Tfx for Measured Fixtures

The impact of Tfx on fixture design and compatibility with other requirements for mated test fixtures

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Supporters

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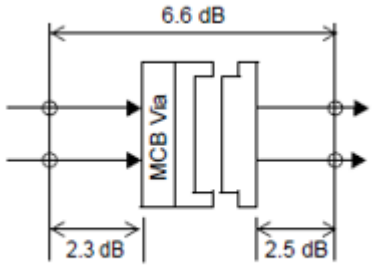
Tfx Definition

How Tfx is defined in the 3ck Specification

- #1 “Tfx represents a propagation delay which sufficiently mitigates the effect of reflections from the test connector and the test fixture transmission line”
- #2 “Tfx represents twice the delay from TP0 to TP0v”
- Explicit locations in 3ck specification
  - 162.9.3.5 Transmitter ERL (0.2ns)
  - 162.11.3 CA ERL (0.2ns)
  - 163.9.2.1.2 TP0v Test Fixture ERL (0ns)
  - 163.9.2.3 Receiver difference ERL (dependent)
  - 163.10.3 Channel ERL TP0-TP5 (0ns)
  - 120F.3.1.1 Transmitter difference ERL (dependent)
  - 120F.3.2.1 Receiver difference ERL (dependent)
  - 120F.4.3 Channel ERL C2C (0ns)
  - 120G.3.1.2 C2M Host output/input ERL (0.2ns)
  - 120G.3.2.3 C2M Module output/input ERL (0.2ns)
  - 162B.1.3.2 Mated Test Fixtures ERL (0ns)

Tfx Definition for MTF

Test fixtures include RF connectors



Mated cable assembly
and test point test fixture

NOTE—2.3 dB MCB PCB IL includes the RF connector (up to the RF connector reference plane). The MCB via allowance is 0.2 dB.

Table 162B–1—Mated test fixture ERL parameter values

Parameter	Symbol	Value	Units
Transition time associated with a pulse	T_r	0.01	ns
Incremental available signal loss factor	β_x	0	GHz
Permitted reflection from a transmission line external to the device under test	ρ_x	0.618	—
Length of the reflection signal	N	400	UI
Equalizer length associated with reflection signal	N_{bx}	0	UI
Time-gated propagation delay	T_{fx}	0	ns
Tukey window flag	tw	1	—
Target detector error ratio	DER_0	10^{-5}	—

NOTE—The mated test fixture test connector and transmission line are not time-gated (by setting T_{fx} to 0) in order to include the entire test fixture.

- In D1p5, ERL replaced the frequency-domain mask used to control Return Loss for Mated Test Fixture (MTF) measurements
- The ERL parameter definition set Tfx to ‘0’ so that the entire test fixture was captured in the ERL computation
  - The *entire* test fixture is evaluated using frequency-domain masks
- The entire test fixture is relevant when determining compliance for other MTF measurements
  - SDD21, SCD21, SCD11/22, FOMILD

