

# Big bad host output

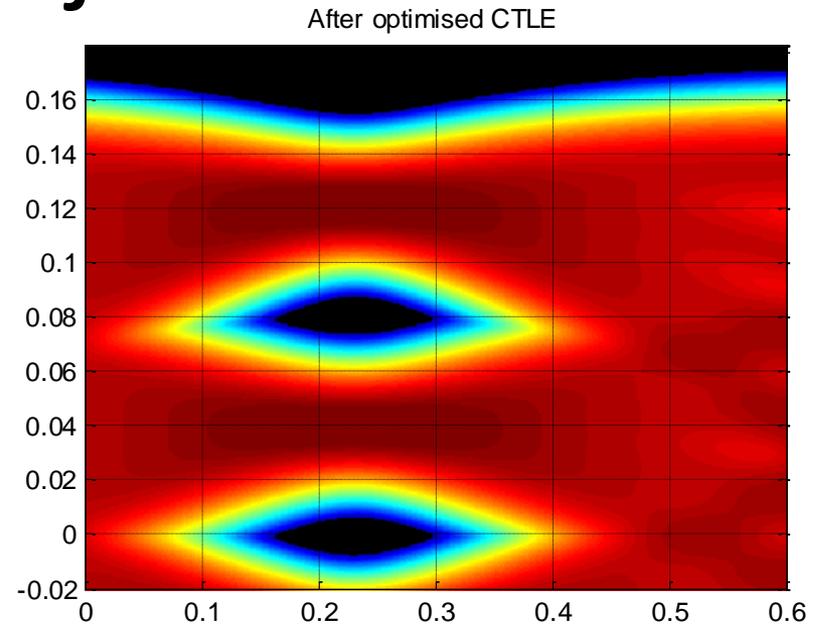
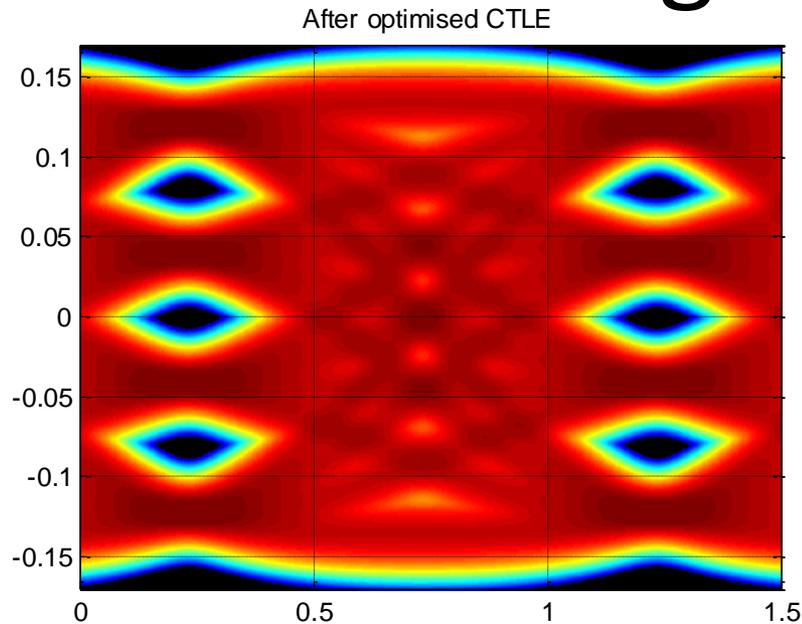
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# Introduction

- It was hoped that eye height and width after CTLE would enforce a receivable signal
- Eye width is relative to 1 UI, eye height is not relative to anything about the signal
- In the transmit direction (host to module) this allows unreasonable signals
- With the new CTLE, a worse signal than before passes
- We should keep the new CTLE but exclude the unreasonable signals another way

