Point Discontinuity
Measurement Method

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Optical Fiber

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Scope

This information describes the current reference method for measuring a point discontinuity in Corning® multimode and single-mode optical fibers.

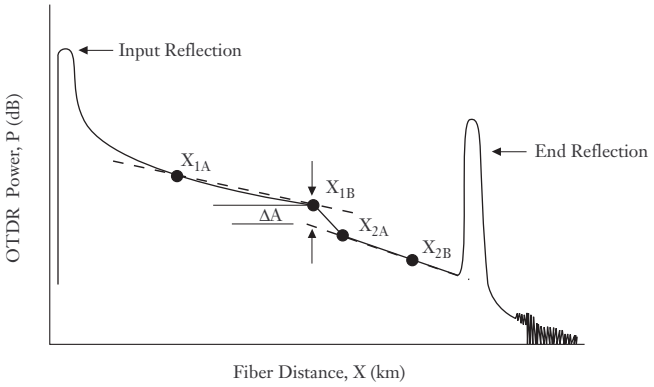
General

A point discontinuity in the fiber is measured using an Optical Time Domain Reflectometer (OTDR). This technique provides a non-destructive means of estimating changes in the transmitted optical-power level along the fiber length as a function of distance from the optical source. The OTDR measures the backscattered optical power at a series of discrete points throughout the fiber length. This backscattered optical power is proportional to the fiber attenuation rate; however, the OTDR does not measure the actual attenuation of the fiber.

Measurement Description

A point discontinuity is defined as a discrete step change in the backscattered optical power at any point along the fiber length. Figure 1 shows a simulated OTDR trace of a fiber containing a single, non-reflective point discontinuity.

Simulated OTDR Trace
Figure 1



The linear portions of the trace, X_{1A} to X_{1B} and X_{2A} to X_{2B}, represent constant attenuation rates; whereas, the abrupt drop in optical power shown as ΔA (between points X_{1B} and X_{2A}) is created by a non-reflective site in the optical path. (Note: a reflective site would appear as a positive spike between points X_{1B} and X_{2A}, but an overall drop in power between these points would still be observed.) The separation between X_{1B} and X_{2A} is a result of the OTDR pulse width and the detector rise and fall times.

The optical power loss between points X_{1B} and X_{2A} (in dB) includes loss due to the point discontinuity as well as loss due to intrinsic fiber attenuation over that distance. The intrinsic fiber loss is removed by using Least Squares Analysis (LSA) to define the slopes of the trace before and after the discontinuity, X_{1A} to X_{1B} and X_{2A} to X_{2B}, respectively. The vertical distance between these two lines at the beginning of the discontinuity (X_{1B}) defines the apparent loss (ΔA). (See Figure 1)

Measurement Conditions

The fiber ends are stripped of coating and prepared with end angles less than 2° with near perfect mirror surfaces.

- Measurement Wavelengths
  Around 850 nm and 1300 nm for multimode fibers
  Around 1310 nm and 1550 nm for single-mode fibers

Apparatus

Commercially available optical time domain reflectometers (OTDR) with different wavelength source units are used to measure attenuation uniformity.

References

EIA/TIA-455-59 (FOTP-59), Measurement of Fiber Point Defects Using An OTDR.

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