SmartClass™ Fiber 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 level of an OLT and an OLT-ID for identification of OLT ports.

Enhanced Feature Set

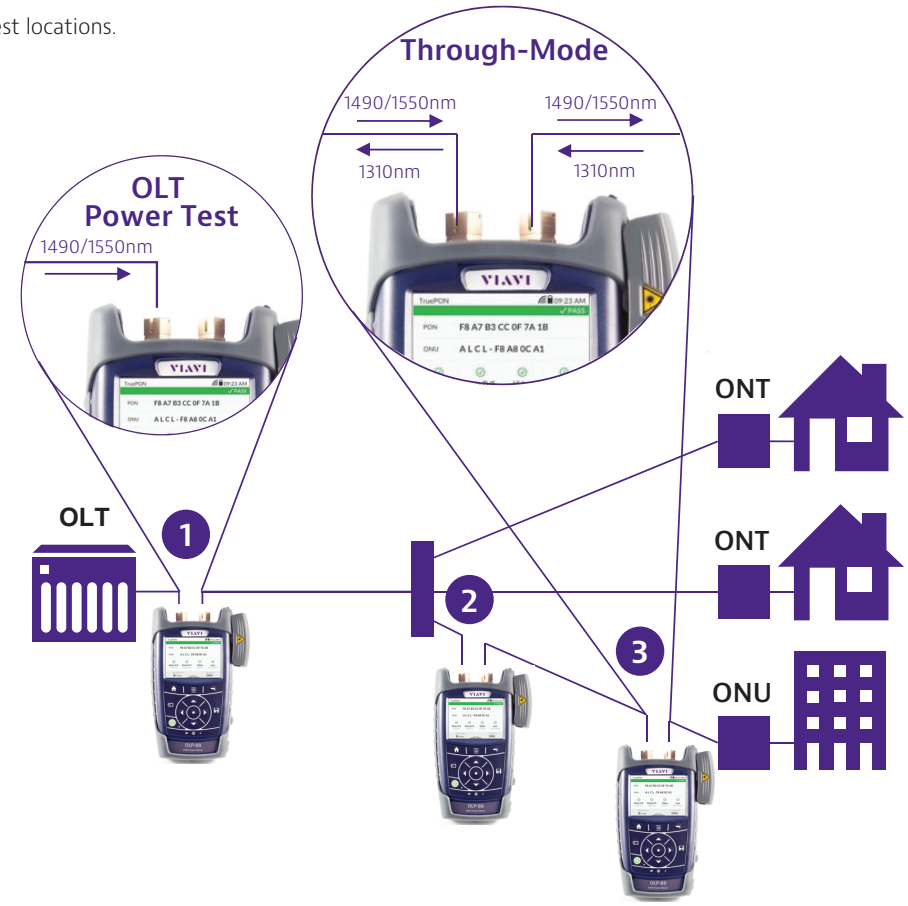
When PON-ID functionality is present in a G-PON network:

- Knowing the ODN class enables auto pass/fail threshold setting 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.

1. Central office site (OLT)
2. Splitter cabinet
3. Customer site (ONT/ONU)



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

Connect and perform measurement anywhere in your PON network.

Summary of Applications

The OLP-88 True Tester performs optical power measurements of:

- Downstream signals at 1490nm in B-PON, G-PON and E-PON networks
- CATV / video signals at 1550nm
- Upstream signals at 1310nm (through mode)

In addition to basic power measurements OLP-88 offers advanced test capabilities that speed up and simplify the activation, maintenance and trouble shooting of G-PON networks.

Test capabilities for G-PON networks (with or without PON-ID)

