TDECQ CER Enhancement to Transmitters Metric

(Comments 261, 262, 263, 264)

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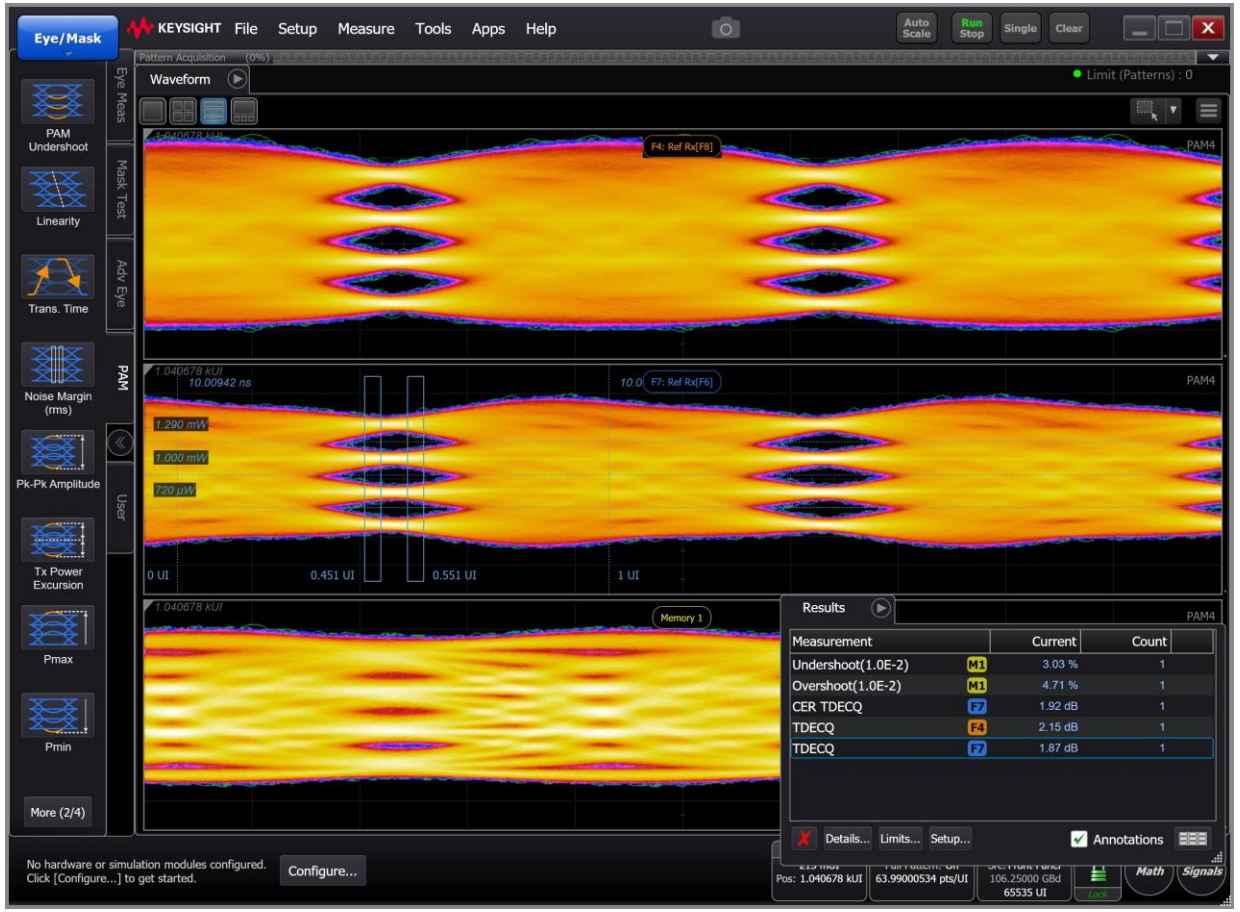
Overview

- **Transmitters from ghiasi_3dj_01a_2509 and some additional transmitters are used for CER TDECQ evaluation**
  - Supplier-I provided typical SiPho and a failing Sipho module (results here are slightly better than September contribution as the BT4 filter are turned off)
  - Supplier-II provided a typical SiPho module and a field return module
- **FlexDCA P.80.30.73 which incorporate CER TDECQ and DJ tap limits is used for the evolution of the waveforms.**

Special thanks and credit to Ahmad El-Chayeb and David Leyba of Keysight Technologies for TDECQ with DFE analysis support!

