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## White paper

# Options for Measuring Rail Telecoms Network Performance with Drive Test Systems

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## Introduction

Today's railways are highly complex technical environments that depend on multiple systems, provided by multiple vendors and suppliers. All these systems need to work together to provide continuous, safe, effective and efficient operations.

This complexity and interdependency, coupled with the ongoing digitisation, of the rail infrastructure, means that there is a greater requirement to more frequently test, measure and monitor rail subsystems, than ever before. For example, the proactive monitoring and testing of the telecommunications and signalling system performances can offer significant operational benefits and efficiencies.

In this paper, we will examine how the highly practical challenges of time and budget can affect rail telecoms performance management. We will also discuss how these challenges can be overcome, to enable those working in rail infrastructure management and rail telecoms operations to improve operational efficiency and effectiveness - using remote and cost-effective solutions.

The main focus of this paper explores the above using the viewpoint of measuring the Telecom's network air interface performance. It should be noted that similar testing methodologies and approaches using probes connected to the Telecom and Signalling networks (should they be available), can also yield complementary, overlapping and valuable network performance information – but are not discussed in this paper.

## A question of balancing priorities

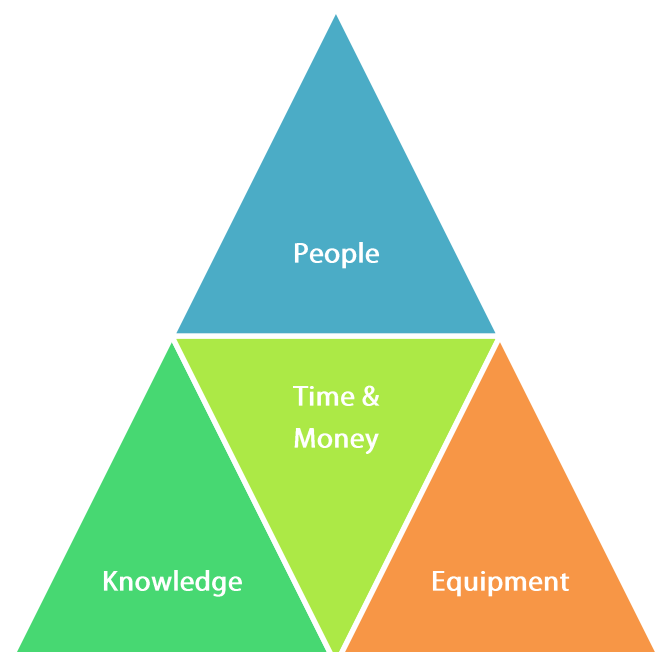
How well a test, measurement or monitoring service can meet requirements depends on the resources available. These are likely to include: number of people, level of knowledge within the team, and type and amount of equipment, as well as amount of time and money allocated.

Each variable can be an 'enabler' or a 'disabler' for the service, as if they fall short of the requirements, they will restrict the service.

For many services, the internal deadlines (time) and budget control (money) are likely to be the most constraining factors in the strive for quality and performance management.

However, within these constraints, the external factors such as the right people still need to be in place, with the necessary knowledge, and access to the right type and amount of equipment.

In the next two sections, we will examine some key points to take into



consideration, when looking to provide a new or enhanced service or project, and where you simply want to get the most value from the assets that already exist.

## 'Buy' or 'rent' – which is best?

When the level of a service needs to be increased, improved or changed, this will usually need to be done within specified project requirements and may involve new equipment, new skills or new people.

For any of these 'external' variables, some key questions will typically be:

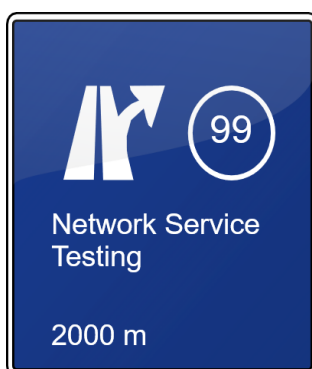
- Where do we find the necessary resources?
- How long do we need them?
- How much will they cost?
- What's the best way to meet the budget and deadlines?

In many cases, the answers will involve deciding what's best (and available within the timescales) when it comes to:

- People: Buy (hiring extra staff) vs rent (using secondees or contractors)
- Knowledge: Buy (hiring highly skilled staff or training existing staff) vs rent (using contractors)
- Equipment: Buy vs rent or lease

## Examples of measuring options

**This section explores how the buy vs rent concept can be used to develop packaged service arrangement options, which offer a practical and flexible approach for rail telecoms test and measurement, combining hardware, software and services. Three example scenarios are outlined.**



**Scenario 1: a vendor responsible for installing rail telecoms on a new line wishes to ensure it meets project requirements and industry standards, in order to gain acceptance from the rail infrastructure organisation.**

In terms of equipment, the vendor has access to a test train, on which a measurement unit, power and 2-3 roof antennas (for radios and scanner etc) need to be installed.

