AN-103

OptoTest
Test Solutions for Fiber Optics

Measuring Insertion Loss/Return Loss For Unlike Connectors Using a Golden Cable and Bi-Directional Return Loss Meter

Overview

Testing hybrid cables poses certain difficulties due to the ends having unlike connector types. Typically hybrid bulkheads/adapters are required (SC-FC, ST-FC, etc.) and many times they solve the problem with minor issues. However, in some circumstances hybrid bulkheads will not suffice.

When testing SC-LC cables, such an instance arises. SC-LC bulkheads have high loss and poor repeatability and as such, they should not be used in the testing process. To get around this issue, the golden cable method can be used.

Referencing

Referencing Insertion Loss with Golden Cable

Similar to testing a DUT on the OP931, connect the golden cable between the two reference cables (FC/APC-SC/PC on A-B source ❶ and FC/APC-LC/PC on B-A source ❷).The golden cable should act as connection between SC-LC without using the high loss bulkhead. Press **Ref**. to reference IL in both the A-B and B-A directions. (To view this on the front panel, press the left arrow twice from the OPM screen to IL).

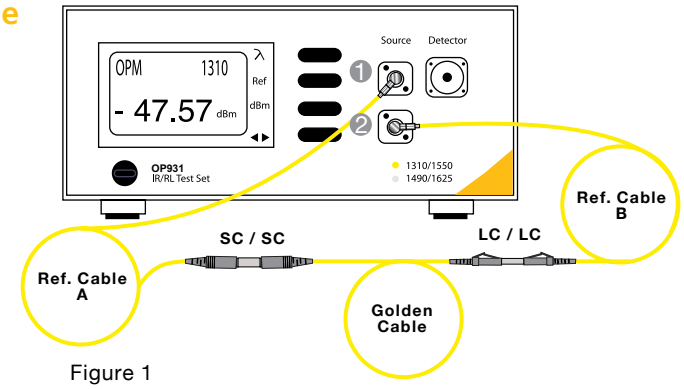

Figure 1

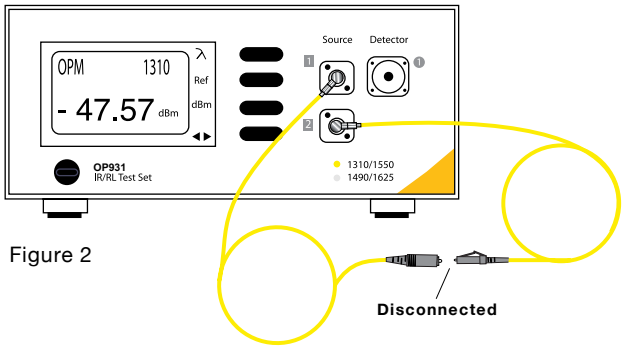

Figure 2

Referencing Return Loss

To reference RL, press the left arrow once to the RL screen from the IL screen. Disconnect the golden cable from both reference cables and leave the LC and SC endfaces open to induce a sufficiently large reflection. Press and hold Ref until you see **Ref: A----** on the front panel screen. This indicates that the OP931 is searching for a large reflection and determining the length of the reference cables. After referencing, the instrument will continue measuring return loss on both wavelengths automatically.

Testing the DUT

Attach the DUT between the reference cables (where the golden cable used to be) and IL and RL readings should start automatically without any further calibration. To view both measurements, navigate to either IL mode or RL mode.

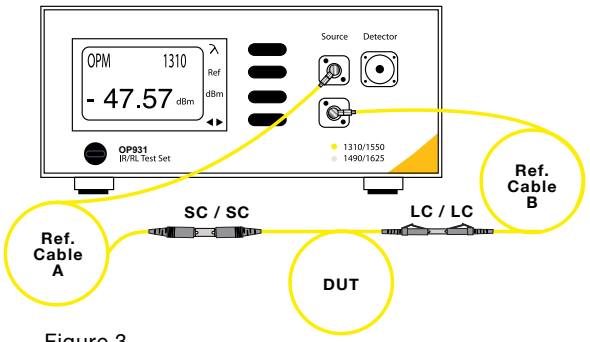

Figure 3

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Concerns When Using the Golden Cable Method

It is possible that if the golden cable is not reference quality, the DUT will actually display gain rather than a loss. This is due to a non-reference quality cable being replaced with a better, low loss DUT. Therefore, the golden cable should have low loss to see a negative value when testing the DUT. However, even when a low loss reference grade golden cable is used, it is still possible to measure zero insertion loss or even a positive insertion loss when measuring a DUT. This may be due to either the reference being done poorly because of dirty connectors or bad bulkheads or that the DUT is actually of higher quality than the golden reference cable.