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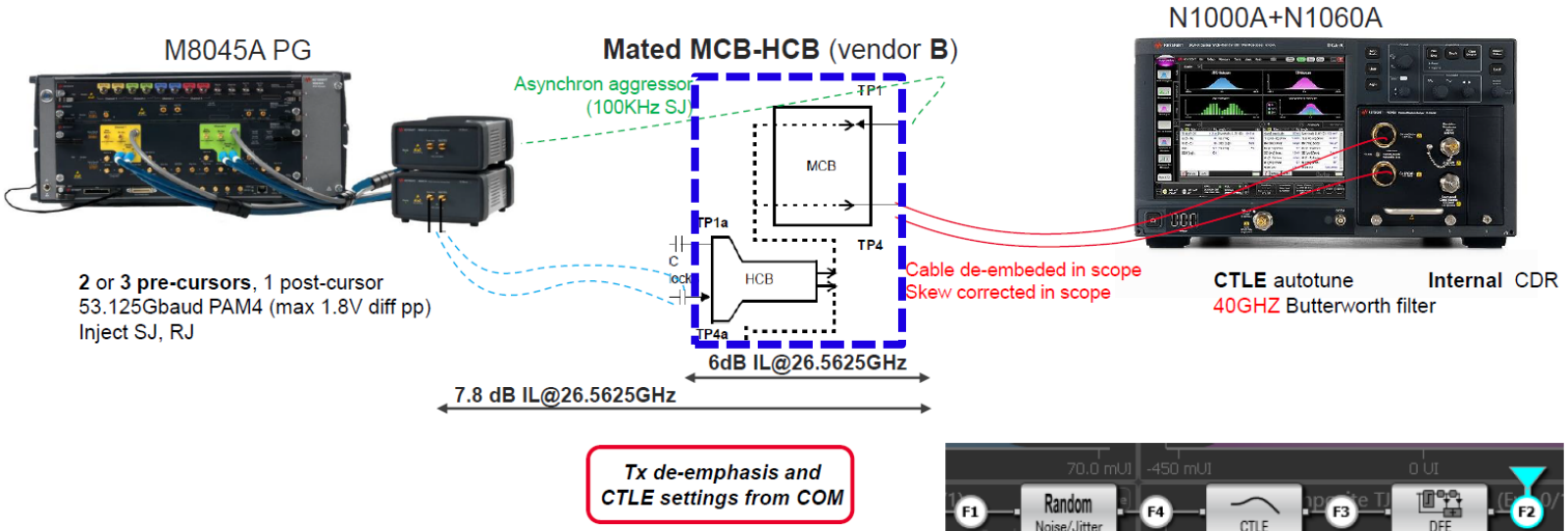
Application of Test Fixtures

How test fixtures are used in the 3ck specification

Experimental setup – stressed input test

HOST INPUT NEAR-END TEST



https://www.ieee802.org/3/ck/public/20_10/calvin_3ck_02a_1020.pdf

- Compliance measurements like the setup shown above rely on high-quality test fixtures to meet performance goals
- Until instruments can gate and window accurately for eye measurements, *quality* is determined with the entire test fixture

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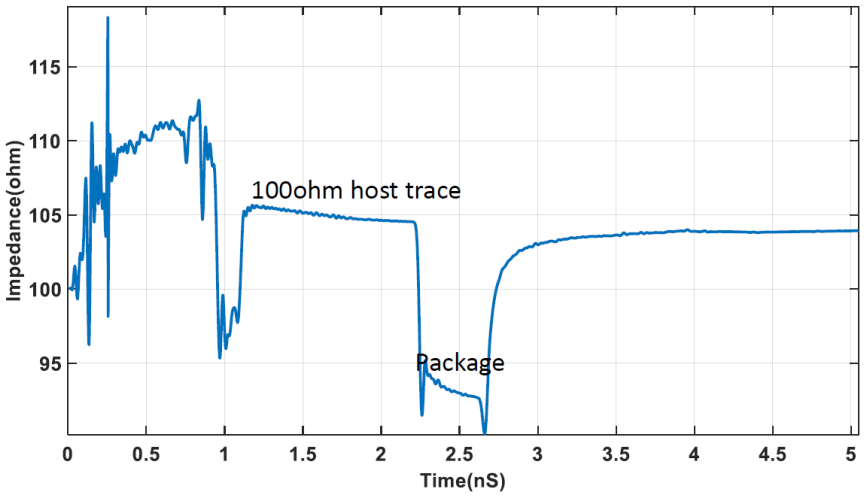
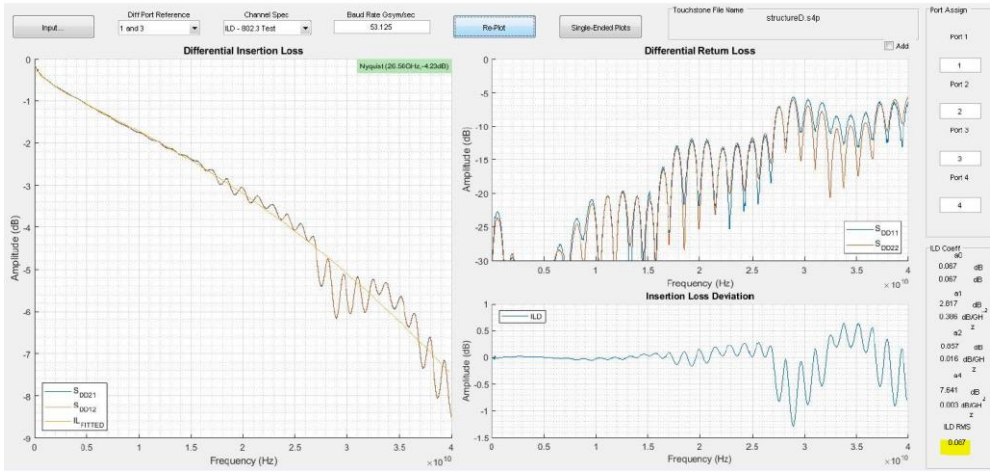
Impact of Test Fixture Quality

