



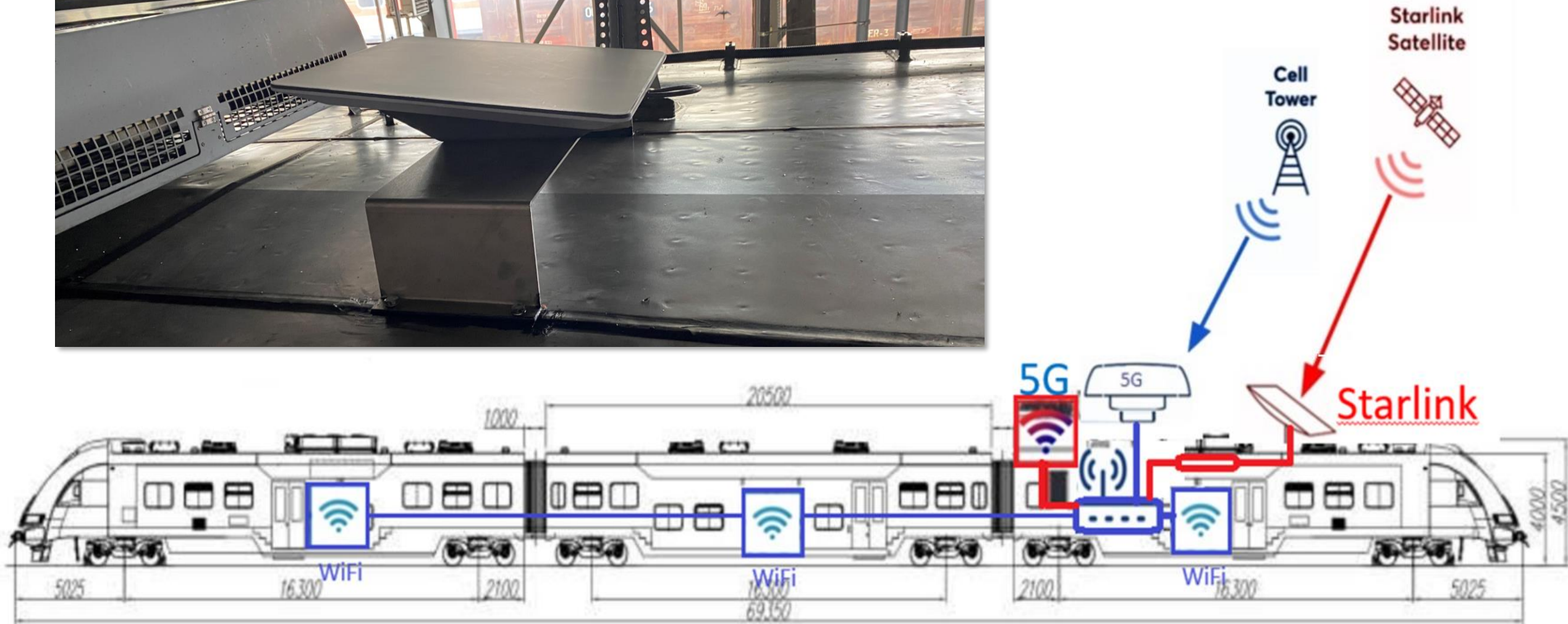
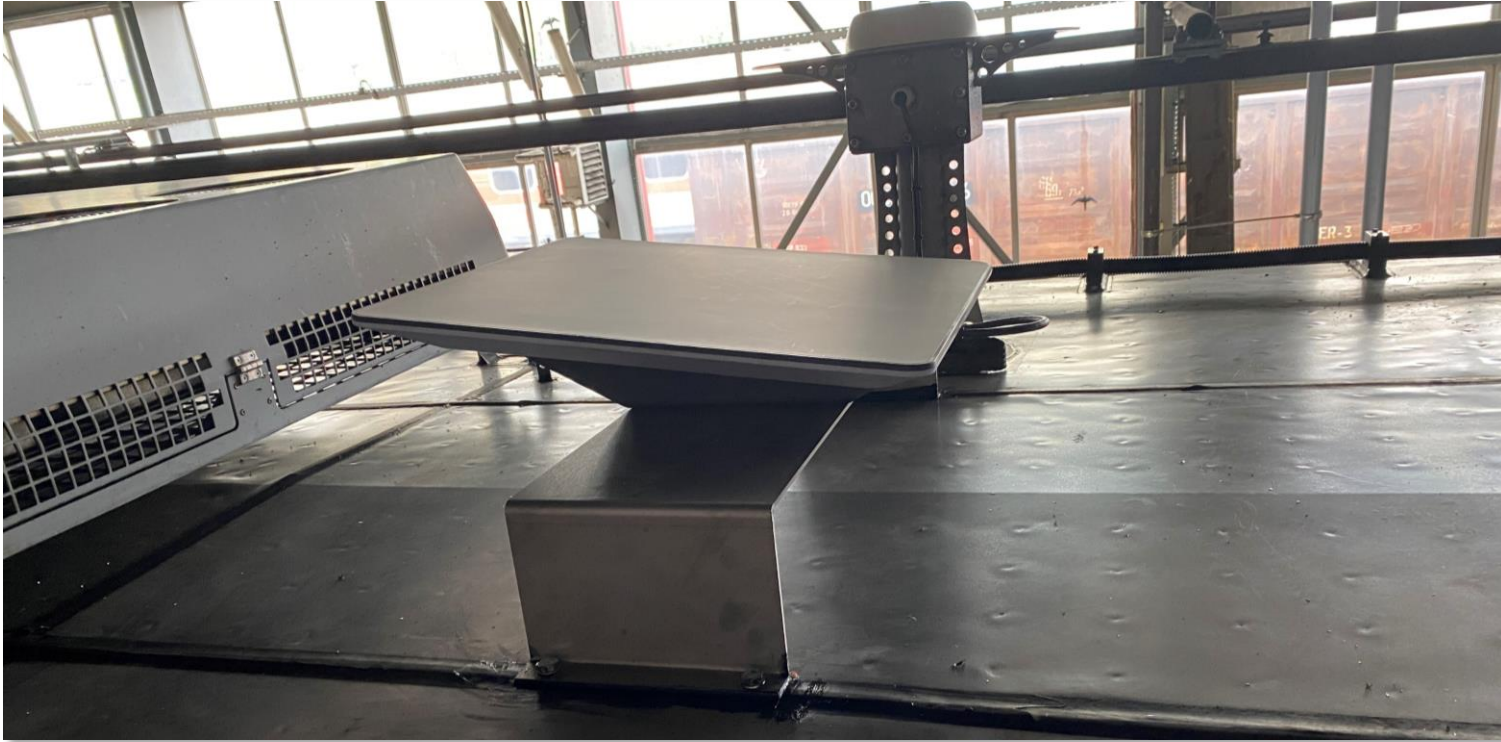
WiFi test results by integrating 5G and Starlink satellite technologies in Lithuanian LTG LINK passenger's trains

