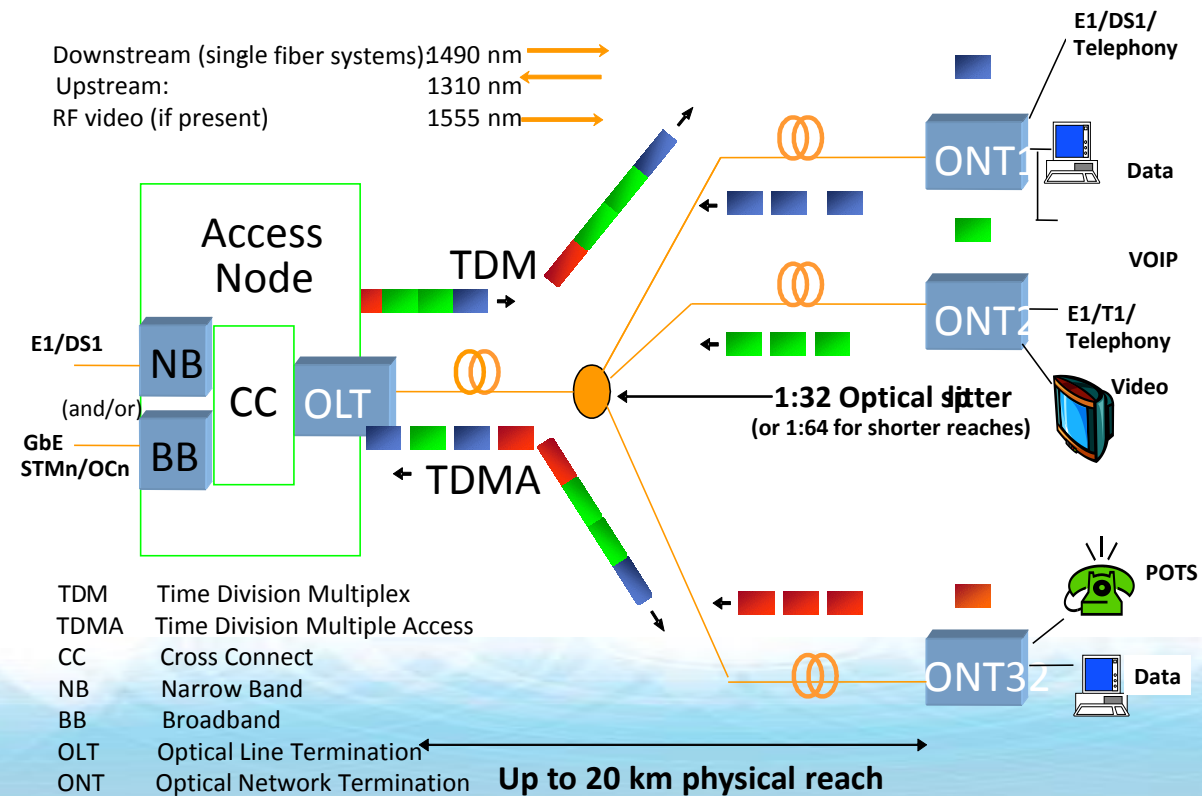


Sítě GPON a jejich analýza pomocí GPON Tracer™

Praha
16.4.2015

Oživení základů PON

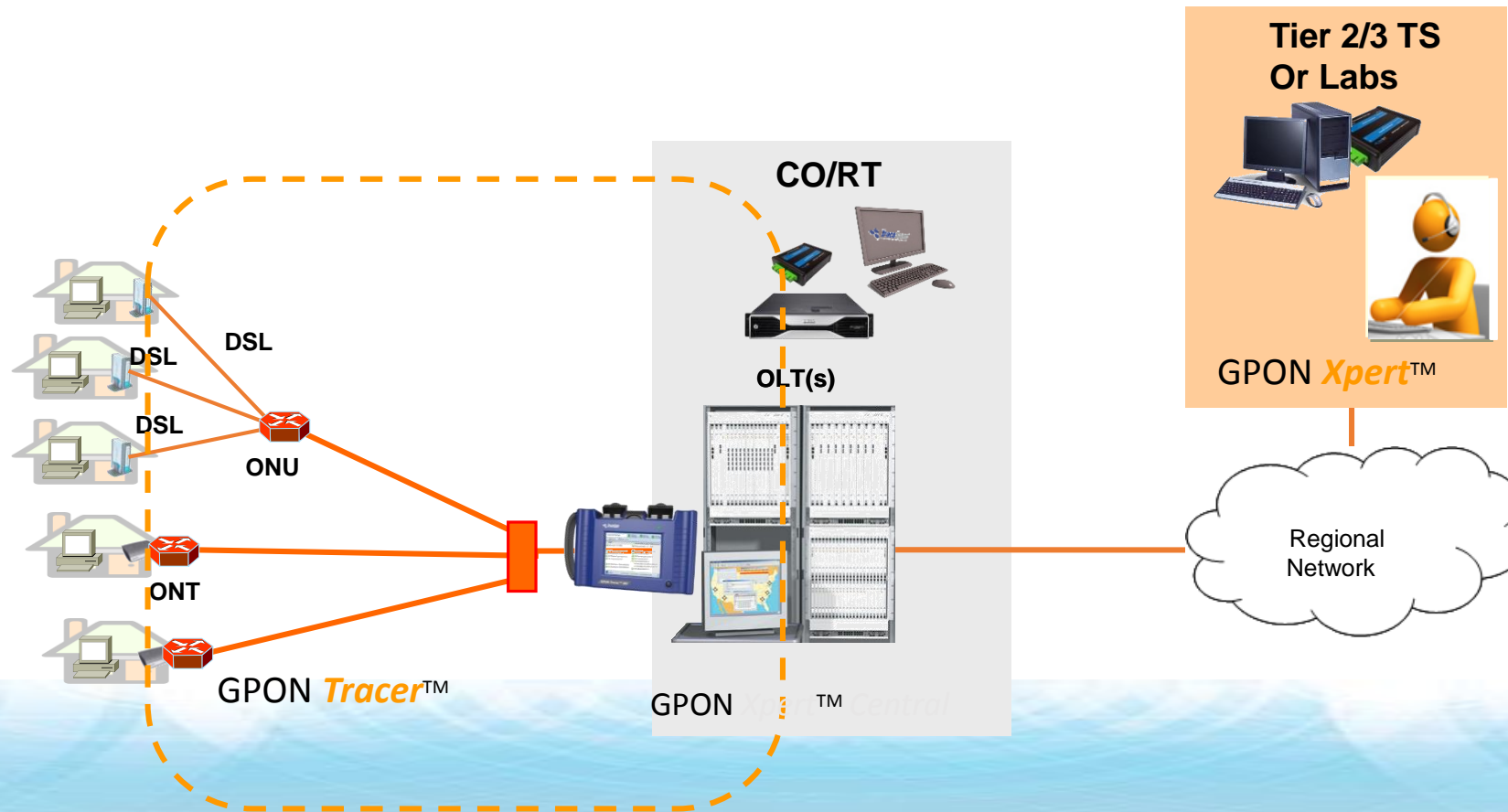
- **Downstream** – TDM transmission with multiple “listeners” (encryption to insure privacy by AES (Advanced Encryption Standard, 128-bit key))
- **Upstream** – TDMA transmission with upstream transmissions (bursts) scheduled to prevent overlap





