Reference poster: fiber deep, RPHY and DAA

Best testing practices in the context of fiber deep and RPHY

CATV and multiple-system operators (MSOs) are transforming networks to support DOCSIS 3.1 and FTTH. The current use of distributed access architecture (DAA) technologies, such as Metro Ethernet, and fiber deep with Node+0 leading to Remote PHY (RPHY) is changing the face of traditional deployments. This poster gives a comprehensive overview of the recommended tests from the headend to the node.

Best practices

Connector inspection

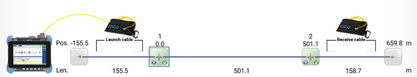
Since faulty or dirty connectors are the number one reason behind network failures, inspecting fiber optic connectors is the vital first step to make sure they are ready to be mated. Only a fully automated FIP will give the technician the correct pass/fail result, hassle free.

FIP-435B with automated features:

- Auto-focus
- Auto-centering
- Auto fiber connection detection and capture
- Auto-analysis with diagnostic on LED

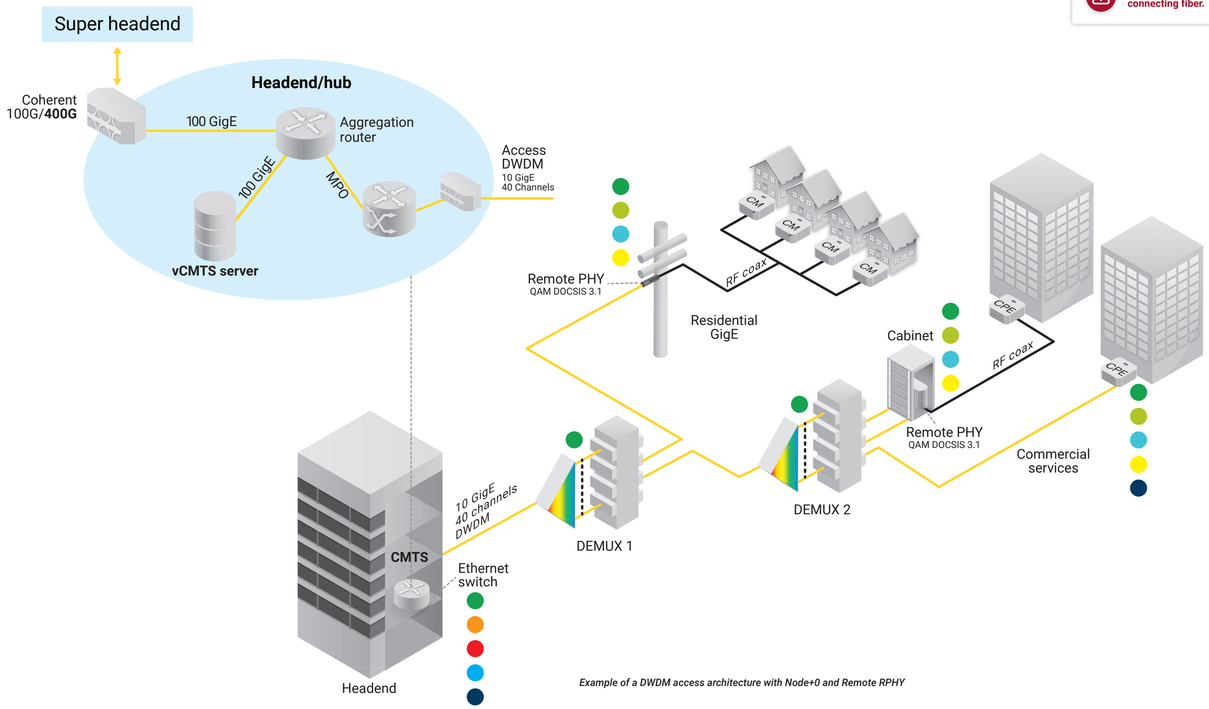
Launch and receive fibers

A launch/receive fiber, packed in a convenient SPSB, is a must-have to make OTDR and iOLM measurements. By eliminating dead zones for connector A and providing extra length of fiber for connector B, it allows technicians to accurately determine link loss and link ORL, and to fully characterize connectors A and B. Though the length will vary when using a classic OTDR (pulse width used, etc.) a minimum of only 15 m is required when using iOLM for any type of network (P2P, PTMP) thanks to Link-Aware™ technology.



