

# 5G Remote Monitoring Solution

Nemo Wireless Network Solutions

## Ensure 5G Network QoE/QoS Remotely, in Real Time with Automated Tests

End-users and business customers have high expectations about all opportunities and experiences that 5G has been said to bring. Typically, extensive testing is needed to gain understanding of new technologies, and deployment of 5G is not an exception. It is essential to ensure that your network, whether it is public or private, works as expected before and after it has been put to use.

We here at Keysight are able to help you to streamline your complex test processes and ensure successful 5G network deployment. Our 5G remote monitoring solution brings operational efficiency and cost savings with the ability to measure the quality and performance of 5G NSA/SA networks remotely, in real time with automated tests.



### Benefits

- Streamline your 5G network test processes
- Measure all the latest technologies from 5G and 4G all the way to 2G
- Manage constant network updates remotely and ensure high network QoE/QoS during 5G network deployment
- Verify the service level in real time based on demand or continuously 24/7
- Measure the quality and performance of 5G NSA/SA networks with automated tests. Automation reduces human errors and speeds up the time to market
- Get an objective view of the network performance to verify that the agreed performance targets and service level are met

# Nemo 5G Remote Monitoring Solution

With Keysight's remote monitoring solution, test campaigns can be performed:

- to verify 5G NSA/SA network QoE/QoS based on demand or continuously for 24/7 multiple service types, such as eMBB, URLLC, mMTC
- frequently and reliably as part of a continuous integration (CI) and continuous deployment (CD) strategy
- case by case to troubleshoot the network, e.g. based on customer complaints
- to ensure network QoS defined in Service Level Agreement (SLA)

Nemo field measurement solutions **Nemo Handy Autonomous Units** and **Nemo Autonomous Probes** are used to perform the field measurements. Both solutions support the latest technologies, 4G and 5G, as well as all the latest flagship devices and test protocols.

**Nemo Cloud** acts as the primary user interface for remote monitoring. The solution offers a specific set of graphical dashboards for each user, service, and technology. With Nemo Cloud, operators and service providers can interact seamlessly with their fleet of measurement products. Centralized control and storage enable direct online management of data while users can easily and effectively share information between solutions.

**Nemo Analyze** is used to post-process the test results. Post-processing can be performed automatically or on an on-demand basis. The solution provides access to all analytics reports and reporting dashboards. The test results can be monitored and analyzed from any accessible device, anywhere, anytime.

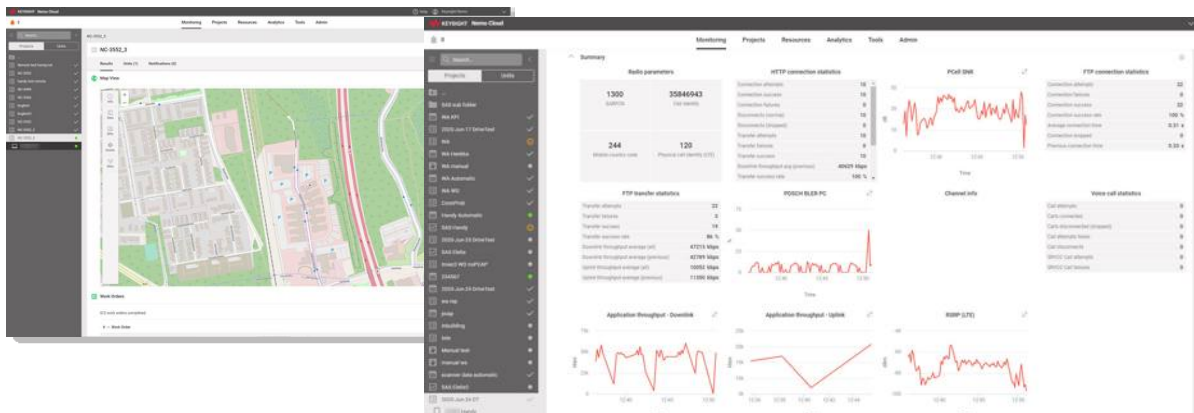


Figure 1. Keysight's Nemo Cloud

## Use Case: On-Demand Remote Monitoring

Keysight's remote monitoring solution is an ideal solution to test the quality and capacity levels of 5G networks on an **on-demand** basis. The solution allows monitoring the network as often as needed, to troubleshoot a specific network problem or to perform more continuous test campaigns. The solution scales based on the customer need – dozens or even hundreds of measurement units can be used to ensure the targeted quality level.

