BERTWave™
MP2110A
MP2100B

All in One BERT+ Sampling Oscilloscope
4ch
~12.5 Gbit/s BERT
~28.2 Gbit/s BERT
For Multi-Channel Optical Module/Device Manufacturing and Development

To cope with exploding data traffic volumes caused by providers offering new unique services, optical modules and devices are transitioning to use of higher bit rates. However, a key issue for data centers is how to hold-down system costs, which requires higher productivity as well as cost reductions at optical module/device manufacturing.

The BERTWave series is designed especially for mass-production of optical modules and features an All-in-one BERT (for bit error rate measurement) plus sampling oscilloscope (for Eye pattern analysis) to help increase optical module production efficiency and cut costs.

Reduce cost. Increase productivity.

All-in-one BERTWave with Built-In BERT + Sampling Oscilloscope
Multi-Channel Optical Module Evaluation Solution
BERTWave MP2110A / MP2100B

25 Gbit/s × 4 ch
For Multi-Channel Optical Module/Device Manufacturing and Development

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25 Gbit/s × 4ch

MP 2110A

All-in-one max. 4ch 28.2 Gbit/s BERT + max. 2ch optical sampling oscilloscope

Captures 1 million samples in about 5 seconds

Integrated BERT and sampling oscilloscope reduce instrument capital costs

Measures optical signals attenuated by peripherals such as optical switches

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

Shorter Measurement Times
High-speed Sampling Oscilloscope (250 ksamples/s)
Multi-channel Measurement (4ch BERT and 2ch Optical Sampling Oscilloscope)

More Accurate Performance
Sampling Oscilloscope
- Bandwidth
  - Optical: 35 GHz (SMF), 25 GHz (MMF)
  - Electrical: 40 GHz
- High Sensitivity: -15 dBm (typ., SMF)
- Low-Jitter: 200 fs rms (typ.)
BERT
- Low-Jitter PPG: 600 fs rms (typ.)
- High-Sensitivity ED: 25 mV (typ.)
Built-in PC for Stable Operation

Efficient Measurement Systems
Easy configuration of flexible measurement system using All-in-one and discrete instruments
Slashes instrument capital costs by up to about 50% depending on selected configuration
Easy measurement system configuration using sample program
All-in-one support (sampling oscilloscope) for both NRZ and PAM4 signals

Target Applications: Evaluating PHY layer performance of optical transceiver modules, cables and component devices
Transmission Paths: Ethernet, CPRI, SDH/SONET, OTN, InfiniBand, Fibre Channel
Modules/Cables: Optical Transceivers, Active Optical Cables (AOC), Direct Attach Cables (DAC)
Devices: TOSA, ROSA, High-Speed Optical Engine, PHY, Driver ICs
**10 Gbit/s × 4ch**

**MP2100B**

**Jitter**

- 1 ps rms

**Built-in 1ch to 4ch 12.5 Gbit/s BERT**

**Error Detector (ED)**

- Sensitivity: 10 mVp-p

**Short Measurement Times**

- Simultaneous 4ch BERT and Eye Pattern Measurements
- Simultaneous 4ch BER Measurements
- High-Speed Eye Mask Tests
- High-Speed BER Tests

**Full-Featured Analysis Functions**

- Wideband Operation Frequency
- Electrical and Optical Interfaces
- Jitter Analysis
- Clock Recovery

**Cost-Effective Investment**

- Flexible Measurement System Configuration
- Multi-channel BERT

**Target Applications**

- Transmission Paths
  - InfiniBand, Fibre Channel, Ethernet, CPRI, OBSAI, SDH/SONET
  - TOSA/ROSA
  - High Speed Optical Engine

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**Pulse Pattern Generator (PPG)**

Jitter: 1 ps rms

**MP2110A**

**Simultaneous 4ch BERT and Eye Pattern Measurements**

**Short Measurement Times**

- High-speed Sampling Oscilloscope (250 ksamples/s)
- Multi-channel Measurement (4ch BERT and 2ch Optical Sampling Oscilloscope)

**Captures 1 million samples in about 5 seconds**

**All-in-one max. 4ch 28.2 Gbit/s BERT + max. 2ch optical sampling oscilloscope**

**Easy configuration of flexible measurement system using All-in-one and discrete instruments**

**Slashes instrument capital costs by up to about 50% depending on selected configuration**

**Easy measurement system configuration using sample program**

- All-in-one support (sampling scilloscope) for both NRZ and PAM4 signals

**PAM4 Analysis**

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

**Measures optical signals attenuated by peripherals such as optical switches**

**More Accurate Performance**

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

- BERT
  - Low-Jitter PPG: 600 fs rms (typ.)
  - High-Sensitivity ED: 25 mV (typ.)

