68.6.6 Comprehensive stressed receiver sensitivity and overload test

The PMD's receiver shall satisfy the comprehensive stressed receiver sensitivity and overload (maximum received power in OMA) specifications in Table 68–4. These parameters are defined by reference to the procedures of 68.6.6.1 through 68.6.6.4. A BER of better than 10^{-12} shall be achieved with asynchronous data flowing out of the optical transmitter of the system under test. The output data pattern from the transmitter of the system under test is to be the same pattern defined for this measurement in Table 68-5.

68.6.6.1 Comprehensive stressed receiver sensitivity and overload test block diagram

Figure 68–8 shows the block diagram for the comprehensive stressed receiver test. As shown in the figure, an electrical signal is created using a pattern generator with pattern according to 68.6.1, and impaired by:

a) a Gaussian noise interferer; and
b) Intersymbol interference (ISI); and
c) additional low pass filtering as needed to achieve the required Gaussian pulse response specified in 68.6.6.2.

The resulting electrical signal is converted to an optical signal with an extinction ratio of 3.5 dB using a linear electrical/optical converter. The optical waveform is connected to an optical attenuator, and to the receiver under test via a mode conditioning patch cord of the type defined in clause 38.11.4 for use with 62/125 μm fiber.

The characteristics of the stressed test signal are defined in 68.6.6.2 and are based on the parameters in Table 68-4. These parameters and the definition in 68.6.6.2 are meant to suggest an implementation for the ISI generator as a tapped delay line with 4 weighted taps and fixed delays.

Other implementations may be used provided that the resulting signal and noise in the optical domain match those created using the implementation shown in Figure 68–8. This consideration includes the shaping of the noise by the ISI generator and the optional pulse shaping filter.

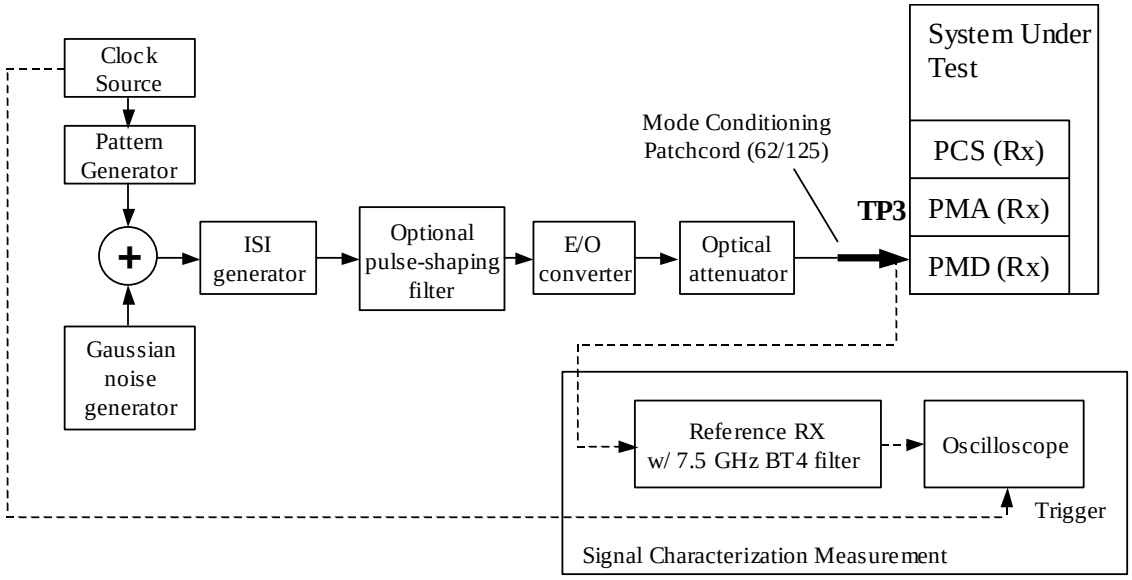

Figure 68-8 – Measurement configuration for normative comprehensive stressed receiver sensitivity and overload test

68.6.6.2 Comprehensive stressed receiver test signal characteristics

The signal impairments are specified in Table 68–4 as the conditions of the comprehensive stressed receiver tests. These conditions define three sets of ISI parameters and are to be used separately as different tests. The ISI impaired test signal is defined as the convolution of the following functions:

$$S_{ISI}(t) = S(t) * \mathrm{G}_{47}(t) * \left[\sum_{i=0}^{3} A_i \delta(t - i \cdot \Delta t) \right]$$

Where S(t) is an ideal NRZ test pattern signal defined in 68.6.1, $G_{47}(t)$ is a Gaussian pulse with 47ps 20-80% rise and fall times, A_i are the 4 impulse response weights defined for each ISI case in Table 68-4 and Δt is the peak spacing defined in Table 68-4 for all test cases.

