VIAVI Solutions

Application Note

VIAVI OLP-88 TruePON

G-PON System Activation Analyzer

The OLP-88 TruePON tester is an innovative tool that uses GPON data analysis technology — bringing PON installation testing and service activation to the next level. This SmartClass Fiber OLP Tester is the first field tester that both measures the power levels of 1490/1310nm PON signals and 1550nm CATV video signals and detects the serial number and the Activation Status of an ONT in a G-PON network. This application note features seven different use cases for the OLP-88.

Background & Terminology

The Activation Status reports the operation of an ONU/ONT connected to the PON network.

Activation Status Summary

Status	Cause	Effect
Activated	ONU/ONT registered at OLT, Communication established	Proper operation
Deactivated	ONU/ONT = faulty => ROGUE ONT	Operations stopped
Unregistered	ONU/ONT not registered at OLT	Operations stopped
Alien	Unknown device connected	May lead to service degradation

The latest G-PON networks are equipped with PON-ID functionality, standardized in ITU-T G.984. Amd 3. This is a software upgrade to a G-PON system which is available and offered as a feature from most vendors. PON-ID provides information about the ODN class of the G-PON system, the transmitted optical power levelof an OLT and an OLT-ID for identification of OLT ports.

Enhanced Feature Set

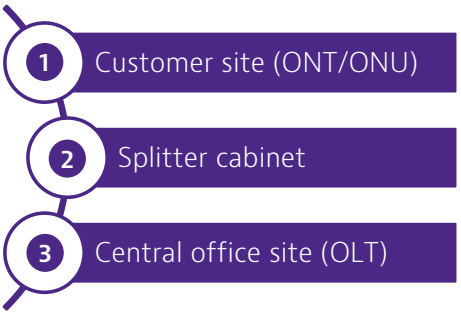
The OLP-88, which features PON-ID functionality activated in a G-PON system offers unique functionality:

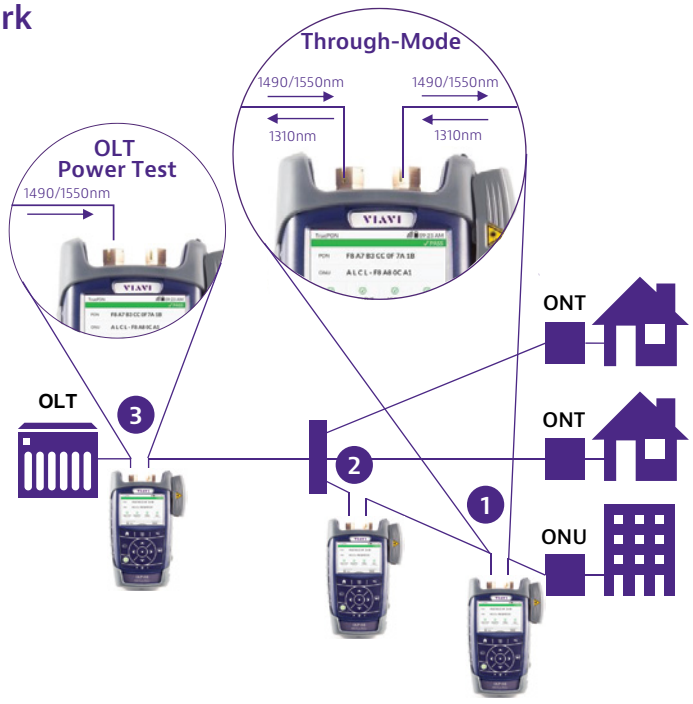
- Knowing the ODN class enables the instrument to automatically select threshold levels for pass/fail analysis without intervention of the user
- Knowing the transmitted optical power level of an OLT enables in-service insertion loss testing of the ODN (optical distribution network)
- With the OLT-ID each OLT / OLT-port can be easily identified

PON Network Testing

PON testing is generally performed at three test locations.

