/Inritsu

MD1260A

40/100G Ethernet Analyzer

All-in-One Compact 40G/100G Ethernet Analyzer

Compact Analyzer for Manufacturing and Installing 40 GbE/100 GbE Equipment and Networks

The all-in-one portable MD1260A 40/100G Ethernet Analyzer supports the latest high-speed transmission technologies, such as 40 GbE/100 GbE, OTU3, and OTU4. It has all the functions needed for manufacturing and installing equipment and networks. Moreover, it can be used for R&D final evaluation of 40G/100G equipment and devices. It is a measuring instrument for assuring the quality of high-speed networks forming the foundation of next-generation applications for cloud computing.

Key Features
- I/F Upgrade matching budget and schedule
- Excellent operability with rugged, compact, lightweight construction
- Expandable multi-unit platform
- Evaluation function supporting 40 GbE/100 GbE unique latest technology

I/F Upgrade Matching Budget and Schedule

One MD1260A supports 40 GbE, 100 GbE, OTU3, and OTU4 interface options that can be added according to budget and schedule.
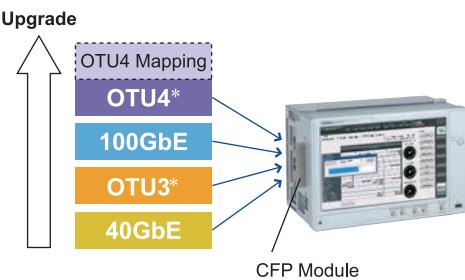
∗: OTU3/4: ITU-T G.709 Annex C

Excellent Operability with Rugged, Compact, Lightweight Construction, and Silent Design

Operation is easy with a large 12.1-inch touch panel and intuitive GUI, and drive crashes are a thing of the past due to the rugged solid-state Flash disk drive. The small footprint and light weight offer easy portability to even the most difficult test sites. The silent design provides a quiet, comfortable working environment.

- 12.1-inch touch panel
- Easy-to-use GUI
- Flash disk drive
- Compact and Lightweight
    Dimensions: 340 (W) × 221.5 (H) × 200 (D) mm
    Weight: ≤8 kg
- Silent design

B0647A Carrying Case

Expandable Multi-unit Platform

Up to sixteen MD1260A units can be connected in a master/slave multi-unit configuration for evaluating multiport switches and routers and batch testing multiple pieces of transmission equipment.
In addition, the Unit Sync function can be used to synchronize the test frame time stamp issued from each MD1260A and the timing for use as a high background load generator when measuring delay in a multi-unit environment.

Unit Sync. Function

Multi-unit Connection
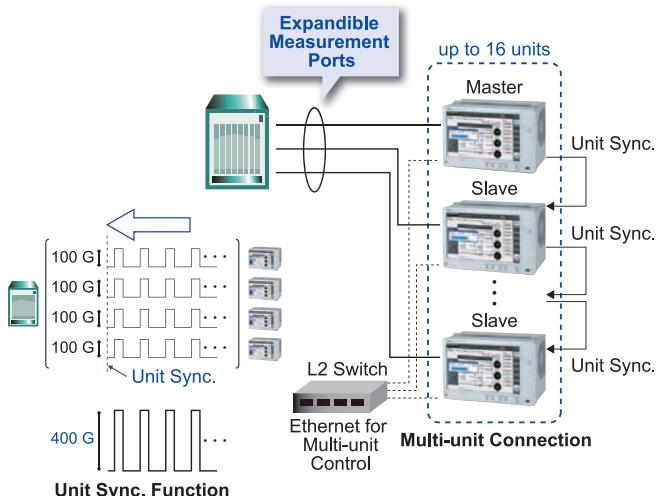
Evaluation Function Supporting 40 GbE/100 GbE Unique Latest Technology

40G/100G tolerance tests exceeding IEEE/ITU-T standards, such as skew margin tests for transmission equipment, are supported using skew generation and monitoring for all Lanes or per Lane. In addition, external output from the electrical interface (CAUI/XLAUI) supports standalone CFP tests and fault isolation between the CFP and transmission equipment. No-frame BER tests support physical layer evaluation without frames.
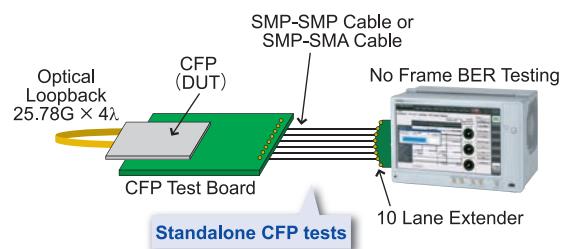
40G/100G tolerance tests exceeding IEEE/ITU-T standards
  Skew margin tests (819.2 ns max.)
  Generates load exceeding full wire rate
  Frame length (60 to 32700 bytes)
  Clock tolerance tests (±120 ppm)∗
 ∗: Excludes CFP

Evaluation using MZ1223C 10 Lane Extender
  The external electrical I/F output (CAUI/XLAUI) supports standalone CFP tests and fault isolation between the CFP and transmission equipment.

Manufacturing Inspection of 40G/100G Transmission Equipment

The all-in-one MD1260A has every test function for manufacturing inspection of transmission equipment.

■ Ethernet/IP Tests
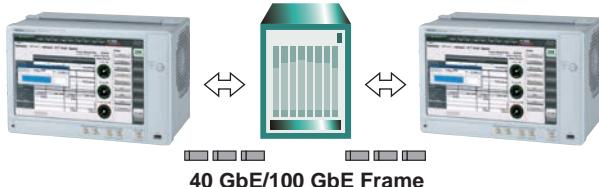
40 GbE/100 GbE Frame

General Ethernet/IP frame tests are supported. Basic Ethernet measurements, such as Throughput, Frame loss, BER, Statistics and RFC2544 Tests, are provided. In addition, a unique function for evaluating 40 GbE/100 GbE skew adjustment between Lanes is supported.

RFC2544 Tests


Throughput, Frame Loss, BER and Statistics
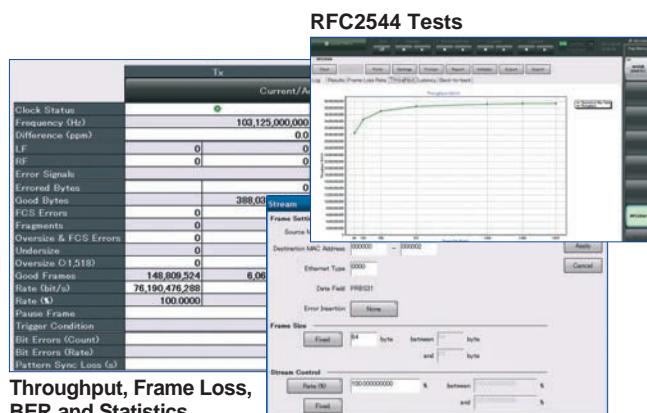
Ethernet/IP Frame Generation

PCS Layer Tests　　　**Skew Generation**
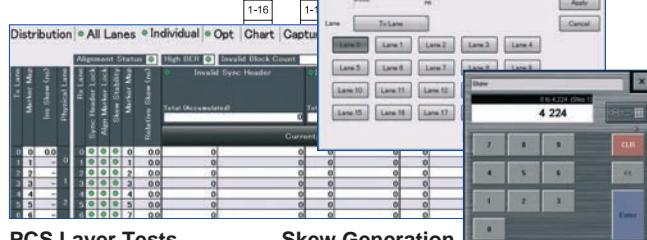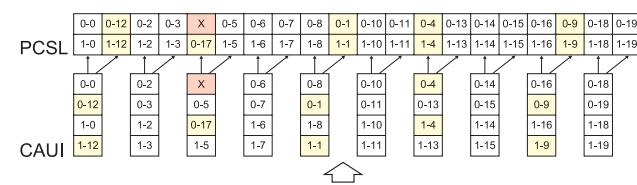
Using an adapter supports both QSFP+ optical modules as well as CFP.

QSFP+　　Adapter for QSFP+　　CFP Slot
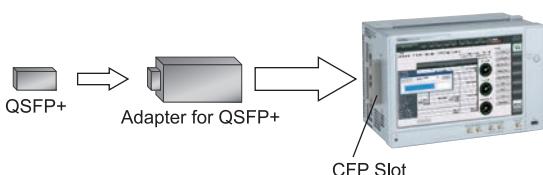
■ OTN Tests
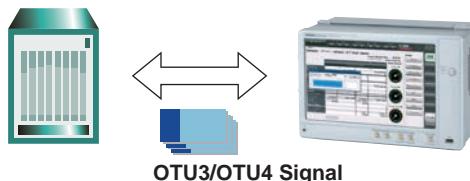
OTU3/OTU4 Signal

General testing using OTU3 and OTU4 signals is supported along with basic OTN measurements, such as errors/alarms, BER, APS measurements and Delay measurements. LLD monitoring for all lanes or per lane as well as an OH edit/monitor function and OTU4 mapping analysis function are supported too.

Error/Alarm Insertion

OH Monitor

Error/Alarm, BER Counter　　　**LLD Monitor**

Mapping Ethernet client signals to OTU4 signals using GMP (Generic Mapping Procedure) supports verification closer to real operation.

OTU4 Signal

OTU4 Mapping
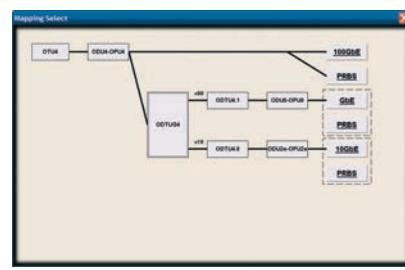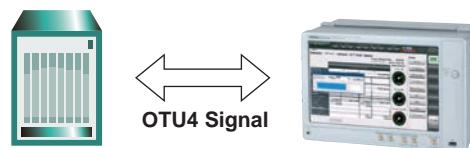
The Through mode monitors the system status and checks operation when errors occur.

