

proxion

Radio Testing for ERTMS

Kimmo Kolehmainen, Proxion

proxion

Radio Testing for ERTMS



Kimmo Kolehmainen, M.sc. Telecommunication

- **Technical Manager**
- **Project manager for Mobile 5G Laboratory**

Background

Why radio communication is needed?

ETCS level 2

- Traffic control communication
- Voice communication

ETCS level 3

- Train integrity and constant position communication

ATO

- ATO operation communication
- Video communication

How to communicate?

GSM-R

Will become obsolete between 2035-2040

Circuit switched communication

Packet switched communication

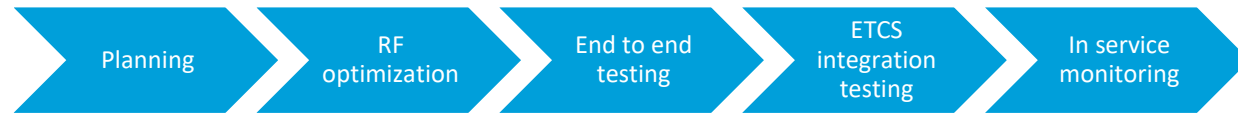
FRMCS

Is replacing GSM-R

Based on 5G technology

Packet switched IP based communication

When radio measurement and testing is needed?



Planning

- Discover current radio network environment

RF optimization

- Measuring radio performance indicators for the network

End to end testing

- QoS testing according to test specification

ETCS integration testing

- Integration tests using RBC and OBU

In service monitoring

- Measuring radio network when system in operation

What should be measured?

Physical layer

- Current cell
- Signal strength
- Signal quality

Network / Transport layer

- Packet delay
- Packet jitter
- Packet loss

Application layer

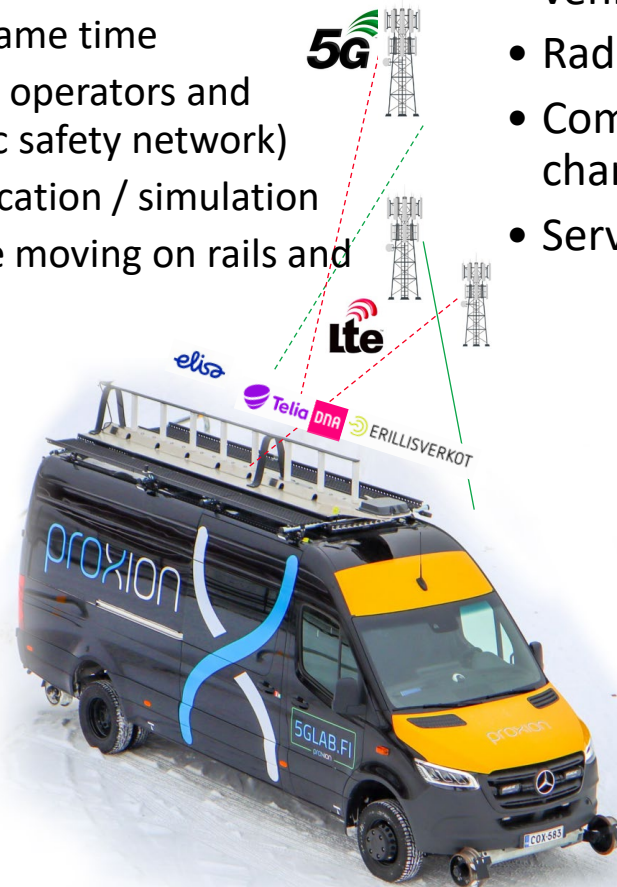
- Connection breaks
- Message success rates



How do we measure?

Mobile 5G Laboratory

- Radio spectrum and interference measurement with RF-scanner
- 4 operators can be measured at the same time
 - E.g. Option to test 3 public network operators and prioritized Virve 2.0 network (public safety network)
- Multi-channel router for ERTMS application / simulation
- Van with rail wheels to enable flexible moving on rails and service roads
 - Office facilities for two
 - Easy to modify and extend



Portable Measurement System

- Can be used in trains, locomotives or any other vehicles
- Radio and GNSS system measurement equipment
- Comprehensive network connectivity's and multi-channel routing
- Server environment for different services

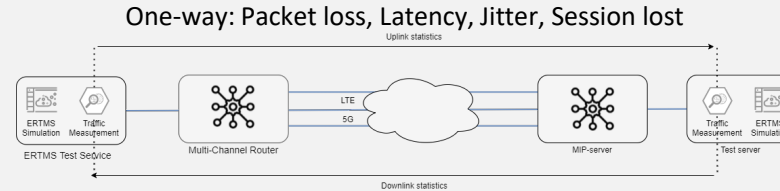
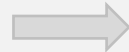


What do we measure?

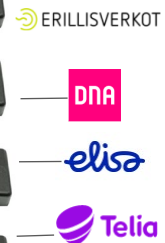
Multi-channel Router



Simulated Voice Communication Test
Movement Authority Violation Rate Test

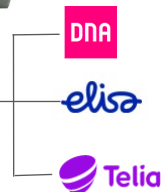
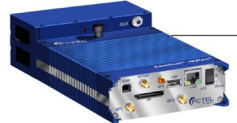


4G / 5G Modems



Signal Information	PCI	Ping Test HTTP Test DNS Test	BER Packet loss Latency Jitter Throughput
	ARFCN		
	RSSI		
	RSRP		
RSRQ			
SINR			

RF Scanner



PCI RSSI RSRP RSRQ SINR	PCI RSSI RSRP RSRQ SINR	PCI RSSI RSRP RSRQ SINR	PCI RSSI RSRP RSRQ SINR	PCI RSSI RSRP RSRQ SINR	PCI RSSI RSRP RSRQ SINR	PCI RSSI RSRP RSRQ SINR
700 MHz	800 MHz	900 MHz	1800 MHz	2100 MHz	2600 MHz	3500 MHz

proxion



Kimmo Kolehmainen

+358 45 145 8063

kimmo.kolehmainen@proxion.fi

WE KEEP
THE WORLD
ON TRACK