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

Additional test capabilities for G-PON networks with PON-ID

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

Use Cases

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

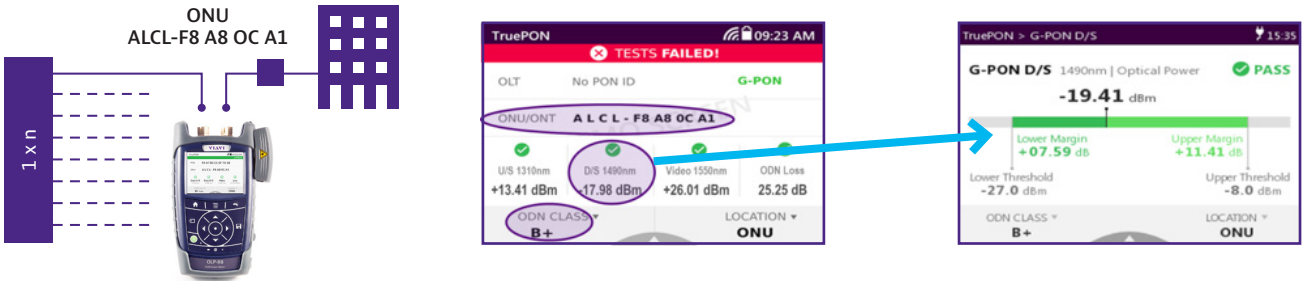
Challenge: While performing power-level verification at a customer ONU, how can I certify that the service meets the specifications? Setting measurement thresholds according to ITU-T G.984 standards is mandatory to get the correct pass/fail results. Allocating the measurement results to the measured 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 can I make 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 thresholds 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:

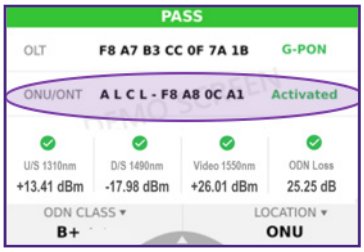
The OLP-88 captures the ONU/ONT serial number using GPON data analysis. Knowing the ONT serial number facilitates allocating measurement results to the ONT respectively to the customer service contract ensuring authenticity of test results and enabling flawless and correct reporting.

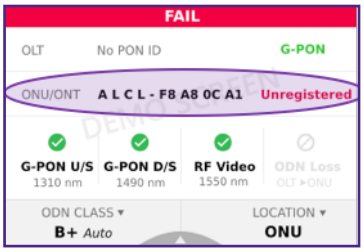


2. ONU/ONT service activation testing, verify ONU/ONT operation

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 that it is working properly.





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3. G-PON service trouble shooting

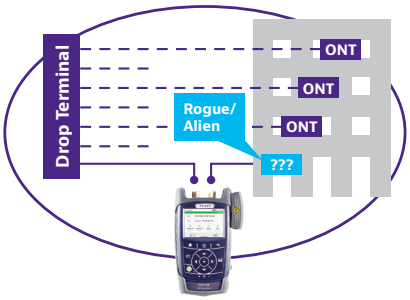
Challenge: How can I easily identify and localize a Rogue ONU (ITU-T Series G Suppl. 49) or an Alien device that degrades or disables the service of other customers?

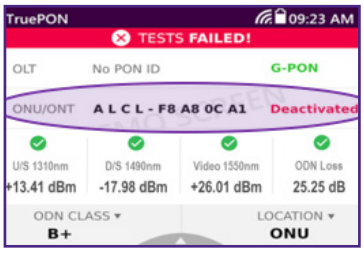
A Rogue device is an ONU that fails to map correctly into its timeslot (TDM) and causes total network disablement of other neighboring ONUs due to the time slot corruption. Rogue devices are deactivated by the OLT to stop operation.

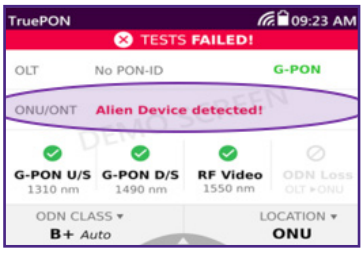
Alien devices are devices sending upstream signals at 1310nm. This can be a faulty ONT that cannot be switched off by the OLT, or a device that permanently sends upstream signals at 1310nm, for example, a media converter. Such Alien devices will interfere with other ONT signals and can degrade the overall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

We have seen real network examples where Rogue and/or Alien devices cause 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.







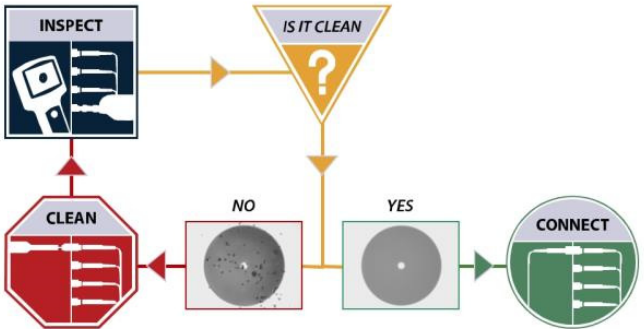
4. Fiber inspection

Challenge: More than 75% of fiber network troubleshooting can be attributed to connector contamination. How can you 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 cases where PON ID is activated. PON-ID is a software upgrade to G-PON systems, available and offered as a feature from most vendors.



