Experimental Post-FEC Results to Validate Functional test Margin Parameters

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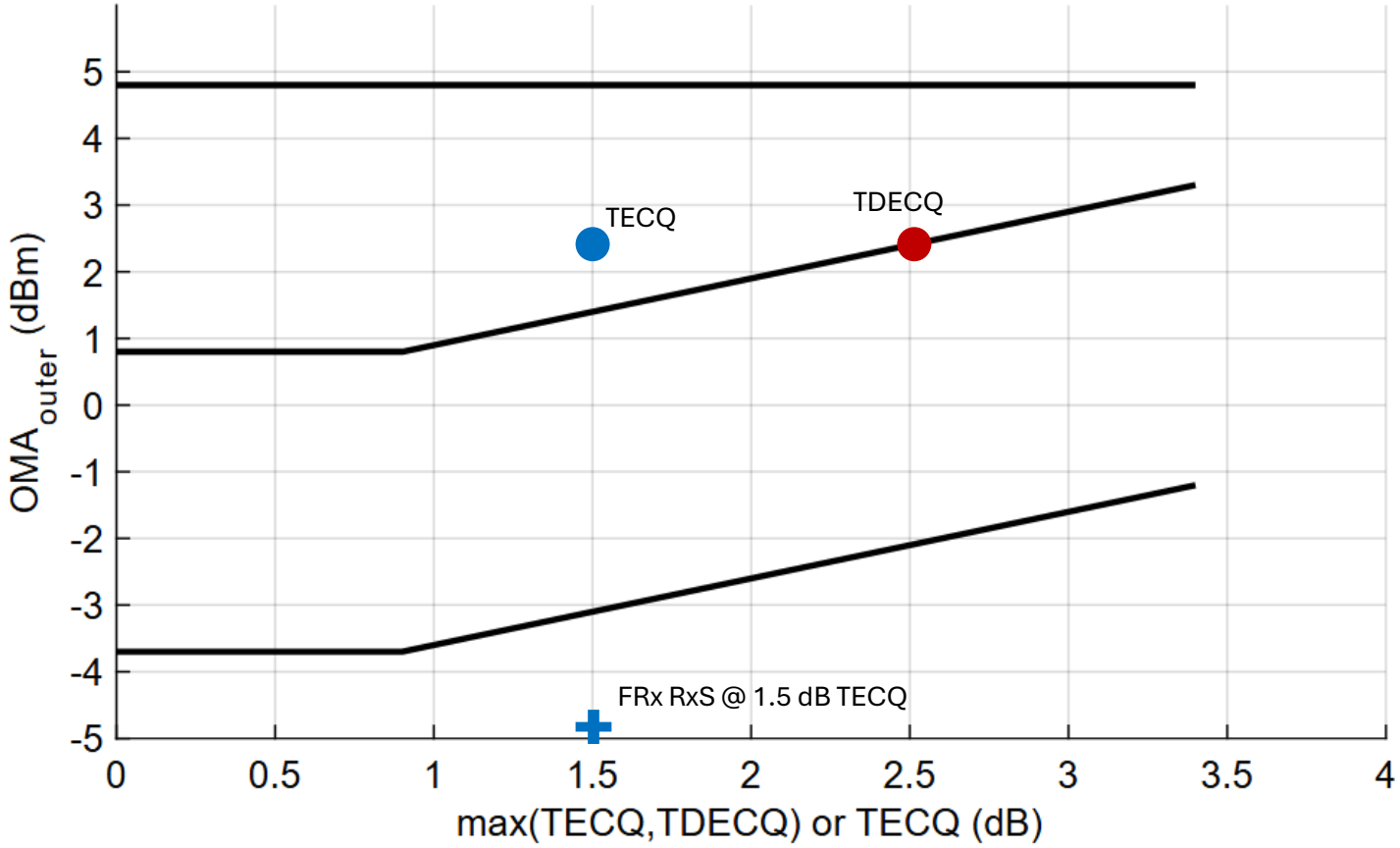
Outline

- Functional Receiver (FRx) OMA Calculation – Step-by-Step
- Post-FEC Analysis for Determining Functional Test Margin

