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Accurate 10Gbs Signal Integrity assessment

Removing the Lossy Effects of your Measurement Channel to get your real DUT Performances!

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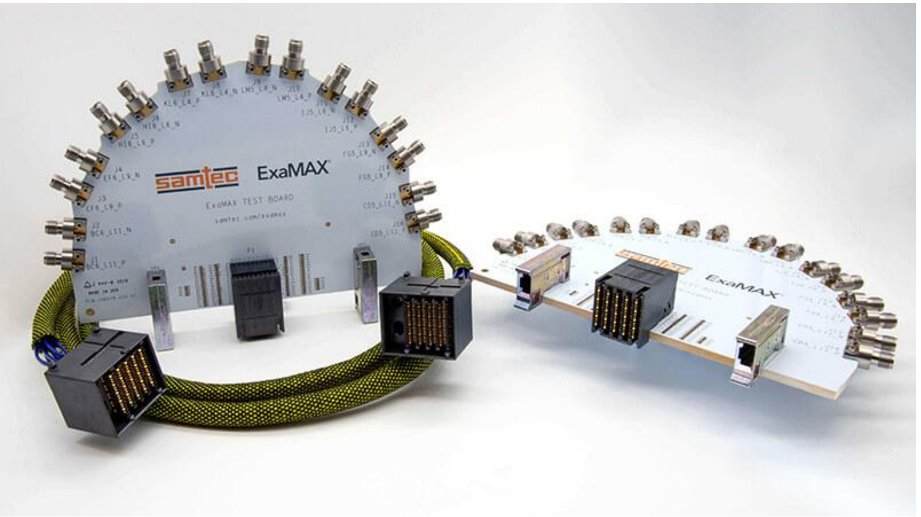
Application is 10Gb/s



In order to access the signal
The DUT Signal is going through

Backplane Connectors
Cable fitted with Backplane Connectors
Break-Out Board 2.92mm/SMA

A pair of Phase Matched 2.92mm Cables will be used to connect the Breakout Board to a low noise 12bits ADC 25GHz 125GSa/s Oscilloscope

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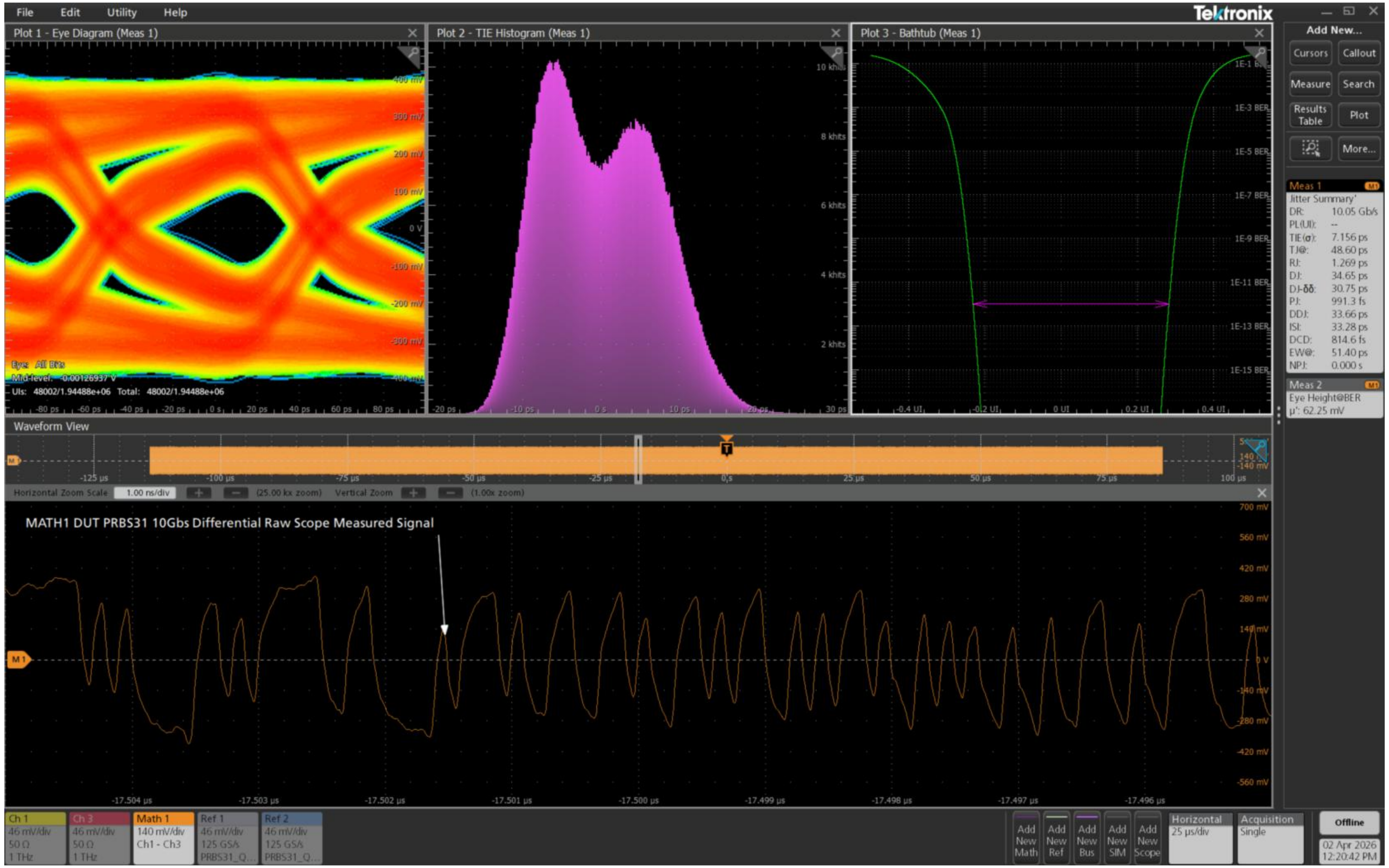
DUT Raw PRBS Observed Signal 31 10Gb/s

Signal has Marginally open Eye Diagram

TJ @ 1e-12 Jitter is Dominated by InterSymbol Interferences (ISI)



Are we Measuring the True DUT Signal?

