802.3da Mixing Segment Specifications D1p1 Comments

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Chris DiMinico
PHY-SI LLC/ MC Communications/SenTekse
cdiminico@ieee.org

Contributors

- Bob Voss/Paul Wachtel - Panduit
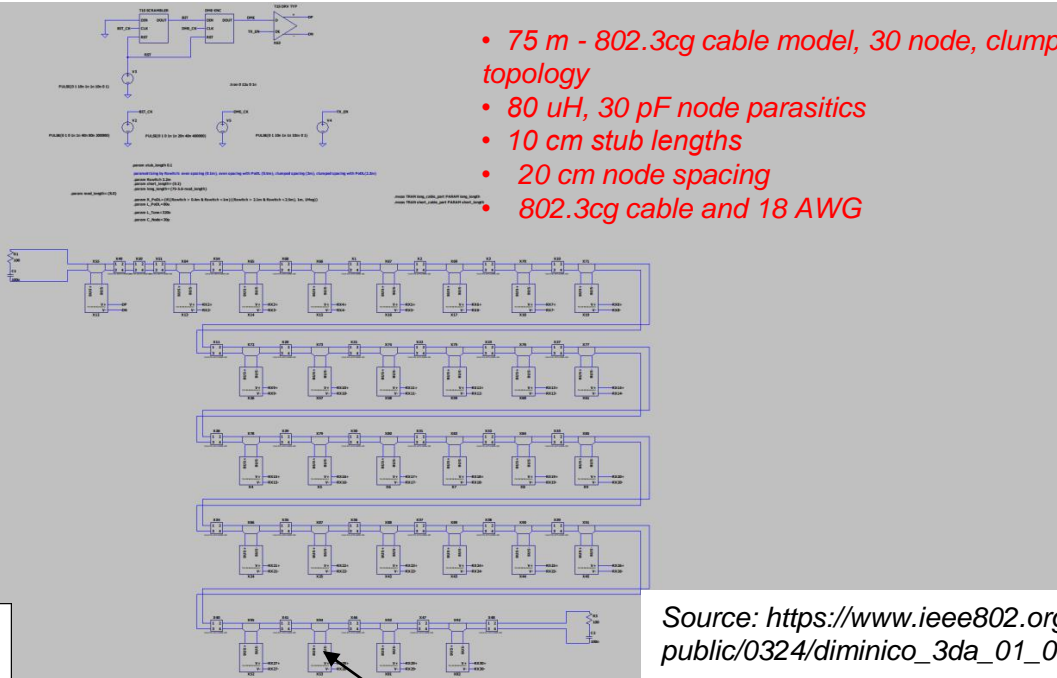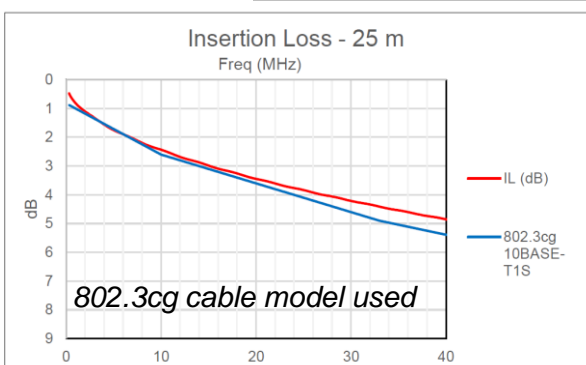- Stephan Schreiner - Rosenberger
- Michael Paul - ADI

Purpose

- **Comments D1.1**
- 168.8.1 Mixing Segment Insertion loss Equation (168–3) is TBD -comment 141
- 168.8.2 Mixing Segment return loss Equation (168–4) is TBD
- comment 142
- 168.9.1.1 TCI Insertion Loss is TBD
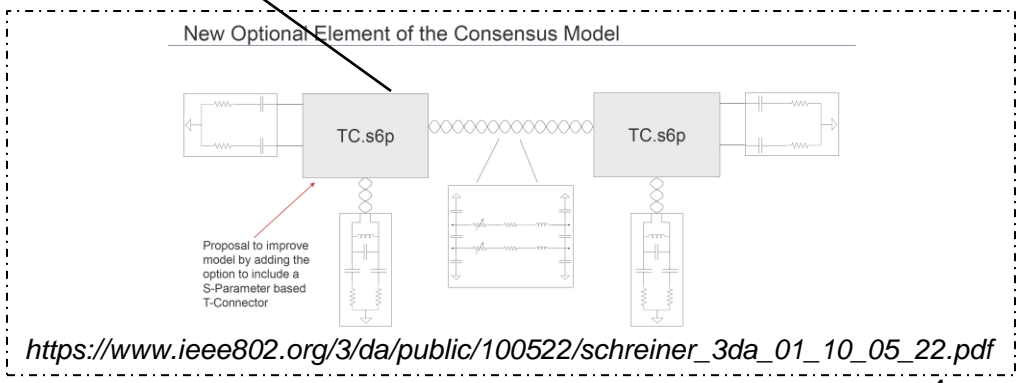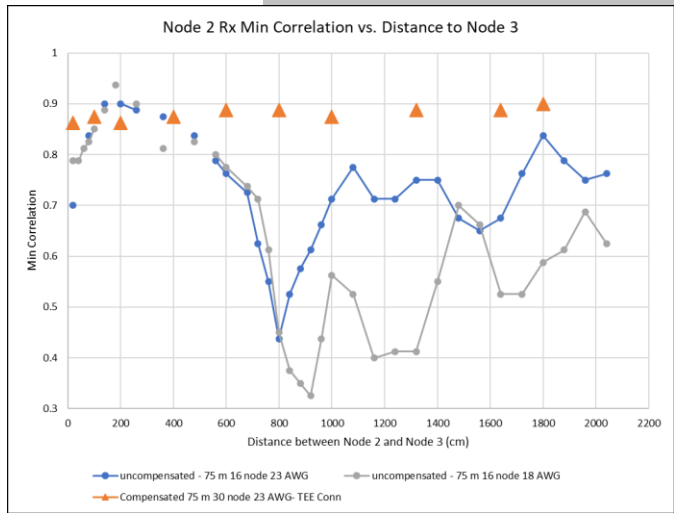- comment 143
- 168.9.1.2 TCI Return Loss is TBD
- comment 144

