Anritsu Advancing beyond

BERTWave™

MP2110A

BERTWave

All In One

4ch Sampling Oscilloscope + BERT

Excellent Eco Product

Reduce cost. Increase productivity.

A single box solution - 40 GHz Sampling Oscilloscope + 25G BERT for Multi-channel

Optical Module Evaluation and 10G to 800G Multi-channel Optical Module Evaluation
BERTWave MP2110A

MP2110A

Multi-channel Optical Module, Device Manufacturing and Development

Data traffic volumes are exploding with the spread of fixed-rate video streaming and cloud services.
As a result, there is a need for optical interfaces for transmission equipment supporting speeds of more than 10 Gbit/s as 100 GbE and even 400 GbE and 800 GbE networks are deployed. However, there are increasing requests for less-expensive optical interfaces due to major problems with how to increase line productivity and cut costs.
The BERTWave MP2110A is an all-in-one instrument with built-in BERT (Bit Error Rate Tester) and Sampling Oscilloscope (Eye pattern analysis) designed for manufacturing inspection of 10G to 800G optical modules. It helps increase line productivity and cuts costs.

All In One
All-in-one 4ch 25G BERT + 4ch sampling oscilloscope
There is a built-in Clock Recovery Unit for Sampling Oscilloscope

Low Cost
Customized test systems can be configured as necessary by combining options freely.

NRZ/ PAM4 Analysis
Easy, fast and high-sensitivity analysis of PAM4 signals including TDECQ with support for clock recovery

250 ksamples/s
The high-speed sampling oscilloscope captures 1 million samples in 4 seconds.
Measurement times are slashed by measuring four channels in parallel.
Built-in PC for Stable Operation

-15 dBm Sensitivity
The high-sensitivity sampling oscilloscope supports accurate performance even for PAM4 signals with a closed Eye opening, and for optical signals attenuated by optical switches, etc.

Supported Applications: Evaluation of physical-layer performance for 10G/25G/50G/100G/200G/400G/800G optical transport modules, optical cables, and associated parts used by data centers, Core/Metro networks, 4G/5G mobile backhaul, and 5G mobile fronthaul

Transmission Paths: Ethernet, eCPRI/RoE, CPRI, SDH/SONET, OTN, InfiniBand, Fibre Channel
Optical Transceiver Modules: SFP28, QSFP28, CFP2/4/8, SFP56, QSFP56, OSFP, QSFP-DD
Cables: Active Optical Cables (AOC), Direct Attach Cables (DAC)
Devices: TOSA, ROSA, High-Speed Optical Engine, PHY, Driver ICs, CPO

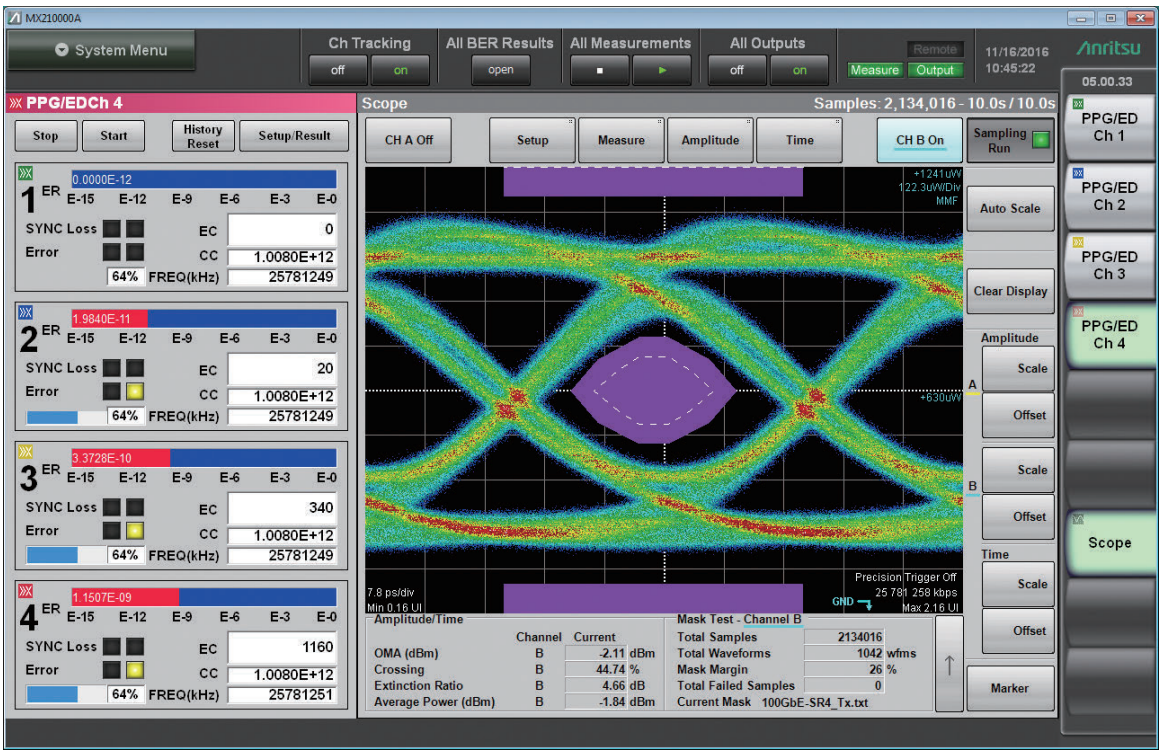
Configuring Efficient Measurement System: Integrated BERT and Sampling Oscilloscope

Previous measurement systems were extremely complex due to the need for a separate BERT as the signal source and a sampling oscilloscope for Eye pattern analysis. Incorporating a BERT and sampling oscilloscope into the All-in-one BERTWave MP2110A greatly simplifies measurement system configuration.
Installing the BERT and sampling-oscilloscope options for up to 4ch in one unit makes it easy to implement simultaneous TRx measurements of optical modules, such as multichannel QSFP, and devices using an easily configured and controlled measurement system. This helps cut growing measurement times as the number of channels increases with development of multichannel optical modules and devices.

Poor Efficiency, Long Time

No Switching Necessary, Simple Measurement System

With a BERT and sampling oscilloscope in one box, measurement results can be captured all at once along with simultaneous Eye pattern display. As a result, all the measurement results needed to evaluate multi-channel optical modules and devices can be seen at a glance, reducing measurement times by large margins.



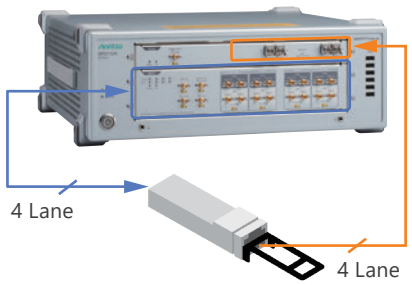
BER measurement results (left) and Eye Pattern analysis results (right) are displayed simultaneously.

Simply setting one channel of the MP2110A sets all channels simultaneously.
Operation is easy with simple settings and user interface. Remote commands are backwards-compatible with all BERTWave series, such as the MP2100B, facilitating instrument upgrades.

Configuring Efficient Measurement System: Supports both Simultaneous Measurement of All Channels and Parallel Measurement

As well as all-at-once simultaneous measurement of all channels using the sampling oscilloscope and BERT, individual channels can be measured separately. An evaluation system matching the application can be configured easily because both multichannel modules and multiple single-channel modules can be measured all at once.

Simultaneous All-Channel Measurement

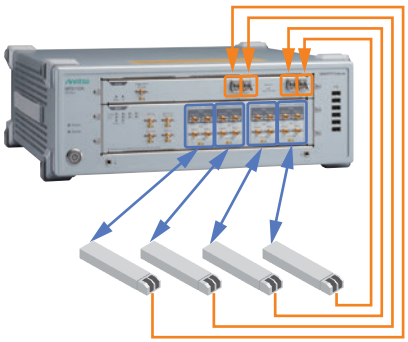


All-at-once test of quad-lane module using simultaneous measurement of all channels

↓

Shorter test times increase throughput

Parallel-Channel Measurement



Parallel test of four single-lane modules using separate measurement of each channel

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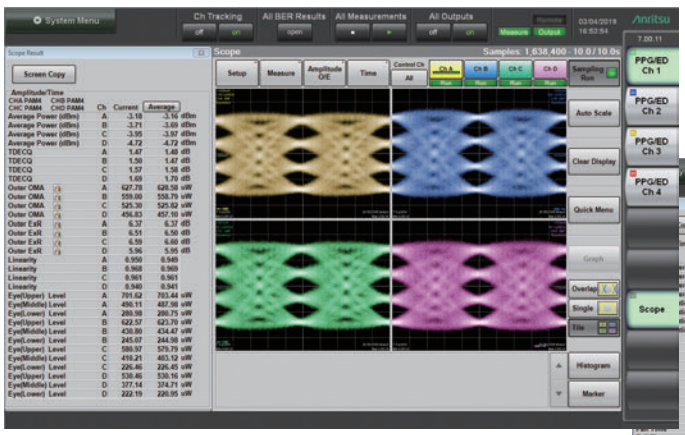
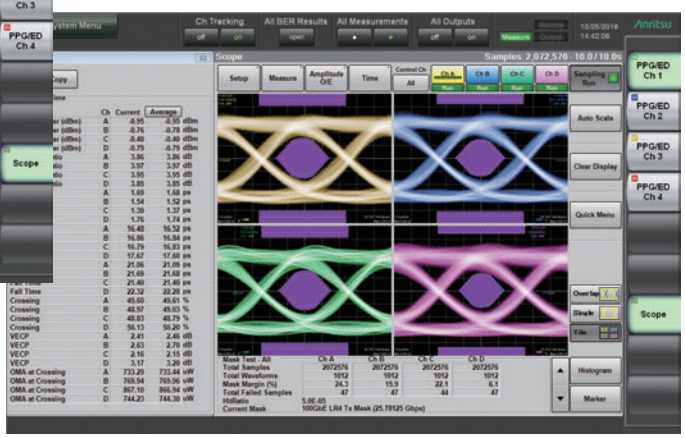
Reduced cost per channel cuts capital investment

