



## Application Note

### Multimode Attenuators

#### Keywords

1000Base, Application, Attenuator, Ethernet, Fiber optics, Gigabit, Multimode, VCSEL

#### Summary

Some multimode applications may, now, require attenuation. These applications use a *laser* launch, not a LED launch. If the incident power, at the receiver, is too high, then an attenuator is required.

#### Scenario

We received a request for multimode attenuators. As you can see from earlier product listings, we did not offer such devices. Actually, a need for such a device never before existed. However, we have received requests for MM attenuators. We needed a process for making multimode attenuators.

#### Question

I asked the Sincor rep, "Can your splicer produce offset-splice, multimode attenuators?" He responded, "Why would you want an attenuator for multimode?"

#### Notes/Answer

One word: **GbE** (Gigabit Ethernet: 1000Base-SX or 1000Base-LX)

LEDs are not capable of the fast pulse rates, which are required for GbE. Therefore, a laser launch is used for GbE, even over multimode fiber. GbE multimode transmitters use a VCSEL (Vertical Cavity Surface Emitting Laser) or a Laser Diode. VCSELs are less expensive than laser diodes.

Just like a single-mode fiber launch, the multimode laser energy is efficiently coupled into the fiber. The coupled power is much greater than a LED launch. As a result, more energy is transmitted through the fiber. Additionally, the VCSEL light is coherent; therefore, VCSEL light is more damaging than LED light. Without appropriate attenuation, the receiver could be damaged.

The following table is a guide to link length. Generally, if the link length is much shorter than the shown value, then attenuation may be necessary. Note: laser output power and fiber-coupling efficiency may be improved, forcing the use of attenuation at *longer* link lengths.

**Warning: measured power, at the receiver, should determine the amount of attenuation.**

Link Distance (ref: IEEE Std 802.3)	1000Base-SX (850 nm)	1000Base-LX (1300 nm)
62.5/125 $\mu$ m MMF	220 m	550 m
50/125 $\mu$ m MMF	500 m	550 m