

# Implementing an Extinction Ratio of 3.5 dB in 50GBASE-FR/LR in P802.3cd

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# Supporters

- Jonathan King, Finisar
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- ..

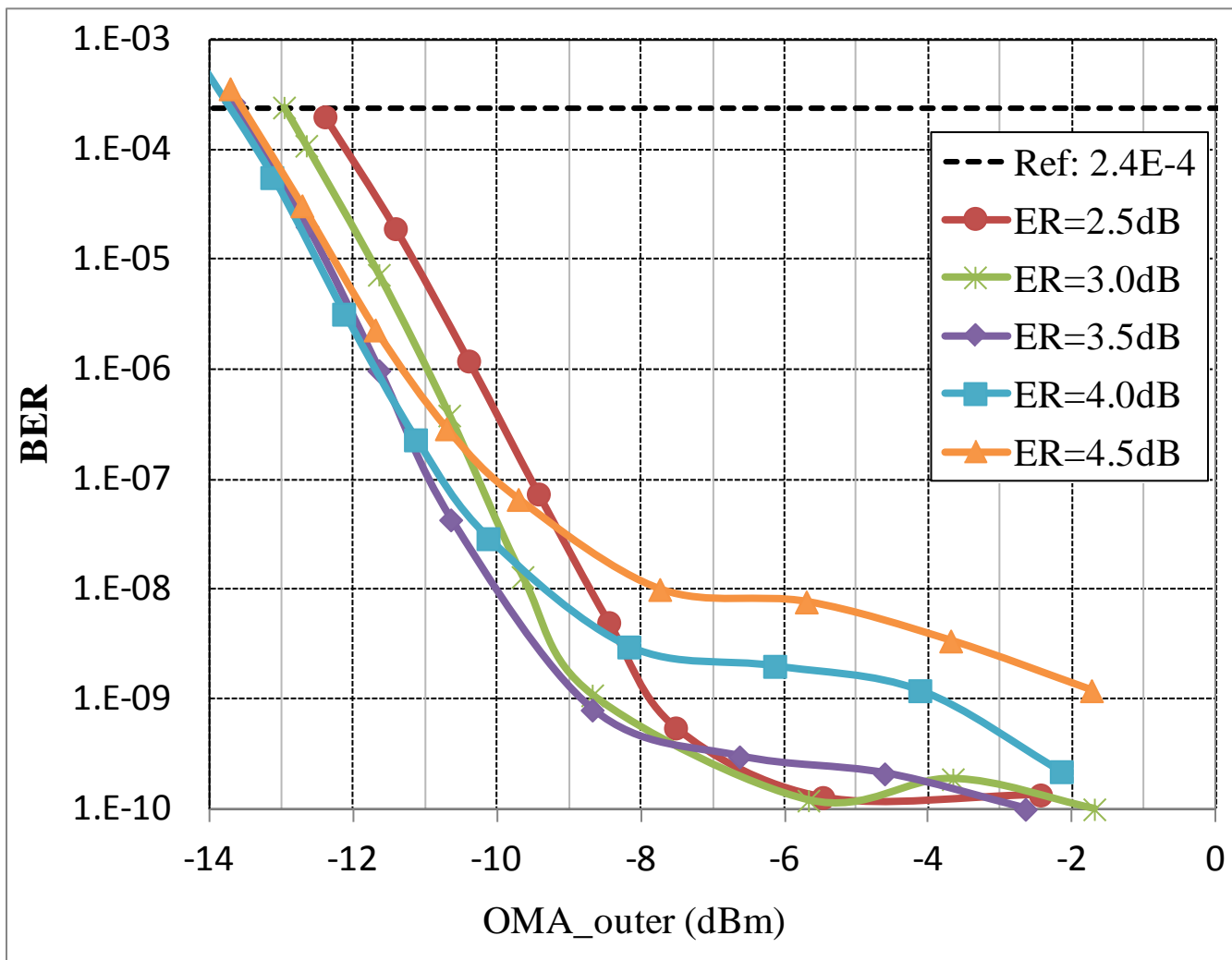
# Introduction

- **Update to stassar\_061417\_3cd\_adhoc-v2 to ad hoc 14 June 2017.**
- For P802.3cd D1.3 it was proposed to lower the Extinction Ratio for 50GBASE-FR and -LR, specified in Clause 139, from 4.5 dB to 3.5 dB.
- As analysed in [king\\_3cd\\_02\\_0317](#) and [anslow\\_01\\_0517\\_smf](#) (in 802.3bs), lowering the ER to 3.5 dB will increase the maximum MPI penalty by about 0.1 dB, noting that for 50GBASE-FR/LR the same model applies as for 200/400GBASE-FRx/LRx.
- Furthermore [anslow\\_01\\_0517\\_smf](#) provides some additional constraints for maximum discrete reflectance to limit the increase in MPI penalty to 0.1 dB.
- This presentation provides some considerations on how to implement an Extinction Ratio of 3.5 dB in Clause 139.

