

minEMBc is the right bandwidth measurement method for OM4

Several applications have led the growing interest in the standardization of a higher-bandwidth type OM4 multimode fiber. As part of the development of the Institute of Electrical and Electronics Engineers (IEEE; www.ieee.org) 100-Gigabit Ethernet standard, an extended-reach *ad hoc* group was formed to investigate options to increase the multimode distance. System lengths up to 250 meters over a higher-bandwidth fiber have been discussed. Also, Fibre Channel liaisons have indicated that a bandwidth “significantly greater than OM3” would be valuable, and lengths up to 150 meters have been discussed.

The supportable link length in a fiber application standard is a function of both the fiber and the transceiver. Because the transceiver specifications have not been finalized for these higher-speed standards, it is impossible to determine the exact link length that could be supported with an OM4 fiber in any emerging application. Assuming, however, the transceivers do not become dispersion-limited, a higher-bandwidth fiber could support the distances mentioned above.

In 2002, the OM3 fiber standard was finalized in conjunction with the 10-GbE standard. The bandwidth of an OM3 fiber can be determined via two standard-compliant bandwidth measurements: minEMBc (calculated minimum effective modal bandwidth) and the differential mode delay (DMD) mask. OM3 fiber has an effective modal bandwidth (EMB) of 2000 MHz·km, which supports utilization of low-cost 850-nm vertical-cavity surface-emitting laser (VCSEL)-based transceivers and can support 10-Gbits/sec over 300 meters. A few years later, some fiber vendors introduced a non-standardized higher-bandwidth fiber that supported 550 meters at 10-Gbits/sec.

Discussions have begun in the Telecommunications

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Standards organizations need to take a step back and focus on what is needed for the new fiber’s data rates and link lengths.

Industry Association (TIA; www.tiaonline.org) and International Electrotechnical Commission (IEC; www.iec.org)—specifically within TIA TR-42.12 and IEC SC86A—to define an OM4 fiber specification that is largely based on the non-standardized higher-bandwidth fiber. Current proposals for OM4 suggest taking the work that was done to develop OM3 and 10-GbE specifications and scaling it directly to OM4.

Corning believes this approach is not rigorous enough for the development of a new application standard.

If the scaling method goes forward as proposed, there is significant risk that OM4 will not be able to support the distance and performance requirements of existing and emerging applications.

Corning recommends that new fiber specification requirements be engineered for OM4 in a similar manner to those originally developed for OM3 during the 10-GbE standardization work. Such an approach will ensure that appropriate fiber-bandwidth and transceiver specification targets are established to achieve desired application link-length requirements.

One area in particular that needs to be addressed is the scaling of the DMD mask. A simple linear scaling method has been proposed, but this is inconsistent with the process that was conducted to develop the DMD mask for OM3. In contrast, the minEMBc bandwidth metric was developed so that it would be



linearly scalable.

The proposed OM4 specifications also discuss overfilled launch (OFL) bandwidth requirements. Today's OM3 fiber includes a 1500 MHz•km OFL bandwidth specification at 850 nm and a 500 MHz•km bandwidth specification at 1300 nm to address utilization with light-emitting diode (LED) sources. Effectively, only 1- and 2-Gbit/sec Fibre Channel applications use the 1500 MHz•km OFL bandwidth. The 500 MHz•km is primarily specified to support legacy 100-Mbit/sec operation.

The current TIA proposal for OM4 calls for an increased OFL bandwidth at 850 nm of 3500 MHz•km, and the IEC proposal calls for an OFL bandwidth at 850 nm between 1500 and 3500 MHz•km (the issue is still under study). One of the main arguments for increasing the 850-nm OFL bandwidth is to provide an extra layer of protection for fibers that are measured via the DMD mask.

Corning has done extensive testing and does not see a similar requirement for fibers that are measured using minEMBc—the bandwidth measurement method that Corning uses to determine EMB for all of its 50- μ m fibers. Burdening the OM4 specification with this additional requirement will only result in the potential for additional costs for the fiber manufacturer and end user.

For a fiber that is measured accurately with minEMBc, there is no functional value gained by increasing the 850-nm OFL bandwidth requirement. The minEMBc validation method is not contingent upon a specific minimum OFL bandwidth. If that is not the case with the DMD mask, it should be fixed versus relying on a legacy OFL bandwidth measurement to predict laser performance.

A major standards body has acknowledged the lack of

interest in higher OFL bandwidth requirements for OM4 fibers. Technical Committee 11 (T11) of the International Committee for Information Technology Standards (INCITS; www.incits.org), which produces Fibre Channel specifica-

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tions, passed a motion on the topic at its plenary meeting in December:

“...to send a letter to ISO/IEC JTC1 SC25 WG3, IEC SC86A WG1 and TIA TR-42.12 informing them that T11.2 intends to include OM4 (4700 MHz•km EMB 850 nm) fiber in our 16GFC (FC-PI-5) specification. 1G and 2G at 850 nm in the Fibre Channel Standard are the only data rates that utilize the OM3 1500 MHz•km OFL BW specification. No Fibre Channel standards require a higher OFL BQW.”

Corning believes this position will be echoed by other applications standards bodies.

It is critical for all standardization groups to focus on specification development that addresses current and future application needs. OM4 fiber must offer greater reach in support for multi-gigabit applications over OM3, be cost effective, and enable greater flexibility for next-generation speeds like 16-, 40-, and 100-Gbits/sec. Corning recommends that the fiber standards organizations take a step back and focus on what is needed for the data rates and link lengths they are trying to address with this new fiber.

At this point, it feels like the cart is a bit too far ahead of the horse. 

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