



**FOR IMMEDIATE RELEASE**

Contact Information:

Picotest.com

Steve Sandler - [Steve@picotest.com](mailto:Steve@picotest.com)

(877) 914-7426

## **Picotest Releases the World's First Water-Cooled Electrical Probe for High-Speed Test Applications**

**February 8, 2023 Phoenix, AZ:** The P2124A High Speed Line Modulator is the first water-cooled probe for electronics testing. Its creation is yet another testament to Plato's axiom that necessity is the mother of invention. Picotest manufactures several Power rail modulators for Power Supply Rejection Ratio (PSRR), Power Supply Modulation Ratio (PSMR) and Power Supply Noise Rejection (PSNR) that are used by engineers to test noise-related performance. These "injectors" allow you to easily impose a modulation signal on a power rail voltage, which is then injected into the device under test (DUT). The input and output noise are then measured and compared to reveal the level of impact and rejection. This enables PSRR, PSMR, and PSNR measurements, which are all measures of how power rail noise appears at the output of voltage regulators, RF amplifiers, and digital channel jitter.

The P2124A release marks a revolutionary change in how test instruments are packaged and implemented. The probe currently addresses high-power, high-injection-level noise immunity testing such as those required for 400G/800G pluggable optical transceivers. Other water-cooled GaN probes are planned by Picotest to address additional test needs.

The rapid growth of the Internet of Things (IoT) and the explosion of cloud computing and 5G, have forced a raising demand on data centers and cloud service providers to increase both network capacity and new solutions to achieve increased data volume required for faster processing, more bandwidth, and increased density without sacrificing reliability. New, higher speed devices, such as optical transceivers, which support these higher data rates, require testing to much higher bandwidths than previously available. This is especially true in the case of testing the signal and power integrity of giga-bit communication interfaces.

Enter the QSFP-DD/QSFP-DD800/QSFP112 Hardware Specification; the test specification for QSFP Double Density 8x and 4x pluggable transceivers. The specification required PSNR testing that was not physically realizable as envisioned. After several discussions with the specification writers, it became evident that a new type of line injector was required. Meeting the interconnection inductance required for the bandwidth limited the interconnect impedance to nanohenries, limiting the interconnect length to fractions of an inch. The interconnecting modulated power cable needed to disappear. The quandary was addressed by Steve Sandler of Picotest, who solved the interconnect issues by downsizing the line injector instrument into a probe form. Many technical challenges, such as the usage of GaN and extraction of the heat from such a small device, had to be solved. This development resulted in the P2124A water-cooled PSNR probe.

Achieving the bandwidth is made possible by utilizing very small eGaN semiconductor devices in place of Si. These very small eGaN devices are extremely fast due to very low junction capacitance combined with very low internal resistance. The very small GaN device and the water cooling allows the circuit to

**Proprietary and Confidential to Picotest.com**

be miniaturized to a very small form factor probe. Solving the thermal issue is the most challenging task. Placing the device in a small, water-cooled probe allows the line injector to get very close to the device under test, allowing the fraction-of-an-inch interconnect required to achieve the bandwidth. The small form factor also prohibits the use of passive cooling solutions, which would be quite large. The thermal issue is resolved using a very small, precision, micro-machined liquid -cooling plenum. Together these innovations enable QSFP-DD/QSFP-DD800/QSFP112 noise testing today, and higher bandwidth/higher power testing in the future.

## **P2124A High Speed Line Modulator Information**

### **Description**

The P2124A is a GaN-based probe used for PSNR and other noise immunity tests. It combines a power rail voltage with a modulation signal to a DUT being tested for noise immunity (PSNR) with input stimulus and power. The modulation signal can be any 50 Ohm analog signal within the bandwidth limits of the probe. Two solder tabbed terminals are used at the probe tip to connect the modulator to the DUT. A SMPM connector at the back end is used to connect the analog modulation source. A 4-pin modulation electronics connector at the back end of the probe connects the external power supply and provides tip voltage sense signals for remote sensing. The probe includes the water-cooling system and supports the connection of two probes simultaneously.

The P2124A supports the QSFP-DD-Hardware-Rev6.x requirement for QSFP Double Density 8X and QSFP.OSFP 4X pluggable transceivers and similar power supply output noise and tolerance testing specifications (OSFP Octal Small Form Factor Pluggable Module Rev. 5) including AEC cable and optical module sinusoidal power supply noise tolerance. The probe can be used by manufacturers or end-users to verify OEM compliance with the requirements. A remote sense module is provided to support optimum voltage compliance for the DUT.