You can use the solution in a situation where the problem does not necessarily occur immediately and is hard to reproduce. For example, you can give a smartphone in which Nemo Handy Autonomous is installed to a user that is experiencing network problems at a certain location. The user simply needs to make sure the mobile device is turned on as all measurements and commands, including real-time monitoring, are made from Nemo Cloud. This enables to quickly identify the problem and ensure the network quality of experience (QoE).



During 5G deployment, you need to run constant network updates and human errors are more likely to happen with tight timelines. With Keysight's remote monitoring solution, you can focus your valuable resources in places and locations where they are actually needed. The quality and performance of 5G NSA/SA networks can be measured in **real time** and code changes in the network can be made whenever necessary with automated tests.

**Automation** enables to use non-technically skilled personnel to perform the measurements in the field, while more technically advanced personnel can focus on the network development tasks. Automating test activities enables engineering teams to deliver network updates frequently and reliably as part of continuous integration (CI) and continuous development (CD) strategy. Automation also reduces human errors and speeds up time to market. All relevant key performance indicators (KPIs) that reflect end-user experience will be collected.

Viewing the measurement results **remotely** in real time in cloud environment is not tied to a specific location. The results can be monitored and analyzed from several different office locations at the same time.

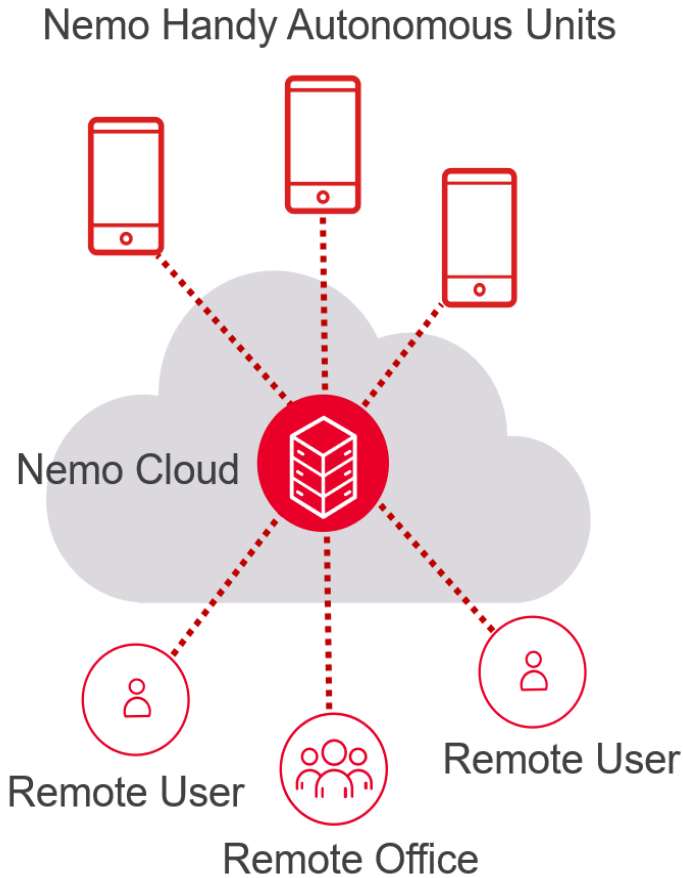


Figure 2. On-Demand Remote Monitoring Solution Architecture

## Use Case: Service Level Agreement (SLA) Monitoring

In the 5G era, the requirement for more agile processes is real. In Service Level Agreement (SLA) monitoring use case the 5G network is typically a private network. Private networks are built to ensure high capacity and reliable communication. Securing a high service quality level for industry customers is often crucial and there is no room for mistakes, especially in mission critical communication.