Error/Alarm/Skew Insertion
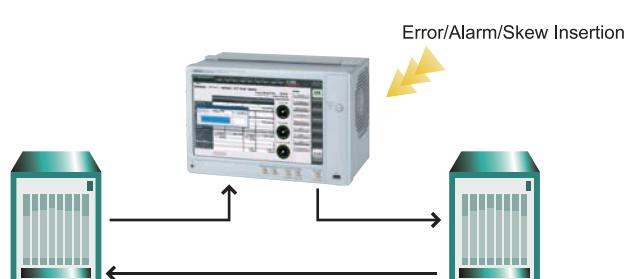
Through Mode:
Transparent, Analyzed (Error/Alarm/Skew Insertion)
OH Overwrite (OH Overwrite and Error/Alarm/Skew Insertion)

Auto Measurements

Automatic remote control of measuring instruments over Ethernet or GPIB using control commands cuts manufacturing inspection costs.
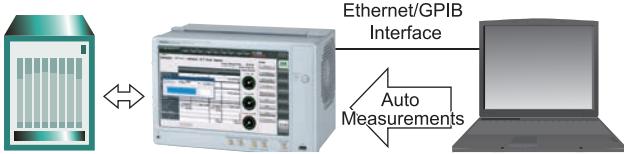
Operation logs are output as a remote command file, cutting the workload for creating automatic control scripts (Operation Recording Function).

Operation Recording Function

Remote Command File

Commissioning 40G/100G Networks

Portable Analyzer

Connection Tests

Easy 40 GbE, 100 GbE, OTU3, and OTU4 network verification tests are supported.

40G/100G Network

Ethernet/IP tests
Throughput, Frame Loss, Statistics, BER

OTN tests
Errors/Alarms, BER
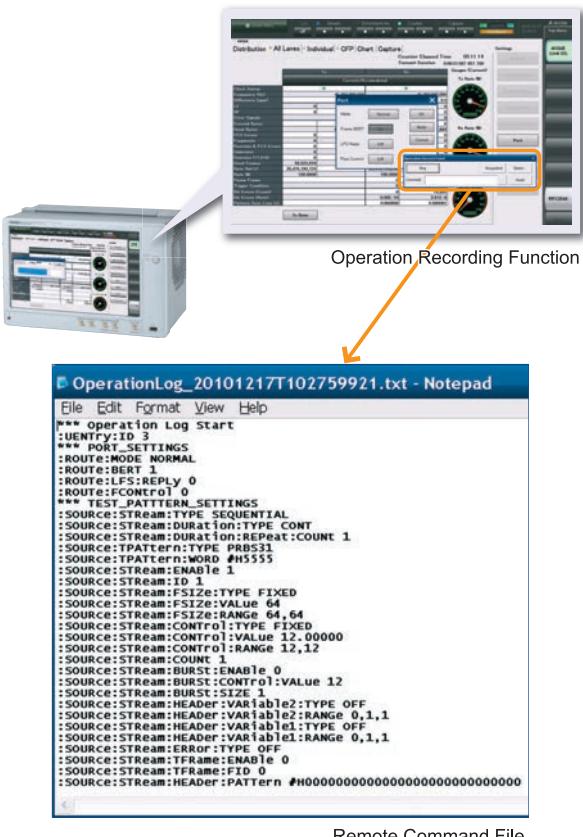
Troubleshooting

Faults are quickly located using the powerful built-in troubleshooting functions.

Capture and Analysis

Error/Alarm Insertion and Monitor   OH Edit/Monitor
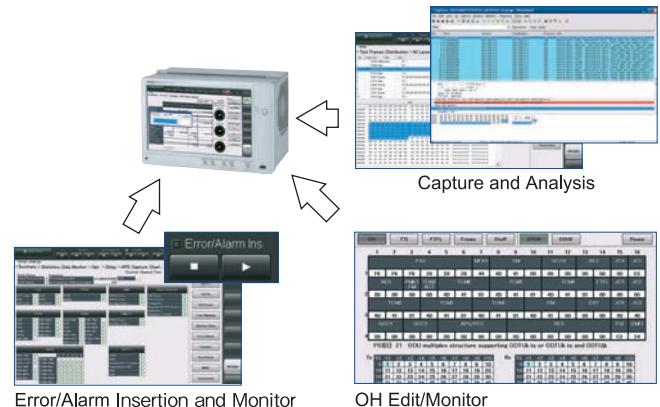
Final Evaluation for 40G/100G Equipment and Device R&D

40G/100G tolerance tests (equipment R&D final evaluation) exceeding IEEE/ITU-T standards and evaluation (device R&D final evaluation) using the 10 Lane Extender are supported.
Using the CFP MDIO analysis function supports simple CFP MDIO register setting and reading. In addition, better device stability is assured because MDIO data can be read regularly.

CFP MDIO Analysis Function

Panel Layout

1. **Frame Ground**
   For connecting anti-static wristband
2. **Display**
   12.1-inch touch panel
3. **Disk Access, Stand-by, Power Lamps**
4. **Power Switch**
5. **USB Port**
6. **Tx Ref Clock Input Terminal**
   Input for reference clock to synchronize Tx clock

7. **Tx Ref Clock Output Terminal**
   Output for reference clock (inverted) synchronized with Tx clock
8. **Tx Ref Clock Output Terminal**
   Output for reference clock synchronized with Tx clock
9. **RX_MCLK Output Terminal**
   Output for CFP RX_MCLK
10. **TX_MCLK Output Terminal**
    Output for CFP TX_MCLK
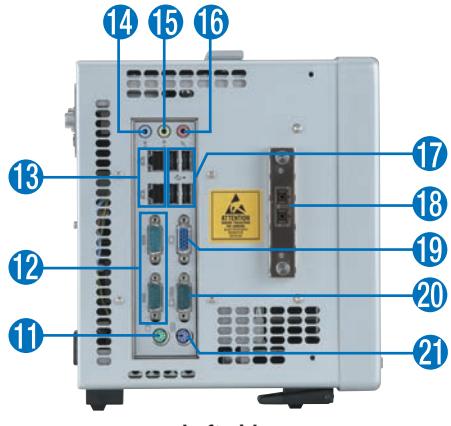
Left side
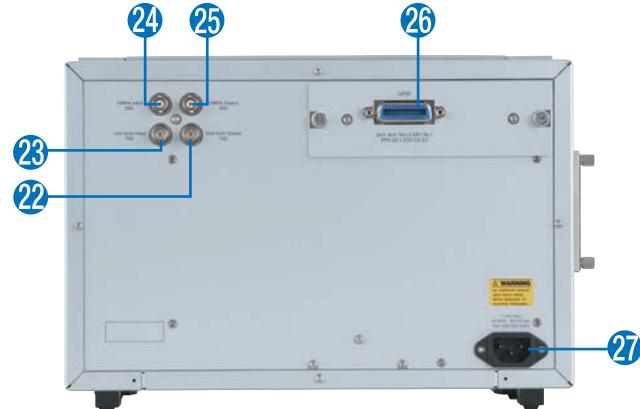
Rear panel

11. **PS2 Port for Mouse**
12. **Serial Interface (not used)**
13. **Ethernet Port**
    Port 1: For external PC, Port 2: For multi-unit control
14. **Line Input (not used)**
15. **Line Output (not used)**
16. **Microphone Input (not used)**
17. **USB Port**
18. **CFP Slot**
    For CFP module and 10 Lane Extender
19. **Monitor Output (15 pins)**
20. **Monitor Output (9 pins)/Serial Interface**
21. **Keyboard PS2 Port**

22. **Unit Sync Output 75Ω**
    Output for synchronizing clock and time when multiple units connected
23. **Unit Sync Input 75Ω**
    Input for synchronizing clock and time when multiple units connected
24. **10 MHz Input 50Ω**
    Input for 10 MHz clock input for synchronizing Tx clock
25. **10 MHz Output 50Ω**
    Output for internal 10 MHz clock (synchronized with built-in oscillator) or locked at 10 MHz (synchronized with Tx clock)
26. **GPIB Connector**
    Used with MD1260A-030
27. **Power Cord Inlet**

