



SOLUTION BRIEF

Virtual Drive Testing Toolset

Field-to-Lab Performance Test Solution

Real-world, field-to-lab automated virtual drive testing of mobile devices and networks in the lab

Mobile operators and manufacturers of 5G devices, chipsets and network equipment are facing a growing challenge to quickly and cost-effectively deploy new products equipped with more features and technologies. The introduction of 5G NR in non-standalone (NSA) and standalone (SA) mode and other supporting 5G technologies, such as multi-user massive MIMO, require advanced test solutions to deliver the quality of service users expect.

Successful 5G roll-outs rely on mobile devices that perform reliably under multi-RAT real-world network conditions. Performance tests mandated by 3GPP are often too simplistic to adequately validate quality of service experienced by end-users. That is leading to the need for more comprehensive testing of multi-mode 5G NR devices that verify the performance under real-world propagation and interference conditions as experienced in the field.



“Be first to market by accelerating field integration of devices and networks using real-life mobility test scenarios in lab”



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Repeatable and Realistic Testing Across the Design Workflow

Keysight's Virtual Drive Testing (VDT) Toolset enables users to evaluate, characterize, and optimize the performance of 5G NR mobile devices, chipsets and network infrastructure. Mobile operators and wireless device and network equipment manufacturers are able to quickly and efficiently benchmark different mobile devices and network infrastructure as well as assess end-users' experience of accessing mobile applications. As a repeatable, realistic and automated lab-based performance and interoperability test solution, VDT Toolset accelerates new design development from prototype to fully functioning 5G devices.



VDT Toolset offers quick and systematic end-to-end performance validation of devices and network equipment.

Keysight's recognized expertise in channel emulation and wireless performance testing has resulted in a unique set of 5G solutions for validating new designs using real devices or network emulators. VDT Toolset forms part of Keysight's comprehensive suite of 5G NR design and test solutions that spans the entire workflow, from simulation, development, and design verification, to conformance and acceptance test, and manufacturing and deployment. The toolset creates a representation of real-world conditions without the need for comprehensive analysis and simulation of the environment. VDT Toolset uniquely supports test requirements across the entire workflow for verifying end-user experience under challenging real-world environments, such in high-speed train scenarios.

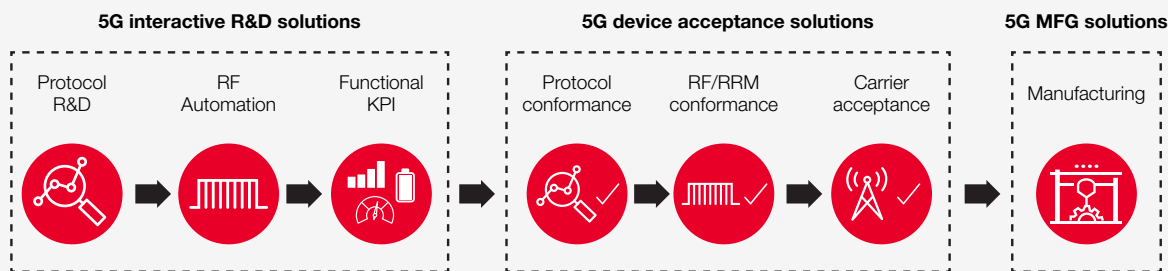


Figure 1. VDT Toolset integrates with Keysight's 5G device test solutions to create real world test conditions across the R&D and device acceptance workflow

By seamlessly integrating Keysight's PROPSIM F64 5G channel emulator and 5G network emulation solutions with Keysight's Nemo Outdoor field measurement solution, users are able to quickly and easily verify the end-user experience based on real-life mobility scenarios. Data captured in the field is imported into VDT Toolset for test case creation, resulting in reliable and repeatable RF replay in a controlled laboratory environment.