### **Features**

- Designed for Optical Transceiver Testing (Module sinusoidal power supply noise tolerance)
- Meets or exceeds the QSFP-DD/QSFP-DD800/QSFP112 Hardware Specification 6.3 and OSFP Octal Small Form Factor Pluggable Module Rev. 5
- 200mOhm typical source impedance
- Low-profile, small footprint probe head minimizes interconnect, essential for high bandwidth
- GaN enabled for low impedance high speed modulation
- Water cooling allows the probe to get close to the DUT, essential for high bandwidth modulation
- Sense lines in the connector support optional remote sense board

### **Applications:**

- Power supply noise immunity testing
- QSFP-DD and OSFP Power Supply Noise Tolerance Testing
- Power supply rejection ratio (PSRR), power supply modulation ratio (PSMR), and power supply signal to noise ratio (PSNR) measurement
- General PSRR/PSMR high power high bandwidth testing

## Specifications

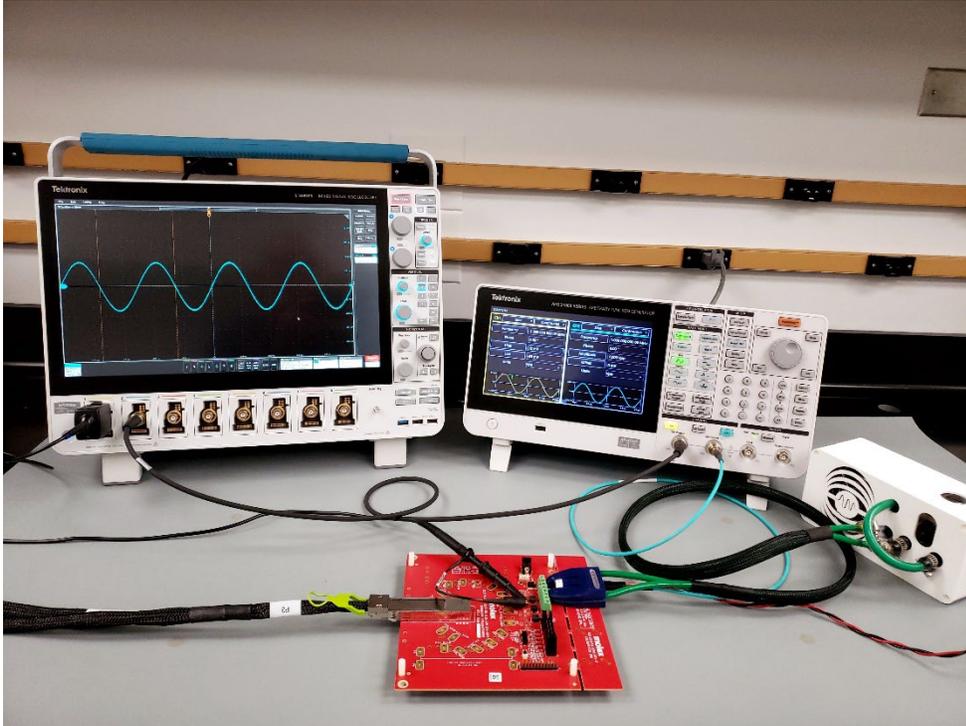
Specifications	Typical	Units
Maximum DC Input Voltage	(Probe) 50V (Transceiver Application) 7.5	V
Peak Current	10	A
Maximum Continuous Current	6	A
Maximum Voltage Drop at 6A	3.5V	V
Modulation Input Impedance	50	Ohms
3dB Frequency Response (typical) (0.6ohm resistive load)	30 – 40M	Hz
Modulation Frequency Range	10-250M	Hz
Temperature Range	35	C
Maximum Altitude	6000	Ft
Output Impedance at 6 Amps (typical)	200m	Ohms