Specifications

• MD1260A 40/100G Ethernet Analyzer

Input Device		Touch panel, Power switch
LCD Display		12.1-inch WXGA (1280 × 768 or 1280 × 800)
Remote Interface		Ethernet, GPIB (Opt-030) ∗: Includes operation record function
Peripheral Connection		VGA output (SVGA), USB (5 Ports, Revision 2.0), Ethernet (2 Ports, 10/100/1000 BASE-T)
OS		Windows Embedded Standard 2009
Internal Memory		RAM: 1 GB, Flash disk drive: 8 GB (includes OS)
Unit Sync Input/Output		For Multi-unit connection (Opt-001, 003) Level: TTL Connector: BNC (75Ω) ∗: Verified up to three units
Measurement Port	CFP Slot	1
	CFP Interface	CFP MSA Hardware Specification, Draft 1.0 CFP MSA Management Interface Specification 1.4
	Bit Rate	100 GbE: 10.312500000 Gbit/s × 10 40 GbE: 10.312500000 Gbit/s × 4 OTU4: 11.180997357 Gbit/s × 10 OTU3: 10.754603390 Gbit/s × 4
	Connector	148-pin Electrical Connector
	Variable Frequency	100 GbE: 103.125000000 GHz ±120 ppm, 1 ppm steps 40 GbE: 41.250000000 GHz ±120 ppm, 1 ppm steps OTU4: 111.809973568 GHz ±120 ppm, 1 ppm steps OTU3: 43.018413559 GHz ±120 ppm, 1 ppm steps Accuracy: ±0.1 ppm ∗: Above frequencies may exceed CFP specifications when CFP used
Tx Ref Clock Output		Can select 1/16 and 1/64 according to Bit Rate of measurement port per lane[*1] (Level: 250 mVp-p to 550 mVp-p, Connector: SMA (Differential 100Ω) × 2)
Tx Ref Clock Input		1/16 according to bit rate of measurement port[*1] (Level: 260 mVp-p to 530 mVp-p, Connector: SMA (50Ω))
TX_MCLK Output		Outputs for CFP TX_MCLK[*2] (Level: Depends on CFP, Connector: SMA)
RX_MCLK Output		Outputs for CFP RX_MCLK[*2] (Level: Depends on CFP, Connector: SMA)
10 MHz Input		Frequency: 10 MHz, Level: –15 to +20 dBm, Connector: BNC (50Ω)
10 MHz Output		Internal 10 MHz or Locked 10 MHz (Frequency: 10 MHz, Level: ≥0 dBm, Connector: BNC (50Ω))
File Saving and Reading		Setting File: Saving/Reading, Binary method Result File: Saving, Text method (csv) Log File: Saving, Text method (csv)
Power Supply		100 V (ac) to 120 V (ac) / 200 V (ac) to 240 V (ac) (auto switching), 50 Hz/60 Hz
Power Consumption		≤300 VA
Temperature Range		Operating: +5° to +40°C, Storage: –20° to +60°C
Dimensions		340 (W) × 221.5 (H) × 200 (D) mm (excluding projections)
Mass		≤8 kg (excluding CFP and other options)
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1
Laser Safety		IEC60825-1: 2007: CLASS 1M[*1, 3] IEC60825-1: 2007: CLASS 1 21CFR1040.10[*2, 4]

∗1: The bit rate per Lane is as follows:
　 40 GbE: 10.312500000 Gbit/s, 100 GbE: 10.312500000 Gbit/s, OTU4: 11.180997357 Gbit/s, OTU3: 10.754603390 Gbit/s
∗2: No clock is generated when using the MZ1225A.
∗3: Warning: It may be dangerous to look directly into the laser light when monitoring laser output using optical equipment from a distance of less than 100 mm.
∗4: Excludes deviations caused by conformance to Laser Notice No.50 dated June 24, 2007

• 100G Ethernet (Opt-001)

Frequency Measurement		100 GbE: 103,125,000,000 Hz ± 200 ppm No Frame 20 Lane: 103,125,000,000 Hz ± 200 ppm No Frame 10 Lane: 10,312,500,000 Hz ± 200 ppm × 10 lanes
Clock Source		100 GbE: Internal, External 10 MHz Input, Tx reference input, Sync. input, Received[1] No Frame 20 Lane: Internal, External 10 MHz Input, Tx reference input No Frame 10 Lane: Internal, External 10 MHz Input, Tx reference input
Clock Monitor		100 GbE: CDR Unlock, Clock Source Loss No Frame 20 Lane: CDR Unlock, Clock Source Loss No Frame 10 Lane: CDR Unlock × 10 Lanes, Clock Source Loss
Transceiver Setting		Tx: VOD, Pre-Emphasis (First post tap, Pre tap, Second post tap) Rx: Equalizer (DC gain, Control)
CFP Monitor		LOS, Programmable Alarm1, Programmable Alarm2, Programmable Alarm3, Global Alarm, Optical power
PCS Layer Measurement	PCS Lane Monitor	Marker map, Relative skew (ns)
	PCS Status	Per lane: Sync. header lock, Alignment marker lock, Skew stability All lanes: Link status, High BER, Alignment status
	Deskew Tolerance	64 Blocks
	PCS Counter	Per lane: Invalid sync. header count, Invalid alignment marker count, BIP error count All lanes: Invalid block count

	PCS Error/Alarm Insert	Error/Alarm type:
		  Per lane: Invalid sync. header (00 or 11), Invalid alignment marker (M0: 0x00, M4: 0xFF), BIP error
		        Can specify multiple lanes
		  All lanes: Invalid block type (0x00, 0x2d, 0x33 or 0x66), High BER
		Insertion mode:
		  Invalid Sync Header, Invalid Alignment Marker, BIP Error
		    Single, Burst, Alternate, Rate, All
		  Invalid Block Type
		    Single
		  High BER
		    All

	PCS Skew Generation	Can specify multiple lanes
		  Tx Lane (Lane 0 to 19): Skew generation 0 to 819.2 ns, 193.94 ps steps
		  Physical Lane (Lane 0 to 9): Skew generation 0 to 819.2 ns, 96.97 ps steps

	PCS Lane Mapping	Odd/Even, Random, Define, Descent, Ascent
Stream Transmission	Number of Streams	16
	Display/Setting Units	Rate (%), Rate (fps), Rate (Gbit/s), Gap Size (byte), Interval (s)
	Duration	Continuous, Time, Repeat
	Stream Send Sequence	Sequential, Random
	Data Field	All 0, All 1, Word16, PRBS31
Stream Setting	Transmission Setting	On, Off
	Number of Frames	1 to 1,099,511,627,775 frames
	Stream Control	Burst Off sets interframe gap and Burst On sets interburst gap Gap Size: 9 to 1,500,017,328,128 bytes[2] Type: Fixed, Random
	Burst	Enable: On, Off Burst Size: 1 to 65535 frames Burst Control: 9 to 65535 bytes[3] Type: Fixed
	Frame Size	Frame Size: 60 to 32700 bytes Type: Fixed, Random
	Supported Protocols	Ethernet, MPLS-TP, PBB, VLAN, MPLS, IPv4, IPv6, ARP, ICMPv4, ICMPv6
	Test Frame	On, Off
	Frame Error Insertion	FCS Error

Error Insertion		PRBS Bit Error[4]: (PRBS31)
		  Timing: Single, Rate
		Local Fault/Remote Fault:
		  Timing: All

Counter Measurement	Tx	Current: Tx Rate (bit/s), Tx Rate (%) Accumulated: Tx Good Bytes, Tx Errored Bytes, Transmit Duration (ns) Current (fps)/Accumulated: Tx Good Frames, Tx Oversize, Tx Oversize & FCS Error, Tx Undersize, Tx Fragments, Tx FCS Errors, Tx Broadcast Frames, Tx Multicast Frames, Tx MPLS-TP, Tx PBB, Tx ARP Request, Tx ARP Reply, Tx PINGv4 Request, Tx PINGv4 Reply, Tx NDP (NS), Tx NDP (NA), Tx PINGv6 Request, Tx PINGv6 Reply Current/Accumulated: LF, RF
	Rx	Current: Rx Rate (bit/s), Rx Rate (%), Current Latency (ns) Accumulated: Rx Good Bytes, Rx Errored Bytes Current (fps)/Accumulated: Rx Good Frames, Rx Oversize, Rx Oversize & FCS Errors, Rx Undersize, Rx Fragments, Rx FCS Errors, Rx Broadcast Frames, Rx Multicast Frames, Pause Frames, Rx MPLS-TP, Rx PBB, Rx ARP Request, Rx ARP Reply, Rx PINGv4 Request, Rx PINGv4 Reply, Rx NDP (NS), Rx NDP (NA), Rx PINGv6 Request, Rx PINGv6 Reply Current/Accumulated: Bit Errors (bit), Bit Error (Rate), Pattern Sync. Loss (s) Resolution 100 ns, LF, RF, Trigger Condition, Error Signals
	Frame Size Distribution (Tx/Rx)	<64 bytes, 64 bytes, 65 to 127 bytes, 128 to 255 bytes, 256 to 511 bytes, 512 to 1023 bytes, 1024 bytes to Oversize, >Oversize
	Gap Size Distribution (Tx/Rx)	Eight gap size setting ranges
	Counter Setting	Oversize: 1518 to 32700 bytes Undersize: 64 bytes (fixed) Sequence error detect: On/Off
	Multi Flow Counter	Number of flow 16
	Flow Filter	Test Frame ID, User Defined, Test Frame ID and User Defined
	Test Item (Tx)	Number of Frames, Number of Bytes, Rate

	Test Item (Rx)	Number of Frames, Number of Bytes, Rate
		Latency: Accuracy 100 ns, Resolution 6 ns
		  Current Latency (ns)
		  Minimum Latency (ns)
		  Maximum Latency (ns)
		Sequence Error (with Test Frame ID filter)

Capture	Memory Capacity	128 kB
	Status Display	Trigger
	Trigger	Pattern: Good Frame, LFS Signal, RFS Signal, Error Signal, FCS Error, Undersize, Fragments, Oversize, Oversize & FCS Error Trigger Position: Middle

	Analysis	Display: Frame, Gap, Malformed
		Data: XLGMII/CGMII
		Error detection: FCS, LF, MII Error data (RXC=1, RXD=0xFE), OVER, RF, UNDER
		Decode:
		  D: Data (RXC=0), I: Idle (RXC=1, RXD=07), S: Start (RXC=1, RXD=FB), T: Terminate (RXC=1, RXD=FD),
		  Q: Sequence (RXC=1, RXD=9C), !: Error (RXC=1, RXD=FE), ?: Unknown or Reserved Other

	Wireshark Convert Function	Supported
Protocol Test	ARP/ICMP	Can send GARP/NS packets, ARP/NA, Ping Reply when receiving ARP/NS, Ping receiving up to 16 streams
	Ping/NS, NA	Packet length can vary from 64 to 32700 bytes
No Frame Measurement	Test Pattern	Tx: PRBS7, PRBS9, PRBS15, PRBS23, PRBS31 (Invert On/Off), Square wave Rx: PRBS7, PRBS9, PRBS15, PRBS23, PRBS31 (Invert On/Off)
	Error Insertion	PRBS Bit error Can specify multiple lanes Timing: Single
	Counter	Each lane Pattern Sync. Loss (s) Resolution 100 ns, Bit error count (bit), Bit error rate
Port Setting		Mode: Normal, Loopback LFS Reply: On, Off Flow Control: On, Off Frame BERT: On, Off
Add-on Function	RFC2544 Tests	Throughput, Latency, Frame loss rate, Back-to-back frames
	CFP Analyzing Function (Opt-031)	Reads and writes MDIO of CFP and displays each register value of CFP
	100GBASE Lambda Grouping Measurement	At 100BASE-LR4/ER4 measurement, displays measurements for each lane of CAUI and PCS as four groups
	Service Disruption Time Measurement	Displays communication interruption time due to loss of Ethernet frame

*1: Using Lane#3 regeneration clock at Received.
*2: Lower limit of gap is 10 bytes when frame size is 16,001 bytes or more.
*3: Lower limit of burst control is 10 bytes when frame size is 16,001bytes or more.
*4: Errors can be inserted when Frame BERT selected.