GPON Tracer™ – GPON Handheld Testing Solution

GPON Tracer Positioning

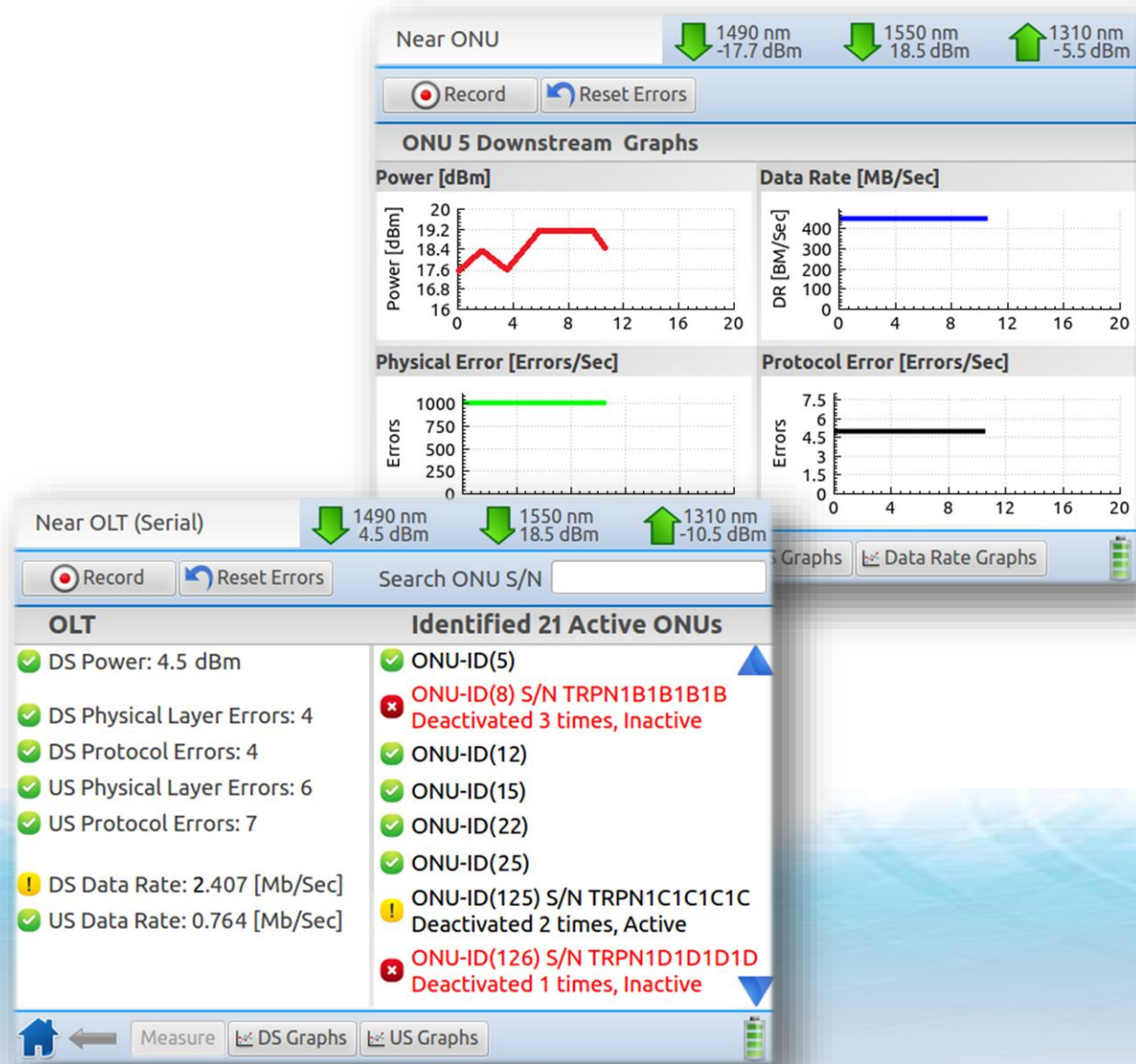


GPON Tracer™ - Support and Operation Tester

- Network Topology – available for field engineers
- Downstream and upstream optical signal existence and optical power levels
- Data rates (downstream and upstream)
- Transmission errors (physical, protocol and data layers)
- Indications of ONU disconnections and service interruptions
- Graphs of network characteristics over time
- PON ID Identification
- Serial ID Identification, Password Identification
- Rogue ONU – Indication and Isolation

Identify and Isolate Problems

- Poor service...
 - Congestion - utilization, errors
 - Low power level caused by reflection or power budget
- Network Issues...
 - Equipment Problem such as Rogue ONU, disconnects, faulty OLT or ONT, IOP
 - Firmware problems
- *RCA “Root Cause Analysis”
 - Automatic Detection of Typical Problems



GPON Tracer Measurement Screen – OLT Side

- The indications at the OLT side are green, yellow or red according to the definitions in the Settings => Thresholds screen

OLT (whole PON)
Parameters

Near OLT (Serial) ↓ 1490 nm 4.5 dBm ↓ 1550 nm 18.5 dBm ↑ 1310 nm -10.5 dBm

Record Reset Errors End Report Search S/N

OLT Identified 21 Active ONUs

<ul style="list-style-type: none"> ✓ DS Power: 4.5 dBm ✓ DS Physical Layer Errors: 0 ✓ DS Protocol Errors: 0 ✓ US Physical Layer Errors: 0 ✓ US Protocol Errors: 0 ✓ DS Data Rate: 1002 [Mb/Sec] ✓ US Data Rate: 597 [Mb/Sec] 	<ul style="list-style-type: none"> ✓ ONU-ID(5) S/N TRPN 1A2B3C4D ✗ ONU-ID(8) S/N TRPN 1A2B3C5E Deactivated 3 times, Inactive ✓ ONU-ID(12) S/N TRPN 1A2B3C5A ✓ ONU-ID(15) S/N TRPN 1A2B3D12 ✓ ONU-ID(22) S/N TRPN 1A2B3CDE ✓ ONU-ID(25) S/N TRPN 1A367908 ! ONU-ID(27) S/N TRPN 2B3B1AAE ✗ ONU-ID(28) S/N TRPN 1A2B3D56 Deactivated 1 time, Inactive
