

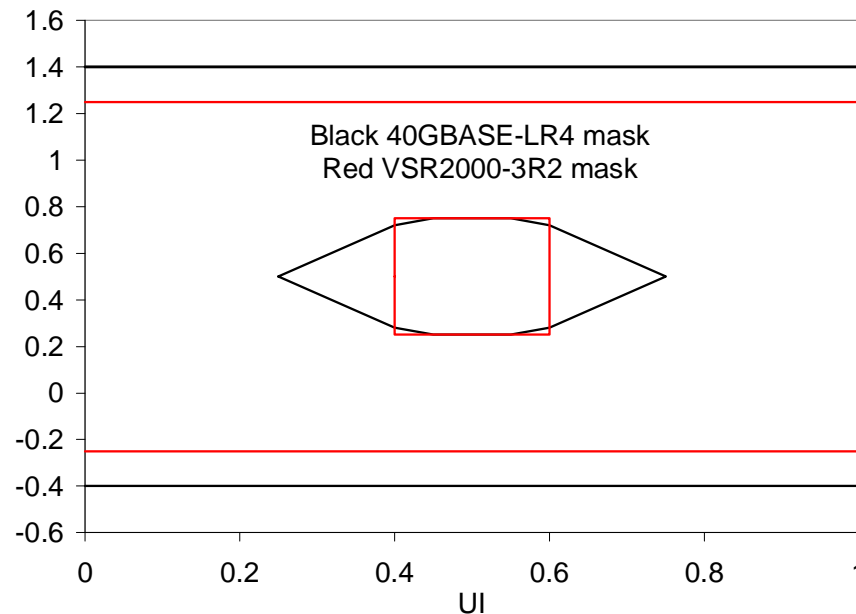
# 40GBASE-FR eye mask

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IEEE P802.3bg, San Diego, July 2010

# Introduction

The eye mask for VSR2000-3R2 in ITU-T G.693 is shown below (red) together with the mask used for the 40 and 100G Ethernet optical PMDs (black).



However, since the corners of the red mask are outside the black mask and the black mask allows a hit ratio of  $5 \times 10^{-5}$  the black mask is easier to pass for transmitters with restricted bandwidth than the red one.

