

MP1900A Selection Guide

Signal Quality Analyzer-R MP1900A

Introduction

The Signal Quality Analyzer-R MP1900A is a modular design offering optional functions for easy customization to users' requirements. As a result, the configuration can be tailored to budget timing while the excellent expandability offers easy addition of new future functions.

This Selection Guide explains the modules and options, as well as their selection conditions and possible combinations. Please use it to check the best configuration meeting the measurement needs.

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1. MP1900A Series Supported Equipment and Software

The MP1900A units support different modules and software. Select the modules, software, and parts extending the functionality based on the measurement application and bit rate.

Model and Name	MP1900A
Module	
MU181000A 12.5GHz Synthesizer* ¹	✓
MU181000B 12.5GHz 4 Port Synthesizer	
MU191000A Synthesizer	
MU181500B Jitter Modulation Source	✓
MU195050A Noise Generator	✓
MU196050B Noise Generator	✓
MU195020A 21G/32G bit/s SI PPG	✓
MU195040A 21G/32G bit/s SI ED	✓
MU196020A PAM4 PPG	✓
MU196020C PAM4 PPG	✓
MU196040B PAM4 ED	✓
MU196040A PAM4 ED	✓
MU196060A 32G baud NRZ/PAM4 Re-Driver	✓
Software	
MX183000A High-Speed Serial Data Test Software	✓
MX183000A-PL001 Jitter Tolerance Test	✓
MX183000A-PL011 PCIe Link Sequence	✓
MX183000A-PL012 USB Link Sequence* ²	
MX183000A-PL021 PCIe Link Training	✓
MX183000A-PL022 USB Link Training	✓
MX183000A-PL023 USB 3.2 x 2 Link Training	✓
MX183000A-PL025 PCIe 5 Link Training	✓
MX183000A-PL026 PCIe 6 Link Training	✓
MX183000A-PL031 DUT Error Counts Import	✓

*1 Manufacturing discontinued.

*2 MX183000A-PL012 is software for MP1800A only.

Model and Name					MP1900A
Automation Software (Granite River Labs Corporation)					
(PCIe)	(Gen3/4)	GRL-PCIe4-RXA*1	(Base)	GRL-PCIe4-BASE-RXA	✓
			(CEM)	GRL-PCIe4-CEM-RXA	✓
	(Gen5)	GRL-PCIe5-RXA*2	(Base)	GRL-PCIe5-BASE-RXA	✓
			(CEM)	GRL-PCIe5-CEM-RXA	✓
	(Gen6)	GRL-PCIe6-RXA*3	(Base)	GRL-PCIe6-BASE-RXA	✓
			(CEM)	GRL-PCIe6-CEM-RXA	✓
	(PCIe7)	GRL-PCIe7-RXA*4	(Base)	GRL-PCIe7-BASE-RXA	✓
GRL-PCIe-PLL (PCIe PLL)					✓
GRL-USB32-RXA (USB3.2)					✓
GRL-USB32-RXA (USB3.2 x2)					✓
GRL-USB4-RXA (USB4)					✓
GRL-TBT3-RXA (TBT3)					✓
GRL-SAS3-RXA (SAS-3)					✓
GRL-SAS4-RXA (SAS-4)					✓
GRL-SAS34-RXA (SAS-3/-4)					✓
GRL-DP14-SINKAN (DP1.4)					✓
GRL-DP21-SINK-AN(DP2.1)					
Automation Software (Teledyne LeCroy)					
(PCIe)	(Gen3/4)	(Base&CEM&PLL)		QPHY-PCIe4-TX-RX	✓
	(Gen5)	(Base&CEM&PLL)		QPHY-PCIe5-TX-RX	✓
	(Gen6)	(Base&CEM)		QPHY-PCIe6-TX-RX	*4
	(Gen7)	(Base)		QPHY-PCIe7-TX-RX	*4
(PCIe Gen3/4/5) QPHY-PCIe-Tx-Rx					✓
(USB3.2) QPHY-USB3.2-Tx-Rx					✓
(USB4/TBT3) QPHY-USB4-Tx-Rx					✓
Automation Software (Tektronix)					
(PCIe)	(Gen4)	(Base&CEM)		RXSW-NLP-PCIe4C	✓
	(Gen5)	(Base&CEM)		RXSW-NLP-PCIe5	✓
	(Gen6)	(Base&CEM)		RXSW-NLP-PCIe6	*4
	(Gen7)	(Base)		*4	*4
(PCIe PLL) RXSW-NLP-PLLBW-PCEG5					✓
(USB4) RXSW-NLP-USB4					✓
(TBT3/4) RXSW-NLP-TBT34					✓

*1 The GRL-PCIe4-RXA automation software supports both PCIe Gen4 Base and CEM specifications.

*2 The GRL-PCIe5-RXA automation software supports both PCIe Gen5 Base and CEM specifications.

*3 The GRL-PCIe6-RXA automation software supports both PCIe Gen6 Base and CEM specifications.

*4 Contact our sales representative.

1-a. Selection of PPG and ED Module According to Measurement Application

Refer to the following table and select the PAM4 PPG (MU196020A)/ED (MU196040B) and SI PPG (MU195020A)/ED (MU195040A) according to usage.

Application Module	PCIe7 Base	PCIe 4-6	PCIe 1-5	IEEE	100G /200G /400G	USB4 v2	USB4 v1	USB 3.1/ 3.2	DP 2.0/2.1	DP 1.4	SAS	TBT	DDR
MU196020C	✓	✓*1	✓*2	✓*1	✓*1,	✓*1							
MU196020A													
MU195020A						✓	✓	✓	✓	✓	✓	✓	✓*3
MU196040B	✓	✓		✓	✓								
MU195040A			✓					✓			✓		✓

*1: Either MU196020C or MU196020A can be selected.

*2: Either SI PPG or PAM4 PPG can be selected.

*3: Two SI PPG modules are required.

When requiring more detailed information, choose the PPG and ED module according to the following measurement application examples. Refer to Table 1-2 for the differences in the functions and performance of each model. When several models are described in Table 1-1, select according to the measurement conditions by referring to the following main functions and performance.

- For PAM4 measurements, choose the MU196020A or MU196020C and MU196040B.
- Choose the MU196020A and MU196040B when using Link Training and LTSSM analysis required by PCIe Gen6.
- Choose the MU195020A and MU195040A when not expecting to require PCIe Gen6 support but requiring a solution supporting only SI PPG/SI ED measurement.
- Propose the minimum configuration meeting the customer's budget when expecting to require PCIe Gen6 support but also wanting a solution supporting only SI PPG and SI ED measurement. Contact our sales representative separately.
- PPG
 - Choose the MU196020C when requiring verification for PCIe7 Base.
 - Choose the MU196020A at PAM4 signal tests or when requiring high functions and high performance or for bit rates exceeding 32G.
 - When evaluating NRZ signals up to 32.1G, choose the MU195020A when requiring the Emphasis Generation function and a widely variable amplitude range.
- ED
 - When requiring high functions and high performance or for bit rates exceeding 32G at PAM4 signal tests, choose the MU196040B.
 - When evaluating NRZ signals up to 32.1G, choose the MU195040A when using the CTLE function and CDR supporting SSC.

Table 1-1 PPGs/EDs Supporting 21 Gbit/s by Measurement Application & Function

Measurement Application		MP1900A Series
Devices, backplanes, active cables BER measurement of devices and backplanes when using Emphasis, Jitter, Clock Recovery functions.	53G/58G (200/400 GbE)	MU196020A/C/40B
	to 28G/32G (10/40/100/200 GbE)	MU196020A/C/40B or MU195020A/40A
Optical modules, TOSA/ROSA, driver amplifiers BER measurement of optical modules and of high-amplitude applications other than those described below	53G/58G (200/400 GbE)	MU196020A/C/40B
	to 28G/32G (10/40/100/200 GbE)	MU196020A/C/40B or MU195020A/40A
EML-TOSA evaluations and tests using high-amplitude signals For EML-TOSA evaluation	53G/58G	MU196020A ^{*1} /C/40B
	to 28G/32G	MU196020A ^{*1} /C or MU195020A ^{*1}
InfiniBand AOC test	HDR ^{*2}	MU196020A/C/40B
	EDR FDR	MU195020A/40A ^{*3}
PON, optical circuit tests and burst signal tests BER measurements using burst signals and patterns with Mark ratio of 1/2 or more	100G PON	-
PCI Express7 Receiver Test Base (PAM4) PCI Express4 to 6 Receiver Test (PAM4) Enables measurement of PCIe7 Receiver Test Base. (PCIe4-6) Supports Link Sequence, Dynamic Link Training, LTSSM analysis, SKP OS insertion/filtering functions, and SSC reception, enabling PCIe4–6 Root Complex and Endpoint receiver sensitivity and JTOL measurements, as well as PCIe6–compliant FEC measurements.		MU191000A MU196020C MU196040B ^{*6} MU196060A MU196050B
PCIe Gen1 to 5 Receiver Test (NRZ Only) Receiver sensitivity and JTOL measurements of PCIe Gen1 to 5 Root complex and End point when using Link Sequence, Dynamic Link Training, LTSSM analysis, SKP OS Insertion/Filtering function and SSC input support.		MU196020A/C ^{*4} or MU195020A ^{*4} MU195040A ^{*4} MU196060A ^{*5}
PCIe Gen4 to 6 Receiver Test (NRZ/PAM4) Receiver sensitivity and JTOL measurements of PCIe Gen4 to 6 Root complex and End point when using Link Sequence, Dynamic Link Training, LTSSM analysis, SKP OS Insertion/Filtering function and SSC input support.		MU196020A/C MU196040B ^{*6} MU196060A
USB3.2 Receiver Test, USB4 v1 Receiver sensitivity and JTOL measurements of USB3.2 Host and Device when using LFPS generation, Link Sequence, SKP OS Insertion/Filtering function and SSC input support.		MU195020A ^{*7} MU195040A ^{*7}
USB4 v2 Receiver Test Supports BER RX test by generating jitter and noise, as well as Signal Frequency Variation Training test. MU196020A used for PAM3 signal generation MU195020A used for aggressor signal generation		MU196020A/C MU195020A

Thunderbolt 3 Receiver Test Supports Thunderbolt 3 Host and Device Stressed Receiver Sensitivity measurement using Emphasis output and Jitter generation	MU195020A* ⁸
SAS Receiver Test Supports Stressed Receiver Sensitivity measurements of Initiator and Expander Device storage products using Emphasis output and Jitter generation	MU195020A MU195040A
DisplayPort 1.4 Sink Test Supports Stressed Receiver Sensitivity measurements of Sink devices using Jitter and Noise generation	MU195020A
DisplayPort 2.0, 2.1 Sink Test Supports Stressed Receiver Sensitivity measurements of Sink devices using Jitter and Noise generation	MU195020A

*1 Requires external amplifier

*2 Due to possible changes in the HDR standards, contact our sales representatives for more details.

