Simplified Backreflection and Output Power Testing of Transceivers

Topics

- **The need to test BR in transceivers**
- **Simplified and accurate testing with the BRM-100**
- **A unique feature: combined BR and power measurements**
- **Typical setup examples**

The efficacy of fiber optic communication systems hinges on mitigating signal loss and optimizing signal quality. Central to this objective is reducing reflections. Accurate measurements of backreflection (BR), also called return loss (RL) is critical for good component selection in your optical network.

While electronics and optics operating at slower speeds, such as 25G-NRZ transceivers, may exhibit lower sensitivity to BR, their faster and more advanced counterparts, like 100G-PAM4 transceivers, demonstrate significantly heightened sensitivity to reflections. The need to test BR in passive components is well established but we now see an increased requirement industry-wide to test BR in active components such as transceivers.

There are many designs to couple the optical signal to the electrical converter which typically include components such as fiber optical connectors, arrays, lenses and waveguides. Defects such as poor polish or bad anti-reflective coatings can contribute to high reflections but so can defects in the coupling such as air bubbles in the epoxy. The only way to be sure the final product does not produce high reflections which can degrade signal quality is to measure the BR once it is full assembled.

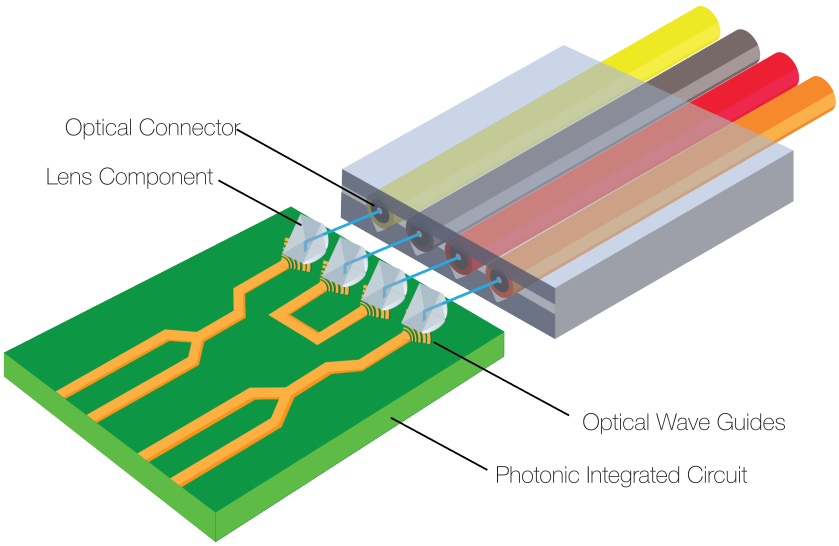

Figure 1: Typical optical coupling to an electrical converter

Santec's BRM-100 is the latest evolution of the most accurate and reliable backreflection meter on the market. Available with either a single channel output or multi-channel outputs and in either single-mode or multimode fiber, the BRM simplifies your testing process.

Single channel Back reflection Meter

Multichannel Back reflection Meter

While combining source and return loss modules on a multi-application platform may operate on a similar principle, they typically require the user to do a calibration themselves. If the process is not perfectly done by the operator, an error could be induced affecting all measurements without any feedback that this occurred. Santec's BRM-100 is a standalone meter and does not require any calibration from the operator. In most applications, you can simply connect your device and measure accurately.

Each channel of the BRM has stored calibration factors and is calibrated under Santec Canada's ISO 17025 accreditation using NIST-traceable standards to guarantee the best BR accuracy in its class of ± 0.4 dB. The BRM has a wide dynamic range from 0 to -85 dB for SM and 0 to -60 dB for MM.

A standard part of transceiver manufacturing is also measuring the output power of each transmitter channel. The BRM can be configured with a 2mm InGaAs detector for single fiber connectors such as LC or an integrating sphere detector for duplex connectors such as duplex LC uniboot or multifiber connectors such as MPO. The detector is calibrated and NIST-traceable for accurate and reliable power measurements.

