

Requirements for Measurement Receiver Bandwidth and Jitter Floor

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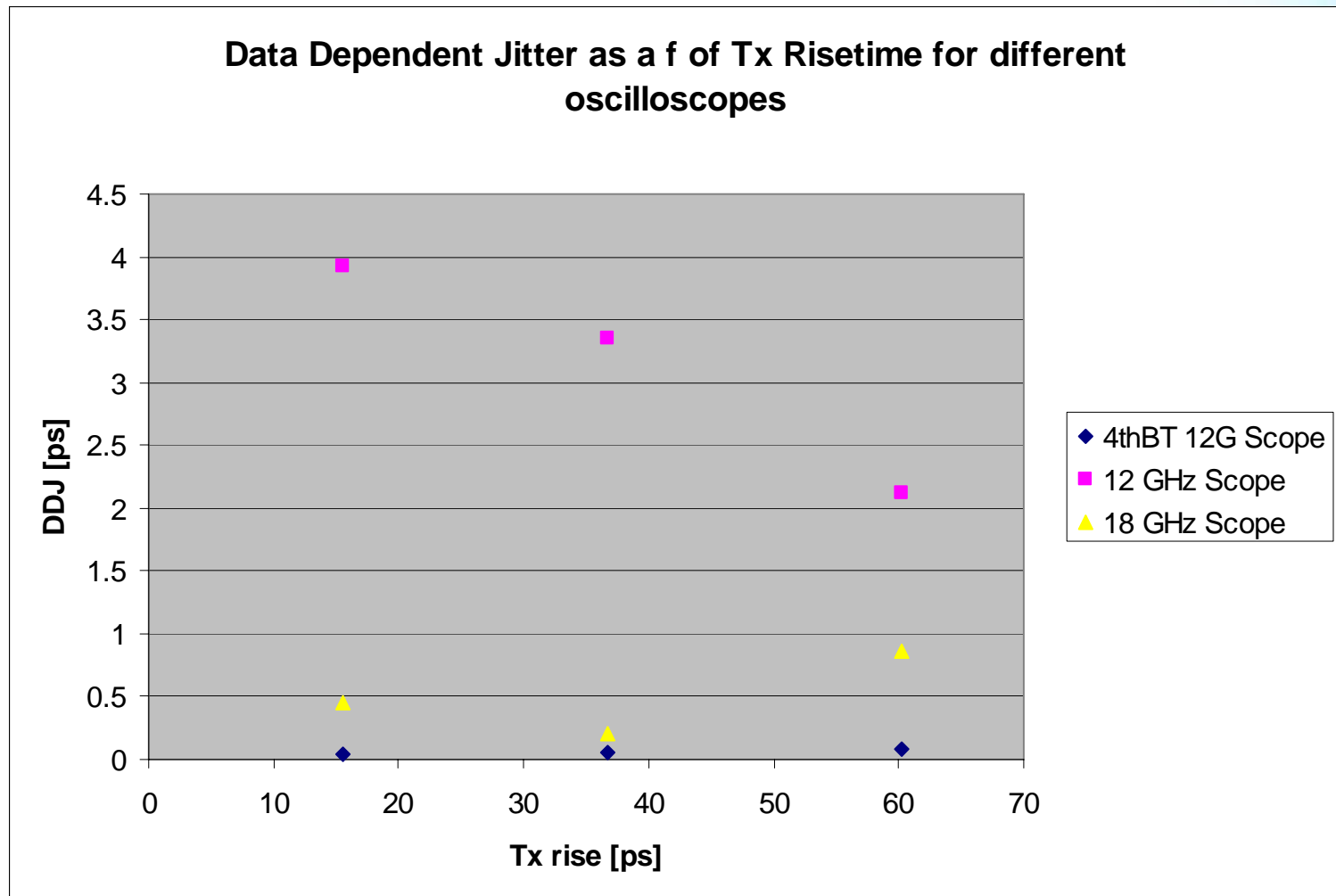
Issue Statement #1

- Where: D2.0 draft, 83A.5 Electrical parameter measurement methods, P383, L32-37