Mindaugas Bereiša, Martynas Diedelevas

Connected Future Transport Systems 2024
July 18th, 2024

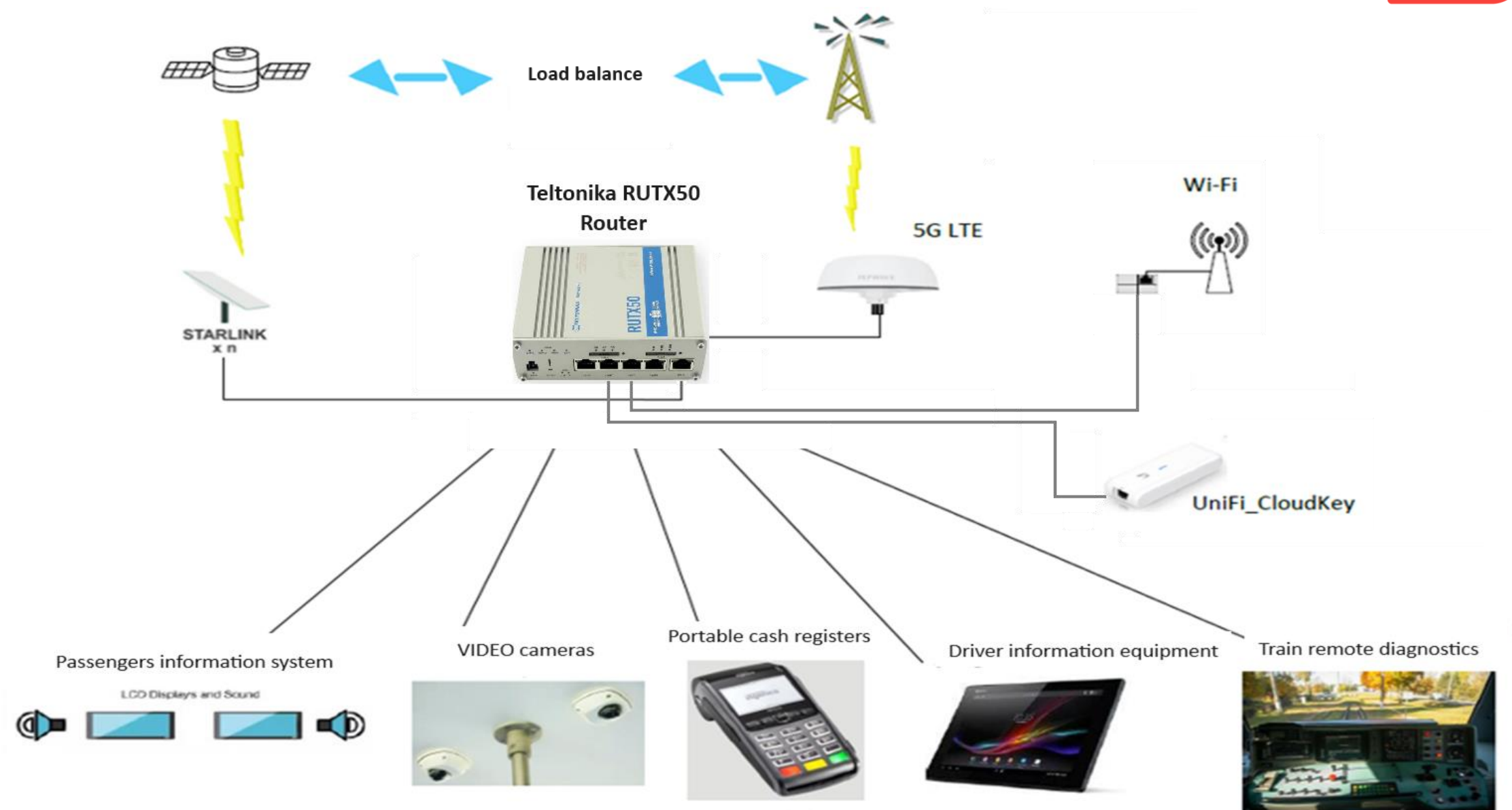
Starlink and 5G integration to WiFi internet

