

WHITE PAPER

DATWYLER DATA CENTRE SOLUTION: TESTED SUCCESSFULLY TO 100G

Is the new data centre cabling system also suitable for future higher-speed applications such as 40/100G Ethernet and 120G InfiniBand®? In order to provide a qualified answer to this question Datwyler arranged for the system to be tested under stringent conditions.

For many years, Datwyler and fibre optic manufacturer Corning Inc. have enjoyed a close strategic partnership. Among other things, since early 2011 Datwyler has exclusively used Corning's bend-optimised G50/125µm fibres (ClearCurve®) in all multimode fibre optic cables of fibre categories OM2, OM3 and OM4 – including the new Data Centre Solution cables.

Corning made its Sullivan Park R&D lab in New York available to test the suitability of the OM3/OM4 versions of this cabling system on 100G Ethernet and 120G InfiniBand® transmissions.

Test conditions for 100G

An appropriate test method for determining the performance of a system is to measure the Bit Error Rate (BER). All the links must achieve transmission with a bit error rate in excess of 10^{-12} . This test method provides the best possible guarantee that all the components in the cabling system will also work reliably in a "real" installation and will comply with the insertion loss (IL) limit values stipulated for 100G – i.e. that the user will not incur any additional error-related costs.

A test bed conforming to the IEEE 802.3ba 100GBASE-SR10 standard was constructed in the Corning laboratory (Fig. 1). In cabling terms this consisted of a 100Gbit/s transmission system utilising parallel optics. The signals were induced by a VCSEL-based 850-nanometer transceiver (12x 10Gbit/s). All the cables, components, transceivers and connectors used on the test bed were standard-compliant products, selected randomly off-the-shelf. In other words, no "special quality" products were installed which could "artificially" enhance performance readings by comparison with a field installation.

Test bed

During performance testing the modulation of the 850nm VCSEL transmitter and receiver was carried out by a PRBS data pattern generator (PRBS: Pseudo-Random Binary Sequence). The VCSEL transceiver was an Avago Technologies device with a 24-fibre single duplex MTP optical port. A bit error rate analyser was

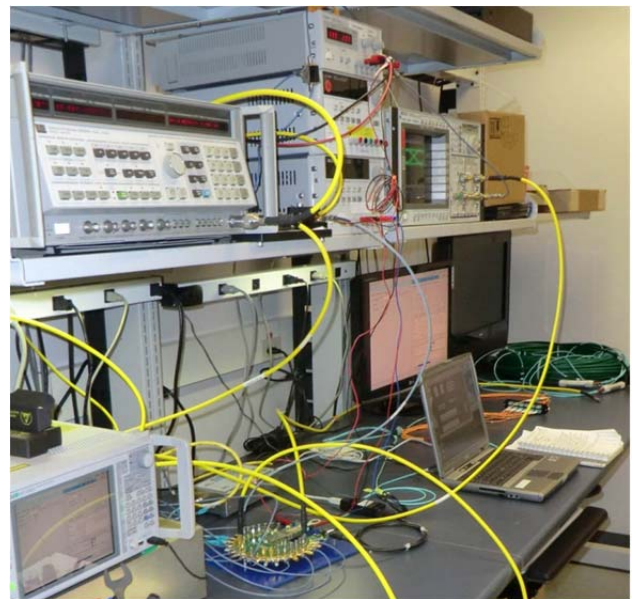


Fig. 1: Test bed in Corning's Sullivan Park laboratory, New York

also connected. A variable optical attenuation (VOA) unit was incorporated in the transmission channel to increase the insertion loss of all twelve transmission lanes (12x 10Gbit/s) as part of the BER assessment (Fig. 2).

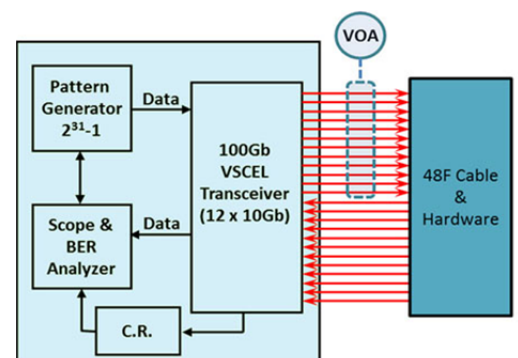


Fig. 2:
Test bed
schematic

In order to pose a realistic challenge to the cabling system, individual trunk cables were joined together using patch cords to create a total loop length of 200 metres – twice the length defined in the Standard. This link also comprised ten connectors, namely 9x MTP and 1x LC (Fig. 3).