Background

- **Mixing Segment LT spice model with RX correlation- compensated Tee**

Insertion Loss - 25 m
Freq (MHz)

IL (dB)

802.3cg
10BASE-
T1S

802.3cg cable model used

- *75 m - 802.3cg cable model, 30 node, clumped topology*
- *80 uH, 30 pF node parasitics*
- *10 cm stub lengths*
- *20 cm node spacing*
- *802.3cg cable and 18 AWG*

Source: https://www.ieee802.org/3/da/public/0324/diminico_3da_01_031224.pdf

Node 2 Rx Min Correlation vs. Distance to Node 3

Min Correlation

Distance between Node 2 and Node 3 (cm)

uncompensated - 75 m 16 node 23 AWG   uncompensated - 75 m 16 node 18 AWG
Compensated 75 m 30 node 23 AWG- TEE Conn

New Optional Element of the Consensus Model

TC.s6p   TC.s6p

Proposal to improve model by adding the option to include a S-Parameter based T-Connector

https://www.ieee802.org/3/da/public/100522/schreiner_3da_01_10_05_22.pdf

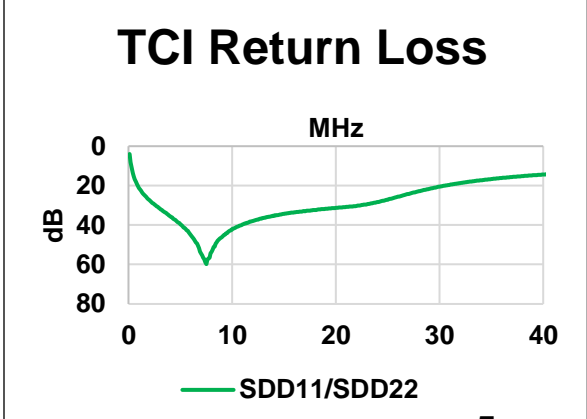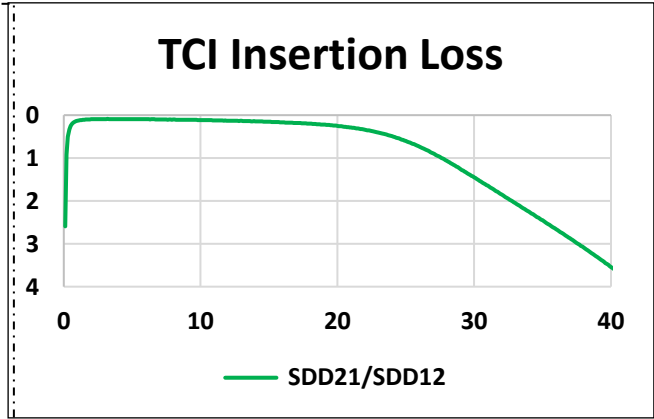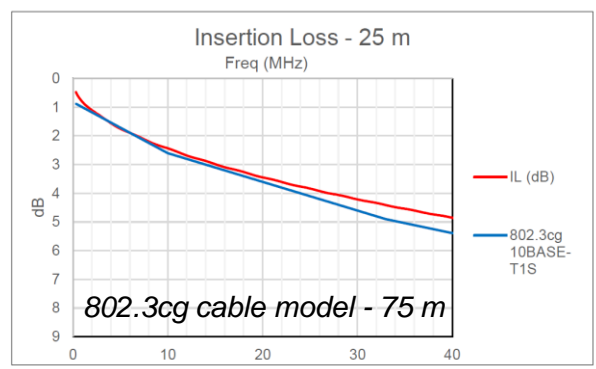**10 Mb/s SPMD Enhancement TG**

Mixing Segment LT spice model with compensated Tee

- *75 m - 802.3cg cable model, 30 node, clumped topology*
- *80 uH, 30 pF node parasitics*
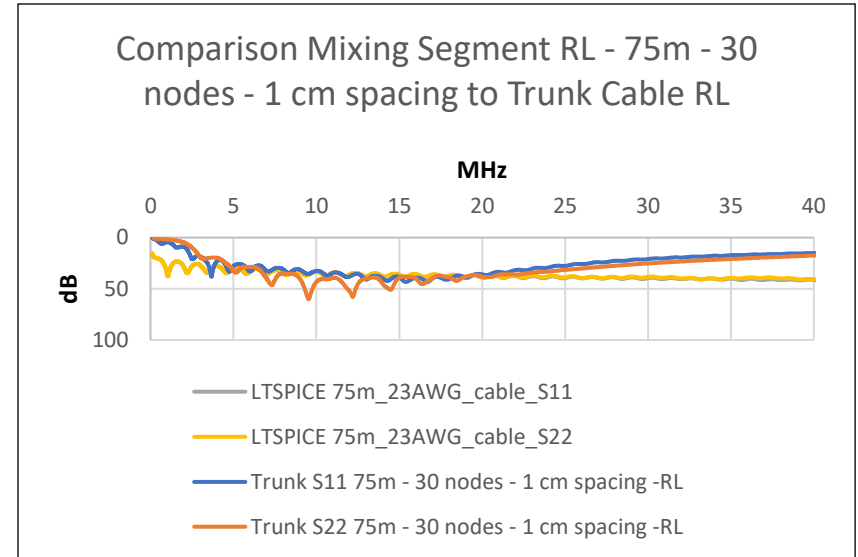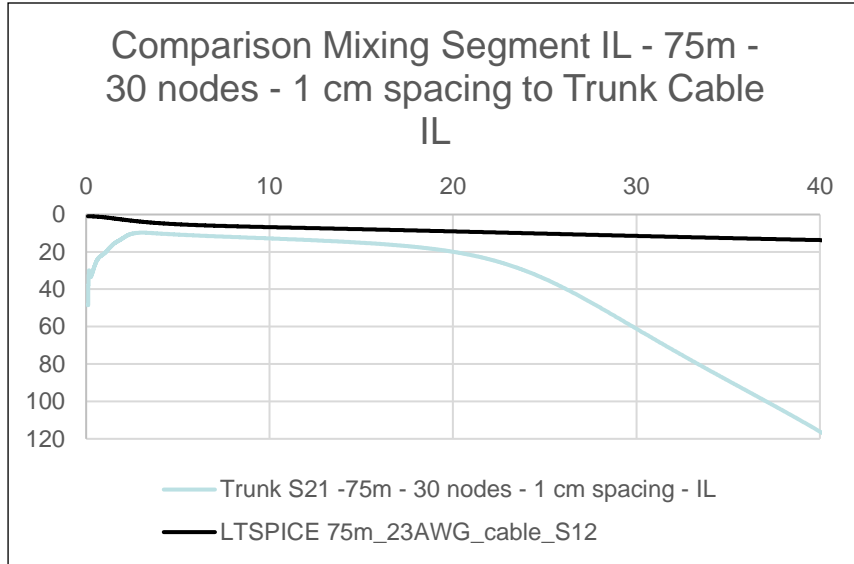- *10 cm stub lengths*
- *1 cm node spacing*

