QUANTIFI PHOTONICS®

QCA SERIES

HIGH-SPEED COMMUNICATION ANALYZER

SPECIFICATION SHEET

quantifiphotonics.com

INTRODUCING THE QCA 1000 SERIES

The **QCA Series High-Speed Communication Analyzer** is a digital equivalent-time sampling oscilloscope with a high-quality precision timebase and low jitter mode.

It's designed to deliver a capable, cost-effective, and scalable test solution to address the requirements of next-generation high-speed interconnects and high-density ASIC s .

With ultra-low jitter performance and unrivalled instrument density, the QCA Series is ideal for conducting high-precision measurements in parallel to optimize test throughput and reduce the cost-of test in high-volume manufacturing applications.

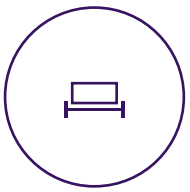
FEATURES

Ultra-low jitter

High quality precision timebase with low jitter mode provides ultra-low jitter noise floor and PLL-based low frequency clock phase tracking.

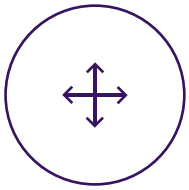
Accurate performance

Comparable feature set and predictive value (correlation) as the prohibitively expensive R&D set-ups.



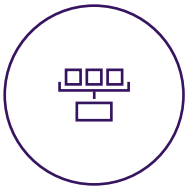
Compact design

Compact design enables high-density, high-channel count, test solutions in a relatively small footprint.



Scalable

Designed to meet the requirements for high channel count validation and high-volume manufacturing and testing.



Ease of integration

Small footprint, remote control and API enable easy integration into probing and assembly equipment.

VISEYE™ signal analysis soft ware

Modern visualization and analysis software that combines powerful analytical capabilities with an intuitive, user-friendly interface.

Lower cost-of-test

Improved test efficiency and test throughput can reduce the cost-of test and accelerate time-to-market.

WHY IS LOW JITTER AND HIGH-CHANNEL-DENSITY SO IMPORTANT?

Next-generation high-speed interconnects as well as novel, densely packed processing, compute and switch ASICs play a critical role in the roll-out of hyperscale data centers and emerging HPC and AI applications. These next-generation devices will contain hundreds of channels, each requiring testing at all stages of development, validation and manufacturing.

This development presents a set of new challenges for the test engineer: how to manage the cost-of-test, while meeting significantly increased test requirements? Densely-integrated technologies have a compressed point of failure – so skipping testing is not a viable option. All channels will need to be validated to make sure they meet specifications.

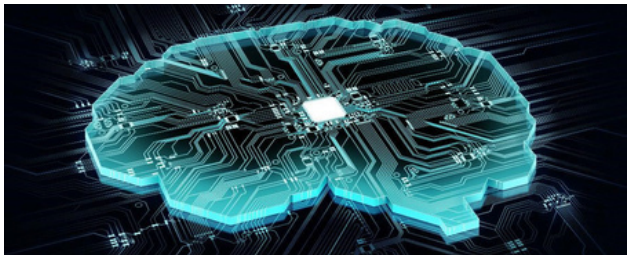
High-speed oscilloscopes have been used to test transmitters for many decades and the tried-and-tested eye diagram, and derived analysis such as TDECQ remain the primary performance measurement and are still a bottleneck in today's design, validation and manufacturing chain. At high baud rates, when jitter is combined with amplitude (or signal) noise, limited bandwidth, and multi-level signalling such as PAM4, timing deviations and signal integrity can get exponentially worse, and error-free transmission will be impossible if jitter is not controlled.

