



VIAVI

VIAVI Solutions

Brochure

Railway Telecom and Signaling Service Assurance

GSM-R · GPRS · ETCS · 5G · FRMCS
Cybersecurity · Drive-Test · Interlocking

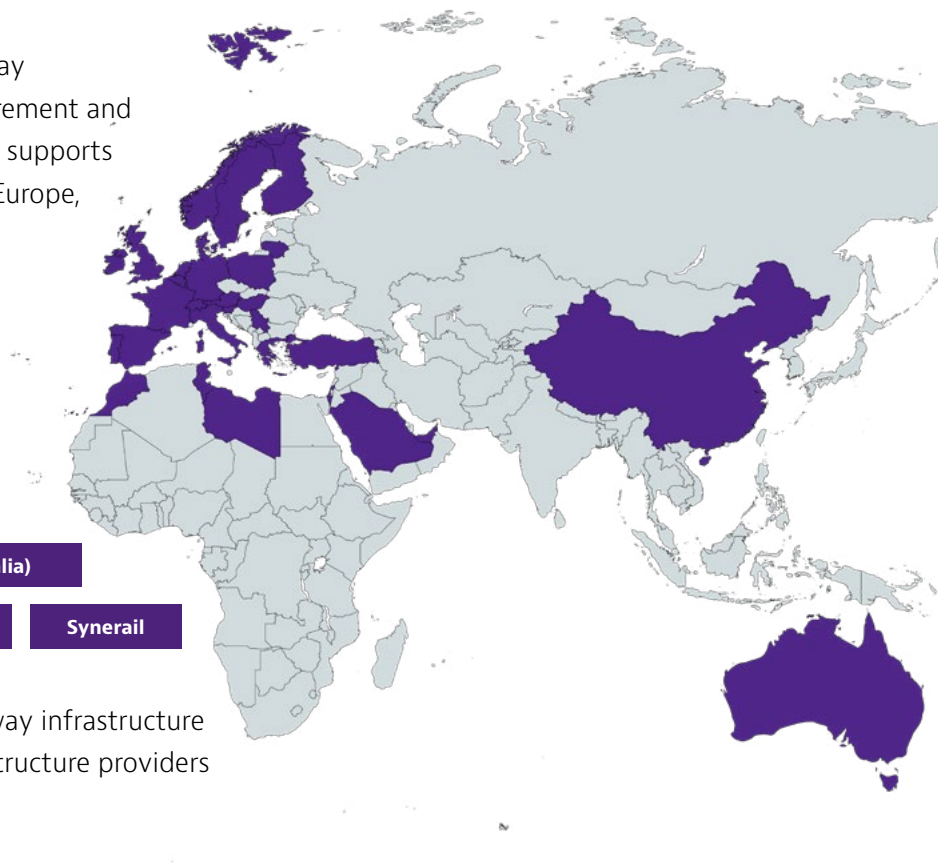
VIAVI Mission Critical & Railway (MCxR)

VIAVI MCxR provides solutions developed by experienced telecom and signaling engineers, and intended to answer all needs from teams working in the railway world. Formerly known as Expandium and Comtest Wireless International, our solutions are used daily by Radio, Signaling, NOC and Safety/Security Engineers and teams. We are currently the leading railway telecommunication and signaling assurance provide, and we monitor 100,000+ km of rail tracks worldwide.

Customers & References

Our portfolio is the de-facto, most-used railway telecommunication and signaling test, measurement and monitoring solutions in the rail industry. VIAVI supports railway operators in over 30 countries across Europe, Africa, Middle East, and Oceania.

ADIF	BaneDanmark	Bane NOR		
CFL	Deutsche Bahn	LGV BPL		
Eurotunnel	Infrabel	Irish Rail		
Mobirail	Network Rail	NIF		
ÖBB	ONCF	PKP	PTA (Australia)	
ProRail	RFI	SBB	SNCF Réseau	Synerail



Our references include railway operators, railway infrastructure and track owners, contractors, network infrastructure providers and mission critical operators.

