

On guarding against overshoot TDECQ measurement

Atlanta-substitute interim 2020/03; Continuation of work
presented in zivny_3cu_01_0120 in Geneva 2020/01

Pavel Zivny, Tektronix

zivny_3cu_01_0320





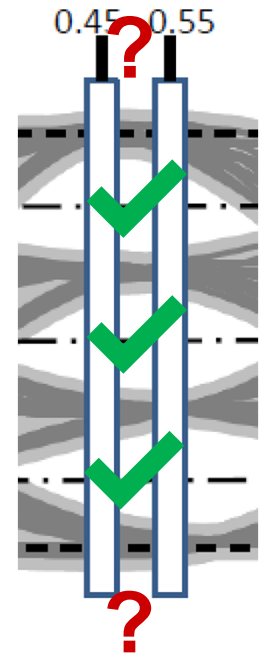
Supporters

- TBD

Requirements for a overshoot / undershoot guarding in standards using TDECQ

Problem statement:

- TDECQ penalty measurement properly takes into account the SER of the 3 eyes of PAM4 signal, as these are the primary contributors to the error rate ...
but TDECQ does only little* to evaluate the impact of the top of eye 3 or the bottom of the eye 1 on the SER.
- For simplicity we'll use the terms overshoot and undershoot in this document for the eye area above the top resp. lowest eye.
- Overshoot and undershoot are less direct contributors to the error rate than the eye closures, but should be controlled nevertheless because they still impact** the error rate when out of control



*The overshoot and undershoot levels do (at the decision time at least) have an impact on the eye threshold and on equalization, so certain amount of control is present

**Mild over/undershoot requires (in the receiver) either protection against saturation or increased dynamic range of the input stages of the receiver (leads to SNR loss and/or cost-of-design increase). Severe over/undershoot can directly cause symbol errors through several possible mechanisms.

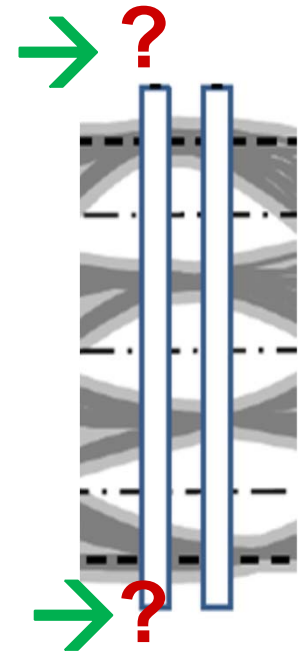


Overshoot's impact on the link performance

- This work was done Roberto Rodes and Vipul Bhatt and is now presented in
 `rodes_3cu_01_0320.pdf`
- The conclusion considered here is the support for the absolute overshoot.