The launch/receive fiber resides between the equipment (OTDR and/or iOLM) and the FUT

DWDM access network



Example of a DWDM access architecture with Node+0 and Remote RPHY

Always inspect before connecting fiber.

DAA using DWDM technology:

- From hybrid fiber-coaxial (HFC) to the optical cable
- 10 Gbit/s SFP for RPHY and up to 100 Gbit/s Ethernet for business services
- Up to 40 ITU-T wavelengths
- Up to 80 km (amplifier possibly present)
- N+0 DOCSIS 3.1 architecture

Watch out for these:

- Wavelength and power loss in SFP carrier at the DEMUX or customer premises
- Dispersion at 10 Gbit/s leading to high BER
- Fiber bends and breaks
- Dirty or damaged connectors

Recommended tests at installation:

- Dispersion (CD and PMD)
- Connector inspection
- Fiber characterization using DWDM ITU-T OTDR/iOLM to validate continuity through the MUX/DEMUX, loss, ORL and length

Recommended tests at activation and for troubleshooting:

- Spectral measurements (activation)
- OSNR (if amplified)
- ITU-T wavelength-specific OTDR
- Connector inspection

Common network issues:

- Macrobends
- Faulty connectors (dirty or damaged)
- Low signal power or high noise level
- High CD or PMD
- Poor throughput
- High latency
- Poor path protection switch time

Why test?

Without path protection and preventive measures, an outage in the backbone impacts hundreds or thousands of subscribers, incurring service-level agreement (SLA) penalties of millions of dollars. Testing ensures optimal performance and reduces the probability of an outage. When fiber path protection is in place, the switch time to the redundant path must be also verified.

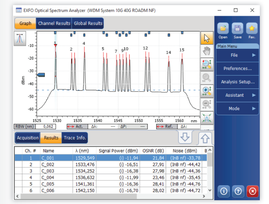
Recommended test tools and procedures

OSI layer 1

FIP
Verify connector endface condition

OSA
Check that channel power/wavelength and OSNR are within receiver requirements:

- Network equipment commissioning
- Troubleshooting transmission errors
- (WDM Investigator)



Dispersion analyzer
Testing for CD/PMD:

- Fiber characterization: validate dispersion is within tolerance to avoid bit errors
- Troubleshooting transmission errors

OTDR

- Fiber characterization (fiber breaks and events, loss/ORL, fiber continuity through MUX/DEMUX)
- Troubleshooting transmission errors

OSI layers 2-4

High-speed transmission tester—100G/400G
Service turn-up and SLA validation:

- Testing the optical transceiver with iOptics
- BERT "SOAK/Burn-in"
- Testing single service against RFC-2544
- Service activation—testing CIR "throughput"/frame loss/jitter/latency against ITU Y.1564

Service troubleshooting:

- Testing the optical transceiver with iOptics
- BER testing for service disruption time and intermittent errors
- Traffic generator to monitor frame loss/throughput/jitter/latency

FIP-400B Series

Connector inspection

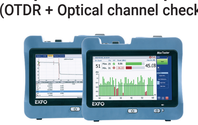
Optical Explorer (Optical fiber multimeter)

Last mile troubleshooting

MAX-5205 (Optical channel checker)

DWDM activation

Optical Wave Expert (OTDR + Optical channel checker)



DWDM troubleshooting

FTB-740 Series

xWDM characterization

FTB-5235 (Optical spectrum analyzer)

xWDM spectral validation

FTB-5700

Dispersion testing

FTBx-8880

Ethernet service validation

Acronyms

CATV	Cable television
CD	Chromatic dispersion
CMTS	Cable modem termination system
Coax	Coaxial cable
CWDM	Coarse wavelength division multiplexing
DAA	Distributed access architecture
DEMUX	Demultiplexer
DOCSIS	Data over cable service interface specification
DWDM	Dense wavelength division multiplexing
FIP	Fiber inspection probe
FUT	Fiber under test
iOLM	intelligent Optical Link Mapper
ITU	International Telecommunication Union
MPO	Multifiber push on connector
MSO	Multiple-system operators
ORL	Optical return loss
OSI layer 1	Physical circuitry, functions
OSA	Optical spectrum analyzer
OSNR	Optical signal-to-noise ratio
OTDR	Optical time-domain reflectometer
PMD	Polarization mode dispersion
QAM	Quadrature amplitude modulation
SLA	Service-level agreement
WDM	Wavelength-division multiplexing

Fiber deep, RPHY and DAA

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