

# Optimizing Private Network Performance

TESTING USE CASE

Campuses

**ROHDE & SCHWARZ**



# Overview

When setting up a network for your organization, one of the driving factors in deciding what kind of network to deploy is user and device connectivity. While it is standard practice to make WiFi networks available, many users instead opt to use public cellular networks connected via mobile devices. However, public networks lack the flexibility, performance, security and control required by many organizations and present a variety of challenges.

## Challenges of Public 5G Networks



### Security Risks

Traffic is transmitted over open internet, allowing potential hacking or interception of data.



### Lack of Control

Carriers do not provide service level agreements tailored to an organization's requirements. Organizations can't manage quality of service or make changes tailored to their needs.



### Carrier Limitations

Public networks depend on carrier upgrade cycles and spectrum holdings. New technology rollouts can be slow.



### Interference

Various equipment and networks can cause interference on unlicensed spectrum used by public carriers.



### Latency

Data must travel across the carrier's entire network, which adds latency. Public networks can become congested in densely populated areas or during events, slowing speeds.



### Limited Coverage

Public networks are designed for broad coverage but may have poor or no service in buildings, remote areas, underground spaces, etc.

Private 5G cellular networks built and managed by a separate network provider can address these challenges. The most common spectrum used to deploy private networks is Citizens Broadband Radio Service (CBRS) (3.5GHz to 3.7GHz). CBRS is a shared spectrum model that enables organizational access without the expensive cost of exclusive licenses and additional equipment from mobile carriers. In addition to being easily accessible, CBRS private networks provide improved security through Identity Credential and Access Management (ICAM) systems that isolate signal traffic to the CBRS frequency range. For university campuses, this can be especially beneficial for protecting sensitive student data. Additionally, because private networks operate on a different frequency range than public networks, they can overcome connectivity challenges of areas with dense architecture and provide low-latency coverage in areas far from cell phone towers.

However, gaps can still exist in private network coverage and performance. Mobile network testing throughout each phase of the deployment process is essential to the success of private networks and ensuring high quality of experience (QoE) and quality of service (QoS).

## How Federated Wireless Justified Private Network Improvements to Cal Poly through Mobile Network Testing

[Federated Wireless](#), a leading CBRS spectrum private network infrastructure provider and manager, [helped California Polytechnic State University \(Cal Poly\)](#) improve their network coverage and connectivity by detecting gaps in coverage using Rohde & Schwarz equipment and identifying ideal locations for CBRS radios.

### Background: Addressing Poor Coverage Across Campus

After a major campus rebuild, Cal Poly received numerous complaints about dead zones and poor cellular signal throughout some of their newest buildings and lecture halls. To address these QoE complaints, they reached out to individual carriers for a solution, but the proposed solutions had a number of problems. For one, purchasing a solution from each major carrier would require a significant investment from Cal Poly. Each carrier would need to install their radios, which would add to the equipment load Cal Poly's IT teams have to manage and would be an eyesore in their newly constructed buildings. Network security would be another problem in working with individual carriers to extend their signals because traffic would be transmitted on open spectrum. Finally, working with multiple carriers would make network coordination cumbersome. After considering this, the university decided to instead solve their challenge by implementing a private network.

Federated Wireless offers a turnkey carrier extension product, Neutral Host 2.0, that helps to close wireless connectivity gaps with a private network and neutral host that operates over CBRS spectrum. Neutral hosts enable private networks to connect to externally originated cellular carrier networks and augment their signals to penetrate dense building materials and extend coverage beyond traditional carrier ranges to remote areas. After learning about Cal Poly's challenge, Federated Wireless agreed to partner with them to showcase their Neutral Host 2.0 and private network solutions in tandem with one of the three largest carriers.

Cal Poly identified four areas on their campus, located in San Luis Obispo, CA, that were priorities for network improvements. One of these was the Frost Physics Building, centrally located on campus in an area that hosts many classes and lectures and sees thousands of students per day. The dense construction of the building caused RF interference that created pockets with scarce service, and the high traffic of this area resulted in a competitive wireless environment.



