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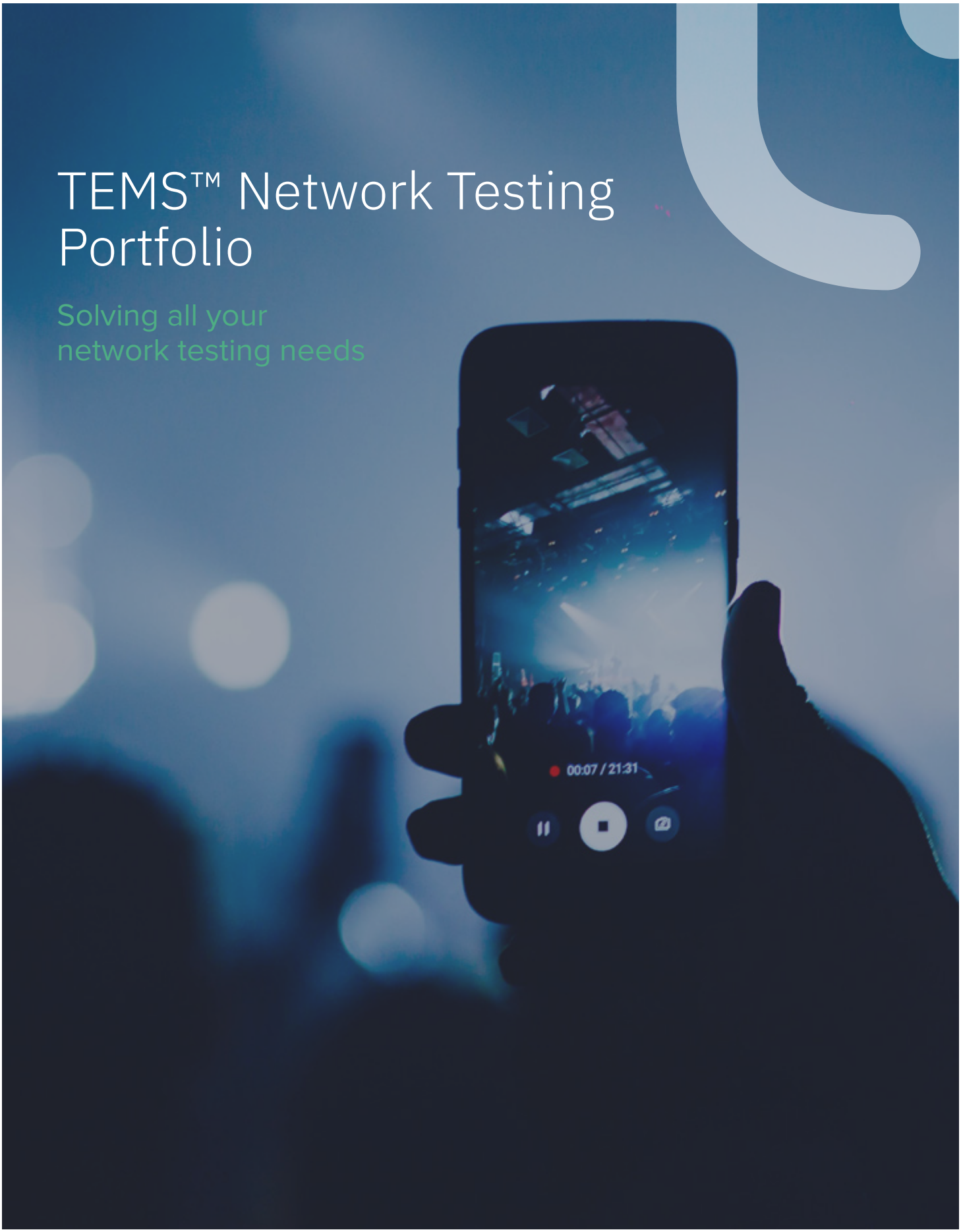
KNOW YOUR NETWORK™

TEMS™ Network Testing Portfolio

Solving all your network testing needs



The TEMS™ heritage and promise

Infovista is the leading provider of cost-effective network performance orchestration solutions that help communications service providers, mobile operators and enterprises meet the challenge of providing top-quality user experience while increasing their capital efficiency.

For more than 20 years, TEMS has been synonymous with the delivery of service excellence for mobile operators and engineering services providers worldwide. The TEMS portfolio of network testing solutions has enabled operators to provide competitive network performance and a superior subscriber experience. It is trusted by the world's leading wireless communications companies, ranging from the largest operators to the most widely deployed network equipment vendors.

