Optical Network Tester (ONT)

Module-E, Jitter Module

Module-E 10 G

Module-E 10 G/2.5 G

Jitter Module 10 G–E

Jitter Module 2.5 G–D

Applications

- Network element design testing
- Network element production testing
- Network system verification
- Network conformance testing

Compliance

- OTN ITU-T G.709
- LAN/WAN IEEE 802.3
- SDH ITU-T G.707
- SONET Telcordia GR-253-Core
- SyncE ITU-T G.8261, 8262, 8264
- Jitter/Wander ITU-T O.171-174

Key Benefits

- All-in-one solution that fully tests from the physical layer up to Layer 3 at 155 Mbps to 11.3 G rates
- Maximizes value with deep OTN, Ethernet, GFP, and SDH/SONET protocol coverage:
  - OTN OTU1/2/2e/1e, ODU multichannel, OTN multiplexing, ODU0, and ODUflex support
  - LAN/WAN with 256 flows, multiple tags, IP, QoS, and BERT per flow
  - SDH/SONET with multichannel and VCat support
- Reduces CapEx with fully structured signals over all supported layers
- Complex traffic generation, deep analysis, and advanced error/alarm insertion ensures optimal system performance
- Terminal, Intrusive Through, and Nonintrusive Through connectivity modes ensure complete test coverage
- Jitter and wander testing from 155 Mbps to 11.1 G for SyncE, OTN, OTL, SDH/SONET, and 10 G FC ensures standard compliance

Today's market is facing tremendous growth of new packet-based services such as VoIP and IPTV. This level of growth and the increase in end-user demand for direct Ethernet access is driving an urgent need for cost-effective high-speed Ethernet transmission systems.

All major operators view 10 Gigabit Ethernet (10 GE) as the key enabling technology in today's market and are, therefore, implementing it into their networks as LAN, WAN, or combined with OTN.

Manufacturers face major challenges in providing interface cards with capabilities for multiple technologies that can verify ports according to standards such as IEEE and ITU-T to guarantee that all network layers interface properly. Ethernet behavior changing from "best effort" to "carrier grade" requires more comprehensive testing.

The Module-E for the JDSU ONT platform addresses the needs of R&D and SVT labs with all of the necessary functionality for testing OTN/LAN/WAN/SDH/SONET/FC networks at various wavelengths.

The ONT together with its broad range of measurement modules offers an ideal tool for testing both current and emerging technologies.

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Application Highlights

Optical Interfaces

Choose either the XFP pluggable high-rate interface supporting tunable XFP optics or built-in fixed optics at 1310 and 1550 nm. The low-rate interface is SFP pluggable optics.

Differential Electrical Interfaces

An added hardware option for the Jitter 10 G module provides differential electrical interfaces for all rates and signals from 9.95 to 11.32 G.

High-Speed Trigger Out

A special XFP pluggable can be used in conjunction with built-in optics or electrical interface to trigger high-speed output from an oscilloscope or other test equipment with high timing-accuracy requirements.

Unframed Testing

All available rates are offered with unframed pattern and BERT capabilities. These functions are useful especially for qualifying components and DWDM links.

- Unframed BERT at 20 different rates: 155.52 and 622.08 Mbps, and 1.063, 1.25, 2.125, 2.488, 2.666, 4.25, 9.953, 10.000, 10.313, 10.519, 10.664, 10.709, 10.755, 11.049, 11.095, 11.181, 11.270, and 11.318 G
- Unframed patterns: PRBS 2^{31}–1, 2^{23}–1, 2^{15}–1, 2^{11}–1, 2^{7}–1 and inverted, PRBS 2^{31}–1 IEEE, DW 32 bits, square wave (Tx only), repeating ones/zeros editable 4 to 11 bits

OTN OTU2/OTU1 Testing

OTN OTU2/OTU1 testing supports OTU2/OTU1 applications including overclocked OTU2 rates for signal generation and analysis with deep signal manipulation (alarm, error, overhead), forward error correction (FEC) generation and analysis. Also supports comprehensive ODU multiplexing (ODU0, ODUflex, ODU1, and ODU2) with multistage multiplexing, as well as ODU multichannel capability.

