The effect of Tfx on ERL using a measured test fixture

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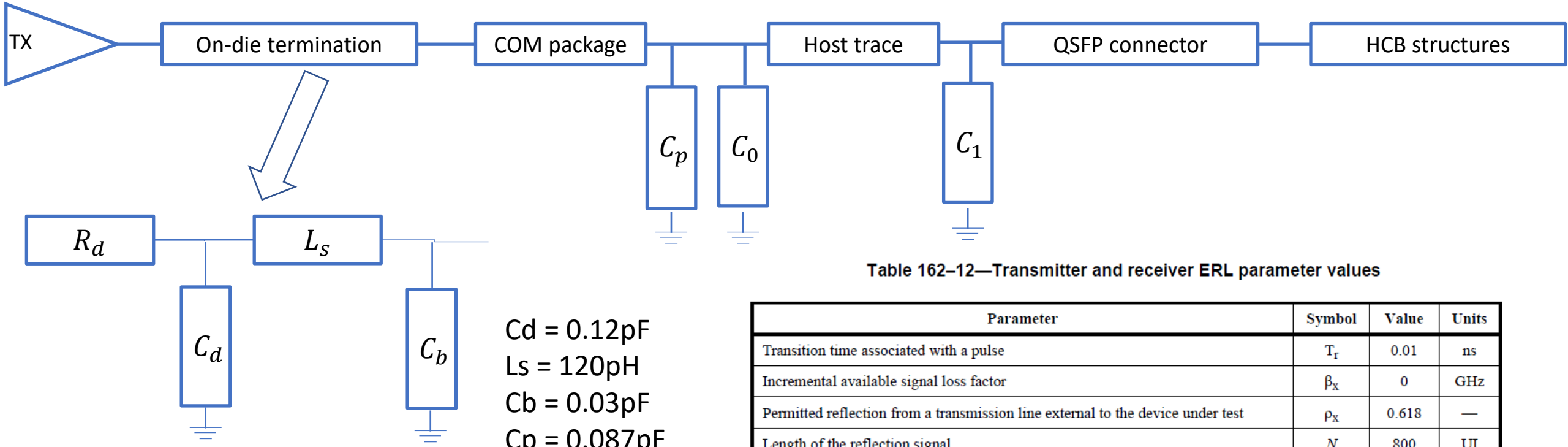
Mike Dudek Marvell
Tao Hu Marvell

Introduction

- The purpose of having the Time-Gated propagation Delay (Tfx) in the ERL measurement is to remove the effect of the discontinuity caused by the RF connector of the test fixture.
- This presentation shows the results of simulations to determine the effect of Tfx value on the measurement of ERL.
- The simulations are of the CR, copper cable host but it is expected that the results will be applicable to all ERL measurements.
- Based on this work I intend to write a comment to change the value of Tfx for these measurements from 0.2ns to 0.3ns.
- During the adhoc meeting on 4/14/21 a question was raised about the host trace impedance shown in the TDRs. Unfortunately the TDR's presented were with 80 Ohm traces not the 100 Ohm traces used for the rest of the analysis. This is corrected in this 01a version of the presentation and the original slides are moved to the back-up.

ERL simulation block diagram at TP2



Cd = 0.12pF
Ls = 120pH
Cb = 0.03pF
Cp = 0.087pF
C0 = 0.029pF
C1 = 0.019pF

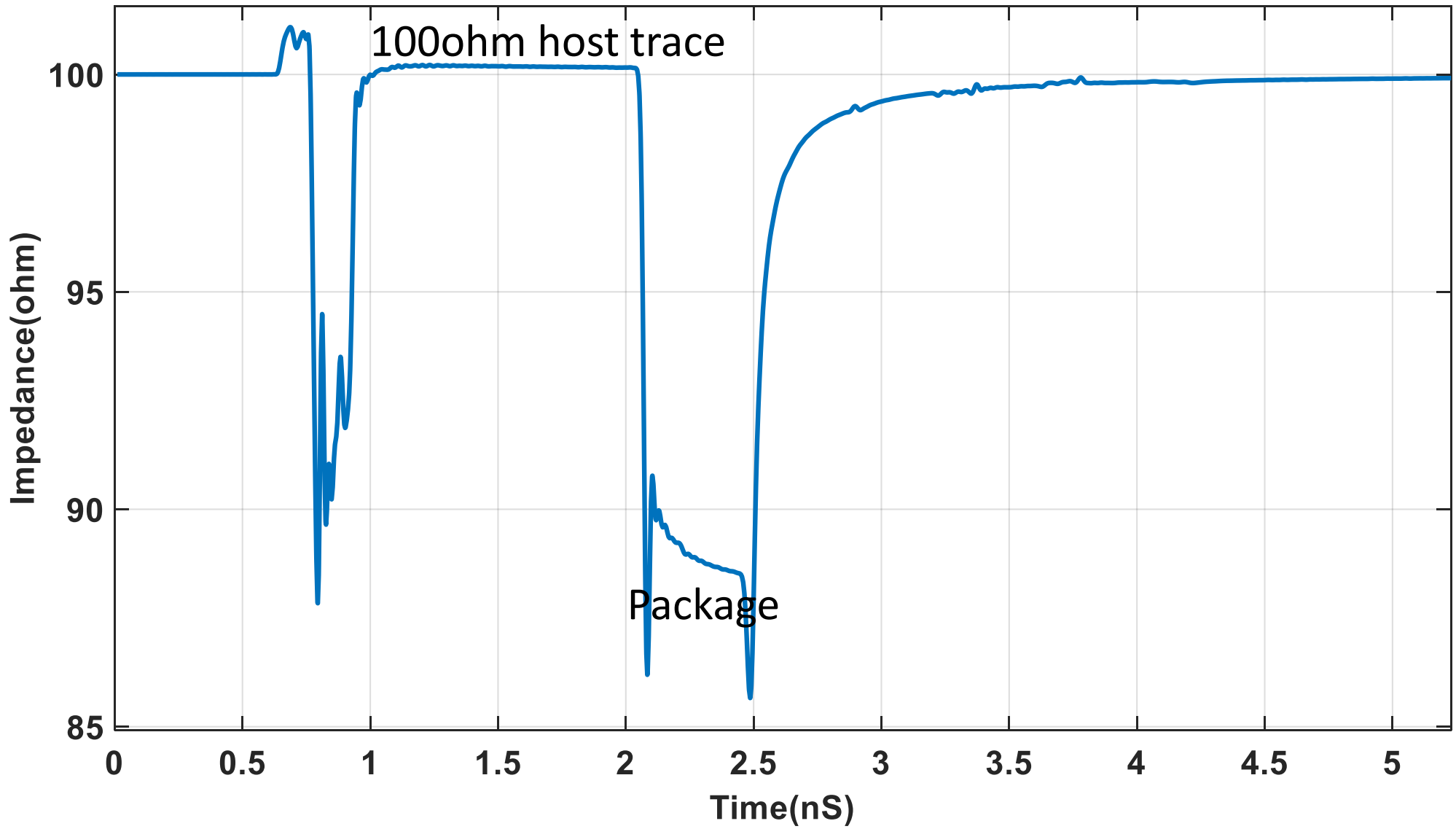
Table 162–12—Transmitter and receiver ERL parameter values

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	800	UI
Equalizer length associated with reflection signal	N_{bx}	0	UI
Time-gated propagation delay	T_{fx}	0.2	ns
Tukey window flag	tw	1	—

