Transmitter Functional Symbol Error Histogram (TxFSEH) Additional Clarifying Text

IEEE P802.3 Ethernet Plenary

802.3dj Task Force Meeting

November 13, 2025

Chris Cole, Coherent

Comment #226

180.9.9.1 Functional receiver (FRx) definition

The functional receiver (FRx) is a variable optical attenuator (VOA) followed by an optical receiver (ORx) that complies with characteristics as given in Table 180–8. The transmitter under test is connected to the FRx by a test fiber, which meets the transmitter compliance channel specifications as given in Table 180-15. VOA level is given by Equation (180–27). The first three terms in the equation normalize differences in transmitters under test, test fibers, and functional receivers, so that symbol errors counts are repeatable across different test conditions. The terms are defined by the same algebraic expressions as define normative transmitter and receiver characteristics.

VOA_level = Tx_DUT_power_budget – Test_fiber_power_budget – ORx_TECQ_allocation – Test_margin (180–27)

where:

—Tx_DUT_power_budget is the transmitter under test power budget as given in Table 180-9, except using measured instead of maximum TDECQ, and is given by Equation (180–28)

—Test_fiber_power_budget is the test fiber power budget as given in Table 180-9, except using estimates of the test fiber channel insertion loss, MPI, DGD and transmitter under test chromatic dispersion (CD) penalties instead of maximum parameters, and is given by Equation (180–29)

180.9.9.1 Functional receiver (FRx) definition (cont.)

—ORx_TECQ_allocation is difference in receiver sensitivities versus TECQ as shown in Figure 180-4, except the difference is between ORx_RxS@DUT_TECQ and RxS_OMA@TECQ=0, and is given by Equation (180–30)

—Test_margin is additional ORx_OMA which reduces test operating BER and equals 1.5dB

Tx_DUT_power_budget = Channel_insertion_loss + MPI_DGD_penalty_allocation + max(DUT_TDECQ, DUT_TECQ) (180–28)

where:

—Channel_insertion_loss is “Channel insertion loss” as given in Table 180–9

—MPI_DGD_penalty_allocation is “MPI DGD penalty allocation” as given in Table 180–9

—DUT_TDECQ is the TDECQ measured for the transmitter under test

—DUT_TECQ is the TECQ measured for the transmitter under test

180.9.9.1 Functional receiver (FRx) definition (cont.)

Test_fiber_power_budget = Test_fiber_loss + Test_fiber_MPI+DGD_penalty + Test_fiber_DUT_CD (180–29)

where:

— Test_fiber_loss is an estimate of the actual channel insertion loss of the test fiber

— Test_fiber_MPI+DGD_penalty is an estimate of the actual MPI and DGD penalty of the test fiber

— Test_fiber_DUT_CD is an estimate of the transmitter under test actual CD penalty over the test fiber

ORx_TECQ_allocation = ORx_RS@DUT_TECQ – RxS_OMA@TECQ=0 (180–30)

where:

— ORx_RS@DUT_TECQ is the ORx receiver sensitivity at the TECQ measured for the transmitter under test

—RxS_OMA@TECQ=0 is the receiver sensitivity OMA for TECQ >= 0.9 dB, as given in Table 180–8, extrapolated down to TECQ = 0 dB (-4.3 dBm)

181.9.9 Transmitter functional symbol error histogram

The transmitter functional symbol error histogram mask for each lane is given in Table 180–18. The transmitter functional symbol error histogram is measured using the method defined in 180.9.9 with the following exceptions:

— The transmitter functional symbol error histogram is measured using the test pattern as given in Table 181–12.

— The Functional Receiver (FRx) is a variable optical attenuator (VOA) followed by an Optical Receiver (ORx) that complies with characteristics as given in Table 181–6. The transmitter under test is connected to the FRx by a test fiber which meets the transmitter compliance channel specifications as given in Table 181–13. VOA level is given by Equation (180–27). The first three terms in the equation normalize differences in transmitters under test, test fibers, and functional receivers, so that symbol errors counts are repeatable across these differences. The terms are defined by the same algebraic expressions as define normative transmitter and receiver characteristics.

