



S8709A Virtual Drive Test Toolset

Field-to-Lab Performance Test Solution

Introduction

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) modes, and other supporting 5G technologies, such as multi-user massive MIMO, require advanced test solutions to deliver the quality that service users expect. Successful 5G roll outs rely on mobile devices that perform reliably under multi RAT real-world network conditions.

Most mandated device performance test plans are only covering a minor part of the existing field network configurations and parameters. Moreover, these test cases often use simplified RF propagation and interference conditions in comparison to the real-world field networks. To adequately validate the quality of service experienced by end users, there is a need for more comprehensive testing of multi-mode 5G NR devices that can verify the performance under real-world propagation and interference conditions as experienced in the field.

What is the S8709A Virtual Drive Test Toolset?

Keysight's S8709A Virtual Drive Test Toolset is a real-world lab test environment for validating 5G devices under a wide range of network signaling and radio channel conditions. It offers a fully controlled test scenario enabling quick and systematic performance validation. Moreover, it enables users to efficiently analyze the performance of 5G new radio (NR) devices deployed in non-standalone (NSA) or standalone (SA) networks and under various mobility scenarios.

By seamlessly integrating Keysight's 5G channel emulation and network emulation solutions with Keysight's Nemo Outdoor and 5G Device Analytics tools, users can quickly and easily verify the end-user experience based on real-life mobility scenarios, such as challenging high-speed train conditions, motorways, tunnels, etc . with cell and network parameters from specific mobile network operator networks. The data captured in the field is imported into the S8709A Virtual Drive Test Toolset test scenario, resulting in reliable and repeatable replay of signaling events and radio channel environment in a controlled laboratory environment.

The S8709A Virtual Drive Test Toolset is a part of Keysight's comprehensive portfolio of 5G NR design and test solutions that spans the entire workflow from simulation, development, and design verification, to conformance and acceptance testing, and finally manufacturing and deployment. It creates a representation of real-world conditions without a need for comprehensive analysis and simulation of the environment. Lab-based testing enables mobile operators and wireless device manufacturers to quickly and efficiently benchmark mobile devices across different real-world network conditions. The S8709A Virtual Drive Test Toolset therefore accelerates the validation of wireless devices, supporting new design development from prototypes to fully functioning 5G devices.

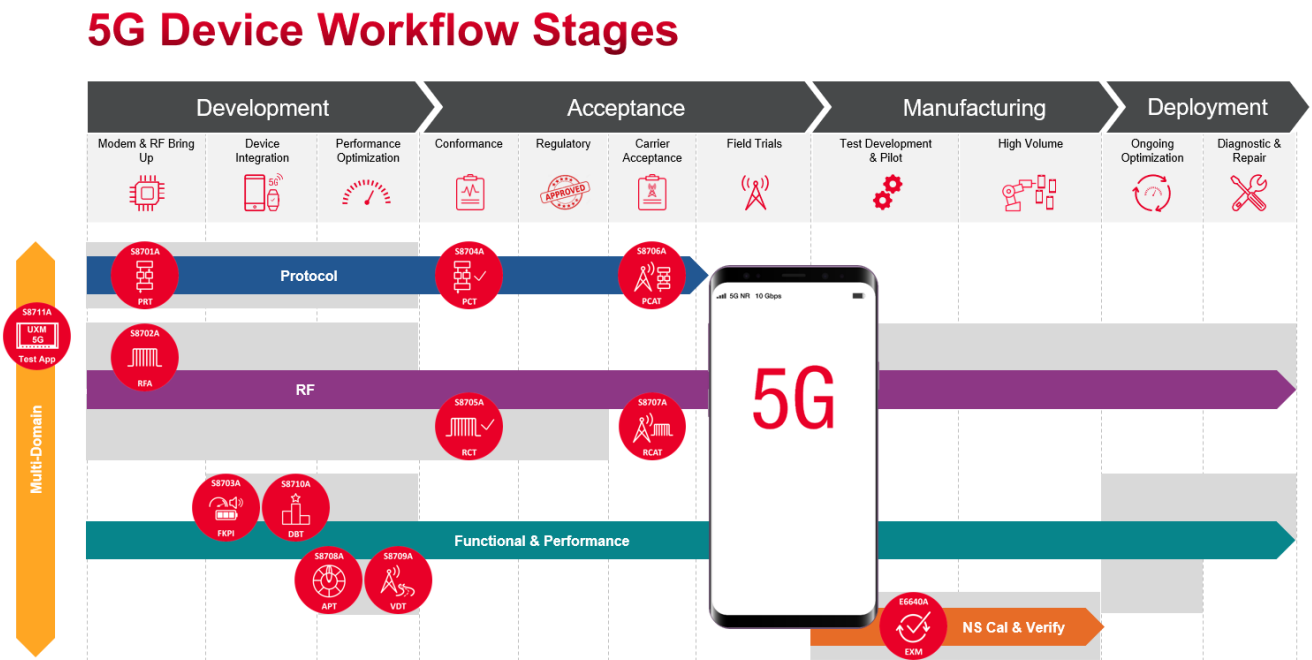


Figure 1. The Virtual Drive Test Toolset integrates seamlessly with Keysight's 5G channel emulation and network emulation solutions. The grey bars illustrate workflow stages covered by the solutions.