• 40G Ethernet (Opt-003)

Frequency Measurement		40 GbE: 41,250,000,000 Hz ±200 ppm No Frame: 10,312,500,000 ±200 ppm × 4 lanes
Clock Source		40 GbE: Internal, External 10 MHz Input, Tx reference input, Sync. input, Received[1] No Frame: Internal, External 10 MHz Input, Tx reference input
Clock Monitor		40 GbE: CDR Unlock, Clock Source Loss No Frame: CDR Unlock × 4 Lanes, Clock Source Loss
Transceiver Setting		Tx: VOD, Pre-Emphasis (First post tap, Pre tap, Second post tap) Rx: Equalizer (DC gain, Control)
CFP Monitor		LOS, Programmable Alarm1, Programmable Alarm2, Programmable Alarm3, Global Alarm, Optical power
PCS Layer Measurement	PCS Lane Monitor	Marker map, Relative skew (ns)
	PCS Status	Per lane: Sync. header lock, Alignment marker lock, Skew stability All lanes: Link status, High BER, Alignment status
	Deskew Tolerance	128 Blocks
	PCS Counter	Per lane: Invalid sync. header count, Invalid alignment marker count, BIP error count All lanes: Invalid block count

	PCS Error/Alarm Insert	Error/Alarm type:
		  Per lane: Invalid sync. header (00 or 11), Invalid alignment marker (M0: 0x00, M4: 0xFF), BIP error
		        Can specify multiple lanes
		  All lanes: Invalid block type (0x00, 0x2d, 0x33 or 0x66), High BER
		Insertion mode:
		  Invalid Sync Header, Invalid Alignment Marker, BIP Error
		    Single, Burst, Alternate, Rate, All
		  Invalid Block Type
		    Single
		  High BER
		    All

	PCS Skew Generation	Can specify multiple lanes Tx Lane (Lane 0 to 3): Skew generation 0 to 819.2 ns, 96.97 ps steps
	PCS Lane Mapping	Odd/Even, Random, Define, Descent, Ascent
Stream Transmission	Number of Streams	16
	Display/Setting Units	Rate (%), Rate (fps), Rate (Gbit/s), Gap Size (byte), Interval (s)
	Duration	Continuous, Time, Repeat
	Stream Send Sequence	Sequential, Random
	Data Field	All 0, All 1, Word16, PRBS31
Stream Setting	Transmission Setting	On, Off
	Number of Frames	1 to 1,099,511,627,775 frames
	Stream Control	Burst Off sets interframe gap and Burst On sets interburst gap Gap Size: 9 to 600,003,575,808 bytes[2] Type: Fixed, Random
	Burst	Enable: On, Off Burst Size: 1 to 65535 frames Burst Control: 9 to 65535 bytes[3] Type: Fixed
	Frame Size	Frame Size: 60 to 32700 bytes Type: Fixed, Random
	Supported Protocols	Ethernet, MPLS-TP, PBB, VLAN, MPLS, IPv4, IPv6, ARP, ICMPv4, ICMPv6
	Test Frame	On, Off
	Frame Error Insertion	FCS Error

Error Insertion		PRBS Bit Error[4]: (PRBS31)
		  Timing: Single, Rate
		Local Fault/Remote Fault:
		  Timing: All

|		
Counter Measurement	Tx	Current: Tx Rate (bit/s), Tx Rate (%) Accumulated: Tx Good Bytes, Tx Errored Bytes, Transmit Duration (ns) Current (fps)/Accumulated: Tx Good Frames, Tx Oversize, Tx Oversize & FCS Error, Tx Undersize, Tx Fragments, Tx FCS Errors, Tx Broadcast Frames, Tx Multicast Frames, Tx MPLS-TP, Tx PBB, Tx ARP Request, Tx ARP Reply, Tx PINGv4 Request, Tx PINGv4 Reply, Tx NDP (NS), Tx NDP (NA), Tx PINGv6 Request, Tx PINGv6 Reply Current/Accumulated: LF, RF
	Rx	Current: Rx Rate (bit/s), Rx Rate (%), Current Latency (ns) Accumulated: Rx Good Bytes, Rx Errored Bytes Current (fps)/Accumulated: Rx Good Frames, Rx Oversize, Rx Oversize & FCS Errors, Rx Undersize, Rx Fragments, Rx FCS Errors, Rx Broadcast Frames, Rx Multicast Frames, Pause Frames, Rx MPLS-TP, Rx PBB, Rx ARP Request, Rx ARP Reply, Rx PINGv4 Request, Rx PINGv4 Reply, Rx NDP (NS), Rx NDP (NA), Rx PINGv6 Request, Rx PINGv6 Reply Current/Accumulated: Bit Errors (bit), Bit Error (Rate), Pattern Sync. Loss (s) Resolution 100ns, LF, RF, Trigger Condition, Error Signals
	Frame Size Distribution (Tx/Rx)	<64 bytes, 64 bytes, 65 to 127 bytes, 128 to 255 bytes, 256 to 511 bytes, 512 to 1023 bytes, 1024 bytes to Oversize, >Oversize
	Gap Size Distribution (Tx/Rx)	Eight gap size setting ranges
	Counter Setting	Oversize: 1518 to 32700 bytes Undersize: 64 bytes (fixed) Sequence error detect: On/Off
	Multi Flow Counter	Number of flow 16
	Flow Filter	Test Frame ID, User Defined, Test Frame ID and User Defined
	Test Item (Tx)	Number of Frames, Number of Bytes, Rate

	Test Item (Rx)	Number of Frames, Number of Bytes, Rate
		Latency: Accuracy 100 ns, Resolution 12 ns
		  Current Latency (ns)
		  Minimum Latency (ns)
		  Maximum Latency (ns)
		Sequence Error (with Test Frame ID filter)

Capture	Memory Capacity	128 kB
	Status Display	Trigger
	Trigger	Pattern: Good Frame, LFS Signal, RFS Signal, Error Signal, FCS Error, Undersize, Fragments, Oversize, Oversize & FCS Error Trigger Position: Middle

	Analysis	Display: Frame, Gap, Malformed
		Data: XLGMII / CGMII
		Error detection: FCS, LF, MII Error data (RXC=1, RXD=0xFE), OVER, RF, UNDER
		Decode:
		  D: Data (RXC=0), I: Idle (RXC=1,RXD=07), S: Start (RXC=1,RXD=FB), T: Terminate (RXC=1,RXD=FD),
		  Q: Sequence (RXC=1,RXD=9C), !: Error (RXC=1,RXD=FE), ?: Unknown or Reserved Other

	Wireshark Convert Function	Supported
Protocol Test	ARP/ICMP	Can send GARP/NS packets, ARP/NA, Ping Reply when receiving ARP/NS, Ping receiving up to 16 streams
	Ping/NS, NA	Packet length can vary from 64 to 32700 bytes
No Frame Measurement	Test Pattern	Tx: PRBS7, PRBS9, PRBS15, PRBS23, PRBS31 (Invert On/Off), Square wave Rx: PRBS7, PRBS9, PRBS15, PRBS23, PRBS31 (Invert On/Off)
	Error Insertion	PRBS Bit error Can specify multiple lanes Timing: Single
	Counter	Each lane Pattern Sync. Loss (s) Resolution 100 ns, Bit error count (bit), Bit error rate
Port Setting		Mode: Normal, Loopback LFS Reply: On, Off Flow Control: On, Off Frame BERT: On, Off
Add-on Function	RFC2544 Tests	Throughput, Latency, Frame loss rate, Back-to-back frames
	CFP Analyzing Function (Opt-031)	Reads and writes MDIO of CFP and displays each register value of CFP
	Service Disruption Time Measurement	Displays communication interruption time due to loss of Ethernet frame

∗1: Using Lane#3 regeneration clock at Received.
∗2: Lower limit of gap is 10 bytes when frame size is 16,001 bytes or more.
∗3: Lower limit of burst control is 10 bytes when frame size is 16,001 bytes or more.
∗4: Errors can be inserted when Frame BERT selected.