Every transmission element in the Measurement chain will impact final results if proper care has not been applied in carefully chose them. Physical Characteristics, materials, length, connectors will induce frequency dependent losses

So Let's Model our Measurement channel to asses and try to compensate for frequency dependent losses

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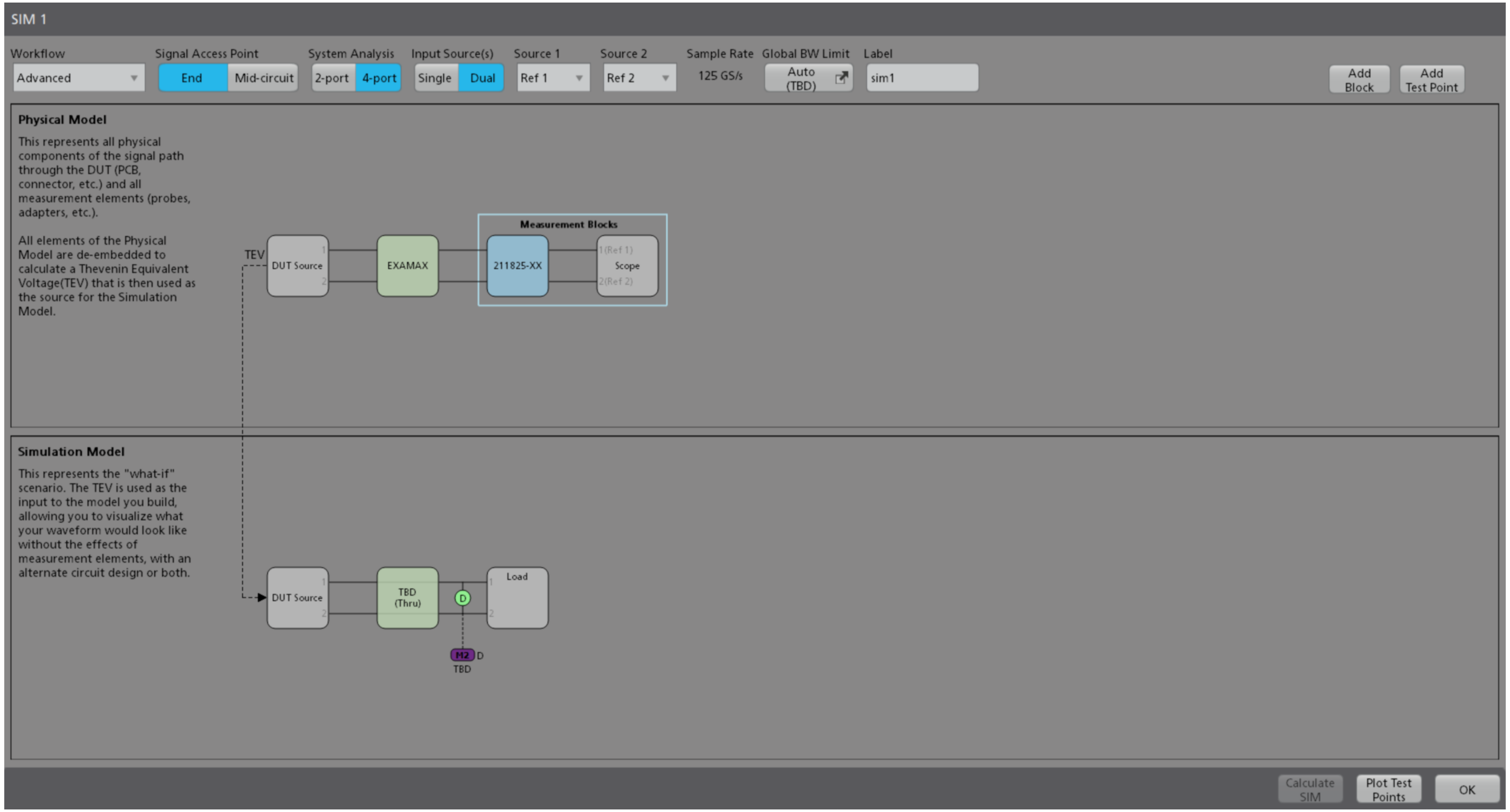
Let's Model the Measurement Channel