Who benefits from using the S8709A virtual drive test toolset?

- Mobile operators to verify new devices prior to market launch and assure device and software interoperability with local network configuration
- Mobile chipset and device manufacturers to stress test software stack, verify interoperability with mobile operator-specific signaling, and validate the compliance of DUT with the typical mobile operator device acceptance test conditions

S8709A Virtual Drive Test Toolset Features

The solution offers:

- Turnkey solution with ready-to-run virtual drive test cases
- Test campaign management with detailed status information and KPI's for serving cell, mobility, data-, and voice call performance
- Result analysis with clear reports for decision making
- Test cases based on real world drive test routes from major operator networks – representing signaling and RF environments in various parts of the world
- Complete end-to-end test solution allowing test case parametrization
- State-of-the art logging, visualization and debugging tools to resolve issues more quickly
- Mobility performance testing, covering:
 - Handover and cell re-selection success rates
 - Call drop rates and service interrupts
 - Data performance
 - Voice call quality metrics

What makes S8709A Virtual Drive Test Toolset different:

- It's the only solution bringing real world logs to the testing workflow.
- It offers test scenarios to reproduce and analyze real field data, previously recorded in defined locations
- It enables users to overcome one of the biggest real-world testing challenges: repeatability. It offers an environment to stress test software stack and verify performance with mobile operator-specific signaling

Software and Hardware Components

The S8709A Virtual Drive Test Toolset is an integrated solution comprising UXM 5G Network Emulation, PROPSIM 5G Channel Emulation, and Nemo Tools, as illustrated in the Figure 2.

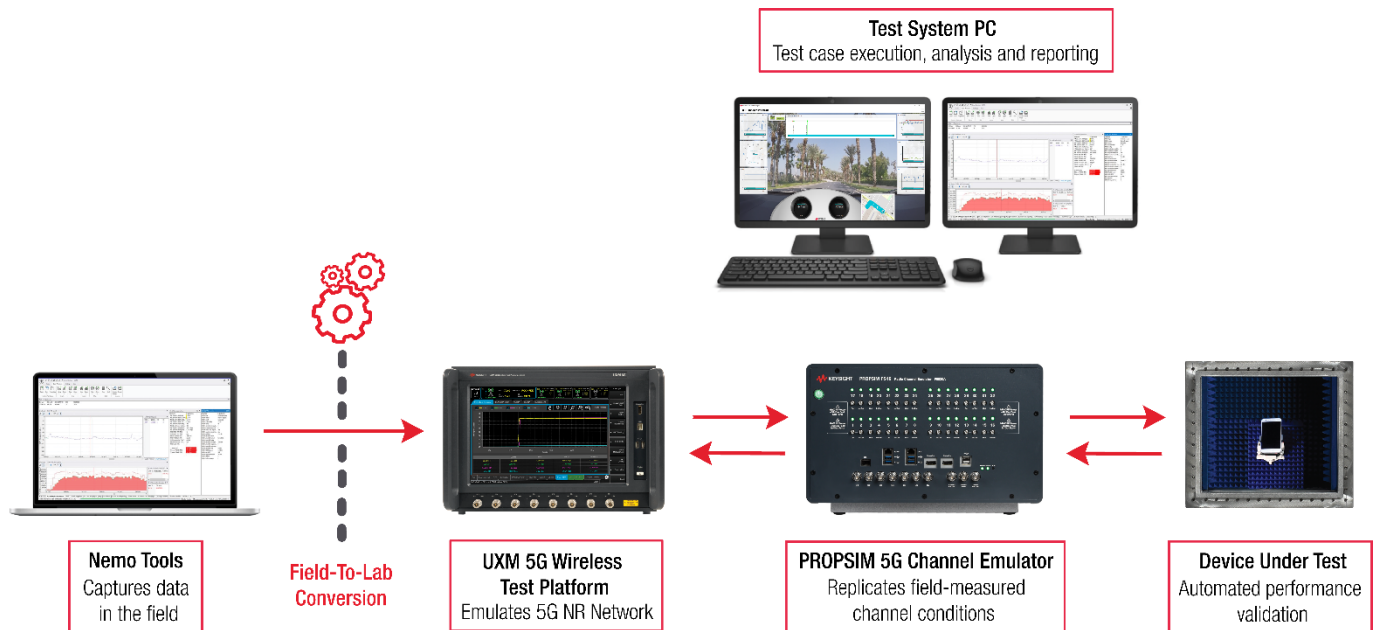


Figure 2. The S8709A Virtual Drive Test Toolset integrates channel and network emulation capabilities with Nemo tools to replay real-world test scenarios in lab environment.