Building a successful private 5G network requires cooperation between the members of the ecosystem – the industry customer, network vendor, mobile operator, and test and measurement equipment provider such as Keysight.

Keysight's remote monitoring solution enables network vendors and mobile operators to ensure new services such as ultra-reliable low-latency communications (URLLC), massive machine-type communications (mMTC), and enhanced mobile broadband (eMBB).





Nemo Autonomous Probes can be placed in multiple factories and industry locations to monitor the quality of the 5G network. Nemo Handy Autonomous units can also be used to perform the measurements. The unattended probes are managed in real time by one end-to-end remote monitoring system via Nemo Cloud.

The solution proactively detects network performance degradation issues before the customers do and guarantees the agreed service level. You can define alerts based on certain errors and get notified immediately about issues in the network. The measurement solution sends an automated alert per every measured key performance indicator (KPI).

The high test frequency, more than four hundred (400) data test case executions can be performed per hour, ensures constant visibility to the network quality of service. With Keysight's remote monitoring solution you can be sure that the network quality is taken care of continuously 24/7.

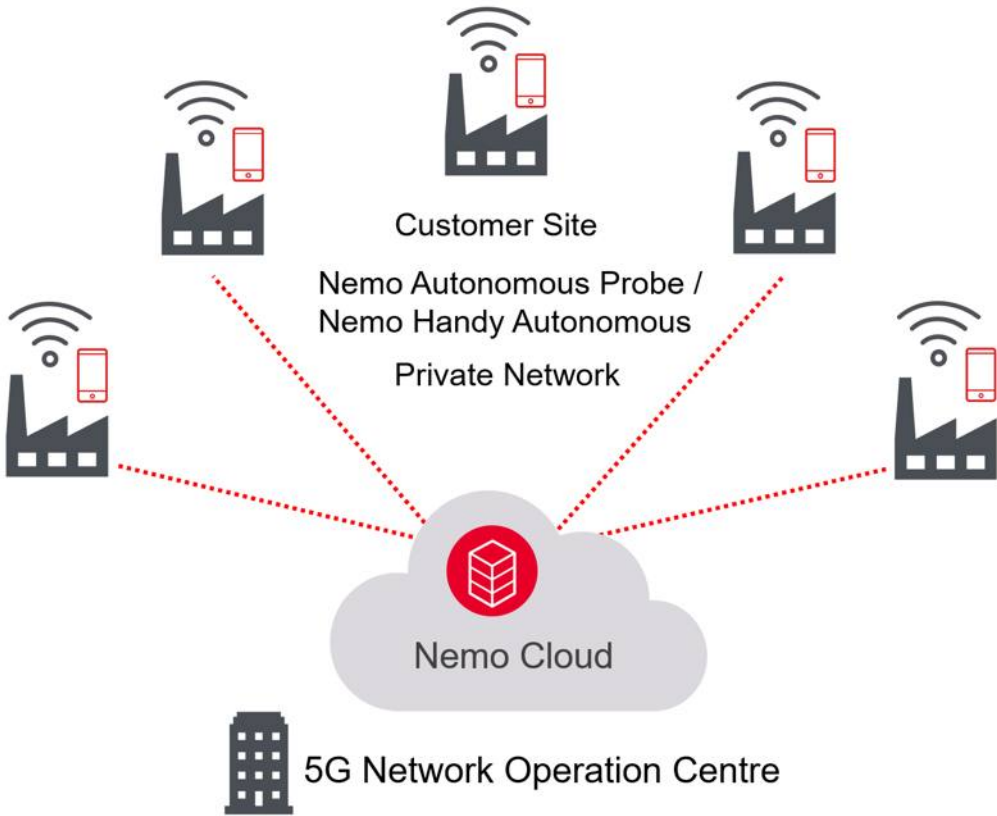






Figure 3. Service Level Agreement (SLA) Remote Monitoring Solution Architecture

## Nemo Remote Monitoring Solution Features

- End-to-end solution can measure the overall performance of both 5G NSA and SA networks
- Full remote control and visibility to field test operations:
  - capability to define the tests and launch them remotely
  - provides a real-time monitoring view to field tests
  - capability to program a set of automatic tests to measure the quality of 5G network. Primary tests support voice calls, data throughput and latency
  - collects key performance indicators (KPIs) from the tests executed: voice (call setup time) and data (throughput DL, throughput UL, latency, MBs during the tests and % time in 5G)
  - stores both traces and KPIs from the tests in a cloud environment
- Typically, three options for voice service:
  - Voice over NR (VoNR)
  - EPS fallback with handover
  - EPS fallback with redirection
- Throughput and latency for eMBB and new use cases
- Low latency test cases
- High throughput test cases
- QoS active testing with
  - real native OTT applications
  - mScore
- Single cloud interface for users to:
  - manage and monitor projects/devices
  - monitor project dashboards
  - access reports



# 5G Remote Monitoring Solution Components

	Field Testing	Remote Monitoring	Post-Processing