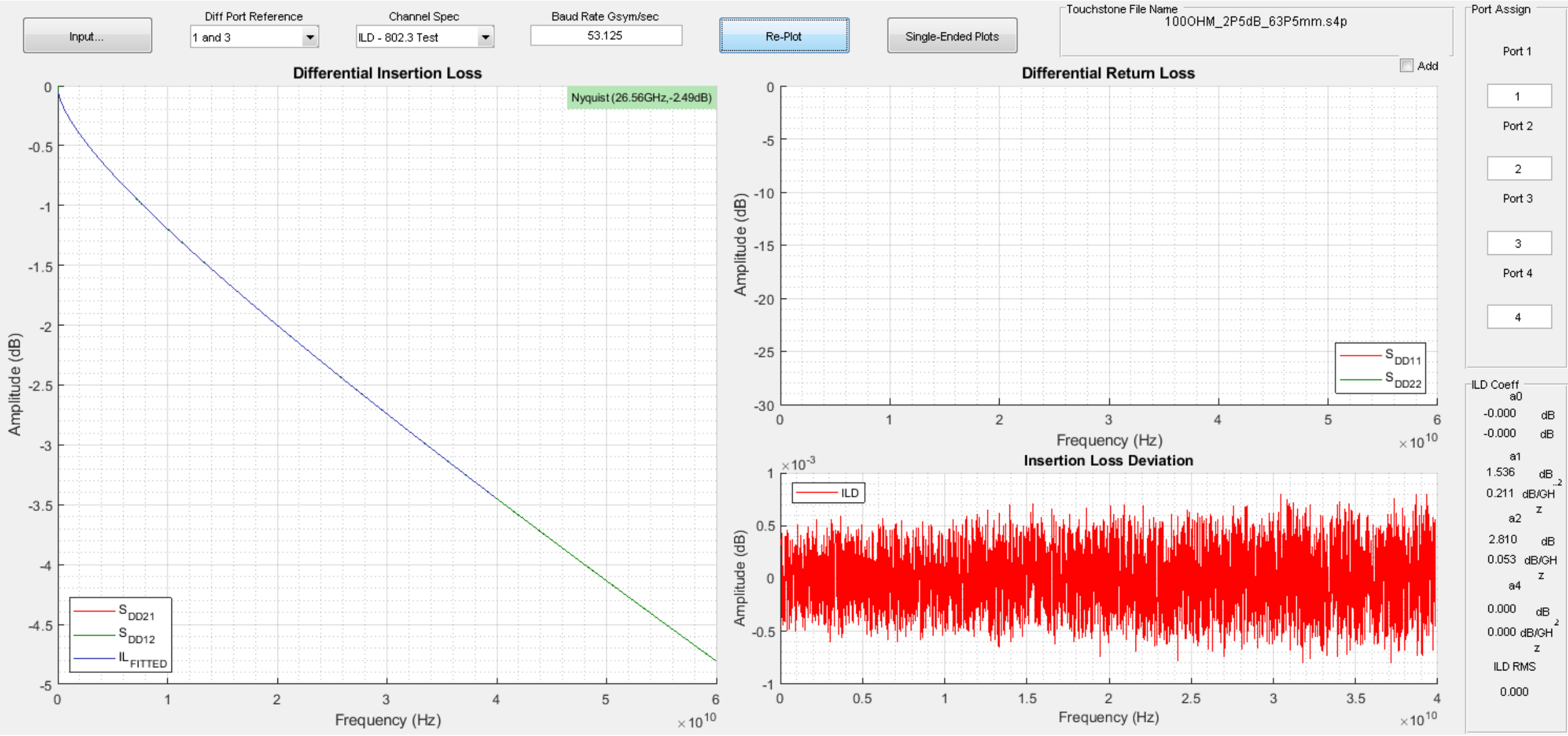
Tfx: 0 to .5ns
Host trace length: 1mm to 400mm w/step 1mm
Host trace impedance: 100 OHM
Package length: 12mm

HCB as perfect 100OHM 2.5dB loss PCB

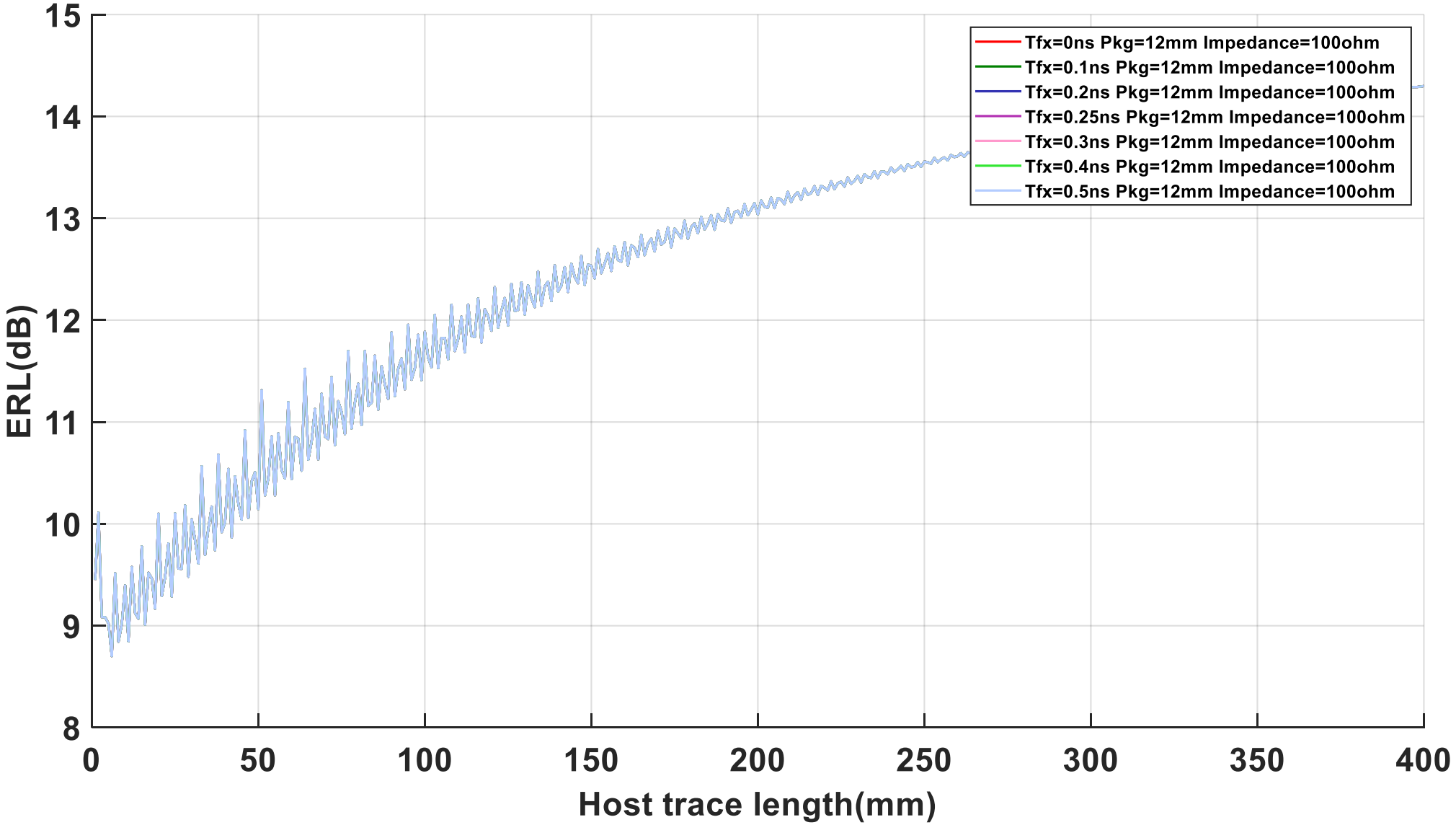
TDR of package, host trace, connector and perfect 100OHM PCB