Source: diminico_SPMD_01a_0720.pdf

Insertion Loss - 25 m
Freq (MHz)

— IL (dB)
— 802.3cg 10BASE-T1S

802.3cg cable model - 75 m

TCI Insertion Loss

— SDD21/SDD12

TCI Return Loss

MHz

— SDD11/SDD22
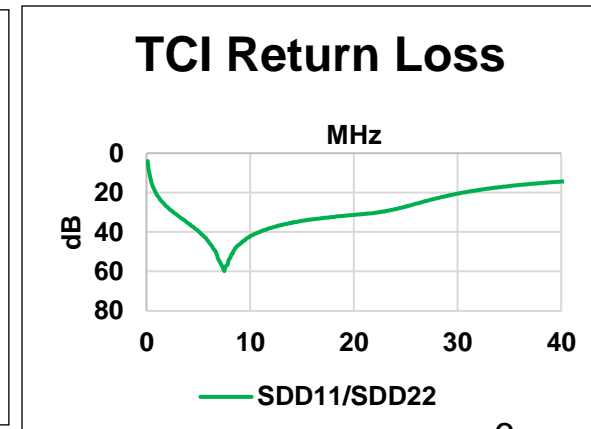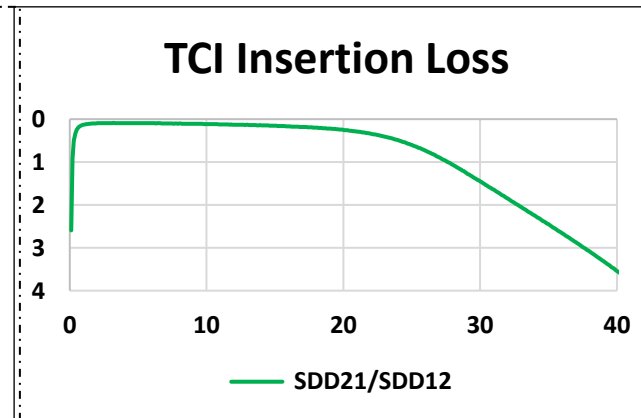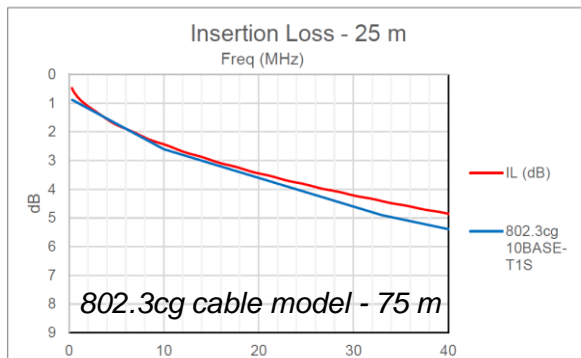
10 Mb/s SPMD Enhancement TG

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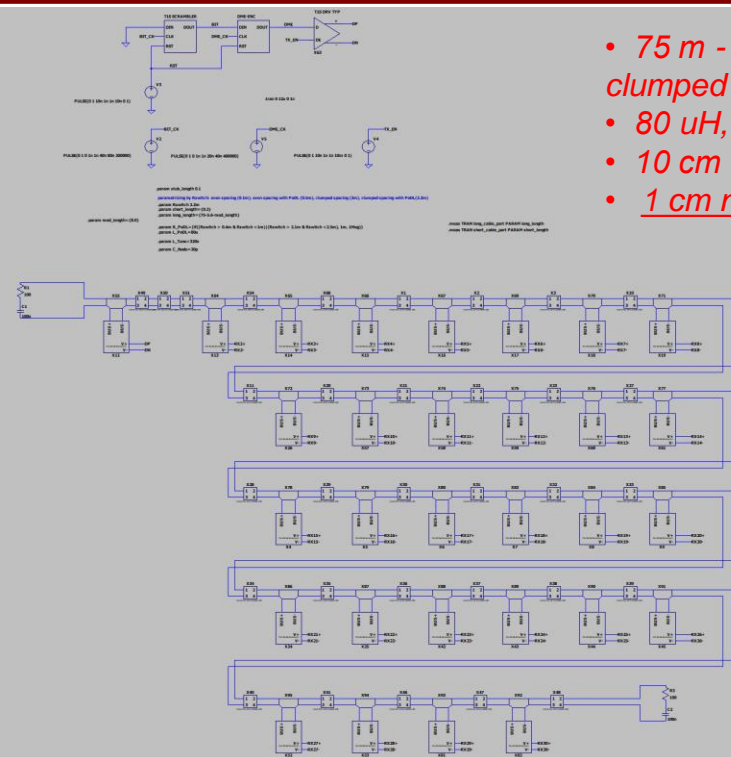
Mixing Segment LT spice model with compensated Tee

