For multimode fibers, testing is usually done at both 850 and 1300 nanometers, using light-emitting diodes. This proves the performance of the cable for every data communications system, including fiber distributed data interface and enterprise systems connection, and meets the requirements of all network vendors.
For single mode fiber cables, testing is usually done at 1310 nm. Sometimes 1550-nm testing is also required to show whether the cable can support wavelength-division multiplexing at 1310 and 1550 nm, for future service expansion. In addition, 1550-nm testing can show micro bending losses that are not obvious at 1310 nm, since the fibers are much more sensitive to bending losses at 1550 nm.

If cabling plant end-to-end loss exceeds total allowable loss, the best solution is to retest each segment of the cabling plant separately, checking suspect cables each way, since the problem is most likely a single bad connector or splice. If the cabling plant is long enough, an optical time-domain reflecto meter may be used to find the problem. Bad connectors must then be re polished or replaced to get the loss within acceptable ranges.

Not long ago, OTDRs were used for all testing of installed cabling plants.
Today, the power meter and source (or optical-loss test set) have replaced the reflecto meter for most final qualification testing, since the direct loss test gives a more reliable test of end-to-end loss than does an OTDR.

Do not use an OTDR for measuring end-to-end loss. It does not accurately measure actual link loss as seen by the transmitters and receivers of the fiber-optic link. As normally used, the OTDR does not count the end connectors` loss because it uses a laser with very restricted mode power distribution, which minimizes the loss of the fiber and intermediate connectors. Finally, the difference in backscattering coefficients of various fibers leads to imprecise connector loss measurements.

However, you may have to use an OTDR to find bad splices or optical return loss problems in connectors and splices in single mode cabling plant. Only with a reflecto meter can optical return loss problems be located for correction. Typical back reflection test sets give only the total amount of backscatter or return loss; they do not give information about the effects of individual components, which is necessary to locate and fix the problem.

If an OTDR has high enough resolution to record short, individual cable assemblies, it can also be used to find bad connectors or splices in a high-loss cabling plant. However, if the cables are too short or the splices too near the end of the fiber (as is often the case with pigtails spliced onto single mode fiber cables), the only way to localize the problem is to use a visual fault locator, preferably a high-powered, helium-neon laser type, which can shine through the jacket of typical yellow or orange PVC-jacketed single-fiber cables. This method of fault location is easiest with single-fiber cables that have yellow or orange jackets, because these are more translucent to laser light.

Fiber-optic networks are always specified to operate over a range of loss, typically called the system margin. Either too much or too little loss can be a problem. If loss is too high, the signal will be low at the receiver, causing a poor signal-to-noise condition in the receiver. If the loss is too low, the power level at the receiver will be too high, causing receiver saturation. Both these conditions will cause high bit-error rates in digital systems and poor analog signal performance.

Testing and troubleshooting networks
The installed network can be tested quickly and easily with a fiber-optic power meter. Set the network transmitter to transmit a clock output or other bit stream of known duty cycle. Set the power meter calibration on the proper wavelength and the reading units on watts. To test the received power --the

most critical element in the network --disconnect the cable connector at the receiver, attach the power meter and measure the power.

If the receiver power is low, check the transmitter power by disconnecting the source jumper cable at the first available connector and measuring the power at that point. Alternatively, you can disconnect the cable at the transmitter and use a jumper that has been pre-tested and is known to be good to measure the coupled power. If the output is measured through a short network jumper cable (less than 30 feet), no compensation for jumper loss is necessary. For longer jumpers, some compensation for cable loss may be necessary.

If receiver power is low but transmitter power is high, something is wrong with the cables. They must be tested at every connection to isolate the bad cables or connectors. Starting from either the transmitter or receiver end, follow the network cables to every patch panel. Disconnect the connector and measure the power at each point. By making measurements in decibels, you can easily calculate the loss of the cable network to each point by subtracting successive readings.

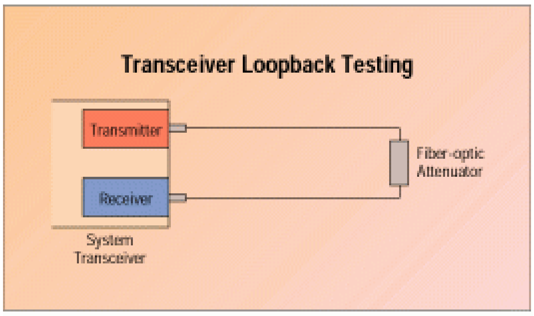
If you note a larger-than-expected loss in the cable link, test the suspect cable using one or more of the following methods. If a cable has attenuation that is higher than specifications but still transmits light, check the connectors using a microscope to determine if they have been damaged and should be replaced. If the connectors look good, the best solution may be to replace the cable or switch to a spare. If a visual fault locator is available, use it to locate breaks in the fiber and find broken connectors. Under some circumstances, such as high loss in long jumper or trunk cables, an OTDR can be used to diagnose cable faults.

