TP0v recap and objectives

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Focus Group Participants & Contributors

Following a Jan 2020 presentation (mellitz_3ck_01a_0120) showing high ambiguity in TP0a implementation and the following idea of having a varying TX TP instead, a brainstorming group was formed.

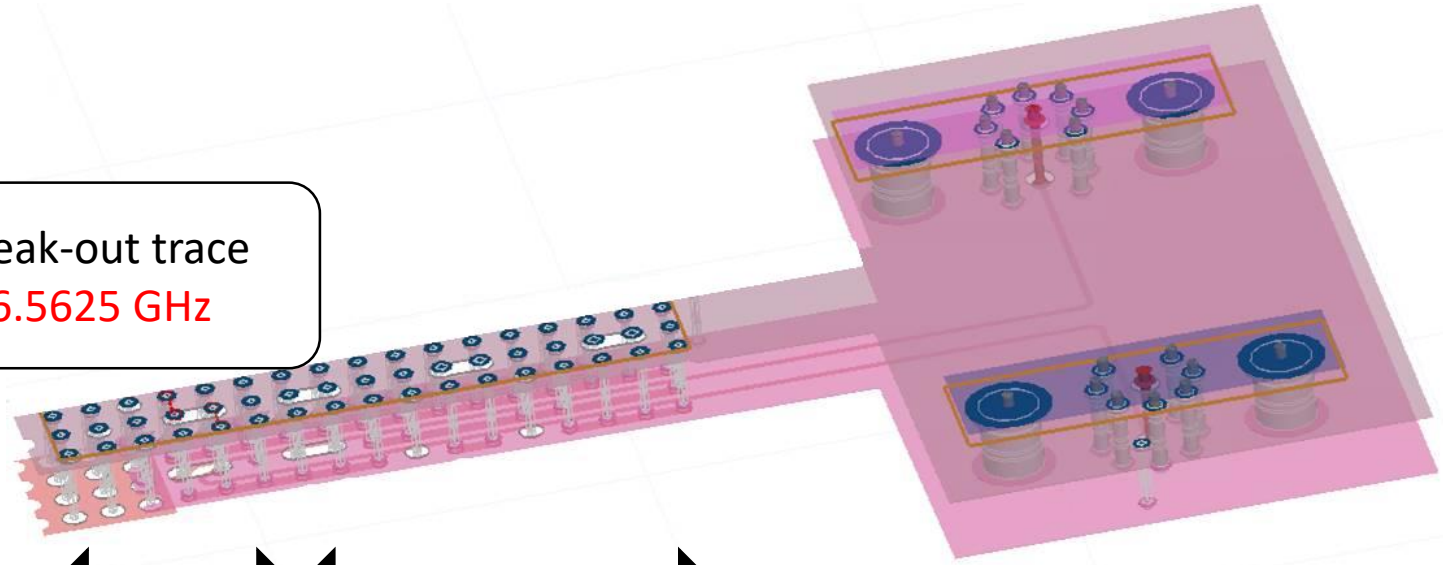
Thoughts, feedback and recommendations of a group of contributors in multiple teleconference sessions were combined to a recommendation (summarized in BenArtsi_3ck_01_0720) and adopted to the baseline

Workgroup consisted of:

- Matt Brown, Huawei Technologies Canada
- Piers Dawe, Mellanox
- Howard Heck, Intel
- Phil Sun, Credo
- Rich Mellitz, Samtec
- Adee Ran, Intel
- Liav Ben-Artsi, Marvell Semiconductor

Rcap: Why Throw Away the "Good-Old method" of specs at TP0a?

Even with high quality material, ~2.4mm via➔ break-out trace from an internal ball ➔ µvia to SMA ≥ 3dB @ 26.5625 GHz



Trace length differences | Routing angles | SMA vias | PCB material | Manufacturing tolerances

Multi-port devices | Test fixture variation

- These inaccuracies makes TP0-TP0a highly implementation and manufacturing dependent ➔ Ambiguity! Implementation and results will vary
- "Can't you de-embed the fixture?!"
- Just thinking:

It is easier to *measure* a test fixture than to *de-embed* it!

Should we be concerned about the new method?

- The focus group identified multiple parameters which pass bar should not vary with TP location (in back-up slides)
- And the things that change?! A methodology was suggested regarding these (in back-up slides)
  - The idea to allow the TP location and loss to vary is new
  - The manner by which one can achieve the pass criteria per TP0-TP0v implementation is actually not that new…

Looking forward

- ✓ Ambiguity was avoided by shifting from TP0a to TP0v
- ✓ Multi-lane measurement was made possible
- ❑ There are a few TBDs yet to be defined regarding TP0v
- ❑ Informative TP TBDs to be defined
- ❑ Close the gaps in the “new” methodology
- ❑ In particular cases can re-form a brainstorming group to achieve consensus on closing gaps and TBDs

