



## CASE STUDY

# Semiconductor ATE Vendor Prepares for 5G

5G New Radio (NR) introduces new challenges to the design and test of radio-frequency integrated circuits (RFICs) and other wireless components. These challenges include flexible numerology, more complex waveforms and channel coding techniques, frequencies that extend into millimeter-wave (mmWave), and evolving standards. Testing 5G chipsets during manufacturing requires verifying that devices meet new requirements at these higher frequencies with greater bandwidths. Addressing these challenges requires new test methodologies and techniques for 5G NR chipsets high-volume production testing.

An industry-leading vendor of automated test equipment (ATE) for discrete, power, linear, RF, and mixed-signal semiconductors needed to design a next-generation RF ATE system for outsourced semiconductor assembly and test (OSAT) services. During its research, the ATE vendor realized it needed a vector transceiver solution that could cater to the test requirements of various end-users. The solution also had to be backward-compatible with 4G, 3G, and 2G connections.



### Company:

- a semiconductor automated test equipment vendor

### Key Issues:

- mmWave frequencies
- OTA requirements
- consistency/reliability of results within tight margins
- robust support from test equipment supplier

### Solutions:

- Keysight M9421A PXIe VXT vector transceiver

### Results:

- improved quality of results
- expanded customer base

## Key Issues: Consistency, Reliability, and Flexibility

Vector transceivers are instruments that combine an RF signal generator and signal analyzer. In semiconductor testing, engineers use vector transceivers to measure and analyze a semiconductor's ability to transmit and receive signals. For previous product generations, the ATE vendor used a vector transceiver solution that was not capable of the consistency or reliability needed for its next-generation product.

OSAT facilities typically run ATE systems in mass production environments, with many systems operating at once. The systems must tightly correlate with one another to provide measurement reliability that falls within a precise margin to guarantee consistent output. The ATE vendor needed a solution that would consistently deliver results that fell within that tight margin to ensure quality.

In addition to consistency and reliability, the ATE vendor required robust support from the test equipment supplier for the selected vector transceiver solution. Because the ATE vendor deals with multiple customers testing many types of semiconductors at any given time, it must also continuously adapt and fine-tune its ATE systems. Choosing a supplier that could provide ongoing support and a highly flexible solution was critical.

With 5G evolving continuously, the ATE vendor also needed to provide future-proof systems capable of supporting future 5G developments. In addition to backward compatibility with legacy communications technologies, the ATE vendor needed a vector transceiver solution that could support the mmWave frequencies, MIMO configurations, and OTA testing requirements of 5G in the future.

## The Solution: The M9421A VXT PXIe Vector Transceiver

Flexibility is particularly important in the context of OSAT facilities. Demand for specific chipsets peaks for one or two months a year. OSAT companies need ATE systems capable of switching to different modes and test capabilities quickly, depending on their needs.

The ATE vendor selected Keysight's M9421A VXT PXIe vector transceiver, which engineers can tune to different testing requirements. The M9421A is a four-slot PXIe vector signal generator and analyzer that offers high throughput for manufacturing test of RFICs, power amplifiers, and other wireless components. It supports frequency ranges from 60 MHz to 6 GHz and up to 160 MHz modulation and analysis bandwidth. Its wide bandwidth support delivers best-in-class error vector magnitude and adjacent channel leakage ratio measurement performance.

The M9421A includes software that supports analog demodulation, noise figure, and a broad range of cellular and wireless connectivity formats. It comes standard with [Keysight IO Libraries Suite](#), including Connection Expert. It also provides access to Keysight's no cost [Command Expert](#) instrument control interface and supports Keysight's [Pathway Signal Creation \(Signal Studio\)](#) PC-based signal creation software. Drivers for use with several popular software environments and development tools, including Keysight's VEE Pro graphical language environment for measurement analysis, are also available.

Keysight's VXT roadmap supports the ATE vendor's 5G plans. Since most 5G chipset and device manufacturers use Keysight's solutions in R&D, adopting the M9421A gave the ATE vendor an advantage to ensure consistent test results.



Figure 1. Keysight's M9421A VXT PXIe vector transceiver

## Putting Keysight to the Test

Before making a final selection, the ATE vendor needed to put the M9421A to the test to ensure it would meet its requirements. The vendor staged two rounds of tests. Keysight brought in personnel from its research and development team to provide direct support.

After a successful first round of tests in which the M9421A met all of the requirements in a lab environment, the ATE vendor was ready to assess the solution's capabilities in a real-world scenario. The vendor built a prototype of its system — incorporating Keysight's M9421A — and installed it in a customer's high-volume testing facility for evaluation. Keysight's M9421A once again satisfied all of the requirements of the ATE vendor and its customer, even in a high-stakes real-world environment.

## The Result: Positioned for Leadership in 5G

The M9421A had a rapid impact on the ATE vendor's business. The quality improvements to its ATE systems enabled by the M9421A allowed the vendor to expand its customer base immediately. Most of the leading chipset makers already use Keysight network emulation solutions, making them more likely to adopt the ATE vendor's system with the integrated M9421A.

Adding 5G capability to its roadmap also increased the ATE vendor's market share significantly, enabling it to claim a place among the leaders in compact ATE systems among OSAT vendors worldwide in the early stages of the 5G era.

## Related Information

- **Brochure:** [5G New Radio Solutions for Chipset and Component Manufacturers](#)
- **Data sheet:** [M9421A VXT PCIe Vector Transceiver](#)
- **Data sheet:** [B1500A Semiconductor Device Analyzer](#)
- **Application note:** [Solutions for RF Power Amplifier Test](#)

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