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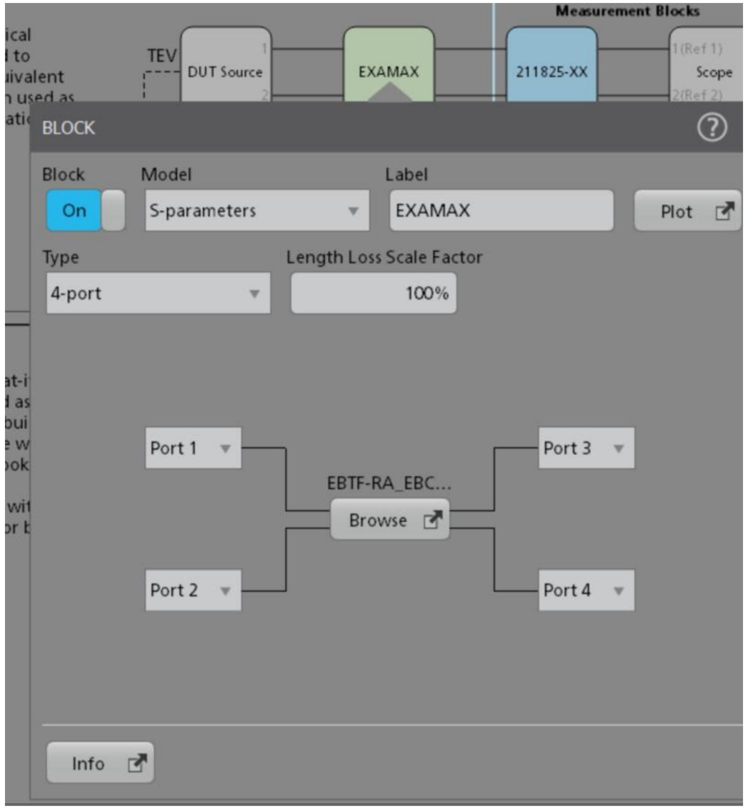
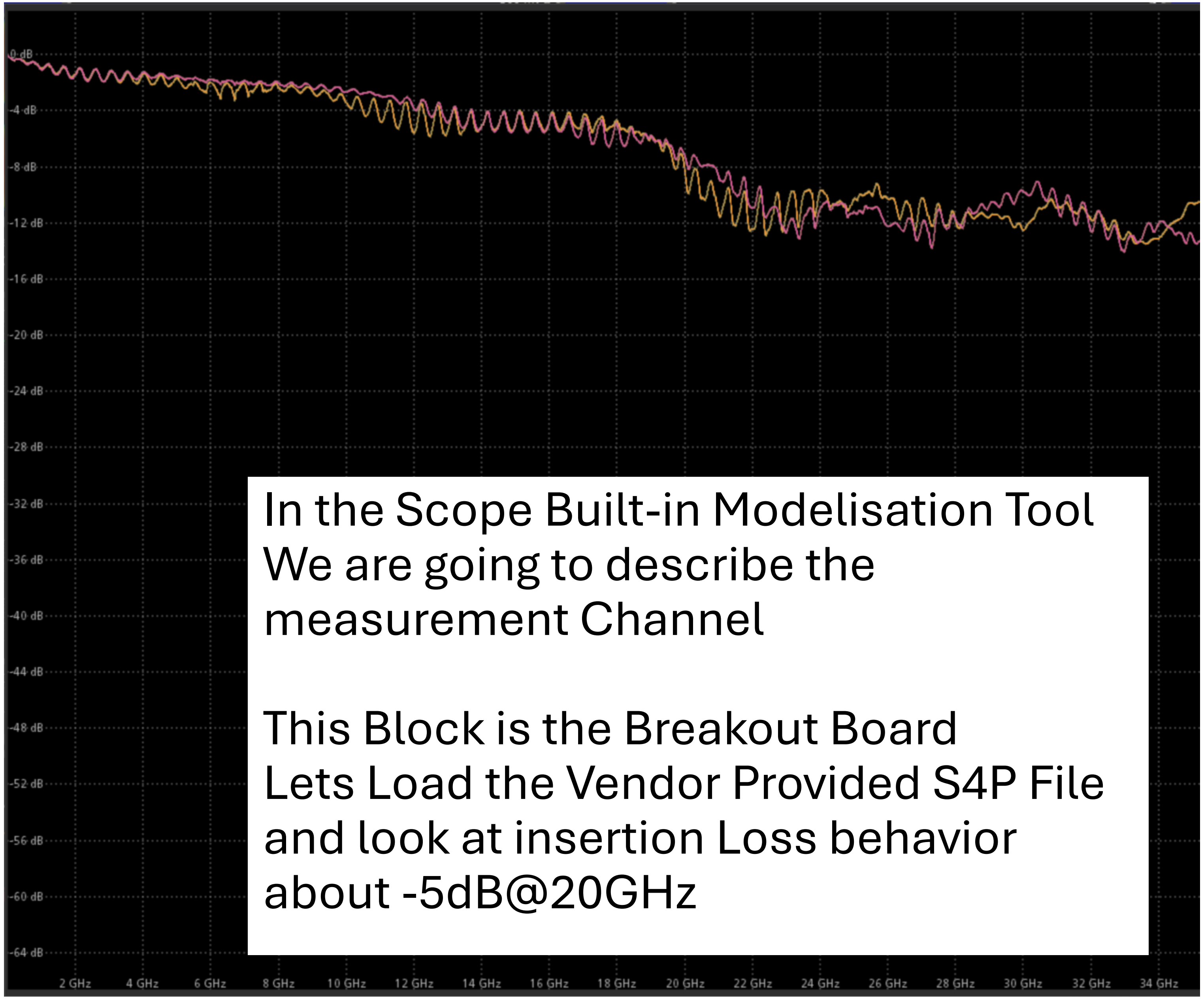
Defining Block 1





In the Scope Built-in Modelisation Tool
We are going to describe the measurement Channel