- Standard and overclocked OTU2 rates
- GFEC
- Bulk and fully structured clients; LAN, WAN, and SDH/SONET
- ODU multichannel with parallel generation and analysis of ODU0/1/flex mixed mappings
- Supports all TCM layers
- Overhead- and payload-based transfer delay
- Overhead byte multiframe sequence capture
- Service disruption tests with high-level detail
- Client offset stuffing control at each layer
- ODU0 with GE and SDH/SONET clients

GFP Testing

The GFP functionality ecapsulates Ethernet MAC into ODU0/1/2/flex or SDH/SONET VCat, with implementation in accordance with ITU-T G.7041, G.707, and ANSI T1.105.02. Both GFP-F and GFP-T are supported. GFP transparent mapping in accordance with ITU-T G.7041 Par.17.4.1 encapsulates both PCS and Ethernet MAC into OTU2.

- Generation and analysis of GFP frame types
- Core header processing
- Payload-type header processing
- Error and alarm processing
- PCS, LAN Layer 2/3 traffic, and MPLS/IP with full feature set
- GFP-F with extension header and full OAM support
- MPLS/IP directly into SDH/SONET via GFP

GE and 10 GE LAN Testing

Testing covers the generation and analysis of PCS and MAC/IP Layer traffic. Testing on GE and 10 GE can be a native line interface or a client signal mapped into OTN or SDH/SONET.

- PCS-layer testing with dynamic block errors and coding statistics
- VPLS and MAC-in-MAC Ethernet frame formats
- Up to 256 traffic flows and independent receiver filters, 16 independent traffic profiles
- Real-time QoS, service disruption, and packet jitter analysis per flow
- IPv4, IPv6, VLAN/Q-in-Q, MPLS, TCP, UDP frame structures
- RFC 2544 suite
- ESMC G.8264 sync message generation and analysis

10 G WAN Testing

- 10 GE WAN Layer 1 and Layer 2/3 traffic
- Full SDH/SONET feature set
- Full 10 GE LAN feature set

10 G FC Testing

Testing covers the generation and analysis of PCS- and FC-2-layer traffic. Testing on 10 G FC can be a native line interface or a client signal mapped into OTU2f or OTU1f.

- Features at the PCS layer are the same as 10 GE LAN
- Single stream with constant traffic, bursty traffic, and full bandwidth support
- Implicit flow control login
- Credit buffer support

SDH/SONET Testing

The SDH/SONET functionality includes mappings down to VC-11/12 and VT-1.5/2 and can be a native interface or a client signal for ODU0/1/2.

- Full SDH/SONET testing for STM-1/STM-4/STM-16/STM-64 and OC-3/OC-12/OC-48/OC-192 with mappings down to VC-11/12 and VT-1.5/2
- Dynamic error/alarm insertion including bursts
- Full access to overhead bytes with byte capture
- Pointer sequence generation and analysis
- Service disruption tests with high-level detail
- Performance monitoring ITU-T G.826/828/829
- HO virtual concatenation (VCat) with mappings VC-4-nv, AU-3/VC-3-xv, and STS-1-xv
- HO multichannel (MC) covers STM-64/OC-192 signals with parallel generation and analysis of up to 64 × VC-4/192 × STS-1 SPE for BER, service disruption, errors, and alarms

Jitter and Wander Testing

Generate and analyzes jitter and wander according to the following standards:

- ITU-T Recommendation O.172 including Appendixes VII and VIII with accuracy map support at 10 G
- ITU-T Recommendations O.173 and O.174
- ITU-T Recommendations G.825, G.8251, G.8261, and G.8262
- Telcordia GR-253
- ANSI standards T1.101, T1.105, and T1.105.03

Jitter and wander testing includes:

