CONSIDERATIONS FOR TX AC COMMON-MODE SPECIFICATIONS

Addressing comments 151, 153, 141

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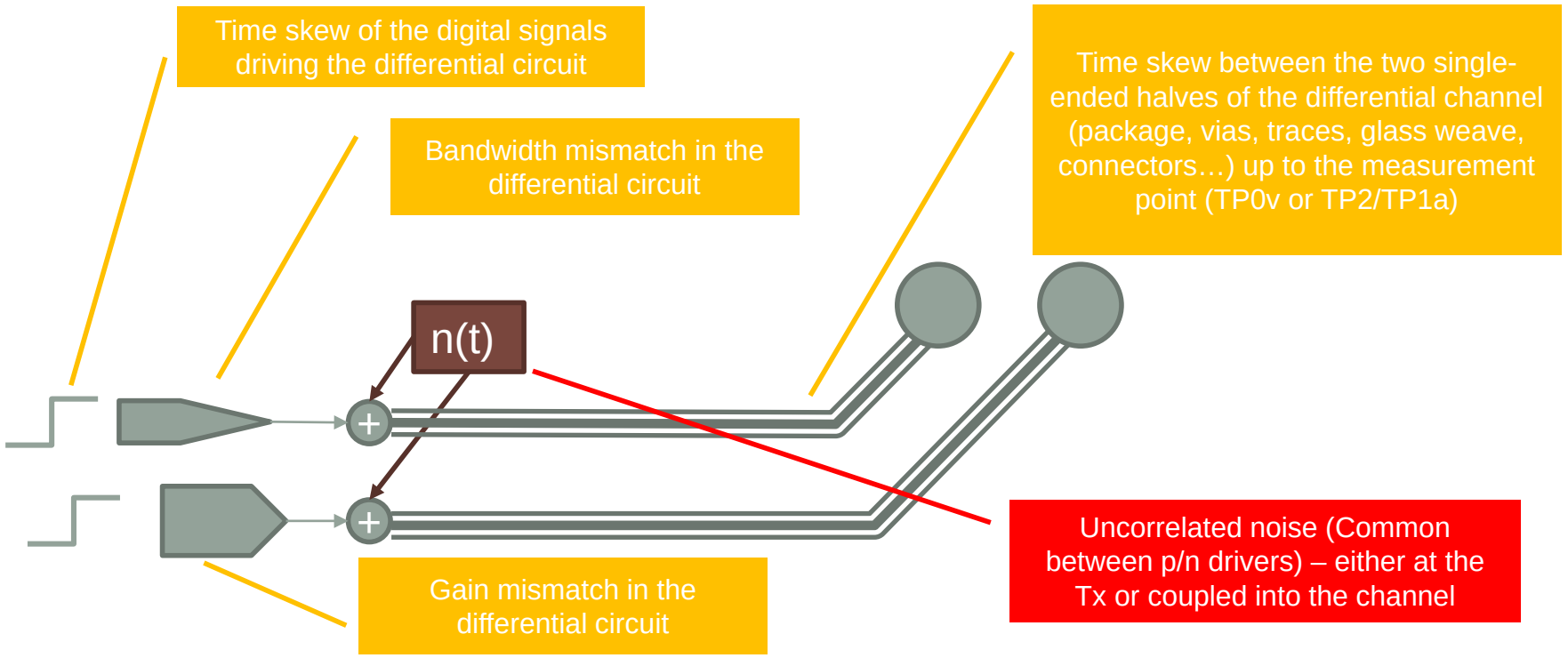
Goal of this presentation

- Study what can cause AC common mode signal, why it should be controlled and how
- Propose future work

Common mode AC output – sources

- Tx for electrical interfaces is typically a fully differential circuit whose output should have constant common mode voltage.
- Typical causes of common mode AC signal in the TX are:



Common mode AC output – impact

- Conversion of differential signal to CM signal
  - Frequency dependent
  - Causes distortion of the differential signal
  - Typically strong at high frequencies
  - Note that the channel (in CR/KR/C2C) can also cause D-C conversion
- Conversion of CM *noise* to differential *noise*
  - Note that the channel (in CR/KR/C2C) can also cause C-D conversion
- Common mode signal/noise impact on the receiver
  - Rx is also differential, but has finite CMRR
- EMI
  - Not performance related; other standards deal with this

Consider…

- Loss of signal from D-C conversion
  - Caused e.g. by channel skew and BW mismatch; concentrated at high frequencies
    - Can be mitigated by equalization
  - Impact on differential signal is measurable (VEC/EH, fitted pulse)
    - **We don't need another way to limit this effect!**
- CM noise (uncorrelated with the desired signal)
  - Can have high-frequency and wideband components
  - Wideband can be converted to differential uncorrelated noise – so should be limited
- CM signal (correlated)
  - High frequency components – from conversion
    - Can be converted back to differential e.g. reverse skew – **but this is harmless (ISI)**
    - If not converted back, hits the RX as CM signal correlated with the differential signal
  - Wide-band converted signal e.g. due to termination or drive mismatch
    - Spectrum is similar to the signal's, so more will appear at the Rx
  - If the Rx converts some of it to a differential signal (finite CMRR) – it becomes ISI (equalizable…)
  - It only hurts through nonlinear effects

Future work required

- Refine AC common mode measurements to separate correlated and uncorrelated components
- Study effect of correlated common mode noise (can we expect the Rx to equalize it?)
- Set more meaningful limits