• OTU4 (Opt-002)

Frequency Measurement		OTU4: 111,809,973,568 Hz ± 200 ppm No Frame 20 Lane: 111,809,973,568 Hz ± 200 ppm No Frame 10 Lane: 11,180,997,357 Hz ± 200 ppm × 10 lanes
Clock Source		OTU4: Internal, External 10 MHz Input, Tx reference input, Received* No Frame: Internal, External 10 MHz Input, Tx reference input
Clock Monitor		OTU4: CDR Unlock, Clock Source Loss No Frame 20 Lane: CDR Unlock, Clock Source Loss No Frame 10 Lane: CDR Unlock × 10 Lanes, Clock Source Loss
Transceiver Setting		Tx: VOD, Pre-Emphasis (First post tap, Pre tap, Second post tap) Rx: Equalizer (DC gain, Control)
CFP Monitor		LOS, Programmable Alarm1, Programmable Alarm2, Programmable Alarm3, Global Alarm, Optical power
OTN Setting	Mapping	OTU4 — No Frame ODU4 (L) — OPU4 (L) — PRBS
	Test Pattern	PRBS15, PRBS23, PRBS31 (Invert On/Off), Word16
OTN OH Measurement	OH Preset	OTU4, ODU4, OPU4 (MFAS and parity byte excluded) Decoding setting for each of TTI (SAPI [1] - [15], DAPI [1] - [15]) and FTFL (OIF) is available.
	OH Monitor	Multiframe analysis for OTU4/ODU4/OPU4 Header, Payload, PT, TTI, and FTFL
Error/Alarm Measurement	Alarm	LLD: LOF Lane (s), OOF (frame), LOR (s), OOR (frame) OTU: LOF (s), OOF (s, frame), LOM (s), OOM (s, frame), SM-TIM (frame), SM-BIAE (s, frame), SM-BDI (s, frame), SM-IAE (s, frame) ODU: ODU-AIS (s, frame), ODU-OCI (s, frame), ODU-LCK (s, frame), PM-TIM (frame), PM-BDI (s, frame) TCM 1 to 6: TCM-TIM (frame), TCM-BIAE (s, frame), TCM-BDI (s, frame), TCM-IAE (s, frame), TCM-LTC (s, frame) OPU: PLM (frame), Client-AIS (s, frame) Test Pattern: Pattern Sync. Loss (s)

	Error	LLD: Displays for each Rx lane
		    FAS-LLD (count)
		OTU: FAS (count), SM-BIP8 (count, rate), SM-BEI (count, rate), FEC-Uncorr EBs, FEC-Corr Errors, FEC-Corr 1 s to 0 s,
		    FEC-Corr 0 s to 1 s
		ODU: PM-BIP8 (count, rate), PM-BEI (count, rate)
		TCM 1 to 6: TCM-BIP8 (count, rate), TCM-BEI (count, rate)
		OPU: Bit Errors (count, rate)

Error/Alarm Insertion	Alarm Insertion	LLD: OOF/LOF, OOR/LOR OTU: OOF/LOF, OOM/LOM, SM-TIM, SM-BIAE, SM-BDI, SM-IAE ODU: ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI TCM 1 to 6: TCM-TIM, TCM-BIAE, TCM-IAE, TCM-BDI, TCM-LTC OPU: Client-AIS
	Error Insertion	LLD: FAS OTU: FAS, SM-BIP8, SM-BEI, Uncorrectable Error, Correctable Error ODU: PM-BIP8, PM-BEI TCM 1 to 6: TCM-BIP8, TCM-BEI Test Pattern: Bit Error Others: Bit all (Poisson distribution 1.0E-2 to 9.9E-9, FAS protection availability setting enabled)
LLD Measurement	LLD Monitor	Per lane (20 lanes): Marker map, Relative skew (ns)
	LLD Status	Per lane (20 lanes): Skew stability All lanes: ILA/OLA
	LLD Skew Generation	Can specify multiple lanes Skew generation 0 to 32000 bits, 1 bit steps
	LLD Lane Mapping	Odd/Even, Random, Define, Descent, Ascent
OH Capture		Target data: OTU4, ODU4, OPU4 Trigger: MFAS=0, Error/Alarm, Manual Number of frames: 512
Frame Capture		Target data: Entire OTU4 frame (OH+Payload+FEC) Trigger: OTU MFAS, OMFI, Error/Alarm, Manual Number of frames: 18
OTN APS Measurement		Trigger: SM-BIP8, PM-BIP8, ODU-AIS, ODU-OCI, ODU-LCK, OOF, LOF Max.detection time: 10,000.0 ms Measurement resolution: 0.1 ms Error Free Period: 1, 10, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 ms
OTN Delay Measurement		Mode: Single, Repeat Measurement resolution: 1.167696 µs
No Frame Measurement	Test Pattern	Tx: PRBS7, PRBS9, PRBS15, PRBS23, PRBS31 (Invert On/Off), Square wave Rx: PRBS7, PRBS9, PRBS15, PRBS23, PRBS31 (Invert On/Off)
	Error Insertion	PRBS Bit error Can specify multiple lanes Timing: Single
	Counter	Each lane Pattern Sync. Loss (s) Resolution 100 ns, Bit error count (bit), Bit error rate
Port Setting		Mode: Normal, Loopback, OTU Through Through Mode: Transparent, Analyzed, OH Overwrite GFEC Encode: On, Off
Add-on Function	CFP Analyzing Function (Opt-031)	Reads and writes MDIO of CFP and displays each register value of CFP
	100GBASE Lambda Grouping Measurement	At 100BASE-LR4/ER4 measurement, displays measurements for each lane of CAUI and PCS as four groups

*: Using Lane#3 regeneration clock at Received.

• OTU3 (Opt-004)

Frequency Measurement		OTU3: 43,018,413,559 Hz ± 200 ppm No Frame: 10,754,603,390 Hz ± 200 ppm × 4 lanes
Clock Source		OTU3: Internal, External 10 MHz Input, Tx reference input, Received* No Frame: Internal, External 10 MHz Input, Tx reference input
Clock Monitor		OTU3: CDR Unlock, Clock Source Loss No Frame: CDR Unlock × 4 lanes, Clock Source Loss
Transceiver Setting		Tx: VOD, Pre-Emphasis (First post tap, Pre tap, Second post tap) Rx: Equalizer (DC gain, Control)
CFP Monitor		LOS, Programmable Alarm1, Programmable Alarm2, Programmable Alarm3, Global Alarm, Optical power
OTN Setting	Mapping	OTU3 — ODU3 (L) — OPU3 (L) — PRBS No Frame — PRBS
	Test Pattern	PRBS15, PRBS23, PRBS31 (Invert On/Off), Word16
OTN OH Measurement	OH Preset	OTU3, ODU3, OPU3 (MFAS and parity byte excluded) Decoding setting for each of TTI (SAPI [1] - [15], DAPI [1] - [15]) and FTFL (OIF) is available.
	OH Monitor	Multiframe analysis for OTU3, ODU3, OPU3 Header, Payload, PT, TTI, and FTFL
Error/Alarm Measurement	Alarm	LLD: LOF Lane (s), OOF (frame), LOR (s), OOR (frame) OTU: LOF (s), OOF (s, frame), LOM (s), OOM (s, frame), SM-TIM (frame), SM-BIAE (s, frame), SM-BDI (s, frame), SM-IAE (s, frame) ODU: ODU-AIS (s, frame), ODU-OCI (s, frame), ODU-LCK (s, frame), PM-TIM (frame), PM-BDI (s, frame) TCM 1 to 6: TCM-TIM (frame), TCM-BIAE (s, frame), TCM-BDI (s, frame), TCM-IAE (s, frame), TCM-LTC (s, frame) OPU: PLM (frame), Client-AIS (s, frame) Test Pattern: Pattern Sync. Loss (s)
	Error	LLD: FAS-LLD (count) OTU: FAS (count), SM-BIP8 (count, rate), SM-BEI (count, rate), FEC-Uncorr EBs, FEC-Corr Errors, FEC-Corr 1 s to 0 s, FEC-Corr 0 s to 1 s ODU: PM-BIP8 (count, rate), PM-BEI (count, rate) TCM 1 to 6: TCM-BIP8 (count, rate), TCM-BEI (count, rate) OPU: Bit Errors (count, rate)
Error/Alarm Insertion	Alram Insertion	LLD: OOF/LOF, OOR/LOR OTU: OOF/LOF, OOM/LOM, SM-TIM, SM-BIAE, SM-BDI, SM-IAE ODU: ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI TCM 1 to 6: TCM-TIM, TCM-BIAE, TCM-IAE, TCM-BDI, TCM-LTC OPU: Client-AIS
	Error Insertion	LLD: FAS OTU: FAS, SM-BIP8, SM-BEI, Uncorrectable Error, Correctable Error ODU: PM-BIP8, PM-BEI TCM 1 to 6: TCM-BIP8, TCM-BEI Test Pattern: Bit Error Others: Bit all (Poisson distribution 1.0E-2 to 9.9E-9, FAS protection availability setting enabled)
LLD Measurement	LLD Monitor	Per lane (4 lanes): Marker map, Relative skew (ns)
	LLD Status	Per lane (4 lanes): Skew stability All lanes: ILA/OLA
	LLD Skew Generation	Can specify multiple lanes Skew generation 0 to 32000 bits, 1 bit steps
	LLD Lane Mapping	Odd/Even, Random, Define, Descent, Ascent
OH Capture		Target data: OTU3, ODU3, OPU3 Trigger: MFAS=0, Error/Alarm, Manual Number of frames: 512
Frame Capture		Target data: Entire OTU3 frame (OH+Payload+FEC) Trigger: OTU MFAS, Error/Alarm, Manual Number of frames: 18
OTN APS Measurement		Trigger: SM-BIP8, PM-BIP8, ODU-AIS, ODU-OCI, ODU-LCK, OOF, LOF Max. detection time: 10,000.0 ms Measurement resolution: 0.1 ms Error Free Period: 1, 10, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 ms
OTN Delay Measurement		Mode: Single, Repeat Measurement resolution: 3.03498 μs
No Frame Measurement	Test Pattern	Tx: PRBS7, PRBS9, PRBS15, PRBS23, PRBS31 (Invert On/Off), Square wave Rx: PRBS7, PRBS9, PRBS15, PRBS23, PRBS31 (Invert On/Off)
	Error Insertion	PRBS Bit error Can specify multiple lanes Timing: Single
	Counter	Each lane Pattern Sync. Loss (s) Resolution 100 ns, Bit error count (bit), Bit error rate
Port Setting		Mode: Normal, Loopback, OTU Through Through Mode: Transparent, Analyzed, OH Overwrite GFEC Encode: On, Off
Add-on Function	CFP Analyzing Function (Opt-031)	Reads and writes MDIO of CFP and displays each register value of CFP

∗: Using Lane#3 regeneration clock at Received.