- Mixing segment and trunk cable: insertion loss and return loss between edge termination attachment points (slide 5).
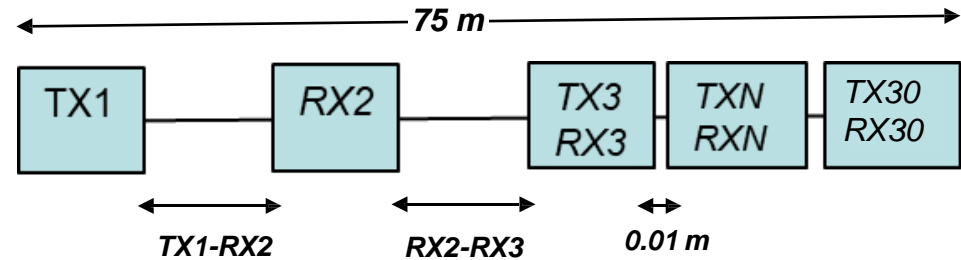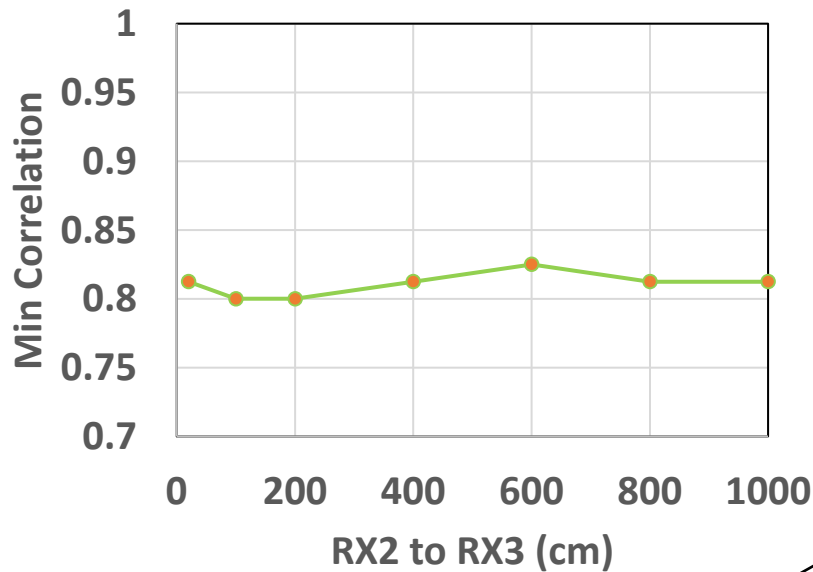

Comparison Mixing Segment IL - 75m - 30 nodes - 1 cm spacing to Trunk Cable IL

— Trunk S21 -75m - 30 nodes - 1 cm spacing - IL
— LTSPICE 75m_23AWG_cable_S12

Comparison Mixing Segment RL - 75m - 30 nodes - 1 cm spacing to Trunk Cable RL

— LTSPICE 75m_23AWG_cable_S11
— LTSPICE 75m_23AWG_cable_S22
— Trunk S11 75m - 30 nodes - 1 cm spacing -RL
— Trunk S22 75m - 30 nodes - 1 cm spacing -RL

Source: diminico_SPMD_01a_0720.pdf

Insertion Loss - 25 m
Freq (MHz)

— IL (dB)
— 802.3cg 10BASE-T1S

802.3cg cable model - 75 m

TCI Insertion Loss

— SDD21/SDD12

TCI Return Loss

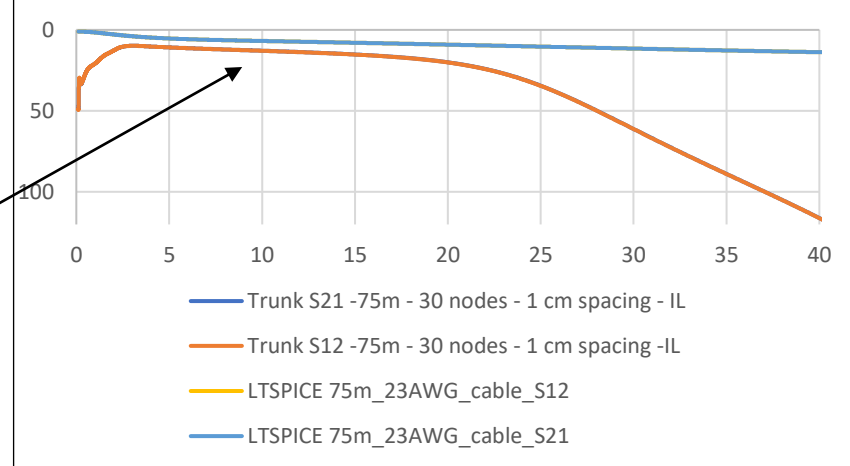— SDD11/SDD22

10 Mb/s SPMD Enhancement TG

Mixing Segment Correlation Topology

- *75 m - 802.3cg cable model, 30 node, clumped topology*
- *80 uH, 30 pF node parasitics*
- *10 cm stub lengths*
- *1 cm node spacing*

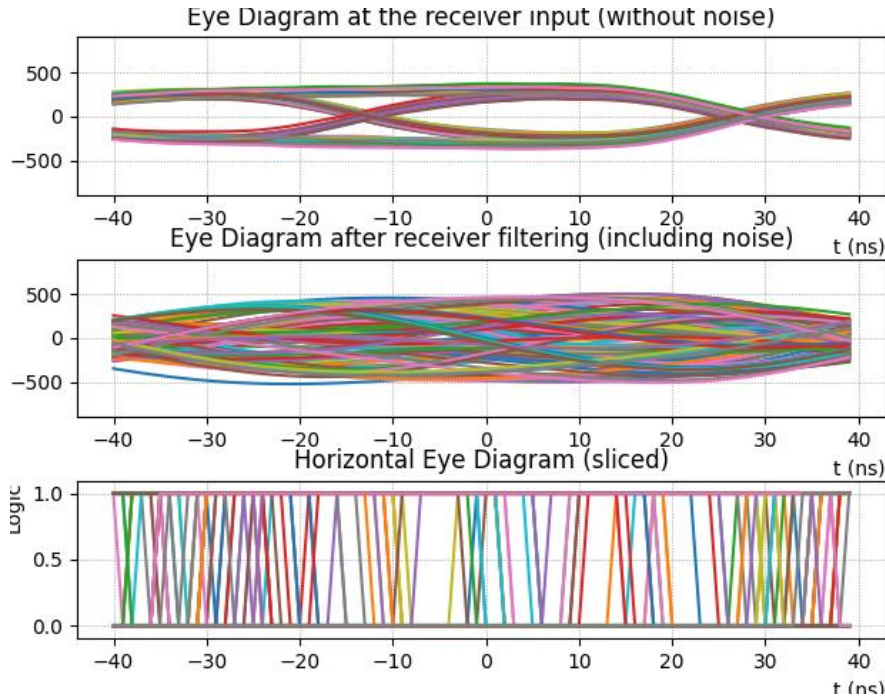## Node 2 Rx Min Correlation vs. Distance to Node 3

