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Bend Insensitive Multimode Fiber Adds Little Value to Enterprise Network Performance

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at work

Introduction

Bend insensitive multimode fiber (BIMMF) has been in the "news" a lot recently and many are now wondering if there is a need for this new product type. A look at the performance requirements of systems today shows that reduced bend sensitivity has only marginal impact on the performance of a typical enterprise network. After quickly reviewing the history of bend insensitive fibers, we can focus on system performance to see why there is no rush to add a special bend insensitive product into the enterprise space.

Table 1 shows the typical specification of standard versus bend-insensitive fibers. For applications typically seen in the field, optical fiber has had a minimum bend radius of 25 mm or more within a connector housing or splice tray. Cabled fiber would have a larger radius based on cable diameter. Single-mode fiber is known to be more sensitive to bending than multimode, and fiber manufactures developed bend insensitive single-mode fibers well before BIMMF was available. It is interesting to note that the availability of single-mode bend insensitive fibers has not had an impact in the enterprise space over the decade. Very few end users experienced a need for this fiber in their network. Market forces have shown that this feature has not been perceived as worth the extra cost; today you do not widely see bend-insensitive single-mode fiber offered as a standard product in the enterprise space.

Table 1 shows the standardized bend loss specifications of traditional 50 µm multimode fiber (MMF) and, in the shaded cells, those proposed to IEC SC86A WG1 in April 2010 [1].

TABLE 1: STANDARD AND PROPOSED BEND LOSS SPECIFICATIONS

Macrobend Loss, max (dB)					
Bend radius (mm)	Number of turns	Traditional 50 µm MMF		50 µm BIMMF	
		850 nm	1300 nm	850 nm	1300 nm
37.5	100	0.5	0.5	no spec	no spec
15	2	1.0	1.0	0.1	0.3
7.5	2	no spec	no spec	0.2	0.5

Whether looking at multimode or single-mode implementations today, a reduced bend radius does not appear to offer many advantages over traditional fiber. Table 2 provides a list of important performance characteristics that generally do not see an improvement when BIMMF is utilized.

TABLE 2: BIMMF DOES NOT APPEAR TO SIGNIFICANTLY IMPROVE SYSTEM PERFORMANCE

Performance Attribute	Improves with BIMMF?
Bandwidth	NO
10/40/100G Distance	NO
Margin / Number of connections allowed	NO
Trunk Cable Diameter	NO
Cable Tray Fill Density	NO
Patch Cord Diameter	New designs do not necessarily require BIMMF
Connection / Splice Loss	NO
Apparatus / Connector Density	NO
Expected Lifespan	NO
Solution Cost	NO

You can see that many of the performance characteristics – such as bandwidth and loss margin - that are most important in designing a solution that will support current and future applications are not improved with the use of BIMMF.

Using standard fibers, cablers are able to achieve very high densities today. Trunk cables, again with standard fiber, are able to provide fiber counts of 144 fibers with a 13.1 mm (0.52 inch) cross-section diameter. Within the rack space, suppliers are able to provide 144 LC connectors within just one rack unit. If that density is not high enough, a changeover to MPO adapters with MPO to LC patch cords can provide a density of 864 fibers PER 1U! This is all being done today with standard fibers. Trunk cables are unlikely to be bent tight enough to cause bending loss and shelves are designed with routing guides to support installation of fibers safely.

There may be some benefit to having patch cords that can be bent to tighter areas, but one must be careful about encouraging poor installation practices. Remember that bend-insensitive is not the same as "break-insensitive". When subjected to the same abuse the likelihood of damage is the same for BIMMF as it is for traditional MMF.

Today there are limited Enterprise application requirements for BIMMF. For comparison, single-mode fiber deployment within homes for an FTTx application requires the cabling to be handled like telephone wire, stapled to baseboards and routed around door frames. There is no corresponding application requiring BIMMF. Data Center and LAN deployments use cable trays, conduits, patch cord trays, slack storage spools, and rack management systems that are all specifically designed to limit bend radii or mitigate deployment stress and error. Therefore the value of BIMMF is an assurance against the unplanned mishap and abuse of the media, not as a solution to address everyday occurrences.

Finally there are some potentially negative issues to consider that may adversely impact for your network.

- There appears to be some incompatibility between standard and BIMMF fiber. Core diameter and numerical aperture are not necessarily the same. Several vendors supplying BIMMF have not made it optional; they have switched across the board. This begs the question, "what happens if I mix fiber solutions?" It will be difficult if not impossible to keep regular and BIMMF patch cords separate, and high loss and/or bandwidth degradation may occur.
- There are currently no published standards available for BIMMF and, looking into current activity within the standards groups, there is not likely to be one for some time. It may be best to wait until the industry has come to some agreement about the expected performance of this fiber type. For example, there is not yet a guarantee that BIMMF from different manufacturers will be compatible. Use of a specific non-standard fiber may limit your options for change, for connecting to networks built at various times, or for upgrading in the future.
- There are also questions about field validation and network acceptance testing. Test standards and equipment are designed to support non-BIMMF; how do you test BIMMF installations in the field? The effects on source output characteristics as well as launch conditioning by mandrel-wrapping during referencing and system testing are some of the initial questions that are not yet answered.

In summary, BIMMF does not seem to significantly improve the state of the industry. Choosing this fiber will not allow a system to handle higher data rates, run over longer distances, or lower the cost of installation or maintenance. At this time, there simply don't seem to be enough benefits to risk installing a non-standard product that may limit you to a specific vendor, may become obsolete once standards are developed, or may have incompatibility issues with legacy and other systems.

References

1. Proposed IEC 60793-2-10 edition 5, contribution WU-22 to IEC SC86A WG1, April 2010.

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