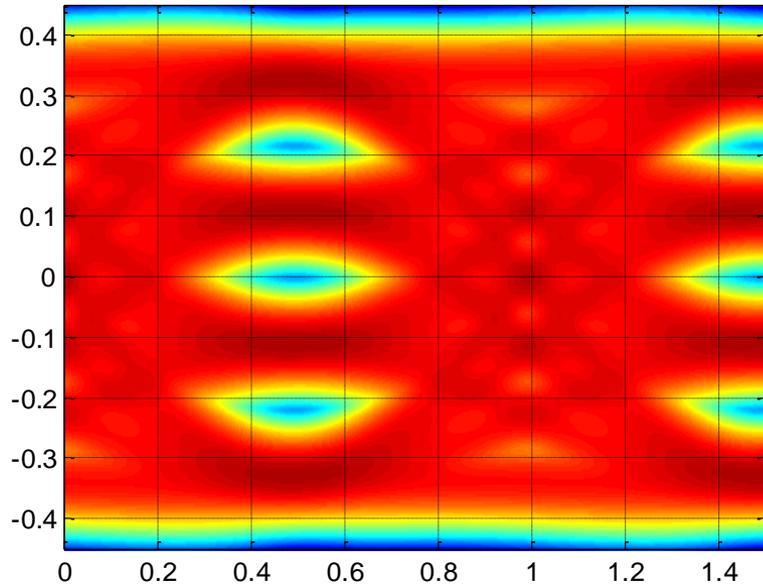
# Design objective



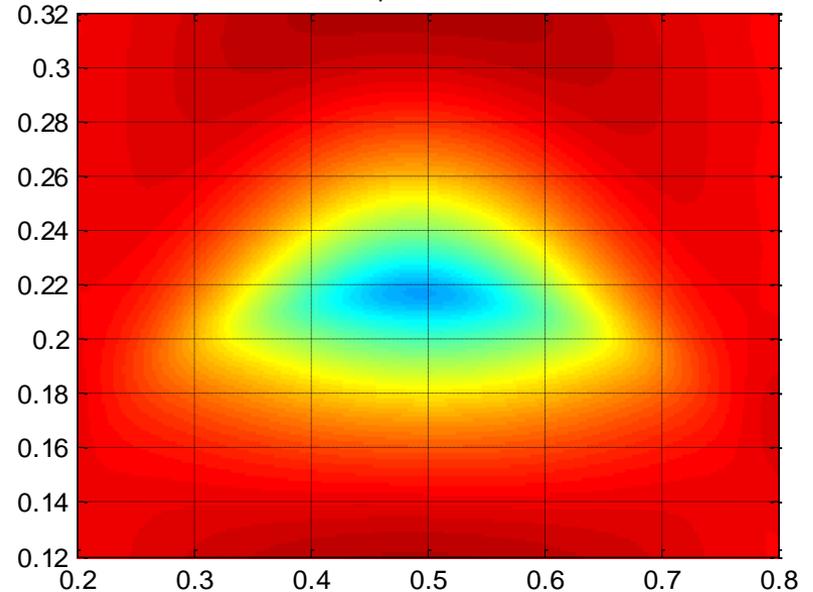
- This is close to the intended worst case host output
  - Seen through the CTLE
- Simulation of the module stressed input signal with 12.2 dB channel and a nominally 900 mV driver. Eye height is at the minimum 32 mV. VEC is 8 dB.

# What the spec allows

After optimised CTLE



After optimised CTLE

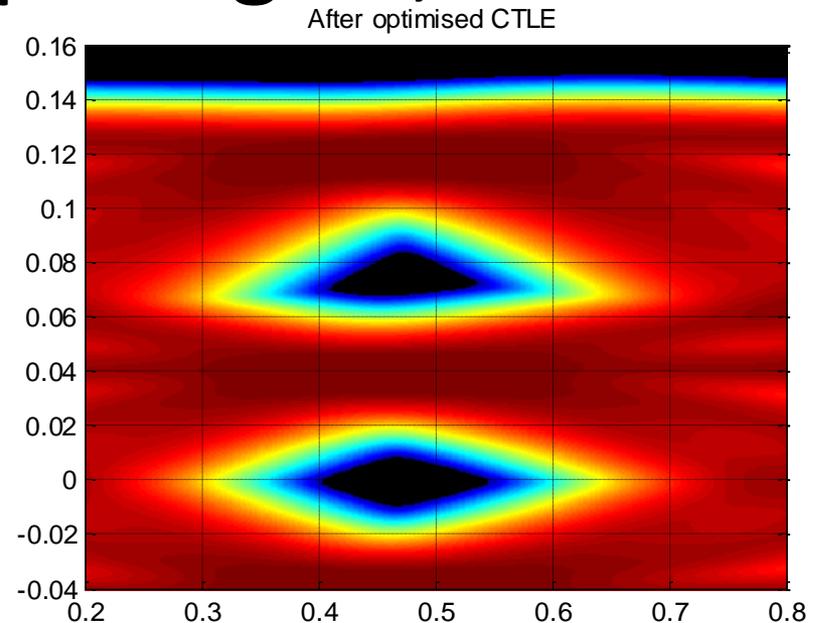
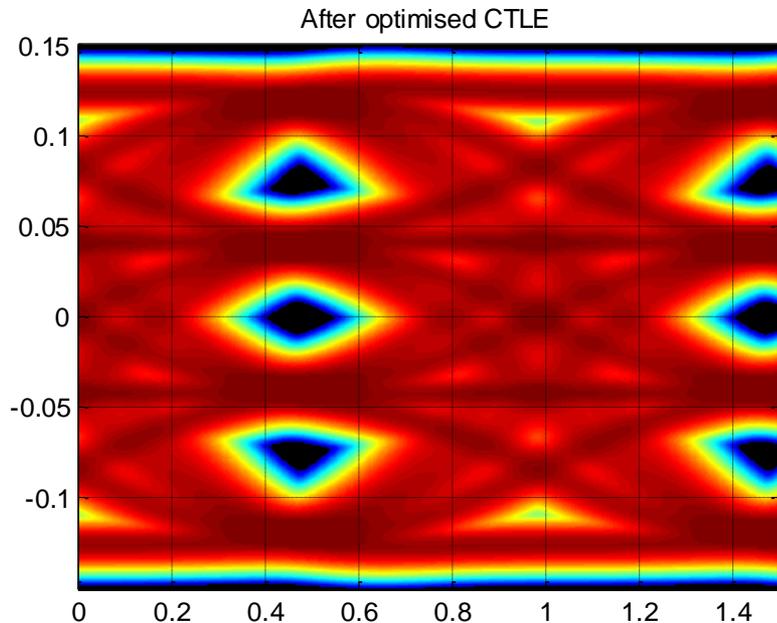


