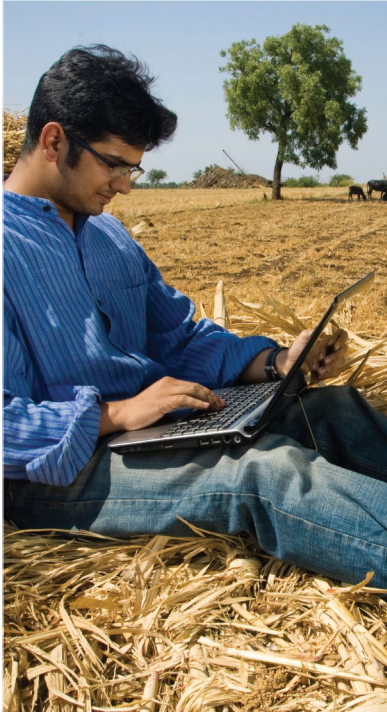


# Broadband Test and Measurement Solutions

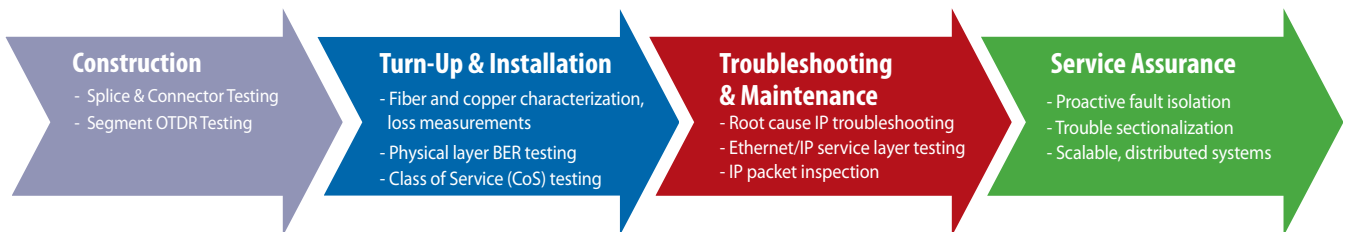
## A Selection Guide for Middle Mile Network Test Tools and Services



As service providers expand the network reach to extend further into rural areas, one of the primary challenges is getting the bandwidth delivered to each rural serving area to support the local buildouts of Incumbent Local Exchange Carriers (ILECs), Competitive Local Exchange Carriers (CLECS), and municipalities. In fact, a significant amount of broadband stimulus funding is for middle mile build-out applications.