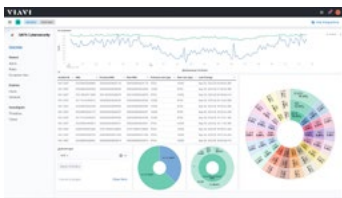
Railway User Group

Each year, worldwide customers, partners and railway professionals have the opportunity to share their experiences, challenges and concerns during the VIAVI Railway User Group. They can shape the design and implementation of future VIAVI products.

Product Portfolio & Solutions

VIAVI Solutions offer a full range of solutions, products and services, to monitor ERTMS/FRMCS, GSM-R, ETCS and GPRS networks' quality-of-service and performance. These solutions are designed and developed to be used for technical and non-technical teams, during the lifecycle of a network, from network planning/acceptance to its daily operation.

For Railway Operating Companies



OT Railway Cybersecurity



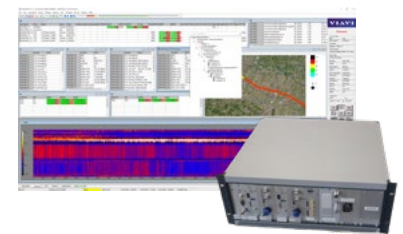
- OT railway-focused cyber-threat alerts and forensics
- Attack vector identification from source to target
- Remediation guidance with ERTMS expertise
- Interlocking threat detection
- IEC 62443 /TS 50701 compliance solution
- 3rd party SIEM integration



ERTMS & FRMCS Railway Assurance



- Real-time GSM-R, ETCS, GPRS and IXL Service Assurance | FRMCS-ready
- End-to-end transaction with full CDRs
- Call tracing & Telecom Frame Tracing (R/T)
- Railway Emergency Call (REC) features
- Movement Authority Analysis
- Train Delay Investigation
- OBU/JRU processing and monitoring



Active Tests & Measurements



- Radio Drive Test & Measurements Quality Analysis
- Diagnostics & Troubleshooting
- Interference detection
- Subset-093 KPIs/Metrics
- Autonomous usage with unattended Probes
- Spots non-compliant areas based on EIRENE specifications



*based on Big Data Technologies featuring Artificial Intelligence (AI) and Machine Learning (ML)

For Mission Critical Operators

Formerly provided by legacy Private Mobile Radio network technologies (TETRA, GSM-R...), Mission Critical features such as push-to-talk (MCPTT), group calls, video (MCVideo) and audio broadcasting, functional numbering, are now supported by standards over LTE and 5G networks. However, the technical complexity and criticality of the services require an independent solution to ensure the network's performance.

OT Railway Cybersecurity

Detect, discover and manage cybersecurity issues on GSM-R railway telecoms, and ETCS signaling systems.

Railway networks are vulnerable to cyber-attacks and security threats

Railway operators face a complex regulatory system that requires a deep understanding of operational cybersecurity measures. In addition, European railways are undergoing major changes in their operations, systems and infrastructure due to digitalization and increased connectivity. Implementation of cybersecurity requirements is mandatory for the industry's digital expansion, for its security and safety.

The railway sector is increasingly vulnerable to cyber-attacks, causing potential safety and service disruption issues. The resulting economic and, or reputational consequences could be disastrous.

While some well-documented attacks have taken place in Germany, Spain and the UK over the last three years, none have yet directly compromised critical infrastructure. However, the need for vigilance is becoming increasingly important world-wide especially when cyber attacks is on the rise.

Moreover, the railway industry is moving from mechanical technology to IP technology. As a consequence, railway operators are now facing the same cybersecurity issues as other markets.

VIAMI's Cybersecurity solution for railway telecoms and signaling systems is based on the development of NetProbe Owl and part of the QATS ecosystem, the well-established railway telecom and signaling service assurance.

It aims to be the go-to railway cyber threat solution and is the ideal solution to prevent and manage OT (Operations Technology) cyber-attacks on railway telecommunication and signaling domains: GSM-R and ETCS.