- This output from a low loss host is allowed by the spec. The signal is more than 2.5x bigger (0.83 V pk-pk vs. 0.31 V after CTLE) but the eye height (usable opening) is still only 35 mV for eye width at minimum. This signal's VEC is 15.8 dB.
  - It was believed that with the previous CTLE, the eye width spec would enforce a better eye height. With the new CTLE, it doesn't do so significantly – a host could have less UBJ and more noise than this one, taking the eye height closer to the minimum 32 mV

# Why is this signal bad?

- Receiving a small inner eye in a big signal stresses tuning and linearity "dynamic range" issues that are beyond the module stressed input test
  - Next slide 6 shows the low loss module stressed input test; the high loss case is on slide 3
  - A module stressed input signal would not be like slide 4 which has much worse noise or ILD than the stressed eye generator

# Module stressed input signal, low loss



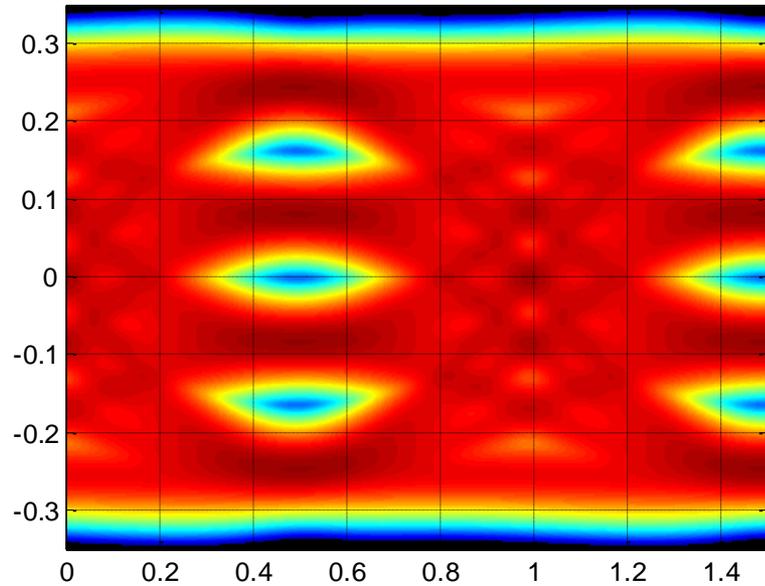
- Eye height 31.7 mV, width 0.219 UI (target is 32, 0.22)
- VEC is 7.9 dB      CTLE is at 2.5 dB
- Nominally 342 mV at driver, no emphasis
- Much cleaner and less pk-pk swing than host is allowed
  - (as expected / intended)
- In this case, the  $1e-5$  contour is in the green region. Because this is a pdf not a cdf, it won't be quite the same in other cases