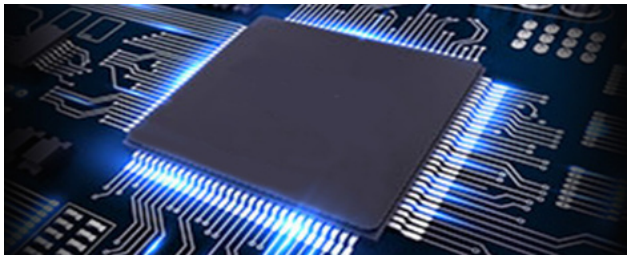
To be able to properly characterize the quality of high-speed interfaces, it is important that the jitter noise floor of the test instrumentation is low enough to be able to measure the jitter of the devices under test. It's also important that measurement equipment can track low frequency variations of the embedded clock in the high-speed signal. So-called clock wander is typical in link technologies that rely heavily on digital signal processing at the receiver or other advanced signalling formats.

Consequently, ultra-low jitter noise floor and PLL-based low frequency clock phase tracking are essential to provide the precision measurement conditions necessary for accurate and repeatable characterization of 100G per channel and above HSIO interfaces.

JITTER MATTERS!

APPLICATIONS





Jitter and eye diagram testing for:

- Switch ASICs
- GPUs/CPUs
- AI/ML processing ICs
- PAM4 DSPs
- Repeater/extender ICs
- Other high-speed ICs such as:
  - DACs, TIAs, and drivers
- Electrical high-speed IO characterization
- High-volume test of high-speed ICs
- Validation testing
- Pre-production testing

The QCA Series uses Quantifi Photonics' new VISEYE™ signal analysis software for an intuitive & easy-to-use experience to operate the oscilloscope and perform jitter and eye measurements.

VISEYE features a modern interface and has been designed to streamline the analysis process while providing full control of hardware and analysis functions. It also has a powerful API that allows streamlined automation for maximum measurement throughput.

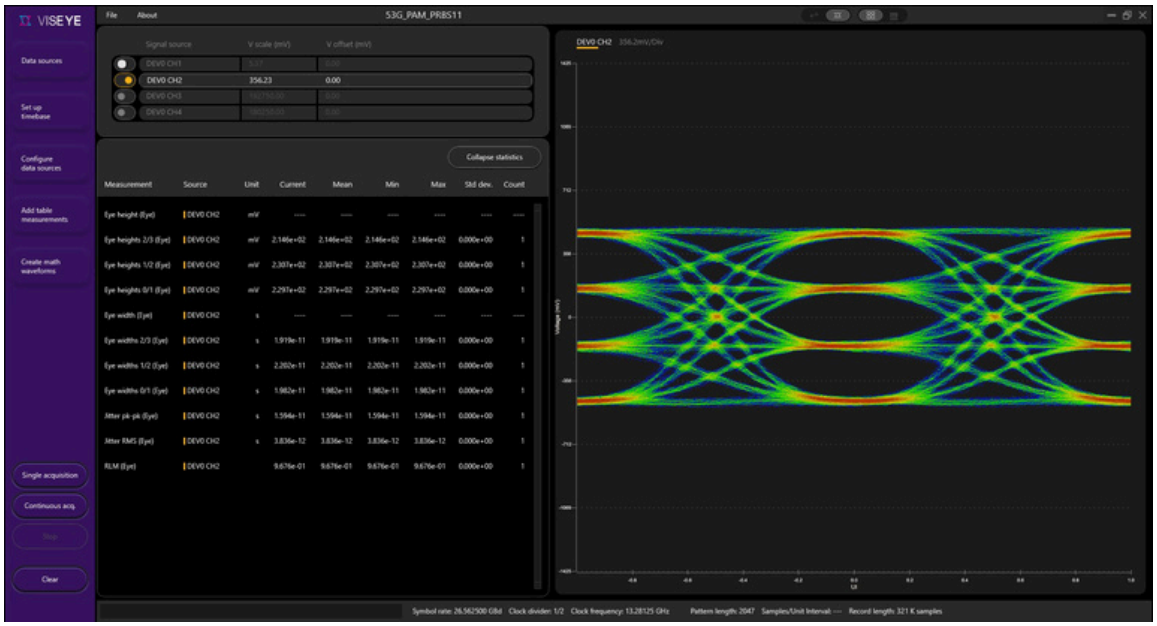


Image: 53 Gbps PAM4 signal eye diagram shown with numerical analysis parameters.

