



Revised rise-time filter for COM interference tolerance calibration

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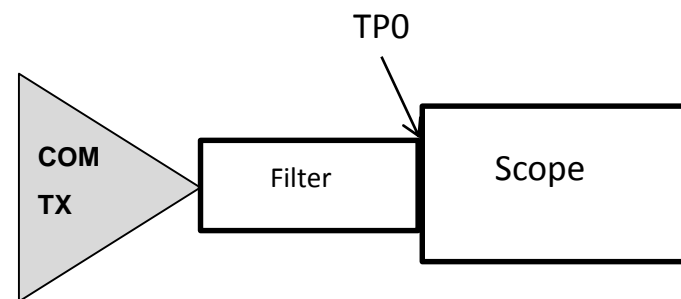
QLogic
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- **In Clause 93 (100GBASE-KR4) a filter is used in the COM simulations for the Interference Tolerance test calibration to replace the package “when a Test transmitter with a high quality termination” is used. The filter is based on the measured rise-time at TP0a**
- **In Clause 92 (100GBASE-CR4) the same filter is used. TP0a is also the measurement point for the risetime, but isn’t well defined in that clause.**
- **802.3by adopted the same methodology and the same filter however for the cable specification (Clause 110) a change was made in Rev 2.2 to measure the rise-time at PGC (equivalent to TP0) without changing the filter. This results in the same filter equation being used whether the rise-time is measured at TP0a or TP0.**
- **This presentation explores the effect this has and suggests improvements.**

- The existent filter defined by (93A-46) is as below.

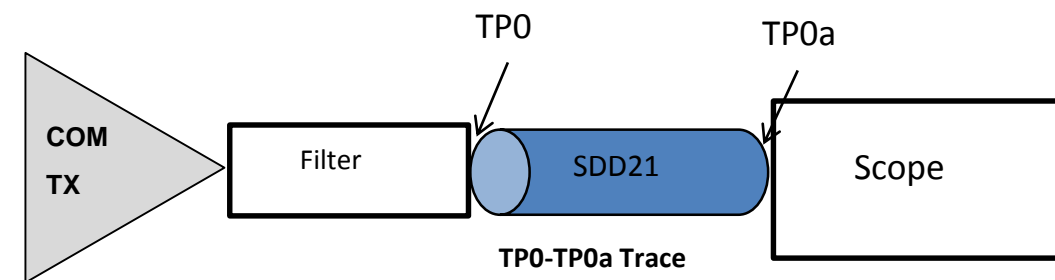
$$H_t(f) = \exp(-(\pi f T_r / 1.6832)^2) \quad (93A-46)$$

- The resulting rise-time at both TP0 and TP0a is simulated over a range of input rise-times



@TP0

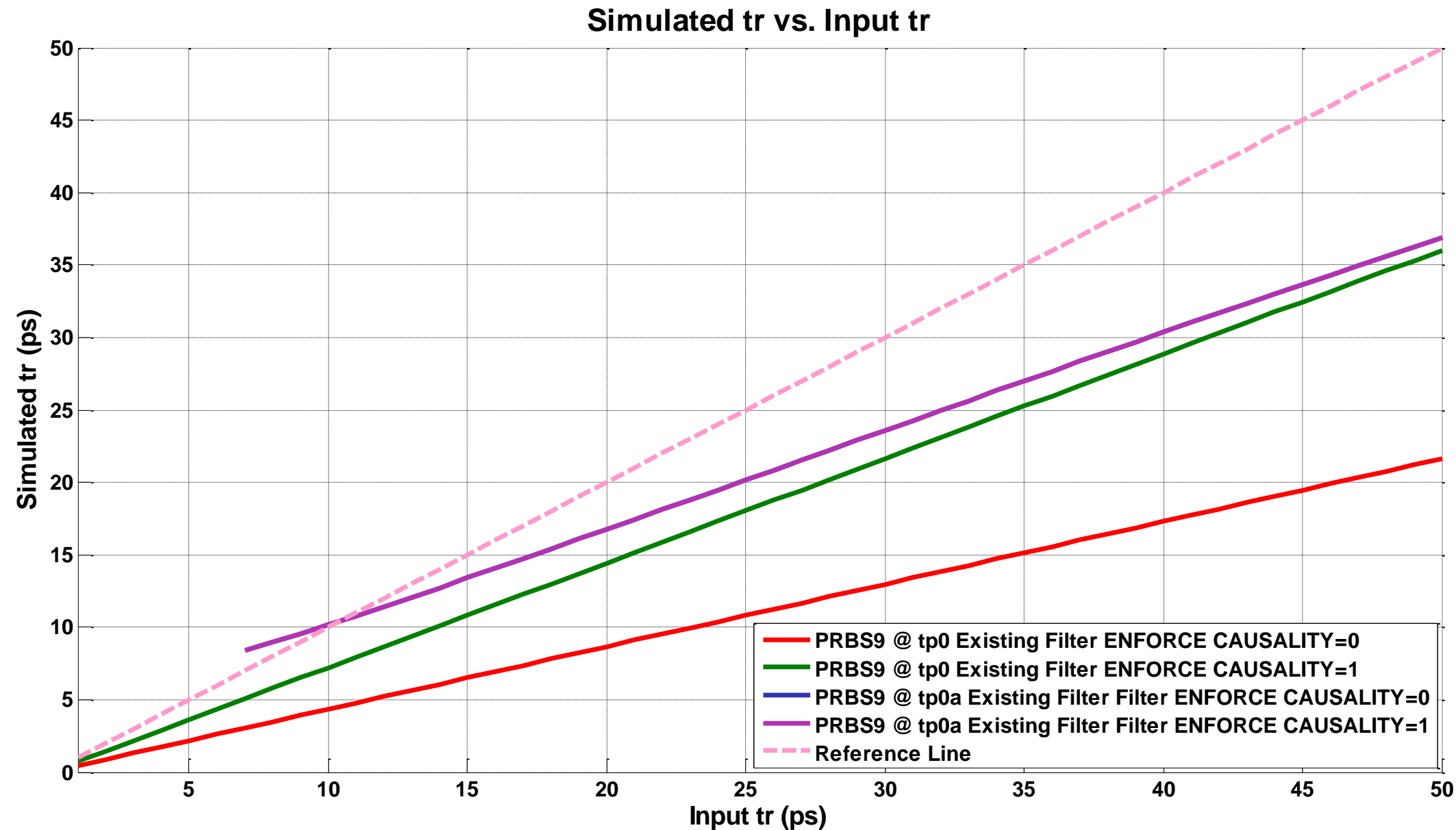
COM PRBS9: PRBS9 * H_t



@TP0a

COM PRBS9: PRBS9 * H_t * SDD21

Simulated tr vs Input tr by Existing Filter



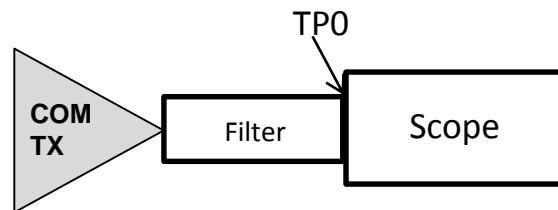
- The existing filter equation is not bad at TP0a with rise-times around 10ps but it has causality problems at TP0 and has significant error over a wider range

Proposed change.