## References

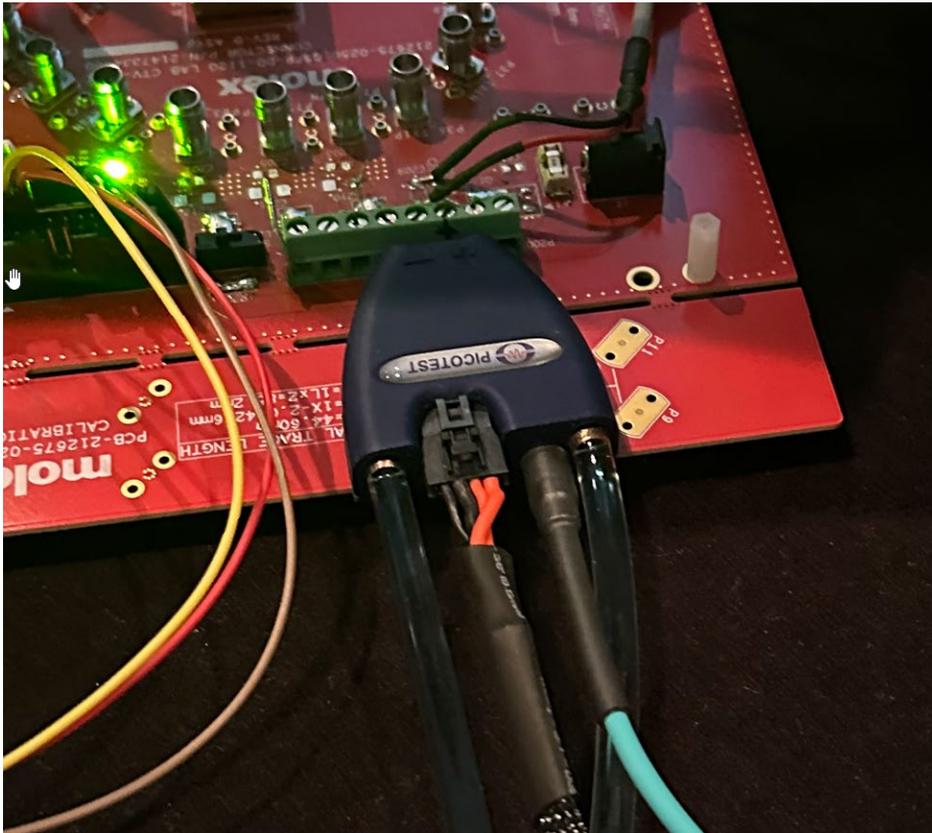
1. “Power Integrity Testing Requirements Introduce Extreme Interconnect Measures”, S. Sandler, SI Journal January 2023.
2. “How To Test PSRR, PSNR, and PSMR for Sensitive Applications, Including Optical Transceivers”, S. Sandler, EDI CON 2022, October 5, 2022.
3. Specification Reference: <http://www.gsfp-dd.com/wp-content/uploads/2022/03/QSFP-DD-Hardware-Rev6.2.pdf>.

\* Into a 0.5 Ohm resistive load

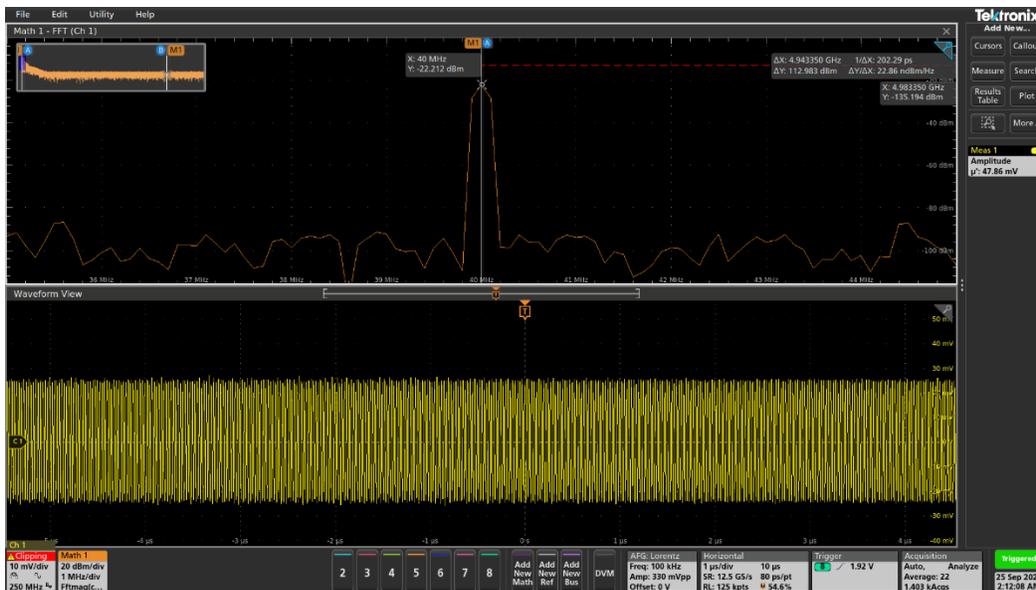
For more information, please see [https://www.picotest.com/products\\_P2124A.html](https://www.picotest.com/products_P2124A.html).