• ODU4-100 GbE Mapping (Opt-005)

Frequency Measurement		111,809,973,568 Hz ± 200 ppm
Clock Source		Internal, External 10 MHz Input, Tx reference input, Received[*1]
Clock Monitor		CDR Unlock, Clock Source Loss
Transceiver Setting		Tx: VOD, Pre-Emphasis (First post tap, Pre tap, Second post tap) Rx: Equalizer (DC gain, Control)
CFP Monitor		LOS, Programmable Alarm1, Programmable Alarm2, Programmable Alarm3, Global Alarm, Optical power
OTN Setting	Mapping	OTU4 — ODU4 (L) — OPU4 (L) — 100GbE
	Test Pattern/Client Signal	100 GbE
	Payload Offset	±120 ppm
OTN OH Measurement	OH Preset	OTU4, ODU4, OPU4 (MFAS and parity byte excluded) Decoding setting for each of TTI (SAPI [1] - [15], DAPI [1] - [15]) and FTFL (OIF) is available.
	OH Monitor	Multiframe analysis for OTU4, ODU4. OPU4 Header, Payload, PT, TTI, and FTFL, Stuff monitor
Error/Alarm Measurement	Alarm	LLD: LOF Lane (s), OOF (frame), LOR (s), OOR (frame) OTU: LOF (s), OOF (s, frame), LOM (s), OOM (s, frame), SM-TIM (frame), SM-BIAE (s, frame), SM-BDI (s, frame), SM-IAE (s, frame) ODU: ODU-AIS (s, frame), ODU-OCI (s, frame), ODU-LCK (s, frame), PM-TIM (frame), PM-BDI (s, frame) TCM 1 to 6: TCM-TIM (frame), TCM-BIAE (s, frame), TCM-BDI (s, frame), TCM-IAE (s, frame), TCM-LTC (s, frame) OPU: PLM (frame), Client-AIS (s, frame)
	Error	LLD: FAS-LLD (count) OTU: FAS (count), SM-BIP8 (count, rate), SM-BEI (count, rate) ODU: PM-BIP8 (count, rate), PM-BEI (count, rate) TCM 1 to 6: TCM-BIP8 (count, rate), TCM-BEI (count, rate) GMP: Rx Inc Over, Rx Dec Over, CRC8 Error, CRC5 Error
Error/Alarm Insertion	Alram Insertion	LLD: OOF/LOF, OOR/LOR OTU: OOF/LOF, OOM/LOM, SM-TIM, SM-BIAE, SM-BDI, SM-IAE ODU: ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI TCM 1 to 6: TCM-TIM, TCM-BIAE, TCM-IAE, TCM-BDI, TCM-LTC OPU: Client-AIS, CSF PCS: High BER
	Error Insertion	LLD: FAS OTU: FAS, SM-BIP8, SM-BEI ODU: PM-BIP8, PM-BEI TCM 1 to 6: TCM-BIP8, TCM-BEI GMP: CRC8 Error, CRC5 Error, Invalid JC1, Invalid JC2, Invalid JC1 & JC2 Others: Bit all (Single)
LLD Measurement	LLD Monitor	Per lane (20 lanes): Marker map, Relative skew (ns)
	LLD Status	Per lane (20 lanes): Skew stability All lanes: ILA/OLA
	LLD Skew Generation	Can specify multiple lanes Skew generation 0 to 32000 bits, 1 bit steps
	LLD Lane Mapping	Odd/Even, Random, Define, Descent, Ascent
PCS Layer Measurement	PCS Lane Monitor	Marker map
	PCS Status	Per lane: Alignment marker lock All lanes: Sync. header lock, High BER, Alignment status
	PCS Counter	Per lane: Invalid alignment marker count, BIP error count All lanes: Invalid sync. header count, Invalid block count, 66B error
	PCS Error/Alarm Insert	Error/Alarm type: Invalid sync. header (00 or 11), Invalid alignment marker (M0: 0x00, M4: 0xFF), BIP error, Invalid block type (0x00, 0x2d, 0x33 or 0x66), High BER, 66B error Insertion mode: Single, Burst, All
Stream Transmission	Number of Streams	1
	Display/Setting Units	Rate (%), Rate (fps), Rate (Gbit/s), Gap Size (byte)
	Duration	Continuous, Repeat
	Data Field	All 0, All 1, Word16, PRBS31
Stream Setting	Stream Control	Sets the gap between frames Gap Size: 9 to 1,500,017,328,128 bytes[*2] Type: Fixed, Random
	Frame Size	Frame Size: 60 to 16376 bytes Type: Fixed, Random
	Supported Protocols	Ethernet
	Frame Error Insertion	FCS Error
Stream Error Insertion		Type: Local Fault, Remote Fault Timing: All
Stream Measurement	Tx	Current: Tx Rate (bit/s), Tx Rate (%) Accumulated: Tx Good Bytes, Tx Errored Bytes, Transmit Duration (ns) Current (fps)/Accumulated: Tx Good Frames, Tx Oversize, Tx Oversize & FCS Error, Tx Undersize, Tx Fragments, Tx FCS Errors Current/Accumulated: LF, RF
	Rx	Current: Rx Rate (bit/s), Rx Rate (%) Accumulated: Rx Good Bytes, Rx Errored Bytes Current (fps)/Accumulated: Rx Good Frames, Rx Oversize, Rx Oversize & FCS Errors, Rx Undersize, Rx Fragments, Rx FCS Errors Current/Accumulated: LF, RF, Error Signal
	Counter Setting	Oversize: 1518 to 16376 bytes, Undersize: 64 bytes (fixed)

OH Capture	Target data: OTU4, ODU4, OPU4 Trigger: MFAS=0, Error/Alarm, Manual Number of frames: 512
Frame Capture	Target data: Entire OTU4 frame (OH+Payload+FEC) Trigger: OTU MFAS, OMFI, Error/Alarm, Manual Number of frames: 18
OTN APS Measurement	Trigger: SM-BIP8, PM-BIP8, ODU-AIS, ODU-OCI, ODU-LCK, OOF, LOF Max. detection time: 10,000.0 ms Measurement resolution: 0.1 ms Error Free Period: 1, 10, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 ms
OTN Delay Measurement	Mode: Single, Repeat Measurement resolution: 1.167696 µs
Port Setting	Mode: Normal, Loopback, OTU Through Through Mode: Transparent, Analyzed, OH Overwrite GFEC Encode: On, Off

∗1: Using Lane#3 regeneration clock at Received.
∗2: Lower limit of gap is 10 bytes when frame size is 16,001 bytes or more.

• ODTU4.1-ODU0- GbE Mapping (Opt-006)

Frequency Measurement		111,809,973,568Hz ± 200 ppm
Clock Source		Internal, External 10 MHz Input, Tx reference input, Received[*1]
Clock Monitor		CDR Unlock, Clock Source Loss
Transceiver Setting		Tx: VOD, Pre-Emphasis (First post tap, Pre tap, Second post tap) Rx: Equalizer (DC gain, Control)
CFP Monitor		LOS, Programmable Alarm1, Programmable Alarm2, Programmable Alarm3, Global Alarm, Optical power
OTN Setting	Mapping	OTU4 → ODU4 (H) → OPU4 (H) (GMP) ODTU4.1 → ODU0 (L) → OPU0 (L) (GMP) → GbE
	Test Pattern/Client Signal	GbE over GFP-T, PRBS31 (Invert On/Off), Word16
	Payload Offset	High Order: ±40 ppm Low Order: ±120 ppm
	ODTU Channel Selection	TP: Select one from 1 to 80. TS: Select TS that belongs to the selected TP from 1 to 80 arbitrarily.
OTN OH Measurement	OH Preset	OTU4, ODU4, OPU4, ODU0, OPU0 (MFAS and parity byte excluded) Decoding setting for each of TTI (SAPI [1] - [15], DAPI [1] - [15]) and FTFL (OIF) is available.
	OH Monitor	Multiframe analysis for OTU4, ODU4, OPU4, ODU0, OPU0 Header, Payload, PT, TTI, and FTFL, Stuff monitor
Error/Alarm Measurement	Alarm	LLD: LOF Lane (s), OOF (frame), LOR (s), OOR (frame) OTU: LOF (s), OOF (s, frame), LOM (s), OOM (s, frame), SM-TIM (frame), SM-BIAE (s, frame), SM-BDI (s, frame), SM-IAE (s, frame) ODU: ODU-AIS (s, frame), ODU-OCI (s, frame), ODU-LCK (s, frame), PM-TIM (frame), PM-BDI (s, frame), PLM (frame), LOFLOM (s) TCM 1 to 6: TCM-TIM (frame), TCM-BIAE (s, frame), TCM-BDI (s, frame), TCM-IAE (s, frame), TCM-LTC (frame) OPU: PLM (frame), Client-AIS (s, frame), CSF (frame) GFP-T: CSF (s), SSF (s) Test Pattern[*2]: Pattern Sync. Loss (s)