Supports both simultaneous and parallel test methods



4ch PAM4 TDECQ Measurement



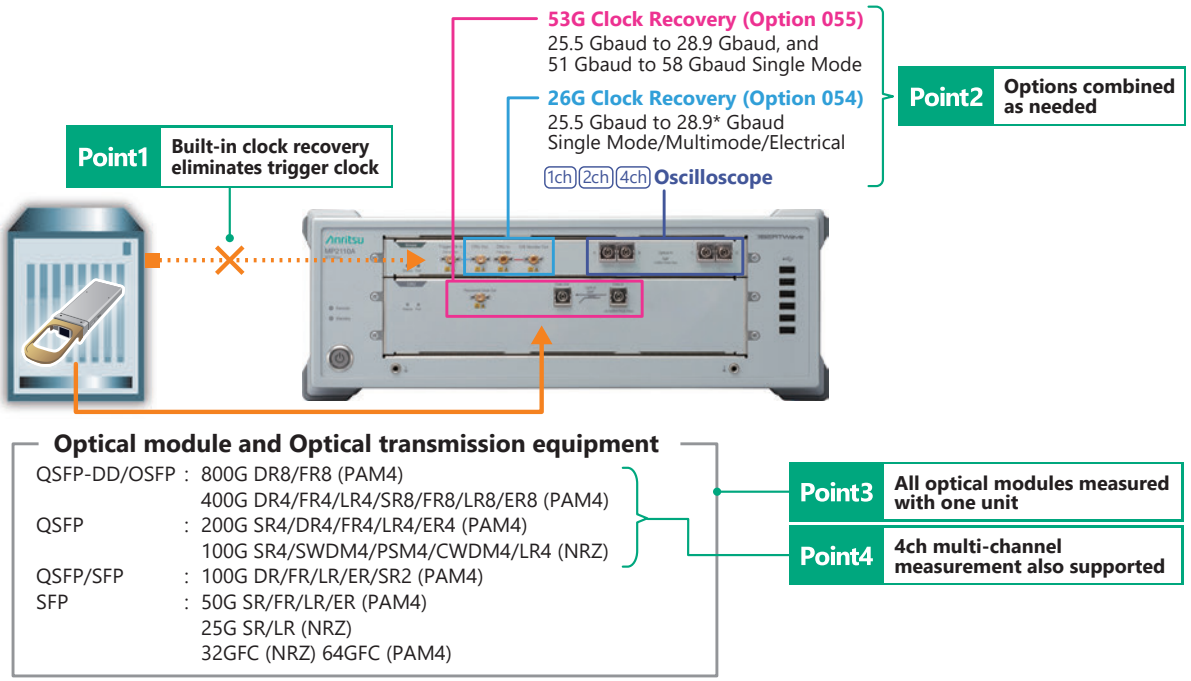
4ch NRZ Mask Margin Measurement

Supports both NRZ and PAM4

Configuring Efficient Measurement System: Built-in Clock Recovery

Accommodates Built-in NRZ/PAM4 Clock Recovery Unit (CRU)

Sampling oscilloscopes for signal waveform quality evaluation require a separate trigger clock signal synchronized with the data signal, but transmission equipment with built-in optical modules and 50G to 800G optical modules outputting PAM4 signals sometimes do not have a trigger signal. In this case, the trigger signal is generated from the data signal using clock recovery. This optional Clock Recovery Unit (CRU) can be installed in the BERTWave MP2110A Sampling Oscilloscope.



*: Requires Option 059 with Option 054 when using 28.2 Gbaud to 28.9 Gbaud.

MP2110A Optical Module Measurement Solution using Clock Recovery Options

Excellent Operability at Lower Cost

Since this clock recovery is built-in, it offers excellent operability at a lower price. The space-saving design and reduced need for complex cable connections as well as the easy-to-use settings help cut initial capital costs.

Wide Range of High-Performance Applications

The following clock recovery unit options are available:

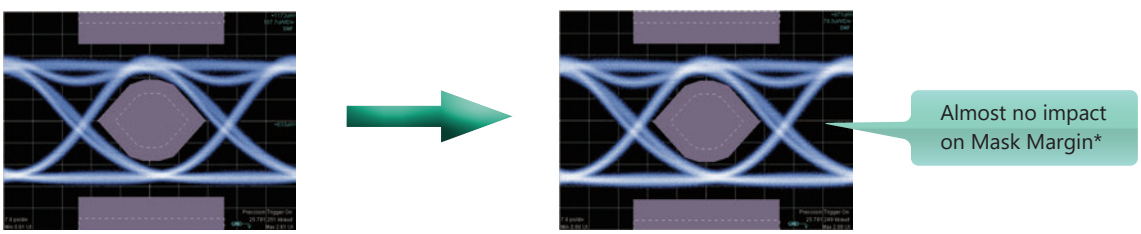
- Option 055: Supports 25.5 Gbaud to 28.9 Gbaud & 51 Gbaud to 58 Gbaud single mode
- Option 054: Supports 25.5 Gbaud to 28.9 Gbaud single mode/multimode/electrical

These options can be combined freely to configure a flexible test system matching the site requirements at optimum cost. When all options are installed, various types of optical modules can be evaluated without a trigger clock using one MP2110A unit.

In addition, combination with a 4ch oscilloscope supports all-at-once measurement using the recovered trigger signal to help cut evaluation times for multichannel optical modules.

High Performance

When using high-sensitivity modules, the impact of insertion loss on the data waveform is minimized by optimizing internal division ratios, demonstrating its usefulness when monitoring signal waveforms requiring high sensitivity. Additionally, there is no waveform degradation due to multimode splitting because Option 054 performs signal splitting for input to the CRU and oscilloscope using electrical signals after O/E conversion.



Without CRU

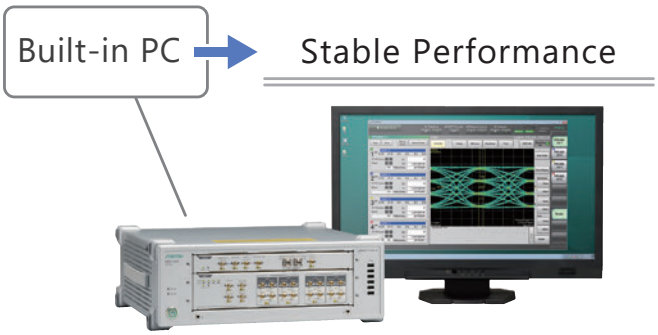
With CRU

*: Waveform comparison at –2 dBm input

Fast and Stable Measurement Performance

The MP2110A supports high-speed sampling at 250 ksamples/s. Measurement of 1 million samples can be completed in about 5 s, cutting pattern analysis time by about 65% compared to previous instruments.

The MP2110A requires no external Windows PC controller, because it has a built-in PC for measurement processing.
It supports high-speed processing irrespective of external PC controller specifications.



BERTWave MP2110A

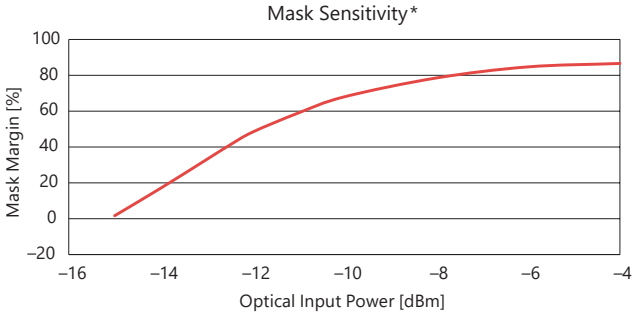
More Accurate Performance Confirmation: Sampling Oscilloscope Performance

Sampling Oscilloscope Functions

The MP2110A sampling oscilloscope has all the performance necessary for measuring optical modules such as 10G to 800G, and optical devices used by optical modules.

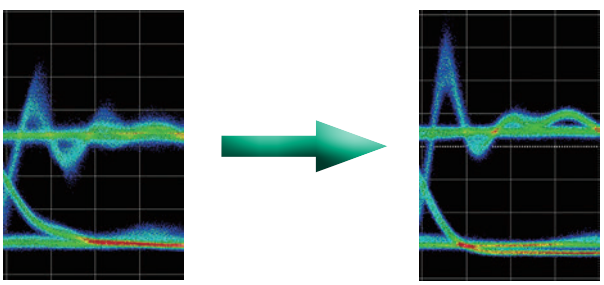
- Bandwidth:
  Optical: 35 GHz (SMF), 25 GHz (MMF)
  Electrical: 40 GHz
- High Sensitivity: –15 dBm (typ. SMF)*
- Low Noise: 3.4 µW (typ. SMF)
- Low-Jitter: 200 fs rms (typ.)

The low-noise and high-sensitivity O/E plus low-jitter trigger support more accurate measurements of narrow Eye openings of PAM4 signals as well as attenuated signals passing through optical switches, etc., helping improve production-line yields.



* Estimated optical power when Mask Margin (Hit Count 0) reaches 0% (calculated from optical noise)

In comparison to conventional instruments, the wideband O/E draws accurate patterns of the characteristics of directly driven optical signals and optical modules for long-distance transmissions.

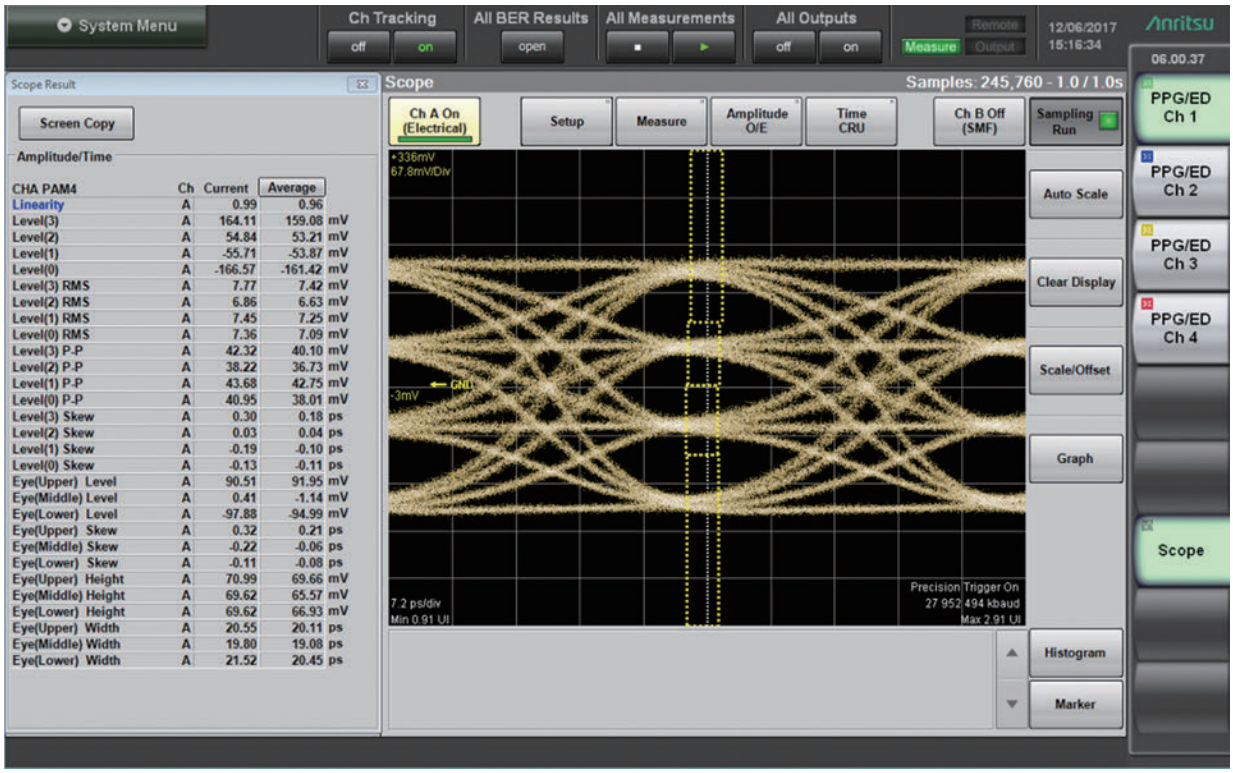


Conventional Instrument (Filter Off)

MP2110A (Filter Off)

Full Range of Measurement Functions (Sampling Oscilloscope)

Sampling oscilloscope supports both NRZ and PAM4 analysis.



Selection of displays for up to 32 measurement items supports confirmation of multiple PAM measurement results at one screen. Additionally, all measurement results, including items not displayed on-screen, can be captured simultaneously using remote control.