 <b>Nemo Handy</b> Handheld measurement solution	●		
 <b>Nemo Autonomous Probe</b> Unattended measurement solution	●		
 <b>Nemo Cloud</b> Remote monitoring solution		●	
 <b>Nemo Analyze</b> Drive test post-processing solution			●

## Nemo Handy

The 5G NR support in Nemo Handy enables operators and network vendors to test the advanced features and performance of 5G NR networks both in outdoors and busy indoor spaces. Nemo Handy supports 5G NR measurements with Samsung Galaxy S20 smartphone family, Qualcomm X50/X55, and Samsung Shannon chipset-based devices.

In Remote Monitoring, Nemo Handy is used to perform the field measurements.

## Nemo Autonomous Probe

Nemo Autonomous Probe is an ideal solution for performing automated, unattended large-scale measurements. It can be deployed in vehicles and fixed locations. Nemo Autonomous Probe is available in two versions, employing either one (1UE) or up to four (4UE) handsets equipped with Nemo Handy Autonomous software and an uplink modem with continuous data connectivity to a remote server.

In Remote Monitoring, Nemo Autonomous Probe is used to perform the field measurements especially in SLA use cases.



## Nemo Cloud

Nemo Cloud is a centralized, web-based service for remote control and management of measurement fleets. Nemo Cloud connects Nemo products, measurement and analysis processes, and data feeds into one end-to-end solution streamlining operations related OPEX. Nemo Cloud provides real-time control and monitoring of measurement product fleets as well as improved responsiveness of measurement projects in the field.

The scalability of the Nemo Cloud service varies from a few measurement units to massive environments – one Nemo Cloud service installation is limited only by the number of Nemo measurement units.

## Nemo Analyze

Nemo Analyze supports the analysis of 5G NR scanning receiver and UE measurements performed with Nemo data collection tools. Nemo Analyze supports a leading set of KPIs for advanced 5G NR analytics and provides a comprehensive set of ready-made report templates and playback workbooks with all the key metrics and KPIs for quick analysis. An automated routine for plotting the SSB beam footprints of all beams is also included.

## Summary

Keysight's 5G remote monitoring solution helps mobile operators and network vendors to streamline the 5G network test process, manage constant network updates remotely and ensure high QoE/QoS during 5G deployment and service. You can verify the service level based on demand or continuously 24/7. Meet and exceed your end-user and industry customer expectations by adding remote monitoring in your 5G network testing toolset.

Learn more at: [www.keysight.com](http://www.keysight.com)

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