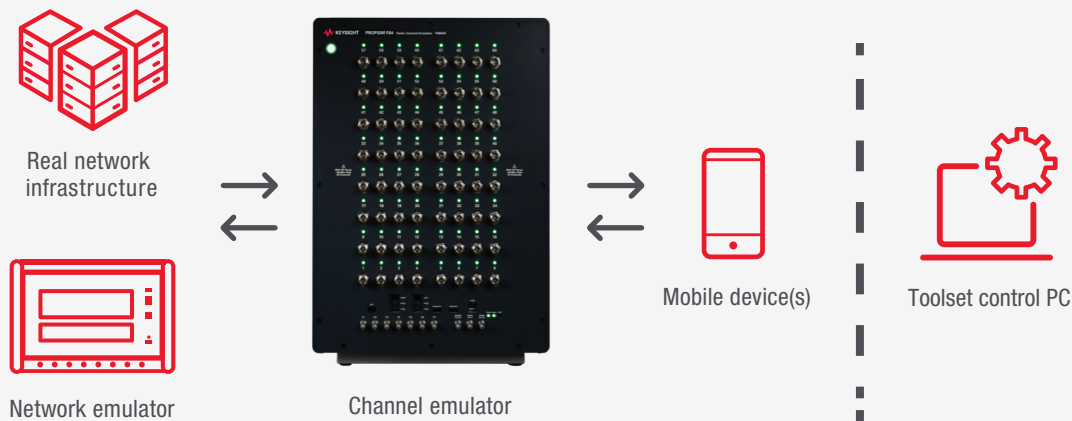


Figure 2. VDT Toolset uses Keysight’s PROPSIM F64 channel emulator and real network infrastructure or network emulator to create a realistic air-interface for testing a mobile device. It uses data captured in the field to build tests that replay drive or indoor test routes by emulating real-world RF network conditions

Industry-First 5G NR Field-to-lab Tool

Keysight’s industry-first VDT Toolset addresses the entire device and base station R&D workflow. VDT Toolset can be used in cabled as well as over-the-air test environments to support test requirements in both sub-6 GHz and mmWave frequency bands. Users are able to easily bridge the gap between lab and field testing under realistic air-interface field conditions through seamless real-world representation of the environment. This accelerates the validation of wireless devices and network equipment. VDT Toolset offers repeatable and realistic lab-based testing to enable users to cost-effectively and quickly verify multiple designs or multiple revisions of a single design. Users can create test scenarios based on any cellular radio technology and apply a wide range of multi-link configurations.

As a field-to-lab tool, the toolset imports real user equipment measurements recorded using Keysight’s Nemo field measurement solutions. Field-to-lab tool imports radio channel parameters (e.g. Cell ID, RSRP, SNR, MIMO correlation) from the measurement files to create channel model for channel emulator. VDT Toolset delivers reliable replication of recorded field conditions without the need for additional modelling or user input. By using the same field test tools and mobile user conditions in the field as in the lab, users of Keysight’s VDT Toolset can seamlessly benchmark multi-mode 5G NR devices and quickly resolve field issues.