NRZ

Average Power (dBm, mW)*1
Mask Margin (%)
Extinction Ratio (dB)*1
OMA (dBm, mW)*1, VMA (mV)*2
VECP (dB)
RIN OMA (dB/Hz)*1, *4
TDEC (dB)*3
One Level, Zero Leve l (µW, mV)*6
Eye Amplitude, Eye Height (µW, mV)*6
Eye Height Ratio
Crossing (%)
SNR
Jitter P-P, RMS (ps)
Rise Time, Fall Time (ps)
Eye Width (ps)
DCD (%)

NRZ Jitter (Option 096)

TJ (J2, J4, J9, User Defined BER), Eye Opening (mUI)
RJ RMS (d-d), RJ RMS (mUI)*5
DJ (d-d) (mUI)
PJ P-P (mUI)*5, PJ Frequency (kHz)*5
DDJ P-P (mUI)*5, DDPWS (mUI)*5
DCD (mUI)*5
ISI P-P (mUI)*5

PAM4 (Option 095)

Average Power (dBm, mW)*1
TDECQ, Partial TDECQ, Ceq (dB)
Noise Margin, Partial Noise Margin (µW, mV)*6
Outer Extinction Ratio (dB)*1
Outer OMA (dBm, µW)*1, Outer VMA (mV)*2
RIN OMA (dB/Hz)*1
Transition Time (Rise/Fall/Slowest) (ps)
Over/Under-shoot (%)
Peak-to-Peak Power (dBm)*1
Power Excursion (dBm)
Linearity
Levels 0/1/2/3 (µW, mV)*6
Levels P-P, RMS 0/1/2/3 (µW, mV)*6
Level Skews 0/1/2/3 (ps)
Eye Levels Upper/Middle/Lower (µW, mV)*6
Eye Heights Upper/Middle/Lower (µW, mV)*6
Eye Widths Upper/Middle/Lower (ps)
Eye Skews Upper/Middle/Lower (ps)

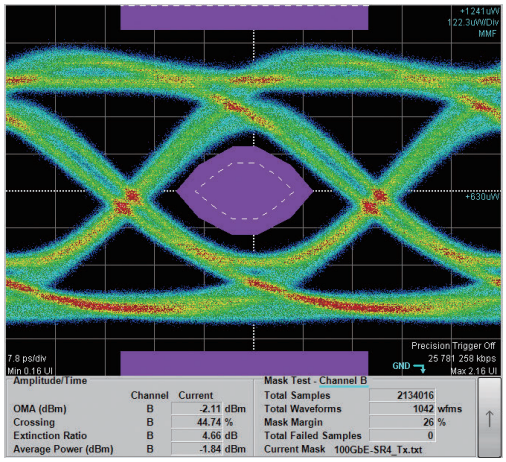
*1: Optical channel only
*2: Electrical channel only
*3: No IEEE-compliant 12.6-GHz hardware filter
*4: Option 095 or Option 098
*5: Enabled when Advanced Jitter Mode
*6: µW for optical channels and mV for electrical channels

Full Range of Measurement Functions (Sampling Oscilloscope)

NRZ Mask Margin Measurement

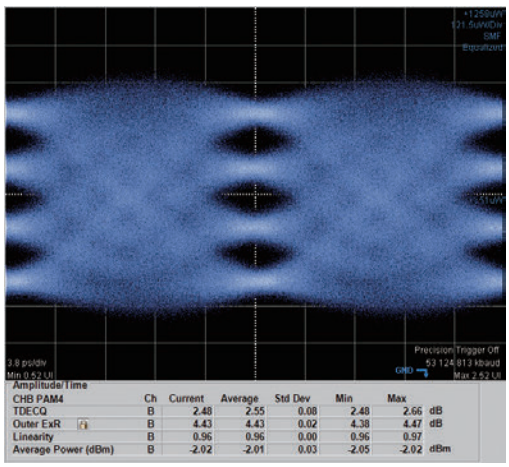
Testing is simple because Mask Margin tests are performed automatically. Furthermore, since the time required for Mask Margin tests is only about 1 second, line productivity is improved because standards-compliant measurements are performed at high speed in a shorter time.

- Automatic measurement within 1 second
- Real-time margin measurements
- Selectable Count and Rate at Mask Hit



PAM4 TDECQ Measurement (Option 095)

Easy capture of measurement results without complex settings.
The low-noise (3.4 µW, typ.) high-sensitivity oscilloscope supports high-reproducibility measurement of even small Eye margin PAM4 signals. High-speed sampling shortens the time required for data collection for TDECQ analysis. Shorter measurement times help improve productivity even at PAM4 signal evaluation.

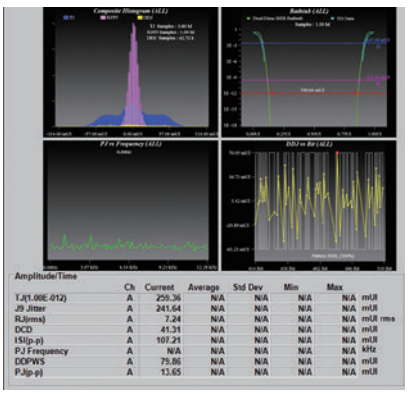


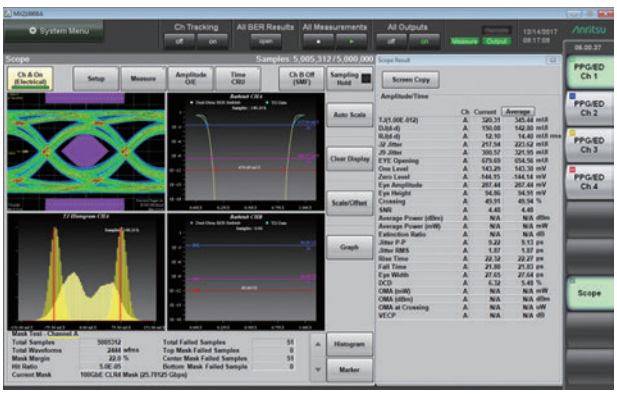
53 Gbaud PAM4 TDECQ Measurement

NRZ Jitter Analysis (Option 096)

This option supports separate analysis of Jitter components such as TJ, DJ, RJ, etc., with display in various graph formats.

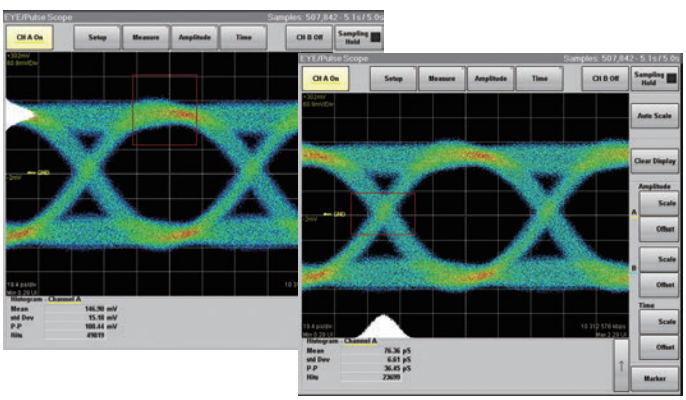
- Fast, easy J2/J9/etc. measurements for manufacturing inspections (Eye Mode)
- Detailed analyses for DJ (Advanced Jitter Mode)
- Simultaneous Jitter Analysis and Eye Mask tests help cut measurement times





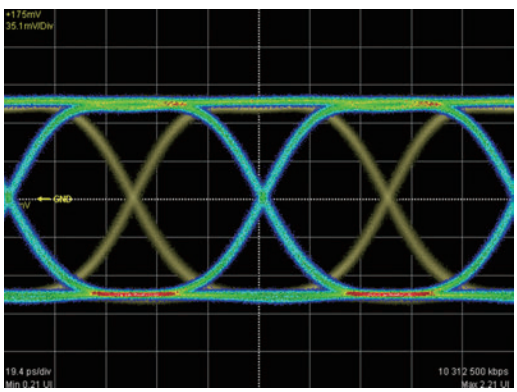
Histogram Measurement

Troubleshooting is made easier because waveform data component analysis can be performed using the mean, standard error, and scatter within the set data distribution.



Reference Trace Function

Saving measured waveform data for reference enables comparison of current data with previous data.



More Accurate Performance Confirmation: BERT Performance

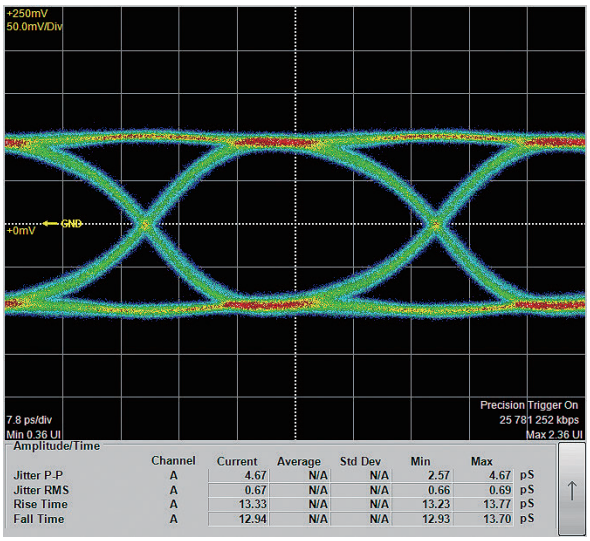
Wideband Operation Frequency

In the standard configuration, the MP2110A BERT operates at bit rates of 24.3 Gbit/s to 28.2 Gbit/s. This range can be extended optionally to support bit rates of 9.5 Gbit/s to 14.2 Gbit/s, enabling use for various applications including 10 GbE and 100 GbE.

PPG/ED Supported Bit Rates	Application Example
24.3 Gbit/s to 28.2 Gbit/s	32G Fibre Channel, CPRI (Option 10), InfiniBand EDR, 100 GbE, 100 GbE FEC, OTU4
9.5 Gbit/s to 14.2 Gbit/s (Option 093)	InfiniBand FDR/QDR, Fibre Channel (16G, 10G, 10G FEC), 10 GbE (WAN, LAN), 40 GbE (4 × 10 Gbit/s), CPRI (Option 8, 9), OC-192/STM-64, OC-192/STM-64 FEC (G.975), OTU1e, OTU2, OTU2e

Excellent PPG/ED Performance

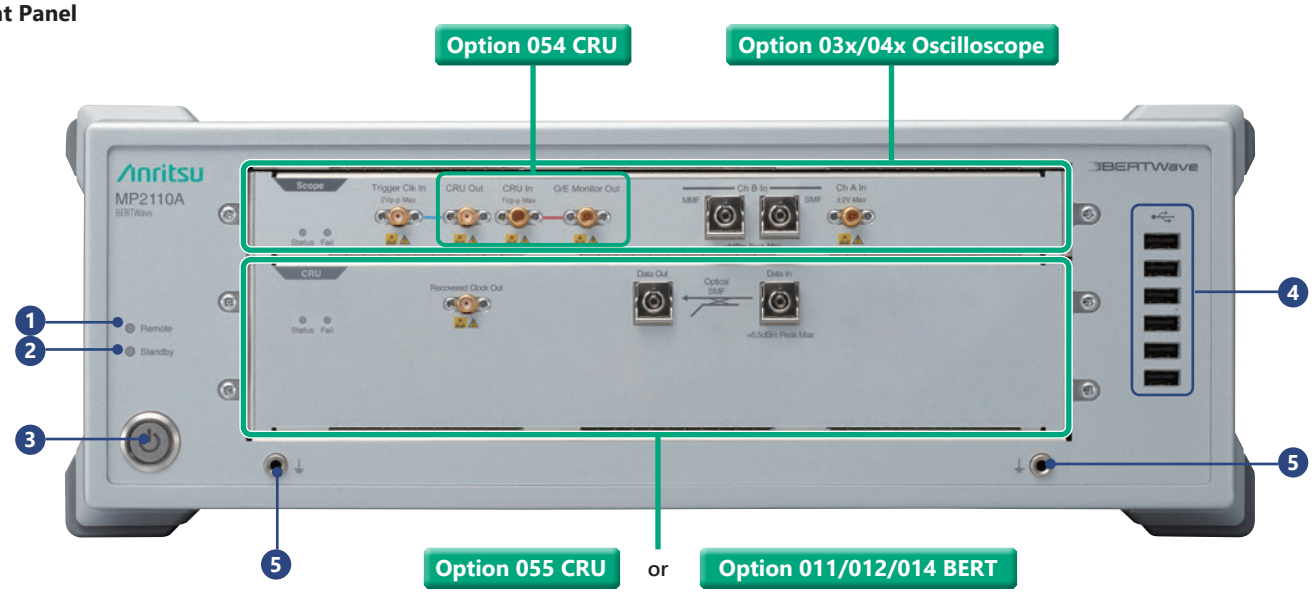
The MP2110A PPG has a low data Jitter of 600 fs rms (typ.) for accurate measurement of the characteristics of optical modules, optical devices, etc. Additionally, the 25 mV (typ.) ED supports BER measurement of low-amplitude signals resulting from transmission path losses, helping improve DUT yields.