	Error	LLD: FAS-LLD (count)
		OTU: FAS (count), SM-BIP8 (count, rate), SM-BEI (count, rate), FEC-Uncorr EBs, FEC-Corr Errors, FEC-Corr 1 s to 0 s,
		    FEC-Corr 0 s to 1 s
		ODU: PM-BIP8 (count, rate), PM-BEI (count, rate)
		TCM 1 to 6: TCM-BIP8 (count, rate), TCM-BEI (count, rate)
		OPU: Bit Errors (count, rate)
		GMP: Rx Inc Over, Rx Dec Over, CRC8 Error, CRC5 Error
		GFP-T: Superblock CRC, Correctable cHEC, Uncorrectable cHEC,
		    Correctable tHEC, Uncrrectable tHEC, CSF Signal, CSF Sync
		Test Pattern[*2]: Bit Errors (count, rate)

Error/Alarm Insertion	Alram Insertion	LLD: OOF/LOF, OOR/LOR OTU: OOF/LOF, OOM/LOM, SM-TIM, SM-BDI, SM-IAE ODU: ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, OOF/LOF, OOM/LOM TCM 1 to 6: TCM-TIM, TCM-BIAE, TCM-IAE, TCM-BDI, TCM-LTC OPU: Client-AIS, CSF
	Error Insertion	LLD: FAS OTU: FAS, SM-BIP8, SM-BEI ODU: PM-BIP8, PM-BEI TCM 1 to 6: TCM-BIP8, TCM-BEI GMP: CRC8 Error, CRC5 Error, Invalid JC1, Invalid JC2, Invalid JC1 & JC2 GFP-T, Ethernet, Test Pattern: Superblock CRC Error, cHEC Error, tHEC Error, 10B Error, PRBS Bit Error Others: Bit all (Single)
LLD Measurement	LLD Monitor	Per lane (20 lanes): Marker map, Relative skew (ns)
	LLD Status	Per lane (20 lanes): Skew stability All lanes: ILA/OLA
	LLD Skew Generation	Can specify multiple lanes Skew generation 0 to 32000 bits, 1 bit steps
	LLD Lane Mapping	Odd/Even, Random, Define, Descent, Ascent

Stream Transmission	Number of Streams	1
	Display/Setting Units	Rate (%), Rate (fps), Rate (Gbit/s), Gap Size (byte)
	Duration	Continuous, Repeat
	Data Field	All 0, All 1, Word16, PRBS31
Stream Setting	Stream Control	Sets the gap between frames Gap Size: 9 to 1,500,017,328,128 bytes*3 Type: Fixed, Random
	Frame Size	Frame Size: 60 to 16376 bytes Type: Fixed, Random
	Supported Protocols	Ethernet
	Frame Error Insertion	FCS Error
Stream Error Insertion		Type: Local Fault, Remote Fault Timing: All
Stream Measurement	Tx	Current: Tx Rate (bit/s), Tx Rate (%) Accumulated: Tx Good Bytes, Tx Errored Bytes Current (fps)/Accumulated: Tx Good Frames, Tx Oversize, Tx Oversize & FCS Error, Tx Undersize, Tx Fragments, Tx FCS Errors
	Rx	Current: Rx Rate (bit/s), Rx Rate (%) Accumulated: Rx Good Bytes, Rx Errored Bytes Current (fps)/Accumulated: Rx Good Frames, Rx Oversize, Rx Oversize & FCS Errors, Rx Undersize, Rx Fragments, Rx FCS Errors
	Counter Setting	Oversize: 1518 to 16376 bytes, Undersize: 64 bytes (fixed)
OH Capture		Target data: OTU4, ODU4, OPU4, ODU0, OPU0 Trigger: MFAS=0, Error/Alarm, Manual Number of frames: 512
Frame Capture		Target data: Entire OTU4 frame (OH+Payload+FEC) Trigger: OTU MFAS, OMFI, Error/Alarm, Manual Number of frames: 18
OTN APS Measurement		Trigger: SM-BIP8, PM-BIP8, ODU-AIS, ODU-OCI, ODU-LCK, OOF, LOF Max. detection time: 10,000.0 ms Measurement resolution: 0.1 ms Error Free Period: 1, 10, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 ms
OTN Delay Measurement		Mode: Single, Repeat Measurement resolution: 1.167696 μs
Port Setting		Mode: Normal, Loopback, OTU Through Through Mode: Transparent, Analyzed, OH Overwrite GFEC Encode: On, Off GbE Auto Negotiation: On, Off

*1: Using Lane#3 regeneration clock at Received.
*2: At PRBS mapping.
*3: Lower limit of gap is 10 bytes when frame size is 16,001 bytes or more.

• ODTU4.8-ODU2e-10 GbE Mapping (Opt-007)

OTN Setting	Frequency Measurement	111,809,973,568Hz ± 200 ppm
	Clock Source	Internal, External 10 MHz Input, Tx reference input, Received*1
	Clock Monitor	CDR Unlock, Clock Source Loss
	Transceiver Setting	Tx: VOD, Pre-Emphasis (First post tap, Pre tap, Second post tap) Rx: Equalizer (DC gain, Control)
	CFP Monitor	LOS, Programmable Alarm1, Programmable Alarm2, Programmable Alarm3, Global Alarm, Optical power
	Mapping	OTU4 — ODU4 (H) — OPU4 (H) (GMP) ODTU4.8 — ODU2e (L) — OPU2e (L) (GMP) — 10GbE
	Test Pattern/Client Signal	10 GbE over PCS, PRBS31 (Invert On/Off), Word16
	Payload Offset	±120 ppm
	ODTU Channel Selection	TP: Select one from 1 to 10. TS: Select TS that belongs to the selected TP from 1 to 80 arbitrarily.
OTN OH Measurement	OH Preset	OTU4, ODU4, OPU4, ODU2e, OPU2e (MFAS and parity byte excluded) Decoding setting for each of TTI (SAPI [1] - [15], DAPI [1] - [15]) and FTFL (OIF) is available.
	OH Monitor	Multiframe analysis for OTU4/ODU4/OPU4/ODU2e/OPU2e Header, Payload, PT, TTI, and FTFL, Stuff monitor

Error/Alarm Measurement	Alarm	LLD: LOF Lane (s), OOF (frame), LOR (s), OOR (frame) OTU: LOF (s), OOF (s, frame), LOM (s), OOM (s, frame), SM-TIM (frame), SM-BIAE (s, frame), SM-BDI (s, frame), SM-IAE (s, frame) ODU: ODU-AIS (s, frame), ODU-OCI (s, frame), ODU-LCK (s, frame), PM-TIM (frame), PM-BDI (s, frame), PLM (frame), LOFLOM (s) TCM 1 to 6: TCM-TIM (s, frame), TCM-BIAE (s, frame), TCM-BDI (s, frame), TCM-IAE (s, frame), TCM-LTC (frame) OPU: PLM (frame), Client-AIS (s, frame), CSF (frame) Test Pattern[*2]: Pattern Sync. Loss (s)
	Error	LLD: FAS-LLD (count) OTU: FAS (count), SM-BIP8 (count, rate), SM-BEI (count, rate), FEC-Uncorr EBs, FEC-Corr Errors, FEC-Corr 1 s to 0 s, FEC-Corr 0 s to 1 s ODU: PM-BIP8 (count, rate), PM-BEI (count, rate) TCM 1 to 6: TCM-BIP8 (count, rate), TCM-BEI (count, rate) GMP: Rx Inc Over, Rx Dec Over, CRC8 Error, CRC5 Error Test Pattern[*2]: Bit Errors (count, rate)
Error/Alarm Insertion	Alram Insertion	LLD: OOF/LOF, OOR/LOR OTU: OOF/LOF, OOM/LOM, SM-TIM, SM-BDI, SM-IAE ODU: ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, OOF/LOF, OOM/LOM TCM 1 to 6: TCM-TIM, TCM-BIAE, TCM-IAE, TCM-BDI, TCM-LTC OPU: Client-AIS, CSF PCS: High BER
	Error Insertion	LLD: FAS OTU: FAS, SM-BIP8, SM-BEI ODU: PM-BIP8, PM-BEI TCM 1 to 6: TCM-BIP8, TCM-BEI GMP: CRC8 Error, CRC5 Error, Invalid JC1, Invalid JC2, Invalid JC1 & JC2 Others: Bit all (Single), PRBS Bit Error
LLD Measurement	LLD Monitor	Per lane (20 lanes): Marker map, Relative skew (ns)
	LLD Status	Per lane (20 lanes): Skew stability All lanes: ILA/OLA
	LLD Skew Generation	Can specify multiple lanes Skew generation 0 to 32000 bits, 1 bit steps
	LLD Lane Mapping	Odd/Even, Random, Define, Descent, Ascent
PCS Layer Measurement	PCS Status	Sync. header lock, High BER
	PCS Counter	Invalid sync. header count, Invalid block count, 66B error
	PCS Error/Alarm Insert	Error/Alarm type: Invalid sync. header (00 or 11), Invalid alignment marker (M0: 0x00, M4: 0xFF), BIP error, Invalid block type (0x00, 0x2d, 0x33 or 0x66), High BER, 66B error Insertion mode: Single, Burst, All
Stream Transmission	Number of Streams	1
	Display/Setting Units	Rate (%), Rate (fps), Rate (Gbit/s), Gap Size (byte)
	Duration	Continuous, Repeat
	Data Field	All 0, All 1, Word16, PRBS31
Stream Setting	Stream Control	Sets the gap between frames Gap Size: 9 to 1,500,017,328,128 bytes[*3] Type: Fixed, Random
	Frame Size	Frame Size: 60 to 16376 bytes Type: Fixed, Random
	Supported Protocols	Ethernet
	Frame Error Insertion	FCS Error
Stream Error Insertion		Type: Local Fault, Remote Fault Timing: All
Stream Measurement	Tx	Current: Tx Rate (bit/s), Tx Rate (%) Accumulated: Tx Good Bytes, Tx Errored Bytes Current (fps)/Accumulated: Tx Good Frames, Tx Oversize, Tx Oversize & FCS Error, Tx Undersize, Tx Fragments, Tx FCS Errors Current/Accumulated: LF, RF
	Rx	Current: Rx Rate (bit/s), Rx Rate (%) Accumulated: Rx Good Bytes, Rx Errored Bytes Current (fps)/Accumulated: Rx Good Frames, Rx Oversize, Rx Oversize & FCS Errors, Rx Undersize, Rx Fragments, Rx FCS Errors Current/Accumulated: LF, RF, Error Signal
	Counter Setting	Oversize: 1518 to 16376 bytes, Undersize: 64 bytes (fixed)
OH Capture		Target data: OTU4, ODU4, OPU4, ODU2e, OPU2e Trigger: MFAS=0, Error/Alarm, Manual Number of frames: 512
Frame Capture		Target data: Entire OTU4 frame (OH+Payload+FEC) Trigger: OTU MFAS, OMFI, Error/Alarm, Manual Number of frames: 18
OTN APS Measurement		Trigger: SM-BIP8, PM-BIP8, ODU-AIS, ODU-OCI, ODU-LCK, OOF, LOF Max. detection time: 10,000.0 ms Measurement resolution: 0.1 ms Error Free Period: 1, 10, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 ms
OTN Delay Measurement		Mode: Single, Repeat Measurement resolution: 1.167696 µs
Port Setting		Mode: Normal, Loopback, OTU Through Through Mode: Transparent, Analyzed, OH Overwrite GFEC Encode: On, Off

