Application Note

VIAVI Solutions

Essentials of Fiber to the Antenna:

Fronthaul Installation Test

1 Fiber Inspection and Connectivity

2 Cable and Antenna Testing

3 Fronthaul Installation Test

4 Fiber Certification

Fronthaul Installation Test

In distributed RAN architectures, CPRI protocol is used to connect remote radio heads (RRH), which are located close to the antenna, to the base band unit (BBU). CPRI protocol enables the RRH and BBU to interact with each other over distances of several miles. An extension of this distributed architecture allows service providers to co-locate a group of BBUs at a remote location; this phenomenon of centralization of RAN offers an enhanced capacity benefit by enabling ultra-dense cell deployments. Then by utilizing some of the key features of LTE Advanced, such as carrier aggregation and Uplink Coordinated Multipoint (UL CoMP), centralized RAN (C-RAN) can significantly improve uplink capacity and cell edge throughput.

When installing RRHs on towers, street light and rooftops, it is extremely important to test the RRH links before connecting them to the BBU for service activation. Incorrect small form-factor pluggables (SFPs) and misconfigured or faulty RRHs will disrupt the service, necessitate the costly return of tower crews, and delay the service introduction. Additionally, in C-RAN architectures, multiplexing several signal wavelengths into a single fiber within the coarse wavelength-division multiplexing (CWDM) or dense wavelength-division multiplexing (DWDM) range is common when connecting the BBU to RRHs requiring specific CWDM and DWDM checks. Both CWDM and DWDM (and hybrids of the two) are common cost-effective strategies for expanding backhaul capacity without laying or lighting more fiber.

Testing C-RAN is a little bit more involved when compared to macrocells. In addition to certifying all the cables, connectors, and other active and passive components, cell site installers may be required to validate new xWDM routes as well.

Fronthaul testing consists of the following:

1. End-to-end link characterization of CWDM/DWDM routes for C-RAN type scenarios
2. CPRI check
3. BBU emulation test

Inspect Before You Connect

Before performing any fiber test, it is essential to inspect and clean all fiber connectors involved in the test. The following table describes the distinct role of each test, as well as the VIAVI enhancements that provide unique, valuable advantages

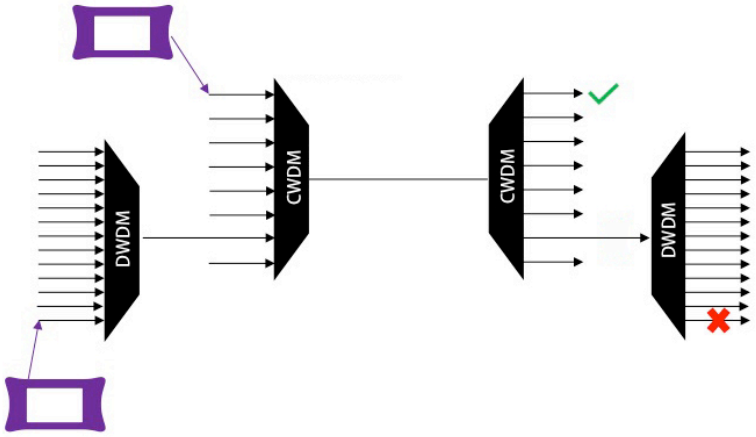
Test	Description	VIAVI Advantage
Link Characterization of CWDM/DWDM Routes	Validates wavelength routes, and checks end-to-end loss through MUX and DEMUX. Also checks SFP wavelength and power level.	· Install and commission cell sites with one instrument and carry less equipment in the field · Test new xWDM wavelength routes and pinpoint exact fault locations without disrupting traffic on active channels · Verify end-to-end continuity with the integrated C-band tunable laser source mode · Comprehensive qualification and troubleshooting solution, for hybrid CWDM/DWDM networks when combined with the VIAVI OTDR modules · Easy setup and interpretation of results with SmartConfigs and Smart Link Mapper (SLM) OTDR applications · Portable and lightweight, most compact xWDM OTDR solution available for physical layer fiber certification and troubleshooting · VIAVI test solutions are approved by major service providers · Our best in class industry warranty (3 years) gives you peace of mind and it shows our commitment to our customers
CPRI (Fronthaul) Installation Test	Verifies the correct SFP is being used on the test set and confirms that the RRH is responding to the test set. For this test, it is recommended that the SFP that will be used in the BBU is used to confirm that it is functioning properly. When the test set establishes communication to the RRH by emulating a BBU, it confirms that the RRH has been properly installed and is responsive	
BBU Emulation Test	Establishes communication with the RRH by issuing commands to the RRH. The purpose of BBU emulation test is to confirm that the RRH has the correct SFP installed, that it has the correct firmware loaded, that fibers have not been swapped, and the RRH supports the expected sectors and frequencies.	
BERT Test	Confirms that any active components in the xWDM or dark fiber network are not creating CPRI frame loss that could impact service.	