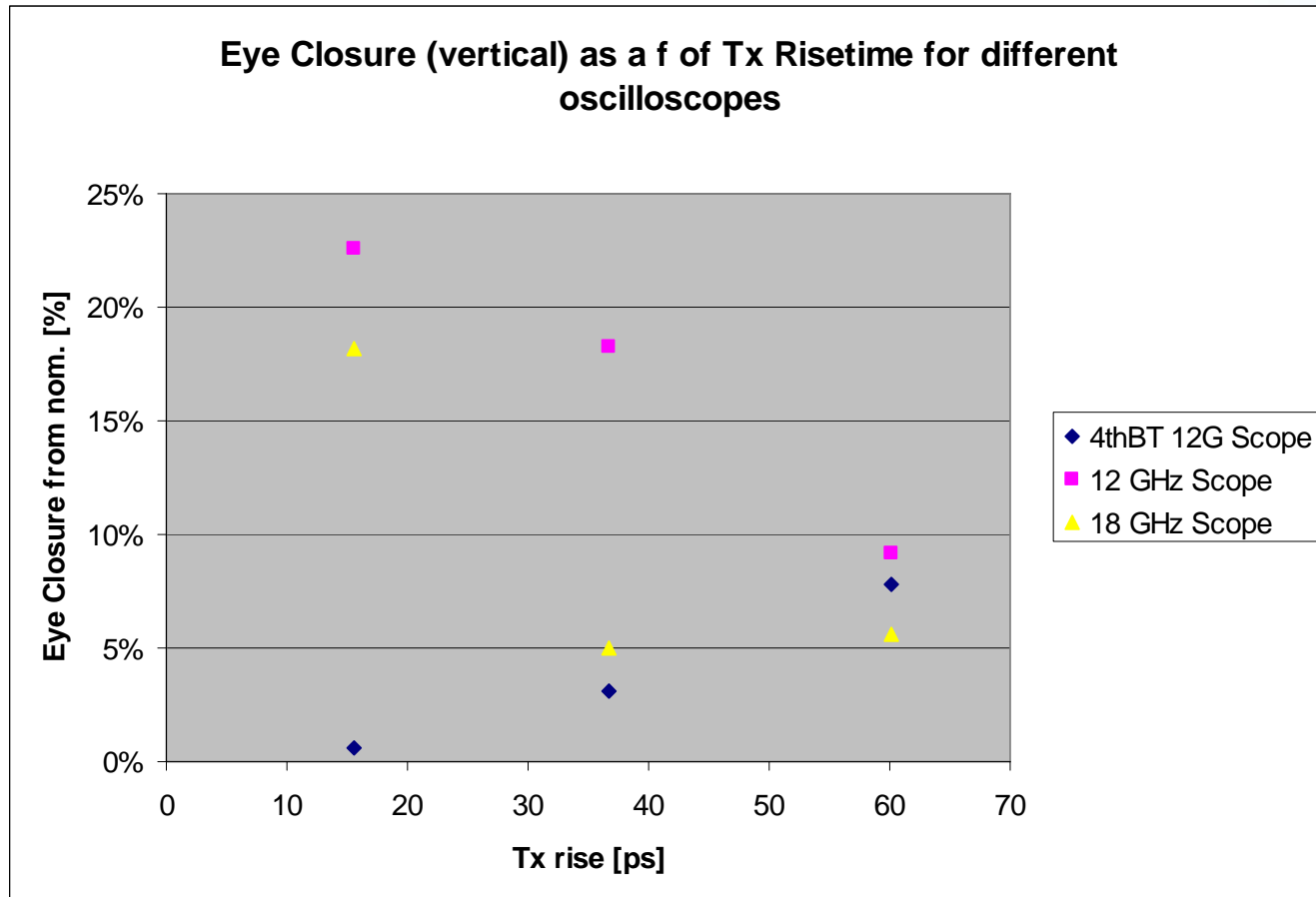
- Issues:

To maintain the minimum error introduced by the measurement equipment such as sampling scope in measuring waveform, eye-diagram, and jitter, a minimum bandwidth (BW) is needed. The rule of thumb is that the BW should be at the 5th harmonic. In the case of 10 Gbps for XALUI/CAUI, it is 25 GHz. The current BW requirement is set at 12 GHz, and it will introduce unacceptable errors.