Functional Receiver (FRx) OMA Calculation – Step-by-Step

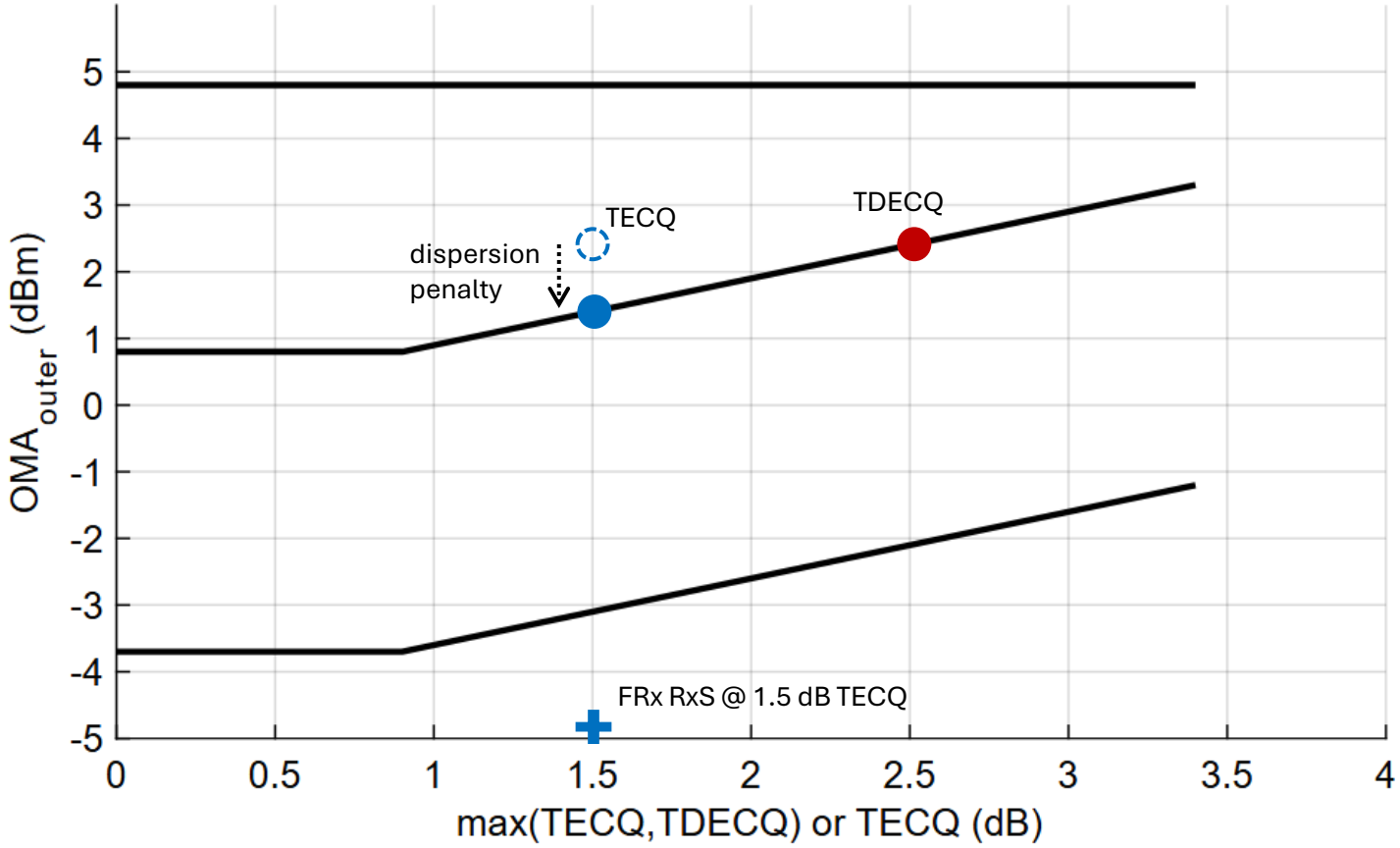


Example Parameters

- TECQ = 1.5 dB
- TDECQ = 2.5 dB
- Dispersion Penalty = 1.0 dB
- FRx Sensitivity Margin = 1.5 dB
- OMAmin Spec Margin = 0 dB