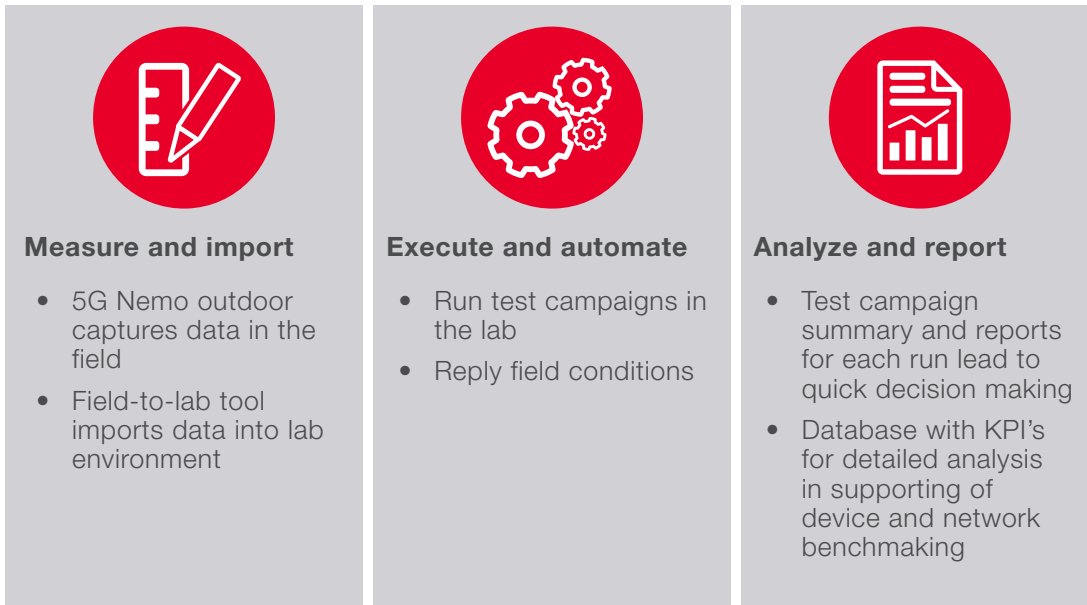


Figure 3. VDT Toolset's repeatable and automated lab-based test environment enables users to replicate field conditions using real devices and real network equipment

Instant Access to Metrics to Support Development and Launch Process

By bridging the gap between lab and field testing through seamless real-world representation of the environment, users are able to significantly reduce unnecessary and costly field testing, accelerating deployment of devices and networks. The solution enables mobile operators as well as device, chipset and network equipment manufacturers to control the device under test, conduct real-time diagnostics, log test results and analyze test data from one single easy-to-use graphical user interface.

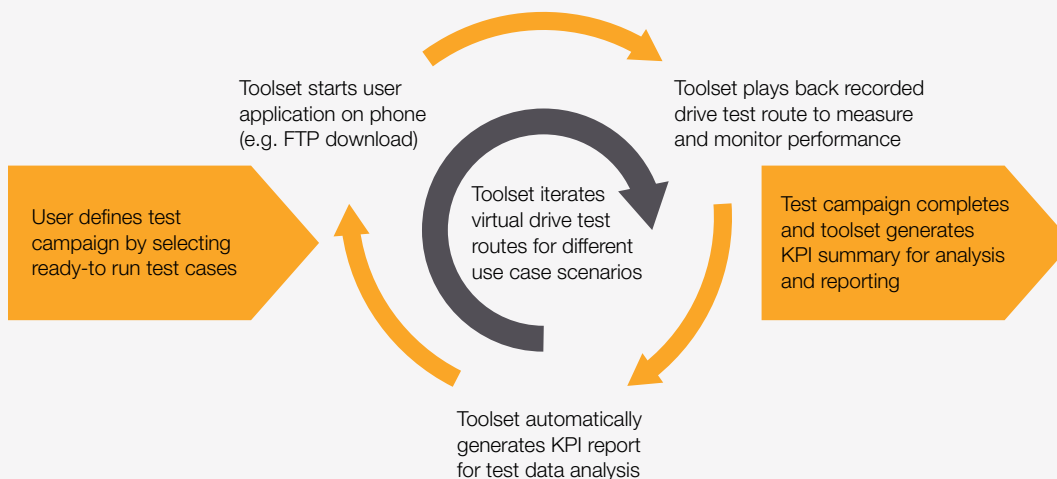





Figure 4. VDT Toolset supports fully automated release validation to systematically test a wide range of mobile devices prior to commercial deployment

Its powerful automation capability allows repetitive testing of virtual field test routes for different use case scenarios. This enables reliable and cost-effective device benchmarking and resolution of issues found in the field. VDT Toolset streamlines the performance and interoperability testing process from early R&D lab evaluation through field testing and optimization.

Quick and systematic end-to-end performance validation		
		
<p>Mobile operators use VDT Toolset to</p> <ul style="list-style-type: none"> • Verify new device prior to market launch • Assure software and network release quality prior to network deployment • Ensure network and device interoperability 	<p>Mobile chipset and device manufacturers use VDT Toolset to</p> <ul style="list-style-type: none"> • Validate DUT to ensure it complies with mobile operator-mandated high-speed train test plans • Verify network vendor-interoperability • Stress test software stack using real applications and network conditions, supported by a comprehensive debug environment • Verify software release using key performance indicators under realistic field network conditions 	<p>Network equipment manufacturers use VDT Toolset to</p> <ul style="list-style-type: none"> • Resolve issues – identified anywhere in the field – in a lab environment • Verify new software releases for key performance indicators under realistic field conditions

Mobile Operators

Exceeding end-users' expectations using automated virtual drive test routes

VDT Toolset helps mobile operators benchmark devices and test interoperability of devices and real networks under repeatable real-life conditions. This supports the existing device acceptance process and helps determine the root cause of any issues found during deployment. Mobile operators also use VDT Toolset to comprehensively verify the end-user experience by replicating and repeating virtual drive test scenarios in a controlled lab environment.

