

# T-BERD®/MTS-8000

## 40/100 G Transport Module



### Key Benefits

- Save time with the only field-optimized optics self-test that ensures CFP and QSFP+ optics modules run error-free
- Maximize efficiency with a single T1/E1 to 100 G instrument that saves time running multiple-port 10 G and 100 G tests concurrently
- Save time by using the quickest RFC 2544 and Y.1564 SAM-Complete test suites in the industry coupled with the J-Quick-Check pre-test
- Confidently guarantee that 100 G deployments will meet stringent SLA compliance requirements from financial customers with high-accuracy, standards-based latency measurements
- Increase testing flexibility from the 100 G core to any network aggregation point with a wide range of ODU multiplexing options and a unique GCC transparency test
- Raise network confidence with a 40/100 G committed burst size (CBS) test that verifies correct traffic management and policing configuration on core network elements, especially critical for connections traversing at 10/100 GE rates
- Ensure operating margins via optics test and trial network equipment performance with skew injection and skew alarm thresholds

### Key Features

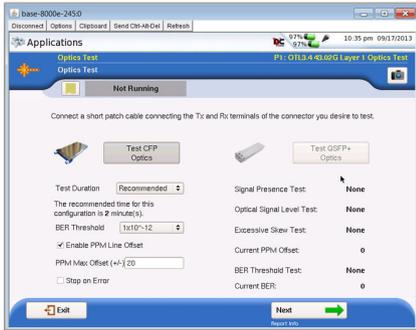
- Supports testing of all high-speed line rates, 40/100 GE, OTU3/4, and OC-768/STM-256 including field-optimized optics self-test
- Supports 40/100 GE with 10 concurrent Ethernet data streams for service testing integration into Y.1564 SAMComplete and J-QuickCheck
- Measures high-accuracy round-trip latency (100 ns accuracy)
- Verifies Layer 2 protocol transparency and prevents network misconfiguration with J-Proof
- Layer 3 test features include ping/ARP and traceroute for IPv4/IPv6
- Provides OTU3/4 with client support and ODU multiplexing with a unique GCC transparency feature

### Applications

- Service activation and commissioning for Ethernet, SONET/SDH, and OTN
- Network service disruption testing and troubleshooting
- Application-driven service monitoring

The JDSU T-BERD/MTS-8000 40/100 G Transport Module is the most versatile test solution on the market and is ideal for field test applications. Its ruggedness, battery power, and control connectivity support full mobility and can withstand the most diverse test conditions. With capabilities designed for carrier Ethernet/packet transport, long-haul, and metro-core networks, as well as government telecommunication centers, this solution represents continued innovation for the family of award-winning, industry-leading T-BERD/MTS test solutions. Empowered with the StrataSync™ asset, configuration, and test-data management tool, the module is the right test tool for achieving the quickest test execution times for networks and optics during service activation and troubleshooting.

This module integrates native pluggable optics support for both the C form-factor pluggables (CFP) applicable to 40 and 100 G line rates and the quad small form-factor pluggables (QSFP+) applicable to 40 G line rates. This greatly simplifies operations as tests alternating between 40 GE/OTU3 and 100 GE/OTU4 or between 40 GE/OTU3 and 40 G SONET/SDH do not require any optical-module manipulations. It also provides service activation, traffic testing, troubleshooting, and monitoring capabilities for synchronous Ethernet, SONET/SDH, and optical transport network (OTN) testing. The combination of J-QuickCheck, Y.1564 SAMComplete, J-Proof Layer 2 transparency, and RFC 2544 provides the most complete service-activation test suite in the industry. Supporting five different line rates with upgradability to span T1/E1 to 100 G including Ethernet, Fiber Channel, CPRI, OTN, and SONET/SDH, this solution helps operators minimize CapEx even in diverse network topologies.

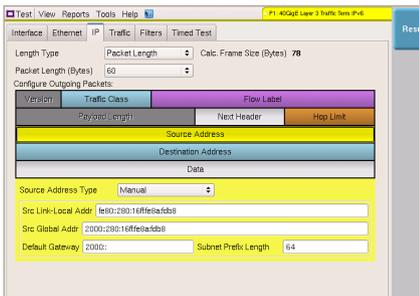


Optics Test window

## Optics Testing and Support

The 40/100 G Transport Module enables network engineers and technicians to prove that CFP and QSFP+ optics work properly either before network turn up or as a troubleshooting tool. The field-optimized optics self test saves time and ensures optics modules run error-free using low-level patterns, automated clock offset variations, and alarm/skew verification. The process is streamlined with report generation.