Step 1: Calibrate for Dispersion Penalty

FRx_OMA = Tx DUT OMA – **Dispersion Penalty**

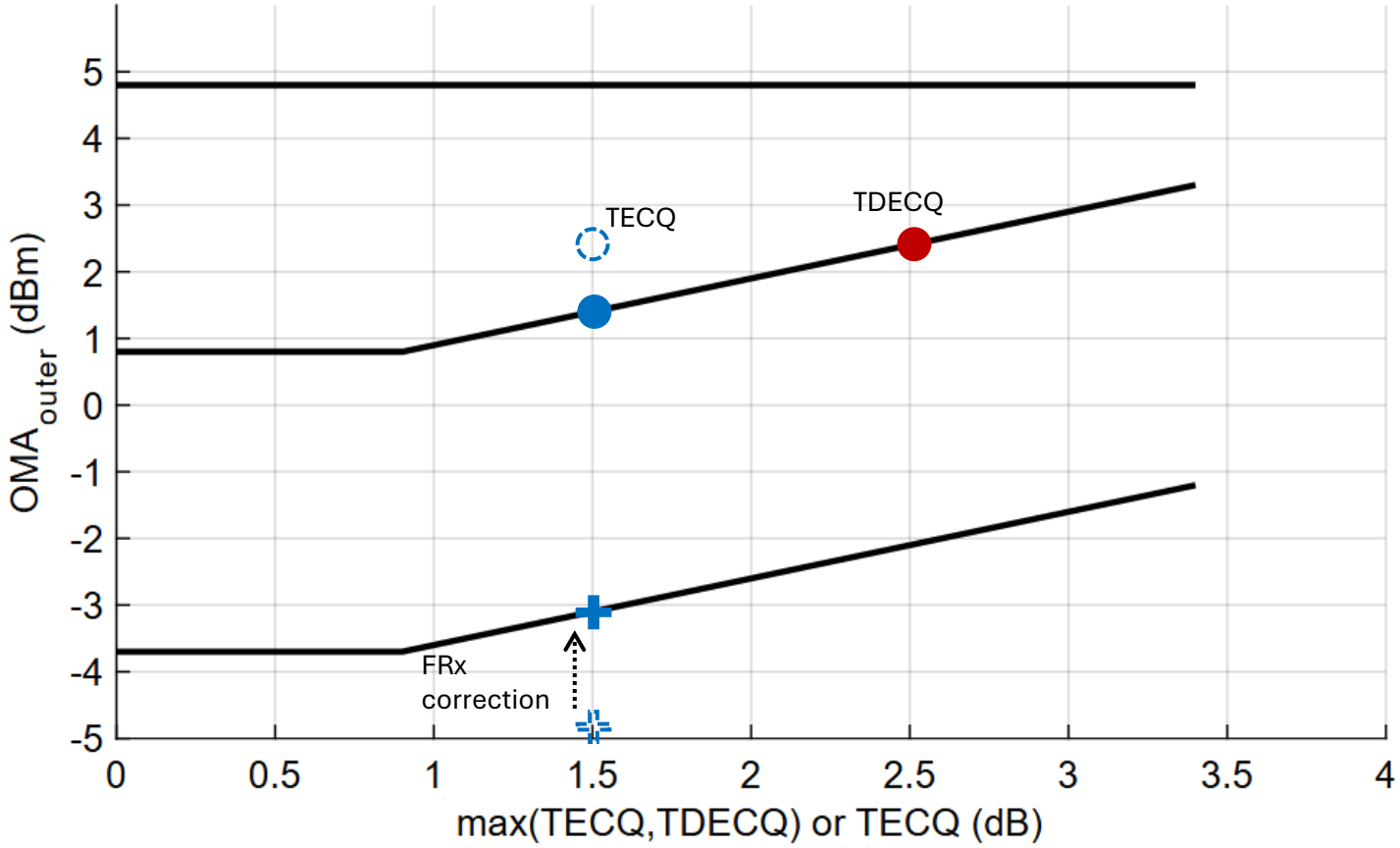


Apply dispersion penalty to the Tx DUT B2B measurement.

This calibration ensures the Tx test setup accounts for optical dispersion.

