

Ensuring Reliable, Secure Communications: 5G Dynamic Spectrum Sharing

Digital Twin Solutions for US Defense

Military leaders need a mechanism to make the defined spectrum available to the commercial sector. They also critically need a way to see who is using the spectrum at any given time, to understand how it is being used, and, most importantly, to have a way to dynamically reprioritize spectrum for military use.

Securing 5G Dynamic Spectrum Sharing

As the US Department of Defense (DoD) moves closer to 5G wireless technology adoption, leaders are working to ensure there is sufficient spectrum to enable an increasing demand for advanced data, video, and voice services.

The DoD need is not simply for defense operations. As one of the largest owners of US spectrum, the DoD has agreed to share its spectrum to support commercial demand as well as defense. Still, the military must be able to immediately, securely, and flexibly control Dynamic Spectrum Sharing (DSS) — ensuring access to the spectrum they need for essential missions.

The Vision of DSS

5G, a flexible wireless communications technology, is the first commercial wireless platform that the government is adopting. Its high speeds and capacity to handle massive numbers of devices and users make it a unique enabler for the DoD, which relies on fast, secure communications across complex, congested, and contested environments.

Before the emergence of 5G, the DoD relied on proprietary communication platforms. Now, government is adopting 5G — and, in some cases, 4G LTE and even 3G — technologies. At the same time, they must share the spectrum with industry. There is limited bandwidth, so all parties must determine the best use of what is available and how to share it.

Defense requirements for 5G DSS are still in development, but the underlying assurance must be that warfighters can reliably and securely conduct communications in any spectrum band, in any environment, anywhere in the world — at all times.

Performance When It Matters

To confidently manage 5G DSS for defense and commercial uses, defense leaders must assure control of spectrum as well as service performance. To this end, they are actively testing and evaluating 5G DSS technologies and techniques to understand how well data, video, and voice communications are currently performing. These tests inform evolutions designed to ensure secure, reliable access and communications when the 5G spectrum is being shared.

Keysight's 5G network digital twin solutions provide an end-to-end 5G test network built upon network emulation, traffic generation simulation, and test automation. Digital twins ensure that 5G technologies function in the lab and, more importantly, that they can perform as needed when live. Using a digital replica of the network, digital twins can support an array of 5G DSS test and evaluation needs, including:

- **Network performance and quality.** Digital twins can support end-to-end over-the-air (OTA) testing of any or all parts of the network when sharing spectrum or taking back ownership. How does this sharing or prioritization impact voice, data, or video services? Testing can validate that the services have been set up correctly and can evaluate whether there is a perceivable negative impact on services when the spectrum is shared.
- **Modeling rugged environments.** Warfighters rely on radio communications in some of the most challenging environments in the world. Digital twins can emulate any environment — urban, mountain, forest, maritime, desert, or other — to test the performance of radio communications across a broad range of spectrum.
- **Traffic emulation.** It is not enough to test communications and network performance in ideal traffic conditions. Communications must be conducted in congested and contested conditions, as well. Digital twins accurately recreate the complex effects of massive traffic, cyberattacks, outages and other interference to reveal communication quality and network behavior under stressed conditions — all in a controlled lab environment.
- **Legacy device performance.** Some of the major commercial wireless service companies are connecting both 4G and 5G users in the same spectrum band. Digital twins support testing for 5G, 4G and even 3G technologies, so defense leaders can ensure that their range of modern and legacy technologies will perform as needed with the available spectrum.

Insights from tests and evaluations are continually informing defense requirements, technology advancements, and protocols for assured 5G DSS across defense and commercial entities.

Tested in the Lab; Delivered in the Field

Because Keysight’s 5G digital twin solutions model the entire 5G network, defense organizations can test any component — or any combination of network technologies — in the lab. To ensure that these lab-tested services will operate similarly in the field, Keysight’s 5G digital twin solutions framework supports the blending of emulated and commercial elements. It is a vendor-agnostic environment that can test any or all network technologies across a wide band of spectrum and a broad range of use cases.