The 40/100 G Transport Module provides native support for both CFP and QSFP+ optics. For example, a user who needs to switch between 100 GE and 40 GE testing does not need to swap optics using the CFP and QSFP+ slots. This solution can test supports just about all available CFP or QSFP+ solutions on the market. JDSU sources and tests optics from multiple vendors for use in the module. A CFP/QSFP+ information menu displays the type of optics used and an expert mode lets the user tweak the CFP parameters as needed via management data input output (MDIO).



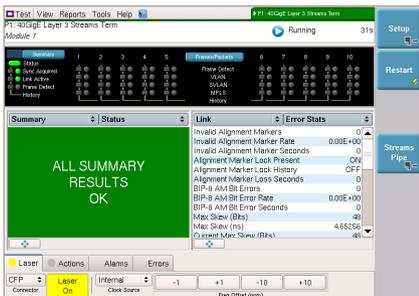
40 GE IPv6 setup

## Ethernet Testing

The 40/100 G Transport Module provides comprehensive Ethernet testing for 40 and 100 GE as well as Ethernet into OTN spanning Layers 1, 2, and 3.

### The Basics of Layer 1 Support

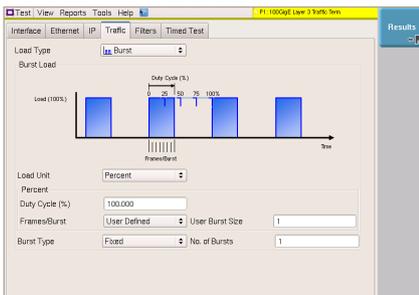
Test capabilities such as skew injection and monitoring, PCS alarms and errors, pause frame support and basic Layer 1 patterns, such as the IEEE 802.3ba scrambled idle pattern, are available on 40/100 GE. In addition, field troubleshooting support is provided at Layer 1 with injections and monitoring of multiple errors/alarms on a per-lane basis.



40 GE streaming

### Ethernet VLAN, Q-in-Q, and MPLS Technologies

Ethernet tagging and encapsulation is commonly used to improve the scalability of Ethernet networks by isolating customer traffic. Regardless of the encapsulation and tagging used, the module tests class of service to confirm key performance indicators such as committed information rate (CIR), committed burst size (CBS), frame delay (FD), frame delay variation (FDV), and frame loss ratio. Support for virtual local area network tags (VLAN tags), Q-in-Q VLAN tags, and multiprotocol label switching (MPLS) enables the module to test any part of a metro or long-haul network.



100 GE burst setup

### ITU-TY.1564 SAMComplete Service Activation Testing

SAMComplete enables fast and straightforward SLA verification for differentiated services. Tests include validating different bandwidth profiles such as committed information rate (CIR), extended information rate (EIR), maximum information rate (MIR), and CBS. KPI pass/fail results for CIR, frame delay (FD) with the possibility of high-accuracy latency (100 ns), frame delay variation (FDV), and frame loss rate (FLR) are provided independently for up to ten simultaneous services. SAMComplete enables CBS testing not only for SLA compliance but also to stress and verify real-world traffic policers in the network. As part of Y.1564 multiple-service tests, SAMComplete emulates real network services such as data, VoIP, and video service test integration. The test suite also integrates the unique JDSU J-QuickCheck pre-test procedure and works with different test interfaces such as GE/10 GE (on T-BERD/MTS MSAM), 40 GE, and 100 GE.

### RFC 2544 Testing

RFC 2544 is an industry standard for Ethernet link activation. In addition to supporting Ethernet throughput for CIR verification, FD/latency, frame loss, and back-to-back burst testing as specified in the RFC, the module also tests for FDV/packet jitter to ensure circuit readiness for transporting time-sensitive services such as IPTV and VoIP. It can measure FD/latency with high accuracy (100 ns). This test suite enables CBS testing not only for SLA compliance but also to stress and verify real-world traffic policers in the network. The RFC 2544 includes the JDSU QuickCheck pre-test procedure and detailed customer-ready reports to complete the activation cycle. It also supports integrated loop-up/down capabilities to allow a local unit to control a far-end unit when providing latching logical loopback capability.