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Measure Graphs Diagnose US Analysis

List of identified ONUs
and their status
(active/inactive) and
deactivation history

Thresholds Screen

- The Thresholds determine the green, yellow and red indications in the Measure screens

After updating parameters you must save them for the update to take effect

These items will appear as green when within the thresholds and **red** when exceeding thresholds

These items will appear as green when within the thresholds and **yellow** when exceeding thresholds

Parameter	Value	Unit
Downstream Power [Min]:	-31	dBm
Downstream Power [Max]:	15	dBm
Upstream Burst Power [Min]:	-30	dBm
Upstream Burst Power [Max]:	15	dBm
DS Physical Layer Error [Max]:	1000	Errors
US Physical Layer Error [Max]:	1000	Errors
DS Protocol Errors [Max]:	1000	Errors
US Protocol Errors [Max]:	1000	Errors
OLT DS Data Rate [Max]:	2350	Mbits/Sec
OLT US Data Rate [Max]:	1200	Mbits/Sec

PON-ID Indication

- Displays the PON-ID and its details (whenever PON-ID maintenance is supported by the OLT)

The screenshot shows the TraceSpan interface for a PON network. At the top, it displays 'Near OLT (Serial)' with three optical power readings: 1490 nm (4.5 dBm), 1550 nm (18.5 dBm), and 1310 nm (-10.5 dBm). Below this are buttons for 'Record', 'Reset Errors', and 'End Report', along with a 'Search S/N' field. The main display area is titled 'OLT (PON ID 0x11223344556677)' and shows 'Identified 21 Active ONUs'. A list of ONUs is displayed, with some marked as inactive. A tooltip is shown over the PON ID, displaying details: 'PON ID Type 0, Class C, TOL 5.0 dBm (0x015E)'. The bottom navigation bar includes icons for Home, Measure, Graphs, Diagnose, and US Analysis, along with a battery level indicator.