Golden Cable Verification

A golden cable would be a reference-quality cable with low insertion loss. Before referencing for the DUT, one should verify that the golden cable has fairly low loss (<0.05 dB).

This requires a simple insertion loss test with the golden cable as the DUT and two OPM adapters, 2.50mm and 1.25mm. First, attach the 2.50mm adapter to the OPM and connect the FC/APC side of the reference cable on the AB source port 1 and the SC/PC end to the 2.50mm adapter 1. Click **Ref.**

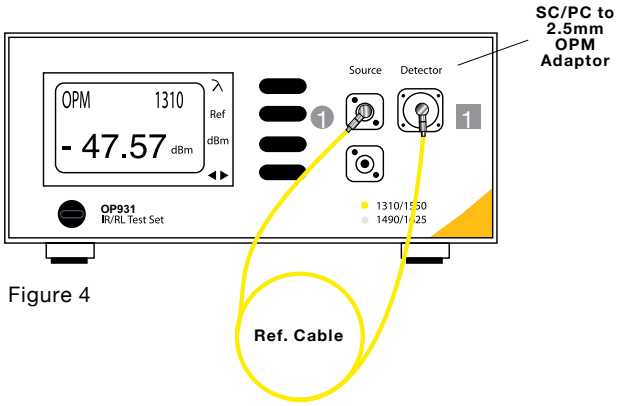

Figure 4

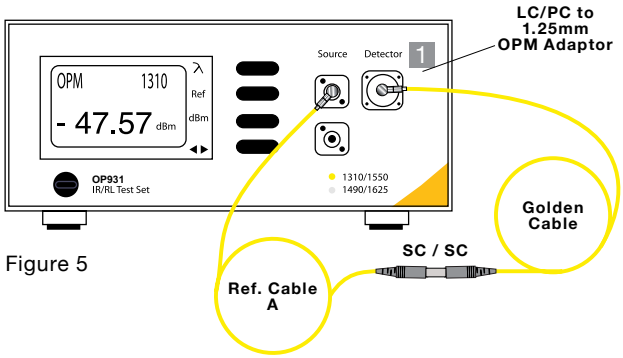

Figure 5

Remove the 2.50mm adapter and connect the 1.25mm adapter to the OPM. Now connect the SC/PC side of the golden cable to the reference and the LC/PC end to the 1.25mm adapter 1 to test its reference quality. Readings should start automatically and can be seen in the IL screen by pressing the right arrow button once from the OPM screen.

To reference the LC/PC side of the cable, switch out the reference cable for LC/LC testing and connect it to the AB source port and the LC/PC end to the 1.25mm adapter 1. Click **Ref.**

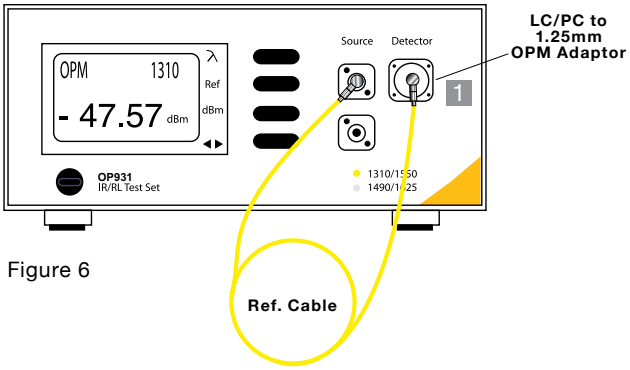

Figure 6

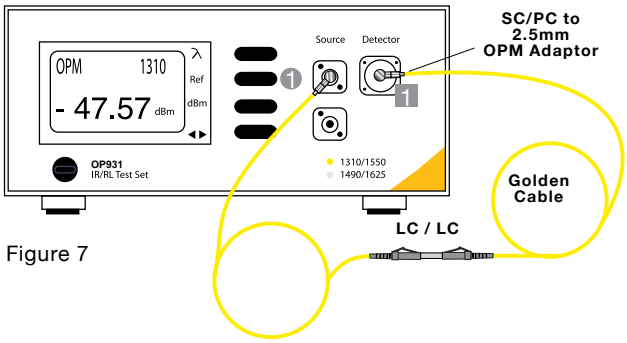

Figure 7

Similar to testing the SC end of the cable, disconnect the 1.25mm adapter 1 and attach the 2.50mm adapter to the OPM and connect the LC/PC side of the golden cable to the reference and the SC/PC end to the 2.50mm OPM adapter 1 to test its reference quality.

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