Perfect 100OHM PCB S parameter



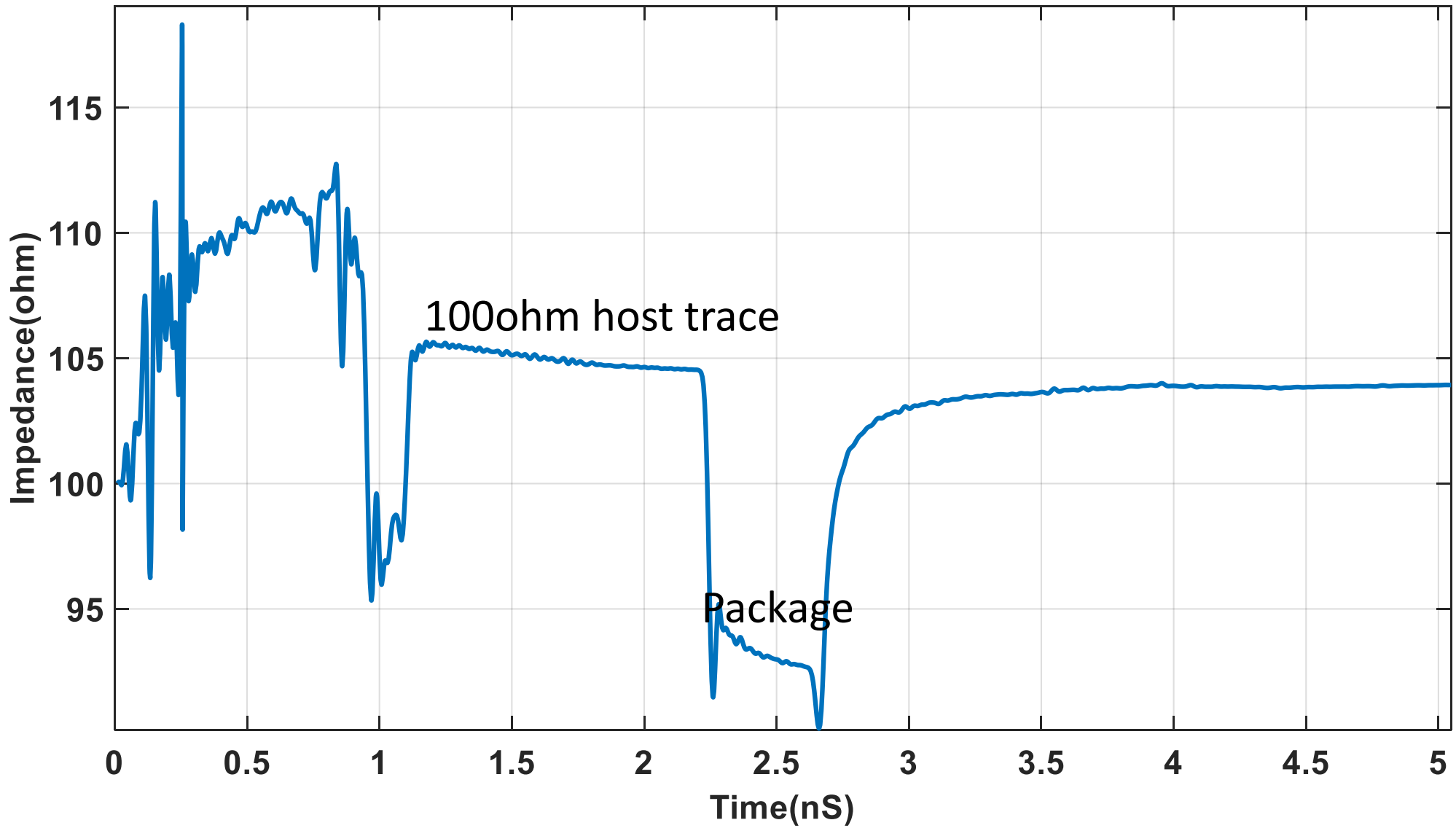
ERL with perfect 100 Ohm trace



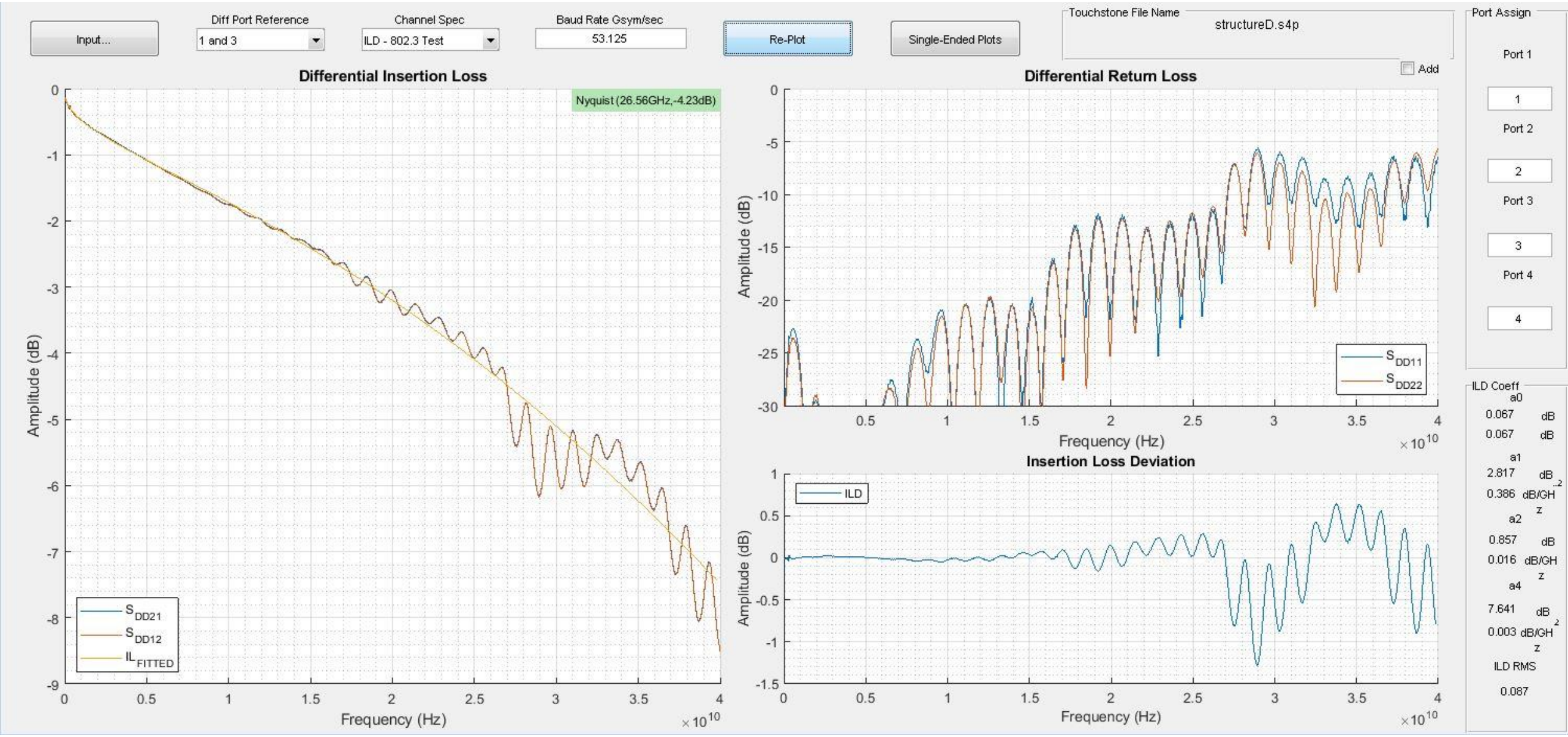
HCB as measured test trace Structure D

Molex SMA 2.92mm(73252-0090) + M6 100 Ohm 2.26 inch Stripline + Molex SMA 2.92mm(73252-0090)