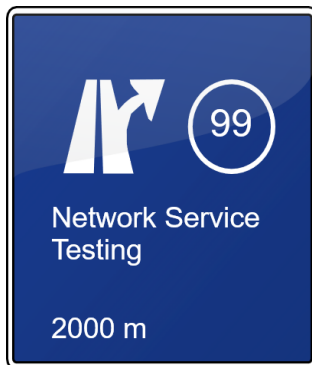
The drive test measurements that are required to be taken relate to the UIC standard O-2475 (CS-PS) and Voice Quality.

Given the equipment is required for the entire period of interest, it probably makes sense in this scenario to lease it rather than purchase it (unless it can be re-used in another upcoming project).

With regards to the people and knowledge levels, the tests require a certain level of expertise in both rail and telecoms to be able to create the scripts, conduct the tests and then produce and interpret the reports. If such knowledge is not currently within the vendor's team, it will need to be

**Why not look at hiring the test equipment and reporting services from a provider with dedicated expertise in this market?**

found – and again, if the project is a one-off, it may be more prudent to consider the ‘rent’ option, rather than hiring permanent head count.



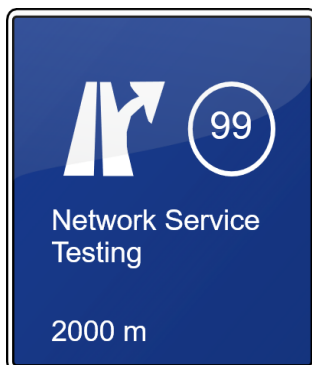
### **Scenario 2: a train operating company needs measurement expertise and services to help identify and manage trouble spots in its GSM-R network.**

One of the train operator’s responsibilities is to provide an international service that links one capital city with another, using a high-speed line.

To ensure the GSM-R network is operating correctly, the high-speed line requires regular testing between the city centre and the border. However, as this needs to be conducted every few months, and requires detailed technical knowledge and expertise, it is more cost-effective for the train operator to outsource the test and measurement than to employ the staff directly.

As a result, it has chosen to ‘rent’ a packaged service that provides both the expertise and personnel needed to collect the drive test data with regards to voice calls, data calls, as well as using a scanner to check for interference.

Once the data is collected and analysed, the train operator receives performance quality reports, as part of the service. These reports highlight the areas where MNO interference is affecting the GSM-R coverage and also identify dead spots, where there is no GSM-R coverage. It means it is easier to detect areas of degradation in service and failures in coverage due to interference or equipment failure. This knowledge is highly valuable in enabling the train operator to be well positioned with regards to working with the relevant third-party organisations to address these issues.



### **Scenario 3: testing and proactive maintenance for a rail telecom infrastructure owner**

This rail infrastructure owner possesses a fleet of test and measurement vehicles. As part of ensuring it provides effective and efficient service, the company needs to regularly test the rail telecoms connectivity along the network and to ensure all equipment is operating correctly.

The organisation chooses a packaged service to help them accomplish this. A small team of dedicated and experienced engineers use remote management to start, stop and manage test train runs, as well as attending selected runs, as required. The attended train runs are used to test equipment, ensure that connectors are working as they should and that data cards are still valid etc. As these are areas which can cause problems, this proactive approach can even prevent issues from occurring.

Also included in the service is data collection and compilation, from which, status reports are provided on an agreed basis. The results are used to ensure operational KPIs and SLAs are met and also to identify current trouble spots.

**Packaged services provide the equipment, expertise and resources so that train operating companies and rail infrastructure providers can focus on their core business, efficiently and effectively.**

## Unattended and automated packaged testing services

Comtest Wireless can offer a range of packaged services including:

- Equipment rental of proven state-of-the-art unattended drive test units
- Installation & testing
- Track database creation
- Creation of a portfolio of reports (typical and tailored to meet specific requirements)
- Access to the Comtest team's expertise, experience and support

As the test and measurement units are unattended, tests can be conducted without needing staff onboard trains. These include tests based on distance, time etc, as well as the ability to use geo-fencing to automatically remotely trigger tests to start/stop based on location.