Step 2: Calibrate FRx to Minimum Spec

FRx_OMA = Tx DUT OMA – Dispersion Penalty – **FRx Correction**



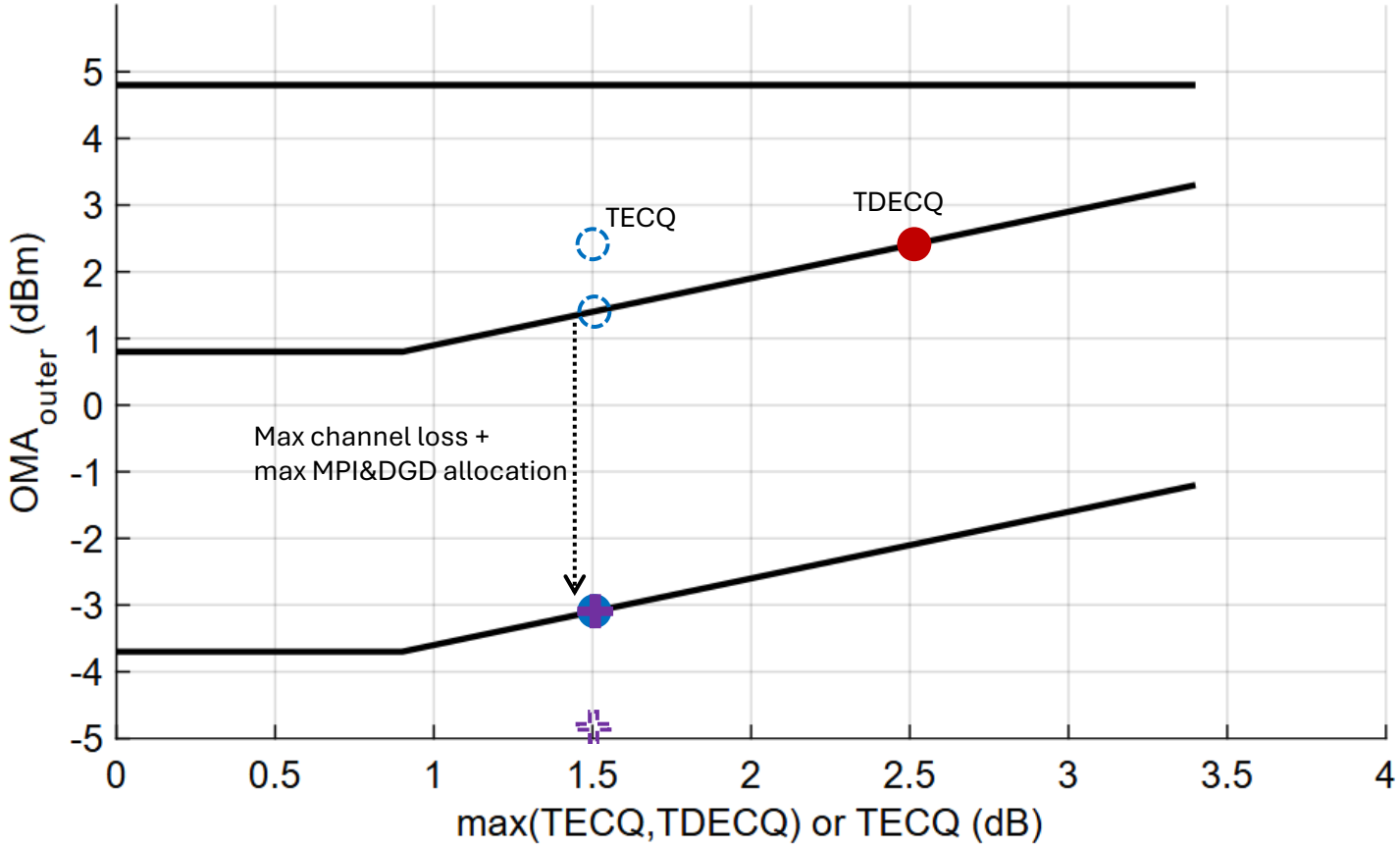
Adjust FRx sensitivity (based on block error ratio) upward by its margin to align with the spec limit.

This is equivalent to attenuating the signal before it reaches the receiver.

Now both the transmitter and receiver are calibrated for dispersion and worst-case sensitivity performance.