PON-ID

PON-ID Details – Appear when Touching the PON-ID

GPON Tracer Measurement Screen – Selected ONU

- The indications at the OLT side and the ONU side are green, yellow or red according to the definitions in the Settings => Thresholds screen

The screenshot displays the GPON Tracer Measurement Screen for a selected ONU. The interface is divided into two main sections: OLT (left) and ONU (right). The OLT section shows parameters for the whole PON, while the ONU section shows parameters for the selected ONU. The OLT side has green checkmarks for DS Power (4.5 dBm), DS Physical Layer Errors (4), DS Protocol Errors (4), US Physical Layer Errors (6), and US Protocol Errors (7). It also shows DS Data Rate (1002 [Mb/Sec]) and US Data Rate (597 [Mb/Sec]). The ONU side has green checkmarks for US Burst Power (-6.7 dBm), DS Physical Layer Errors (4), DS Protocol Errors (4), US Physical Layer Errors (2), and US Protocol Errors (1). It also shows US Missing Packets (2), ONU Deactivations (4), and Power Outages (2). The DS Data Rate Per ONU is 97.40 [M...] and the US Data Rate Per ONU is 12.05 [M...]. The HEX Password is 0x47433430373337443300. The top of the screen shows Near OLT (Serial) with three power levels: 1490 nm (4.5 dBm), 1550 nm (18.5 dBm), and 1310 nm (-10.5 dBm). The bottom of the screen has navigation buttons: Home, Measure, Graphs, Diagnose, and US Analysis.

OLT (whole PON) Parameters

Parameters for the selected ONU

ONU Password Indication

- Indicates the password sent by the ONU
- Helps identify issues of ONU deactivation due to password conflict

Near OLT (Serial) 1490 nm 4.5 dBm 1550 nm 18.5 dBm 1310 nm -10.5 dBm

Record Reset Errors End Report

OLT

- ✓ DS Power: 4.5 dBm
- ✓ DS Physical Layer Errors: 4
- ✓ DS Protocol Errors: 4
- ✓ US Physical Layer Errors: 6
- ✓ US Protocol Errors: 7
- ✓ DS Data Rate: 1002 [Mb/Sec]
- ✓ US Data Rate: 597 [Mb/Sec]

ONU ID 5, S/N: TRPN1A1A1A

- ✓ US Burst Power: -6.7 dBm
- ✓ DS Physical Layer Errors: 4
- ✓ DS Protocol Errors: 4
- ✓ US Physical Layer Errors: 2
- ✓ US Protocol Errors: 1
- ! US Missing Packets: 2
DS Data Rate Per ONU: 97.40 [M...
US Data Rate Per ONU: 12.05 [M...
- ! ONU Deactivations: 4
- ! Power Outages: 2

