AN-126

Measuring Accurate Return Loss through Optical Components

Overview

Often, return loss is measured as though it is a metric that is completely independent from the other qualities a cable possesses. In reality, this is a valid train of thought for the true return loss of a connector, but a connector's measured return loss is deeply affected by its insertion loss and the attenuation of its cable. For every 1dB of added loss, the measured return loss of the cable increases by 2dB. Therefore, it becomes important to account for the loss in the cable when the system has measurable loss.

Having a 14dB (Fresnel) reflection is important for a number of reasons. Not only does this allow the unit to easily find the reference reflection, but the measured value of 14dB lets the user know the quality of the reference. Without referencing to a high-quality UPC connector, it is difficult to know if the return loss being measured is the true return loss or a product of the reference setup. If a reference cable does not have UPC termination, a short, low loss UPC to APC termination stub will need to be used to perform the return loss reference.

Figure 1: Typical OTDR-like trace for an open flat connector

For example, assume a single mode test setup where the cable runs from the OP930 into a 2m jumper through an optical switch before reaching a 3m launch lead with a PC termination. When this setup is referenced, it may give a distance of 6.5m and a RL reference value of 16.4dB. If this extra loss is subtracted out, the RL will read 14.00dB and all subsequent calculations will account for the extra 2.4dB of return loss that is inherent to the system. *(see Figure 4)*

This can affect whether cables pass by increasing the measured return loss to make a cable seem as though it has passing values. Going back to the previous example, assume that all reference cycles have been completed but the 2.4dB of additional loss is not referenced out. Now imagine a cable is connected and the RL meter reads 56.1dB. At first glance, this cable has passing return loss and if its insertion loss also passes, it will move on to the next stage of the production line. However, if that additional 2.4dB of return loss is subtracted out, our meter will now report that the return loss is 53.7dB - a value which is failing in many production facilities.

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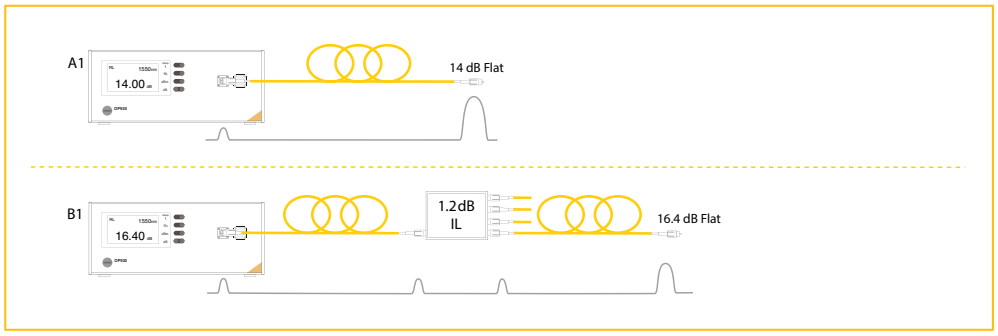


Figure 2: 14dB reflection degraded when traveling through lossy system

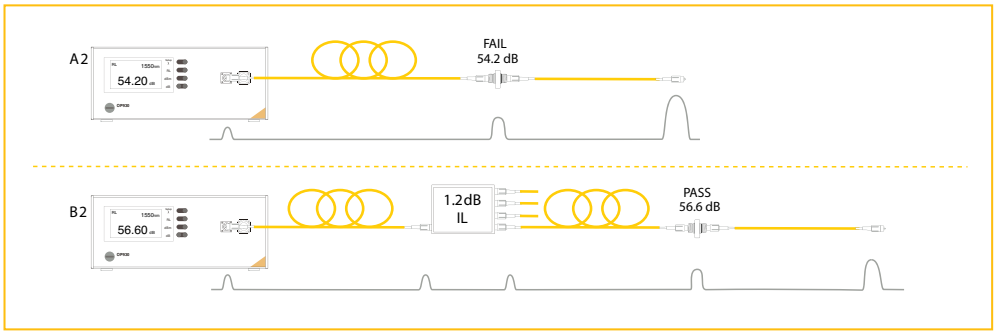
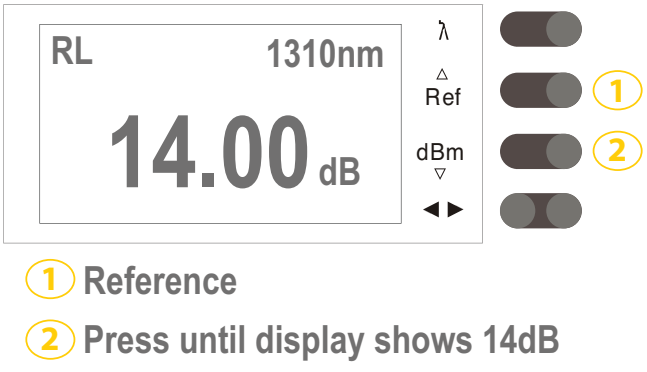


