

**Anritsu** envision : ensure

# Signal Quality Analyzer-R

## MP1900A

 **SQA-R**



# Support 400 GbE and PCIe Gen4/5

Due to the explosive growth of data traffic resulting from the popularity of smartphones and mobile terminals, network interfaces are transitioning to faster 200 GbE/400 GbE standards, and PCI bus interface speeds now exceed 10G. In addition, the equipment and chipsets using these interfaces support multi-channels and multi-protocols. The MP1900A is a high-performance BERT with excellent expandability for supporting Physical layer evaluations of these high-speed interfaces. The all-in-one design is ideal for early stage R&D evaluations of all interfaces covering next-generation Ethernet networks to bus interconnects.

## MP1900A Signal Quality Analyzer-R



### Excellent Expandability

All-in-one support for both high-speed Ethernet and PCI Express interface tests

Supports transmissions up to 512 Gbit/s

- 32G bandwidth : 16ch NRZ, 8ch PAM4
- 64G bandwidth : 8ch NRZ, 4ch PAM4

8 slots for adding extra modules

Backwards compatibility with MP1800A series modules

### Signal Integrity Evaluation

10Tap Emphasis built-in

Variable ISI Function

Multi-band CTLE

CDR Function (supports SSC)

Jitter Addition (SJ/RJ/BUJ/SSC) function

Voltage Noise Addition

(CM/DM/Gaussian) function

### Link Training

Receiver tests are supported by the built-in Protocol Awareness PCIe Link Training, USB Link Training and LTSSM analysis functions.

Supports PCI Express Gen1 to Gen4 as well as future Gen5 (32 GT/s)

### High Waveform Quality and High Sensitivity

Low Intrinsic (Residual) Jitter output (115 fs rms)

High-sensitivity Data input (15 mV)

Operation bit rates from 2.4 Gbit/s to 32.1 Gbit/s





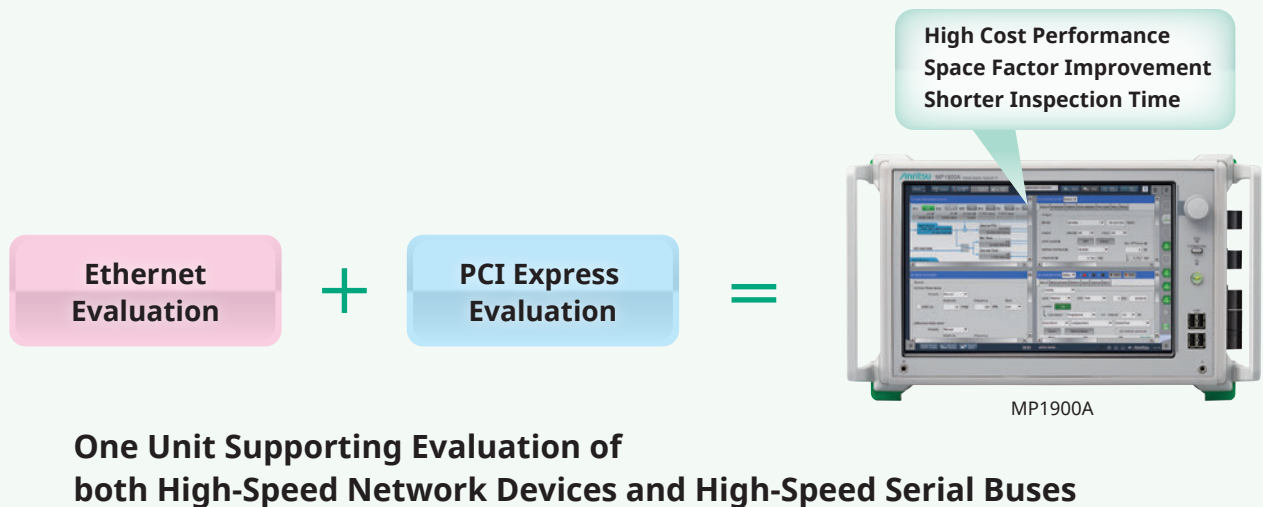
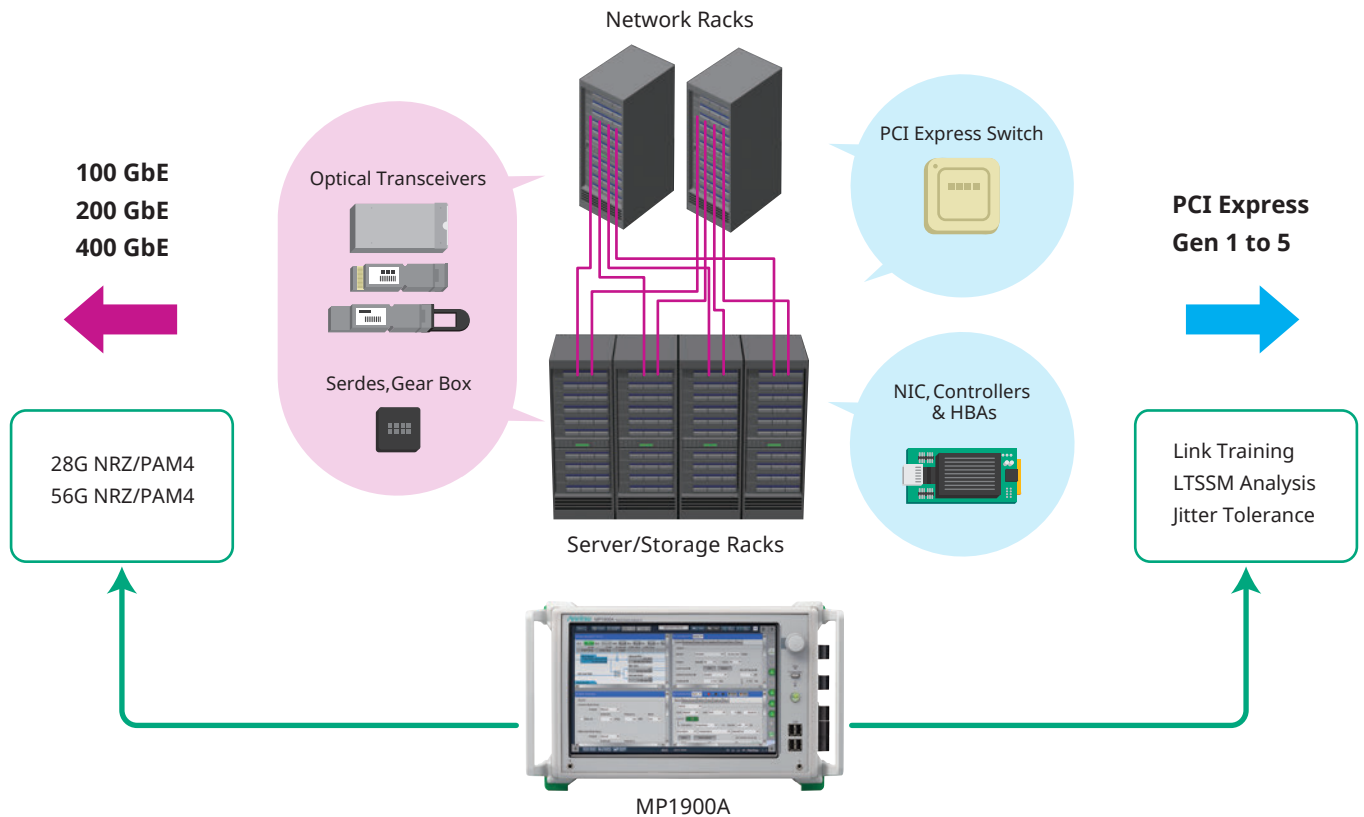
## Wide Application Support

100 GbE/200 GbE/400 GbE, CEI-25G/28G/56G/112G, InfiniBand EDR/HDR, Fibre Channel  
 PCI Express Gen1 to 5, Thunderbolt 3, USB3.1 Gen1/2  
 Optical module, SERDES, AOC, High-speed Interconnect

## Excellent Expandability

### All-in-One Support for Evaluating Next-Generation NRZ/PAM4 Network Interfaces and High-Speed Serial Buses

The Signal Quality Analyzer-R MP1900A is a modular Bit Error Rate Tester (BERT) supporting equipment external interfaces, such as next-generation Ethernet, by installing a pulse pattern generator (PPG) for outputting high-quality multi-channel NRZ/PAM4 signals over a wide bandwidth of 2.4 Gbit/s to 32.1 Gbit/s, a high-sensitivity input error detector (ED), jitter modulation sources for Jitter Tolerance tests, etc. Additionally, optional noise generation and 10Tap Emphasis functions can be installed for Voltage Noise Tolerance tests, etc., and installing the High-Speed Serial Data Test Software MX183000A software enables efficient design evaluation for increasingly faster PCIe, USB, and Thunderbolt receivers.



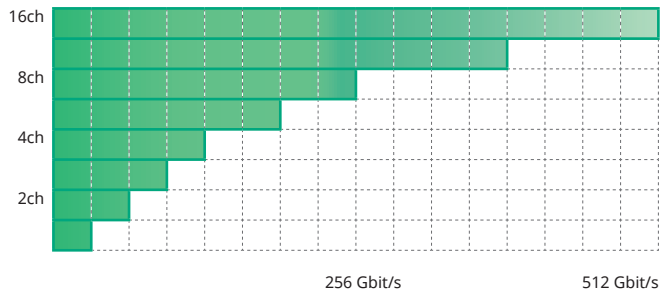
## Excellent Expandability

### Easy Flexibility for Multi-Channel Measurements at Various Transmission Rates and Formats

400 GbE is the standard for the next generation of large-capacity transmissions but it is still unknown how much further data traffic will grow. To cope with this data traffic growth, in addition to speeding-up NRZ signals and introducing multi-channel signalling, introduction of PAM4-format signals is also progressing. To facilitate this change to multi-channels and the new PAM4 signals, the MP1900A series is an 8-slot modular instrument that can be easily customized by selecting and adding required function modules. This flexible expandability supporting the latest communications methods ensures both efficient R&D investment and the fastest time to market.

#### SI PPG/ED Module Expandability

- NRZ (Max. 32 Gbit/s at 1ch)

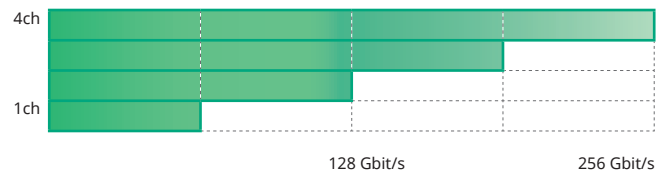


- PAM4 (Max. 32Gbaud at 1ch)

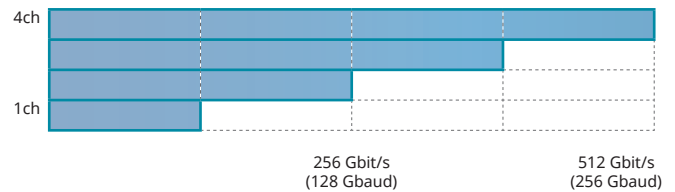
Low-cost expandability to 32G PAM4 BER measurement is supported by using the 32Gbaud Power PAM4 Converter G0375A, and 32Gbaud PAM4 Decoder with CTLE G0376A.

#### PAM4 PPG/ED Expandability\*

- NRZ (Max. 64 Gbit/s at 1ch)



- PAM4 (Max. 64 Gbaud at 1ch)

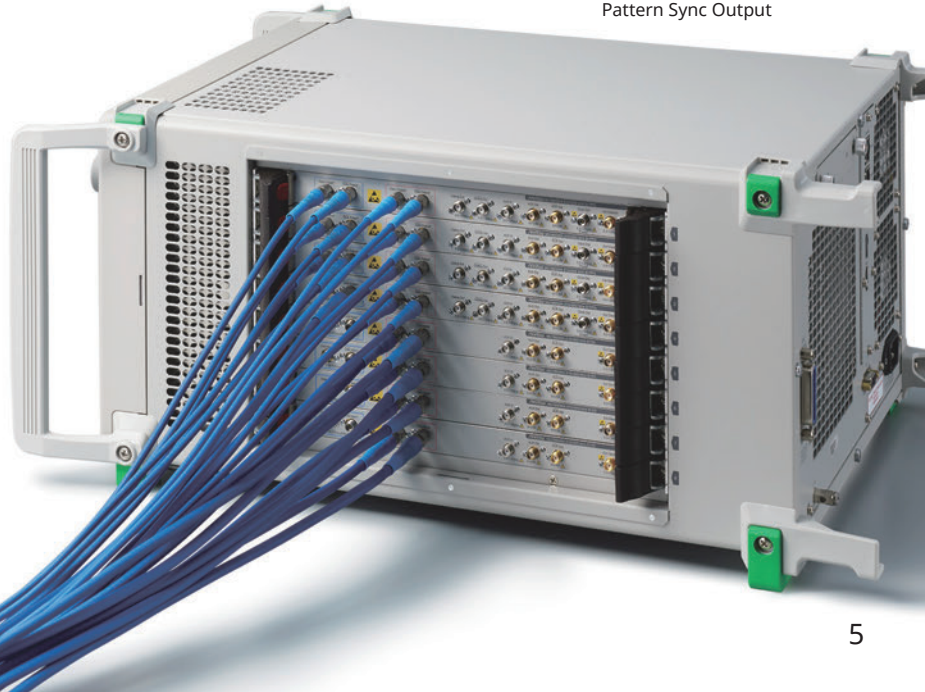
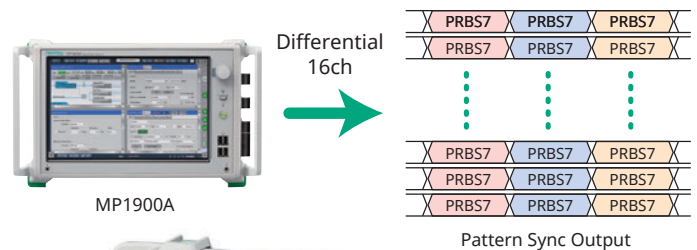


\*: ED (<32.1G), 2ch to 4ch support in future

In addition to installing PPG, ED, and noise-generation modules in the 8-slot main unit, existing modules for the previous MP1800A series can also be installed. The 21G/32G bit/s SI PPG/ED modules support selection of both one and two channels, enabling up to 16-channel measurement for both the PPG and ED. The PAM4 PPG and ED modules can be installed simultaneously to support up to a 4ch PPG and 4ch ED in a one channel per module configuration. Moreover, the pattern for each channel can be synchronized, providing an ideal solution for evaluating DAC, MUX and DEMUX devices as well as for crosstalk and skew tolerance tests.

