10GBASE-S/L/E eye mask

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Introduction

It has been proposed to “add to Clause 52 an alternative optical transmitter eye-mask test, which leverages the statistical eye mask measurement techniques developed for 802.3aq and 802.3ba”

The existing eye mask for 10GBASE-S/L/E in Clause 52 has to be met with no samples at all violating the mask. This test suffers from poor reproducibility in that there is a significant device performance change needed to go from always passing to always failing the test. See:

http://www.ieee802.org/3/ba/public/mar08/dawe_01_0308.pdf

The transmitter requirements for 10GBASE-LRM, 40GBASE-SR4/ER4, 100GBASE-SR10/LR4/ER4 in Clauses 68, 86, 87 and 88 have all departed from this methodology by specifying a maximum hit ratio of 5×10^{-5}.

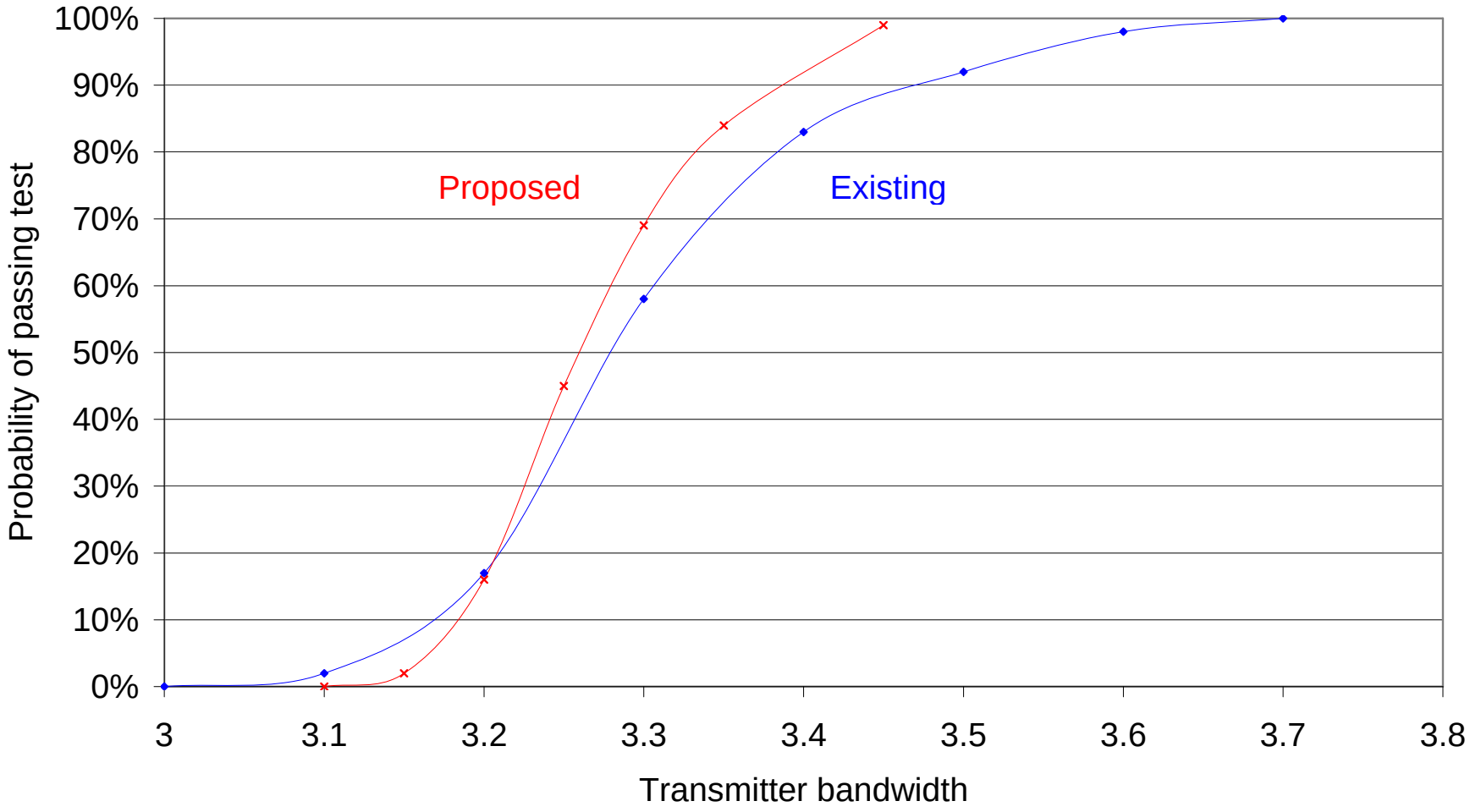
If the eye mask were to be changed to allow a hit ratio of 5×10^{-5} using the same mask coordinates, this would allow worse transmitters to pass the new test than can pass the existing one.