Connect and perform measurement anywhere in your PON network





1. **ONU (ONT) customer activation**
   - Perform upstream and downstream Activation
2. **Splitter hub or FCP (fiber concentration point)**
   - Perform downstream and or upstream measurements (if ONU/ONT is active).
3. **Central office site (OLT)**
   - Get information related to the PON ID and ODN Class
   - Downstream measurement only at 1490nm and/or 1550nm
   - Check transmitted optical power levels of OLT and CATV source

Use Cases

The OLP-88 True Tester performs all standard measurements and tests:

- Power measurements: B PON, G PON, E PN
- CATV Video Test
- Upstream 1310nm Test (through mode)

In addition to the basic uses, the OLP-88, with the expanded feature set can be used in the following applications:

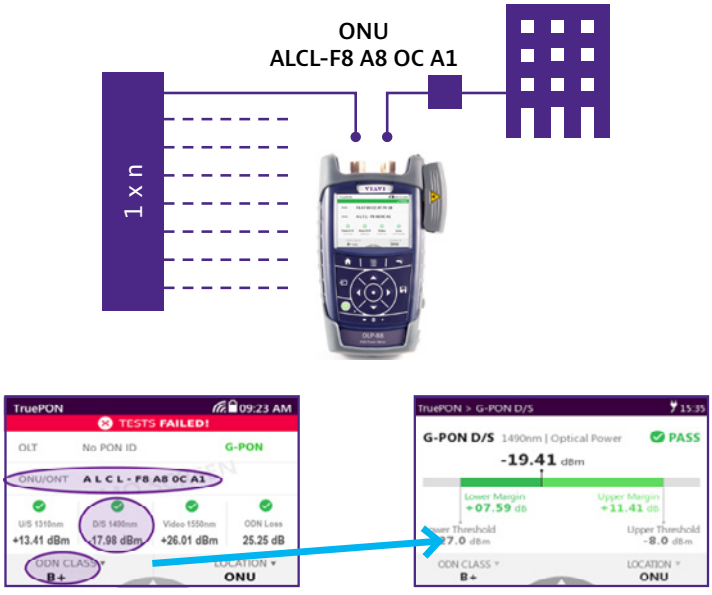
All G-PON Systems (with or without PON-ID)

1. G-PON power measurement, pass/fail analysis and ONT identification
2. ONU/ONT service activation testing, verify ONU/ONT operation
3. G-PON service trouble shooting
4. Fiber inspection

G-PON Systems with PON-ID

5. In-service ODN loss qualification
6. Auto PON-Test
7. Splitter activation

1. G-PON power measurement, pass/fail analysis, and ONT identification



Challenge: While performing power-level verification at a customer ONU, how can I certify that the service meets the specifications? Setting measurement thresholds according to ITU-T G.984 standards is mandatory to get the correct pass/fail results. Allocating the measurement results to the measured ONU/ONT for test documentation and report generation is another challenge. Since these tests are often performed by subcontractors, they must provide test reports for each turn-up. How making sure that tests are performed correctly and test reports correspond to the jobs they are paid for?

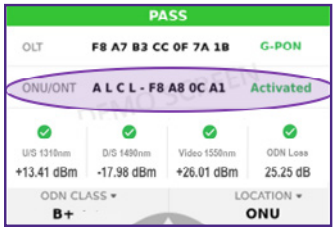
Solution: 1. Pass/Fail threshold setting:

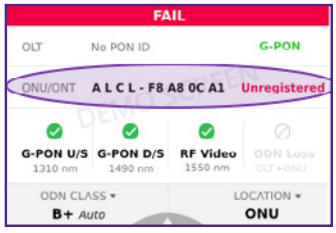
ODN class specifies standardized physical parameters for transmission. This includes Bit rate, operating wavelength, launch power, sensitivity and attenuation range. Knowing the ODN class enables test instruments threshold settings for auto pass/fail analysis against PON standards. The user just needs to select the ODN class and all P/F threshold will be set by the instrument. With P/F thresholds embedded we ensure first time compliance to standards for upper and lower margins for both upstream and downstream power levels for network signals. So the network is ready for activation and can handle degradation due to aging or environmental effects on the optical plant.

2. Allocating test results to the ONU/ONT:

The OLP-88 captures ONU/ONT serial number using GPON data analysis. Knowing the ONT serial number facilitates allocating measurement results to the ONT respectively to the customer service contract ensuring authenticity of test results enabling flawless and correct reporting.