\*: Refer to the MP1900A Selection Guide for details of the supported multi-channel configurations and module combinations.

Consult our business sales representative for use of other module configurations not described in the MP1900A Selection Guide.

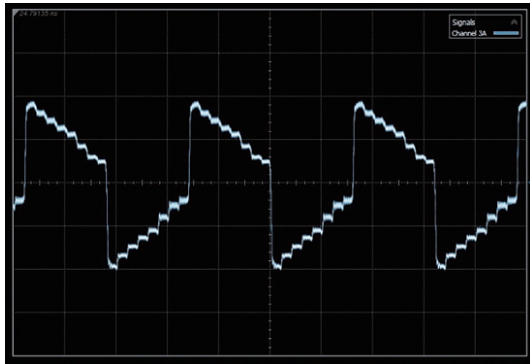


## Strengthened Signal Integrity Evaluations in Addition to New SI PPG, SI ED and Noise Generator Modules

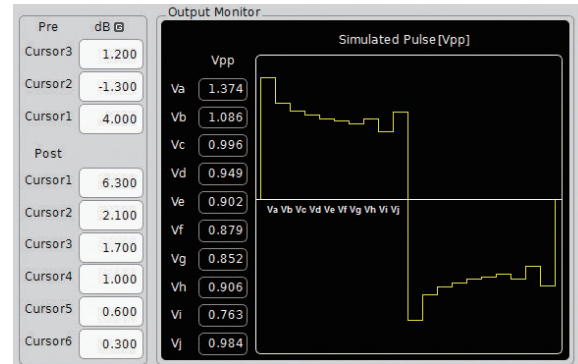
Emphasis and equalizer functions are built-in to correct transmission path losses and assure signal integrity as signals become faster and as high-speed devices use lower signal levels to help reduce power consumption.

### 10Tap Emphasis

The 10Tap Emphasis option installed in the transmission-side 21G/32 Gbit/s SI PPG MU195020A can accurately replay simulated waveforms for various devices and channels (corrected for loss after passage through channel) to help improve design efficiency.



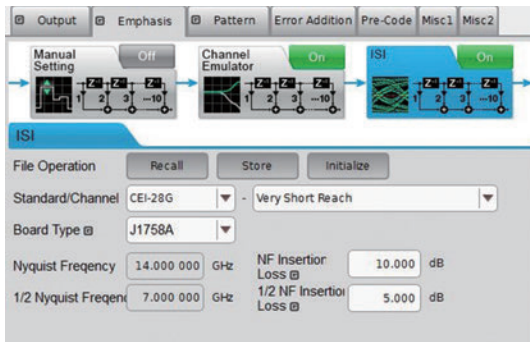
Waveform adjustment using 10Tap Emphasis Function



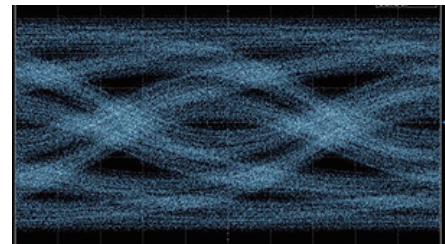
Emphasis Setting Screen Example

Additionally, the Variable ISI (option) can generate a signal with simulated Loss between the Tx and Rx channels of high-speed devices by setting the channel Loss for the frequencies defined in CEI-28 G/25G and the S-parameter information, and can also easily output a Loss-corrected waveforms. As a result, channel-Loss dependent high-speed device performance tests can be run easily with good reproducibility without needing to prototype multiple channel boards, helping cut development time.

✱ For Variable ISI (option), use either in combination with ISI Board J1758A (select J1758A) or in combination with external channel board (select Not Specified).



ISI Setting Screen Example

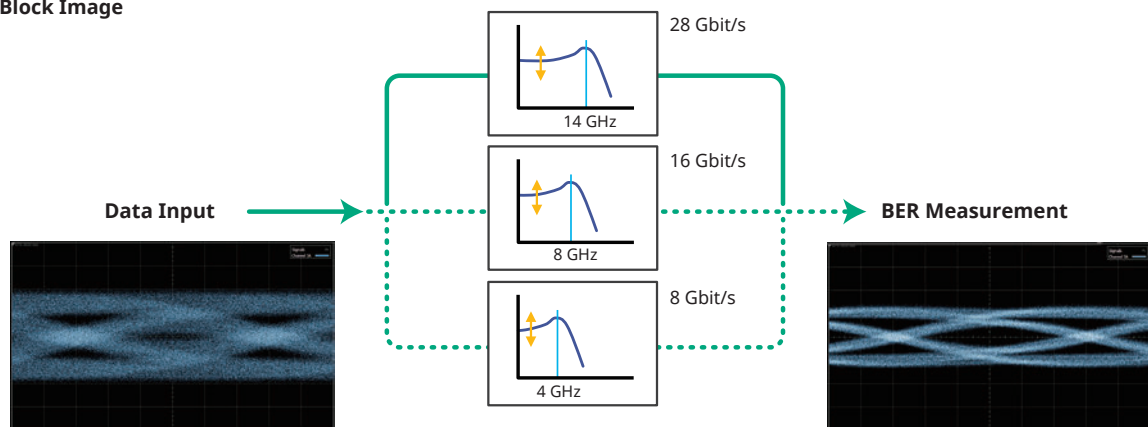


ISI, CEI-28G, 14 dB Loss waveform (typical)

### Multi-band CTLE

Installing the CTLE option supporting multi-band input signals of 28, 16, and 8 Gbit/s at the receive-side of the 21G/32G bit/s SI ED MU195040A permits BER measurements even when the Eye is closed by transmission path losses. Since this CTLE function is a hardware equalizer rather than the software emulator, it supports evaluation of TRx BER performance under near-to-live conditions, such as BER evaluation of test signals, and comparison of DUT BER measurement results.

#### 3-band CTLE Block Image

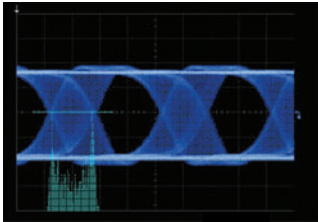


Waveform after passage through 28 Gbit/s, -10 dB @ 14 GHz channel

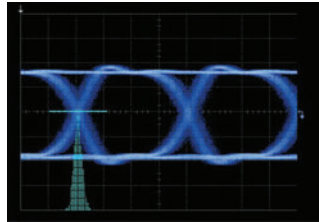
28 Gbit/s open Eye waveform using CTLE

## Jitter/Noise Addition

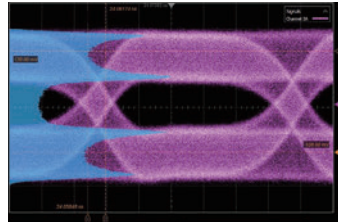
To perform DUT receiver stressed input tolerance tests, the BER is measured under the worst conditions using a stressed signal with added jitter and voltage noise. Using the MP1900A series with the Jitter Modulation Source MU181500B, Jitter Tolerance Test MX183000A-PL001 software, and Noise Generator MU195050A for adding CM/DM/White Noise supports receiver tolerance tests in conformance with the various interface standards. The MP1900A series offers strong support for receiver stressed input tolerance tests by generating high-quality signals before jitter and noise addition as well as for adding high-linearity jitter and noise.



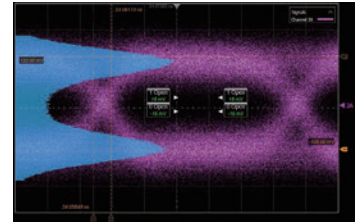
Sinusoidal Jitter (SJ)



Random Jitter (RJ)



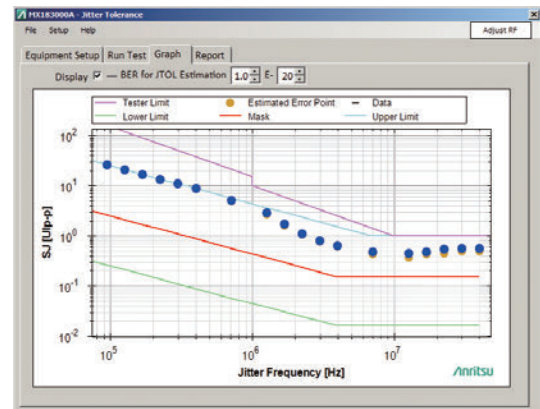
CM/DM Noise



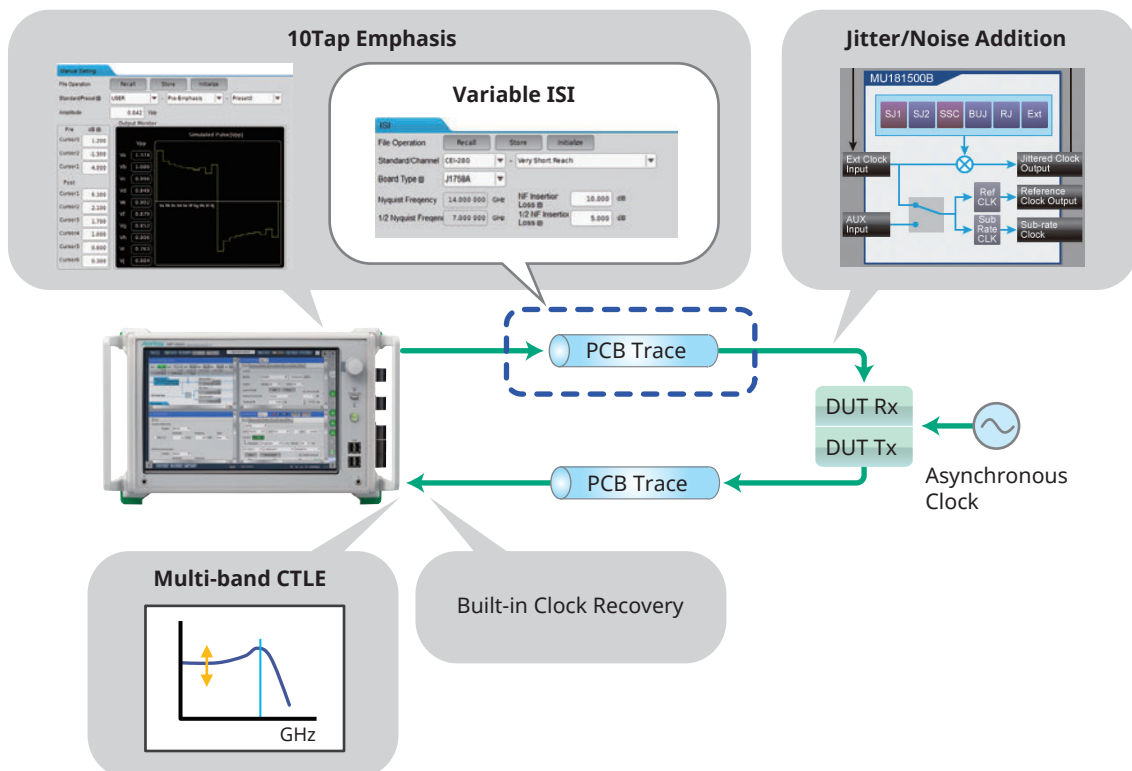
White Noise

## Jitter Tolerance Test Function (MX183000A-PL001)

- High-versatility Jitter Tolerance measurements
- PHY Device Jitter Tolerance tests by impressing SJ/RJ/BUJ
- Standards-compliant Mask measurements
- Fast measurement times using low error rate estimation function, such as  $1E-12$  and  $1E-15$
- Tolerance measurements versus device characteristics using four Binary, Upward, Downward, Binary + Linear methods



Low Error Rate Estimation BER Measurements



## Link Training

The PCI Express and 10 Gbit/s USB3.1 standards require PHY layer tests such as Jitter Tolerance tests on an established Link to assure interconnectivity between the host and device. Additionally, it is necessary to determine whether the cause is a physical or logical fault at a Link fault.

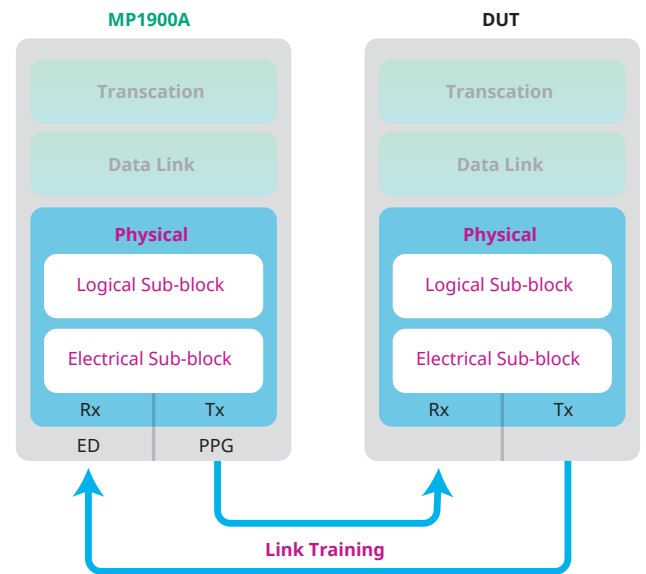
The MP1900A PCI Express/USB functions have Protocol Awareness with a Link Training function required for evaluating the PHY layer as well as an analysis function for detecting each LTSSM state transition to help troubleshoot faults.

These all-in-one functions facilitate efficient PHY layer evaluation of PCIe Gen1 to Gen5\* and USB3.1 receivers through inspection and fault troubleshooting.

Moreover, combination with the Jitter Tolerance Measurement function (MX183000 A-PL001) supports consistent receiver tests of high-speed serial interfaces.