HEX Password 0x47433430373337443300

Measure Graphs Diagnose US Analysis

Clicking this icon toggles the password format between hexadecimal and ASCII

Password

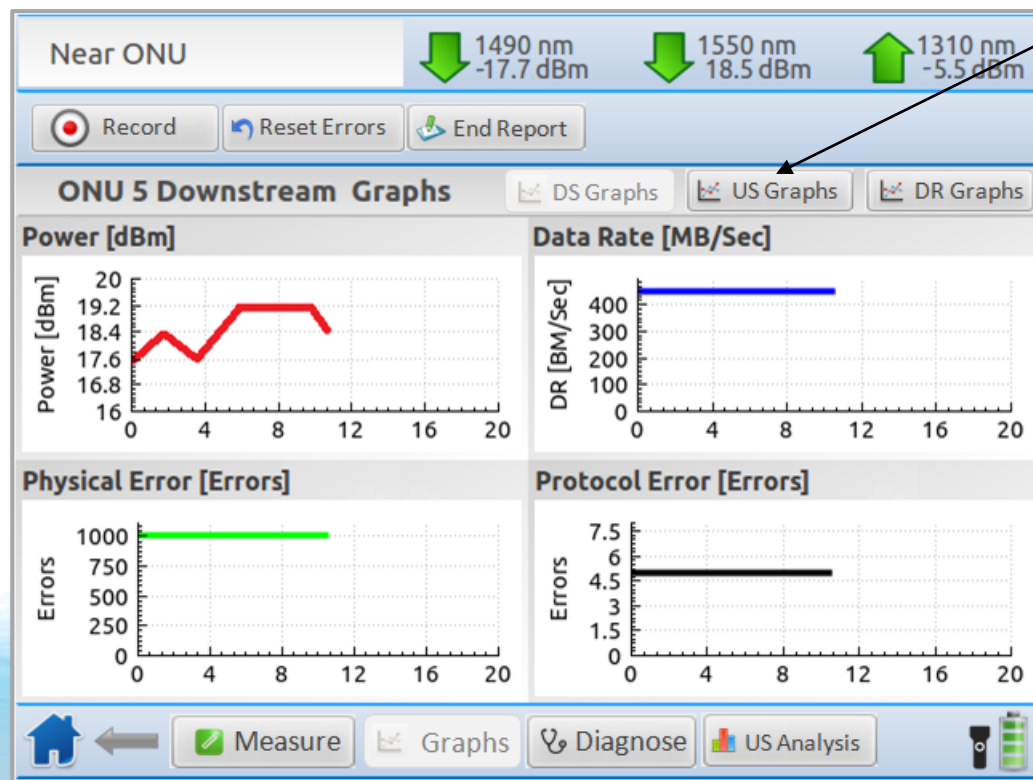
ONU Power Outage Indication

- Identifies ONU deactivations resulting from power outages or power disconnections

The screenshot displays the TraceSpan software interface for monitoring an ONU. At the top, it shows 'Near OLT (Serial)' with three power levels: 1490 nm (4.5 dBm), 1550 nm (18.5 dBm), and 1310 nm (-10.5 dBm). Below this are buttons for 'Record', 'Reset Errors', and 'End Report'. The main display is divided into two columns. The left column shows OLT statistics: DS Power: 4.5 dBm, DS Physical Layer Errors: 4, DS Protocol Errors: 4, US Physical Layer Errors: 6, US Protocol Errors: 7, DS Data Rate: 1002 [Mb/Sec], and US Data Rate: 597 [Mb/Sec]. The right column shows ONU ID 5, S/N: TRPN1A1A1A with statistics: US Burst Power: -6.7 dBm, DS Physical Layer Errors: 4, DS Protocol Errors: 4, US Physical Layer Errors: 2, US Protocol Errors: 1, US Missing Packets: 2, DS Data Rate Per ONU: 97.40 [M...], US Data Rate Per ONU: 12.05 [M...], ONU Deactivations: 4, and Power Outages: 2. A yellow exclamation mark icon is next to 'ONU Deactivations: 4' and 'Power Outages: 2'. At the bottom, there are navigation buttons: Home, Measure, Graphs, Diagnose, and US Analysis, along with a battery icon.

Indicates the number of ONU deactivations resulting from power outages

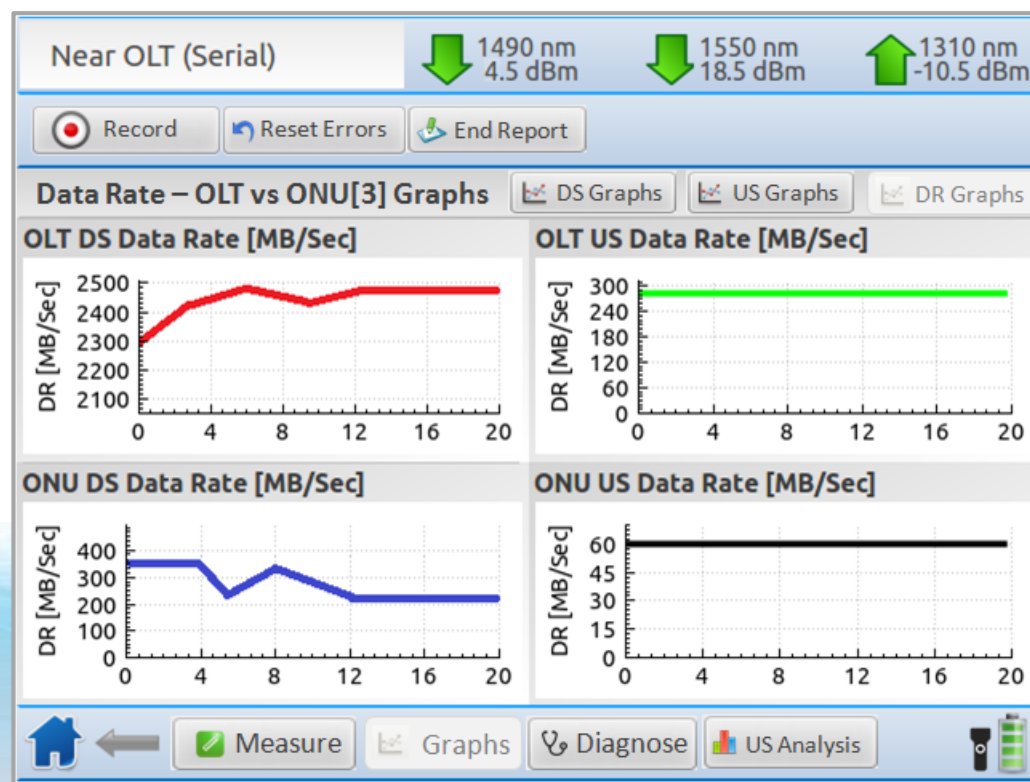
Downstream Graphs



The upstream graphs show similar information for the upstream direction

Data Rate Graphs

- Available when selecting a specific ONU
- Side-by-side presentation of the data rate for the selected ONU and the whole PON



Identification and Diagnosis of Typical Issues

- Correlates the GPON Tracer measurements and indications with typical problems and failure scenarios, thus speeding up the troubleshooting process

The screenshot displays the 'PON Diagnose' screen. At the top, it shows 'Near OLT (Serial)' with three power level indicators: 1490 nm (4.5 dBm), 1550 nm (18.5 dBm), and 1310 nm (-10.5 dBm). Below this are buttons for 'Record', 'Reset Errors', and 'End Report', along with a 'Search S/N' field. The main area is titled 'PON Diagnose' and contains a list of three error messages, each with a yellow exclamation mark icon, a timestamp, and a description of the issue. A 'Clear' button is located to the right of the list. At the bottom, there is a navigation bar with icons for Home, Measure, Graphs, Diagnose, and US Analysis, along with a battery level indicator.