- To remove any issues with causality a fourth-order BT filter function is proposed as below.

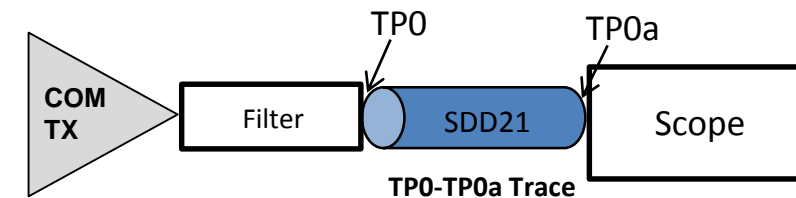
$$H_t(f) = \frac{105}{(fkt_r)^4 - j10(fkt_r)^3 - 45(fkt_r)^2 + j105fkt_r + 105}$$

- Create PRBS9 pattern waveforms at TP0 and TP0a and extract the rise-times while sweeping ktr.
- Search for empirical expressions of k versus tr.



@TP0

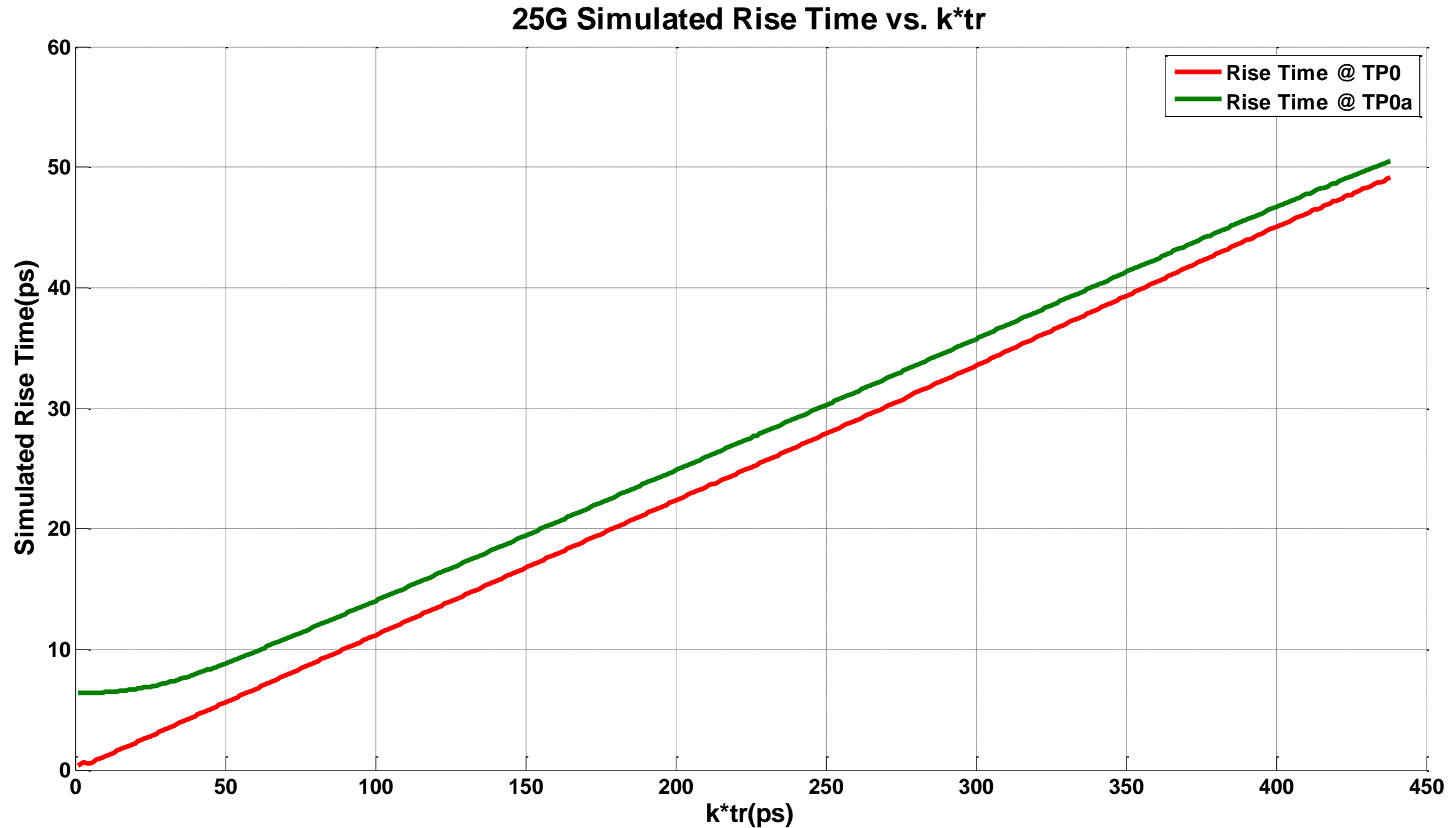
COM PRBS9: PRBS9 * H_t



@TP0a

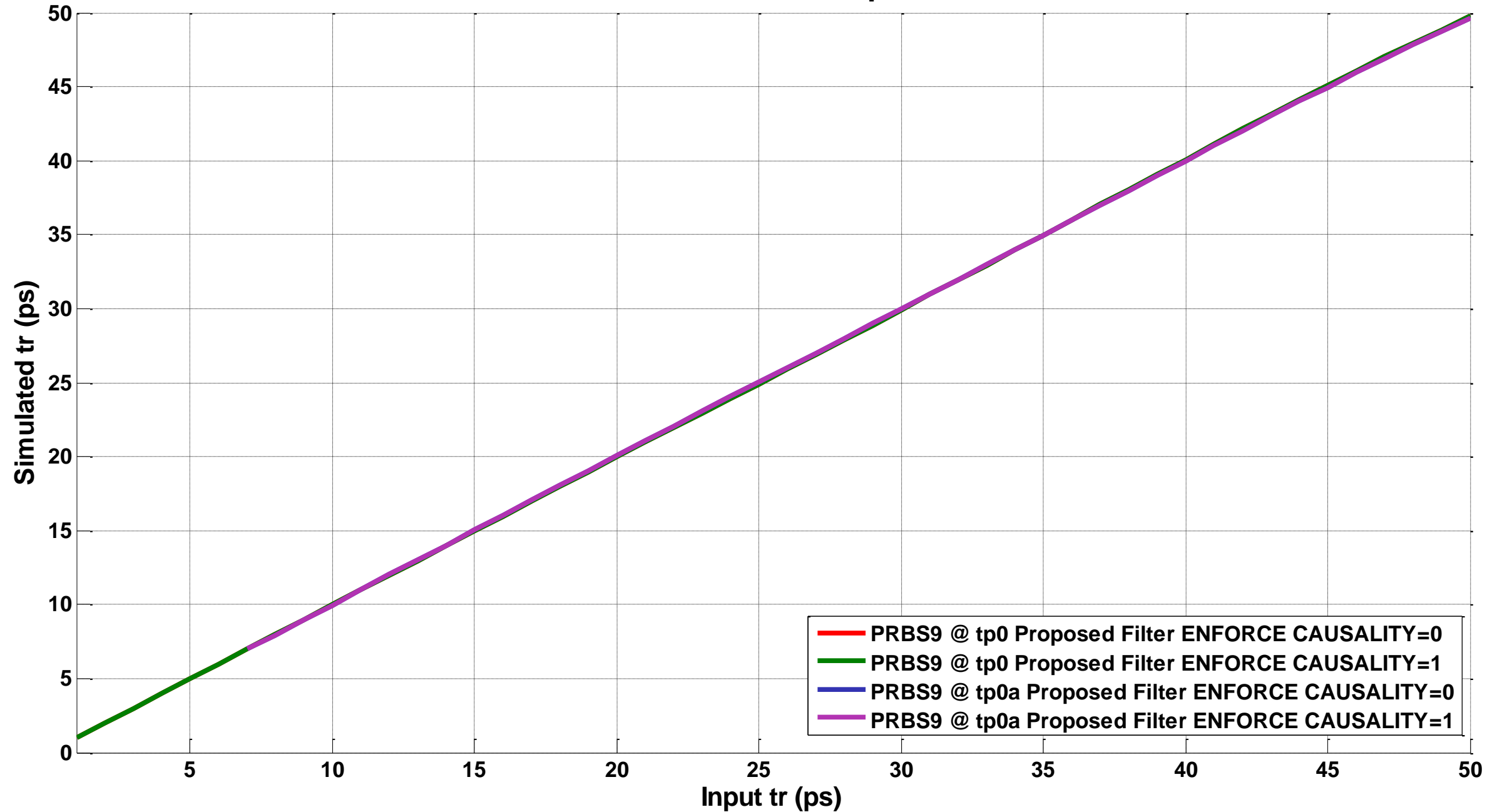
COM PRBS9: PRBS9 * H_t * SDD21