*3 Measuring instrument recommended at IBTA Plugfest

*4 PCI-SIG certified test instrument

*5 Recommended for System test when Return Path ≥ 18 dB (for PCIe5 NRZ)

*6 Use MU195040A when testing PCIe1 to 5, and MU196040B when testing PCIe4 to 6.

However, the MU196060A is required when using the MU196040B.

*7 USB-IF certified test instrument. SI ED not required for USB4 v1.

*8 Measuring instrument recommended at Thunderbolt Plugfest.

Table 1-2 Selection by Difference in Functions and Performance
For details, see Data Sheet.

Function/Performance	MU1960xx series		MU1950xx series
	(MU196020C/ MU196040B)	(MU196020A/ MU196040B)	(MU195020A/ MU195040A)
PPG/ED Common Items			
Coding	NRZ, PAM4	NRZ, PAM4	NRZ
Operating rate	2.4 to 32.1/58.2/64.2 Gbaud (option selection)*1	2.4 to 32.1/58.2/64.2 Gbaud (option selection)*1	2.4 to 21/32.1 Gbit/s (option selection)
Link Training and LTSSM Analysis*2	Supported	Supported	Supported
Sequence Editor function *3	Not supported	Supported (option) PCIe6, CXL2/3 supported	Supported
PPG			
Output amplitude (Single-end)	0.07 to 0.8 Vp-p	0.07 to 0.8 Vp-p	0.1 to 1.3 Vp-p
Output setting control	Common for Data/Xdata		
Emphasis tap	4 Taps (option)	4 Taps (option)	10 Taps (option)
Emphasis gain control	-20 to +20 dB	-20 to +20 dB	
ISI additional function	Supported (option)	Supported (option)	Supported (option)
Tr/Tf (NRZ, 20% to 80%) (typ.)	6.0 ps (typ.)	9 ps @ 32.1G 8.5 ps @ 58.2G at J1749A 40 cm cable	12 ps @32.1G
Cross-point	50% fixed	50% fixed	
Intrinsic Jitter RJ(typ.)	108 fs rms	170 fs rms	115 fs rms
Offset function	-	-	-2.0 to +3.3 VOH
FEC Pattern Generation	Supported (option)	Supported (option)	—
ED			
Input amplitude (Single-end)	NRZ: 0.05 to 1.0 Vp-p PAM4: 0.3 to 1.0 Vp-p	NRZ: 0.05 to 1.0 Vp-p PAM4: 0.3 to 1.0 Vp-p	0.05 to 1.0 Vp-p
Input sensitivity (PAM4) (Eye height) (typ.)	23 mV @ 32.1 Gbaud 49 mV @ 58.2 Gbaud	23 mV @ 32.1 Gbaud 49 mV @ 58.2 Gbaud	—
Input sensitivity (NRZ) (Eye height) (Eye amplitude) (typ.)	19 mV 25 mVp-p ≤50 mVp-p @ 32.1 Gbit/s	19 mV 25 mVp-p ≤50 mVp-p @ 32.1 Gbit/s	15 mV 22 mVp-p ≤31 mVp-p @ 28 Gbit/s, at CTLE off
CTLE function	Supported (with MU196060A)	Supported (with MU196060A)	0 to -12 dB (option) 0 to -30 dB (with MU196060A)
LFE function	-2.0 to 0.0 dB (option)	-2.0 to 0.0 dB (option)	-
DFE function(typ.)	-1.4 dB @ 53.1G (option)	-1.4 dB @ 53.1G (option)	-
Clock recovery	2.4 to 32.1 Gbit/s, 51.0 to 58.2 Gbit/s (option)	2.4 to 32.1 Gbit/s, 51.0 to 58.2 Gbit/s (option)	2.4 to 32.1 Gbit/s (option), SSC input support
PAM4 counter	MSB/LSB, Symbol 0 to 3	MSB/LSB, Symbol 0 to 3	

*1 The MU196040B upper limits are 64.2G for NRZ, and 58.2G for PAM4.

*2 MX183000A-PL021/PL022/PL023/PL025/PL026

*3 MU195020A-050/051 MU196020A-051/052/056

2. Functions and Features of Main Unit, each Module, and each Option

This section explains the functions and features of main unit, each module, and each option. Refer to the catalog for details of functions and features.

Table 2-1 Main Unit Functions and Features

MP1900A Signal Quality Analyzer-R	Main unit with touch panel operation screen. Up to 8 expansion modules can be inserted in slots. The MX190000A Signal Quality Analyzer Control software is installed. Functions for remote control over LAN and GPIB are supported.
MP1900A-110 Windows10 Upgrade Retrofit	Units with Windows Embedded Standard 7 will be upgraded to Windows 10 by hardware modification. After modification, any Windows Embedded Standard 7 components that are no longer needed will be disposed of by our company. For further details, contact your sales representative. This modification is applicable to MP1900A models ordered before July 2020. Orders received from July 2020 already use the Windows 10 operating system.

Table 2-2 Functions and Characteristics of Clock Module

MU191000A Synthesizer	1-slot module that outputs clocks from 0.1 GHz to 16.05 GHz. It provides four clock output ports. Functions equivalent to the MU181000B-002 are available as standard without additional options. For PCIe7 measurements, use the MU191000A. It also supports measurements for applications other than PCIe7. For details, see 4.3 Option Configuration Examples.
MU181000B 12.5 GHz 4Port Synthesizer	This 2-slot wide module supports output of clocks of 0.1 to 12.5 GHz. There are four output ports that can be used as clock sources for the PPG and module. Does not support PCIe7 measurements.
~~MU181000B-001 Jitter Modulation~~	~~This option outputs a jittered clock. Inputting the jittered clock to either the PPG or MUX module can be used to output jittered data. The internal sinusoidal jitter source can impress jitter of up to 80 MHz.~~ Discontinued product
MU181000B-002 SSC Extension	When PCIe Host is DUT, supports input of Refclk signal from Host and output of synchronized clock. Option for use with MP1900A.
MU181500B Jitter Modulation Source	This 2-slot wide module adds any jitters such as SJ, RJ, BUJ and SSC to the incoming clock. Two kinds of SJ are available by combination with a jittered synthesizer (MU181000B-001)

Table 2-3 Noise Module Functions and Features

MU196050B Noise Generator		Using a pick-off tee, common mode and differential mode noise can be added to the output of the MU196020C PPG. For PCIe7 measurements, use the MU196050B. Use of the MU196050B is recommended when measuring PCIe4–6 in a PAM4 configuration. For details, see 4.3 Option Configuration Examples. ⚠ Always use in combination with the Pick OFF Tee J1793A standard accessory.
MU195050A Noise Generator		Noise generation module for adding common mode, differential mode, and White noise (option) to MU195020A 2ch PPG Data input for output When using the MU195020A/40A, use the MU195050A. For the following applications, use the MU195050A: USB, SAS, DP, DDR For details, see 4.3 Option Configuration Examples.
	MU195050A-001 White Noise	Option for adding White noise.

Table 2-4 PPG Module Functions and Features

MU195020A 21G/32G bit/s SI PPG		PPG module supporting differential interfaces outputting signals from 21Gbit/s to 32.1Gbit/s. Can generate various patterns such as PRBS. Select 1ch or 2ch Data output configuration as option. Supports PCIe Link Training.
	MU195020A-001 32.1Gbit/s Expansion	Option extending upper operation frequency from 21 Gbit/s to 32.1 Gbit/s. Can be used in bit rate range from 2.4 Gbit/s to 32.1 Gbit/s. Without this option, the bit rate is from 2.4 Gbit/s to 21 Gbit/s.
	MU195020A-010 1ch Data Output	Option supporting 1ch differential data output and output amplitude from 0.1 Vp-p to 1.3 Vp-p. Either option -010 or -020 is required; both cannot be applied simultaneously.
	MU195020A-020 2ch Data Output	Option supporting 2ch differential data output and output amplitude from 0.1 Vp-p to 1.3 Vp-p. Either option -010 or -020 is required; both cannot be applied simultaneously.
	MU195020A-011 1ch 10Tap Emphasis	Option adding built-in 10Tap Emphasis function to 1ch differential data output. Can be selected when Opt-010 installed.
	MU195020A-021 2ch 10Tap Emphasis	Option adding built-in 10Tap Emphasis function to 2ch differential data output. Can be selected when Opt-020 installed.
	MU195020A-030 1ch Data Delay	Option for varying phase. Can vary Data phase versus Clock. Can be selected when Opt-010 installed.
	MU195020A-031 2ch Data Delay	Option for varying phase. Can vary Data phase versus Clock. Can be selected when Opt-020 installed.
	MU195020A-040 1ch Variable ISI	Generates signal emulating ISI using Emphasis control. Requires Opt-010 and Opt-011.
	MU195020A-041 2ch Variable ISI	Generates signal emulating ISI using Emphasis control. Requires Opt-020 and Opt-021.
	MU195020A-050 Sequence Editor Function	Sends and saves any edited Link Training sequence with support for PCIe Gen1 to 4, and USB3.2. There are no dependencies with other options.