Throughout this time, we have continually enhanced the TEMS portfolio, through the introduction of new models and capabilities, to anticipate and meet new requirements, driven by changing customer usage habits and advances in network and device technology. As a result, our unique TEMS solutions have been able to consistently reach and exceed the expectations of users, helping them to meet the challenges of each phase of mobile and fixed network evolution. Today, our expanding portfolio enables operators to confidently introduce and operationally assure new services.

Moving to the 5G future

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 doesn't 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

At the same time, many operators are extending capabilities to prepare for the massive deployment of IoT devices and the emergence of critical IoT solutions. The industry is poised for the next phase of growth, driven by consumer and business demand.

Infovista is involved in many of these 5G roll-outs.

Network evolution and the evolution of TEMS™

In addition, the need to introduce automation has grown exponentially. To address this, Infovista has produced a new set of tools that can plan, test, and operate every aspect of your network throughout the lifecycle without needing staff with 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, whereas our new tool for autonomous drive testing and benchmarking has revolutionized network testing during the Covid-19 outbreak.

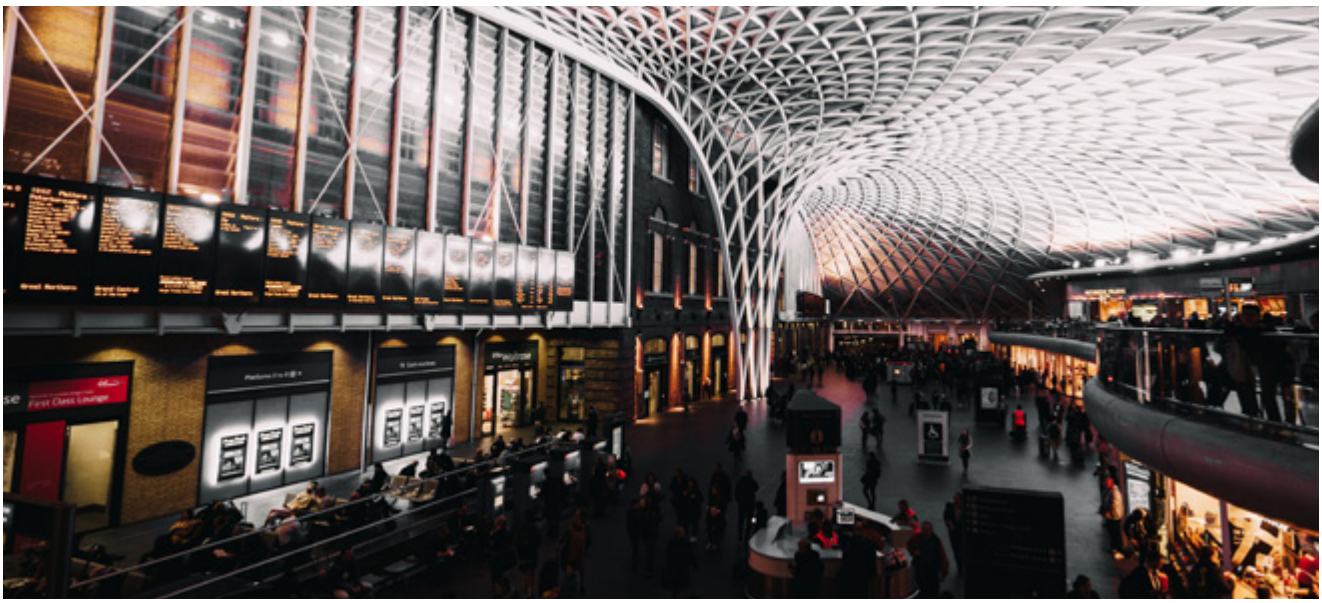
Uniquely, TEMS equipment can be combined with other Infovista tools, like Planet, KLERITY, VistaInsight, and Vista Experience, to form a complete testing and monitoring solution.

A growing diversity of use cases and applications is fueling these technical advances:

- Streaming media
- Public safety networks
- Smart cities, Industry 4.0
- Internet-of-Things (IoT)
- Virtual reality and augmented reality
- Connected cars

This evolution creates new business challenges for operators. They must wrestle with the problems of:

- Densifying the network and expanding coverage
- Building the foundations of 5G
- Acquiring high definition maps with detailed vegetation and tuning 5G propagation models
- Expanding network coverage while containing costs
- Anticipating changing customer demands
- Launching new devices, technologies, and services
- Maintaining and growing subscriber revenues
- Enhancing the mobile subscriber's experience
- Reducing churn and acquiring customers
- Maximizing operational efficiency
- Detecting and fixing intermittent faults
- Understanding customer experience and the effect network performance has on customer opinion



TEMS OVERVIEW

Manual drive testing. TEMS Investigation and **TEMS Pocket** support manual measurement collection on smartphones, scanners and custom-designed hardware on which the active test software is operated by a user.