LINK



Hardware connection scheme

LINK



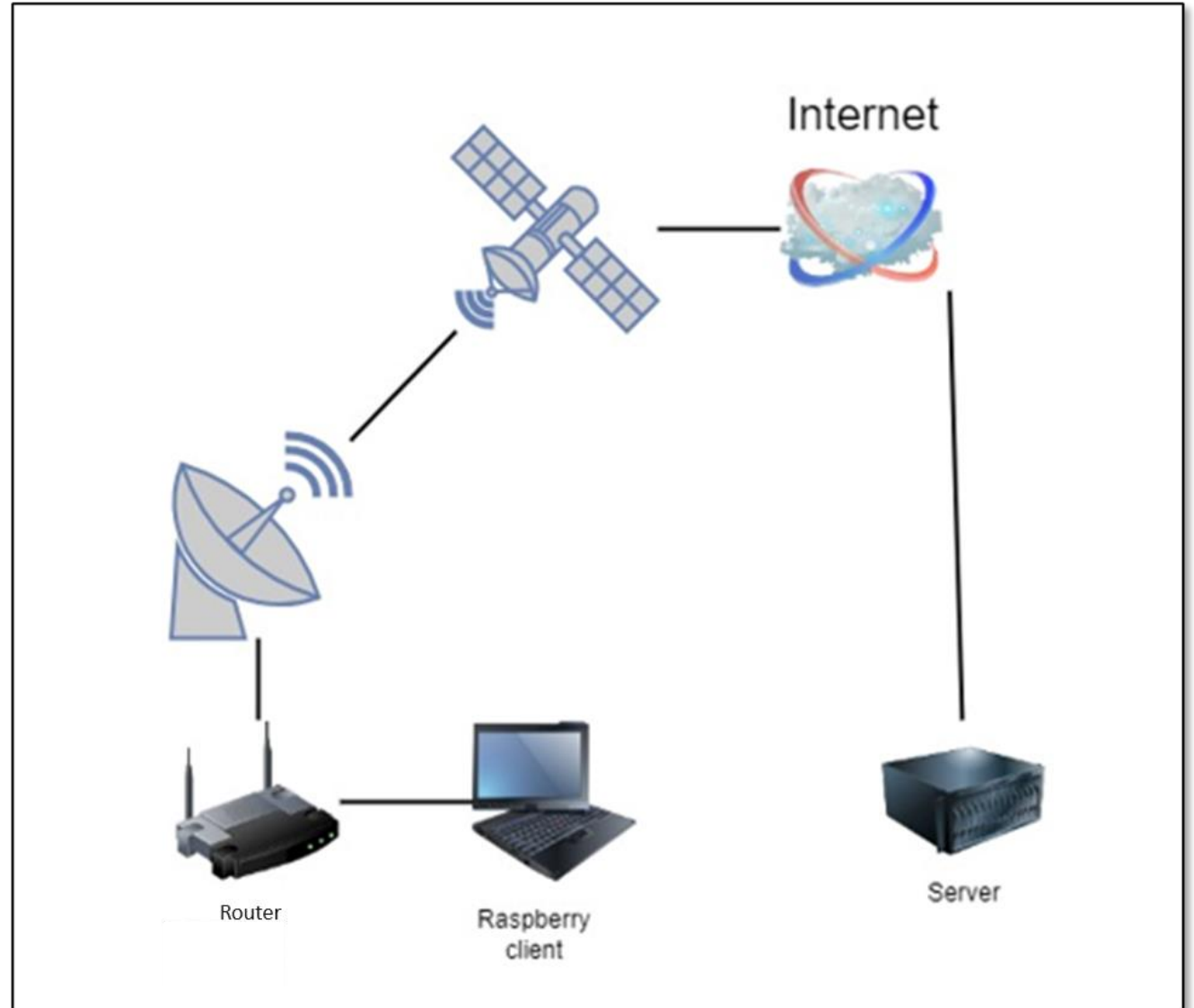
Quality of connection 4G LTE network



Evaluation of experience and performance by latency and speed measurements

LINK

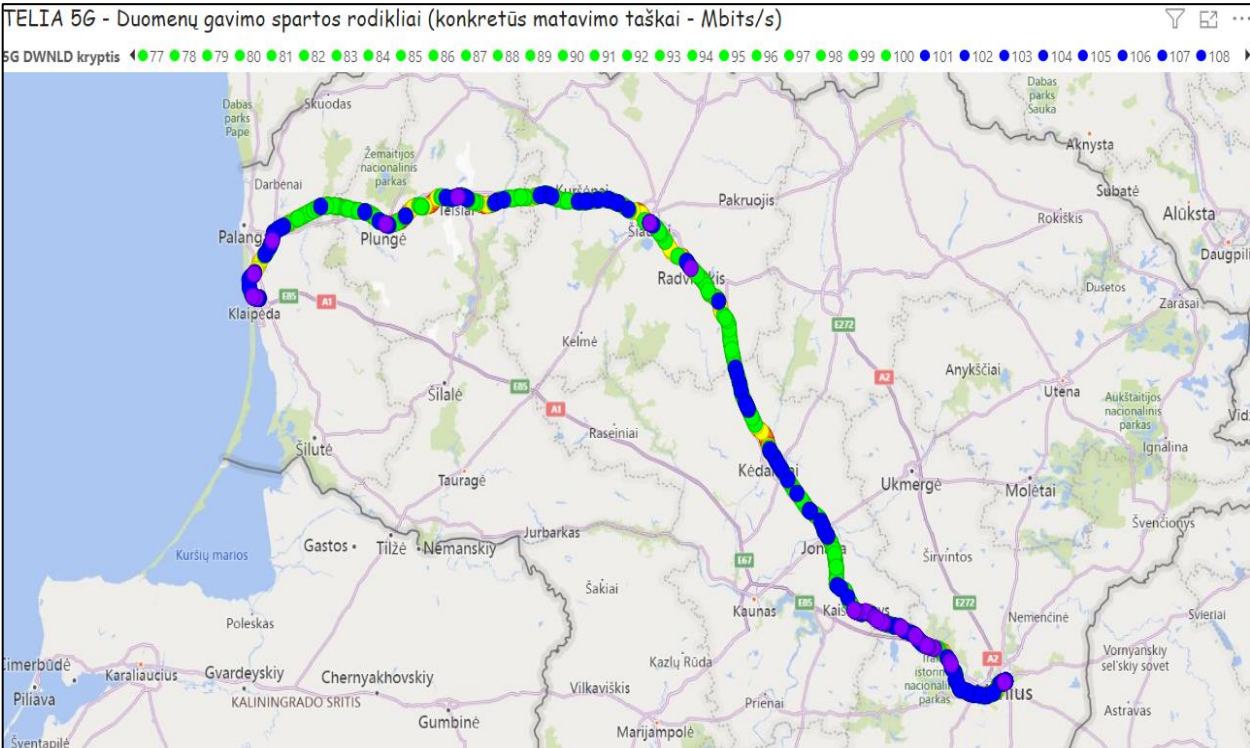
iPerf3 – It is an open source tool for measuring network link bandwidth and quality using TCP and UDP protocols.