The test signal is further impaired by a broadband white Gaussian noise generator with a minimum bandwidth specified in Table 68-4 and with the amplitude adjusted such that the ratio of the OMA to 2 x rms noise level of the test signal with the ISI impairment removed is given by the value in Table 68-4.

The extinction ratio of the test signal shall be 3.5 dB.

When convolved with a 7.5 GHz fourth order Bessel-Thomson filter response, the pulse responses of the three signal shapes are given by Table 68-x.

Finally, the OMA of the test signal is given by the minimum receiver power in OMA in Table 68-4 for the sensitivity tests and by the maximum received power in OMA in Table 68-4 for the overload tests.

68.6.6.3 Comprehensive stressed receiver test signal calibration

The test signal may be calibrated using the following steps using an optical reference receiver with a multimode compatible input and a 7.5 GHz fourth order ideal Bessel-Thomson response.

The extinction ratio of the optical output with no impairments should be adjusted to a value of 3.5 dB as defined in 68.6.3.

With no ISI impairment active, the level of the Gaussian noise generator should be adjusted such that the ratio of the OMA to 2 x the rms noise amplitude of the signal is the value given in Table 68-4. The rms noise level should be measured on the logic ONE level during any portion of the pattern with a repeated ONE pattern using a 1 UI wide histogram with at least 1000 points. The measurement should be compensated for noise in the measurement system.

The ISI generator should be configured and calibrated for each of the three ISI cases specified in Table 68-4. The calibration of the ISI may be done with any portion of a repeating test signal, with one convenient example being an isolated ONE bit with at least 10 ZERO bits before and after. The ISI generator should be adjusted such that the signal, S_{meas} recorded on the reference receiver is given by the following convolution:

$$S_{Meas}(t) = S_{cal}(t) * \mathrm{G}_{47}(t) * \left[\sum_{i=0}^{3} A_i \delta(t - i \cdot \Delta t) \right] * \mathrm{BT4}_{7.5\,\mathrm{GHz}}(t)$$

where S_{cal} is the calibration test signal from the pattern generator, G_{47}, A_i and Δt are defined as in 68.6.6.2, and $BT4_{7.5GHz}(t)$ is the impulse response of an ideal 7.5 GHz fourth order Bessel-Thompson filter representing the optical reference receiver response. The bandwidth or need for the pulse shaping filter shown in block diagram of Figure 68-8 will be determined by the characteristics of the signal source, ISI generator and E/O converter such that the final measured signal has the overall pulse response given by the above equation.

As a practical example, Figure 68-x shows the required measured test signals for each of the three cases specified in Table 68-4 where the test signal, S_{test} is a single ONE bit (rectangular pulse with 1 UI width). Table 68-x gives the tabulated amplitude vs. time for the curves in Figure 68-4.

The attenuator setting is determined by measuring the OMA of the impaired test signal according to 68.6.2.