2. ONU/ONT service activation testing, verify ONU/ONT operation

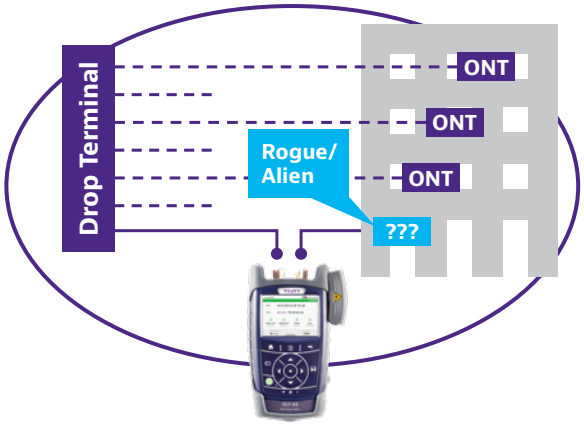


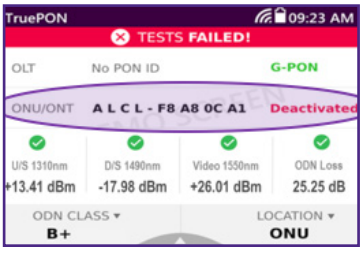


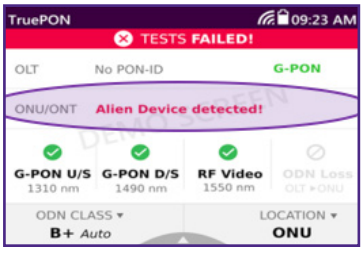
Challenge: When installing a new ONU/ONT in a PON network, the device needs to be activated from the OLT to join operations on the PON. Until now this could only be done by logging into the PON management system. This involves calling the NOC or operations center to check the activation status and network readiness.

Solution: OLP-88 extracts the activation status on the ONU/ONT. So we can ensure that registration has been done and activation is successful. We ensure the ONT joined PON operations and is it working properly.

3. G-PON service trouble shooting







Challenge: How can I easily identify and localize a Rogue ONU (ITU-T Series G Suppl. 49) or an Alien device that degrades or disables the service of other customers?

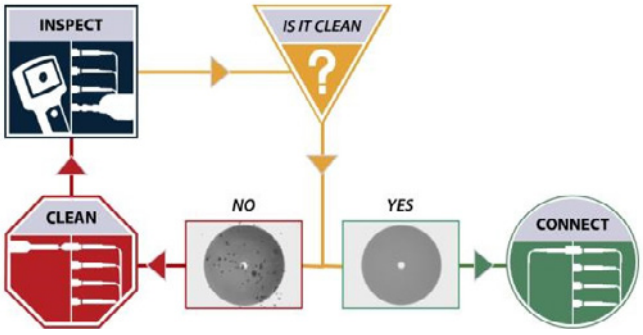
A Rogue device is an ONU that fails to map correctly into its timeslot (TDM) and causes total network disablement of other neighboring ONU due to the time slot corruption.

Alien devices are devices sending upstream signals at 1310nm.This can be a faulty ONT that cannot be switched off by the OLT, or a device that permanently sends upstream signals at 1310nm for example a media converter. Such Alien devices will interfere with other ONT signals and can degrade the overall PON performance

We have seen real network examples where Rogue and/or Alien devices causing total network outage to all customers served by the single OLT.

Solution: OLP-88 can extract the activation status and can report a Rogue device (status = deactivated) or detect an Alien device (status = Alien). Using the OLP-88 brings down the total fault finding time and enables the Rouge/Alien detection in the field quickly without having to engage NOC or operations.

4. Fiber inspection



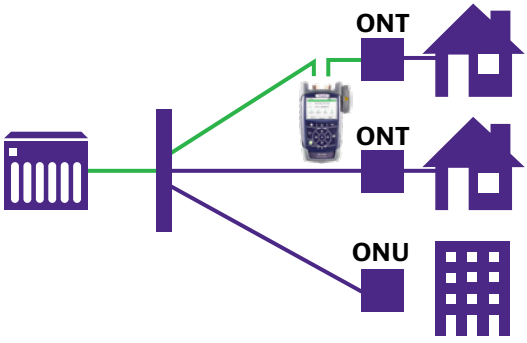
Challenge: More than 75% of fiber network troubleshooting can be attributed to connector contamination. How to be sure fiber technicians follow best practices?

Solution: OLP-88 is P5000i digital analysis microscope compatible. OLP-88P is the patchcord microscope version performing auto PASS/FAIL certification of fiber endfaces

This drives user workflow and behavior to eliminate the issues caused by poor practices.

Here are a couple of use cased when PON ID is activated. PON-ID is a software upgrade to G-PON systems, available and offered as a feature from most vendors.