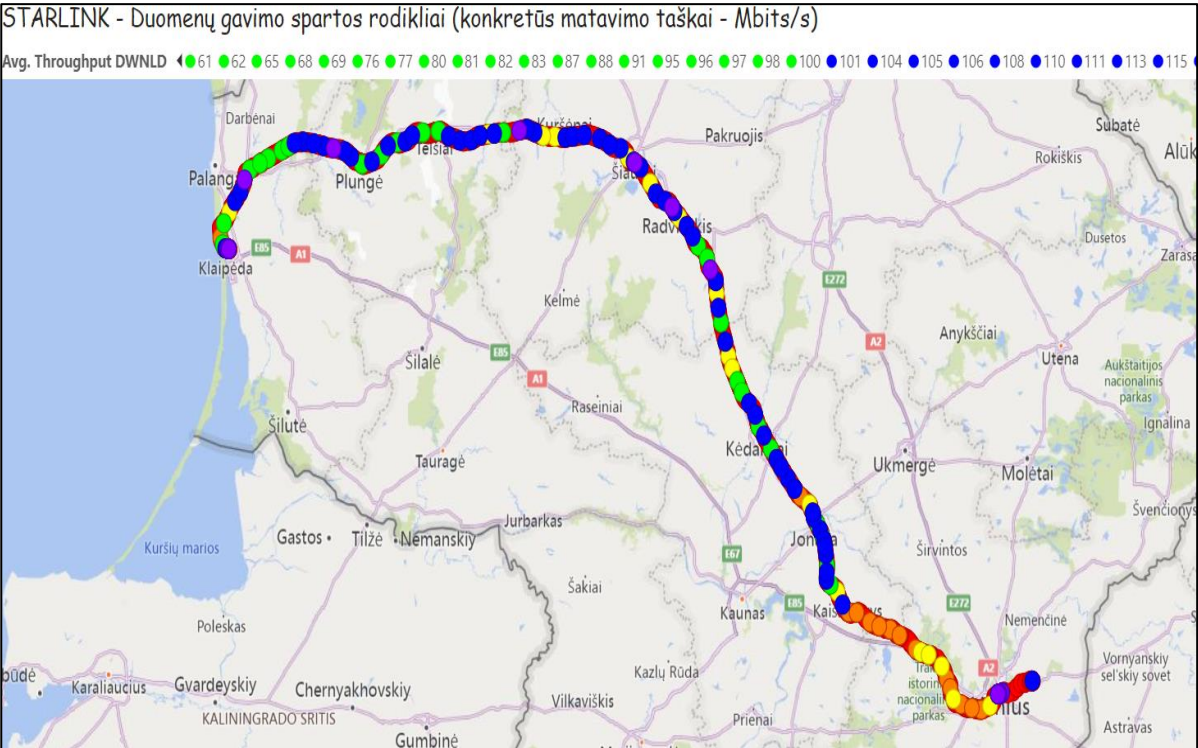
Internet speed measurements Klaipėda -Vilnius