Key Functionalities of OT Cybersecurity

Stay on the lookout and get real-time alerts and forensics report if something happens:

- Attack vector identification source and target of the attack
- Scenario identification
- Raw data of event(s) triggering alerts
- Historical information

Response in alert dashboard:

- Potential impacts available to SOC
- Remediation guidance with ERTMS expertise

Reaching IEC 62443 & TS 50701 Requirements

QATS Cybersecurity helps Telecom, Signaling, SoC technicians and engineers, to monitor access from untrusted networks, audit records generated by equipment and protect the integrity of transmitted information.

It prohibits unnecessary ports, protocols, and services and can also track unsuccessful login attempts. Unauthorized wireless devices logged on the network are continuously reported and any changes to any sort of information during any kind of communication also.

IEC 62443 is an international series of standards that address cybersecurity for operational technology in automation and control systems while TS 50701 provides guidance and specifications specific for railway operators, system integrators and product suppliers.

SIEM / SOAR Integration

QATS Cybersecurity can be integrated with the operator's SIEM (Security Information and Event Management) or SOAR (Security Orchestration, Automation, and Response) solutions if needed.

They are available as a standalone system or can be integrated into an existing QATS Railway solution.

Using the same data lake and QATS probe infrastructure, means you can integrate new cyber functionalities to discover system vulnerabilities, detect attacks, monitor current statuses, and manage issues more quickly and effectively.



Use Case examples:

- Identify calls to RBCs starting from an unauthorized BTS
- Identify ETCS connection attempts made by unauthorized SIM cards
- Identify unknown eurobalises, reported by trains or from unexpected location.
- Identify ETCS level and mode changes in unexpected positions
- Identify a high number of call attempts to an RBC over a period of time.
- Identify simultaneous calls from the same SIM card



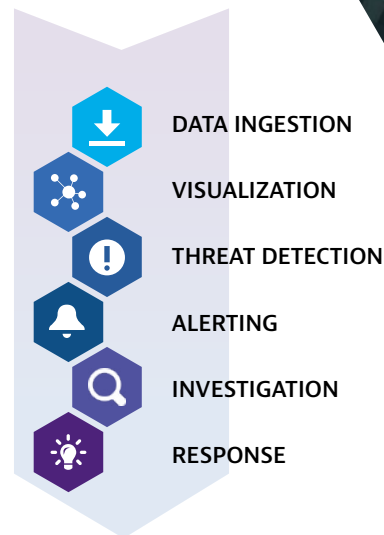
QATS Cybersecurity

Railway cyber-attack monitoring



Key Features of QATS Cybersecurity:

- Cyber sniffing of passive data
- Designed to track suspicious messages and sessions in monitored traffic
- Supports a range of pre-defined detection algorithms to spot abnormal events on GSM-R & ETCS procedures
- Sends alerts in real-time
- Conduct further analysis at protocol level in post-processing to better understand the pattern of attacks conduct
- Uses existing hardware, where possible



Safety and Security

QATS Cybersecurity applies a proven framework that proactively and automatically detects security vulnerabilities and cyber threats, reveals unknown breaches, and alerts relevant stakeholders. Below are some possible cyber-attack scenarios and/or threats with its possible impact/risk.

Cyber-attack scenario	Possible Impact or risk
Stolen SIM card	Traffic disturbance
ETCS L2 service degradation attempt on train	Safety (train accident)
Intrusion attempts on ETCS Network	Information Leaks
Global GSM-R disturbance attempt	Train stop, train delays
Local GSM-R disturbance attempt	Train stop, REC Alert inhibition
Alteration of train presence on a track session	Safety (train accident)

ERTMS & FRMCS

Best-in-class Railway Telecommunication & Signaling Service Assurance for GSM-R, ETCS, GPRS, IXL and already FRMCS-ready.