LTSSM: Link Training Status State Machine

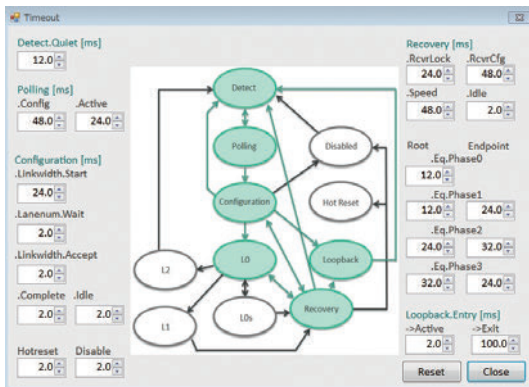
✧ Anritsu is an active member of PCI-SIG and is fully engaged in helping establish new PCI Express specifications. Anritsu provides PCI Express Gen5 pattern generation tools to PCI-SIG members to support future PCIe Gen5 implementation. Contact our sales representative for more details.



Supports physical layer measurements of add-in cards and system boards

- Tx/Rx Link Equalization Response Test
- Rx Link Equalization Test
- Receiver Jitter Tolerance Test

### PCI Express Link Training (MX183000A-PL021)

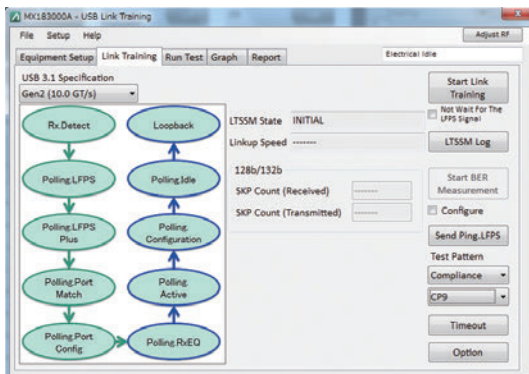


PCIe Link Training State Transition

| Time [ns] | ΔTime [ns] | State             | Speed[GT/s] | Detect Preset | Error Count | Link Preset | Pre-cut | Counter | Post-counter | Detail                  |
|-----------|------------|-------------------|-------------|---------------|-------------|-------------|---------|---------|--------------|-------------------------|
| 0         | 0          | INITIAL           | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 00 00 00 00 00 00 00 |
| 17280     | 17280      | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 01 00 00 00 00 00 00 |
| 12017280  | 12000000   | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 02 00 00 00 00 00 00 |
| 12017296  | 16         | POLLING_ACTIVE_S1 | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 03 00 00 00 00 00 00 |
| 12017286  | 24000000   | INITIAL           | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 04 00 00 00 00 00 00 |
| 12017292  | 16         | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 05 00 00 00 00 00 00 |
| 40017292  | 12000000   | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 06 00 00 00 00 00 00 |
| 40017290  | 16         | POLLING_ACTIVE_S1 | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 07 00 00 00 00 00 00 |
| 72017290  | 24000000   | INITIAL           | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 08 00 00 00 00 00 00 |
| 72017244  | 16         | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 09 00 00 00 00 00 00 |
| 84017244  | 12000000   | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 10 00 00 00 00 00 00 |
| 84017260  | 16         | POLLING_ACTIVE_S1 | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 11 00 00 00 00 00 00 |
| 100017260 | 24000000   | INITIAL           | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 12 00 00 00 00 00 00 |
| 100017276 | 16         | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 13 00 00 00 00 00 00 |
| 100017276 | 12000000   | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 14 00 00 00 00 00 00 |
| 100017296 | 16         | POLLING_ACTIVE_S1 | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 15 00 00 00 00 00 00 |
| 144017296 | 24000000   | INITIAL           | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 16 00 00 00 00 00 00 |
| 144017400 | 16         | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 17 00 00 00 00 00 00 |
| 154017400 | 12000000   | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 18 00 00 00 00 00 00 |
| 154017424 | 16         | POLLING_ACTIVE_S1 | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 19 00 00 00 00 00 00 |
| 160017424 | 24000000   | INITIAL           | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 20 00 00 00 00 00 00 |
| 160017440 | 16         | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 21 00 00 00 00 00 00 |
| 190017440 | 12000000   | DETECT_ACTIVE     | 16.0        | ---           | ---         | ---         | ---     | ---     | ---          | 00 22 00 00 00 00 00 00 |

LTSSM Log of each LTSSM State Transition

### USB Link Training (MX183000A-PL022)



USB Link Training State Transition

| Time [ns]  | ΔTime [ns] | State                     | Speed[GT/s] | Detail                  |
|------------|------------|---------------------------|-------------|-------------------------|
| 0          | 6,945,704  | INITIAL                   | 10.0        | 00 00 00 00 00 00 00 00 |
| 6,945,704  | 24         | DETECT_ACTIVE             | 10.0        | 00 02 00 00 00 00 00 00 |
| 6,945,728  | 69,440     | POLLING_LFS_GCD1          | 10.0        | 00 12 00 00 00 00 00 00 |
| 7,015,168  | 121,888    | POLLING_LFS_PLUS          | 10.0        | 00 14 00 00 00 00 00 00 |
| 7,137,032  | 71,808     | POLLING_LFS_ENDCD1        | 10.0        | 00 18 00 00 00 00 00 00 |
| 7,206,840  | 89,048     | POLLING_PORT_MATCH        | 10.0        | 00 16 00 00 00 00 00 00 |
| 7,297,888  | 110,080    | POLLING_PORT_CONFIG_READY | 10.0        | 00 17 00 00 00 00 00 00 |
| 7,407,968  | 26,896     | POLLING_PORT_ENDCDPM      | 10.0        | 00 18 00 00 00 00 00 00 |
| 7,434,860  | 7,176,248  | POLLING_LINK              | 10.0        | 00 14 00 00 00 00 00 00 |
| 14,612,608 | 2,176      | POLLING_ACTIVE            | 10.0        | 00 18 00 00 00 00 00 00 |
| 14,614,784 | 2,192      | POLLING_CONFIGURATION     | 10.0        | 00 1C 00 00 00 00 00 00 |
| 14,618,878 | 24         | POLLING_IDLE              | 10.0        | 00 10 00 00 00 00 00 00 |
| 14,617,000 | 0          | LOOPBACK_ACTIVE           | 10.0        | 00 04 00 00 00 00 00 00 |

LTSSM Log of each LTSSM State Transition

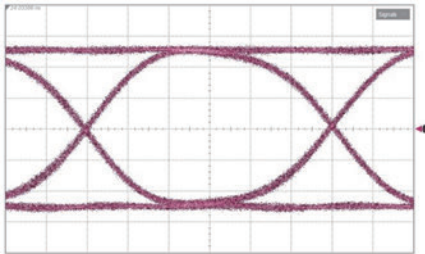
# High Waveform Quality and High Sensitivity

## Low-Noise, High-Quality BERT with Low Intrinsic Jitter Output, High Sensitivity and Wideband Input

Assuring DUT design margins has become an important issue as transmission rates have become faster and PAM4 Signal formats have been introduced. Designers require more accurate evaluations to confirm that adequate margins are maintained. As a result, the impact of uncertainty elements, such as noise and Intrinsic Jitter characteristics of measuring instruments, on results can no longer being ignored. These newly developed best-of-class PPG with lowest-level Intrinsic Jitter and high-sensitivity ED can measure DUT guaranteed margins more accurately to help improve R&D efficiency.

### Low Intrinsic Jitter Data Output PPG

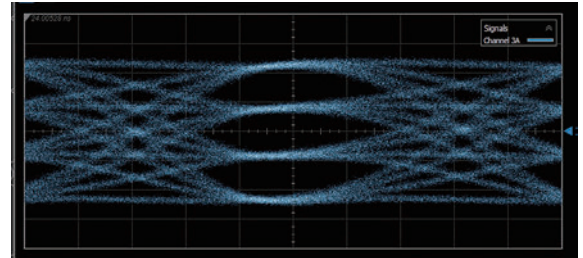
The MU195020A PPG has an Intrinsic Jitter of just 115 fs rms. As a result, it can generate PAM4 waveforms for wide Eye openings.



28.1 Gbit/s PRBS  $2^{31} - 1$   
Typical Output Waveform



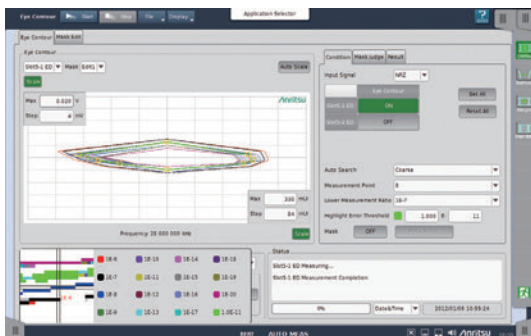
Low intrinsic RJ 115 fs rms



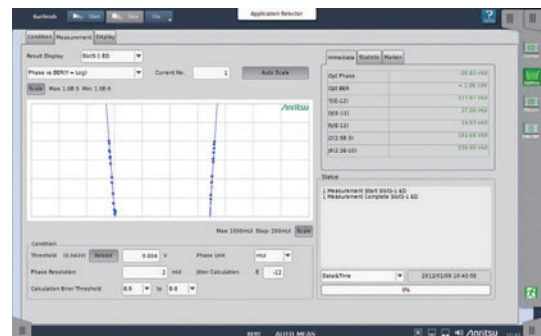
28 Gbaud QPRBS13 Typical Output Waveform  
(Output after G0375A remote head)

## High-Sensitivity, Wideband Input ED

The assured ED input analog bandwidth is 40 GHz. This bandwidth supports evaluation of Eye margin characteristics with high reproducibility even at input of small signals.



Example of Eye Contour Measurement at Input of Small 50 mVp-p Signal



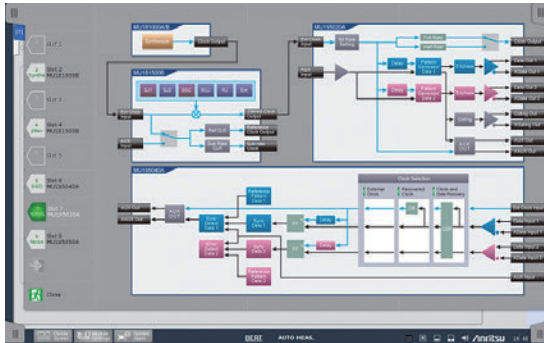
Bathtub Measurement Example

## Easy to Use Operability

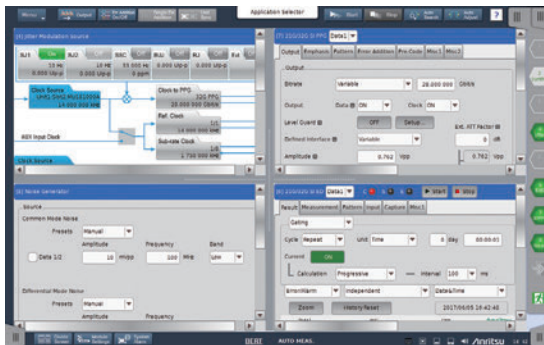
### Improved Operability with New System View, User Interface, and Multi-windows

The MP1900A features easy intuitive operability based on a redesigned GUI and large 12.1-inch touch-panel LCD. Fast mistake-free settings help shorten measurement times.

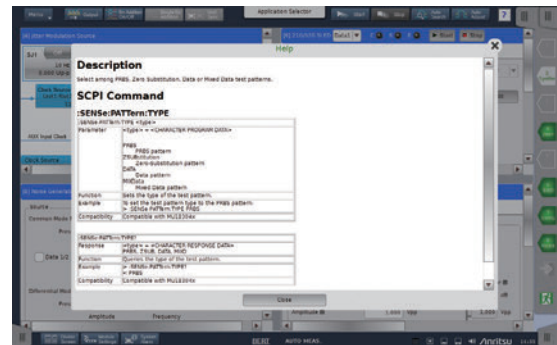
The newly developed system view displays system functions as easy-to-understand blocks, supporting smooth settings and easy operation of each module.



Four split screens help improve the efficiency of multi-channel measurements.

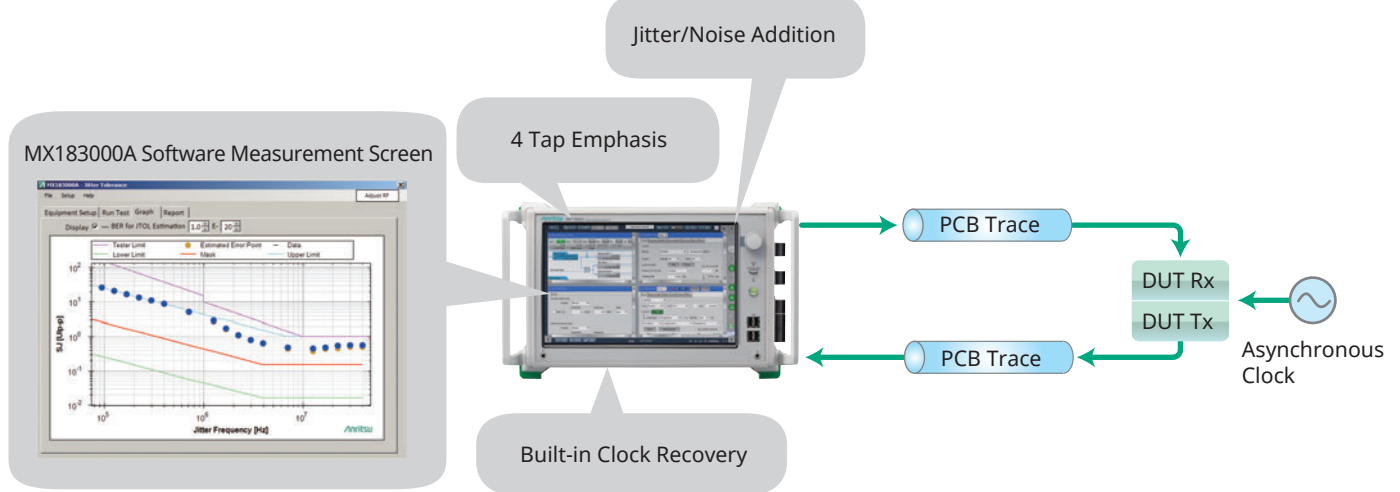


The Help function displays the remote commands corresponding to GUI operations, which simplifies automated system configurations.