Step 3: Include Maximum Link Budget Losses

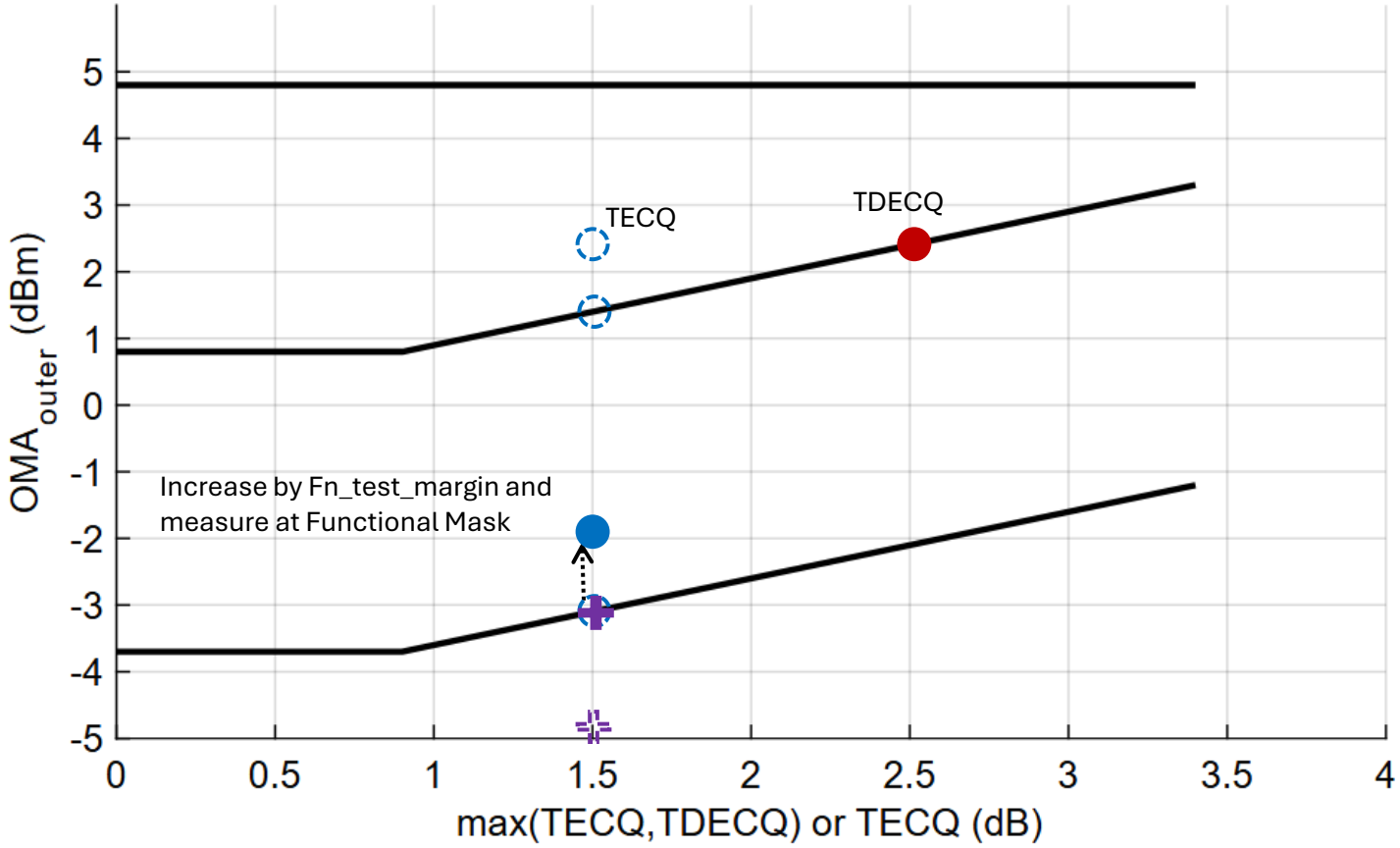
FRx_OMA = Tx DUT OMA – Dispersion Penalty – FRx Correction – **Max Channel Loss – Max MPI/DGD Allocation**



Add the maximum allowed optical channel loss, and worst-case contributions from MPI and DGD

Step 4: Evaluate Near Typical Operating Point

FRx_OMA = Tx DUT OMA – Dispersion Penalty – FRx Correction – Max Channel Loss – Max MPI/DGD Allocation **+ Fn_test_margin**