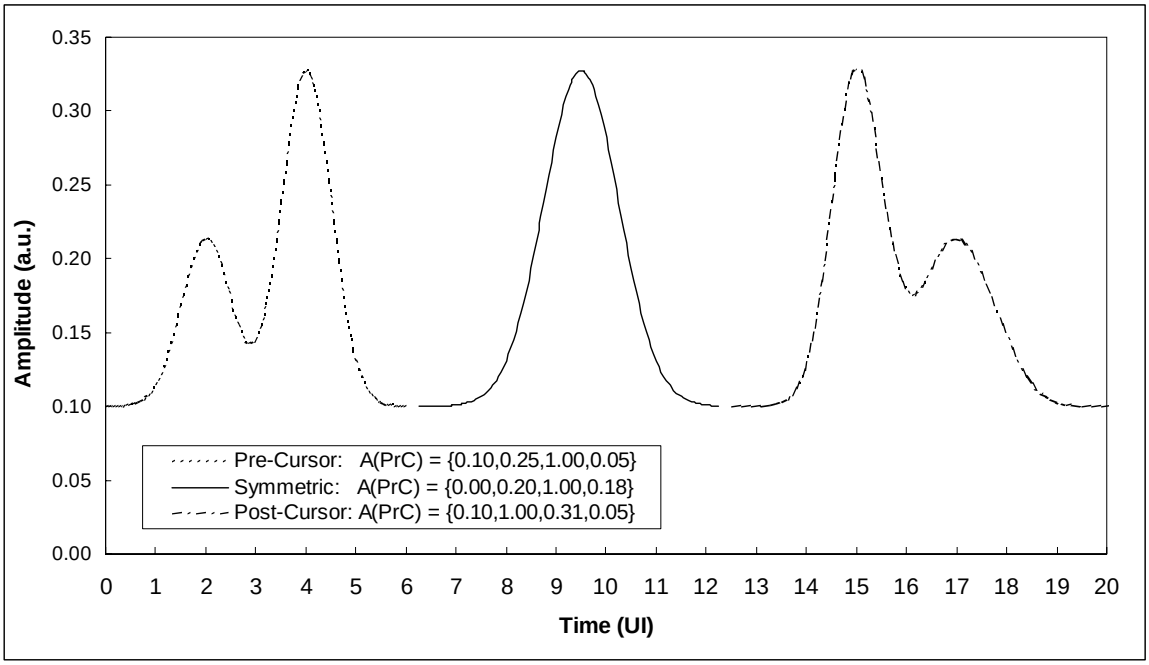

Figure 68-x – Required comprehensive stressed receiver test signals measured with an isolated single ONE test pattern for each of the three ISI cases defined in Table 68-4.
(Arbitrary time values and offset for clarity)
[NOTE: DC offset shown to represent 3.5 dB extinction ratio]

Table 68-x – Tabulated amplitude vs. time values for test signals of Figure 68-x

Time (UI)	Pre-Cursor (a.u)	Symmetric (a.u)	Post-Cursor (a.u)
0.00	0.00	0.00	0.00
0.02	0.10	0.02	0.01
:	:	:	:

68.6.6.4 Comprehensive stressed receiver test procedure

The three ISI impairments defined in Table 68-4 and 68.6.6.2, together with the two OMA values (i.e. the comprehensive stressed receiver sensitivity OMA, and the overload OMA, both specified in Table 68–4) define six discrete signal conditions.

With the test system setup as described in 68.6.6.2 and 68.6.6.3, for each case, select the required ISI impairment and set the attenuator to obtain either the sensitivity or overload OMA values specified in Table

68-4. Set the pattern generator to one of the patterns in Table 68-5 for the comprehensive stressed receiver sensitivity measurement. Finally connect the test signal to the system receiver TP3.

A BER of better than 10^{-12} shall be achieved for each case

68.6.7 Simple stressed receiver sensitivity and overload test (informative)

The simple stressed receiver sensitivity and overload are informative and compliance is not required. If measured, the receiver under test will be expected to satisfy the simple stressed receiver sensitivity and overload (maximum received power in OMA) specifications in Table 68–4. Figure 68–9 gives the block diagram for the simple stressed receiver test. A pattern generator output is impaired using a 4th order Bessel-Thomson low pass filter. The resulting electrical signal is converted to an optical signal using a linear electrical/optical converter. Other signal impairments, such as rise/fall times, jitter and RIN should be negligible. The optical waveform is connected to an optical attenuator, and to the receiver under test via a mode conditioning patch cord. The bandwidth of the Bessel-Thomson filter is specified in Table 68–4 as the condition of the simple stressed receiver test. For the two OMA values (i.e. the simple stressed receiver sensitivity OMA, and the overload OMA, both specified in Table 68–4), a BER of better than 10^{-12} should be achieved.

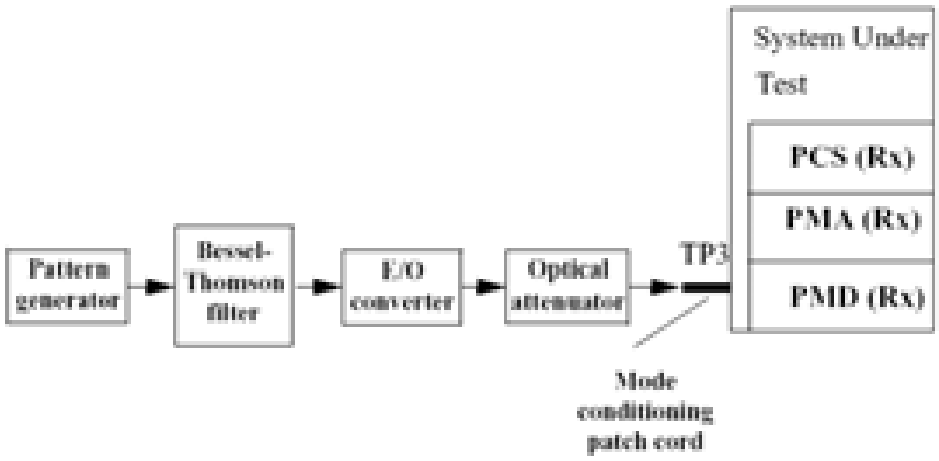

Figure 68–9—Measurement configuration for informative simple stressed receiver sensitivity test