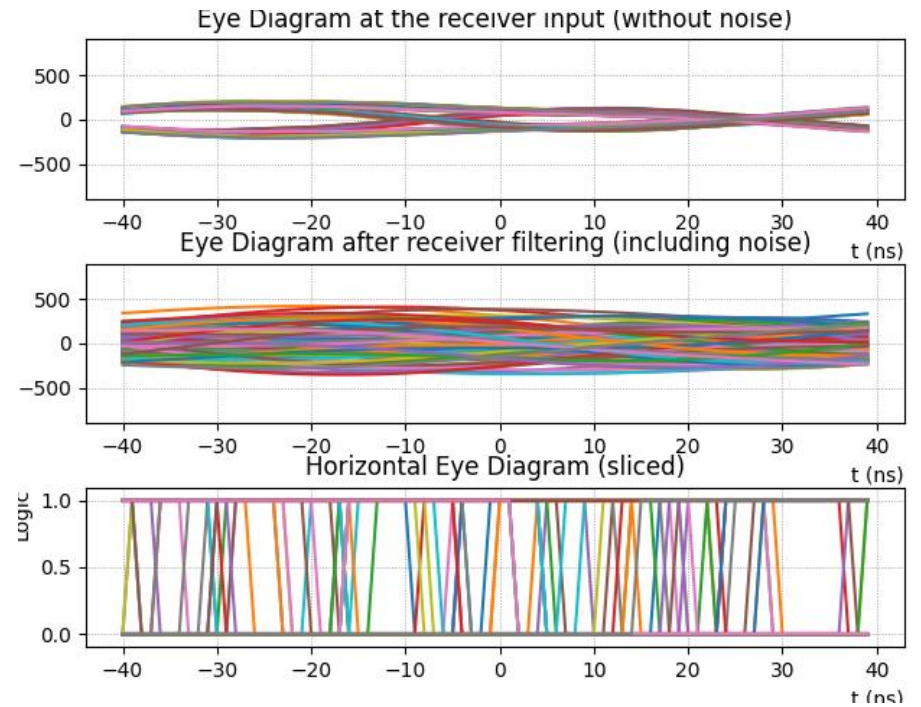- *Mixing segment IL well behaved; minimal IL deviations*

Mixing Segment LT spice model with compensated Tee

- Mixing segment (slide 5): Eye and RX correlation with noise; node "2" and node "30".

Node "2"

Node "30"

CWA	CORR_AVG	CORR_MAX	CORR_MIN	JITTER	JITTER_MAX
0.000000	0.967110	1.000000	0.862500	2.309426	5.000000
0.050000	0.965231	1.000000	0.812500	2.476145	8.000000
0.100000	0.959299	1.000000	0.762500	2.830755	10.000000
0.150000	0.950459	1.000000	0.700000	3.361484	13.000000
0.200000	0.939719	1.000000	0.625000	4.027576	17.000000
0.250000	0.927581	1.000000	0.500000	4.863266	39.000000

| CWA	CORR_AVG	CORR_MAX	CORR_MIN	JITTER	JITTER_MAX
0.000000	0.934511	1.000000	0.825000	3.385856	8.000000
0.050000	0.930980	1.000000	0.687500	3.867826	13.000000
0.100000	0.913585	1.000000	0.500000	5.380310	39.000000

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TCI Specifications

- S-parameter measurements of ferrite compensated Tee <u>used in LT spice model</u> provides the basis for <u>TCI and Mixing Segment specifications</u>; illustrates specification is achievable.
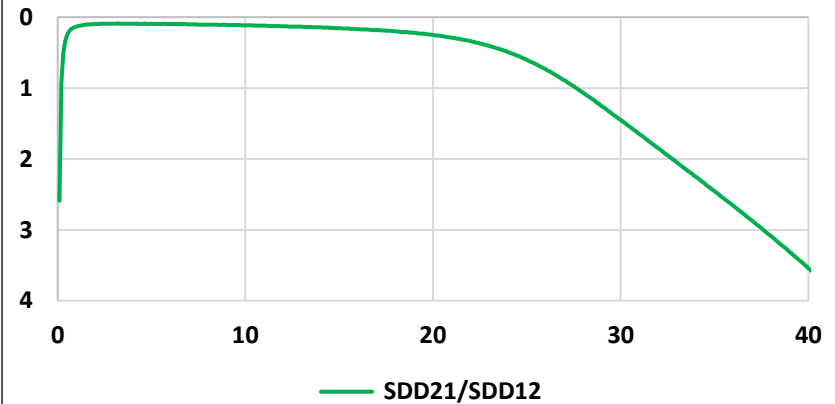

Source; Stephan Schreiner - Rosenberger
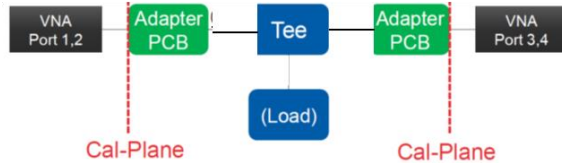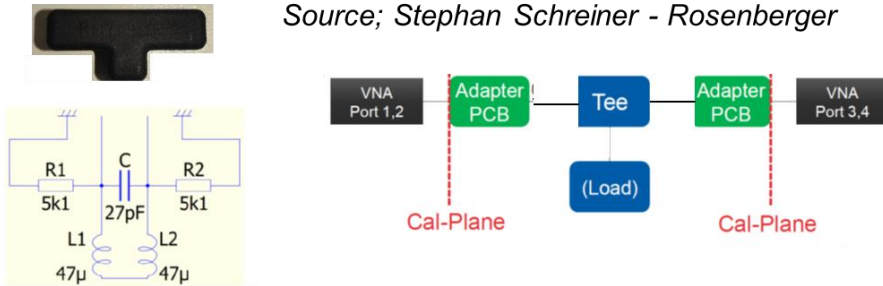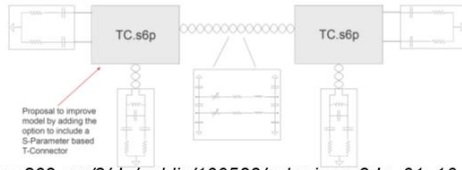
https://www.ieee802.org/3/da/public/100522/schreiner_3da_01_10_05_22.pdf