Typical PPG Waveform
25.78125 Gbit/s Electrical Loopback Waveform
(at PRBS 31, 200 mV Amplitude, and Precision Trigger Option On)

BERTWave MP2110A Panel Layout

Front Panel



1 Remote Lamp
Lit green while MP2110A under remote control.

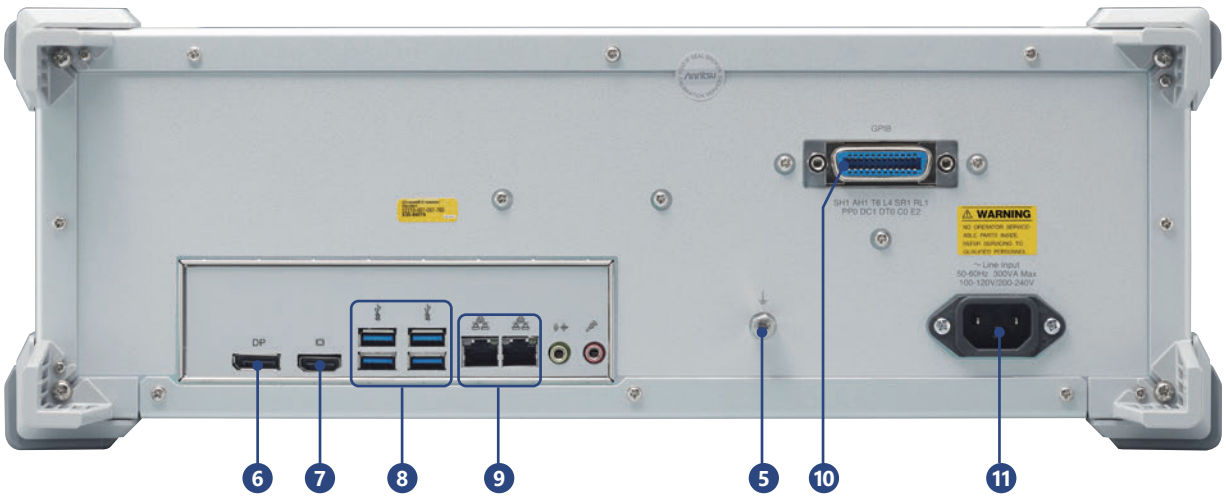
2 Standby Lamp
Lit orange while power supplied to MP2110A.

3 Power Switch
Lit green while MP2110A powered-on; flashes during shutdown.

4 USB 2.0 × 6
For connecting peripheral accessories, such as mouse, keyboard, etc.

5 Frame Ground
For connecting wrist strap and DUT.

Back Panel



6 Display Port
For connecting external monitor supporting Display Port specification*.

7 HDMI
For connecting external monitor supporting HDMI specification*.

8 USB 3.0 × 4
For connecting accessories such as keyboard, mouse, external hard disk.

9 Ethernet × 2
For connecting PC or network to control MP2110A remotely.

10 GPIB
For connection to PC to remote control MP2110A.

11 Power Inlet
For connecting accessory power cord.

*: Screen output requires a display with a resolution of 1280 × 800 or higher

BERTWave MP2110A Panel Layout

Option 03x/04x Oscilloscope

Option 021
(Electrical 2ch)

Option 033/043
(SMF&MMF 1ch + Electrical 1ch)

Option 035/045
(SMF 1ch)

Option 036/046
(MMF 1ch)

Option 032/042
(SMF&MMF 2ch)

Option 030/040
(SMF 4ch)

Option 039/049
(MMF 4ch)

12 Status Lamp
Lit when remote command received at normal operation.
Color indicates Trigger Clock input status.
Green: Trigger Clock detected normally
Red: No trigger Clock detected — check signal input at Trigger Clock Input connector
Orange: Incorrect trigger clock input frequency setting

13 Fail Lamp
Lit red when hardware fault detected.
This may light briefly at power-on, but there is no abnormality.

14 Trigger Clock Input Connector (SMA)
For trigger input.

15 Channel A/B/C/D Input (K or FC)
This is the oscilloscope signal input. The connector type differs depending on the option. The electrical channel uses a K-connector. The optical channel SMF and MMF can be switched.

Option 054 CRU

16 Clock Recovery Unit Output (SMA)
Connect the standard accessory U-link coaxial cable (SMA) to the Trigger Clk In connector for use.

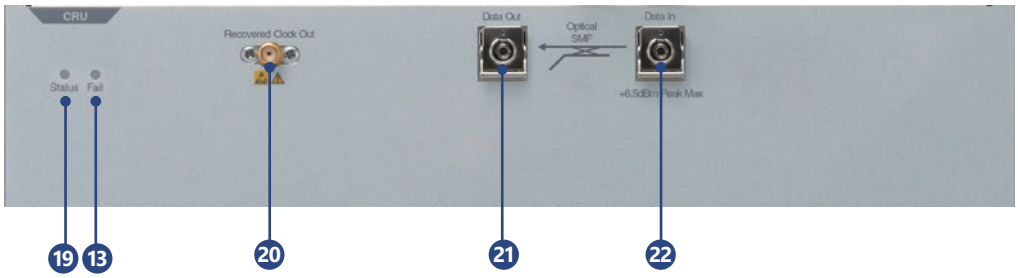
17 Clock Recovery Unit Input (K)

18 O/E Monitor Output (K) (Optical channel installed)*
Connect the standard accessory U-link coaxial cable (K) to the CRU In connector for use*.

*: Fit the accessory Terminator (J1632A) when not connected.
The signal cannot be monitored correctly without termination.

BERTWave MP2110A Panel Layout

Option 055 CRU



19 Status Lamp
Lit when receiving remote commands at normal start operation. Color indicates clock recovery lock status.
Green: Locked
Red: Unlocked (no signal input)
Orange: Unlocked (incorrect rate setting)

20 Recovered Clock Output (SMA)
Clock Recovery Unit output. Connected to Trigger Clk In.

21 Data Output (FC)
Branch data input signal output. Connected to oscilloscope SMF optical signal input (Ch A/B/C/D In).

22 Data Input (FC)
SM Optical Data signal input

Option 011/012/014 BERT

23 Output Lamp
Lit green during signal output from PPG connector.

24 Error Lamp
Lit orange at following condition at ED.
- Unable to synchronize pattern (Sync Loss)
- Bit error detected

25 Status Lamp
Lit green when receiving remote commands at normal start operation

26 Clock Output Connector (SMA)
Outputs divided clock.

27 Sync Clock Output Connector (SMA)
Outputs PPG Sync clock.
Outputs PPG Sync clock (inverted)*.

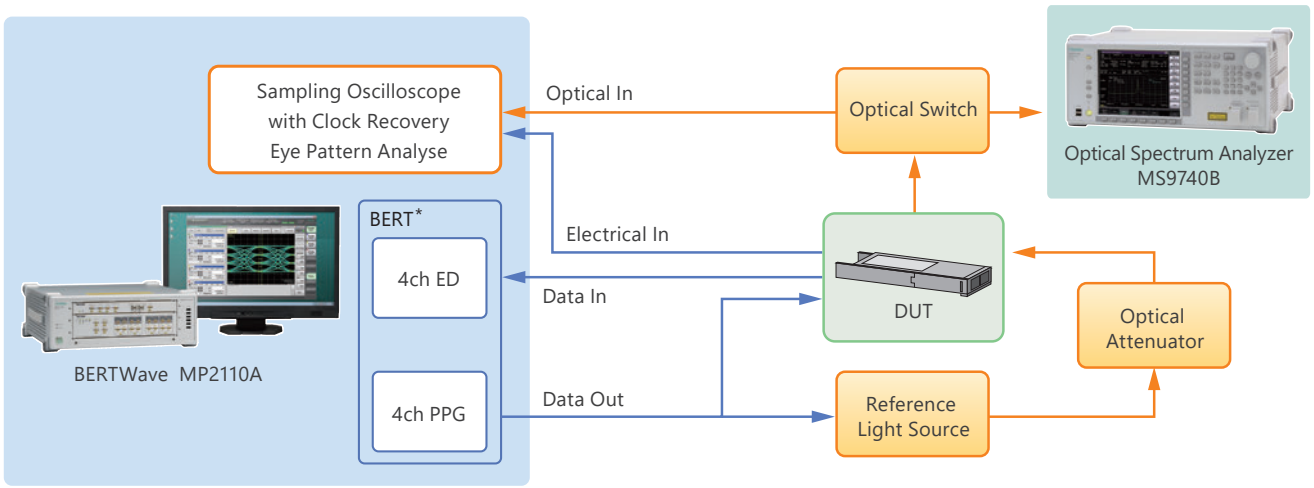
28 External Clock Input Connector (SMA)
For input of external clock.

29 PPG Output*/ED Input Connector (K)
Photograph shows configuration with Option 014 (4ch) installed; Option 011 adds 1ch and Option 012 adds 2ch.

*: Fit the accessory Terminator (J1632A) when not connected.