While most test solutions use simplified or representative network configurations – and not real data – Keysight's VDT Toolset uses field data derived from drive test logs to build virtual test routes that mimic specific end-user scenarios. This is important since performance issues in challenging local conditions are only visible with exact replication of the physical environment. Furthermore, the toolset supports a mobile operator's specific infrastructure elements and services, which makes it possible to create test conditions that more realistically simulate end-users' experiences. This enables mobile operators to verify interoperability between a device and their network prior to releasing new features to its subscribers.

Device and Chipset Manufacturers

Verifying device performance with real-life mobility scenarios

Device manufacturers need to perform comprehensive testing of multi-mode 5G NR devices to achieve seamless user experience for both voice and data under varying network conditions. VDT Toolset supports modem stack stress testing using real applications and a wide range of mobility and roaming scenarios. By seamlessly integrating Nemo field measurement solutions with VDT Toolset, R&D teams are able to easily replicate field issues experienced in remote locations. Its ability to replicate field scenarios in an accurate and repetitive manner accelerates device performance testing and enables debugging of issues found in the field.



Resolving high speed train mobile experience issues

Keysight's VDT Toolset for simulated networks, is the only tool used as part of China Mobile's test plan to verify mobile device performance in high-speed train scenarios. The mobile operator's mandated test plan requires suppliers to demonstrate device performance under challenging mobility conditions prior to market introduction, which helps improve end-user quality of experience.

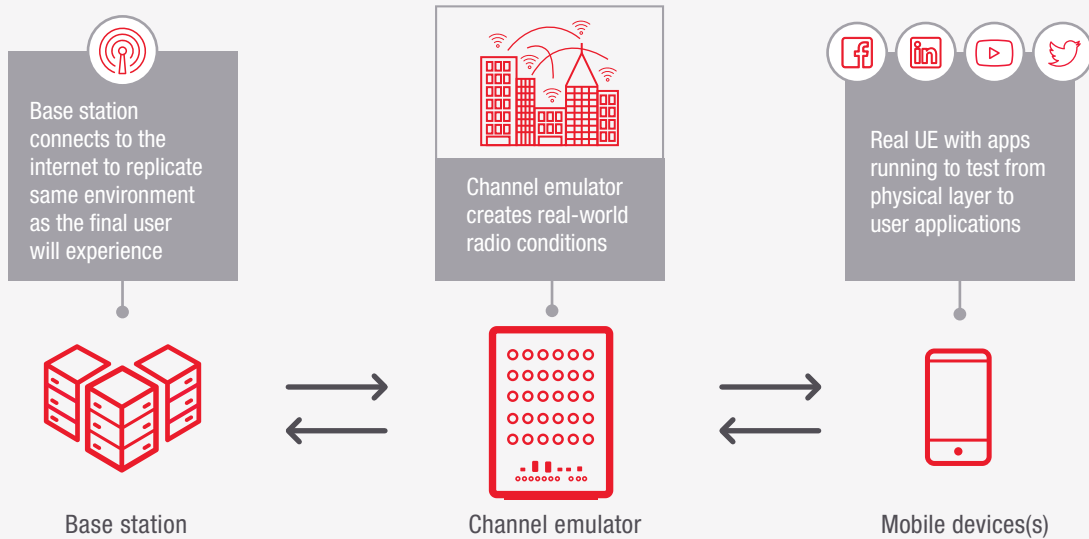


Figure 5. VDT Toolset emulates the real-world air-interface with all its imperfections to create a test environment that enables users to stress test real applications under a wide range of conditions

VDT Toolset offers a repeatable lab-based environment based on realistic network conditions to bridge the gap between testing a product in the field and validating its design in the R&D phase. By emulating the complete air-interface in a field-measured lab environment, users are able to easily and reliably resolve issues found in different software variants. The toolset creates test scenarios that enable vendors to analyze the performance of their designs and compare them to designs developed by competitors. The toolset's 24/7 automation capability, test coverage and reporting tools support users' demanding go-to-market project timelines. By benchmarking designs with other leading solutions, vendors are able to more confidently launch new products.