TCI Insertion Loss

SDD21/SDD12

TCI Return Loss

MHz

SDD11/SDD22
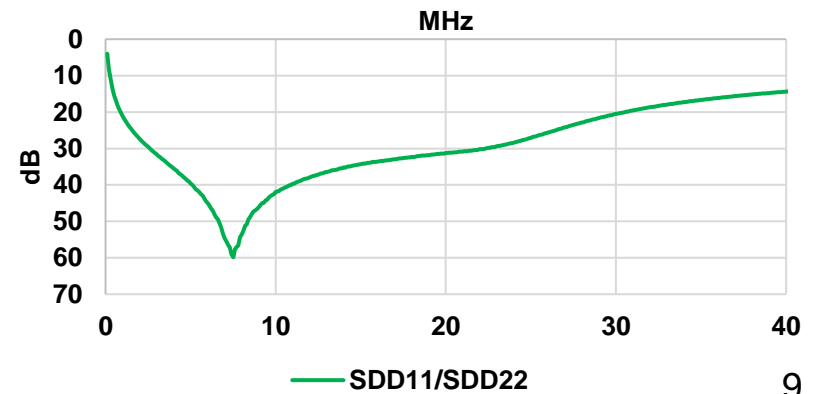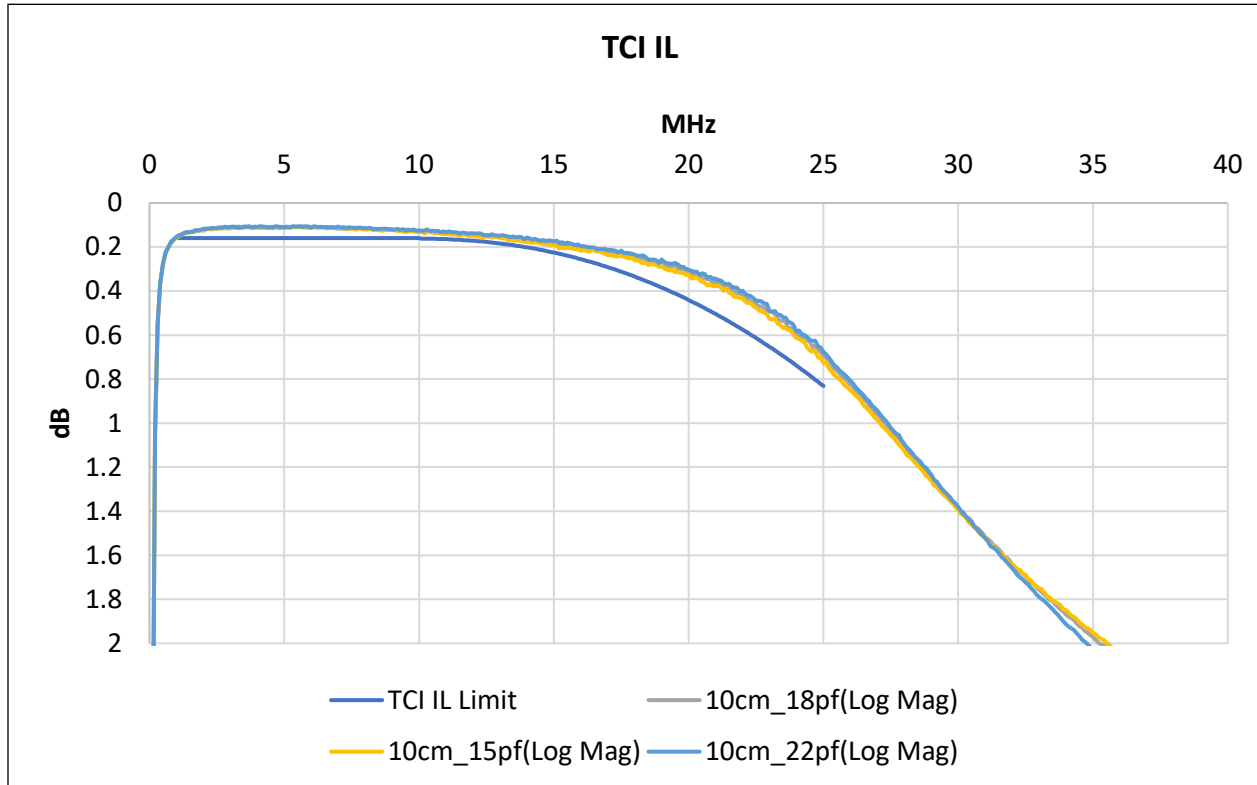
168.8.1.1 TCI Insertion Loss

168.8.1.1 TCI Insertion Loss

With the PMA or PMA load present at TC3, the differential insertion loss of the TCI between TC1 and TC2 shall be less than Equation (168–TBD) measured in both directions. The differential reference impedance is 100 ohm.

TCI IL ≤ 1.6 dB   1 ≤ f (MHz) ≤ 10
0534+(0.22*1/fMHz)+0.63*SQRT(fMHz)-0.18*fMHz+0.0004*fMHz^2   10 < f (MHz) ≤ 24