- Optical (dual-wavelength) and electrical jitter/wander testing at 155 and 622 Mbps and 1.25, 2.5, 2.7, 9.9, 10.3, 10.519, 10.709, 10.755, 11.049, 11.095, and 11.181 G
- Synchronous Ethernet G.8261/8262 support
- Parallel measurement filters
- Automatic jitter modes for jitter/wander tolerance and transfer
- Highest jitter receiver accuracy verified by using ITU-T O.172 Appendix VII/VIII and support of accuracy maps
- Graphical TIE, MTIE, TDEV analysis
- TDEV/white noise, MTIE transient and sinusoidal wander generation
- Wander for BITS/SETS (64 kHz, 1.5/2 MHz, DS1/E1) and 1 pps signals
- Wander measurements on clock signals CC64 kHz, 1.5/2/6.3/10 MHz

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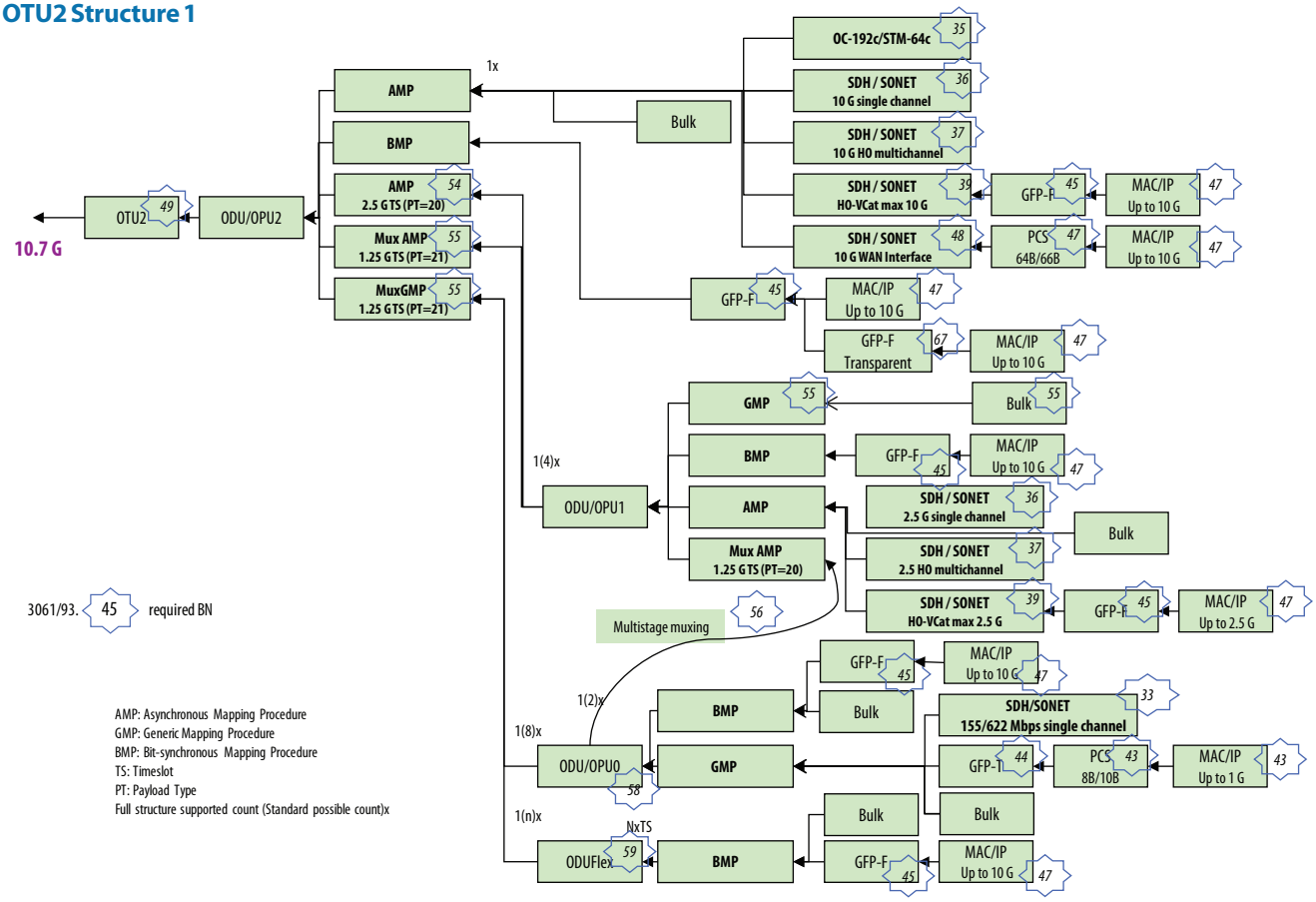
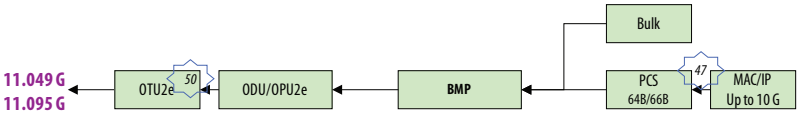
Signal Structures