Solutions Across Entire Network Lifecycle

VIAVI Solutions offer a full range of solutions, products, and services, during the entire lifecycle of your railway telecommunication and signaling networks, on current standards such as GSM-R, ETCS, GPRS or on upcoming standard such as the Future Railway Mobile Communication System (FRMCS). Either used from network planning all the way to network testing and optimization, or for your daily operations, VIAVI has you covered.



- Certify to UIC/ERA specifications and standards
- Guarantee neutrality by providing independent and non-biased solutions
- New tracks/lines rollout tests on telecom, signaling and interlocking
- Assist railway operators with the future transition to FRMCS (5G-based)

- Assure quality of service for NOC/SOC
- Alert and pinpoint network issues for faster resolution
- Minimize and/or prevent train-delays
- Ensure processes were respected during incidents requiring legal investigations.

- Alleviate drive-test constraints through automation and unattended equipment
- Free-up personnel and save OPEX: "do and get more accurate tests with less"
- Improve operational efficiency with predictive maintenance based on machine learning
- Increase network's security and safety with recent railway cyber attacks

Railway Telco and Signaling Service Assurance

Railway operators need dependable, unbiased, future-proof, secure, end-to-end monitoring and troubleshooting tools for railway telecommunication and signaling networks. Either for current-gen ERTMS or to prepare and deploy FRMCS, railway telecommunications must be totally monitored from end-to-end for performance, economic and safety reasons.

Our QATS and NetProbe products were developed for and with Railway Operators across the globe, to monitor, detect, troubleshoot, and optimize any aspects of a railway's telecommunication and signaling networks.



QATS Railway

Passive GSM-R & ETCS Monitoring



QATS Railway is a quality monitoring and troubleshooting solution designed from the ground-up for railway telecommunication networks. The solution is built around the latest and upcoming industry standards such as the European Rail Traffic Management System (ERTMS), including GSM-Railway (GSM-R), GPRS and European Train Control System (ETCS) and the Future Railway Mobile Communication System (FRMCS).

Over 30+ railway operators trust VIAVI Solutions, QATS Railway's being the best-seller product. QATS Railway is a railway telecommunication quality-of-service performance monitoring and troubleshooting tool.

KPIs & Alarms

A large set of Key Performance Indicators (KPIs) is available in QATS Railway providing the most meaningful metrics for day-to-day monitoring and/or reporting purposes.

With the addition of an alarm console, which automatically triggers alerts upon thresholds set by the user, operators are able to monitor, and troubleshoot their network proactively.



QATS Railway

QATS Railway is the leading performance monitoring and troubleshooting solution for railway telecommunication networks. Used to monitor 100,000+ km of tracks around the world, QATS Railway is the benchmark tool used by European railway operators, during daily operations and rollouts of their various networks.

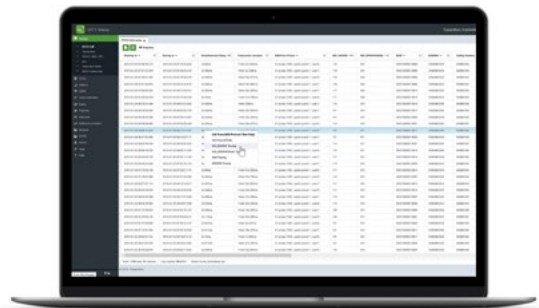


Call Tracing

QATS Railway offers an all-in-one call tracing feature which stores and displays all the network's transactions from end-to-end in a graphical scaled view. Operators are able to export traces and analyze through packet analyzers, GSM, GPRS, GSM-R & ETCS protocols.

Tracing, Subscriber Activity & Radio Stats.

QATS Railway records the entire network's activity. Operators are able to replay long term data records of any GSM-R or ETCS transaction that occurred in their networks. Specific condition and filter editors have been designed to easily find calls the operators need to investigate. It uses a top-down philosophy.



Case study

QATS Railway is being used to provide network performance reporting, record and replay all trains, dispatchers and equipment activities to troubleshooting failures. QATS Railway also analyzes functional behavior and is regularly used during legal matters to ensure all processes were respected.