For 5G DSS use cases, testing can help determine if the wireless network is set up properly, how well the network performs under duress, and whether services are degraded when the spectrum is shared. All elements can be orchestrated by automation, configured, and coordinated to execute complex testing scenarios.

Digital twin solutions emulate conditions in the field — or replay captured live conditions — to recreate:

- **Traffic**, including mobile signaling and data usage as well as OTA voice, video, and data
- **Network protocol exchanges** across a range of channel modeling scenarios

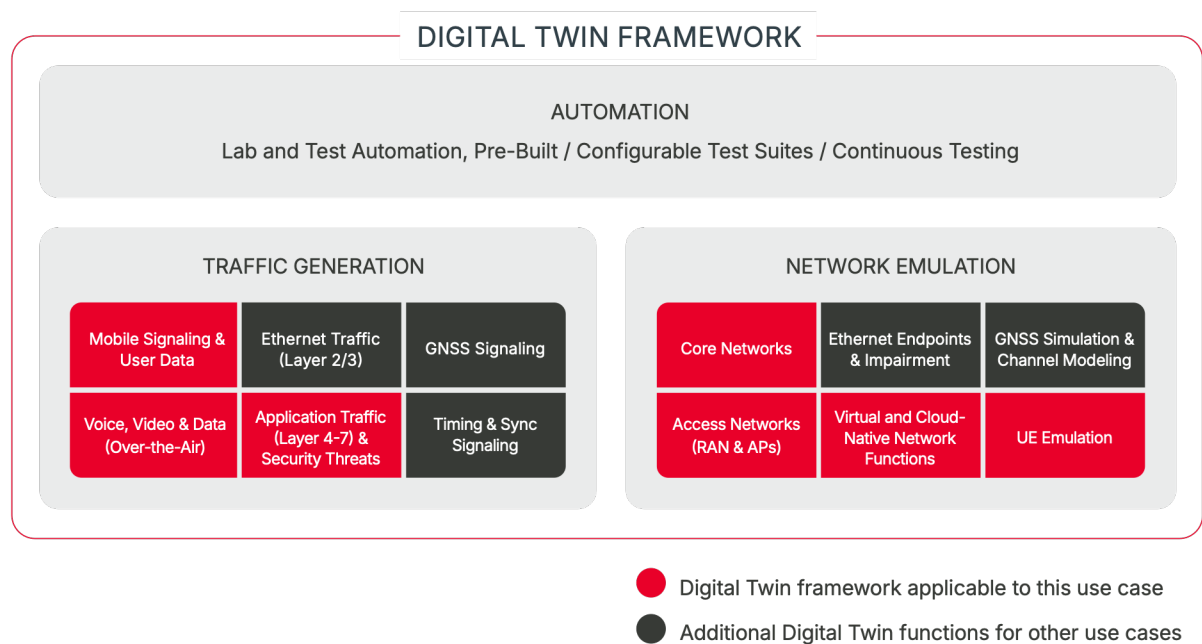


Figure 1. Digital twin framework chart showing traffic generation and network emulation capabilities

Why Choose 5G Network Digital Twin Solutions for DSS?

Keysight's 5G digital twin solutions offer defense leaders instant access to the most advanced 5G network environment, without a capital investment. It also provides access to a team of experts who have deep experience with legacy and emerging communication platforms — and who understand the unique requirements of the defense community.

Combining a single source of testing across the entire 5G network with defense community experts for defense networks, cybersecurity, and technologies, digital twin solutions can inform requirements and technology advancements that can make government-commercial 5G DSS a reality.

For 5G DSS initiatives, Keysight's digital twin solutions provide defense leaders:

- **Accelerated research and development (R&D)**, based on proven experience executing large-scale 5G, 4G, and 3G network tests
- **Technology flexibility**, with an ability to test any network technologies — from the physical layer through application layers and security — from any vendor, across a wide band of spectrum for numerous defense use cases
- **Improved reliability, resilience, and security** across integrated technologies
- **Reduced risk** of inefficient or ineffective testing that could jeopardize mission outcomes
- **Strengthened links to commercial sectors**, for shared learning and technologies

Contact your Keysight representative to experience the power of Keysight's digital twin and 5G DSS solutions for defense leaders.



Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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