Frequently Asked Questions

**Keysight M9484C VXG Vector Signal Generator**

1. **What is Keysight Announcing?**

   - Keysight is introducing the M9484C VXG vector signal generator, a new member of Keysight’s VXG series signal generators. The new VXG expands the portfolio with real-time capabilities to support demanding wireless industry applications. The M9484C VXG signal generator is a four-channel vector signal generator, with frequency up to 54 GHz that offers up to 5 GHz of radio frequency (RF) bandwidth and low phase noise in a single instrument. With a V3080A vector signal generator frequency extender, the frequency range of the VXG extends up to 110 GHz to address the needs for the latest and evolving standards.

2. **What are the industry applications for this product?**

   - New 5G mobile communications, 6G research, satellite communications and radar applications increasingly utilize a wide range of frequencies, up to and including millimeter wave (mmWave) spectrum. Testing these applications requires signal generation equipment capable of creating millimeter-wave signals at extremely high bandwidth. These new applications also adopt multi-antenna techniques, such as spatial diversity, spatial multiplexing and beamforming to achieve diversity, multiplexing and antenna gains for high-throughput and robust communications.

   - Companies that produce or consume RF components for manufacturing electronic equipment have unique requirements for signal fidelity to accurately characterize their components or sub-systems.

3. **How will this product introduction benefit customers?**

   This product will help customers reduce their test system setup complexity and achieve accurate and repeatable multi-channel measurements in a single instrument. Key customer benefits include:

   - The scalable architecture enables the most demanding wideband and multichannel test signals with frequencies up to 110 GHz.
      - Generates demanding test signals with an RF bandwidth up to 5 GHz.
      - Covers frequency ranges from 9 kHz to 54 GHz and up to 110 GHz with a V3080A vector signal generator frequency extender.
      - Enables multi-antenna test applications such as MIMO and beamforming with precise phase coherence and timing synchronization.

   - The fully integrated, calibrated and synchronized signal generation solution delivers low phase noise and minimizes measurement uncertainty.
      - Overcomes the excessive path loss experienced at mmW frequencies with low error vector magnitude (EVM) and distortion at high output power.
      - Delivers advanced RF performance with direct digital synthesis (DDS) technology for accurately characterizing device under tests (DUTs).
      - Enables precise multi-channel / multi-instrument synchronization and triggering test applications.
The sophisticated real-time signal processing and comprehensive signal creation tools enable complex test scenarios and simplify test complexity for receiver and performance tests.

- Supports MIMO real-time fading for all 3GPP 5G new radio (NR) required base station conformance tests with PathWave Signal Generation software.
- Streamlines complex receiver test scenarios with the world's first 8-virtual-signal emulation per RF channel, up to 32 signals in one instrument.
- Simplifies test workflow with pre-defined compliance test setups, auto-configuring signal analysis and graphic user interface.

4. What problems does this product solve?

The M9484C VXG signal generator helps designers generate high frequency, wide channel bandwidth signals in multiple coherent channels. These capabilities, combined with the spectral purity and real-time signal processing, make addressing multichannel test requirements for MIMO, beamforming, selectivity and blocking tests simple and fast. This product’s unique capabilities enable engineers to:

- Optimize measurement integrity and minimize measurement uncertainty by generating signals with a fully integrated, calibrated and synchronized multichannel signal generation solution.
- Innovate designs that enable higher frequencies, wider bandwidths and multichannel applications, and ensure they meet the latest and evolving standard test requirements.
- Simplify measurement setup and complex calibration routines associated with multi-box solutions with a one-box approach. This saves time and reduces measurement errors related to changing equipment configuration and cabling.
- Eliminate signal impairments caused by traditional analog I/Q modulators with a new DDS architecture and deliver advanced signal fidelity for wideband signal generation.

5. What are engineering breakthroughs in this new signal generation solution? What are the challenges and customer’s benefits for these breakthroughs?

Keysight Labs, the research laboratory of Keysight Technologies, has been working for years on the underlying semiconductor, ASIC and MMIC technology designed to deliver industry-leading performance, purposely built for test and measurement equipment. The new ASIC in the M9484C VXG provides powerful digital signal processing for digital upconversion and generates IF/RF signals up to 8.5 GHz direct from a high-sampling-rate 14-bit digital-to-analog converter (DAC) without signal impairments found in traditional vector signal generator architectures.

The DDS eliminates signal impairments caused by a traditional analog I/Q modulator, such as gain imbalance, timing skew, quadrature skew, DC offset and phase noise. This new architecture improves a signal’s dynamic range and offers advanced signal fidelity, especially for wideband signal generation. The performance of the VXG enables accurate characterization of components and receivers.

Another key DSP ASIC can emulate up to 8 baseband signals and aggregate them into one wideband signal in real time. It provides flexible, real-time manipulation of baseband signals, where each baseband signal can be independently controlled, filtered, faded and placed anywhere within a 2.5 GHz bandwidth in real time.
The combination of these two ASICs allows customers to generate 8 RF signals in one RF channel without generating intermodulation distortion and carrier feedthrough. This solution simplifies the receiver test setups that conventionally require several signal generators for simulating wanted and interfering signals with improved signal fidelity, simple test setup and cost-effectiveness.

6. What about Keysight’s signal analyzer portfolio?

Keysight offers a complete signal analyzer portfolio to partner with the new M9484C signal generator. The portfolio offers multi touch user interface, covers frequency ranges from 2 Hz to 110 GHz, with up to 4 GHz fully integrated instantaneous bandwidth and 11 GHz bandwidth with external IF output.

7. Why does the VXG use an external frequency extender instead of a built-in upconverter for frequencies from 54 GHz to 110 GHz?

At millimeter-wave frequencies, excessive path loss makes RF power limited and costly. When building a millimeter-wave test system, cables and accessories in the path between a signal generator and the DUT increase insertion loss. The cable loss can be more than 5 dB and can reduce the signal-to-noise ratio (SNR) of the test system. Using an external frequency extender allows customers to move the RF output close to the DUT to shorten the millimeter-wave signal routing — reducing the path loss and improving SNR.

The V3080A vector signal generator frequency extender provides a clean, filtered 2.5 GHz bandwidth without image signals and a 110 GHz electronic attenuator.

8. Designing wireless receivers is challenging because the wireless device is required to handle a wide variety of input signal conditions. This makes the process of designing, testing and isolating system problems more complex. How does Keysight help your customers shorten development cycle?

The sophisticated real-time signal processing of the VXG enables complex test scenarios for receiver and performance tests. The VXG’s built-in DSP ASIC allows engineers to emulate MIMO fading with additive white Gaussian noise (AWGN) for 5G base station performance conformance testing.

Keysight PathWave Signal Generation software is a flexible suite of signal-creation tools that will reduce the time engineers spend on signal simulation. The software’s performance-optimized reference signals – validated by Keysight – enhance the characterization and verification of wireless devices. The software supports a wide range of general-purpose or standard-based signals and ensures wireless designs meet the latest standards and test requirements.