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Applications
Engineering Note

Link Attenuation Testing Tutorial w/ case study OptiTap Jumpers for FTTX

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Link-loss or link attenuation testing is a critical step in the validation of a fiber optic system. Therefore, it is imperative that one does the testing correctly. Too often, an engineer or technician will reference too little or too much out of the system resulting in false pass/fail results. The following AENote will dictate properly referencing your jumpers based on the system to be tested.

Determining Which Jumper Reference Method to Use

There are three jumper reference methods: one-jumper, two-jumper, and three-jumper references. The rule of thumb to determine which jumper reference method to use is:

 # jumper reference = 3 - #patch panels on the end of your system

Or more explicitly:

If your system connects **electronics → patch panel → cable → patch panel → electronics**, use a one-jumper reference.

If your system connects **electronics → patch panel → cable → electronics**, use a two-jumper reference.

If your system connects **electronics → cable → electronics**, use a three-jumper reference.

Based on these three system constructions, determine which type of system your system is.

Performing the 1, 2, or 3 jumper reference

Regardless of what kind of jumper reference you are performing, you must start with the 1 jumper reference procedure and go in number order. To do otherwise will result in an incorrect referencing.

1-jumper reference

First, make sure you have the correct port adapters for your source and meter and the correct adapters to connect your jumpers. Attach the correct adapters to your source and meter, and then connect a jumper between your source and meter. If you are using a multimode jumper, you must use the appropriate mandrel. The mandrel for 62.5 µm fiber is

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17 mm and for 50 µm fiber is 22 mm. At this point in the referencing, **your meter's units must be set to dBm.** When the meter is set to these units, the meter will reference out the relative laser power of the source. If you are using an OTS-400 test set, the meter will typically read 4-6 dBm for a single-mode jumper, 18-20 dBm for a 62.5 µm jumper, and 20-22 dBm for 50 µm jumper. If you are using a different kind of source and meter, please check the unit's specification sheet for the minimum readout on the meter. If the meter reads higher than the minimum value as dictated by the spec sheet, you must change jumpers. If the loss is still too high, there is something wrong with your source and meter, and your test set needs to be recalibrated or repaired.

If the readout is good, **disconnect the jumper from the meter side** and attach a second jumper. Connect both jumpers and check the meter to make sure the meter reads ≤0.5 dB. A readout of ≤0.5 dB guarantees that the connectors are good. If the meter does not read ≤0.5 dB, replace your jumpers. If replacing your jumpers does not work, switch interconnect sleeves/adapters. If the jumpers are good and you are doing a 1-jumper reference, disconnect the jumpers from each other and go test. If you are doing a 2-jumper reference, continue to the next section.

2-jumper reference

After verifying the readout, you can **reference the jumper**, **disconnect the jumpers from each other** and go test. By referencing the 2nd jumper, you reference out a connector pair's worth of loss. If you are performing a 3-jumper reference, proceed to the next section.

3-jumper reference

After referencing the second jumper, **disconnect the two jumpers and connect a third jumper** in between the first two jumpers. Verify that the meter again reads ≤0.5 dB and then **reference out the third jumper**. By referencing the 3rd jumper, you reference out a second connector pair. Again, if the meter does not read ≤0.5 dB replace your jumper until you get a good one or switch interconnect sleeves. If everything checks out, **remove the 3rd jumper** and go test.

Case study: OptiTap jumpers for FTTX

In many FTTX applications, the fiber optic system will contain multiports or other terminals with OptiTap connectors in addition to other connector types at the Local Convergence Point (LCP) or central office (CO). Proper referencing is critical to ensure accurate power-through data is collected.

Referencing Jumpers with Systems with SC/APC and OptiTap Connectors:

For this AE Note, our sample FTTX system consists of an SCAPC OptiTap connector used in multiports or terminals on one end and SCAPC connectors commonly found in the LCP on the other. Because this system is a 2-patch panel type system, the proper referencing method for this system is a one-jumper reference. The following steps describe referencing jumpers using an OTS-400 test set for power-through testing, and the same general procedure can be used for other test sets but the display, initial reference values and interface will be different.

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1) Turn on the source and meter, ensuring the proper wavelength(s) is/are selected. Set the power meter to display dBm as the units. As a reminder, the typical initial reference values for single-mode jumpers are 4-6 dBm for an OTS-400.

Figure 1 – Display shows 0.00 dB

2) Plug the first jumper containing the SCAPC connector into the source and the other end into the meter. If the meter reading is good, push reference button and note the readings change to 0.00 dB. See Figure 1.

3) Disconnect the SCAPC connector from the meter.

4) Plug the SCAPC connector just unplugged into the hybrid adapter.

5) Plug the second jumper containing the OptiTap connector into the other end of the hybrid adapter. **Note**: the OptiTap connector has a small arrow on the housing, which aligns with a notch in the hybrid adapter. See Figure 2 on the next page.

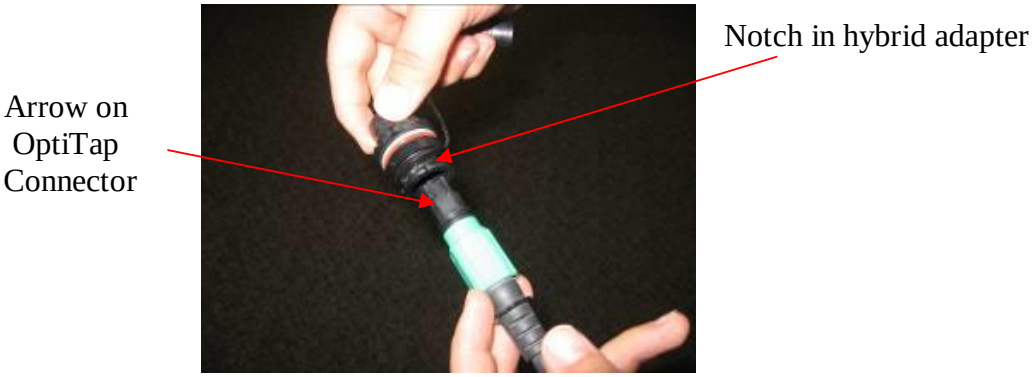

Figure 2 – OptiTap Connector and Adapter

6) Plug the other end of the second jumper into the power meter. The meter displays the connector pair loss. See Figure 3.

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Figure 3 – Connector Pair Loss

7) Note the connector pair loss. If it is less than or equal to 0.5 dB, then the connector pair is good. Remove the OptiTap connector and SCAPC connector from the hybrid adapter and begin testing. If the connector pair loss is greater than 0.5 dB, clean connectors and check loss again. If the losses are still above 0.5 dB, try another hybrid adapter or replace jumpers until the connector pair loss is less than or equal to 0.5 dB.

Referencing Jumpers for Systems with SC/UPC and OptiTap Connectors:

The following steps describe referencing jumpers for power-through testing an FTTX system consisting of an SCAPC OptiTap ports on one end and SCUPC connectors on the other.

1) Perform the 1-jumper reference procedure described above using jumpers with SC/APC and OptiTap connector first. This ensures the connector pair and jumpers, both on the source and meter are functioning properly.

2) Remove jumpers and set aside. The OptiTap jumper will be used later.

3) Repeat a one-jumper reference using two SCUPC/SCUPC jumpers. After completing this one-jumper reference, we know that both the SCUPC and SCAPC type jumpers are functioning properly.

4) Disconnect the meter side jumper. Do not remove the source side jumper.

5) Place the jumper with the SCAPC OptiTap connector onto the meter and begin testing.

For any additional information, visit www.corning.com or contact Corning Optical Communications at 1-800-743-2671.

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