QUANTIFI PHOTONICS™

Automated Optical Transceiver Testing in PXI

APPLICATION NOTE

BERT-1005 PXIe module

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Introduction

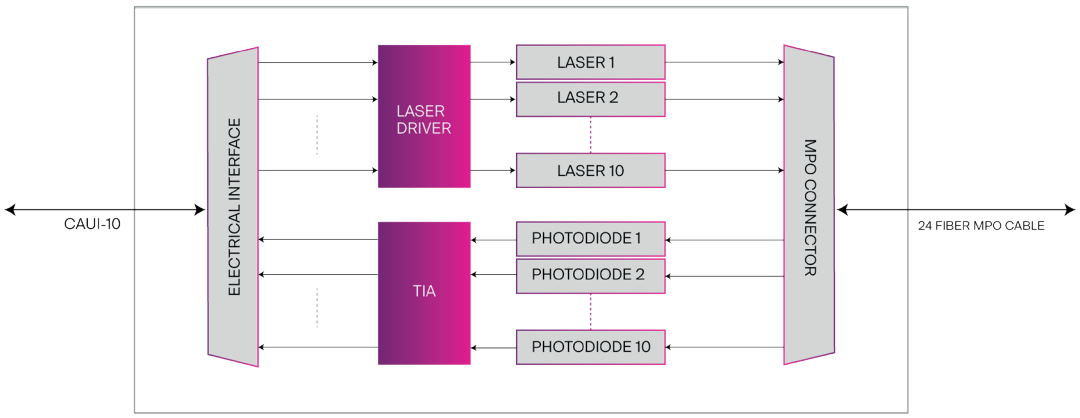
Modern optical transceivers have been integral to meeting the significant and ever-increasing demand for bandwidth in datacom transmission. Because of the wide variety of formats available, optical transceivers are increasingly being deployed into non-datacom applications in the automotive, aerospace and defence industries. As the transceivers form a core part of data connectivity, testing them for their performance is an important part of the system construction. In this application note, we will showcase some of the common test configurations designed for transceivers which use multi-fiber channels of multimode fiber (MMF), running at the wavelength range of 850nm. Such multi-channel transceivers often use MPO fiber bundle connectors. The use of multi-fiber channels makes it even more desirable to have an automated test system which can perform sequential test of each channels with minimal operator handling.

What is an Optical Transceiver?

Optical transceivers are devices that transmit and receive optical light modulated with data. They typically come in compact, pluggable modular form factors and there are many different types, each conforming to industry specifications. Almost all transceivers contain sets of Lasers and photodetectors to perform the transmitting and receiving functions.

Figure 1:

Block diagram of a 100GBase-SR10 transceiver module with MPO connector



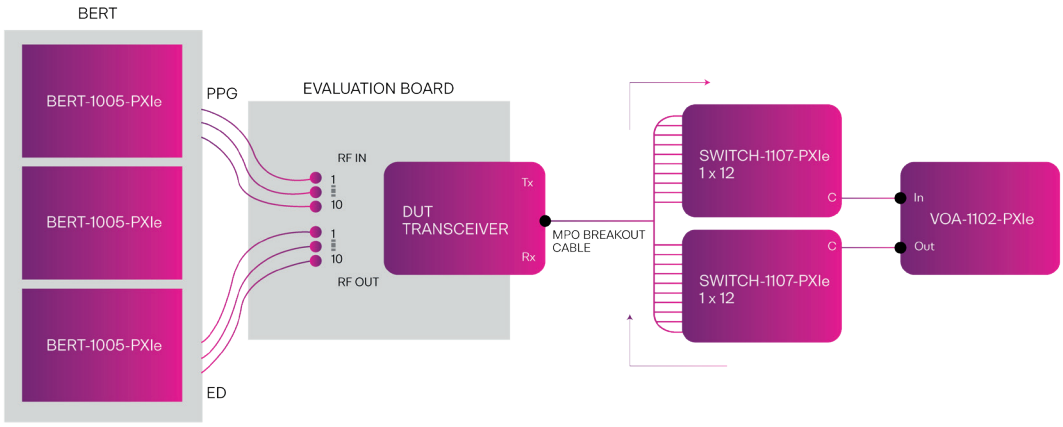
Common Transceiver Tests

Some of the common tests performed on optical transceiver modules include Loop back BER test, receiver sensitivity test, and Tx/Rx pair cross-test. In its simplest form, a transceiver loop-back test can be performed with just an MPO patch cable, but in order to make the test far more comprehensive, variable optical attenuators and optical switches can be used to perform fiber loss simulation and Tx/Rx pair cross test. Quantifi Photonics manufacture a variety of PXIe-based optical test modules which can be configured into a single, integrated test system that performs all the tests mentioned above. Coherent Solutions manufactures the following products suited to MMF 850nm range.