10 Mb/s SPMD Enhancement TG

168.8.1.2 TCI - Return Loss

168.8.1.2 TCI Return Loss

With a PMA or PMA load present at the TCI connection, the return loss of the TCI at TC1 and TC2 shall be greater than Equation (168–5) with the other trunk connection (i.e., TC2 or TC1, respectively) terminated in 100 Ω.
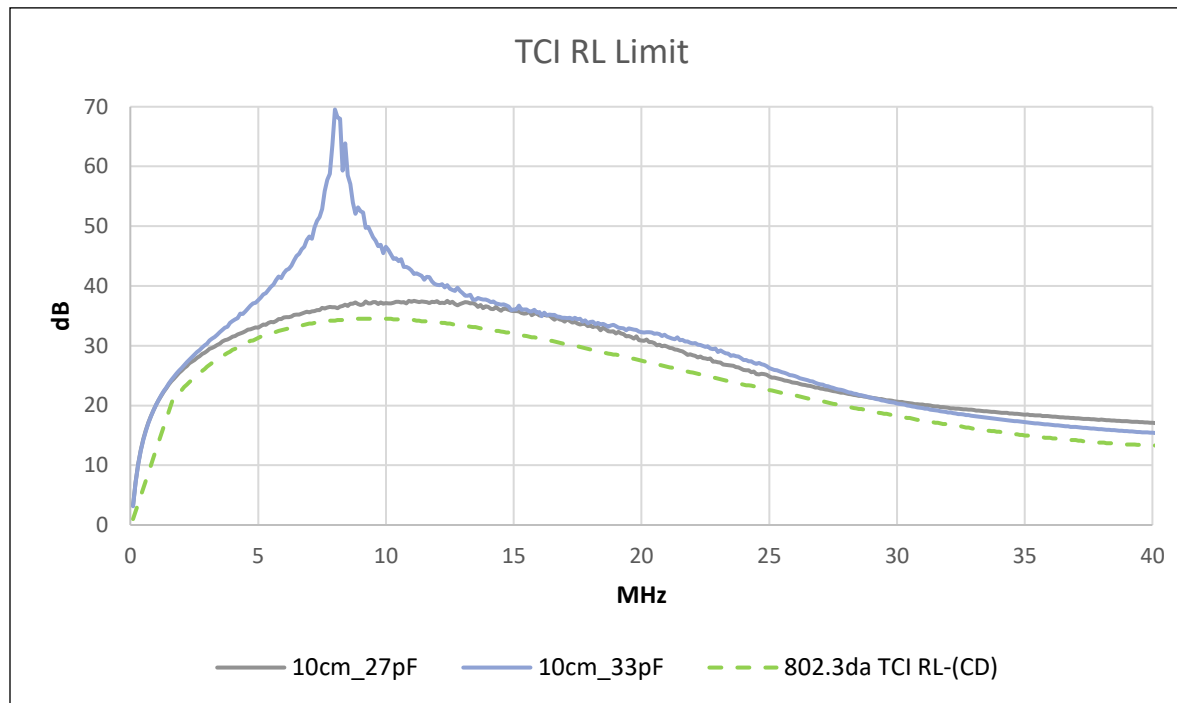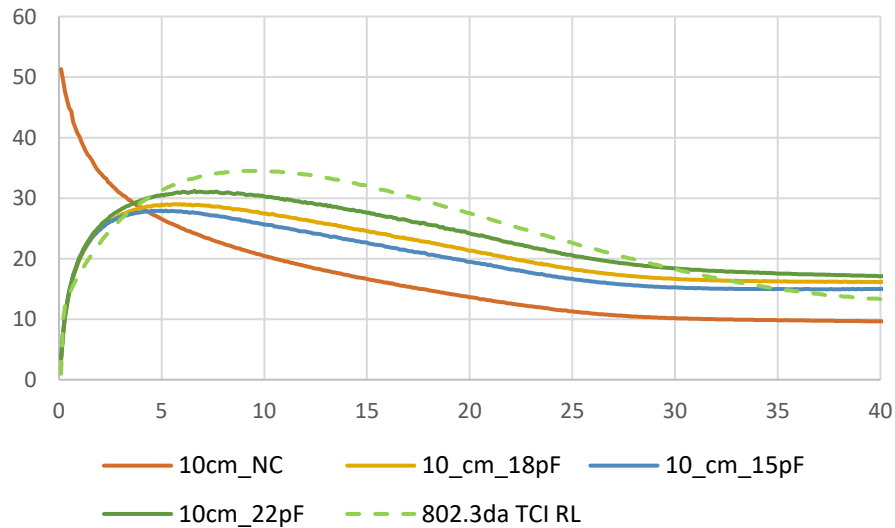

$RL \geq -0.30 + 13.0 * f(MHz)$ $0.3 \leq f(MHz) < 1.7$

$-38.55 - (50.28 * LOG(fMHz)) - (3.16 * 1/fMHz) + (69.31 * SQRT(fMHz)) - (10.19 * fMhz) + (0.0636 * fMHz^2)$ $1.7 \leq f(MHz) \leq 40$

10 Mb/s SPMD Enhancement TG

168.8.1.2 TCI - Return Loss

168.8.1.2 TCI Return Loss

TCI RL Limit (proposed - fail)

- 10cm_NC
- 10_cm_18pF
- 10_cm_15pF
- 10cm_22pF
- 802.3da TCI RL

TCI TDD11 Step Respone ~4 ns Rise Time
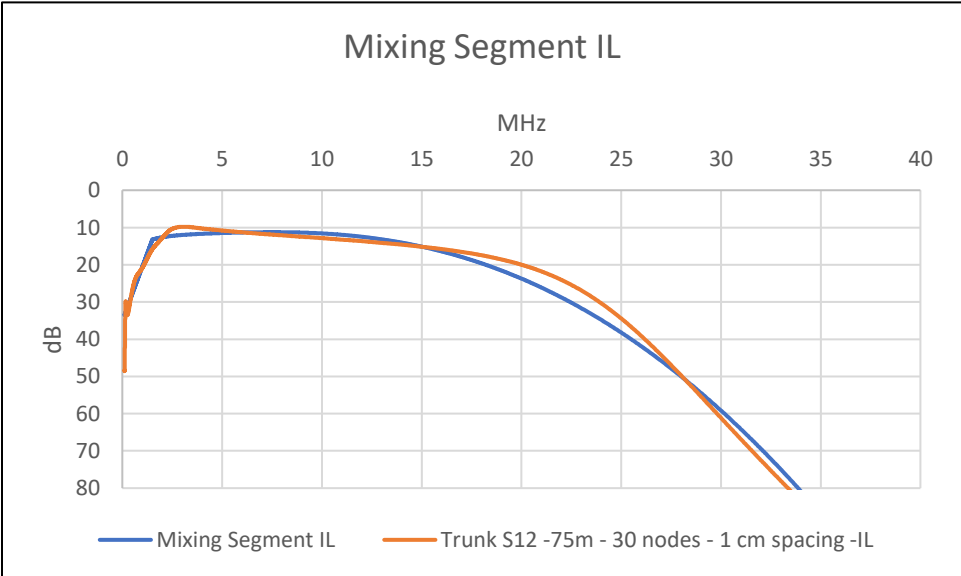
- 22pF(Step_Impedance)
- 15pF(Step_Impedance)
- 18pF(Step_Impedance)
- NC(Step_Impedance)
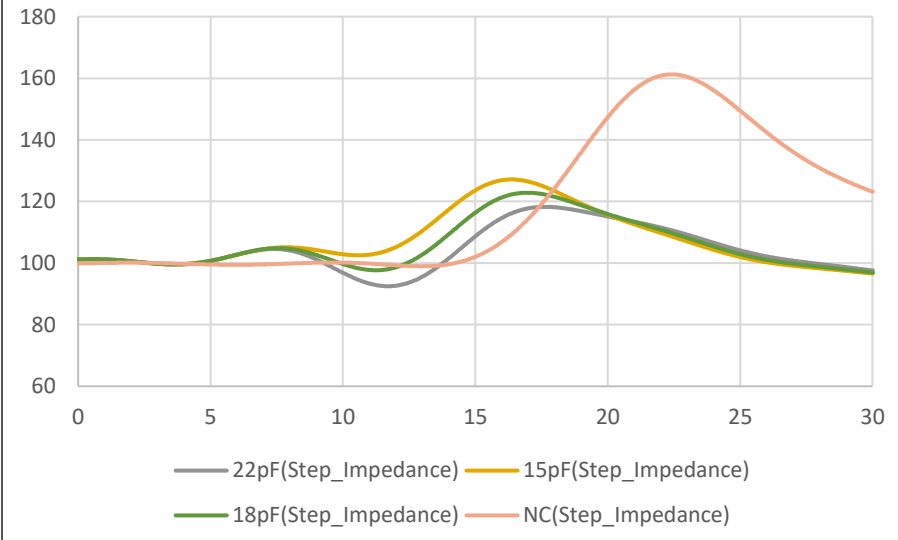
168.8.1 Insertion loss