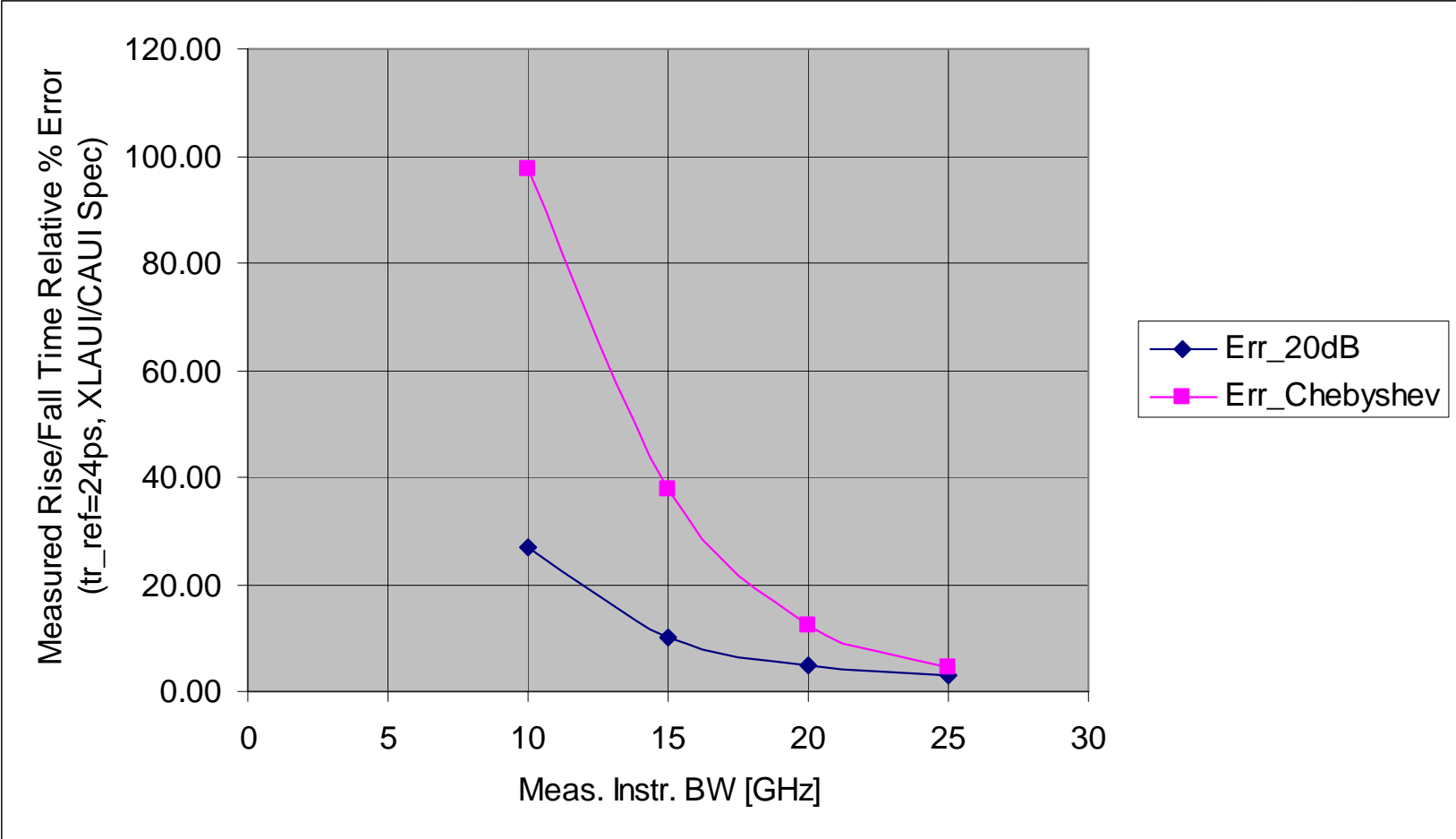
Measurement Rx Induced DDJ Error As a Function of Its BW



Measurement Rx Induced Vertical Eye-Closure (DDN) As a Function of Its BW



Rise/Fall Time Error As a Function of Measurement Rx BW



References from Other Standards/Studies

- PCI Express specified that the BW for the measurement Rx need to be at 5th order harmonics (i.e., 2.5xBit Clock Freq)
- [1], [2] reach the same conclusions

Issue #1 Remedy

- Change the last sentence of

“the eye is measured using a receiver with a -3dB bandwidth of 12 GHz”,

to

“the signal waveform, eye, and jitter is measured using a receiver with a minimum -3dB bandwidth of 18 GHz, with a roll-off slope no faster than 20 dB/decade at above 18 GHz ” to cover higher than the 3rd harmonic and this will be the minimum change since 18 GHz scope is very common today.