MU195020A-051 Sequence Editor Function PCIe 5 Extension	Can send and save any edited Link Training sequence. Supports PCIe Gen 5. Requires MU195020A-050,001.
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MU196020A/C PAM4 PPG	PPG module supporting PAM4 and NRZ with differential I/F for outputting signals up to 32.1 Gbaud, 58.2 Gbaud, or 64.2 Gbaud. Can generate various patterns for PAM4 and NRZ. For PCIe7 measurements, use the MU196020C. The MU196020C is also recommended for measurements of PCIe4-6, USB 3.2, USB4 v1/v2, and Thunderbolt 3/4. For details, see 4.3 Option Configuration Examples.
MU196020A/C-001 32 Gbaud	Can be used in operating rate range from 2.4 Gbaud to 32.1 Gbaud. Requires one of the following options: Opt-001, -002, or -003. More than one option cannot be used simultaneously.
MU196020A/C-002 58 Gbaud	Can be used in operating rate range from 2.4 Gbaud to 58.2 Gbaud. Requires one of the following options: Opt-001, -002, or -003. More than one option cannot be used simultaneously.
MU196020A/C-003 64 Gbaud	Can be used in operating rate range from 2.4 Gbaud to 64.2 Gbaud. Requires one of the following options: Opt-001, -002, or -003. More than one option cannot be used simultaneously.
MU196020A/C-112 32G to 58G baud Extension Retrofit	Extends upper operation rate from Opt-001 to 58.2 Gbaud. Requires Opt-001.
MU196020A/C-113 32G to 64G baud Extension Retrofit	Extends upper operation rate from Opt-001 to 64.2 Gbaud. Requires Opt-001.
MU196020A/C-123 58G to 64G baud Extension Retrofit	Extends upper operation rate from Opt-002 to 64.2 Gbaud. Requires Opt-002 or 112.
MU196020A/C-011 4Tap Emphasis	Option adding built-in 4Tap Emphasis function. There are no dependencies with other options.
MU196020A/C-030 Data Delay	Option for varying phase. Can vary Data phase versus Clock. There are no dependencies with other options.
MU196020A/C-040 Adjustable ISI	Generates signal emulating ISI using Emphasis control. Requires Opt-011.
MU196020A/C-042 FEC Pattern Generation	Generates FEC patterns. There are no dependencies with other options.
MU196020A/C-043 FEC Error Insertion for PCIe6	Option for adding errors used for Flit FEC logic verification defined in PCIe 6.0. There are no dependencies with other options.
MU196020A/C-045 USB4 Gen4 Pattern Generation	Generates signal emulating for the USB4 v2 compliance test. There are no dependencies with other options.
MU196020A/C-050 Inter-Module Synchronization	Multi-channel operation is possible. Opt-030 is required. It is necessary to add this option to all the modules to be synchronized, and the operation rate option of 32/58/64 Gbaud is the same. Requires Opt-030 for this function.
MU196020A-051 Sequence Editor Function	Can send and hold arbitrarily edited link training sequences. Supports PCIe1-6. Requires Opt-060.
MU196020A-052 Sequence Editor Function for Multi-Channel	Can send and hold arbitrarily edited link training sequences using multiple MU196020A units. Supports PCIe1-6. All modules require Opt-050, and 051.

MU196020A-056 Sequence Editor Function PCIe 6 and CXL 3 Flits Extension	Can send and hold arbitrarily edited link training sequences. Supports CXL2/3. Requires Opt-051.
MU196020A-060 PCIe6 LEQ	Option supporting PCIe 6.0 4Tap Emphasis Dynamic Link EQ and required option for Link Training with MX183000A-PL026. Requires Opt-011.

Table 2-5 ED Module Functions and Features

MU195040A 21G/32G bit/s SI ED	ED module for differential interfaces supporting analysis of signals from 21 Gbit/s to 32.1Gbit/s. Operates with half-rate Clock input from PPG or with Clock recovered from Data input. Select 1ch or 2ch Data input configuration as option. Supports PCIe Link Training.
MU195040A-001 32.1Gbit/s Expansion	Option extending upper operation frequency from 21 Gbit/s to 32.1 Gbit/s. Can be used in bit rate range from 2.4 Gbit/s to 32.1 Gbit/s. Without this option, the bit rate is from 2.4 Gbit/s to 21 Gbit/s.
MU195040A-010 1ch ED	1ch differential Data input option Either option -010 or -020 is required; both cannot be applied simultaneously.
MU195040A-020 2ch ED	2ch differential Data input option Either option -010 or -020 is required; both cannot be applied simultaneously.
MU195040A-011 1ch CTLE	Option adding built-in CTLE function to 1ch differential Data input. Requires Opt-010.
MU195040A-021 2ch CTLE	Option adding built-in CTLE function to 2ch differential Data input. Requires Opt-020.
MU195040A-022 Clock Recovery	Option for recovering Clock from Data input. Supports SSC input. There are no dependencies with other options.

MU196040B PAM4 ED	ED module supporting PAM4 and NRZ with differential interface for signal analysis up to PAM4 58.2 Gbaud (NRZ 64.2 Gbit/s). Operates with half-rate clock input from PPG, or clock recovered from data input.
MU196040B-001 32G baud *1	Option for decoding PAM4/NRZ 2.4G to 32.1G signals. Be sure to select one of the following options: -001, -002, or -005.
MU196040B-002 58G baud *1	Option for decoding PAM4 signals from 2.4G to 58.2G, and NRZ signals from 2.4G to 64.2G. Be sure to select one of the following options: -001, -002, or -005.
MU196040B-005 64G baud	Option for decoding PAM4/NRZ 2.4G to 64.2G PAM4 signals. Please contact us for more information. Be sure to select one of the following options: -001, -002, or -005.
MU196040B-011 Equalizer	Option for building Low Frequency Equalizer and Decision Feedback Equalizer functions into differential data input. There are no dependencies with other options.
MU196040B-112 32G to 58G baud Extension	Option for extending upper frequency limit from 32.1G to 58.2G for Opt-001; adding this option supports range of 2.4G to 58.2G for PAM4 and range of 2.4G to 64.2G for NRZ.
MU196040B-115 32G to 64G baud Extension Retrofit	Option for extending upper frequency limit from 32.1G to 64.2G for Opt-001; adding this option supports range of 2.4G to 64.2G for PAM4/NRZ. Please contact us for more information.
MU196040B-125 58G to 64G baud Extension Retrofit	Option for extending upper frequency limit from 58.2G to 64.2G for Opt-002; adding this option supports range of 2.4G to 64.2G for PAM4/NRZ. Please contact us for more information.

MU196040B-021 29G Clock Recovery	Option for recovering clock from 2.4G to 29G data input. Options-022 or 021 are mutually exclusive.
MU196040B-022 32G Clock Recovery	Option for recovering clock from 2.4G to 32.1G data input. Options-022 or 021 are mutually exclusive.
MU196040B-023 58G Clock Recovery Extension	Option for recovering clock from 51G to 58.2G data input. Requires Opt-002 or Opt-112 Requires Opt-021 or Opt-022.
MU196040B-124 32G Clock Recovery Extension	Option for extending clock recovery upper rate from 29G to 32.1G for Opt-021; adding this option supports range of 2.4G to 32.1G. Requires Opt-021.
MU196040B-041 SER Measurement	Option for analyzing PAM4 signal symbol errors. There are no dependencies with other options.
MU196040B-042 FEC Analysis	Supports real-time FEC symbol error measurements. There are no dependencies with other options.
MU196040B-043 FEC Analysis for PCIe6	Supports real-time FEC symbol error measurements (PCIe6); requires Opt-041
MU196040B-051 PCIe Sequence Editor Pattern Analysis	Analyzes errors in PCIe encoding data input to MU196040B.

MU196040A PAM4 ED	ED module supporting PAM4 and NRZ with differential I/F for analyzing signals up to 32.1G. Operates with half-rate clock input from PPG or clock recovered from Data input.
MU196040A-001 32.1 Gbaud Decoder (mandatory option)	Option for decoding PAM4 signals.
MU196040A-022 25.5G to 32.1G Clock Recovery	Option for recovering Clock from Data input.
MU196040A-041 SER Measurement	Option for analyzing PAM4 signal symbol errors.

Table 2-6 Re-Driver Module Functions and Features

MU196060A 32G baud NRZ/PAM4 Re-Driver	Supports loss-attenuated NRZ/PAM4 signal up to 32.1 Gbaud to correct signal loss by equalizing with CTLE.
MU196060A-001 Clock Recovery for SSC	This option regenerates clocks up to 32.1 Gbaud from SSC-modulated input data.

Table 2-7 Software Functions and Features

MX190000A Signal Quality Analyzer Control Software	Software for controlling modules installed in MP1900A. Installed at MP1900A shipment.
MX183000A High Speed Serial Data Software	Adding this software option supports Jitter Tolerance measurements as well as PCIe and USB receiver measurements. It is installed at MP1900A shipment.
MX183000A-PL001 Jitter Tolerance Test	This software supports the jitter tolerance and jitter sweep tests when used in combination with the jitter modulation source (MU181500B).
MX183000A-PL011 PCIe Link Sequence	Software using Link Sequence Pattern generation function for transitioning PCIe Gen1 to 4 Devices to Loopback mode.
MX183000A-PL021 PCIe Link Training	Software using Link Training function with negotiation process for transitioning PCIe Gen1 to 4 Devices to Loopback mode.

MX183000A-PL025 PCIe 5 Link Training	Software using Link Training function with negotiation process for transitioning PCIe Gen5 Devices to Loopback mode. The MX183000A-PL021 is required.
MX183000A-PL026 PCIe 6 Link Training	Software using Link Training function with negotiation process for transitioning PCIe Gen6 Devices to Loopback mode. The MX183000A-PL021 and PL025 are required.
MX183000A-PL022 USB Link Training	Software for transitioning USB3.2 devices to Loopback mode using Link Training function for performing negotiation.
MX183000A-PL023 USB 3.2 x 2 Link Training	Software for transitioning USB 3.2 x2 device to Loopback mode using Link Training function for performing negotiation. Requires MX183000A-PL022.
MX183000A-PL031 DUT Error Counts Import	Capture DUT bit error count via USB or Ethernet connection. To measure jitter tolerance using this count value, MX183000A - PL001 is required.

High-speed bus (HSB) Automation Software	Automation software for compliance testing for various HSB standards. Controls MP1900A and oscilloscopes to perform compliance tests.
(GRL Corporation)	Controls MP1900A and Keysight/Tektronix oscilloscope to perform PCIe, USB, and TBT3 compliance tests. This software is a product of GRL Corporation, but is sold and supported by Anritsu.
GRL-PCIE4-BASE-RXA GRL-PCIE4-CEM-RXA GRL-PCIE4-RXA	Automation software supporting PCIe Gen3/4 measurements. GRL-PCIE4-BASE-RXA supports the Base Spec measurements. GRL-PCIE4-CEM-RXA supports the CEM Spec measurements. GRL-PCIE4-RXA supports both the Base and CEM Spec measurements.
GRL-PCIE5-BASE-RXA GRL-PCIE5-CEM-RXA GRL-PCIE5-RXA	Automation software supporting PCIe Gen5 Base Spec measurements. GRL-PCIE5-BASE-RXA supports the Base Spec measurements. GRL-PCIE5-CEM-RXA supports the CEM Spec measurements. GRL-PCIE5-RXA supports both the Base and CEM Spec measurements.
GRL-PCIE6-BASE-RXA GRL-PCIE6-CEM-RXA GRL-PCIE6-RXA	Automation software supporting PCIe Gen6 Base Spec measurements. GRL-PCIE6-BASE-RXA supports the Base Spec measurements. GRL-PCIE6-CEM-RXA supports the CEM Spec measurements. GRL-PCIE6-RXA supports both the Base and CEM Spec measurements.
GRL-PCIE7-BASE-RXA	GRL-PCIE7-BASE-RXA supports the Base Spec measurements.
GRL-TBT3-RXA	Automation software supporting TBT3 measurements
GRL-USB32-RXA	Automation software supporting USB3.2/USB3.2x2 measurements
GRL-USB4-RXA	Automation software supporting USB4 measurements
GRL-SAS3-RXA	Automation software supporting SAS-3 measurements
GRL-SAS4-RXA	Automation software supporting SAS-4 measurements
GRL-SAS34-RXA	Automation software supporting SAS-3/4 measurements
GRL-DP14-SINKAN	Automation software supporting DisplayPort1.4 measurements
(Teledyne LeCroy)	Controls MP1900A and Teledyne LeCroy oscilloscopes LabMaster 10Zi-A series to perform PCIe compliance tests. This software is sold and supported by Teledyne LeCroy.
QPHY-PCIE-Tx-Rx	Automation software supporting PCIe Gen3/4/5/6 measurements. For PCIe 7 inquiries, please contact us.
QPHY-USB3.2-Tx-Rx	Automation software supporting USB3.2 measurements.
QPHY-USB4-Tx-Rx	Automation software supporting USB4 and TBT3 measurements.
(Tektronix)	Controls MP1900A and Tektronix oscilloscopes MSO/DPO/DSA series to perform PCIe compliance tests. This software is sold and supported by Tektronix.
Tek Rx Test Application Software	Automation software supporting PCIe Gen3/4/5/6, USB4 and TBT3/4 measurements. For PCIe 7 inquiries, please contact us.