Figure 3: PC-PC connection degraded when traveling through same lossy system as in Figure 2 above

OptoTest has designed several ways to correct for this so that the measured return loss is as close to the true return loss as possible. Using the front panel controls, immediately after referencing return loss, press and hold the dB/dBm button.

Figure 4: Typical OP930 front panel display



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When the setting has been applied, the RL values should read 14.00dB and all subsequent measurements will include the correction. When performing measurements in OPL-Max and OPL-Log, there is a setting in the program set via the sequence file which is usually referred to as “14dB offset“.

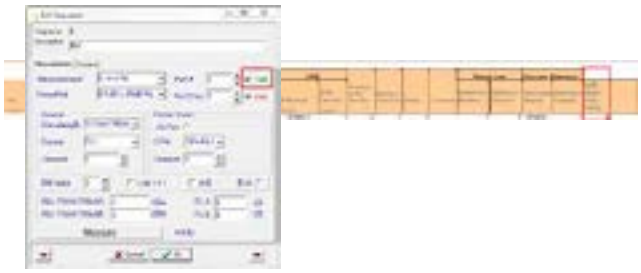

Figure 5: OPL-Max sequence editor pop-up

In OPL-Pro, the setting is available from the Return Loss Reference Window by clicking the Advanced button after performing a reference. Once in the Advanced tab, select the Return Loss Offset option and enter the appropriate offset amount. The offset should be the difference between the reported RL value and 14.0dB.

Figure 6: OPL-Pro 930 RL reference pop-up

Figure 7: OPL-Pro 930 reference pop-up showing advanced options

Once the Return Loss offset has been set, all subsequent measurements will have that amount subtracted from them.

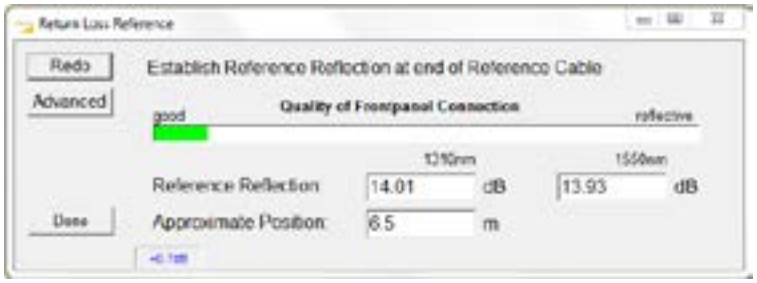

Figure 8: OPL-Pro 930 RL reference showing RL offset in bottom left corner

In order to ensure that the value reported by an OptoTest OP930 Return Loss Test Set is not largely a product of the reference setup, there are a few simple steps that must be taken. First, use a high-quality UPC termination cable to create reliable 14dB Fresnel reflection. Second, make sure all connections are free of contaminants and properly mated. Cables that are not properly cleaned or mated may exhibit very high insertion loss or large reflections which can, in turn, affect the measured return loss of the cable. Finally, subtract any loss inherent to the system using one of the methods described above. Following this procedure will help to keep the measured return loss as close to the true return loss as possible.

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