUI 198.976 mUI
L2 82.8346 mUI 178.193 mUI 170.888 mUI
L1 144.674 mUI 182.746 mUI 86.9178 mUI
L0 145.310 mUI 115.382 mUI 54.1733 mUI
Ch 1-2 Jrms Table (211 Patterns)
Fror | To L0 | To L1 | To L2 | To L3
All 5.81704 mUI
L3 6.77483 mUI 10.6368 mUI 22.4946 mUI
L2 10.2134 mUI 20.7275 mUI 24.8052 mUI
L1 25.1113 mUI 21.0606 mUI 9.81725 mUI
L0 17.6221 mUI 13.7397 mUI 7.52190 mUI
Ch 1-2 Composite Histogram
Transitions: 424
J3u: 89.9919 mUI
J4u: 125.696 mUI
J5u: 147.568 mUI
J6u: 167.200 mUI
J8u: 201.794 mUI
Jrms: 5.81704 mUI
-40.00 mUI
0.0 UI
40.00 mUI