Autonomous drive testing. TEMS Paragon, **TEMS Sense – Handheld** and **TEMS Sense – Mobile** support manual measurement collection on smartphones, scanners and custom-designed hardware on which the active test software runs without user interaction.

Active network testing. TEMS Sense – Stationary performs active network testing software enabling layer 1 to 7 end-to-end network testing, supporting attended and unattended use cases.

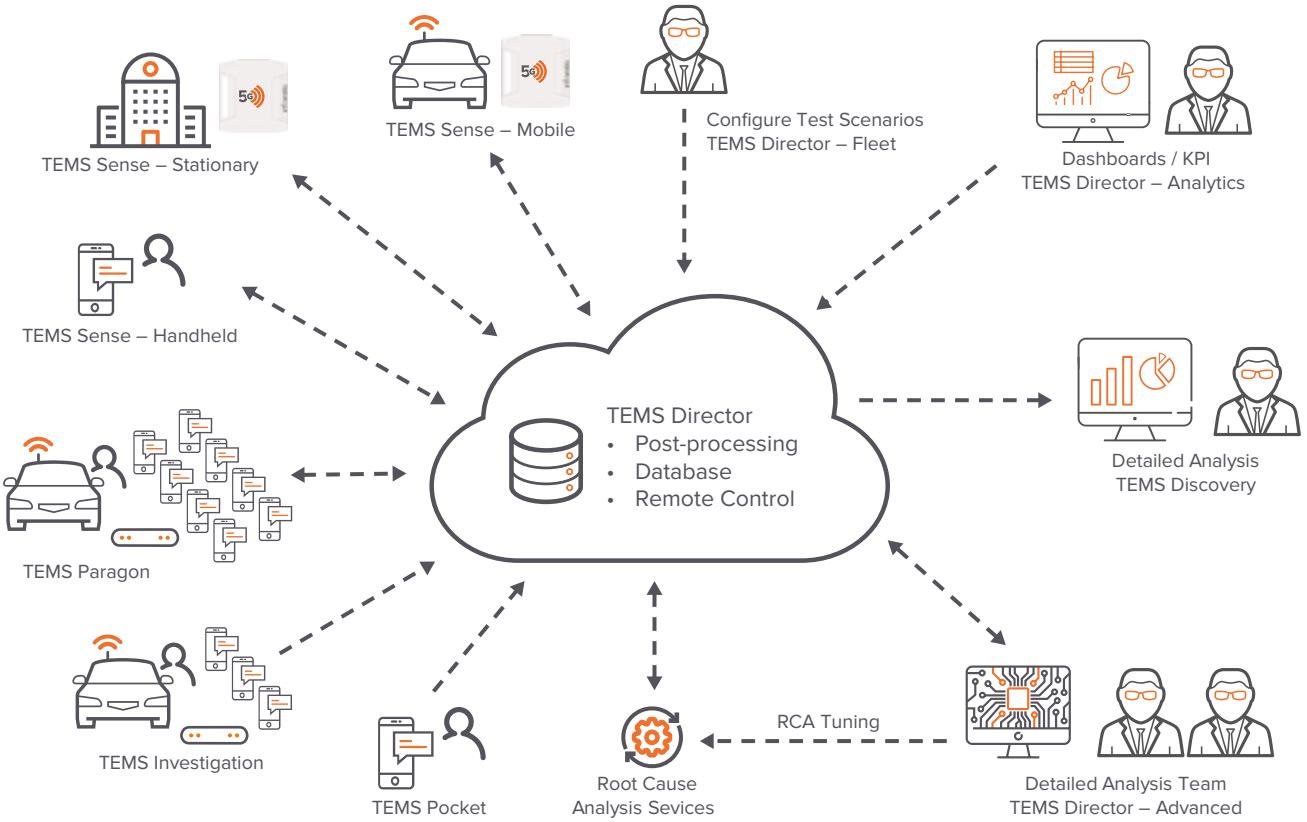
Network test orchestration. TEMS Director – Fleet provides a centralized platform enabling management, control, and real-time reporting and analysis of network test results.

Network test analysis. TEMS Director – Analytics and **TEMS Discovery** provide Insightful post-processing and analysis of collected network test results using TEMS products or third-party network test solutions.