5G



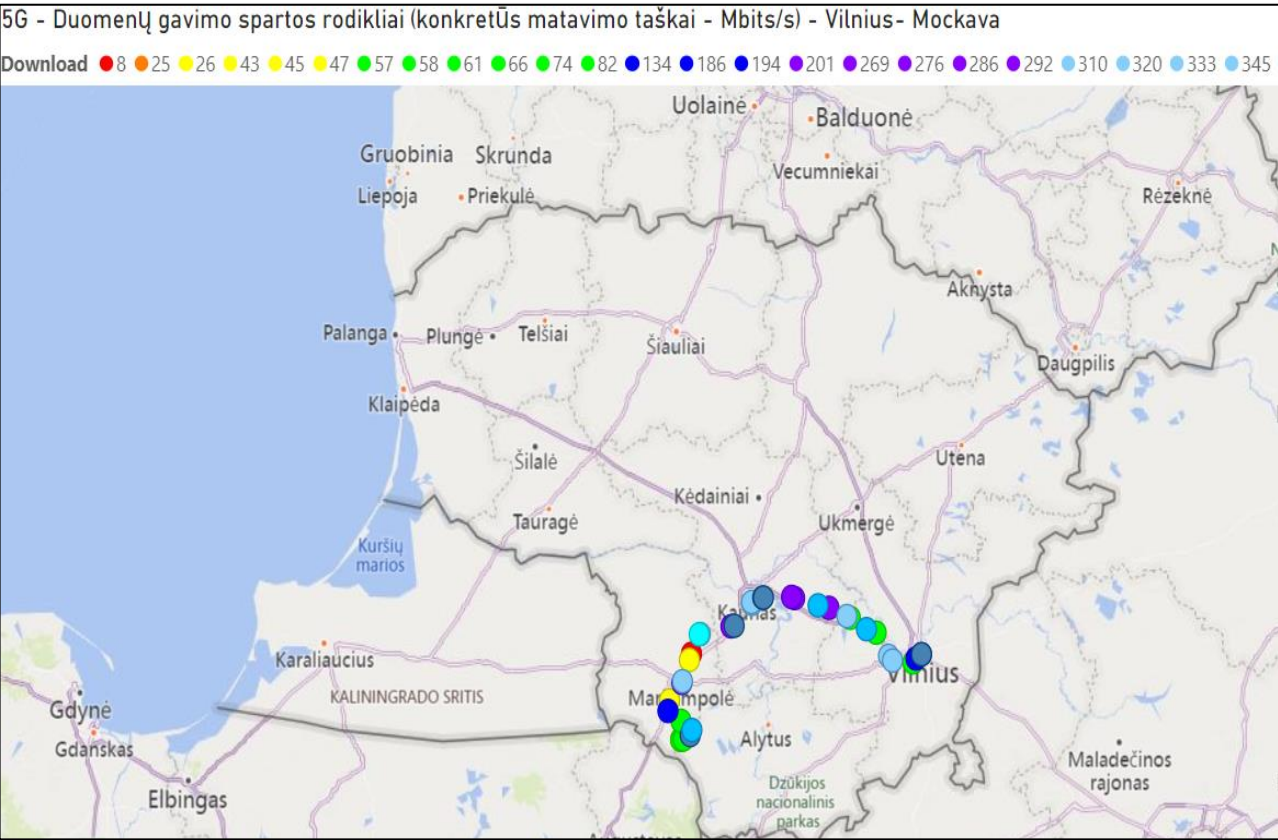
Starlink



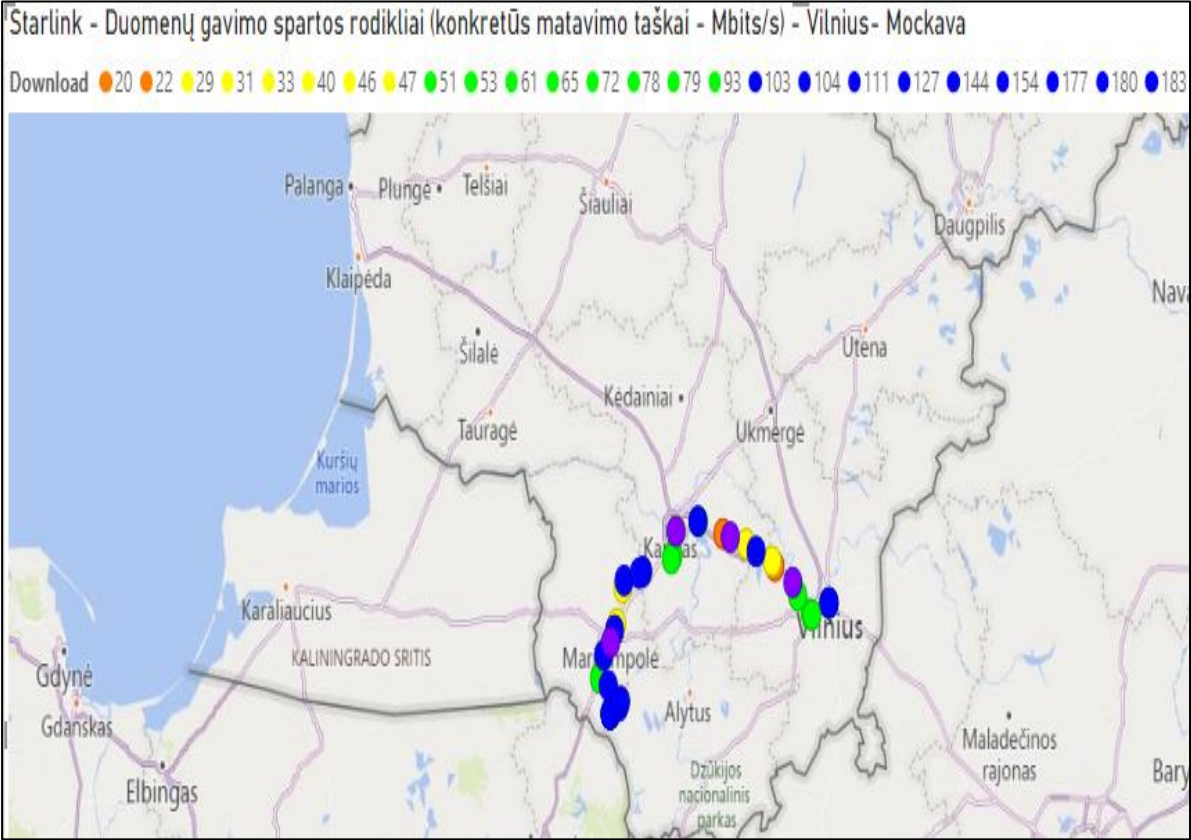
Internet speed measurements Vilnius - Mockava

LINK

5G



Starlink



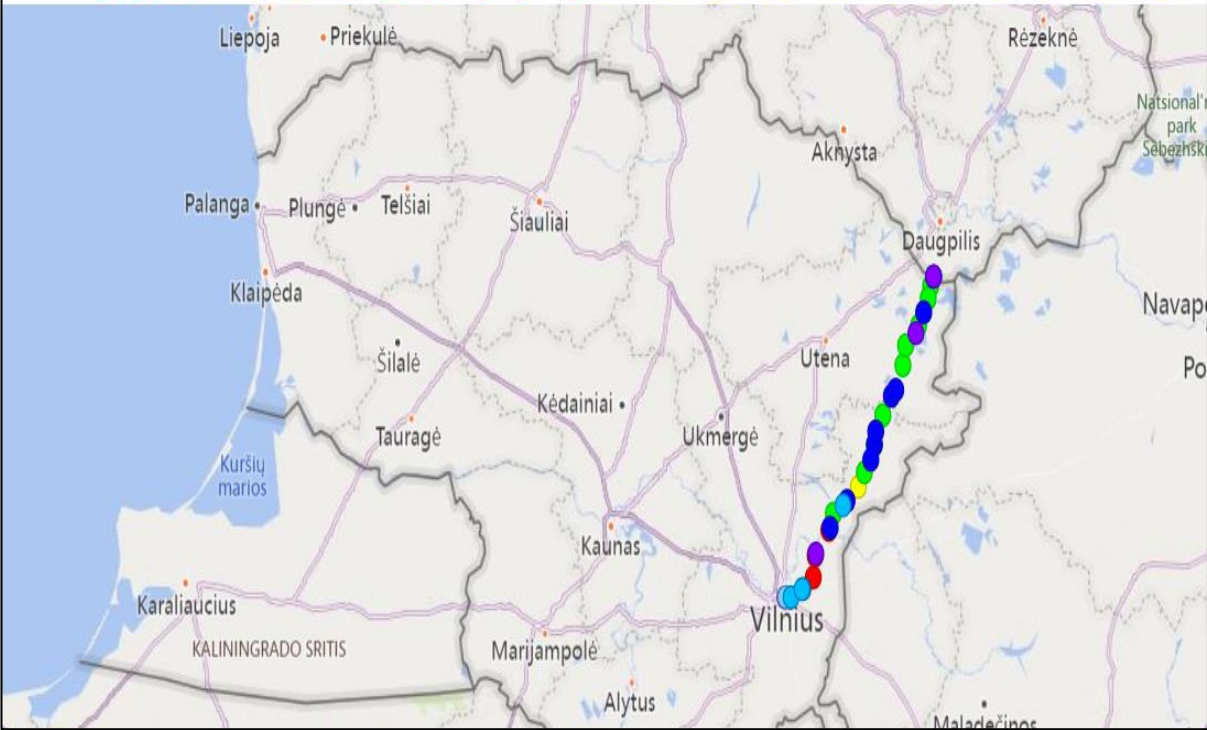
Internet speed measurements Vilnius - Turmantas



