What Is A PON Power Meter?

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Measuring optical power is one of the most important measurements in optical networks, performed using optical power meters. Measurements are used to verify the output optical power at transmitters, as well as the optical power levels at receivers and at various locations in the network. Optical power measurement is covered by the TIA FOTP-95 standard and numerous ISO/IEC standards.

There is more on fiber optic power meters in the FOA Guide: https://foa.org/tech/ref/testing/Instruments/instr.html and measuring optical power https://foa.org/tech/ref/testing/test/power.html.

Optical power meters use photodetectors made from various semiconductor materials that are sensitive to specific wavelength ranges (Figure 1). The detectors are generally indium gallium arsenide photodiodes sensitive in the range of ~800 to 1600 nm. Over the range of typical fiber optic power measurements, the sensitivity of the detector varies considerably, so the power meter is calibrated at the typical wavelengths used in fiber optics (850, 1300/1310, 1550 nm) and sometimes other wavelengths uses in special systems.

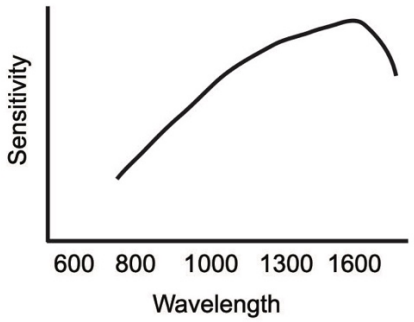

Figure 1. Sensitivity of InGaAs photodiode (source: FOA)

Power meters generally require manual selection of the wavelength when making measurements. That works well for typical links where the tech knows the wavelength of the link, but creates a problem with networks like PONs (passive optic networks) that use wavelength division multiplexing to send signals in both directions on a single fiber and even have two different PON protocols operating at one on one PON cable plant.

The large scale adoption of PON along with the need to simplify and speed up testing by FTTH techs has led to the introduction of a new type of fiber optic power meter, a PON power meter. A conventional optical power meter is able to measure a broad range of wavelengths with manual calibration choices. A PON power meter is a “selective” power meter which only measures at specific wavelengths, those used in PON networks.

Figure 2. OPM (left) and PON meters (right) (VG photo)

A PON selective power meter is used in single-mode fiber PON systems, where it allows simultaneous measurement only at the specific wavelengths used by the system. PON meters can be designed only for measuring optical power in the downstream direction — so-called downstream PON meters — or as PON meters that allow measurements in both downstream and upstream directions.

What is the difference between an OPM and a PON meter?

In PON networks, a minimum of two or more wavelengths are used within the same fiber — GPON uses 1490 nm, 1310 nm and sometimes 1550 nm, while XG(S)-PON uses 1557 nm and 1270 nm. Service providers may also be deploying two PON standards within the same network, such as GPON alongside XG(S)-PON.

In these dual networks, the use of conventional OPM cannot distinguish the individual wavelengths which leads to incorrect measurement results. If GPON and XG(S)-PON are present in a PON network, the measurement result will be the total combined power of 1490 nm and 1577 nm wavelengths (in the downstream).

In PON networks, a conventional OPM cannot identify which wavelength it is measuring. For this reason, special optical power meters designed for PON networks include built-in splitters and filters placed in front of the photodiodes to allow the simultaneous measurement of specific wavelengths only. In a PON meter designed for GPON and XG(S)-PON, there are two filters: one for 1490 nm (GPON) and the other for 1577 nm (XG(S)-PON).

Figure 3. PON Power Meter Display

Because of their wavelength selective circuitry is unique, PON meters are exclusively used for measurements in PON networks. But when used in PON networks, they are virtually foolproof and ensure accurate measurement results and enables reliable maintenance and troubleshooting.

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