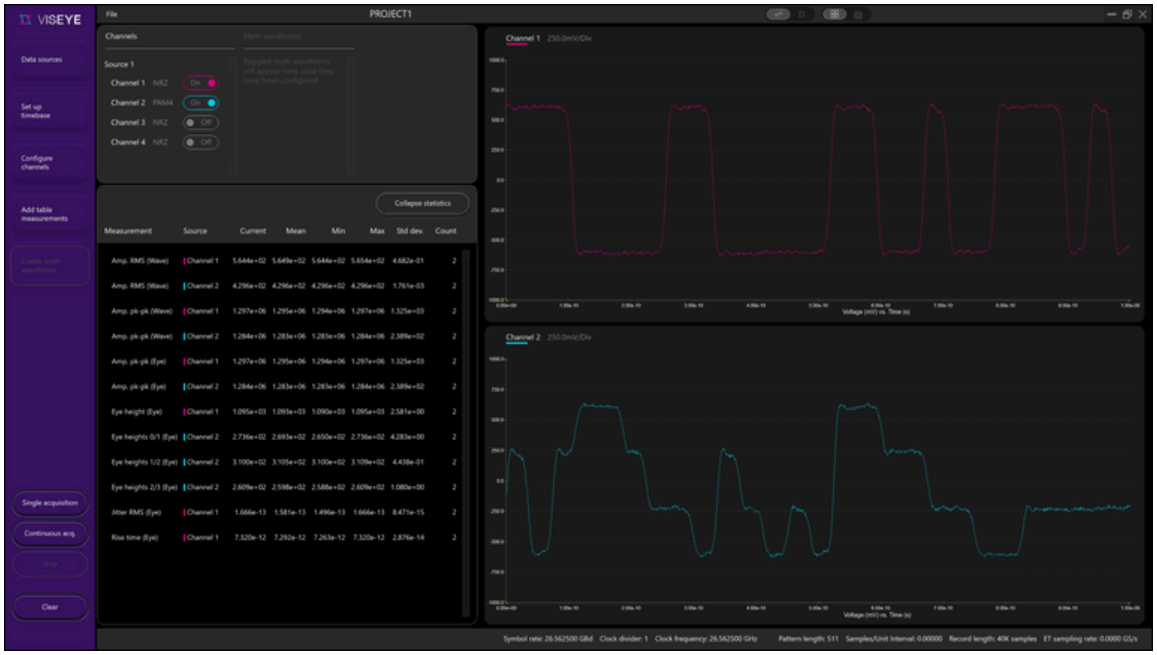


Image: 26 GBaud PAM4 trace plot shown with statistics of the numerical parameters.

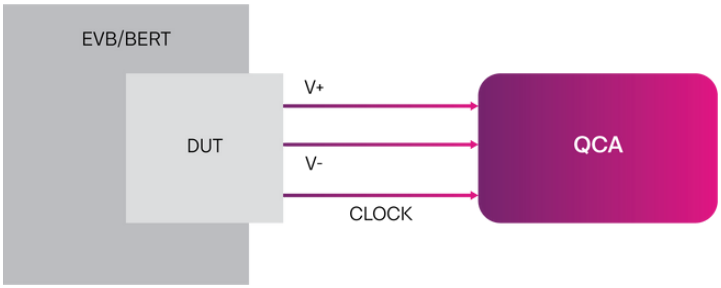
Use case 1: Triggering using a synchronous clock

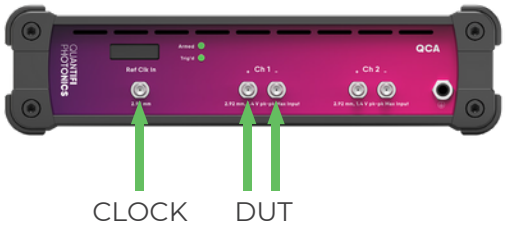
Synchronous clock signal is provided.

