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MANAGING 40/100 GbE INSTALLATIONS

by

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The Fibreoptic Industry Association always welcomes the arrival of new network solutions which allow users to implement enhanced system designs by virtue of the low signal loss or high bandwidths offered by optical fibre. Some would even argue that if those implementations also force the users to consider the installation new types of optical fibre with better performance to fully exploit those enhancements, then so much the better - it benefits our members, most of whom are installers.

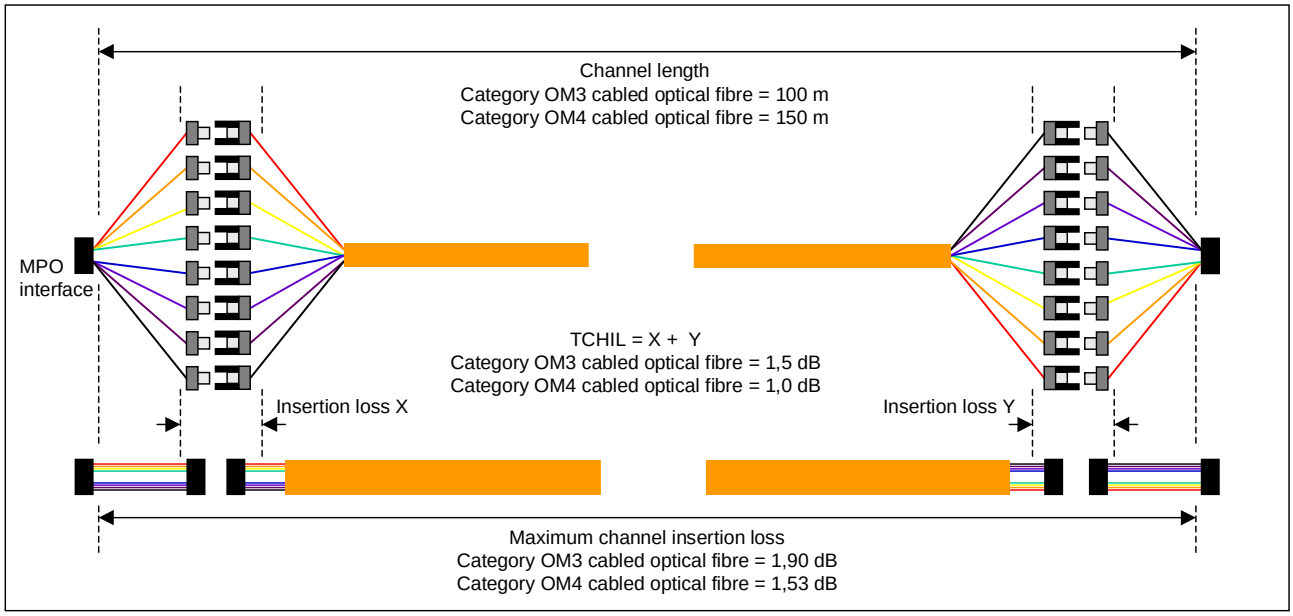
So the advent of the 40 and 100 Gb Ethernet standards should be an opportunity for the FIA to celebrate. However, we do have some reservations about the philosophies underpinning the multimode solutions that are necessary to achieve the stated distances of support. The FIA Technical Directorate should not be portrayed as Luddites or kill-joys - commercially available multimode products are available that will support the objectives of IEEE for 40 and 100 Gb Ethernet - but significantly more control will need to be employed in the procurement, installation and operational phases of projects than have typically been applied to date.

The reasons for this are threefold: firstly, the limits on channel insertion loss are more restrictive than ever before: secondly, we will be encouraged to use multi-fibre array connectors at patch panels as part of those channels and thirdly, we will have to manage the polarity maintenance issues generated at the transmission equipment. These three issues operating in combination essentially present a move away, for perhaps the first time, from standards-based optical fibre cabling and towards proprietary systems. Is this necessarily a bad thing? Certainly not - if the transmission demands of a customer depend upon using the components, tools and procedures from a specific supplier then why not apply those rules. However, one does question whether a standard published by a well established standards development organisation such as IEEE, respected for their commitment to open systems, should encourage such approaches.