181.9.9 Transmitter functional symbol error histogram, cont.

—Tx_DUT_power_budget is the transmitter under test power budget as given in Table 181-7, except using measured instead of maximum TDECQ, and is given by Equation (180–28)

—Test_fiber_power_budget is the test fiber power budget as given in Table 181-7, except using estimates of the test fiber channel insertion loss, MPI, DGD and transmitter under test chromatic dispersion (CD) penalties instead of maximum parameters, and is given by Equation (180–29)

—ORx_TECQ_allocation is difference in receiver sensitivities versus TECQ as shown in Figure 181-4, except the difference is between ORx_RxS@DUT_TECQ and RxS_OMA@TECQ=0, and is given by Equation (180–30)

182.9.9 Transmitter functional symbol error histogram

The transmitter functional symbol error histogram mask for each lane is given in Table 180–18. The transmitter functional symbol error histogram is measured using the method defined in 180.9.9 with the following exceptions:

— The transmitter functional symbol error histogram is measured using the test pattern defined in Table 182–14.

— The functional receiver (FRx) is a variable optical attenuator (VOA) followed by an optical receiver (ORx) that complies with characteristics in Table 182–8. The transmitter under test is connected to the FRx by a test fiber which meets the transmitter compliance channel specifications in Table 182–15. VOA level is given by Equation (180–27). The first three terms in the equation normalize differences in transmitters under test, test fibers, and functional receivers, so that symbol errors counts are repeatable across these differences. The terms are defined by the same algebraic expressions as define normative transmitter and receiver characteristics.

182.9.9 Transmitter functional symbol error histogram, cont.

—Tx_DUT_power_budget is the transmitter under test power budget as given in Table 182-9, except using measured instead of maximum TDECQ, and is given by Equation (180–28)

—Test_fiber_power_budget is the test fiber power budget as given in Table 182-9, except using estimates of the test fiber channel insertion loss, MPI, DGD and transmitter under test chromatic dispersion (CD) penalties instead of maximum parameters, and is given by Equation (180–29)

—ORx_TECQ_allocation is difference in receiver sensitivities versus TECQ as shown in Figure 182-4, except the difference is between ORx_RxS@DUT_TECQ and RxS_OMA@TECQ=0, and is given by Equation (180–30)

183.9.9 Transmitter functional symbol error histogram

The transmitter functional symbol error histogram mask for each lane is given in Table 180–18. The transmitter functional symbol error histogram is measured using the method defined in 180.9.9 with the

following exceptions:

— The transmitter functional symbol error histogram is measured using the test pattern as given in

Table 183–14.

— The functional receiver (FRx) is a variable optical attenuator (VOA) followed by an optical receiver (ORx) that complies with characteristics as given in Table 183–7. The transmitter under test is connected to the FRx by a test fiber which meets the transmitter compliance channel specifications as given in Table 183–15. VOA level is given by Equation (180–27). The first three terms in the equation normalize differences in transmitters under test, test fibers, and functional receivers, so that symbol errors counts are repeatable across these differences. The terms are defined by the same algebraic expressions as define normative transmitter and receiver characteristics.

183.9.9 Transmitter functional symbol error histogram, cont.

—Tx_DUT_power_budget is the transmitter under test power budget as given in Table 183-9, except using measured instead of maximum TDECQ, and is given by Equation (180–28)

—Test_fiber_power_budget is the test fiber power budget as given in Table 183-9, except using estimates of the test fiber channel insertion loss, MPI, DGD and transmitter under test chromatic dispersion (CD) penalties instead of maximum parameters, and is given by Equation (180–29)

—ORx_TECQ_allocation is difference in receiver sensitivities versus TECQ as shown in Figure 183-4, except the difference is between ORx_RxS@DUT_TECQ and RxS_OMA@TECQ=0, and is given by Equation (180–30)

TxFSEH Additional Clarifying Text

Thank you