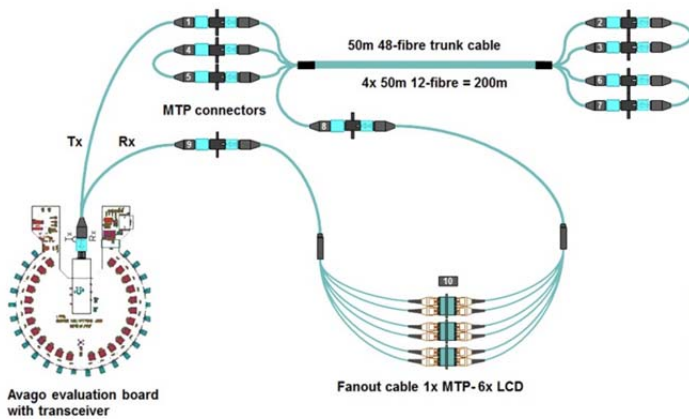


Fig. 3: Stringent test conditions over 200 metres with 10 connectors

Testing process and measurement results

Bit error testing was carried out by transmitting 60 terabits (60,000,000,000,000 bits) of data over the channels for a period of ten minutes. The data pattern generator produced a $2^{31}-1$ pseudo random signal (PRBS31), the most demanding pattern specified in IEEE 802.3ba 86.8.2. Bit error measurement covered all the channels in the link. In order to check the sensitivity of receivers to additional insertion loss, BER testing also included waterfall curve measurements. These result from the additional attenuation introduced in 0.5 dB steps using VOA.

The BER limit stipulated in the IEEE Standard is 10^{-12} , but not one single bit error was detected during testing, even with artificially introduced attenuation.

As part of BER testing a luminescent oscilloscope was attached at the end of the 200 metre link to record “eye diagrams”. These diagrams are created by the repeated graphic superimposition of several measurements of the same digital signal at different points in time. An “open eye” indicates minimal signal distortion due to interference. The eye diagrams created during BER testing were wide open for all 12 channels and complied with the IEC 61280-2-2 and IEEE 802.3ba (100GBASE-SR10) standards in every respect (Fig. 4).

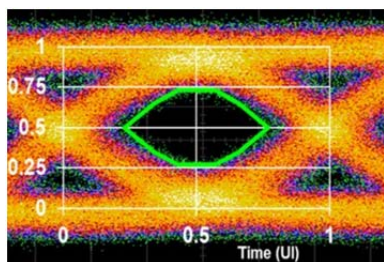


Fig. 4: Eye diagrams at 200 metre link length

The cabling skew between the link’s 12 fibre optic channels was also measured. The IEEE 802.3ba (100GBASE-SR10) standard allows a maximum transit time difference of 79 nanoseconds (ns) between the fastest and slowest signal over 100 metres.

In this test the maximum skew measured for the Datwyler Data Centre Solution was 0.43 ns (Fig. 5). Despite a link length of 200 metres this meant that both the 79 ns maximum skew of IEEE 100G and the considerably more rigorous 0.75 ns of InfiniBand® transmission were easily met.

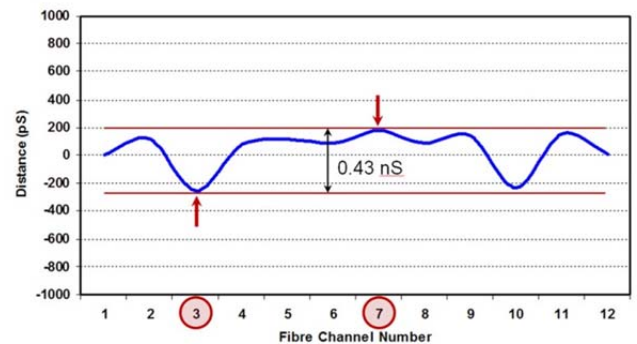


Fig. 5: Result of skew measurement at 200 metre link length

Finally, insertion loss (IL) was measured at a link length of 150 metres. For this measurement the OM3 link comprised:

- 3x 50 m mini trunk cable MTP-MTP
- 1x 1 m 24-fibre Y patch cord MTP-MTP
- 2x 1 m 12-fibre patch cord MTP-MTP
- 2x 1 m 12-fibre fanout cable MTP to LC

In the 150 metre link there were a total of eight connections: 7x MTP-MTP and 1x LC-LC.

The IEEE 802.3ba standard for 100GBASE-SR10 specifies a maximum insertion loss of 1.9 dB per channel for OM3, but test bed measurements produced readings of between 0.3 and 1.0 dB. There are therefore extremely high reserves at the defined limit.

Summary

Datwyler’s Data Centre Solution passed the 100G test with flying colours – despite doubling the link length. Up to ten connectors per link are possible with this solution, thanks to the use of premium quality cables and components and the high-precision connector configuration. There was 100% compliance with the maximum bit error rate of 10^{-12} , and insertion loss was significantly below the 1.9 dB maximum on all fibres. The skew limits for 100GbE and 120GIB were easily met, even at double the link length. This means that even in the 100G test Datwyler’s Data Centre Solution sets standards for fibre optic cabling systems in data centres. With its comfortable reserves on the limits of the applicable standards, it provides headroom for emerging applications and maximum investment protection.