QATS Signaling

ERTMS Signaling & Interlocking
Monitoring



QATS Signaling is a solution entirely dedicated for ETCS monitoring. It has been developed closely with Signaling Engineers and Operators in order to answer specifically to their needs such quickly sorting issues between GSM-R & ETCS, Movement Authority Analysis, Train Delay Investigation and more. QATS Signaling shares the same architecture as QATS Railway and can operate efficiently without any additional hardware.

Session Tracing

QATS Signaling's main feature is to display ETCS Call Tracing as well as Telecom Frame Tracing. Users are able to visualize in one window performance monitoring, session tracing and troubleshooting of ETCS.



QATS Signaling

QATS Signaling is a product developed purely for the monitoring and troubleshooting of ERTMS and interlocking. It detects and analyzes malfunctions affecting railway operators' overall quality of service, such as train run delays, end-of-session issues and other metrics.



ERTMS Performance Monitoring

By measuring all Subset-093 metrics based on real ETCS traffic, QATS Signaling can assess a network's accessibility, retainability and integrity by measuring KPIs such as connection establishment delays/errors, the connection loss rate and many other metrics.

Train Trip Root Cause

QATS Signaling monitors all ETCS trains driving mode updates. If a train turns into Trip Mode, its emergency brakes are automatically applied which will disturb the railway traffic. QATS Signaling is able to identify the root cause of the Trip mode activation (e.g. T_NVCONTACT expired, missed linked Balise group, Unconditional Emergency Brake, and more), and enables a troubleshooting within the Subset-026 messages for behavior analysis.



Finding the root-cause of train delays

QATS Signaling can help operators investigate if a train delay is the result of an ETCS issue. It can be used either proactively or in response to a detected issue by comparing any current train run with a reference timetable.



REC Alert

Railway Emergency Call Monitoring

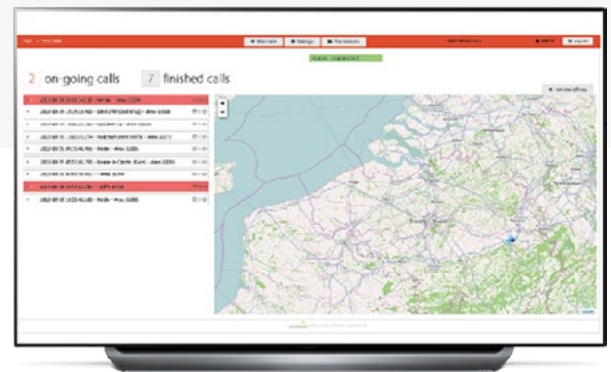
REC Alert is a solution built to easily monitor Railway Emergency Calls in real-time. It offers a simple, yet very effective, user interface that stores and monitors constantly the highest priority calls of your network ensuring maximum safety. The solution includes a translation feature enabling users to display understandable information instead of codes (for areas for example). Therefore REC Alert is an easy-to-learn and easily accessible for NOC Teams.

Details, Reports & Exports

REC Alert displays by default a summary of each RECs. If the user needs more information, the SCCP, mobile and fixed dispatchers' lists are displayed. The user can export the data to other third-party solutions and easily generate reports, which can be used for legal issues when incidents occur.

Real-time REC Monitoring

REC Alert will display the complete details of ongoing and completed railway emergency calls on its main interface. It includes a map to pinpoint where the REC occurred.



Services

A dedicated Service Team provides a full range of services over the whole life cycle of your network: radio design, acceptance, optimization, operation and maintenance. Our team can work with off-the-shelf VIAVI products, develop dedicated tools or even work with your tools and solutions.

Radio coverage: To assess the quality of the radio coverage including RF design, EIRENE criteria analysis. From network deployment to performance control, the compliancy to SLAs and SRS are analyzed and recommendations are given.

QoS, interferences and compliance to standards: This service aims to measure the quality of service through KPI or drive tests analysis. Recommendations are provided to improve the network's behavior in order to meet railway requirements in compliance with railway constraints.