Signal types:
- 26.56 GBd PAM4
- 25 - 32 G NRZ

Used for:
- Jitter and eye diagram measurements
- Fully synchronous Clock (to Tx)

*Can be used for 53.125 GBd PAM4 if local clock/PLL is available for triggering.



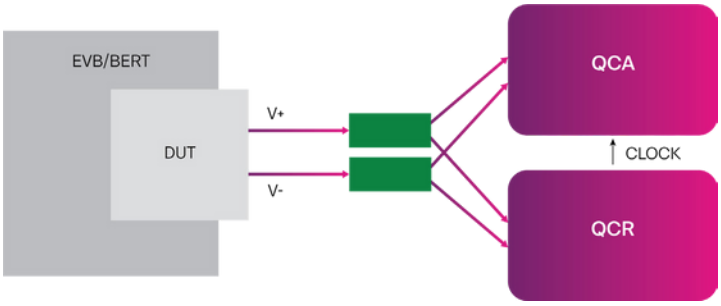


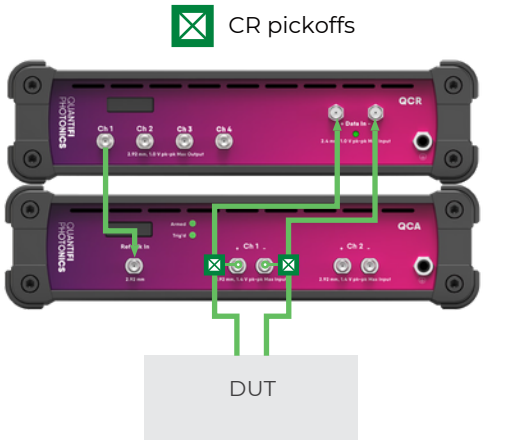
Use case 2: Triggering using a recovered clock

Includes QCR Clock Recovery instrument and CRU Pick-off kit.

Ideal for:
- 53.125 GBd PAM4
- 26.56 GBd PAM4
- 25 - 32 G NRZ

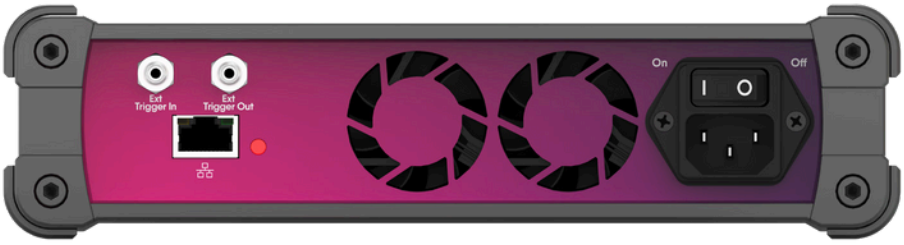
Used for:
- Jitter and eye diagram measurements
- Retimed Tx (local PLL)



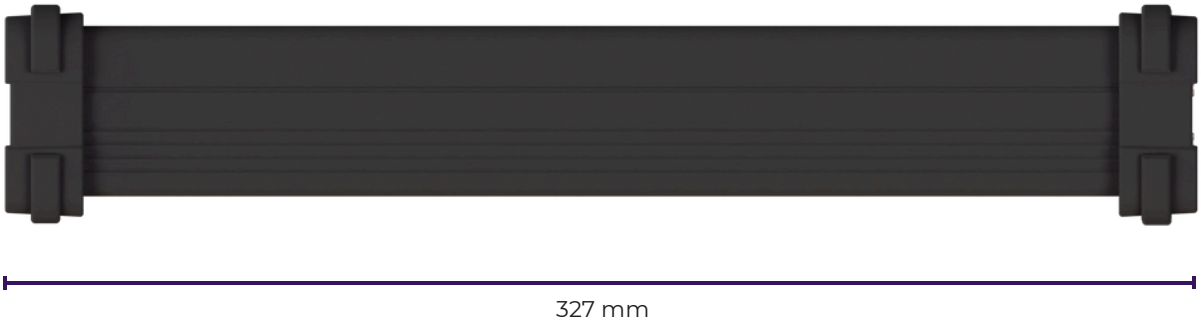


Front view

Rear view



Side view



QCA SERIES TECHNICAL SPECIFICATIONS

General Specifications	QCA
Dimensions (HxWxD)	60 x 244 x 327 mm | 2.36 x 9.6 x 12.9 inches
Weight	2.71 kg
Bus connection	Ethernet
Number of channels	1 or 2 differential
Operating temperature range	5 °C to 45 °C | 41 °F to 113 °F
Storage temperature range	-40 °C to 70 °C | -40 °F to 158 °F