Network Equipment Manufacturers

Verifying network infrastructure performance under real-world propagation scenarios

VDT Toolset enables network equipment manufacturers (NEMs) to verify the performance of network infrastructure in combination with mobile devices under real-world wireless propagation scenarios. By virtually roaming between different locations across the globe, VDT Toolset users are able to verify the performance of a device under a wide range of roaming conditions and replicate field issues reported and measured by any mobile operator.

The toolset allows NEMs to verify infrastructure performance under a numerous usage scenarios, radio access technologies and cellular conditions. Its automation capability supports both the use of commercially available devices and user equipment (UE) simulators. Its device automation capability and reporting tools provide access to device performance metrics in addition to the base station test framework results. Such a complete set of end-to-end data simplifies debugging and issue resolution for cost-effective and quick verification of multiple designs or revisions of a single design.



MediaTek, a leading semiconductor company, uses Keysight's VDT Toolset to accelerate end-to-end data throughput performance validation of multimode 5G NR devices. VDT Toolset enables them to validate the performance of new 5G products under typical mobile user conditions such as video streaming, web browsing, and voice calls without running consuming field tests.

Virtual Drive Testing Toolset is an end-to-end performance test solution that supports

- Field-to-lab test case creation based on users' field measurements
- All cellular radio access (e.g. 5G NR, LTE, WCDMA, GSM) and Wi-Fi technologies
- The use of both real network infrastructure and network emulation solutions
- Test campaign management with detailed status information and KPIs
- Result analysis with clear reports for decision making

Mobility performance testing, covering:

- Handover and cell reselection success rates
- Call drop rates and service interrupts
- Data and application performance
- Voice call quality metrics

Simple and repeatable replication of field measured drive test conditions

- Field-to-lab tool converts field traces to lab environment for device and base station testing
 - Solution supports Keysight Nemo drive test tools
 - Open data format to support native modem log data conversion
- Imported field measured data replicate RF conditions experienced in the field
 - Record radio channel from real network
 - Map recorded cells from the field to your lab setup
 - Replicate field condition in your lab in repeatable manner
- Device and test automation to accelerate performance evaluation
 - Device and test automation allow fully automated 24h testing
 - Results are stored in database for further benchmarking
 - Summary report is created for each of the test campaigns
 - Leverage same Nemo tool in lab for UE automation and detailed result analyze

As a field-to-lab tool, VDT Toolset enables users to overcome one of the biggest real-world testing challenges – repeatability. It allows users to integrate real-world emulation of networks as part of their lab automation framework to bridge the gap between lab and field testing.



Verifying software variants under local conditions prior to release

Keysight's VDT Toolset allows NEMs to significantly reduce field testing and improve release quality by verifying compliance of software releases to operators' specific network conditions.

Keysight's PROPSIM F64 radio channel emulator

- Emulates dynamic RF channel conditions in real-time for testing devices and base stations
- Emulates impairments of complex 3D real-world radio channel conditions including:
 - Dynamic multipath propagation
 - Range pathloss and blocking effects
 - Doppler from mobility
 - Noise and synchronous programmable interference (virtual cells, and users)
- Supports all 5G NR deployment scenarios with and without LTE anchor cells and coexistence of 3G and 2G cells
- Supports 5G NR frequency band 1 (FR1) and 2 (FR2). From 450 MHz up to 44 GHz.
- Ready and user-defined multi-RAT test scenarios for building a wide range of configuration options using the Prosim standard tools wizard
- Supports user-defined advanced virtual drive test scenarios and Keysight's Geometric Channel Modeling (GCM) Tool to validate sub-6GHz MIMO, massive MIMO beamforming, 5G CA scenarios, and Multi-RAT technologies in a lab-based environment prior to field deployment
- Supports Wi-Fi offloading scenarios, WLAN 802.11ax MU-MIMO, and beamforming testing

Optional Keysight Nemo Drive and indoor testing tools for field testing support

- 5G NR, LTE, WCDMA/HSPA, GSM, Wi-Fi
- Applications testing with single and multiple test mobiles
- Connected tools for lab and field testing
- Smooth field-to-lab process

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