OTU2 Structure 1



OTU2 Structure 2

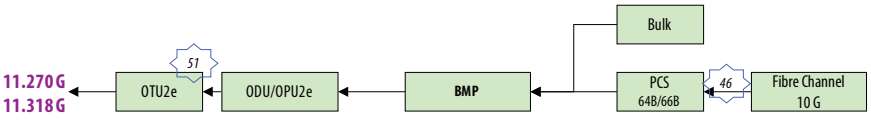
ITU-T G.Sup43



3061/93. xy required BN

OTU2 Structure 3

ITU-T G.Sup43



3061/93. xy required BN

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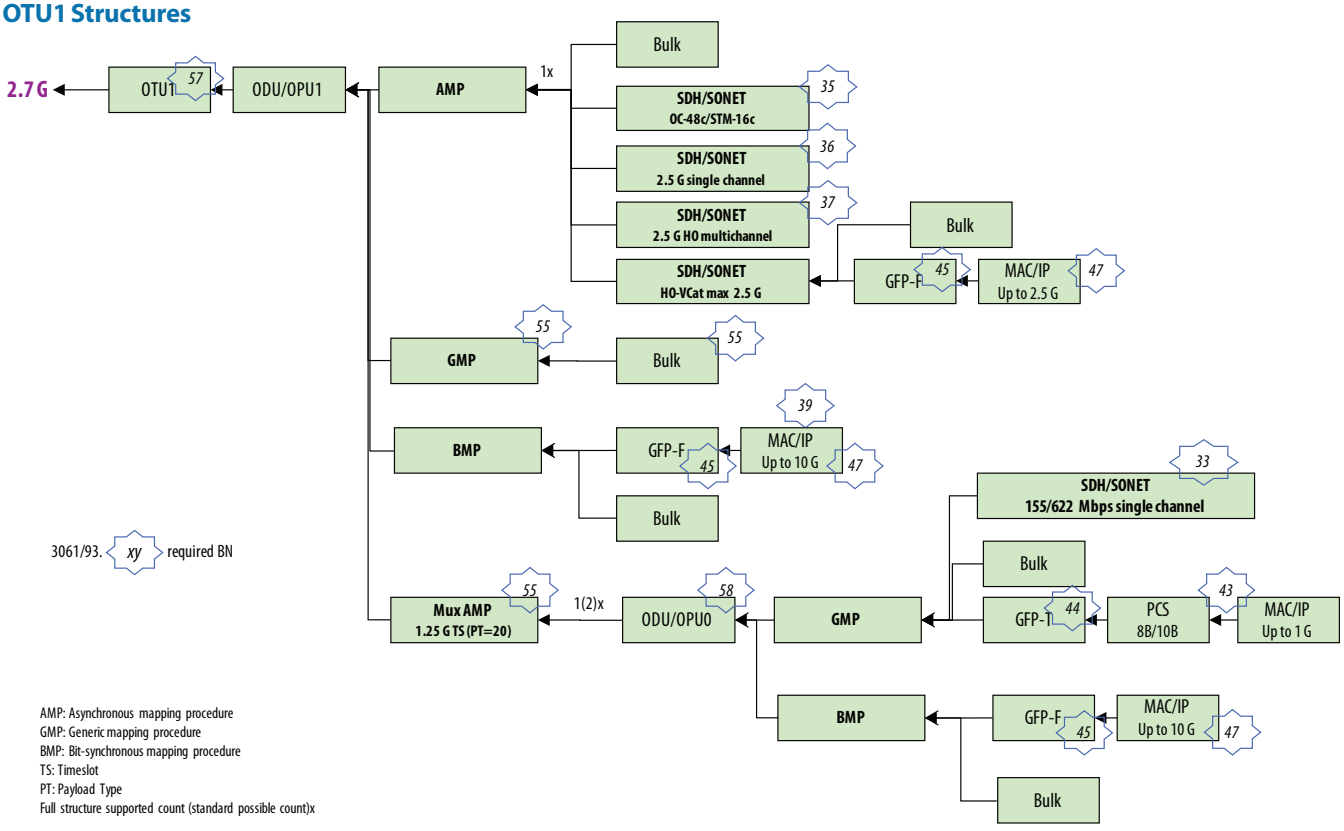
Signal Structures