Lane #	Virtual Lane ID	Rate (Gbps)	Rate (M)	Test Assessed	Header Lock	Code Mismatch
0	0	20	3.88	ON	ON	0
1	1	20	3.88	ON	ON	0
3	2	14	2.72	ON	ON	0
2	3	15	2.91	ON	ON	0
4	4	14	2.72	ON	ON	0
5	5	14	2.72	ON	ON	0
7	6	18	3.88	ON	ON	0
6	7	20	3.88	ON	ON	0
8	8	0	0.00	ON	ON	0
9	9	0	0.00	ON	ON	0

Per-lane results

### J-Proof Ethernet Transparency Test

J-Proof is a carrier Ethernet test that confirms end-to-end transparency of Ethernet between two end points anywhere on a network using slow protocol data unit (PDU) generation that will not interrupt an existing service. Service providers can use J-Proof to confirm the transparent transport of control-plane messages such as STP, GARP, and Cisco® proprietary protocols such as CDP. A powerful, customizable Ethernet frame generator tests the transparency of almost any Ethernet control-plane message, even when a pre-defined frame is not available. Testing with J-Proof lets customers guarantee that an intermediate network is not filtering their control-plane traffic.

### IPv4 and IPv6 Testing

Layer 3 test features incorporate traffic generation and analysis for both IPv4 and IPv6. Router connectivity is enabled via support of the ARP protocol to dynamically determine destination MAC addresses. In addition, the T-BERD/MTS supports ping and traceroute testing. Specific to IPv6, the neighbor discovery protocol provides support for IPv6 address resolution.

Summary	Ping	Summary	Status
Ping Requests Tx	5		
Ping Replies Rx	5		
Lost Pings	0		
Lost Ping %	0		
Delay (ms) C0			
Average	< 1		
Minimum	< 1		
Maximum	< 1		
Ping Requests Rx	5		
Ping Replies Tx	5		

ALL SUMMARY RESULTS OK

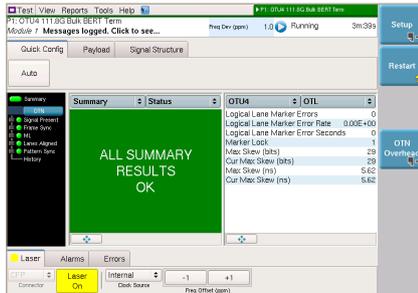
100 GE ping

### CoS Verification with Multiple Streams

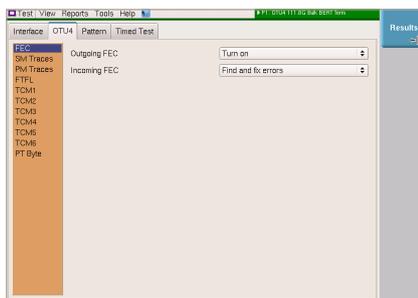
Multistream testing delivers traffic generation and analysis at the Ethernet and IP layers so technicians can emulate various types of traffic with CoS mappings letting them assess the impact of traffic prioritization on the overall network architecture and to confirm proper queuing, policing, and shaping. Users can generate and analyze up to 10 individually configured streams because of key per-stream parameters such as VLAN ID and priority, type of service/differentiated services code point (TOS/DSCP) marking, packet size, stream bandwidth, and source/destination MAC and IP addresses. Configuring constant, burst, or ramp traffic enables near real-world traffic simulation before actually delivering a service. This level of testing can confirm network design and drastically reduce post-installation troubleshooting by measuring high-accuracy round-trip latency (100 ns accuracy).

### Service Disruption Test

The T-BERD/MTS measures service interruption based on the time interval when the Ethernet frame flow is disrupted. This capability also extends to Ethernet clients mapped in OTN.



OTU4 OTL



OTU4 overhead settings



OTN SD

## OTN Testing

OTN testing is provided for both OTU3 and OTU4 interfaces (with provisions for OTU1/2/2e on MSAM), which includes the ability to run service-activation testing and troubleshooting on native OTN interfaces whether serial or multi-wavelength. OTN wraps client signals, provides alarm and error support in its overhead, and offers signal robustness using forward error correction (FEC). In addition, more recent OTN implementations support ODU multiplexing with a possibility of providing Layer 1 switching at the ODU level. With OTU3/4, optical channel transport lane (OTL) layer support provides error/alarm injection and monitoring. This module features two methods for round-trip delay (RTD) measurements: a GCC transparency test and multiple client mappings including ODU multiplexing capabilities.

### Alarms, Errors, and FEC Testing

High-speed OTN interfaces require the standard G.709 FEC. The module enables monitoring and correcting the FEC on incoming signals; conversely, it can inject correctable or uncorrectable errors in the transmit direction. Furthermore, it can verify OTN alarms and errors with injection capabilities such as loss of frame (LOF), alarm indication signal (AIS), and backward defect indication (BDI). Connectivity to nonstandard FECs is also possible via the use of an all-zero algorithm. The module can also monitor OTN signals while connected in-line on a circuit. An overhead editor provides full manipulation of OTN overhead bytes with additional capabilities for editing and monitoring trace messages (TTI), payload type (PT), and fault signaling (FTFL).