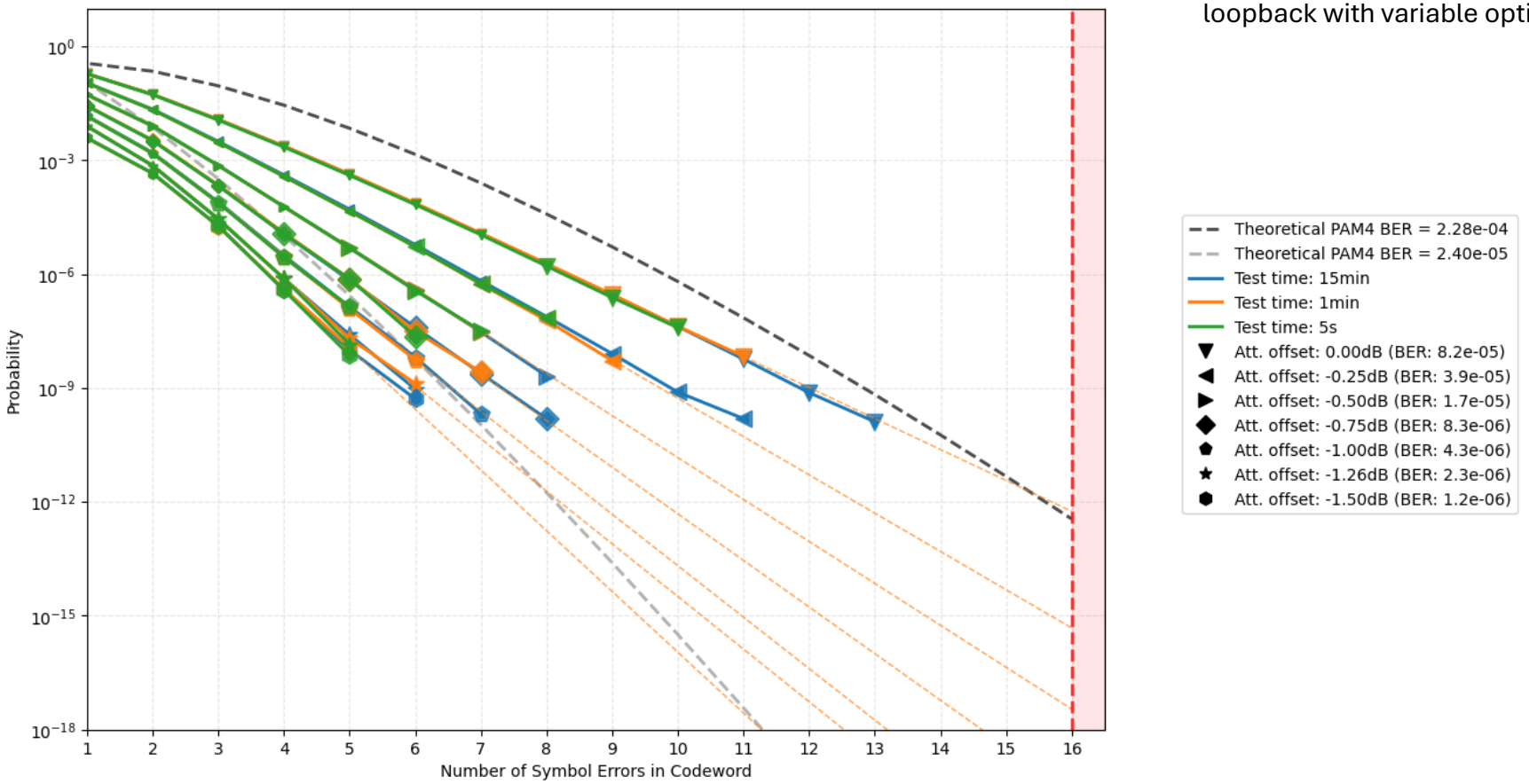


Increase receive input power into FRx to test closer to the typical operating point instead of at the SNR limit

Evaluate performance against the block error mask corresponding to random error BER of 2.4e-5 (Functional Mask)

