Keywords

1000Base, Differential Mode Delay, DMD, Ethernet, Fiber, Gigabit, Multimode

Summary

A Mode-Conditioning Patch Cord is required, only if DMD (Differential Mode Delay) is reducing fiber-optic transmission reliability. Generally, DMD is an issue in GbE (Gigabit Ethernet) *multimode* applications (i.e. 1000Base-LX (SM) over multimode fiber).

Scenario

LEDs (Light Emitting Diodes) are too slow for GbE data transmission rates. Therefore, *multimode* GbE products use lasers instead of LEDs. Lasers shine into the fibers (i.e. launch) with a very small beam. The illuminated area is much smaller than the multimode fiber core. In fact, the beam diameter is close to the size of single-mode fiber core.

Question

So what?

Notes/Answer

In manufacturing, optical fiber is “improved” by adding special materials to the glass. This process is called doping, and the added material is called a dopant. The dopants and their concentrations are selected, based upon the desired fiber qualities (e.g. transmission wavelength, attenuation, strength). During the doping process, the dopant tends to concentrate in the center of the core. This concentration actually degrades the fiber’s performance. Usually, this degradation is not noticeable because multimode launches, by LEDs, fill the fiber with light.

With the advent of GbE, multimode applications use lasers instead of LEDs. The laser beam enters the multimode fiber in the degraded (high-dopant) area. Such a fiber link may experience DMD. To prevent DMD, a mode-conditioning patch cord is used.

The Mode-conditioning Patch Cord uses single-mode fiber at the laser output port of the equipment. Then, the single-mode fiber is connected to multimode fiber. At that connection, the centers of both fibers are precisely misaligned, or *offset*. Now, the light signal is injected into the side of the core of the multimode fiber where it can travel freely and the effects of DMD are greatly reduced.

Note: for each GbE multimode link, two (2) Mode-Conditioning Patch Cords are required -- one for each transmitter (i.e. laser).

Additional Reference: IEEE Standard 802.3, paragraph 38.11.4