Application Examples

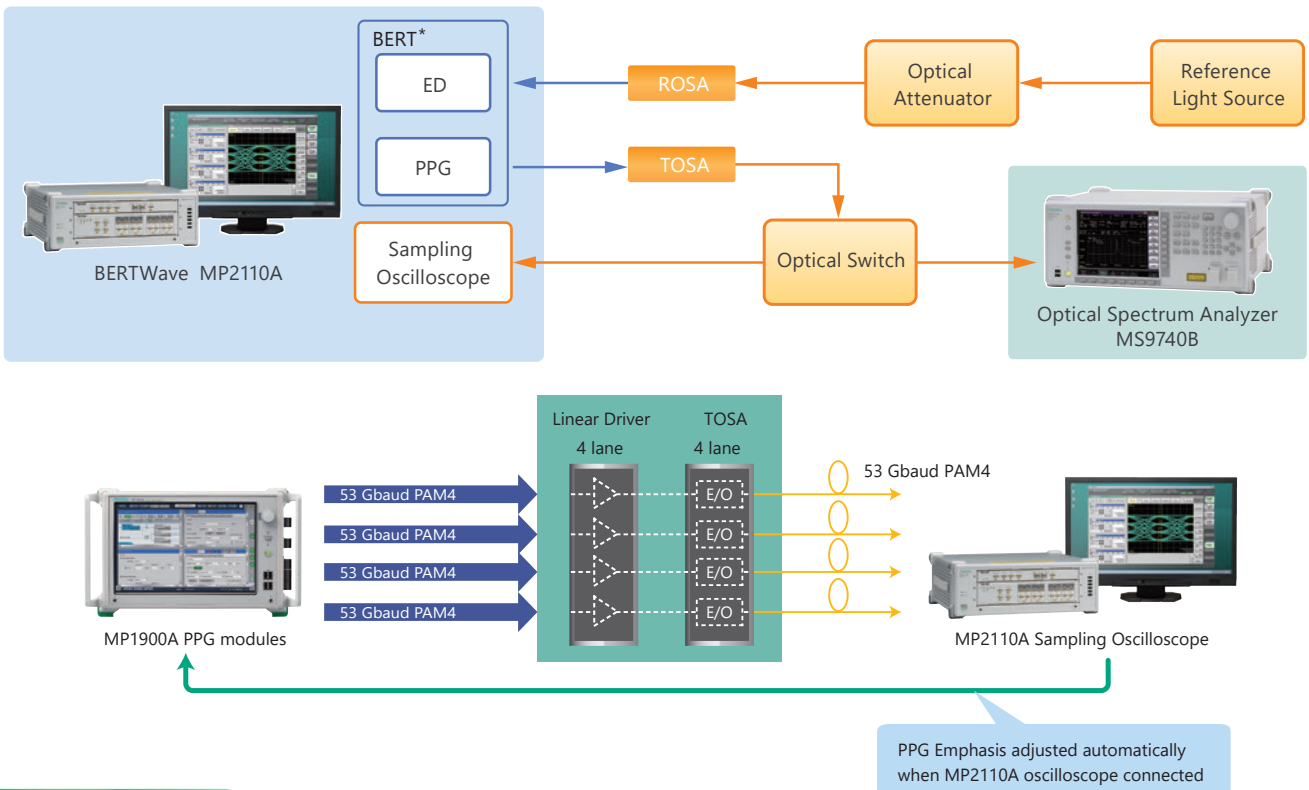
Multi-channel Optical Module Evaluation



Required Test Items

- Rx Electrical Signal Eye Pattern Analysis (NRZ: Mask Margin, Jitter, Tr/Tf, etc.)
- Tx Optical Signal Eye Pattern Analysis
  (Optical Power, NRZ: Mask Margin, Jitter, Tr/Tf, Extinction Ratio, PAM4: TDECQ, Outer OMA/Extinction Ratio, Linearity etc.)
- Rx Signal Rx Sensitivity Test (BER Measurement)

TOSA/ROSA Evaluation



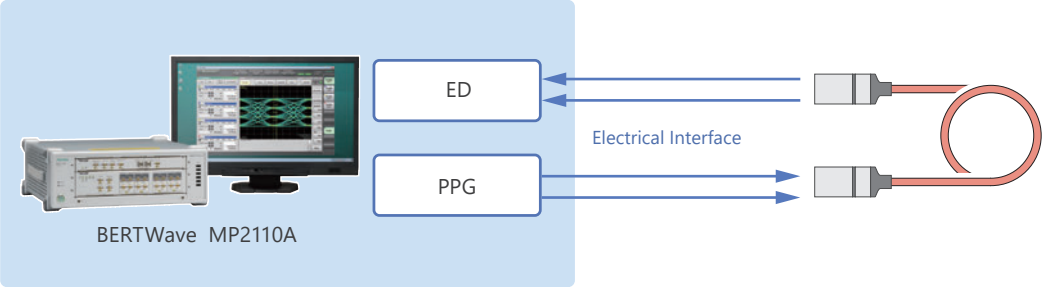
Required Test Items

- Tx Optical Signal Eye Pattern Analysis
  (Optical Power, NRZ: Mask Margin, Jitter, Tr/Tf, Extinction Ratio, PAM4: TDECQ, Outer OMA/Extinction Ratio, Linearity etc.)
- Rx Signal Rx Sensitivity Test (BER Measurement)

*: Use MP1900A/MP1800A PPG/ED, etc., at PAM4 signal evaluation.

BERTWave MP2110A Application Examples

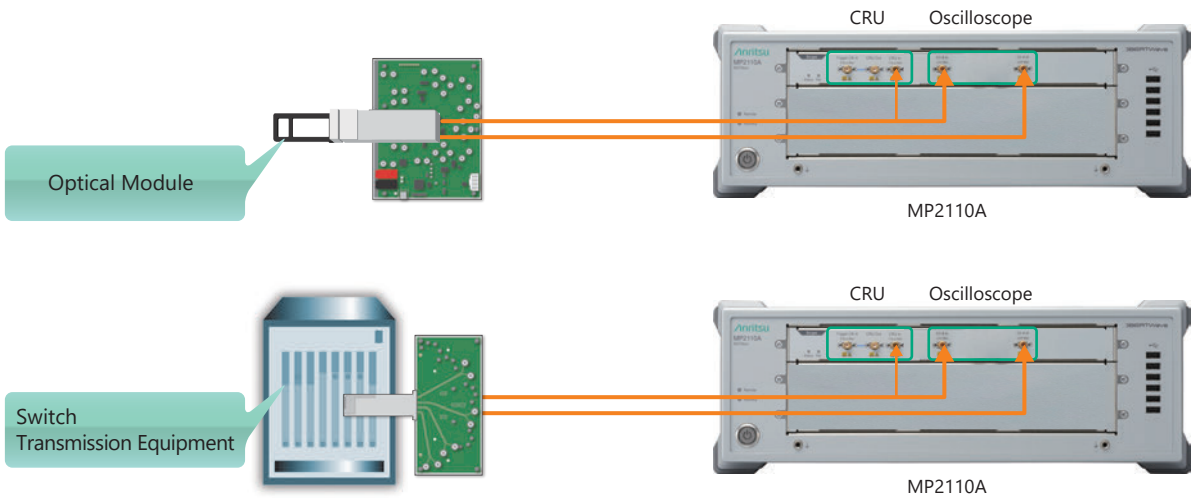
Active Optical Cables (AOC)/Direct Attach Cables (DAC) Evaluation



Required Test Items

- 4ch Simultaneous BER Measurement (Crosstalk Test)
- Differential Electrical Signal Eye Pattern Analysis
- Differential Electrical Signal Jitter Analysis

NRZ/PAM4 Differential Electrical Signal Evaluation



The Eye pattern of differential electrical signals can be analyzed using the Differential Electrical Channel Oscilloscope (Option 021) and Signal Processing Option (Option 098).

- A standards-compliant band filter and equalizer, such as CTLE, can be applied.
- The measurement system, such as cables, can be calibrated using the De-embedding function.

Additionally, installing the Clock Recovery Unit (CRU, Option 054) eliminates the need to provide a trigger signal.

Common

Remote Interfaces		Ethernet, GPIB
Peripheral Devices		HDMI, Display Port, USB3.0 (4 ports on rear panel), USB2.0 (6 ports on front panel), Ethernet (2 ports, 10/100/1000 Base-T), Line-Out, Mic * Screen output requires a display with a resolution of 1280 × 800 or higher
OS		Windows 10
Internal Storage devices		SSD, 60 GB or more
Power Voltage		100 VAC to 240 VAC, (100 VAC/200 VAC System Auto-switching), 50 Hz/60 Hz
Power Consumption		≤300 VA
Operating Temperature		+5°C to +40°C
Storage Temperature		–20°C to +60°C
Dimensions		422 (W) × 142.5 (H) × 389.4 (D) mm (excluding projections)
Mass		<11 kg
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018

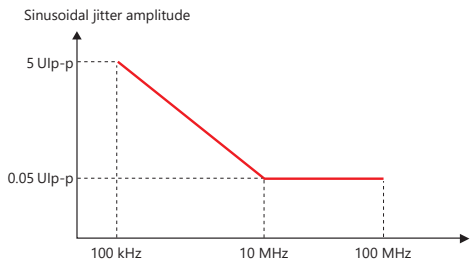
BERT (shared PPG/ED)

Internal Clock	Frequency: 10 MHz Frequency Accuracy: ±10 ppm (1 hour after power-on, design guaranteed) Bit Rate Offset:±100 ppm (common to all channels)
External Clock Input	Connector: SMA (f) Termination: 50Ω, AC coupled Amplitude: 0.2 Vp-p to 1.6 Vp-p Waveform: Square Wave or Sine Wave Division: 1/16 (at operating bit rate of 9.5 Gbit/s to 14.2 Gbit/s) 1/40 (at operating bit rate of 24.3 Gbit/s to 28.2 Gbit/s)
Clock Output	Connector: SMA (f) Termination: 50Ω, AC coupled Clock Source: Ch1/2 or Ch3/4 Division Ratio: 1/2 (at 9.5 Gbit/s to 14.2 Gbit/s operation bit rate) 1/4 (at 24.3 Gbit/s to 28.2 Gbit/s operation bit rate) Amplitude: 0.3 Vp-p to 0.5 Vp-p Duty: 50 ±10%
Sync Output	Connector: SMA (f) Division Ratio: Pattern Sync, 1/8, 1/16, 1/40 Output Level High Level (V_{OH}): –0.2 V to 0.05 V Low Level (V_{OL}): –1.2 V to –0.7 V
Operation Bit Rates	24.3 Gbit/s to 28.2 Gbit/s 9.5 Gbit/s to 14.2 Gbit/s (with Option 093 installed) (in 1 kbit/s steps)

PPG

Data Output	Number of Channels MP2110A-011: 1 (Data Out, $\overline{\text{Data}}$ Out) MP2110A-012: 2 (Data Out, $\overline{\text{Data}}$ Out) MP2110A-014: 4 (Data Out, $\overline{\text{Data}}$ Out) Connector: K (f) Amplitude Setting Range: 0.1 Vp-p to 0.8 Vp-p, 10 mV steps (single-end) 0.2 Vp-p to 1.6 Vp-p, 20 mV steps (differential output) Accuracy: ±0.02 V ±20% for settings (at 25.78125 Gbit/s) Data Crossing: 50% ±10% (at 25.78125 Gbit/s, 0.3 Vp-p Amplitude) Tr/Tf (20 to 80%): 15 ps (typ.), 17 ps (max.) (at 25.78125 Gbit/s, 0.3 Vp-p Amplitude) Jitter | | Typ. | Max. | | Jitter (rms)*1 | 600 fs*3 900 fs*4 | 900 fs*3 1200 fs*4 | | Intrinsic RJ (rms)*2 | 400 fs*3 800 fs*4 | 600 fs*3 1000 fs*4 | *1: At 25.78125 Gbit/s, 0.3 Vp-p Amplitude, at 25°C ±5°C test pattern PRBS $2^{31} - 1$ *2: At 25.78125 Gbit/s, 0.3 Vp-p Amplitude, at 25°C ±5°C, 1/16 Clock Pattern *3: With MP2110A-014 installed and when measurement channel and same channel clock source selected Example: Ch1/2 selected as clock source and measuring Ch1 *4: With MP2110A-014 installed and when measurement channel and different channel clock source selected Example: When Ch3/4 selected as clock source and measuring Ch1 Data Out/$\overline{\text{Data}}$ Out Skew: ±8 ps: Internal (at 25.78125 Gbit/s, 0.3 Vp-p Amplitude)
Data Format	NRZ
Test Patterns	PRBS: $2^7 - 1$, $2^9 - 1$, $2^{15} - 1$, $2^{23} - 1$, $2^{31} - 1$ Auxiliary Pattern: 1/2 Clock Pattern, 1/16 Clock Pattern
Functions	Output On/Off, Pattern Inversion, Error addition

