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The Effect of Noise on an Ultra320 SCSI System

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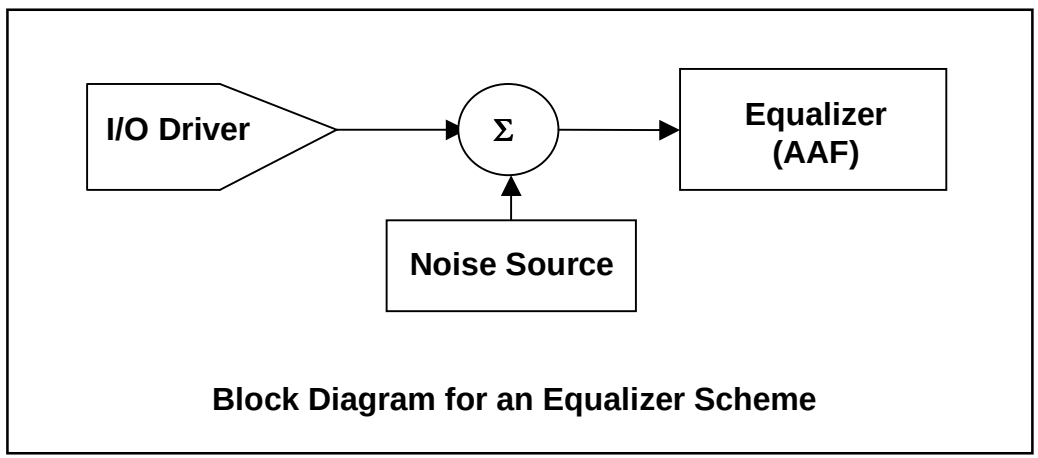
Introduction

- This presentation is a discussion of noise in an Ultra320 system including the effect of noise on a receiver equalizer scheme (AAF) and a transmitter precompensation with cutback scheme (TxPC).
- The following are the assumptions used in this presentation:
  - The driver level without TxPC (that used for AAF) is 500 mV.
  - For TxPC: the maximum driver level is 500 mV, the cutback level is 330 mV (though the conclusions apply regardless of the ratio of maximum to cutback).
  - The information-carrying signal is at 80 MHz.
  - The cable attenuation = A.



Block Diagram for an Equalizer Scheme

Simplified Noise Calculation for AAF

- The signal-to-noise ratio at the equalizer input

  $= (A \times 0.5) / (A \times Vn)$

  $= 0.5 / Vn$

- At 80 MHz the equalizer boost = k

  The signal-to-noise ratio at the equalizer output

  $= (A \times k \times 0.5) / (A \times k \times Vn)$

  $= 0.5 / Vn$

- At frequencies lower or higher than 80 MHz the equalizer boost = g (which is less than k)

  The signal-to-noise ratio at the equalizer output

  $= (A \times k \times 0.5) / (A \times g \times Vn)$

  $= (k / g) (0.5 / Vn)$

  where $(k / g) > 1.0$

Simplified Noise Calculation for TxPC

- At 80 MHz the signal-to-noise ratio at the receiver

$$= (A \times 0.5) / (A \times Vn)$$

$$= 0.5 / Vn$$

  which is identical to the equalizer.

- At frequencies lower than 80 MHz the amplitude of the driver is at the cutback level. Therefore the signal-to-noise ratio at the receiver

$$= (A \times 0.33) / (A \times Vn)$$

$$= 0.33 / Vn$$

  which is 1.5 times less than the signal-to-noise ratio for the equalizer scheme.

Conclusions

- For an equalizer (AAF) scheme:
  - AAF boosts signal and noise at 80 MHz by the same amount, so the signal-to-noise ratio remains the same for noise at 80 MHz regardless of the boost factor.
  - For noise at frequencies lower and higher than 80 MHz, AAF improves the signal-to-noise ratio due to the reduction of the boost of the other frequencies relative to 80 MHz.
- For a transmitter precomp (TxPC) scheme:
  - A signal running at cutback amplitude will have a worse signal-to-noise ratio than a signal at maximum amplitude (and the signal at maximum will only have the same signal-to-noise ratio as AAF at the same driver amplitude).
  - When the data pattern is random the amplitude will be at cutback more than 50% of the time, so most of the time, the signal-to-noise ratio will be that for the cutback amplitude.
- The overall effect of noise is worse on a system using a transmitter precomp scheme and better on a system using an equalizer scheme.

Frequency Response of Quantum's AAF