This Block is the Breakout Board
Lets Load the Vendor Provided S4P File and look at insertion Loss behavior about -5dB@20GHz

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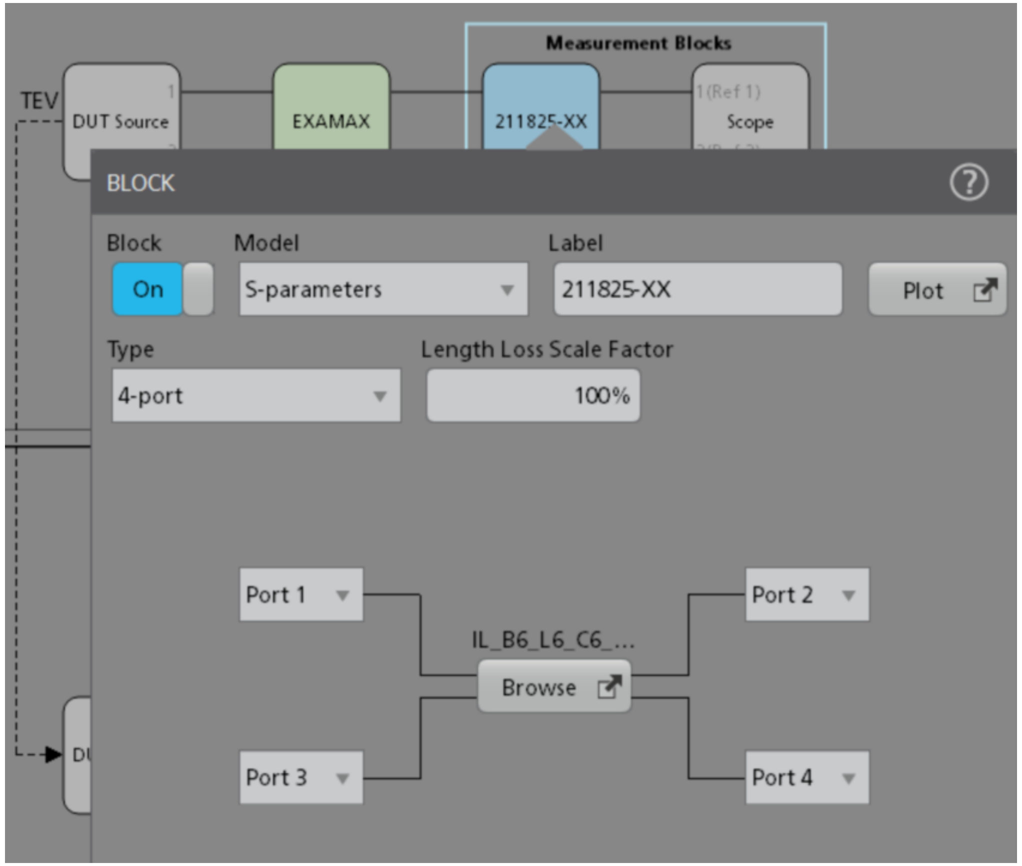
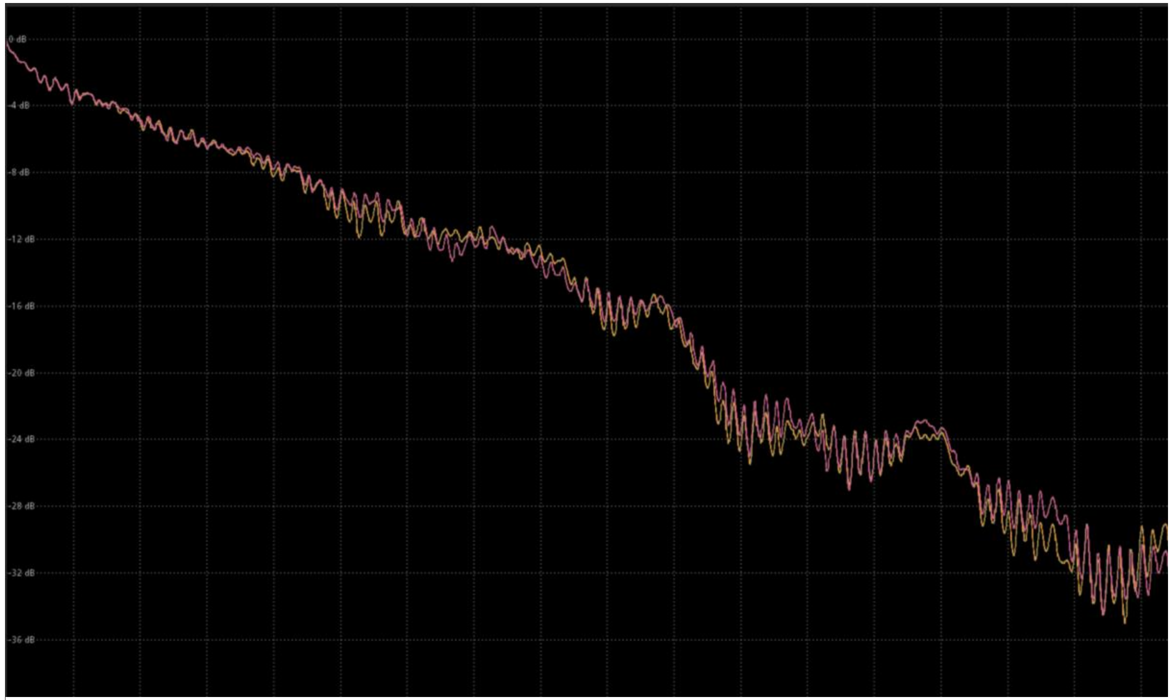
Defining Block 2 Loading Cable Vendor S4P