How Tfx relates to other requirements for MTF compliance

TDR of package, host trace, connector and structure D



Structure D S parameter



https://www.ieee802.org/3/ck/public/adhoc/apr14_21/dudek_3ck_adhoc_01a_041421.pdf

- If RF launches like the example above are expected to be used in 3ck test fixtures, it will be challenging to meet current specs
- ERL results with the measured launch above produced an ERL result 4dB lower when compared with an ideal launch case
- FOMILD for the measured launch structure consumes nearly 66% of the 3ck requirement, with no MDI connector

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Impact of Test Fixture Quality

Test fixture quality required for 3ck compliance

- Test fixtures that do not place significance on the RF connector performance are not compatible with current requirements for MTF compliance measurements
  - The requirements should match, and be supported by data of real measurements
- A significant number of contributions have been submitted by test fixture suppliers and connector manufacturers
  - Data supports a FOMILD limit of 0.18dB

Cl **162B** *SC* **162B.1.3** *P* **262** *L* **36** # **111**

Kocsis, Sam — Amphenol

Comment Type **TR** *Comment Status* **A** *MTF FOMILD*

MTF FOM_ILD requirement is TBD

SuggestedRemedy

Replace TBD with 0.18dB

Response *Response Status* C

ACCEPT IN PRINCIPLE.

Change the transition time T_t to 8.5 ps and set the FOMILD (max) value to 0.13 dB.

Straw poll #12 (chicago rules)
Straw poll #13 (pick one)
I support the following proposal to address MTF FOMILD:
A: FOMILD (max) = 0.18 dB, T_t = 8.5 ps **Supporting data presented**
B: FOMILD (max) = 0.13 dB, T_t = 8.5 ps **No supporting data presented**
C: FOMILD (max) = 0.18 dB, T_t = 7.5 ps **Supporting data presented**
SP12: A: 15 B: 21 C: 21
SP13: A: 7 B: 17 C: 11

Straw poll #6 (chicago rules)
Straw poll #7 (pick one)
I support the following value for the FOMILD transition time (T_t) parameter:
A: 7.5 ps (currently in D1.4)
B: 9 ps
C: 9.6 ps
D: 10 ps
SP6: A: 12 B: 16 C: 14 D: 11
SP7: A: 8 B: 5 C: 5 D: 7

