Reel Time

1, 2, 3 … Oh My, 4

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Berk-Tek's Adventum's cable is constructed with GIGAlite™10XB fiber which can deliver 10 Gb/s at 4900 MHz out to 600 meters, outperforming the proposed OM4 specifications.

Just when you thought you were set with your aqua-colored OM3 50-micron fiber to carry you through the next generation of multi-gigabit applications, along comes its heir – OM4. But, when it comes to cable performance (copper or fiber) it's all about bandwidth and speed; and there's always a "next generation" waiting to be born.

Defining OM (Optical Multmode) cables, as designated by ISO/IEC 11801 international standards, includes characterizing fiber performance (bandwidth), light sources and distance relative to bandwidth. Minimum bandwidth is determined by the light source from the transceiver -- either OFL (overfilled launch) or EMB (effective modal bandwidth or "laser"). The light source will become key as we progress through the OMs.

The first OM (OM1) typically is a 62.5 micron fiber with a minimum OFL bandwidth of 200 MHz•km at a wavelength of 850 nm or 500 MHz•km at 1300 nm. OM2 incorporates 50 micron or 62.5 micron fiber having a minimal OFL bandwidth of 500 MHz•km for both 850 nm and 1300 nm. Both OM1 and OM2 are identified with orange jacketing (per ANSI/TIA-598-C) and can support one-Gigabit applications up to 550 meters (per IEEE 802.3z), see Table 1.

The development of OM3 threw fiber optics into the arena for 10 Gigabit applications. OM3 grade multimode fiber enables the use of lower cost light sources, called VCSELs (Vertical Cavity Surface Emitting Lasers), to achieve speeds and distances previously only possible through more expensive singlemode fiber lasers, such as Fabry-Perot or Distributed Feedback lasers. When utilizing VCSEL technology, OM3-grade fiber can support Gigabit Ethernet to 1,000 meters and 10 Gb/s Ethernet up to 300 meters. Higher grades of LOMF (laser optimized multimode fiber) can further deliver 10 Gb/s up to 600m more cost effectively than switching to singlemode fiber technology which utilizes the much more costly lasers mentioned above. Per TIA-598-C, the aqua jacket designation is assigned to OM3 cables containing laser optimized fibers with a minimum effective modal bandwidth of 2000 MHz•km and corresponding distance guarantee of 300 meters.

Both the TIA standard, along with the ISO/IEC 11802 (2nd edition) which define laser bandwidth for OM3 fiber, enable enterprises to confidently install high-bandwidth 10 Gb/s networks today, or at the least, assure an easy migration for tomorrow. But just when you thought it was safe to jump feet first into the 10 Gigabit waters … along comes a newer and better swimmer – OM4.

TABLE 1. ISO 11801 CHANNEL DISTANCES FOR OM

GRADE *	BANDWIDTH @850NNM	1 GBE DISTANCE	10 GBE DISTANCE
OM1	200 MHz•km (OFB)	300 meters	N/A
OM2	500 MHz•km (OFB)	550 meters	N/A
OM3	2000 MHz•km (EMB)	1 kilometer	300 meters
OM4	4700 MHz•km	1 kilometer	550 meters

*OM1 and OM2 are identified with orange jackets. OM3 and the proposed OM4 are designated with aqua jacketing, but all cables are not the same. Make sure you see the manufacturers' specifications before buying.

NEW OM ON THE BLOCK

Whereas the 10GBASE-SR Ethernet standard for 10 Gb/s using VCSEL sources sets the maximum distance on OM3 at 300 meters, some fiber manufacturers actually produced fibers that could reach further distances – resulting in offering higher grades beyond OM3 for better performance and distances.

OM4, as the proposed standard is currently defined, is an 850nm laser-optimized 50 micron fiber and has an EMB

(minimum bandwidth) of 4700 MHz•km and can reach 550 meters using 10GBASE-SR devices. And because OM4 was designed with backwards compatibility, it is defined as the first "universal" multimode fiber media. This means it is backwards compatible across all generations of 50/125 μm fibers.

Manufacturers of active and passive equipment are looking beyond 10 Gigabit applications, primarily for data storage and accessibility in the data center and SAN arena – remember, it's all about bandwidth and speed.

IEEE 802.3ba is the Task Force developing the 40-100 Gb/s Ethernet. This group expects to release this standard by mid-2010. The Task Group has already identified that information transport at 40-100 Gb/s must reach a minimum of 100 meters, making OM4 the obvious choice since it enables longer distances.

Right now, transceivers used for 10 Gb/s Ethernet are precise light sources that take advantage of the bandwidth and reach capabilities of OM3 and OM4 fibers. The OM4 system (combined active and passive components) is well-below the cost of singlemode fiber and its associated active equipment and can reach 300 meters while some OM4 fibers can reach beyond 550 meters using these same VCSEL's. Therefore, it makes sense to install OM4 today to support 1 - 10 Gb/s.

ROADBLOCKS

So, what's the catch? As history has demonstrated, it is not always the wisest choice to be an "early adopter." In this case, while OM4 is under review for ratification and guarantees 10 Gb/s can reach out to 550 meters (10GBASE-SR), 40/100 Gb/s Ethernet on multimode fiber is currently being specified at reduced distances. The difference is primarily due to the light sources. 10GBASE-SR uses VCSELs with a spectral width of 0.25nm. This narrow width light source can take full advantage of the superior bandwidth performance of OM4 fibers.

40/100GBASE-SRxx currently specifies a 0.65nm spectral width light source. While this wider light source will reduce the cost of the transceiver, it might create additional problems due to the added chromatic dispersion (spreading of light and colors) which would limit the possible distance given a specific bandwidth. If this is the case, these broader lasers cannot leverage the superior bandwidth, low loss and DMD performance of OM4 fibers. It should be noted that although these early 40/100 Gb/s light sources will have broad spectral width characteristics, it is almost a certainty that market demand will drive the specification of tighter sources that can reach longer distances over installed fiber. By installing OM4 fiber, you can ensure that the longest possible reach over multimode fiber will be available given current and future Ethernet transportation speeds.

THE BOTTOM LINE

Your best bet is to specify OM4 today for fiber applications over multimode for 10 Gigabit applications and beyond. In fact, some manufacturers offer a higher grade of fiber that extends beyond the specifications of OM4, which had been referred to as a premium laser-optimized OM3 but has been called "OM4-plus" or enhanced OM4. Stay tuned for updates on the 40/100 Gigabit application standards. ■

"Reel Time" addresses cable topics including both copper and fiber constructions, applications, installation practices and standards updates. If you have a particular cable issue, please send an E-mail to: carol.oliver@nexans.com and we will feature the solution in an upcoming issue.