3. Option Combinations

The following tables list the combinations of main units, modules, and options. Refer to each table for option combinations.

3.1 21G/32G bit/s SI PPG MU195020A

Table 3-1-1: 21G/32G bit/s SI PPG MU195020A(Basic option)

Model	Name	Description
MU195020A-010	1ch Data Output Option	—
MU195020A-020	2ch Data Output Option	—

Table 3-1-2: Additional Options when Selecting MU195020A-010

Model	Name	Option dependency
MU195020A-011	1ch 10Tap Emphasis	—
MU195020A-030	1ch Data Delay	—
MU195020A-040	1ch Variable ISI	Requires MU195020A-011

Table 3-1-3: Additional Options when Selecting MU195020A-020

Model	Name	Option dependency
MU195020A-021	2ch 10Tap Emphasis	—
MU195020A-031	2ch Data Delay	—
MU195020A-041	2ch Variable ISI	Requires MU195020A-021

Table 3-1-4: Additional Options and Dependencies

Options listed below can be added according to required functionalities. For options required for each application, please refer to Section 4. Combination of Modules.

Model	Name	Option dependency
MU195020A-001	32G bit/s Extension	—
MU195020A-050	Sequence Editor Function	—
MU195020A-051	Sequence Editor Function PCIe 5	Requires MU195020A-050 Requires MU195020A-001

Table 3-1-5: List of Retrofit Options (Common for MU195020A-010 and MU195020A-020)

Model	Name	Option dependency
MU195020A-101	32G bit/s Extension	Same as MU195020A-001
MU195020A-350	Sequence Editor Function	Same as MU195020A-050
MU195020A-351	Sequence Editor Function PCIe 5	Same as MU195020A-051

Table 3-1-6: List of Exclusive Retrofit Options for MU195020A-010

Add the following options according to required functions after purchasing the module.

Model	Name	Option dependency
MU195020A-111	1ch 10Tap Emphasis Retrofit	Same as MU195020A-011
MU195020A-130	1ch Data Delay Retrofit	Same as MU195020A-030
MU195020A-140	1ch Variable ISI Retrofit	Same as MU195020A-040
MU195020A-340		

Table 3-1-7: List of Exclusive Retrofit Options for MU195020A-010

Add the following options according to required functions after purchasing the module.

Model	Name	Option dependency
MU195020A-121	2ch 10Tap Emphasis Retrofit	Same as MU195020A-021
MU195020A-131	2ch Data Delay Retrofit	Same as MU195020A-031
MU195020A-141	2ch Variable ISI Retrofit	Same as MU195020A-041
MU195020A-341		

3.2 PAM4 PPG MU196020A/C

Table 3-2-1: PAM4 PPG MU196020A Basic Option (Must Select One Option)

Model	Name	Description
MU196020A/C-001	32G baud	Operating rate range: 2.4 to 32.1 Gbaud
MU196020A/C-002	58G baud	Operating rate range: 2.4 to 58.2 Gbaud
MU196020A/C-003	64G baud	Operating rate range: 2.4 to 64.2 Gbaud

Table 3-2-2: Additional Options and Dependencies

Options listed below can be added according to required functions. For options required for each application, refer to Section 4. Combination of Modules.

Model	Name	Option dependency
MU196020A/C-011	4Tap Emphasis	—
MU196020A/C-030	Data Delay	—
MU196020A/C-040	Adjustable ISI	Requires MU195020A-011
MU196020A/C-042	FEC Pattern Generation	—
MU196020A/C-043	FEC Error Insertion for PCIe6	—
MU196020A/C-045	USB4 Gen4 Pattern Generation	—
MU196020A/C-050	Inter-Module Synchronization	Requires MU196020A/C-030
MU196020A-051	Sequence Editor Function	Requires MU196020A-060
MU196020A-052	Sequence Editor Function for Multi-Channel	Requires MU196020A-050, and 051
MU196020A-056	Sequence Editor Function PCIe 6 and CXL 3 Flits Extension	Requires MU196020A-051
MU196020A-060	PCIe6 LEQ	Requires MU195020A-011

Table 3-2-3: Baud Rate Extension Option After Purchase

The operating rate can be extended after purchase according to required functions.

Model	Name
MU196020A/C-112	32G to 58G baud Extension Retrofit
MU196020A/C-113	32G to 64G baud Extension Retrofit
MU196020A/C-123	58G to 64G baud Extension Retrofit

Baud rate after adding option

Current baud	Baud rate after adding option	
	58 Gbaud	64 Gbaud
32 Gbaud (001)	MU196020A/C-112	MU196020A/C-113
58 Gbaud (002 or 001 + 012)	-	MU196020A/C-123

Table 3-2-4: List of Retrofit Options

Add the following options according to required functions after purchasing the module.

Model	Name	Option dependency
MU196020A/C-111	4Tap Emphasis Retrofit	Same as MU196020A-011
MU196020A/C-130	Data Delay Retrofit	Same as MU196020A-030
MU196020A/C-140	Adjustable ISI Retrofit	Same as MU196020A-040
MU196020A/C-340		
MU196020A/C-142	FEC Pattern Generation Retrofit	Same as MU196020A-042
MU196020A/C-342		
MU196020A/C-343	FEC Error Insertion for PCIe6 Retrofit	Same as MU196020A-043
MU196020A/C-145	USB4 Gen4 Pattern Generation	Same as MU196020A-045
MU196020A/C-345	Retrofit	
MU196020A/C-150	Inter-Module Synchronization Retrofit	Same as MU196020A-050
MU196020A-351	Sequence Editor Function	Same as MU196020A-051
MU196020A-352	Sequence Editor Function for Multi-	Same as MU196020A-052

	Channel	
MU196020A-356	Sequence Editor Function PCIe 6 and CXL 3 Flits Extension	Same as MU196020A-056
MU196020A-160 MU196020A-360	PCIe6 LEQ Retrofit	Same as MU196020A-060 MU196020A-360 Only for MU196020A with serial numbers starting from 6272477551

3.3 21G/32G bit/s SI ED MU195040A

Table 3-3-1: 21G/32G bit/s SI ED MU195040A Basic option (Must Select One Option)

Model	Name	Description
MU195040A -010	1ch ED	
MU195040A -020	2ch ED	

Table 3-3-2: Additional Options when Selecting MU195040A-010

Model	Name	Option dependency
MU195040A-011	1ch CTLE	None

Table: 3-3-3 Additional Options when Selecting MU195040A-020

Model	Name	Option dependency
MU195040A-021	2ch CTLE	None

Table 3-3-4: Additional Options and Dependencies (Common for MU195040A-010 and MU195040A-020)

Options listed below can be added according to required functions. For options required for each application, refer to Section 4. Combination of Modules.

Model	Name	Option dependency
MU195040A-001	32G bit/s Extension	None
MU195040A-022	Clock Recovery	None

Table 3-3-5: List of Retrofit Options

Add the following options according to required functions after purchasing the module.

Model	Name	Option dependency
MU195040A-101	32G bit/s Extension Retrofit	Same as MU195040A-001
MU195040A-111	1ch CTLE Retrofit	Same as MU195040A-011
MU195040A-121	2ch CTLE Retrofit	Same as MU195040A-021
MU195040A-122	Clock Recovery Retrofit	Same as MU195040A-022

3.4. PAM4 ED MU196040B

Table 3-4-1: PAM4 ED MU196040B Basic Option (Must Select One Option)

Model	Name	Description
MU196040B-001	32G baud	—
MU196040B-002	58G baud	—
MU196040B-005	64G baud	—

Table 3-4-2: Additional Options and Dependencies

Options listed below can be added according to required functions. For options required for each application, refer to Section 4. Combination of Modules.

Model	Name	Option dependency
MU196040B-011	Equalizer	None
MU196040B-021	29G Clock Recovery	MU196040B-021 and 022 are mutually exclusive.
MU196040B-022	32G Clock Recovery	MU196040B-021 and 022 are

		mutually exclusive.
MU196040B-023	58G Clock Recovery Extension	1: Requires MU196040B-002 or 005 2: Requires MU196040B-021 or 022
MU196040B-041	SER Measurement	None
MU196040B-042	FEC Analysis	None
MU196040B-043	FEC Analysis for PCIe6	Requires MU196040B-041
MU196040B-051	PCIe Sequence Editor Pattern Analysis	None

Table 3-4-3: List of Retrofit Additional Options

Add the following options according to required functions after purchasing the module.

Model	Name	Option dependency
MU196040B-111	Equalizer Retrofit	Same as MU196040B-011
MU196040B-112	32G to 58G baud Extension Retrofit	Requires MU196040B-001
MU196040B-115	32G to 64G baud Extension Retrofit	Requires MU196040B-001
MU196040B-125	54G to 64G baud Extension Retrofit	Requires MU196040B-002
MU196040B-141 MU196040B-341	SER Measurement Retrofit	Same as MU196040B-041
MU196040B-342	FEC Analysis Retrofit	Same as MU196040B-042
MU196040B-343	FEC Analysis for PCIe6 Retrofit	Same as MU196040B-043
MU196040B-121	29G baud Clock Recovery Retrofit	Same as MU196040B-021
MU196040B-122	32G baud Clock Recovery Retrofit	Same as MU196040B-022
MU196040B-123	58G baud Clock Recovery Extension Retrofit	Requires MU196040B-002,005,112, 115 or 125 Requires MU196040B-021,022,121 or 122
MU196040B-124	32G baud Clock Recovery Extension Retrofit	Requires MU196040B-121
MU196040B-351	PCIe Sequence Editor Pattern Analysis	Same as MU196040B-051

3.5. 32G baud NRZ/PAM4 Re-Driver MU196060A

Table 3-5-1: 32G baud NRZ/PAM4 Re-Driver MU196060A

Model	Name	Description
MU196060A-001	Clock Recovery for SSC	None

Table 3-5-2: List of Retrofit Additional Options

Model	Name	Option dependency
MU196060A-301	Clock Recovery for SSC Retrofit	Same as MU196060A-001

3.6. SIGNAL QUALITY ANALYZER-R MP1900A

Table 3-6-1: List of Retrofit Additional Options (Purchased before July 2020)

Model	Name	Option dependency
MP1900A-110 MP1900A-210	Windows10 Upgrade Retrofit	None

4. Module Combinations

This chapter explains the following supported module configurations.