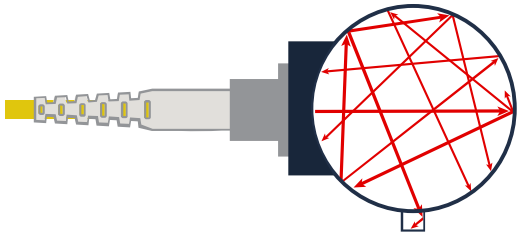

Figure 2: Integrating sphere

An ideal tool for production as well as labs and R&D, Santec provides free software to run the instrument which can save test data and generate reports. For customers who want to integrate the BRM into their own systems, it is programmable via simple SCPI commands through either USB or Ethernet communication.

The BRM also has the unique ability to measure BR and output power of two difference channels at the same time by integrating Santec's 2C switches. This makes testing faster and with fewer connections to the device under test (DUT) which reduces the chances of damaging it. A single wavelength, 8 channel test (4 Tx transmit and 4 Rx receive lanes) for both BR and power can be completed in under 5 seconds.

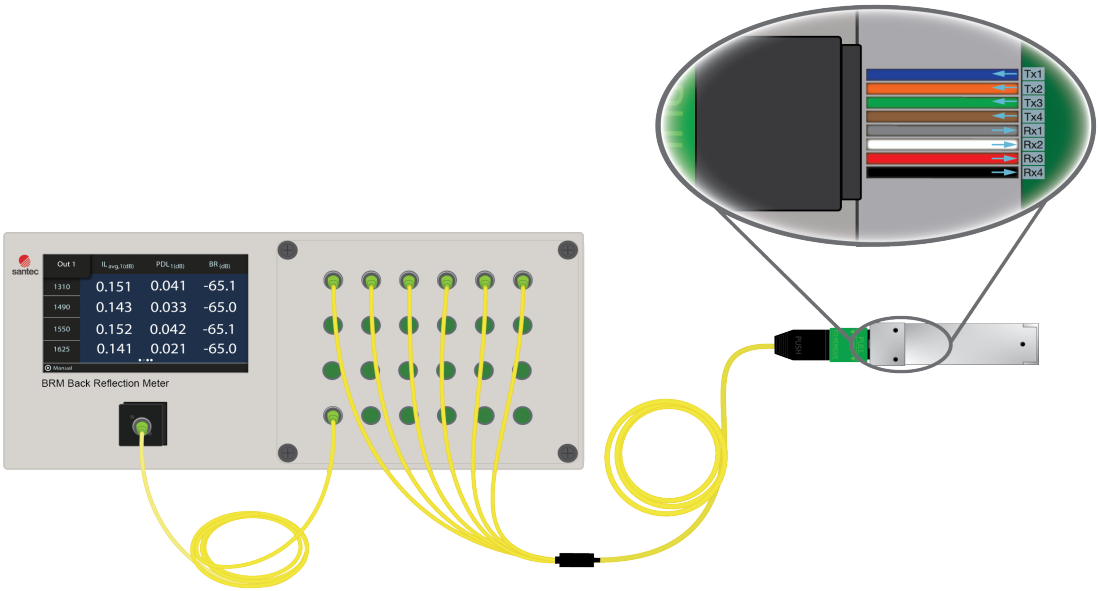

Figure 3: Measurement setup for a typical transceiver

Figure 3 below shows a measurement setup for a typical transceiver with dedicated Tx and Rx fibers. Thanks to the special 2C configuration, the switch only needs to go from channel 1 to 4 instead of 1 to 8 which cuts the measurement time in half. While on channel 1, the meter measures BR on Rx1 and output power from Tx1. The switch then goes to channel 2 and so on.

There are many more device configurations out there with as many ways of optimizing the test setup. You can reach out to one of our experts to help configure the right instrument for your needs.

The increasing sensitivity of high-speed transceivers, particularly evident in advanced technologies like 100G-PAM4, underscores the industry's evolving need to extend BR testing from passive to active components. The BRM-100 simplifies transceiver manufacturing, incorporating backreflection and output power measurements as an efficient, programmable, and versatile tool for both production and research environments.