or to

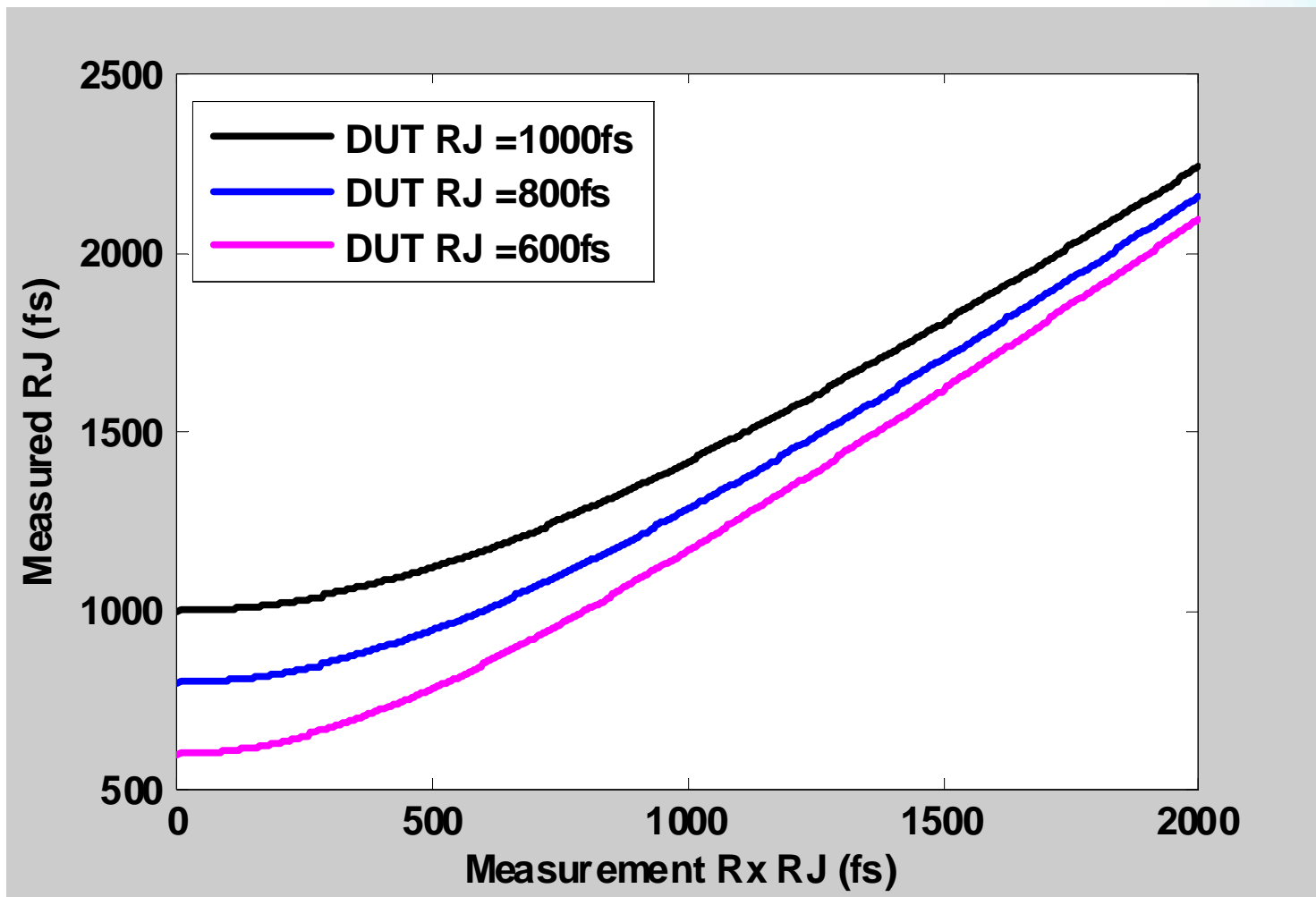
“the signal waveform, eye, and jitter is measured using a receiver with a minimum -3dB bandwidth of 25 GHz, with a roll-off slope no faster than 20 dB/decade at above 25 GHz ” to cover up to the 5th harmonic and this will give sufficient accuracy.