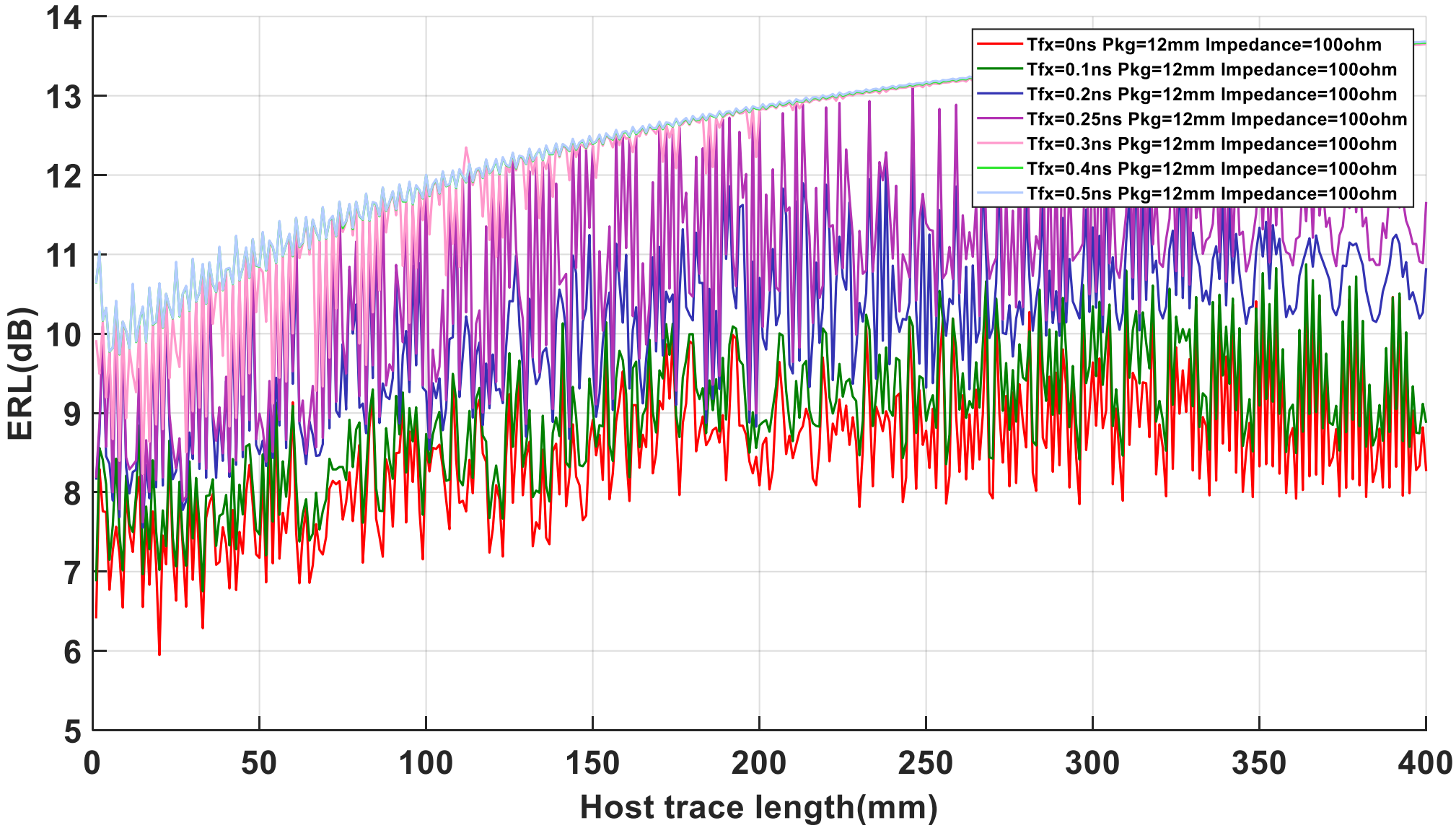
TDR of package, host trace, connector and structure D