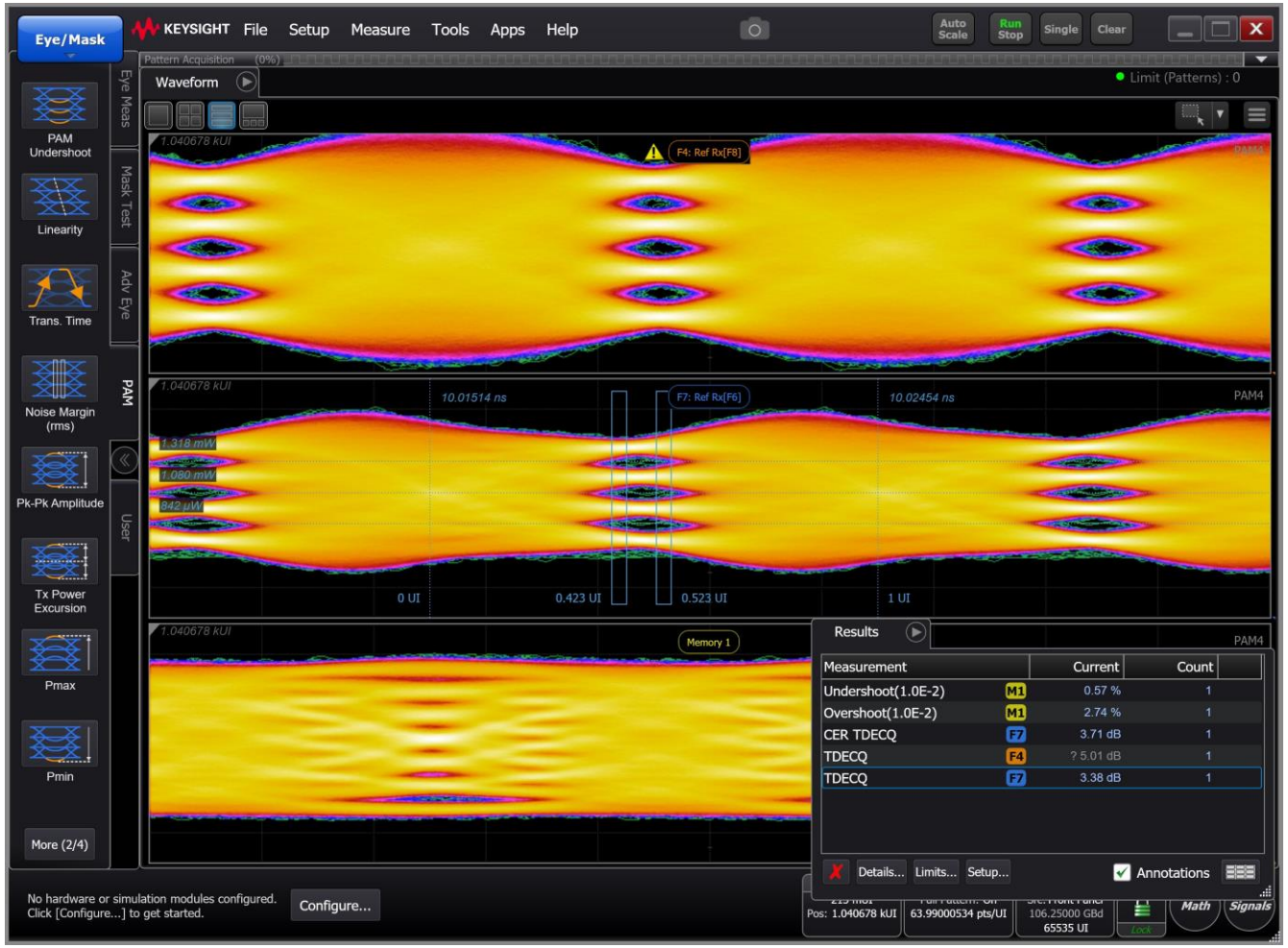
Supplier I - 200G SiPho MZM TDECQ

- **TDECQ results for a typical transmitter**
  - TDECQ with 15T FFE is 2.15 dB
  - TDECQ with 15T FFE + 1T DFE is 1.87 dB
  - CER TDECQ with 15T FFE + 1T DFE is 1.92 dB
- **For good transmitters CER TDECQ is about the same as TDECQ.**