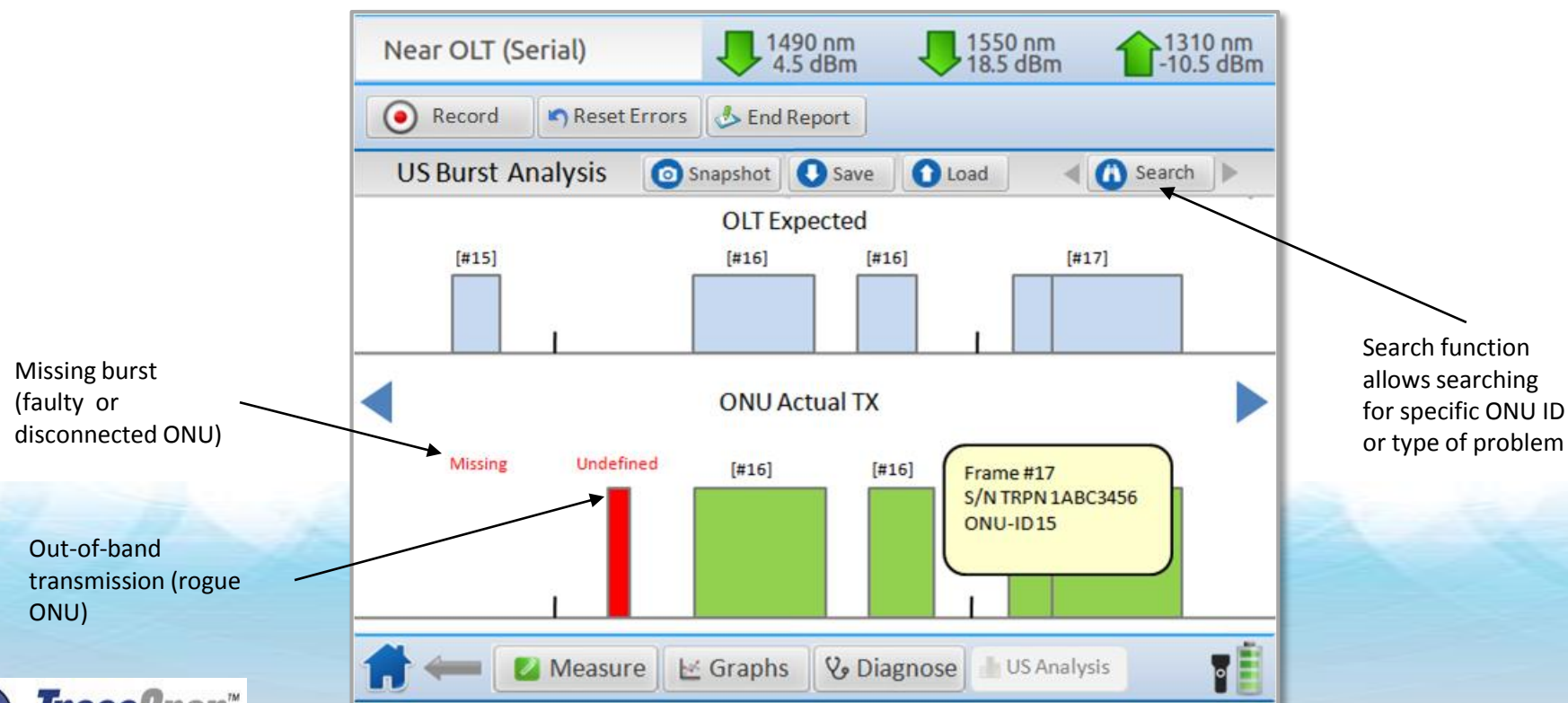
Timestamp, severity indication and the suspected network element are indicated for every identified issue