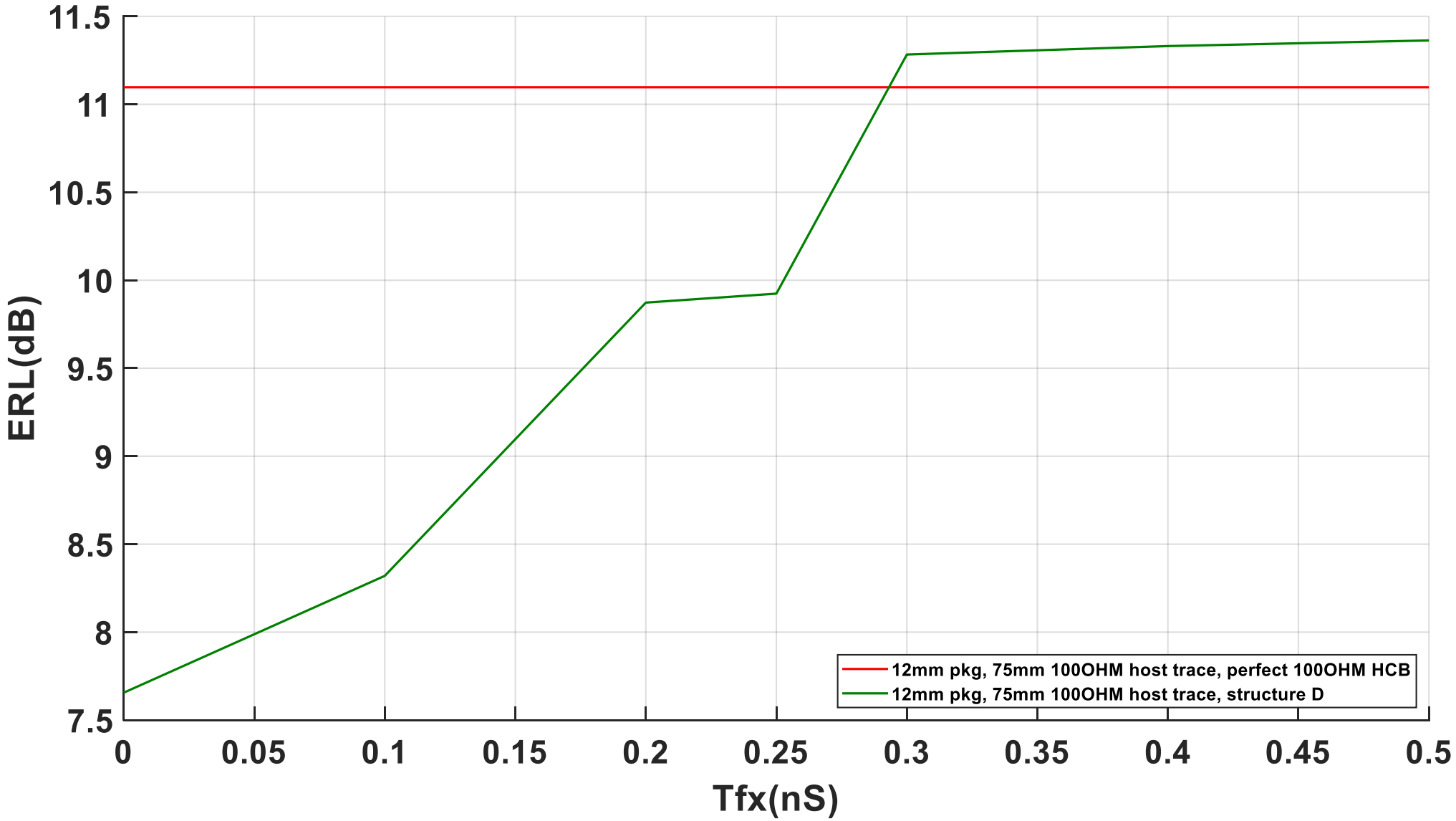
Structure D S parameter



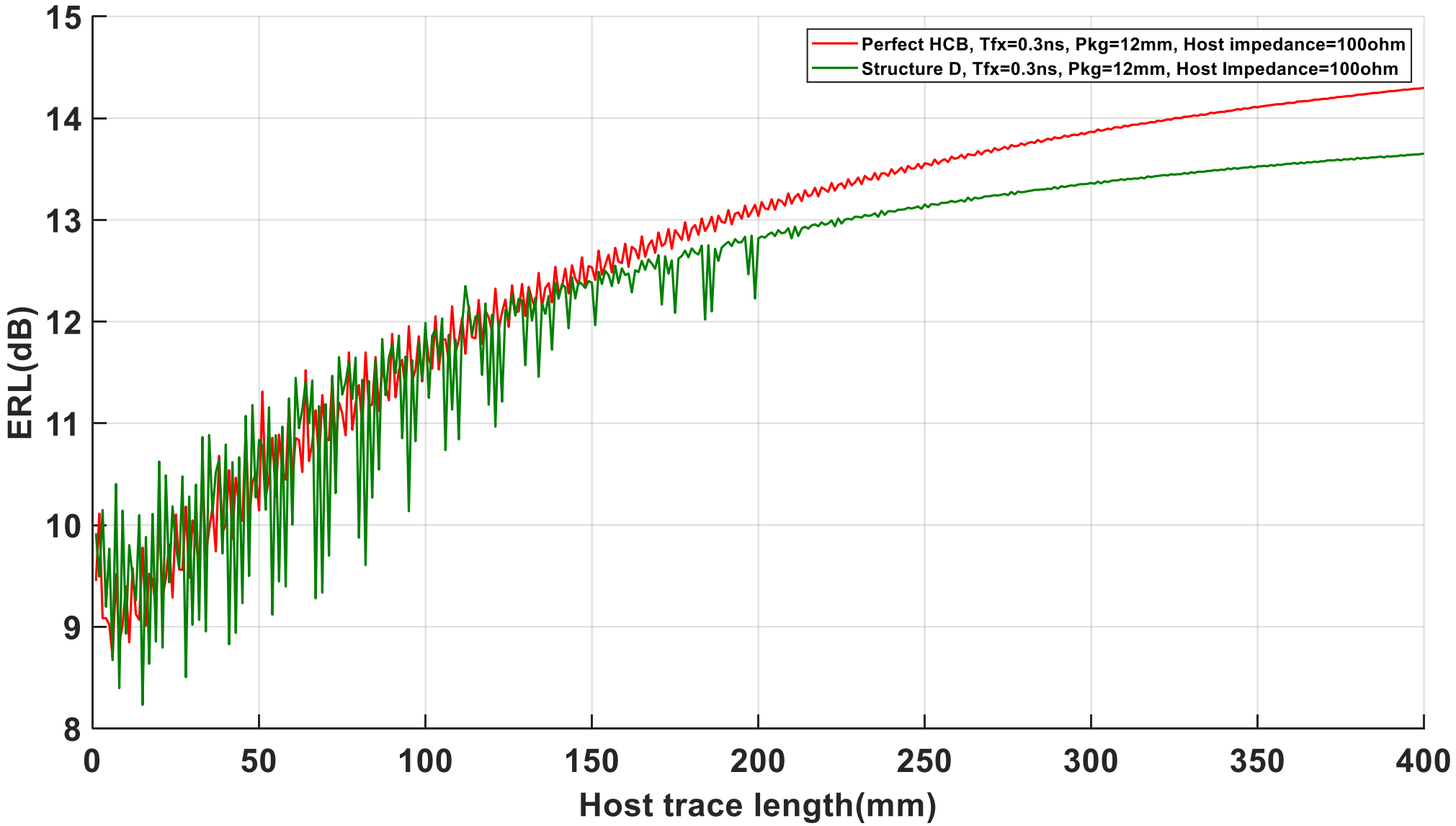
ERL with measured structure D



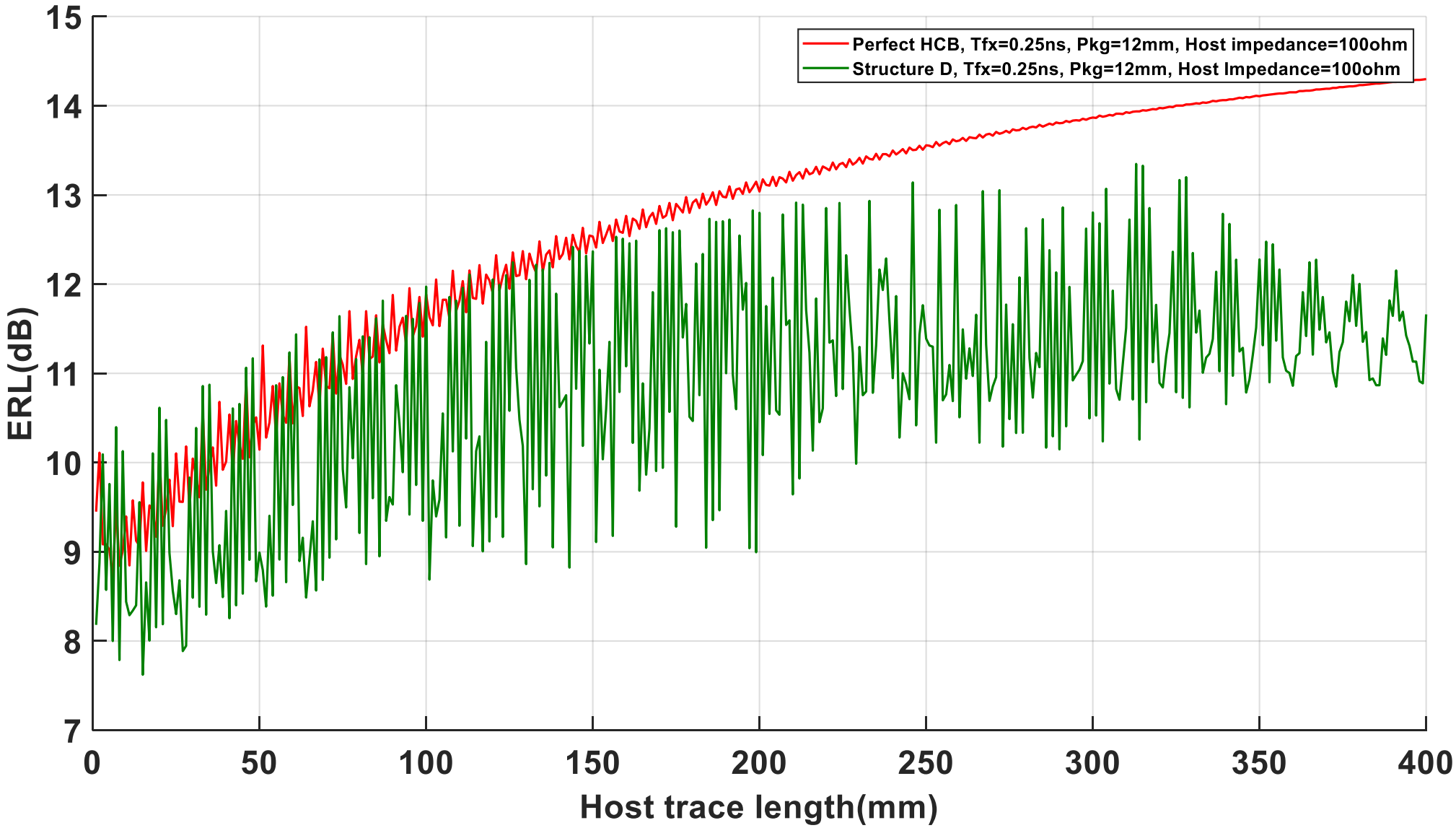
ERL versus Tfx



ERL versus host trace length when Tfx=0.3ns



ERL versus host trace length when Tfx=0.25ns



Conclusions

- The present value of 0.2ns for Tfx is too short to remove the effect of the RF connector resulting in pessimistic (and variable) ERL measurements.
- Having too large a value of Tfx can result in optimistic results as it may remove the effect of discontinuities in the host itself.
- A value of 0.3ns is large enough to remove the RF connector effects without affecting the measurements of the host itself.