Power Specifications	QCA
AC input voltage range	100 to 240 V
AC input current	1.3 A (115 V), 0.9 A (230 V)
AC frequency range	47 to 63 Hz

Model	1001	1002
Number		
Electrical QCA	AC-coupled, differential or single-ended	AC-coupled, differential or single-ended
Coupling Analog bandwidth (-3 dB)	32 GHz	50 GHz
Equivalent-time sampling rate, max	3.5 MHz	3.5 MHz
Pattern capture	Up to PRBS15	Up to PRBS15
Front panel connectors	2.92 mm	2.4 mm
Vertical		
RF termination	50 Ω (single-ended) 100 Ω (differential)	50 Ω (single-ended) 100 Ω (differential)
RF connector	2.92 mm	2.4 mm
Max input (damage threshold)	± 600 mV (each single-ended input)	± 600 mV (each single-ended input)
Linear dynamic range (AC-coupled)	± 500 mV (single-ended) 1000 mVpp (differential)	± 500 mV (single-ended) 1000 mVpp (differential)
Vertical noise floor - diff.	1.0 mV (rms)	1.4 mV (rms)
Ref Clock Trigger Input		
RF connector	2.92 mm (female)	2.92 mm (female)
Nominal impedance	50 Ω AC-coupled	50 Ω AC-coupled
Frequency range	5 - 16 GHz	5 - 16 GHz
Maximum input amplitude (single-ended)	900 mVpp (≥ 10 GHz) 800 mVpp (< 10 GHz)	900 mVpp (≥ 10 GHz) 800 mVpp (< 10 GHz)

Model Number	1001	1002
Jitter (for sinusoidal trigger input)1		
RMS jitter in low-jitter mode	150 fs	150 fs
Jitter floor (trigger signal ≥ 10 GHz, ≥ 250 mV_{pp})	≤ 140 fsrms	≤ 140 fsrms
Jitter floor (trigger signal < 10 GHz, ≥ 350 mV_{pp})	≤ 160 fsrms	≤ 160 fsrms
Trigger sensitivity2	75 mVpp (≥ 10 GHz) 150 mVpp (< 10 GHz)	75 mVpp (≥ 10 GHz) 150 mVpp (< 10 GHz)

Notes

1. For channel signal input ≥ 300 mVpp
2. Pattern trigger and low-jitter timebase operational; jitter floor is degraded to ≤ 190 fs_{rms} (typ.)
3. Preliminary specs as of December 2024 and subject to change.

- Use up to eight sources of data, combined from the QCA instrument channels, captured waveform data files, or math waveforms.
- Show up to eight plots in a grid or stack view, in waveform mode or eye diagram mode.
- Use the project configuration file to capture your project settings to load it back easily for future use.
- Save your measurements results and statistics as a CSV file for further analysis.
- Configure the eye diagram plots – Select the heat map type, eye accumulation type, and the desired saturation intensity.
- Apply chains of mathematical functions to existing sources.