https://www.ieee802.org/3/ck/public/21_01/diminico_3ck_01a_0121.pdf
https://www.ieee802.org/3/ck/public/21_01/champion_3ck_03_0121.pdf
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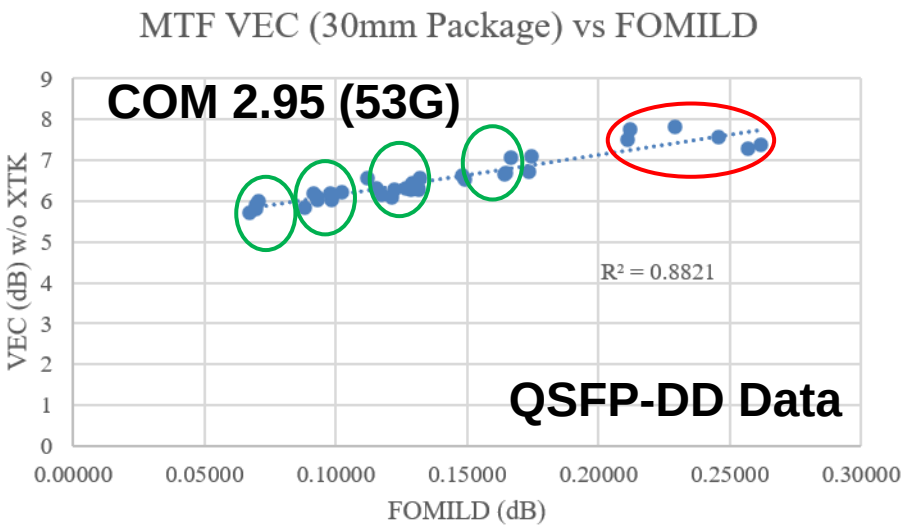
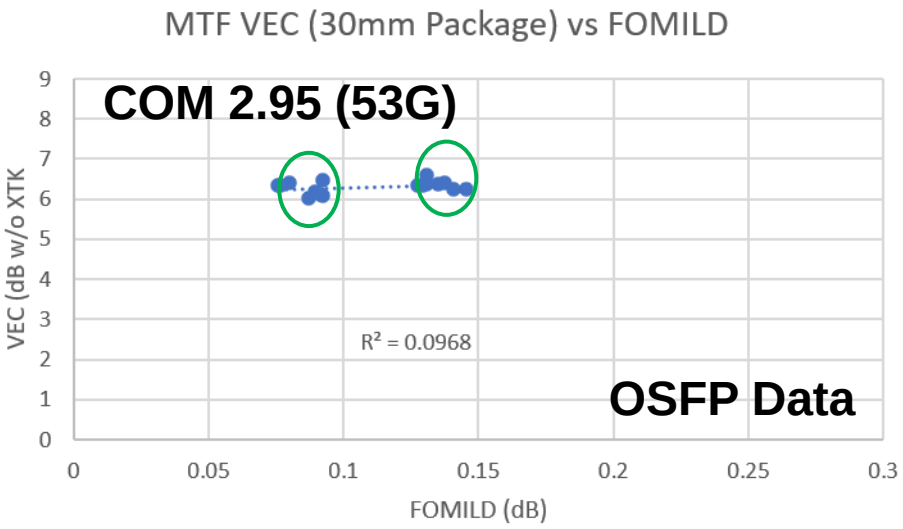
FOMILD

Revisiting an area strongly related to test fixture quality





- Expanding upon the data shared at the 3ck ad-hoc on 011321…
  - QSFP-DD data shows 4 concentrated groupings of results, matches MDI “paths”
  - OSFP data shows 2 concentrated grouping of results, matches MDI “paths”
- The proposal for a 0.18dB FOMILD limit was based on measured results compatible with C2M VEC expectations and consistent with other MTF performance requirements
- There does not appear to be strong correlation between FOMILD and VEC consistent across all MDIs and test fixtures

Summary

- A fixed value of Tfx can significantly impact the result of ERL computations and obscure evaluation of a test fixture quality
- A Tfx value of 0 captures the entire test fixture implementation
- Several compliance measurements using the test fixtures defined in 3ck are going to include effects of the entire fixture
- FOMILD is especially sensitive to test fixture design
- Requirements for MTF compliance should be verified with *real* compliant fixtures
- Data presented to this group suggests that FOMILD value of 0.18dB is a practical limit for real test fixtures
  - Same data suggests that FOMILD may not have significant correlation to any channel compliance parameter