The multimode implementations of 40 Gb and 100 Gb Ethernet (designated 40GBASE-SR4 and 100GBASE-SR10 respectively) support transmission distances of 100 metres using Category OM3 cabled optical fibre and 150 metres over OM4. The move away from open systems begins at this point since, whereas the OM3 implementation allows up to 1,5 dB total connecting hardware insertion loss (TCHIL), the OM4 solution TCHIL is restricted to only 1,0 dB. This change to the original OM4 objective of 125 metres (with 1,5 dB TCHIL) was only introduced at the last minute - clearly to substantially differentiate OM3 and OM4 (no channel length is specified for 1,0 dB TCHIL using OM3). One might shrug ones shoulders and utter something to the effect that “all is fair in love, war and networking standards” - but how realistic is restricting TCHIL to only 1,0 dB?

> For 1 and 10 Gigabit Ethernet applications, a model was issued that allowed calculations to be made on what distance of support would be achieved for a variety of different cabled optical fibre performance and TCHIL values. This has not been done yet for 40 Gb and 100 Gb Ethernet - suggestions have been forthcoming to indicate that these models are proprietary - adding further impetus to the move away from standards to supplier-specific solutions.

A huge amount of work has been done over many years to produce “open system” optical fibre connector standards which guarantee 0,75 dB under random mated conditions. With tolerances acting in line with expectations, a large percentage but not all of those random mated connections will provide performance of no more than 0,5 dB. Moreover, most of our field experience of such random mated performance is based on circular connectors containing one optical fibre - SC, LC etc. - not on rectangular interfaces having to achieve that performance over 12 or 24 individual optical fibres. Of course it is not strictly necessary to use the multi-fibre MPO connections at the patch panels but where one chooses to do so, the need to control the components in those connections become even more critical.



So how do we guarantee a 1,0 dB TCHIL? The answer is easy - by using enhanced performance products which basically means restricting the selection of components with each connection to a given supplier, just as we used to do in the old days of FSMA connectors - before the advent of connecting hardware standards.

An MPO connector on a cord

The schematic shows two implementations of 40GBASE-SR4 - one using simplex connections at the patch panels and there other using MPO interfaces. If we are to minimise "false fails" when testing such short installed links, we need to rigorously apply the latest standards (as defined in BS EN 61280-4-1 and the latest FIA Technical Support Documents) using reference test cords to minimise measurement error. Unfortunately, reference cords which are only vaguely defined for rectangular connectors. Moreover, applying the standard test methods to links with MPO interfaces presents significant difficulties for many items of existing test equipment. So where array connectivity is employed, the standards cannot provide much assistance and the responsibility for the definition of the test method, test equipment (and even test limits) lies with the supplier.

MPO connections at the patch panels certainly simplify the maintenance of polarity at the panels. Unfortunately, there are a number of different polarity maintenance schemes and the solution employed is supplier-specific. Procurement of the correct cords is critical to the basic function of the cabling - but this simply adds to the impetus behind component selection controls at the interfaces to provide the required insertion loss.

Assuming that we adopt the correct selection criteria to achieve the desired TCHIL in the first place, and are able to test to assure that we have that performance and follow the correct procurement rules to ensure that polarity is maintained, the next substantive challenge is maintaining that performance.

The maintenance of the low TCHIL across all eight (for 40GBASE-SR4) and twenty optical fibres (for 100GBASE-SR10) is critical to network function. Failure of a single optical fibre path to perform correctly results in system failure - "one out, all out". This will present new demands for cleanliness in the spaces in which the patch panels and equipment connections are housed. These demands will not only require substantial improvements in the "housekeeping" practices employed by users but will also demand cleaning and inspection procedures that are unfamiliar to most users. As the connecting hardware is likely to be supplier-specific, it is incumbent on the supplier to educate not only the installer but the user in the application of such procedures. Failure to do so, could significantly impact the acceptance of the multimode implementations.

Based on past experience of other rectangular connectors - some of which was not good - there are many who look askance at the MPO connector technology. Suppliers try to counter this reaction by reminding that these connectors are already used widely in Infiniband applications (where they tend to be installed as cords - and are easily replaced) and also in pre-terminated solutions where the connections are housed inside panels or other closures and are rarely touched following installation. Some would argue that experienced gained in such applications is not indicative of the performance of such connections at patch panels where they are subject to direct user and environmental influence.

To conclude, the push to deliver acceptable channel lengths using multimode optical fibre at 40 and 100 Gbit/s is not necessarily bad news but installers and users will be forced to seek, understand and implement supplier-specific instructions for the channel construction, commissioning and maintenance - and suppliers will need to make sure that those instructions are both comprehensive and accurate if a backlash is to be avoided.