OTU1 Structures



AMP: Asynchronous mapping procedure
GMP: Generic mapping procedure
BMP: Bit-synchronous mapping procedure
TS: Timeslot
PT: Payload Type
Full structure supported count (standard possible count)x

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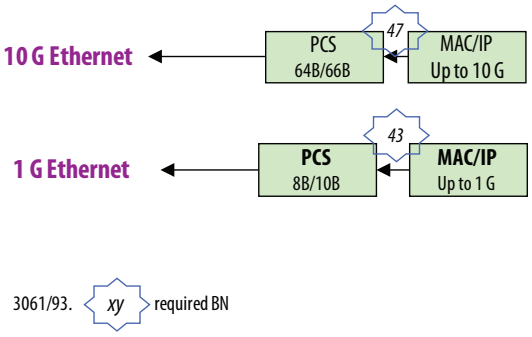
Signal Structures

Ethernet Structures



3061/93. *xy* required BN

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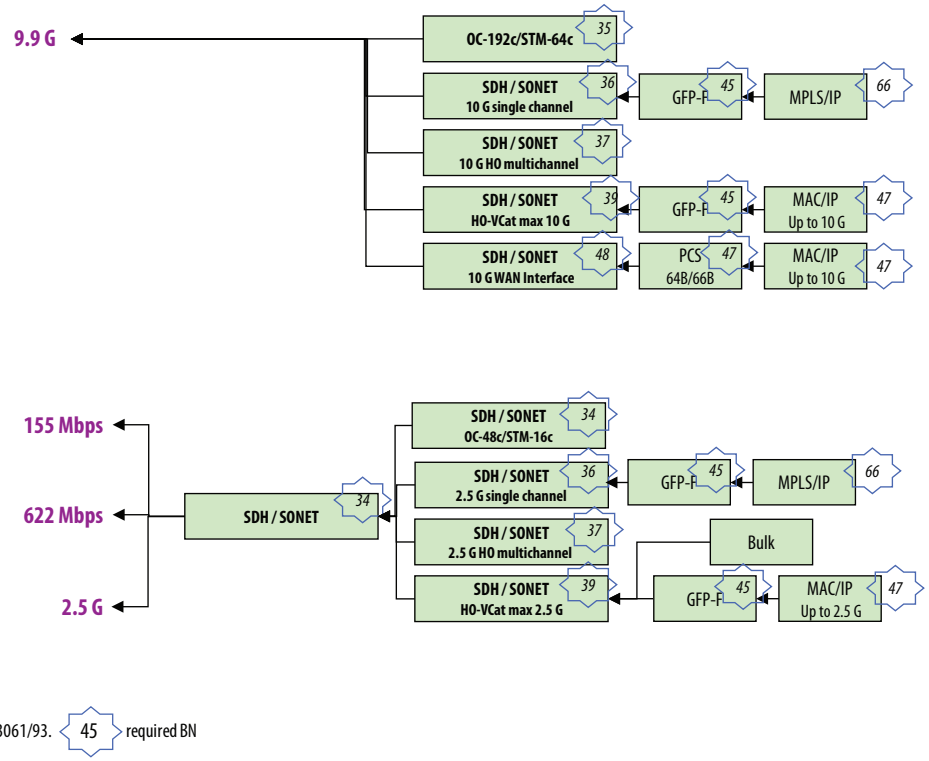
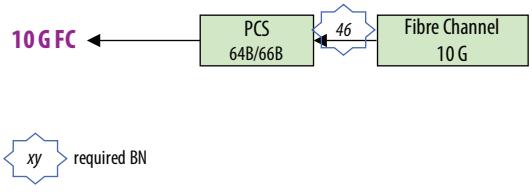
Signal Structures