# Application Examples

## PAM4 Signal Jitter Tolerance Test using One MP1900A



### Required Items

- PAM4 BER measurement
- Jitter Tolerance Test

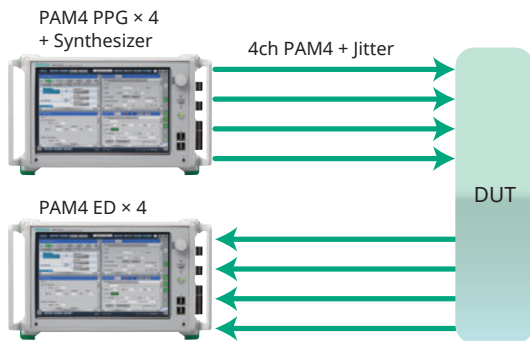
### BER Measurements of 32-Gbaud PAM4 Signals

BER measurements can be performed in real-time using the PAM4 PPG and ED modules with no need for other external equipment\*.

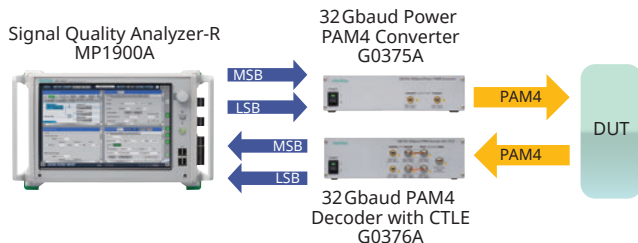
- World-first, all-in-one solution requiring no other external equipment (at October 2018)
- Module with built-in clock recovery (MU196040A-022 option, 25.5 to 32.1G)
- Wide-range Emphasis function (-20 to +20 dB)
- Baud rate of 2.4 Gbaud to 32.1 Gbaud
- High-sensitivity data input (23 mV, Eye height, PAM4)
- Symbol BER evaluation (MU196040A-041 option)

### Jitter Tolerance Test

Testing the DUT receiver input stress tolerance requires BER measurements under severe conditions using a stressed signal with added jitter and noise. The all-in-one MP1900A series supports receiver stress tests for various interface specifications using the Jitter Modulation Source MU181500B for adding SJ, RJ, BUJ, and SSC simultaneously, the Jitter Tolerance Test MX183000A-PL001 software, and the Noise Generator MU195050A for adding CM/DM/White voltage noise. The MP1900A series provides strong support for high-quality signals prior to jitter and noise addition, as well as receiver stressed-signal tolerance tests using high-linearity jitter and noise addition functions.

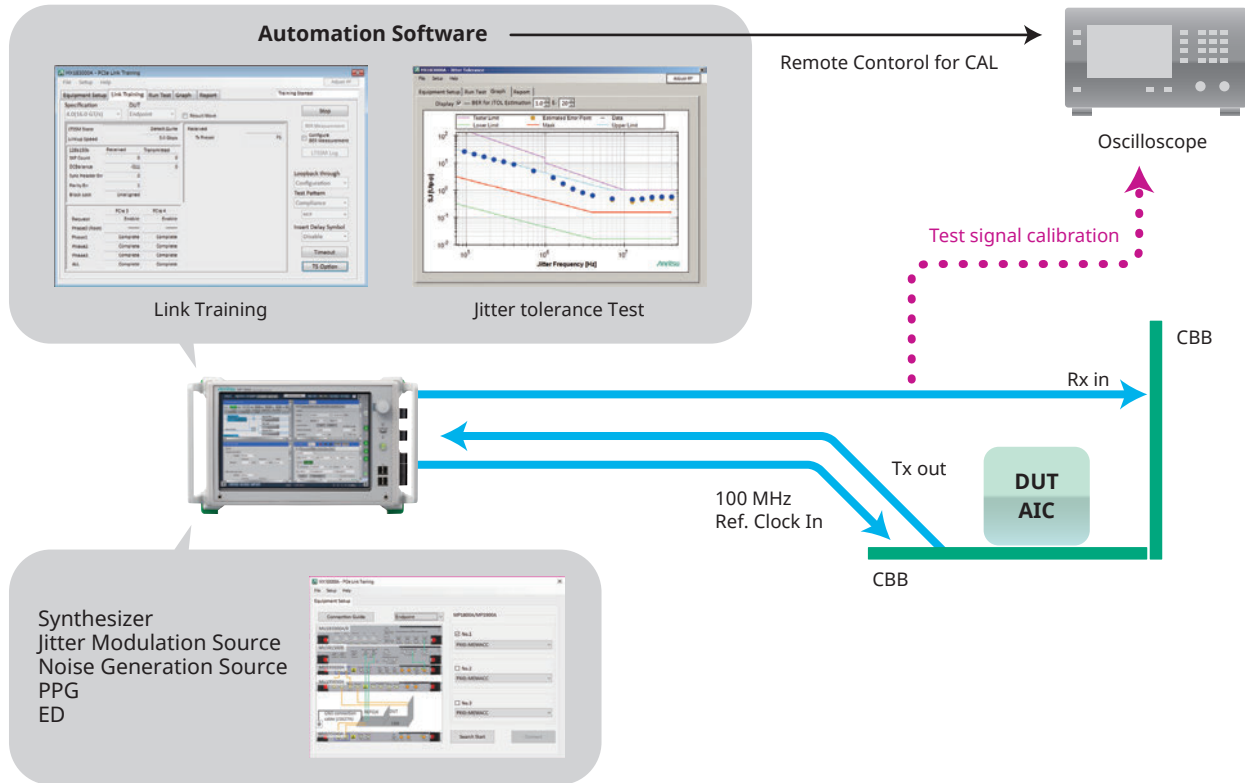


\*: SI PPG/ED modules can be extended to provide a low-cost 32G PAM4 BER measurement solution using the 32 Gbaud Power PAM4 Converter G0375A and 32 Gbaud PAM4 Decoder with CTLE G0376A options.



# Application Examples

## PCIe Gen4 Receiver Test Solution



### Required Items

- Link Training function
- Jitter Tolerance Test
- Emphasis Effect Validation
- Supports Common/Separate Clock Architecture

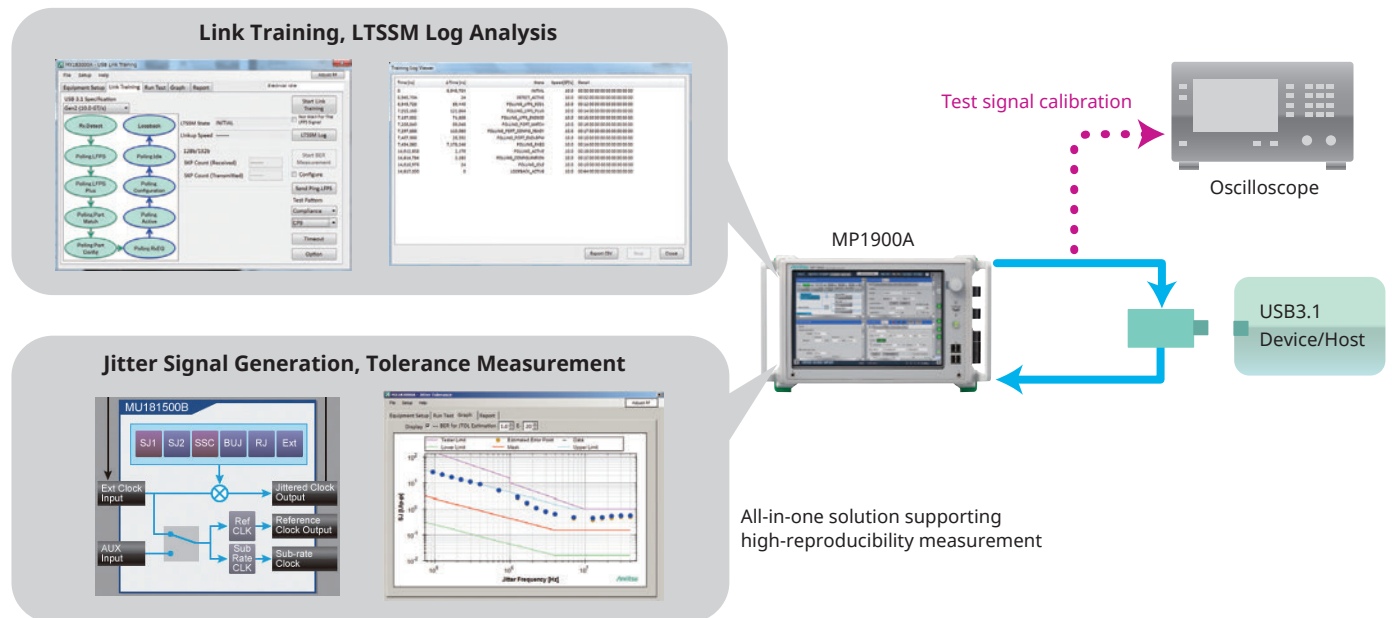
### PCI Express Evaluation Solution Features

- All-in-one support for Protocol Awareness PCIe Gen1 to Gen5 receiver tests
  - Event Trigger Function for Tx/Rx Link Equalization Test
  - 2.4 Gbit/s to 32.1 Gbit/s high-speed BERT
  - Low-intrinsic-jitter and high-quality output waveform, high-sensitivity ED
  - Link Training, Link Equalization and LTSSM analysis functions
  - 10Tap Emphasis function
  - 12 dB CTLE and Clock Recovery functions
  - CMI and DMI Noise addition, and SJ, RJ, BUJ, and SSC Jitter Addition functions
  - Thunderbolt 3, USB3.1, PCI Express Gen5\* support
- \*: Anritsu is an active member of PCI-SIG and is fully engaged in helping establish new PCI Express specifications. Anritsu provides PCI Express Gen5 pattern generation tools to PCI-SIG members to support future PCIe Gen5 implementation. Contact our sales representative for more details.

### Link Training Function

The PCI Express receiver test requires establishment of the Link status using LTSSM before performing the DUT BER test. Installing the PCIe Link Training MX183000A-PL021 option in the MP1900A supports verification of the Link status required for measurement. Additionally, the PCIe Link Training option has an LTSSM Analysis function for troubleshooting problems the Link status cannot be configured.

## USB Receiver Test Solution



### Required Functions

- Loopback State Setting Function
- Jitter Tolerance Function
- Automatic Receiver Test Function
- Link Training Function

### Link Training Function

The Link status required for measurement can be configured automatically using the MX183000A and options.

- The test mode can be transitioned to the Loopback mode required for evaluating USB3.1 Gen1 and Gen2 devices.

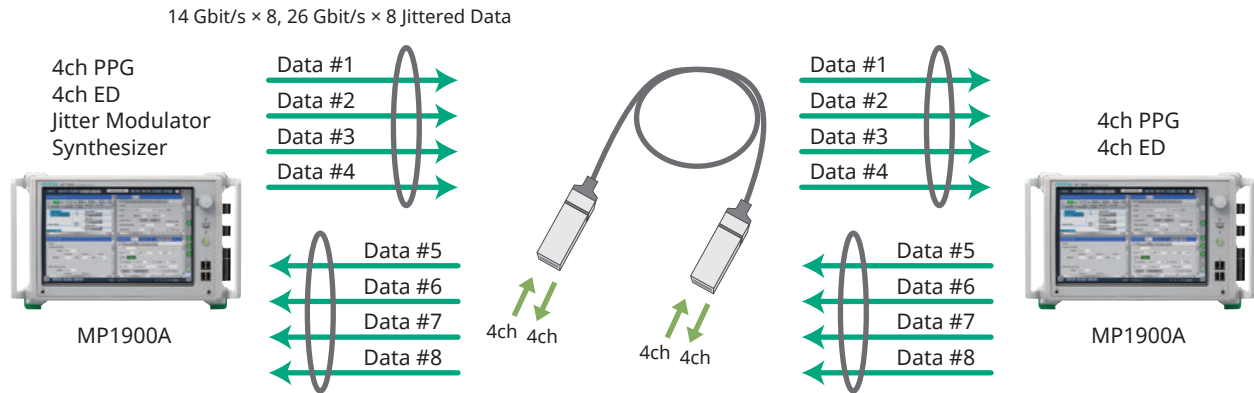
Additionally, the Link Training option (MX183000A-PL022) has an LTSSM Analysis function for troubleshooting problems the Link status cannot be configured.

### Receiver Jitter Tolerance Test

Jitter Tolerance tests can be automated using the MX183000A-PL001 software to help shorten the design validation time.

## Application Examples

### InfiniBand EDR (25.78G) AOC Evaluation



#### Required Test Items

- 8ch (4ch two ways) simultaneous BER measurement
- Crosstalk Test
- Jitter Tolerance Test
- Bathtub Jitter and Eye Diagram Analysis

#### 8ch (4ch two ways) Simultaneous BER Measurement

QSFP Active Optical Cables (AOC) used by InfiniBand, etc., perform simultaneous transmission over a total of 8 channels using two-way transmissions over 4 channels. The MP1900A incorporates 8 channels (8ch PPG + 8ch ED) simultaneously in one main unit and can measure all channels at one time, offering excellent performance and shorter measurement times. Moreover, InfiniBand HDR measurement is also supported using PAM signals.

#### Jitter Tolerance Test

AOCs in data centers are using low input and output amplitude levels to cut power consumption costs, making it important to assure interconnectivity. With its high sensitivity data input and CTLE, the MU195040A supports reception of low-amplitude, low-Eye-opening Data signals and perform high-reproducibility DUT Jitter Tolerance tests.