Telecom Safety Audit: VIAVI safety audit ensures that Voice Group Call Services (VGCS), Railway Emergency Calls or Location Dependent Addressing (LDAs) are in conformity for maximum safety. Metrics include calls routed to expected dispatchers, calls successfully broadcasted to cells and dispatchers or calls established in less than 2 seconds.

Managed Services

A full service during a pre-defined timeframe allowing operators to spare their technical team, save time and gain from VIAVI specialized tools and expertise.

Pre-acceptance consultancy services

Our service team can capture, decode, provide full report with analysis and recommendations on the various issues detected before an acceptance in order to be fully compliant.

Support Services

Our product platform is installed and an access to all fully fledged solutions is provided to the network operator with full support of VIAVI for the operator's various analyses.

e.g. of analysis

- Analysis of white communication/calls
- CM-88: detect/locate broken links
- V.110 and LDA analysis
- Train delay root-cause identification

Active Tests & Measurements

Industry-leading Railway Drive Test Equipment
and more.

Introduction to Drive Testing

Railway operators depend on efficient and reliable telecoms networks to ensure operations run smoothly and efficiently. Our NetProbe wide range of products is there to meet your budget and test/measurement requirements.

Testing Network Compliance

Drive Tests involve the use of specialized electronic equipment that measures the mobile network air interface. This can be either installed in a test vehicle or used as a portable device. The test systems can be operated manually, remotely or automatically, along a pre-defined route.

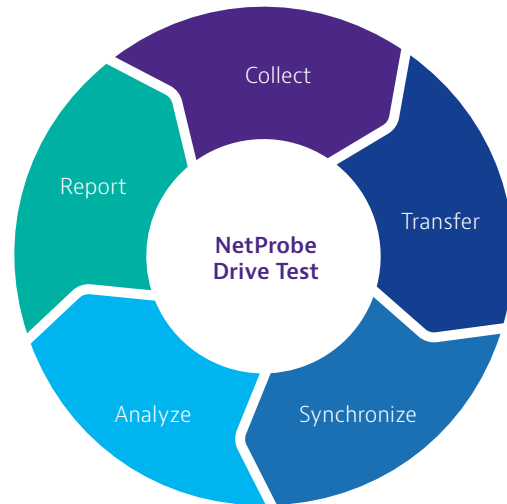
They collect and record information relating to a network's service in the given geographical area they are testing.

The results are then used to measure the Quality of Service (QoS) against a set of pre-determined KPIs, as well as for diagnostic and troubleshooting purposes.

The initial test & measurement of a rail telecoms network normally takes place at the installation and acceptance stages, using a Drive Test system. Even before installing the network, it is important to make sure the frequencies to be used are not affected by interference from third parties (band clearance).

During the installation phase, first coverage and network accessibility tests are performed. This is followed by reliability testing while moving across the network.

Eirene SRS and FRS together with O-2875 and Morane are key rail test specifications that are often used. These are normally met by the telecom vendors but it is key for a railway operator to know exactly which specification or standard the network is compliant to.



Example network acceptance tests	
QoS	<ul style="list-style-type: none"> • Radio coverage • Call setup and connection loss rate • Handover break time • Functional number registration/deregistration • Test of ASCII functions • O-2875 – EIRENE QoS requirements
Additional mandatory tests to comply to ETCS L2	<ul style="list-style-type: none"> • O-2475 data testing in CS mode • O-2475 data testing in PS mode
Additional functionality testing	<ul style="list-style-type: none"> • Intra and extra system interference • E2E Voice Quality test • 3G, 4G, 5G MNO interference • Radio performance benchmarking • TETRA service



NetProbe Drive Test

Active GSM-R & ETCS Network Testing

The Drive Test Portfolio

Choose the right NetProbe Drive Test solution to suit your budget and requirements. The wide range of options means you can collect data using remote, automated, and manually operated systems, installed in a vehicle or as portable devices.