5. In-service ODN loss qualification

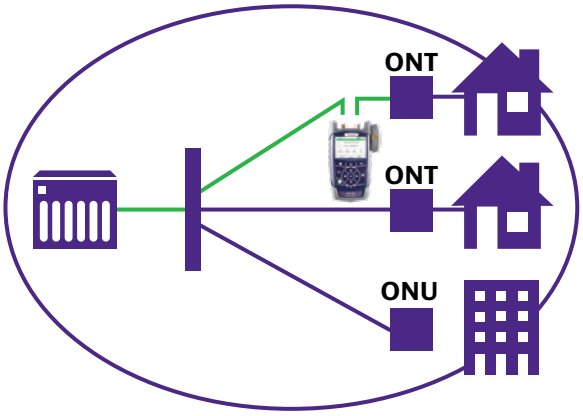


Challenge: During the construction phase, the optical distribution network (ODN) is qualified against loss budget by end-to-end loss testing. Verifying the insertion loss (IL) between OLT and the ONT of new customers is required to guarantee QoS for new subscribers. Relying on end to end loss qualification using just a simple level measurement can lead to erroneous results. Until now in-service IL-testing was not possible. So the only way to perform IL-test for activation of new subscribers was to bring the complete PON system out of service and perform IL-test with a loss test set.

Solution: The PON-ID coded into the PON downstream signal carries information about the transmitted optical level (ToL) of the OLT transmitter. This power level is calibrated by the manufacturer and provides a good accuracy (typ < ±1dB). OLP-88 can decode the ToL enabling the calculation of the in-service IL of the link by measuring the power level of the downstream signal at 1490nm. This provides qualification of the ODN against standardized IL values to guarantee high QoS.

6. Auto PON-Test

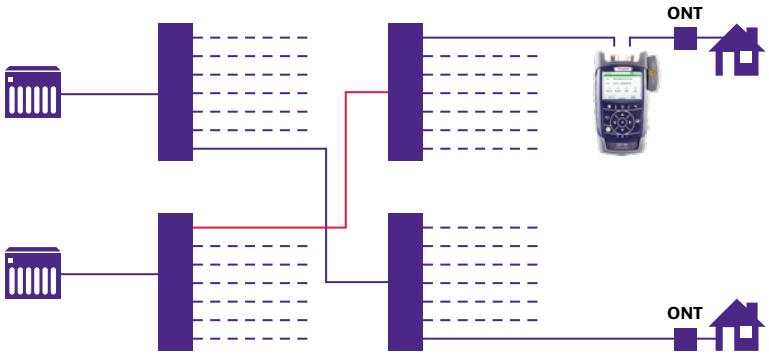
Auto pass/fail analysis of power levels and insertion loss according ITU-T standards without the need of instrument setting by the user.



Challenge: More and more installation tests were performed by unskilled workers and subcontractors. To guarantee that power levels and insertion loss values are within ITU-T standardized limits, correct pass/fail criteria depending on the ODN class have to be selected. With a mixture of multiple ODN classes this is difficult and can be faulty. Test instruments need to be easy to set up and fool proof to operate.

Solution: OLP-88 can extract information such as ODN class carried in the PON-ID. By knowing the ODN class the instrument enables auto setting of the correct threshold limits. , With standardized P/F thresholds embedded in the instrument we ensure that the power level measurements are in compliance with standards for upper and lower margins for both upstream and downstream power levels for network signals as well as for insertion loss. This avoids misinterpretation of pass/fail results and ensures first time compliance to standards, so that the network is ready for activation and can handle degradation due to aging or environmental effects on the optical plant.

7. Splitter activation



Challenge: When connecting a new customer cross errors during network construction, e.g. due to wrong splicing and mislabeling may causes polarity issues in the network. ONU/ONT's are often registered to work in specific TDM slots with their associated OLT card. When connecting a new customer the technician would normally only check the absolute power level and verify whether it is in the expected range. He may connect to the wrong splitter bank. Given several ONU/ONTs would feed the same splitter cabinet then expected levels would be similar. This leads to many issues related to port allocation and random plugging of drops. If the links are inverted? behind the splitter it leads to unregistered ONU/ONTs.

Solution: When PON-ID is activated OLP-88 can extract and display OLT-ID information (display format can be set to Hex or alpha). Field technicians can then easily identify the OLT to make sure they are connected to the correct OLT/splitter bank and to ensure a proper connection and get it right the first time. Using this process they can detect connectivity errors done during network construction.

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