#### Crosstalk Effect Confirmation

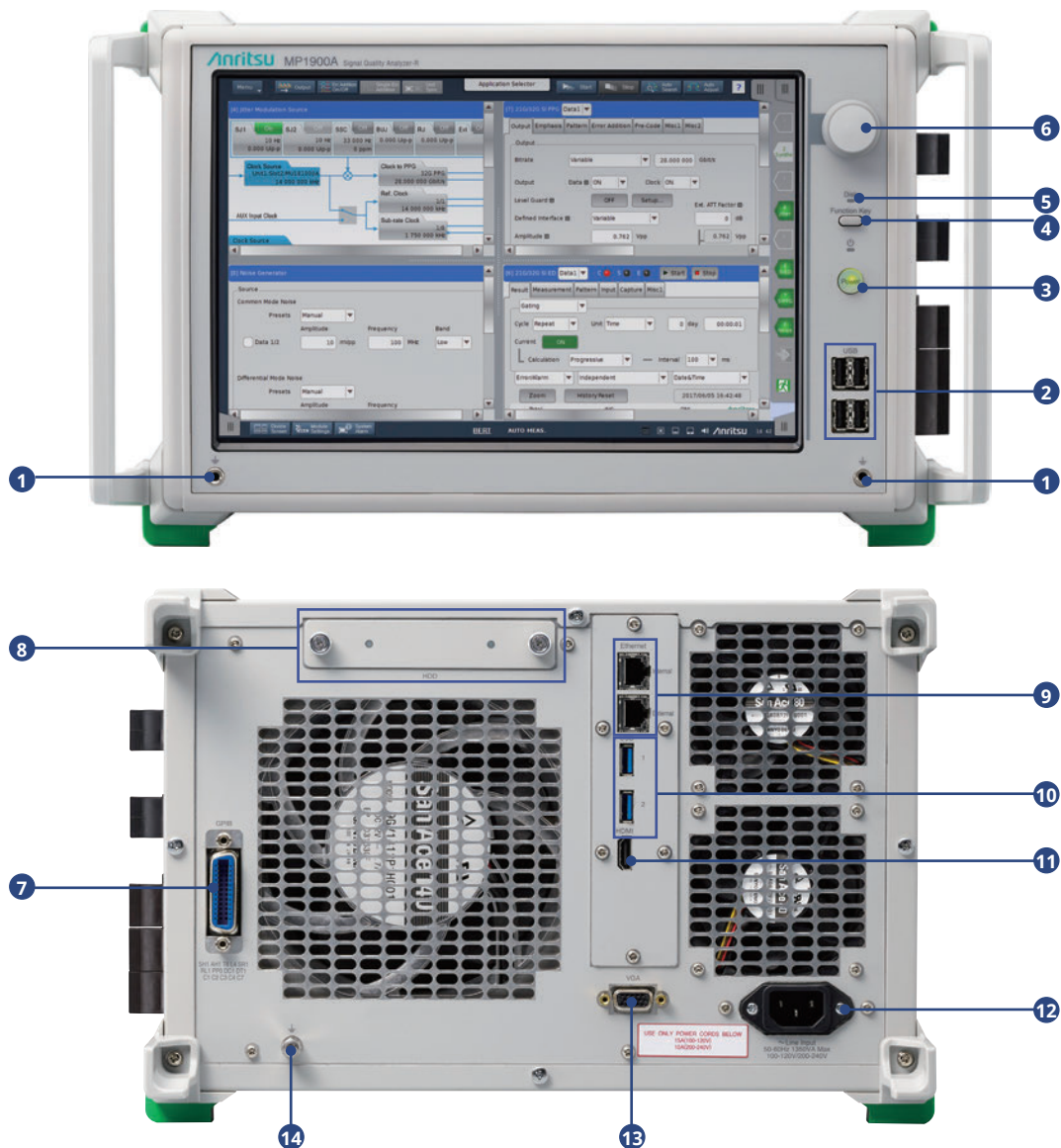
Implementing 20 Gbit/s class transmissions not only requires logic tests but also requires actual equipment verification tests. Since the MP1900A has both pattern synchronization and independent phase tuning for each channel, tests on items such as the effect of AOC crosstalk are implemented easily.

#### Bathtub Jitter and Eye Diagram Analysis

Bathtub Jitter Analysis (separate TJ, RJ, DJ) is supported by the built-in as standard Clock Delay function. Low bit error rates, such as 1E-12 and 1E-15, can also be estimated quickly from the change in bit error rate versus phase.

# Signal Quality Analyzer-R MP1900A Panel Layout

## Front Panel

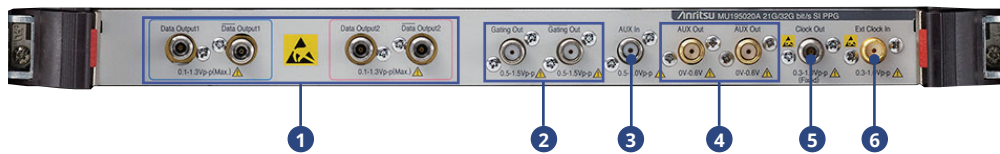


- 1 Ground Jack**  
Wrist strap to discharge static electricity
- 2 USB Port**  
Four USB2 ports for connecting peripherals
- 3 Power Switch**  
Switches power on and off; Standby LED over power switch lights when power cord connected and Power switch set to off
- 4 Function Keys**  
Keys for defining functions using software
- 5 HDD Access LED**  
Lamp that lights during access to built-in HDD
- 6 Rotary Encoder**  
Switch to increase/decrease numeric values by turning knob
- 7 GPIB**  
GPIB Connector
- 8 HDD**  
Slot for secondary 2.5" HDD
- 9 Ethernet Connector**  
External: For Remote Control  
(Internal: Reserved for future function expansion)
- 10 USB Port**  
Two USB 3.0 ports for peripherals
- 11 HDMI**  
HDMI connector for displaying screens on external screen
- 12 Power Inlet**  
Socket for connecting 3-pole power cord to supply 100 V(ac) to 12 V(ac) or 200 V(ac) to 240 V(ac) power
- 13 VGA**  
VGA connector for displaying screens on external screen
- 14 Frame Ground Terminal**  
Terminal for discharging electrostatic charges; connect DUT and common ground using ground strap

# Signal Quality Analyzer-R MP1900A Panel Layout

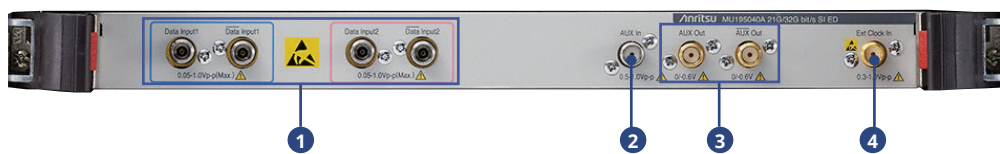
## Modules

### 21G/32G bit/s SI PPG MU195020A



- 1 Data Output,  $\overline{\text{Data}}$  Output**  
Connectors outputting differential Data and  $\overline{\text{Data}}$  signals
- 2 Gating Out,  $\overline{\text{Gating}}$  Out**  
Repeat: Timing signal output  
Burst: Timing signal output used at Burst
- 3 Aux In**  
Auxiliary signal input connector  
Either Error Injection or Burst can be selected.
- 4 Aux Out,  $\overline{\text{Aux}}$  Out**  
Auxiliary signal output connectors  
Output of any of 1/N Clock, Pattern Sync, and Burst2 can be selected.
- 5 Clock Out**  
Clock signal output connector
- 6 Ext Clock In**  
Clock signal input connector

### 21G/32G bit/s SI ED MU195040A

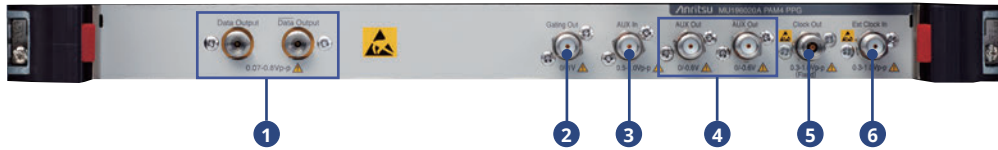


- 1 Data Input,  $\overline{\text{Data}}$  Input**  
Input connectors for Data and  $\overline{\text{Data}}$  signals  
Supports both differential and single inputs  
When the Clock Recovery MU195040A-x22 is installed, the clock is recovered from the signal input to Data Input1.
- 2 Aux In**  
Auxiliary signal input connector  
Any of External Mask, Burst, and Capture External Trigger can be selected.
- 3 Aux Out,  $\overline{\text{Aux}}$  Out**  
Auxiliary signal output connectors  
Any of 1/N Clock, Pattern Sync, Error, Sync Gain can be output.
- 4 Ext Clock In**  
Clock signal input connector

# Signal Quality Analyzer-R MP1900A Panel Layout

## Modules

### PAM4 PPG MU196020A



- 1 Data Output,  $\overline{\text{Data}}$  Output**  
Connectors outputting differential Data and  $\overline{\text{Data}}$  signals
- 2 Gating Out**  
Repeat: Timing signal output  
Burst: Timing signal output used at Burst
- 3 Aux In**  
Auxiliary signal input connector  
Either Error Injection or Burst can be selected.
- 4 Aux Out,  $\overline{\text{Aux}}$  Out**  
Auxiliary signal output connectors  
Output of any of 1/N Clock, Pattern Sync, and Burst2 can be selected.
- 5 Clock Out**  
Clock signal output connector
- 6 Ext Clock In**  
Clock signal input connector

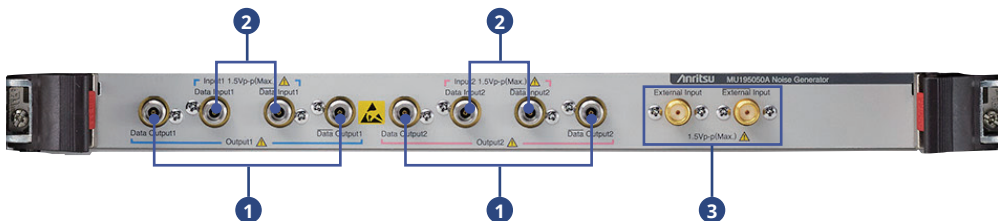
### PAM4 ED MU196040A



- 1 Data Input,  $\overline{\text{Data}}$  Input**  
Input connectors for Data and  $\overline{\text{Data}}$  signals  
Supports both differential and single inputs  
When the Clock Recovery MU196040A-x22 is installed, the clock is recovered from the signal input to Data Input.
- 2 Aux In**  
Auxiliary signal input connector  
Any of External Mask, Burst, and Capture External Trigger can be selected.
- 3 Aux Out,  $\overline{\text{Aux}}$  Out**  
Auxiliary signal output connectors  
Any of 1/N Clock, Pattern Sync, Error, Sync Gain can be output.
- 4 Ext Clock In**  
Clock signal input connector

★ Capture External Trigger function to be supported in future

### Noise Generator MU195050A



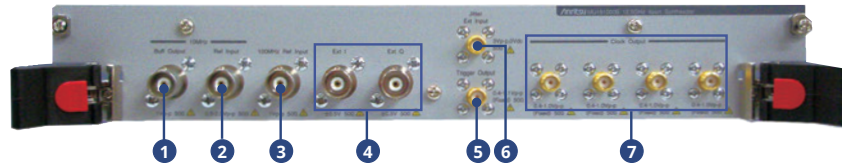
- 1 Data Output,  $\overline{\text{Data}}$  Output**  
Connector for outputting differential Data and  $\overline{\text{Data}}$  Signal with added noise
- 2 Data Input,  $\overline{\text{Data}}$  Input**  
Connector for inputting Data and  $\overline{\text{Data}}$  signal with added noise
- 3 External Input,  $\overline{\text{External}}$  Input**  
External noise input connectors

★ Input2 and Output2 are not used by the MU196020A

# Signal Quality Analyzer-R MP1900A Panel Layout

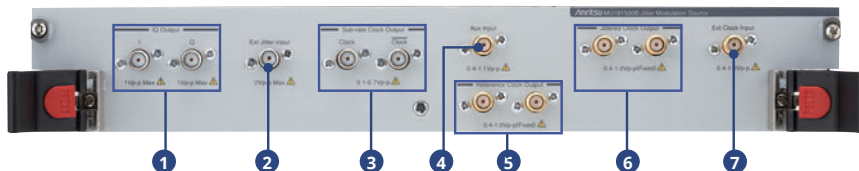
## Modules

### 12.5 GHz 4port Synthesizer MU181000B



- 1 10 MHz Buff Output**  
Output 10 MHz clock for reference
  - 2 10 MHz Ref Input**  
Inputs 10 MHz clock for reference
  - 3 100 MHz Ref Input<sup>\*1</sup>**  
Inputs 100 MHz clock for reference
  - 4 Ext I, Q<sup>\*2</sup>**  
Inputs I, Q signals
  - 5 Trigger Output<sup>\*2</sup>**  
Outputs 1/1 or 1/64 clock frequency
  - 6 Jitter Ext Input<sup>\*2</sup>**  
Inputs modulation signal source
  - 7 Clock Output 1 to 4**  
Outputs clocks
- <sup>\*1</sup>: Only when Jitter Modulation Option (MU181000B-001) or SSC Extension (MU181000B-002) installed  
<sup>\*2</sup>: Only when Jitter Modulation Option installed (MU181000B-001)

### Jitter Modulation Source MU181500B



- 1 IQ Output**  
Outputs IQ signal
- 2 Ext Jitter Input**  
Inputs Jitter Modulation Source
- 3 Sub-rate Clock Output**  
Output either of following input clocks as 1/8 to 1/256 divided differential clock signal  
• Ext Clock Input • Aux Input
- 4 Aux Input**  
Inputs clock signal
- 5 Reference Clock Output**  
Two outputs either of following input clocks as 1/1, 1/2, or 1/4 divided clock  
• Ext Clock Input • Aux Input
- 6 Jittered Clock Output**  
Two outputs jitter modulated clock signal
- 7 Ext Clock Input**  
Inputs external clock

### 28G/32G bit/s PPG (1ch or 2ch) MU183020A



- 1 Data1/Data1 Output<sup>\*3</sup>**  
Output for 1ch differential data signal
  - 2 Data2/Data2 Output<sup>\*4</sup>**  
Output for 2ch differential data signal
  - 3 Gating Output**  
Output for burst timing signal
  - 4 Aux Input**  
Input for auxiliary signal
  - 5 Aux/Aux Output**  
Output for differential auxiliary signal
  - 6 Clock Output**  
Output for clock signal
  - 7 Ext Clock Input**  
Input for external clock signal
- <sup>\*3</sup>: Data/Data when 1ch option was selected.  
<sup>\*4</sup>: Not implemented when 1ch option was selected.