25G Simulated Rise Time vs. $K \cdot Tr$ by Proposed Filter



Result -Simulated tr vs Input tr by Proposed Filter

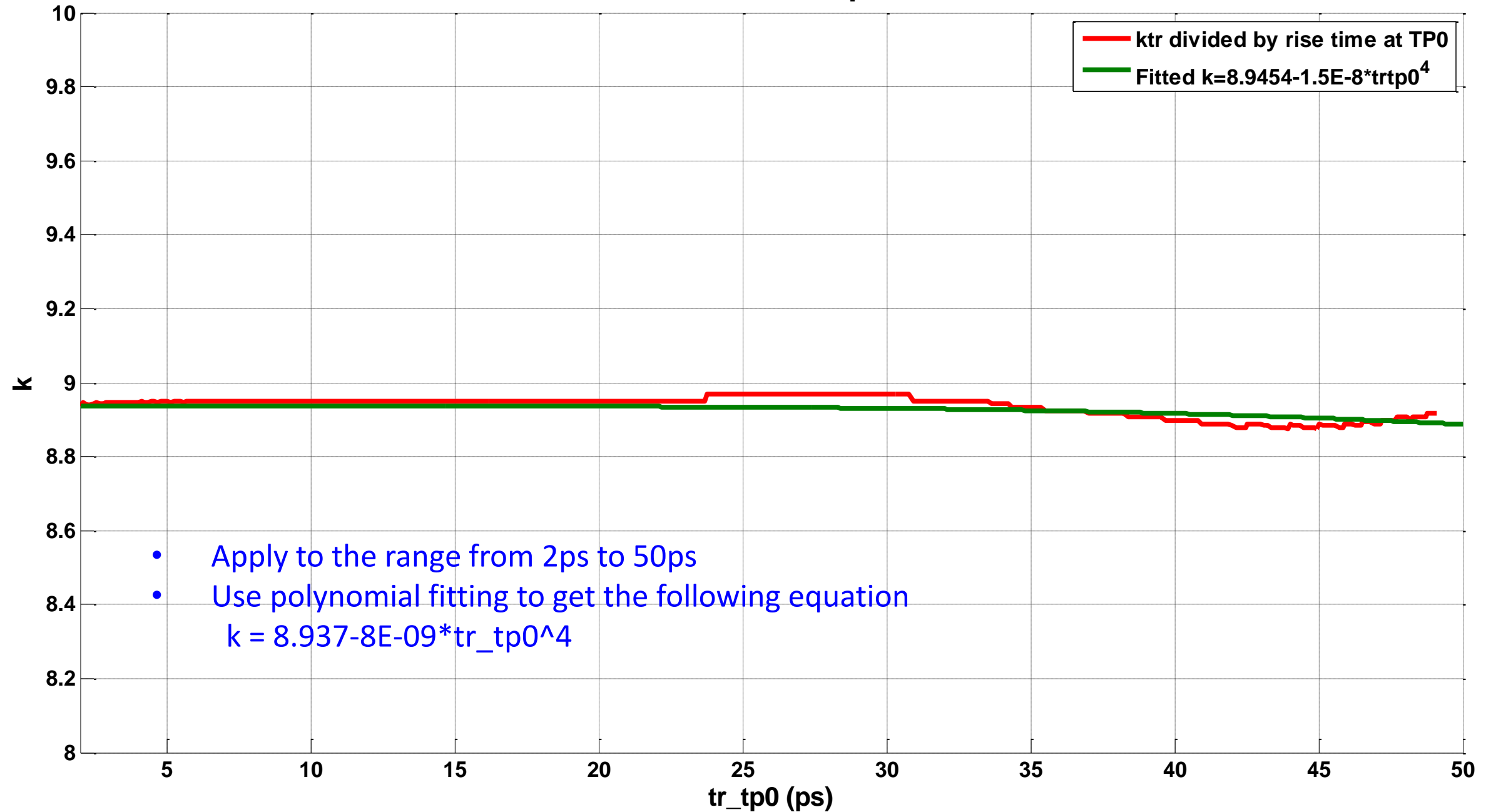
Simulated tr vs. Input tr



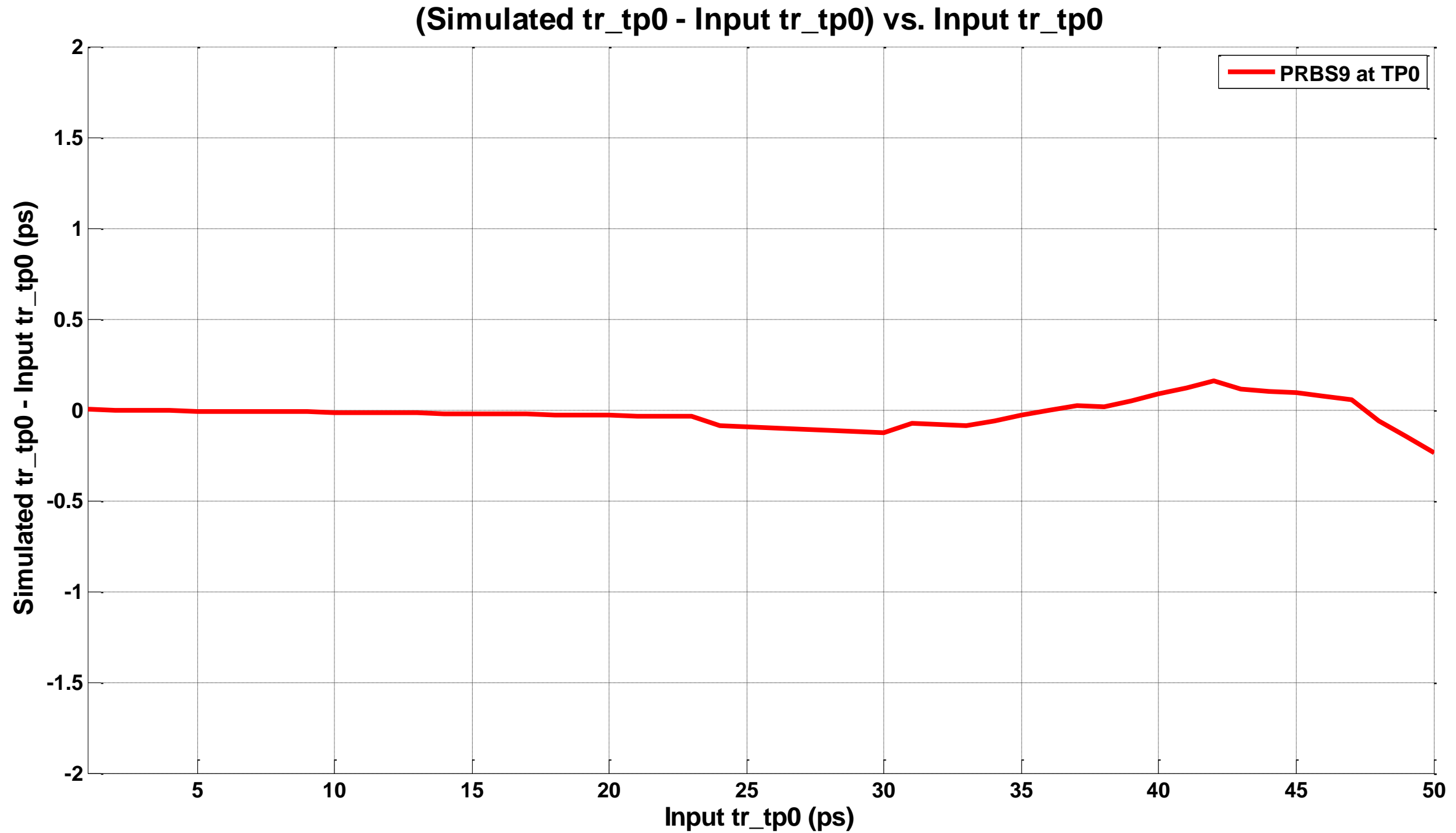
25G Curve Fitting for k vs. tr_tp0 (ie at PGC)