# Considerations

- In [dawe\\_3cd\\_01\\_0517](#) it was proposed to put the “burden” of an extinction ratio between 3.5 and 4.5 dB on those transmitters needing it by proposing an increase in the minimum  $\text{OMA}_{\text{outer}} - \text{TDECQ}$  by 0.1 dB for an ER between 3.5 and 4.5 dB.
- During the New Orleans meeting, 22 – 26 May, it was verbally suggested to consider putting the whole burden on the receiver instead of the transmitter, if sufficient margin would be present in 50G PAM4 receiver performance.
- The following slide shows test results of PAM4 receiver sensitivity for a wide range of ER values.

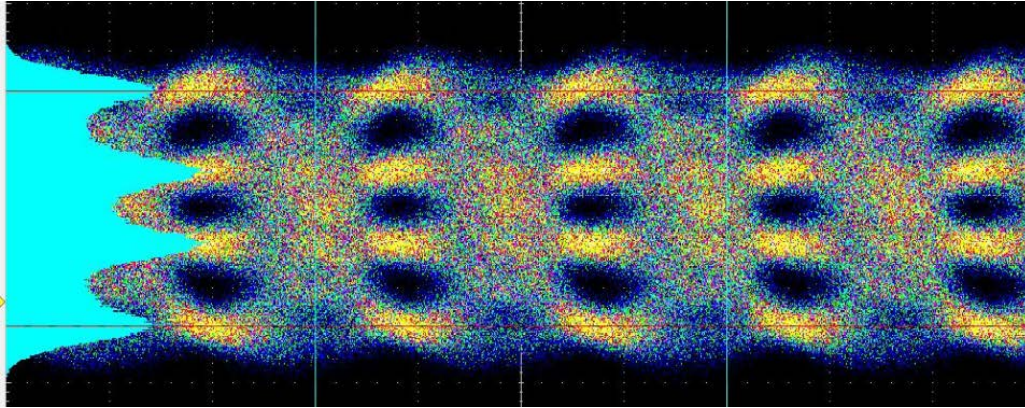
# BER performance 50G PAM4 Rx versus ER



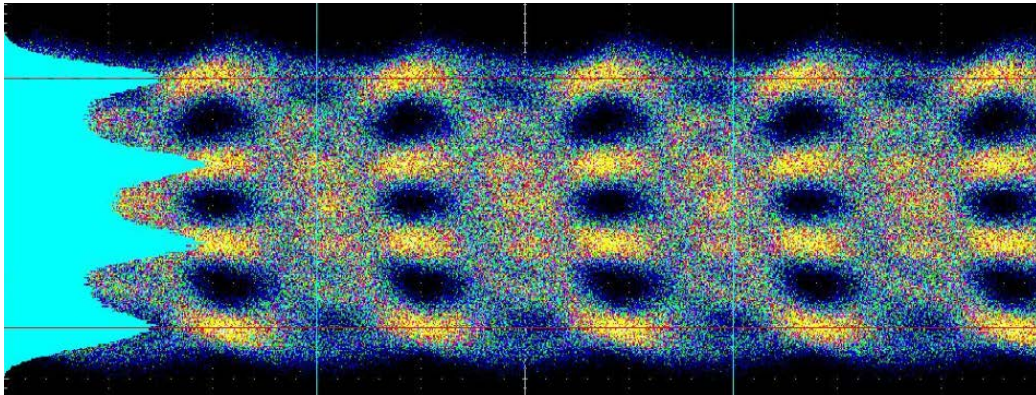
Rx @ 25C  
Source: DML  
Pattern: PRBS31