SDH/SONET Structures



Fibre Channel Structures



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Ordering Information

Module-E 10 G/2.5 G and Options

Part Number	Description
3076/92.05	Module E 10 G/2.5 G XFP/SFP Slot 10 G/2.5 G, without fixed optics, unframed.
3076/92.06	Module E 10 G/2.5 G 1310/SFP Slot 10 G/2.5 G, 1310 fixed optics, unframed.
3076/92.08	Module E 10 G/2.5 G 1310_1550/SFP Slot 10 G/2.5 G, 1310 and 1550 fixed optics, unframed.
3061/93.34	Lower-rate SDH/SONET
3061/93.35	OC192c/STM-64c BERT
3061/93.36	SDH/SONET single channel
3061/93.37	Multichannel 10 G HO
3061/93.39	10 G VCat HO
3061/93.44	GFP-T
3061/93.45	10 G GFP-F
3061/93.46	10 G Fibre Channel
3061/93.49	OTN 10.7 G
3061/93.50	OTN 11.05/11.1 G
3061/93.51	OTN 11.27/11.32 G
3061/93.54	OTN multiplexing OTU2
3061/93.55	OTN multiplexing enhanced
3061/93.56	OTN multistage multiplexing
3061/93.57	OTN 2.7 G
3061/93.59	OTN ODUflex
3061/93.58	OTN ODU0
3061/93.33	ODU0 with SDH/SONET client
3061/93.61	OTN ODU multichannel
3061/93.47	10 GE LAN
3061/93.64	HDLC capture for GCC from an OTU1/2
3061/93.48	10 GE WAN
3061/93.43	1 G Ethernet
3061/93.60	MAC-in-MAC 802.1ah
3061/93.65	Capture MAC/IP
3061/93.62	IPv6
3061/93.63	ESMC G.8264
3061/93.66	MPLS/IP into OC192c/STM-64c
3061/93.67	OTN transparent 10 G GFP-F mapping
3061/92.20	XFP optics 850 nm
3061/92.21	XFP optics 1310 nm
3061/92.22	XFP optics 1550 nm

Module-E 10 G/2.5 G Jitter/Wander Modules and Options

Part Number	Description
3076/90.75	Jitter 10 G-E 1550 nm
3076/90.76	Jitter 10 G-E 1310 nm/1550 nm
3076/90.70	Jitter 10.3 G-E
3076/90.63	Jitter 10.5 G-E
3076/90.78	Jitter 10.7 G-E
3076/90.79	Jitter 11.05/11.1 G-E
3076/90.81	Jitter 10.75 G-E
3076/90.99	Jitter 11.18 G
3076/90.77	Jitter Module 10 G-E electrical interfaces
3061/93.95	Wander 10 G
3061/93.97	Wander 10 G Expert
3076/90.66	Jitter 2.5 G-D 1550 nm
3076/90.67	Jitter 2.5 G-D 1310/1550 nm
3076/90.68	Jitter 2.7 G-D
3076/90.69	Jitter 1.25 G-D
3061/93.92	Wander 2.5/2.7 G
3061/93.89	Wander 2.5/2.7 G expert

Options Available with Jitter 10 G and Jitter 2.5 G Modules

Part Number	Description
3061/93.96	Wander DS1/E1+BITS
3061/93.90	Jitter DS1/E1+BITS
3076/90.74	Wander BITS expert
3061/95.98	External wander analysis

For additional options, please contact your JDSU representative.

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