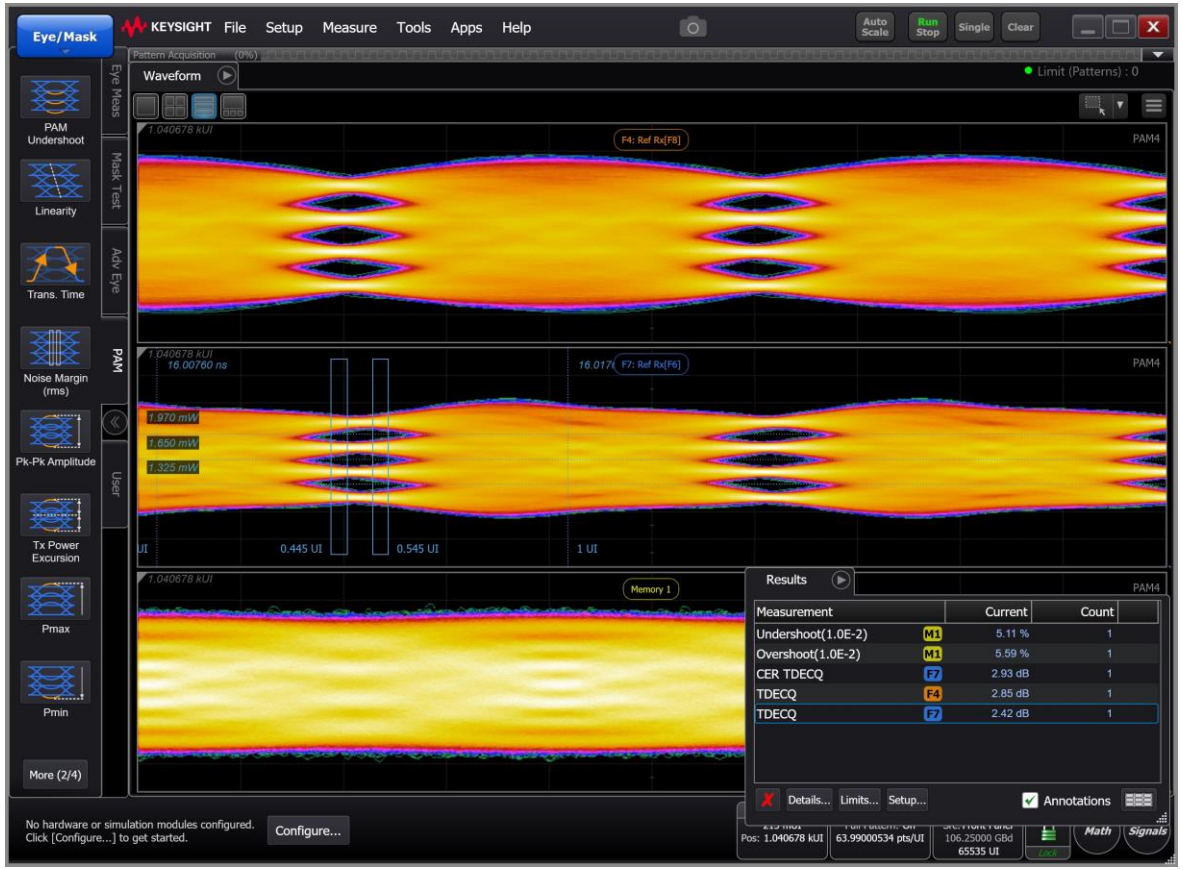
Supplier 1-200G Sipho MZM TDECQ

- **TDECQ results for a failing transmitter**
  - TDECQ with 15T FFE is ~5.0 dB
  - TDECQ with 15T FFE + 1T DFE is 3.38 dB
  - CER TDECQ with 15T FFE + 1T DFE is 3.72 dB
- **CER TDECQ rightfully would fail this transmitter!**