ED

Data Input	Input Number MP2110A-011: 1 (Data, $\overline{\text{Data}}$, Differential Input) MP2110A-012: 2 (Data, $\overline{\text{Data}}$ Out, Differential Input) MP2110A-014: 4 (Data, $\overline{\text{Data}}$ Out, Differential Input) Connector: K (f) Termination: 50Ω, AC coupled * The DC component is terminated to GND via a 50Ω. Data Format: NRZ, Mark Ratio 50%, single-end or differential input Amplitude: 0.05 Vp-p to 0.8 Vp-p Threshold: –0.085 V to +0.085 V, 1 mV steps (single-end input, with external ATT factor of 0 dB) Sensitivity: 25 mVp-p typ. (20°C to 30°C) 40 mVp-p max. (25.78125 Gbit/s bit rate, PRBS $2^{31} - 1$ test pattern, single-end, Mark Ratio 1/2, loopback connection) Jitter Tolerance: 25.78125 Gbit/s bit rate, PRBS $2^{31} - 1$ test pattern, single-end, 50 mV amplitude 
Clock Recovery	Built-in
Test Patterns	PRBS: $2^7 - 1$, $2^9 - 1$, $2^{15} - 1$, $2^{23} - 1$, $2^{31} - 1$, Inverted Pattern
Measurements	Alarm Detection: Sync Loss (test pattern and asynchronous) Bit Error Rate Detection Error Rate: 0.0001E–18 to 1.0000E–03 Error Count: 0 to 9999999, 1.0000E07 to 9.9999E17 Regenerating Clock Detection: Input signal frequency (sampling method) History: Sync Loss, Bit Error (display reset supported)
Gate Settings	Measurement time: 1 second to 9 days 23 hours 59 minutes 59 seconds Gating cycle: Single/Repeat/Untimed Display update interval: Can display results during measurement (Current)

Sampling Oscilloscope

Sampling Mode	Eye, Pulse, Coherent Eye, Advanced Jitter (Option 096) Sampling Speed 250 ksamples/s (nominal, Sampling Mode Eye, Number of Samples 1350, 25.78125 Gbaud bit rate, 6.4453125 GHz clock rate, 2 UI bit count)
NRZ Measurement	Average Power*1, Mask Margin, Extinction Ratio*1, OMA*1 , VMA*2, VECP, RIN OMA*1, *4, TDEC*3, One Level, Zero Level, Eye Amplitude, Eye Height, Eye Height Ratio, Crossing, SNR, Jitter P-P, RMS, Rise Time, Fall Time, Eye Width, DCD Mask Test Supported Masks: Selected by filter, user created Mask Adjustment: Auto Align, user defined Margin Type: Hit Count, Hit Ratio Jitter Analysis (Option 096) TJ (J2, J4, J9, User Defined BER), Eye Opening, RJ RMS (d-d), RJ RMS*5, DJ (d-d), PJ P-P*5, PJ Frequency*5, DDJ P-P*5, DDPWS*5, DCD*5, ISI P-P*5 Graph: TJ/RJ/PJ/DDJ Histogram, DDJ vs. Bit, Bathtub, PJ vs. Frequency
PAM4 Measurement (Option 095)	Average Power*1, TDECQ, Partial TDECQ, Ceq, Noise Margin, Partial Noise Margin, Outer Extinction Ratio*1, Outer OMA*1, Outer VMA*2, RIN OMA*1, Transition Time (Rise/Fall/Slowest), Over/Under-shoot, Peak-to-Peak Power*1, Power Excursion, Linearity, Levels 0/1/2/3, Levels P-P, RMS 0/1/2/3, Level Skews 0/1/2/3, Eye Levels Upper/Middle/Lower, Eye Heights Upper/Middle/Lower, Eye Widths Upper/Middle/Lower, Eye Skews Upper/Middle/Lower TDECQ Measurement TDECQ Equalizer No. of Taps: 3 to 21 Tap Width: 1 UI (T-spaced) Threshold Adjustment (IEEE802.3cd) Target SER can be specified

*1: Optical channel only
*2: Electrical channel only
*3: No IEEE 12.6 GHz hardware filter
*4: Option 095 or Option 098
*5: Enabled when Advanced Jitter Mode

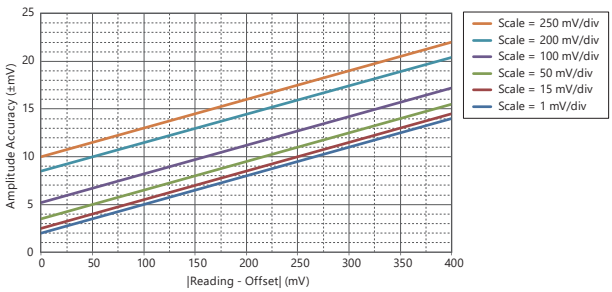
Sampling Oscilloscope (Horizontal System)

Trigger Clock Input	Connector: SMA (f) Termination: 50Ω, AC coupled Frequency: 0.1 GHz to 15.0 GHz Division Ratio: 1 to 99 (but 1, 2, 4, 8, 16, 32, 40, 48, 64 only in Pulse Mode and Coherent Eye Mode) Trigger clock Sensitivity: 100 mVp-p (typ.), 200 mVp-p (max., typ. value using Option 024) *Specified as square-waveform input but also supports sine-wave input above 1 GHz Max. Amplitude: 1.2 Vp-p Absolute Max input: 2 Vp-p RMS Jitter

Option	1ch, 2ch			4ch	
Trigger Clock Frequency (GHz)	0.1 to 1.25	1.25 to 15	2.4 to 15*2	0.1 to 1.25	1.25 to 15
Typ.	1.0 ps	400 fs	200 fs	1.0 ps	350 fs
Max.	1.5 ps	1.35 ps	280 fs	1.5 ps	600 fs

*: Option 024 Precision Trigger On

Sampling Oscilloscope (Electrical Channel)

Data Input	Connector: K (f) Termination: 50Ω, DC coupled Absolute Max. Rating: ±2 V Dynamic Range: ±400 mV (Relative value of amplitude offset), Recommended input amplitude (Non-Saturated Range) ≤400 mVp-p
Amplitude Setting	Scale: 1 mV/Div to 200 mV/Div, 1 mV steps Offset: –500 mV to +500 mV, 1 mV steps
Amplitude Accuracy	± (2% of reading) ± (Amplitude Accuracy shown in the figure below) 
3-dB Bandwidth	40 GHz (typ.)
Flatness	±1 dB (10 MHz to 30 GHz, typ.)
RMS Noise	1.5 mV (typ.) 2.5 mV (max.)
Digital Filter (Option 098)*1	33 GHz
Embedding/De-embedding (Option 098)*1	Measurement system calibration by loading S2P/S4P file
CTLE (Option 098)*1	Defined by text file

Sampling Oscilloscope (Optical Channel)

Connector

FC Connector (changeable)

Wavelength, Fiber Coupling

Input	Option		Fiber Input	Calibrated Wavelength	Wavelength Range
SMF	1/2 ch		62.5 µm*	1550/1310 nm	860 nm to 1650 nm
	4 ch	040+061	62.5 µm*	1550/1310/850 nm	850 nm to 1650 nm
		040/030	9 µm	1550/1310 nm	1260 nm to 1650 nm
MMF	1/2/4 ch		62.5 µm*	850 nm	800 nm to 860 nm

*: Compatible with 9-µm single-mode fibers and 50/62.5-µm multimode fibers

Bandwidth (No Filter)

SMF Input: 35 GHz (typ.)
MMF Input: 25 GHz (typ.)

Filters

Hardware Filter	Digital Filter (Option 095 or Option 098)*
19.34 GHz - 100 GbE/4 (25.78125 Gbit/s) 20.8 GHz - 100 GbE/4 FEC (27.7393 Gbit/s) 21 GHz - OTU4 (27.952493 Gbit/s) 21 GHz - 32GFC (28.05 Gbit/s)	7.46 GHz - 9.95328 Gbaud 7.5 GHz - 10.3125 Gbaud 10.35 GHz - 26.5625 Gbaud MM 11.2 GHz - 26.5625/28.9 Gbaud MM TDECQ 12.4 GHz - 28.9 Gbaud MM 12.6 GHz - 25.78125/26.5625 Gbaud TDEC 13.28125 GHz - 26.5625 Gbaud SM TDECQ 14.45 GHz - 28.9 Gbaud SM TDECQ 19.34 GHz - 25.78125/26.5625 Gbaud 26.5625 GHz - 53.125 Gbaud SM TDECQ 38.7 GHz - 53.125 Gbaud

*: Operation at Fast Pattern Lock (when Coherent Eye Mode and Test Pattern setting is not Variable)

Optical Noise

Wavelength	Input	Option		Filter	RMS Optical Noise*
1310 nm	SMF	03x	Other than 030	OTU4 Filter	Typ. 3.4 µW, Max. 4.3 µW (Typ. 4.8 µW, Max. 6.1 µW)
				No Filter	Typ. 5.4 µW, Max. 7.5 µW (Typ. 7.6 µW, Max. 10.6 µW)
			030	OTU4 Filter	Typ. 4.8 µW, Max. 6.1 µW (Typ. 6.8 µW, Max. 8.6 µW)
				No Filter	Typ. 7.6 µW, Max. 10.6 µW (Typ. 10.8 µW, Max. 15.0 µW)
		04x	Other than 040	OTU4 Filter	Typ. 4.1 µW, Max. 5.2 µW (Typ. 5.8 µW, Max. 7.4 µW)
				No Filter	Typ. 5.5 µW, Max. 7.5 µW (Typ. 7.8 µW, Max. 10.6 µW)
			040+061	OTU4 Filter	Typ. 4.1 µW, Max. 5.2 µW (Typ. 5.8 µW, Max. 7.4 µW)
				No Filter	Typ. 5.5 µW, Max. 7.5 µW (Typ. 7.8 µW, Max. 10.6 µW)
			040	OTU4 Filter	Typ. 5.8 µW, Max. 7.3 µW (Typ. 8.2 µW, Max. 10.4 µW)
				No Filter	Typ. 7.8 µW, Max. 10.6 µW (Typ. 11.0 µW, Max. 15.0 µW)
850 nm	SMF	040+061		100 GbE/4 Filter	Typ. 12.2 µW, Max. 14 µW (Typ. 17.3 µW, Max. 19.8 µW)
	MMF	03x		OTU4 Filter	Typ. 6.7 µW, Max. 8.4 µW (Typ. 9.5 µW, Max. 11.9 µW)
				No Filter	Typ. 8.1 µW, Max. 10.5 µW (Typ. 11.4 µW, Max. 14.9 µW)
		04x		OTU4 Filter	Typ. 7.0 µW, Max. 8.9 µW (Typ. 9.9 µW, Max. 12.6 µW)
				No Filter	Typ. 8.6 µW, Max. 11.1 µW (Typ. 12.1 µW, Max. 15.7 µW)

*: Numeric values in parenthesis are values for channel B when the Option 054 Clock Recovery Unit is installed.