Updated:  
ER measured via  
Scope.  
IEEE method  
≤ 0.15 dB higher  
value

# Eye diagrams



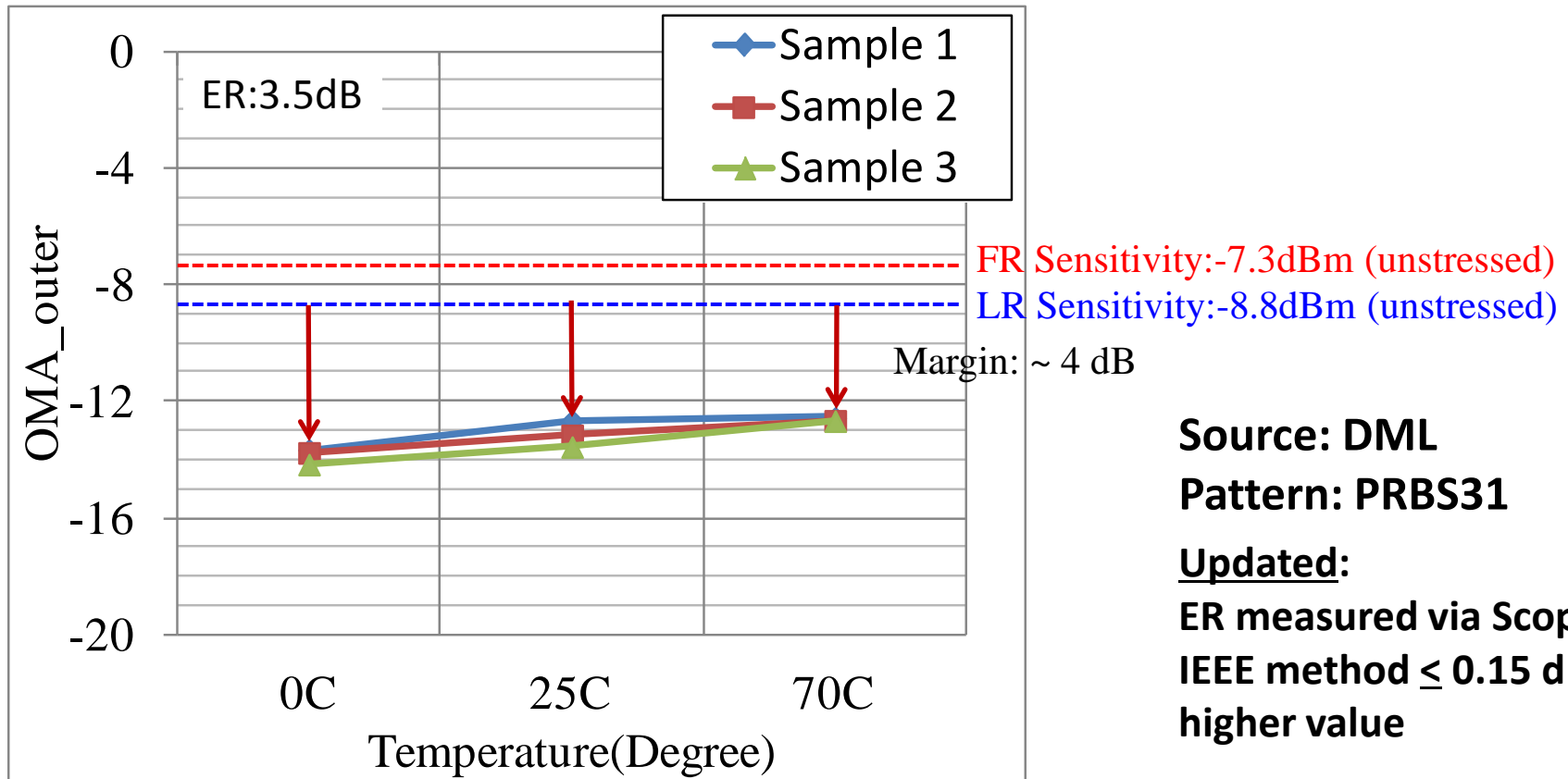
ER: 3.5dB



ER: 4.5dB

**Updated:**  
ER measured via  
Scope.  
IEEE method  
 $\leq 0.15$  dB higher value

# Margins for PAM4 Receiver Sensitivity ( $OMA_{outer}$ )



Margin >4 dB against -8.8 dBm LR (unstressed) receiver sensitivity spec for perfect transmitter (SECQ = 0dB)

Actual margin even bigger because test transmitter will have SECQ > 0dB

# Margins

- The shown test results demonstrate a margin of more than 4 dB against the specified receiver sensitivity ( $\text{OMA}_{\text{outer}}$ ) (max) of -8.8 dBm for 50GBASE-LR and more than 5.5 dB for the 50GBASE-FR specification of -7.3 dBm.
- 50GBASE-LR and FR receiver (unstressed) sensitivity values are for a perfect transmitter, so more margin in this test, assuming that test transmitter has  $\text{SECQ} > 0\text{dB}$ .
- These results support the suggestion that even after tightening the receiver sensitivities of 50GBASE-FR/LR by 0.1 dB there would still be more than sufficient margin to allow low cost manufacturing of receivers for both applications.



# Proposed specification changes

## Table 139-6

- Change Extinction ratio (min) from 4.5 dB to 3.5 dB

## Table 139-7

- Change Receiver sensitivity ( $\text{OMA}_{\text{outer}}$ ) (max):
  - From -7.3 dBm to -7.4 dBm for 50GBASE-FR
  - From -8.8 dBm to -8.9 dBm for 50GBASE-LR.
- Change Stressed receiver sensitivity ( $\text{OMA}_{\text{outer}}$ ) (max):
  - From -5 dBm to -5.1 dBm for 50GBASE-FR
  - From -6.3 dBm to -6.4 dBm for 50GBASE-LR.

# Proposed further specification changes

## Table 139-8

- Change Power budget (for maximum TDECQ):
  - From 6.6 dB to 6.7 dB for 50GBASE-FR
  - From 9.3 dB to 9.4 dB for 50GBASE-LR.
- Allocation for penalties (for maximum TDECQ):
  - From 2.6 dB to 2.7 dB for 50GBASE-FR
  - From 3 dB to 3.1 dB for 50GBASE-LR.

## Table 139-14

- Change maximum value for each discrete reflectance:
  - From -39 dB to -40 dB for 8 reflectances for 50GBASE-FR
  - From -40 dB to -41 dB for 10 reflectances for 50GBASE-FR
  - From -38 dB to -39 dB for 10 reflectances for 50GBASE-LR

# Thanks