Methodology for a overshoot / undershoot guarding in standards using TDECQ

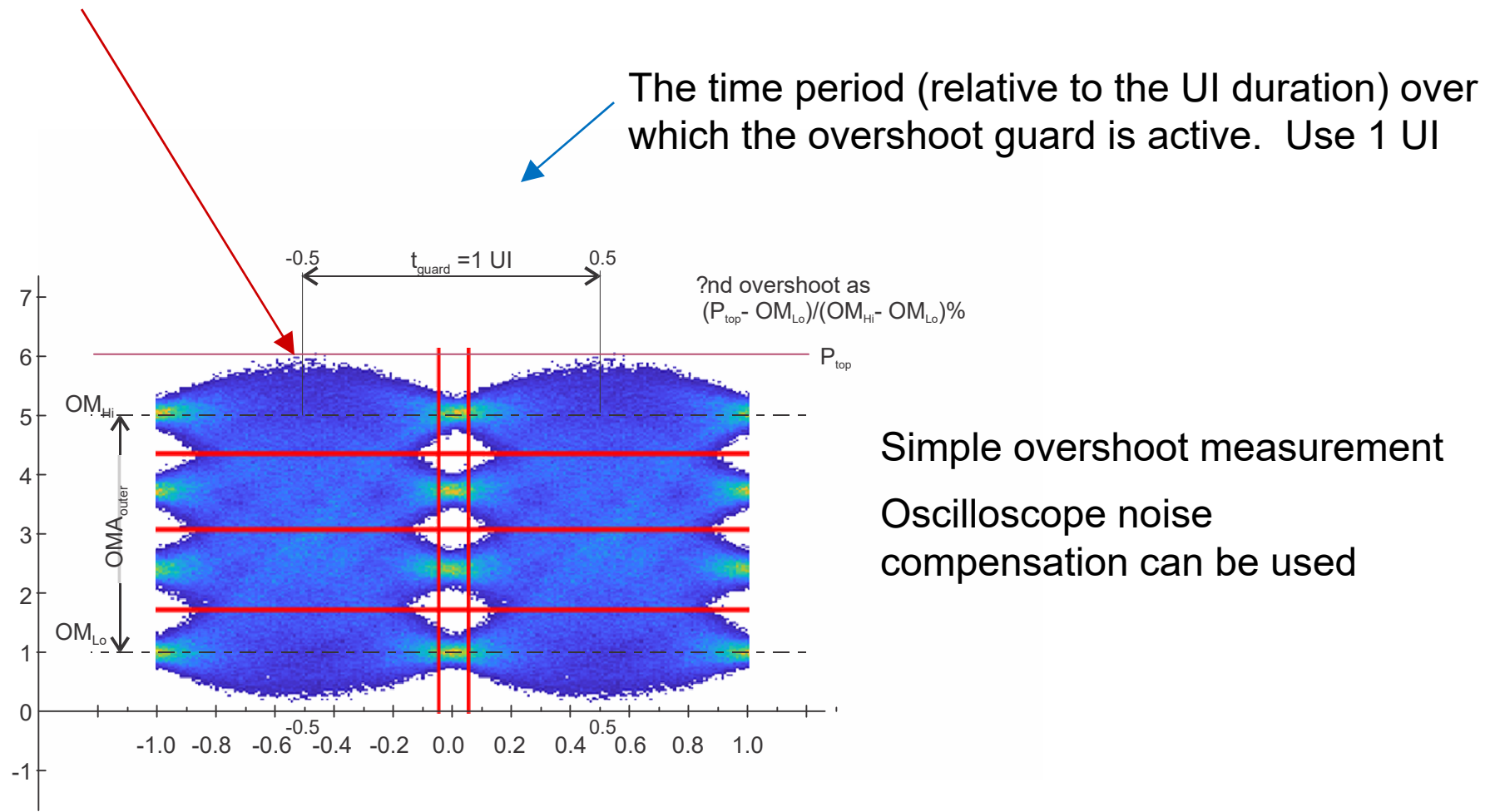
- Overshoot on small signals should be controlled in a statistically effective way:
 1. peak-peak measurement is less desirable as it penalizes the longer, more statistically valid, acquisitions... if used then the population should be specified
 2. The oscilloscope noise impacts the result to capture a more conservative result
 3. Use same acquisition for as the one used by TDECQ
- The time-span of the guard should be *the whole UI* because the overshoot can impact the input stage anywhere
- The overshoot to guard against is the *absolute overshoot* – a problem with a relative overshoot (on a small signal) is not a strong enough case
- The pattern used should be SSPRQ because (also see 3 above)
 - It presents a mix of frequencies, thus exciting more overshoot effects
 - It is practical – already used, no need to change the DUT into another mode
- The observation bandwidth is the same as for TDECQ measurement (also see 3 above)



Guarding against the overshoot

Absolute overshoot measurement doesn't need oscilloscope noise compensation

- Focusing on the overshoot (above the eye 3). Undershoot not proven needed.





Questions?

- Thank you,

Pavel