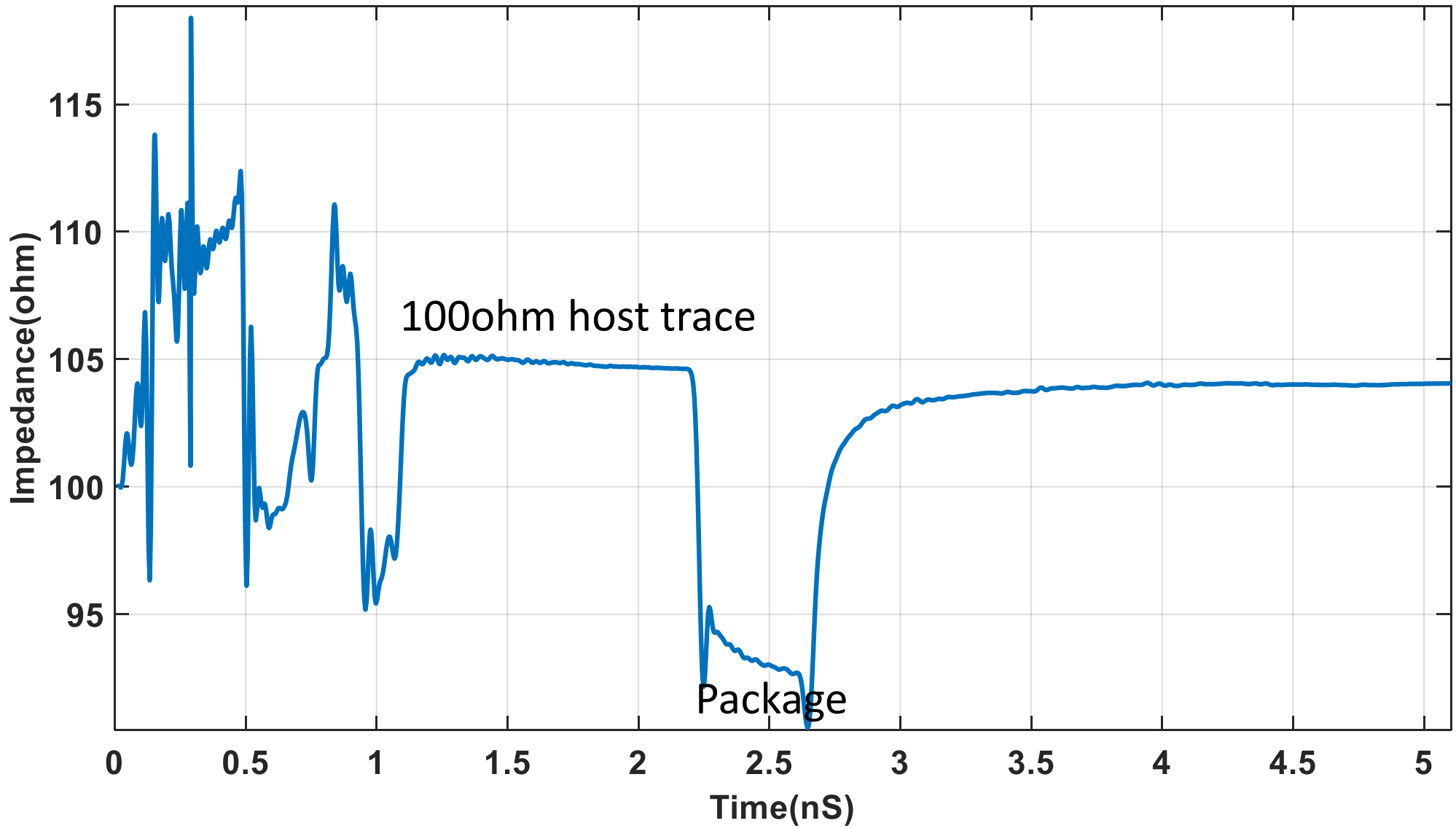
Backup

Effect of discontinuity in test trace.

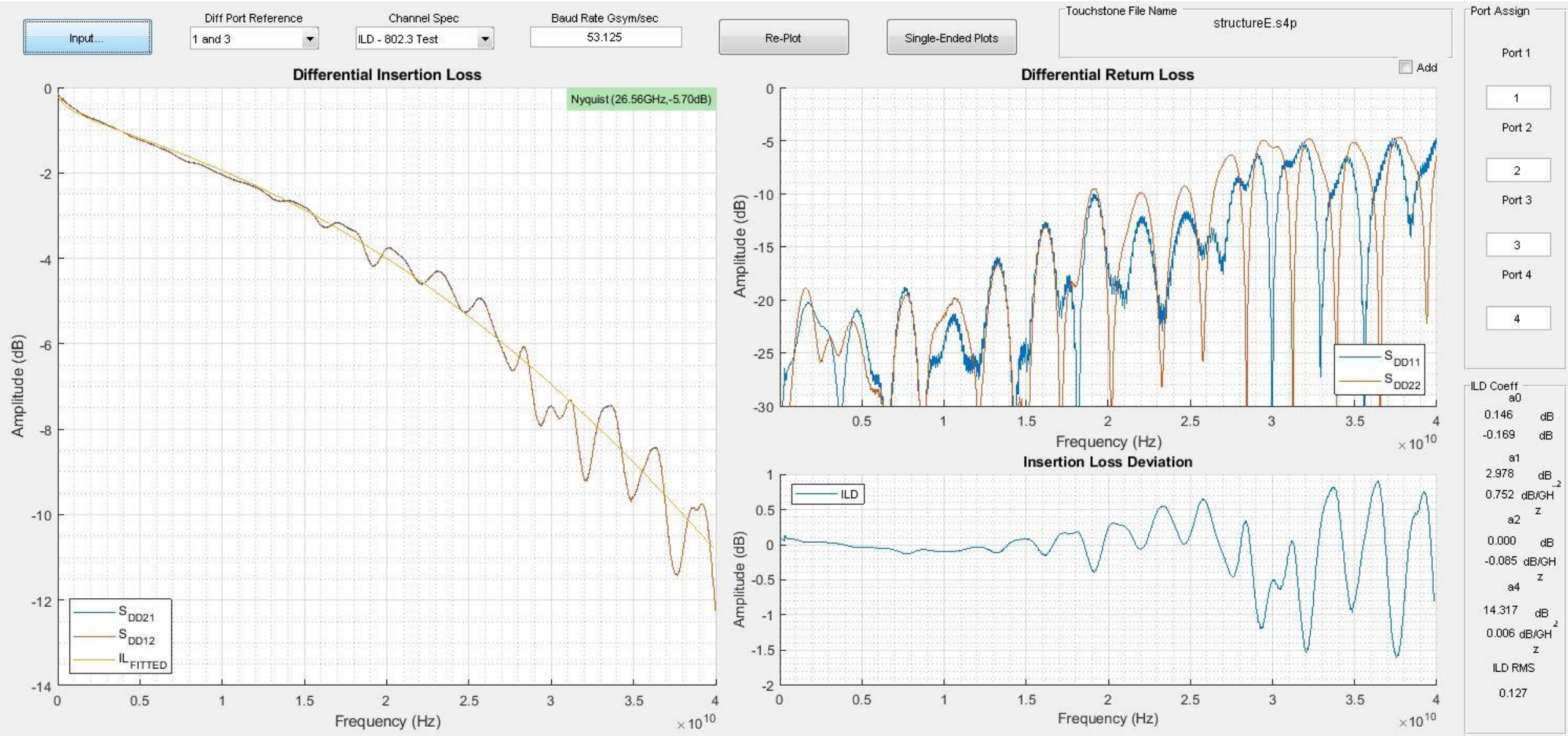
HCB as measured Structure E

Molex SMA 2.92mm(73252-0090) +
M6 100 Ohm 1.13 inch Microstrip + Via +
M6 100 Ohm 1.13 inch Stripline +
Molex SMA 2.92mm(73252-0090)

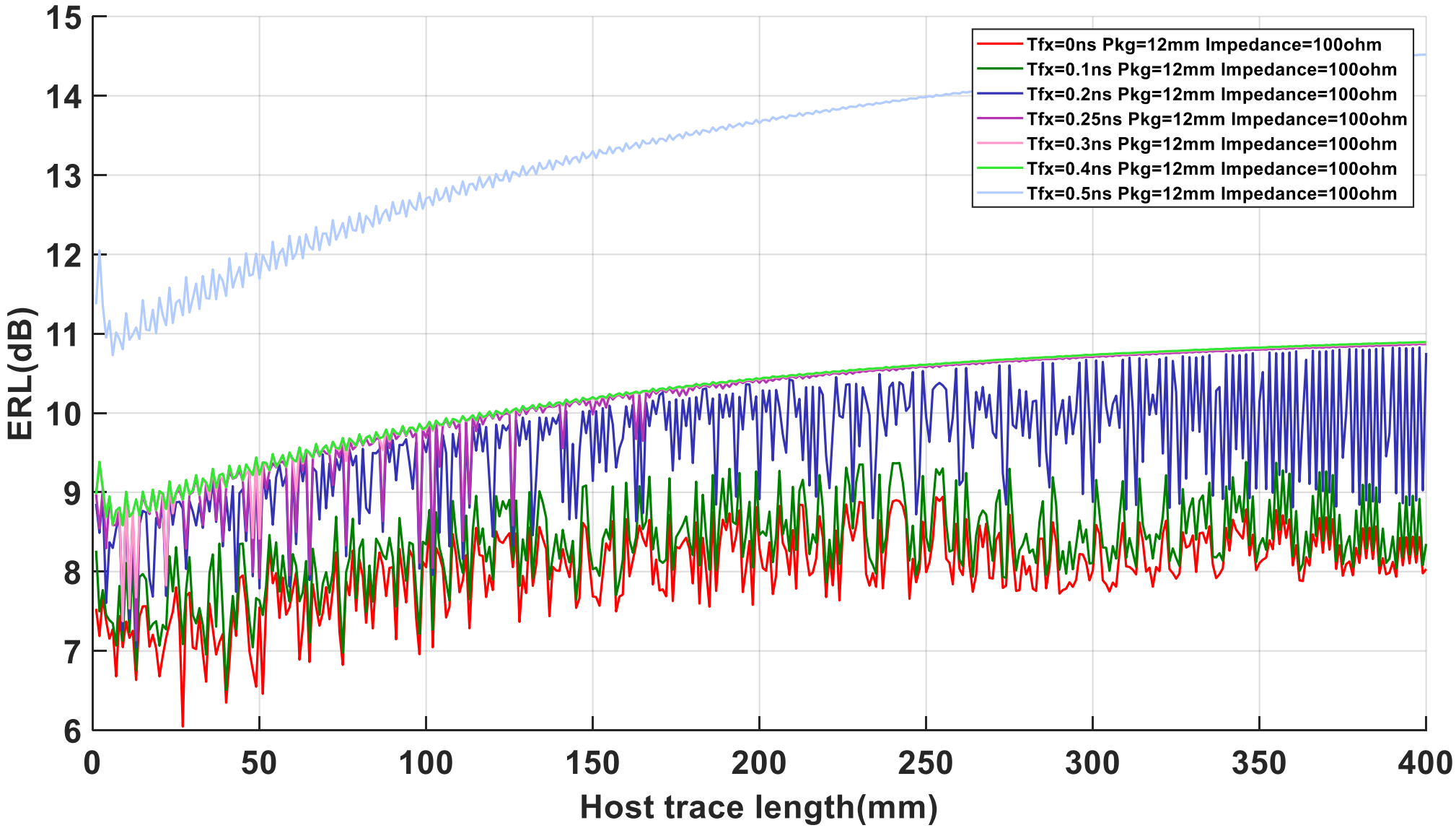
TDR of package, host trace, connector and structure E