Figure 1 The William and Linda Frost Center for Research and Innovation was identified as one of the locations on Cal Poly's campus that could benefit from CBRS radios.

## Problem

The Frost Physics Building presented two network challenges that Federated Wireless was poised to solve with their Neutral Host 2.0: connectivity issues and poor network coverage. In order to justify the value of their private network solution, Federated Wireless needed to show that their neutral hosts could improve coverage and provide value for Cal Poly's IT infrastructure.

## Challenges

For Cal Poly, their biggest challenges were budget constraints, RF security and network coordination. Federated Wireless had the technology to address these challenges but faced their own challenge in proving the value of their private network solution. They didn't have the technology to measure their impact on Cal Poly's RF ecosystem.

## Approach

Federated Wireless proposed a phased approach to private network deployment that involved installing their Neutral Host 2.0 radios in locations that Cal Poly had received the worst QoE reports and demonstrating that their radios improved coverage. This required mobile network testing solutions. In order to show how their radios enhanced coverage, Federated Wireless reached out to Rohde & Schwarz (R&S) to help them determine a benchmark for network coverage. This would help them define gaps in mainstream carrier coverage across these problem areas and illustrate how their neutral hosts boosted coverage.



Figure 2 The Rohde & Schwarz Freerider 4 backpack is a lightweight, modular mobile network testing solution that can be configured to suit your needs.

To get a full picture of network coverage in these areas, we turned to our [QualiPoc probes](#), [R&S®TSM6B walk test scanner](#) and [SmartMonitor](#) and [SmartAnalytics](#) software solutions combined with our [Freerider 4 backpack solution](#) to conduct indoor and outdoor walking tests in each of the locations identified. During these tests, or campaigns, we walked around the problem areas identified by Cal Poly and measured voice quality, video quality, upload and download speeds, and signal strength along the way.

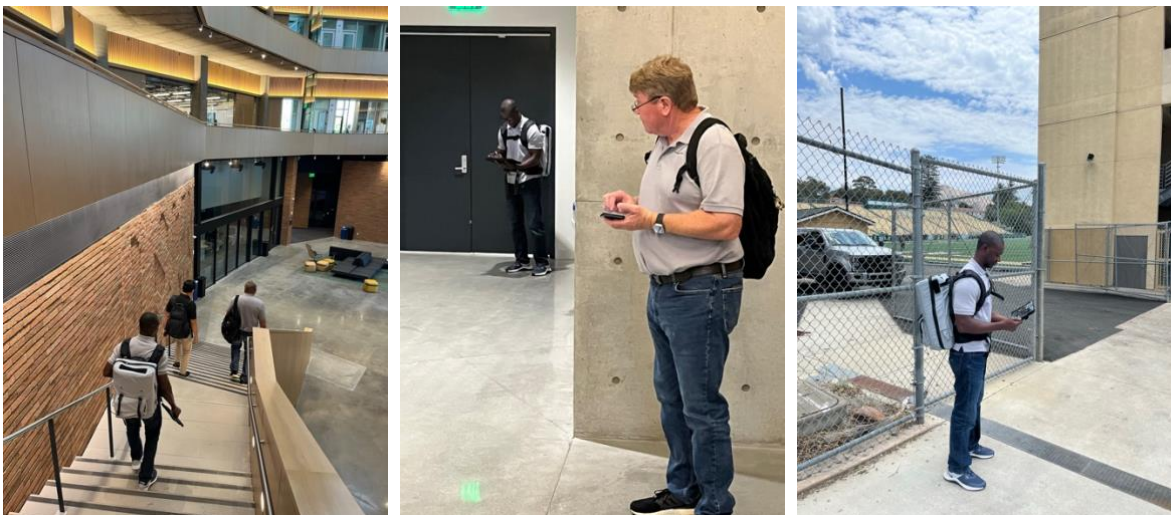


Figure 3 The Rohde & Schwarz Freerider 4 can be used in a variety of environments for both indoor and outdoor walking tests.