5G

5G - Duomenų gavimo spartos rodikliai (konkretūs matavimo taškai - Mbits/s) - Vilnius - Turmantas

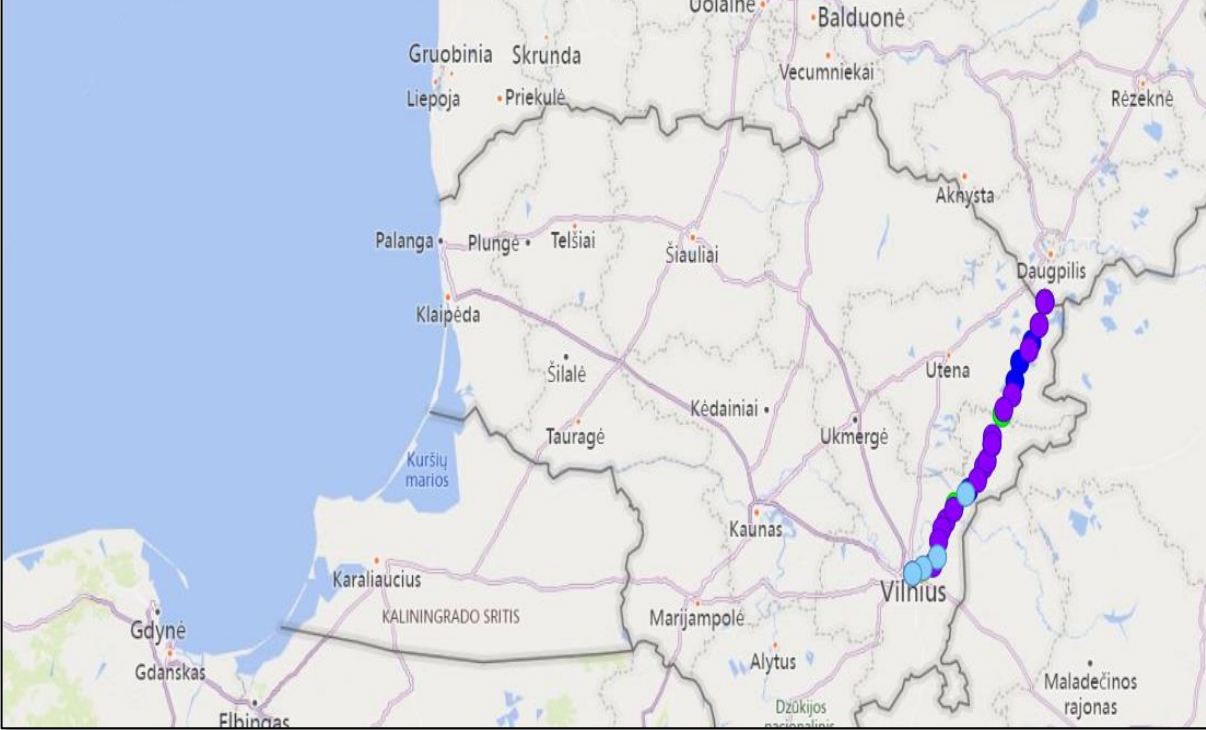
Download 6 7 8 47 63 66 69 74 83 91 95 96 103 113 114 116 123 141 151 160 216 254 289



Starlink

Starlink - Duomenų gavimo spartos rodikliai (konkretūs matavimo taškai - Mbits/s) - Vilnius- Turmantas -