- VOA-1102-PXIe: OM3 MMF, 800 – 900nm wavelength range
- Switch-1100-PXIe Series: OM3 MMF, 800 to 1420nm wavelength range in various switch configurations
- BERT-1005-PXIe: 4-channel 14Gbps NRZ bit error rate tester consisting of a Pulse Pattern Generator (PPG) and Error Detector (ED)

Figure 2:

Schematic diagram of a single transceiver Tx/Rx cross test setup with optical link loss simulation



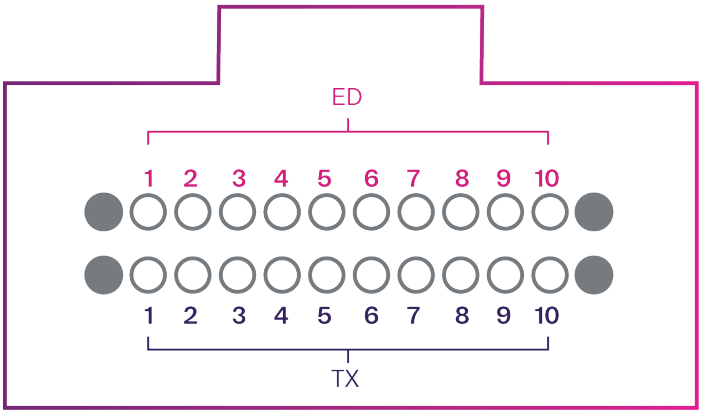
In this simple example, we assume the DUT to be a 100GBase-SR10 pluggable transceiver which uses a 24-fiber MPO for 10 channels of 10Gbps NRZ signal.

3 units of 4Ch BERTPXIe-1005 provides the 10 channels of differential PPG output needed to drive the transceiver, connected via an eval-board.

The MPO optical connection on the transceiver has 24-fibers, where the bottom 10 fibers transmit and the top 10 fibers receive.

Figure 3:

Front-end view of a 24-fiber MPO connector



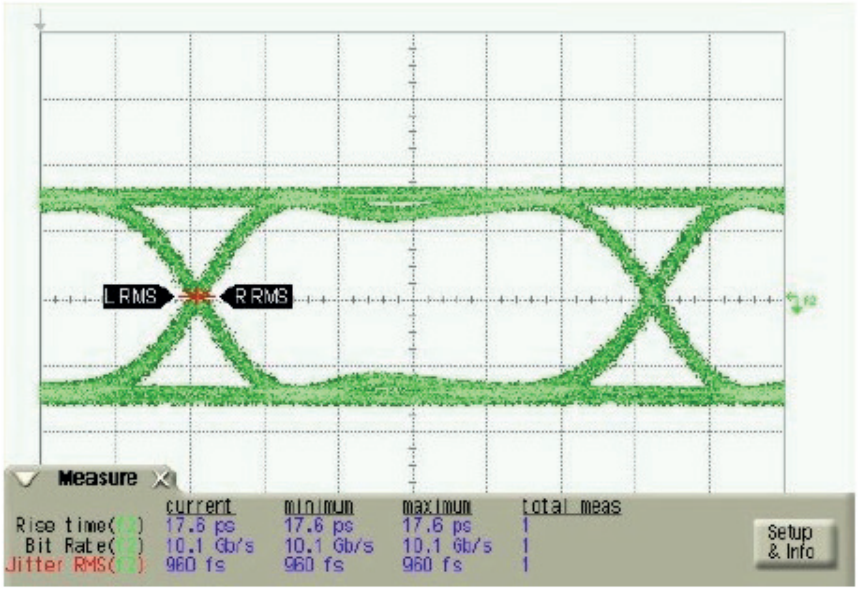
The 1x12 switches are connected to the transceiver using a 24-fiber MPO break-out cable, with each row of 12 fibers connecting to a 1x12 switch. The common ports of the two 1x12 switches are then connected to the input and output of the Variable optical attenuator.

In this arrangement, any of the 10 Tx channels can be routed to any of the 10 Rx channels using the two 1x12 switches, allowing cross-testing of the Tx/Rx channels. The VOA allows simulation of lossy fiber links, to test the Rx performance at various input powers.

An additional benefit of this grid-switching configuration is that only one VOA is needed to test the full 10 channels. The BERTPXIe-1005 allows the user to generate high-quality PRBS patterns up to 14Gbps on four channels. The built-in error detector part of the BERT uses internal CDR so that no trigger or data-edge connection back to the PPG is needed, making it perfect for use in cross-testing configuration.

Figure 4:

Differential 10 Gbps eye diagram of BERTPXIe-1005 PPG NRZ Signal



This example shows individual channel cross-test capability of the test system on a single transceiver module, but the setup is scalable. It can easily be configured to cross-test Tx and Rx parts across multiple transceiver modules to identify the point of failure.

The PXIe modules can be controlled from Coherent Solutions' web-based Cohesion UI software, which provides full control and monitoring from any modern web-enabled mobile device or PC connected to the same network. A full set of SCPI commands is also available for remote control in user's own automation code.

Advantages of PXI

The compact size of Coherent Solutions' PXI optical test modules enables the testing of hundreds of channels to be set up in just a few 19-inch PXIe chassis (each chassis provides up to 17 free slots).

In addition, the entire test system can be connected as a single synchronized PXIe system, and setting up remote control codes is simple and straight-forward using LabVIEW, SCPI, Python or C. For applications requiring fast sequential measurements, the high speed synchronized backplane trigger across all modules ensures that there is minimal lag or latency between instruments.

Figure 5:

18-slot PXI chassis with various PXI modules installed (indicative image)

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