*1: Using Lane#3 regeneration clock at Received.
*2: At PRBS mapping.
*3: Lower limit of gap is 10 bytes when frame size is 16,001 bytes or more.

• MZ1225A Adapter for QSFP+

Interface	CFP MSA Hardware Specification Revision 1.4 CFP MSA Management Interface Specification Version 1.4 SFF-8436 Specification for QSFP+ COPPER AND OPTICAL MODULES Rev 3.5 SFF-8472 Specification for Diagnostic Monitoring Interface for Optical Transceivers Rev 11.0
Connector	for MD1260A: 148-pin CFP (Module) for QSFP+: 38-pin QSFP+ (Host, 1 slot)
Temperature Range	Operating: +5° to +40°C, Storage: –20° to +60°C
Mass	≤1 kg
Dimensions	82 (W) × 14 (H) × 145 (D) mm (excluding projections)

• MZ1223C 10 Lane Extender

Interface/Connector	Host Side: CFP MSA Draft 1.4 Compatible Interface Network Side: SMP (plug) × 46
Insertion/Removal Cycles (Max)	Host Side: 180 (CFP connector) Network Side: 480 (SMP connector)
Insertion Loss	≤3.5 dB @ 5.59050 GHz (1/2 × 11.1809793568 Gbit/s) Including connector
Telecommunications Quality	Bit Error Rate: 1.0E-13 or less (Condition) for Evaluation: Installed in MD1260A, Loopback via 30 cm Semi-rigid cable Bit Rate: 11.1809793568 Gbit/s × 10 lane Pattern: PRBS31
Connector Assignment	(see diagram and table below)

Line 12 11 10 9 8 7 6 5 4 3 2 1 (TOP)

Top side / Bottom side

SMP type connector × 46

Line	12	11	10	9	8	7	6	5	4	3	2	1
Top side	RefCLK p	Tx 9p	Tx 7p	Tx 5p	Tx 3p	Tx 1p	Rx 10p	Rx 8p	Rx 6p	Rx 4p	Rx 2p	Rx 0p
	RefCLK n	Tx 9n	Tx 7n	Tx 5n	Tx 3n	Tx 1n	Rx 10n	Rx 8n	Rx 6n	Rx 4n	Rx 2n	Rx 0n
Bottom side		Tx 10p	Tx 8p	Tx 6p	Tx 4p	Tx 2p	Tx 0p	Rx 9p	Rx 7p	Rx 5p	Rx 3p	Rx 1p
		Tx 10n	Tx 8n	Tx 6n	Tx 4n	Tx 2n	Tx 0n	Rx 9n	Rx 7n	Rx 5n	Rx 3n	Rx 1n

∗: Each I/O of Tx10p, Tx10n, Rx10p, and Rx10n is not connected with MD1260A when MZ1223C is installed in MD1260A.
∗: Tx/Rx indicates transmission signal/reception signal. p/n indicates Positive/Negative sides for a differential interface. The logic level of the sending and receiving signal is 1.4VPMCL (Differential).
∗: MZ1223C and MD1260A are DC Coupled, and the capacitor for the AC coupling is not arranged in MZ1223C and MD1260A.

Temperature Range	Operating: +10° to +30°C, Storage: –20° to +60°C
Mass	≤2 kg
Dimension	160 (W) × 59.7 (H) × 218.4 (D) mm (excluding projections)

MZ1225A Adapter for QSFP+[*]
∗: This adapter only supports 40GbE, QSFP+ module is not included.

MZ1223C 10 Lane Extender

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No	Name	
	Main frame	
MD1260A	40/100G Ethernet Analyzer	
	Standard accessories	
J0491	Shield Power Cord (13A):	1 pc
Z1442A	MD1260A Software/Manual CD-ROM:	1 pc
B0642A	Blank Panel:	1 pc
J1137	SMA 50Ω Terminator:	4 pcs
J1341A	SMA Connector Cover:	1 pc
	Option	
MD1260A-001	100G Ethernet[*1]	
MD1260A-002	OTU4[*1]	
MD1260A-003	40G Ethernet[*1]	
MD1260A-004	OTU3[*1]	
MD1260A-005	ODU4-100GbE Mapping[*2]	
MD1260A-006	ODTU4.1-ODU0-GbE Mapping[*2]	
MD1260A-007	ODTU4.8-ODU2e-10GbE Mapping[*2]	
MD1260A-030	GPIB[*3]	
MD1260A-031	CFP MDIO Analysis	
	Warranty	
MD1260A-ES310	3 Years Extended Warranty Service	
MD1260A-ES510	5 Years Extended Warranty Service	
	Application parts	
G0259A	CFP 100GBASE-LR4[*4]	
G0279A	CFP 40GBASE-LR4[*5]	
G0296A	QSFP+ 40GBASE-SR4[*5, *6]	
MZ1225A	Adapter for QSFP+[*5, *7]	
MZ1223C	10 Lane Extender[*8, *9]	
J1502A	SMP-SMA Cable, 40cm[*10]	
J1503A	SMP-SMP Cable, 40cm[*10]	
J1540A	SMP-GPPO Cable, 40cm[*10]	
Z0975A	Keyboard (USB)	
Z0541A	USB Mouse	
J0660B	Optical Fiber Cord (SM, SC-SC connectors), 2 m	
J1519A	Optical Fiber Cord (MM, MPO-MPO connector), 3 m	
J0775B	Coaxial Cord (BNC, 75Ω), 0.5 m	
J0775D	Coaxial Cord (BNC, 75Ω), 2 m	
J0776D	Coaxial Cord (BNC, 50Ω), 2 m	
J0008	GPIB Cable, 2m	
J1343A	Coaxial Cord (SMA), 1 m	
J1049A	Fixed Optical Attenuator (SC, 5 dB)	
Z0306A	Wrist Strap	
B0648A	Front Cover	
B0647A	Carrying Case[*11]	
Z1578A	MZ1223C Operation Manual (CD-ROM)	
W3395AE	MD1260A Operation Manual	
W3406AE	MD1260A Remote Control Operation Manual	
W3483AE	MD1260A Add-on Function Operation Manual	
W3485AE	MZ1225A Operation Manual	
W3492AE	MZ1223C Operation Manual	

*1: Requires at least one of MD1260A-001, MD1260A-002, MD1260A-003 or MD1260A-004.
*2: Requires MD1260A-002
*3: Order the MD1260A-030 GPIB option with the main frame.
*4: for 100GbE
*5: for 40GbE
*6: Application parts for MZ1225A
*7: Supplied with Z1442A
*8: Supplied with Z1578A
*9: Use J1502A, J1503A or J1540A when connecting to the DUT. If the cables other than J1502A, J1503A or J1540A are used, the required performance may not be obtained.
*10: Application parts for MZ1223C. Cables sold as single units.
   J1502A: SMP (Jack) - SMA (Plug)
   J1503A: SMP (Jack) - SMP (Jack)
   J1540A: SMP (Jack) - GPPO (Jack)
*11: Always fit the Front Cover when using the Carrying Case.

Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

IEC 60825-1: 2007
INVISIBLE LASER RADIATION
DO NOT VIEW DIRECTLY WITH
OPTICAL INSTRUMENTS
(MAX OUTPUT POWER) (PULSE DURATION)   (WAVELENGTH)
6.5mW   CW   840 to 860nm
CLASS 1M LASER PRODUCT

IEC 60825-1: 2007
CLASS 1 LASER PRODUCT

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