To view the list of identified issues navigate to the 'Diagnose' screen

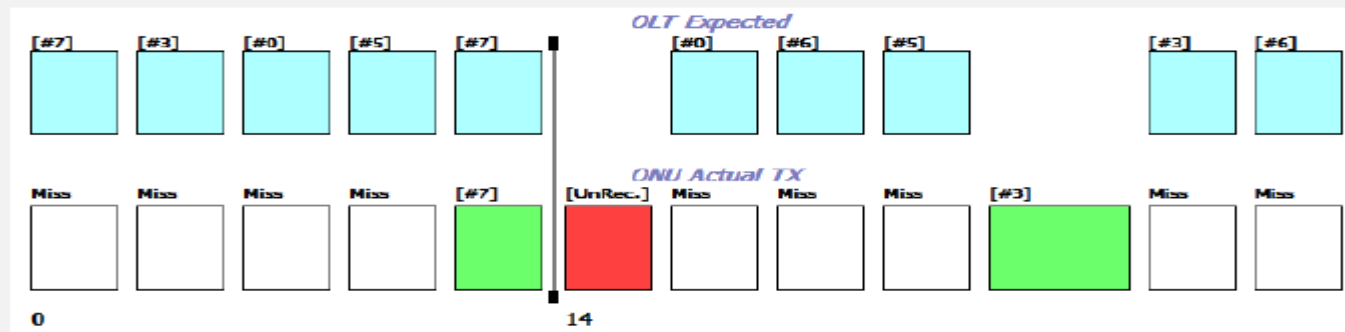
The list remains on the screen until cleared by the user

Upstream Burst Analysis Screen

- Compares the planned upstream transmission (OLT BWmap allocations) with the actual transmission and presents it in a graphical format
- Immediately and easily highlights collision problems, missing bursts and Rogue ONU



Rogue ONU



OLT Expected

Frame #	ONU ID	Size	S/N
0	7	87	PMCS44373039
0	3	13	PMCS39383039
0	0	6	PMCS38463039
0	5	6	PMCS45333039
0	7	6	PMCS44373039
1	0	13	PMCS38463039
1	6	13	PMCS35393039
1	5	13	PMCS45333039
1	3	6	PMCS39383039
1	6	6	PMCS35393039

ONU Actual TX

Frame #	ONU ID	Size	S/N
0	Mss	87	
0	Mss	13	
0	Mss	6	
0	Mss	6	
0	7	6	PMCS44373039
1	UnRec.	10	PMCS45333039
1	Mss	13	
1	Mss	13	
1	Mss	13	
1	3	150	PMCS39383039
1	Mss	6	
1	Mss	6	

Legend

Green	Proper upstream transmission
Cyan	Proper downstream transmission
White	Missing upstream transmission
Blue	Upstream ranging transmission
Red	Unrecognized upstream transmission

Report/End Report Button (1)

- A report file is generated automatically for each measurement
- The user can stop saving data to the file by touching the 'End Report' button

The screenshot displays the HKE TraceSpan software interface. At the top, it shows 'Near OLT (Serial)' with three wavelength and power indicators: 1490 nm (4.5 dBm), 1550 nm (18.5 dBm), and 1310 nm (-10.5 dBm). Below this is a control bar with buttons for 'Record', 'Reset Errors', and 'End Report'. An arrow points from the 'End Report' button to a text annotation on the right that reads 'Touch the button to end the report generation'. The main display area is titled 'OLT' and 'Identified 21 Active ONUs'. It lists various ONU parameters and their status, such as 'DS Power: 4.5 dBm', 'DS Physical Layer Errors: 0', and 'US Physical Layer Errors: 0'. Some ONUs are marked as 'Deactivated' or 'Inactive'. At the bottom, there is a navigation bar with icons for Home, Measure, Graphs, Diagnose, and US Analysis, along with a battery level indicator.

Cable Identification (PON ID)

The screenshot displays the PON ID identification software interface. At the top, it shows the OLT (Near OLT) status with three wavelengths: 1490 nm (4.5 dBm), 1550 nm (18.5 dBm), and 1310 nm (-10.5 dBm). Below this, there are buttons for 'Record', 'Reset Errors', and a search field for 'ONU S/N'. The main display is titled 'Identified 21 Active ONUs' and lists various ONU IDs and their status. A tooltip is visible over the OLT details, showing 'PON ID Type 0, Class C TOL 5.0 dBm (0x015E)'. The interface also shows error counts and data rates for both DS and US.

ONU ID	Status	Notes
ONU-ID(5)	Active	
ONU-ID(8)	Inactive	S/N TRPN1B1B1B1B Deactivated 3 times
ONU-ID(12)	Active	
ONU-ID(15)	Active	
ONU-ID(22)	Active	
ONU-ID(25)	Active	
ONU-ID(125)	Active	S/N TRPN1C1C1C1C Deactivated 2 times
ONU-ID(126)	Inactive	S/N TRPN1D1D1D1D Deactivated 1 time

GPON Tracer IPTV Service Analysis Solution

- Expands the functionality of GPON Tracer by allowing its users to **troubleshoot IPTV services on-site**
- Analyzes the IPTV channels on the network and presents a variety of service quality metrics for each these channels
- Runs on a laptop and analyzes a recording file

Service Analysis Tool – Summary Screen

- Presents the list of identified Multicast IPTV channels and service metrics for each one