Model	Description	Model	Description	Model	Description
MU191000A MU181000B	Synthesizer	MU196020A/C	PAM4 PPG	-	-
MU181500B	Jitter	MU196040A/B	PAM4 ED	-	-
MU195050A MU196050B	Noise	MU195020A	SI PPG	-	-
MU196060A	Re-Driver	MU195040A	SI ED	-	-

4.1 Restrictions

4.1.1 Restrictions on Module Combination

Restrictions																	
Synthesizer Module Jitter Module	There are no restrictions on the slot positions.																
	The SJ2 Jitter generation function can be used when Opt-001 is installed in the Synthesizer MU181000A/B module and the Jitter Modulation Source MU181500B module is installed in same unit. To achieve the best SJ2 accuracy and reliability, the synthesizer module and jitter modulation source module combination is tuned at shipment. Consequently, the performance cannot be guaranteed if the shipped module configuration is changed. When adding a new jitter modulation source module to a customer's existing synthesizer configuration (with Opt-001), since the SJ2 Jitter generation accuracy described in the catalog will not be met, the customer's synthesizer module must be returned to Anritsu for readjustment.																
SI PPG/ED Module	Use either the standard BERT module configuration described in section 4.2.1, or the module configuration described in sections 4.2.2 to 4.2.4. *																
	A combined total of up to four PPG and ED modules can be mounted in one MP1900A. When using multiple PPG modules, install the PPG modules sequentially from slot 1 When using four or more PPG modules, this can be achieved by synchronization between two chassis (Unit Sync). During Unit Sync, this function is enabled only when two or more PPG modules are installed in each MP1900A. Example: When using five PPG modules, install three PPG modules in the Primary MP1900A and two in the Secondary MP1900A. When using six or seven PPG modules, install three or four PPG modules in the Primary MP1900A and two or three in the Secondary MP1900A.																
	The following option are required to use the 2ch Combination function. MU195020A-x20 2ch Data Output2ch MU195040A-x20 2ch ED																
	Channel Synchronization and Combination functions between modules.																
	<table><tr><td></td><td>The following option is required for all modules.</td></tr><tr><td></td><td>MU195020A-x31 2ch Data Delay</td></tr><tr><td></td><td>The following option configurations must be the same for all modules.</td></tr><tr><td></td><td>MU195020A-x01 32G bit/s Extension</td></tr><tr><td></td><td>MU195020A-x20 2-channel Data Output</td></tr><tr><td></td><td>Contact us for information about the Sequence Editor for SIPPg multi-channel.</td></tr></table>		The following option is required for all modules.		MU195020A-x31 2ch Data Delay		The following option configurations must be the same for all modules.		MU195020A-x01 32G bit/s Extension		MU195020A-x20 2-channel Data Output		Contact us for information about the Sequence Editor for SIPPg multi-channel.				
		The following option is required for all modules.															
	MU195020A-x31 2ch Data Delay																
	The following option configurations must be the same for all modules.																
	MU195020A-x01 32G bit/s Extension																
	MU195020A-x20 2-channel Data Output																
	Contact us for information about the Sequence Editor for SIPPg multi-channel.																
PAM4 PPG/ED Module	Use either the standard BERT module configuration described in section 4.2.1, or the module configuration described in sections 4.2.2 to 4.2.4.*																
	A combined total of up to four PPG and ED modules can be mounted in one MP1900A. When using multiple PPG modules, install the PPG modules sequentially from slot 1. When using four or more PPG modules, this can be achieved by synchronization between two chassis (Unit Sync). During Unit Sync, this function is enabled only when two or more PPG modules are installed in each MP1900A. Example: When using five PPG modules, install three PPG modules in the Primary MP1900A and two in the Secondary MP1900A. When using six or seven PPG modules, install three or four PPG modules in the Primary MP1900A and two or three in the Secondary MP1900A. When performing Unit Sync, use either all MU196020A modules or all MU196020C modules for the PPGs.																
	Channel Synchronization functions between modules.																
	<table><tr><td></td><td>The following option configurations must be the same for all modules.</td></tr><tr><td></td><td><table><tr><th>Option/Function</th><th>Required</th><th>Sequence Editor PCIe1-6</th><th>Sequence Editor CXL 2/3</th></tr><tr><td>MU196020A-x30 Data Delay</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>MU196020A-x50 Inter-Module Synchronization</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr></table>		The following option configurations must be the same for all modules.		<table><tr><th>Option/Function</th><th>Required</th><th>Sequence Editor PCIe1-6</th><th>Sequence Editor CXL 2/3</th></tr><tr><td>MU196020A-x30 Data Delay</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>MU196020A-x50 Inter-Module Synchronization</td><td>✓</td><td>✓</td><td>✓</td></tr></table>	Option/Function	Required	Sequence Editor PCIe1-6	Sequence Editor CXL 2/3	MU196020A-x30 Data Delay	✓	✓	✓	MU196020A-x50 Inter-Module Synchronization	✓	✓	✓
		The following option configurations must be the same for all modules.															
		<table><tr><th>Option/Function</th><th>Required</th><th>Sequence Editor PCIe1-6</th><th>Sequence Editor CXL 2/3</th></tr><tr><td>MU196020A-x30 Data Delay</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>MU196020A-x50 Inter-Module Synchronization</td><td>✓</td><td>✓</td><td>✓</td></tr></table>	Option/Function	Required	Sequence Editor PCIe1-6	Sequence Editor CXL 2/3	MU196020A-x30 Data Delay	✓	✓	✓	MU196020A-x50 Inter-Module Synchronization	✓	✓	✓			
Option/Function	Required	Sequence Editor PCIe1-6	Sequence Editor CXL 2/3														
MU196020A-x30 Data Delay	✓	✓	✓														
MU196020A-x50 Inter-Module Synchronization	✓	✓	✓														

	MU196020A-051 Sequence Editor Function		✓	✓
	MU196020A-052 Sequence Editor Function for Multi-Channel		✓	✓
	MU196020A-056 Sequence Editor Function PCIe 6 and CXL 3 Flits Extension			✓
	MU196020A-060 PCIe6 LEQ		✓	✓
	NOTE: ✓ = Requires Channel Synchronization for all modules.			
	The following Option configurations must be the same for all modules. MU196020A/C-x01 32G baud MU196020A/C-x02 58G baud, MU196020A-x12 32G to 58G baud Extension one of them MU196020A/C-x03 64G baud, MU196020A-x13 32G to 64G baud Extension, MU196020A-x23 58G to 64G baud Extension one of them The MU196020A and the MU196020C cannot perform Channel Synchronization. Example			
	No.	Module 1	Module 2	Module 3
	1	MU196020A-x01	MU196020A-x01	MU196020A-x01
	2	MU196020A-x02	MU196020A-x02	MU196020A-x12
	3	MU196020A-x03	MU196020A-x13	MU196020A-x23
	4	MU196020A-x01	MU196020A-x12	MU196020A-x23
	5	MU196020C-x01	MU196020A-x01	MU196020C-x01
32G PPG/ED Module	Use the module configuration described in sections 4.2.2 to 4.2.4			
	The 2ch Combination function across two modules is not supported. The 2ch Combination function requires the 2ch PPG/ED option. Use of two 1ch PPG/ED modules does not support 2ch Combination setting.			
Noise Module	There are no restrictions on the slot positions. Install in the slot above or below the PPG to connect the PPG using the standard accessory cable.			
Re-Driver Module	There are no restrictions on the slot positions. Install in the slot above or below the ED to connect the ED using the standard accessory cable.			

* Note the restrictions for this item; use is possible after removing some modules from the configuration as described in "Expert BERT."

4.1.2 Restrictions on Jitter Tolerance Test

Restrictions of Jitter Tolerance Test (MX183000A-PL001) in combination of PPG / ED modules are as follows.

* The following are restrictions on PAM4. There is no restriction on NRZ.

		ED Module	
		MU196040A/B	MU195040A
PPG Module	MU196020A/C	✓	-
	MU195020A	-	✓*

* G0375A is required on the PPG side. Please use PAM4 Control screen of MX183000A. (Production of the G0375A is being discontinued. In future, use the MU196020A.)

4.2 Verified module configuration

The verified module configuration is shown below. If you want to use the configuration not listed here, please contact our sales representative.

4.2.1 Bert for PCIe1 to 7 Module Configurations

Slot No.	Bert for PCIe1 to 7 1ch NRZ/PAM4 BER Measurement Or PCIe Gen4 to 7 Measurement Applications
Slot1	Synthesizer (MU191000A)
Slot2	Jitter
Slot3	
Slot4	Blank
Slot5	Re-Driver ^{*2}
Slot6	PAM4 ED
Slot7	PAM4 PPG
Slot8	Noise

4.2.2 Standard BERT Module Configurations

This configuration can be started as "Standard BERT" with MX190000A control software.

Slot No.	Standard BERT for PAM4 1ch NRZ/PAM4 BER Measurement Or PCIe Gen4 to 7 Measurement Applications	Standard BERT for PAM4 1ch NRZ/PAM4 BER Measurement Or PCIe4 to 6 Measurement Applications
Slot1	Synthesizer (MU191000A)	Synthesizer (MU191000A) ^{*1}
Slot2	Jitter	Jitter
Slot3		
Slot4	Blank	Blank
Slot5	Re-Driver ^{*2}	Re-Driver ^{*2}
Slot6	PAM4 ED	PAM4 ED
Slot7	PAM4 PPG	PAM4 PPG
Slot8	Noise	Noise

Slot No.	Standard BERT for SI 1 to 2ch NRZ or 1ch PAM4 BER Measurement PCIe1-5/USB3.2/USB4/TBT/DP Applications [*]	Standard BERT for SI and PAM4 1ch NRZ or 1ch PAM4 BER Measurement PCIe 1 to 5/Ether Applications
Slot1	Synthesizer (MU191000A) ^{*1}	Synthesizer (MU191000A) ^{*1}
Slot2	Jitter	Jitter
Slot3		
Slot4	Blank	Blank
Slot5	- ^{*3}	PAM4 ED or Re-Driver
Slot6	SI ED	SI ED
Slot7	SI PPG	PAM4 PPG
Slot8	Noise	Noise

^{*1} Slot1/2: MU181000A; Slot3/4: MU181500B is also possible.