This second Block is the specific cable fitted with the Backplane connectors
Lets Load the Vendor Provided S4P File and look at insertion Loss behavior
about -16dB @20GHz

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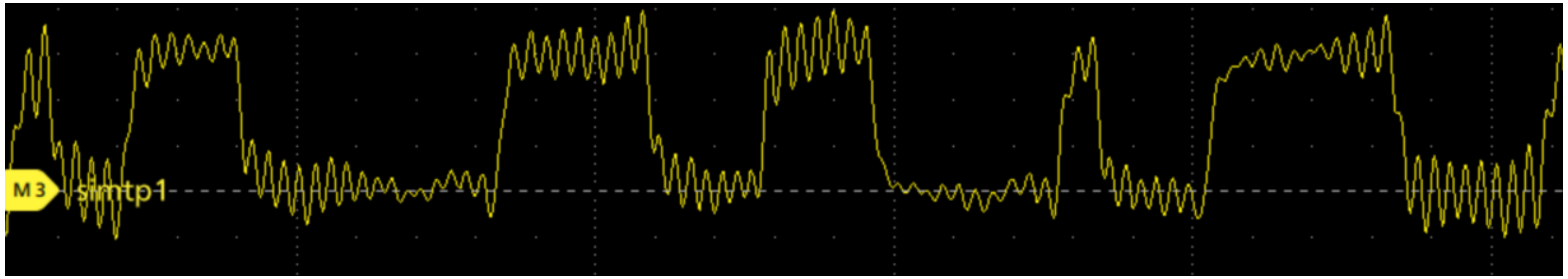
What is De-Embedding?

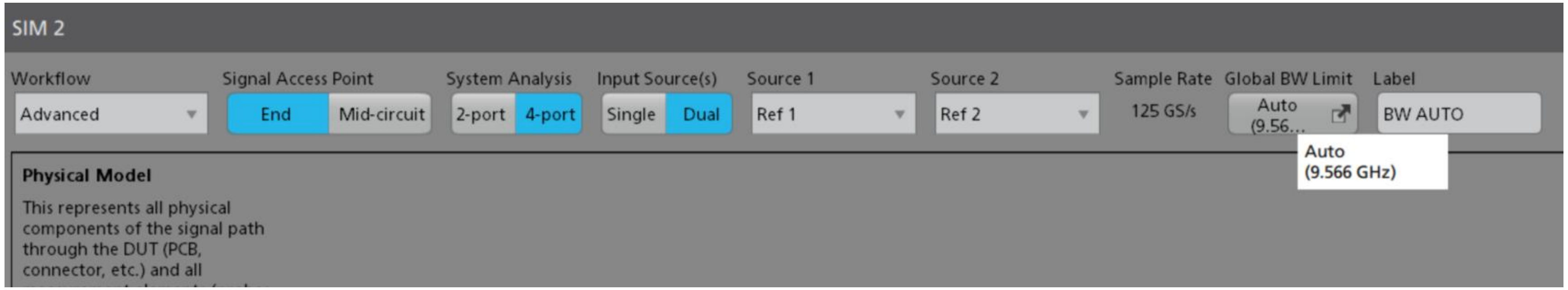
Compensating for Measurement Channel Frequency dependent Losses
How much Gain Loss can we compensate for?
->It depends on Scope Enob and Signal Noise Floors
For a 8bit ADC Scope: 12dB is good starting point
For a 12bits ADC Scope with excellent Enob >=20dB can be compensated

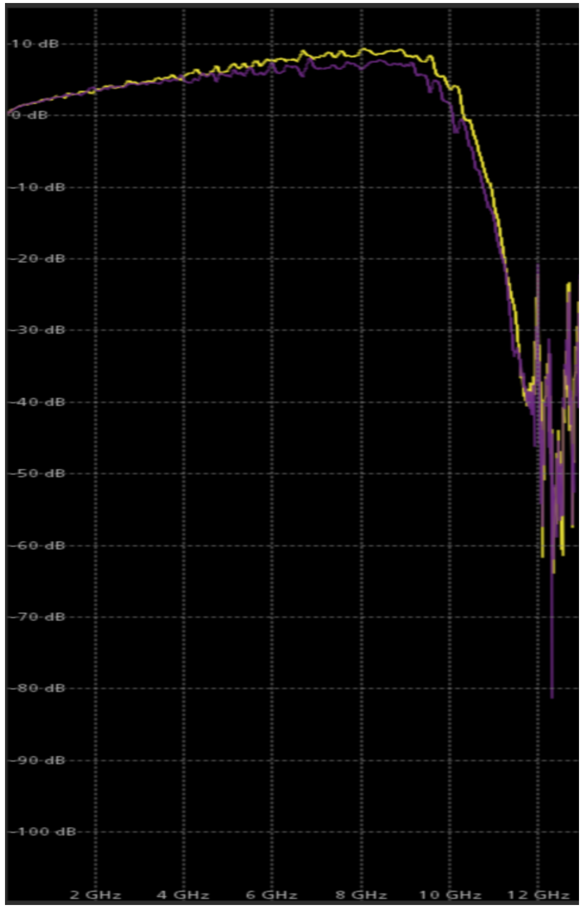
What happened if I de-Embedded too much Bandwidth with too much Gain:
De-Embedded Signal will exhibit Rigging or/and excessive noise