Installed Racks & Cabinets

for test trains



Portable Trolleys

for network testing
& certification



Portable Backpacks

Easy to use for certification



Smartphone Solutions

2G, 3G, 4G, and 5G App-based testing

Operational Methods: Manual or Unattended

Collecting data from NetProbe drive test equipment is easy. You can collect data remotely, and even automatically in some instances, with unattended drive test. You do not need to physically dedicate an operator on site, which saves you cost, time, while being covid-safe. Data collection can be triggered by time, distance or geolocation. You can schedule repetitive test patterns, collect measurements and events and receive real-time alarms. If you prefer manual data collection, you can use an operator in attendance to start/stop tests, and change test configurations using the expert onboard option.

Installed rack solutions

Dedicated test trains provide the facility to permanently install Drive Test equipment in racks or cabinets.

Each solution is configured based on customer requirements and can be set up to be operated manually, remotely or automatically, along a pre-defined route.



Portable solutions

Diagnostic and maintenance teams often find it convenient to use portable Drive Test solutions. That's because the test train may not always be in the right location at the right time, to run the necessary telecoms tests. This is especially true when frequent testing is needed for ECTS level 2 operational lines.

Portable trolleys and backpacks make it easy to run the same rail telecoms diagnostic tests, whenever and wherever they are needed.



Portable Key Features

- Allows full network certification for GSM-R Voice, CS, PS and ETCS L2
- Use in manual, remote, and unattended modes
- Up to 2 trace modem 8W
- 1 RF scanner (TSME)
- 1 odometry & GPS onboard
- Battery life: 3 hours continuous operation

Smartphone solutions

NetProbe Drive Test Pocket makes it easy to both verify railway telecom network deployments and ensure ongoing service assurance.

Because it is App-based, it's straightforward to script and run automated tests on a smartphone. Then it is just as easy to transfer all data collected for further analysis and reporting.



Smartphone Key Features

- Suitable to test and measure 2G, 3G, 4G & 5G railway telecom networks
- NetProbe Pocket App runs on most commercial smartphones
- Supports both Qualcomm and HiSilicon (Huawei) chipsets with one universal license
- Transfer licenses from one device to another
- Real-time view of license usage
- Easy to set up and launch automatic scripts
- Store data in the handset and download manually, or upload it automatically to a central server

Benefits of Unattended Drive Testing

With Unattended Probes, users are able to create and upload remotely, different testing scenarios to the onboard probes. Once the onboard probes have been set, they become fully autonomous and transmit the metrics used to build KPIs providing the actual network's quality-of-service.

Features

- Latest modems: GSM-R 8W, 3G, 4G and 5G.
- Scanner available.
- Smart power module: includes batteries to avoid dropped calls when the train is powered-off.
- Autonomous: remote management and automatic data upload to the Drive Test server.
- Scenario starts based on GPS/trackline position
- Certification: EN 50155, 45545-2 and more.



	Traditional Drive Test	Unattended Probes
Type	Active	Active & Passive
Usage*	On-field, requires a technician or an engineer onboard the train	Remotely, no one needed onboard
Continuous Monitoring	No	Yes
Coverage	Limited, usually sections	Entire lines/network
Train type*	Measurement trains	Measurement, maintenance and/or commercial trains
Data transfer	Manual	Automatic data transfer
Availability*	Limited, requires booking a train	24/7

* *Cost-effective solution: the Unattended Probes solution enables a lot of cost-savings for the railway operator. All the information is accessible and can be downloaded from the front-end of the solution, making it more cost-effective, faster, and less time-consuming for operators than conventional drive-tests. After the initial installation, no further intervention is needed on the train equipment side.*

Compatibility

Non-exhaustive list of supported-devices

Cab radios	<ul style="list-style-type: none"> • Funkwerk • Triorail • Sepura (Tetra)
RF scanners	<ul style="list-style-type: none"> • R&S TSME • R&S TSM-L • R&S TSM-Q • R&S TSMU and TSMW
Standard modems	<ul style="list-style-type: none"> • Sierra Wireless • Triorail • Quectel • Telit