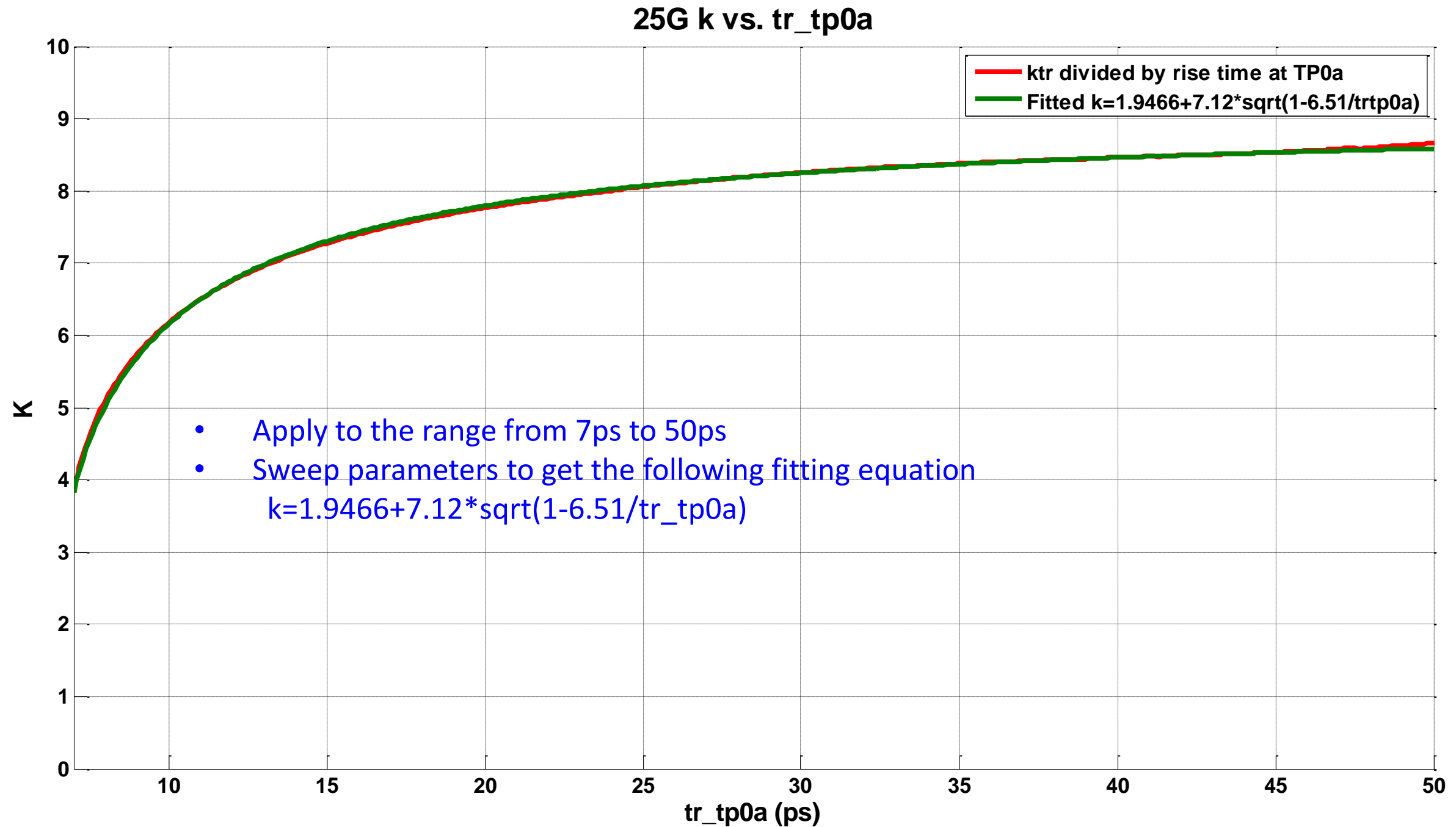
25G k vs. tr_tp0



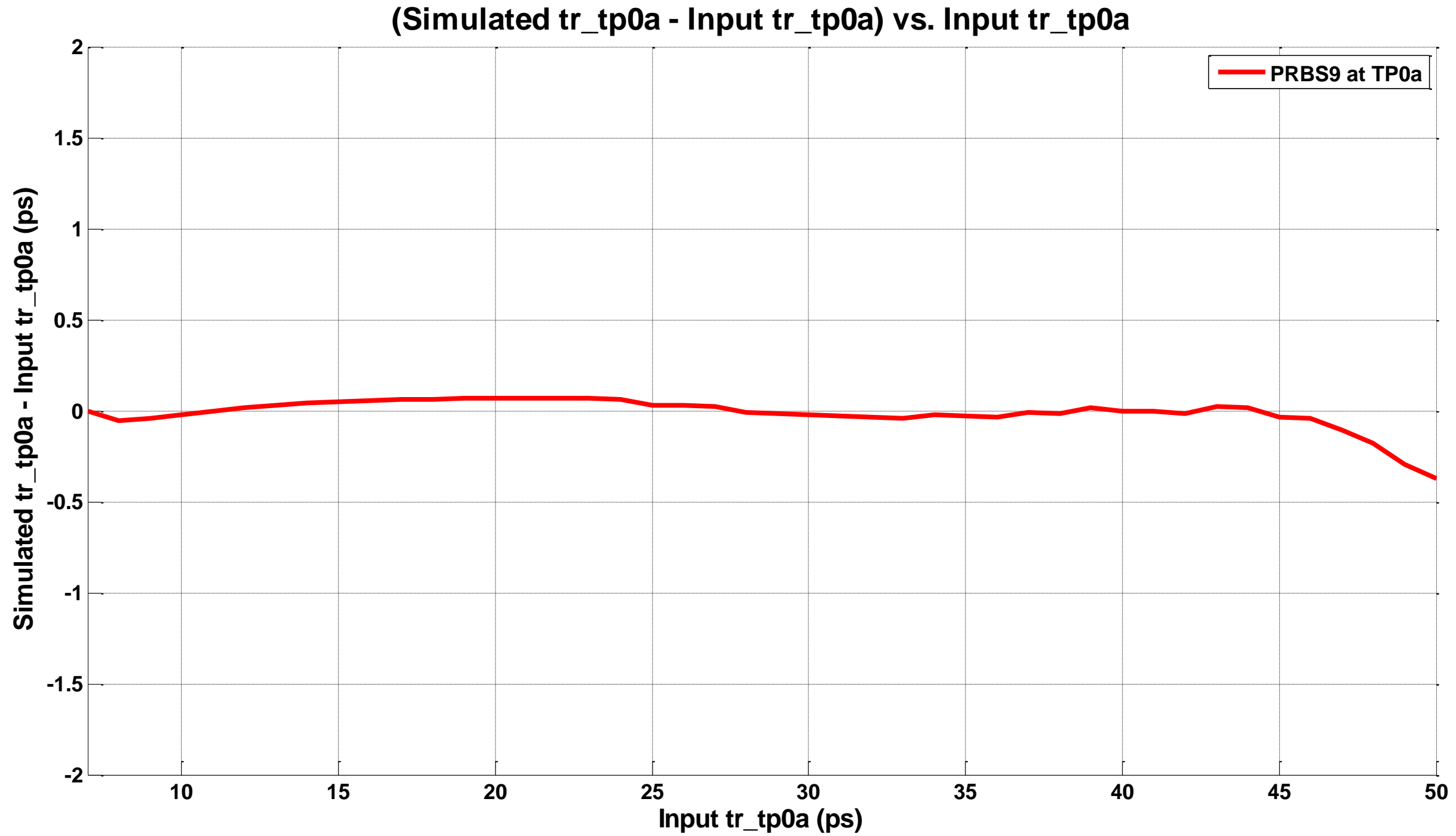
(Simulated tr_tp0 - Input tr_tp0) vs. Input tr_tp0



25G Curve Fitting for k vs. tr_tp0a



(Simulated tr_tp0a - Input tr_tp0a) vs. Input tr_tp0a



Simulated Rise-times of Various Patterns

- The PRBS9 and 8180 rise-times are measured with the different methods of determining the “1” and “0” levels as described in 86A.5.3.3

	@TPO		@TPOa	
Input tr (ps)	PRBS9 (ps)	8180 (ps)	PRBS9 (ps)	8180 (ps)
10	9.986	9.986	9.979	10.179
20	19.969	19.969	20.067	20.392
30	29.873	29.936	29.979	30.495
40	40.086	39.816	39.998	40.517
50	49.764	49.545	49.627	50.436