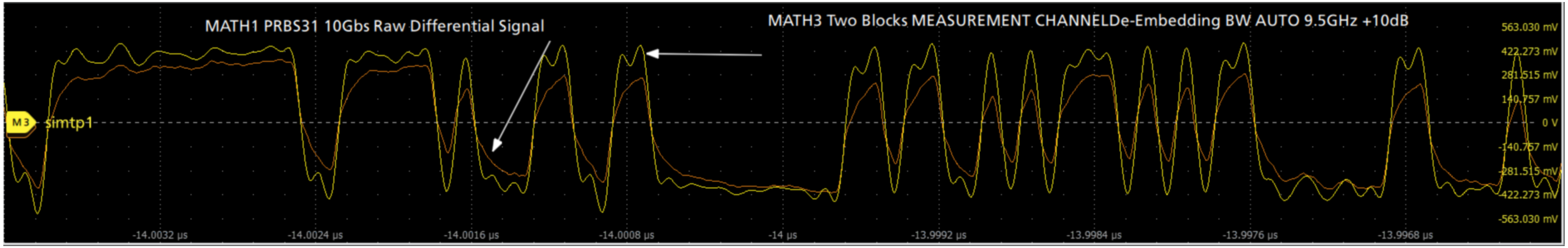


De-Embedding :Global BW Limit AUTO

So practically we are compensating Math1 signal of Measurement Channel Loss up to about 10dB which happens to be at about 9.5GHz
Output is Yellow Math3 signal







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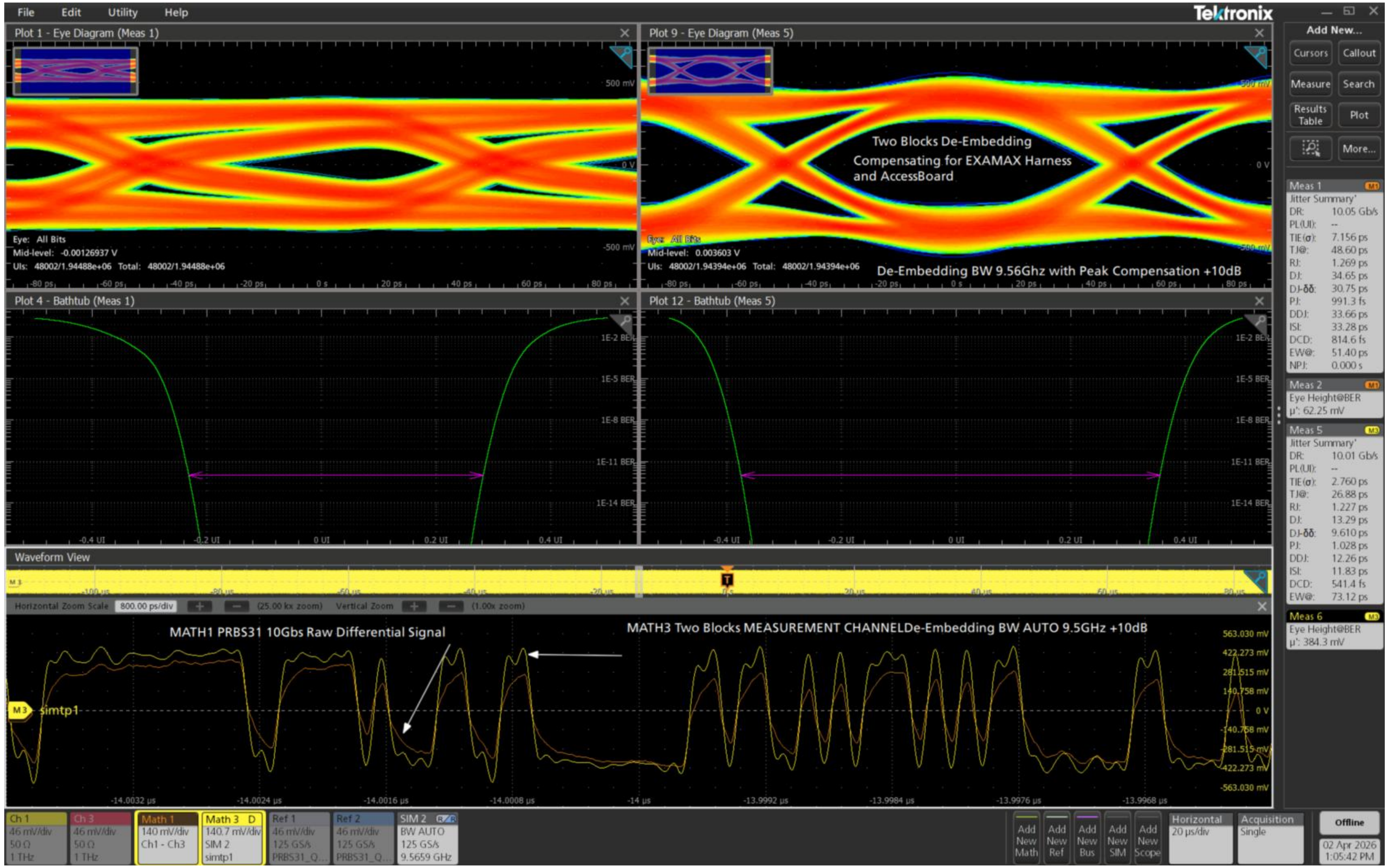
10Gbs PRBS31 with De-Embedding up to 9.5GHz