Channel/Wavelength Provisioning

1. Validate wavelength route – birth certificate. Perform OTDR tests at specific CWDM or DWDM wavelengths (single ended test) and use tunable laser source with broadband power meter (dual ended test) during construction or once xWDM network is live (in-service)
2. Verify new CWDM/DWDM channel routing
3. Check end-to-end loss through MUX and DEMUX
4. Find dirty or poor connections

Troubleshooting Live Network

1. Perform OTDR tests at a specific CWDM/DWDM wavelength on the live network (no traffic disruption)
2. Check end-to-end loss through MUX and DEMUX
3. Pinpoint fiber fault – find defective segment



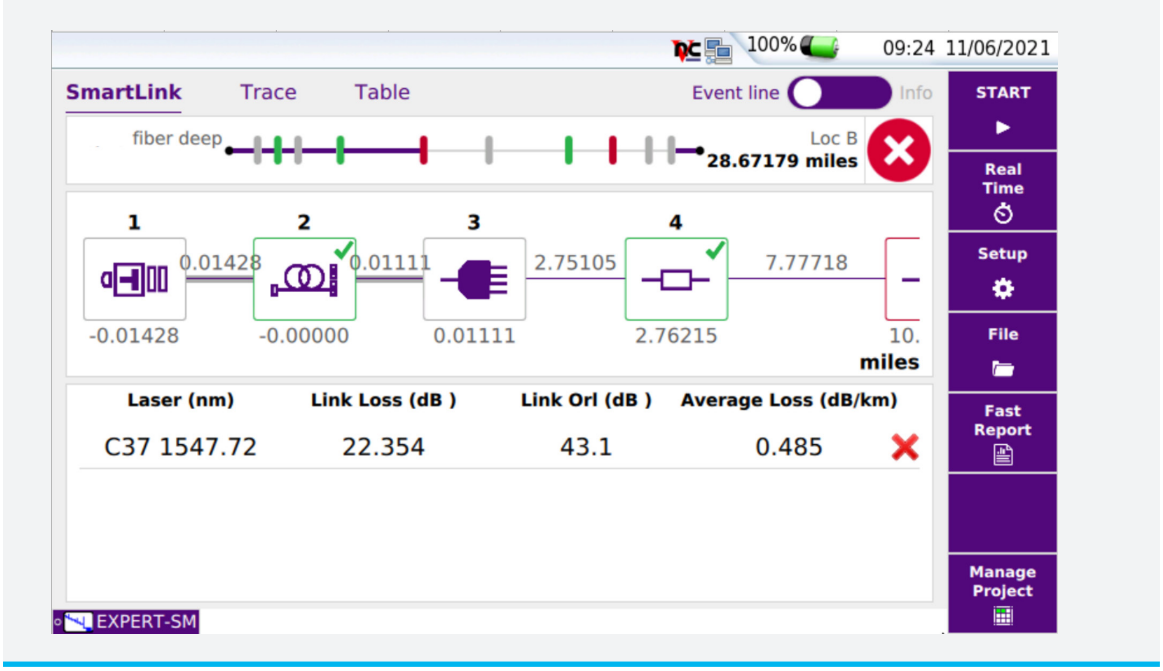
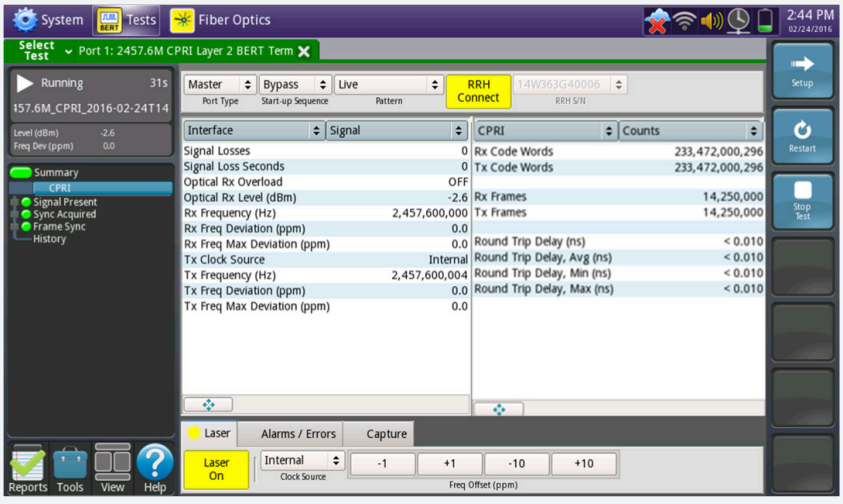


