

Corrections Needed in Clause 180.9.6

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Addresses Comments: R2-188, R2-189, R2-16, R2-17, R2-18

Supporters

- Marek Hajduczenia

Introduction

- With the changes introduced in 3.2, there are a few things that need cleaning up in clause 180.9.6
- The DFE is based on a:
 - Mean zero input signal
 - Balanced and scaled alphabet, $\{-1, -1/3, 1/3, 1\}$for the transmitted sequence
- SSPRQ is specified as a sequence from the unbalanced alphabet $\{0, 1, 2, 3\}$
- The signal out of the reference receiver is not mean zero
 - It is referred to as “optical power” in the clause, which cannot be negative

Comments: R2-188

The equalizer is modeled as shown in Figure 180–10, where

- $r(t)$ is the output of the reference receiver defined in 180.9.2, with the mean value subtracted from the signal
- $\eta(t)$ is colored Gaussian noise, generated from additive white Gaussian noise (AWGN) filtered by a Bessel-Thomson (BT) filter as defined in 180.9.2
- $z(t)$ is the input signal given by Equation (180–1)
- z_n is the sampled response of input signal $z(t)$, given by Equation (180–2)
- v_n is the equalizer output corresponding to x_n
- X_n is the n th symbol in the test pattern sequence, $X_n \in \{0, 1, 2, 3\}$, and x_n is given by Equation (180-3)
- w is the set of feed-forward tap coefficients, given by Equation (180- 4)
- $b(1)$ is the feedback tap coefficient
- the feedback is modeled as correct, i.e., x_n is the pattern used to generate the input $r(t)$
- the received signal $r(t)$ is aligned with the test pattern such that $r(nT)$ corresponds to x_n

$$z(t) = r(t) + \eta(t) \quad (180-1)$$

$$z_n = z(nT + \phi), \text{ where } 0 < \phi < T \quad (180-2)$$

$$x_n = 2/3 X_n - 1, \quad x_n \in \{-1, -1/3, 1/3, 1\} \quad (180-3)$$

$$w = \{w(a), w(a+1), \dots, w(a+14)\} \quad (180- 4)$$

Parameter	Symbol	Value	
		Minimum	Maximum
Number of feed-forward taps	N_w	15	
Number of pre-cursor feed-forward taps	—	0	3
Main tap coefficient limit	$w(0)$	$0.9 - b(1)$	2.5
Normalized feed-forward tap coefficient limits: $i = -3$ $i = -2$ $i = -1$ $i = 1$ $i = 2$ $i = 3$ $i = 4$ $i = 5$ $i = 6$ $i \geq 7$	$w(i)/w(0)$	-0.15 -0.1 -0.5 -0.6 -0.2 -0.15 -0.15 -0.15 -0.15 -0.1	0.1 0.25 0.1 0.2 0.3 0.15 0.15 0.15 0.15 0.1
Pre-post-cursor tap coefficient difference limit: $ w(1)/w(0) - b(1) - w(-1)/w(0) $	—	—	0.25
Feed-forward tap DC gain ^a	—	1	
Number of feedback taps	N_b	1	
Feedback tap coefficient limit ^b	$b(1)$	0	0.33

^a The sum of all 15 feed-forward tap coefficients, $w(i)$.

^b The feedback tap coefficient $b(1)$ is referenced to $OMA_{TDECQ}/2$ (see 180.9.6.4 for definition of OMA_{TDECQ}).



The new definition of x_n is now consistent with footnote b.

Comments: R2-188, R2-18

y_n is implicitly a function of x_n (or X_n)

$$P(y_{n,L}, \sigma_G) = \frac{1}{2} \begin{cases} \operatorname{erfc}\left(\frac{P_{th1} - y_{n,L}}{\sqrt{2} C_{eq} \sigma_G}\right) & X_n = 0 \\ \operatorname{erfc}\left(\frac{y_{n,L} - P_{th1}}{\sqrt{2} C_{eq} \sigma_G}\right) + \operatorname{erfc}\left(\frac{P_{th2} - y_{n,L}}{\sqrt{2} C_{eq} \sigma_G}\right) & X_n = 1 \\ \operatorname{erfc}\left(\frac{y_{n,L} - P_{th2}}{\sqrt{2} C_{eq} \sigma_G}\right) + \operatorname{erfc}\left(\frac{P_{th3} - y_{n,L}}{\sqrt{2} C_{eq} \sigma_G}\right) & X_n = 2 \\ \operatorname{erfc}\left(\frac{y_{n,L} - P_{th3}}{\sqrt{2} C_{eq} \sigma_G}\right) & X_n = 3 \end{cases}$$

Use X_n instead of x_n

$X_n = 0$

One or the other! Not both!

(180-7)

$X_n = 3$

Alternatively, change values to $\{-1, -1/3, 1/3, 1\}$

where

C_{eq}

is a coefficient which accounts for the reference equalizer noise enhancement

$P_{th1}, P_{th2}, P_{th3}$

are thresholds adjusted from $P_{0,th1}, P_{0,th2}, P_{0,th3}$ within limits described below

Addresses Hajduczenia Comment R2-18.