A wide range of tests can be conducted by the specialist team at Comtest, including:

- LTE WCDMA GSM decoding
- RF measurement
- Voice call
- UIC O 2475 CS tests and PS tests (latest draft)
- Voice Quality
- ASCI Test (with no interaction)
- 3G, 4G throughput & Quality of Service (QoS)

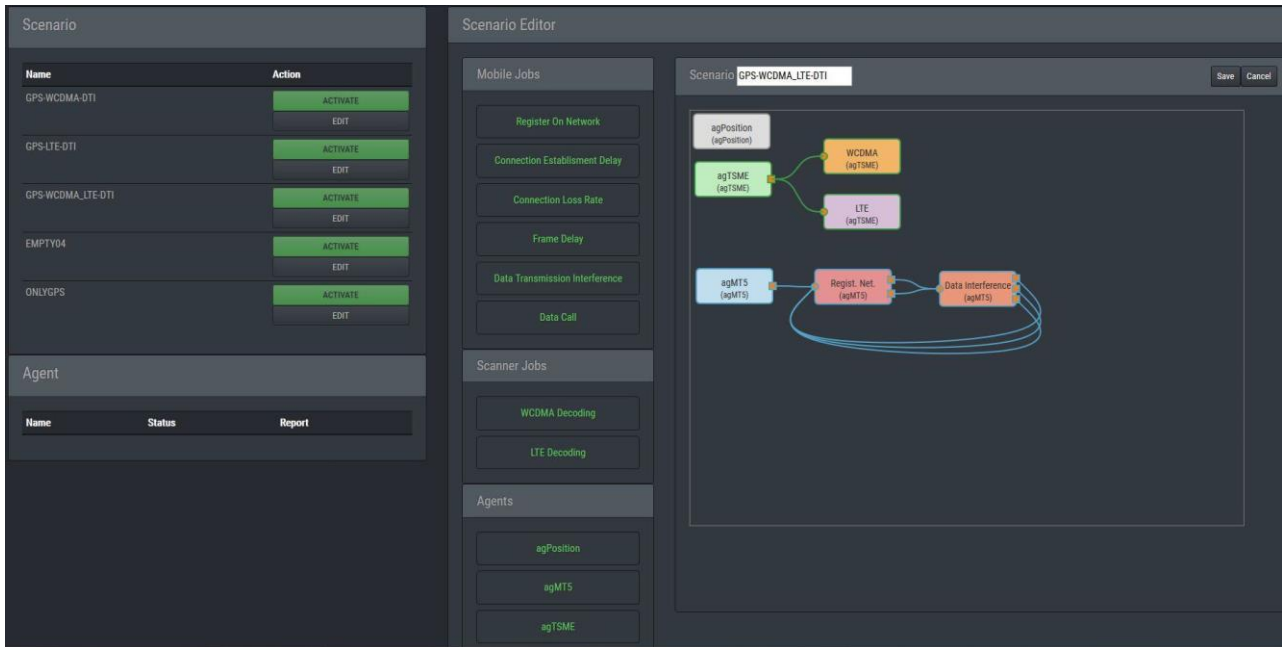
**“In situations such as Covid-19, which affect general travel and access to certain worksites, the use of unattended units and automated data collection and reporting can enable vendors to continue testing with no personnel onboard trains.**