As the industry evolves, so too must the solutions that operators need to help them accomplish their business goals and objectives – and to confront these challenges.

Infovista's TEMS portfolio of network performance measurement and analytics solutions is leading the way, ensuring that operators continue to deliver excellence and deliver uninterrupted, high-quality services to their customers, cost-effectively and efficiently.

The TEMS portfolio offers comprehensive, full-stack architecture, from data collection to test analysis.



TEMS Architecture

TEMS™ Portfolio

The TEMS portfolio provides outstanding measuring and analysis capability to understand network performance and subscriber experience. It's optimized for operators, helping them perform more testing, across a wider geographic area, faster, while maximizing the efficient use of engineering resources. They drive efficiency through automation, orchestration, and seamless integration.

TEMS delivers key operational advantages:

- Increased insight into network performance and subscriber experience across the network
- Large-scale testing before and after new technology deployments
- Faster gap analysis and network improvements where needed most
- Quicker issue identification and resolution
- More efficient processes and use of engineering personnel

While offering key business advantages:

- Higher customer satisfaction with the mobile network experience
- Higher ARPU from increased data usage, add-on-services, and plan upgrades
- Higher revenue from new subscribers and additional subscriptions
- Lower churn from increased loyalty
- Reduced operational and labor costs

To meet these challenges, the TEMS network testing portfolio has evolved with the introduction of new solutions: TEMS Paragon, TEMS Sense and TEMS Director.

This is in addition to our market-leading products for: network verification (TEMS Investigation); walk testing (TEMS Pocket); and analysis (TEMS Discovery).

TEMS portfolio is now able to test 5G NR networks with the latest smartphones and scanners. We have successfully helped customers in 85+ countries around the world. Dozens of the largest vendors and mobile operators have selected TEMS Investigation for 5G. We now support almost all 5G devices on the market. In particular, we support the latest 5G versions of Samsung smartphones, plus multiple devices from Apple, OnePlus, Xiaomi, Sony, Oppo, Huawei, ZTE, LG, and many more.

TEMS™ INVESTIGATION

TEMS Investigation, our market-leading network testing solution, allows you to test every new function and feature in your network. This allows you to better understand customer experience and to verify, optimize and troubleshoot your mobile network. Through our close cooperation with equipment vendors, chipset manufactures and device vendors we can use all major new devices. This allows us to quickly provide in-depth subscriber (QoE) and network (QoS) insights to enable you to make better network investment choices.

Whether you are rolling out a new network technology like 5G SA or 5G NSA, implementing a new network service like NB-IoT or VoNR, or optimizing existing mobile infrastructure, TEMS Investigation gets the job done right the first time. When integrated with TEMS Director, TEMS Investigation becomes a key component of your mobile network test platform. For the latest news about TEMS Investigation click **here**.

TEMS™ POCKET

TEMS Pocket is our premium portable testing solution. TEMS Pocket allows you to verify, optimize and troubleshoot your mobile network in environments requiring portability, such as malls, stadiums, offices, and other large venues. Its advanced testing capabilities, including the ability to support multiple devices and a scanner, provides the subscriber (QoE) and the network (QoS) actionable insights to improve your subscribers' mobile experience.

With over 80% of all mobile data traffic occurring indoors, TEMS Pocket lets you plan and optimize your indoor and small cells investments with great efficiency. When integrated with TEMS Director, TEMS Pocket becomes a key component of your mobile network testing platform. All TEMS Pocket devices now include includes indoor automatic pinpointing as standard, which reduces the need for manual intervention when testing indoors. This feature alone has considerably reduced the cost of inbuilding site verification and means that for most use cases, TEMS Pocket is much more effective to use. For the latest news about TEMS Pocket click **here**.

TEMS™ DISCOVERY

TEMS Discovery is the wireless industry's most well used 5G NR network analytics and optimization platform, providing you with unparalleled insight into network performance as perceived by your subscribers at the device, application, and network level. TEMS Discovery is highly configurable and extremely user-friendly. It allows engineers to easily assess wireless performance and quickly pinpoint network problems.

Highly automatic data processing increases efficiency and provides instant access to knowledge about the behavior and performance of your network. No other product can match the variety of information elements that TEMS Discovery handles, allowing thorough analysis of the collected data. With comprehensive GIS data support and display, you can pinpoint and visualize network problems. Analyzing air interface measurements in TEMS Discovery is the best way to obtain a true picture of the network, thanks to the many unique and advanced features that competing reporting and analysis products cannot match. For the latest news about TEMS Discovery click **here**.