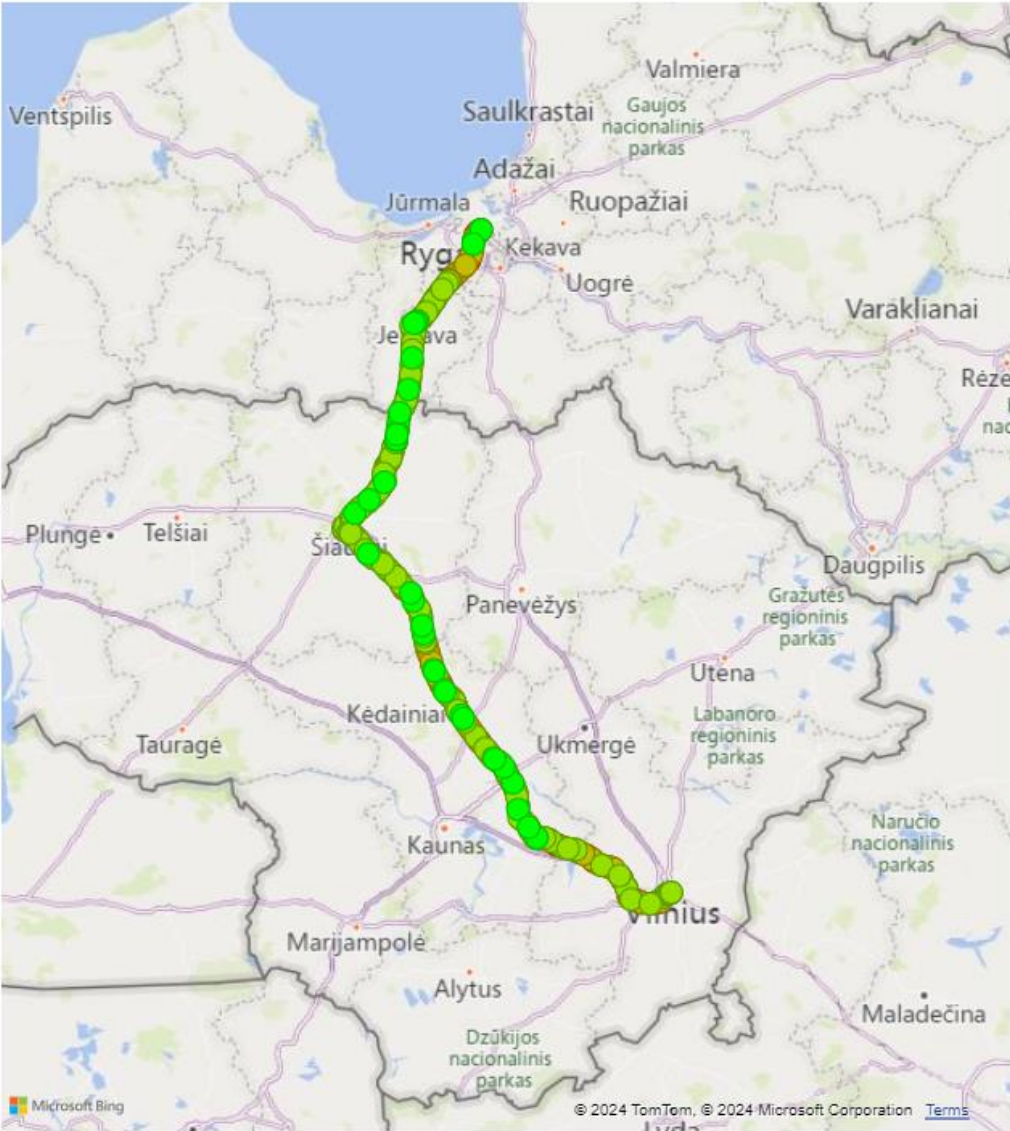
Download (Tuščia) 29 38 55 79 153 157 161 170 175 203 208 214 218 228 229 231 238 240 248 249 255 256



Starlink measurements Vilnius - Ryga

Internet speed

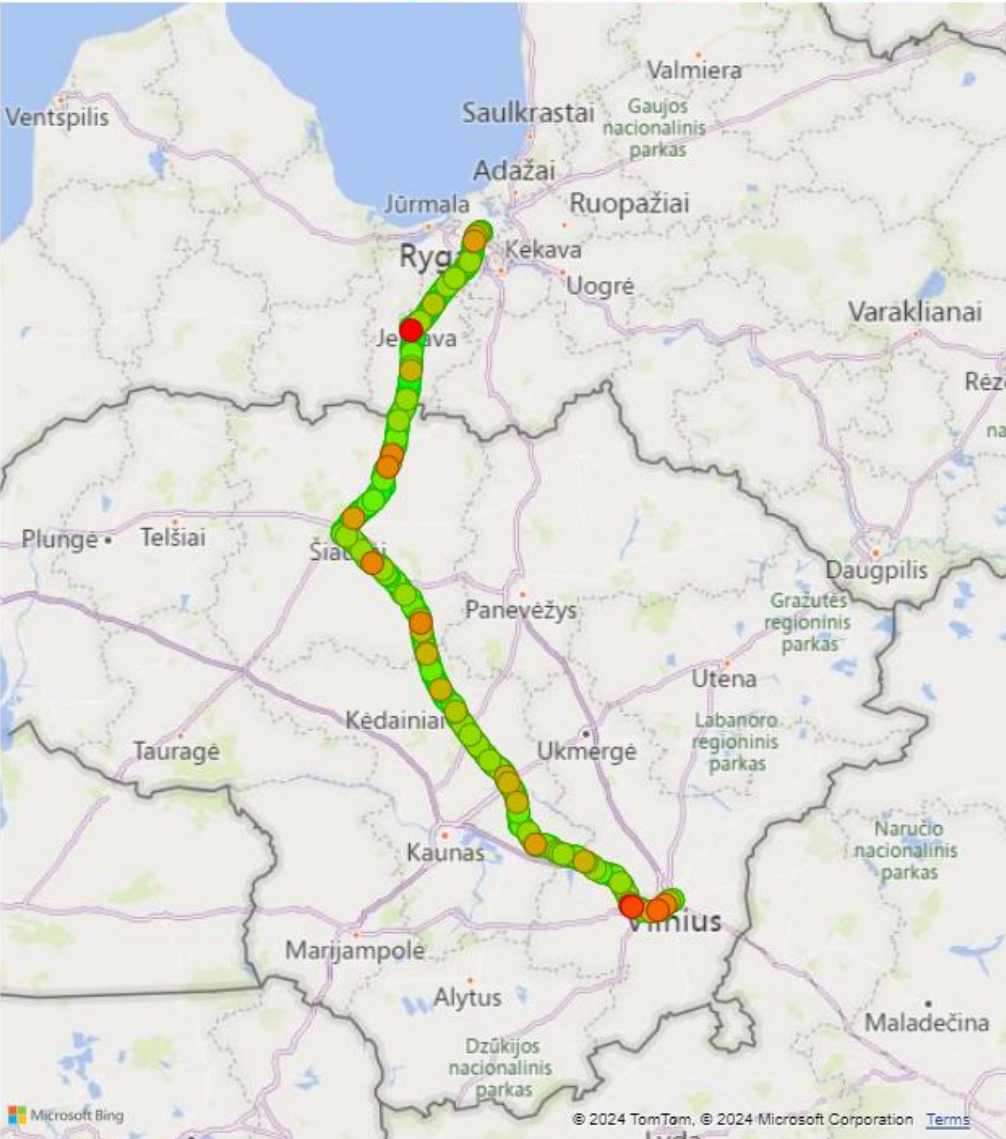
Ryga Download krypti... 11 12 13 14 15 16 17 18 19 20 21 22 ▶