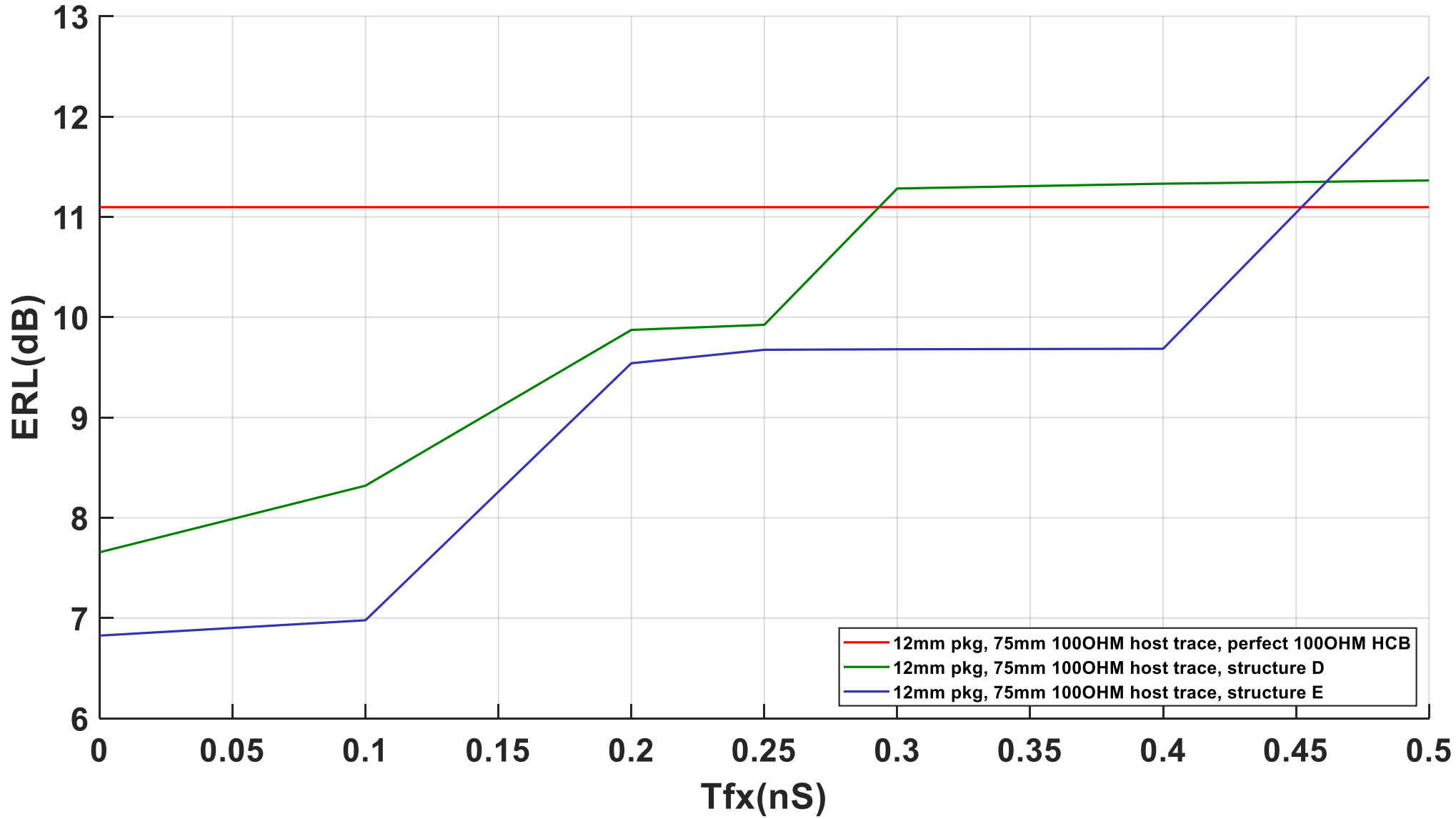
Structure E S parameter



ERL with measured structure E

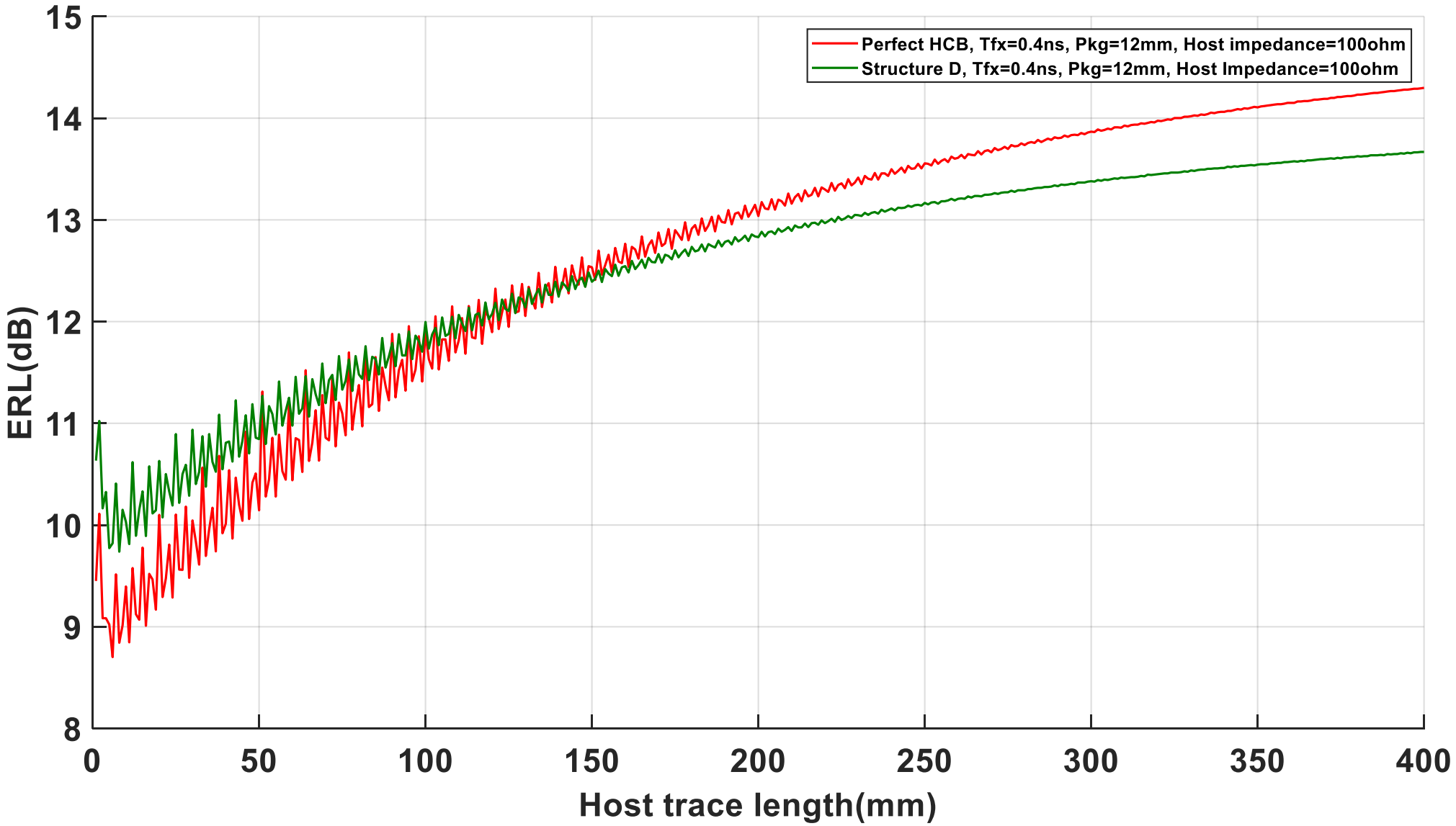


ERL versus Tfx



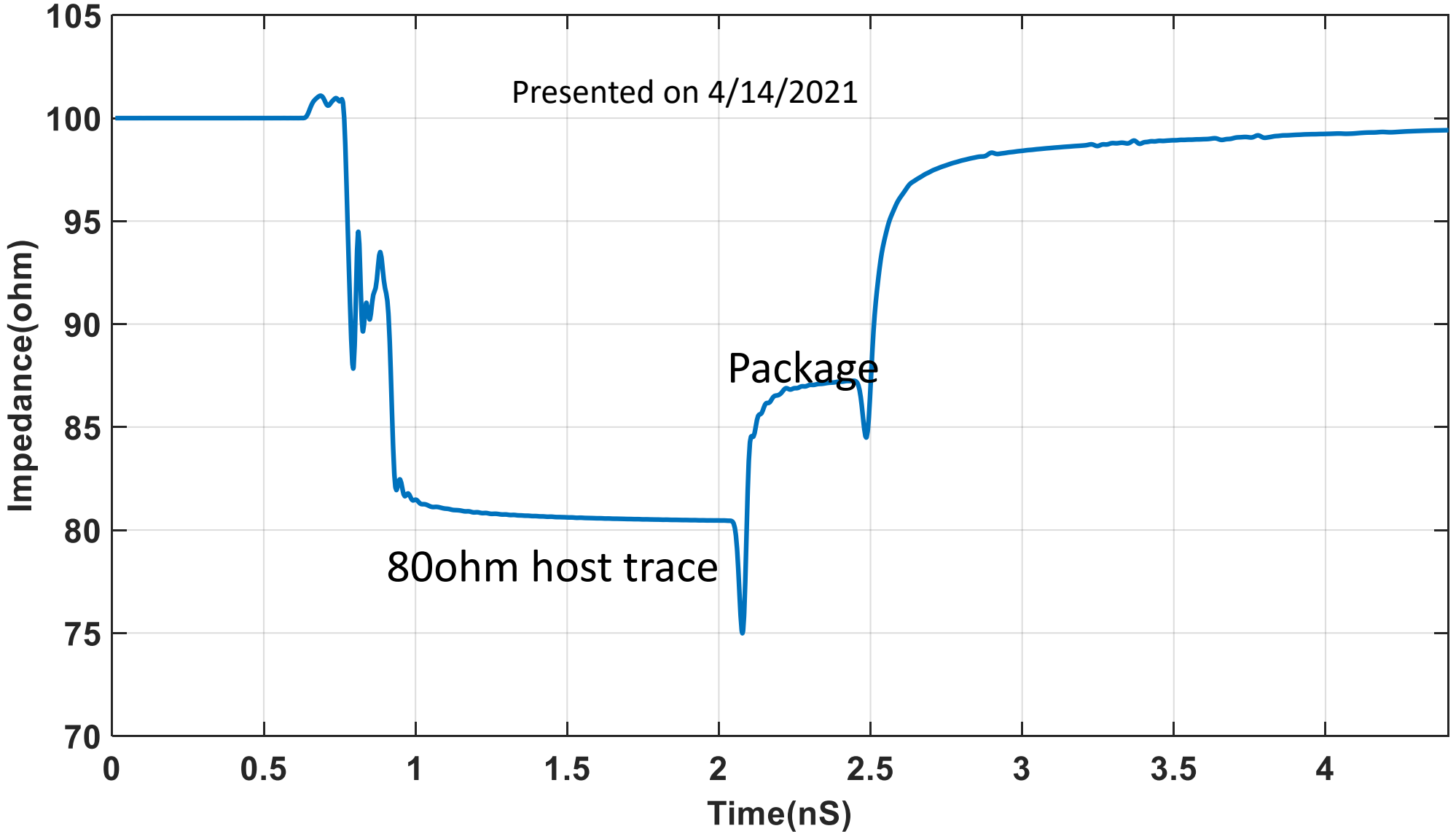
ERL with Tfx = 0.4ns

ERL versus host trace length when Tfx=0.4ns