# Remedy

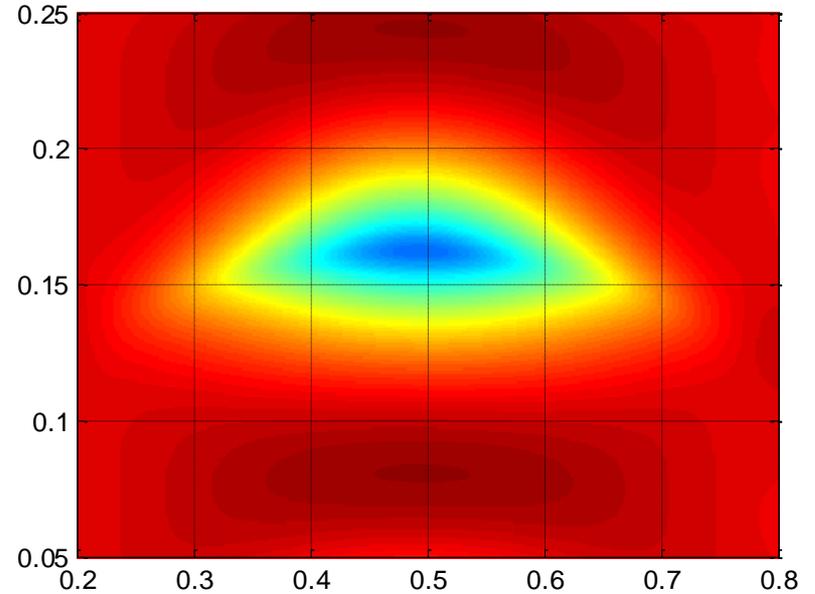
- The module stressed input signals have VEC around 8 dB
- The bigger, but still near minimum height, eye has a VEC about 16 dB
- A low loss host might have a worse VEC than a high loss host, but not 8 dB worse
- Limit the host output VEC to 12 dB
  - There is no need to do the same for the module output because the signal swing is limited before the host loss and the minimum eye height is enforced after it

# What the spec would allow – 14 dB

After optimised CTLE

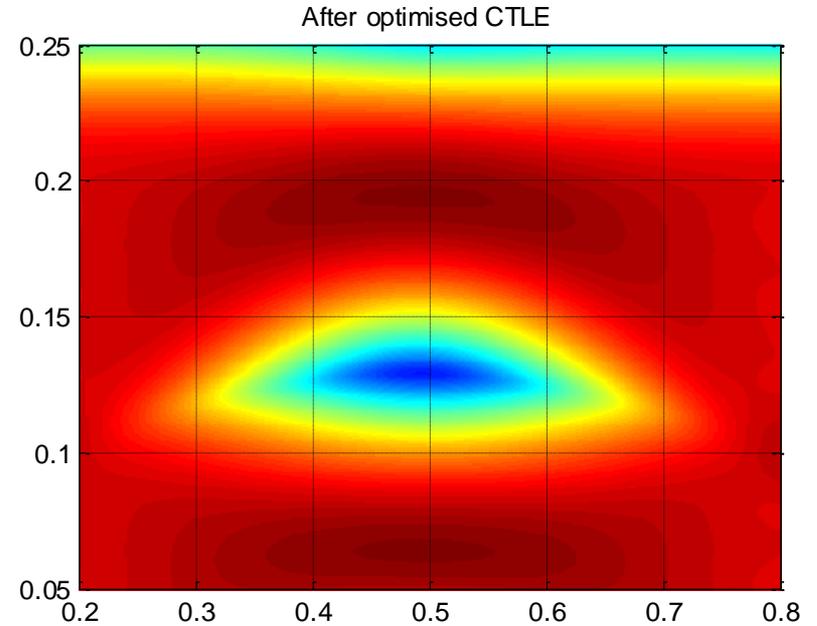
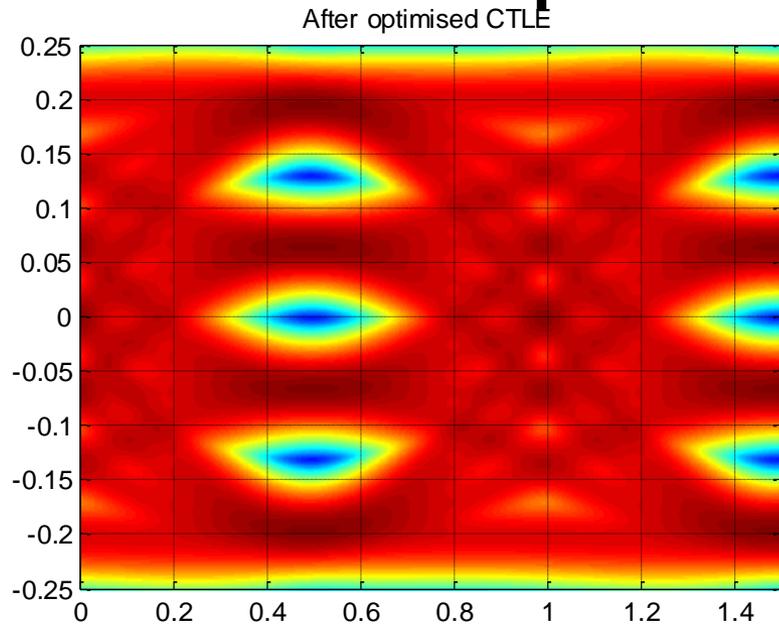


After optimised CTLE



- This signal 0.67 V pk-pk after CTLE
- VEC is 13.8 dB
- Eye height is 33 mV

# What the spec would allow – 12 dB



- This signal 0.49 V pk-pk after CTLE
- VEC is 12.0 dB
- Eye height is 32.6 mV