### Support for Overhead Features and Six TCM Sets

The T-BERD/MTS supports all six tandem connection monitoring (TCM) sets, including testing of associated alarms and trail trace identifiers (TTI), which includes concurrently checking expected trace messages on all TCMs and SM/PM. In addition, the module supports RTD measurements using G.709 DMp/DMti which interworks with network equipment and runs concurrently with other tests. Another value-add function is the ability to test network management channel transparency using PRBS over the general communication channels (GCC).

### Mappings

The module supports multiple PRBS patterns as bulk OTN payload, including PRBS 9, 23, 31, and inverts. A full-featured STS-768/STM-256 and 40 GE transcoded in OTU3 and 100 GE client mapped into OTU4 using generic mapping procedures (GMP) are available for dual-layer service activation and troubleshooting.

### ODU Multiplexing

Advanced mappings including single- and multi-level ODU multiplexing of ODU0, ODU1, ODU2/2e are available. Hence, the module provides extensive coverage for all OTN deployment and troubleshooting activities.

### Service Disruption Measurements

The module measures the protection switch times of core backbone links and rings and their effects on clients. Simultaneous monitoring of various error and alarm conditions lets providers verify that their transport network is providing adequate redundancy to guarantee OTN-level SLAs.

## SONET/SDH

The module tests 40 G SONET/SDH BER in end-to-end or loopback applications, and supports error insertion and alarm monitoring to verify NE conformance and connectivity. This module provides the possibility to add lower-rate interfaces, down to T1/E1, when combined with an MSAM module. Importantly, this module supports the use of a serial CFP for OC-768/STM-256, OTU3, and 40 GE testing while it is possible to concurrently house an LR4 CFP for 40 GE and OTU3 multi-wavelength testing. These capabilities greatly reduce the need to swap optics in and out of the unit, making this module the most versatile solution on the market.

### Alarm and Error Testing

The module offers the full integration of 40 G and 100 G interfaces including OC-768/STM-256. SONET/SDH error and alarm testing encompasses not only line-to-path testing but also the inclusion of the STL layer used to operate pluggable CFP optics. This solution supports testing and connectivity to any 40 G SONET/SDH device including pluggable CFP and fixed 300-pin MSA-based implementations.

### SONET/SDH Overhead Byte Manipulation and Analysis

Using the overhead byte manipulation and analysis capability, users can modify K1 and K2 bytes to test automatic protection switching (APS) to specify and identify user-configurable path trace messages and payloads. The path overhead (POH) capture feature facilitates troubleshooting end-to-end problems. In addition, this solution provides all the necessary tools to test the insertion and detection of trace messages. This module is the industry's smallest, lightest solution for testing.

### Mappings

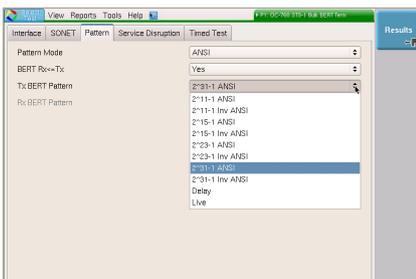
SONET/SDH mappings include all intermediate mappings down to STS-1 and VC-4/VC-3 in addition to BERT payload with multiple PRBS choices. Round-trip delay (RTD) testing is provided.

### Through Mode Support

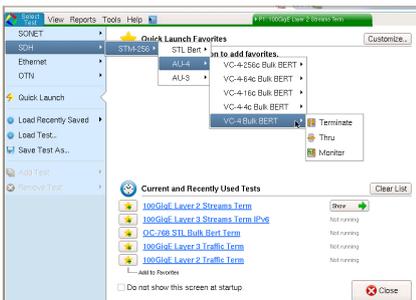
Connecting the test unit in-line provides not only monitoring capabilities but also the possibility of injecting errors. This provides for an effective tool in service-disruption testing.

### Performance Monitoring

Performance results are available via G.828 and G.829 results.