Key Takeaways

	What to test	When to test
Unattended Drive Test <i>e.g. Racks, trolleys, and backpacks</i>	<ul style="list-style-type: none"> • Standard network acceptance • Network monitoring • High sampling KPI collection 	<ul style="list-style-type: none"> • Frequent measures (high numbers) • Generate traffic • Test coverage and simple QoS
Manual Drive test <i>e.g. Trolleys and backpacks</i>	<ul style="list-style-type: none"> • EIRENE acceptance test • ERTMS E2E QoS verification 	<ul style="list-style-type: none"> • Dedicated train not available • Line certification • Complex tests needed • Flexibility needed
Remote Drive Test <i>e.g. Test trains, trolleys, and backpacks</i>	<ul style="list-style-type: none"> • EIRENE acceptance test • ERTMS E2E QoS verification • Interference, blocking etc • 4G or 5G Coverage • Tetra assessment 	<ul style="list-style-type: none"> • Accurate network measurement • Line certification • Complex test needed • MNO assessment
Drive Test Pocket <i>e.g. Smartphone</i>	<ul style="list-style-type: none"> • 2G, 3G, 4G or 5G coverage 	<ul style="list-style-type: none"> • Measure KPs such as: radio coverage, interference detection, telecom quality of service including dropped calls, initiation time, and throughput

Mission Critical Communications

Beyond Railways – troubleshooting, reporting and monitoring solutions for Mission Critical Operators

QoE solutions for mission critical systems using 3GPP-based push-to-x and mobile data services

The Emergency services, power plants, offshore platforms, and the transportation industry, are just some of the organizations who depend on public and/ or private networks for their mission critical communications.

At VIAVI, we understand that maintaining a high quality of service and quality of experience in such technically complex environments is just as important as providing the service itself.

Our expertise in testing, measuring and managing quality of service (for both telecoms networks and mission critical communications systems means we can give you all the support you need

Use our solutions to monitor your mission critical communications networks, keep track of SLAs and troubleshoot, easily and quickly.

Key Features

- Real-time end-to-end systems solutions for mission critical communications running on public and/or private networks
- Troubleshoot with SecureQOS, a comprehensive solution to pinpoint issues quickly and easily
- Check KPIs, SLA performance with ExploreQOS, a configurable reporting dashboard
- Test the network automatically or on demand with 'Drive Test' solutions to test coverage vs SLAs and identify interference issues
- Suitable for group calls, video calls, chat, emergency calls, MC Data calls and more
- Powerful reporting and alerting features
- 4G and 5G ready

Example of MCPTT KPIs	
3GPP TS 22.179 version 14.3.0 KPIs <ul style="list-style-type: none">• MCPTT Access time (KPI 1)• End to end MCPTT Access time (KPI 2)• Maximum Late call entry time (without application layer encryption) (KPI 4)• Maximum Late call entry time (with application layer encryption) (KPI 4)	Additional KPIs <ul style="list-style-type: none">• MCPTT identifiers• Group Broadcast Group• MCPTT Emergency Group Call• MCPTT Group Call• Broadcast Group• MCPTT Request• Preemption• Interworking with non 3GPP PTT systems<ul style="list-style-type: none">• Interaction with telephony services• Legacy land mobile radio GSM-

Request our Railway and Critical Communication Architecture Posters



VIAVI covers all protocols and interfaces in mission critical and railway networks. Our teams follow closely the latest specifications and adds twice a year at each product releases, new protocols and interfaces.

Download our free network architecture posters at www.viavisolutions.com

About VIAVI Solutions Inc.

VIAVI (NASDAQ: VIAV) is a global provider of network test, monitoring and assurance solutions for communications service providers, enterprises, network equipment manufacturers, government and avionics. We help these customers harness the power of instruments, automation, intelligence and virtualization to Command the network. VIAVI is also a leader in light management solutions for 3D sensing, anti-counterfeiting, consumer electronics, industrial, automotive, and defense applications.

Learn more about VIAVI at www.viavisolutions.com or contact our Sales team at expandium.sales@viavisolutions.com



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