APPLICATION NOTE: OTDR

Optical Time Domain Reflectometer (OTDR) is used for the characterization of optical fibers. In an OTDR device a light pulse generated by a laser diode is coupled into a fiber. The light pulse travels in the fiber and experiences reflections from defects, splices and connectors. The reflected light signal is directed to a sensitive photodetector, which is suitable for detecting the light emitted by the laser diode. As the speed at which the light propagates in the fiber is known as well as the time when the light pulse is sent into the fiber, the distance that the pulse has traveled can be calculated giving the position of defects in the fiber as well as the length of fiber. The received OTDR signal trace is plotted on a logarithmic as a function of distance (see Figure 1 B). The slope of the curve gives the attenuation of the fiber, while local deviations from the linear trend indicate defects or splices or connector positions.

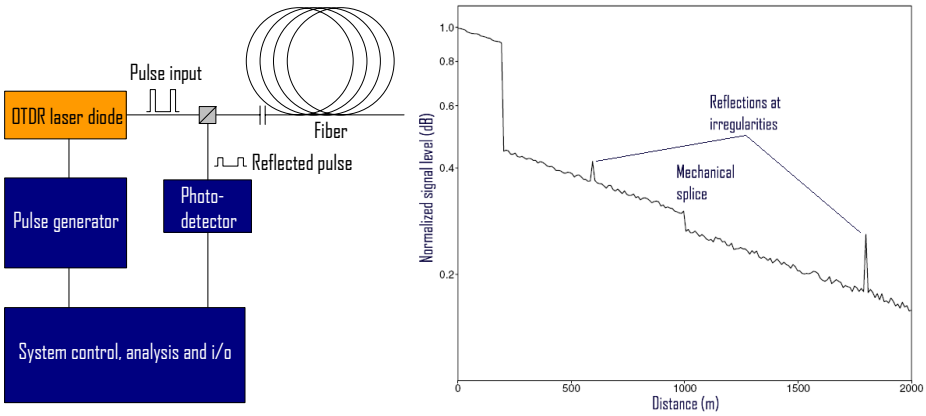

Figure 1. A) An OTDR component setup and B) an example of an OTDR measurement curve

In addition to fiber characterization, OTDR can also be used for sensing chemicals and gases as certain substances cause changes to the light guiding properties of the fiber and those can be observed as changes in the measurement curve.

OTDR lasers are Fabry-Pérot lasers that commonly operate at 1310 nm, 1550 nm and 1625 nm wavelengths. As only a small fraction of propagating light is reflected back to the detector forming a trace signal, for a good measurement a sufficient amount of light needs be fiber-coupled. To meet this requirement, the laser has to achieve peak optical output power of a couple of hundreds mW. Furthermore, as OTDR devices are mainly used for the characterization of the single mode fibers, the output laser beam must also be single mode in order to obtain good enough fiber coupling efficiency.

By widening the pulse the amount of light reflected back can also be increased. However, as the pulse width is increased, the resolution is worsened since the pulse width sets the minimum distance between two observable features. In an OTDR system pulse widths from 5 m to 500 m (25 ns to 25 µs in time) are typically used.

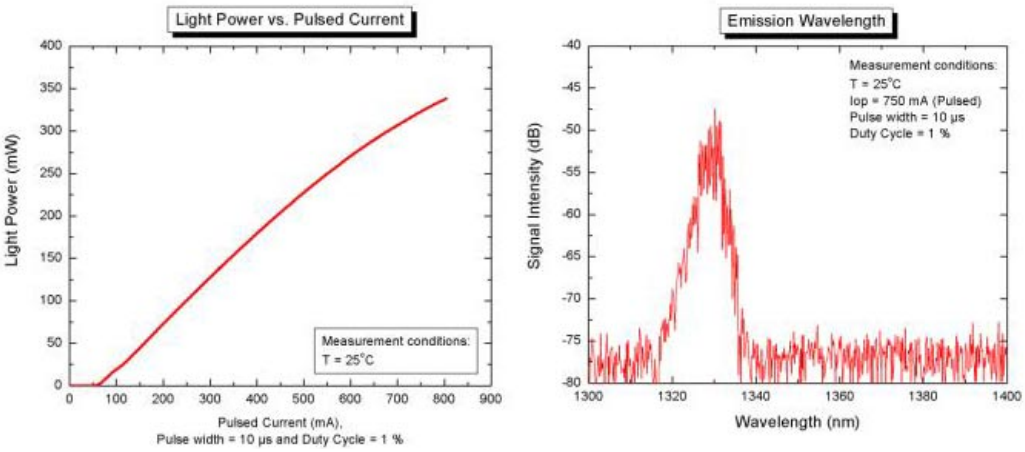

Figure 2. Examples of single-mode light power vs. current curve and emission spectrum for Modulight's high-power 1310 nm diode in pulsed mode.