Raw Signal
EyeHeight@BER: 62.5mV
TJ@BER 1e-12: 48.6ps

De-Embedded
EyeHeight@BER: 384mV
TJ@BER 1e-12:26.9ps

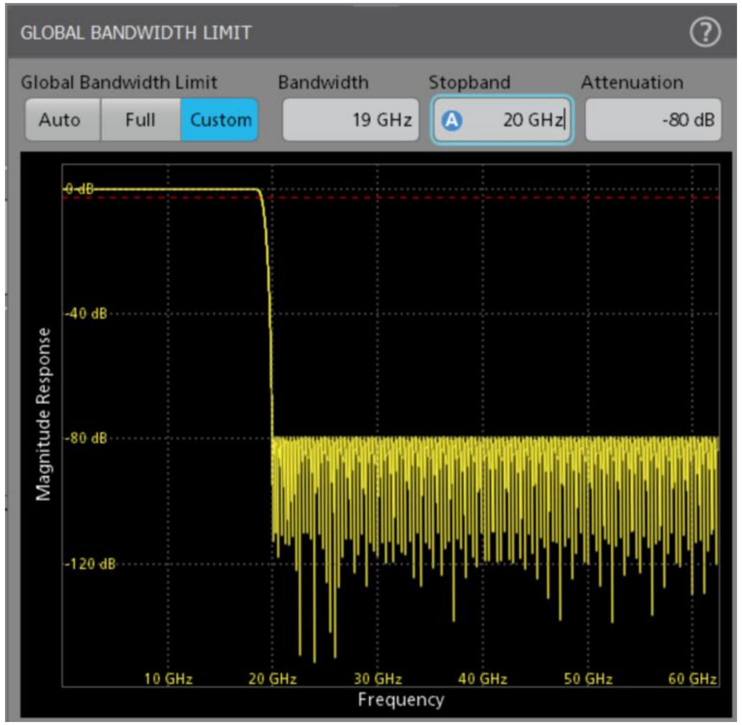
Major Improvement

in Vertical Eye Opening
and Predicted Total Jitter



Pushing the De-Embedding BW?

If your DUT signal Vertical RMS Noise is low
and Oscilloscope vertical Noise Floor also Low,
yielding Low Random Jitter despite the Channel
insertion loss,
We can Push the De-Embedding Global Bandwidth
Limit to 19GHz (about +10db @10GHz up to
+19dB@GHz)



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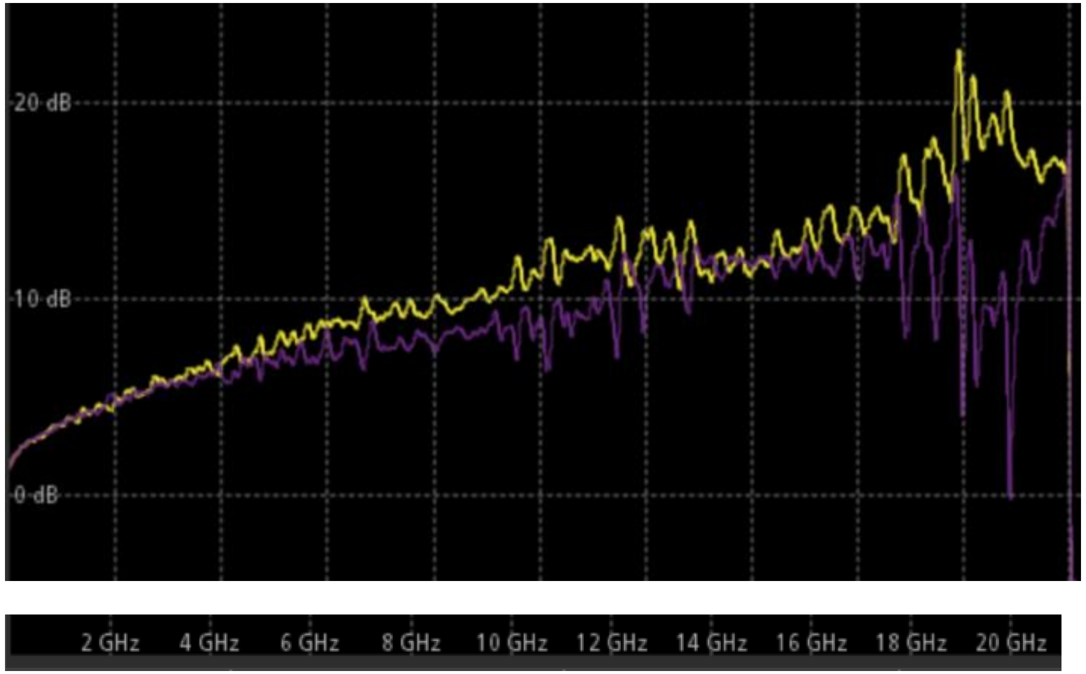
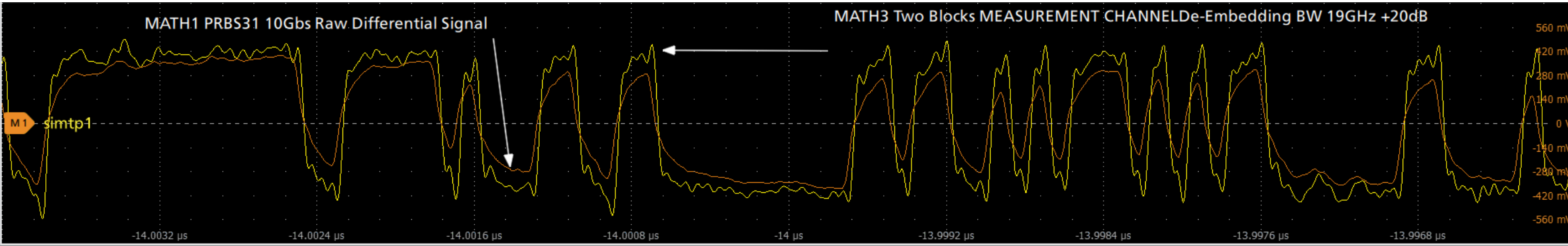
Global BW Limit MANUAL