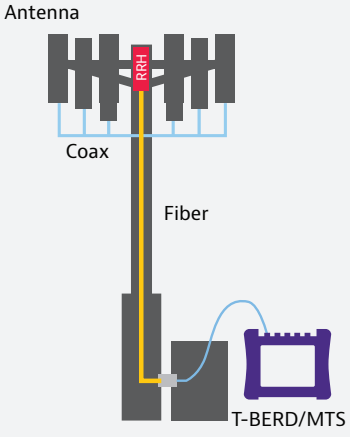
Figure 1. Smart Link Mapper view of DWDM link/route

To simplify interpretation of OTDR traces, VIAVI developed its Smart Link Mapper (SLM) capability. This application provides an easy to read icon based view of a fiber link (connector, splice, MUX, DEMUX, etc.) with intelligent MUX and DeMUX detection and identification and clear OTDR event icons, labels and descriptions. Instant toggling between OTDR trace and SLM view reduces the chance of OTDR trace interpretation errors and misdiagnosing faults, leading to faster job completion and reduced repeat truck rolls.

CPRI Check and BBU Emulation

Performing CPRI check and BBU emulation tests during the installation phase will reduce need for additional tower climbs during the commissioning phase if installation-related issues are found. VIAVI CellAdvisor™ with BBU emulation lets technicians achieve more test coverage during the initial build process, identifying and isolating issues in one site visit to avoid repeat dispatches. Testing with BBU emulation also isolates problems more effectively and helps to identify problem sources such as fiber, coax, antenna, radio equipment, SFP, or RF.





SFP Check

Check SFP wavelength and power level with xWDM Channel Checker or Optical Spectrum Analyzer (OSA)

Conclusion

Whether you are working on a macrocell or a CRAN architecture, VIAVI T-BERD/MTS 5800 solution makes it easy to validate and turn up any kind of fiber fronthaul. Our comprehensive test solutions deliver acceptance reports per service provider test criteria, and are considered documented, authentic proof (birth certificate) that the installation meets specifications, enabling quick acceptance, and helping contractors get paid faster.

VIAVI Solutions

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