Receive Equalizer used for Quantum Ultra320 Eye Diagram Data

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The Receive Equalizer is used to boost the AC magnitude at the receiver to compensate for the frequency response losses of the loaded cable plant.
Method for Calculating Equalized Eye

- Capture differential data from a cable and backplane setup.
- Send raw data to a PC to run mathematical simulation script:
  - Same data sets as used for no-comp and precomp measurements
  - Numerical adaptive equalization
  - Generate and evaluate eye diagrams
Rx Equalizer Transfer Function

Equalizer Function used for calculated eye diagrams:

\[ H(s) = \frac{A \times (K \times s + B)}{(s + C) \times (s^2 + D \times s + E)} \]

\[ K = \text{boost gain} \]
Rx Equalizer Frequency Response

Equalizer AC response

Gain (dB) vs Frequency (Hz)

-10  -8  -6  -4  -2  0  2  4  6  8  10

10^6  10^7  10^8  10^9
Receiver Equalization requires a training pattern containing both low and high frequency signals.

Proposed adaption procedure:

- Apply a low frequency pattern.
- Sample and store the low frequency signal amplitude at the equalizer output.
- Apply a maximum frequency "101010…" pattern.
- Adjust equalizer boost to match the "1010" pattern equalized amplitude to the stored low-frequency amplitude value.
Comments on Rx Eq Adaption

- Simple adaption gives excellent results for U320 speeds for a wide variety of cable and load configurations.
- Filter design requirements are not stringent:
  - Low order filter
  - Fixed frequency filter design
    - No tuning range requirements
  - Low sensitivity to component tolerances
    - Filter calibration not required
    - Adaptation provides adequate compensation for tolerances
  - Adapted by varying a single parameter (K)