^{*2} Can be used with SI ED. The Re-Driver is required for PCIe.

^{*3} Can be used with PAM4 PPG, PAM4 ED, 32G ED or Re-Driver

^{*4} Launch Application USB4, TBT, and DP using "Expert BERT".

Start with "Expert BERT" instead of "Standard BERT".

Start with Expert BERT instead of Standard BERT :						
Slot No.	Only PAM4 PPG or ED		SI PPG/ED and 32G PPG/ED Mixed Configurations			SI PPG x2 (For DDR5)
Slot1	Synthesizer*1(MU181000B)					
Slot2						
Slot3	Jitter					
Slot4						
Slot5	-				SI PPG*2	
Slot6	-	PAM4 ED	32G ED		SI ED	
Slot7	PAM4 PPG	-	SI PPG	32G PPG		SI PPG
Slot8	Noise	Noise	Noise	-	-	Noise

*1 Slot1: MU191000A; Slot2/3: Jitter; Slot4: Blank is also possible.

*2 Slot 7 requires the MU195020A-020 for DDR5 measurements. See "Option Configuration Examples" for details.

Slot No.	SI PPG/ED and PAM4 PPG/ED Mixed Configurations	
Slot1	Synthesizer ^{*1} (MU181000B)	
Slot2		
Slot3	Jitter	
Slot4		
Slot5	SI PPG	PAM4 PPG
Slot6	Blank/PAM4 ED/SI ED	
Slot7	PAM4 PPG	SI PPG
Slot8	Noise ^{*2}	

*1 Slot1: MU191000A; Slot2/3: Jitter; Slot4: Blank is also possible.

*2 Requires MU195050A

4.2.3 Bert for PCIe1-6 Forced Link Configurations

Start with " Bert for PCIe1-6 Forced Link " .

Slot No.	Bert for PCIe1-6 Forced Link For Sequence Editor (1CH)	Bert for PCIe1-6 Forced Link For Sequence Editor (Multi CH)
Slot1	Synthesizer (MU191000A) ^{*1}	MU196020A
Slot2	Jitter	MU196020A
Slot3		MU196020A
Slot4	Blank	MU196020A
Slot5	Re-Driver ^{*2}	Jitter
Slot6	SI ED	
Slot7	SI PPG	Synthesizer (MU191000A) ^{*1}
Slot8	Noise	

*1 Slot1/2: MU181000B; Slot2/3: MU181500B is also possible.

*2 Blank is also possible.

4.2.4 2ch PAM4 BERT, 4ch NRZ SI BERT, 4ch 32G BERT Configurations

Install the PPG modules sequentially from slot 1

Start after selecting [Expert BERT] at the MX190000A control software.

Slot No.	PAM4 PPG/ED	PAM4 PPG/ED (with Noise)	SI PPG/ED
Slot1	PAM4 PPG x 2	PAM4 PPG x 2	SI PPG x 2
Slot2			
Slot3	Jitter	Noise	Jitter
Slot4		PAM4 ED	
Slot5	Synthesizer ^{*1} (MU181000B)	Jitter	Synthesizer ^{*1} (MU181000B)
Slot6			
Slot7	PAM4 ED x 2 ^{*2}	Synthesizer ^{*2} (MU181000B)	SI ED x 2 ^{*2}
Slot8			

*1 Slot5: MU191000A; Slot6: Blank is also possible.

*2 Load the ED in Slot 8 when using a configuration with two PPGs and one ED.

*3 Slot7: Blank; Slot8: MU191000A is also possible.

Slot No.	SI PPG and PAM4 ED	SI PPG/ED and 32G PPG/ED
Slot1	SI PPG x2	SI PPG x2 or 32G PPG x2 or 32G PPG 4CH
Slot2		
Slot3	Jitter	Jitter
Slot4		
Slot5	Synthesizer ^{*1} (MU181000B)	Synthesizer ^{*1} (MU181000B)
Slot6		
Slot7	PAM4 ED x2 ^{*2}	SI ED x2 or 32G ED x2 or 32G ED 4CH ^{*2}
Slot8		

*1 Slot5: MU191000A; Slot6: Blank is also possible.

*2 Load the ED in Slot 8 when using a configuration with two PPGs and one ED.

4.2.5 PAM4 PPG/SI PPG 2 Module + Noise Configuration

Start after selecting "Expert BERT" at the MX190000A control software.

Start after selecting "Expert BERT" at the MX150000A control software.				
Slot No.	PAM4 PPG/ED		SI PPG/ED ^{*2}	
	Unit No.1	Unit No.2	Unit No.1	Unit No.2
Slot1	Jitter	Synthesizer ^{*3} (MU181000B)	SI PPG x2	Synthesizer ^{*3} (MU181000B)
Slot2				
Slot3	Noise	-	Jitter	-
Slot4	PAM4 PPG			
Slot5	PAM4 ED ^{*1}		Noise x2	
Slot6	PAM4 ED ^{*1}			
Slot7	PAM4 PPG		SI ED x2 ^{*1}	
Slot8	Noise			

^{*1} Load the ED in Slot 5 when using a configuration with two PPGs and one ED. It can be used either without this module or with the synthesizer module loaded.

^{*2} Use eight pieces of the Electrical Length Specified Coaxial Cable J1728A to input data from the PPG module to the Noise module.

^{*3} Slot1: MU191000A is also possible.

Slot No.	Unit No.1	Unit No.2
Slot1	Jitter	Synthesizer ^{*2} (MU181000B)
Slot2		
Slot3	Noise	-
Slot4	PAM4 PPG	
Slot5	PAM4 ED ^{*1}	
Slot6	SI ED ^{*1}	
Slot7	SI PPG	
Slot8	Noise	

^{*1} No module, or a Synthesizer can be inserted.

^{*2} Slot1: MU191000A is also possible.

4.2.6 PAM4 PPG/SI PPG 4 Module Configuration

Install the PPG modules sequentially from slot 1. Start after selecting [Expert BERT] at the MX190000A control software.

Use the two J1748A Power Splitter units and six J1728A Electrical Length Specified Coaxial Cables to supply clocks from the Jitter module to the four PPG modules.

Slot No.	PAM4 PPG/ED		SI PPG/ED	
	Tx	Rx	Tx	Rx
Slot1	PAM4 PPG x 4 ^{*1,2}	PAM4 ED x 4	SI PPG x 4	SI ED x 4
Slot2				
Slot3				
Slot4				
Slot5	Jitter	-	Jitter	-
Slot6				
Slot7	Synthesizer ^{*3} (MU181000B)		Synthesizer ^{*3} (MU181000B)	
Slot8				

^{*1} The Multi-Channel function cannot be used for a MU195020A and MU195020C combination.

^{*2} To use the Sequence Editor (PCIe1-6, CXL) function, select "BERT for PCIe1-6 Forced Link" at the MX190000A control software.

^{*3} Slot8: MU191000A; Slot7: Blank is also possible.

When using four or more PPG modules, inter-chassis synchronization (Unit Sync) between two MP1900A units is available. Using the Unit Sync function allows multiple MP1900A units to be synchronized for pattern generation. For details, see [MX190000A Signal Quality Analyzer-R Control Software Operation Manual](#).

Slot No.	PAM4 PPG configuration		SI PPG/ED configuration	
	Primary MP1900A	Secondary MP1900A	Primary MP1900A	Secondary MP1900A
Slot1	PAM4 PPG x 4 ^{*1}	PAM4 PPG x 4 ^{*1,4}	SI PPG x 4 ^{*1,4}	SI PPG x 4 ^{*1,4}
Slot2				
Slot3				
Slot4				
Slot5	Jitter(Optional) ^{*2}	Jitter(Optional) ^{*2}	Jitter(Optional) ^{*2}	Jitter(Optional) ^{*2}
Slot6				
Slot7	Synthesizer ^{*3}		Synthesizer ^{*2}	
Slot8				
	(MU181000B)		(MU181000B)	

*1 MU196020A and MU196020C cannot perform Channel Sync.

*2 Contact us if a Jitter module is required.

*3 Slot8: MU191000A; Slot7: Blank is also possible.

*4 When using five PPG modules, install three MU196020A modules in the MP1900A (Primary) and two in the MP1900A (Secondary). When using six or seven MU196020A modules, install four in the MP1900A (Primary) and two or three in the MP1900A (Secondary).

Slot No.	Tx			Rx
Slot1	32G PPG x4	SI PPG x2	SI PPG x2	32G ED x4
Slot2				
Slot3				
Slot4		32G PPG x2	32G PPG 4CH	
Slot5	Jitter			-
Slot6				
Slot7	Synthesizer* ¹			
Slot8				

*1 Slot8: MU191000A; Slot7: Blank is also possible.

4.3 Option Configuration Examples

If 1ch xx is specified as either the MU195020A or MU195040A product name in “Typical Option Configurations”, it can be changed to 2ch xx (xx is the same name).

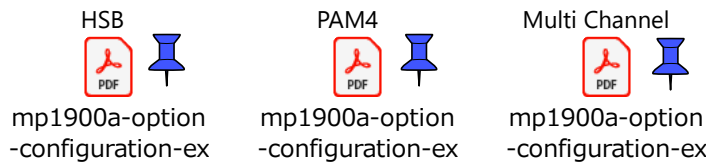
However, the number of channels must be the same within one module.

Example: For MU195020A-001, 010, 030 configuration

MU195020A-030 (1ch Data Delay) can be changed to MU195020A-031 (2ch Data Delay). In this case, MU195020A-010 (1ch Data Output) must also be changed simultaneously to MU195020A-020 (2ch Data Output) so the number of channels match.

If 2ch xx is specified as the product name in “Typical Option Configurations”, it cannot be changed to 1ch.

Refer to the attached file for details.



5. Combinations of Automation Software and Real-time Oscilloscopes for Compliance Tests

Refer to the following table for the combinations of automation software used for each type of compliance test and supported real-time oscilloscope.