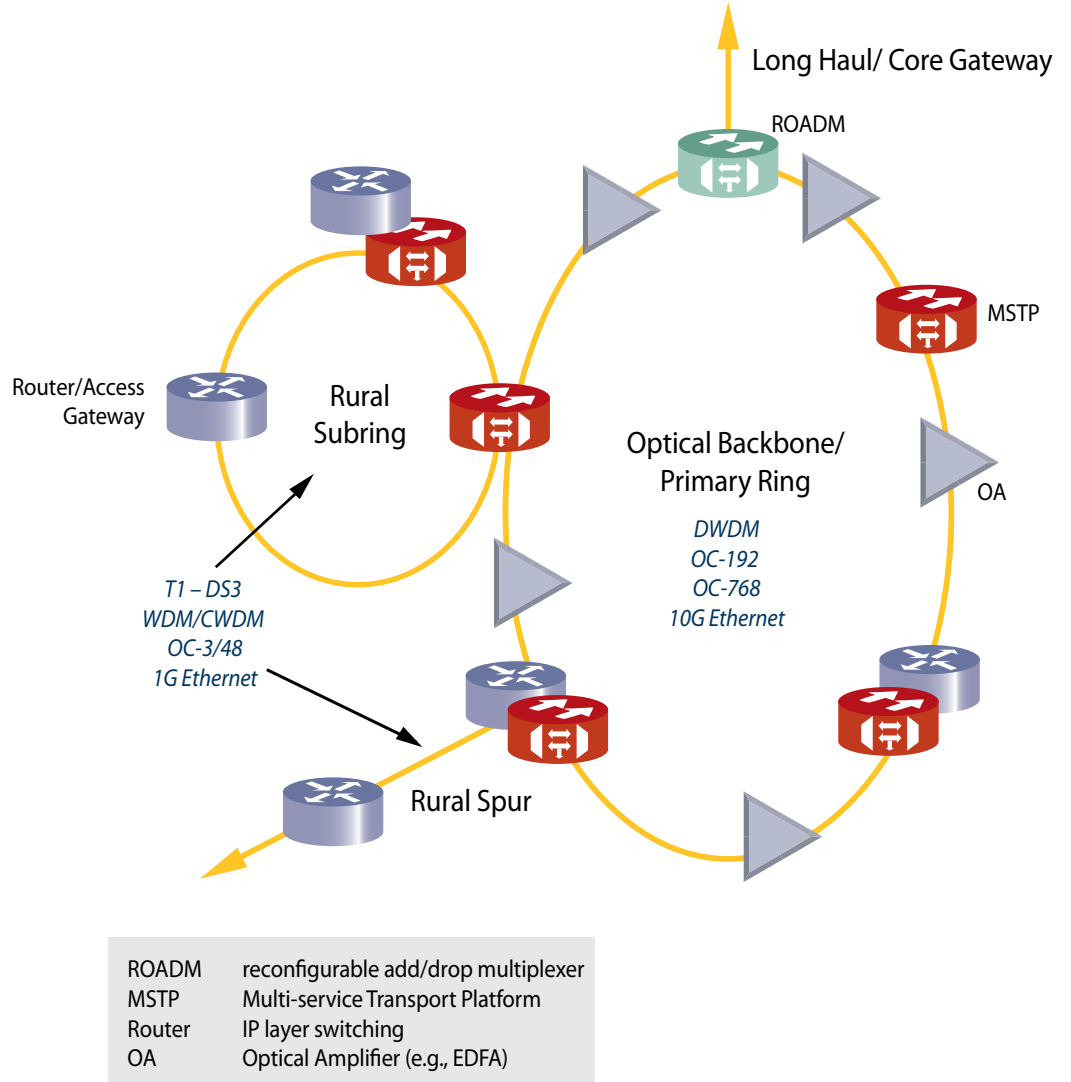
Middle mile breaks down into two categories: 1) primary buildouts (typically rings or point-to-point links); and 2) subrings or spurs to provide access to rural/local service providers in a particular serving area. This provides the final link to provide fiber to the home in rural America with speeds that enable telecommuting, transparent remote office presence, and rural businesses and institutions to compete globally.

This selection guide provides an overview of the typical middle mile network and identifies key tests to conduct in each deployment layer as well as the class of equipment that can perform them. It also summarizes the test solutions and services that JDSU can provide as your partner in deploying the middle mile.



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## Inside the Middle Mile Network



Example of a Middle Mile Network

## Testing the Middle Mile Network Defining the Tests & the Tools

Fiber Layer		Connector Inspection Tools	T-BERD 8000	T-BERD 6000	T-BERD 4000	SmartClass Meters	SmartPocket Meters
Tests to Perform	Tool Category						
Evaluate Connector End Face Quality	Connector Inspection	■	■	■	■		
Verify Link Length	OTDR		■	■	■		
Evaluate Fiber, Connector & Splice Loss, Connector Reflectance	OTDR		■	■	■		
Measure Power Levels	BB Power Meter	■ <sup>1</sup>	■	■	■	■	■
Measure Link Loss	OTDR, Loss Test Set	■ <sup>1</sup>	■	■	■	■	■
Measure Optical Return Loss	OTDR, ORL Meter		■	■	■	■	
Link Characterization (OTDR/IL/ORL/CD/PMD/AP)	FC Tester		■	■			
Network Characterization	Dispersion Tester		■	■			

