

Validating Tactical Communications with Digital Twin Solutions

Digital Twin Solutions
for U.S. Defense



Deploying next-generation technologies faster than the adversaries can be a significant battlefield advantage. Defense leaders are eager to explore the promise and power of 5G for their tactical radio communication devices, MANET performance and, ultimately, the field environment.



Tactical Radio for U.S. Defense

Ensuring Mission-Critical 5G Communications

The U.S. Department of Defense has focused its 5G wireless technologies exploration on smart warehouses, telemedicine, AR/VR and other support use cases. Until now, system design is complete for 3GPP Release 17, the third installment of the global 5G standard. 3GPP R17 builds on 5G's faster, data-rich, flexible-bandwidth communication capabilities by introducing new and enhanced sidelink capabilities that enable 5G to directly connect devices. Since warfighters at the tactical edge rely on peer-to-peer communications to relay mission-critical messages and information, the sidelink enhancements are compelling the DOD to explore the viability of 5G for tactical communications, as well.

Yet before relying on next-gen tactical communications in the field, the military must be assured that their critical messages will be delivered and understood – quickly, reliably and with a low probability of interception or interference.

Innovation and Complexity

Mobile ad hoc networks (MANETs) are the backbone of tactical communications in the battlespace, autonomously connecting nodes – tactical radios, vehicles, aircraft, satellites and base stations – to extend the reach for RF signal propagation. Over many years, tactical communication technologies have evolved to become more flexible and resilient – and more complex.

Today's military forces have a choice of a range of interoperable radio components. With 3GPP R17 chipsets now available, the DOD may now explore 5G for tactical communications use cases and new technologies such as tactical radios that can use 5G in addition to legacy capabilities.

Adding 5G to the mix is an exciting and complex undertaking. Before introducing new tactical communication technologies or 5G into the field, though, every element of the communication chain must be scrutinized to ensure that critical communications are conveyed efficiently, securely and reliably – so warfighters stay one step ahead of their adversaries.

Performance at the Tactical Edge

To confidently assure reliable tactical communications, defense leaders seek to validate today's tactical radios and emerging 5G-enabled devices, as well as mesh and ad hoc network configurations and protocols.

Spirent's 5G Network Digital Twin solutions provide an end-to-end 5G test environment built upon network emulation, traffic generation simulation and test automation – making it possible to validate new concepts by recreating highly realistic field conditions in the lab.

A digital twin can flexibly support the testing of a range of tactical communication use cases and concepts, including:

- **Advanced channel emulation.** Warfighters operate in varied and rugged environments, where it's not possible for radio signals to travel in a straight line. A digital twin can recreate real-world RF environments for peer-to-peer connections, base station connectivity, vehicle/aircraft links or mobile ad hoc network connections to identify and isolate performance issues. Spirent's channel emulation capabilities model RF environments to test and validate both existing tactical radio technology as well as 5G.
- **Mesh network topologies.** A digital twin can emulate multiple mesh topologies – star, convoy, looping, full mesh, etc. – to test each of the devices/nodes and the connections among them to optimize mesh topology options for tactical communications.
- **Device performance.** Military radios have a life span of five to 10 years, with essential components hardened for the duration. At the same time, tactical radios have become more modular – with many options for components. A digital twin supports the testing of legacy, new and 5G-enabled radios – with current or new component configurations – to understand and optimize device performance.
- **Core network slicing.** 5G enables the creation of multiple virtual networks, known as “slices,” over the shared physical network and the DOD is exploring how to best configure secure 5G network slices dedicated to tactical radio communications. A digital twin can emulate the slices, for robust security and performance testing.
- **Massive MIMO.** 5G's massive multiple input, multiple output (MIMO) technology brings together hundreds or thousands of antennas attached to a base station, along with radios and spectrum to enable higher capacity and speed. A digital twin can emulate this complex and intricate environment, to test the throughput and resistance to interference for tactical communications.



Minimizing Risk with Robust, Repeatable Lab Tests

Spirent's 5G Digital Twin solutions model the entire 5G network, so defense organizations can test any component – or any combination of network technologies – in the lab. To ensure that the services tested in the lab will operate similarly in the field, the Spirent 5G Digital Twin solution framework supports the blending of emulated and commercial elements. It's a vendor-agnostic environment to test any or all network technologies across a broad range of use cases.