Simulations

In order to investigate this, simulations were performed on transmitters that were preceded by a fourth-order Bessel-Thomson filter in order to close the transmitted eye and with some noise added at the test receiver to model oscilloscope sampling noise. These transmitters were then assessed using the Clause 52 eye mask with the requirement that no samples should be within the mask. The results are shown on the blue curve on the next slide where the probability of passing the test is plotted against the transmitter bandwidth (262,144 samples in each test).

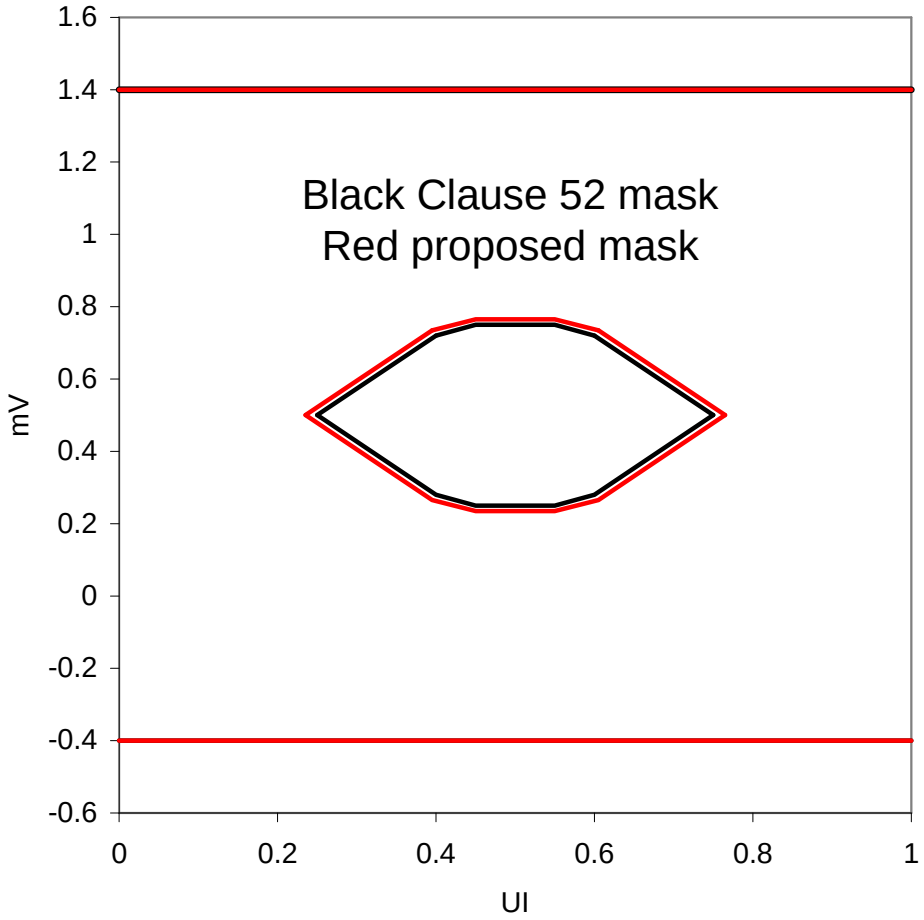
A second set of simulations were then performed using a slightly expanded version of the Clause 52 mask with an allowed hit ratio of 5×10^{-5}. The expanded mask was chosen so that the two tests start to pass devices at the same transmitter bandwidth (red curve on the next slide).

Simulations



Resulting mask

The eye mask for the current 10GBASE-S/L/E is shown below (black) together with the proposed alternative mask (red).



Conclusions

As can be seen from the curves on slide 4, the proposed hit ratio test is much steeper than the zero hits eye mask and therefore provides a better discriminator between a “good” and “bad” transmitter. Devices that passed the old test with a low probability (less than 15%) have a lower probability of passing the new test, so the “worst” passing device becomes better. The payback is that devices that only occasionally fail (around 10% failure rate) will nearly always pass with the new test.

Note: the steepness of this curve can be further improved by capturing a higher number of samples than were used for the simulations.

Existing Clause 52 eye mask:

{X1, X2, X3, Y1, Y2, Y3} = {0.25, 0.4, 0.45, 0.25, 0.28, 0.4}

Proposed alternative eye mask:

{X1, X2, X3, Y1, Y2, Y3} = {0.235, 0.395, 0.45, 0.235, 0.265, 0.4} with 5×10^{-5} hits allowed

Thanks!