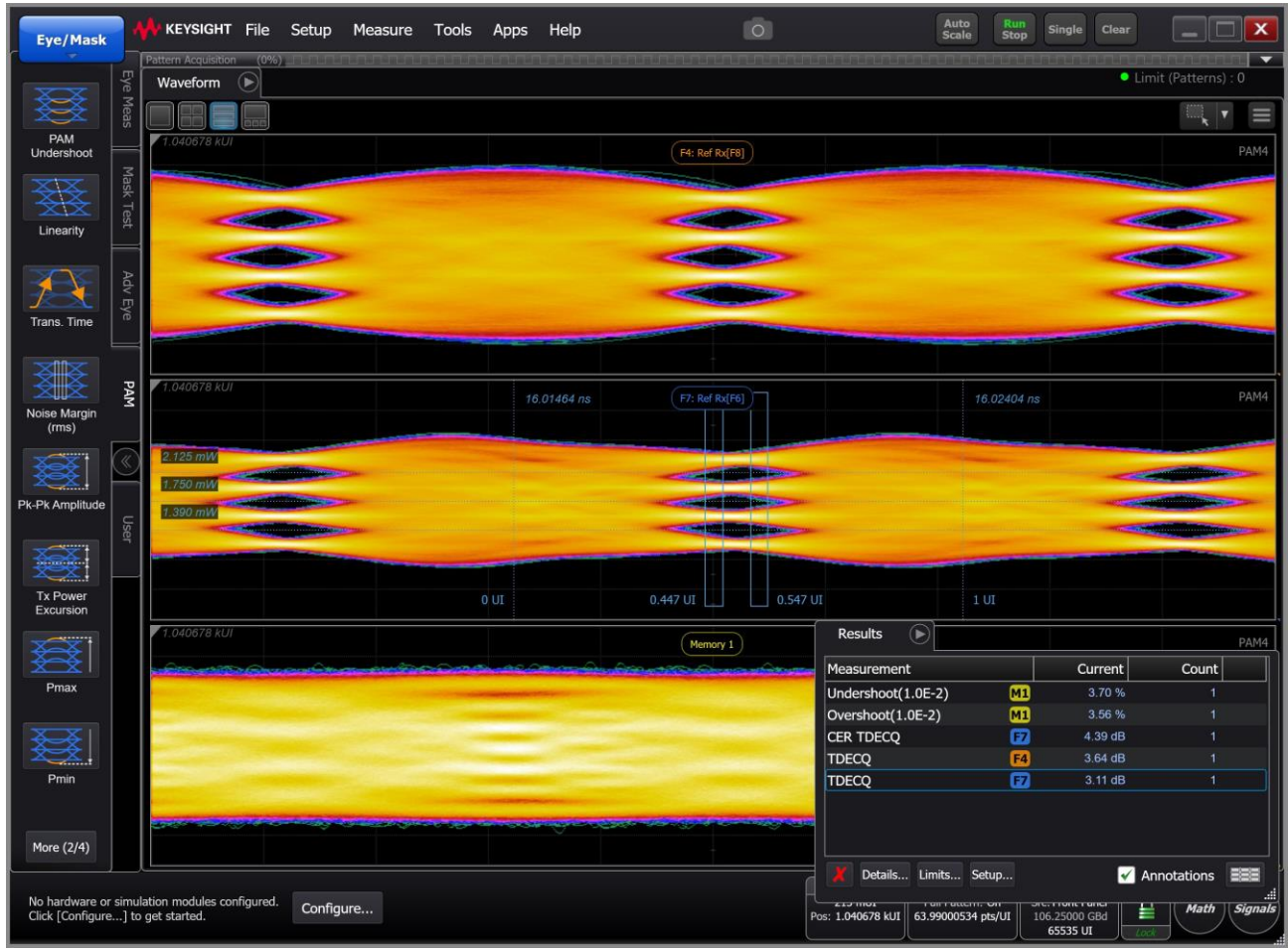
Supplier 2-200G Sipho MZM TDECQ

- **TDECQ results for a typical transmitter**
  - TDECQ with 15T FFE is 2.85 dB
  - TDECQ with 15T FFE + 1T DFE is 2.42 dB
  - CER TDECQ with 15T FFE + 1T DFE is 2.93 dB
- **CER TDECQ in this case is ~ 0.5 higher!**



Supplier 2-200G Sipho MZM TDECQ

- **TDECQ results for a failing transmitter**
  - TDECQ with 15T FFE is 3.64 dB
  - TDECQ with 15T FFE + 1T DFE is 3.11 dB
  - CER TDECQ with 15T FFE + 1T DFE is 4.39 dB
- **CER TDECQ rightfully would fail this transmitter!**



Improved TDECQ Test Worth the Effort

- **TDECQ measures the transmitter penalty against a golden reference receiver with less variability**
  - TDECQ penalty is used for all link budget analysis, and one can't afford 1.5 dB slop
- **Functional receiver FRx are measured for block errors at +1.5 dB above RxS sensitivity not to fail marginally passing transmitters**
  - FRx is very effective to identify transmitters with high low frequency RJ where some FEC frame have high block errors but has average number of block errors and passing TDECQ
  - FRx likely will pass transmitter even with TDECQ of 4.0 dB as long it doesn't have non uniform error burst
- **Improving TDECQ(including CER TDECQ) is well spend effort!**

Summary

- **CER TDECQ with penalty correlated back to code word errors is an improved method and is a better fit for DJ optical PMDs with intention to correlate back to code word errors**
  - The CER TDECQ main drawback is the test time of 1-2 minutes and the code is more stable
  - For well behaved module CER TDECQ is about the same as classic TDECQ with the same reference equalizer
  - CER TDECQ when tested on real time scope can capture both synchronous and asynchronous jitters, but CER TDECQ on sampling scope still capture the more problematic synchronous jitter
    - FRx can capture both synchronous and asynchronous jitters but doesn't have accuracy of TDECQ due to variability of FRx and testing at +1.5 dB above sensitivity
  - CER TDECQ would fail a module that has failed but based on standard TDECQ the same module would be a pass
- **CER TDECQ is an improved TDECQ test but we need more time to evaluate it**
  - Given the initial result CER TDECQ with the same 3.4 dB limit should remain in the draft
  - At D3.0 we can decide to keep both or remove one of the TDECQ.

Thank You!