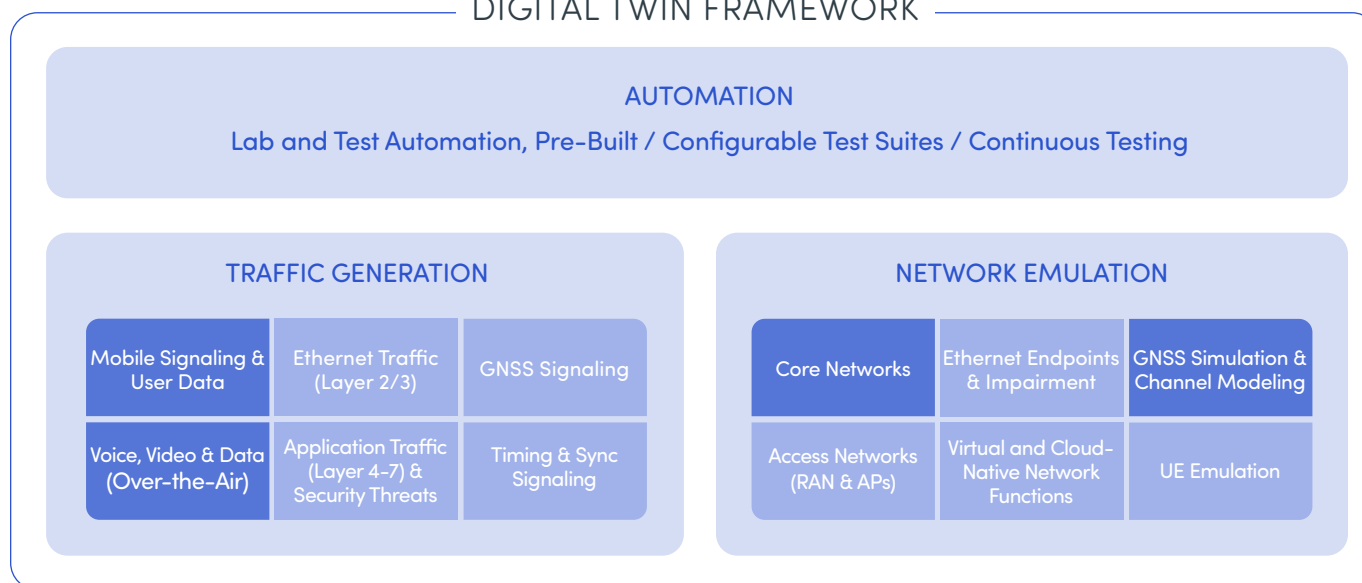
For tactical communications, it's nearly impossible to field test all the conditions and situations that happen in the real world. By creating realistic field conditions in the lab, Spirent's Digital Twin solutions can emulate complex environments and repeatedly test numerous use cases with a

vast number of variables. Activating the relevant components for each use case, testing can be configured, coordinated and automated to execute complex testing scenarios – efficiently and effectively.

Spirent's Digital Twin solutions emulate conditions in the field – or replays captured live conditions – to recreate:

- **Traffic**, including mobile signaling and data usage, as well as over-the-air voice, video and data, and
- **Network protocol exchanges** across core networks and/or a range of channel modeling scenarios.

DIGITAL TWIN FRAMEWORK



Why Spirent 5G Digital Twin Solutions for Tactical Radio Communications?

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

Spirent Digital Twin solutions are used to test today's tactical radios as well as to shape 5G requirements and technology advancements for future 5G tactical communication concepts, providing defense leaders:

- **Faster, Deeper Visibility** into how today's radios perform – and how 5G tactical communications technologies will need to perform – across a range of situations and environments.
- **Immense Flexibility** in testing scenarios, without the need to field test every possible configuration or environment.

- **Technology Choice**, with an ability to test any devices and network technologies from any vendor, with the support of a vendor-neutral expert partner.
- **"What If" Insights** that come from automated and continuously run testing scenarios against an emulated environment, to discover pitfalls and make improvements.
- **Improved Reliability, Resilience and Security** across complex technologies.
- **Accelerated Development and Adoption** of next-generation technology that can deliver competitive advantage on the battlefield.
- **Reduced Risk** of deploying unproven technology innovations that could jeopardize mission outcomes.

Contact us to experience the power of Spirent's 5G Digital Twin solutions for tactical communications.



Americas 1-800-SPIRENT

+1-800-774-7368 | sales@spirent.com



Europe and the Middle East

+44 (0) 1293 767979 | emeainfo@spirent.com



Asia and the Pacific

+86-10-8518-2539 | salesasia@spirent.com

Contact Us

For more information, call your Spirent sales representative or visit us on the web at www.spirent.com/ContactSpirent.