

SOLUTION BRIEF

TEMS™ Sense

Ensuring that mobile networks work by monitoring quality of experience and checking that service level agreements are met around the world



All mobile networks, whether private or public, need extensive planning and testing to ensure that they work and can handle the expected traffic everywhere coverage is needed. We have been involved in testing mobile networks since Day One and have led the work in providing 5G test capability to the largest set of customers in the world. In the initial stages, where the infrastructure, smartphones, chipsets and underlying protocols are untested, it is essential to rely on someone that has done this before and understands the challenges.

Many mobile operators and equipment vendors understand this, and have decided to rely on TEMS to test their 5G network. We are enormously proud of every one of the 6000+ users that depend on TEMS, which is why we mention them anonymously in the [TEMS 5G reference map](#).

However, with 5G we have seen a different sort of end-user and business customer with grand expectations of what 5G could bring, but without the underlying understanding of how RF complicates things. For them, the challenge does not end at network deployment. Yes, they need someone to verify that the network works as expected before and after it has been turned on. But more importantly, they need to ensure that it continues to work – through thick and thin – for many years.

To help, Infovista has produced a set of tools that can test every aspect of your network throughout the lifecycle without you needing deep technical knowledge. We can help you understand if something looks suspicious even if it is hardly noticeable in the statistical KPIs. Being able to predict when things could go wrong helps avoid them doing so. Our 5G SLA monitoring tool, TEMS Sense, is used by some of the biggest mobile operators in the world. Later, we'll explain why they chose TEMS.

Many things change during the network lifecycle

Isn't it always safer to test things first?

But as changes are occurring more rapidly can you do this manually?

The Infovista monitoring solution, TEMS Sense, allows you to perform test campaigns 24/7.

It allows you to monitor both 5G NSA and 5G SA, as well as a combination of LTE and LTE-A networks in parallel. Designed to measure QoE and QoS KPIs not readily available from monitoring systems, it ensures performance of eMBB, URLLC and mMTC networks.

BOTTOM-LINE, WILL THE CHANGE AFFECT CUSTOMERS? ARE YOU SURE?

Many operators use TEMS Sense to ensure that all network features always work well. In addition to thorough background testing, TEMS Sense can break in and perform individual tests on each device in the probe and see exactly what is visible to the user. This feature makes it possible to reproduce situations gleaned from

customer complaints, thus making it often possible to detect exactly what has happened.

In TEMS Sense we support simple probes, like TEMS OnBoard and TEMS Sense – Handheld, where customers place the devices in places to be tested. But TEMS Sense – Remote units can also be physically installed in key locations to perform 24/7 measurements. Both solutions support the latest technologies – 4G and 5G – as well as all the latest flagship devices and test protocols from Qualcomm, Samsung and HiSilicon.

USE THE CLOUD TO ENSURE CONSISTENT PERFORMANCE

All probes are operated remotely from the cloud. The fleet of test devices can be operated using TEMS Director – Fleet, and all the measurements, including KPI and alarms, are returned to the cloud for storage in TEMS Director – Analytics. TEMS Director – Fleet is the primary user interface for remote monitoring all TEMS tools. The solution offers a wide set of graphical dashboards, graphs, reports and KPI analysis, for all applications, services, and technologies.

With TEMS Director – Fleet, staff can interact seamlessly with the complete fleet of measurement products wherever they might be. In many cases, probes can be installed in inaccessible areas or even in different countries. TEMS Director – Fleet allows for the centralized control of work-orders on all TEMS probes and TEMS Director – Analytics provides the storage of all data and enables direct online analysis. Users can easily and effectively share information, dashboards, and reports, or optionally produce ETSI reports for regulators

If required, detailed drop-down analysis of the measurements can be performed by most third-party processing tools. But we always offer the option to use the tool used by most major vendors to analyze and troubleshoot RF problems: TEMS Discovery.

INFOVISTA TOOLS CAN BE USED TO AUTOMATE THROUGHOUT THE LIFECYCLE

Uniquely, TEMS Sense can be combined with other Infovista tools, including Planet, KLERITY, VistaInsight and VistaNeo, to form a complete testing and monitoring solution.

New features are always supposed to improve things, but isn't it prudent to check first?

Use Case: Network monitoring and regression testing

Infovista's remote monitoring portfolio is an ideal solution to test the quality and capacity of both 4G and 5G NR NSA networks. The ability to see the network from the user perspective in such a granular way enables you to observe the most subtle changes. It also allows a full set of tests to be regularly repeated and compared over time and against other nodes.

Integrated with a Big Data solution that runs AI rules in the cloud, TEMS Sense provides essential historical data to show what happened every time there was a network change.

EXAMPLES OF USE:

One Tier 1 American operator uses TEMS Sense to measure the VoLTE and VoNR quality of calls handled on their network. Placing multiple probes in every state enables them to see the most subtle changes and predict which areas, vendors and software releases produce questionable results.