Issue Statement #2

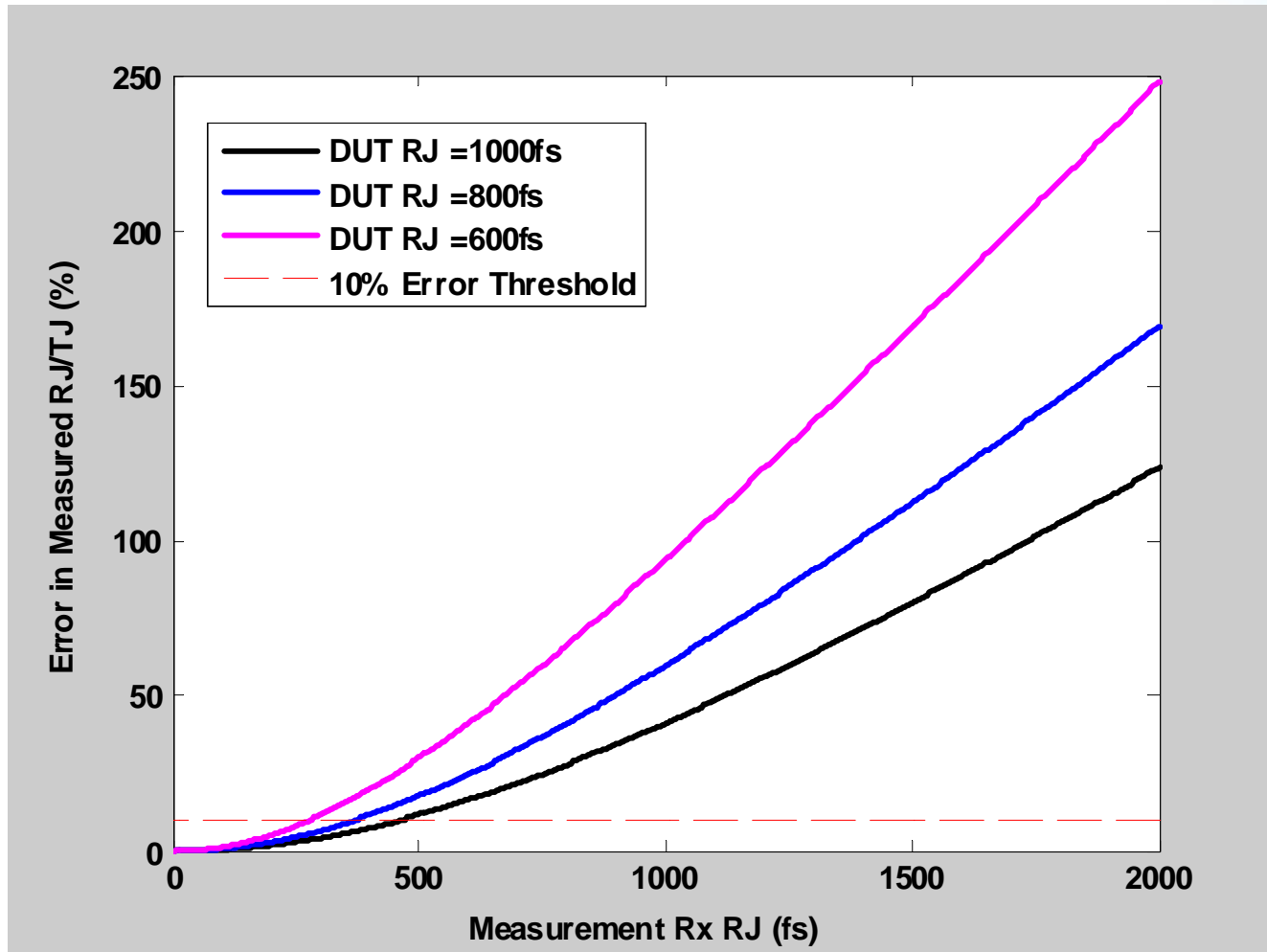
- Where: D2.0 draft, 83A.5 Electrical parameter measurement methods, P383
- Issues:

The Tx RJ inferred is at 1.1 ps RMS. There is no requirement on the jitter floor for the measurement receiver. This measurement error will be significant if jitter floor of the measurement receiver is at 1 ps or above.

Effects of Measurement Receiver RJ Floor to the RJ Measurement Results



RJ/TJ Measurement Error As a Function of Rx RJ Floor



* TJ here is assumed entirely due to RJ

* Even to maintain a 10% error, RX RJ need to be < 500 fs

Issue #2 Remedy

- Add a requirement that the measurement receiver needs to have a RJ floor that is 400 fs rms (~ 3 -sigma below the DUT RJ and maintain a $\sim 5\%$ error) or lower.

Acknowledgements

We thank Masashi Shimanouchi of Altera and Klaus Engenhardt of Tektronix for their assistants for this presentation.

References

1. Brig Asay, “The Fifth Harmonic: Tradeoffs Between Sampling and Real Time Oscilloscopes”, ED Online ID #20499, January 13, 2009
2. “Oscilloscope Bandwidth Requirements for Emerging Serial Data Interfaces”, www.eeplace.com/dm/agilent/admf/2008/papers/cn/Paper12.pdf

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