**This can help to reduce any delays in gaining acceptance, project completion and payment.”**

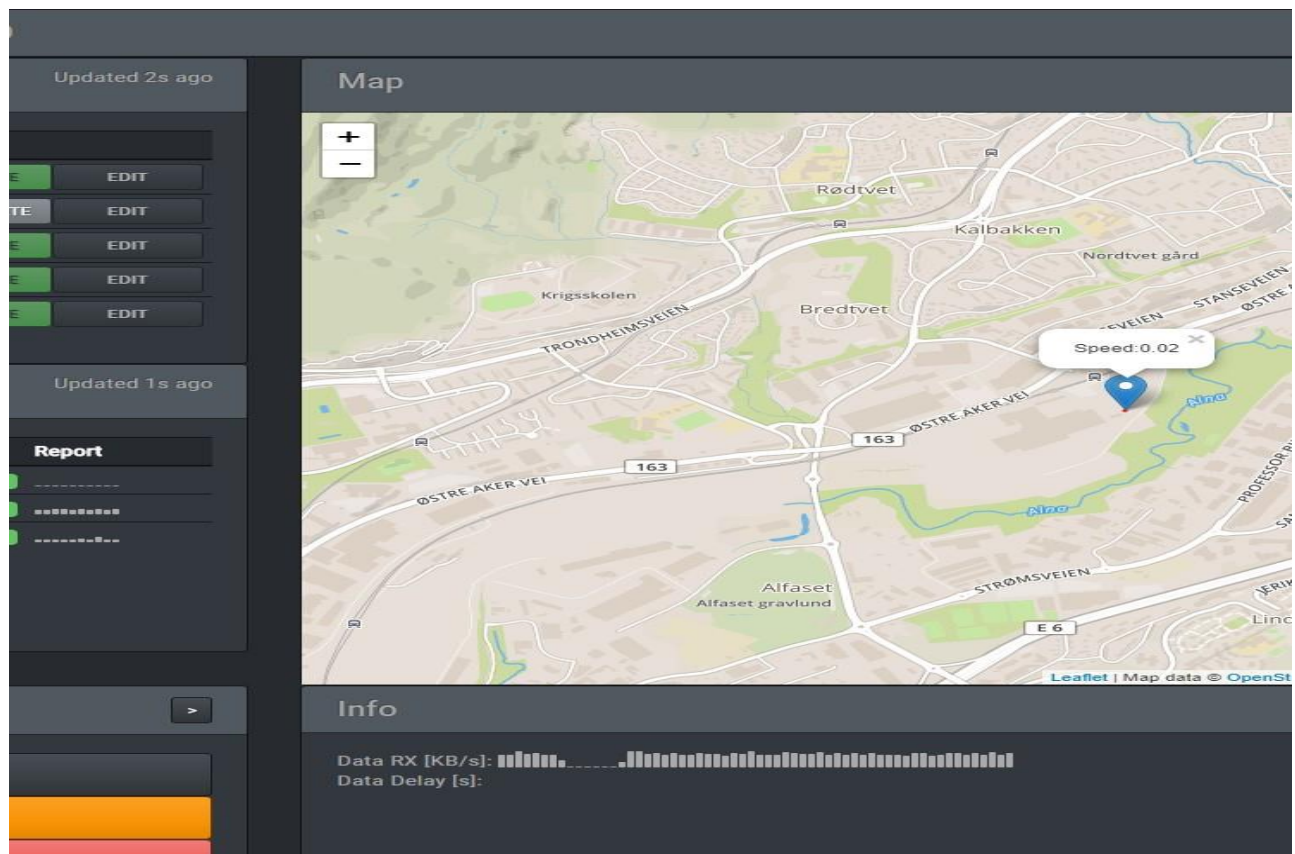
## Remote test configuration

All the test scenarios can also be remotely configured (for example: see images below).

Test scenarios can be re-run or adapted.



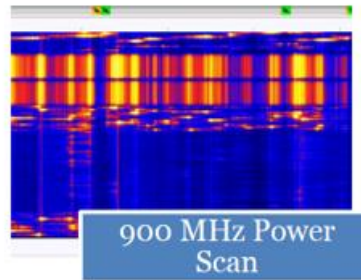
All the data collected from the train runs and tests is transferred in real-time from the equipment using a 3 or 4G bearer or Wi-Fi into the Analytics platform.



The inclusion of a track database means that geo-positioning is dramatically improved, which helps to create better and more accurate reports.

# Professional reports

A range of typical and customised reports can be provided by Comtest Wireless, some example screenshots are shown below:



Handover analysis

General KPIs



KPI measurement reports, which can be produced include those for basic, advanced and ERTMS KPIs, such as:

- **Coverage**
  - Envelope
  - Eirene 95 th percentile (Lee Criteria)
- **Voice Call (MOC)**
  - Accessibility (CED CEER)
  - Retainability (CLR)
- **Handover**
  - Success rate
  - Handover break time
- **ASCI Call**
  - Accessibility (CED, CEER)
- **Voice Call**
  - Mobile Terminating Call
  - MOS evaluation (PESQ)
- **MNOs wide band emission evaluation**
  - Blocking & Interference
- **O - 2475 QoS Circuit Switch**
  - CED
  - CEER
  - CLR
  - TTi TRec
  - TD
  - RD
- **O - 2475 QoS Packet Switch**
  - Transaction Transfer Delay
  - IP Resolution Delay
  - GPRS Attach Delay
  - PDP Context Activation Delay

Other reports and KPI reports are available on request.

## About Comtest Wireless

**Comtest Wireless is an Anglo-Italian company that provides world-class on-board & wayside test, measurement and monitoring solutions for rail telecoms and signalling systems.**

As vendor independent experts, its solutions enable data to be collected and monitored on-board and wayside from multiple sources, vendors and types of equipment. This provides a unique, consolidated view across the total network, which saves time & money on conducting telecoms and signalling performance assessments and on failure investigations.

Customers are vendors and operators of rail telecoms and signalling systems. They include rail operators, telecom operators, equipment vendors and government agencies. Clients have access to the team at Comtest Wireless, who have extensive and valuable domain knowledge and expertise. They are happy to discuss client requirements, including specifications, installations, data collection, software and reporting customisation, as well as training and support.

## What next?

**If you are interested in learning more about how Comtest Wireless can help your organisation with a new way of measuring, using our packaged services, please get in touch.**

**Email: [contact@comtestwireless.eu](mailto:contact@comtestwireless.eu)**

**Visit: [www.comtestwireless.eu](http://www.comtestwireless.eu)**

**Thank you**