Many mature MNOs are sceptical about new claims, preferring to test features first

Use Case: On-demand 5G testing

Infovista’s remote monitoring portfolio is an ideal solution to test the quality and capacity of 4G, 5G NR NSA and 5G NR SA networks. The solution monitors the underlying network using smartphones and IoT devices used by customers. Both controlled and on-demand tests can be performed. You can initiate these tests as often as needed to provide a 24/7 view of the network.

On-demand tests can be used to troubleshoot a specific network problem, whereas continuous test campaigns are often performed to identify subtle changes after software updates. The TEMS Sense solution scales based on the customer need – we have many customers with hundreds of measurement units, but often a handful can be used to ensure the targeted quality level. When in on-demand mode, TEMS Sense can be used to debug intermittent faults which may be hard to reproduce. For example, you can give a TEMS Sense – Handheld smartphone to a user who is experiencing network problems at a certain location. Or you can provide a TEMS OnBoard device, where a vehicle is experiencing connectivity issues. The user simply needs to make sure the mobile device is turned on (or in the TEMS OnBoard case, plugged in) and all measurements and commands are initiated from TEMS Director – Fleet. This enables you to quickly identify problems and ensure the quality of experience (QoE) of you end customers.

During network deployment, network and smartphone updates occur often and human errors are more likely to occur. Using an automated monitoring solution like TEMS Sense, you can focus attention on places and locations where they are actually needed. TEMS Sense allows you to monitor the quality and performance of 5G NSA/SA networks, but also to validate that the underlying 4G network is not affected. As all tests are done in real time it

is possible both to see anomalies and see trends to detect subtle changes in the network. Automation enables you to employ less skilled personnel to perform measurements in the field, while more technically skilled personnel can focus on solving network tasks. We have many examples of mobile network operators automating their testing activities to allow engineering teams to deliver network updates more reliably. For them, TEMS Sense has become a part of their network lifecycle automation (NLA) strategy. They understand that NLA reduces human errors and speeds up time to market. With TEMS Sense, they get all the relevant key performance indicators (KPIs) seen from an end-user experience perspective.

EXAMPLES OF USE:

One Tier 1 UK operator uses TEMS Sense to verify in-store performance, enabling them to detect issues with 5G core.



In some cases, ensuring the network functions is life and death

Use Case: Service level agreement (SLA) monitoring

In the 5G era, the requirement for processes that are more agile is very real. In service level agreement monitoring use cases, the 5G network is typically private. 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 all members of the ecosystem – the industry customer, network vendor, mobile operator, and test and measurement equipment providers. TEMS Sense enables network vendors and mobile operators to ensure each new service, such as ultra-reliable low-latency communications (URLLC), massive machine-type communications (mMTC), and enhanced mobile broadband (eMBB). By performing active tests, we can see that each of these features works as expected.

EXAMPLES OF USE:

One prison operator in Latin America uses TEMS Sense to verify blocking software to ensure prisoners are unable to use any mobile networks inside the prison.

One Tier 1 American operator uses TEMS Sense to verify the performance of the first responders that are given priority access to their network.

TEMS Sense can be placed in multiple sites (mines, ports, arenas, or industrial locations) to monitor the quality of the 5G network. TEMS Sense or TEMS OnBoard probes can also be used to perform the measurements. These unattended probes are managed in real time by TEMS Director – Fleet. The solution is used throughout the world to proactively detect network performance degradation issues before customers do and thus guarantee agreed service levels. You can define alerts based on certain errors and get notified immediately about issues in the network.



Connectivity is essential for many new verticals

Use Case: Connectivity testing

Infovista’s remote monitoring portfolio is an ideal solution to test the connectivity of both 4G and 5G NR NSA networks. Using TEMS OnBoard or TEMS Remote – Handheld, it is possible to see the network from the user perspective in so granular a way as to spot where you might lack perfect connectivity. It also allows a full set of tests to be regularly repeated and compared over time and against other nodes.

Integrated with a Big Data solution that runs AI rules in the cloud, TEMS Sense provides essential historical data to show what happened every time there was a network change.

EXAMPLES OF USE:

A big container port operator uses TEMS Sense to verify that ports in multiple countries have consistent connectivity. This has enabled them to improve the efficiency of loading and unloading container ships.