Mask Sensitivity (Estimated optical power when Mask Margin (Hit Count 0) reaches 0% (calculated from optical noise))

Wavelength	Input	Option		Filter	Mask Sensitivity*
1310 nm	SMF	03x	Other than 030	OTU4 Filter	–15 dBm (–13.5 dBm)
			030	OTU4 Filter	–13.5 dBm (–12 dBm)
		04x	Other than 040	OTU4 Filter	–14 dBm (–12.5 dBm)
			040+061	OTU4 Filter	–14 dBm (–12.5 dBm)
			040	OTU4 Filter	–12 dBm (–10.5 dBm)
850 nm	SMF	040+061		100 GbE/4 Filter	–10 dBm (–8.5 dBm)
	MMF	03x/04x		OTU4 Filter	–12 dBm (–10.5 dBm)

*: Numeric values in parenthesis are values for channel B when the Option 054 Clock Recovery Unit is installed.

Amplitude Setting

Scale: 1 µW/Div to 200 µW/Div, 1 µW steps
Offset: –500 µW/Div to 500 µW/Div, 1 µW steps

Recommended Input Power (Non-Saturated Range)

Wavelength	Recommended Input Power
1310 nm	Peak Level ≤ 1 mW
850 nm	Peak Level ≤ 2 mW

Absolute Max. Rating (Damage-free Range)

	SMF Input	MMF Input
Average Value	+5 dBm	+7 dBm
Peak	+8 dBm	+10 dBm

Optical Return Loss

SMF Input: –27 dB (typ., at 1310 nm SMF connection)
MMF Input: –20 dB (typ., at 850 nm MMF connection)

Optical Power Meter Accuracy (typ.)

Input Level	–18 to –12 dBm	–12 to 0 dBm	0 to +2 dBm*2
Accuracy (typ.)*1	±0.6 dB	±0.35 dB	±0.55 dB

*1: In the actual measurement, it is necessary to consider the uncertainty due to the optical fiber connector.
*2: This specified value does not apply to SMF input at the 1ch, 2ch or 040+061 configurations.

1ch: 033/043/035/045/036/046
2ch: 032/042
4ch: 030/040/039/049

03x: 030/032/033/035/036/039
04x: 040/042/043/045/046/049

BERTWave MP2110A Specifications

Clock Recovery

Option	25G SMF/MMF/Electrical Clock Recovery (Option 054)	26G/53G SMF Clock Recovery (Option 055)
Data Input	Connector: K (f), 50Ω, AC coupled * The DC component is terminated to GND via a 50Ω.	FC Connector (changeable) Wavelength: 1260 nm to 1620 nm, Applicable Fiber: Single Mode fiber Optical Return Loss: –30 dB (typ., 1310 nm)
	Data Format: NRZ, PAM4	Data Format: NRZ, PAM4
	Bit Rate: 25.5 Gbaud to 28.2 Gbaud, 28.2 Gbaud to 28.9 Gbaud (Option 059)	Bit Rate: 25.5 Gbaud to 28.9 Gbaud, 51 Gbaud to 58 Gbaud
	Input Sensitivity: 10 mVp-p (typ.)*1, *2, 20 mVp-p (max.)*2 Max. Amplitude: 800 mVp-p	Input Sensitivity: Outer OMA 100 µW (typ., 26.5625/53.125 Gbaud Open Eye (PRBS13Q, TDECQ 2.0 dB)) Outer OMA 630 µW (typ., 53.125 Gbaud Stressed Eye (SSPRQ, TDECQ 3.4 dB))
	Absolute Maximum Input: 1 Vp-p	Absolute Max. Rating: +9.0 dBm (Average), +12.0 dBm (Peak)
	Contiguous Zeros Tolerance: ≥500 bits at PRBS15 Zero Substitution Pattern	Contiguous Zeros Tolerance: ≥500 bits at PRBS15 Zero Substitution Pattern
	Auto Relock	Auto Relock
Data Output	Ch B O/E Monitor Out (with built-in optical channel oscilloscope) Connector: K (f) Insertion Loss: 1.5 dBo (typ.) Conversion Gain: 60 V/W (SMF input, typ.), 33 V/W (MMF input, typ.)	Optical Data Output FC Connector (changeable) Insertion Loss: 1.5 dB (typ.), 2.3 dB (max., 1310 nm)
Recovered Clock Output	Connector: SMA (f), 50Ω, AC coupled	Connector: SMA (f), 50Ω, AC coupled
	Recovery Mode Amplitude: 480 mVp-p (typ.) Division Ratio: 1/2 Jitter: 250 fs rms (typ.)*1, *3, 400 fs rms (max.)*3 Loop Bandwidth: Select from 4 MHz, 10 MHz, bit rate/1667, Attenuation: –20 dB/dec	Recovery Mode Amplitude: 440 mVp-p (typ.), 340 mVp-p (min.) Division Ratio: 1/4 (at 25.5 Gbaud to 28.9 Gbaud input), 1/8 (at 51 Gbaud to 58 Gbaud input) Jitter: 200 fs rms (typ.)*1, *4, *5, 400 fs rms (typ.)*4, *5 Loop Bandwidth: Select from 4 MHz, 10 MHz, bit rate/1667, Attenuation: –20 dB/dec

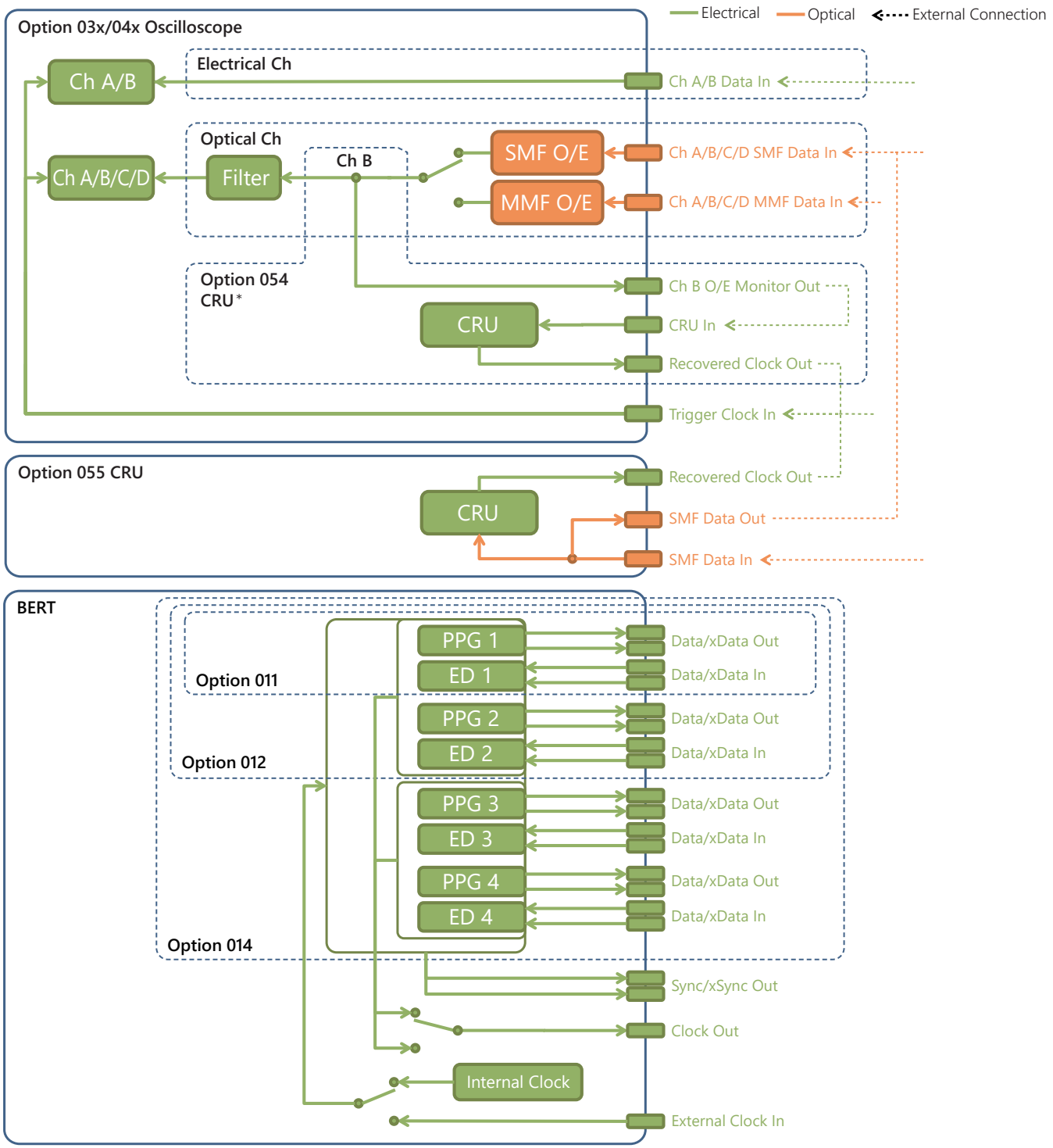
*1: 25°C ±5°C
*2: NRZ, at 25.78125 Gbit/s, PRBS31, 10-MHz Loop Bandwidth, using MP2110A PPG
*3: NRZ, at 25.78125/26.5625/28.05 Gbit/s, 400 ±100 mVp-p, 1/4 Clock Pattern, 10-MHz Loop Bandwidth, using MP2110A PPG
*4: 4 MHz Loop Bandwidth
*5: at 26.5625/53.125 Gbaud Clock Pattern, Outer OMA 0 dBm

MP2110A Selection Guide

Function and Selection Conditions							Selection/Option Addition
MP2110A	Upper slot	Oscilloscope	Select any one.	1/2ch	Electrical 2ch		021
					Optical SMF/MMF 1ch + Electrical 1ch		043 (or 033*)
					Optical SMF 1ch		045 (or 035*)
					Optical MMF 1ch		046 (or 036*)
					Optical SMF/MMF 2ch		042 (or 032*)
					Select additions.	Precision Trigger	024
				4ch	Optical SMF Input 4ch	Low Noise 1310/1550 nm, 850-940 nm support	040+061
						1310/1550 nm	040 (or 030*)
					Optical MMF Input 4ch	Low Noise 850 nm	049 (or 039*)
			Select additions.	Clock Recovery	SMF/MMF/Electrical, 26G (25.5G to 28.2G)		054
					Select additions.	28.2G to 28.9G Rate Extension	059
				Software	Optical Channel	Fast Pattern Lock Waveform data export Digital Filter RIN OMA	098 or 095
					Electrical Channel	Fast Pattern Lock Waveform data export Differential Skew Adjustment (Software)	
						Digital Filter Embedding/De-embedding CTLE	098
					NRZ Jitter Analysis		096
					PAM4 Analysis, TDECQ Equalizer		095
	Lower slot	Select any one.	Clock Recovery		SMF, 26G/53G (25.5G to 28.9G, 51G to 58G)		055
			BERT	Select any one.	1ch		011
					2ch		012
					4ch		014
				Select additions.	10G Rate Extension		093

*: Only the reference receiver characteristics (bessel filter approximation characteristics) of hardware filter are different for Option 04x and Option 03x.