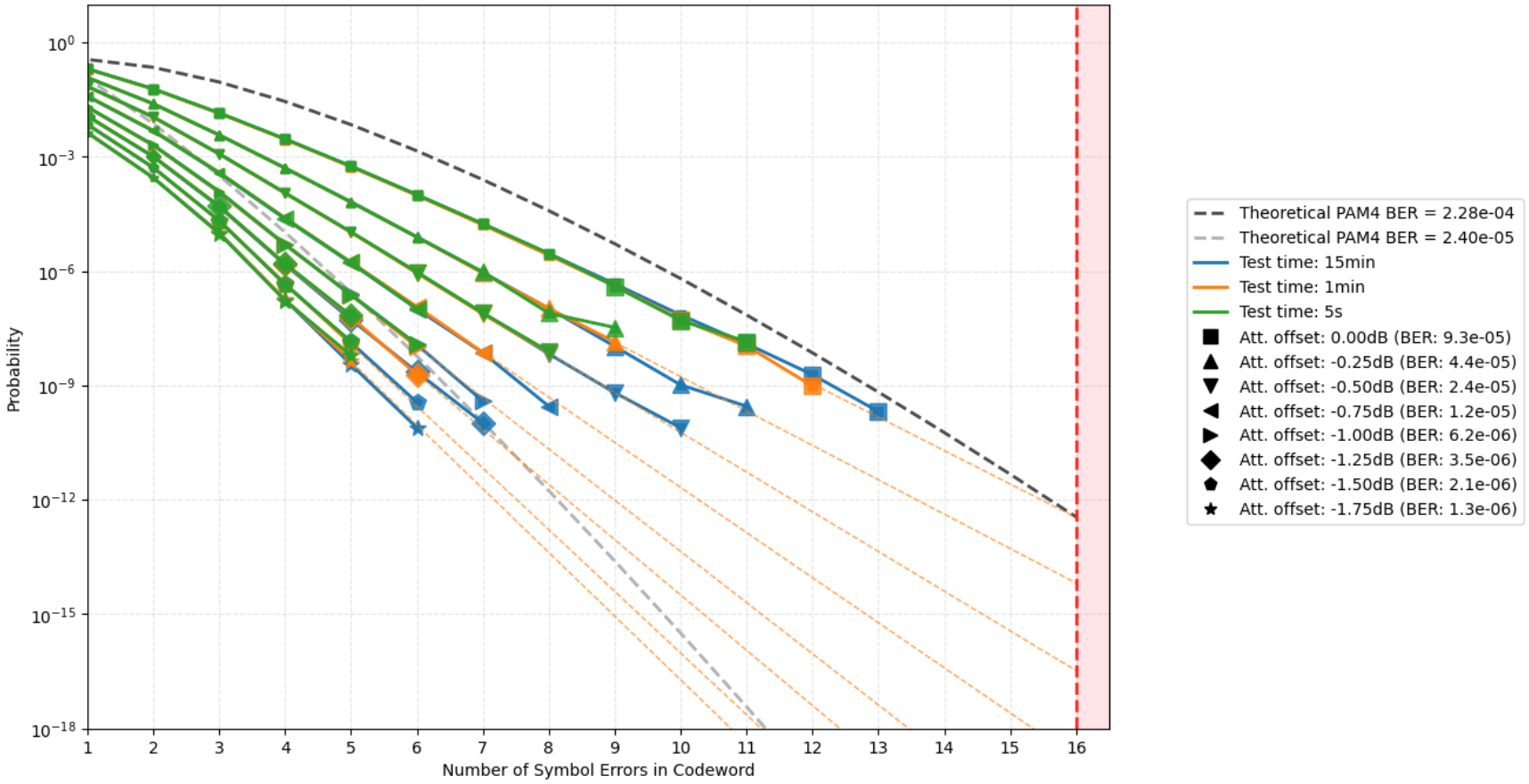
PostFEC results - Example 1

*Testing individual lane of an 800G module using a Viavi ONT in 4x200G mode, configured in optical loopback with variable optical attenuation