### 28G/32G bit/s High Sensitivity ED (1ch or 2ch) MU183040B



- 1 Data1/Data1 Input<sup>\*5</sup>**  
Input for 1ch differential data signal
  - 2 Data2/Data2 Input<sup>\*6</sup>**  
Input for 2ch differential data signal
  - 3 Aux Input**  
Input for auxiliary signal
  - 4 Aux/Aux Output**  
Output for differential auxiliary signal
  - 5 Ext Clock Input**  
Input for external clock signal
- <sup>\*5</sup>: Data/Data when 1ch option was selected.  
<sup>\*6</sup>: Not implemented when 1ch option was selected.

# Signal Quality Analyzer-R MP1900A Specifications

## Signal Quality Analyzer-R MP1900A

|                              |      |                                                                                                   |
|------------------------------|------|---------------------------------------------------------------------------------------------------|
| LCD                          |      | 12.1" WXGA 1280 × 800                                                                             |
| Remote Interface             |      | GPIO, LAN                                                                                         |
| Module Slots                 |      | 8                                                                                                 |
| External Equipment Interface |      | USB × 6, VGA × 1, HDMI × 1                                                                        |
| OS                           |      | Window Embedded Standard 7                                                                        |
| Power Supply                 |      | 100 V(ac) to 120 V(ac), 200 V(ac) to 240 V(ac), 50 Hz to 60 Hz<br>Power consumption: 1350 VA max. |
| Dimensions and Mass          |      | 340 (W) × 222.5 (H) × 451 (D) mm, 20 kg (excluding modules)                                       |
| CE                           | EMC  | 2014/30/EU, EN61326-1, EN61000-3-2                                                                |
|                              | LVD  | 2014/35/EU, EN61010-1                                                                             |
|                              | RoHS | 2011/65/EU, EN50581                                                                               |

## 12.5 GHz 4 Port Synthesizer MU181000B

|                                                                 |                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clock Output                                                    | Number of Output: 4<br>Frequency Range: 0.1 GHz to 12.5 GHz, Steps: 1 kHz/1 MHz<br>Level: 0.4 Vp-p to 1 Vp-p (AC)<br>Connector: SMA (f), Termination: 50Ω/GND                                                                                                  |
| 10 MHz Input                                                    | Frequency: 10 MHz ±10 ppm<br>Level: 0.5 Vp-p to 2.0 Vp-p<br>Connector: BNC, Termination: 50Ω/GND                                                                                                                                                               |
| 10 MHz Output                                                   | Level: 1.0 Vp-p ±30% (AC)<br>Connector: BNC, Termination: 50Ω/GND                                                                                                                                                                                              |
| 100 MHz Reference Signal Input<br>(SSC Extension MU181000B-002) | Outputs either 100 MHz with phase deviation x25, x50, or x80 frequency-multiplied clock from Clock Output connector<br>Supports PCI Express Host Refclk input<br>Modulation Frequency: 30 kHz to 33 kHz<br>Level: 0.15 Vp-p to 1.3 Vp-p (AC)<br>Connector: BNC |

## Jitter Modulation Source MU181500B

|                                      |                                                                                                                                                                                                                                                                                                              |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| External Clock Input                 | Frequency Range: 0.800 000 GHz to 15.000 000 GHz<br>Amplitude: 0.4 Vp-p to 1.0 Vp-p<br>Connector: SMA (f), Termination: 50Ω/AC Coupling                                                                                                                                                                      |
| Jittered Clock Output                | Number of Output: 2<br>Amplitude: 0.4 Vp-p to 1.0 Vp-p<br>Connector: SMA (f), Termination: 50Ω/AC Coupling                                                                                                                                                                                                   |
| SJ1                                  | Modulation Frequency: 10 Hz to 250 MHz<br>Amplitude: 0 to 2000 UI @Modulation Frequency 10 kHz to 100 kHz<br>0 to 1 UI @Modulation Frequency 10 MHz to 250 MHz (Different depending on the operating bit rate)                                                                                               |
| Built-in SJ2                         | Modulation Frequency: 33 kHz, 87 MHz, 100 MHz, 210 MHz                                                                                                                                                                                                                                                       |
| Spread Spectrum Clocking<br>(SSC)    | Modulation Frequency: 28 kHz to 37 kHz<br>Deviation: 0 to 7000 ppm                                                                                                                                                                                                                                           |
| Random Jitter (RJ)                   | Bandwidth: 10 kHz to 1 GHz<br>Amplitude: 0 to 0.5 UI (Different depending on the operating frequency)                                                                                                                                                                                                        |
| Bounded Uncorrelated Jitter<br>(BUJ) | PRBS Pattern Length: $2^n - 1$ (n = 7, 9, 11, 15, 23, or 31)<br>BUJ Rate: 0.1 Gbit/s to 3.2 Gbit/s, 4.9 Gbit/s to 6.25 Gbit/s, 9.8 Gbit/s to 12.5 Gbit/s<br>Filter Type (LPF 3 dB Bandwidth): 50, 100, 200, 300, 500 MHz, Through<br>Amplitude: 0 to 0.5 UI (Different depending on the operating frequency) |
| External Jitter                      | Bandwidth: 10 kHz to 1 GHz                                                                                                                                                                                                                                                                                   |

## Noise Generator MU195050A

|                              |                                   |
|------------------------------|-----------------------------------|
| Number of Channels           | 2                                 |
| Insertion Loss               | -3 dB                             |
| CMI: Common Mode Noise       | 0.1 GHz to 6 GHz: Sinusoidal wave |
| DMI: Differential Mode Noise | 2 GHz to 10 GHz: Sinusoidal wave  |
| White Noise                  | 10 MHz to 10 GHz                  |
| Crest Factor                 | >5                                |

## Signal Quality Analyzer-R MP1900A Specifications

### 21G/32G bit/s SI PPG MU195020A

|                         |                                                                                                                                                                                                                                                                          |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation Bit Rate      | 2.4 Gbit/s to 21 Gbit/s or 32.1 Gbit/s                                                                                                                                                                                                                                   |
| Number of Channels      | 1 or 2                                                                                                                                                                                                                                                                   |
| Output Amplitude        | 0.1 Vp-p to 1.3 Vp-p (Single-end)<br>0.2 Vp-p to 2.6 Vp-p (Differential)                                                                                                                                                                                                 |
| Emphasis                | 10Tap                                                                                                                                                                                                                                                                    |
| Channel Emulator        | Normal: Emulates Insertion Loss using S-parameter data<br>Inverse: Performs De-Emphasis compensation for S-parameter Insertion Loss<br>S-Parameter file: S2P,S4P                                                                                                         |
| ISI                     | Emulates ISI output using CEI-28G/25G Nyquist frequency loss setting<br>Supports loss control in combination with ISI Board J1758A accessory<br>Insertion Loss setting: 1.5 to 25 dB, 0.01 dB step, Nyquist frequency<br>0 to 25 dB, 0.01 dB step, 1/2 Nyquist frequency |
| Tr/Tf (20 to 80%)       | 12 ps (typ.)                                                                                                                                                                                                                                                             |
| Random Jitter           | 115 fs rms (typ.)                                                                                                                                                                                                                                                        |
| PCIe, USB Link Training | Supported (MX183000A-PL021, MX183000A-PL022)                                                                                                                                                                                                                             |
| I/O Connectors          | K (f)                                                                                                                                                                                                                                                                    |

### 21G/32G bit/s SI ED MU195040A

|                         |                                                                                        |
|-------------------------|----------------------------------------------------------------------------------------|
| Operation Bit Rate      | 2.4 Gbit/s to 21 Gbit/s or 32.1 Gbit/s                                                 |
| Number of Channels      | 1 or 2                                                                                 |
| Input Attitude          | 0.05 Vp-p to 1.0 Vp-p (Single-End)<br>0.1 Vp-p to 2.0 Vp-p (Differential)              |
| Input Sensitivity       | 15 mV (Eye Height 28.1 Gbit/s, NRZ)<br>30 mV/Eye (Eye Height 28.1 Gbaud, PRBS15, PAM4) |
| CTLE                    | Peak Frequency: 14, 8, 4 GHz<br>Gain: 0 to -12 dB                                      |
| Clock Recovery          | Yes, supports SSC                                                                      |
| PCIe, USB Link Training | Supported (MX183000A-PL021, MX183000A-PL022)                                           |
| I/O Connectors          | K (f)                                                                                  |

### PAM4 PPG MU196020A

|                                   |                                                                                                                                                                                                                                    |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation Rate (PAM4/NRZ)         | 2.4 Gbaud to 32.1/58.2/64.2 Gbaud (option selection)                                                                                                                                                                               |
| No. of Channels                   | 1                                                                                                                                                                                                                                  |
| Output Amplitude                  | 70 mVp-p to 800 mVp-p (Single-end)<br>140 mVp-p to 1600 mVp-p (Differential)                                                                                                                                                       |
| Offset                            | -2 V to +3.3 V                                                                                                                                                                                                                     |
| Emphasis                          | 4 Tap, -20 to +20 dB                                                                                                                                                                                                               |
| Channel Emulator                  | Generates waveform with insertion loss and simulates waveform with corrected insertion loss<br>Set by loading S-Parameter file (S2 P, S4 P)                                                                                        |
| ISI                               | Simulates ISI generation waveform<br>Set using loss (-8.00 to 8.00 dB) at CEI-specified Nyquist frequency<br>Used in combination with channel board, such as J1800A/J1758A (optional accessories parts), or Noise Module MU195050A |
| Independently Variable PAM4 3 Eye | 20 to 50% (PAM4 Amplitude 0/3 level = 100%)                                                                                                                                                                                        |
| PAM4 Pattern                      | SSPRQ, PRBS13Q, PRBS31Q, RS-FEC, etc.                                                                                                                                                                                              |
| PAM4 Pattern Error Addition       | MSB Error, LSB Error, LSB&MSB Error, RS-FEC Symbol Error                                                                                                                                                                           |
| Tr/Tf (20 to 80%)                 | 8.5 ps (typ., NRZ)                                                                                                                                                                                                                 |
| Random Jitter                     | 170 fs rms (typ., NRZ)                                                                                                                                                                                                             |
| I/O Connector                     | V (f)                                                                                                                                                                                                                              |

### PAM4 ED MU196040A

|                           |                                                                                                 |
|---------------------------|-------------------------------------------------------------------------------------------------|
| Operation Rate (PAM4/NRZ) | 2.4 Gbaud to 32.1 Gbaud                                                                         |
| No. of Channels           | 1                                                                                               |
| Input Amplitude           | PAM4: 300 mVp-p to 1000 mVp-p<br>NRZ: 50 mVp-p to 1000 mVp-p                                    |
| Input Sensitivity         | PAM4: 23 mV (typ., PRBS31, Eye height for each Eye, 26.5625 Gbaud)<br>NRZ: 23 mV (typ., PRBS31) |
| Stressed Margin           | BER < 1E-12*                                                                                    |
| Clock Recovery            | Yes (25.5G to 32.1G)                                                                            |
| PAM4 Pattern              | SSPRQ, PRBS13Q, PRBS31Q, etc.                                                                   |
| PAM4 Counter              | MSB/LSB, Symbol 0 to 3                                                                          |
| I/O Connector             | K (f)                                                                                           |

\*: At input of PAM4 Stressed waveform equivalent to CEI-56 G-VSR

Refer to the MP1900A Data Sheet for detailed specifications.  
Refer to the MP1800A Brochure about the other modules.

## Signal Quality Analyzer-R MP1900A Application

| Category             | Model/Name                                | 21G or 32.1G<br>1ch BERT | 32G Interconnects,<br>Signal Integrity/<br>Measurement | PCI Express<br>Gen3/4<br>Base spec, CEM | USB3.1<br>Rx Test | 100 GbE 4ch<br>Backplanes/<br>AOC |
|----------------------|-------------------------------------------|--------------------------|--------------------------------------------------------|-----------------------------------------|-------------------|-----------------------------------|
| Main Frame           | MP1900A<br>Signal Quality Analyzer-R      | 1                        | 1                                                      | 1                                       | 1                 | 2                                 |
| Synthesizer          | MU181000B<br>12.5 GHz 4 Port Synthesizer  | 1                        | 1                                                      | 1                                       | 1                 | 1                                 |
|                      | MU181000B-001<br>Jitter Modulation Source |                          |                                                        |                                         |                   |                                   |
|                      | MU181000B-002<br>SSC Extension            |                          |                                                        | 1                                       |                   |                                   |
| Jitter<br>Modulation | MU181500B<br>Jitter Modulation Source     |                          | 1                                                      | 1                                       | 1                 | 1                                 |
| 21G/32G PPG          | MU195020A<br>21G/32G bit/s SI PPG         | 1                        | 1                                                      | 1                                       | 1                 | 2                                 |
|                      | MU195020A-001<br>32G bit/s Extension      | (1)                      | 1                                                      |                                         |                   | 2                                 |
|                      | MU195020A-010<br>1ch Data Output          | 1                        | 1                                                      | 1                                       | 1                 |                                   |
|                      | MU195020A-020<br>2ch Data Output          |                          |                                                        |                                         |                   | 2                                 |
|                      | MU195020A-011<br>1ch 10Tap Emphasis       |                          | 1                                                      | 1                                       | 1                 |                                   |
|                      | MU195020A-021<br>2ch 10Tap Emphasis       |                          |                                                        |                                         |                   | 2                                 |
|                      | MU195020A-030<br>1ch Data Delay           |                          |                                                        |                                         |                   |                                   |
|                      | MU195020A-031<br>2ch Data Delay           |                          |                                                        |                                         |                   | 2                                 |
|                      | MU195020A-040<br>1ch Variable ISI         |                          | 1                                                      |                                         |                   |                                   |
|                      | MU195020A-041<br>2ch Variable ISI         |                          |                                                        |                                         |                   | 2                                 |
|                      |                                           |                          |                                                        |                                         |                   |                                   |
| 21G/32G ED           | MU195040A<br>21G/32G bit/s SI ED          | 1                        | 1                                                      | 1                                       | 1                 | 2                                 |
|                      | MU195040A-001<br>32G bit/s Extension      | (1)                      | 1                                                      |                                         |                   | 2                                 |
|                      | MU195040A-010<br>1ch ED                   | 1                        | 1                                                      | 1                                       | 1                 |                                   |
|                      | MU195040A-020<br>2ch ED                   |                          |                                                        |                                         |                   | 2                                 |
|                      | MU195040A-011<br>1ch CTLE                 |                          | 1                                                      | 1                                       | 1                 |                                   |
|                      | MU195040A-021<br>2ch CTLE                 |                          |                                                        |                                         |                   | 2                                 |
|                      | MU195040A-022<br>Clock Recovery           |                          | 1                                                      | 1                                       | 1                 | 2                                 |
| Voltage Noise        | MU195050A<br>Noise Generator              |                          | 1                                                      | 1                                       | 1*                | 2                                 |
|                      | MU195050A-001<br>White Noise              |                          |                                                        |                                         |                   | 2                                 |
| Software             | MX183000A-PL001<br>Jitter Tolerance Test  |                          | 1                                                      | 1                                       | 1                 | 1                                 |
|                      | MX183000A-PL011<br>PCIe Link Sequence     |                          |                                                        | 1                                       |                   |                                   |
|                      | MX183000A-PL021<br>PCIe Link Training     |                          |                                                        | 1                                       |                   |                                   |
|                      | MX183000A-PL022<br>USB Link Training      |                          |                                                        |                                         | 1                 |                                   |

★: Not required when using Pick Off Tee J1510A (2 pcs).