Optical Signal Layer		T-BERD-8000	T-BERD-4000	SmartClass Meters
Tests to Perform	Tool Category			
DWDM Spectral Analysis (Power & Wavelength per Channel, Drift, OSNR)	DWDM OSA	■		
Advanced DWDM Spectral Analysis (Above + ROADM In-band OSNR, Overlapping Spectral Analysis)	DWDM In-Band OSA	■		
CWDM Spectral Analysis	CWDM OSA	■	■	
Channel Verification & Power	Channel Checker	■	■	■

Transport Layer		T-BERD-8000	T-BERD-6000A	HST-3000	SmartClass Ethernet
Tests to Perform	Tool Category				
STS-1 – OC-192	Layer 1/ 2/ 3	■	■		
10 Mbps – 1 GigE	Layer 1/ 2/ 3	■	■	■	■
10 GigE	Layer 1/ 2/ 3	■	■		
40 G	Layer 1/ 2/ 3	■			
T1 / T3	Layer 1/ 3	■	■	■	
Jitter / Wander	Layer 1	■			

<sup>1</sup> Fiber characterization services available

## Testing the Middle Mile Network Defining the Tests & the Tools

Service Assurance		ONMS Optical Network Monitoring	Optical Network Mapping
Tests to Perform	Tool Category		
Monitor the fiber network, alarm, and dispatch repair	Network Probe	■	
Added Software to ONMS system to provide GIS-based documentation & fault location mapping	GIS Mapping	■	■

## Products and Services At-a-Glance



### Fiber Inspection, Cleaning, and Test Kits

#### *Inspection, cleaning, and testing*

JDSU provides the most complete and efficient product portfolio in the industry for inspecting and cleaning fiber optic connectors. Achieving optimized performance in today's networks requires technicians to perform systematic and proactive methods for inspecting, cleaning, and testing fiber connectivity. JDSU designs its solutions, such as the FIT-HP3-80, specifically to integrate these essential tools into a seamless system that enables fast, portable, and easy implementation to inspect, clean, and test fiber.



### SmartPocket™ Optical Handhelds

#### *Basic tools for fiber optic power measurement and loss testing*

The JDSU SmartPocket Optical Handhelds are pocket-sized optical handheld instruments such as light sources and optical power meters that provide accurate measurements in a simple, entry-level unit at an affordable price. Small and lightweight, these handy instruments provide all of the basic functionality needed for fiber optic power measurement and loss testing.



### SmartClass™ Optical Channel Checkers

#### *Ideal product family for CWDM or DWDM testing during turn-up and first-level maintenance*

The JDSU SmartClass OCC-55 enables optical channel verification through wavelength and power level measurements according to the International Telecommunications Union (ITU-T) grids, making it the ideal tool for technicians who deal with coarse wavelength division multiplexing (CWDM) transmission systems. For dense wavelength division multiplexing (DWDM) transmission, the OCC-56C (C-Band) and OCC-56L (L-Band) provide the best Tier-1 solution.



### T-BERD®/MTS-8000

The next-generation, modular, and cost-effective JDSU T-BERD/MTS-8000 platform solution with its innovative design combines traditional synchronous optical network/synchronous digital hierarchy (SONET/SDH) and Ethernet/Internet Protocol (IP) testing—all in a single test module. The T-BERD/MTS-8000 provides physical layer test modules, including optical time domain reflectometer (OTDR), polarization mode dispersion (PMD), and chromatic dispersion (CD). It also provides service-layer test modules, such as 10 Gigabit Ethernet (GigE) and SONET/SDH, to test various fiber networks (FTTx) as well as CWDM and DWDM networks.