The S8709A Virtual Drive Test Toolset is the only solution bringing real world logs to the testing workflow. Nemo Tools records the field conditions with a commercial UE from production network ensuring that the test results will reflect the real user experience. Device under test is recorded using the same tools offering fully integrated solution to replicate field conditions in the lab for real-world performance testing.

The S8709A Virtual Drive Test Toolset makes repeatable real-world performance testing accessible to R&D teams by integrating instrumentation and the test environment under a single lab solution. Users gain access to field measured geometrical channel models with high-capacity fading options as well as signaling scripts replicating operator-specific network capabilities. The solution offers test cases in a single user interface with reports and a live test execution view to monitor the progress of the test run.



Figure 3. Keysight's S8709A Virtual Drive Test Toolset offers a single interface for test case execution, analysis and reporting

This enables device R&D teams to benchmark the performance of different builds and support network operator device acceptance testing with automatic reports and verdicts. Moreover, the S8709A Virtual Drive Test Toolset is highly customizable to fit different use cases and needs. Developers of prototypes can use the toolset to verify how well a device performs by stressing the design in demanding real-world conditions. Test conditions can be customized in the UXM 5G wireless test platform to support device performance development. It allows users to integrate real-world representation of networks around the globe as part of their lab automation framework to bridge the gap between lab and field testing with realistic performance test cases.

Supported Test Cases

The solution builds on top of Keysight's NEMO field testing tools and global presence to replicate drive test routes around the world. Advanced users can further customize their testing with protocol scripting and geometrical channel modelling tools available for UXM and PROPSIM platforms. The flexible and user-friendly UI allows users with different levels of experience to have an easy and smooth access to the powerful benchmarking capabilities speeding up the time-to-revenue of new 5G NR devices.

Urban city test cases

5G Networks are being deployed around the world, with operator-specific parameters. Each network has its unique set of capabilities enabled for the end users. In addition to signaling, each operator has their unique way to deploy networks as part of the local infrastructure, which vary from wide boulevards between skyscrapers to narrow historical city centers. As a result, the radio channel propagation conditions vary significantly between different locations.

The test cases of S8709A Virtual Drive Test Toolset are based on live network measurements. RF metrics such as RSRP power level and 5G NR Channel Impulse Response represent radio channel impairments and signal strength measured in the field. The field logs include Layer 3/RRC signaling, which reveals site specific network capabilities. Live network measurements are performed with Keysight Nemo Outdoor by using a scanner and latest flagship mobile devices to ensure that the latest network features are enabled.

The urban city test cases represent test scenarios resembling the conditions of typical urban areas in different parts of the world. The S8709A Virtual Drive Test Toolset solution will provide a test case package including the following groups of tests:

- Urban city in Europe
- City centers in US
- Highways in US
- Downtown with skyscrapers in Asia

The following table shows the scenario test conditions and KPIs for one drive route in the European urban city test cases:

Drive route	Scenario	Cell setup / Network configuration	Application	Key performance indicator
City - Europe	Attach, single cell performance	1x n78 4x4 MIMO 1x b3 2x2 MIMO	FTP/iPerf	Throughput (MAC/application)
City - Europe	Mobility & real-world performance	3x n78 4x4 MIMO	FTP/iPerf	Mobility (handover success)
	Field Network config.	3x b3 2x2 MIMO		Throughput (MAC/application)
City - Europe	Mobility & real-world performance	3x n78 2x2 MIMO	FTP/iPerf	Mobility (handover success)
	Reduced Network config.	3x b3 2x2 MIMO		Throughput (MAC/application)
City – Europe	Call success rate & real-world performance	3x n78 4x4 MIMO	Voice call (VoLTE), data on	Mobility (handover success)
	Field Network config.	3x b3 2x2 MIMO		Call success rate (MAC/application)

Network operator test plans

Keysight can help network operators show case network segments, such as high-speed train, and benchmark success in real-world implementations. The S8709A Virtual Drive Test Toolset test enables operators to verify new devices prior to market launch and assure device and software interoperability with local network configurations. Real world implementations, that require high performance in an advanced propagation environment, set the first class of network operators. Customizable testing allows the network operators to develop their own test plans in co-operation with Keysight. As a result, network operators can validate real-life device performance with test plans that are based on field tests in their own networks.



Figure 4. The test cases of S8709A Virtual Drive Test Toolset are based on live network measurements. (Google Maps, 2020).

Keysight 5G Solutions

Keysight's 5G end-to-end design and test solutions enable the mobile industry to accelerate 5G product design development from the physical layer to the application layer and across the entire workflow from simulation, design, and verification to manufacturing, deployment, and optimization.

Keysight offers common software and hardware platforms compliant to the latest 3GPP standards enabling the ecosystem to quickly and accurately validate 5G. You can test chipsets, devices, base stations, and networks, as well as emulate subscriber behavior scenarios. Additional information about Keysight's 5G solutions is available at www.keysight.com/find/5G.

- For more information about PROPSIM Channel Emulation Solutions, visit www.keysight.com/find/propsim
- For more information about PROPSIM FS16 RF Channel Emulator, visit www.keysight.com/find/propsimfs16

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