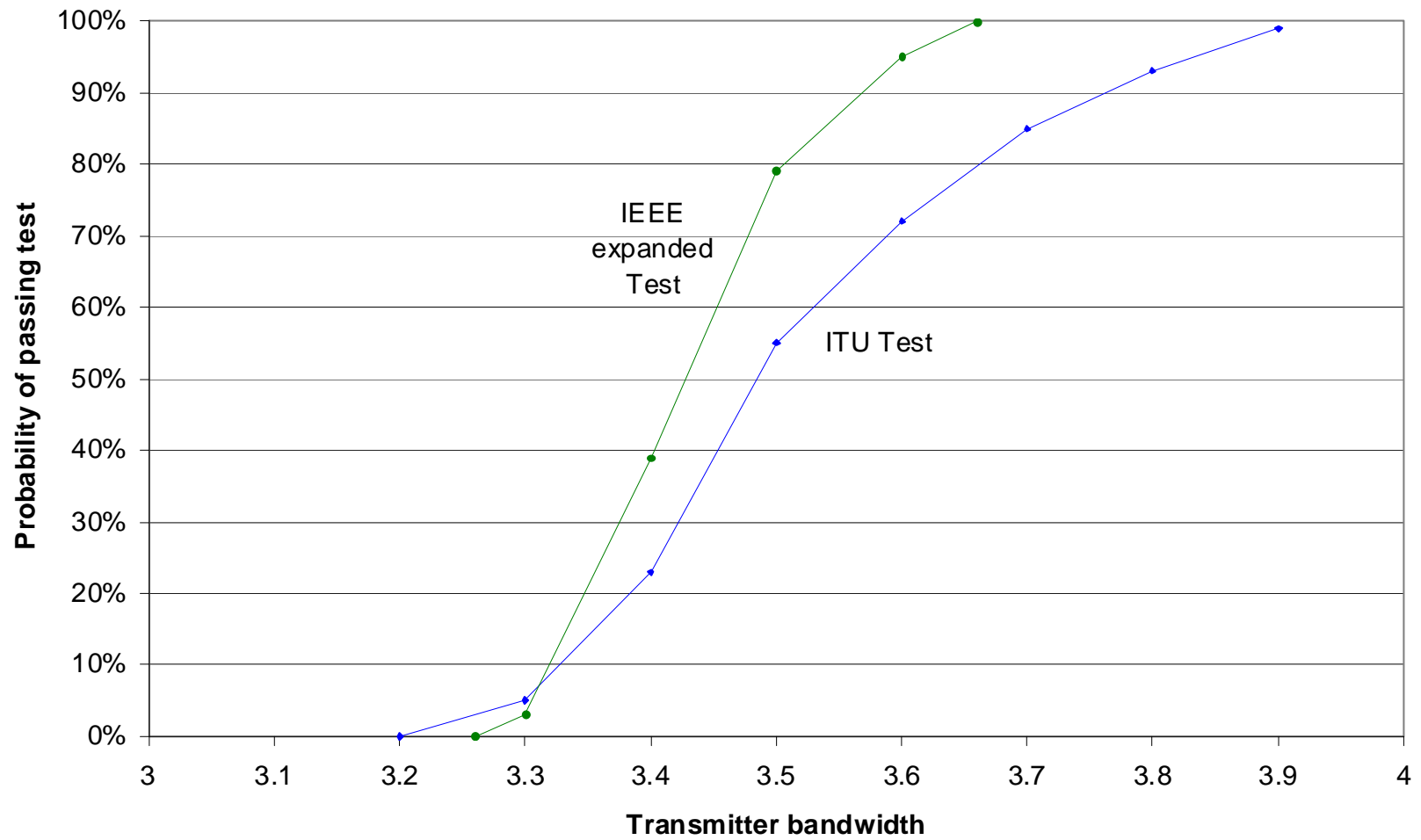
# Simulations

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 added noise at the receiver to model oscilloscope sampling noise. These transmitters were then assessed using the ITU eye mask with the requirement that no samples should be within the rectangle. The results are shown on the blue curve on the next slide where the probability of passing the test (262,144 samples in each test) is plotted against the transmitter bandwidth.

A second set of simulations were then performed using a version of the 40GBASE-LR4 mask expanded vertically (still with a hit ratio of  $5 \times 10^{-5}$ ) so that the two tests start to pass devices at the same transmitter bandwidth (green curve on the next slide).

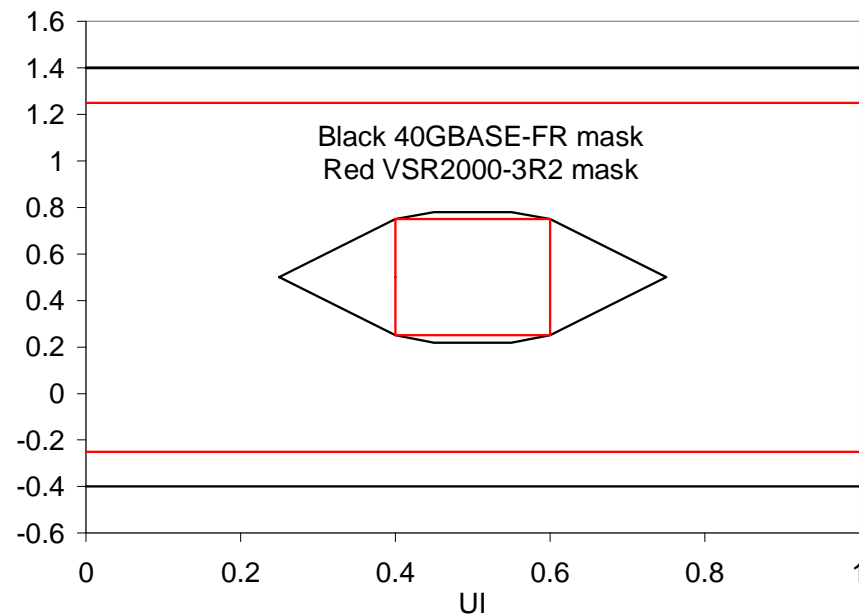
This latter eye mask has been adopted by ITU-T SG15 for new applications and is the mask in Draft 1.0 of P802.3bg for 40GBASE-FR.

# Simulations



# Resulting mask

The eye mask for 40GBASE-FR is shown below (black) together with the mask used for VSR2000-3R2 in ITU-T G.693 (red).



# Conclusions

As can be seen from the curves on slide 4, the hit ratio test is much steeper than the zero hits eye mask and therefore provides a better discriminator between a “good” and “bad” transmitter.

For this reason it is being adopted by ITU-T SG15 for new applications and as confidence in its use grows may be adopted (at least as an alternative) for existing applications.

This eye mask is therefore a good choice for use in 40GBASE-FR.

Thanks!