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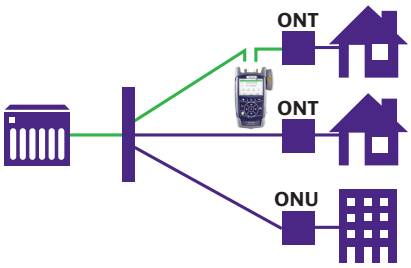
5. In-service ODN loss qualification

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 an 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.

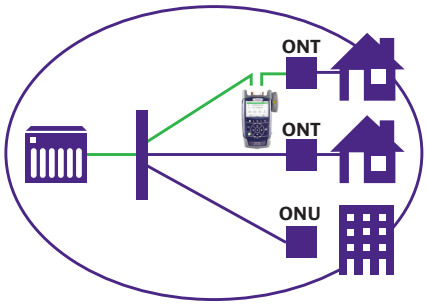


6. Auto PON-Test

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 are performed by unskilled workers and subcontractors. To guarantee that power levels and insertion loss values are within ITU-T standardized limits, you must select correct pass/fail criteria depending on the ODN class. 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. This ensure that the network is ready for activation and can handle degradation due to aging or environmental effects on the optical plant.



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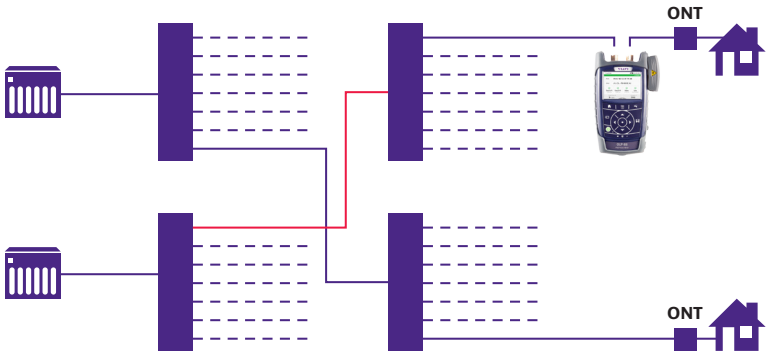
7. Splitter activation

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 that occurred during network construction.



Microscopes for Fiber Inspection and Basic Optical Test Tools

PowerChek OP-1
Optical Power Measurement

FFL-050/FFL-100
Visual fault locator (VFL) for continuity check

FI-60
Fiber identification

FiberChek FIT-FC-KIT1
"All in One" Fiber Inspection

Handheld Test Tools for Insertion Loss and Power-Level Measurements

SmartPocket™ OMK-35 Kit
Insertion loss and power-level measurement

SmartClass™ Fiber OLP-82/-85
Insertion loss[2] and power-level measurement and connector inspection with pass/fail analysis

SmartClass Fiber OLP-87
PON/XG-PON power-level measurement and connector inspection with pass/fail analysis

SmartClass Fiber OLP-88
PON power-level measurement, GPON ONT activation process verification, ONT/ONU identification, rogue/alien-ONU detection, and connector inspection with pass/fail analysis

Solutions for Fault Location/OTDR/IL/ORL/Power-Level Measurements

T-BERD®/MTS-2000 OTDR or SmartOTDR™
Handheld/Handsfree modular test set for fault localization/OTDR measurement

T-BERD/MTS-2000 FiberComplete™
Handheld/hands-free modular test kit for automated bidirectional loss, return loss, and OTDR measurements from one optical port

T-BERD/MTS-4000 with OTDR and PON Power Meter or FiberComplete and PON Power Meter
Large-screen modular test platform accommodates dual modules for PON power-level measurements and either OTDR only or bidirectional OTDR and insertion and return loss

Remote Fiber Test System

ONMSi
Remote fiber testing and monitoring for point-to-point and point-to-multi-point networks

[1] Compatible with PC, laptop, SmartClass Fiber Series, and T-BERD/MTS-2000 and -4000 Platforms
[2] When paired with a companion light source
[3] FTTH-SLM (Smart Link Mapper): Icon-based/schematic OTDR map view

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