The mixing segment insertion loss is specified including any through-path insertion loss for the TCIs. See 168.9.1 for specification of the insertion loss and return loss (reflections) at the TCI connections.

The mixing segment insertion loss, with a PMA or PMA load present at the TCI connections, shall meet the values determined using Equation (168–3) between edge termination attachment points. The reference impedance is 100 Ω.


$IL \leq 35-14.54*f(MHz)$ $0.3 \leq f(MHz) < 1.5$
  $-27-(53*LOG(fMHz))-(1.7*1/fMHz)+(52*SQRT(fMHz))-(8.9*fMhz)+(0.163*fMHz^2)$ $1.5 \leq f(MHz) \leq 40$

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10 Mb/s SPMD Enhancement TG

168.8.2 Return loss

The mixing segment return loss, with PMA or PMA loads present at the TCI connections. with DTEs attached shall meet the values determined using Equation (168–4) at the edge terminations. The reference impedance is 100 Ω.

Mixing Segment and TCI RL Limit
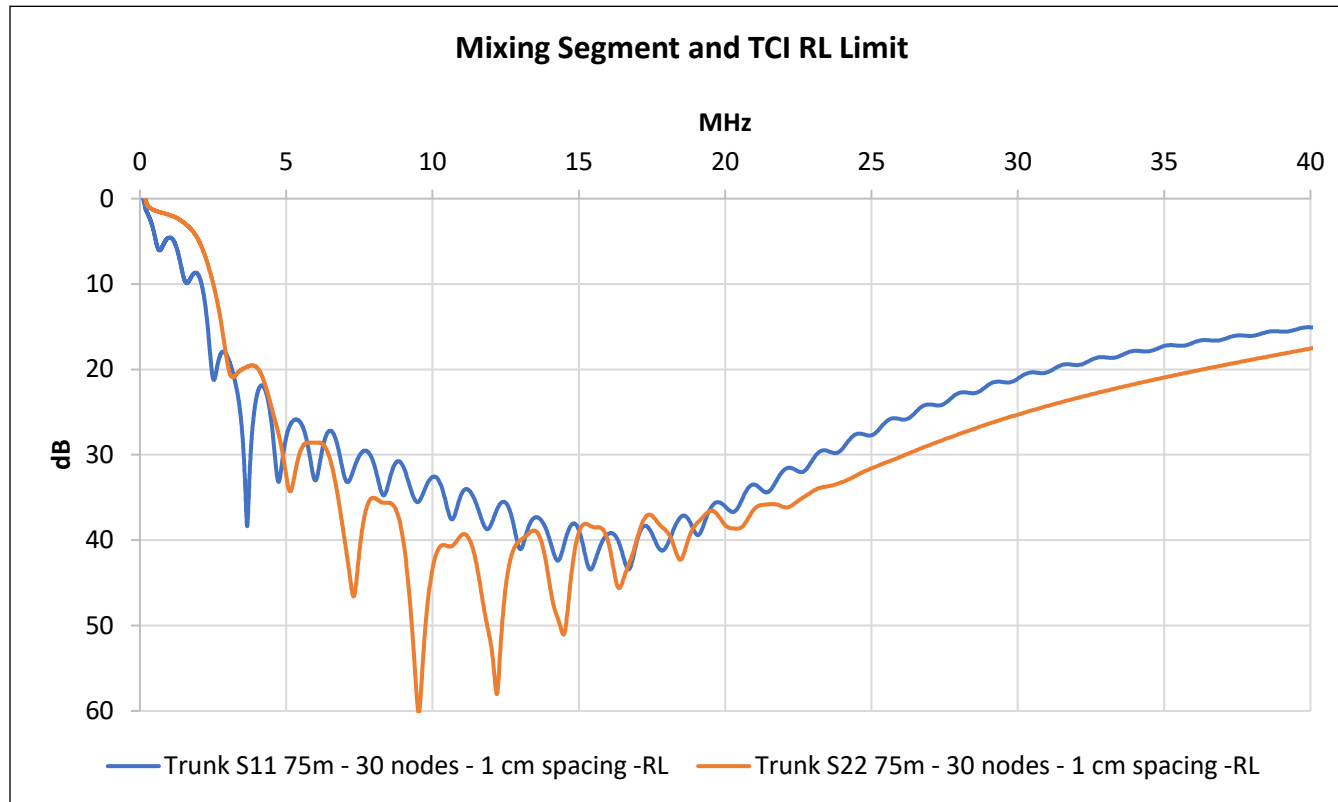
TBD

Summary

- **Comments D1.1**
- **168.8.1 Mixing Segment Insertion loss Equation (168–3) is TBD**
- **168.8.2 Mixing Segment return loss Equation (168–4) is TBD**
- **168.9.1.1 TCI Insertion Loss is TBD**
- **168.9.1.2 TCI Return Loss is TBD**