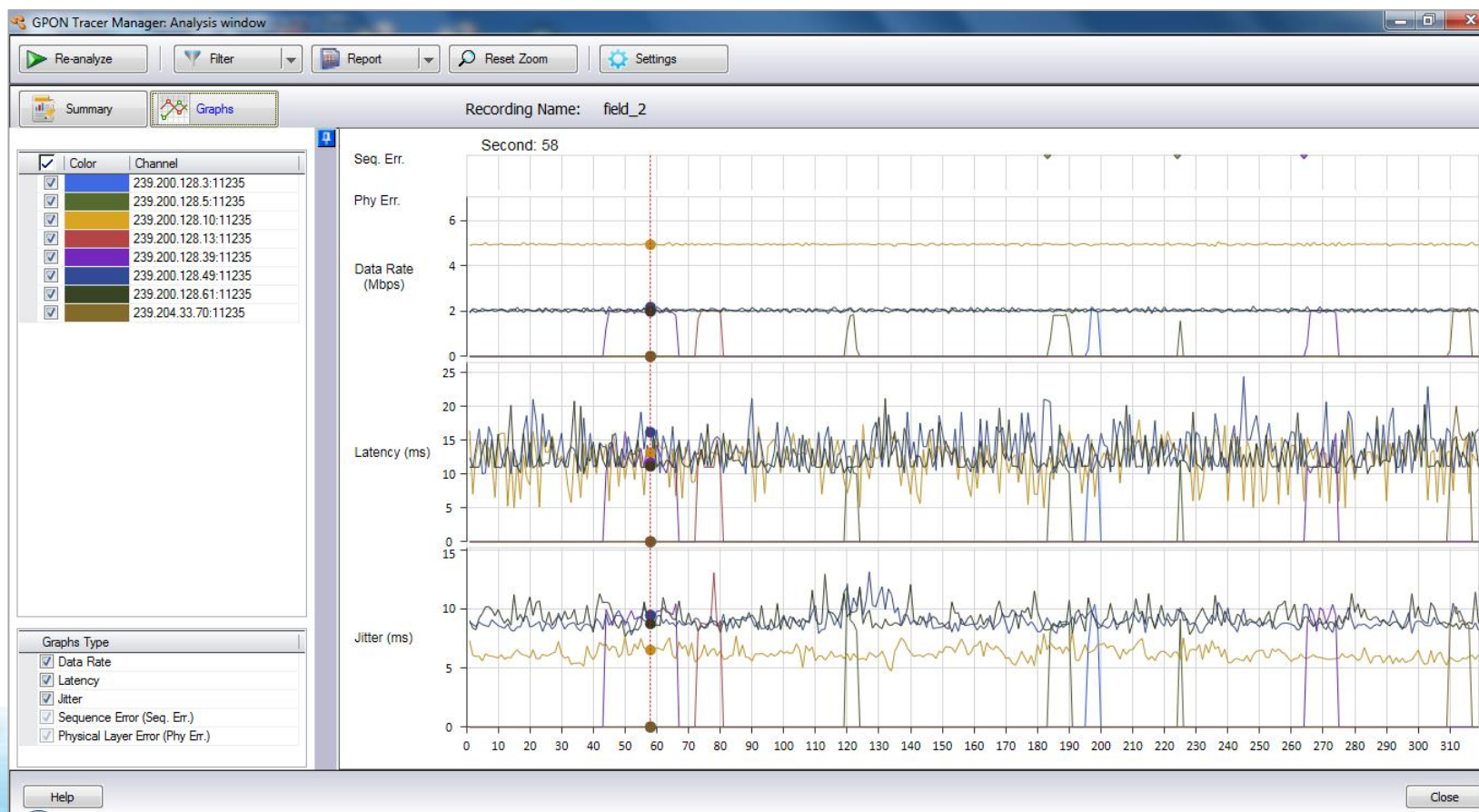
GPON Tracer Manager: Analysis window

Re-analyze Filter Report Reset Zoom Settings

Summary Graphs Recording Name: field_2

Index	Port	IP	Channel	Data Rate (Mbps)			Latency (Milliseconds)			Jitter (Milliseconds)		Sequence Error	
				Min	Max		Min	Max		Min	Max	Appearances	
1	11235	239.200.128.3		0.00	2.18	✓	0.00	12.88	✓	0.00	10.39	✓	0
2	11235	239.200.128.5		0.00	1.85	✓	0.00	17.25	✓	0.00	12.11	✗	2
3	11235	239.200.128.10		4.84	5.06	✓	5.00	18.63	✓	4.74	8.06	✓	0
4	11235	239.200.128.13		0.00	2.04	✓	0.00	15.00	✓	0.00	13.06	✓	0
5	11235	239.200.128.39		0.00	2.10	✓	0.00	16.25	✓	0.00	10.43	✗	1
6	11235	239.200.128.49		1.84	2.22	✓	10.00	24.38	✓	7.77	13.13	✓	0
7	11235	239.200.128.61		1.89	2.17	✓	10.00	21.13	✓	7.64	12.94	✓	0
8	11235	239.204.33.70		0.00	2.10	✓	0.00	20.00	✓	0.00	10.18	✓	0

Service Analysis Tool – Graphs



GPON Tracer – Additional features

- IPTV Service Analysis
- ONU stand-alone test (OLT emulation)
- Infrastructure for multi-language support
- Triggers
- Remote Access

Děkuji za pozornost !