SONET patterns



SDH selection

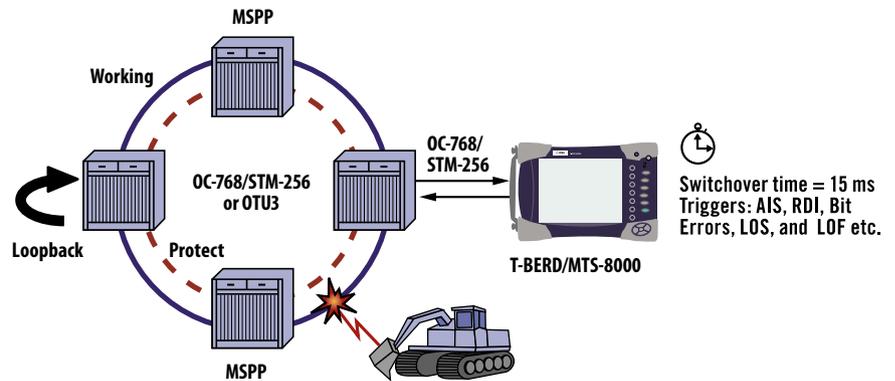


### StrataSync — Empower Your Assets

StrataSync is a hosted, cloud-enabled solution that provides asset, configuration, and test-data management of JDSU instruments and ensures all instruments have the latest software and options installed. StrataSync manages inventory, test results, and performance data anywhere with browser-based ease and improves technician and instrument efficiency. StrataSync manages and tracks test instruments, collects and analyzes results from the entire network, and informs and trains the workforce.

## Service Disruption

The 40/100 G Transport Module measures the protection switch times of SONET/SDH rings and their effects on tributaries. Simultaneous monitoring of various error conditions, based on multiple trigger conditions, on the tributaries lets providers verify that the transport network is providing adequate redundancy.



Service disruption

## Additional Features and Applications

The full-featured 40/100 G Transport Module provides:

- Comprehensive QoS testing: FD, FDV, frame loss, and out-of-sequence per stream, including CIR testing and the SAMComplete CBS feature
- Integrated J-QuickCheck, RFC 2544, J-Proof Layer 2 transparency, and Y.1564/SAMComplete test suites and reporting
- IPv4, IPv6, ARP, ping, and traceroute testing for router applications
- Support for CFP and native QSFP+ pluggable optics including a field-optimized optics self-test
- Applications include high-accuracy latency measurement support, far-end Ethernet logical loopback via address swapping, and connectivity verification.
- Layer 1 OTL/STL BERT capability for OTN/SONET/SDH interfaces including skew injection and monitoring, and Ethernet scrambled idle patterns
- High-level scalability can be combined with DMC/MSAM to add one or multiple ports at 10 G and below. It can also be combined with optical modules such as an optical spectrum analyzer
- Automation via SCPI commands and scripting capabilities for production and similar environments
- A complete OTN feature set covering clients, multiplexing, standards-based latency testing, and GCC transparency
- Test and asset management via remote connectivity is provided with JDSU StrataSync and AccessAnywhere tools

## Ordering Information

Part Number	Description
CH040103	40/100 G Transport Module — one-level applications
CH043112	40/100 G Transport Module — one- and two-level applications
CH40GE	40 GE test option
CH100GE	100 GE test option
CH40GSONSDH	40 G SONET/SDH test option
CHOTU3	OTN - OTU3 bulk 43 G test option
CHOTU4	OTN - OTU4 bulk 112 G test option
CHCOS	Multiple streams/COS test option
CHJPROOF	J-Proof Layer 2 transparency test option
CHIPV6	IPv6 test option
CHMPLS	MPLS test option
CHREMCTRL	Command line remote control
CH100GEINOTU4	100 GE in OTU4 test application
CH40GEINOTU3	40 GE transcoded in OTU3 test application
CH40GSONSDHINOTU3	40 G SONET/SDH mapped in OTU3 test application
CHODU0	ODU0 multiplexing test application
CHODU1	ODU1 multiplexing test application
CHODU2	ODU2 and ODU2e multiplexing test application
CCFP-112G-3-4	CFP 100 GE and OTU4, 1310 nm, 4λ, LC
CCFP-112G-5-10	CFP 100 GE and OTU4, 1550 nm, 10λ, LC
CCFP-112G-8-10	CFP 100 GE and OTU4 and 40 GE and OTU3, 850 nm, 24 fibers, MPO connector
CCFP-43G-5-1	Serial CFP OC-768/STM-256, OTU3, 40 GE 1550 nm, LC
CQSFP-43G-3-4	QSFP+ 40 GE (LR4), OTU3 and OC-768/STM-256, 1310 nm, 4λ, LC
CQSFP-40G-8-4	QSFP+ 40 GE (SR4), 850 nm, 12 fiber MPO connector

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