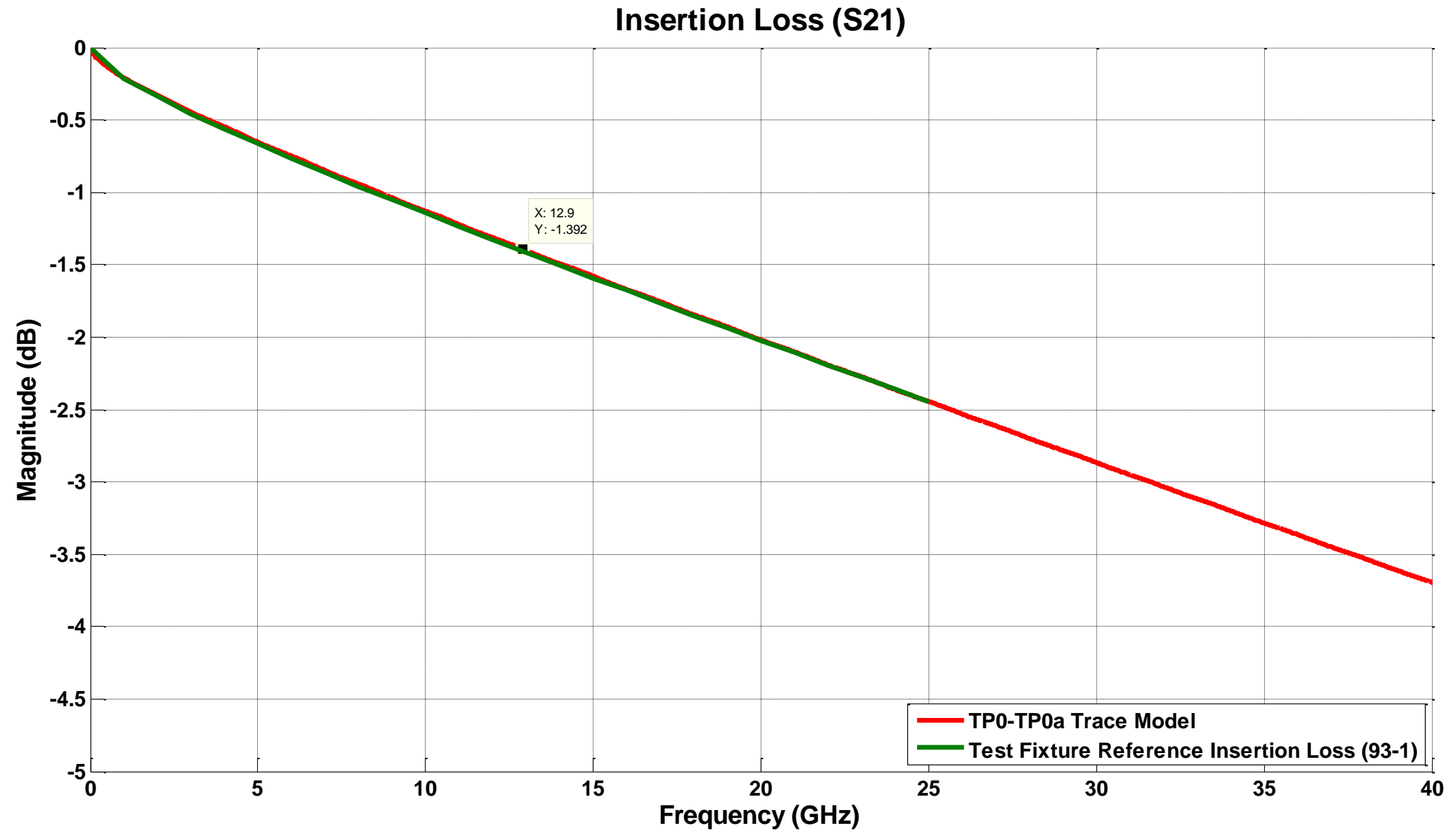
- For best reproducibility it is recommended that we specify the PRBS9 pattern methodology for this calibration. (It is the PRBS9 methodology that has been used in the rest of the presentation).



