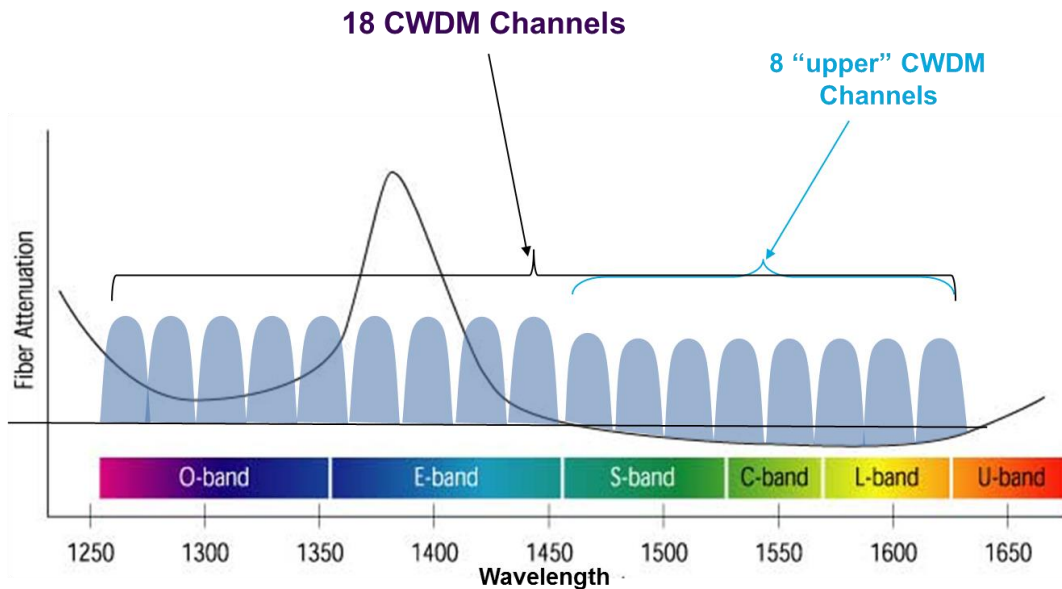


## Testing CWDM in Deep Fiber Applications

In the previous tip, [Introduction to Deep Fiber Node +0](#), we talked about the characteristics of fiber, connector types and how to inspect and clean those connectors, and briefly touched on the three main technologies you'll come across in the field. In this tip, we dive deeper into the first of those three technologies, Coarse Wave Division Multiplexing (CWDM), and discuss how to test and troubleshoot it in cable network applications.

Wave Division Multiplexing is the idea of combining (or multiplexing) multiple wavelengths into a single signal that is then transmitted over a single fiber. CWDM, defined by ITU-T G.694.2 standards, supports up to 18 channels in a single fiber and uses a spectrum range from 1271 to 1611 nanometers (nm) with 20 nm spacing. However, this wide spectrum range can limit deployments as some older fibers, such as G.652, exhibit higher attenuation in the "water peak" region (typically from about 1351 to 1431 nm). For G.652 fibers, CWDM systems only deploy the eight upper wavelengths (1471-1611 nm) or ten upper wavelengths (1431-1611 nm). Newer G.652.C or G.652.D fibers nearly eliminate this higher attenuation region and can support the full spectrum of all eighteen wavelengths.

If the fiber type is unknown, a series of Fiber Characterization tests including Polarization Mode Dispersion (PMD) and Chromatic Dispersion (CD) can be performed to determine the fiber type and capabilities. CWDM was the preferred solution for data rates up to 2.5Gbps and spans up to 70 kilometers due to its lower cost stemming from the use of uncooled lasers. DWDM, which we'll discuss in a future tech tip, provides higher data rates, and is now similar in deployment costs due to the higher volumes.



**CWDM Channels vs. G.652 Fiber Attenuation**

Testing and maintaining CWDM networks are very different than traditional HFC networks for a couple reasons. First, wavelength-specific muxes and demuxes are used that pass or reject certain wavelengths. Second, since multiple wavelengths are combined over a single fiber, the network is live as soon as the first customer or wavelength is transmitted. From a maintenance standpoint, you'll need to isolate the problem service or wavelength without disrupting other subscribers. The problem wavelength should be on your trouble ticket. With that information, you're ready to test.

**1) Check for Wavelength and Power Levels** – You'll use a CWDM power meter (aka channel checker), such as the VIAVI OCC-55 for this. Simply connect the tester onto the fiber and scan for present wavelengths and power levels. Since CWDM is based on an ITU-T standard, the CWDM grid is already configured in the channel checker. The tester then gives you simple pass/fail results by taking the results of your test and comparing them to the standards. Is the wavelength present? Are the power levels within acceptable ranges?

If you received a pass result for both of these questions, the problem is likely the electronics at the subscriber site. Replace the electronics and go to the next step. If either of the tests failed, the electronics are not the issue. Go directly to the next step.

**2) Use an OTDR to Find the Problem** – A CWDM-based OTDR, such as the VIAVI T-BERD 2000 or 4000 with 41CWDMxx OTDR module, is needed for this step to test through the wavelength-specific components and not disrupt the other channels and customers present on that fiber. An OTDR sends a pulse of light through the fiber and traces the fiber route to find a problem. The tester will show a map of the fiber and identify which fibers have a problem.

For example, it may show a break in a fiber, a bad mux, or that there is a high loss or high reflection, which means you have a dirty connector. Fix the problem and go to the next step. There could also be more than one problem. In this case, fix the largest problem identified and go to the next step.

**3) Retest with the OTDR** – Once the initial problem is fixed, retest with the OTDR. If all characteristics are now within acceptable ranges, close the trouble ticket. If not, isolate the problem, fix it and retest. If you had more than one problem identified in the previous step and your first problem is resolved, fix the next problem identified and then retest. Keep doing this until all problems are resolved.

CWDM technology is more complex than copper or traditional fiber systems but learning to test CWDM is not hard if you have the right tools. The testers do most of the work for you, and since the testers have the industry standards already included, many of the results are pass/fail or clearly show the issues that are outside of those standards. After a few CWDM trouble tickets, you'll be testing and solving subscriber issues with speed and efficiency.

Learn more about [CWDM OTDRs](#). There is also a great [OTDR poster](#) that can quickly show you the capabilities of the testers.

### **Products You'll Use for Testing:**

[FiberChek Probe Microscope](#)

[OTDR 4100 Series Modules](#)

[T-BERD 2000](#)

[CWDM OTDR Module](#)

[T-BERD 4000v2](#)

[OCC-55/56 Optical Channel Checker](#)