Supported measurements

- Amplitude average
- Amplitude peak-peak
- Amplitude RMS
- Eye amplitude
- Eye center amplitude
- Eye crossing percentage
- Eye height (NRZ/PAM4)
- Eye one level
- Eye skews
- Eye width (NRZ/PAM4)
- Eye zero level
- Fall time
- Jitter peak-peak
- Jitter RMS
- Levels
- One/Zero levels
- Rise time
- Signal-to-noise ratio (SNR)
- Symbol period (Bit rate)
- Transmitter linearity (RLM)

Advanced math

- Continuous Time Linear Equalizer (CTLE)
- Linear Feed Forward Equalizer (FFE)
- S-parameter embedding and de-embedding (s2p file)

Math functions

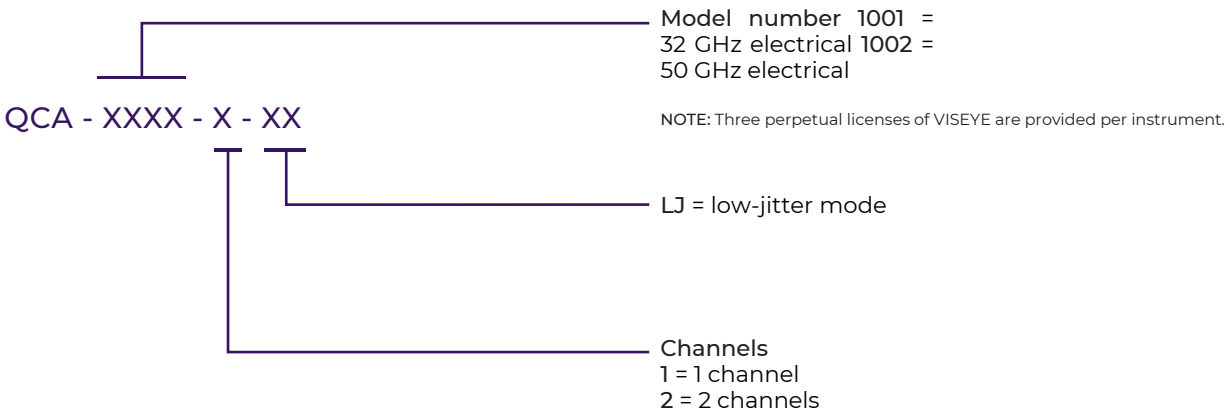
- Absolute Value
- Add/Subtract
- AlignDelay
- Amplify
- Average
- Common Mode
- Difference
- Invert
- Max./Min.
- Median
- Minimum
- Multiply
- Square
- Square Root
- Subtract
- Summation

*Future software updates will include additional measurement functions.

MINIMUM PC REQUIREMENTS

- Operating system: Microsoft Windows® 10 (64-bit)
- Processor: Intel® CoreTM i9 or faster CPU
- Memory: 32 GB or greater of RAM

ORDERING INFORMATION



Recommended auxiliary equipment:

Quantifi Photonics' QCR Clock Recovery Instrument.

WARRANTY INFORMATION

This product comes with a standard 1 year warranty.

EXTENDED WARRANTIES AND CALIBRATION PLANS

With an **extended warranty and calibration plan** you'll spend more time focused on your priorities and less time worrying about maintenance.

Add a **3 or 5 year extended warranty** when you purchase your Quantifi Photonics instruments.

Guarantee performance

Ensure your equipment is operating at the best it can be for reliable and accurate results.

Lower cost of ownership

Lock in savings and maximise your testing budget with a lower base cost of ownership.

Peace of mind

Spend less time worrying about maintenance and more on generating results.

CALIBRATION PLANS FOR ADDITIONAL DISCOUNTS

Order a **calibration plan** when purchasing your Quantifi Photonics instruments and get additional discounts.

10% Discount On calibrations ordered at the time of purchase.

25% Discount Add on an extended warranty and receive a 25% discount on calibrations.

Over time and with regular use, all optical parts and connectors require re-calibration and maintenance to guarantee accurate and reliable performance. We recommend Quantifi Photonics optical instruments are re-calibrated every 12 months. With an instrument calibration performed by Quantifi Photonics technicians you receive:

- Comprehensive calibration to factory specifi cations
- End-to-end inspection to ensure all instrument functions are working and connectors are clean
- Firmware, soft ware and documentation updates
- Certifi cate of calibration which includes detailed test results

How to do I secure my extended warranty or calibration plan?