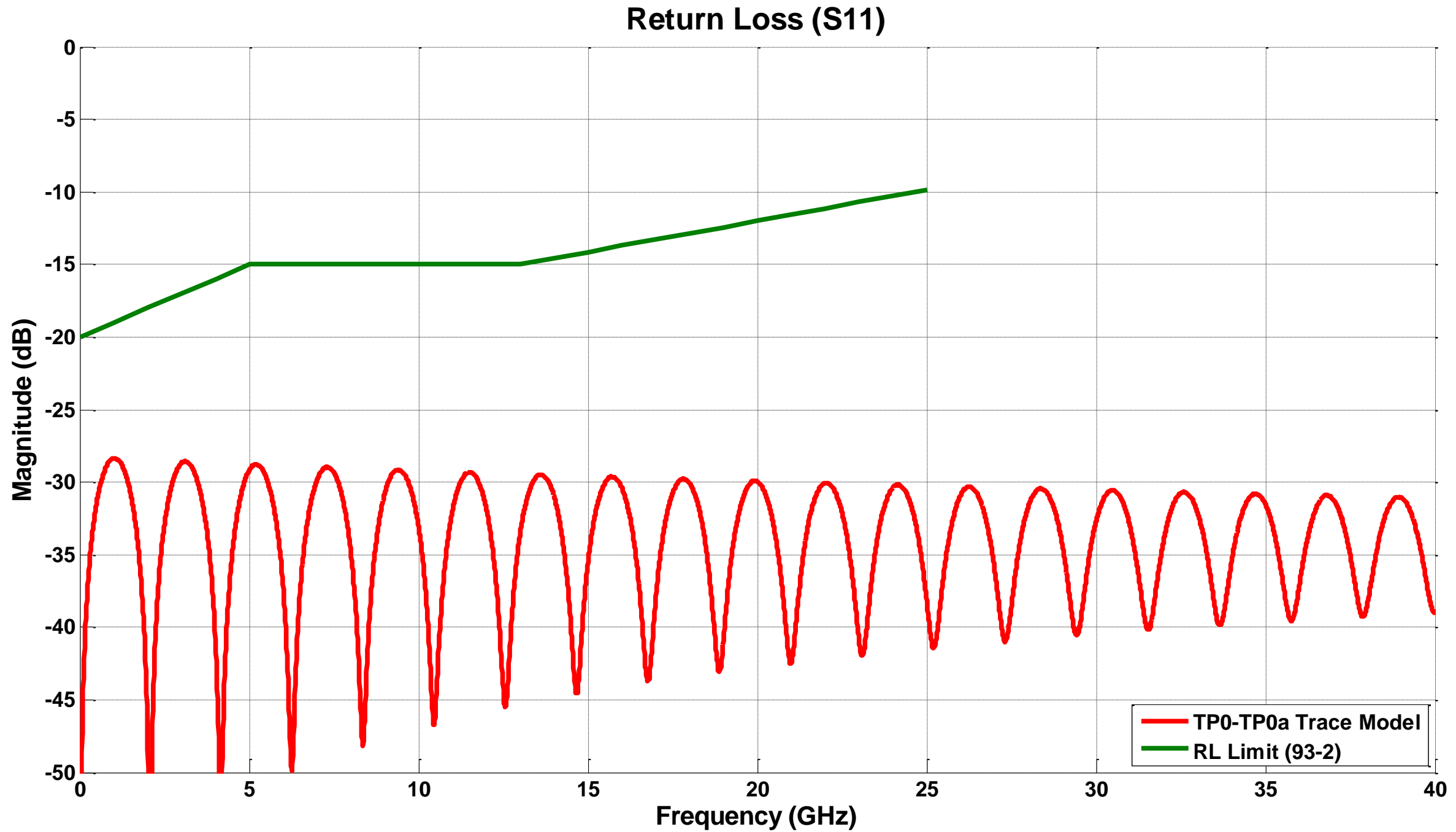
**Back up
TP0-TP0a Trace Model**

TP0-TP0a Insertion Loss

- Trace model is based on the host board model in COM with modified parameters



TP0-TP0a Return Loss



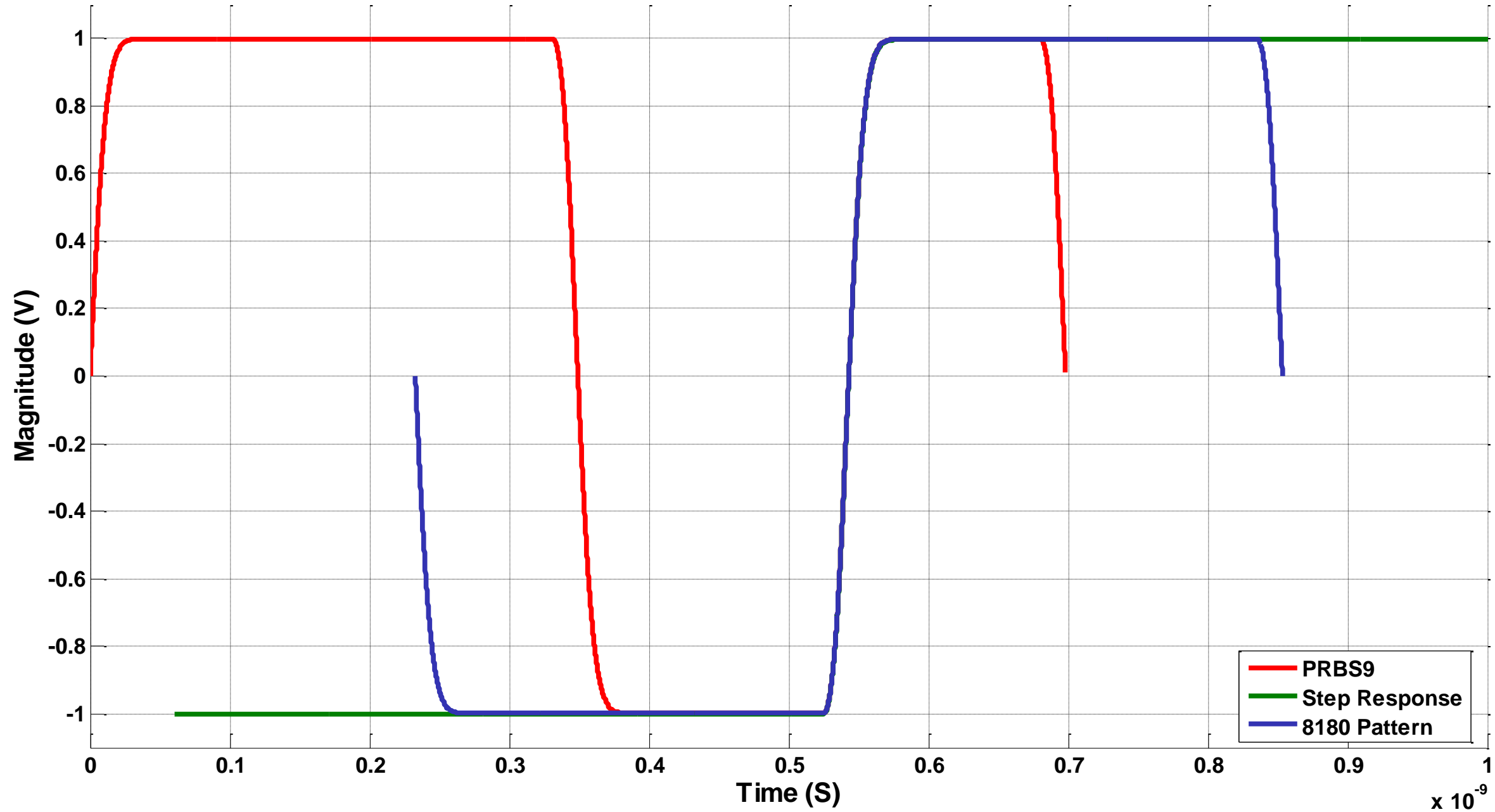


Back Up

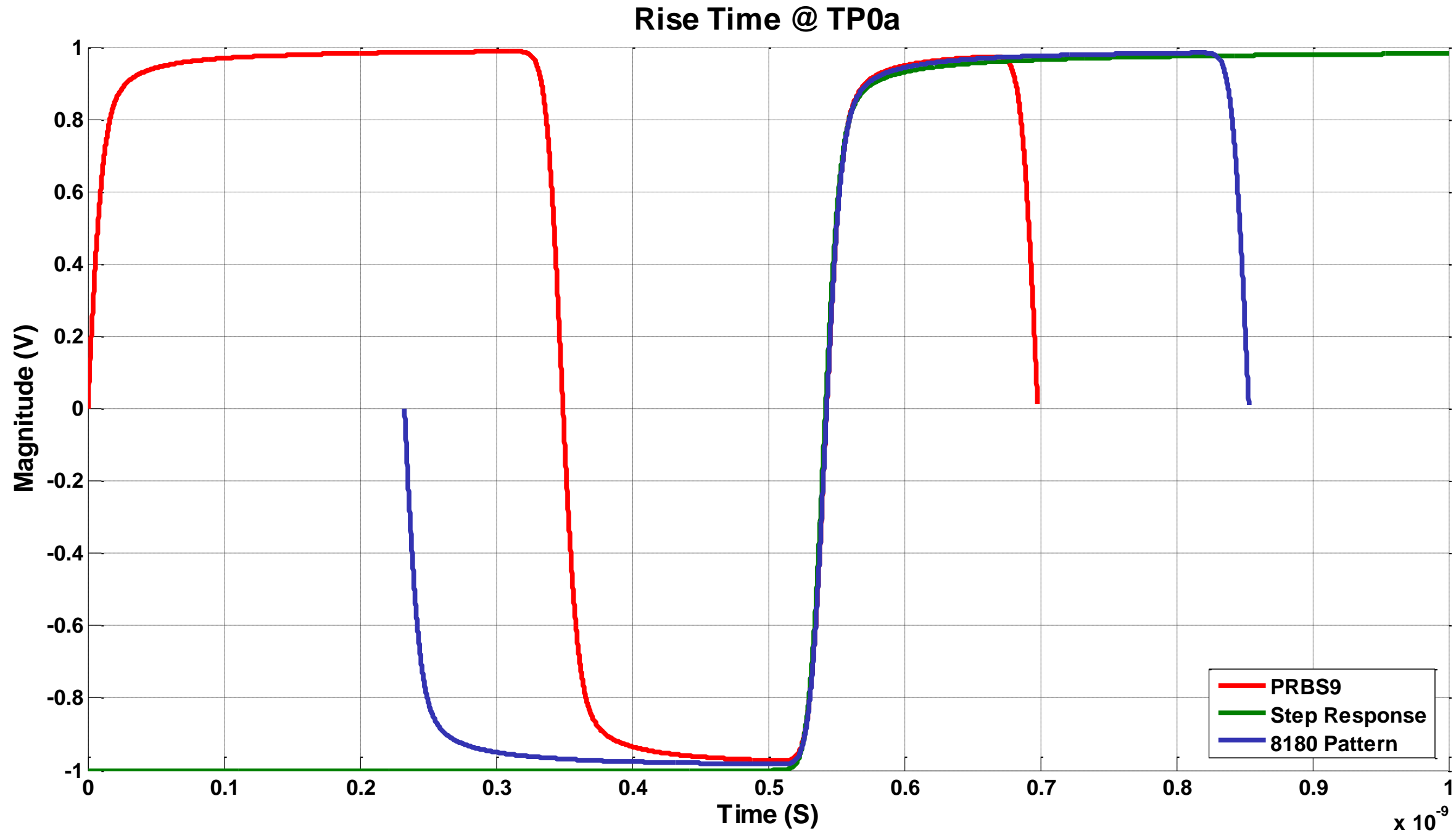