Transceiver loopback testing

The data communications capabilities of the network can be tested with a loopback test. This test uses a calibrated fiber-optic attenuator placed between the transmitter and receiver on a piece of equipment to see if it can transmit data to itself. Many types of network equipment have diagnostics to do loopback testing. This loopback method tests the transmitter and receiver of the unit under standard data transmission conditions over the specified link loss budget.

Some data communications equipment can also institute an electrical network loopback test, where the loopback path is inside the equipment, looping back over the entire data link to the equipment on the far end of the link. If both ends of the link pass a unit loopback test but fail a network loopback test, the problem is in the cables, which then need testing.

Once installation is complete, the cabling plant is tested and network equipment is running smoothly, what is likely to go wrong in a fiber-optic network? Fortunately, not much. One of the biggest selling points for fiber optics has been its reliability. But there are some potential problems that can be addressed by the end user.



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Loop Back Testing.

Whether installing new cable, or troubleshooting existing cable, cable testing plays an important role in the process. Common tests for datacom cabling include length, wire map, attenuation, NEXT, DC loop resistance, and return loss.

Visual Tracing LS

Continuity checking makes certain the fiber are not broken and to trace a path of a Fibre from one end to another through many connections with the use of a visible light source. This allows us to carry out a first line check to identify a faulty or a functional fibre very quickly.

OTDR Testing

Unlike light sources and power meters which measure the loss of the Fibre optic cable plant directly, the OTDR works indirectly. The source and meter duplicate the transmitter and receiver of the Fibre optic transmission link, so the measurement correlates well with actual system loss.

The OTDR, however, uses backscattered light of the Fibre to imply loss. The OTDR works like RADAR, sending a high power laser light pulse down the Fibre and looking for return signals from backscattered light in the Fibre itself or reflected light from connector or splice interfaces.

At any point in time, the light the OTDR sees is the light scattered from the pulse passing through a region of the Fibre. Only a small amount of light is scattered back toward the OTDR, but with sensitive receivers and signal averaging, it is possible to make measurements over relatively long distances. Since it is possible to calibrate the speed of the pulse as it passes down the Fibre, the OTDR can measure time, calculate the pulse position in the Fibre and correlate what it sees in backscattered light with an actual location in the Fibre. Thus it can create a display of the amount of backscattered light at any point in the Fibre.

Since the pulse is attenuated in the Fibre as it passes along the Fibre and suffers loss in connectors and splices, the amount of power in the test pulse decreases as it passes along the Fibre in the cable plant under test. Thus the portion of the light being backscattered will be reduced accordingly, producing a picture of the actual loss occurring in the Fibre. The OTDR presents this information onto the display allowing the engineer to detect problems in the cable caused during installation. If a Fibre is broken, it will show up as the end of the Fibre much shorter than the cable or a high loss splice at the wrong place. If excessive stress is placed on the cable due to kinking or too tight a bend radius, it will look like a splice at the wrong location.

We have the capabilities, expertise, and approvals necessary to provide you with a cost-effective solution for your Fiber Optic Testing needs, including GR-20-CORE, GR-409-CORE, and GR-13-CORE.

We test safety, reliability and performance of fiber optic components (FOC), including connectors, fiber cables, fiber distribution frames, splice closures, pedestals and indoor/outdoor fiber cabinets.

With Intertek FOC testing you can rely on:

- Getting faster service delivery
- Benefiting from global expertise with local presence
- Reducing your risk while protecting your brand
- Gaining new efficiencies

Testing Standards for Fiber Optic Components (FOC)

- GR-20-CORE: Optical Fiber and Fiber Cable
- GR-409-CORE: Premises Fiber Optic Cable
- GR-13-CORE: Pedestal Terminal Closure
- GR-771-CORE: Fiber Optic Splice Closures
- GR-765-CORE: Single Fiber Single-Mode Optical Splices and Splicing Systems
- Bi-directional testing on 2 links at once
- Dual-fiber, dual-wavelength
- Integrated OPM, OLS and VFL (650 mm)

- Encircled Flux compliant
- SM and MM versions

Structured Cabling

Structured cabling provides the critical backbone of a communication system. AFL understands the complex issues involved in planning, installing and maintaining network communication systems. With our expertise and experience, AFL provides our customers with the commitment that the telecommunications infrastructure, no matter how complex, will be designed, constructed and installed to meet current and future requirements.

Network Design and Consulting

- Structured cabling system design
- Preparation of structured cabling specifications
- Development of bid specifications and RFP packages
- Planning, budgeting and engineering review
- Construction plan review for EIA/TIA standard compliance
- Database development for cable management

Structured Cabling Installation

- Installation of copper and fiber optic cable
- Installation of wiring racks, cabinets and patch panels
- Manufacturer certified installers
- Manufacturers' extended warranties
- Cable certification and compliance testing
- Cabling solutions
  - Fiber and copper
- Design and installation
  - New or existing site assessment
  - Data center consolidation
  - Raised flooring
  - Equipment racks
  - Ladder racking
  - Patch panels
  - Power systems
  - Certified professionals
- Test and inspection equipment
- Fusion splicers
- Smart Row