**Built-in PC for Stable Operation**
**BERTWave Series Features**

Supports Optical-module and Optical-device Measurements at Bit Rates from 1 Mbit/s to 100 Gbit/s (25 Gbit/s × 4ch)

**All-in-one**
The All-in-one design incorporates a BERT and sampling oscilloscope in one cabinet, supporting simultaneous BER measurements at the Rx side of optical modules and devices while analyzing the signal Eye pattern at the Tx side to greatly improve measurement efficiency.

**Shared GUI and Compatible Remote Commands**
With its simplified shared GUI, the BERTWave series supports easy measurement. Additionally, since the remote commands are compatible with all BERTWave series, production-line configuration is easy because one program can be used for lines with different bit rates.

**BERTWave MP2110A**

*Fast, Low-Noise, High-Sensitivity Sampling Oscilloscope*
With a sampling speed of 250 ksamples/second, the sampling oscilloscope captures 1 Msamples in about 5 seconds. In addition, the Auto-Mask Margin function cuts the time required for Mask Margin tests. These features support low noise values of 3.4 µW and a Mask Margin sensitivity of –15 dBm (typ., SMF) using a high-sensitivity O/E module. Moreover, the sampling oscilloscope has a built-in high-accuracy trigger signal of 200 fs rms. As well as enabling accurate measurement of DUT characteristics, this high-performance hardware also supports a built-in Clock Recovery Unit (CRU) option.

*Max. 4ch High-Sensitivity ED and Low-Jitter PPG*
With a low data jitter of 600 fs rms (typ.), the MP2110A PPG supports high-accuracy measurement of optical-module and optical-device characteristics. The 25 mV (typ.) ED enables BER measurement of low-amplitude signals caused by transmission path losses to help improve DUT yields.

**BERTWave MP2100B**

*High-Speed Eye Pattern Analysis*
With a sampling speed of 150 ksamples/s, 1 million samples can be captured in about 8 seconds. The automatic Mask Margin measurement function built-in as standard reduces Mask Margin measurement test times.

*Clock Recovery Option*
A clock recovery option for the sampling oscilloscope can be installed in the MP2100B to support operation ranges of 8.5 GHz to 12.5 GHz and 0.1 GHz to 2.7 GHz covering bit rates for existing standards used by transmission equipment. This clock recovery option is used to evaluate the characteristics of optical equipment for long-distance transmissions and transmission equipment with no clock output.

*Wideband Operating Frequency*
The built-in PPG and ED operate at 1/N bit rates over the range of 8.5 Gbit/s to 11.32 Gbit/s as standard. Installing MP2110A-092 supports all bit rates ranging from 125 Mbit/s to 12.5 Gbit/s used by various applications such as STM-1, 10GFC, etc., in one set.

**Option Configuration**

<table>
<thead>
<tr>
<th>BERT</th>
<th>1ch</th>
<th>2ch</th>
<th>4ch</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sampling Oscilloscope</strong></td>
<td>Differential Electrical</td>
<td>Electrical 1ch</td>
<td>Optical 1ch</td>
</tr>
<tr>
<td></td>
<td>Optical 2ch</td>
<td></td>
<td></td>
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</tbody>
</table>

For details please refer to the separate catalog.
### Optical Spectrum Analyzer MS9740A

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
- Excellent cost performance
- >58 dB dynamic range (0.4 nm from peak wavelength)
- 30 pm minimum resolution
- Low power consumption (75 VA), lightweight (15 kg max.)

The MS9740A reduces production costs by shortening active optical device evaluation times and supporting efficient analysis applications.

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### Optical Attenuator G035xF/S

This bench-top optical attenuator has an optical attenuation of 60 dB. Support for remote control over GPIB makes it easy to configure a remote measurement setup in combination with the BERTWave series. Choose the model with the correct fiber connectors for the application.

### Optical Switch G034xF/S

This bench-top optical switch supports 1×4, 2×4, and 1×16 switching. Support for remote control over GPIB makes it easy to configure a remote measurement setup in combination with the BERTWave series. Choose the model with the correct fiber connectors for the application.

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**Application Examples: Optical Module Evaluation**

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