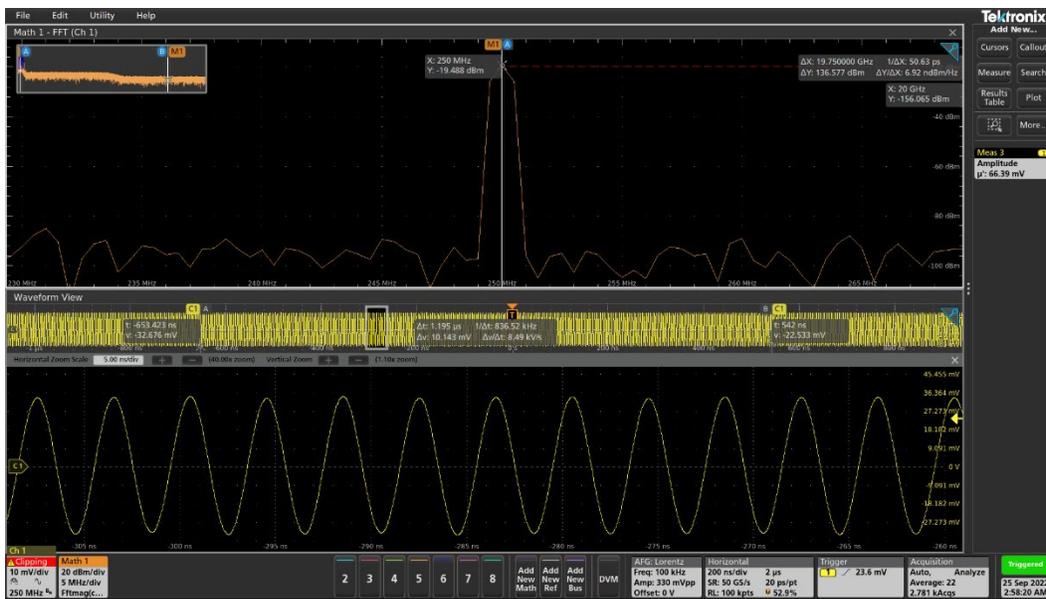
Sample PSNR Test Setup using the Picotest P2124A and the Molex Transceiver board.



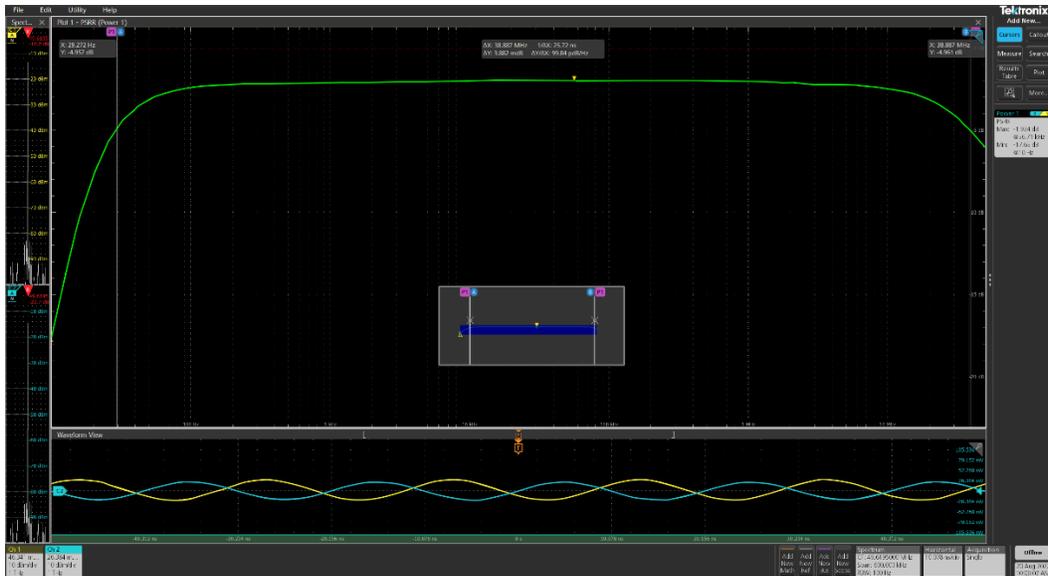
The compact head on the P2124A probe eliminates interconnect inductance by bringing the line injector electronics into the probe head.



The P2124A modulates the bus voltage into a 0.6 Ohm Load with 5.5Amp DC Bias and 40MHz operation.



While the response is attenuated, increasing the input modulation source level achieves modulation up to 250MHz.



**P2124A Probe 3dB Bandwidth 29.27Hz – 38.887MHz 0.6 Ohm Load with 5.5Amp DC Bias.**

## About Picotest.com

Picotest.com was founded in 2010 for the purpose of developing high performance test and measurement solutions, particularly the interface between the board being tested and the measurement instrument. Picotest specializes in high fidelity, customized test and measurement probes, injectors, and other equipment, primarily for power supply and power integrity related applications. Picotest.com aims to utilize its strong R&D capability to provide the highest quality test-related products and services to customers worldwide. Picotest.com is located in Phoenix, Arizona and serves customers worldwide. The company is led by Steve Sandler, an award-winning international expert and educator in the field of Power Integrity.

All logos and trademarks in this release are the property of their respective owners.

###