## Results: Federated Wireless’s Private Network Improved RF Coverage

The R&S mobile network testing solutions helped Federated Wireless illustrate how their private network offering affected signal coverage in the areas where it was deployed. The charts below show the Reference Signal Received Power (RSRP) along the campaign in the Frost Physics Building for three major carriers and CBRS. Areas in green, blue and purple have a strong signal; areas in red have the poorest coverage. Locations where Federated Wireless neutral hosts are identified on the maps.



Figure 4 The maps above show the LTE coverage RSRP on CBRS and across three major carriers. Anticipated gaps in coverage are circled on the map.

In the areas nearest to where Federated Wireless had installed their Neutral Host 2.0 radios, signal coverage was strong and there were significant improvements in QoE for their carrier partner. Adding more neutral host radios would boost network coverage across carriers agnostically by allowing all carriers to connect to Federated Wireless's radios and augment their signal to be transmitted via CBRS, extending signal reach farther. Not only would this improve coverage, transmitting traffic over CBRS would bolster network security by isolating the traffic on Cal Poly's private infrastructure and increase signal latency by minimizing the distance that signals need to be carried.



Figure 5 The flexibility of the Rohde & Schwarz Freerider 4 allows comprehensive testing with support for up to 12 smartphones and scanners.

To ensure that their private network continues to serve Cal Poly optimally, Federated Wireless has installed additional QualiPoc probes in enclosures throughout Cal Poly's problem areas. These probes can be remotely controlled and monitored with R&S's SmartMonitor software. They run a series of network tests at regular intervals and have programmed alarms that will alert the IT team of anomalies in Cal Poly's RF environment.

# Featured Equipment

The solutions employed in this use case demonstrate some of the latest portable test equipment for benchmarking, troubleshooting, and optimizing wireless networks. The QualiPoc Android probe provides extensive service quality assessment, enabling deep analysis of voice, video, and application metrics. For efficient drive testing and optimization, the R&S TSMA6B scanner simplifies multicarrier testing and analysis while the Freerider 4 modular platform allows flexible, scalable benchmarking of networks indoors and out. Finally, the SmartMonitor and SmartAnalytics solutions provide webbased, real-time visibility into network quality and insights to enhance quality of experience through data-driven optimization and monitoring. Together, these cutting-edge tools form an integrated workflow for ensuring optimal network performance and user experience.



## QualiPoc Probe

Get comprehensive service quality assessment and RF optimization.

### Features and Benefits

- Assess voice, video and app quality
- Streamline testing efficiency



## R&S®TSMA6B Walk Test Scanner

Optimize, troubleshoot and measure RF and QoS with a non-intrusive scanner.

### Features and Benefits

- Simplify multi-carrier testing
- Optimize latest devices
- Enhance analysis with new metrics



## Freerider 4

Benchmark, optimize, and monitor networks with a modular portable test solution.

### Features and Benefits

- Test anywhere flexibly
- Scale system capacity on demand
- Futureproof investment



## SmartMonitor

Web-based, real-time network service quality monitoring.

### Features and Benefits

- Configure campaigns with ease
- Real-time quality visibility
- Secure access and control



## SmartAnalytics

QoE insight through benchmarking, optimization and monitoring intelligence.

### Features and Benefits

- Improve end-user experience
- Identify and diagnose issues
- Informed optimization decisions