THANK YOU

Backup Slides

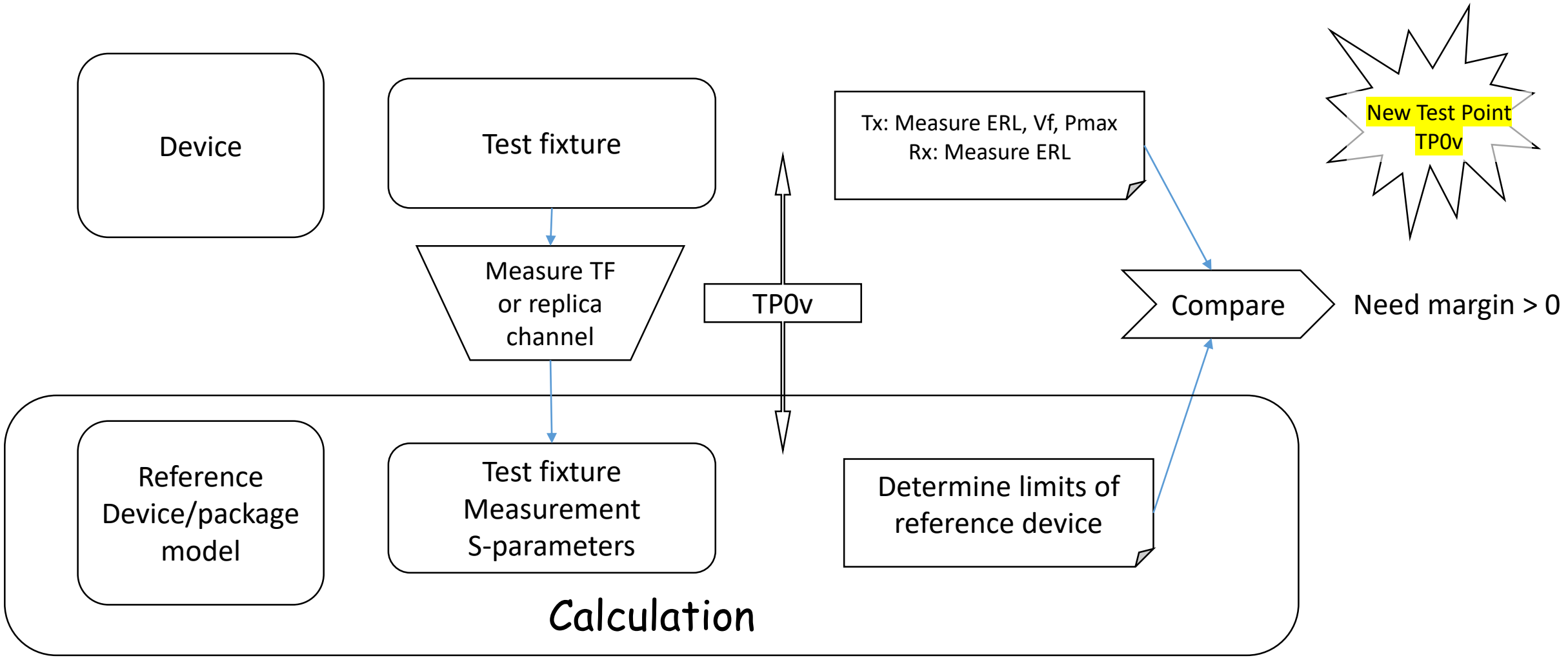
Measurements which do not vary with TP location Thus, no need to change specs

- ❑ Signaling rate
- ❑ Differential pk-pk voltage (max) Tx disabled/enabled
- ❑ DC common mode voltage (max/min)
- ❑ AC common mode voltage RMS (fixture has low effect)
- ❑ Transmitter steady state voltage (max/min)
- ❑ Transmitter waveform
  - The method for finding Tx FFE taps is independent of TP0-TP0a; actually works even at TP2.
  - See: http://www.ieee802.org/3/cb/public/jan16/mellitz_cb_01a_0116.pdf slide 6-15
    C is vector if tap coefficients. P is fitted un-equalized pulse response. R is the fitted equalized pulse response. $C= (R^T*R)-1*R^T*P$.
  - Need to make sure scope CDR can lock ➔ suggested TP0-TP0v loss ≤ 5dB @ 26.5625GHz; ILD≤Loss/20 (2dB ≤Loss≤5dB ➔ 0.25dB for 5dB loss)
- ❑ SNDR – Tx parameters to be measured on an optimized test board, breakout section is part of the device budget; package/breakout Xtalk is included in measurement

Parameters that should be measured with adjustment to overcome test fixture loss

- Jitter
  - In D1.2: “jitter measurements are made with a single transmit equalizer setting selected to compensate for the loss of the transmitter package and TP0 to TP0a test fixture”
  - Need to be clarified to avoid ambiguity
  - Spec limit value can stay unchanged
- RLM
  - In Annex 120D it is under **Output waveform** for which “The state of the transmit equalizer is controlled by management interface “
  - Clarify that Tx equalization should be used to get clean level measurements
  - Spec limit value can stay unchanged

Enabling implementation-dependent test fixture



Proposed new Methodology

- Measure TP0-TP0v channel (or replica) for the device/lane under test
- Concatenate Tr filter, Tx reference device and package model, and B-T measurement filter (same equations used in COM)
- Using the concatenated channel, calculate an output pulse response (with minimum A_v) and TDR at TP0v, with ideal termination
- Calculate Vf, Vpeak/Vf, and ERL
  - The results are the expected parameters of the reference Tx at this TP0v
  - This is the bar that the DUT should be compared to!
- Now measure Vf, Vpeak, and ERL of the DUT at TP0v using existing method
- Margin from the calculated reference values ➔ pass/fail