Legend: ✓ = Can be used

Module	Solution	MP1900A	GRL Automation SW		LeCroy	Tektronix
			Keysight Scope	Tektronix Scope		
SI PPG + SI ED	PCIe Gen3 Rx	✓	✓	✓	✓	-
	PCIe Gen4 Rx	✓	✓	✓	✓	✓
	PCIe Gen5 Rx	✓	✓	✓	✓	✓
	PCIe PLL Test	✓	✓	✓	✓	✓
	USB3.2 1 lanes Rx	✓	✓	✓	✓	-
	USB3.2 2 lanes Rx	✓	✓	✓	-	-
	USB3.2 Ping LFPS	✓	✓	✓	✓	-
	USB3.2 Retimer (Embedded&Component&Active Cable)	✓ ^{*1}	-	-	-	-
	USB4 v1 Rx	✓	✓	✓	✓	✓
	SAS3/4 Rx(12G 22.5G Only PRBS Ber Test)	✓	✓	✓	-	-
	DisplayPort 1.4 (DP 1.4)	✓	✓	✓	✓	-
	DisplayPort 2.0, 2.1 (DP 2.0, DP 2.1)	✓	✓	✓	✓	-
	TBT3 Rx	✓	✓	-	✓	-

PPG Module	Solution	MP1900A	GRL Automation SW		LeCroy	Tektronix
			Keysight Scope	Tektronix Scope		
PAM4 PPG	PCIe Gen3 Rx	✓	✓	✓	✓	-
+ SI ED	PCIe Gen4 Rx	✓	✓	✓	✓	✓
	PCIe Gen5 Rx	✓	✓	✓	✓	✓
	PCIe PLL Test	✓	-			
PAM4 PPG	PCIe Gen3 Rx	✓	-			
+ PAM4 ED	PCIe Gen4 Rx	✓	*2	*2	✓	*2
	PCIe Gen5 Rx	✓	*2	*2	✓	*2
	PCIe Gen6 Rx Base	✓	✓	✓	✓	✓
	PCIe Gen6 Rx CEM	-	✓	✓	*2	*2
	PCIe PLL Test	✓	-			
PAM4 PPG (only MU196020C)	PCIe Gen7 Rx Base	✓	✓	✓	*2	*2
SIPPG + PAM4 PPG	USB4 v2 Rx	✓	*2	*2	*2	*2

*1 Active Cable supports up to USB 3.2 Gen1.

*2 Enquire about support status.

6. Compliance Test Measurement Kit

The following table lists the peripheral equipment for performing each compliance test.

Compliance Test Item		Model	Name	Qty	Remarks	
PCIe Gen4-6 (When using MU196020C/MU196050B when DUT TYPE = K-connector) *1		J1815A	MP1900A PCIe Measurement Component Set	1		
		Z2025A	PCIe CBB Controller	1	For add-in-card test; supports GRL automation software	
		Z2029A	PCIe 100 MHz Reference Clock Buffer	1	For add-in-card test	
		34VFK50A	Fixed Adapter (V-M, K-F)	4	MU195060A Data Input V->K MU195050B Data Output V->K	
		J1900A	Passive Low Frequency Equalizer	2	Using this product may allow for a more accurate BER measurement. Please contact us for more information.	
		G0447A	PCIe6 External Re-Driver	1		
PCIe Gen6-7 (When using MU196020C/MU196050B when DUT TYPE = V-connector)		Z2025A	PCIe CBB Controller	1	For add-in-card test; supports GRL automation software	
		Z2029A	PCIe 100 MHz Reference Clock Buffer	1	For add-in-card test	
		J1932A	Coaxial Skew Matched Cable Pair (0.8m, V Connector)	3	• DUT Input (1 pair) • DUT Output for Tx LEQ (2 pair)	
		J1625A	COAXIAL CABLE 1M(SMA connector)	2	For 100 MHz Clock	
		J1715A	COAXIAL SKEW MATCH CABLE(0.1M, SMP-J,SMA-J)	1	For 100 MHz Clock	
		J1759A	BNC-SMA Connector Cable(1m)	1	For Tx LEQ, Real Time Oscilloscope Trigger	
		V240C	PRECISION POWER DIVIDER, 65GHz, V(f)-V(f)	2	For Tx LEQ	
		34VV50	PRECISION ADAPTER, DC-65GHz, V(m)-V(m)	2	Adapter for V240C	
		J1900A	Passive Low Frequency Equalizer	2	Using this product may allow for a more accurate BER measurement. Please contact us for more information.	
		G0447A	PCIe6 External Re-Driver	1		
	Gen7 Base only		Z2025A	PCIe CBB Controller	1	For add-in-card test; supports GRL automation software
			Z2029A	PCIe 100 MHz Reference Clock Buffer	1	For add-in-card test
			J1932A	Coaxial Skew Matched Cable Pair (0.8m, V Connector)	2(1) *1	• DUT Input (1 pair) • DUT Output for Tx LEQ (2 pair)
			J1625A	COAXIAL CABLE 1M(SMA connector)	2	For 100 MHz Clock
			J1715A	COAXIAL SKEW MATCH CABLE(0.1M, SMP-J,SMA-J)	1	For 100 MHz Clock
	PCIe Gen4-6 (When using MU196020A/MU195050A when DUT TYPE = K-connector)		J1815A	MP1900A PCIe Measurement Component Set	1	
			Z2025A	PCIe CBB Controller	1	For add-in-card test; supports GRL automation software
			Z2029A	PCIe 100 MHz Reference Clock Buffer	1	For add-in-card test
			34VKF50A	Fixed Adapter (V-M, K-F)	2	MU196060A Data Input V->K
		J1900A	Passive Low Frequency Equalizer	2	Using this product may allow for a more accurate BER measurement. Please contact us for more information.	
		G0447A	PCIe6 External Re-Driver	1		
PCIe Gen1-5 (When using MU195040A)		J1815A	MP1900A PCIe Measurement Component Set	1		
		Z2025A	PCIe CBB Controller	1	For add-in-card test; supports GRL automation software	
		Z2029A	PCIe 100 MHz Reference Clock Buffer	1	For add-in-card test	
		-	Re-Driver	1	G0430A is a discontinued product. Use MU1906060A.	
		34VKF50A	Fixed Adapter (V-M, K-F)	2	MU196060A Data Input V->K (When using MU196060A)	

	34VFK50A	Fixed Adapter (V-F, K-M)	2	MU195040A Data Input K->V (When using MU196060A)
USB3.2/USB3.2x2	J1551A	Coaxial Skew Matched Cable (0.8 m)	2 (4) ^{*2}	K-connector
	USB31CET	USB3.1 Type-C Test Fixture ^{*3}	1	Purchase from Wilder Technology Corporation
USB4 v1, Thunderbolt 3	J1551A	Coaxial Skew Matched Cable (0.8 m)	3	K-connector
	K261	DC Block	2	
	-	K-SMP Adapter	4	Equivalent to Rosenberger Corporation 02K119-K00E3
	ISI-USB4	ISI Channel	1	Purchase from Wild River Technology Corporation
	USB4-TPA-UC-K	USB4/TBT 3 Test Fixture	1	Purchase from Wilder Technology Corporation
USB4 v2 (CTS1.00)	AH54192A	Differential linear amplifier	1	
	J1943A	MP1900A USB4 v2 Measurement Component Set	1	Enquire about details. (Summer 2026 sales launch) See Appendix for details.
		ISI Channel	1	Purchase from either Wilder Technologies or Wild River Technology.
		USB4 v2 Fixture	1	Purchase from either Wilder Technologies or Luxshare-ICT.
		USB4 v2 Micro Controller	1	Purchase from either Wilder Technologies or Granite River Labs.
SAS-3	K261	DC Block	4	
	J1550A	Coaxial skew match cable (0.8 m)	3	APC3.5 Connector
	J1758A	ISI Board	1	
	-	SAS Test Fixture	1	
SAS-4	K261	DC Block	4	
	J1551A	Coaxial skew match cable (0.8 m)	4	K-connector
	MG3692C	2 GHz to 20 GHz Signal Generator	1	
	K241C	Power Splitter	1	
	J1758A	ISI Board	1	
	-	SAS Test Fixture	1	

Compliance Test Item	Model	Name	Qty	Remarks	
DisplayPort1.4 (DP 1.4) Basic Accessory	K261	Ultra Wide Band DC Block, 10 kHz - 40 GHz	2		
	AN44182A	1:4 Power divider	2		
	DSG815	297MHz Jitter Source	1	Purchase DSG815 1.5GHz RF Signal Generator from RIGOL .	
	41KB-6	6 dB attenuator (For 297 MHz SJ)	1	41KC-6 also OK	
	CLE1000-A2	Artek ISI-A2	1	Purchase CLE1000-A2 from aceunitech.	
	DPT-200 controller set	DPT-200, USB-A to USB-B cable, Power adaptor DisplayPort RefSource AUX Controller(OPTION)	1	Purchase DPT-200 controller set from UNIGRAF. Requires DisplayPort RefSource AUX Controller license	
	HL9450-60	Transition Time Converter (<1 GHz) 60ps	2	Purchase from HYPERLABS. HL9452-60 also OK	
	HL9450-150	Transition Time Converter (<1 GHz) 150ps	2	Purchase from HYPERLABS. HL9452-150 also OK	
	J1821A	Coaxial skew match cable(0.8m, K connector)	8	J1551A also OK J1550A also OK	
	J1625A	COAXIAL CABLE 1M(SMA connector)	1		
	J1398A	N-SMA ADAPTOR	1		
	J1632A	TERMINATOR	6		
	For Full-size DP Accessory	DP-TPA-P	DisplayPort Plug Adapter(For DP1.4)	1	Purchase from Wilder Technology.
		DP R	DisplayPort Receptacle Adapter(For DP1.4)	1	Purchase from Wilder Technology.
		DP-TPA-A	Display Port Aux Control Adapter	1	Purchase from Wilder Technology.
		DP Cable	DP cable for AUX control No length specified.	1	This AUX connection does not impact measurement.
	For Type-C Accessory	DPC Plug	Display Port Type-C Plug Adapter	1	Purchase from Wilder Technology.
		DPC Receptacle	Display Port Type-C Receptacle Adapter	1	Purchase from Wilder Technology.
		DPC Control board	Display Port Type-C Control Board	1	Purchase from Wilder Technology.
		DP-Type C Cable	DP cable for AUX control	1	Use cable supporting DP output and Type-C input, or bidirectional cable.

Compliance Test Item	Model	Name	Qty	Remarks
DisplayPort2.1 (DP 2.1) Basic Accessory	K261	Ultra Wide Band DC Block, 10 kHz - 40 GHz	2	
	AN44182A	1:4 Power divider	2	
	ISI-USB4	WildRiver ISI board	1	<u>ISI-USB4 – ISI Loss Modeling Platform Set for USB4 RX and DisplayPort 2.0 Sink – from Wild River Technology</u>
	DPT-200 controller set	DPT-200, USB-A to USB-B cable, Power adaptor DisplayPort RefSource AUX Controller(OPTION)	1	Purchase from UNIGRAF. <u>DPT-200 controller set</u> requires DisplayPort RefSource AUX Controller license .
	J1551A	Coaxial skew match cable(0.8m, K connector)	8	
	J1632A	TERMINATOR	6	
	For Full-size DP Accessory	ENH-DP-TPA-P	1	Purchase from Wilder Technology.
		ENH-DP-TPA-R	2	Purchase from Wilder Technology.
		DP-TPA-A	1	Purchase from Wilder Technology
		DP2.1 Cable 0.8m	1	
		DP2.1 Cable 2m	1	
		DP Cable	1	
	For Type-C Accessory	DPC Plug	1	Purchase from Wilder Technology.
		DPC Receptacle	2	Purchase from Wilder Technology.
		DPC Control board	1	Purchase from Wilder Technology.
		USB-C cable 0.8m	1	Lintes Technology cable recommended
		USB-C cable 2m	1	Lintes Technology cable recommended
		DP-Type-C Cable	1	Use cable supporting DP output and Type-C input, or bidirectional cable.