## Signal Quality Analyzer-R MP1900A 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.

### MP1900A

| Model/Order No. | Name                                           |
|-----------------|------------------------------------------------|
| MP1900A         | <b>Main Frame</b><br>Signal Quality Analyzer-R |
|                 | <b>Standard Accessories</b>                    |
| G0342A          | ESD DISCHARGER: 1                              |
| J1211           | POWER CORD. 3M: 1                              |
| J1627A          | GND connection cable: 1                        |
| P0031A          | USB Memory: 1                                  |
| Z0306A          | Wrist Strap: 1                                 |
|                 | <b>Maintenance Service</b>                     |
| MP1900A-ES310   | Three Years Extended Warranty Service          |
| MP1900A-ES510   | Five Years Extended Warranty Service           |

### MU181000B\*1

| Model/Order No. | Name                                           |
|-----------------|------------------------------------------------|
| MU181000B       | <b>Module</b><br>12.5 GHz 4port Synthesizer    |
|                 | <b>Standard Accessories</b>                    |
| J1624A          | Coaxial Cable 0.3 m (SMA, DC to 18 GHz): 4 pcs |
|                 | <b>Option</b>                                  |
| MU181000B-001   | Jitter Modulation                              |
| MU181000B-002   | SSC Extension                                  |
|                 | <b>Retrofit Option</b>                         |
| MU181000B-101   | Jitter Modulation Retrofit                     |
| MU181000B-102   | SSC Extension Retrofit                         |
|                 | <b>Maintenance Service</b>                     |
| MU181000B-ES310 | Three Years Extended Warranty Service          |
| MU181000B-ES510 | Five Years Extended Warranty Service           |

### MU181500B\*1

| Model/Order No. | Name                                          |
|-----------------|-----------------------------------------------|
| MU181500B       | <b>Module</b><br>Jitter Modulation Source     |
|                 | <b>Standard Accessories</b>                   |
| J1624A          | Coaxial Cable 0.3 m (SMA, DC to 18 GHz): 1 pc |
| J1508A          | BNC-SMA Connector Cable (30 cm): 2 pcs        |
| J1137           | Terminator: 6 pcs                             |
| J1341A          | Open: 2 pcs                                   |
| Z0897A          | MP1800A Manual CD: 1 pc                       |
| Z0918A          | MX180000A Software CD: 1 pc                   |
|                 | <b>Maintenance Service</b>                    |
| MU181500B-ES310 | Three Years Extended Warranty Service         |
| MU181500B-ES510 | Five Years Extended Warranty Service          |

### MU195050A

| Model/Order No. | Name                                                                                                             |
|-----------------|------------------------------------------------------------------------------------------------------------------|
| MU195050A       | <b>Module</b><br>Noise Generator                                                                                 |
|                 | <b>Standard Accessories</b>                                                                                      |
| J1632A          | Terminator: 4                                                                                                    |
| J1359A          | Coaxial Adapter (K-P, K-J, SMA): 4                                                                               |
| J1717A          | COAXIAL ADAPTOR (SMA-P, SMA-J): 2                                                                                |
| J1341A          | Open: 6                                                                                                          |
| J1746A          | Skew Match Pair Semrigid Cable<br>(K connector, Data Input1): 1 set                                              |
| J1747A          | Skew Match Pair Semrigid Cable<br>(K connector, Data Input2): 1 set                                              |
| J1792A          | Skew Match Pair Semrigid Cable<br>(V-K connector, MU196020A PPG Output to<br>MU195050A Noise Data Input1): 1 set |
|                 | <b>Option</b>                                                                                                    |
| MU195050A-001   | White Noise                                                                                                      |
|                 | <b>Retrofit Option</b>                                                                                           |
| MU195050A-101   | White Noise Retrofit                                                                                             |
|                 | <b>Maintenance Service</b>                                                                                       |
| MU195050A-ES310 | Three Years Extended Warranty Service                                                                            |
| MU195050A-ES510 | Five Years Extended Warranty Service                                                                             |

## Signal Quality Analyzer-R MP1900A Ordering Information

### MU195020A

| Model/Order No. | Name                                                                |
|-----------------|---------------------------------------------------------------------|
| MU195020A       | <b>Module</b><br>21G/32G bit/s SI PPG                               |
| J1632A          | <b>Standard Accessories</b><br>Terminator: 5                        |
| J1341A          | Open: 2                                                             |
| J1359A          | Coaxial Adapter (K-P, K-J, SMA): 1                                  |
| J1717A          | COAXIAL ADAPTOR (SMA-P, SMA-J): 6                                   |
| MU195020A-001   | <b>Option</b><br>32G bit/s Extension                                |
| MU195020A-010   | 1ch Data Output                                                     |
| MU195020A-020   | 2ch Data Output                                                     |
| MU195020A-011   | 1ch 10Tap Emphasis                                                  |
| MU195020A-021   | 2ch 10Tap Emphasis                                                  |
| MU195020A-030   | 1ch Data Delay                                                      |
| MU195020A-031   | 2ch Data Delay                                                      |
| MU195020A-040   | 1ch Variable ISI                                                    |
| MU195020A-041   | 2ch Variable ISI                                                    |
| MU195020A-101   | <b>Retrofit Options</b><br>32G bit/s Extension Retrofit             |
| MU195020A-120   | 2ch Data Output Retrofit                                            |
| MU195020A-111   | 1ch 10Tap Emphasis Retrofit                                         |
| MU195020A-121   | 2ch 10Tap Emphasis Retrofit                                         |
| MU195020A-130   | 1ch Data Delay Retrofit                                             |
| MU195020A-131   | 2ch Data Delay Retrofit                                             |
| MU195020A-140   | 1ch Variable ISI Retrofit                                           |
| MU195020A-141   | 2ch Variable ISI Retrofit                                           |
| J1632A          | <b>When Option 010/110 Installed</b><br>Terminator: 2               |
| J1359A          | Coaxial Adapter (K-P, K-J, SMA): 2                                  |
| J1632A          | <b>When Option 020/120 Installed</b><br>Terminator: 4               |
| J1359A          | Coaxial Adapter (K-P, K-J, SMA): 4                                  |
| MU195020A-ES310 | <b>Maintenance Service</b><br>Three Years Extended Warranty Service |
| MU195020A-ES510 | Five Years Extended Warranty Service                                |

### MU195040A

| Model/Order No. | Name                                                                |
|-----------------|---------------------------------------------------------------------|
| MU195040A       | <b>Module</b><br>21G/32G bit/s SI ED                                |
| J1632A          | <b>Standard Accessories</b><br>Terminator: 2                        |
| J1341A          | Open: 1                                                             |
| J1717A          | COAXIAL ADAPTOR (SMA-P, SMA-J): 4                                   |
| MU195040A-001   | <b>Option</b><br>32G bit/s Extension                                |
| MU195040A-010   | 1ch ED                                                              |
| MU195040A-020   | 2ch ED                                                              |
| MU195040A-011   | 1ch CTLE                                                            |
| MU195040A-021   | 2ch CTLE                                                            |
| MU195040A-022   | Clock Recovery                                                      |
| MU195040A-101   | <b>Retrofit Options</b><br>32G bit/s Extension Retrofit             |
| MU195040A-120   | 2ch ED Retrofit                                                     |
| MU195040A-111   | 1ch CTLE Retrofit                                                   |
| MU195040A-121   | 2ch CTLE Retrofit                                                   |
| MU195040A-122   | Clock Recovery Retrofit                                             |
| J1341A          | <b>When Option 010/110 Installed</b><br>Open: 3                     |
| J1359A          | Coaxial Adapter (K-P, K-J, SMA): 2                                  |
| 41KC-6          | Fixed Attenuator 6 dB: 2                                            |
| J1341A          | <b>When Option 020/120 Installed</b><br>Open: 5                     |
| J1359A          | Coaxial Adapter (K-P, K-J, SMA): 4                                  |
| 41KC-6          | Fixed Attenuator 6 dB: 4                                            |
| MU195040A-ES310 | <b>Maintenance Service</b><br>Three Years Extended Warranty Service |
| MU195040A-ES510 | Five Years Extended Warranty Service                                |

### MU196020A\*5, \*6

| Model/Order No. | Name                                                                |
|-----------------|---------------------------------------------------------------------|
| MU196020A       | <b>Module</b><br>PAM4 PPG                                           |
| J1632A          | <b>Standard Accessories</b><br>TERMINATOR: 4                        |
| V210            | TERMINATOR (V): 2                                                   |
| J1341A          | OPEN: 2                                                             |
| J1359A          | COAXIAL ADAPTOR (K-P.K-J,SMA): 1                                    |
| J1717A          | COAXIAL ADAPTOR (SMA-P.SMA-J): 5                                    |
| MU196020A-001   | <b>Option</b><br>32G baud*                                          |
| MU196020A-002   | 58G baud*                                                           |
| MU196020A-003   | 64G baud*                                                           |
| MU196020A-011   | 4Tap Emphasis                                                       |
| MU196020A-030   | Data Delay                                                          |
| MU196020A-040   | Adjustable ISI                                                      |
| MU196020A-042   | FEC Pattern Generation                                              |
| MU196020A-050   | Inter-Module Synchronization                                        |
| MU196020A-112   | <b>Retrofit Options</b><br>32G to 58G baud Extension Retrofit       |
| MU196020A-113   | 32G to 64G baud Retrofit                                            |
| MU196020A-123   | 58G to 64G baud Retrofit                                            |
| MU196020A-111   | 4Tap Emphasis Retrofit                                              |
| MU196020A-130   | Data Delay Retrofit                                                 |
| MU196020A-140   | Adjustable ISI Retrofit                                             |
| MU196020A-142   | FEC Pattern Generation Retrofit                                     |
| MU196020A-150   | Inter-Module Synchronization Retrofit                               |
| MU196020A-ES310 | <b>Maintenance Service</b><br>Three Years Extended Warranty Service |
| MU196020A-ES510 | Five Years Extended Warranty Service                                |

### MU196040A\*6

| Model/Order No. | Name                                                                   |
|-----------------|------------------------------------------------------------------------|
| MU196040A       | <b>Module</b><br>PAM4 ED                                               |
| J1632A          | <b>Standard Accessories</b><br>TERMINATOR: 2                           |
| J1341A          | OPEN: 2                                                                |
| J1359A          | COAXIAL ADAPTOR (K-P.K-J,SMA): 1                                       |
| J1717A          | COAXIAL ADAPTOR (SMA-P.SMA-J): 3                                       |
| MU196040A-001   | <b>Option</b><br>32.1G baud Decoder                                    |
| MU196040A-022   | 25.5G to 32.1G baud Clock Recovery                                     |
| MU196040A-041   | SER Measurement                                                        |
| MU196040A-122   | <b>Retrofit Options</b><br>25.5G to 32.1G baud Clock Recovery Retrofit |
| MU196040A-141   | SER Measurement Retrofit                                               |
| J1341A          | <b>Standard Accessories for MU196040A-x001</b><br>Open: 2              |
| J1359A          | COAXIAL ADAPTOR (K-P.K-J,SMA): 2                                       |
| MU196040A-ES310 | <b>Maintenance Service</b><br>Three Years Extended Warranty Service    |
| MU196040A-ES510 | Five Years Extended Warranty Service                                   |

\*: Select any one

# Signal Quality Analyzer-R MP1900A Ordering Information

## MU183020A\*1

| Model/Order No. | Name                                                                    |
|-----------------|-------------------------------------------------------------------------|
| MU183020A       | <b>Module</b><br>28G/32G bit/s PPG                                      |
| J1137           | <b>Standard Accessories</b><br>Terminator: 3 pcs                        |
| J1359A          | Coaxial Adaptor (K-P, K-J, SMA): 1 pc                                   |
| J1341A          | Open: 1 pc                                                              |
| J0541E          | 6 dB Fixed Attenuator: 1 pc                                             |
| Z0897A          | MP1800A Manual CD: 1 pc                                                 |
| Z0918A          | MX180000A Software CD: 1 pc                                             |
| MU183020A-001   | <b>Options</b><br>32G bit/s Extension                                   |
| MU183020A-012   | 1ch 2 V Data Output                                                     |
| MU183020A-013   | 1ch 3.5 V Data Output                                                   |
| MU183020A-022   | 2ch 2 V Data Output                                                     |
| MU183020A-023   | 2ch 3.5 V Data Output                                                   |
| MU183020A-030   | 1ch Data Delay                                                          |
| MU183020A-031   | 2ch Data Delay                                                          |
| MU183020A-101   | <b>Retrofit Options</b><br>32G bit/s Extension Retrofit                 |
| MU183020A-112   | 1ch 2 V Data Output Retrofit                                            |
| MU183020A-113   | 1ch 3.5 V Data Output Retrofit                                          |
| MU183020A-122   | 2ch 2 V Data Output Retrofit                                            |
| MU183020A-123   | 2ch 3.5 V Data Output Retrofit                                          |
| MU183020A-130   | 1ch Data Delay Retrofit                                                 |
| MU183020A-131   | 2ch Data Delay Retrofit                                                 |
| J1137           | <b>Standard Accessories for MU183020A-x12, x13</b><br>Terminator: 2 pcs |
| J1359A          | Coaxial Adaptor (K-P, K-J, SMA): 2 pcs                                  |
| J1137           | <b>Standard Accessories for MU183020A-x22, x23</b><br>Terminator: 4 pcs |
| J1359A          | Coaxial Adaptor (K-P, K-J, SMA): 4 pcs                                  |
| MU183020A-ES310 | <b>Maintenance Service</b><br>Three Years Extended Warranty Service     |
| MU183020A-ES510 | Five Years Extended Warranty Service                                    |