Transmit errors

LINK

TCP Retransmit Count... 6 7 9 10 12 13 15 16 17 18 19 23 24



Starlink connection quality depends on the positions of the satellites

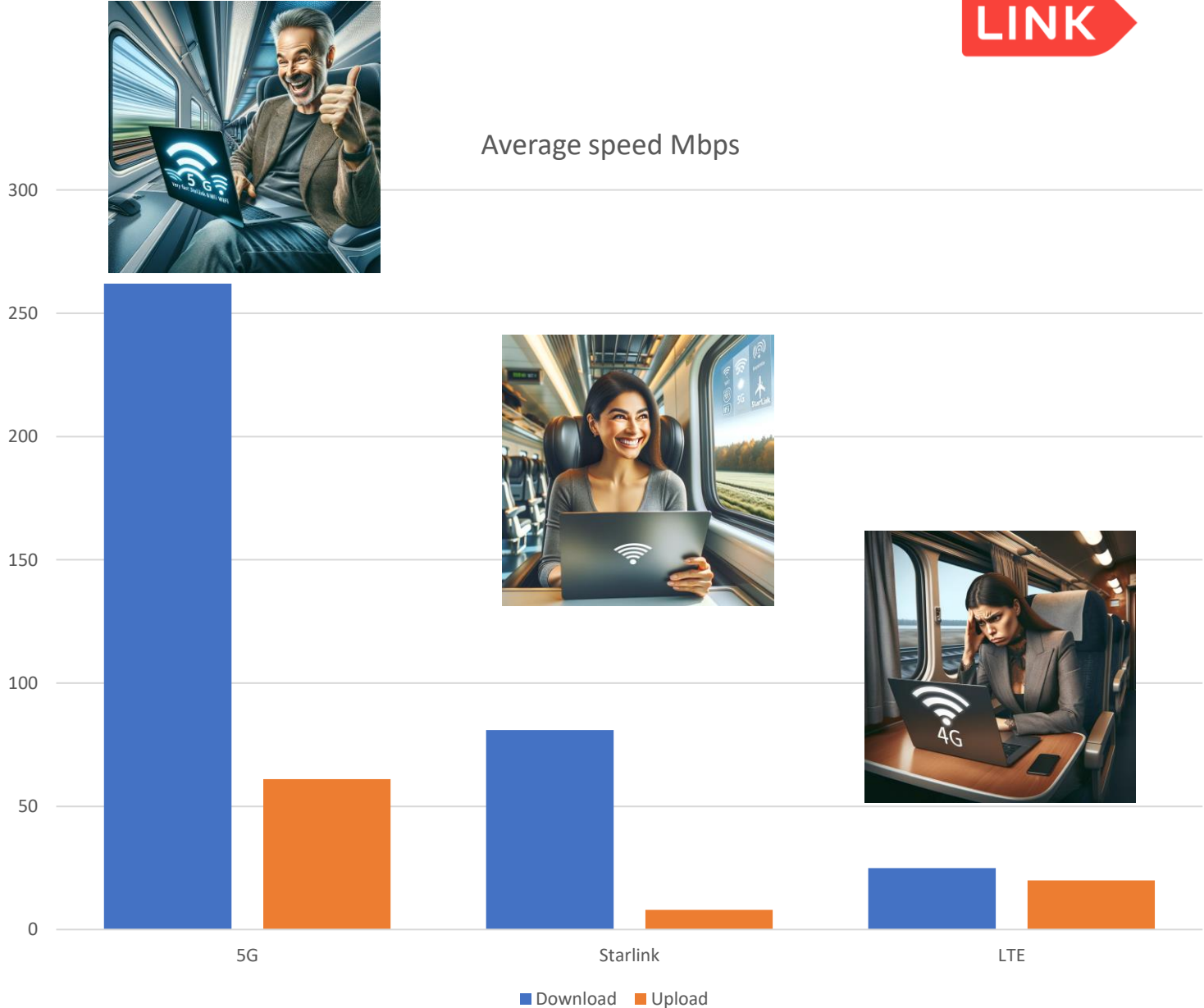
LINK



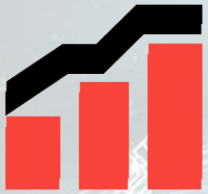
Average speed comparison of 5G, Starlink and LTE



- Starlink and 5G are two modern wireless internet standards that offer high speed and reliability.
- 5G offers much faster speeds than LTE. This means you'll be able to download files, watch videos and play games faster with 5G.
- 5G connection is more reliable than LTE connection. This means that with 5G you are less likely to experience connection loss or disruption.



• Starlink advantages



• Little latency

- Starlink has low latency, which is important for video conferencing.



• Reliability

- Starlink is very reliable because it has many satellites that can protect against disconnections. If one satellite is unavailable, other satellites can take over.



• Wide availability

- Starlink can reach even remote areas with poor mobile coverage

Starlink 550km

• Starlink disadvantages



• Speed

- STARLINK internet is usually slower than 5G internet. This affects uploading large files.



• Price

- One of the main disadvantages of STARLINK is the price compared to 5G.



• Temporary disturbances

- STARLINK may experience short-term disruptions due to railway infrastructure constructions (bridges, tunnels).

Starlink 550km



STARLINK

LTG LINK

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