Why new method?
(stressed eye calibration)

- Problem
  - Random noises (jitter, RIN, etc.), long pattern DDJ, and the Golden PLL cloud the ability to calibrate deterministic terms
  - “Knob” setting are interdependent
- Goals
  - Be able to calibrate with short patterns
  - Eliminate low frequency terms from calibration so Golden PLL is not required
  - Eliminate BER scan for jitter cal

Knobs

- Filter BW (vertical closure due to ISI) – difficult to change, moderate control
- Filter amplitude/phase response vs frequency – difficult to change, moderate control
- *Added sine signal amplitude – easy to change, high control*
- Added sine signal frequency (not critical but must have limits) – easy to change, high control
- *Sine jitter magnitude – easy to change (to a point…), good control*
- Sine jitter frequency profile – easy to change, high control
- *Optical attenuator – easy to change, good control*
- Calibration pattern – easy to change, high control
- Test pattern – easy to change, high control

Jitter issues

- The old jitter values were typically 0.3 high probability and 0.21 low probability for 0.51 UI t total jitter pk-pk at 1e-12. Do we want to emulate all jitter with only high probability? With the proposed approach, I see no alternative. So, it begs the questions of whether we should cal to the same pk-pk. This would be conservative but probably harsh.

- Some amount of low probability jitter will most likely exist in a test source, but we're trying to minimize and not otherwise specify this…

Gain/phase flatness and patterns

For improved visibility for calibration, it is imperative that the Bessel-Thomson filter and all other elements in the signal path (cables, DC blocks, E/O converter etc.) have wide and flat frequency response and linear phase response throughout the spectrum of interest (what can we recommend?). Baseline wander and overshoot and undershoot should be minimized. If this is achieved, then data dependent effects should be minimal, and short data patterns (K28.5s? A05F? PRBS7?) can be used for calibration with the benefit of providing much improved trace visibility on sampling oscilloscopes.

Actual patterns for testing the receiver shall be as specified in Table???.

RIN, etc.

To further improve visibility for calibration, random noise effects such as RIN and random clock jitter should also be minimized.

Other

- The Bessel-Thomson filter should have a –3 dB corner frequency of approximately 5 GHz to result in the appropriate level of initial ISI eye closure before the sinusoidal terms are added. The frequency response tolerance shall be given in Table ???. The O/E converter should be fast and linear such that the waveshape and edge rates are predominantly controlled or limited by the electrical circuitry. Electrical summing of the sinusoidal AM signal before the E/O is an option to avoid the 2nd optical source, but high linearity is mandatory.

Calibration steps

- Set data rate
- Set the extinction ratio to approximately 3 dB (square wave pattern).
- Turn on the calibration pattern
- Observe the ISI closure on the oscilloscope (on the order of 1 dB)
- Turn on the sinusoidal AM to develop YYY pk-pk jitter. *(Note - what value for YYY? This value should represent reasonable worst case realistic stress for pulse shrinkage and BLW, but also bounded so that unrealistic situations are not created. This is in part why I added filter induced ISI)*. Be sure to not consider any random jitter. The frequency for the sinusoidal AM signal can be from 100 MHz to 2 GHz.
- Add sine jitter not less than the specifications in ???. *(Note - this is the SJ template, but how much do we add now? Do we emulate RJ and all other unnamed jitter too?)*. Since a clock recovery unit is not involved in calibration, a frequency above 4 MHz is required.
- Adjust the optical attenuator to achieve the inner eye amplitude = stressed_OMA – VECP. Do not consider random noise.
- Switch to actual test pattern