Application Note 002

Good practices for accurate RL measurements using the MS12001

Mark Berezny, Senior Product Line Manager
Emmanuel Kolczynski, Product Line Manager

In fiber optic networks it is critical to limit the amount of light that is reflected between the transmitter and the receiver. High amounts of reflection can directly impact network performance by causing laser instability, interfere with the receiver, lower optical-signal-to-noise ratio (OSNR) and ultimately raise bit-error-rates (BER).

Return Loss is a measurement that indicates the amount of light reflected by a single discontinuity in a transmission line or optical fiber. The MS12 Return Loss Meter, part of the JGR's MS12001 Cable Assembly Test System, uses a mandrel free approach based on optical time-domain reflectometry (OTDR) technology to measure the reflectance of connectors, cable assemblies, or fiber optic components.

MS12 operation principle

The MS12 Return Loss Meter can reliably and accurately measure Insertion Loss (IL) and Return Loss (RL). The internal source is used in CW mode during an IL measurement and pulsed to obtain mandrel free RL measurements. Figure 1 below shows a general diagram of the MS12 operating principle.

While performing IL measurements, an internal detector is used to monitor the source power in order to compensate for any potential variations. This is a critical design feature to ensure stable, accurate and reliable measurements especially in facilities where the temperature and humidity are difficult to control.

While taking RL measurements an internal reflectance reference is used to provide a known calibrated reflection point This known reflection point will allow the instrument to correct for variations in the power of the source.

A key feature of the single-mode MS12 module is its capability to accurately measure reflectance values in the typical reflectance range of UPC and APC connectors today. Typical UPC & APC connectors have RL of >55dB and >65dB respectively. Instead of using a -15dB glass to air reflection as a reference, the MS12 internal reference is set to -52dB which is much closer to that of current real world measurements.

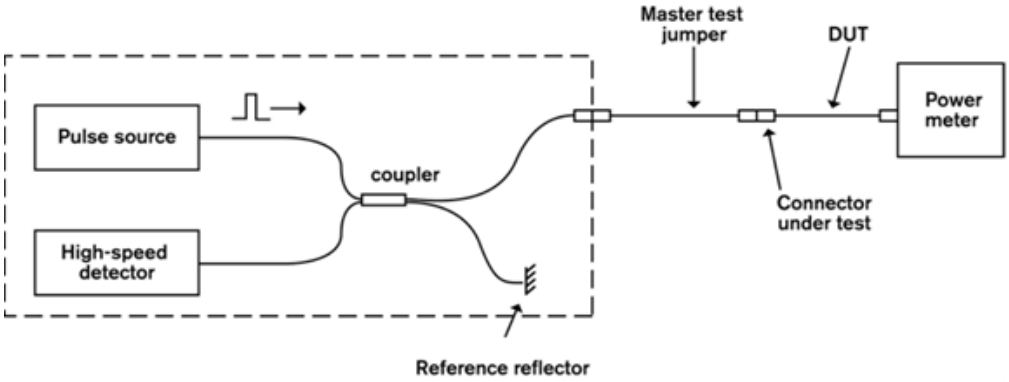

Figure 1- MS12 Single-mode Return Loss Meter general operating principle

Referencing Master Test Jumpers (MTJ)

Referencing the Master Test Jumper is an essential part of the testing process used by the MS12001 Cable Assembly Test System.

During the MTJ reference, the MS12 Return Loss Meter makes two measurements which are critical to ensuring the accuracy of the Return Loss measurements:

- IL of the complete optical path.
    - Compensates for the insertion loss of the system during RL calculations including all connections, switches, master test jumpers, and anything else in the optical path.
- Length of the MTJ1.
    - Find the end position of MTJ1 to determine the location where the DUT Return Loss is to be measured.

One key element of the MS12001 design is the way it manages the Master Test Jumper reference. The system will automatically and without any additional steps required by the user, account for any loss due to dirty connectors or poor mating on the front panel. In addition, the intelligent MS12001 software will notify the user if the path is too obstructed and requires cleaning. However, remember that it remains very important to pre-emptively properly inspect and clean all connectors to avoid damaging your test instruments or Master Test Jumpers.

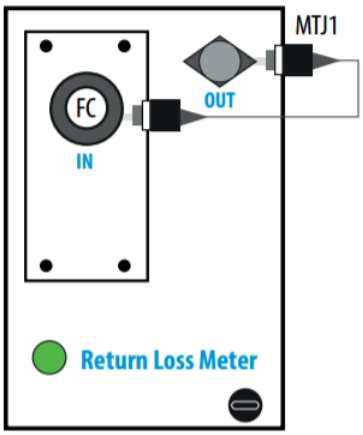

Figure 2- MTJ1 referencing for typical measurements

RL Measurements

The MS12 Return Loss Module is fully automated by integrating a factory calibrated reflectance reference. It is therefore not required to perform a glass-to-air verification, only a single MTJ reference is needed to achieve the most accurate RL measurements in the industry.

A typical testing sequence for a standard cable shown in Figure 3 below.

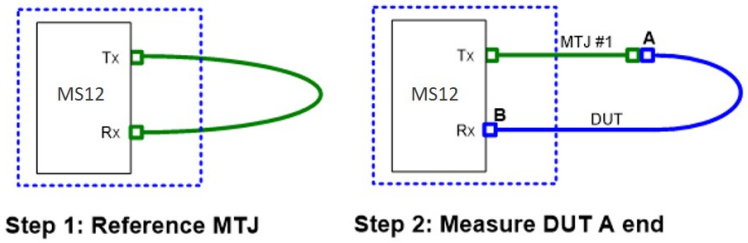

Figure 3- Typical testing sequence with MS12001

Conclusion

Minimizing network return loss is critical to achieve optimum performance. With its unique design, the MS12001 Cable Assembly Test System provides an easy to use accurate and error free approach to measure IL and RL.

After correctly referencing, users provide the MS12001 software all the required information to make accurate measurements of both IL and RL. Through meticulous design the MS12 is capable of accurately, and reliably measure Return Loss up to 80 dB which satisfies the needs of even the most demanding market applications.