Switching to Custom Global BW Limit, and Pushing BW to 19GHz and setting StopBand to 20GHz to reach about +20dB of Max compensation



Yellow Signal is clearly more define with faster rise times But without excessive noise nor ringing artifacts



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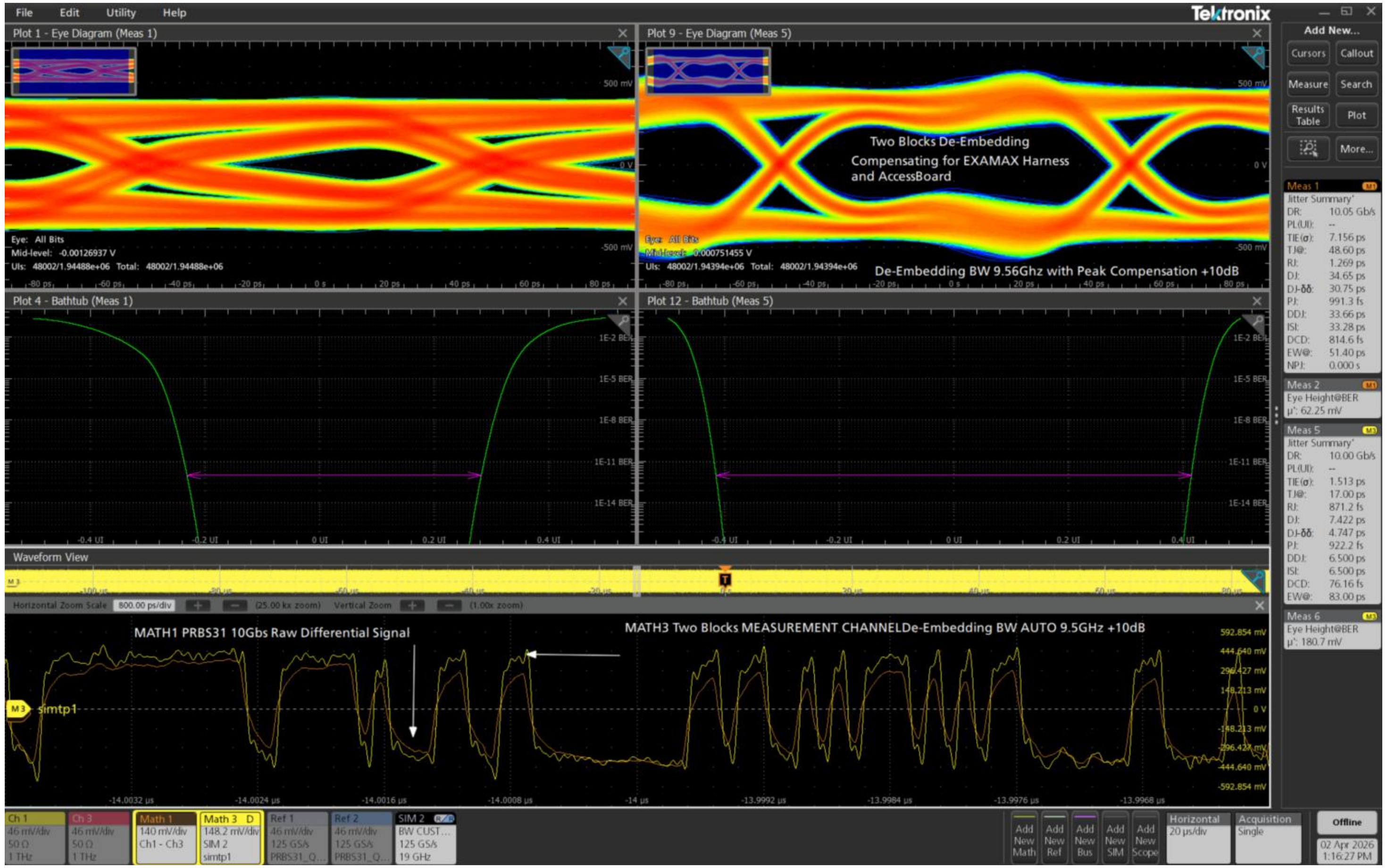
10Gbs PRBS31 with De-Embedding up to 19GHz

RJ:
Raw 1.269ps RMS
DE: 0.87ps RMS

ISI
Raw:33.28ps
DE:6. 5ps

TJ@1e-12
Raw:48.60ps
DE:17ps



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Conclusion

When Oscilloscope and DUT Noise Floors are very Low, Higher Measurement Channel Frequency Dependent Losses De-Embedding can be achieved to Recover DUT Real Signal WITH acceptable noise Penaltyyielding Eye Opening and Jitter Performances closer to True DUT Performances

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