SCHOOL OF ELECTRICAL ENGINEERING
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SKEE 3742
OPTICAL COMMUNICATION LABORATORY

OPTICAL TIME-DOMAIN REFLECTOMETER

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Optical Time-Domain Reflectometer

Introduction

Optical Time-Domain Reflectometer (OTDR) is an optoelectronic instrument used for fiber characterization, based on scattering and reflections. An OTDR transmits a series of optical pulses into one end of the tested transmission path, and extracts the scattered/reflected light from points along the transmission path where the index of refraction changes. The strength of the return pulses (backscattering)is measured as a function of time, and is can be interpreted as a function of distance. OTDR can be used for estimating the characteristic (e.g., length, attenuation, reflectance) of fibers, splices and connectors. Multiple fibers and components with different characteristics may be concatenated over a very long distance, and OTDR can be used for estimating the fiber/splice/connector locations and characteristics from just one end of the system, in only one measurement. Reflective components (e.g., connectors) create a spike to the OTDR trace, while non-reflective components (e.g., fusion splices) do not since no excess light is reflected back. OTDR trace can also be used for fault localization and measurement of power losses.

Problem Statement

You will be given two span of optical fibers, and tasked with characterizing the fibers. You are expected to run several tests and observe the fiber properties for acquiring the transmission path characteristics.

In your report, you must include the total transmission loss (in dB) between the two end of each fiber, the length of the fiber span (in km), the attenuation of the fiber span (in dB/km) per each supported wavelengths, the reflectance/loss caused by connectors and the distances to these events. It is expected that the fiber loss must not exceed 0.4 dB/km at 1550 nm, connector loss must not exceed 0.75 dB, reflectance at each connector must not exceed -15 dB, and the total loss for the transmission path must not exceed 20 dB. Discuss also the effect of wavelengths and OTDR pulse width on the characterization results. Your report should include the OTDR trace, block diagram of the transmission path, and relevant discussion on whether the fiber is fit to be deployed.

Based on the transmission path characteristics, select the best fiber span to be use for deployment, and justify your choice.

Trigger

1. Literature study on the characteristics of optical fibers.
2. Awareness on the safety and accuracy issues in dealing with optical equipments.
3. Characterization of fiber using OTDR.
4. Analysis of results.