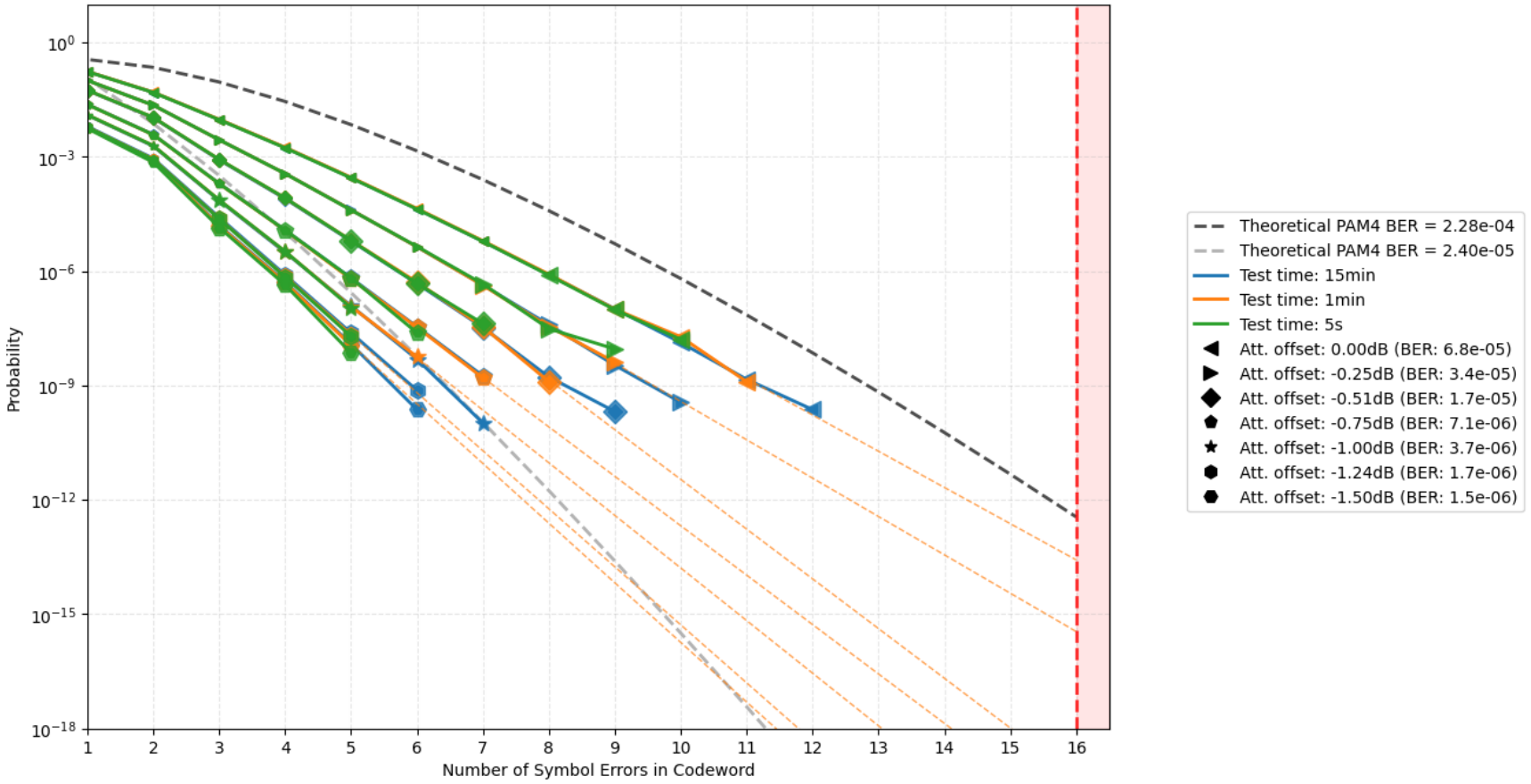
With attenuation set to the Rx sensitivity limit, the 1.5 dB functional_test_margin crosses the Functional Mask around 1e-18 probability.

PostFEC results - Example 2



With attenuation set to the Rx sensitivity limit, the 1.5 dB functional_test_margin crosses the Functional Mask around 1e-18 probability.

PostFEC results - Example 3



Although this transmitter had some Tx OMA margin, it still crosses the functional mask before reaching a probability of 1e-18, even with a 1.5 dB functional_test_margin applied.

Summary

- Recommendation: Use 1.5 dB as the Functional Test Margin