### T-BERD®/MTS-8000 Transport Module

The JDSU Transport Module combines traditional SONET/SDH, Ethernet/IP, and Transmission Control Protocol/User Datagram Protocol (TCP/UDP) testing and supports 10 Mbps to 10 Gbps Ethernet, ensuring that proven test methodologies for Ethernet services remain the same regardless of the rate. The Transport Module offers a blend of bit error rate testing (BERT) and Ethernet/IP/Virtual Private LAN Service (VPLS)/Multiprotocol Label Switching (MPLS)/TCP/UDP (with multiple streams, patent pending), Fibre Channel, and optical transport network (OTN) test capabilities in a superior portable design.



### T-BERD®/MTS-6000A

#### *Compact and highly integrated test platform for fiber and Ethernet/IP-based networks*

The JDSU T-BERD/MTS-6000A is designed for all phases of the fiber and Ethernet/IP-based network life cycle. It provides field service technicians with the highest levels of performance and upgradeability on the market, providing over 40 different modules supporting a wide range of applications. The versatility of the T-BERD/MTS-6000A allows technicians to standardize using one type of test equipment and then introduce new testing capabilities in the field without incurring additional training and device costs.



### T-BERD®/MTS-6000A Multi-Services Application Module (MSAM)

One rugged, handheld JDSU Multi-Services Application Module (MSAM) provides the most compact 10-GigE multifunction tester in the industry used for the installation and maintenance of Carrier-grade services. It supports applications ranging from verifying Ethernet and IP service level agreements (SLAs) (including VPLS/MPLS) to verifying provider backbone transport/optical amplifier module (PBT/OAM) functionality for true Carrier Ethernet SLAs. It also supports application-centric testing (focused on TCP/UDP) in the presence of background test streams (patent pending). Technicians can also add testing capability with pluggable physical interface modules (PIMs) to create a variety of field-configurable optical/electrical test combinations.



### T-BERD®/MTS-4000

#### *The first handheld tester to combine advanced fiber, copper, xDSL, and Triple-Play features*

The JDSU T-BERD/MTS-4000 offers advanced fiber, copper, and IP-based voice, video, and data (triple-play) capabilities in a single tester with all of the testing functions that technicians need to install, turn up, and maintain fiber and copper-based networks carrying triple-play services. The modular design of the T-BERD/MTS-4000 offers field service technicians the highest performance and superior levels of scalability and upgradeability with features that offer multilayer tests to reduce turn-up and installation time. An easy-to-use, icon-based graphical user interface (GUI) and flexible connectivity allow for testing with minimal training, especially for newer technologies such as voice over IP (VoIP) and IP-based video.



### HST-3000 Ethernet Module

The JDSU HST-3000 Handheld Services Tester is a modular, portable, and rugged instrument that tests multiple technologies (including xDSL, copper, T1/E1, fiber, and Ethernet) in both Metro and Access networks. The Ethernet module supports physical layer testing (cable diagnostics), service quality verification (RFC-2544 at Layers 2 to 4 and class of service [CoS]), and application performance analysis (VoIP and IP video). The HST-3000, equipped with the Ethernet module and the mainframe's VoIP and IP video options, addresses the broad requirements for 7-layer testing (including IPv6) in a rugged, modular platform perfect for field use.



### SmartClass™ Ethernet

A cost-effective, rugged, and portable test instrument designed for field technicians who install Ethernet and IP services, the JDSU SmartClass Ethernet provides a complete range of Ethernet test capabilities, including support for cable diagnostics to RFC-2544 (including Asymmetrical RFC-2544), multiple streams support, and MPLS enabling service providers to successfully verify Carrier Ethernet SLAs at installation.



### Optical Network Management System

The JDSU Optical Network Management System (ONMS) reduces mean time to repair (MTTR) in fiber networks by accurately locating faults and degradation by monitoring the fiber using OTDR technology. It monitors unused dark fiber or out-of-band fibers carrying traffic and links the monitoring data with network location data to accurately locate faults and to enable immediate dispatch. ONMS can link to most GIS-based network mapping/documentation systems or can be combined with JDSU OFM-500 Optical Fiber Mapping software.

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