## MU183040B\*1

| Model/Order No. | Name                                                                |
|-----------------|---------------------------------------------------------------------|
| MU183040B       | <b>Module</b><br>28G/32G bit/s High Sensitivity ED                  |
| J1137           | <b>Standard Accessories</b><br>Terminator: 2 pcs                    |
| J1341A          | Open: 1 pc                                                          |
| Z0897A          | MP1800A Manual CD: 1 pc                                             |
| Z0918A          | MX180000A Software CD: 1 pc                                         |
| MU183040B-001   | <b>Options</b><br>32 Gbit/s Extension                               |
| MU183040B-010   | 1ch ED                                                              |
| MU183040B-020   | 2ch ED                                                              |
| MU183040B-022   | 2.4G to 28.1G bit/s Clock Recovery                                  |
| MU183040B-023   | 25.5G to 32.1G bit/s Clock Recovery                                 |
| MU183040B-101   | <b>Retrofit Options</b><br>32 Gbit/s Extension Retrofit             |
| MU183040B-110   | 1ch ED Retrofit                                                     |
| MU183040B-120   | 2ch ED Retrofit                                                     |
| MU183040B-122   | 2.4G to 28.1G bit/s Clock Recover Retrofit                          |
| MU183040B-123   | 25.5G to 32.1G bit/s Clock Recovery Retrofit                        |
| J1341A          | <b>Standard Accessories for MU183040B-x10</b><br>Open: 2 pcs        |
| J1359A          | Coaxial Adaptor (K-P, K-J, SMA): 2 pcs                              |
| 41KC-6          | Precision Fixed Attenuator 6 dB: 2 pcs                              |
| J1341A          | <b>Standard Accessories for MU183040B-x20</b><br>Open: 4 pcs        |
| J1359A          | Coaxial Adaptor (K-P, K-J, SMA): 4 pcs                              |
| 41KC-6          | Precision Fixed Attenuator 6 dB: 4 pcs                              |
| MU183040B-ES310 | <b>Maintenance Service</b><br>Three Years Extended Warranty Service |
| MU183040B-ES510 | Five Years Extended Warranty Service                                |

## G0374A\*2

| Model/Order No. | Name                                                                    |
|-----------------|-------------------------------------------------------------------------|
| G0374A          | <b>Main Frame</b><br>64Gbaud PAM4 DAC                                   |
| J1611A          | <b>Standard Accessories</b><br>Coaxial Cable (1.3 m, K connector): 1 pc |
| J1741A          | Electrical Length Specified Coaxial Cable<br>(0.8 m, K Connector): 4 pc |
| V210            | Coaxial Terminator: 1 pc                                                |
| J0017F          | POWER CORD, 2.6M: 1 pc                                                  |
| G0342A          | ESD DISCHARGER: 1 pc                                                    |

## G0375A\*2

| Model/Order No. | Name                                                                                                   |
|-----------------|--------------------------------------------------------------------------------------------------------|
| G0375A          | <b>Main Frame</b><br>32 Gbaud Power PAM4 Converter                                                     |
| J1741A          | <b>Standard Accessories</b><br>Electrical Length Specified Coaxial Cable<br>(0.8 m, K Connector): 4 pc |
| J1475A          | USB Cable: 1 pc                                                                                        |

## G0376A\*2

| Model/Order No. | Name                                                                                                   |
|-----------------|--------------------------------------------------------------------------------------------------------|
| G0376A          | <b>Main Frame</b><br>32 Gbaud PAM4 Decoder with CTLE                                                   |
| J1728A          | <b>Standard Accessories</b><br>Electrical Length Specified Coaxial Cable<br>(0.4 m, K connector): 2 pc |
| J1475A          | USB Cable: 1 pc                                                                                        |

- \*1: Other MP1800A-series modules will be supported one-by-one in future. Refer to the selection guide for details.
- \*2: The warranty period shall be 1 year under normal use. Repair by exchange for new during the warranty period shall be limited to one instance. Repair using new spare parts shall be charged after the warranty period has expired. Moreover, Anritsu Corporation will deem this warranty void when:
- When new spare parts can no longer be easily obtained when more than 5 years have elapsed after manufacture.

## Software

| Model/Order No. | Name                                 |
|-----------------|--------------------------------------|
| MX183000A       | High-Speed Serial Data Test Software |
| MX183000A-PL001 | Jitter Tolerance Test                |
| MX183000A-PL011 | PCIe Link Sequence                   |
| MX183000A-PL021 | PCIe Link Training                   |
| MX183000A-PL022 | USB Link Training                    |
| MX183000A-PL031 | DUT Error Counts Import              |

## On Using VISA\*3

The National Instruments™ (NI hereafter) NI-VISA\*4 software must be installed to use the MX183000A (this product hereafter). We recommend using NI-VISA saved on the product USB memory stick. Customers may only use NI-VISA saved on the product memory stick. NI-VISA on the memory stick may not be used for other applications with other products. When uninstalling this product from the controller PC, etc., also uninstall NI-VISA from the USB memory.

- \*3: Abbreviation for Virtual Instrument Software Architecture. This is I/O software for remote control of measuring instruments via GPIB, Ethernet and USB interfaces.
- \*4: NI-VISA was developed by National Instruments for VXI Plug&Play Alliance standards compliant I/O interfaces. National Instruments™, NI™, and NI-VISA™ are registered trademarks of National Instruments Corporation.

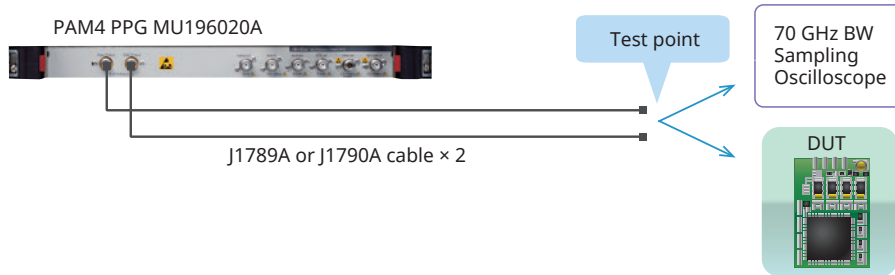
# Signal Quality Analyzer-R MP1900A Ordering Information

## Optional Accessories

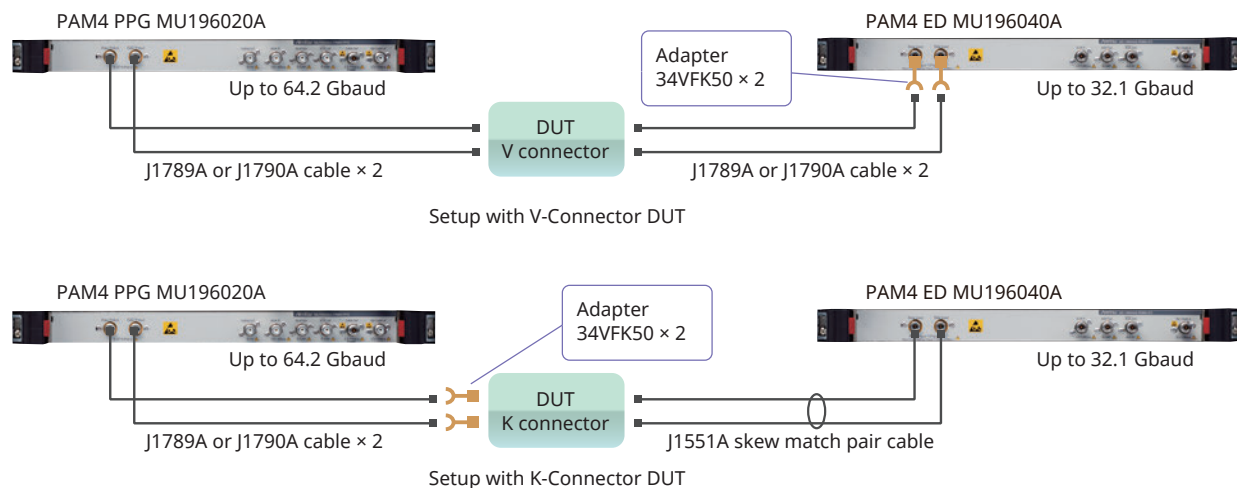
| Model/Order No. | Name                                                                                 |
|-----------------|--------------------------------------------------------------------------------------|
| J1632A          | Terminator                                                                           |
| V210            | TERMINATOR (V)                                                                       |
| J1678A          | ESD Protection Adapter-K                                                             |
| J1679A          | ESD Protection Adapter-V                                                             |
| J1359A          | Coaxial Adapter (K-P, K-J, SMA)                                                      |
| 34VFK50         | Fixed Adapter (V-F, K-M)*6                                                           |
| 34VKF50         | Fixed Adapter (V-M, K-F)                                                             |
| 41KC-3          | Fixed Attenuator 3 dB                                                                |
| 41KC-6          | Fixed Attenuator 6 dB                                                                |
| 41KC-10         | Fixed Attenuator 10 dB                                                               |
| 41KC-20         | Fixed Attenuator 20 dB                                                               |
| 41V-3           | Fixed Attenuator 3 dB                                                                |
| 41V-6           | Fixed Attenuator 6 dB                                                                |
| 41V-10          | Fixed Attenuator 10 dB                                                               |
| 41V-20          | Fixed Attenuator 20 dB                                                               |
| J1758A          | ISI Board                                                                            |
| J1800A          | ISI Board V                                                                          |
| K240C           | Precision Power Divider                                                              |
| V240C           | Fixed Power divider                                                                  |
| J1510A          | Pick OFF Tee (K)                                                                     |
| J1793A          | Pick OFF Tee (V)                                                                     |
| J1748A          | Power Splitter (1.5 GHz to 18 GHz, SMA, using MU195020A × 4 to MU181500B connection) |
| J1624A          | COAXIAL CABLE 0.3 m (18 GHz and SMA)                                                 |
| J1342A          | COAXIAL CABLE 0.8 m (APC3.5 connector)                                               |
| J1439A          | Coaxial cable (0.8 m, K connector)                                                   |
| J1625A          | Coaxial Cable 1 m (18 GHz, SMA)                                                      |
| J1449A          | Measurement kit (J1324A × 2, J1439A × 2, J1625A × 1)                                 |
| J1550A          | Coaxial skew match cable (0.8 m, APC3.5 connector)                                   |
| J1551A          | Coaxial skew match cable (0.8 m, K connector)                                        |
| J1728A          | Electrical Length Specified Coaxial Cable (0.4 m, K connector)                       |

| Model/Order No. | Name                                                                                                 |
|-----------------|------------------------------------------------------------------------------------------------------|
| J1741A          | Electrical Length Specified Coaxial Cable (0.8 m, K Connector)                                       |
| J1742A          | Electrical Length Specified Coaxial Cable (0.84 m, K Connector, G0375A PAM4 for non-linear output)   |
| J1789A          | Electrical Length Specified Coaxial Cable*5 (0.4 m, V connector)                                     |
| J1790A          | Electrical Length Specified Coaxial Cable*5 (0.8 m, V connector)                                     |
| J1792A          | Skew match pair semirigid cable (V-K connector, MU196020A PPG Output to MU195050A Noise Data Input1) |
| MZ1834A/B       | 4PAM Converter                                                                                       |
| G0361A          | 64 Gbaud 2-bit DAC with MUX                                                                          |
| G0374A          | 64 Gbaud PAM4 DAC                                                                                    |
| G0375A          | 32 Gbaud Power PAM4 Converter                                                                        |
| G0376A          | 32 Gbaud PAM4 Decoder with CTLE                                                                      |
| J1735A          | Combiner (G0375A PAM4 for non-linear output)                                                         |
| W3911AW         | MP1900A Operation Manual                                                                             |
| W3913AW         | MX190000A Operation Manual                                                                           |
| W3915AW         | MU195020/40/50A Operation Manual                                                                     |
| W3976AW         | MU196020/40A OPERATION MANUAL                                                                        |
| B0576A          | Blank Panel                                                                                          |
| B0736A          | Front Cover (For MP1900A)                                                                            |
| B0737A          | Carrying Case (For MP1900A, with G0736A)                                                             |
| B0738A          | Rack Mount Kit (For MP1900A)                                                                         |
| Z1746A          | Stylus                                                                                               |
| Z0541A          | USB Mouse                                                                                            |
| J0008           | GPB CABLE, 2.0 m                                                                                     |
| Z0917A          | Shielded LAN Cable, 5 m                                                                              |
| Z1953A          | Gigabit Ethernet Switch (5 Port)                                                                     |
| Z0306A          | List Wrap                                                                                            |
| Z1964A          | Torque Wrench (Right Angle)                                                                          |

\*5: We recommend using either the J1789A or J1790A as the coaxial cable for the MU196020A data output. The MU196020A data output specifications are defined based on the performance observed using a 70-GHz bandwidth oscilloscope connected as shown below.



\*6: The MU196020A data outputs and the J1789A/J1790A cables use V-connectors, but the MU196040A data inputs use K-connectors. Use the 34VFK50 adapter as shown in the following figure.









Specifications are subject to change without notice.

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