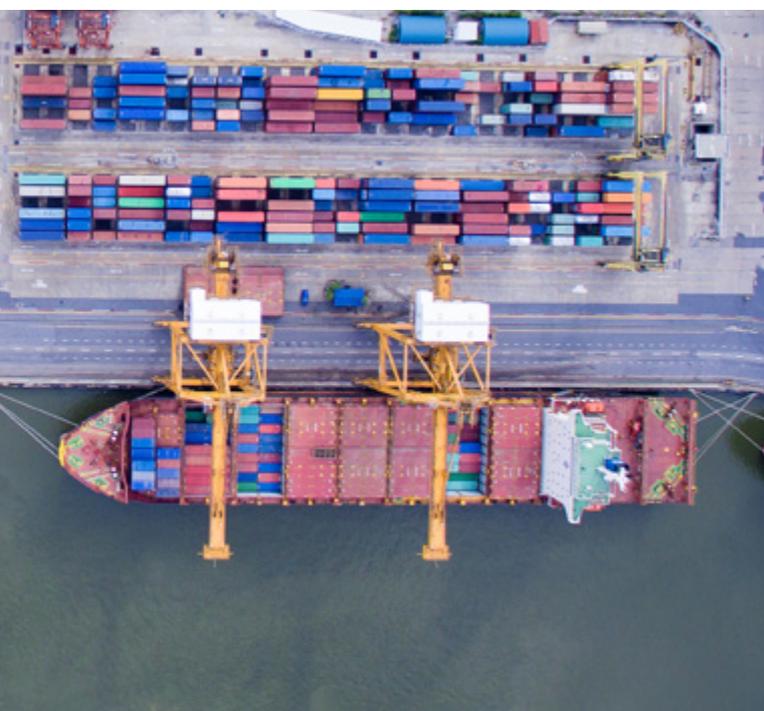
One major vehicle manufacture used TEMS Sense Onboard to better understand the connectivity challenges with their new TCU. TEMS Sense helped them document where the mobile networks had poor or limited coverage.

TEMS Sense allows you to actively test everything that affects customer quality of experience

Infovista tools produce scores that correlate with NPS.

TEMS Sense has numerous features and benefits.

- Use active testing to measure the overall performance of both 5G NSA and SA networks
- Ability to repeat same tests, day after day in exactly the same conditions, to detect changes over time
- Full RF-logging to troubleshoot awkward issues
- Ability to define work orders centrally and run a set of probes from TEMS Director – Fleet
- Ability to use each probe for interactive testing
- Real-time monitoring of the progress of each probe
- Produces ETSI-based key performance indicators (KPIs) such as voice (call setup time) and data (throughput DL, throughput UL, latency, jitter, loss)
- Voice over NR (VoNR); using sQLEAR and POLQA
- Ability to generate alarms based on AI/KL rules
- Ability to use both fixed and mobile probes to investigate root-cause analysis of issues found
- Ability to detect rare problems from analysis of measurements collected (outlier detection)
- Scalable to many hundreds of probes
- Single pain-of-glass interface for users to manage and monitor multiple projects/devices; monitor project dashboards; and access reports



TEMS ONBOARD

The **TEMS OnBoard** application has been developed to work on both automotive telecommunication control units (TCU), or on dongles that can be plugged into them. This gives a simple and convenient way of expanding testing to various sorts of IoT device that require connectivity.



TEMS SENSE – HANDHELD

The 5G NR support in **TEMS Sense – Handheld** enables operators and network vendors to test the advanced features and performance of 5G NR networks both in outdoors and busy indoor spaces. TEMS Sense – Handheld supports 5G NR measurements with Samsung Galaxy S21 smartphone family, Qualcomm X50/X55/X60, and Samsung Shannon chipset-based devices.



TEMS SENSE – REMOTE

TEMS Sense – Remote is an ideal solution for performing automated, unattended large-scale measurements. It can be deployed in vehicles and fixed locations. TEMS Sense – Remote units are equipped with TEMS software, an uplink modem with continuous data connectivity to TEMS Cloud, and a SIM-switch device.



TEMS DIRECTOR – FLEET

TEMS Director – Fleet is a centralized, web-based service for remote control and management of measurement fleets. TEMS Director – Fleet provides real-time control and monitoring of all TEMS measurement tools as well as improved responsiveness of measurement projects in the field. TEMS Director – Fleet solution manages all TEMS products, measurement and analysis processes, and data feeds into one end-to-end solution, streamlining operations-related OPEX.



TEMS DISCOVERY

TEMS Discovery supports the analysis of 5G measurements collected with TEMS collection tools. TEMS Discovery supports a wide set of KPIs for advanced 5G NR analytics and provides a comprehensive set of ready-made reports and analyses.



About Infovista

Infovista, the global leader in network lifecycle automation, powers complex intelligent networks to ensure they deliver brilliant user experience, maximizing productivity and efficiency, securely. At the core of the company's approach are automation and analytics, enabling Infovista software solutions to span the entire network lifecycle. From managing service legacy networks to optimizing 5G deployments, from providing applications visibility to securing and controlling the extended edge, Infovista helps Communications Service Providers and Enterprises to fully unlock their digital business potential. More than 1,700 customers, including 350 Mobile Network Operators, around the world rely on Infovista.