TEMS™ PARAGON

TEMS Paragon is our premiere drive test system, optimized for mobile network benchmarking projects. You can use it to compare the performance of multiple networks, bands and technologies synchronously to discover how your network performs next to others.

TEMS Paragon mirrors the features and functionality supported by TEMS Investigation but does this on common off-the-shelf hardware that can be run completely autonomously from a centralized operation center. TEMS Paragon can be expanded to handle dozens of devices and multiple work orders all created and issued from TEMS Director – Fleet. It has become the gold standard for autonomous benchmarking, allowing companies like umlaut to significantly reduce their operational costs, whilst maintaining the highest standards of performance and accuracy.

Fully integrated with TEMS Director, it provides you with an innovative scripting engine, remote device control capability, turn-by-turn navigation, and innovative technologies to reduce your operational costs and improve the quality of your results.

Whether you are a mobile operator, a consulting firm or a regulator, TEMS Paragon supports the latest commercially available devices and offers you the in-depth TEMS network testing capabilities you want in a ruggedized multi-device system. For the latest news about TEMS Paragon click **here**.

TEMS™ SENSE

Ensure that no subscriber gets left behind. Deploying **TEMS Sense** maximizes your lifetime customer value. Your mobile subscribers rely on high-quality, uninterrupted services. To maintain the first-rate service, even during network upgrades, you need to continuously monitor your network performance end-to-end. Staying proactive means staying ahead of potential issues.

With our powerful network testing and measurement software, TEMS Sense, you can implement automated, remote monitoring of service performance from a variety of locations. Using comprehensive active service testing capabilities, TEMS Sense provides you with complete end-to-end service performance visibility so you can avoid potential issues and give your subscribers the quality they deserve.

TEMS Sense has been deployed by many mobile operators rolling out 5G NR NSA, as a way of ensuring that legacy 4G network isn't affected by the increase in signaling needed to support 5G. TEMS Sense can detect small changes in quality of service, and hence ensure no degradation occurs. In addition, the largest operators in the western world use it to evaluate VoNR. In TEMS Sense we support simple probes, like TEMS OnBoard (for IoT) and TEMS Sense – Handheld, where customers place these devices in places to be tested. TEMS Sense – Remote units can also be installed in key locations to perform 24/7 measurements. For the latest news about TEMS Sense click here.

TEMS™ DIRECTOR

TEMS Director is a web-based service that allows you to remotely control and manage a fleet of TEMS probes. In addition, it links the data collected by these probes with thresholds determining what tests need to be performed. TEMS Director helps you decide which work orders should be executed by each probe, and which routes should be driven to collect sufficient data. In the long run, this allows you to better manage your team, improving their efficiency and reducing the need for highly skilled individuals.

TEMS Director helps you improve overall efficiency, increase productivity, and reduce operational costs. It is an all-in-one solution for remote management and monitoring of a variety of mobile and/or fixed test probes, as well as real-time data analytics and reporting.

With TEMS Director, your team can plan and manage multiple network testing projects across a variety of TEMS solutions, including TEMS Pocket, TEMS Investigation, TEMS Paragon and TEMS Sense, all from a centralized back-office web-based user interface.

The evolution of the TEMS portfolio means that mobile network operators, engineering services providers, infrastructure vendors and industry regulators are better equipped to ensure a competitive network experience for subscribers and do so more effectively and efficiently.

With TEMS, Infovista is anticipating the challenges you will face and providing solutions to ensure you continue to deliver excellence to your subscribers. We help you make the most effective investments to succeed in the transition to the next phase of mobile network technology. With the evolved TEMS portfolio, Infovista now offers end-to-end solutions for all your network testing needs. Visit **www.infovista.com** today to learn more or request information. For the latest news about TEMS Director click **here**.

TEMS™ FOR SSV

TEMS for SSV is a web-based service that allows you to remotely control and manage a fleet of TEMS probes needed for single site verification (SSV). In addition, it links the data collected by these probes with thresholds deciding what tests need to be performed. TEMS Director helps you decide which work orders should be executed by each probe, and which routes.

Based on the autonomous tools created for normal drive-testing and benchmarking, TEMS for SSV has been extended to use commercial off-the-shelf smartphones available to the general public, and to use AI/ML techniques to determine exactly where the driver should go, what tests to perform, how long he or she should perform a test and when to move on. Our simple ‘definition of done’ algorithm and the introduction of precision drive-testing means that both uber drivers and drone pilots will soon be able to perform single site verification without any RF knowledge whatsoever. TEMS for SSV is described more fully in this **solution brief**.

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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.

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