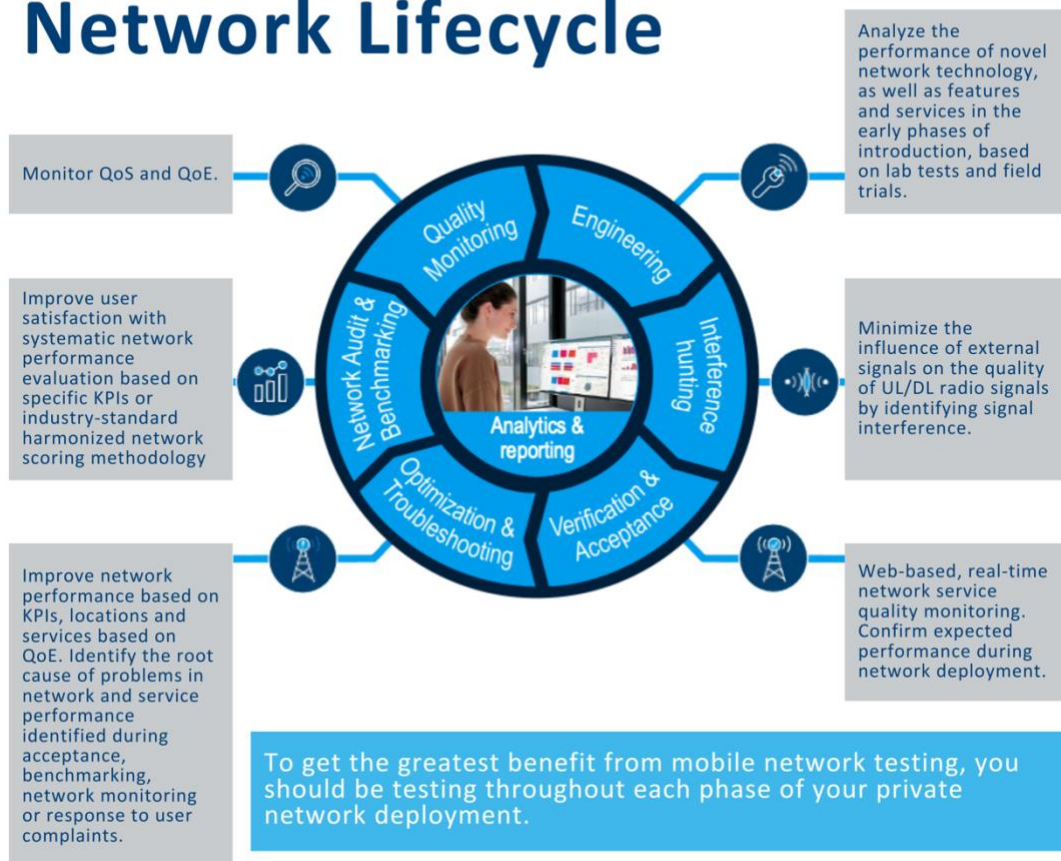
# Applying Mobile Network Testing for Your Private Network

If you've been tasked with deploying a private network at your facility, it's important to understand your current wireless landscape before engineering begins. Whether you're implementing a new private network for a university campus or seeking to improve private network security in your financial institution, mobile network testing can help you identify gaps in existing network coverage to determine the optimal placement of carrier extender radio equipment.

## Key Considerations

Throughout your private network implementation, it is essential to measure key performance indicators (KPIs) such as signal coverage, network security, latency rates and network resiliency.

## Testing Throughout the Network Lifecycle



During the engineering phase, mobile network testing will help you understand your current RF environment, identify where coverage needs to be augmented and determine the optimal location to install private network radios. As your implementation progresses, you can employ mobile network testing tools to hunt for signal interference and verify your installation. Ongoing maintenance, troubleshooting and optimization can benefit especially from automatic data collection and monitoring as well as visualizations generated by analytics software.

## **Find the Right Mobile Network Testing Tools for Your Application**

Regular testing and continuous optimization are the key to ensuring user satisfaction and securing network investments. The right mobile network testing technology will enable you to reconcile your current and future RF dilemmas.

At Rohde & Schwarz, we empower IT and networking professionals to make QoE-centric business decisions with confidence, to deliver better services with higher QoE, to reduce time to market for new technologies and services, and to secure and increase the value of their business. Our mobile network testing solutions provide all the software, hardware and resources you need to deliver better services with higher quality for customers while enabling you to increase the value of your networks and products. With more than 85 years of experience in RF testing, secure communications, networks and cybersecurity and broadcast and media markets, organizations worldwide rely on Rohde & Schwarz and our cutting-edge solutions.

**[Contact us to learn more about mobile network testing and work with an RF expert to find the right tools for your private network application.](#)**

## Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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