Contact your Quantifi Photonics sales representative or email **sales@quantifi photonics.com**

Extended warranties and calibration plans must be ordered at the time of purchase and are available only for Quantifi Photonics' products. The 25% calibration discount only applies to calibrations while the product is covered by the extended warranty period.

Our portfolio of optical & electro-optical test modules is rapidly expanding to meet a wide range of customer requirements and applications.

For more details visit **quantifi photonics.com/products**

Tunable Laser Sources

Versatile telecom laser sources with full tunability across C or L bands. Narrow 100 kHz linewidth, up to 16.5 dBm of power, optional whisper mode to disable frequency dither.

Fixed Wavelength Laser Sources

Highly-customizable DFB or FP laser sources available in a wide range of wavelengths and powers up to 24 dBm. Supports SMF, MMF and PMF.

Swept, Tunable Continuous Wave Laser

Swept, tunable continuous wave (CW) laser source with 0.01 dB power stability and 400 nm/s high-speed scan rate for R&D and production testing.

Superluminescent Diode Broadband Light Source

Super-luminescent LED light source with high output power, large bandwidth and low spectral ripple and various wavelengths.

Erbium-Doped Fibre Amplifi er (EDFA)

High power Erbium-Doped Fiber Amplifi er for signal power amplifi cation in C and L bands with various control modes, including automatic gain control.

Variable Optical Att enuator (VOA)

Fast att enuation speed with low insertion loss and built-in power monitoring. Operates in fi xed att enuation or constant output power modes. Support SMF, MMF and PMF.

Polarization Controller & Scrambler

High-speed automated polarization control with broad wavelength coverage from 1260nm to 1650nm, low insertion loss and back refl ection. Full remote control via intuitive GUI, LabVIEW or SCPI.

Optical Power Meters

Fast terminating or inline monitoring of optical signal power from -60 to +10 dBm across 750 – 1700 nm wavelengths. Model with logarithmic analog output for applications such as silicon photonics fi ber alignment.

Optical Spectrum Analyzer (OSA)

Cost-eff ective, spectral measurement in a compact module with built-in analysis for: SMSR, OSNR & spectral width. Targeted wavelengths for specifi c applications in O band, C band & L band.

Optical-to-Electrical Converter

High bandwidth, broadband O-to-E converter. Available in a range of confi gurations; choose from 1 or 2 channels, AC or DC coupling and various conversion gain and operating wavelength ranges.

Digital Sampling Oscilloscope (DSO)

Digital equivalent-time sampling oscilloscope (DSO) with high-quality precision timebase and low jitt er mode, available in 1 or 2 channels in a compact benchtop instrument.

Bit Error Rate Tester (BERT)

4 or 8-channel Pulse Patt ern Generator and Error Detector at rates up to 29 Gbps for the design, characterization and production of optical transceivers and opto-electrical components.

Photonic Doppler Velocimeter (PDV)

Purpose-built module for Photonic Doppler Velocimetry (PDV). A circulator, two VOAs and a passive coupler all built into one compact module.

Optical Switch

Proven reliability and fast switching time. Wide variety of switch onfi gurations: 1x4, 1x16, 16x16 and more. Models support SMF, MMF and PMF.

Photocurrent Amplifi er

Versatile photodiode amplifi er to measure photocurrent in photonic integrated circuit (PIC) applications. Digital and analog measurement.

Passive Component Integration

Integrate passive optical components of your choice such as WDM couplers, splitt ers, band-pass fi lters, PM beamsplitt ers and circulators. SMF, MMF and PMF.

Test.
Measure.
Solve.™

Quantifi Photonics is transforming the world of photonics test and measurement. Our portfolio of optical and electrical test instruments is rapidly expanding to meet the needs of engineers and scientists around the globe. From enabling ground-breaking experiments to driving highly effi cient production testing, you'll fi nd us working with customers to solve complex problems with experience and innovation.

To fi nd out more, get in touch with us today.

General Enquiries	sales@quantifi photonics.com
Technical Support	support@quantifi photonics.com
Phone - NZ	+64 9 478 4849
Phone - USA	+1-800-803-8872

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