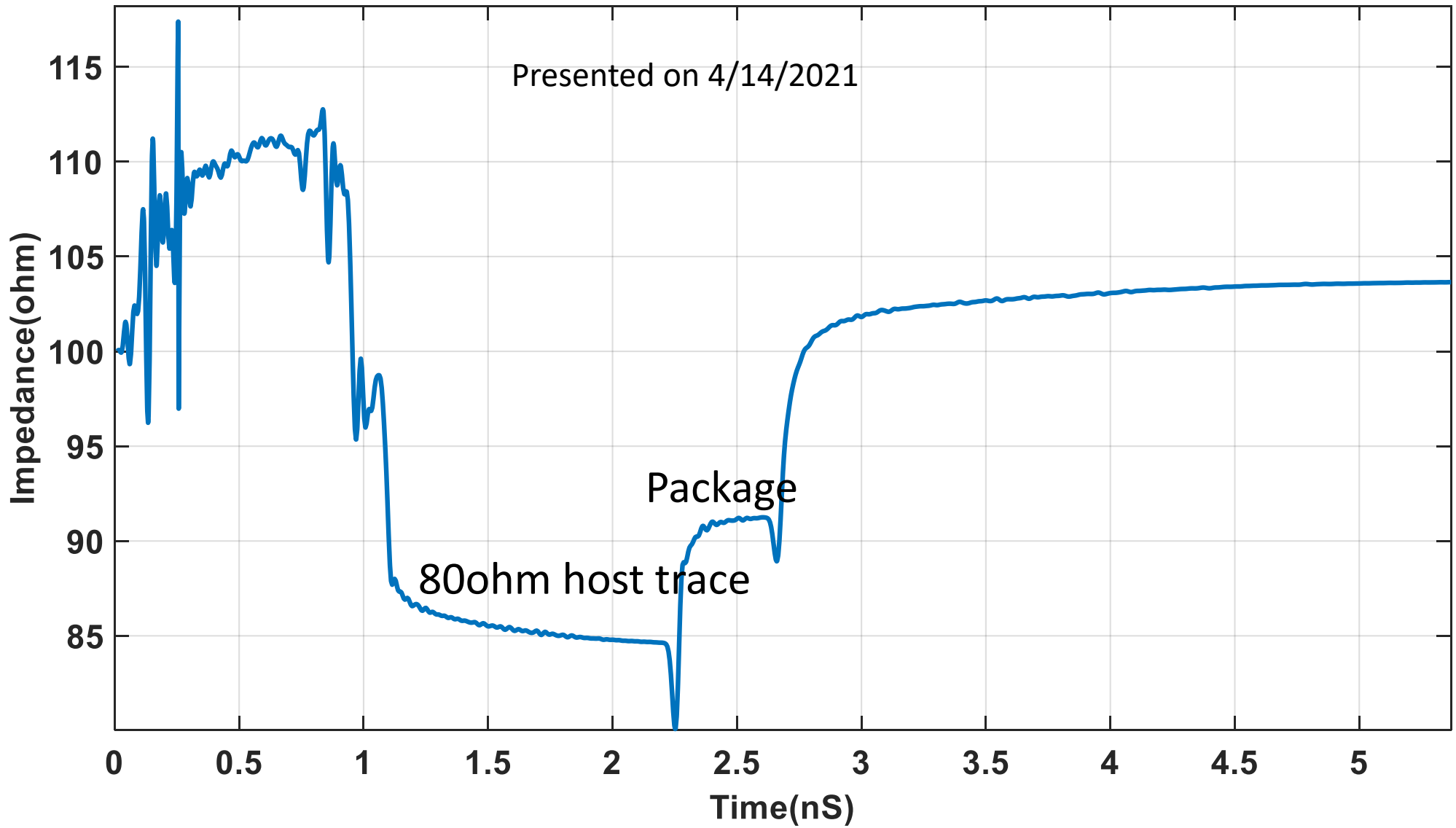


TDR with 80 Ohm host trace as originally presented in 4/14/21 ad hoc call.

TDR of package, 80ohm host trace, connector and perfect 100OHM PCB



TDR of package, 80ohm host trace, connector and structure D



TDR of package, 80ohm host trace, connector and structure E