**Waveforms using different patterns with
Proposed Filter**

Waveforms at TP0 when $tr_{tp0} = 20\text{pS}$

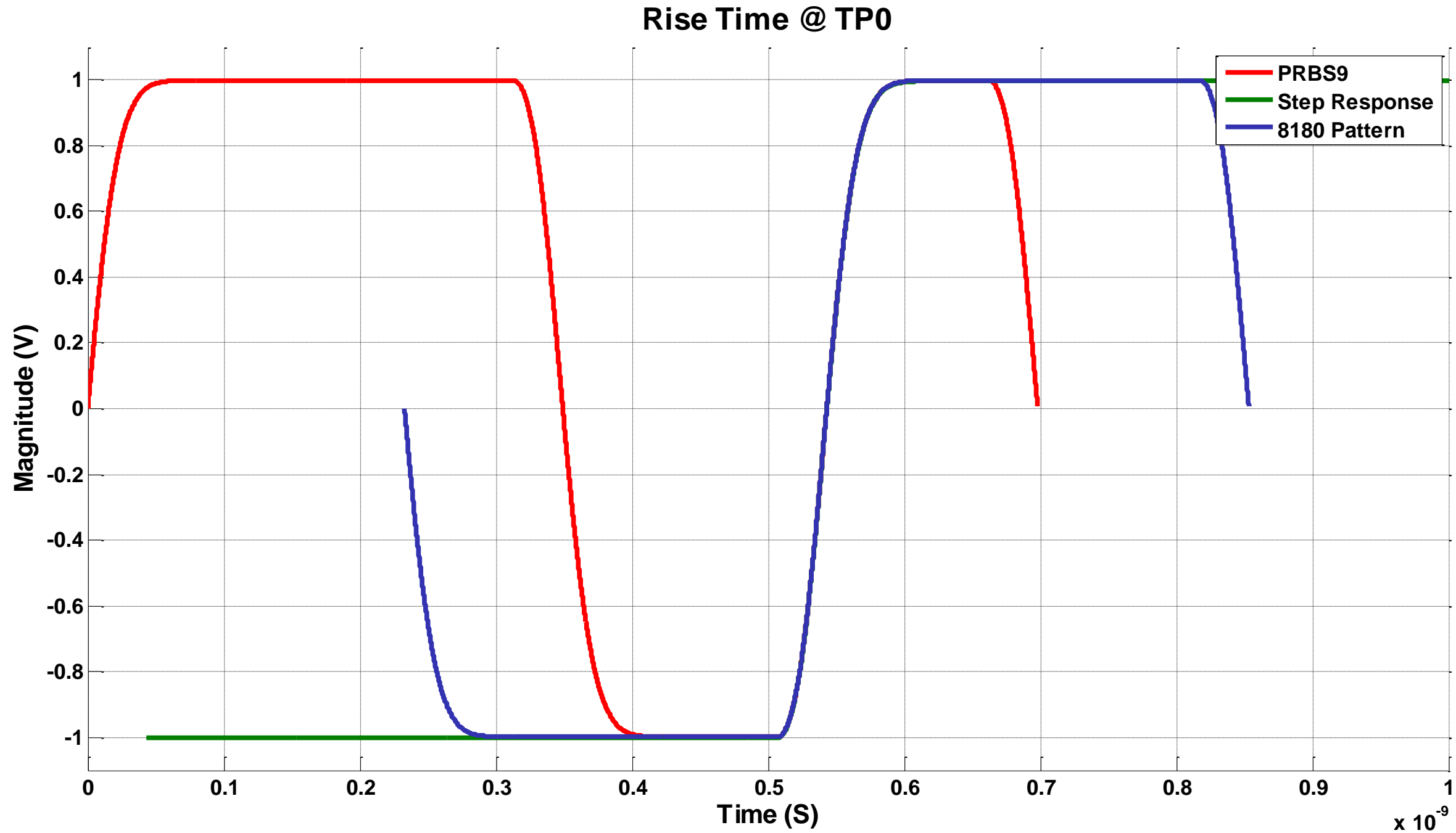
Rise Time @ TP0



Waveforms at TP0a when $tr_{tp0a} = 20pS$



Waveforms at TP0 when $tr_{tp0} = 40pS$



Waveforms at TP0a when $tr_{tp0a} = 40pS$