BERTWave MP2110A Block Diagram



* Optical channel: The clock in the optical signal input to Ch B is recovered.
Electrical channel: There is no Monitor Out connector when Ch B is an electrical channel. Split the signal using the Pick-off tee and input to CRU In.

BERTWave MP2110A Ordering Information

When making a contract, determine the configuration by referencing the selection guide (p. 20/21) and specify the type, model, name, and quantity.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main Frame	
MP2110A	BERTWave	
	Standard Accessories	
	Power Cord	
J1627A	GND Connection Cable:	1
	MX210000A BERTWave Control Software CD-ROM:	1
	Options	
MP2110A-011	1ch BERT	
MP2110A-012	2ch BERT	
MP2110A-014	4ch BERT	
MP2110A-021	Dual Electrical Scope	
MP2110A-024	Precision Trigger	
MP2110A-030	Quad Optical Scope for Singlemode Baseband Flat	
MP2110A-032	Dual Optical Scope Baseband Flat	
MP2110A-033	Optical and Single-ended Electrical Scope Baseband Flat	
MP2110A-035	Optical Scope for Singlemode Baseband Flat	
MP2110A-036	Optical Scope for Multimode Baseband Flat	
MP2110A-039	Quad Optical Scope for Multimode Baseband Flat	
MP2110A-040	Quad Optical Scope for Singlemode	
MP2110A-061	Low Noise and Multimode Support for Opt.040	
MP2110A-042	Dual Optical Scope	
MP2110A-043	Optical and Single-ended Electrical Scope	
MP2110A-045	Optical Scope for Singlemode	
MP2110A-046	Optical Scope for Multimode	
MP2110A-049	Quad Optical Scope for Multimode	
MP2110A-054	Clock Recovery (Electrical/Optical)	
MP2110A-055	26G/53Gbaud Clock Recovery (SM Optical)	
MP2110A-059	25G Clock Recovery Range Extension	
MP2110A-060	Optical Scope Custom Gain Adjustment	
MP2110A-093	PPG/ED Bit Rate Extension	
MP2110A-095	PAM4 Analysis Software	
MP2110A-096	Jitter Analysis Software	
MP2110A-098	Signal Processing Software	
	Retrofit Options[*1, *2]	
MP2110A-110	Windows10 Upgrade Retrofit[*3]	
MP2110A-111	1ch BERT Retrofit	
MP2110A-112	2ch BERT Retrofit	
MP2110A-114	4ch BERT Retrofit	
MP2110A-121	Dual Electrical Scope Retrofit	
MP2110A-124	Precision Trigger Retrofit	
MP2110A-130	Quad Optical Scope for Singlemode Baseband Flat Retrofit	
MP2110A-132	Dual Optical Scope Baseband Flat Retrofit	
MP2110A-133	Optical and Single-ended Electrical Scope Baseband Flat Retrofit	
MP2110A-135	Optical Scope for Singlemode Baseband Flat Retrofit	
MP2110A-136	Optical Scope for Multimode Baseband Flat Retrofit	
MP2110A-139	Quad Optical Scope for Multimode Baseband Flat Retrofit	
MP2110A-140	Quad Optical Scope for Singlemode Retrofit	
MP2110A-142	Dual Optical Scope Retrofit	
MP2110A-143	Optical and Single-ended Electrical Scope Retrofit	
MP2110A-145	Optical Scope for Singlemode Retrofit	
MP2110A-146	Optical Scope for Multimode Retrofit	
MP2110A-149	Quad Optical Scope for Multimode Retrofit	
MP2110A-154	Clock Recovery (Electrical/Optical) Retrofit	
MP2110A-155	26G/53Gbaud Clock Recovery (SM Optical) Retrofit[*4]	
MP2110A-159	25G Clock Recovery Range Extension Retrofit[*5]	
MP2110A-359	25G Clock Recovery Range Extension Retrofit[*5]	
MP2110A-193	PPG/ED Bit Rate Extension Retrofit	
MP2110A-195	PAM4 Analysis Software Retrofit	
MP2110A-395	PAM4 Analysis Software Retrofit[*6]	
MP2110A-196	Jitter Analysis Software Retrofit	
MP2110A-396	Jitter Analysis Software Retrofit	
MP2110A-198	Signal Processing Software Retrofit	
MP2110A-398	Signal Processing Software Retrofit[*7]	
	Standard Accessories MP2110A-011	
J1632A	Terminator:	3
J1341A	Open:	5
	Standard Accessories MP2110A-012	
J1632A	Terminator:	5
J1341A	Open:	7
	Standard Accessories MP2110A-014	
J1632A	Terminator:	9
J1341A	Open:	11
	Standard Accessories MP2110A-021	
J1341A	Open:	3
	Standard Accessories MP2110A-030/032/039/040/042/049	
J0617B	Replaceable Optical Connector (FC-PC):	4
Z0397A	FC ADAPTER CAP:	4
J1341A	Open:	1

Model/Order No.	Name	
	Standard Accessories MP2110A-033/043	
J0617B	Replaceable Optical Connector (FC-PC):	2
Z0397A	FC ADAPTER CAP:	2
J1341A	Open:	2
	Standard Accessories MP2110A-035/036/045/046	
J0617B	Replaceable Optical Connector (FC-PC):	1
Z0397A	FC ADAPTER CAP:	1
J1341A	Open:	1
	Standard Accessories MP2110A-054	
J1632A	Terminator (Only for optical channel):	1
J1341A	Open:	2
J1763A	U Link Coaxial Cable (K):	1
J1764A	U Link Coaxial Cable (SMA):	1
	Standard Accessories MP2110A-055	
J1341A	Open:	1
Z0397A	FC ADAPTER CAP:	2
	Maintenance Service	
MP2110A-ES310	3 Years Extended Warranty Service	
MP2110A-ES510	5 Years Extended Warranty Service	
	Optional Accessories	
J1341A	Open (Coaxial connector cover)	
J1632A	Terminator	
J1359A	Coaxial Adaptor (K-P · K-J, SMA compatible)	
J1349A	Coaxial Cable (0.3 m, SMA connector)	
J1342A	Coaxial Cable (0.8 m, SMA connector)	
J1343A	Coaxial Cable (1 m, SMA connector)	
J1439A	Coaxial Cable (0.8 m, K connector)	
J1551A	Coaxial Skew Match Cable (0.8 m, K connector)	
J1763A	U Link Coaxial Cable for Option 054 (K connector)	
J1764A	U Link Coaxial Cable for Option 054 (SMA connector)	
J1819A	U Link Coaxial Cable for Option 055 (SMA connector)	
J1510A	Pick OFF Tee	
Z0397A	FC ADAPTER CAP	
J1824A	Fixed Optical Attenuator (SM, 1 dB)	
J1825A	Fixed Optical Attenuator (SM, 2 dB)	
J1826A	Fixed Optical Attenuator (SM, 3 dB)	
J1827A	Fixed Optical Attenuator (SM, 5 dB)	
J0617B	Replaceable Optical Connector (FC-PC)	
J0618D	Replaceable Optical Connector (ST)	
J0618E	Replaceable Optical Connector (DIN)	
J0619B	Replaceable Optical Connector (SC)	
J0635A	FC/PC-FC/PC-1M-SM	
J1139A	FC/PC-LC/PC-1M-SM	
J1344A	LC/PC-LC/PC-1M-SM	
J1345A	SC/PC-LC/PC-1M-SM	
J0660A	SC/PC-SC/PC-1M-SM	
J0893A	FC/PC-FC/PC-1M-GI (50/125)	
J1347A	FC/PC-LC/PC-1M-GI (62.5/125)	
J1346A	LC/PC-LC/PC-1M-GI (62.5/125)	
J1348A	SC/PC-LC/PC-1M-GI (62.5/125)	
J0839A	SC/PC-SC/PC-1M-GI (50/125)	
J1519A	Optical Fiber Cord (MM, 12FIBER, MPO,3 m)	
J1681A	MPO Loopback Cable	
J1682A	MPO to FC convert cable	
G0364A	100G LR4 1310 nm QSFP28	
G0366A	100G SR4 850 nm QSFP28	
Z0914A	Ferrule Cleaner	
Z0915A	Replacement Reel for Ferrule Cleaner	
G0306C	Video Inspection Probe	
G0342A	ESD DISCHARGER	
Z0306A	Wrist Strap	
Z0541A	USB Mouse	
Z1944A	LCD Monitor	
B0734A	Carrying Case	
B0735A	Rack Mount Kit	
W3831AE	MP2110A BERTWave Operation Manual	
W3773AE	BERTWave Series Remote Control Operation Manual	

Notes for retrofitting options:
*1: BERT retrofit supported when BERT not installed or to increase number of channels
*2: Oscilloscope retrofit supported when oscilloscope not installed or when changing Option 03x and 04x, same channel configuration.
*3: This option upgrades the Windows Embedded Standard 7 to the Windows 10 Enterprise LTSC. It is performed by Anritsu factory or service center return.
*4: Option 055 can be retrofitted when the BERT is not installed.
*5: If Option 054 is already installed, option 159/359 can be ordered for serial numbers 6262201559 or larger.
*6: Option 395 can be ordered for serial numbers 6261844875 or larger.
*7: Option 398 can be ordered only for optical-channel configurations, or for serial numbers 6272280900 or larger.

In addition, refer to page 20/21 (MP2110A Selection Guide) for any restrictions on option configurations.

BERTWave MP2110A Related Products

Signal Quality Analyzer-R MP1900A

Support 400 GbE/800 GbE and PCIe Gen4/5.
All-in-One Support for Evaluating Next-Generation NRZ/PAM4 Network Interfaces and High-Speed Serial Buses

- All-in-one support for both high-speed Ethernet and PCI Express interface tests
- Easily configured and easy-to-use all-in-one 64-GBaud PAM4 BER measurement system supporting FEC analysis
- Receiver tests are supported by the built-in Protocol Awareness PCIe Link Training and LTSSM analysis functions
- High-reproducibility measurements due to high waveform quality and high input sensitivity
- Supports true signal integrity analysis, such as bit error rate measurements, Jitter Tolerance tests, etc.

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 ext-generation Ethernet networks to bus interconnects.

Excellent Eco Product

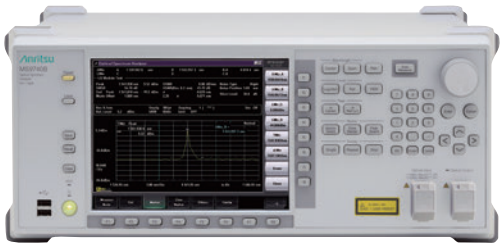
Optical Spectrum Analyzer MS9740B

600 nm to 1750 nm

Faster measurement speed shortens measurement time and improves production efficiency

- Faster measurement speed of <0.2 s/5 nm reduces total analysis time for active optical devices
- Built-in applications for evaluating active optical devices
- Built-in Fast mode cuts measurement time by 50% for better production efficiency to predecessor MS9740A using 200 Hz or 1 kHz bandwidth
- Excellent cost performance
- >58 dB dynamic range (0.4 nm from peak wavelength)
- 30 pm minimum resolution
- Low power consumption (75 VA), light weight (15 kg max.)

The MS9740B reduces production costs by shortening active optical device evaluation times and supporting efficient analysis applications.



Excellent Eco Product

Anritsu Advancing beyond

Specifications are subject to change without notice.

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