Compliance Test Item	Model	Name	Qty	Remarks
DDR5	41KC-6	Precision Fixed Attenuator (6 dB)	3	
	J1551A	Coaxial skew match cable (0.8 m, K connector)	3 Pairs	
	J1439A	Coaxial cable (0.8 m, K connector)	2	
	J1624A	COAXIAL CABLE 0.3 m (SMA connector)	(4)	Use MU181000B standard accessory cables (4 pcs).
	J1746A	Skew match pair semirigid cable (K connector, Data Input 1)	(1 Pair)	Use MU195050A standard accessory.
		SMP to SMA adapter cable	7	Wilder Technologies p/n 415-0080-002 (reference product)
		Power Supply (2 outputs , +12 V,+3.3V)		Keithley 2220 or 2230 (reference product)
		Red Banana-Plug Jumper Cable, Power Supply - > Fixture connection. 3.3 V, 12 V. 8"	1 Pair	Keithley CA-560-2 (reference product)
		Black Banana-Plug Jumper Cable, Power Supply -> Fixture connection, ground. 8".	1	Keithley CA-560-0 (reference product)
		Real Time Oscilloscope with BW >=21 GHz	1	DPO7000DX MSO7000DX DPO7000SX Contact Tektronix.
		Lan Hab (3 or more ports)	1	Commercial product for automation
	A9-AUTO-01	Reset Automation Kit	1	Contact ASTEK. https://www.astekcorp.com/
	A9-CTC2-01	DDR5 CTC2 Test Fixture	1	
	A9-DIMM5	DDR5 Parametric Test Card	1	
		USB Type A-MicroUSB Type B	1	Commercial product ASTEK A9-CTC2-01 for control

*1 When adding Gen7 Base test, add J1932A.

For DUT Receiver Test only (MU196020C output side only): J1932A x1

For BER measurement using DUT Loopback (when using MU196040B-005): J1932A x2

*2 Used for USB4 and Thunderbolt 3 Compliance Test; not required for USB3.2.

*3 Used for USB3.2 Compliance Test; not required for USB4 and Thunderbolt 3 Receiver Test.

7. Supported Software Versions

The MP1900A main unit and each application model support the following software versions. Use the latest upgrade of each software version. However, refer to the GRL software release notes published on the company webpage for the MX190000A and MX183000A software versions supported by the GRL software.

Model	MX190000A/MX183000A Supported version
MU181000B 12.5GHz 4Port Synthesizer MU181500B Jitter Modulation Source MU195050A Noise Generator MU195020A 21G/32G bit/s SI PPG MU195040A 21G/32G bit/s SI ED	Ver. 1.00
MU181000B-002 SSC Expansion MX183000A-PL001 Jitter Tolerance Test MX183000A-PL011 PCIe Link Sequence MX183000A-PL021 PCIe Link Training	Ver. 2.00
MU196020A PAM4 PPG MU196040A PAM4 ED MX183000A-PL022 USB Link Training	Ver. 3.00
MU196020A-040 Adjustable ISI MU196020A-042 FEC Pattern Generation MU196020A-050 Inter-Module Synchronization	Ver. 3.01
MX183000A-PL031 DUT Error Counts Import	Ver. 3.07
MU196040B PAM4 ED	Ver. 4.01
MX183000A-PL025 PCIe 5 Link Training	Ver. 4.03
MU195020A-051 Sequence Editor Function PCIe 5 Extension MX183000A-PL023 USB 3.2 x 2 Link Training	Ver. 7.02.30
MU196020A-043 FEC Error Insertion for PCIe6 MU196040B-043 FEC Analysis for PCIe6 MU196020A-060 PCIe6 LEQ MU196060A 32G baud NRZ/PAM4 Re-Driver MU196060A-001 Clock Recovery for SSC MX183000A-PL026 PCIe 6 Link Training	Ver. 10.00.00
MU196020A-045 USB4 Gen4 Pattern Generation	Ver. 10.03.02
J1900A Passive Low Frequency Equalizer MU196020A-051 Sequence Editor Function MU196020A-352 Sequence Editor Function for Multi-Channel MU196040B-051 PCIe Sequence Editor Pattern Analysis	Ver. 10.05.02
MU196040B-005 64G baud 64G baud operation is supported only in version 11. For details, please contact us.	Ver. 11.XX.XX

MU196020A-056 Sequence Editor Function PCIe 6 and CXL 3 Flits MU191000A Synthesizer MU196020C PAM4 PPG MU196020C-001 32G baud MU196020C-002 58G baud MU196020C-003 64G baud MU196020C-011 4Tap Emphasis MU196020C-030 Data Delay MU196020C-040 Adjustable ISI MU196020C-045 FEC Pattern Generation MU196020C-042 FEC Error Insertion for PCIe6 MU196020C-043 USB4 Gen4 Pattern Generation MU196020C-050 Inter-Module Synchronization MU196050B Noise Generator (MU196040B-005 64G baud does not support in this version. For compatibility status, see the latest MP1900A Signal Quality Analyzer-R Release Notes.)	Ver. 12.0X.0X
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8. Appendix

8.1 J1943A MP1900A USB4 v2 Measurement Component Set

The contents of the J1943A MP1900A USB4 v2 Measurement Component Set are listed in the following table.

Model	Name	Qty	Remarks
K261	DC Block	2	
J1821A	Coaxial Skew Matched Cable Pair (0.8 m, K-connector)	4 Pair	
J1949A	Coaxial Skew Matched Cable Pair (0.6 m, K-connector)	1 Pair	Sales start soon (currently January 2026). Enquire about details.
J1789A	Electrical Length Specified Coaxial Cable (0.4 m, V-connector)	2	
J1820A	Electrical Length Specified Coaxial Cable (0.4 m, K-connector)	4	
J1888A	Fixed Attenuator (6 dB, V-connector)	2	41VA-6 can also be used
J1792A	Skew Matched Pair Semirigid Cable (V-K)	1	Pair cable
J1808A	Fixed Adapter (K(f)-K(f))	2	
J1748A	Power Splitter	2	For Aggressor signal splitting
J1632A	Terminator (SMA)	2	

9. Document History

Date	Modifications
2018.7.31	- Added module configuration details to Table 4-2 describing operation functions added by multi-modules for modules other than MU195020A and MU195040A - Added postscript to Table 4-4 (The MX183000A software can control one G0376A)
2018.11.21	Added MU196020A and MU196040A.
2019.3.6	Added Options - MU196020A -040 Adjustable ISI, -042 FEC Pattern Generation, -050 Inter-Module Synchronization - MX183000A-PL031 DUT Error Counts Import
2019.4.10	Updated "Module Combinations"
2019.5.30	Corrected errors
2019.10.25	Added MU196040B.
2019.11.25	Added PCIe Gen5 Base Spec support
2020.2.25	Added PCIe Gen5 CEM Spec support
2020.4.10	Updated "Module Combinations"
2020.7.6	Added Automation software for compliance tests
2020.10.21	Added support for SAS, DP and PCIe PAM4 configurations Added support for Compliance Test Kit
2020.11.20	Added Option MU195020A-050 Sequence Editor Function
2021.2.15	Added Option MU196040B-042 FEC Analysis
2021.10.25	Added Options MU195020A-051 Sequence Editor Function PCIe 5 Extension MX183000A-PL023 USB 3.2 x 2 Link Training
2022.3.9	Updated "Module Combinations"
2022.8.31	Updated following items - MP1900A and MP1800A Series Supported Equipment and Software - Table 2-6 Software Functions and Features 4.2 Verified module configuration 4.3 Option Configuration Examples 5. Combinations of Automation Software and Real-time Oscilloscopes for Compliance Tests 6. Compliance Test Measurement Kit
2023.7.31	Updated MP1900A and MP1800A series Supported Equipment and Software Updated PPG/ED Module Selection using Measurement Application, and Table 1-1 PPGs/EDs Supporting 21 Gbit/s by Measurement Application & Function. Updated Module Combinations (added SI PPG 2 Module + Noise Configuration)
2023.10.25	Added following item - Re-Driver Module Functions and Features Updated following items - MP1900A and MP1800A Series Supported Equipment and Software - Selection of PPG and ED Module According to Measurement Application - PPGs/EDs Supporting 21 Gbit/s by Measurement Application & Function - Selection by Difference in Functions and Performance - Functions and Features of Main Unit, each Module, and each Option - Software Functions and Features - Option Combinations - Module Combinations - Verified module configuration - Option Configuration Examples - Combinations of Automation Software and Real-time Oscilloscopes for Compliance Tests - Compliance Test Measurement Kit
2024.3.1	Updated following items - Selection by Difference in Functions and Performance - Option Configuration Examples - Compliance Test Measurement Kit

2024.8.20	Updated following items 1. Selection of PPG and ED Module According to Measurement Application 2. Option Combinations 3. Combinations of Automation Software and Real-time Oscilloscopes for Compliance Tests 4. Compliance Test Measurement Kit
2025.2.27	Updated following items (For DisplayPort, contact our sales department.) 1. Module Combinations 2. Compliance Test Measurement Kit
2025.3.31	Updated following items 1. Option Combinations 2. Module Combinations 3. Compliance Test Measurement Kit
2025.7.23	Change the format Updated following items 1. MP1900A Series Supported Equipment and Software 2. Functions and Features of Main Unit, each Module, and each Option 3. Option Combinations 4. Module Combinations 5. Combinations of Automation Software and Real-time Oscilloscopes for Compliance Test 6. Compliance Test Measurement Kit 7. Supported Software Versions
2025.8.1	Updated following item Compliance Test Measurement Kit (Correct the number of J1900A from 1 to 2.)
2026.2.18	Updated following items (For support USB4 v2 CTS 1.00.) 1. Compliance Test Measurement Kit 2. Appendix
2026.3.18	Updated following items (For launch G0447A) 1. Compliance Test Measurement Kit
2026.5.27	Added MU191000A, MU196020C, and MU196050B Added MU196020A-056
2026.7.17	Corrected errors
2026.9.3	Updated following items 1. MP1900A Series Supported Equipment and Software 2. Selection of PPG and ED Module According to Measurement Application 3. Option Combinations 4. Module Combinations 5. Supported Software Versions



Specifications are subject to change without notice.

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