The nominal threshold levels $P_{0,th1}$, $P_{0,th2}$, and $P_{0,th3}$, are determined from the OMA_{TDECQ} and the average optical power P_{ave} as defined in Equation (180–4), Equation (180–5), and Equation (180–6), and illustrated in Figure 180–11.

$$P_{0,th1} = P_{ave} - \frac{OMA_{TDECQ}}{3} \quad (180-4)$$

$$P_{0,th2} = P_{ave} \quad (180-5)$$

$$P_{0,th3} = P_{ave} + \frac{OMA_{TDECQ}}{3} \quad (180-6)$$

where OMA_{TDECQ} is measured on the equalized captured waveform y_n using the method defined in 180.9.5.

$r(t)$ is no longer a power, as the mean has been subtracted off, and y_n is a discrete-time signal, not a continuous-time signal. The method defined in 180.9.5 is for a continuous-time signal with runs of threes and runs of zeros. I suggest introducing a continuous-time signal when we introduce the eye diagram, then use that to define OMA_{TDECQ} .

Original:

An eye diagram to help illustrate TDECQ is shown in Figure 180–11. The eye diagram corresponds to the optimized equalizer setting at sampling phase ϕ_0 . The feedback symbol x_n changes at phase $\phi = \phi_0 - T/2$.

I suggest:

An eye diagram to help illustrate TDECQ is shown in Figure 180–11. The eye diagram corresponds to the optimized equalizer setting at sampling phase ϕ_0 . The feedback symbol x_n changes at phase $\phi = \phi_0 - T/2$.

value to x_{n+1} at time $t = nT + \phi_0 + T/2$.

The eye diagram reflects a continuous-time waveform $y(t)$ corresponding to y_n , where $y(t)$ would be the output of a continuous-time equalizer obtained by removing the sampler in Figure 180-10.

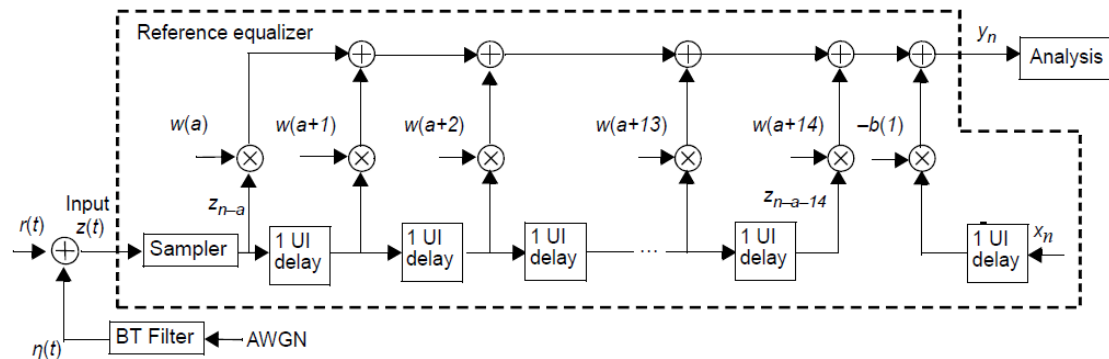


Figure 180–10—TDECQ reference equalizer functional model

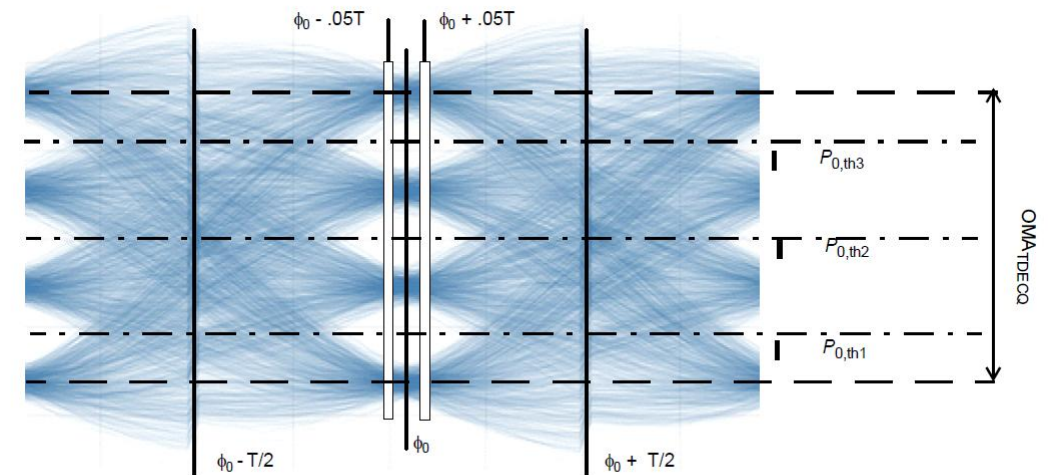


Figure 180–11—Illustration of the TDECQ measurement

The nominal threshold levels $P_{0,th1}$, $P_{0,th2}$, and $P_{0,th3}$, are ~~determined from the OMA_{TDECO} and the average optical power P_{ave}~~ defined in Equation (180-4), Equation (180-5), and Equation (180-6), and illustrated in Figure 180-11.

$$P_{0,th1} = \cancel{P_{ave}} - \frac{OMA_{TDECO}}{3} \quad (180-4)$$

$$P_{0,th2} = \cancel{P_{ave}} \quad 0 \quad (180-5)$$

$$P_{0,th3} = \cancel{P_{ave}} + \frac{OMA_{TDECO}}{3} \quad (180-6)$$

where OMA_{TDECO} is measured on the equalized captured waveform $y(t)$, using the method defined in 180.9.5, and where $y(t)$ is the continuous time waveform corresponding to the eye diagram shown in Figure 180-11.

Thank you